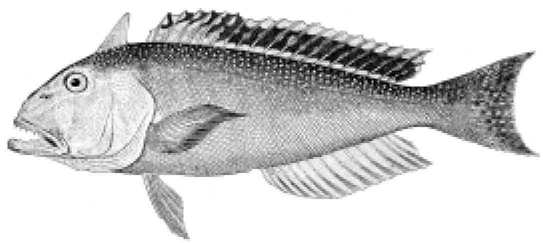
AMENDMENT 1
TO THE TILEFISH
FISHERY MANAGEMENT PLAN

(Includes Environmental Impact Statement, Preliminary Regulatory Economic Evaluation and Essential Fish Habitat Assessment)



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APPENDICES
Volume 2 of 2

APPENDIX A. BRIEF SUMMARY OF LIMITED ACCESS PRIVILEGE (LAP) PROGRAM PROVISIONS IN 2006 MAGNUSON-STEVENS ACT REAUTHRIZATION

Refer to the Act for exact language

A "Limited Access Privilege" (LAP) is defined as a Federal permit, issued as part of a limited access system to harvest a quantity of fish expressed by a unit or units representing a portion of the total allowable catch of the fishery that may be received or held for exclusive use by a person (person has a very wide definition in the Magnuson-Stevens Act).

A LAP may be revoked, limited, or modified at any time (without compensation) in accordance with the Act, including if the system is found to have jeopardized the sustainability of the stock or the safety of fishermen. LAPs will be issued for a period of not more than 10 years and will be automatically renewed unless the permit has been revoked, limited, or modified for reasons specified in the Act. A program review is required after five years and subsequently with review of the relevant fishery management plan (minimally once every seven years).

Only U.S. citizens, permanent resident aliens, corporations, partnerships, or other entities established under U.S. or state laws, that also meet requirements established in the program, may acquire harvest privileges. LAPs may be held, acquired, used by, or issued to persons who substantially participate in the fishery, including a specific sector of the fishery. Fish harvested under a LAP program must be processed by U.S. vessels or on U.S. soil though the Secretary may waive this requirement in certain cases.

Each LAP program must: assist in rebuilding a fishery that is over-fished or subject to a rebuilding plan; contribute to reducing capacity in a fishery that is determined to have overcapacity; include an effective system for enforcement, monitoring, and management (including the use of observers or electronic monitoring systems); include an appeals process for initial allocations; provide information for anti-competitive review; ensure initial allocations are fair and equitable based on the nature of the fishery; ensure that LAP holders do not acquire an excessive share (must specify a maximum share); have a policy on transferability of LAP shares; and have criteria for the approval and monitoring of transfers.

Councils must consider and may provide an auction or other program to collect royalties on the distribution of LAPs. The result must meet the other requirements of LAP programs. Councils must assess programs that support a LAP program and provide for fees to recover costs of management, data collection/analysis, and enforcement activities. The three percent (of the ex-vessel value) cap on cost recovery remains.

LAP programs must include measures, when necessary and appropriate, to assist entry-level and small entities, and fishing communities. Councils may develop a program to reserve up to 25 percent of cost recovery fees to help small-boat/entry level fishermen purchase LAPs.

Individual fishing quota (IFQ) programs by the New England Council and Gulf of Mexico Council require eligible permit holders to approve the program in a referendum by more than 2⁄3 for the New England Council and by a majority for the Gulf of Mexico Council.

The bill does not require a reallocation or reevaluation of imminent (finalized by July 12, 2007) or existing quota programs (including sector allocations).

APPENDIX B. SUPPLEMENTAL ADMINISTARTIVE RECORD FOR THE FISHERY MANEGEMENT PLAN FOR THE TILFISH FISHERY

Evolution of the Limited Access Permit Categories

On October 26, 2001, Hadaja, Inc., filed a lawsuit challenging the limited access permitting scheme for the tilefish fishery and the ban on conducting a directed fishery for tilefish with trawl gear that were adopted by the Mid-Atlantic Fishery Management Council (Council) in the Fishery Management Plan for the Tilefish Fishery (FMP) and approved and implemented by the National Marine Fisheries Service (NMFS). Judge William E. Smith of the District Court for the District of Rhode Island found in favor of Hadaja, Inc., on May 15, 2003. He set aside those provisions of the regulations at 50 C.F.R. Part 648 that implemented the permitting scheme and the ban on conducting a directed tilefish fishery with trawl gear. The Judge concluded that these measures violated national standard 2 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). With respect to the limited access permitting scheme, the Judge concluded:

> Therefore, this court holds that the TFMP's limited access scheme is not based on scientific evidence, but born of political compromise between two powerful industry groups. It is clearly arbitrary and should be set aside. The Secretary must adopt a plan that is based on the best available scientific evidence. That may well be the same plan that was adopted - but only if the record evidence clearly supports it.

The Council made certain choices when it determined what criteria to adopt as a basis for qualifying for the various limited access permit categories (full-time tier 1, full-time tier 2 and part-time) for the tilefish fishery. The basis for those choices is not clearly reflected in the administrative record of the FMP that was submitted to the Court in connection with the lawsuit. This supplemental administrative record will review the Council's decisions with respect to the subject qualifying criteria and expound on the bases for their selection. This supplemental administrative record will not address the ban on conducting a directed tilefish fishery with trawl gear that was overturned by the Court.

Management of the tilefish fishery was first considered in earnest in 1993, after first being initiated in 1981. There was a recognition that the fishery was over-exploited and the boats in the fishery already had more capacity than needed to harvest any sustainable quota from the fishery. This conclusion was expressed in the notice of intent to prepare an environmental impact statement published in the Federal Register on February 24, 1993. It was reiterated in the notice of a control date published in the Federal Register on June 15, 1993. This notice of control date advised the public that if they entered the tilefish fishery after the publication date of the notice, they were not assured of future access to the fishery should a system be developed that limited access to the fishery. One of the concerns that motivated the control date was the possibility of new entrants coming into the tilefish fishery as the result of the ever tightening controls on the multispecies fishery in New England. On the other hand, some fishermen were concerned that the control date would prevent those fishermen who had been active in the tilefish fishery in the last ten years prior to the control date, but left for various reasons, from participating in the fishery in the future.

The Council was also faced with the declining abundance of tilefish. New entrants into the fishery would exacerbate this situation. The then most recent Stock Assessment Workshop advice on the state of the stock was as follows:

> The stock is at low biomass and overfished. MSY is estimated at around 1200 mt with F_{max} approximately 0.1. Current biomass levels are about 40% of the level producing MSY and fishing mortality rates are about 3.5 times larger than F_{msy}. Management measures should reduce current F and rebuild SSB.

Upon consideration of the scientific advice, the Council's staff in December 1993 proposed for Council consideration measures for a potential management scheme. The measures included: (1) new entrant moratorium; (2) total quota, with potentially a longline quota and trawl subquota and possibly some seasonal subquotas; (3) effort reduction program; (4) increase age at entry to discourage targeting on small fish; (5) habitat protection measures; and (6) permitting and reporting for all dealers and fishermen. The toughest component of the program to deal with was the effort reduction component. Initial thoughts on effort reduction centered around the days at sea concept used to manage the New England multispecies fishery, but there was a general recognition that there were many ways to reduce effort in the tilefish fishery.

As contemplated by section 302 of the MSA, the Council enlisted the aid of industry advisors to shape the effort reduction program. At the industry advisors subcommittee meeting in February 1994, the concept of dividing the tilefish fishery into full-time and part-time vessels was raised. This concept was based largely on the management scheme for scallops, which employs full-time, part-time and occasional vessel permit categories. While the three scallop permit categories had different levels of allowable fishing days associated with them, the possibility of dividing the overall tilefish quota among various permit categories emerged. This was at least one solution for dealing with the roughly thirty longline boats in the fishery in 1993 and a limited quota.

The Council did not revisit tilefish management until 1999, due to a spate of more pressing fishery management issues involving other overfished fisheries and the new statutory requirement in the MSA as the result of passage of the Sustainable Fisheries Act in 1996. In 1999, the situation of the tilefish resource was not much different than in 1993: total biomass was 36 percent of the level that produced MSY and the fishing mortality was 2.8 times higher than $F_{msy.}$ Landings had rebounded somewhat from a low in 1989 of 450 mt a year to between 666 mt and 1,838 mt in the 1990s. However, the number of vessels targeting tilefish had declined. During 1995 through 1997 only six vessels accounted for more than 70 % of the total tilefish landings.

Upon a return to considering a limited access program for tilefish, the Council eliminated a days-at-sea program because of its inherent difficulties. Also dropped from consideration was an individual transferable quota system: Congress had imposed a temporary moratorium on the use of this type of management scheme. The Council believed that developing a limited access fishery would be complicated particularly due to the existence of historical participants who developed the fishery but who had since left the fishery for a variety of reasons including the decline of the stock. To reinitiate consideration of a limited access system, the Council's staff recommended a limited access system for "directed vessels" and an incidental permit for vessels that caught tilefish incidentally in other fisheries. Using the proposed limited access rules published by NMFS for the swordfish and large coastal shark fisheries as a model, the staff recommended that there should be a minimum amount of landings required just prior to the control date and some minimum amount of landings after the control date to qualify for a permit.

Due to the passage of time, the Council had the NMFS publish another notice of intent to prepare an environmental impact statement for the FMP. During the scoping hearings, it became clear that there was a contingent of fishermen from New Jersey who claimed historical participant status even though they were not then currently participating in the fishery. This was an issue that the Council would have to deal with pursuant to section 303(b)(6) of the MSA. This section enumerated the factors the Council had to consider if entry into a fishery was to be limited. As a consequence, the Tilefish Committee recommended that several industry advisors from New Jersey be added to the Tilefish Industry Advisors Subcommittee. The members of this Subcommittee immediately prior to this recommendation, and who were involved in the fishery, were all from New York because they were the active participants in the fishery. Three industry advisors from New Jersey were added to the Subcommittee. Somewhat contemporaneously with adding the new industry advisors, the Council during its April 29, 1999, meeting was advised by the Chairman of the Tilefish Committee that:

> Finally, I would like to alert the council to two issues that I believe are going to be central when we bring you this FMP – or excuse me, this public hearing document, and I'd like people to be thinking about that. The issues that we have identified as a committee that I think will probably take three-fourths of the time on May the 6th to discuss will be at what level of participation did you have to be involved in this fishery in the past to determine what your level of participation may be in the future. More specifically, for those of you who are not familiar with tilefish, we basically have two groups of people. A lot of people who used to fish for tilefish who have no recent landings. And I mean just about no recent landings. And we have another group of people who have recent landings that I'm talking about 90 – this is my estimation – maybe 98 percent of the commercial landings in the last six or seven years, a 10 to 20 year history of involvement in the fishery. But the second group of people is not the same as the first group of people. And so it's a tough one. It's a real tough one. We've wrestled with it and we are going to wrestle with it again on May the 6th.

Prior to this Council meeting, the Tilefish Committee had met on April 1, 1999. The concept of categories crystallized further. After reviewing the landings data presented by the Northeast Fisheries Science Center (Center), industry advisors suggested that 250,000 pounds be used as a basis for qualifying for a permit for a directed fishery and 10,000 pounds for an incidental permit. If there was to be a third or middle category then 50,000 pounds should be used as a basis for qualifying for this category. Also, it was suggested that the amount of landings needed to qualify for the directed fishery be applied to the last three years in order to distinguish those that were making a living from the fishery and those that were not. In looking at the landings data, it became apparent that there was a wide gap between vessels that landed 250,000 pounds of tilefish a year and those that did not. This prompted one Committee member to recommend that there be a full-time and a part-time directed category. Selecting various previous landing levels as a basis for qualifying for a permit for the directed tilefish fishery resulted in a varying number of vessels being included in or excluded from the directed fishery according to the landings data presented by the Center. The concept of subjecting the incidental category to a trip limit was also raised at this meeting. The incidental category would then be an open access category without a permit qualification requirement.

After considerable debate, the Committee elected to recommend that the Council go with three categories: full-time; part-time; and incidental. However, the Committee asked the Center to conduct further analysis on the amounts of tilefish landed by vessels in the full - time category in any three of the six years for the time period 1993-1998. Also, the Committee asked the Center to investigate whether there were vessels that did not land 250, 000 pounds of tilefish a year but were really conducting a directed fishery for tilefish. Industry advisors were concerned that if there were no delineation between part-time and full-time vessels in the directed fishery, you would end up with twenty-five boats in a derby fishery for a relatively small quota come the start of the fishing year. This would hurt the already overfished and overcapitalized fishery and knock the price down. The Committee also asked the Center to look at the impact of requiring a minimal amount of landings prior to 1993 in order for a vessel to qualify for the directed fishery.

At the Tilefish Committee meeting on May 6, 1999, the concept of subjecting the incidental category to a trip limit was reaffirmed. A 300 pound trip limit was considered to be in line with the limited overall quota and the small percentage of the overall landings that were made by otter trawl vessels. It also reflected the most prevalent amount of tilefish landed per trip by vessels using otter trawls. Table 42 of the hearing draft of the FMP reflects that only five non-longline vessels of the two-hundred twenty three vessels that landed tilefish in 1998 landed in excess of 300 pounds per trip. The 300 pound trip limit represented a natural break in the data. Further, the concept of a two tier full-time category was adopted by the Committee. The upper tier landings qualifying criteria was 250,000 pounds or greater from 1993-1998, while the second tier landings qualifying criteria was 30,000 pounds or greater from 1993-1998. These amounts were required to have been landed in any three of the years in this time period. Also, in order to qualify for either tier, a vessel was required to have landed one pound of tilefish before the control date of June 15, 1993. This split in the tiers would recognize present participants in the fishery yet acknowledge those who derived the bulk of their livelihood from the fishery by landing 250,000 pounds for three out of the last six years before the FMP was developed and for which relatively complete landings data were available. Also, there was a significant gap in landings between the tier 1 vessels and those that would qualify for tier 2.

The Committee also adopted qualifying criteria for the part-time category: 10,000 pounds per year in any one year from 1988-1993 and 10,000 pounds per year in any one year from 1994-1998. This reflected an element of present participation in the fishery yet not at the level of a full-time vessel. The Committee as a logical extension of establishing these different limited access permit categories next considered establishing seasonal subquotas for each of these categories as a means of controlling further the effort in the fishery. Subquotas had been advanced very early on as a means of dealing with longline and trawl vessels separately and with seasonal periods.

The Council considered the Committee's recommendations at its May 25, 1999, meeting. Industry members voiced concern over the cutoff date for the qualifying window being set at 1988. Though they were not present participants in the fishery, a number of them had been in the fishery in the late 1970s and early to mid-1980s. The industry group representing these individuals (who numbered about twenty) in front of the Council was the Historical Tilefish Coalition. These fishermen had left the fishery for a variety of reasons: overfishing had significantly reduced the abundance of larger tilefish and other fisheries were more lucrative. The 1988 date was originally selected because the Center had only analyzed landings data back until 1988. Even at that, this data was not regarded as complete because there was no requirement for vessel owners to report landings of tilefish until the mid-1990s and then only because tilefish was caught incidental to other species for which the vessel had a Federal fisheries permit.

The industry's suggestion regarding moving the qualifying window back in time sparked a debate over whether fishermen who left the fishery fifteen to twenty years ago really had any rights in the fishery. A number of Council members believed no such rights existed. Regardless, a motion was made to move the qualifying window back for the part-time category: none of the historical participants who left the fishery could qualify for the full-time category because the qualifying criteria for that category required a significant element of present participation in the fishery. The Council adopted an alternative for the public hearing draft of the FMP that would have allowed a vessel to qualify for the part-time category if it landed 10,000 pounds of tilefish in any one year between 1977 and June 15, 1993. The year 1977 was selected because the Center had been able to estimate landings back to 1977, although it had been unable to associate those landings with individual vessels. The document produced by the Center indicated that there were 119 longline vessels in the data base that landed tilefish between 1977 and 1998. Although, the Council passed this motion, some members were concerned about letting this number of vessels into the fishery given the reduced quota needed to rebuild the fishery and the need to scale back significantly fishing effort.

Following this Council meeting, a hearing draft of the FMP was prepared by the Council's staff. With respect to the full-time and part-time vessel categories supported by the Council as a means for managing the overall quota, the hearing draft of the FMP proposed five options:

> Option 1: Full-time=at least 50,000 pounds in one year 1988-1993, and at least 25,000 pounds/year for two years 1994-1998. Part-time=at least 10,000 pounds

in one year 1988-1993, and at least 10,000 pounds in one year between 1994-1998.

Option 2: Full-time=Tier 1=at least 250,000 pounds/ year for three years between 1993- 1998, Tier 2=at least 30,000 pounds/year for three years between 1993-1998 and for both Tiers there had to be at least one pound of landings prior to the 15 June 1993 control date. Part-time=same as Option 1.

Option 3: Full-time=same as Option 1. Part-time=at least 10,000 pounds in one year between 1988 and 15 June1993. The combination of the two separate preferred categories produces this as the overall preferred.

Option 4: Full-time=at least 50,000 pounds in one year 1988 to 15 June 1993. Part-time=same as Option 3.

Option 5: Full-time=at least 50,000 pounds in one year 1977 to 15 June 1993. Part-time=at least 10,000 pounds in one year 1977 to 15 June 1993.

Table 37 in the draft FMP depicted the number of vessels that would qualify for each of the categories depending on the qualifying criteria selected. The number of qualifying vessels ranged from 18 to 119. The table also explained in a footnote that the subquota for each of the vessel categories would be based on the percentage of the overall tilefish landings from 1988 through 1998, represented by the landings during that period of the vessels that qualified for that category.

Following public hearings in August 1999, the Council convened on October 14, 1999 in North Carolina, which is in the MAFMC jurisdiction, but outside of the management unit for this species. Tilefish south of the Virginia/ North Carolina border are managed as part of the SAFMC Snapper/Grouper FMP. Thus, the Council decision on the final version of the FMP was deferred until November 23, 1999, when a special Council meeting to address only the FMP was to be convened in Secaucus, New Jersey. This location was more accessible to tilefish fishermen that fished in the management unit of this FMP. The October Council meeting was used to inform the members concerning the points of contention regarding the alternatives in the FMP and to answer any questions the members had regarding the FMP.

At the November Council meeting, virtually every active fisherman in the tilefish fishery was present or represented. The historical participants from New Jersey were represented by the Historical Tilefish Coalition. The current and historical participants in the fishery caucused at the meeting in order to assist the Council in its deliberations. Central to their discussions was the level of consideration that should be accorded historical participants in the fishery. This, in turn, factored into the allocation of the overall quota to the varying categories since the category allocation percentages were based on the landings of the vessels that qualified for the category. The options included in the public hearing draft of the FMP countenanced the inclusion of vessels landing tilefish as far back as 1977. This would have allowed as many as 119 longline vessels into the fishery. The industry proposed that the Council exercise its discretion to limit participation in the fishery only to those vessels that landed a certain amount of tilefish after 1984, and then only in the part-time category. The industry proposal, referred to as a compromise, actually proposed that the Council adopt Option 2 in the hearing draft with a slight modification; that is, a vessel could qualify for the part-time category if it landed 28,000 pounds in any one year between 1984 and 1993 provided at least one pound was landed prior to June 15, 1993. Also, the industry asked the Council to pledge to revisit the status of historical participants captured by the proposed modification to Option 2 once the fishery was rebuilt in ten years. The day long deliberations ended with the Council adopting a modified Option 2 . This was identified in the final FMP as Option 6:

> Option 6: Full-time=same as Option 2. Part-time=same as Option 1 with an alternative qualifying criterion of 28,000 pounds of tilefish in one year between 1984 and 1993.

Additional language supported by the industry was incorporated into the FMP. It reflected that when the tilefish fishery is rebuilt or at the end of the10 year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered. This language sparked a lengthy debate among the Council members at the November meeting. The industry was advised that the Council could not guarantee such a prospective action as the membership of the Council would change as well as the circumstances of the fishery. Legal counsel also advised the membership that the Council could not bind itself to such an action. Industry understood that the Council would endeavor to pursue an amendment in the future to revisit the limited access system it had adopted once the resource had been rebuilt sufficiently. Interestingly, whatever consideration could be given to the historical participants in the future was limited due to the fact that a rebuilt tilefish fishery could support a quota of no larger than 4,000,000 pounds on a sustained basis. This equated to roughly a $10,000,000 fishery. The vessels that qualified for tier 1 and tier 2 had more than enough capacity to harvest this level of quota. In fact, in 1997, one of the vessels that qualified for tier 1 landed 703,516 pounds of tilefish.

Rationale Underlying the Limited Access Permit Categories

There were myriad factors that the Council considered in adopting the criteria for the various limited access categories. First and foremost, the Council recognized that rebuilding the tilefish fishery, which was determined by the Secretary to be overfished, would necessitate an annual quota that represented a significant decrease in the landings over the last several years. As a consequence of this recognition, effort in the fishery would have to be scaled back. One of the principal means of doing this is to limit access to the fishery. In considering limiting access to the tilefish fishery, the Council considered several factors mandated by section 303(b)(6) of the MSA, foremost among which were present participation in the fishery and historical fishing practices in, and dependence on the fishery. After reviewing the landings data for the fishery provided by the Center, the Council proposed that there be three limited access categories: full-time; part-time; and incidental. The latter category represented a significant level of tilefish mortality given the large number of vessels that potentially would fall into this category. This level of mortality had to be controlled if not reduced if the tilefish fishery was to be rebuilt.

There were a varying number of vessels that potentially could qualify for the full-time category depending on the qualifying criteria adopted by the Council. In debating the appropriate criteria to be adopted, the Council concluded that the full-time category should be split into two tiers, i.e., a tier 1 and a tier 2 level. This was occasioned by the fact that there were four vessels that landed significantly more tilefish than the other active vessels in the fishery. The landings data indicated that four vessels landed at least 250,000 pounds of tilefish annually for several of the last six years before Council deliberations on the FMP began again in 1999. Given the need to scale back effort in the fishery, and recognizing that these four vessels could harvest the entire reduced annual quota, the Council adopted the following qualifying criteria for the tier 1 category: 250,000 pounds of tilefish per year for any of 3 years between 1993 and 1998, at least 1 pound of which was landed prior to June 15, 1993. These criteria reflected both present participation in the fishery as well as a substantial involvement and dependence on the fishery. The adoption of the requirement to have landings prior to the control date incorporated somewhat of an element of historical participation into the qualifying criteria. The qualifying period ended with 1998 because that was the last year for which complete annual landings were then available.

Turning to a consideration of the other present participants in the fishery, the Council deliberated over the criteria to be adopted for tier 2. Since the Council had broken out the tier 1 vessels, there was some sentiment amongst the members to adopt qualifying criteria more in line with those proposed under Options 1 and 4, that is: at least 50,000 pounds in one year 1988-1993, and at least 25,000 pounds per year for two years 1994 -1998. The Council was still concerned about the number of vessels that would qualify for the limited access fishery given the reduced annual quota that would apply to the fishery. This was less of a concern, however, when the Council decided to apply subquotas to each of the categories. These category subquotas would be a percentage of the overall quota that would reflect the percentage of the overall tilefish landings from 1988 to1998 represented by the landings during that period by vessels qualifying for the category. Thus, as more vessels qualified for a particular category, the larger the percentage of the overall quota that would be allocated to that category. Based on the landings data, the Council adopted an annual landing requirement of 30,000 pounds. This level was set high enough above the landing requirement being considered for the part-time category, (i.e., 10,000 pounds) to represent a level of participation in the fishery that could be considered full-time. Thus, in order to qualify for the tier 2 category, a vessel had to have landed 30,000 pounds of tilefish for any of 3 years between 1993 and 1998, at least 1 pound of which was landed prior to June 15, 1993. These qualifying criteria also resulted in only four vessels qualifying for the category. This limitation on the number of vessels qualifying for this category was important to the Council because the addition of another vessel into the tier 2 category would have resulted in a material change to the percentage of the overall quota calculated for the tier 1 category; some of the vessels that narrowly missed qualifying for the tier 2 category had significant landings during the qualifying years. A decrease in the percentage of the overall quota calculated for tier 1 as the result of adding more vessels to tier 2 would have unfairly dissipated the economic return to the vessel owners in the tier 1 category since they had landed the bulk of tilefish over the last several years, that is 89-99 percent of their income was derived from fishing for tilefish, and they were facing a 50 percent reduction in landings as the result of the reduced annual quota that was to apply to the fishery.

Probably, the most difficult decision facing the Council was how to deal with the large number of vessels that landed tilefish in varying amounts but which either were no longer fishing for tilefish or were currently in the fishery but not considered "full-time" vessels, in that their landings averaged only several hundred pounds a week. This was complicated by the fact that many historical participants in the tilefish had come forward as the FMP was being developed and beseeched the Council to make provision for them in the management scheme. Some of these historical participants had started fishing for tilefish in the late 1970s and had continued through the mid-1980s.

Initially, the Council decided to create a part-time and an incidental category to deal with these vessels. A review of the landings data indicated that most of the vessels used otter trawls and landed tilefish incidental to species caught in other fisheries (i.e., yellowtail flounder, summer flounder, squid, and scup). Most of these vessels landed 300 pounds or less per trip. [See tables 40-42 in the public hearing draft of the FMP] Thus, the Council decided to establish the incidental category as an open access category subject initially to a 300 pound trip limit. The Council also determined that this category would be allocated five percent of the overall quota. This represented a reduction from the average seven percent of the overall landings made by otter trawlers in the period between 1988 through 1998. However, since the harvest by longliners was being significantly reduced, it appeared equitable to effect a reduction in the level of landings that most otter trawlers had enjoyed over this time period, that is 300 pounds or less per trip. Since the category was open access, the Council adopted a mechanism to allow for an adjustment of the trip limit should the five percent allocation to the incidental category be exceeded.

While the incidental category dealt with the large number of vessels that would not qualify for the full-time categories, there were a significant number of vessels that caught tilefish using longline gear at irregular intervals during the year in amounts that were well above the level of an incidental catch. The Council adopted the concept of a part-time category to deal with these vessels. The Council considered a number of alternative qualifying criteria for the part-time category. The initial consideration with respect to qualifying criteria was the level at which to set the annual landing requirement. Recognizing that the tier 2 landing requirement was 30,000 pounds, the Council looked at a lower annual poundage level to reflect the part-time nature of the fishery. It settled upon the 10,000 pound level since it was significantly below the poundage requirement for the full-time tier 2 category yet above the annual level landings of vessels that truly landed only an incidental catch of tilefish. Also, the Council was concerned that the level be set high enough to limit the number of vessels that would qualify. The Council understood, however, that this category would have the largest number of vessels of the three limited access categories because it would include some historical participants in the fishery.

The Council's concern about the number of qualifying vessels in the part-time category was motivated by two factors. First, the more vessels that qualified for this category, the greater the likelihood that the subquotas allocated to tier 1 and tier 2 would be diminished. This concern was somewhat mitigated by the fact that the landings of the vessels that would qualify for the part-time category were low relative to the landings of the full-time vessels. Second, a large number of vessels in a category with a small subquota would strain NMFS ability to keep track of the landings by vessels in the category and close the fishery for the category subquota before it was exceeded. This could put somewhat of a strain on the already overfished resource; even if any quota overage was deducted from next year's subquota, such overage would have a negative impact on the statutorily mandated maximum rebuilding period.

The Council developed a number of qualifying criteria options for the part-time category bearing in mind their need to address the historical participants in the fishery. The first was 10,000 pounds in one year between1988 and 1993, and at least 10,000 pounds in one year between 1994 and1998. While this had a historical participant component, the requirement for annual landings between 1994 and 1998 left out those historical participants that exited the fishery in the 1980s. Another option required at least 10,000 pounds in any one year between1988 and June 15, 1993. This option had no present participation component and did not go back far enough in time to address the bulk of the so-called historical fishery in the late 1970s and early to mid-1980s. Yet another option allowed a vessel to qualify if it landed at least 10,000 pounds in any year between 1977 and June 15, 1993. This option outstripped the individual vessel landings data that the Center had in its possession. However, there was aggregate annual landings information back to 1977, which indicated that 119 vessels might qualify under this option, since this option also had the same qualifying time period for the full time category with a landing requirement of 50,000 pounds in any one of those years.

One issue before the Council members was whether the full-time category addressed adequately present participation in the fishery. It was open to question whether there was a need for the qualifying criteria for the part-time category to include a present participation criterion. Similarly, given that these vessels were only fishing for tilefish on a part-time basis, some believed there was no need to require multiple years of a minimum amount of tilefish landings in order to qualify for the part-time category. The sticking point for the Council was how far back to set the qualifying window. The landings data back to 1977 threatened that a flood of vessels would qualify for the part-time category if the qualifying criteria were set at 10,000 pounds in any year between 1977 and June 15, 1993. This raised all the equity and conservation concerns that the Council had wrestled with in selecting the criteria for the other categories. Alternatively, setting the qualifying window to begin in 1988 raised real concerns because it failed to capture the time period of the historical fishery. Landings peaked at 8.7 million pounds in 1979 as the longline fleet became fully developed. Landings of 4 million pounds were sustained through the mid-1980, jumped to 7 million pounds in 1987 and then plummeted to only 1 million pounds in 1989.

Hampering the Council's decision on selecting the appropriate qualifying criteria for the part-time category was the lack of vessel specific landings data back to 1988. Council members had suggested to the industry that they come forward with the landings data from their vessels. A number of New York based vessel owners actually submitted their landings information to the State of New York representative on the Council who, in turn, provided them to the Council. These data were important to an accurate calculation of the percentage of the overall quota that was to be allocated to each category. Other vessel owners from New Jersey also came forward with their landings data and provided them to the Historical Tilefish Coalition to aid the group's representative in making comments on the Council's options. In addition to coming forward with landings data at the November 23, 1999, Council meeting, the industry asked the Council to consider a proposed modification to Option 2 by allowing an alternative basis for qualifying for a part-time category permit; a vessel would qualify for the part-time category if it landed 28,000 pounds in any year between 1984 through 1993. Just prior to this Council meeting, the Center had provided the Council with individual vessel landings data back to 1980. With the industry information and the new Center data, the Council was able to ascertain that moving the qualifying window back to 1984 allowed 42 vessels to qualify for the part-time category. While this allowed 32 more vessels to qualify for the part-time category than under Option 1, it actually allowed 7 fewer vessels to qualify for this category than under Option 3, which was the Council's preferred Option in the hearing draft of the FMP. This modification to Option 2 was attractive to the Council members because it limited participation in the category even more so than its previously preferred option and captured a time period when the historical fishery was still strong with very few vessels having departed for more lucrative pursuits.

In adopting a modification to Option 2 [later identified as Option 6 in the FMP], the Council broadened its consideration of historical participants to include those that remained in the fishery and those that developed the fishery but left. Since the modification was intended to address those historical participants who departed the fishery largely when the fishery was strong but who had been what might be considered full-time fishermen prior to their departure, it appeared reasonable to impose a landing requirement more in line with the tier 2 requirements. The 28,000 pound landing requirement proffered by industry based on their landings information seemed reasonably in line with those requirements. Actually, the industry landings information included more individual vessel landings data than the information provided by the Center and served as a more reliable basis for setting this level. Given that these vessels would only qualify for the part-time category, it seemed unnecessary to require that they meet the minimal landings requirement for more than one year during the qualifying time period. To do so would have conflicted with the alternative basis for qualifying for the part-time category, that is landing 10,000 pounds in any one year during certain time periods.

The Best Available Scientific Information Available to the Council

The Court set aside the permitting requirements for the tilefish fishery, which appear at 50 C.F.R. 648.4(a)(12). The Court concluded that there was no evidence in the administrative record of the FMP that indicated the permitting scheme, and in particular the qualifying criteria for the three categories of limited access permits, was based on the best scientific information available. This constituted a violation of national standard 2. National standard 2 requires that "[c]onservation and management measures shall be based on the best scientific information available." The Guidelines for the National Standards, which appears in 50 C.F.R. Part 600, indicates that scientific information includes, but is not limited to, information of a biological, ecological, economic or social nature. The initial focus of the FMP was on the biological and ecological data that pertains to the tilefish fishery due to the fact that the fishery was determined by the Secretary to be overfished. The biological information pertaining to tilefish was generated by the NMFS' NEFSC and incorporated into the FMP.

According to the then latest (1999) stock assessment done by the Center, the tilefish stock was only 35 percent of the stock level that would produce the maximum sustainable yield from the fishery on a continuing basis. As a consequence of the overfished status of the tilefish fishery, the Council was legally obligated by the MSA to develop a plan that would rebuild the fishery in a period not to exceed ten years. The Council adopted a plan that called for an immediate reduction in fishing mortality and a constant harvest strategy for the ten year rebuilding period that employed an annual quota of 1.995 million pounds.

In addition to imposing an obligation on the Council to develop a rebuilding plan for tilefish, the MSA required the Council to consider measures to protect essential tilefish habitat from any adverse impacts from fishing. There was an unanswered question regarding whether trawl gear was having an adverse impact on essential tilefish habitat, which consisted largely of burrows in the canyons and continental slope areas. There was an inference that could be drawn from studies done on other types of structured ocean bottom that trawl gear was having an adverse impact on tilefish habitat. Ecological information generated by the Center and information from a host of other studies, as referenced in the bibliography to the FMP, was incorporated into the FMP. After reviewing this information, the Council concluded that trawling was not having an adverse impact on essential tilefish habitat and decided that no measures were needed to protect tilefish habitat from impacts generated from fishing with trawl nets. This decision on the part of the Council was challenged in New York District Court by the Natural Resources Defense Council. The Court concluded that the Council's decision not to impose measures to protect essential tilefish habitat was consistent with the MSA and other applicable law.

Neither the biological nor ecological data in the FMP served as a direct basis for the tilefish permitting system that was set aside by the Court. Since the biological data made it abundantly clear that the tilefish fishery was overfished, the logical conclusion that fishing effort had to be reduced followed. The scheme ultimately settled on by the

Council to reduce effort was a limitation on access to the fishery. That is, the number of vessels that could participate in the fishery would be limited through the use of a permitting scheme involving qualifying criteria A days-at sea program similar to the one used to manage the multispecies fishery in New England was considered to reduce fishing effort but discounted because of the administrative and other difficulties associated with such a system. The possibility of an individual transferable quota system was discussed but ruled out because there was a moratorium on the implementation of such systems in the MSA when the FMP was being developed. Thus, the biological data, which indicated a need to reduce fishing effort, was an indirect basis for the Council's consideration of a limited access system tied to the issuance of a permit. The ecological data available to the Council did not factor into the creation of the limited access permit system since the Council concluded that there was no basis to limit the number of vessels in the fishery to protect essential tilefish habitat.

The only data available to the Council with which to craft the limited entry scheme was the vessel permit and landings data files that were in possession of the Center. These files were converted into tables reflecting annual individual vessel landings and the exclusionary impact on certain vessels of selecting various thresholds to qualify for a limited access permit for the tilefish fishery. Certain conclusions became evident from a review of the tables. First, there was a wide range of participation in the fishery. Table 85 in the FMP, which reflected the Center's weighout data for 1998, indicated that there were 223 vessels that landed at least a pound of tilefish that year. This included vessels using all gear types. However, only 16 of these vessels had an annual landing over 10,000 pounds. More significantly for the Council was that five vessels using longline gear had landings of 1,907,678 pounds that year. Looking at landings data over several years [table 75], four vessels collectively landed in excess of the 1.995 million pound quota that would control landings from the fishery over the rebuilding period. In fact, one vessel from this four vessel group landed 703,516 pounds in 1997. Clearly, there was enough capacity in these four vessels to harvest the annual quota. Consequently, these landings data were used initially to get a sense of how many vessels should be allowed into the fishery.

The thought of giving an entire fishery over to just four vessels raised a number of issues. National standard 4 requires that if there was to be an allocation of fishing privileges among domestic fishermen that it be fair and equitable, reasonably calculated to promote conservation, and carried out in such a manner that no entity acquires an excessive share of such privileges. Further, section 303(b)(6) required the Council to consider several factors when considering limiting access to a fishery. Among these factors were present participation and historical fishing practices and dependence on the fishery. Given these requirements, the Council used the landings data to look beyond the number of vessels needed to harvest the quota. The data showed that in addition to the four boats that could harvest in excess of the annual quota, there were a number of boats that were presently participating in the fishery that had significant landings but at a level well below those of the top four vessels in the fishery. The Council used these data to delineate three limited access categories: full-time tier 1; full-time tier 2; and part-time. These data allowed the Council to exercise an element of judgment in identifying those breaks in the landings data and the overall time frame that should be used as the qualifying criteria for the individual categories to reflect their differing levels of participation in the fishery. By looking at different qualifying criteria for a particular category, the Council was able to identify the number of vessels that would qualify for the category and decide on an appropriate number of vessels to which the category should be limited. This enabled the Council to determine the percentage of the overall quota that would be allocated to a particular category. The percentage allocated to a category would be the percentage of the overall landings from 1988 through 1998 represented by the landings of the vessels during that same time period that qualified for that category. In exercising their judgment on the number of vessels to allow into a category, Council members considered: for tier 1- the actual number of vessels that accounted for most of the tilefish landings over a sustained recent time period and were heavily dependant on the fishery; and for tier 2 and part-time, the impact the number of vessels in these categories would have on the allocation to the tier 1 vessels and the ability to constrain these vessels to the subquota for the category. This latter consideration was more important for the part-time category. The number of vessels qualifying for the part-time category was expected to exceed those in the other two categories as it was to include those considered historical participants in the fishery. The Council also created an open access incidental catch category that allowed controls to be imposed on the large number of vessels that landed a small amount of tilefish annually. These tilefish were caught incidentally to other species of fish that these vessels were pursuing. However, the overall landings of this category, the number of vessels in which could increase, represented a significant level of mortality that had to be controlled if the fishery was to be rebuilt.

Two limitations of the landings data became apparent as the Council deliberated on the final management program for the FMP. The Center’s 1988 through 1998, data, which were the best scientific information available, did not capture the total landings of all the vessels in the data files during that time period. Some industry members from New York who recognized their vessels in the masked individual vessel data tables provided to the Council by the Center volunteered to provide more landings data. The State of New York acted as an intermediary between the Council and these industry members. The Council used these data to augment the data provided by the Center. As the Council attempted to respond to the industry’s and their advisors’ concerns about the options being considered to include historical participants in the fishery, the temporal limitations of the landings data supplied by the Center acted to frustrate Council action. The Council was considering Option 5 that would have moved the qualifying window back to 1977 for both the full-time and part-time categories. However, the Center’s initial individual vessel data did not predate 1988. While the Center worked to provide individual vessel data further back in time to the Council, the industry was also encouraged by council members to come forward with additional landings data. Less than a month before the November 23, 1999, meeting, the Center provided the Council with a table of annual landings for all vessels landing 15,000 pounds or more of tilefish in any one year from 1980 through 1998. Considering this table together with the individual vessel landings data provided by the industry, in particular the Historical Tilefish Coalition, the Council pursued the same type of analysis that had gone into selecting the criteria for the tier 1 and tier 2 categories. It identified that moving the qualifying window back to 1984 and requiring a level of landings that reflected a significant yet historical participation in the fishery (i.e., 28,000 pounds) resulted in a number of vessels qualifying within the range of qualifying vessels from the other Options.

Section 303(b)(6) Analysis

Section 303(b)(6) of the MSA requires the Council to consider a number of factors when it develops a management scheme that limits access to a fishery. Specifically, the Council is required to consider: (A) present participation in the fishery; (B) historical fishing practices in, and dependence on, the fishery (C) the economics of the fishery; (D) the capability of fishing vessels used in the fishery to engage in other fisheries; (E) the cultural and social framework relevant to the fishery and any affected fishing communities; and (F) any other relevant considerations.

(A) present participation in the fishery

The Council's consideration of present participation in the fishery was tempered by the fact that a control date of June 15, 1993, was published in the Federal Register on that date. It advised that those entering the fishery after the control date would not be assured future access to the fishery if a limited access scheme was developed that used the control date. The control date was published coincidental with the Council's efforts to develop a FMP in 1993. These efforts stalled. Work on the FMP was not resumed until 1999. Thus, the Council had to consider whether present participation should be restricted to those vessel in the fishery at the time of the control date or should consideration of present participation embrace those boats in the fishery when work resumed on the FMP in 1999. The Council opted to include those vessels in the fishery as of 1998, the last year for which individual vessel data was available, as present participants but to require a minimal level of landings (i.e., 1 pound) prior to the control date. This was motivated by the fact that the control date was somewhat stale.

The Council was cognizant of the number of vessels that were then presently participating in the fishery. In fact, the several tables provided by the Center regarding individual vessel landings clearly depict those vessels that were participating in the fishery since 1980. These data reflect obviously both present and historical participants in the fishery. When the Council initially began development of the FMP in 1999, the weighout data indicated that there were 223 vessels that landed tilefish in 1998 and 188 that landed tilefish in 1997. This included vessels that caught tilefish with longline and otter trawl gear. Since longline vessels landed roughly 95 percent of the tilefish over the 1993 to 1998 time period, the Council's analysis focused on the landings of longline vessels. To aid the Council in the beginning stages of FMP development, the Center provided individual vessel landings over the period 1988 through1998. This period was later expanded to include the period 1980 through 1998. These data were masked to protect the confidentiality of the data, as required by section 402 of the MSA. These present participants were stratified into four categories: full-time tier 1; full-time tier 2; part-time; and incidental. These categories reflected the differing levels of participation of varying segments of the fishery as evidenced by their annual landings. The large bulk of the vessels that were then present participants in the fishery landed tilefish caught incidentally with otter trawls in other directed fisheries. These vessels were allowed to continue in the fishery subject to a variable 300 pound trip limit. For the large majority of these vessel, this initial trip limit represented the same amount of or more tilefish than they had landed prior to the development of the FMP. As a consequence of the varying limited access categories, present participation was not only considered but provided for in the FMP.

(B) historical fishing practices in, and dependence on, the fishery

(1) historical fishing practices

Section 2.3.1 of the FMP outline the development of the commercial fishery for tilefish. Prior to the 1970s, tilefish were largely harvested incidentally with otter trawl gear. The longline fishery for tilefish developed in the 1970s and became the predominant gear that harvested tilefish. In the ten years preceding development of the FMP, longline gear accounted for roughly 93 percent of all tilefish landings. Otter trawls were the only other gear that had a measurable harvest of tilefish. While the FMP prohibited conducting a directed tilefish fishery with otter trawls, it still allowed otter trawl vessels to continue to harvest and to land tilefish subject to a trip limit. Thus, the FMP took into account and provided for the historical fishing practices in the fishery by allowing the continued use of gear that had historically been employed in the fishery.

This provision has also become synonymous with a requirement to consider the "historical participants" in a fishery who undertook those historical fishing practices in a fishery. By far, how to deal with historical participants was the most difficult issue facing the Council. More specifically, the issue was how broad a range of historical participants should the Council allow to qualify for a limited access category particularly given the fact that the vessels qualifying for the tier 1 category had the capability to harvest the entire annual quota of 1.995 million pounds needed to rebuild the tilefish fishery. Since the overwhelming majority of these historical participants would not qualify as full-time vessels, either because they left the fishery or were landing reduced amounts of tilefish, they would necessarily fall into the part-time category. The Council considered an option of allowing vessels landing specified amounts of tilefish as far back as 1977 to qualify for the fishery. The Council knew that this option would allow 119 vessels to qualify for the limited access categories. While the Council did not have individual vessel landings for 1977 through 1979, it did have information from the Center showing individual landings of all vessels that landed at least 15,000 pounds of tilefish in any one year between 1980 and 1998. Thus, for each of the options that the Council considered, it had a precise idea of the number of historical participants that would qualify and those that would be excluded. The impacts of those excluded from the limited access categories under the various options is discussed in the Social Impact Assessment in section 5 of the FMP. Thus, the Council not only considered "historical participants" in the fishery but deliberated repeatedly over what qualifying time period and landings level to use in order to allow this sector to participate in the fishery.

The Council was unambiguous in its rejection of the option that would have allowed vessels landing tilefish as far back as 1977 to qualify for the limited access categories. On the other end of the balance beam, the Council's industry advisors and many in the tilefish industry at large provided comments to the effect that the Council's initial option for including historical participants (i.e., at least 10,000 pounds in any one year between 1988 and 1993) failed to capture the true time period of the historical fishery. After a peak high landings of 7,000,000 pounds in 1987, the fishery plummeted to landings of only 1,000,000 pounds in 1989. Prior to this, annual tilefish landings remained steady, however, at 4,000,000 pounds from about 1982 through 1986. This level of annual landings is equivalent to the level of landings that would be supported by a rebuilt tilefish fishery.

Based upon the individual vessel landings data provided by the Center for the period 1980 through 1998, with supplemental data provided by individual vessel owners either through the State of New York or the Historical Tilefish Coalition, the Council accepted industry comment that the Council's Option 2 should be modified. In addition to the qualifying criteria being considered by the Council for the part-time category under Option 2, the Council considered an alternative qualifying time period set to begin at 1984, the middle of the period when the landings for the historical fishery were constant and within an acceptable biological level of removals from the fishery. Since the Council recognized that there was a need to limit the number of vessels in the part-time category, and the industry comments had focused on "letting in" those historical participants that developed the historical tilefish fishery, the Council agreed to consider inclusion of those vessels that had significant landings during the time period 1984 through 1993. At the time, these boats were full-time participants in the fishery. Consequently, a landings requirement to qualify as a "historical participant, should be somewhat consistent with the landing qualification for the full-time category. The data did not reflect that there was any small group of boats similar to the tier 1 vessels that landed the bulk of the tilefish during the 1984 through 1993 time period. Thus, considering a landing requirement more in line with the annual landing requirement for tier 2 (i.e., 30,000 pounds) appeared reasonable. The data available to the Council suggested that the appropriate level was 28,000 pounds.

This modification to Option 2 would allow 42 vessels to qualify for the part-time category. Reducing the landings qualification to 20,000 pounds would have allowed an additional ten boats to qualify for the part-time category, while reducing the landing requirement to 15,000 pounds would have allowed an additional twenty-two vessels to qualify for this category. Both of these alternative landings requirements would have allowed in more vessels than the preferred alternative Option 3 which the Council included in the hearing draft of the FMP. By adopting the modification to Option 2, the Council allowed roughly 35 percent of all longline vessels (i.e., 119 vessels) identified as participating in the fishery as far back as 1977 to continue to pursue the tilefish fishery under part-time category established in the FMP on the basis of their participation in the fishery prior to the control date of June 15, 1993. The vast majority of these vessels are considered "historical participants" in the fishery.

Further, those otter trawl vessels that participated in the tilefish fishery at any time either prior to or subsequent to the control date were allowed to continue fishing in the tilefish fishery by virtue of the Incidental Category. This sector of the fishery represented the largest number of vessel that participated in the tilefish fishery at any point in time. For example, in 1998, of the 223 vessels landing tilefish only 27 were longline vessels. In 1992, only 28 of the 136 vessels landing tilefish were longline vessels. The only limitation imposed on the Incidental Category is a variable trip limit. Thus, the FMP did not operate to exclude totally any otter trawl vessel from the tilefish fishery. Consequently, the Council considered historical participation in the fishery and provided for the continuation of many of the historical participants in the fishery.

(2) dependence on the fishery

The tier 1 vessels are the most dependent on the tilefish fishery. The income generated by fishing for tilefish represents from between 89 to 99 percent of the total income of the owners of the four vessels that qualified for tier 1. All but one of the vessels qualifying for tier 1 fished every year from 1993 through 1998. One of these vessels did not fish in 1993. The tier 2 vessel owners are less dependant on the fishery since the average landings for their vessels are less than the tier 1 vessels. In fact, only two of the four tier 2 vessels fished in 1998. None of the tier 2 vessels fished every year from 1993 through 1998. Only one of these vessels fished for five of the six years between 1993 through 1998, while one fished four years during that period and two fished only for three years of the period.

The part-time category vessels were less dependent overall on the tilefish fishery simply by virtue of their level of landings compared to the vessels in the full-time category. Of the forty-two vessels qualifying for the part-time category, only six had landing in 1998, with an average landing of 14,436 pounds. Landings ranged from 2,915 pounds to 30, 749 pounds for the six vessels. This is well below the average landings of the tier 1 vessels landing in 1998, that is 390,412 pounds, and the tier 2 vessels landing in 1998, that is 89,281. Only twenty of the vessels qualifying for the part-time category had landing during the period 1993 through 1998, while only eight had landings during the period of 1994 through 1998. These figures demonstrate that the part-time category vessels were much less dependent on the tilefish fishery than the full-time vessels both due to their level of landings and a lack of sustained participation in the fishery during the period immediately preceding development of the FMP.

Interestingly, roughly one-third of the longline vessels identified as having landing of tilefish during the period 1980 through 1998 had no landings of tilefish after 1987. Thus, whatever dependence on the fishery they may have had previously ended. This situation undoubtedly reflects the fact that the fishery was in a precipitous decline with landings tumbling from 7,000,000 pounds in 1987 to 1,000,000 pounds in 1989. Undoubtedly, however, the level of landings prior to this period of decline of the vessels qualifying for the part-time category were significant.

Vessels using trawl gear and landing tilefish caught incidentally in other directed fisheries have no demonstrable dependence on the tilefish fishery particularly for the period from 1992 through 1998. In 1992, there were one-hundred and fifteen otter trawl vessels that landed tilefish. In 1998, there were one-hundred and ninety-six otter trawl vessels that landed tilefish. However, the vast majority of these vessels landed 300 pounds or less of tilefish per trip. Those few otter trawl vessels that landed sufficient amounts of tilefish to qualify for the part-time category were not excluded from this category due to the fact that the tilefish were harvested with other than longline gear. This provision recognized the degree of dependence that these vessels had over the remainder of the otter trawl vessels. While these boats did qualify, the FMP contained a prohibition on conducting a directed fishery with otter trawl gear. This prohibition has since been struck down by the court

C) economics of the fishery

The information in the economic impact statement which includes the regulatory impact review and the regulatory flexibility analysis in section 4 and section 2.3 which is the description of the fishing activities in the FMP need no further supplementation or explanation and are not repeated here.

(D) capability of fishing vessels used in the fishery to engage in other fisheries

Initially, there is no physical characteristic of vessels that participated in the tilefish fishery that would prevent them for fishing in other fisheries. The gear used to catch tilefish is almost exclusively longline and otter trawls. The catch of tilefish by other gear types is simply *de minimus*. Some 93 percent of the tilefish landed in the 1988 through 1998 period was harvested by longline vessels. Roughly 7 percent was harvested by otter trawl vessels during that period.

This consideration is relevant only to the longline vessels that pursued the tilefish fishery as otter trawl vessels are not excluded from the fishery, but subject to a variable trip limit. Nonetheless, tilefish landed by otter trawl vessels are caught incidentally to other species for which they are conducting a directed fishery. The vast majority of otter trawl vessels land no more than 300 pounds of tilefish on a trip. Consequently, these vessel are active participants in other fisheries from which their owners derive the overwhelming majority of their income.

Roughly one-third of the longline vessels identified as having annual landing of tilefish of 15,000 pounds or more in any one year from 1980 through 1998, had no reported landings after 1987. It is reasonable to assume that the large majority of these vessels were engaged in other fisheries, while a few may have exited the fishery. This conclusion obtains from the fact that the fisheries pursued by longline vessels in the exclusive economic zone at that point in time were either unregulated or open access fisheries, for which their were no qualification requirements to obtain a fishing permit.

The principle obstacle to a longline vessel participating in another fishery is the existence of a limited access permit for which it does not qualify. Limited access permit limitations for species caught by longline were initiated in 1994 with the implementation of the limited access permit for multispecies. Prior to this, the Federal fishery permit for multispecies was an open access permit. Longline vessels that were issued a multispecies permit in 1991 and landed multispecies could qualify for the limited access permit. The other main species of fish pursued with longline gear such as tuna, sharks and swordfish were not managed under a limited access system until 1999, when development of the tilefish FMP was well underway.

Longline vessels that landed some tilefish in 1998, which numbered twenty-seven, also landed a broad spectrum of other species. These other species included: conger eel, sharks (several species), grouper, black sea bass, squirrelfish, anglerfish bluefish, cod, spiny dogfish dolphin fish, escolar, red and white hake, mullets skates, swordfish, tuna (several species), wahoo, cusk, American plaice, witch flounder, haddock, halibut, pollock, redfish, wolffish, king mackerel, wreckfish, opah, cunner, pompano, red snapper, and striped bass. Typically, these vessels landed several other species in addition to tilefish. Only one vessel landed fewer than five species of fish in addition to tilefish. Seven of the longliners landing tilefish in 1998, qualified for a limited access tilefish permit. The other longline vessels, which failed to qualify for a limited access tilefish permit, were active participants in other regulated or unregulated fisheries as reflected by their landings of other species of fish.

The twenty-eight vessels that landed some tilefish in 1992, the year before the control date of June 15, 1993, landed almost exactly the same range of species. Typically, these vessels landed several other species in addition to tilefish. Only seven vessels landed fewer than four species of fish in addition to tilefish. Twelve of the longliners landing tilefish in 1992, qualified for a limited access tilefish permit. The other longline vessels, which failed to qualify for a limited access tilefish permit, were active participants in other regulated or unregulated fisheries as reflected by their landings of other species of fish.

(E) the cultural and social framework relevant to the fishery and any affected fishing communities

The information in the social impact statement and other sections in the FMP need no further supplementation or explanation and are not repeated here.

APPENDIX C. DETAILED DESCRIPTION REGRADING THE EVOLUTION OF COLLABORATIVE MANAGEMENT IN THE TILEFISH FISHERY

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The evolution of collaborative management in the Northeast USA tilefish fishery

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Abstract

This paper explores the evolution of collaborative management in the Northeast, US Tilefish fishery. Through proactive participation in the fisheries management process along with their own internal agreements, the Montauk Tilefish Association members have stopped racing to fish and have become resource managers themselves. This paper explores how social networks and trust has helped this group create a management regime that reduces the race to fish, improves safety at sea and provides a more stable and fresh supply of fish to the market. It also examines the role of the council process and policies in the evolution of this collaborative management regime.

Keywords: Collaborative/decentralized fisheries management; Cooperatives; Montauk Tilefish Association

1. Introduction

Fishermen affect and are affected by the quality and quantity of the stocks they fish. The social and economic impacts of depleting stocks on fishing businesses, families, and communities in the Northeast United States have not been insignificant. Regulatory regimes imposed to reduce fishing pressures have often exacerbated these impacts. In some cases, new regulations have heightened competition between fishery sectors or among stakeholders. In others, stakeholders have viewed cooperation as necessary to improve the viability of their activities and secure their livelihoods. Over the past few years, a variety of groups have organized themselves to become more active in the management process and in the decisions affecting their businesses [1]. In some cases, these initiatives are changing the way fishermen relate to the stocks they depend on as well as to the management process that governs their fishing activities.

This paper provides a case study from the northeast USA of a fishermen's association—the Montauk Tilefish Association (MTA)—that has worked to create and foster a fisheries management regime that is efficient and encourages resource stewardship at the local level. Other important outcomes from this collaboration include fresher fish for the market and a more stable operating environment. The MTA's experience suggests that a high degree of social capital and trust between members can provide a strong foundation for collaborative behavior. However, these social factors alone may not be enough to create long lasting collaborative resource management arrangements. This paper reviews the history of the USA Atlantic coast fishery for tilefish (*Lopholatilus chamaeleonticeps*), the development of the tilefish fishery management plan (FMP), and the evolution of the MTA as inferred from interviews with MTA members. This paper also examines how the MTA has achieved important short-term goals, and presents the positive outcomes of their collaboration. We conclude by highlighting various policy implications related to this experience.

2. Building collaboration

Fisheries management in the USA has frequently been criticized for not doing enough to foster trust between fishermen and government agencies [2,3]. An outcome of

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this lack of trust is the adversarial environment that has been the backdrop for the fisheries management process [4].

Until recently, most fishermen have not played a proactive role in the management process. Although the USA Regional [Marine] Fisheries Management Council system (coupled with the requirements of the National Environmental Policy Act) provide opportunities for participation (through participation in public hearings, membership on advisory committees, submission of written comments, etc.) most of these are limited to passive forms of participation [5].

Improving the quality of participation by fishing groups in the management process is considered by many as essential for achieving more sustainable, equitable and efficient management outcomes [1,6–8]. Collaborative management of marine resources involves shared responsibility between government (or, in this case, the Regional Fishery Management Councils) and fishery stakeholders (such as fishermen). Success also depends on having a clearly stated policy that encourages these types of relationships. In principle, fostering greater participation by stakeholder groups should be a simple task; in practice, such groups need to be ready, willing, and able to assume greater responsibility. Our study suggests that the ability of fishermen to organize themselves to successfully participate in the management process depends, in part, on the existence of social networks and trust among the fishermen involved.

The literature on common property resource theory points to design principals that can be determining factors for the ability of user groups to sustain cooperative behavior over time. Ostrom's [6] by now well-known principals include small group size, effective monitoring and enforcement, and minimal rights to organize among others. Critical too are relationships between resource users, and the relationships between resource users and the government.

Ostrom [6] also identifies the degree of trust and sense of shared identity within a group as important ingredients for successful community resource management. Local-level social capital facilitates such management by providing the social relationships and trust upon which rules and monitoring can be based [9]. Putnam [10, p. 167] defines social capital as 'trust, norms and networks' that facilitate social co-ordination and co-operation for mutual benefit. Social capital generally refers to the institutions, relationships, and norms that shape the quality and quantity of a society's social interactions. Social cohesion is critical for economic prosperity and for sustainable development [6,11,12]. Social capital is not simply the sum of the institutions or individuals underpinning a society, it is the 'glue' that holds them together.

Baland and Platteau [13] assert that government should support communities in areas that complement local capabilities. Such areas include providing a legal framework that legitimizes collaborative arrangements, and furnishing technical assistance or guidance. When relevant, economic incentives for participation and rule compliance should also be considered.

In this paper, we describe a group of vessel owners that, despite the lack of a clear policy framework, have achieved positive social and economic outcomes for group members through their collaborative behavior. Participants in the US Atlantic coast tilefish fishery played a very proactive role in the development of the Tilefish Fishery Management Plan (FMP) prepared by the Mid-Atlantic Fishery Management Council [14]. Tilefish fishermen initiated the development of the FMP and actively participated in the meetings and discussions that eventually led to the Plan's implementation. Within this process, two stakeholder groups emerged, one of which—the MTA—has continued to collaborate in the management process long after the enactment of the FMP. The following sections describe the tilefish fishery, the development of the FMP, and the MTA.

3. The tilefish fishery

The majority of the USA Atlantic tilefish fishery is concentrated in the offshore Mid-Atlantic region between Hudson and Veatch Canyons (see Fig. 1). Tilefish (also known as golden tilefish) inhabit the outer continental shelf from Nova Scotia to South America and are relatively abundant at depths between 80 and 440 m [15]. Tilefish reach lengths of up to 4 feet and live as long as 35 years. They are bottom-dwellers and are generally found around canyons where they dig out large burrows on the ocean floor.

Since the early 1900s, tilefish have been harvested off the Mid-Atlantic and New England coasts using longline gear, and to a lesser extent, otter trawls. After World War II, a trawl fishery developed in New England and accounted for most of the landings through the mid-1960s. In the early 1970s, a directed commercial longline fishery rapidly developed and expanded in the Mid-Atlantic region. In the early 1980s, several New Jersey-based vessels switched to other fisheries such as swordfish. By the late 1980s and early 1990s, participants in the tilefish fishery were primarily from eastern Long Island, NY and had upgraded their vessels and adapted to newer technologies. These larger steel-hulled vessels were more resilient to bad weather and able to steam further offshore. Trip length increased and the fleet became more dedicated to tilefish fishing.

Currently, longline vessels account for more than 80% of the commercial catch of tilefish. Longline vessels typically set between 40 and 45 miles of gear per day, and fish between 4000 and 4500 hooks per day. Gear is set during the day and hauled back at night. Hooks are snapped on by hand, a fairly labor intensive process, and baited with *Illex* squid or frozen mackerel.

Nearly all the tilefish landed in the Northeast region are gutted, iced, and trucked to New York City's Fulton Fish Market for redistribution and sale. Predominately small fish markets in the tri-state area (New York, New Jersey, and Connecticut) buy whole tilefish daily from the Fulton

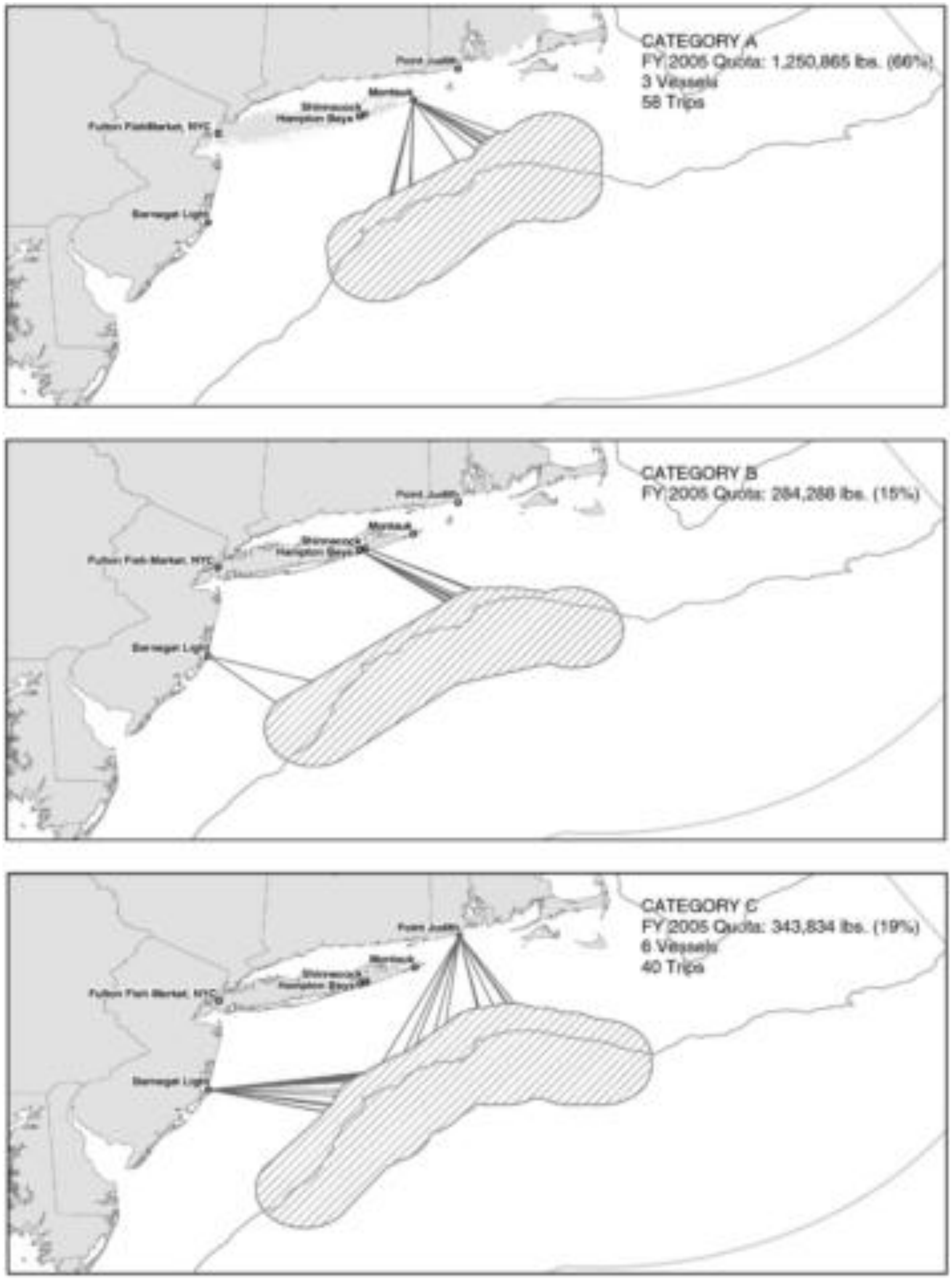

Fig. 1. Geographic distribution of the tilefish fishery during the 2005-fishing year (maps by Charles Fulcher, NEFSC).

Fish Market in 1 or 2 carton quantities (60 or 120 lbs). Tilefish purchased at the retail level is primarily cooked at home for its flaky white-fleshed meat and is sometimes used for sushi. While landings at Long Island, NY are the primary source of tilefish for the Fulton Fish Market (see Fig. 1), other supplies come in from New Jersey, Rhode Island, and Massachusetts. A similar species of tilefish (blueline or gray tilefish: *Caulolatilus microps*), landed predominantly in Port Canaveral, Florida, is also shipped to Fulton and is indistinguishable to the consumer from the golden tilefish.

The ex-vessel price of tilefish tends to be quite sensitive to both the timing and quantity of tilefish landed. When the market is flooded (i.e., if more than 60,000 lbs are landed in one week), prices typically decline as much as \$0.75–\$1.00/pound. Prices also vary according to the size of fish landed, with large or extra large fish bringing the highest prices. Although different sizes bring different prices in the market, vessels will land all the sizes they catch since the survival rate of discarded tilefish is very low. Unmarketable sizes are avoided primarily by using larger hook sizes.

4. Development of the fishery management plan (FMP)

Prior to implementation of the Tilefish FMP on 1 November 2001, the tilefish fishery was an open access fishery. Overfishing was occurring in the fishery and the stock was determined to be in an overfished condition [14]. Fishing trips were about 10 days long and crews sometimes worked up to 22 h/day. Full-time vessels were fishing up to 330 days per year, with vessels coming to port only long enough to land their catch, replace crews, and perform necessary vessel maintenance. As early as 1992, tilefish fishermen lobbied for the development of an FMP for this fishery but the regional council only began this process in 1999 after biological conditions had deteriorated.

The goals of the FMP are to: (a) eliminate/prevent overfishing and rebuild the tilefish stock; (b) prevent overcapitalization in the fishery and limit new entrants; (c) identify and describe essential fish habitat; and (d) collect necessary data to develop, monitor and assess biological, economic and social impacts of management measures designed to prevent overfishing and reduce bycatch in all fisheries. The management unit for the FMP is defined as all tilefish inhabiting US waters north of the Virginia/North Carolina border (tilefish south of this border are managed under the South Atlantic Fishery Management Council's FMP for the Snapper-Grouper Fishery).

To achieve the objectives of the FMP, a suite of management measures was enacted. The principal measures included a 10-year stock rebuilding schedule as required by the Magnuson-Stevens Act for overfished stocks; a commercial quota divided into full-time (with two different tiers), part time, and incidental categories; a trip limit for the incidental category (non-longline); and limited entry for the full-time and part-time quota categories. Although some tilefish fishermen were in favor of using individual transferable quotas (ITQs) as a management tool, the US Congress had imposed a moratorium on implementing any type of individual fishing quotas (IFQ) in US marine fisheries during this time.

Most tilefish vessel owners believed they had a stake in the outcome of the FMP process. The development of the Tilefish FMP provided the impetus for the initial collaboration of different fishery stakeholder groups representing different positions and concerns. One of the groups to emerge from this process was the MTA, a group of four highly active tilefish fishermen all located in Montauk, Long Island, who together accounted for 90% of the total US Northeast Atlantic commercial tilefish landings during 1998–2000. Since all landings were to be reduced under the FMP, the MTA's primary concern was that reductions occurred proportionally across all vessel size categories according to historic landings levels. The MTA did not want to incur what they felt was more than their fair share of the cost of rebuilding.

The Historical Tilefish Coalition (HTC) was also formed during the development of the FMP by approximately 24 fishermen and dealers from Barnegat Light, New Jersey and Hampton Bays, New York. HTC members had developed the longline tilefish fishery during the late 1970s, but by the beginning of the 1980s many Coalition members had left the tilefish fishery to pursue other fisheries. Since limited access programs were becoming increasingly used as a management tool in the Northeast and qualifying criteria were usually based on landings history, the main concern of the HTC was securing future access to the tilefish fishery.

Ultimately, the FMP limited access to the fishery and established an annual total allowable landings (TAL) fishing quota of 1.995 million pounds (905 mt), reducing landings by half in comparison to pre-FMP landings. In developing the qualifying criteria for the limited access program, the Mid-Atlantic Council considered a number of alternatives all of which addressed the need to consider historical participation in the fishery. The FMP qualified 51 vessels, only 9 of which were considered full-time. The Council also adopted a proposal, advanced by present and historic fishery participants, that established three tiers or permit categories (A, B and C)[1] of qualified, limited-access, participants based on tilefish landings during an 11-year (1988–1998) period (See Table 1). Before any of the annual TAL is distributed among the three limited-access permit categories, 5% of the TAL is deducted to reflect the expected incidental bycatch of tilefish in other fisheries and up to 3% of the TAL is set aside for funding tilefish research projects (not yet utilized). Of the remaining 92% of the TAL, 66% is allocated to Category A vessels, 15% to Category B vessels, and 19% to Category C vessels (see Table 1). Also included in the FMP is a provision that a future amendment could revise the limited entry program to allow additional vessels into the fishery based on improvements in stock status. However, the MTA thinks it is very unlikely that the Council will qualify additional vessels into Category A.

Fig. 1 illustrates the land–sea connections for the active tilefish limited access permit holders during the 2005-fishing year. Interestingly, each FMP permit category is geographically differentiated by port or series of ports (See Fig. 1). Category A vessels fish out of Montauk, while Category B vessels fish from Hampton Bays, Long Island and from Barnegat Light, New Jersey. The six active part-time Category C vessels fish from Barnegat Light and Pt Judith, Rhode Island. Although the data used to generate Fig. 1 are for the 2005-fishing year (from 1 November 2004 to 31 October 2005), all permit categories have historically fished in the same geographic areas, along the 50-fathom line.

5. MTA

The MTA is a registered non-profit organization whose objective is to provide an organizational structure for making collective decisions for its members. The MTA also provides members protections under the Fishermen's Collective Marketing Act [16]. Although the MTA does

[1]The FMP refers to these three permit categories as Full-time tier 1, Full-time tier 2, and Part-time, but the National Marine Fisheries Service issued permits under Categories A, B, & C.

Table 1
Qualification criteria per permit category

Permit category	Number of qualifiers	% of quota	Qualification criteria
Category A	4	66	> 250,000 lb of tilefish per year for any 3 years between 1993 and 1998 at least 1 lb of which was landed prior to June 15, 1993
Category B	5	15	> 30,000 lb per year for any of 3 years between 1993 and 1998 at least 1 lb of which was landed prior to 15 June 1993
Category C (part-time)	42	19	10,000 lb of tilefish in any 1 year between 1988 and 1993 and 10,000 lb in any 1 year between 1994 and 1998, or landed 28,000 lb of tilefish in any one year between 1984 and 1993, at least 1 lb of which was landed prior to 15 June 1993

not generate revenue (members share association costs equally—not according to quota share), the individual members of the MTA do generate profit through the sale of tilefish. The collective decisions made by the MTA are intended to enhance the performance of all member businesses.

The MTA was formed so that its members would have a common voice in the development of the FMP. The group supported the introduction of ITQs in the tilefish fishery but this option was unavailable to them due to the national moratorium in place at the time. Given that ITQs were not an option, the MTA felt that if they could be grouped into one permit category they could collaborate with each other to achieve a similar outcome. Ultimately, all four members were grouped into Category A. While this outcome promoted collaboration, other characteristics of the group were as important for fostering collaboration, if not more.

All members live and fish out of Montauk, NY, use the same dock and packing facilities, and have known each other and each other's families for many years. Close social and business ties, coupled with the Category A allocation of the majority of the TAL (66%), provides MTA members with a unique foundation for collaboration. Since the development of the FMP, the four MTA members have continued to work together, cooperate, and coordinate their fishing activities.

From previous experience, the members realized that racing to fish had led to uncertain outcomes, over-investment in fishing inputs, and catching as many fish as quickly as possible. Derby fishing also induced such behavior as fishing in bad weather and delaying needed repairs. Additionally, MTA members acknowledged that derby fishing could lead to shortened fishing seasons, generating shortages and gluts in the market. Members of the MTA noticed that when multiple vessels landed tilefish at the same time, ex-vessel prices dropped. Consumers and fish dealers generally prefer and are willing to pay more for a steady supply of fresh fish. Given these factors, the MTA developed informal arrangements to avoid derby fishing in order to ensure a more stable operating environment.

The FMP did not include any restrictions on how Category A members could fish their quota. As a result, the MTA had many options to choose from in terms of how to collectively harvest their portion of the TAL. For example, the MTA could have simply alternated fishing trips, allocated days-at-sea among members, or subdivided the quota into a number of short seasons, among others. Ultimately, the MTA took an approach that fit the conditions of their organization and fishery. The key element in the MTAs strategy was the division of the Category A TAL among the four members based on the same 11-year period (1988–1998) of tilefish landings used in the FMP. Some further revisions were necessary to finalize the allocations for the vessels with the lowest and highest landings history. Shares ranged from approximately 20–29% of the total Category A catch quota. However, in 2004, subsequent to the implementation of this agreement, one of the MTA members decided to sell his vessel. Two of the three remaining MTA members formed a corporation and purchased the vessel and its Category A landings history. The corporation, as the holder of the landings history from the purchased vessel, then sold the vessel and divided the vessel's share of the Category A quota between the vessels of the two corporation members.

Given the close relationship among MTA members, agreements were made expeditiously and without the aid (and cost) of a lawyer. Decisions concerning allocations of quota were reached via consensus—as are all decisions made by the group. All members signed an allocation agreement, but the members admit this was more of a formality than a necessity as they had agreed to work together during the development of the FMP and had lobbied for the creation of a permit category that would include all four members and thereby create a de facto group allocation (a policy option not formally available).

Absent from the MTA agreement is any formal mechanism (e.g. based on business contract law) with which to enforce the share agreement or to apply sanctions if a member exceeds his agreed share of the quota. To track their landings, MTA fishermen call in their trip totals to one of the members who coordinates the Association's fishing activities. The landings are entered into a ledger and a running total is kept. Given the very small size of the MTA, members feel they "are either all in or all out". Therefore, formal internal enforcement and monitoring of the group is not considered necessary. However, the group is concerned with external enforcement of fishery participants in the other two permit categories as any unlawful behavior by these participants has implications for both the association and the sustainability of the resource.

MTA members coordinate their landing patterns to ensure that multiple vessels do not land within the same week so as to ensure a stable flow of product to the market. Members also try to stay aware of Categories B and C vessel activity to avoid landing fish at the same time as these vessels. Since Categories B and C vessels have continued to derby fish under the FMP, the landings from these fleets generally occur in the early part of the fishing year. However, because each permit category has a separate annual quota, there is no incentive to race for fish between categories. This allows the MTA to delay its landings without fear that vessels in other categories will catch the Association's share. The relationship between the MTA and its primary dealer in Fulton Fish Market is also quite important for staying informed about activity in the market.

When an MTA vessel returns to port, a separately owned packing business near the Association's dock packs the fish in 60-pound cartons and transports them to market. Trips are scheduled so that deliveries can be made on Mondays to enable the dealer to hold fish in cold storage and thus have supply available to sell over the course of a week. MTA fishermen sell their fish on consignment, accepting the best price available to them.

MTA members have not considered pooling their revenues and expenses as is done, for example, in the Chignik Alaskan salmon fishery. Although MTA fishermen enjoy the benefits of cooperation, they wish to continue to maintain their separate businesses. Keeping a balance between cooperation and independence is important to them. While members make collective decisions on many levels, some decisions are made independent of the group. For example, though members have traditionally used the same delivery service, one of the MTA members recently decided to work with another company. This same member has temporarily re-rigged his vessel to participate in other fisheries for part of the fishing year.

Since forming the Association, MTA members have become more involved in cooperative research projects as they now feel they have a financial stake in the health of the stock. Members also collaborate with NMFS in tracking the quota landings in all permit categories. Since they also closely monitor all tilefish shipments into Fulton Fish Market, they make sure that NMFS is getting timely and accurate information.

6. Outcomes of cooperation

Cooperation among MTA members has resulted in a number of positive outcomes including improved safety conditions, improved product quality, and a more stable operating environment. A steady supply of fresh fish is now available to consumers who previously experienced periods of product unavailability or of lower quality. This steady flow also benefits fish dealers since they can be more confident about future supplies, avoid market gluts, make longer-range business plans, and explore new market niches. Fresher fish translates into higher prices. The higher prices do not result from withholding product from the market, since the MTA annually lands the entire Category A quota. Rather, the higher prices result from meeting consumer needs and providing a higher quality product.

Current FMP regulations require the owner or operator of any vessel having a tilefish permit to submit a landings report via the Interactive Voice Response (IVR) system within 24 h after a vessel returns to port. Figs. 2 and 3 (based on the IVR data) illustrate how fishing behavior and strategy differ between Categories A and C vessels. Category A vessels (i.e., the MTA vessels) spread their landings evenly over the year, while Category C vessels take their quota early in the fishing year. In the 2005-fishing year, Category C vessels attained their quota in four and a half months, resulting in a prohibition on landing tilefish by these vessels for the remainder of the fishing year (until 1 November 2005). Category B landings cannot be reported for confidentiality reasons. However, these vessels also engaged in a race for fish, resulting in the closure of their fishery within 8 months. MTA vessels have never exceeded their Category A allocation (except by 193 pounds in 2005), have not had to shorten their fishing season, and have always maintained their share agreements.

Fishing has also become safer for MTA members. If the weather is bad or a piece of equipment vital to the safe operation of a vessel is broken, a trip can be postponed until weather improves or repairs made without fear of 'losing' catch to someone else. MTA fishermen no longer need to invest in equipment or fishing power that is necessary only to catch fish faster.

As highlighted in the previous section, one of the benefits of building on existing social capital and informal agreements is that the transaction costs of doing business are low. MTA members have benefited from their Association without having to invest heavily in legal fees, enforcement, and formal monitoring mechanisms.

7. The future of tilefish management and the MTA

Amendment 1 of the Tilefish FMP is currently under development and includes a proposal to consider an ITQ program. Not only has the Congressional moratorium on IFQ's been lifted but market-based management is now being encouraged by the administration [17]. Given these new opportunities, the MTA are likely to rethink the current arrangement and hope to formalize it through the council process.

Despite the success of its informal agreements, the MTA still sees ITQs as a desired outcome of the management process. Members feel that ITQ's will provide them with more security, flexibility and control and that their future fishing rights will be better protected. Additionally, while

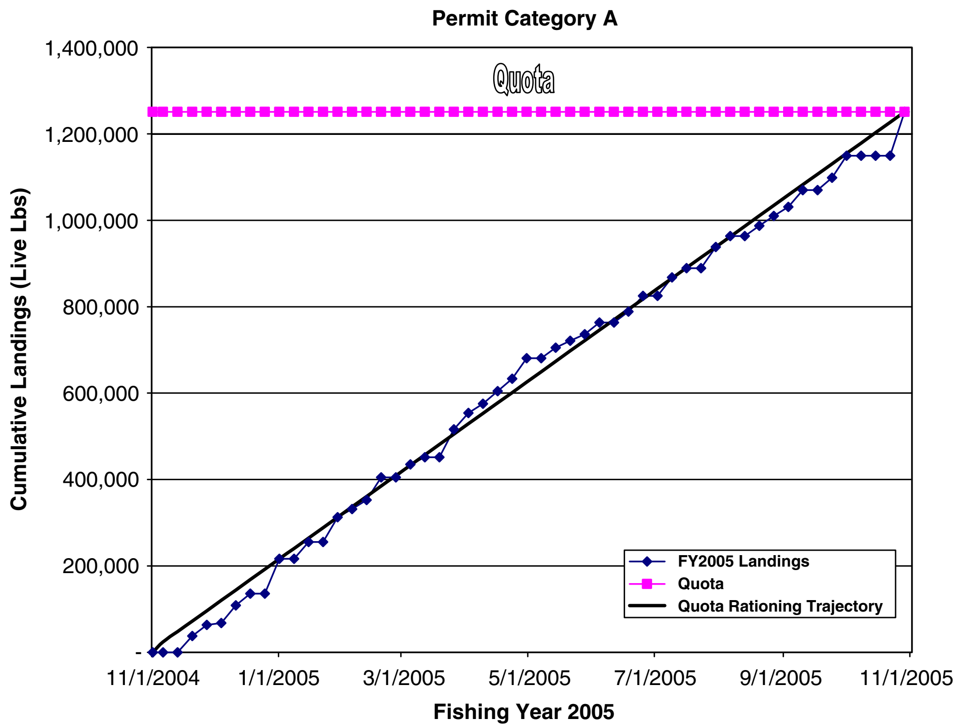

Fig. 2. Category A landings and quota.

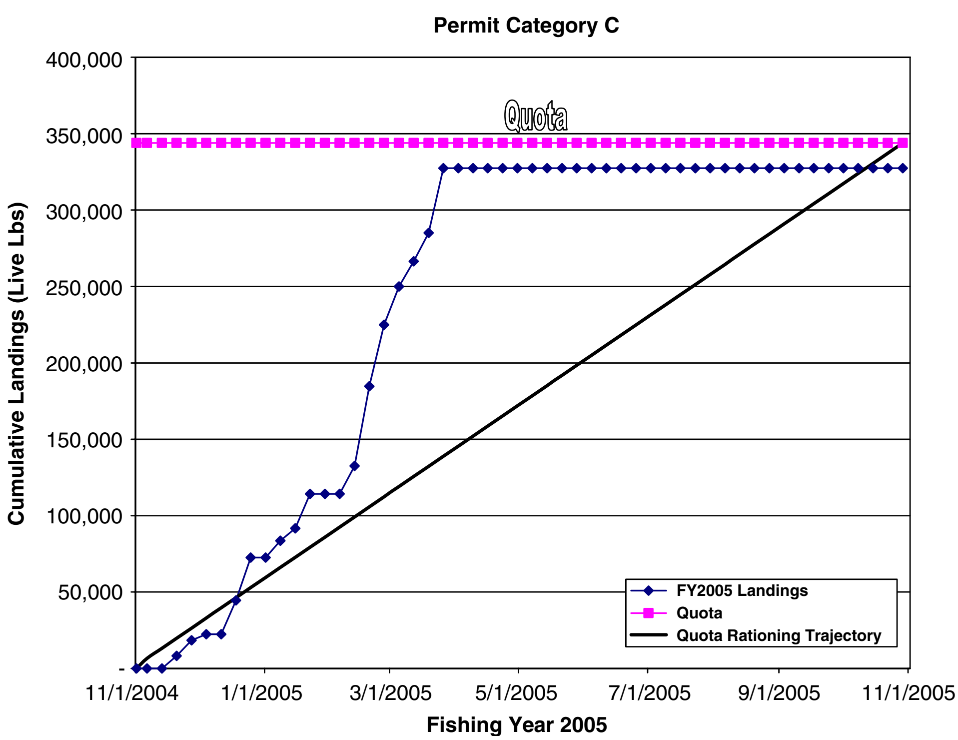

Fig. 3. Category C landings and quota.

MTA members can currently trade quotas among themselves within their agreement, it is unclear how this might affect a vessel's future catch share in a management system that relies heavily on landings history in making allocation decisions. ITQs may also allow the MTA to purchase quota from vessel owners in the other two permit categories, which currently is not possible.

The MTA also feels that ITQs would help resolve some of the uncertainties that would arise if one of their members wanted to leave or decided to break the internal agreement. While this particular issue could be resolved internally through the use of private business contracts, the MTA feels that ITQs achieve the same result without the additional expense, planning, and negotiating. Additionally, the MTA members who bought out the fourth member are concerned about the status of the fishing history associated with the purchased vessel. Even though NMFS provided them official documentation confirming their ownership of the fishing history associated with this vessel, the new owners are uncertain how tenable that history is if the original vessel that was sold is not fishing for tilefish. In their minds, they see ITQs as a way of resolving some of these uncertainties.

8. Conclusions/policy implications

The tilefish fishery is a small and relatively uncomplicated fishery. There are few participants and simple marketing structures. Nevertheless, its history encapsulates a process that is common in many fisheries in the Northeast region and beyond. Prior to the introduction to the FMP the tilefish fishery was an open access fishery. Not surprisingly, overfishing was occurring and the resource became overfished. Fishermen were seeing diminishing returns from their efforts and experiencing other negative impacts (longer hours, longer trips, etc.) as a result of the continuing degradation of the resource.

The FMP introduced regulations (TAC, limited access) to halt the degradation of the tilefish resource. However, like in so many fisheries, significantly reducing landings came at significant social and economic costs to fishery participants and their families. Not only could less fish be harvested but new measures did not (in and of themselves) change the relationship among harvesters that had led to suboptimal outcomes in the fishery before the FMP (derby fishing, market flooding, etc.). Nevertheless, limiting access and creating a system of quota categories (a proposal initiated by participants), did provide fishermen with the possibility of building on the FMP and introducing additional (informal) management measures. The MTA took advantage of this opportunity and crafted an internal agreement that eliminated the race to fish, and helped their fishing businesses stay viable under the new regulations. Interviews with MTA members reveal that while the FMP helped secure the future of the resource, the MTA and the informal institutions they developed helped secure the livelihoods for the Montauk tilefish fishermen.

The MTA benefited from a number of social characteristics that facilitated cooperation including social capital and trust between members, small group size and others. Additionally, getting involved early and participating in the development and preparation of the Tilefish FMP also improved their chances of success. These attributes may or may not be applicable to other groups seeking similar outcomes. For example, although other tilefish harvest sectors exhibited some of these same qualities they have not as of yet organized themselves to avoid sub-optimal outcomes (i.e., derby fishing).

In addition to securing the livelihoods of the tilefish fishermen, this process also transformed their relationship with the resource. Since the 1990s, MTA members have accounted for the vast majority of tilefish landings in the Northeast. Given this, before the introduction of the FMP, they inevitably played a significant role in the depletion of the resource. Since the introduction of the FMP and informal management measures, they have gone from being a threat to the resource to being the stewards and managers of the resource. They now see a direct connection between their actions and the quality of the resource and their livelihoods and have the means to control these outcomes. The development of these informal institutions has also created a different relationship to the management process that most fishermen do not enjoy—they are no longer passive actors in the management process and are now proactive participants in the process of designing relevant management institutions and helping to rebuild the resource.

Collaboration has helped MTA members achieve their management and business planning objectives given the available opportunities. Although ITQs were not a management option at the time the Tilefish FMP was being developed, the MTA recreated ITQ elements that they wanted by crafting a contractual agreement that divided the Category A quota among its four members. The MTA also included additional features in their internal agreement to gain further benefits and to balance independence with important elements of collaboration. If ITQs are implemented, they would initially supplant the MTA's current quota-division agreement. However, members say they would continue to stagger landings in order to maintain the market benefits.

Achieving a balance between cooperation versus independence has been the key for maximizing benefits to MTA members. While Association members have acted independently to determine some aspects of their harvesting strategy, they have collaborated on other levels to achieve greater benefits. Collaboration among members has generated benefits that would not have been possible via Council actions.

The MTA experience is significant for fisheries management as many of the positive outcomes achieved by the Association were the result of decisions made outside the management process. This suggests that some management decisions are often best made at a local level. As such, it is critical to promote the development of opportunities for more decentralized management structures that can lead to decisions that reduce transaction costs, improve resource stewardship, and make governance structures more relevant and adaptable.

The MTA example also illustrates the importance of having a clearly stated and proactive policy on decentralized management if, in fact, that is the intention of fisheries managers. This is illustrated by the MTA's desire to pursue ITQs in reaction to the management uncertainties described above. It seems counter-intuitive that, even though the MTA members successfully manage their allocation of quota, they prefer ITQs. With clearer guidelines and a more deliberate position on decentralized management by fisheries managers, one wonders if this would still be the case. Certainly, ITQs may be the optimal management tool for this fishery but if implemented, a group such as the MTA looses the flexibility to change its management strategy if conditions change. Given assurances that rules would not arbitrarily change and the government supports shared management arrangements (in the form of manuals, policy document, and trainings), groups like the MTA might welcome the flexibility to change their quota management strategies.

Acknowledgments

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APPENDIX D. RESEARCH AND INFORMATION NEEDS

Research and information needs for tilefish have been suggested in several different documents. The first list of research needs provided here was suggested in the source document entitled "Essential Fish Habitat Source Document: Tilefish, *Lopholatilus chamaeleonticeps*, Life History and Habitat Characteristics" (Steimle et al. 1999, Appendix F). Updates to the information contained in this document were provided in an update memo in 2005 entitled "Essential Fish Habitat Source Document Update Memo: Tilefish, *Lopholatilus chamaeleonticeps*, Life History and Habitat Characteristics" (Steimle et al. 2005, Appendix F). This update included three additional research recommendations which are provided in the second list. Electronic versions of the source document and update memo are available at the following website: http://www.nefsc.noaa.gov/nefsc/habitat/efh/
Full citations to the literature referenced below can be found in that document.

In addition, the 41st Northeast Regional Stock Assessment Workshop (41st SAW) Assessment Report provided a list of research recommendations. The Science and Statistical committee (1999) also produced a list of research needs for tilefish. Both lists of their recommendations are also provided.

Steimle et al. (1999) Research Needs:

- Are tilefish protogynous (a size-related sex change from female to male) at pre-maturation (Dooley 1978; Idelberger 1985; Grimes et al. 1988)? If so, how is it affected by the social structure of a local population (sex ratio of mature fish) and how is that affected by fishing?
- Do tilefish off southern New England and Georges Bank leave suitable habitats during the winter and where do they go (Grimes et al. 1986)?
- Assume that the boundaries of tilefish habitat are flexible and dictated by physical (sediments, shelter, temperature), biological (burrow builders, prey, competition, recruitment), and fishery (stock size, harvest intensity, and population size structure) processes. Can a probabilistic model be developed that identifies the size and shape of suitable habitat (after Warner 1987)?
- Are adult male tilefish territorial? If so, how does the removal by the fishery of large, dominant males effect the social structure of a local population (Grimes et al. 1988)?
- If vertical burrows, the primary habitat of tilefish according to Able et al. (1982) and Grimes et al.(1986), are filled with loose sediments because of intensive trawling (Churchill 1989), offshore sediment disposal, or a major storm, can the burrows be cleared and reused by the tilefish? By other organisms?
- What degree of symbiosis or mutualism exists between tilefish and other developers/users of burrow habitats; e.g., galatheid crabs (Grimes et al. 1987)?
- Do tilefish form long-term associations with individuals of the opposite sex (pair bonds) (Grimes et al. 1986)? How does harvesting affect the social structure and breeding potential of the population?
- Peak activity and feeding in tilefish has been reported to be daytime (Freeman and Turner 1977) or nighttime (Grimes et al. 1987). Peak activity and feeding are usually coincident (for energetic reasons) unless feeding grounds are well away from resting grounds; why the difference in conclusions?
- The Katz et al. (1983) study of stock identification between the Middle and South Atlantic Bights did not examine tilefish between Toms Canyon (south of Hudson Canyon) and the border between North Carolina and South Carolina. Do tilefish from near Cape Hatteras (e.g., Norfolk Canyon) support separating the population into two biologically distinct stocks?
- More information on the age structure of the population in different years is needed to improve estimates of mortality rate and to determine sexual differences in mortality rate (Turner et al. 1983).

- The attributes of habitat that trigger larval tilefish settlement and juvenile transition are unknown. These are especially important for recruitment and maintenance of local, non-migratory populations.
- The range of environmental parameters for tilefish egg survival and development are unknown.
- Are tilefish affected by the relatively low levels of anthropogenic contaminants that are in their tissues (Steimle et al. 1996)?
- Do juvenile tilefish aggregate in certain areas? If so, where and what are the habitat characteristics (Freeman and Turner 1977)?
- Does the oxygen minimum band on the upper slope affect tilefish distribution?
- Is tilefish cannibalism caused by inadequate shelter habitat for small juveniles or the territoriality of adults? If so, can juvenile shelter and survival be increased artificially?
- Do juveniles tolerate lower temperatures than adults?

Steimle et al. (2005) Research Needs:

- Coleman and Williams (2002) suggest important ecological roles for tilefish, but offer no new data in support of their arguments. To what degree does the activity of tilefish contribute to system biodiversity? What is the role of their burrowing in carbon cycling?
- There is a strong spatial overlap between tilefish and a variety of other resource species that migrate to the outer shelf to overwinter. However, as a result of the difficulty in sampling during winter, no detailed investigations of tilefish habitats have been conducted in that season. How do tilefish interact with other overwintering resource species, especially those like black sea bass that may be seeking habitats containing structured shelters?
- Stock assessment for tilefish is based primarily on fisheries-independent surveys using trawl gear, but this method is very inefficient for capturing this species. Some progress was been made in identifying and quantifying tilefish burrows using side scan sonar on the east coast (Able et al. 1987a) and in the Gulf of Mexico (Scanlon et al. 2002). How could side scan or other acoustic or more recent optical scanning methods (Yoklavich et al. 2002) be employed as an aid to assess the northeast U.S. stock?

41st SAW Research Needs:

- Conduct a hook selectivity study to determine partial recruitment changes with hook size. Determine catch rates by hook size. Update data on growth, maturity, size structure, and sex ratios at length.
- Collect data on spatial distribution and population size structure. This can help answer the question of the existence of a possible dome shaped partial recruitment pattern where larger fish are less vulnerable to the fishery due to spatial segregation by size.
- Continue to develop the forward projecting catch-length model as additional length data becomes available. Investigate the influence of adding a tuning index of abundance and model estimated partial recruitment (logistic) to the catch-length model.
- Collect appropriate effort metrics (number and size of hooks, length of main line, soak time, time of day, area fished) on a haul basis to estimate commercial CPUE.
- Initiate a study to examine the effects of density dependence on life history parameters between the 1978-82 period and present.
- Increased observer coverage in the tilefish fishery to obtain additional length data.
- Develop a bioeconomic model to calculate maximum economic yield per recruit.

Science and Statistical Committee (1999) Research Needs:

- Ensure that market category distributions accurately reflect the landings.
- Ensure that length frequency sampling is proportional to landings by market category.
- Increase and ensure adequate length sampling coverage of the fishery.

- Update age- and length- weight relationships.
- Update the maturity-at-age, weight-at-age, and partial recruitment patterns.
- Develop fork length to total length conversion factors for the estimation of total length to weight relationships.
- Incorporate auxiliary data to estimate r independent of the ASPIC model.

APPENDIX E. GEAR EFFECTS EVALUATION, OVERLAP ANALYSIS, AND THE DEVELOPMENT OF EFH RELATED ALTERNATIVES

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1.0 Fishing Impacts on Habitat (Gear Effects Evaluation)

To minimize to the extent practicable adverse effects on EFH, as required by the Magnuson Stevens Act / EFH Provisions (50 CFR Part 600.815 (a)(2)), it is necessary to summarize the information available on the impacts of fishing gears in the tilefish (*Lopholatilus chamaeleonticeps*) fishery. This evaluation should include any information available on the intensity, extent, and frequency of impacts to EFH, as well as identify the habitat functions that may be impacted by these activities. Based on analysis given in section 1.3 of this appendix, about 89% of the tilefish landings were taken using long-lines set with hooks and 9% of landings were taken using bottom otter trawls for fish (Table A1). As stated in section 1.3 of this appendix, no other gear had any significant commercial landings with minimal catches reported for dredge (other), lobster pot/traps, and gillnets (Table A1). Therefore, the following discussion will focus on summarizing the literature available on potential impact on EFH relative to these fishing gear categories where gear specific information on impacts is unavailable.

NMFS compiled available information on the impacts of fishing gears on marine habitats in the Northeast region of the United States in the "Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat" (Stevenson et al. 2004). The results of this report provide the basis for the following summary of fishing gear effects that describes both generalized effects and those specific to the gear types used in this fishery.

1.1 General Impacts of Fishing on Habitat

The effects of fishing gear on habitat have been addressed in a number of scientific reviews, with several types of gear effects being identified including the alteration of physical structure, sediment suspension, chemical modification, change to benthic community, and ecosystem effects (McAllister 1991; ICES 1992; Jennings and Kaiser

1998; Auster and Langton 1999; Blaber et al. 2000; Collie et al. 2000). These studies suggest it is important to consider the long-term and short-term effects of fishing gear on the environment.

Fishing gear can impact the physical structure of habitat by scraping, ploughing, burying mounds, smoothing sand ripples, removing stones, dragging and turning boulders, eliminating structure providing taxa, and eliminating or damaging submerged aquatic vegetation (Fonseca et al. 1984; Messieh et al. 1991; Black and Parry 1994; Gordon et al. 1998; Kaiser et al. 1998; Lindeboom and deGroot 1998; Schwinghamer et al. 1998; Auster and Langton 1999; Kaiser et al. 1999; Ardrizzone et al. 2000). Physical alterations may reduce the heterogeneity of the sediment surface, alter sediment texture, and reduce the structured habitat available to biota. The magnitude and duration of physical alteration varies with fishing gear types and habitat or sediment types.

Sediment suspension (turbidity), which occurs as fishing gears are dragged across the bottom, can cause reduced light penetration in the water column, smother benthic species and spawning areas, and negatively effects feeding and metabolic rates of organisms. It can also affect regional nutrient budgets by burying fresh organic matter or exposing deep anaerobic sediments. Re-suspension over a large enough area can actually cause large scale redistribution of sediments (Messieh et al. 1991; Black and Parry 1994). In addition, species reaction to turbidity depends on life history characteristics of the species. Mobile organisms can move out of the affected area and quickly return once the disturbance dissipates (Simenstad 1990; Coen 1995), while sessile benthic organisms cannot. Even if species experience high mortality within the affected area, those with short life history stages, high levels of recruitment, and high mobility can repopulate the affected area quickly. However, if effects are protracted and occur over a large area, recovery through recruitment or immigration may be hampered. Furthermore, chronic resuspension of sediments may lead to shifts in species composition, by favoring rapid colonists or those that can take advantage of the pulsed nutrient supply released from the seafloor to the euphotic zone (Churchill 1989).

Alteration of the chemical composition of both the sediments and overlying water mass can occur through mixing of sediments with overlaying waters. In shallow water this mixing might be insignificant relative to tides, storm surge, and wave action, but in deeper, stable waters this mixing can have significant effects (Rumohr 1989). It remains unclear how the alteration of sediment and water chemistry may impact fish populations. When nutrients supplies are low, the effective mixing of sediments could cause increased phytoplankton primary productivity and/or eutrophication (Rjinsdorp and Van Leeuwen 1996). Alternatively, ICES (1992) concluded pulses of nutrients are compensated by lower fluxes after the trawl has passed, and nutrient releases due to fishing gear activity that simply recycle existing nutrients are probably less influential than new inputs, such as from rivers and land runoff (ICES 1992).

Fishing impacts on benthic species depend on life history, ecology and physical characteristics of the species in question (Bergman and Van Santbrink 2000). Mobile species that exhibit high fecundity and rapid generation time will recover more quickly than sessile, slow-growing species. Species such as mollusks and crustaceans are also vulnerable to bottom-tending gear impacts because of potential damage to their hard parts. Thin shelled bivalves and starfish show higher damage than solid-shelled bivalves in fished areas (Rumohr and Krost 1991). Species which retract into the sediments or reside below the penetration depth of the fishing gear will typically sustain less damage than epibenthic organisms. Species that are more elastic (flexible) will suffer much less damage than those that are hard and inflexible (Eno et al. 2001).

Increased fishing pressure can also lead to redistribution of species, either away from or towards the fished area (Kaiser and Spencer 1993, 1996; Ramsay et al. 1996; Kaiser and Ramsay 1997; Morgan et al. 1997; Ramsay et al. 1998; Bradshaw et al. 2000; Demestre et al. 2000). Opportunistic feeders may, however, be attracted to areas disturbed by mobile fishing gear (Kaiser and Spencer 1994; Frid and Hall 1999).

The roles the alterations of physical structure, sediment suspension, chemical modifications, and changes to benthic community have on the production of many important finfish species is in many cases unknown. However, increasing empirical observations and modeling suggests that effects can indeed be seen in population responses. The data on this subject are somewhat limited and therefore in 2002, at the request of NMFS, the National Research Council evaluated the effects of trawling and dredging on seafloor habitats (NRC 2002). This NRC report provides a series of recommendations to improve our understanding of the effects of fishing on benthic habitats.

While many of the studies described throughout this section focus on specific aspects of gear impacts on seafloor habitats, most agree that there is some alteration of habitat, which in many cases are negative. It remains important to consider the long-term and short-term effects of fishing gear on structural components of habitat, community structure, and ecosystem processes, as well as the implications of these effects for management (Auster and Langton 1999).

1.2 Gear-Specific Impacts on Habitat

Stevenson et al. (2004) reviews the impacts of specific fishing gear utilized within the Northeast region, and their potential impacts on marine habitat types typical of the Northeast Shelf Ecosystem. The following paragraph summarizes the findings of this report as it applies to the fishing gears that contact the bottom habitat and are used in the tilefish fishery.

In studies examining the effect of bottom otter trawling on a variety of substrate types, it was demonstrated that the physical effects of trawl doors contacting the bottom produced furrows and some shifts in surface sediment composition, although there is a large variation in the duration of these impacts. Typically the more dynamic environment and less structured bottom composition, the shorter the duration of impact. This type of fishing was demonstrated to have some effects on composition and biomass of benthic species in the effected areas, but the directionality and duration of these effects varied by study and substrate types.

1.3 Gear Impacts of the Tilefish Fishery on EFH

Pursuant to the Magnuson Stevens Act / EFH Provisions (50 CFR Part 610.815(a)(2)), it is mandated that an evaluation of the potential adverse effects of fishing for tilefish on EFH designated under the FMP, including the effects of each fishing activity regulated under other Federal FMPs. This evaluation should consider the effects of each fishing activity occurring in the fishery for the managed resource on each type of habitat found within designated EFH. It should develop conclusions as to the whether EFH is being impacted, and if so how it is being impacted, based on examination of the distribution of fishing effort and all relevant information on the subject. The evaluation should also consider the cumulative effects of multiple fishing activities on EFH. The evaluation provided in this section satisfies these requirements.

The management of many different fisheries within the Northeast region falls within the jurisdiction of the New England and mid-Atlantic Fishery Management Councils, as well individual states from Maine through North Carolina under the jurisdiction of the Atlantic States Marine Fisheries Commission. Therefore all gear types within this region are considered in this evaluation. Within this region, sixty different categories of fishing gear were identified as being used in estuaries and bays, coastal waters (0 to 3 miles) and offshore waters of the EEZ (3 to 200 miles) based on 1999 NMFS commercial fisheries landings data for all managed species (Stephan et al. 2000). Of those gears identified by Stephan et al. (2000), 42 are known to contact the seabed. Descriptions of each of these gears are provided in a report by Stevenson et al. (2004) entitled "Characterization of The Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat".

To determine which of these gears are used in directed fishery for tilefish fishery, the percentage of landings from directed trips were described by gear using dealer data (1996 through 2005; Table A1). Directed trips for tilefish were defined as trips comprising 75% or more by weight of tilefish landed. These definitions identified the gears that contribute to the majority of the landings. Dealer reports are required for all federally permitted dealers. In the case of tilefish, the fishery is prosecuted exclusively in Federal waters. Upon examination of the cumulative landings from directed trips, about 89% of the tilefish landings were taken using long-lines set with hooks and 9% of landings were taken using bottom otter trawls – fish (Table A1). As stated in section 6.1 of this EIS, no other gear had any significant commercial landings with minimal catches reported for dredge (other), lobster pot/traps, and gillnets (Table A1).

Table A1. Tilefish commercial landings ('000 lb live weight) by gear, Maine through Virginia, 1996-2005 combined.

Gear	Pounds	Percent
Otter Trawl Bottom, Fish	1,973	9
Otter Trawl Bottom, Scallop	*	*
Otter Trawl Bottom, Shrimp	*	*
Otter Trawl Bottom, Other	*	*
Otter Trawl, Midwater	*	*
Gillnet, Drift, Other	88	*
Pots and Traps, Lobster, Inshore/Offshore Combined	26	*
Pots and Traps, Fish/Other Combined	9	*
Lines Hand, Other	179	*
Lines Long Set with Hooks	19,501	89
Lines Trawl, Other	6	*
Dredge Scallop, Sea	*	*
Dredge, Other	4	*
Unknown, Other Combined Gears	132	*
All Gear	21,918	100

Note: * = less than 1,000 pounds or less than 1%.
Source: NMFS unpublished dealer data.

General descriptions of the two primary gears used in the tilefish commercial fishery are provided below, although additional description of these gears and other gears used in the Northeast can be found in the NOAA technical memorandum entitled "Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat" and the "Workshop on the Effects of Fishing Gear on Marine Habitats off the Northeastern United States October 23-25, 2001 Boston, Massachusetts" (Stevenson et al. 2004; NREFHSC 2002; respectively). The following provides descriptions of these two gear types and a generalized discussion of potential impacts from each gear type.

Bottom-Tending Mobile Gears

Otter Trawls: Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function may be defined by the part of the water column where the trawl operates (e.g., bottom) or by the species that it targets (Hayes 1983). There is a wide range of otter trawl types used in the NMFS Northeast Region because of the diversity of fisheries prosecuted and bottom types encountered in the region (NMFS 2002). The specific gear design used is often a result of the target species (whether they are found on or off the bottom) as well as the composition of the bottom (smooth versus rough and soft versus hard). There are several components of the otter trawl that come in contact with the sea bottom: the doors, the ground cables and bridles which attach the doors to the wings of the net, and the sweep (or foot-rope) which runs along the bottom of the net mouth. Bottom trawls are towed at a variety of speeds, but average about 5.5 km/hr (3 knots or nmi/hr).

The traditional otter board is a flat, rectangular wood structure with steel fittings and a steel "shoe" along the bottom, which prevents the bottom of the door from damage and wear as it drags over the bottom. Other types include the V type (steel), polyvalent (steel), oval (wood), and slotted spherical otter board (steel; Sainsbury 1996). It is the spreading action of the doors resulting from the angle at which they are mounted that creates the hydrodynamic forces needed to push them apart. These forces also push them down towards the sea floor. On fine grained sediments, the doors also function to create a silt cloud that aids in herding fish into the mouth of the net (Carr and Milliken 1998). In shallow waters, lightweight doors are typically used to ensure that the doors and the net spread fully. In these cases, light, foam filled doors can be used (Sainsbury 1996). Vessels fishing large nets in deeper water require very large spreading forces from the doors. In these cases, a 15 m^2 (49 ft^2) V-door weighing 640 kg (1480 lb) can provide 9 metric tons of spreading force (Sainsbury 1996).

Bottom-tending otter trawls harvested approximately 1.973 million lb live weight, or 9% of the tilefish landings, during the 10-year period, 1996-2005 (Table A1). A directed otter trawl fishery for tilefish was initiated in the late 1940s, but competition and market conditions caused this fishery to cease by the late 1960s (Freeman and Turner 1977). Tilefish are also an important component of the bycatch in the groundfish fishery, particularly for offshore hake, as well as the squid, mackerel, butterfish fisheries. According to a NMFS port agent in Rhode Island (Chiarella pers. comm. 2006), most of the Rhode Island's tilefish commercial landings are a bycatch from the squid fishery in the Hudson Canyon.

Pelagic Longline

Longline: The general design of the longline is simple, consisting of a main line with a number hooks attached. Main lines are coiled without hooks on a drum until deployed; each end of the main line is attached to an anchor line and fitted with a surface float when deployed. Longlines may be fished at the surface, bottom, or intermediate depths. An advantage of longlines is that few men are needed to work a large number of hooks that can be fished over a wide geographic area (Stansby 1963). Tilefish longlines are typically coiled on a drum. The longline is fair-led off the drum and the hooks are snapped onto the line at specified intervals depending upon fishing conditions. During haul-back, the longline is fair-led back to the drum as the hooks are unsnapped (L. Nolan pers. comm. 2000). This gear is the principal commercial harvest method accounting for approximately 19.501 million lb (live weight) of tilefish landed, or approximately 89% of the total tilefish landings during the 10-year period, 1996-2005 (Table A1).

This gear has minimal detectable impacts to marine habitats. Longlines modify the structural component of the habitat, but the impacts are short-term and temporary. Additionally, deployment and retrieval of anchors result in minimal disturbance to bottom sediments; effects (e.g., increased turbidity) are minimal and ephemeral. Because of the limited length of time this gear is deployed, effects at the community and ecosystem levels are not detectable.

Conclusions

Based on examination of research studies of gear effects on habitat described in section 1.2, bottom-tending mobile gears (specifically bottom otter trawling) in the tilefish directed fishery is the only gear type expected to impact bottom habitat or EFH. Bottom otter trawls, however, constitute a small proportion of landings and trips in the directed tilefish fishery; therefore, widespread impacts from bottom otter trawls are not expected. Specifically, only 7 directed trips, trips where tilefish constituted 75% or more of the total landings, in three ten minute square areas were taken over the 1996-2005 time period based on VTR data. This indicates that most landings of tilefish with bottom otter trawl (fish) are incidental, and tilefish are not being specifically targeted with this gear. The dominant gear type in the tilefish fishery is bottom long-lines set with hooks, which constitutes 89% of the landings and is not associated with impacts to bottom habitat or EFH.

While impacts to habitat from tilefish directed fishing are not anticipated, there may be potential for other fisheries using these bottom trawling gears to impact tilefish habitat and EFH. The Northeast Region EFH Steering Committee Workshop (NREFHSC 2002; Stevenson et al. 2004) concluded that there was potential for a high degree of impact to the physical structure of hard clay outcroppings (pueblo village habitats) by trawls that would result in a change to the major physical feature that provides shelter for tilefish habitat. In addition, Stevenson et al. (2004) indicated that juvenile and adult tilefish EFH have no vulnerability to clam dredges, and a low vulnerability to New Bedford style scallop dredges, pots/traps, and sink gill nets and bottom longlines. Pots/traps, sink gill nets, and bottom longlines, all of which are fixed gear types, have fewer or minimal detectable impacts to marine habitats when compared with bottom tending mobile gears (Barnette 2001; Chuenpagee et al. 2003; Morgan and Chuenpagee 2003; Dayton et al. 2002). Vessel monitoring data indicate that scallop dredges may only operate to a small extent in areas overlapping tilefish EFH (Stevenson et al. 2004). In addition, a large scale sea scallop study in the Mid-Atlantic Bight indicated that no sea scallop recruitment was seen at depths greater than 85 m (279 ft), and sea scallop recruitment rapidly declined from a peak at about 60 m depth (197 ft), to very low recruitment beyond 75 m (246 ft) in the Mid-Atlantic Bight (Hart 2006). Hart (2006) indicates that the sand star may be a dominant component of the benthic community that is capable of excluding sea scallops from those deeper areas.

Able and Muzeni (2002) did not find evidence of impacts of otter trawling on tilefish habitat. They concluded the greater impact on habitat resulted from the longline fishery for tilefish, through removal of tilefish thus preventing those burrows from being maintained. In addition, (Guida et al. unpublished report) did not find conclusive evidence of impacts of trawling on tilefish habitat and the benthic community. However, given the concern for this specific highly vulnerable habitat type, measures to mitigate potential impacts of trawling on tilefish EFH and HAPC are being considered.

1.4 Gear Impacts of Other Fisheries on Tilefish EFH

1.4.1 Impacts Analysis

Fishing Activity of Concern

In section 1.3 above, it was concluded that the primary fishing gear used in directed trips for tilefish that account for 89% of the cumulative landings was pelagic long-lines set with hooks. This primary gear is believed to be characteristic of the directed fishery, based on the steps taken to define directed trips that accounted for the vast majority of the landings using dealer data from 1996 through 2005. However, while impacts to habitat from tilefish directed fishing are not anticipated, there may be potential for other fisheries using these bottom trawling gears to impact tilefish EFH, as well as habitat for other species. Bottom otter trawls in the Northeast are used to catch many federally managed species in the Northeast Region (Table A2; Stevenson et al. 2004). This gear type is used in inshore coastal areas, estuaries and bays, and offshore in the federally-managed waters of the EEZ (3 to 200 mi). The vulnerability of the EFH for individual life stages to bottom otter trawling is given in Table A3 (Stevenson et al. 2004). As shown, juvenile and adult tilefish are considered to be highly vulnerable to bottom otter trawling activity, therefore those life stages are the focus of the overlap analysis presented below which will examine bottom otter trawling fishing effort relative to tilefish EFH.

Table A2. Summary of federally-managed species in the Northeast Region that were landed by bottom otter trawls (fish), excluding highly migratory species (i.e., tuna, sharks, billfish, swordfish), in 2004. Source: Stevenson et al. (2004)

Federally-managed species (common names and groupings)		
American plaice	Haddock	Skates
Atlantic cod	Hake: Red, White, Silver	Spanish mackerel
Atlantic halibut	King mackerel	Spiny dogfish
Atlantic herring	Longfin inshore squid	Summer flounder
Atlantic mackerel	Northern shortfin squid	Tilefish
Black sea bass	Ocean pout	Windowpane flounder
Bluefish	Pollock	Winter flounder
Butterfish	Redfish	Witch flounder
Cobia	Scup	Yellowtail
Goosefish	Sea scallop	

Table A3. The vulnerability of Northeast and Mid-Atlantic Federally-managed species, by life stage, to bottom otter trawling. (E=Egg, L=Larvae, J=Juvenile, A=Adult, SA=Spawning Adult).

Species	High Impact	Medium Impact	Low Impact	No Impact	Not Applicable
American plaice	A, SA	J			E, L
Atlantic cod		A, SA	J		E, L
Atlantic halibut		J, A, SA		E	L
Atlantic Herring			E, SA		L, J, A
Atlantic Mackerel					E, L, J, A
Atlantic salmon					E, L, J, A, SA
Atlantic sea scallops		J			L
Barndoor Skate		J, A			
Black Sea Bass	L, J, A				E
Bluefish					E, L, J, A
Butterfish					J, A
Clearnose Skate		J, A			
Cobia					E, L, J, A, SA
Golden Crab			E, L, J, A,SA		
Haddock	J, A, SA				E, L
Illex					J, A
King Mackerel					E, L, J, A, SA
Little Skate		J, A	E		
Loligo	E				J, A
Monkfish			J, A, SA		E, L
Ocean pout	E, L, J, A, SA				
Ocean Quahog			J, A,		

Table A3 (continued). The vulnerability of Northeast and Mid-Atlantic Federally-managed species, by life stage, to bottom otter trawling (E=Egg, L=Larvae, J=Juvenile, A=Adult, SA=Spawning Adult).

Species	High Impact	Medium Impact	Low Impact	No Impact	Not Applicable
Offshore Hake			J, A, SA		E, L
Pollock		A, SA			E, L
Red Crab			J, A, SA		E, L
Red Drum			J, A		
Red Hake	J	A, SA			E, L
Redfish	J	A, SA			E, L
Rosette Skate		J, A			
Scup		J	A		E, L
Silver Hake		J	A, SA		E, L
Smooth Skate		J, A			
Spanish Mackerel					E, L, J, A, SA
Summer Flounder		J, A			E, L
Surfclam			J, A		
Thorny Skate		J, A			
Tilefish	J, A				E, L
White Hake		J	A, SA		E, L
Windowpane Flounder			J, A, SA		E, L
Winter Flounder		A, SA	E, L, J		
Winter Skate		J, A			
Witch Flounder		J, A, SA			
Yellowtail Flounder		J, A, SA			E, L

Therefore, a more detailed examination of bottom otter trawl effort relative to tilefish EFH and HAPC is considered in order to identify measures that may reduce potential impacts from this fishing activity. Trips that used bottom otter trawls will be used to map fishing effort with bottom otter trawls. Fishing effort using bottom otter trawls for all Federal fisheries in the Northeast was defined as the time that gear type was fished (in days) using VTR data from 1996 through 2005.

More specifically, days fished was calculated for each vessel trip as the product of the average reported tow duration and the number of trawl tows, and then summed by ten minute square. This resulted in days fished by bottom otter trawl for each ten minute square, and therefore provides a measure of the days spent actively fishing with bottom otter trawl on the sea floor (Figure A1). It should be noted that because the data are self-reported there are errors in the spatial information which could be due to inaccurate reporting, unclear handwriting, or error in transcribing the written information. This results in some fishing activity being reported in “unrealistic” locations. There were 1,619,482 days fished with bottom otter trawl (fish) over the 1996-2005 period within the coverage area of the VTR data. The effort data was scaled into four groups (approximate quartiles). By scaling the data, those ten minute squares with highest numbers of days fished using bottom otter trawls could be identified visually (Figure A1).

Tilefish Habitat

EFH designations in the Northeast region are based primarily on Level 2 information, or quantitative data such as density and relative abundance. The EFH text definitions by life history stage for tilefish and text definitions for tilefish HAPC (described in sections 5.16 and 5.17 of this EIS), as well as other Federally-managed species are available at the following website:
http://www.nero.noaa.gov/hcd/list.htm

For many federally-managed species, there are also map depictions of EFH by ten minute square based on NEFSC trawl catch-per-unit effort (CPUE) data; however, for tilefish this information was not considered representative and only text definitions exist. These text definitions can be used to create map representations of the EFH and HAPC, as shown in sections 5.16 and 5.17. The clay outcroppings found on the slopes of submarine canyons that intersect the shelf on the southern edge of Georges Bank and the New York Bight provide important habitat for tilefish and other benthic organisms which burrow into the clay. As discussed in section 5.17, there are thirteen large canyons that have been identified in the Northeast Shelf area that either have or would be expected to have steep walls which might result in exposed clay outcroppings, a tilefish habitat type considered to be highly vulnerable to bottom otter trawling activity.

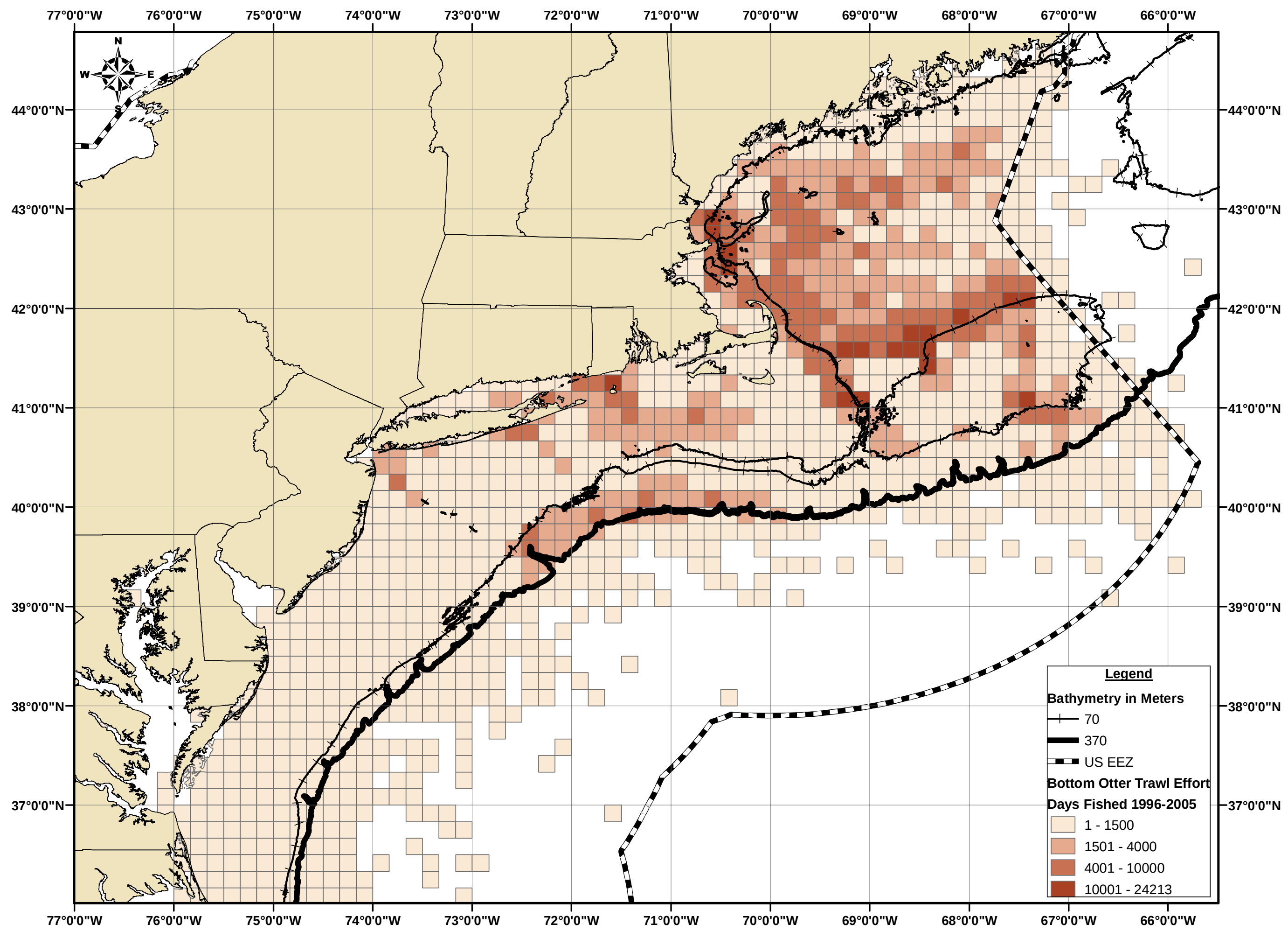

Figure A1. Bottom otter trawl effort, calculated as all days fished by ten minute square with bottom otter trawls in the based on VTR data, 1996 through 2005.

1.4.2 Potential Adverse Fishing Impact Areas

Based on the an examination of bottom otter trawling effort relative to tilefish EFH and HAPC tilefish (as described above in Appendix Section 1.4.1), the areas along the shelf from Hudson Canyon along to Atlantic Canyon (within statistical areas 537 and 616) may be at risk for potential adverse impacts from the use of bottom otter trawls on clay outcrops/pueblo habitats. Specifically, this area is The finest scale of the VTR data (by ten minute square) relative to the size of the canyons prevent the VTR data from being useful for examining fishing activity in within canyon areas, particularly along the steep canyon walls where clay outcrops might be found. In addition, it has been suggested that much of this fishing activity occurs on the margins of the canyons and not on the steep slopes themselves because fishing gear could be damaged through contact with the canyon walls (James Ruhle, Pers. comm. 2007).

2.0 Development of EFH-Related Alternatives

2.1 Alternatives to Designate EFH and HAPC

2.1.1 Designation of EFH

There are two possibilities with respect to the current tilefish EFH designations. The first is given the new information available since tilefish egg, larvae, juvenile, and adult EFH was first designated, the EFH designations for this species should be modified. The second possibility is that the new information indicates that the current EFH designations are still appropriate and should not be modified. For tilefish, the original EFH designations were done using depth information. Text definitions of EFH were developed which include depth and temperature, with mention of bottom type (rough bottom, small burrows and sheltered areas). Therefore, the literature and data available for tilefish habitat was re-examined and any new information available taken into account when considering alternatives to designate EFH.

Seasonal bottom temperature distributions have been developed, since the original EFH text definitions were written, using the NEFSC data from the bottom trawl survey and the hydrographic data base (Mountain 2005 unpublished). There was some redundancy in the two databases, which was accounted for as well as two months of trawl survey information which was deleted because the correct temperatures could not be resolved.

A ‘reference ocean’, derived from the NEFSC MARMAP data was used to rigorously account for the interannual variability in observations scattered over space and time, to create seasonal average bottom temperature distributions that represented the time period of the trawl survey (1963-2005). The MARMAP program had a set of over 150 standard stations at fixed locations (1977-1987) and made about 50 observations of temperature at each location. Using these data, characteristic annual cycles of bottom temperature were calculated for each standard station location. By interpolating between the fixed stations, a method was developed to estimate the expected bottom temperature at any location on the shelf on any calendar day (Mountain and Holzwarth, 1989; Mountain et al. 2004). Using this method, the difference between an observed value and expected value (i.e., an anomaly) could be determined for every observation in the trawl survey and hydrographic data bases.

The EFH temperature and salinity distributions were determined on a ten minute square basis because they were a convenient grid size, consistent with the grid used in the original EFH mapping, the temperature distributions characteristically have a longer spatial scale of variation. The EFH value for each ten minute square was determined by adding a mean value derived from the MARMAP annual curves and an average anomaly derived from all of the observations in the data bases. This was done separately for four seasons, defined as spring (March-May), summer (June-August), fall (September-November) and winter (December-February). These seasons were based on the NMFS spring trawl survey generally beginning in March, the fall survey generally beginning in September or later and the winter survey being in February.

For each season, the MARMAP mean value at the center of each ten minute square was derived by averaging the values estimated by the MARMAP annual cycles for each day of the 3 month season. This was done for bottom temperature for each season and for each ten minute square which contained at least one observation in the trawl survey data base. The bottom temperature anomaly was calculated for each observation in the hydrographic data base. For a temperature observation to be considered a bottom value, it had to be taken within 10 meters of the observed bottom depth. Similarly bottom temperature anomalies were calculated for all observations in the trawl survey data base through the end of 1991. Beginning in 1992 the survey observations were made by CTD (conductivity-temperature-depth) instruments and are in the hydrographic data base.

The bottom temperature anomalies in each ten minute square, and within each season, were then averaged for 3 time blocks (1963-1976, 1977-1991, and 1992-2005) dividing the whole period approximately into thirds. For each square that had an anomaly value in each time block, the 3 average anomaly values were themselves averaged to get the average anomaly over the whole time period. This procedure was done to insure that the whole time period was represented and because the recent decade had many more observations than the earlier decades, which could bias a straight average of all anomalies toward recent environmental conditions. For the ten minute squares in which an average anomaly was not able to be calculated (i.e., no value in each of the three time blocks), a value was determined by averaging the anomalies of the neighboring squares with anomaly values. For each ten minute square and for each season, the anomaly was added to the MARMAP seasonal average value. The result was the EFH seasonal bottom temperature distributions.

It is useful to recognize that the characteristic interannual variability in temperature is approximately +/- 1^{o}C. Given the seasonal mean distributions, this magnitude of year-to-year change would correspond to spatial changes of many tens of kilometers, suggesting that the meaningful spatial scale for these parameters is fairly coarse.

These seasonal bottom temperature distributions were then mapped and scaled to reflect juvenile and adult temperature ranges from 46^{o}F to 64^{o}F (7.8^{o}C to 17.8^{o}C) as well as the bathymetric ranges of 250 ft to 1200 ft (76 to 366 m) as described in the current EFH definitions (Figures A2, A3, A4, and A5). As discussed in section 6.3 of this EIS, tilefish require stable, moderate temperature regime. Despite, the seasonal changes in the coastal temperature through the summer, fall, and winter, the area in which the current tilefish EFH is designated remains stable. However, a review and a closer re-examination of the literature suggest that the temperature and associated depth ranges for tilefish EFH should be narrowed (Steimle et al. 1999, 2005). For tilefish eggs and larvae, there is limited information on their distribution. Therefore, the water column temperatures (to a maximum of 200 m; maximum of 656.2 ft) range for tilefish eggs were based on information from the NEFSC MARMAP ichthyoplankton surveys (1978-1987, all years combined). Specifically, it is the range in temperatures at which the proportion of the sum of all standardized catches (number/10 m^2) from this survey was greater than the proportion of all stations surveyed, at a given temperature. For larvae, there was very limited sampling and it is inferred that the temperature range for eggs would be representative for larvae, as the limited information on larvae distribution falls within the egg temperature ranges. Therefore, it is suggested that the mean water column temperatures ranging from 7.5°C to 17.5°C (45.5°F to 63.5°F) would be the most appropriate EFH designation for tilefish eggs and larvae based on the information available in the EFH source documents.

For juvenile and adult tilefish EFH, Grimes et al (1986) and Able et al. (1982), both of which are cited in Steimle et al. (1999, 2005), consider habitat areas where tilefish are most abundant to be at bottom water temperatures from 9°C to 14°C (48.2°F to 57.2°F), which generally corresponds to depths between 100 and 300 m (328 to 984 ft). In addition to temperature and depth information, substrate type is very important in identifying tilefish habitat.

As described in section 6.3 of this EIS, the key substrate property that allows tilefish to burrow is cohesiveness (Wenner and Barans 2001); therefore, burrows often occur in areas where there is a thin layer of loose sand or mud overlying semi-lithified clay, but not in areas with deep deposits of non-cohesive sediments where burrows can not be maintained (Guida 2001, 2002). Therefore, for both adult and juvenile tilefish it was noted that they can create horizontal or vertical burrows in semi-lithified clay sediments, a substrate type with cohesive properties that allow the burrows to maintain their shape (Steimle et al. 1999, 2005). This source documents also indicated that tilefish may also utilize rocks, boulders, scour depressions beneath boulders, and exposed rock ledges as shelter. This information was used to develop more specific text to describe tilefish EFH. Information that could be used to identify areas with clay sediments could prove useful in the designation of EFH. In some submarine canyon areas, and elsewhere on the continental shelf, clay outcroppings occur where the gradient is steep enough to allow loose sediments to slough-off and expose the more cohesive clay material, allowing tilefish to develop pueblo burrows. Therefore, information on sediments and sea floor topography could provide additional information to Identify tilefish EFH.

Since the identification of tilefish HAPC in the original FMP (MAFMC 2000), there have been studies and information reviews conducted examining sediment information and sea floor topography of the sea floor. Poppe and Polloni (2000) compiled an interpolated shapefile of sediment types based on multiple sediment samples collected over several decades (Figure A6). This information indicates where some areas of clay may exist, but does not specifically identify the clay out-crop areas which are found in submarine canyon areas, and are considered to be vulnerable to bottom otter trawls. That sediment information was updated in Poppe et al. (2003). Most recently, Reid et al. (2005) built off the information from those studies described above as well as other information to compile a more comprehensive data set, with multiple sources and levels of data quality which can be used to identify areas ocean bottom with clay (Figure A7). The information indicates that clay is found in most areas and is not useful in identifying clay outcroppings in canyon areas.

Based on the new information available and a careful re-examination of tilefish studies which discuss habitat, it appears the current EFH definitions could be revised to include a more refined temperature (depth range) for eggs and larvae, and juvenile and adult tilefish. In addition, there is information available to provide a better text description of the types of habitat (benthic substrate) that juvenile and adult tilefish utilize. Therefore, a proposed redesignation alternative (Alternative 16B) is provided in Section 5.16 of this EIS.

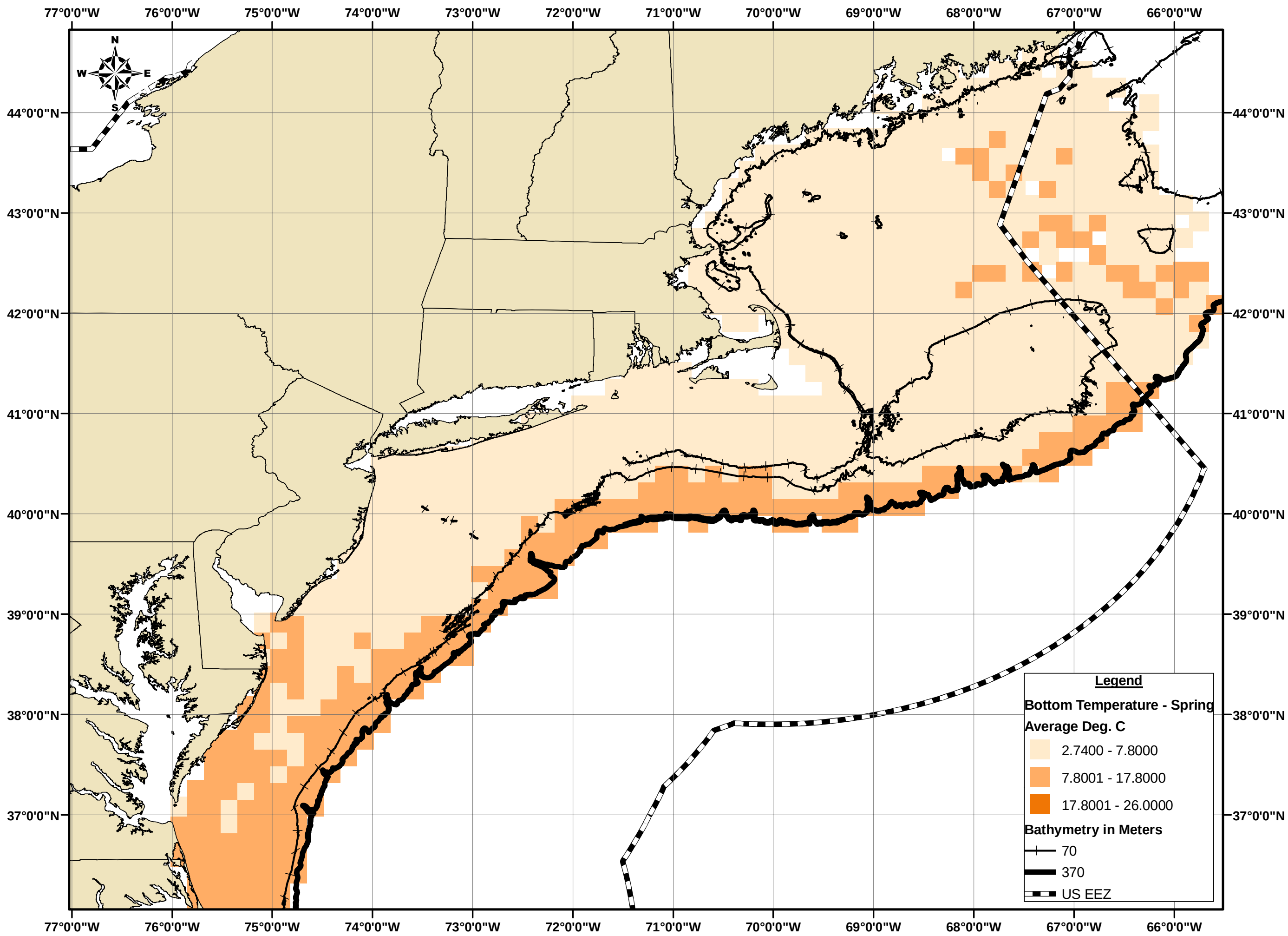

Figure A2. The average Spring bottom temperature along the Northeast Shelf.

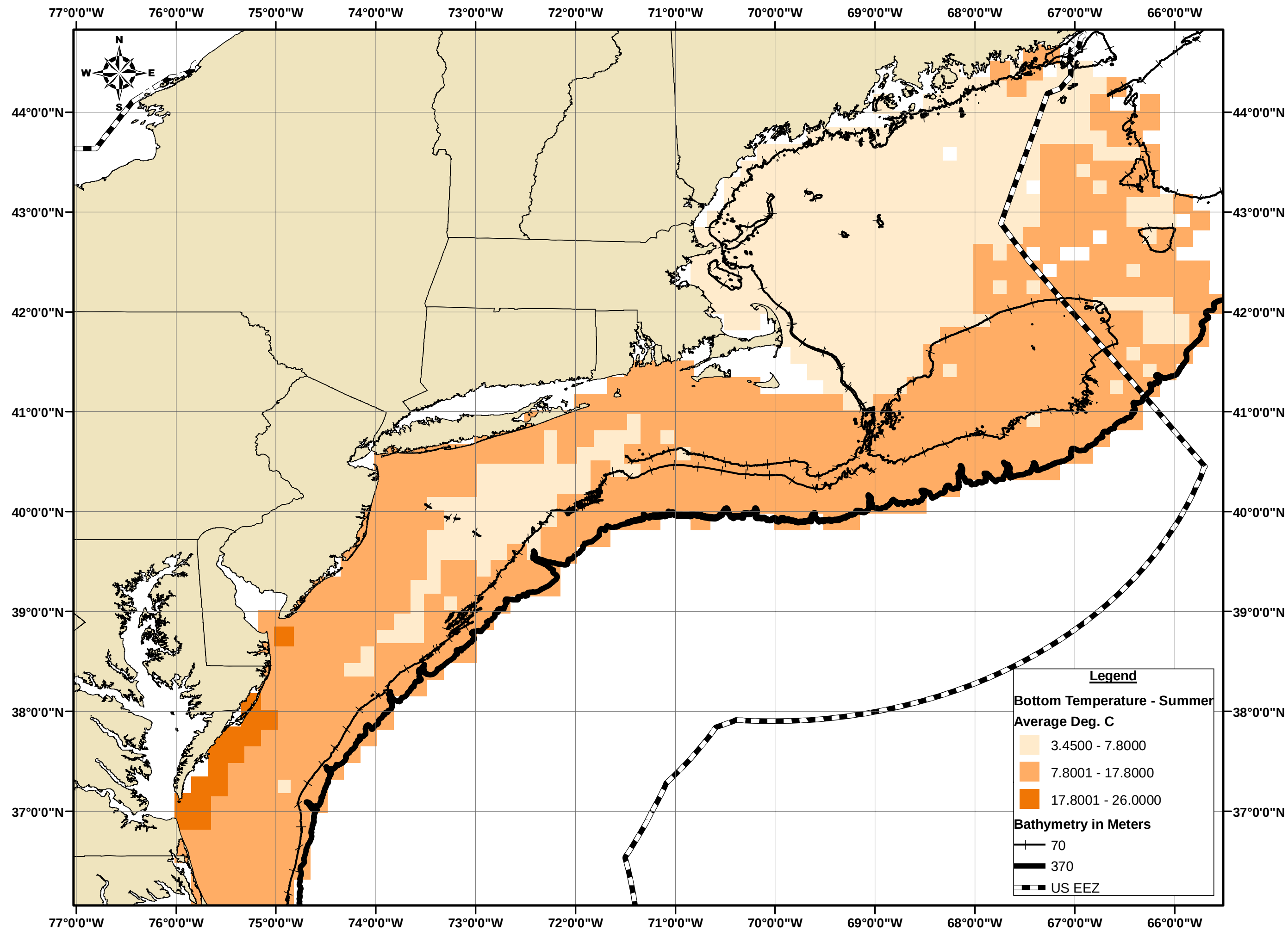

Figure A3. The average Summer bottom temperature along the Northeast Shelf.

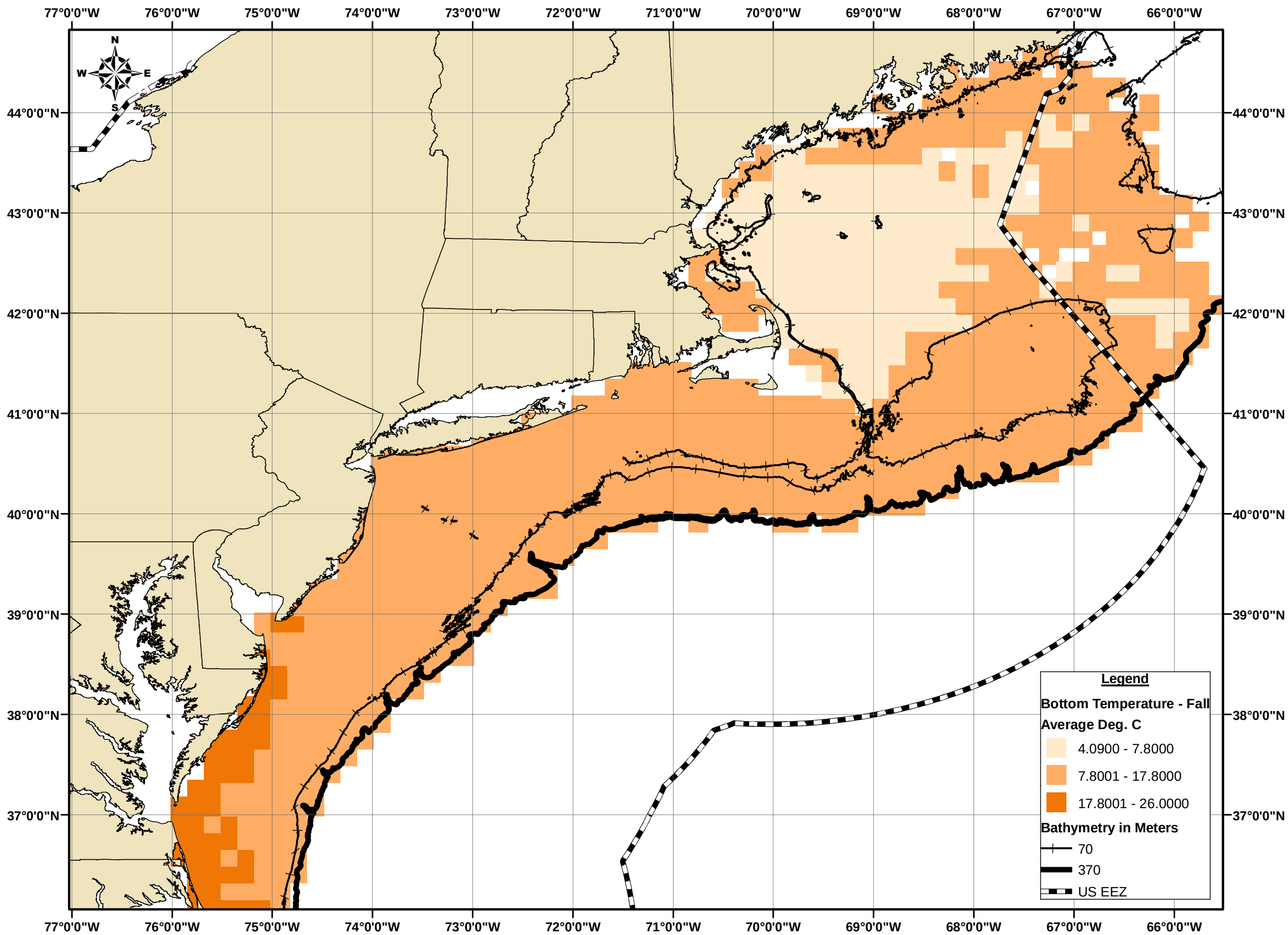

Figure A4. The average Fall bottom temperature along the Northeast Shelf.

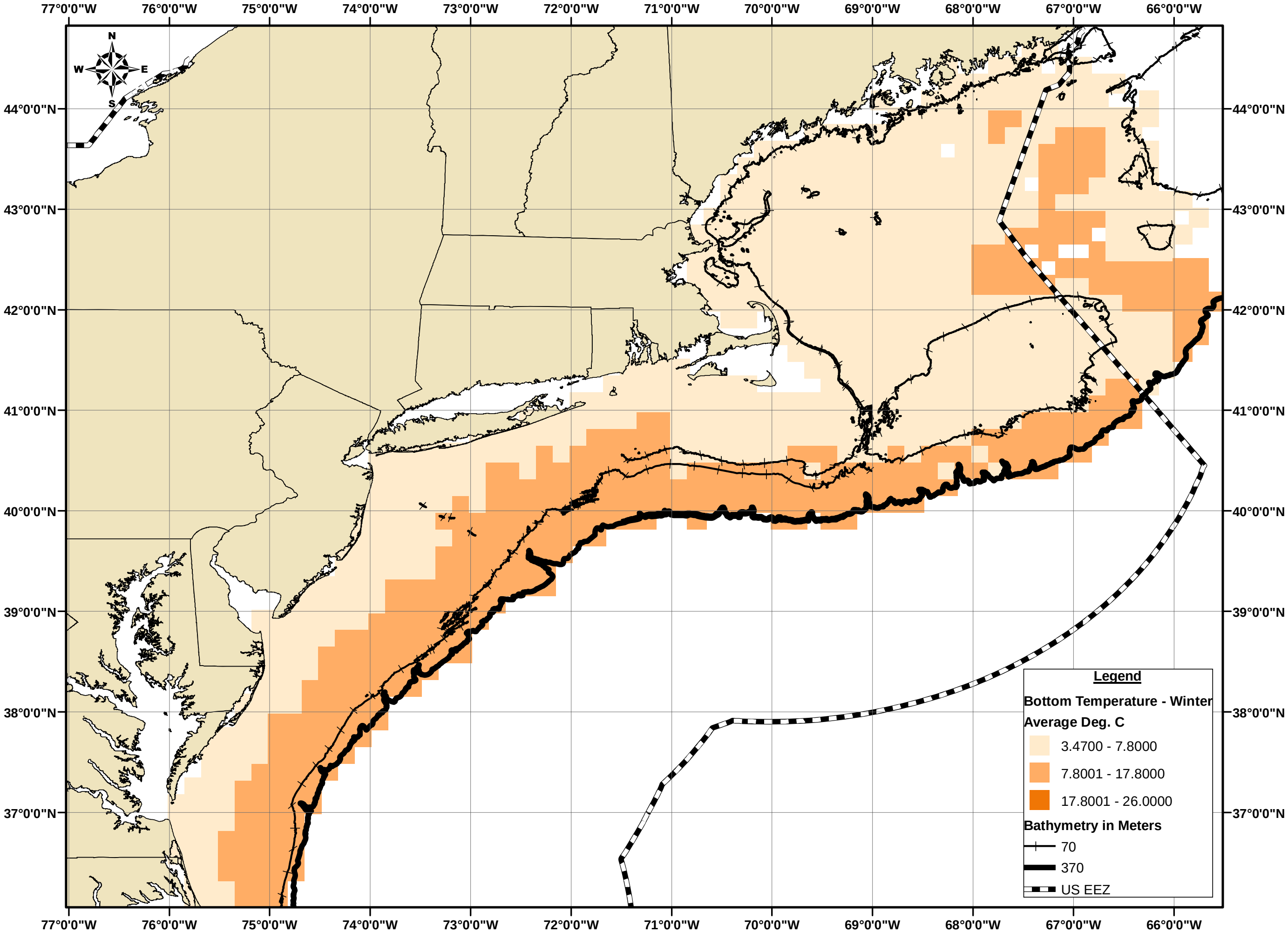

Figure A5. The average Winter bottom temperature along the Northeast Shelf.

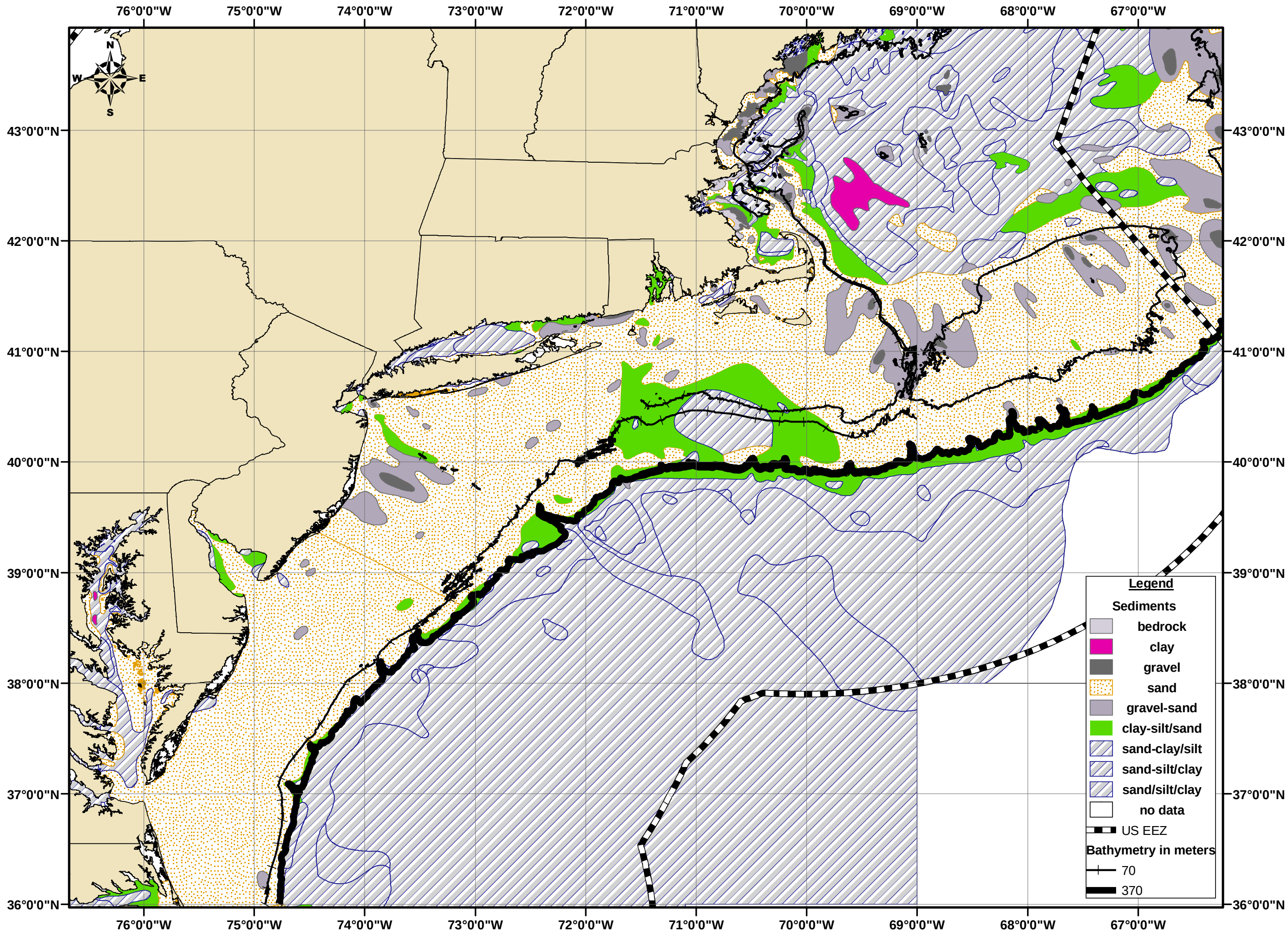

Figure A6. Poppe and Polloni (2003) sediment data showing areas identified as clay or clay-combinations.

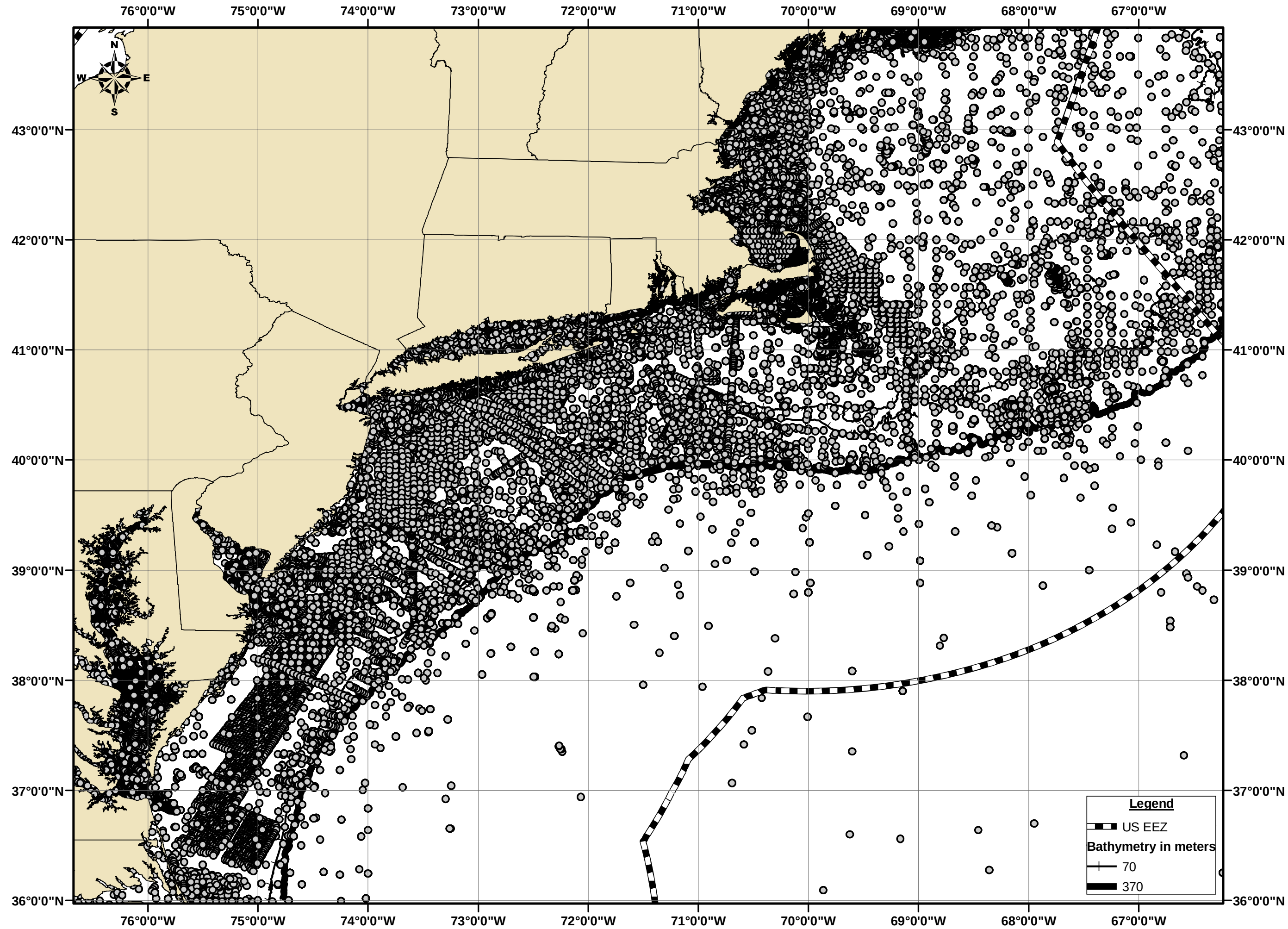

Figure A7. Reid et al (2005) sediment data, with points identified as clay shown.

2.1.2 Designation of HAPC

As discussed in section 6.3 of this EIS, the substrate between the 250 and 1,200 ft isobath, from U.S. / Canadian boundary to the Virginia / North Carolina boundary within statistical areas 616 and 537 be had been designated as HAPC for juvenile and adult tilefish. The statistical areas 537 and 616 were identified as HAPC since greater than 90% of the recent landings come from these areas (MAFMC 2000). There are two possibilities with respect to the current tilefish HAPC designations. The first is given the new information available since tilefish juvenile and adult HAPC was first identified, the EFH designations for these species should be modified. The second possibility is that the new information indicates that the current HAPC designations are still appropriate and should not be modified.

The landings of tilefish in pounds, by all gear types, based on VTR data were mapped by statistical area, as reported in the VTR data over the period from 1996-2005 (Figure A8). It should be noted that because the data are self-reported there are errors in the spatial information which could be due to inaccurate reporting, unclear handwriting, or error in transcribing the written information. This results in some fishing activity being reported in “unrealistic” locations. This information does indicate that the area currently designated as HAPC (within statistical areas 537 and 616) has some of the highest landings, aggregated over the 1996-2005 time period (Figure A8). However, it is unclear whether the presence of high landings levels indicates habitat that meets the four criteria (ecological function, sensitive to human induced environmental degradation, developing activities stressing habitat type, or rarity of habitat (50 CFR Part 600.815 (a)(9)) to justify designating it as HAPC.

As discussed in section 6.3 of this EIS, tilefish require stable, moderate temperature regime as well as semi-lithified clay materials to create their burrows. The Northeast Region EFH Steering Committee Workshop (NREFHSC 2002; Stevenson et al. 2004) concluded that there was potential for a high degree of impact to the physical structure of hard clay outcroppings (pueblo village habitats) by trawls that would result in a change to the major physical feature that provides shelter for tilefish habitat. On that basis, clay outcrop/pueblo habitats for tilefish may be considered HAPC because they are potentially sensitive to human-induced environmental degradation, may serve a specific ecological function and allow for secondary burrowing by other species, and as it is not the most common burrow type and could be considered to be a rare habitat type for tilefish. On this basis, alternatives were developed to designate areas which have or could potentially contain clay outcrops/pueblo habitat and are described in Section 5.17 of this EIS.

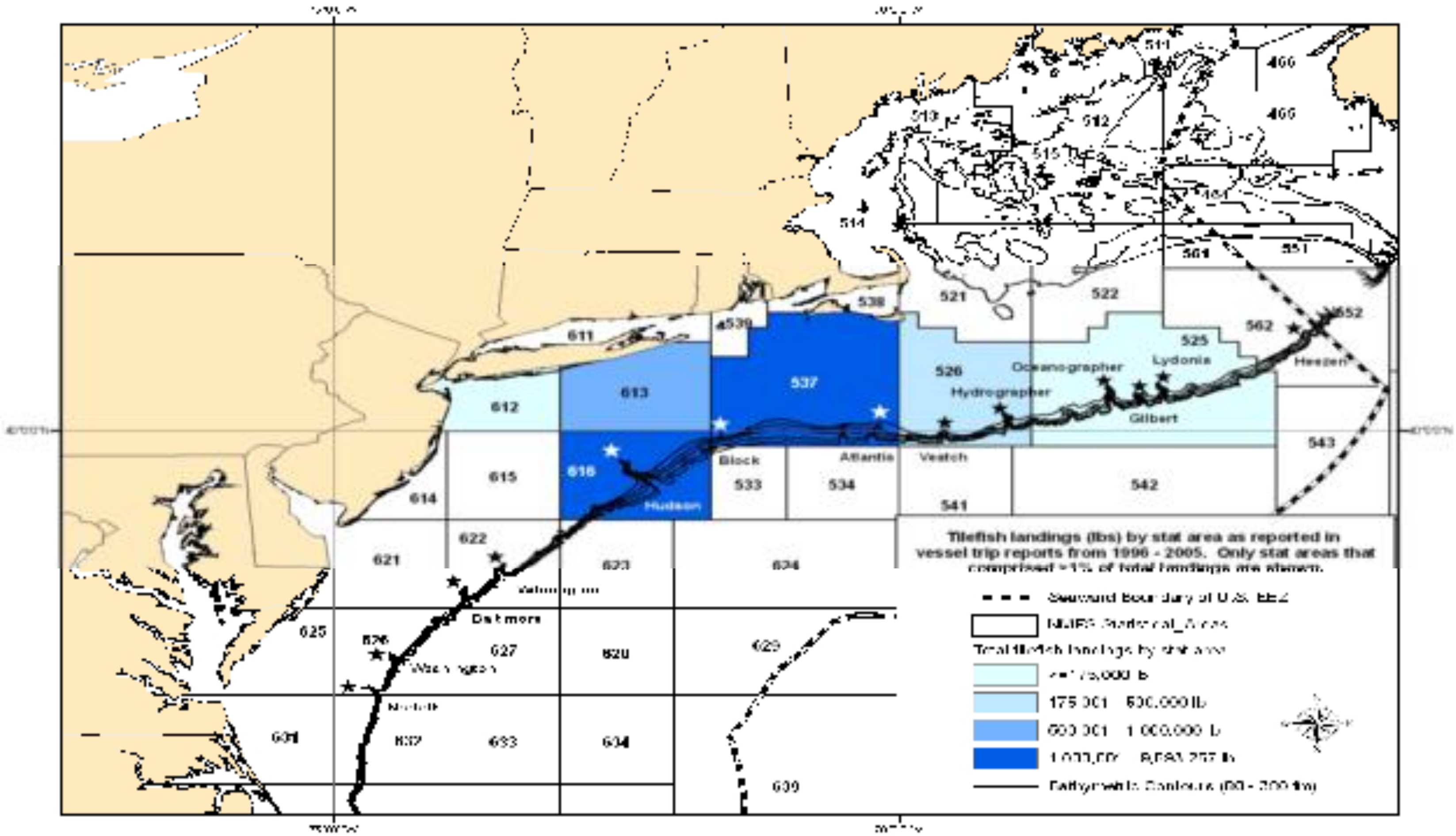

Figure A8. Tilefish landings (lbs) by statistical area as reported in the VTR data, 1996 through 2005.

2.2 Alternatives to Avoid, Minimize, and Mitigate Impacts on EFH

The Magnuson-Stevens Act requires that Council evaluate potential adverse effects of fishing activities on EFH and include in FMPs management measures necessary to minimize adverse effects to the extent practicable. In this amendment to the FMP, the Council is considering alternatives (section 5.18 of this EIS) that could close several areas to the use of bottom otter trawl gear (Gear Restricted Areas - GRAs).

2.2.1 Derived Based on Gear Effects Evaluation

These potential area closures were based on concerns to protect highly vulnerable habitat for tilefish. Specifically, clay outcroppings (pueblo habitats) are thought to be vulnerable to permanent disturbance by bottom tending mobile gear such as the bottom otter trawl (section 6.3 of this EIS).

Description of GRAs to Minimize Impacts to EFH

The following potential area closures were identified through overlap analysis conducted above in section 1.4. Bottom tending mobile gear such as the bottom otter trawl is frequently implicated as having a high potential for adverse impacts on bottom habitats. The following section describes potential GRAs closures which could be considered to minimize impacts to tilefish EFH, with the indirect benefit of protecting EFH for other federally-managed species.

Tilefish Statistical Area GRAs

Tilefish are “shelter-seeking and habitat limited”, therefore part of their EFH was designated as HAPC because it meets three of four criteria used to designate HAPC for a species (50 CFR Part 600.815 (a)(9)). These criteria are ecological function, sensitive to human-induced environmental degradation, and rarity of habitat.

Based on an examination of bottom otter trawling fishing effort relative to tilefish EFH and HAPC, a GRA that would close tilefish habitat within statistical areas 616 and 537 to bottom otter trawling activity is presented. This area is being considered because of the extensive bottom otter trawling (fish) activity identified in section 1.4 within the two statistical areas (616 and 537) currently defined as HAPC for juvenile and adult tilefish at depths of 76 to 366 m (250 to 1200 ft). As modification to the EFH designation is proposed in this document, the proposed GRA area is contingent on the selection of the EFH designation alternative.

Option A: If the no action EFH designation alternative (Alternative 16A) is selected, the tilefish GRA would be the areas within Statistical Areas 616 and 537 at the depth range of 76 to 366 m (250 to 1200 ft) based on the current EFH designation (Figures A9 and A10). Therefore, no bottom otter trawling would be permitted in this area. The latitude and longitude for the corner points of this GRA are as follows:

Tilefish GRA within Statistical Areas based on depth ranges of 250 to 1200 ft (76 and 366 m)

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
39	0	73	10
39	0	72	40
39	50	71	30
39	50	70	0
40	30	70	0
40	30	71	50
39	0	73	10

Option B: If the action EFH designation alternative (Alternative 16B) is selected, the tilefish GRA would be the areas within Statistical Areas 616 and 537 at the depth range of 100 and 300 m (328 to 984 ft) based on the new EFH designation (Figure A11, A12). Therefore, no bottom otter trawling would be permitted in this area. The latitude and longitude for the corner points of this GRA are as follows:

Tilefish GRA within Statistical Areas based on depth ranges of 100 and 300 m (328 to 984 ft)

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	20	71	0
40	20	70	0
39	50	70	0
39	50	71	30
39	0	72	40
39	0	73	0
39	40	72	30
40	20	71	0

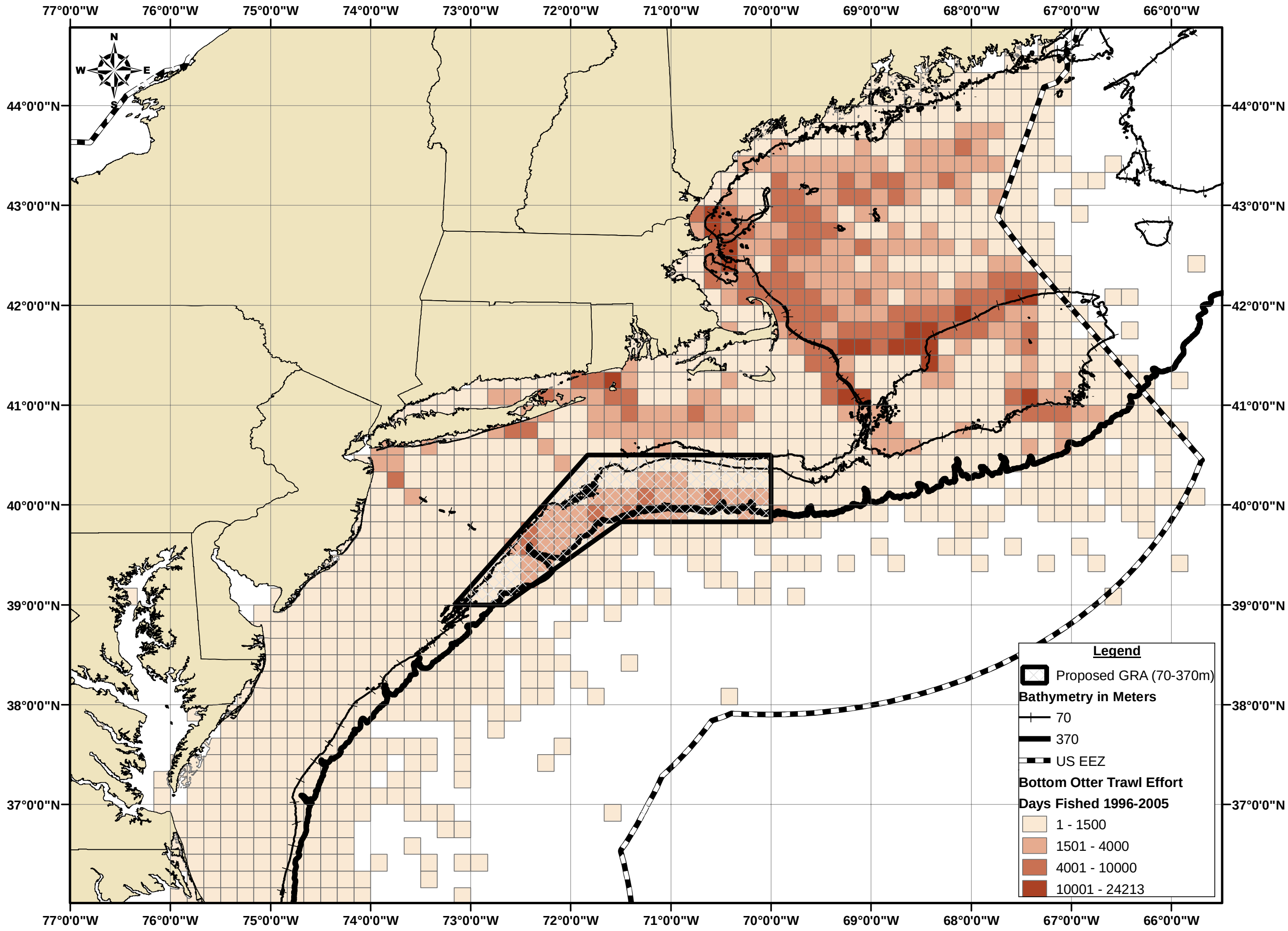

Figure A9. Effort overlap component, calculated as days fished by ten minute square with bottom otter trawls based on VTR data, 1996 through 2005, and the proposed statistical area GRA (at 76 and 366 m (250-1200 ft)).

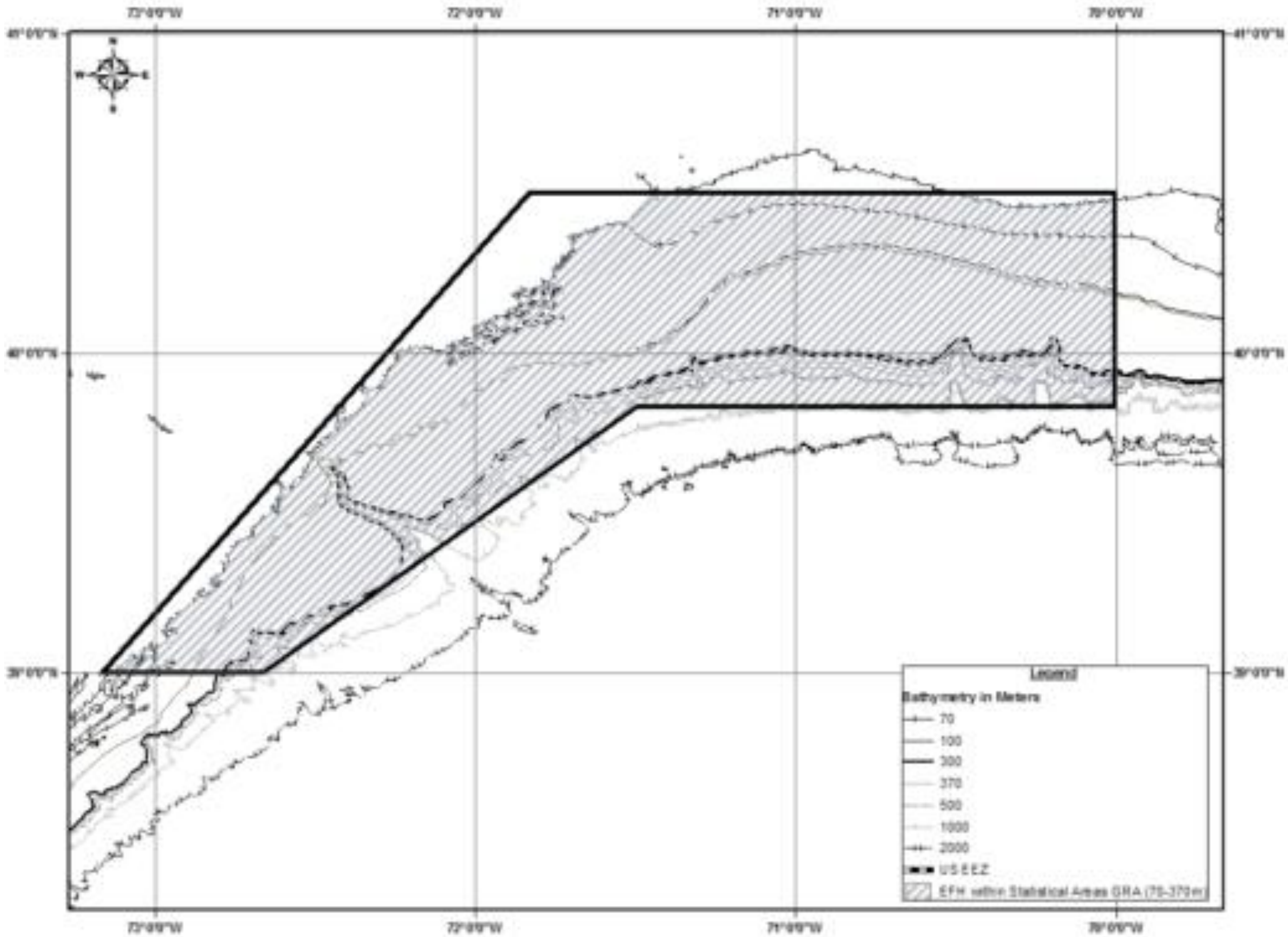

Figure A10. Proposed statistical area GRA (based on 76 to 366 m (250-1200 ft) depth contours).

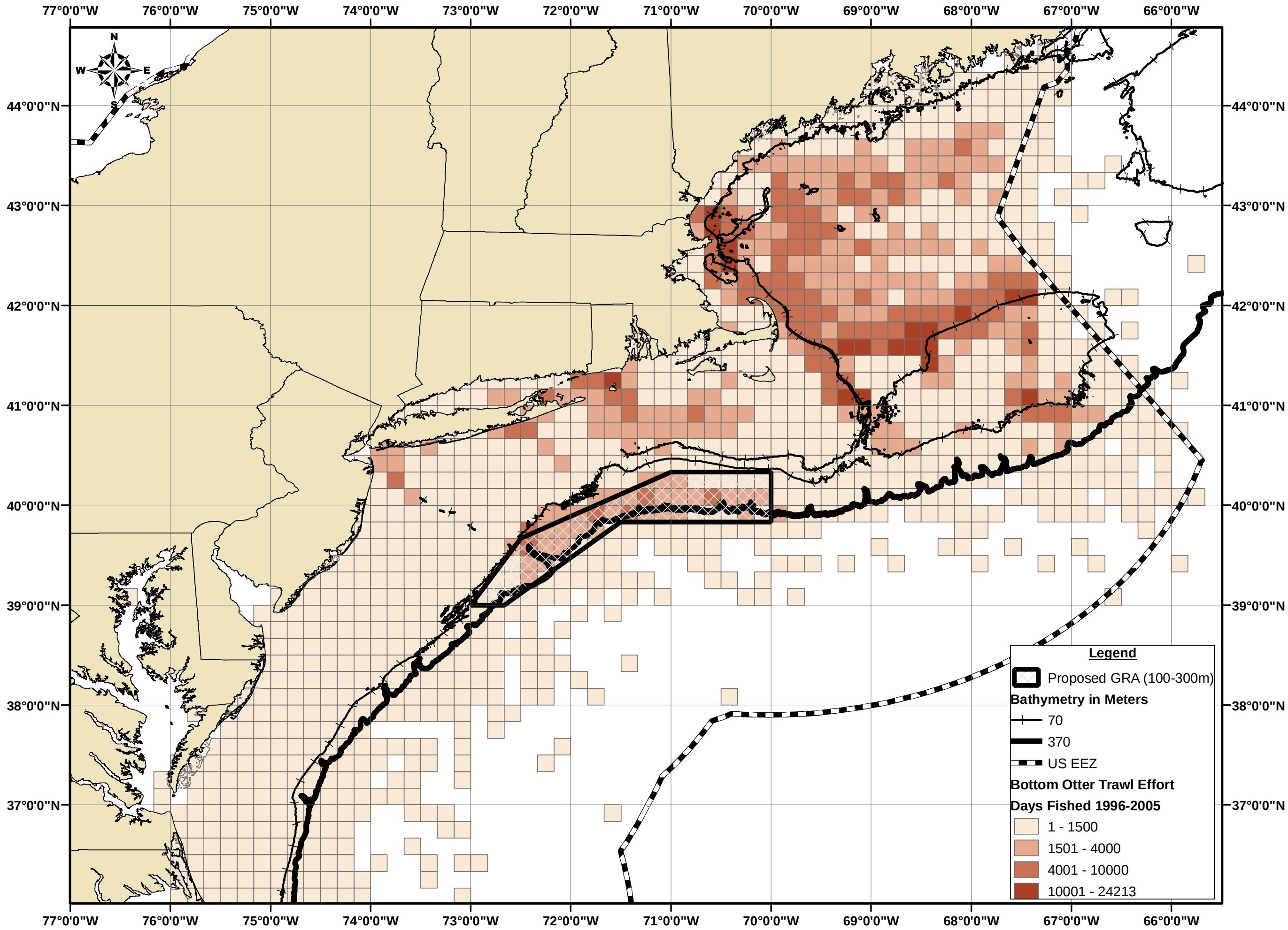

Figure A11. Effort overlap component, calculated as days fished by ten minute square with bottom otter trawls based on VTR data, 1996 through 2005, and the proposed statistical area GRA (at 100 and 300 m (328-984 ft)).

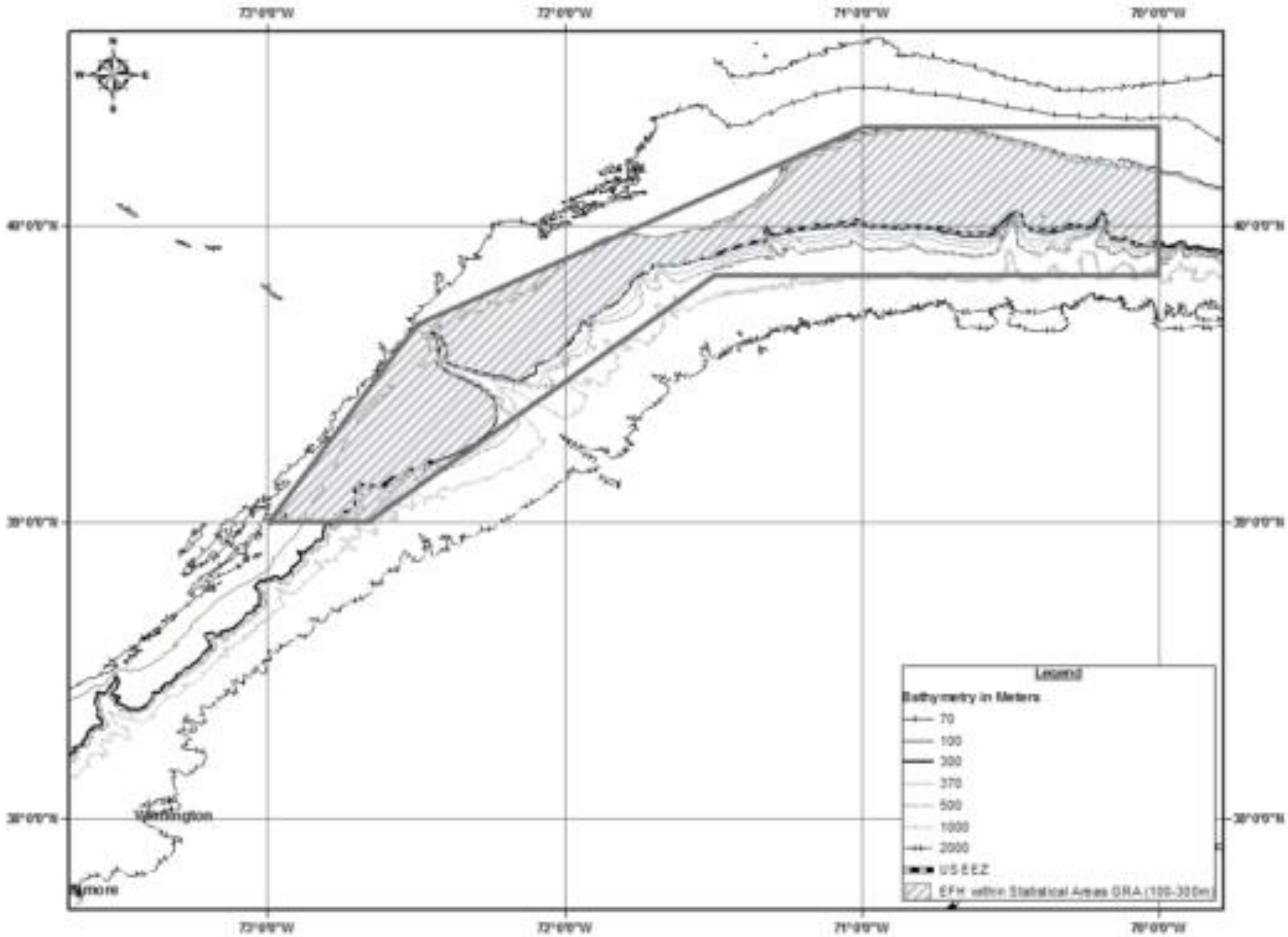

Figure A12. Proposed statistical area GRA (based on 100 to 300 m (328-984 ft) depth contours).

EEZ GRA

The potential EEZ GRA covers a broad area (approximately 11.7 million km^2; 4.5 million mi^2; 3.4 million nm^2) from 3 to 200 miles and the outer boundary is as indicated in Figure A1. This area is being considering because of the extensive bottom otter trawling (fish) activity that occurs throughout the EEZ and potential impacts from this gear to tilefish EFH. Sediment types cover the whole suite described and include bedrock, gravel, sand, silt, and clay in various combinations (Figures A6, and A7). Habitat in the EEZ is varied and is also described in section 6.3.

2.2.2 Derived Based on Other Information Sources

Canyon GRAs

In some submarine canyon areas, and elsewhere on the continental shelf, clay outcroppings occur where the gradient is steep enough to allow loose sediments to slough-off and expose the more cohesive clay material, in which tilefish can develop burrows called pueblo habitat. It has been concluded that there is potential for a high degree of impact to the physical structure of hard clay outcroppings by trawls that would result in a change to the major physical feature that provides shelter for tilefish habitat (NREFHSC 2002; Stevenson et al. 2004). Therefore, closure of canyons to bottom otter trawling could potentially protect these clay outcroppings from disturbance by fishing. There are thirteen large canyons that have been identified in the Northeast Shelf area that either have or could potentially contain clay outcrops. Although extensive research has not been conducted in all thirteen canyons, these canyons would be expected to have steep walls which might result in exposed clay outcroppings. In the Able and Muzeni (2002) review of archived video and submersible logs, Norfolk, Veatch, and Lydonia Canyons were noted as having tilefish pueblo burrows which are formed in exposed clay outcroppings. Valentine et al. (1980) noted the presence of clay outcroppings in Oceanographer Canyon. The latitude and longitude for the corner points of the thirteen large canyons (potential canyon GRAs), starting with the southernmost canyon and moving along the shelf, are as follows in Tables A4 and A5. Because there are two potential depth ranges for the EFH designation from 76 to 366 m (250-1200 ft) or 100 to 300 m (328-984 ft), proposed GRAs were developed under each scenario. Figures A13 to A16 show maps of the proposed GRAs which correspond to the coordinates given in Tables A4 and A5. In addition, Figures A17 to A36 provide close-up views of these GRAs and highlight the EFH that is contained within those proposed canyon closures.

As indicated above, in this amendment to the FMP, the Council is considering alternatives (section 5.18 of this EIS) that could close several areas to the use of bottom otter trawl gear (Gear Restricted Areas - GRAs). The Council chose 18C as its preferred alternative. Under alternative 18C, the Council had to decide which canyons to select for GRA designation. That is, the Council could have selected to close one, some, or all of the following 13 canyons. The Council selected to close Norfolk, Veatch, Lydonia, and Oceanographer canyons to otter bottom trawl gear to reduce gear impacts on juvenile and adult tilefish EFH. The Council revised the areas associated with these GRAs from what was initially provided in the document under alternative 18C. Table A5 shows the coordinates for the modified GRAs in Lydonia, Oceanographer, Veatch, and Norfolk canyons. The revised four canyons areas were chosen to minimize adverse economic impact on fishermen while providing protection to areas that are known to have clay outcrop/pueblo habitats. Figures A20a shows the revised GRAs for Oceanographer and Lydonia, A22a for Veatch, and A36a for Norfolk. The revised GRAs are smaller than the previously derived GRA for those four canyons under alternative 18C. The Council was concerned that closing the entire designated HAPC around these four canyons (Figures A20 for Oceanographer and Lydonia, A22 for Veatch, and A36 for Norfolk) could potentially restrict fishing in areas that are neither clay outcrop nor pueblo habitat and have large adverse economic impacts.

Table A4. Coordinates for each of the thirteen canyon GRAs along the Northeast Shelf/Slope based on depth ranges of 76 and 366 m (250-1200 ft).

Norfolk

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
37	5	74	47
37	7	74	44
37	5	74	33
36	54	74	37
37	5	74	47

Washington

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
37	29	74	31
37	28	74	22
37	17	74	29
37	29	74	31

Baltimore

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
38	13	73	54
38	17	73	52
38	8	73	45
38	1	73	52
38	13	73	54

Wilmington

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
38	33	73	30
38	22	73	26
38	17	73	36
38	26	73	36
38	33	73	30

Hudson

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
39	42	72	31
39	31	72	4
39	14	72	20
39	42	72	31

Block

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	20	71	27
39	56	71	16
39	55	71	21
40	20	71	27

Table A4 (continued). Coordinates for each of the thirteen canyon GRAs along the Northeast Shelf/Slope based on depth ranges of 76 and 366 m (250-1200 ft).

Atlantis

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	22	70	9
39	57	70	9
39	59	70	15
40	22	70	9

Veatch

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	14	69	39
39	55	69	32
39	54	69	42
40	14	69	39

Hydrographer

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	27	69	9
40	2	68	57
39	60	69	6
40	27	69	9

Oceanographer

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	43	68	13
40	10	67	59
40	10	68	12
40	43	68	13

Gilbert

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	45	68	3
40	20	67	45
40	17	67	56
40	45	68	3

Lydonia

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	44	67	44
40	16	67	34
40	16	67	42
40	44	67	44

Heezen

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
41	27	66	48
41	6	66	19
40	60	66	25
41	27	66	48

Table A5. Coordinates for each of the thirteen canyon GRAs along the Northeast Shelf/Slope based on depth ranges of 100 and 300 m (328-984 ft).

a. Original coordinates for the 13 canyons

Norfolk

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
37	5	74	46
37	7	74	42
37	4	74	34
36	58	74	37
37	5	74	46

Washington

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
37	29	74	31
37	28	74	24
37	17	74	30
37	29	74	31

Baltimore

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
38	12	73	53
38	15	73	51
38	7	73	46
38	2	73	51
38	12	73	53

Wilmington

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
38	30	73	29
38	22	73	27
38	18	73	36
38	26	73	36
38	30	73	29

Hudson

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	12	70	9
39	57	70	9
39	60	70	15
40	12	70	9

Block

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	12	70	9
39	57	70	9
39	60	70	15
40	12	70	9

Table A5 (continued). Coordinates for each of the thirteen canyon GRAs along the Northeast Shelf/Slope based on depth ranges of 100 and 300 m (328-984 ft).

a. Original coordinates for the 13 canyons

Atlantis

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	12	70	9
39	57	70	9
39	60	70	15
40	12	70	9

Veatch

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	6	69	37
39	55	69	32
39	54	69	42
40	6	69	37

Hydrographer

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	14	69	8
40	15	69	4
40	2	68	57
40	0	69	7
40	14	69	8

Oceanographer

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	33	68	12
40	33	68	9
40	10	67	59
40	10	68	12
40	33	68	12

Gilbert

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	33	67	60
40	20	67	44
40	18	67	56
40	33	67	60

Lydonia

Latitude		Longitude	
Degrees	**Minutes**	**Degrees**	**Minutes**
40	34	67	44
40	27	67	38
40	16	67	34
40	16	67	42
40	34	67	44

Table A5 (continued). Coordinates for each of the thirteen canyon GRAs along the Northeast Shelf/Slope based on depth ranges of 100 and 300 m (328-984 ft).

a. Original coordinates for the 13 canyons

Heezen			
Latitude		Longitude	
Degrees	Minutes	Degrees	Minutes
41	8	66	27
41	7	66	20
41	0	66	25
41	8	66	27

b. Modified coordinates for the proposed GRAs in four canyons (revised canyons) selected by the Council under preferred alternative 18C.

Canyon	Latitude				Longitude			
	Degrees	Minutes	Seconds	Dec Deg	Degrees	Minutes	Seconds	Dec Deg
Oceano-grapher (revised coordinates)	40.0	29.0	50.0	40.497	-68	10	30.00	-68.175
	40.0	29.0	30.0	40.492	-68	8	34.80	-68.143
	40.0	25.0	51.6	40.431	-68	6	36.00	-68.110
	40.0	22.0	22.8	40.373	-68	6	50.40	-68.114
	40.0	19.0	40.8	40.328	-68	4	48.00	-68.080
	40.0	19.0	5.0	40.318	-68	2	19.00	-68.039
	40.0	16.0	41.0	40.278	-68	1	16.00	-68.021
	40.0	14.0	28.0	40.241	-68	11	28.00	-68.191
Lydonia (revised coordinates)	40.0	31.0	55.2	40.532	-67	43	1.20	-67.717
	40.0	28.0	52.0	40.481	-67	38	43.00	-67.645
	40.0	21.0	39.6	40.361	-67	37	4.80	-67.618
	40.0	21.0	4.0	40.351	-67	43	1.00	-67.717
	40.0	26.0	32.0	40.442	-67	40	57.00	-67.683
	40.0	28.0	31.0	40.475	-67	43	0.00	-67.717
Veatch (revised coordinates)	40.0	0.0	40.0	40.011	-69	37	8.00	-69.619
	40.0	0.0	41.0	40.011	-69	35	25.00	-69.590
	39.0	54.0	43.0	39.912	-69	33	54.00	-69.565
	39.0	54.0	43.0	39.912	-69	40	52.00	-69.681
Norfolk (revised coordinates)	37.0	5.0	50.0	37.097	-74	45	34.00	-74.759
	37.0	6.0	58.0	37.116	-74	40	48.00	-74.680
	37.0	4.0	31.0	37.075	-74	37	46.00	-74.629
	37.0	4.0	1.0	37.067	-74	33	50.00	-74.564
	36.0	58.0	37.0	36.977	-74	36	58.00	-74.616
	37.0	4.0	26.0	37.074	-74	41	2.00	-74.684

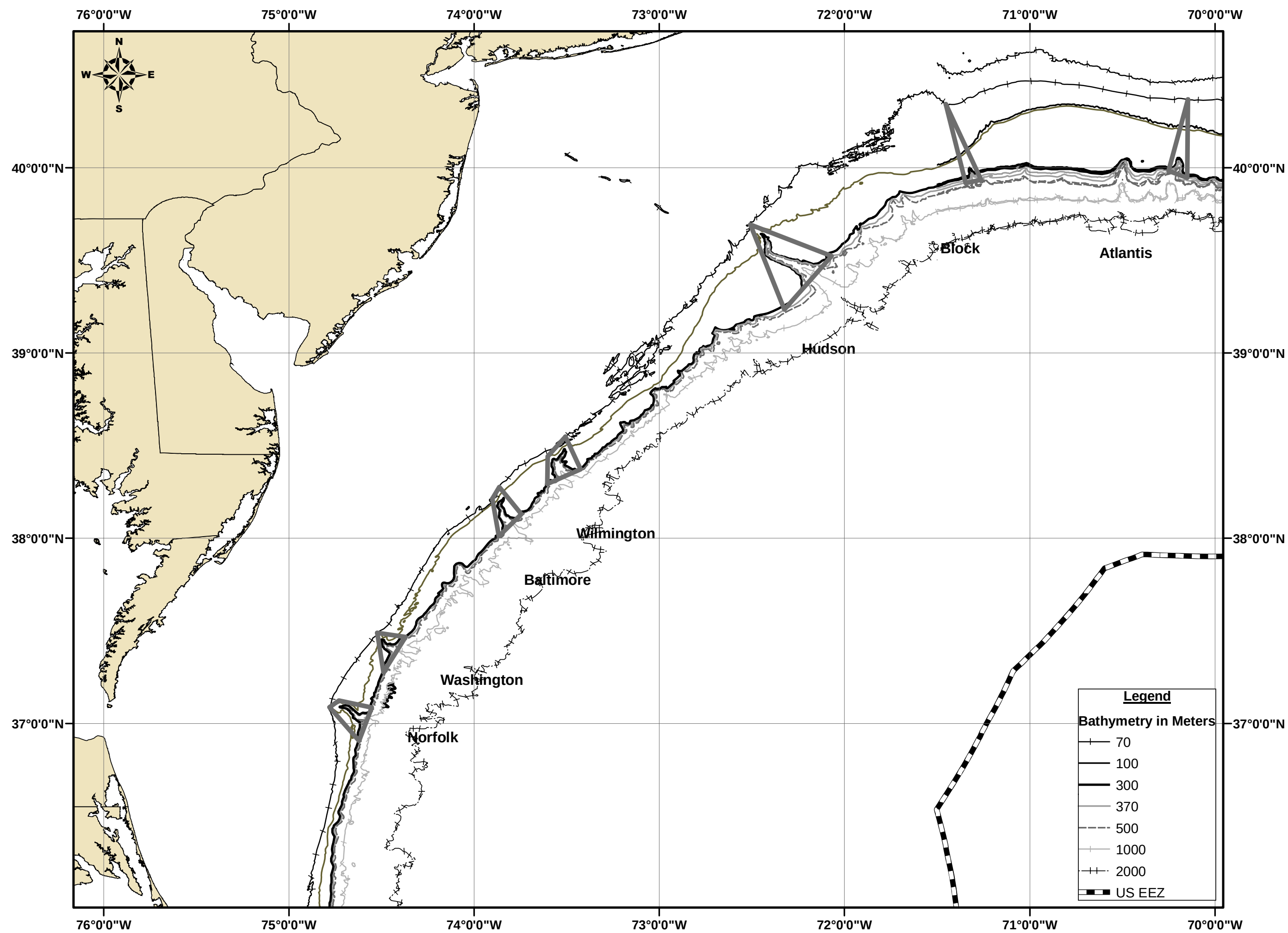

Figure A13. Southernmost view of proposed canyon GRAs (based on 76 to 366 m (250-1200 ft) contours).

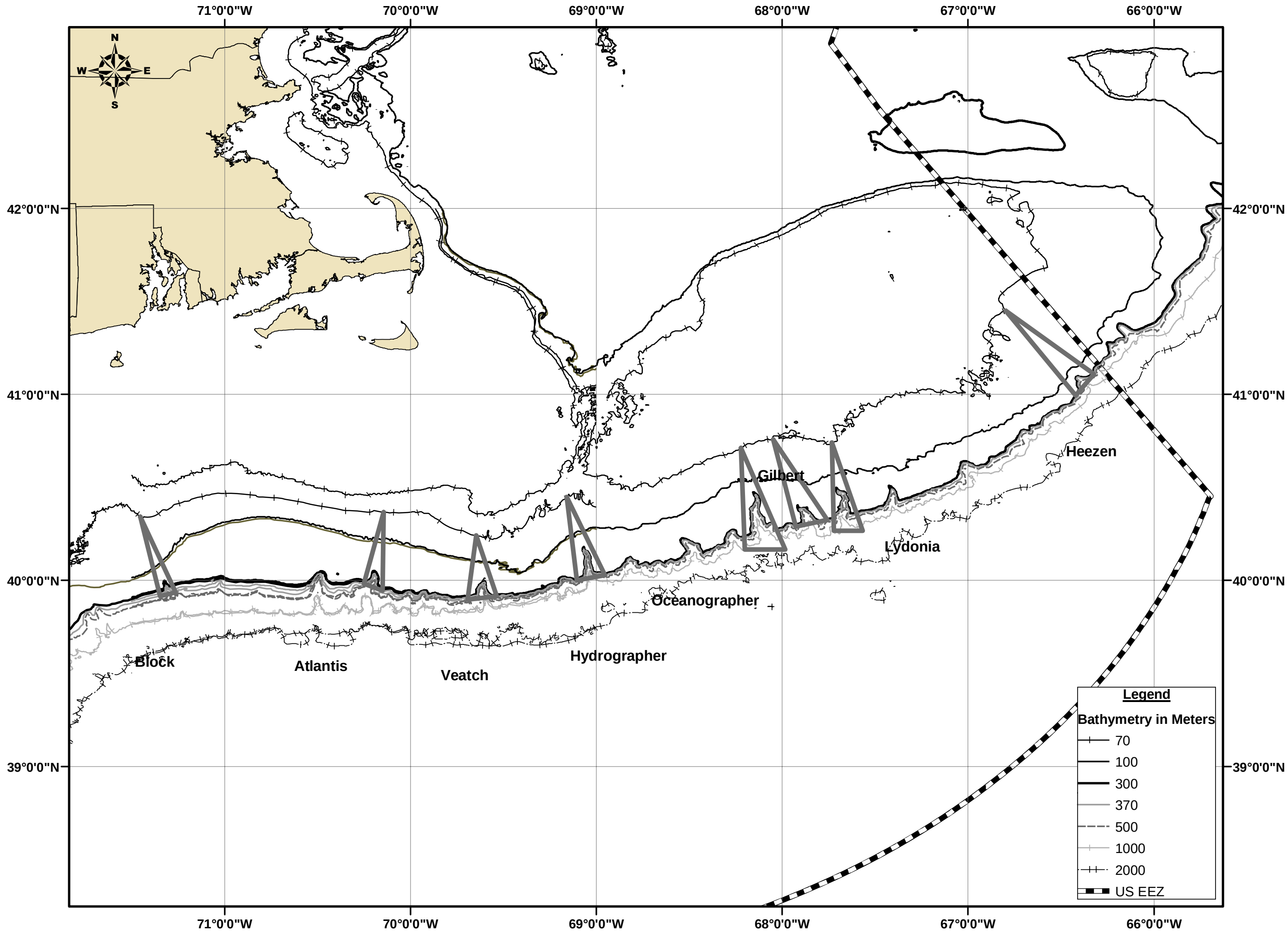

Figure A14. Northernmost view of proposed canyon GRAs (based on 76 to 366 m (250-1200 ft) depth contours).

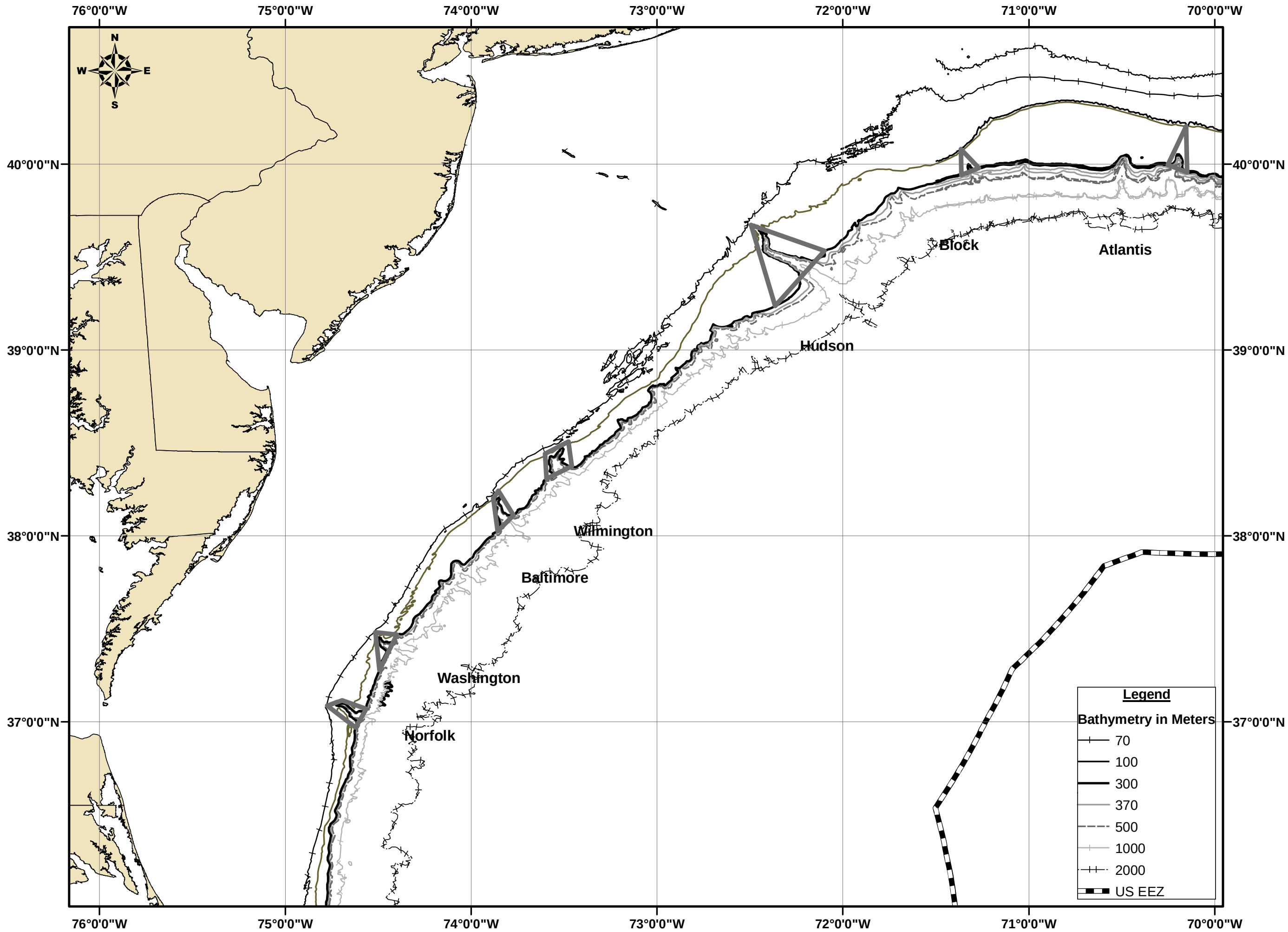

Figure A15. Southernmost view of proposed canyon GRAs (based on 100 to 300 m (328-984 ft) depth contours).

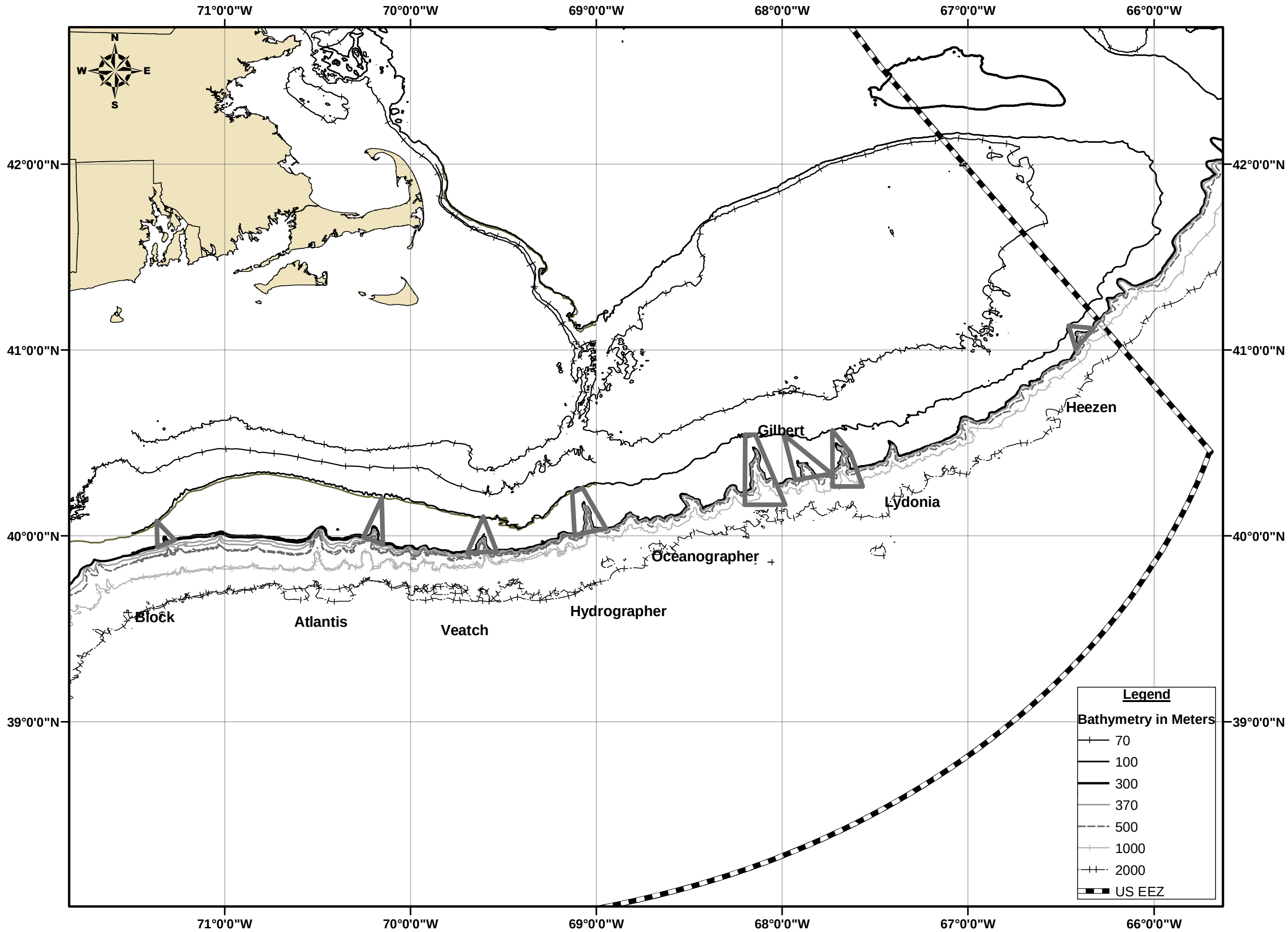

Figure A16. Northernmost view of proposed canyon GRAs (based on 100 to 300 m (328-984 ft) depth contours).

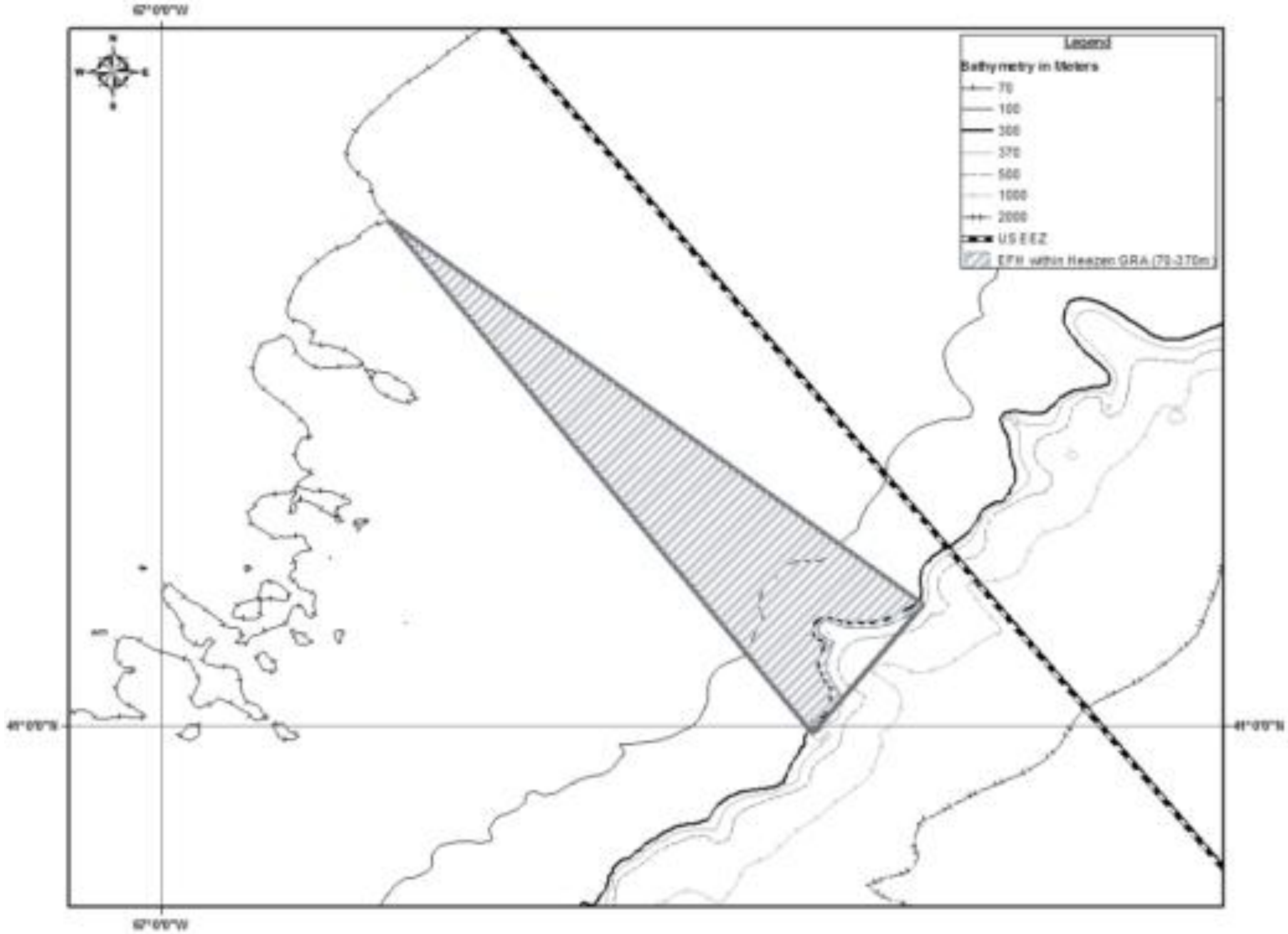

Figure A17. Proposed Heezen Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

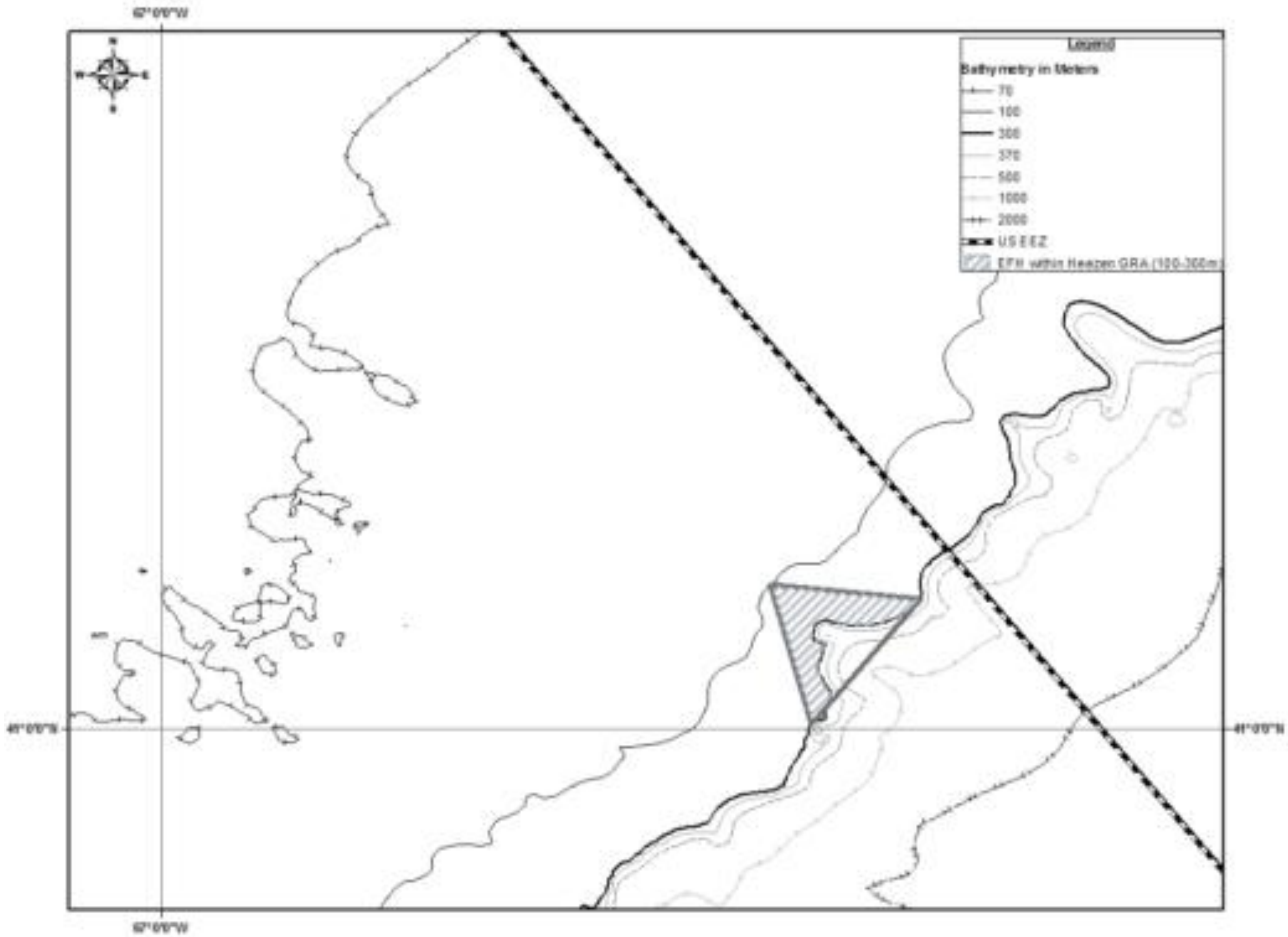

Figure A18. Proposed Heezen Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

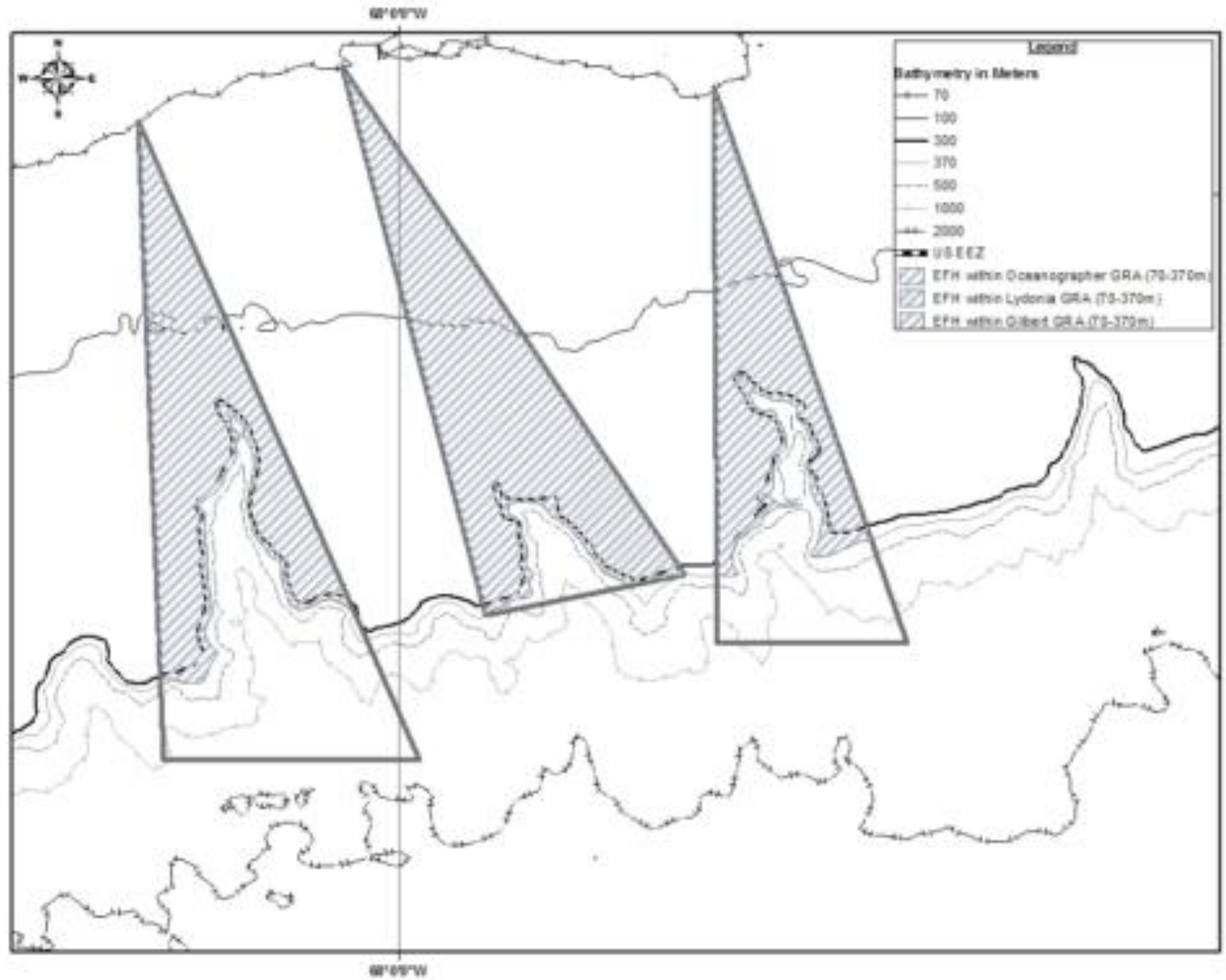

Figure A19. Proposed Oceanographer, Gilbert, and Lydonia Canyon GRAs from left to right (based on 76 to 366 m (250-1200 ft) depth contours).

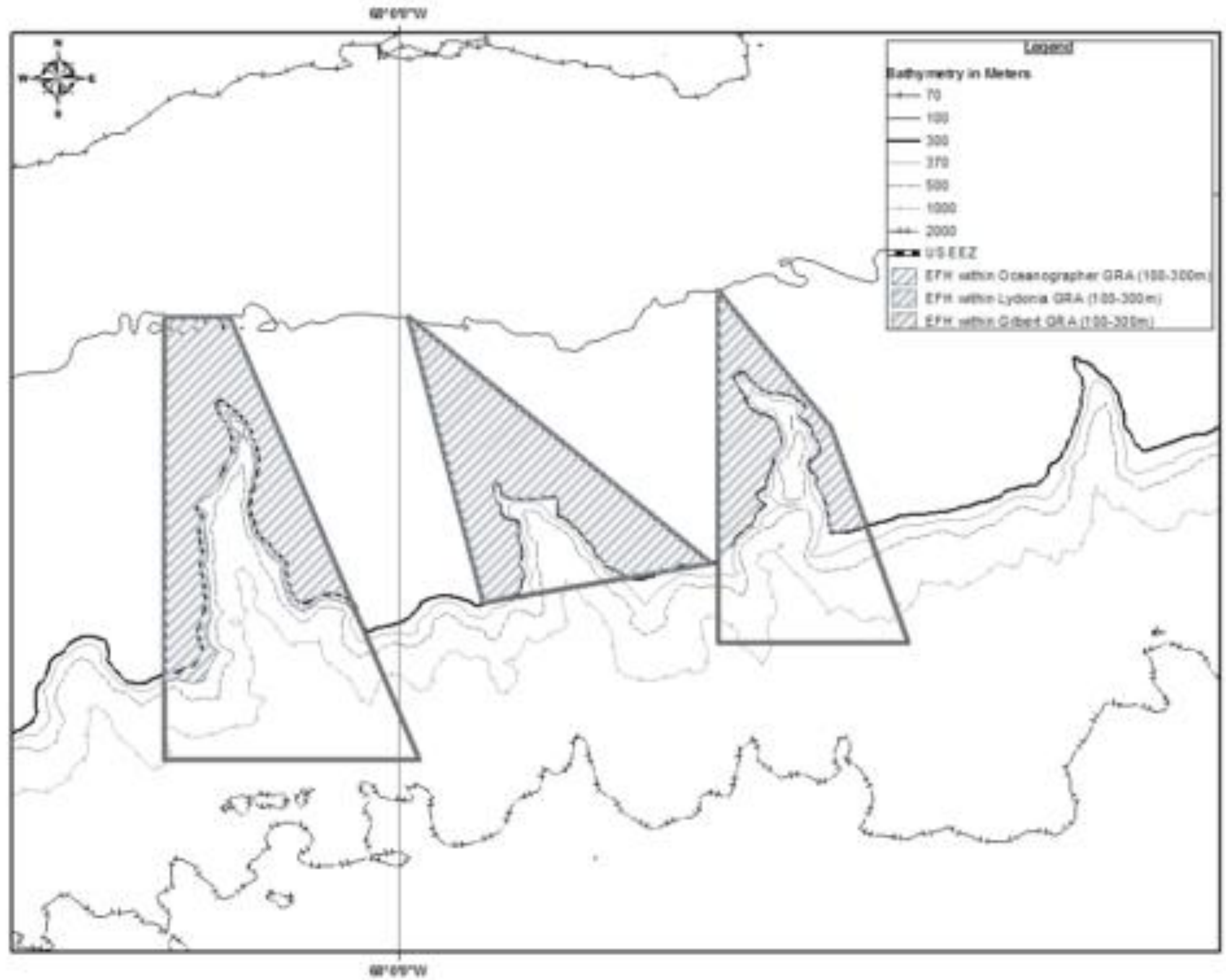

Figure A20. Proposed Oceanographer, Gilbert, and Lydonia Canyon GRAs from left to right (based on 100 to 300 m (328-984 ft) depth contours).

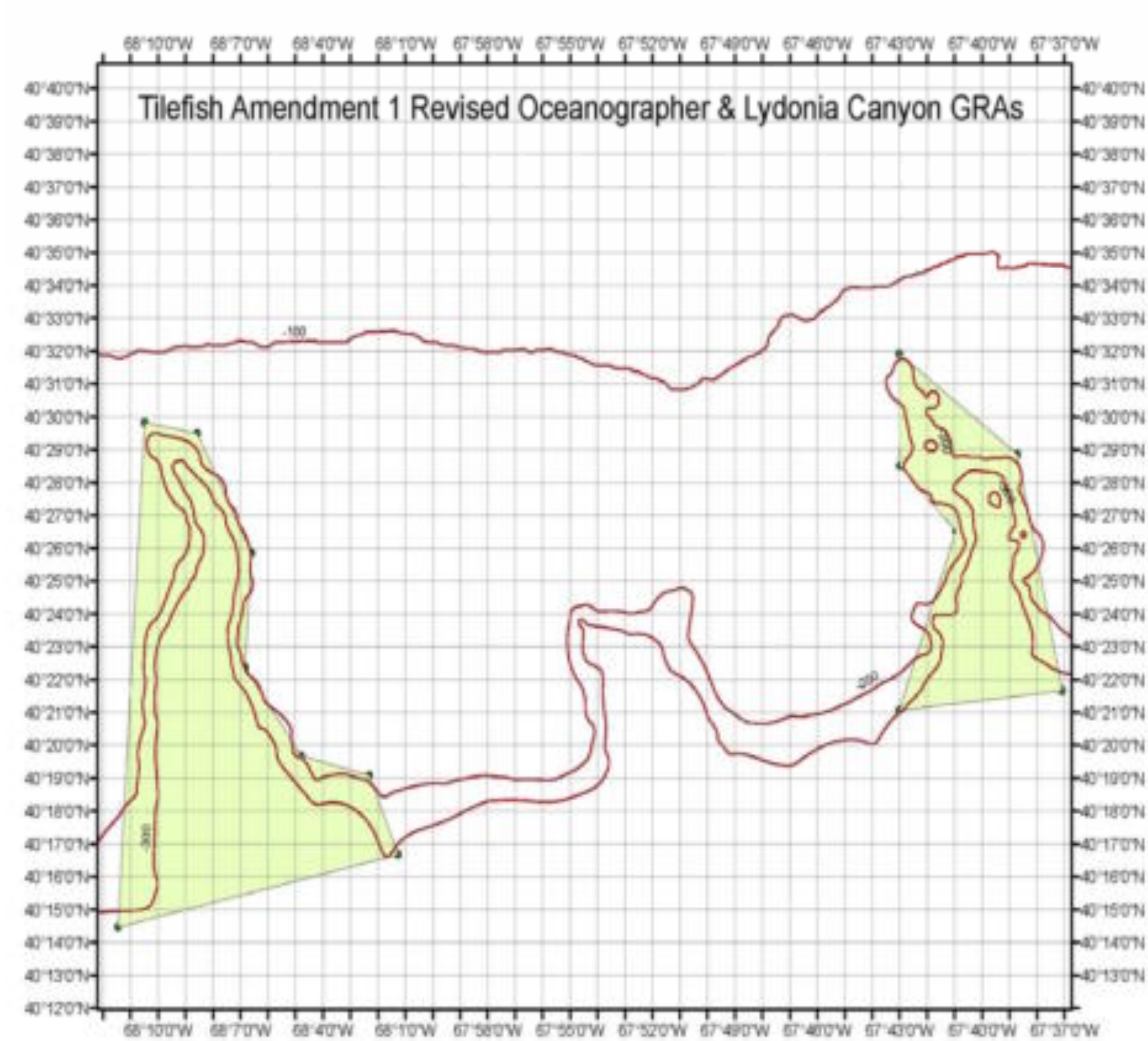

Figure A20a. Revised (modified closed areas) Oceanographer and Lydonia Canyon GRAs from left to right.

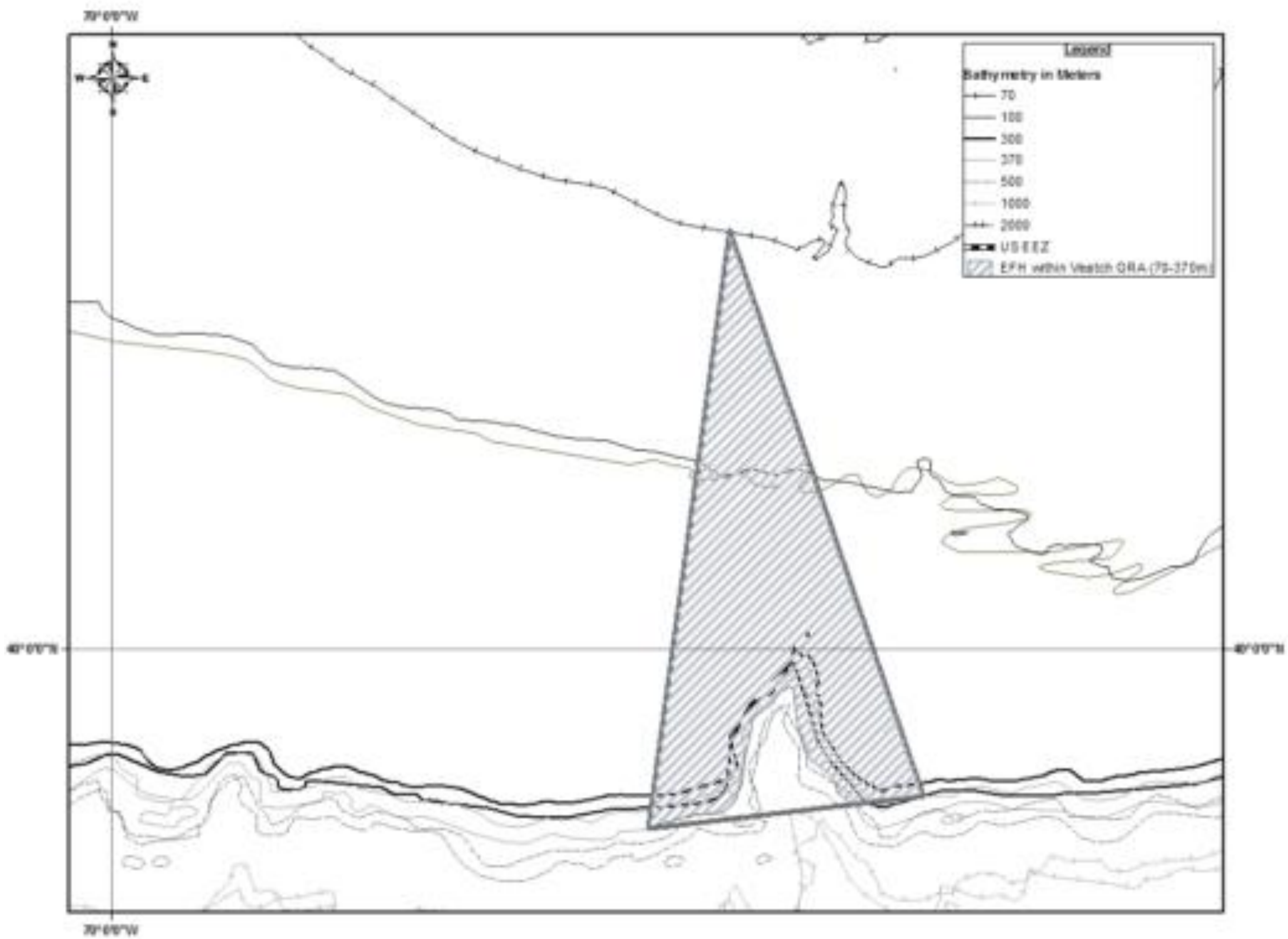

Figure A21. Proposed Veatch Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

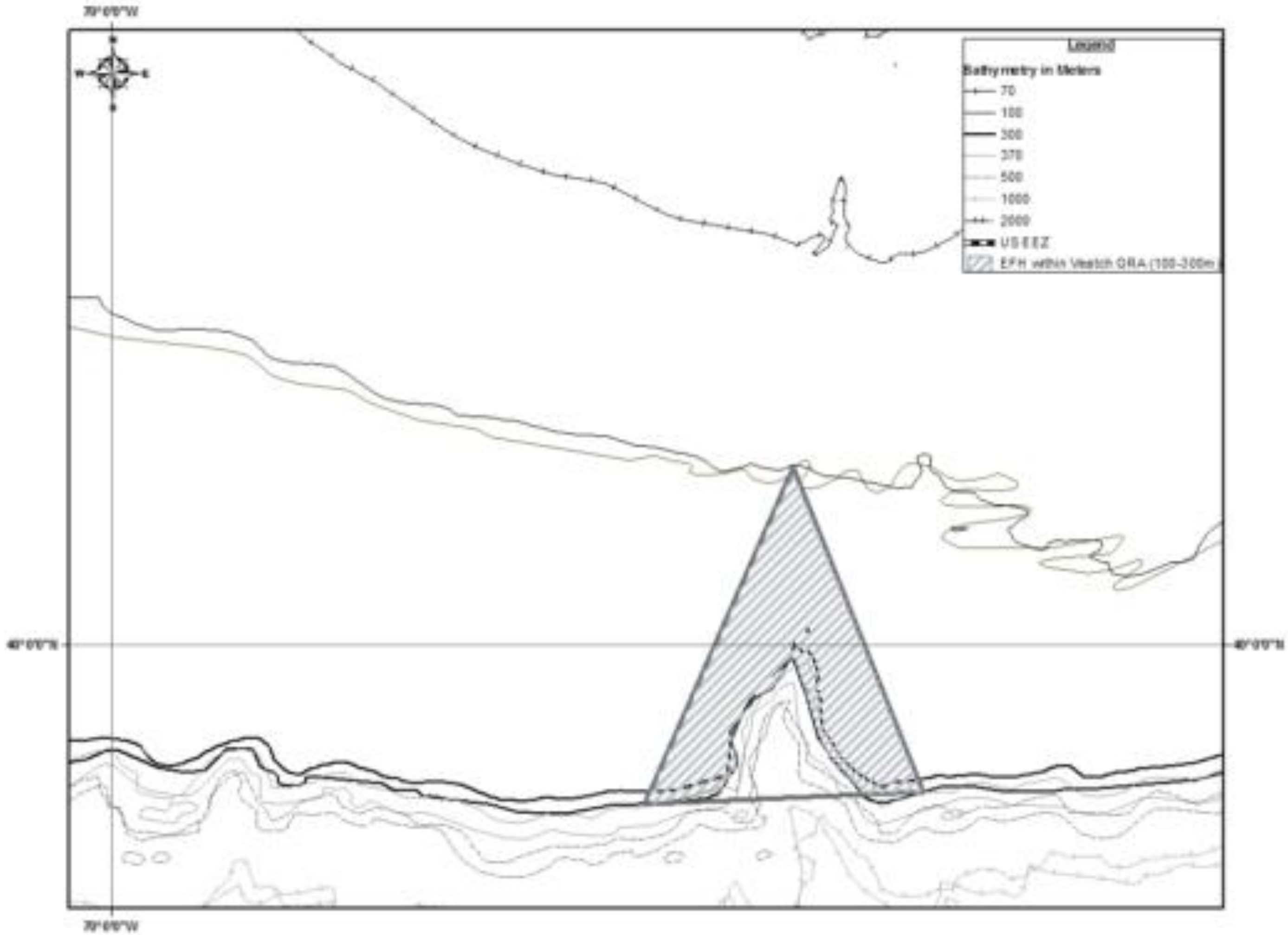

Figure A22. Proposed Veatch Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

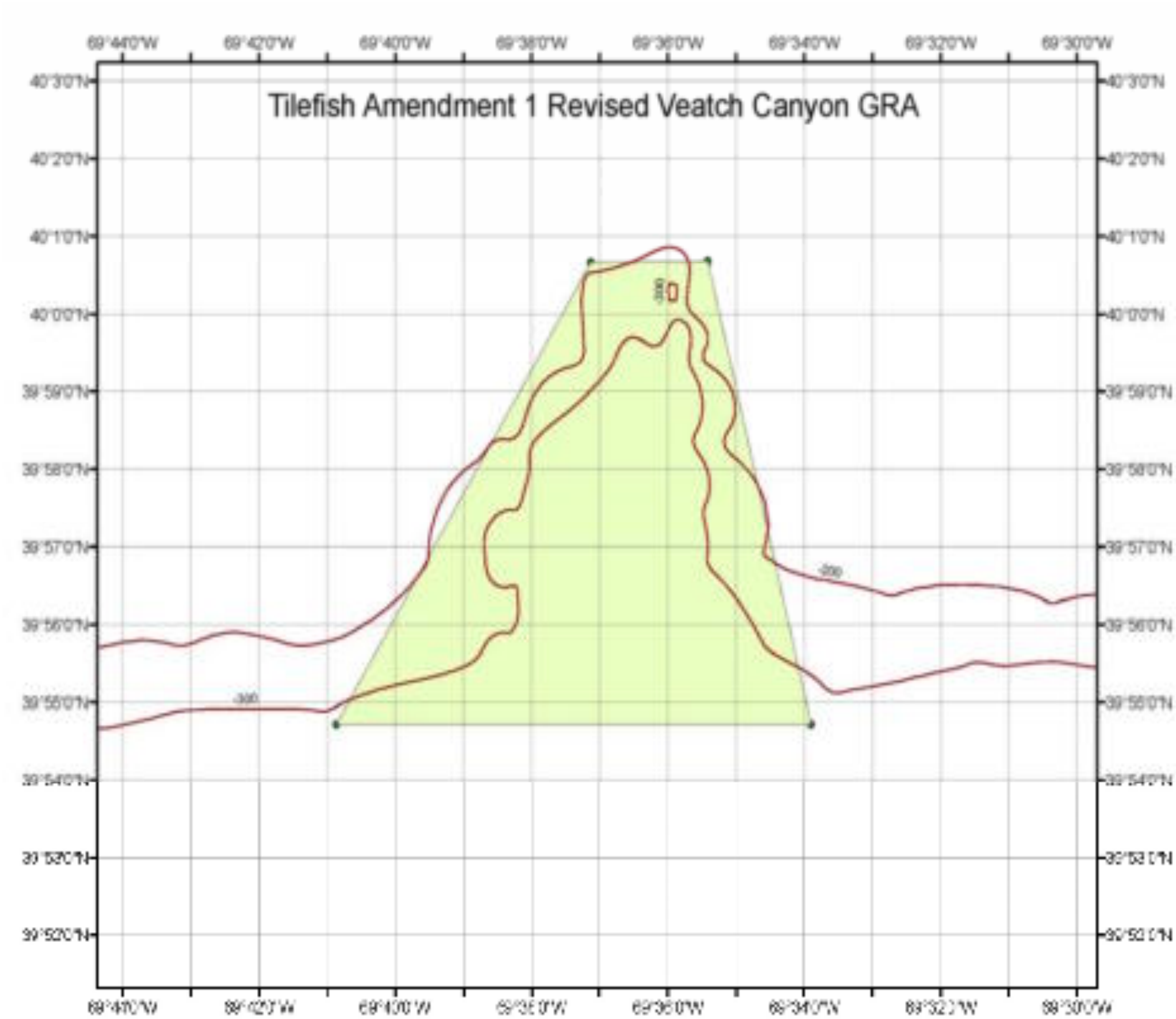

Figure A22a. Revised (modified closed areas) Veatch Canyon GRA.

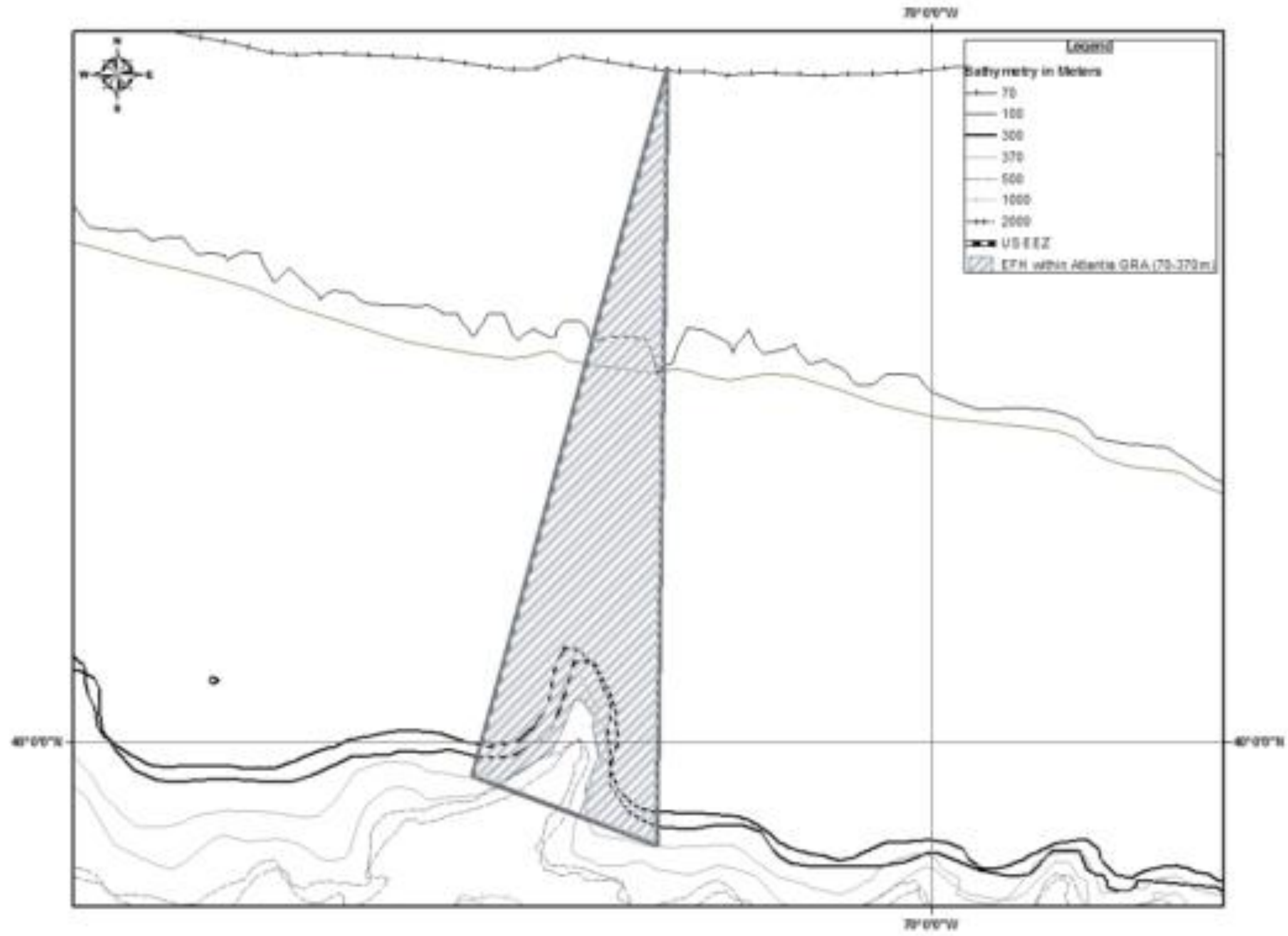

Figure A23. Proposed Atlantis Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

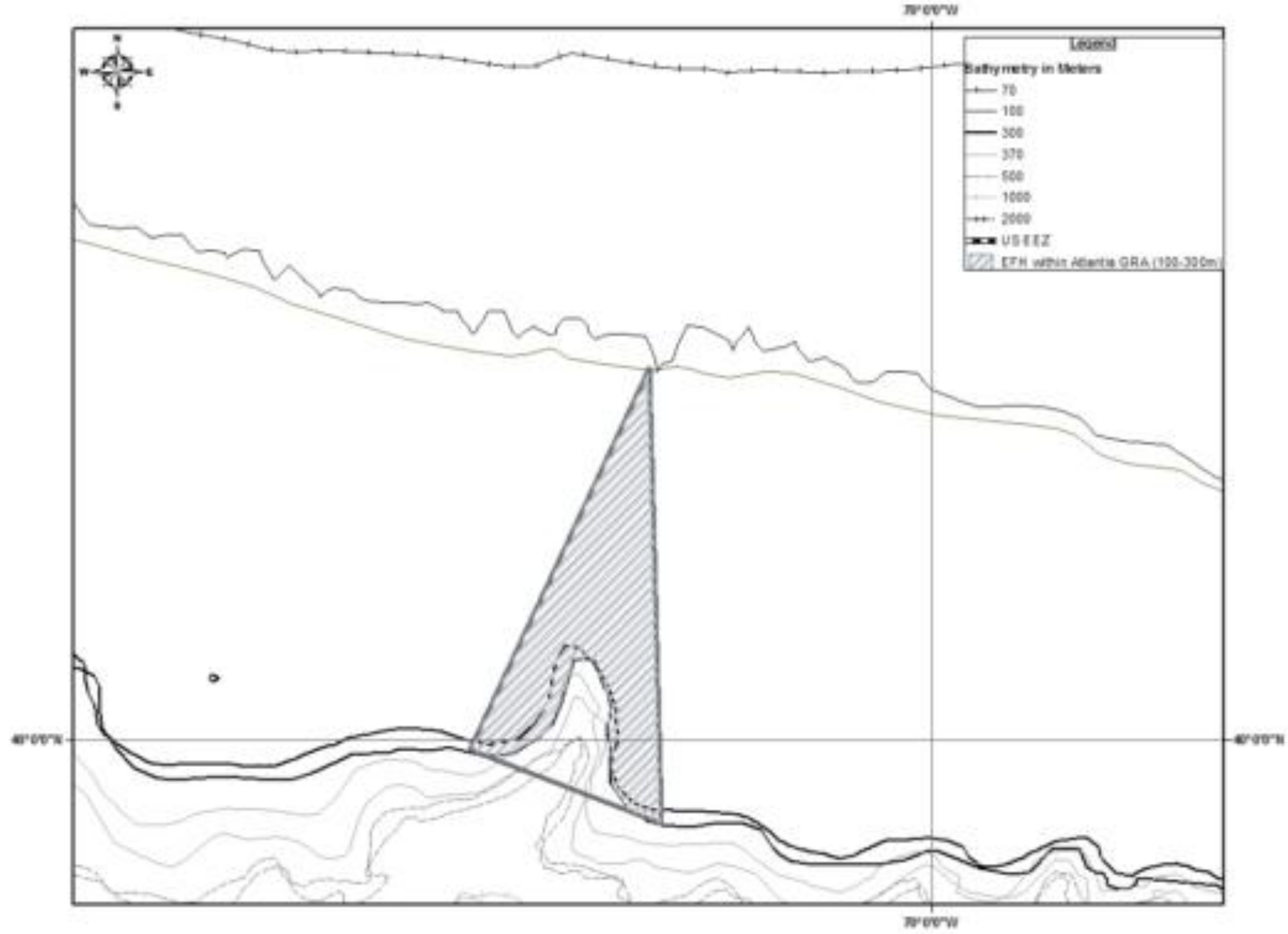

Figure A24. Proposed Atlantis Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

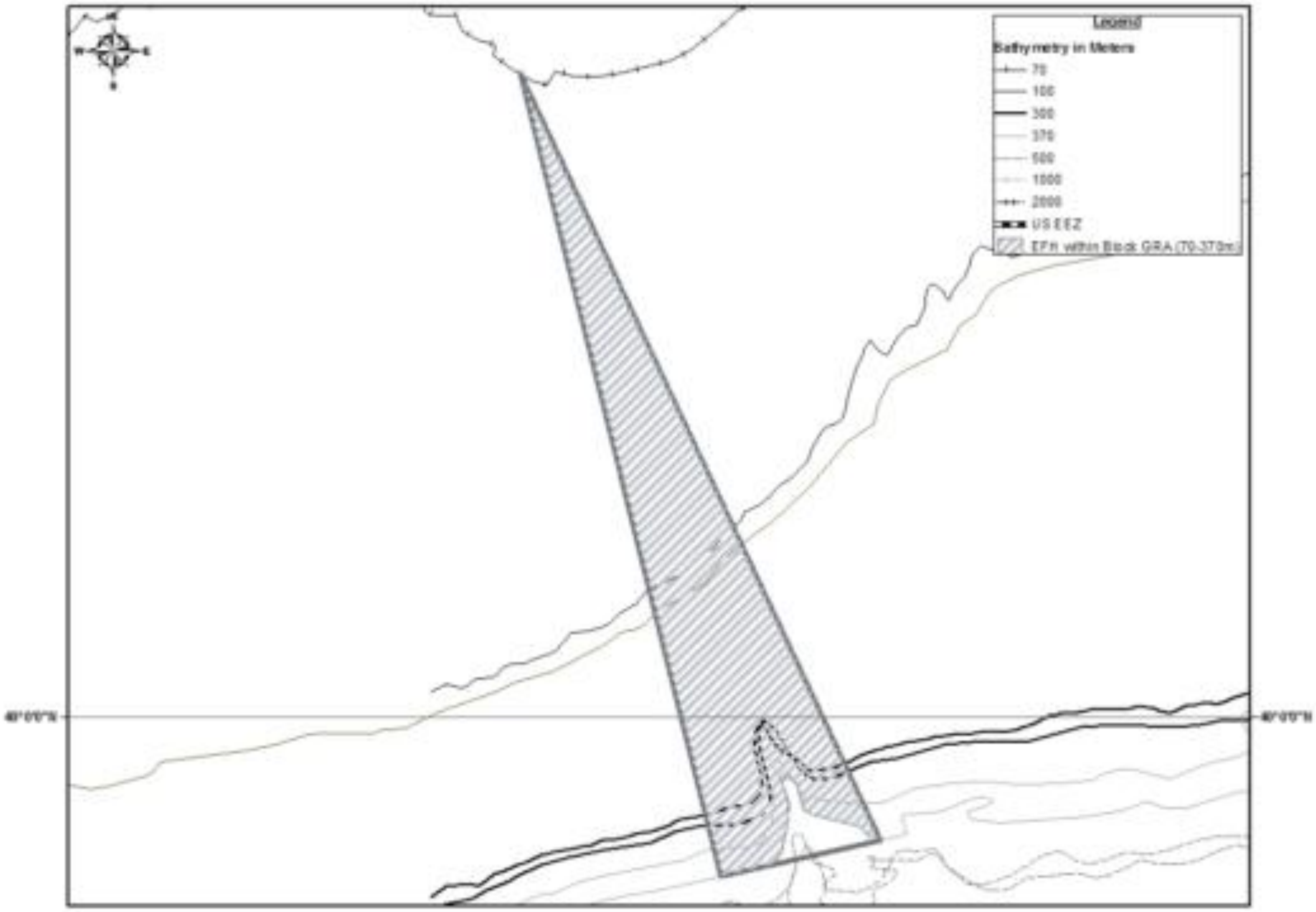

Figure A25. Proposed Block Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

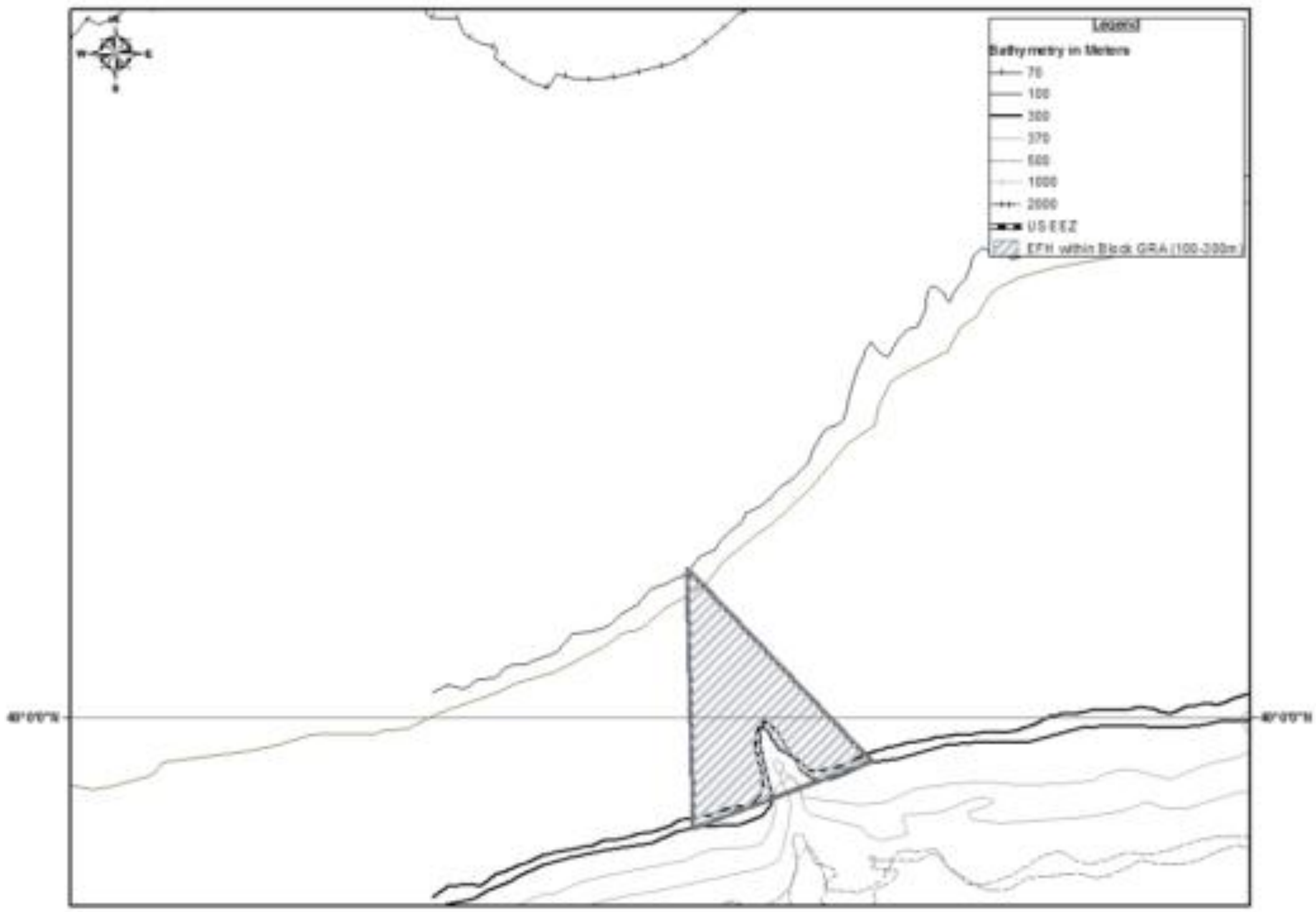

Figure A26. Proposed Block Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

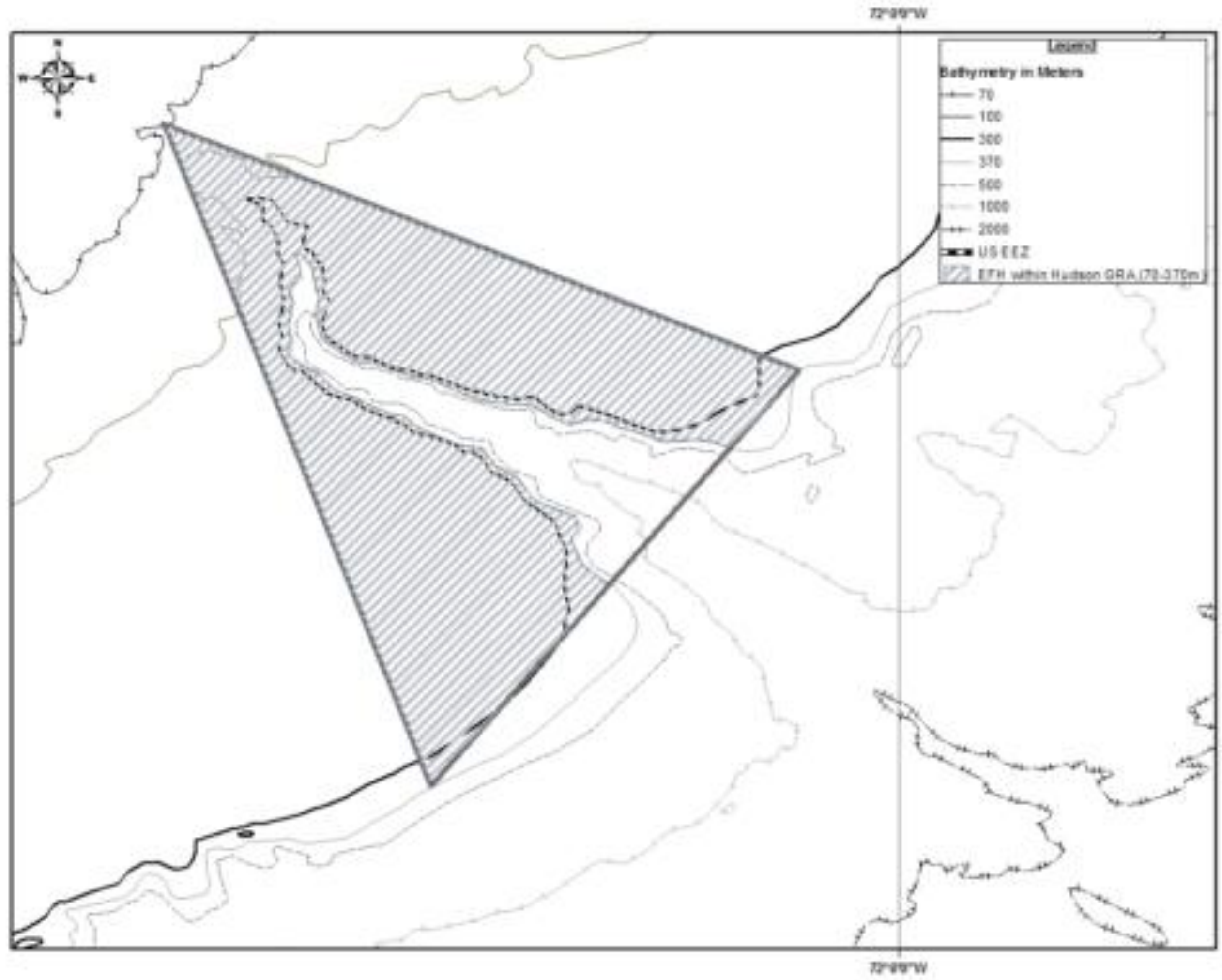

Figure A27. Proposed Hudson Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

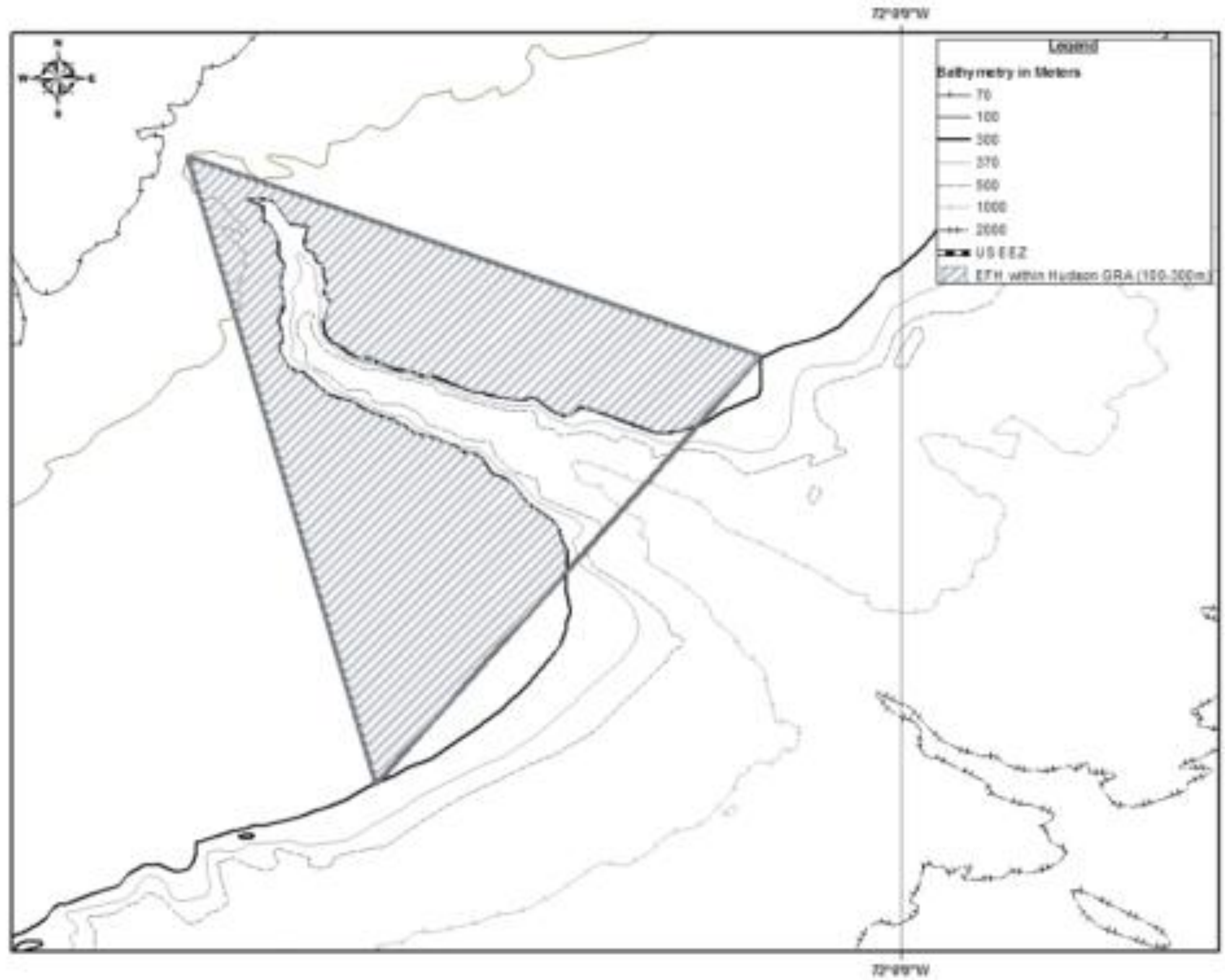

Figure A28. Proposed Hudson Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

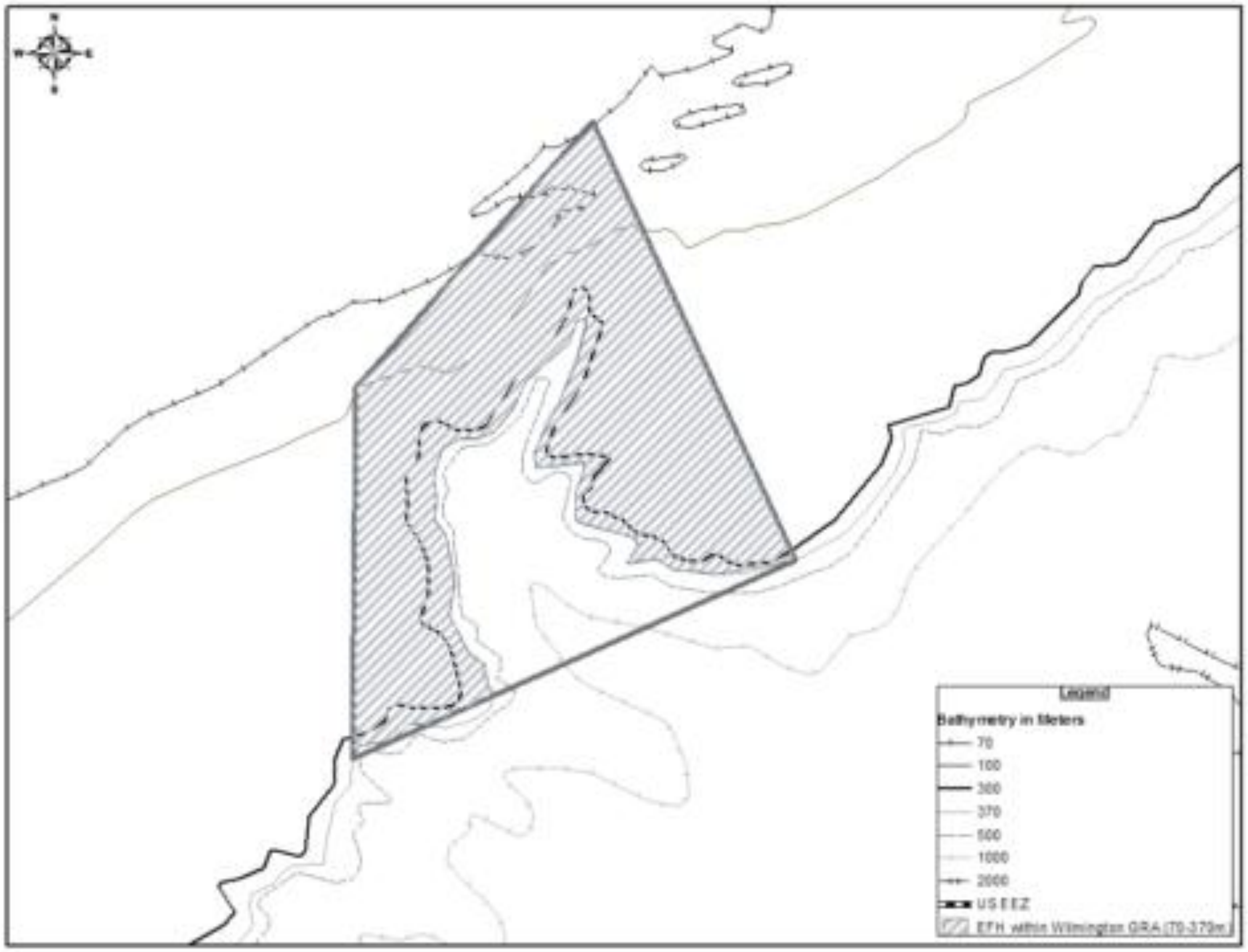

Figure A29. Proposed Wilmington Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

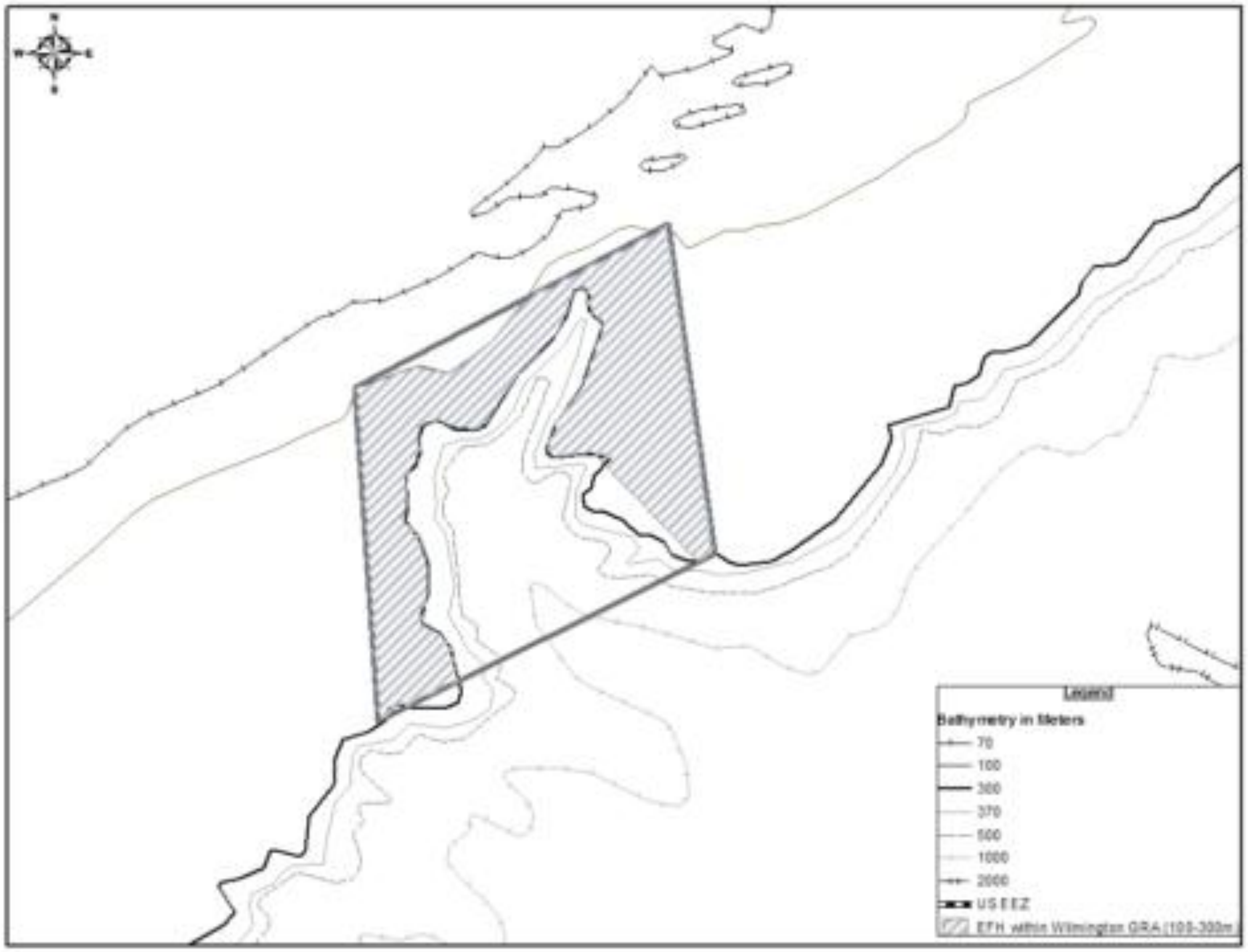

Figure A30. Proposed Wilmington Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

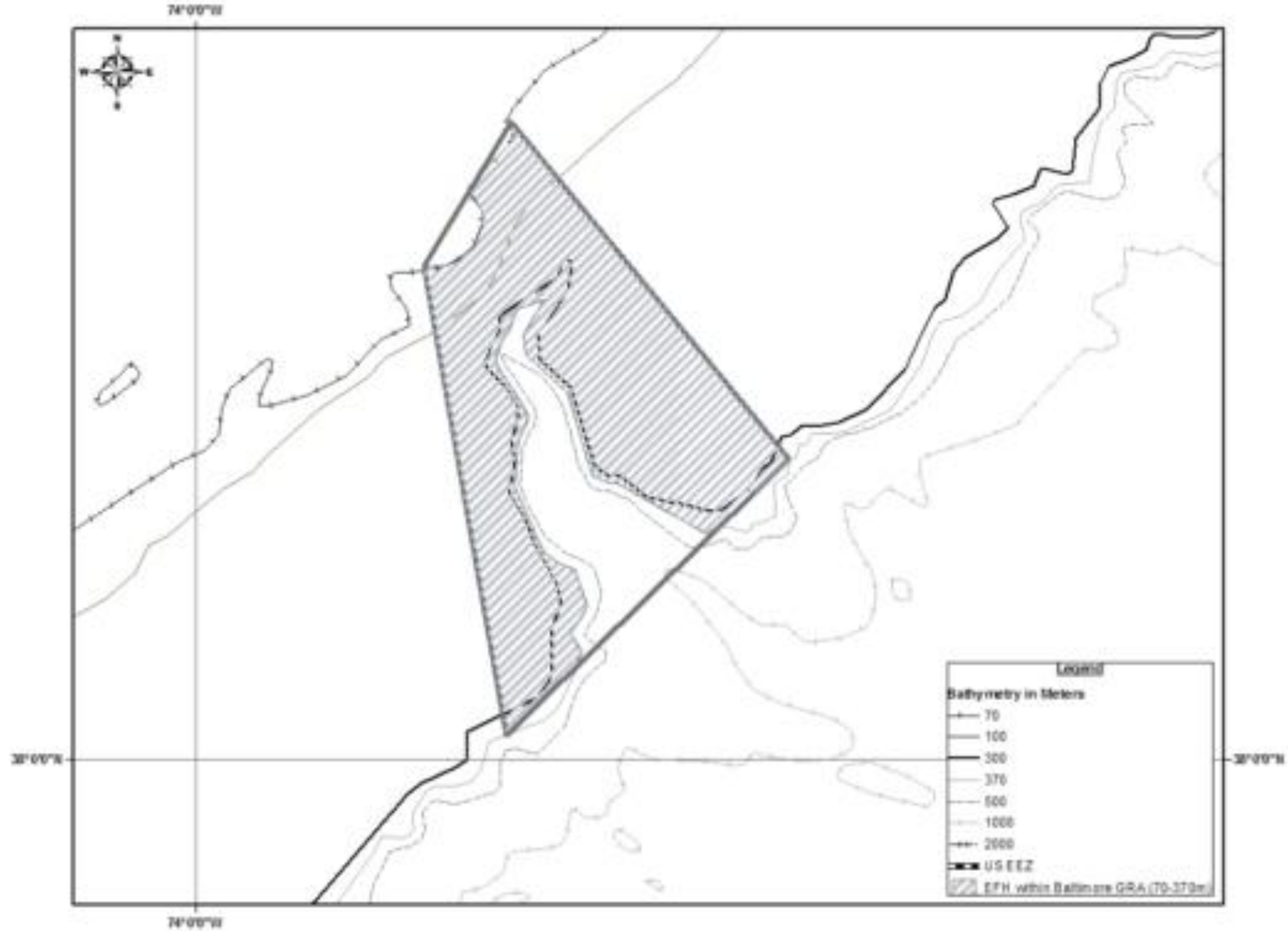

Figure A31. Proposed Baltimore Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

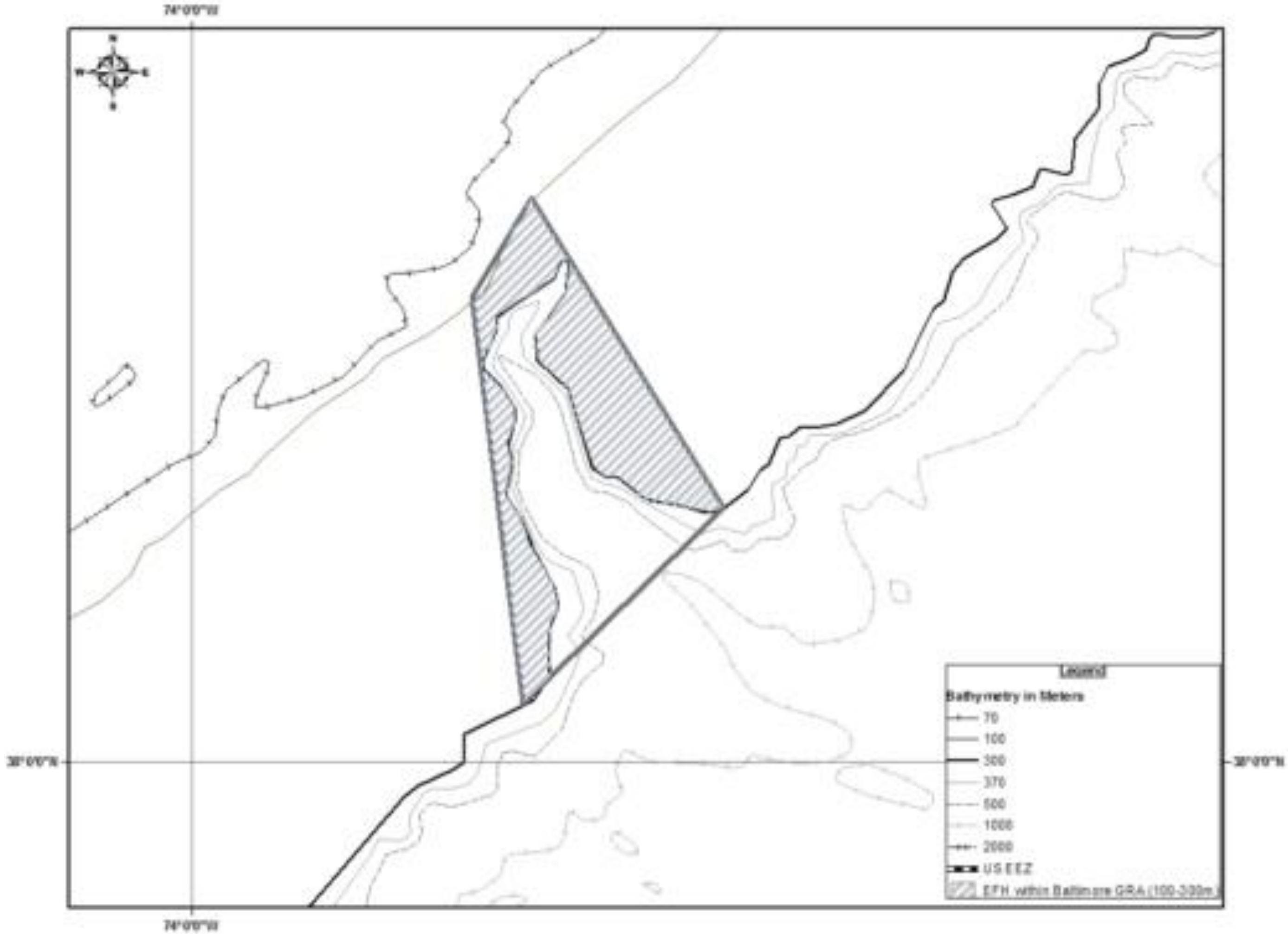

Figure A32. Proposed Baltimore Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

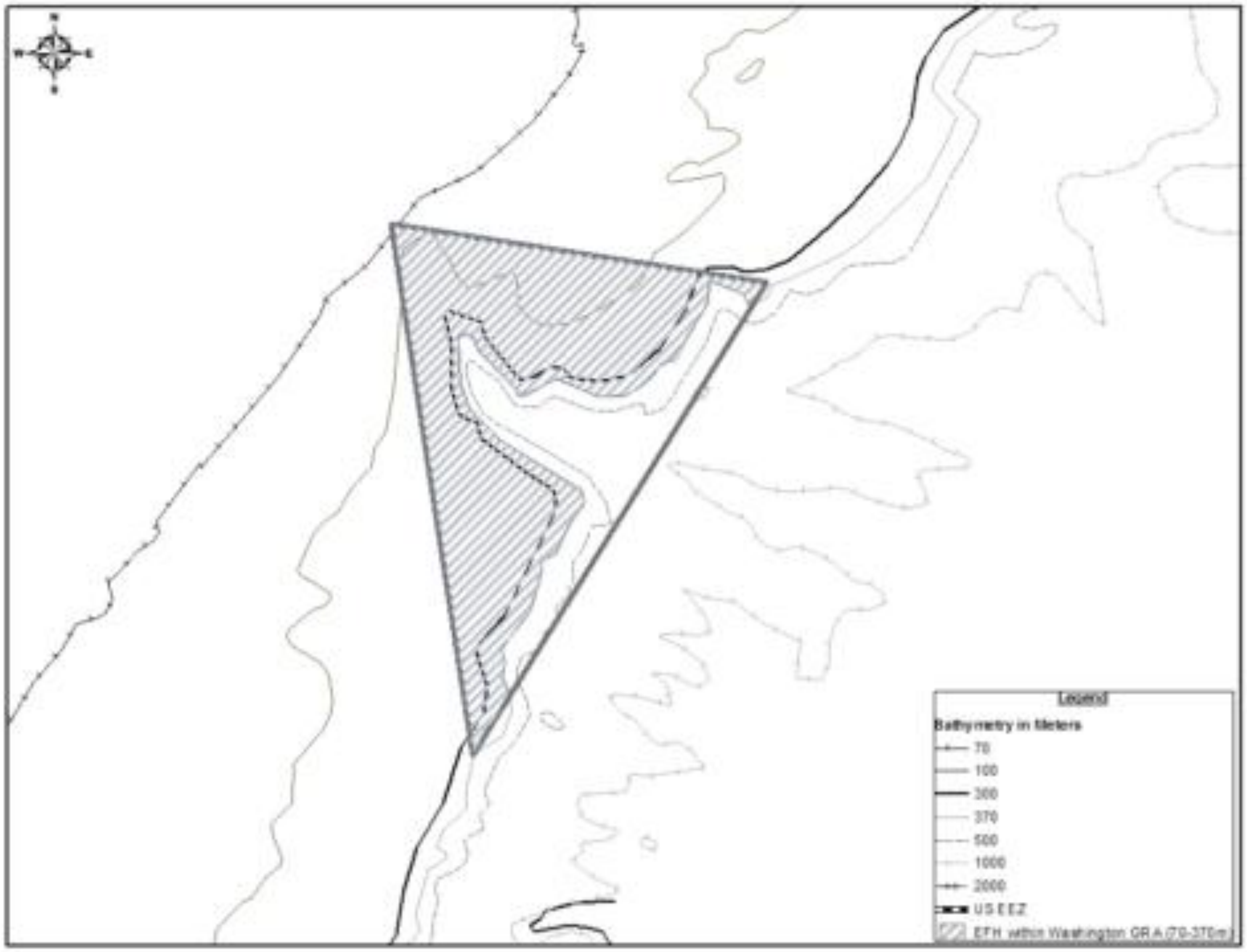

Figure A33. Proposed Washington Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

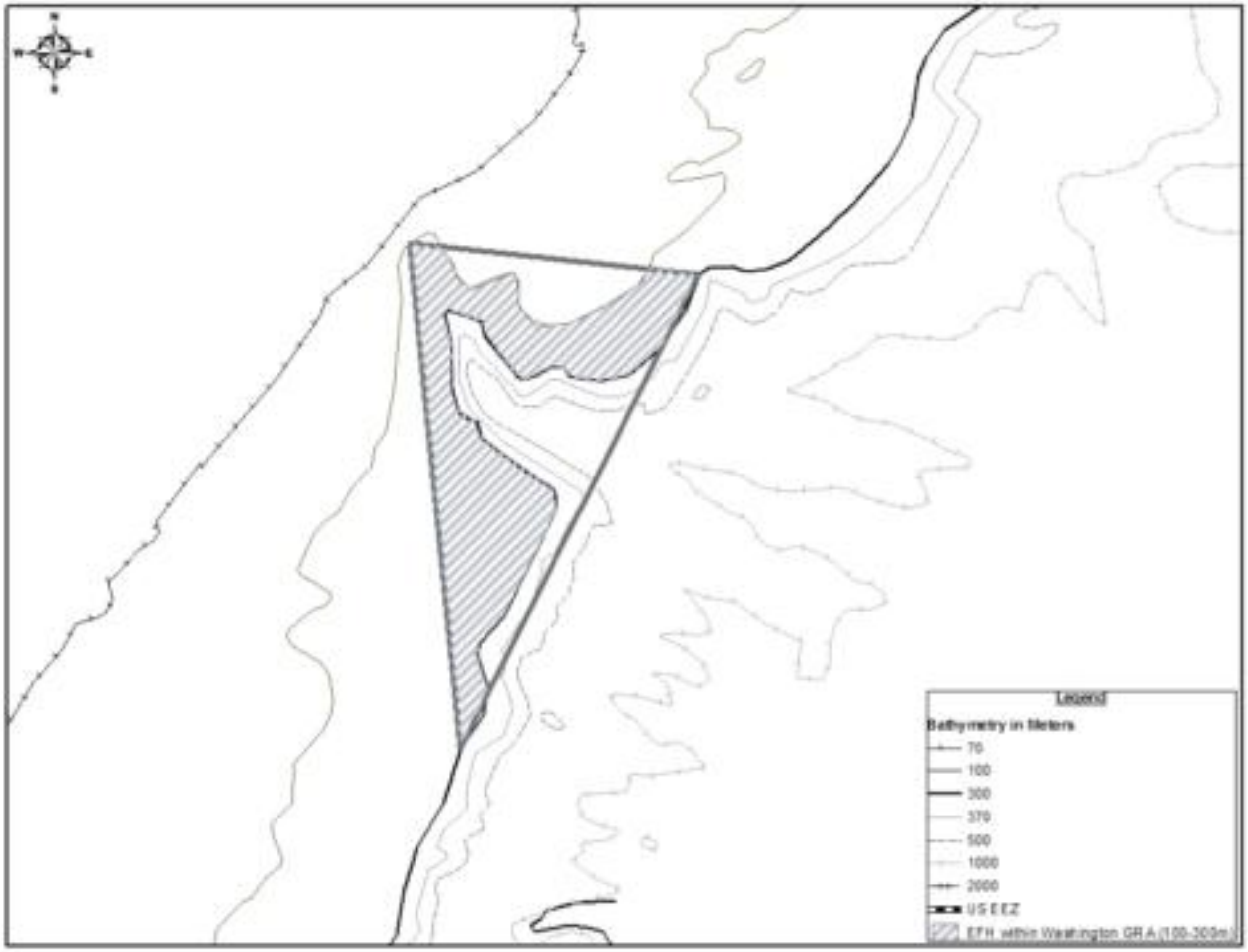

Figure A34. Proposed Washington Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

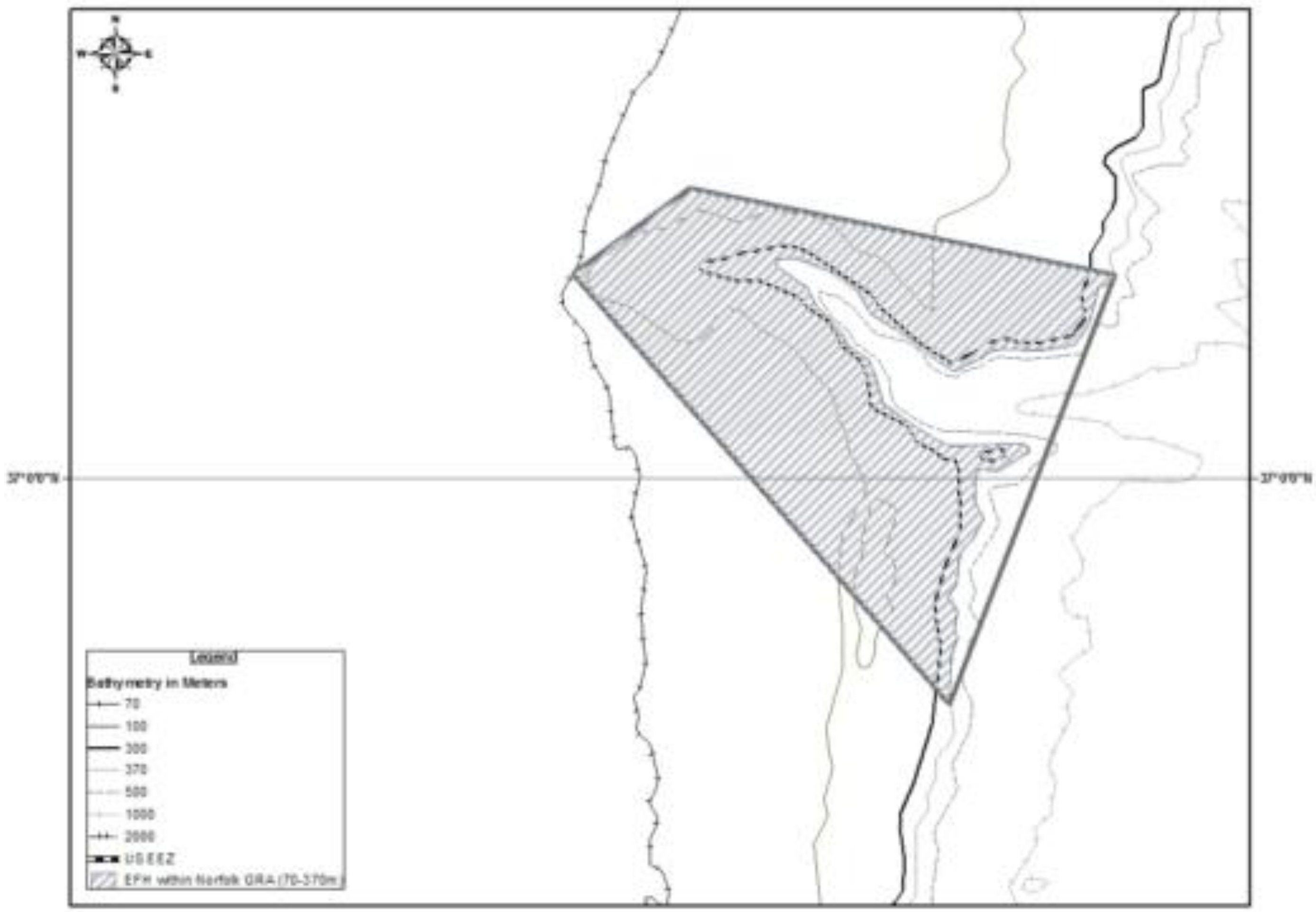

Figure A35. Proposed Norfolk Canyon GRA (based on 76 to 366 m (250-1200 ft) depth contours).

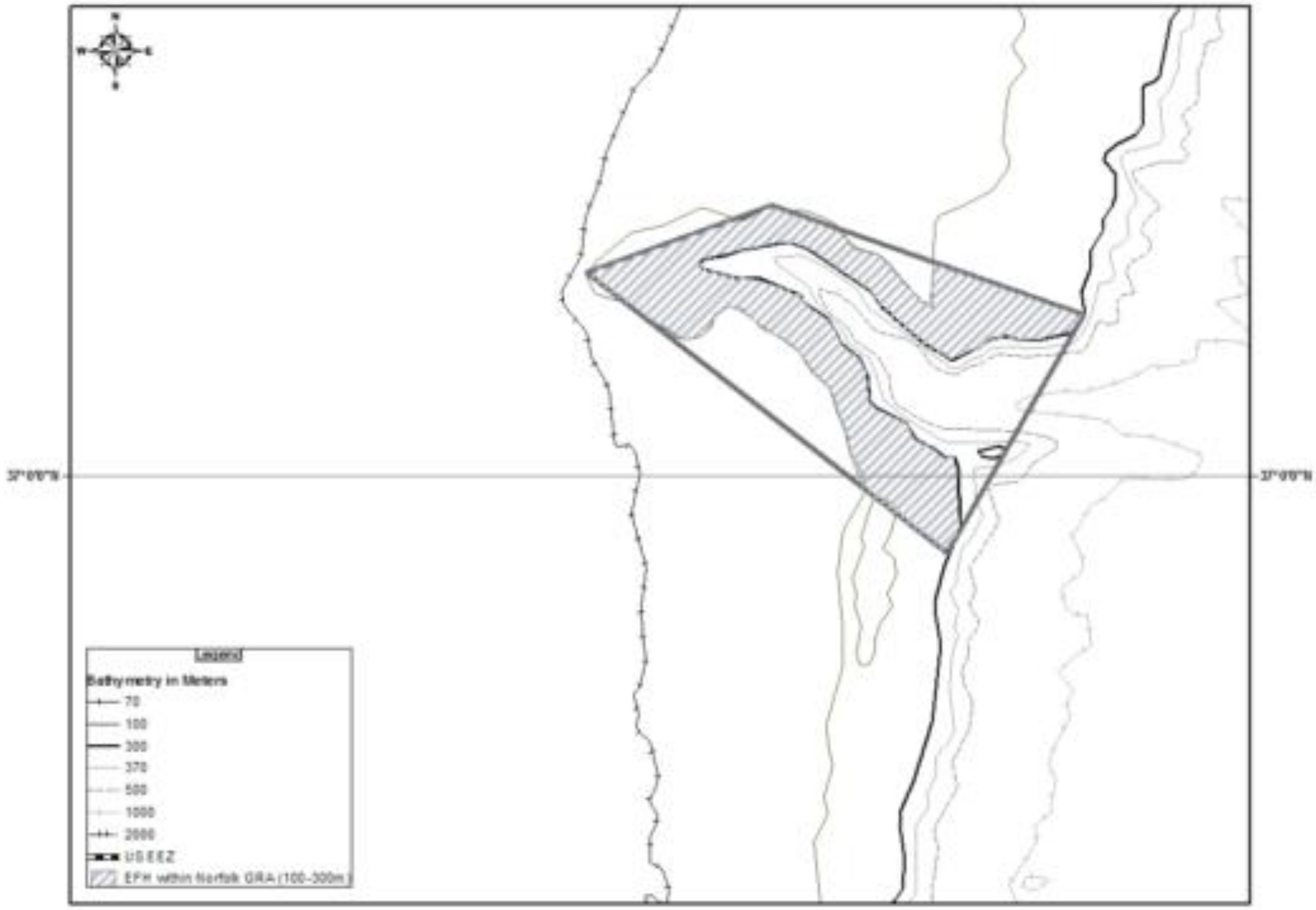

Figure A36. Proposed Norfolk Canyon GRA (based on 100 to 300 m (328-984 ft) depth contours).

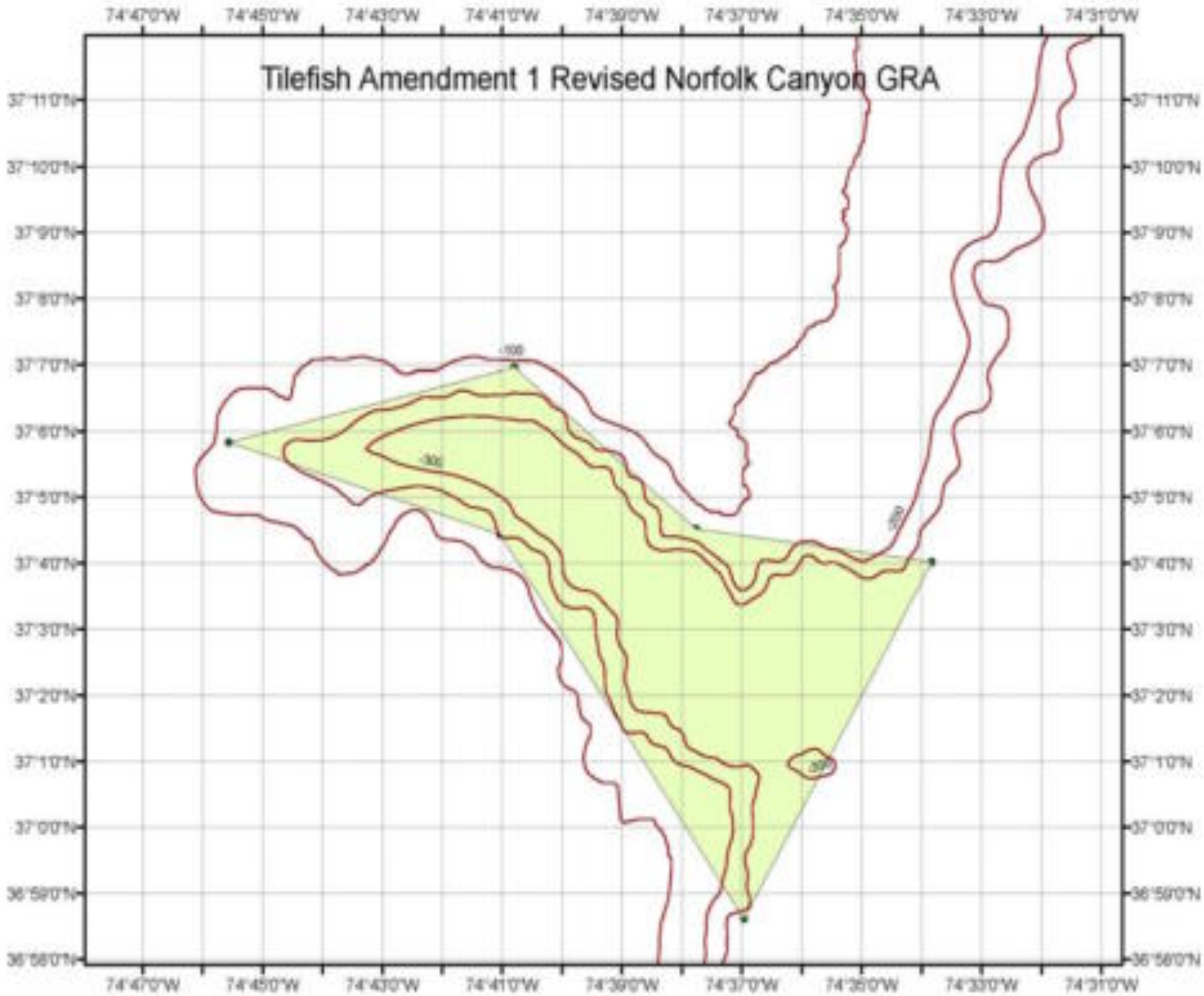

Figure A36a. Revised (modified closed areas) Norfolk Canyon GRA.

APPENDIX F. EFH SOURCE DOCUMENTS

Essential Fish Habitat Source Document
Update Memo:

Tilefish, *Lopholatilus chamaeleonticeps,* Life History and Habitat Characteristics

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Highlands, NJ 07732

May 2005

FOREWORD

The initial series of EFH species source documents were published in 1999 in the *NOAA Technical Memorandum NMFS-NE* series. Updating and review of the EFH components of the New England and Mid-Atlantic Councils' Fishery Management Plans is required at least every five years by the NOAA Fisheries Guidelines for meeting the Sustainable Fisheries Act/EFH Final Rule. Update memos of the original species source documents were written to provide the updated information needed to meet these requirements. The update memos summarize and present new and recent literature and research, incorporate updated and revised maps and graphs, and provide new information where necessary on life history, geographic distribution, and habitat requirements. This update of the tilefish EFH source document is based on the original by Frank W. Steimle, Christine A. Zetlin, Peter L. Berrien, Donna L. Johnson, and Sukwoo Chang, with a foreword by Jeffrey N. Cross, and published in 1999 as NOAA Technical Memorandum NMFS-NE-152. The updated references and discussion were collected and provided by Vincent G. Guida of the James J. Howard Marine Sciences Laboratory.

Dave Packer and John McCarthy, editors
Northeast Fisheries Science Center
James J. Howard Marine Sciences Laboratory

Tilefish – New or Additional Information Since 1999

- Tilefish are most abundant from Georges Bank to Key West, Florida and throughout much of the Gulf of Mexico (Matlock *et al.* 1991) including the Mexican coast as far south as the Bay of Campeche (Bigelow and Schroeder 1953). They are occasionally reported from as far south as off the southernmost Caribbean Islands (Barbados, Trinidad and Tobago, Curaçao and Aruba), and the northern coast of South America from French Guiana to Colombia. However, they have not been reported from intervening Caribbean islands (Dooley 1978, Cervigón *et al*. 1992).
- Dooley (1978) speculated that tilefish recently colonized the outer continental shelf off southern New England because there are no reported catches of the species in the deep-water, longline cod fishery prior to 1879 (although the fishery probably was focused in shallower water because of the time and effort required to retrieve the gear by hand). In contrast, Twichell *et al*. 1985 found evidence that tilefish have been excavating burrows off New Jersey for centuries, substantially altering outer shelf topography and stratigraphy.
- Tilefish habitat is almost exclusively restricted to the outer continental shelf and upper continental slope (80 to 540 m depth) south of the Gulf of Maine. The two factors that are probably most responsible for restricting this species' range to that narrow geographic band are the distributions of substrate type and temperature regime. Adult tilefish require sediments in which they can burrow within a zone with a stable, moderate temperature regime (Grimes and Turner 1999).
- Regardless of sediment composition or topography, the key substrate property that allows tilefish to burrow is cohesiveness: an ability to maintain a firm shape without collapse when excavated (Wenner and Barans 2001). Such sediments include deposits of such diverse origins as the Pleistocene clays of the Hudson Canyon region (Able *et al*. 1982) and the foraminiferal calcilutite ooze of the Charleston Bump area (Wenner and Barans 2001). Burrows often occur in areas where there is a thin veneer (few cm) of loose sand or mud overlying semilithified clay, but not in areas with deep deposits of clean gravel, clean sand, or soft silt with no clay, where stable burrows can not be excavated or maintained (Guida 2001, 2002).
- Tilefish habitat is used by other fish and invertebrates, especially crustaceans. Among these associates, galatheid and gonaplacid crabs, and black bellied rosefish (*Helicolenus dactylopterus*) are the most frequently observed (Grimes *et al.* 1986, V. Guida, NOAA Fisheries, NEFSC, James J. Howard Marine Sciences Laboratory, Highlands, NJ, unpublished data). Also included are species whose geographic range may extend into this habitat; e.g., scorpion fishes [*Pontinus* spp., Guida, (unpublished data)].
- Harris *et al.* (2001) suggests that more than one female may maintain reproductive territories within the larger territory of a dominant male. This results in a complex breeding system in which both male and female adults that are too small to hold territories may not contribute to reproduction, in spite of physiological maturity (Grimes and Turner 1999; Harris *et al*. 2001).
- Bowman *et al*. (2000) summarized stomach contents data, primarily from the NEFSC bottom trawl surveys from 1977-1980 (Table). Ophiuroids dominated the diet (75% of stomach content by weight), followed by crustaceans (22% by weight).
- There is one record of tilefish in the stomach of a > 90 cm TL goosefish (Rountree 1999; Bowman *et al*. 2000).
- Hoenig (1983) used longevity estimates of 40-50 years for "unexploited" tilefish population in a regression model to predict total annual mortality M = 0.09-0.11, the mean (0.10) of which has been used for stock assessment (Nitschke 2000).
- Sex ratios are skewed in favor of males at larger sizes; however, both sexes are equally abundant at most ages (Grimes *et al*. 1988).
- Able (2002) discusses age and growth. During intensive sampling at a relatively unexploited phase of the fishery, maximum sizes were 95 cm FL for females and 112 cm FL for males, and maximum ages were 35 and 26 years, respectively (Turner *et al*. 1983). Based on validated otoliths, both sexes grew about 10 cm/yr FL for the first four years. At age 4, males and females averaged 43 and 41 cm FL, respectively. By the 9th year males averaged 74 cm FL and females averaged 64 cm FL. Females had a much smaller L_∞ (90 cm FL) and a larger K (0.153) than males (L_∞ = 111 cm FL and K = 0.130). Growth models (von Bertalanffy) for males [$L_\infty = 111.3(1 - e^{-0.130(t - 0.216)})$] and females [$L_\infty = 90.2(1 - e^{-0.153(t - 0.026)})$] were significantly different with faster growth for males.

- Regarding the massive mortality of tilefish and other outer shelf fishes and crustaceans and subsequent fishery collapse in 1882, analyses of stable oxygen isotopes from dated shells of ocean quahogs (*Arctica islandica*) indicate that bottom water temperature on the outer mid-Atlantic shelf reached a minimum of 3.2°C at some time during 1881-1882, the lowest temperature indicated for the entire period 1875-1983. Unusually intense southwesterly transport of cold Labrador Current water, alone or in concert with Gulf of Maine water, has been suggested as the cause of this cooling event. The event followed within one year of a minimum in the value of the North Atlantic Oscillation (NAO) index, a large-scale pattern of atmospheric alteration characterized by the difference in sea level atmospheric pressure between Iceland and the Azores. Low NAO index value is known to intensify the southwesterly flow of the Labrador Current, although some additional factor is thought to have exacerbated the effects of the NAO minimum of the early 1880s that presumably resulted in the tilefish kill (Marsh *et al*. 1999).
- Grimes and Turner (1999) suggest that it is the complex life history of the tilefish, featuring long life, slow growth, low stock productivity; i.e., with portions of the mature population that are unable to reproduce, and extreme habitat specificity, allowing high catchability, that renders the stock especially vulnerable to exploitation. Furthermore, selective removal of the largest males may result in sperm limitation or reduced spawning opportunity for females. Harris *et al.* (2001) add to these concerns the possibility of reduced female fecundity as a result of selective removal of the largest females. Grimes and Turner (1999) suggest that heavy exploitation of the complex tilefish stock since 1915 has resulted in successive 20- to 25-year cycles of rapid increases in catches, followed by sharp declines.
- Beyond the issue of the stability of the tilefish stock for the purpose of sustainability of the fishery is the matter of role of this species in the outer shelf-upper slope ecosystem. Coleman and Williams (2002) suggest that tilefish influence the habitats they occupy both in their roles as top-level predators, and as "marine ecosystem engineers;" i.e., restructuring system architecture through their burrowing activities, creating habitats for other species, and possibly also exerting an important influence on biogeochemical carbon cycling. These authors argue for restriction of exploitation of this and similar "engineering" species on the basis of promoting ecosystem stability.
- Updated Research Needs:
    1. Coleman and Williams (2002) suggest important ecological roles for tilefish, but offer no new data in support of their arguments. To what degree does the activity of tilefish contribute to system biodiversity? What is the role of their burrowing in carbon cycling?
    2. There is a strong spatial overlap between tilefish and a variety of other resource species that migrate to the outer shelf to overwinter. However, as a result of the difficulty in sampling during winter, no detailed investigations of tilefish habitats have been conducted in that season. How do tilefish interact with other overwintering resource species, especially those like black sea bass that may be seeking habitats containing structured shelters?
    3. Stock assessment for tilefish is based primarily on fisheries-independent surveys using trawl gear, but this method is very inefficient for capturing this species. Some progress was been made in identifying and quantifying tilefish burrows using side scan sonar on the east coast (Able *et al.* 1987) and in the Gulf of Mexico (Scanlon *et al.* 2002). How could side scan or other acoustic or more recent optical scanning methods (Yoklavich *et al.* 2002) be employed as an aid to assess the northeast U.S. stock?

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Table 1. Diet composition and sampling data for tilefish. Data expressed as percentage of stomach content by weight. Squared brackets indicate major taxon subtotal; parentheses indicate minor taxon subtotal. Source: Bowman *et al*. (2000); from NEFSC groundfish surveys, 1977-1980.

Stomach Contents	Tilefish
MOLLUSCA	[0.3]
Gastropoda	(0.1)
Bivalvia	(0.1)
Pectinidae	0.1
Bivalvia unid.	
Cephalopoda	
Illex sp.	
Cephalopoda unid.	
POLYCHAETA	[0.2]
CRUSTACEA	[21.9]
Copepoda	
Isopoda	(1.2)
Cirolana polita	1.0
Isopoda unid.	0.2
Amphipoda	(0.2)
Euphausiacea	(0.5)
Decapoda	(4.4)
Euprognatha rastellifera	1.6
Ovalipes ocellatus	
Bathynectes sp.	
Munida iris	1.3
Shrimp unid.	
Crabs unid.	
Decapoda unid.	1.5
Crustacea unid.	(15.6)
ECHINODERMATA	[74.8]
Ophiuroidea	(74.8)
Amphioplus sp.	10.4
Amphiuridae	64.4
ASCIDIACEA	
OSTEICHTHYES	[<0.1]
Myoxo. octodecemspinosus	
Scophthalmus aquosus	
Pleuronectiformes	
Osteichthyes scales	
Osteichthyes unid.	<0.1
ANIMAL REMAINS AND MISC.	[2.9]
Number sampled	9
Number empty	3
Mean stomach content (g)	0.3
Mean fish length (cm)	39
Fish length range (cm)	25-45

Updated Distributional Maps

Juveniles

The distributions and abundances of juvenile tilefish collected during NEFSC bottom trawl surveys are shown in Figures 1-4. Note that winter and summer distributions are presented as presence data only. In winter they occurred in the Mid-Atlantic and southern New England between the 100-200 m isobaths; they were also found off of Cape Hatteras (Figure 1). In the spring, small numbers of juvenile tilefish were also found along the 200 m isobath between southern New England and the Mid-Atlantic (Figure 2). In summer, they were only found in one spot on the southern edge of Georges Bank (Figure 3). In the fall they were also found between the Mid-Atlantic and southern New England, but with slightly lower numbers as compared to spring (only 1 per each tow; Figure 4). One was found in nearshore Long Island.

Adults

The distributions and abundances of adult tilefish collected during NEFSC bottom trawl surveys are shown in Figures 5-8. Note again that winter and summer distributions are presented as presence data only. Like the juveniles, in the winter they occurred in the Mid-Atlantic and southern New England between the 100-200 m isobaths (Figure 5). In the spring, fewer adults than juveniles were found in the Mid-Atlantic/southern New England areas (Figure 6). One positive tow occurred off southern New England in summer (Figure 7). Very few adults were found in the fall (Figure 8).

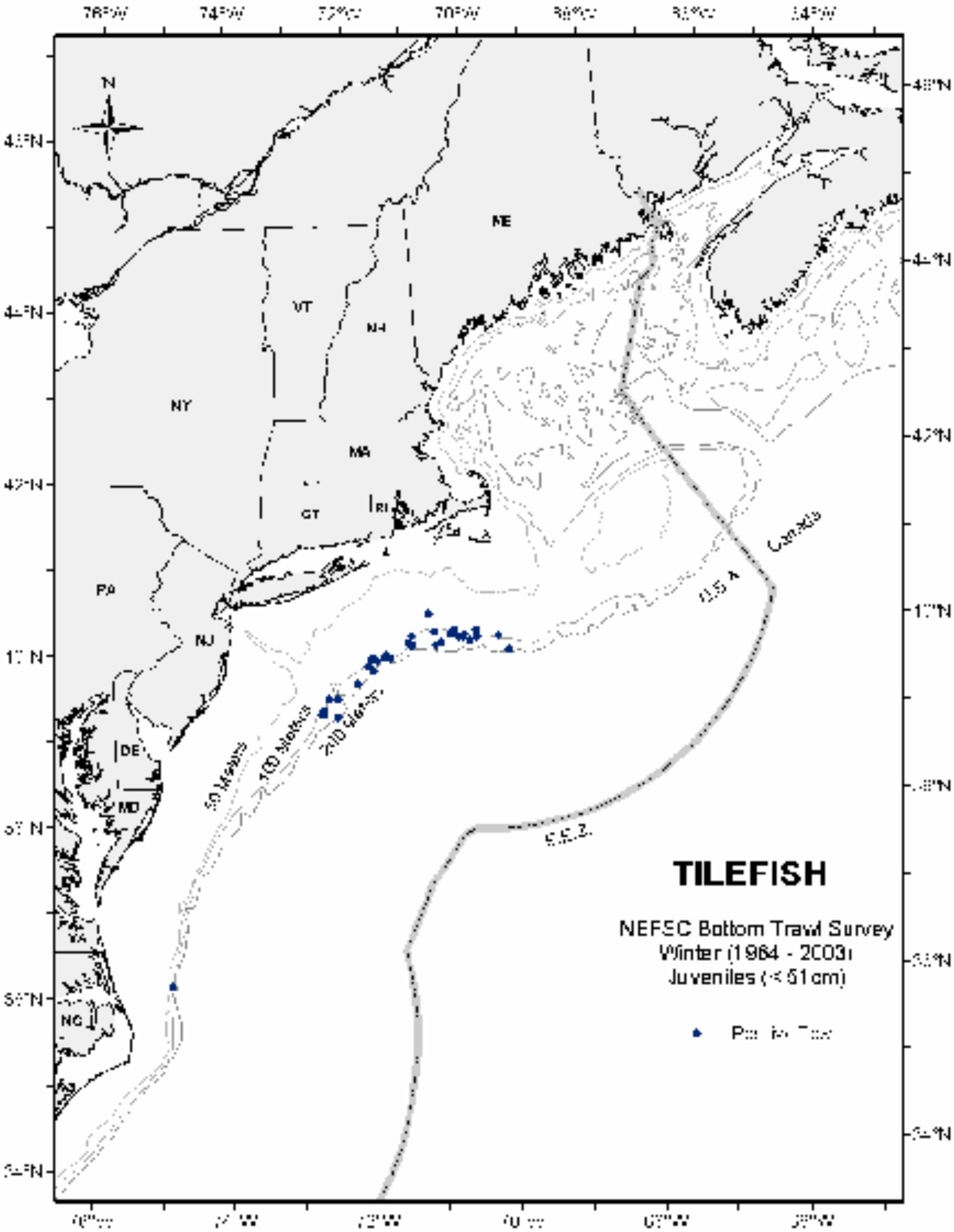

Figure 1. Distribution of juvenile tilefish collected during NEFSC winter bottom trawl surveys (1964-2003, all years combined). Distributions are displayed as presence only.

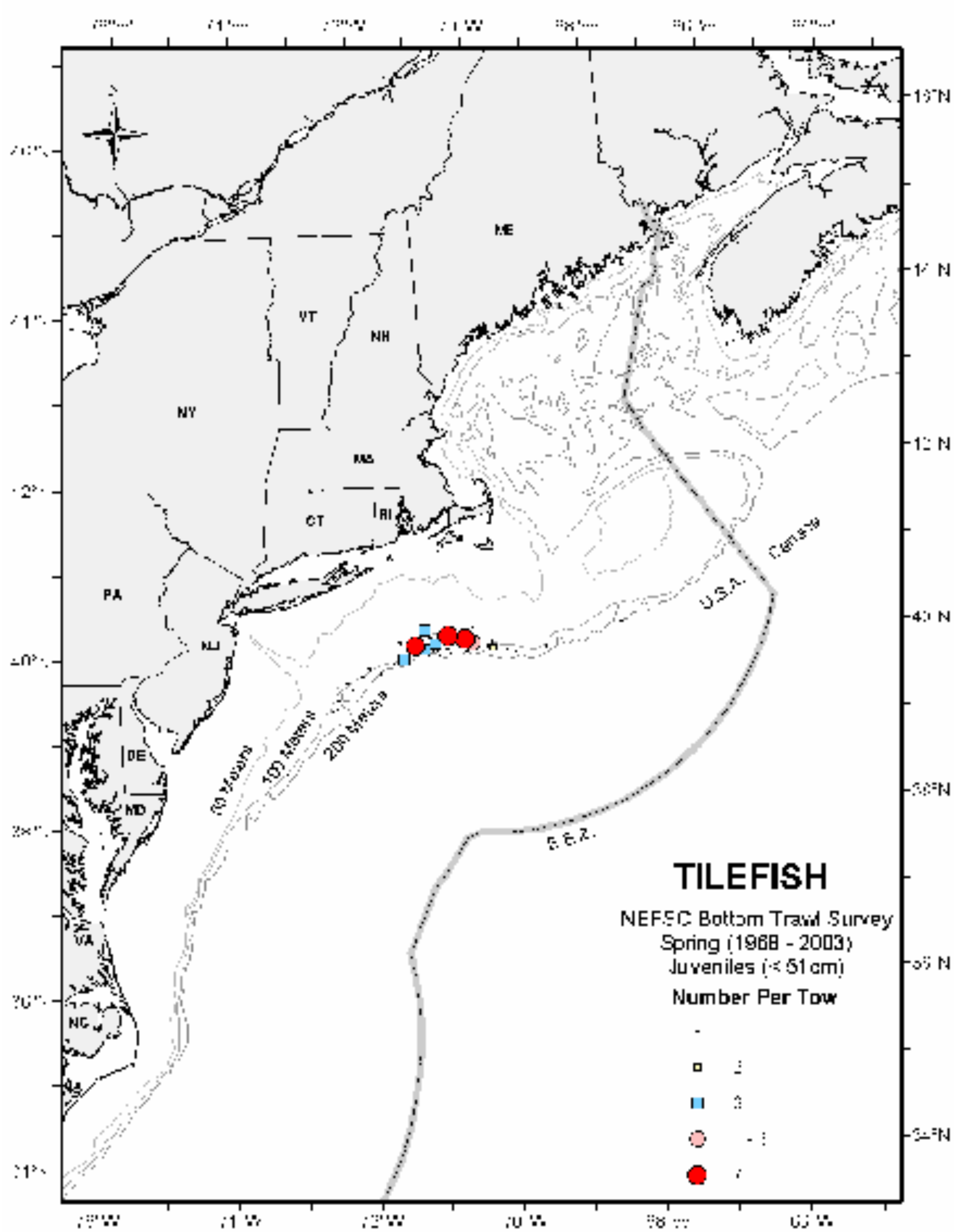

Figure 2. Distribution and abundance of juvenile tilefish collected during spring NEFSC bottom trawl surveys (1968-2003, all years combined). Survey stations where juveniles were not found are not shown.

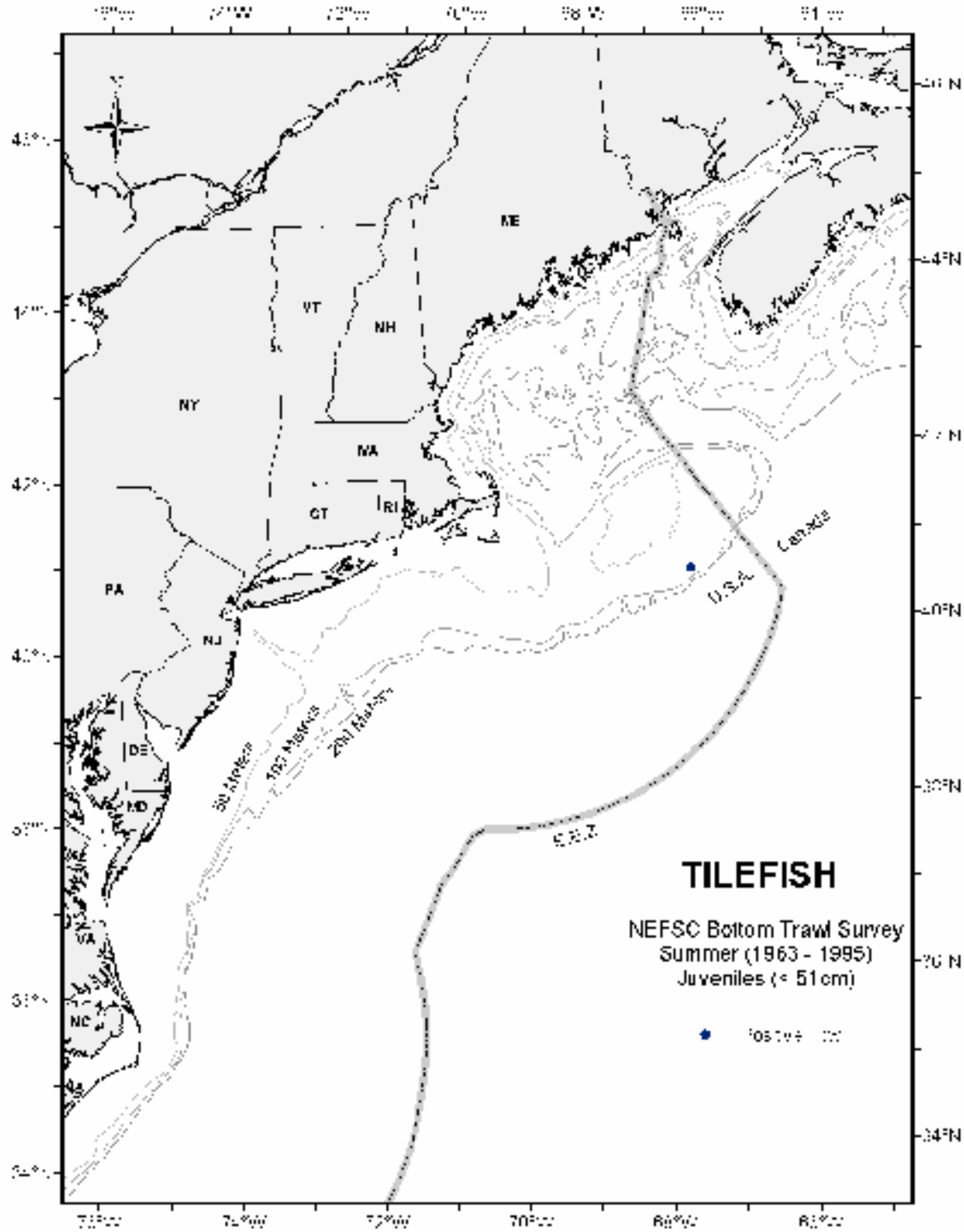

Figure 3. Distribution of juvenile tilefish collected during NEFSC summer bottom trawl surveys (1963-1995, all years combined). Distributions are displayed as presence only.

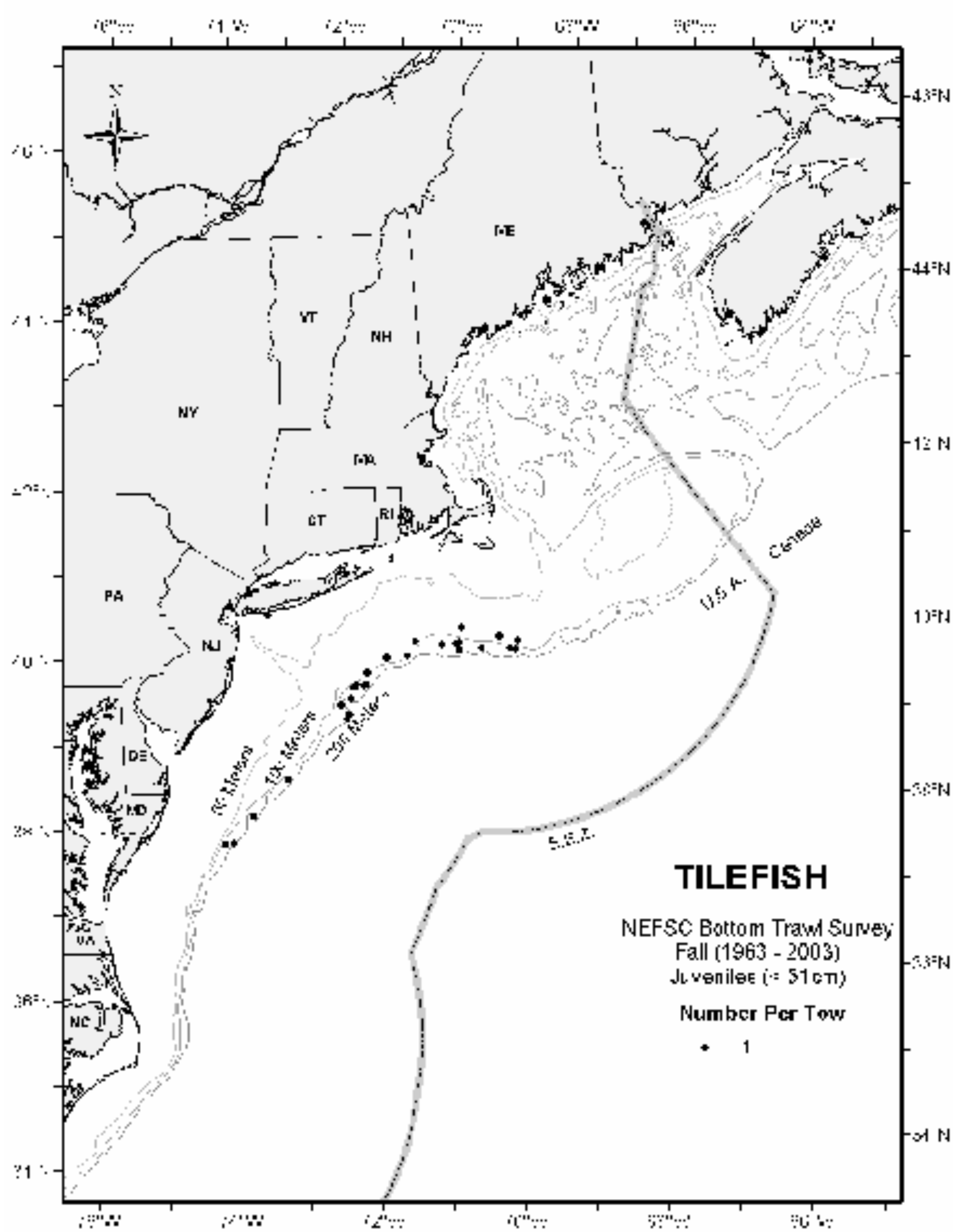

Figure 4. Distribution and abundance of juvenile tilefish collected during fall NEFSC bottom trawl surveys (1963-2003, all years combined). Survey stations where juveniles were not found are not shown.

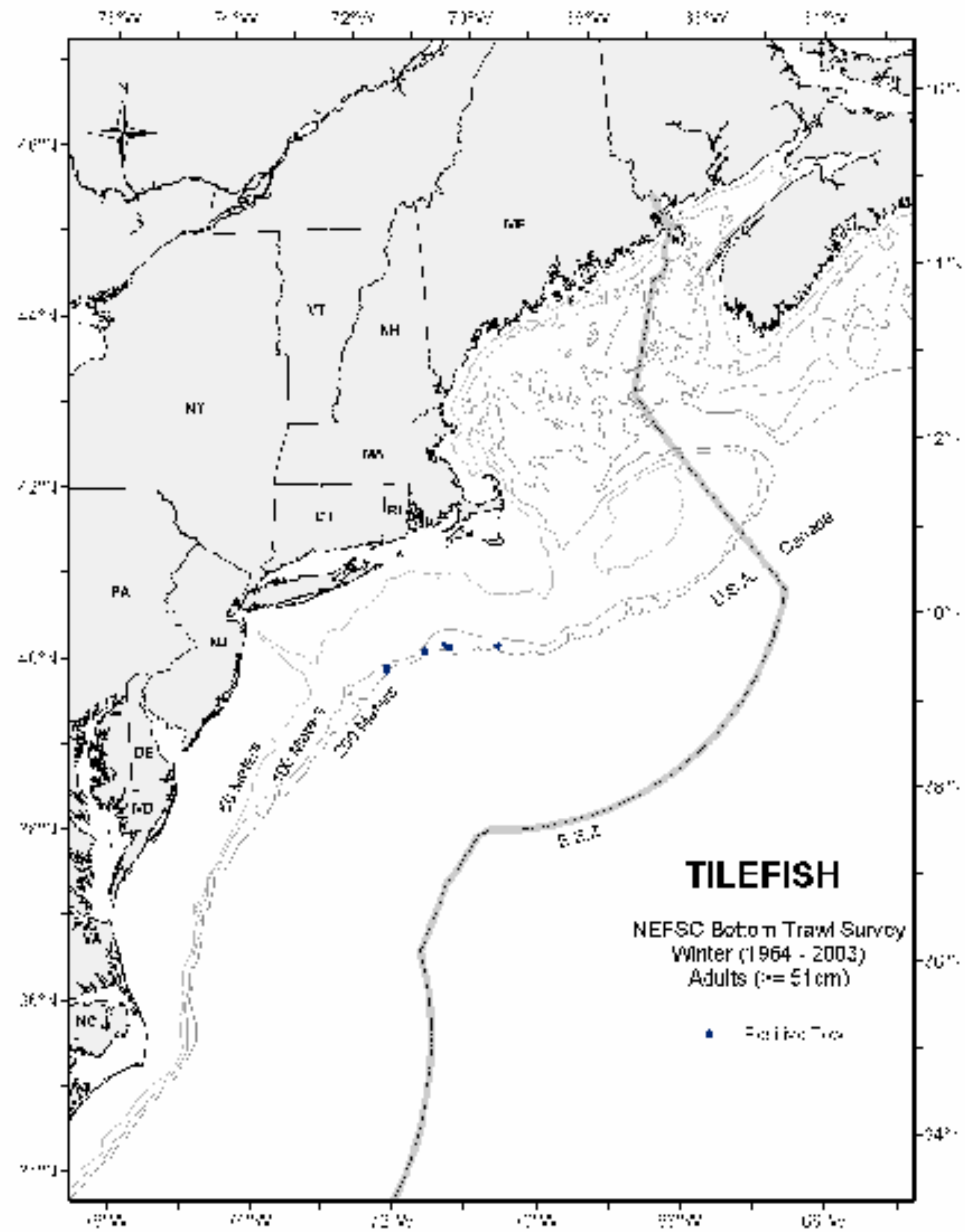

Figure 5. Distribution of adult tilefish collected during NEFSC winter bottom trawl surveys (1964-2003, all years combined). Distributions are displayed as presence only.

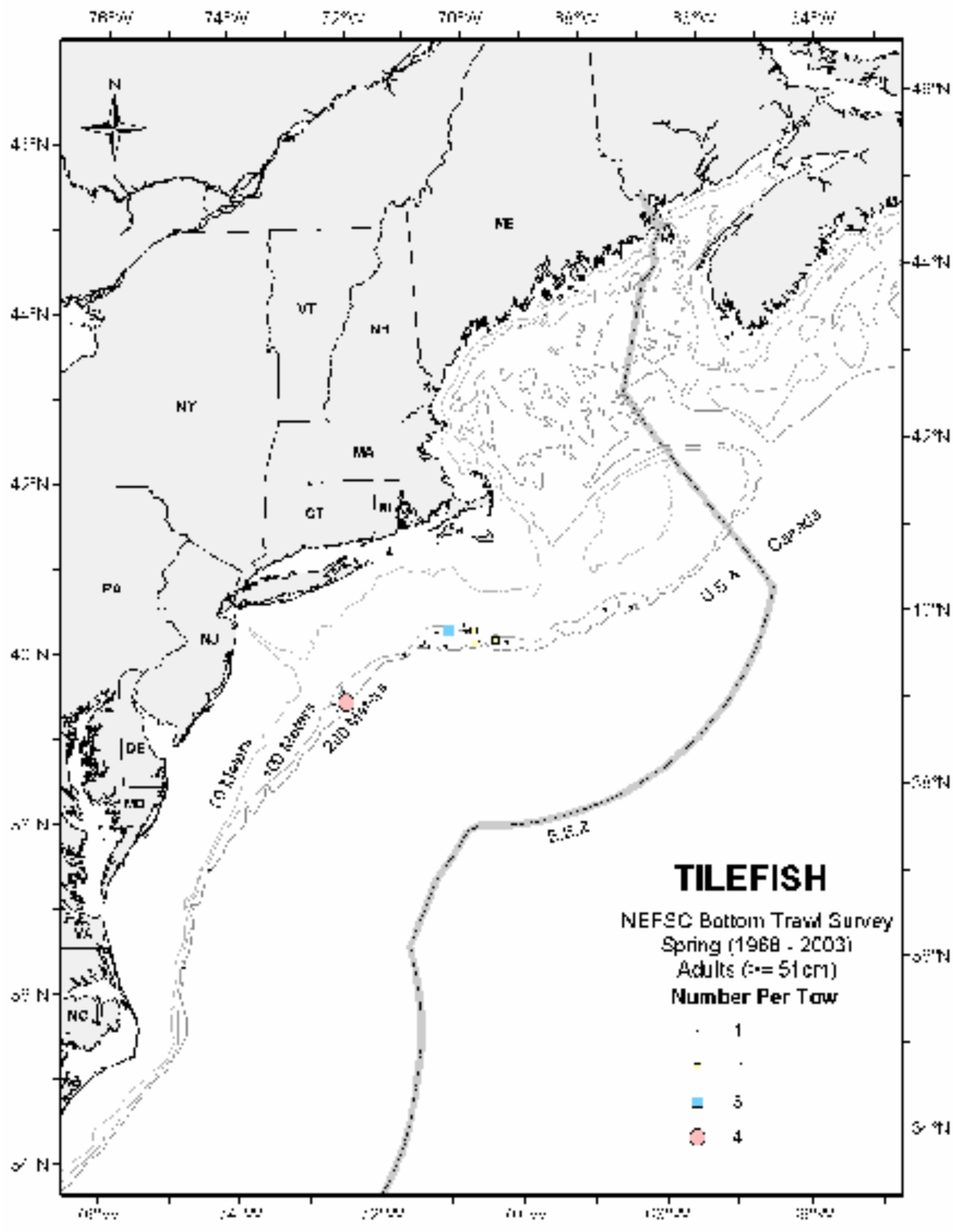

Figure 6. Distribution and abundance of adult tilefish collected during spring NEFSC bottom trawl surveys (1968-2003, all years combined). Survey stations where adults were not found are not shown.

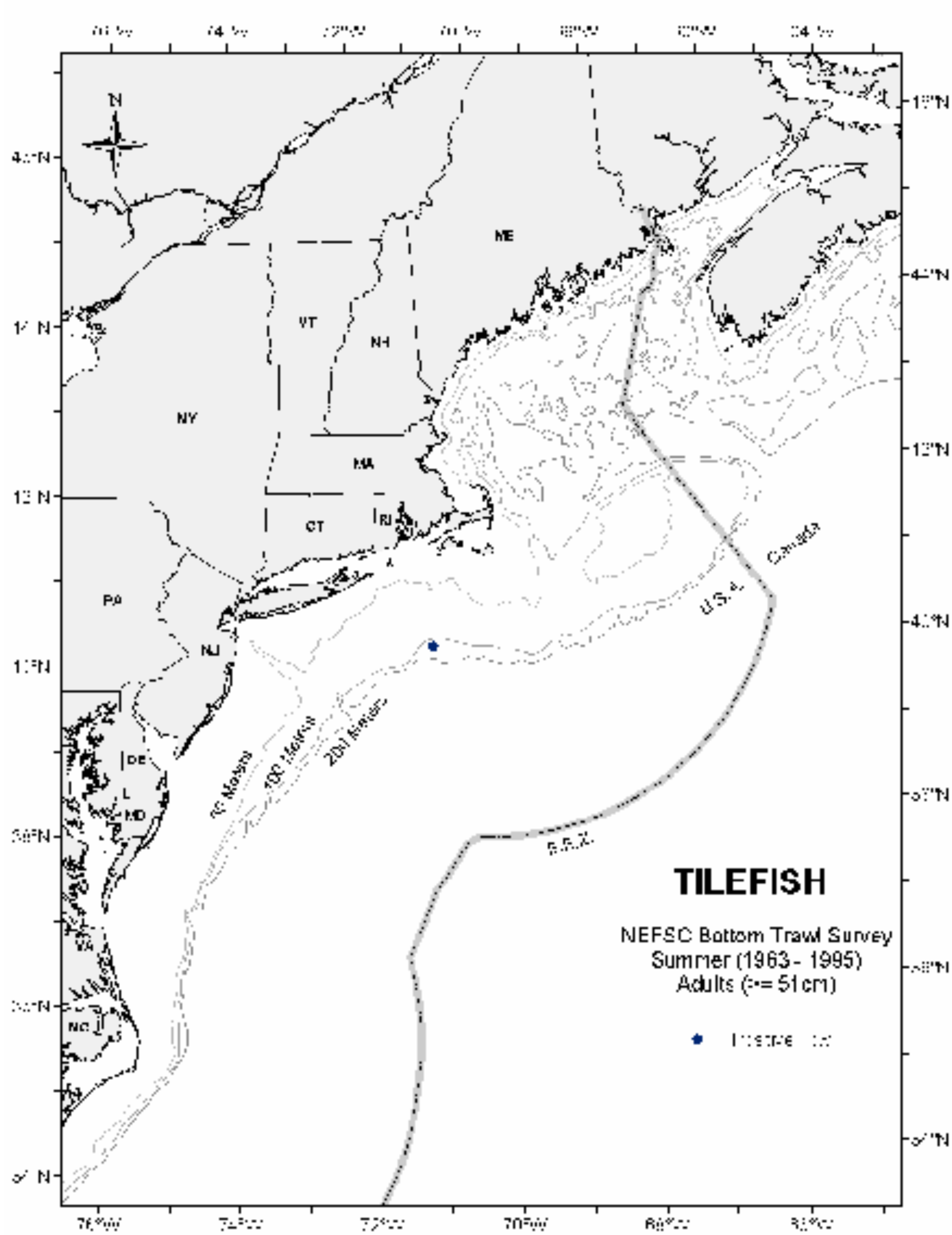

Figure 7. Distribution of adult tilefish collected during NEFSC summer bottom trawl surveys (1963-1995, all years combined). Distributions are displayed as presence only.

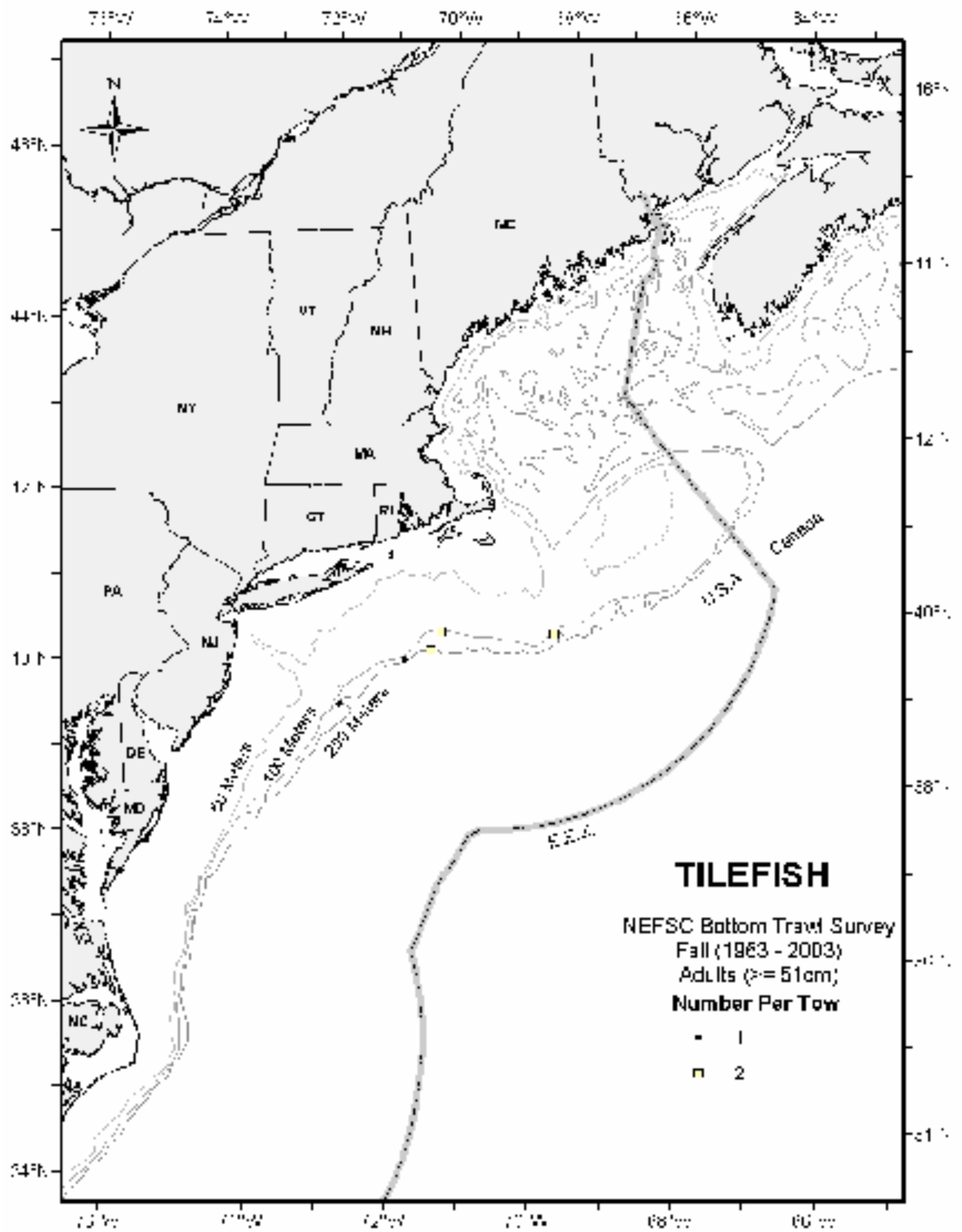

Figure 8. Distribution and abundance of adult tilefish collected during fall NEFSC bottom trawl surveys (1963-2003, all years combined). Survey stations where adults were not found are not shown

Updated Bar Charts

Juveniles

The spring and fall distributions of juvenile tilefish relative to bottom water temperature, depth, and salinity based on 1963-2003 NEFSC bottom trawl surveys from the Gulf of Maine to Cape Hatteras are shown in Figure 9. In the spring, juveniles were found between 4-15°C, with peaks at 11-12°C. During autumn, they were found mostly between 11-16°C, with the majority between 12-13°C. They occurred at depths ranging from 81-300 m in the spring and mostly between 91-400 m in the fall. The majority were found between 101-160 m in the spring and between 91-140 m in the fall. In the spring, their salinity range was between 33-36 ppt, with most at 35-36 ppt. In the fall, of the few that were found, 80% were at 35 ppt.

A single, remarkable catch was made during fall in warm (20°C), low salinity (31 ppt), shallow (< 20 m deep) water.

Distributions of juveniles with regard to temperature, depth, and salinity were clearly not skewed by survey fishing effort, as the distributions of juvenile tilefish catches with regard to those three factors were very different from those for trawl numbers in both seasons.

Adults

The spring and fall distributions of adult tilefish relative to bottom water temperature and depth based on NEFSC bottom trawl surveys are shown in Figure 10. In the spring, the adults were found over a temperature range of 7-14°C and in the fall, the few that were found occurred over a range of 11-13°C. In the spring, the majority were found at 10-12°C, while in the fall most were found at 11°C. Their depth range in both seasons was from 101-300 m.

No adult tilefish were caught in trawls for which salinity data were available. As with juveniles, comparison of adult catches with trawl numbers indicates no skewing resulting from the distribution of survey fishing effort.

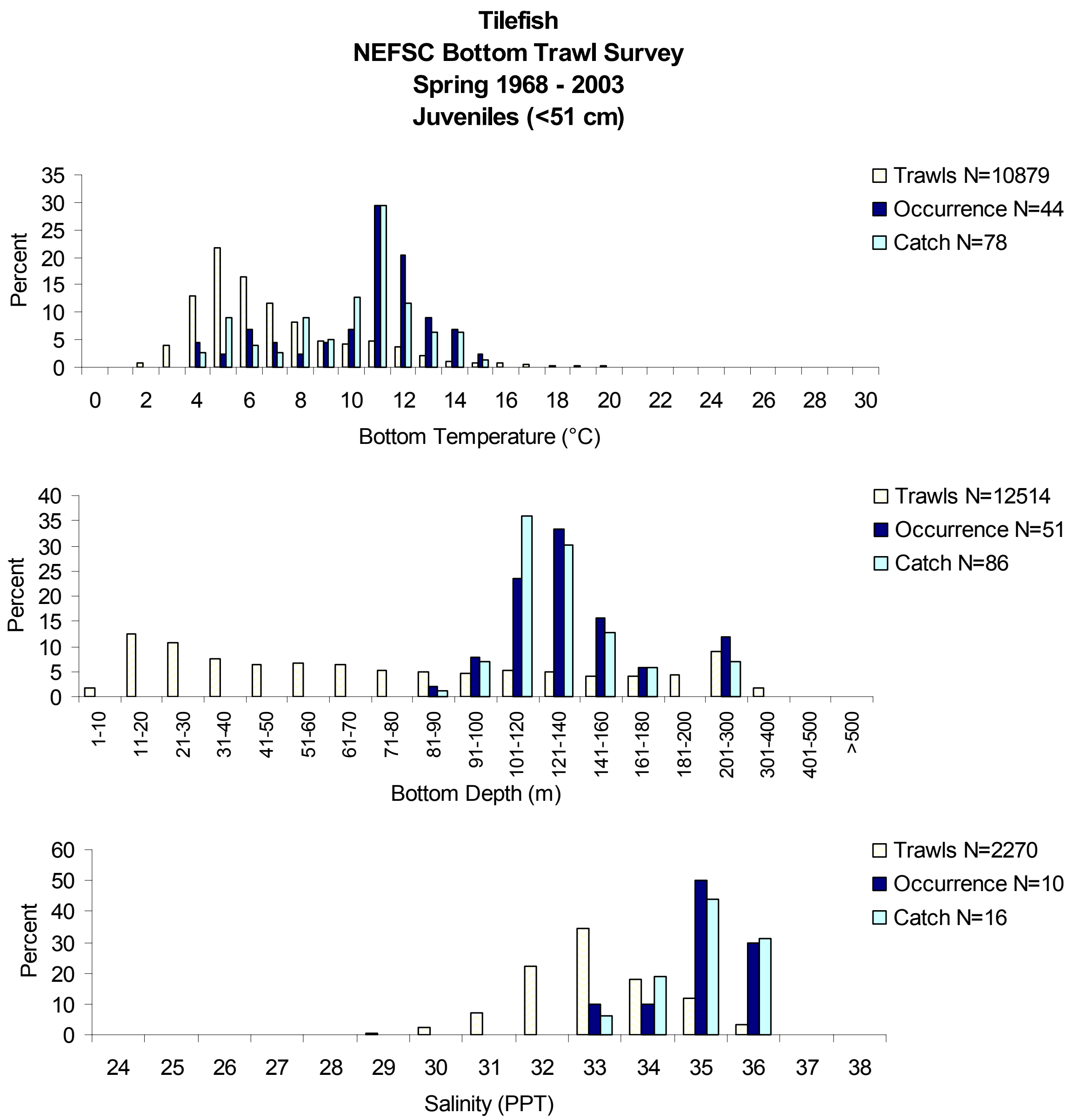

Figure 9. Distributions of juvenile tilefish and trawls from NEFSC bottom trawl surveys relative to bottom water temperature, depth, and salinity. Based on NEFSC spring bottom trawl surveys (temperature and depth: 1968-2003, all years combined; salinity: 1991-2003, all years combined). Light bars show the distribution of all the trawls, dark bars show the distribution of all trawls in which tilefish occurred and medium bars show, within each interval, the percentage of the total number of tilefish caught. Note that the bottom depth interval changes with increasing depth.

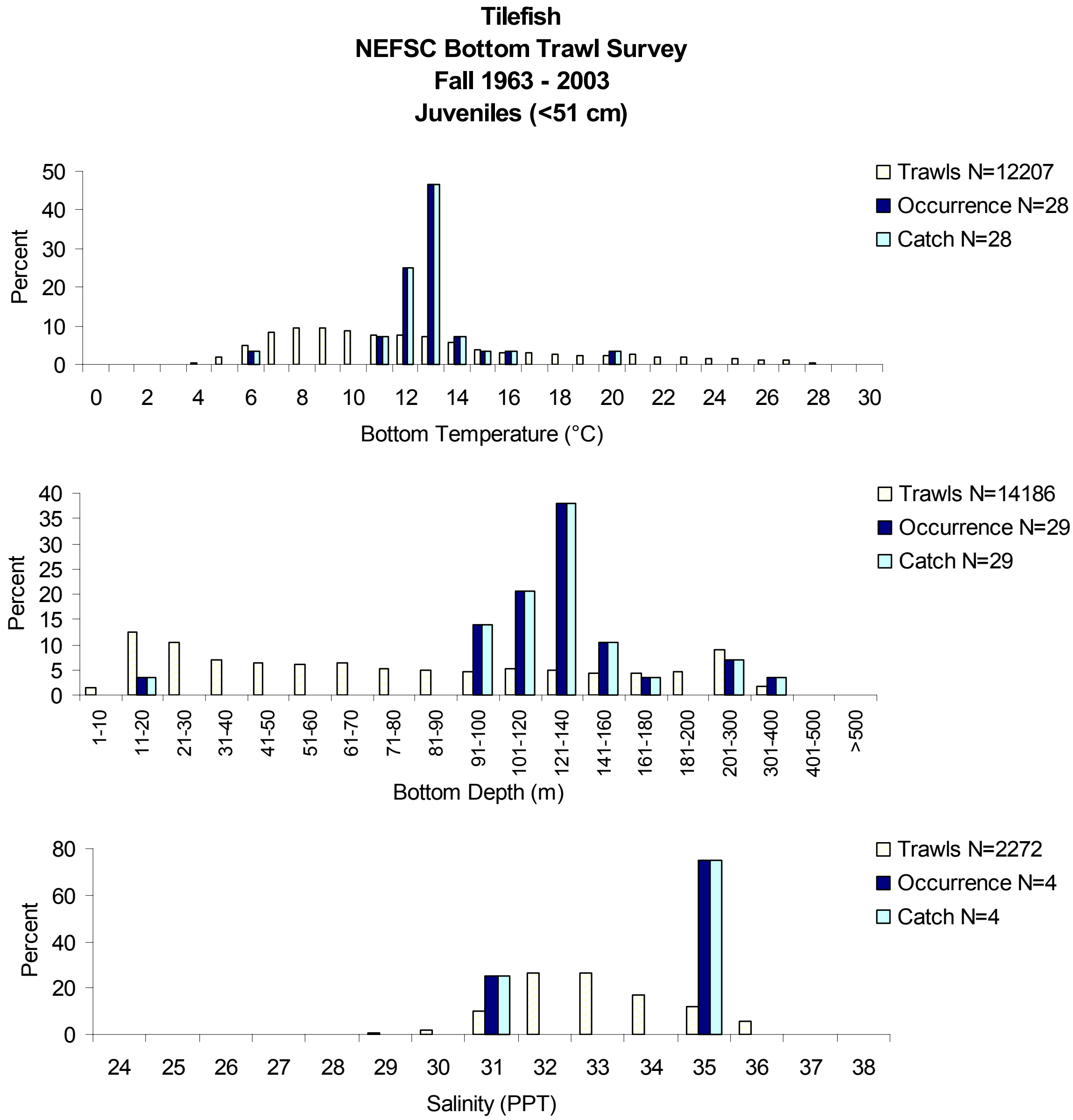

Figure 9. Cont'd. Based on NEFSC fall bottom trawl surveys (temperature and depth: 1963-2003, all years combined; salinity: 1991-2003, all years combined). Light bars show the distribution of all the trawls, dark bars show the distribution of all trawls in which tilefish occurred and medium bars show, within each interval, the percentage of the total number of tilefish caught. Note that the bottom depth interval changes with increasing depth.

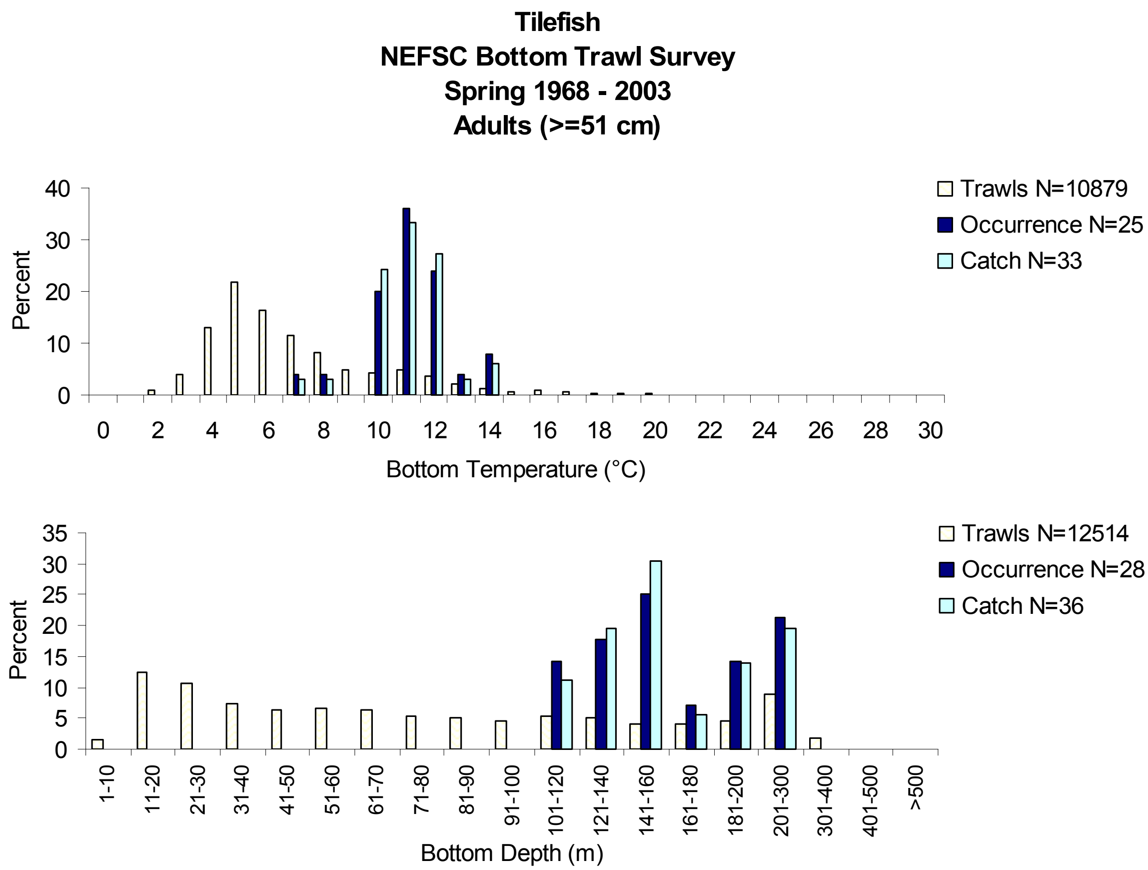

Figure 10. Distributions of adult tilefish and trawls from NEFSC bottom trawl surveys relative to bottom water temperature, depth, and salinity. Based on NEFSC spring bottom trawl surveys (temperature and depth: 1968-2003, all years combined; salinity: 1991-2003, all years combined). Light bars show the distribution of all the trawls, dark bars show the distribution of all trawls in which tilefish occurred and medium bars show, within each interval, the percentage of the total number of tilefish caught. Note that the bottom depth interval changes with increasing depth.

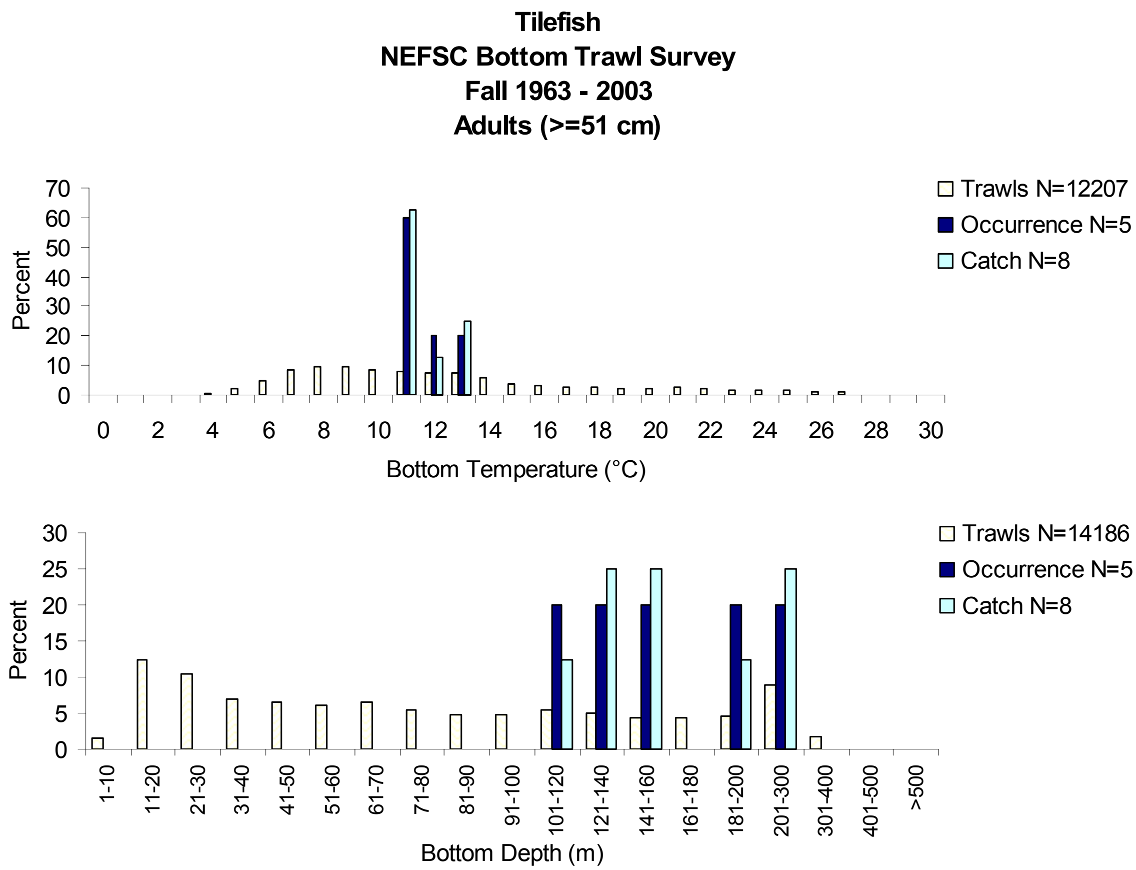

Figure 10. Cont'd. Based on NEFSC fall bottom trawl surveys (temperature and depth: 1963-2003, all years combined; salinity: 1991-2003, all years combined). Light bars show the distribution of all the trawls, dark bars show the distribution of all trawls in which tilefish occurred and medium bars show, within each interval, the percentage of the total number of tilefish caught. Note that the bottom depth interval changes with increasing depth.

NOAA Technical Memorandum NMFS-NE-152

Essential Fish Habitat Source Document:

Tilefish, *Lopholatilus chamaeleonticeps*, Life History and Habitat Characteristics

U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Region
Northeast Fisheries Science Center
Woods Hole, Massachusetts

September 1999

Recent Issues

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106. **Selected Living Resources, Habitat Conditions, and Human Perturbations of the Gulf of Maine: Environmental and Ecological Considerations for Fishery Management.** By Richard W. Langton, John B. Pearce, and Jon A. Gibson, eds. August 1994. iv + 70 p., 2 figs., 6 tables. NTIS Access. No. PB95-270906.

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NOAA Technical Memorandum NMFS-NE-152

This series represents a secondary level of scientifiic publishing. All issues employ thorough internal scientific review; some issues employ external scientific review. Reviews are -- by design -- transparent collegial reviews, not anonymous peer reviews. All issues may be cited in formal scientific communications.

Essential Fish Habitat Source Document:

Tilefish, *Lopholatilus chamaeleonticeps*, Life History and Habitat Characteristics

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Woods Hole, Massachusetts

September 1999

Editorial Notes on Issues 122-152
in the
NOAA Technical Memorandum NMFS-NE Series

Editorial Production

For Issues 122-152, staff of the Northeast Fisheries Science Center's (NEFSC's) Ecosystems Processes Division have largely assumed the role of staff of the NEFSC's Editorial Office for technical and copy editing, type composition, and page layout. Other than the four covers (inside and outside, front and back) and first two preliminary pages, all preprinting editorial production has been performed by, and all credit for such production rightfully belongs to, the authors and acknowledgees of each issue, as well as those noted below in "Special Acknowledgments."

Special Acknowledgments

David B. Packer, Sara J. Griesbach, and Luca M. Cargnelli coordinated virtually all aspects of the preprinting editorial production, as well as performed virtually all technical and copy editing, type composition, and page layout, of Issues 122-152. Rande R. Cross, Claire L. Steimle, and Judy D. Berrien conducted the literature searching, citation checking, and bibliographic styling for Issues 122-152. Joseph J. Vitaliano produced all of the food habits figures in Issues 122-152.

Internet Availability

Issues 122-152 are being copublished, *i.e.*, both as paper copies and as web postings. All web postings are, or will soon be, available at: *www.nefsc.nmfs.gov/nefsc/habitat/efh*. Also, all web postings will be in "PDF" format.

Information Updating

By federal regulation, all information specific to Issues 122-152 must be updated at least every five years. All official updates will appear in the web postings. Paper copies will be reissued only when and if new information associated with Issues 122-152 is significant enough to warrant a reprinting of a given issue. All updated and/or reprinted issues will retain the original issue number, but bear a "Revised (Month Year)" label.

Species Names

The NMFS Northeast Region's policy on the use of species names in all technical communications is generally to follow the American Fisheries Society's lists of scientific and common names for fishes (*i.e.*, Robins *et al.* 1991[a]), mollusks (*i.e.*, Turgeon *et al.* 1998[b]), and decapod crustaceans (*i.e.*, Williams *et al.* 1989[c]), and to follow the Society for Marine Mammalogy's guidance on scientific and common names for marine mammals (*i.e.*, Rice 1998[d]). Exceptions to this policy occur when there are subsequent compelling revisions in the classifications of species, resulting in changes in the names of species (*e.g.*, Cooper and Chapleau 1998[e]).

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[a]Robins, C.R. (chair); Bailey, R.M.; Bond, C.E.; Brooker, J.R.; Lachner, E.A.; Lea, R.N.; Scott, W.B. 1991. Common and scientific names of fishes from the United States and Canada. 5th ed. *Amer. Fish. Soc. Spec. Publ.* 20; 183 p.

[b]Turgeon, D.D. (chair); Quinn, J.F., Jr.; Bogan, A.E.; Coan, E.V.; Hochberg, F.G.; Lyons, W.G.; Mikkelsen, P.M.; Neves, R.J.; Roper, C.F.E.; Rosenberg, G.; Roth, B.; Scheltema, A.; Thompson, F.G.; Vecchione, M.; Williams, J.D. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. 2nd ed. *Amer. Fish. Soc. Spec. Publ.* 26; 526 p.

[c]Williams, A.B. (chair); Abele, L.G.; Felder, D.L.; Hobbs, H.H., Jr.; Manning, R.B.; McLaughlin, P.A.; Pérez Farfante, I. 1989. Common and scientific names of aquatic invertebrates from the United States and Canada: decapod crustaceans. *Amer. Fish. Soc. Spec. Publ.* 17; 77 p.

[d]Rice, D.W. 1998. Marine mammals of the world: systematics and distribution. *Soc. Mar. Mammal. Spec. Publ.* 4; 231 p.

[e]Cooper, J.A.; Chapleau, F. 1998. Monophyly and interrelationships of the family Pleuronectidae (Pleuronectiformes), with a revised classification. *Fish. Bull. (U.S.)* 96:686-726.

FOREWORD

One of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats.

Magnuson-Stevens Fishery Conservation and Management Act (October 11, 1996)

The long-term viability of living marine resources depends on protection of their habitat.

NMFS Strategic Plan for Fisheries Research (February 1998)

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), which was reauthorized and amended by the Sustainable Fisheries Act (1996), requires the eight regional fishery management councils to describe and identify essential fish habitat (EFH) in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." The MSFCMA requires NMFS to assist the regional fishery management councils in the implementation of EFH in their respective fishery management plans.

NMFS has taken a broad view of habitat as the area used by fish throughout their life cycle. Fish use habitat for spawning, feeding, nursery, migration, and shelter, but most habitats provide only a subset of these functions. Fish may change habitats with changes in life history stage, seasonal and geographic distributions, abundance, and interactions with other species. The type of habitat, as well as its attributes and functions, are important for sustaining the production of managed species.

The Northeast Fisheries Science Center compiled the available information on the distribution, abundance, and habitat requirements for each of the species managed by the New England and Mid-Atlantic Fishery Management Councils. That information is presented in this series of 30 EFH species reports (plus one consolidated methods report). The EFH species reports comprise a survey of the important literature as well as original analyses of fishery-independent data sets from NMFS and several coastal states. The species reports are also the source for the current EFH designations by the New England and Mid-Atlantic Fishery Management Councils, and have understandably begun to be referred to as the "EFH source documents."

NMFS provided guidance to the regional fishery management councils for identifying and describing EFH of their managed species. Consistent with this guidance, the species reports present information on current and historic stock sizes, geographic range, and the period and location of major life history stages. The habitats of managed species are described by the physical, chemical, and biological components of the ecosystem where the species occur. Information on the habitat requirements is provided for each life history stage, and it includes, where available, habitat and environmental variables that control or limit distribution, abundance, growth, reproduction, mortality, and productivity.

Identifying and describing EFH are the first steps in the process of protecting, conserving, and enhancing essential habitats of the managed species. Ultimately, NMFS, the regional fishery management councils, fishing participants, Federal and state agencies, and other organizations will have to cooperate to achieve the habitat goals established by the MSFCMA.

A historical note: the EFH species reports effectively recommence a series of reports published by the NMFS Sandy Hook (New Jersey) Laboratory (now formally known as the James J. Howard Marine Sciences Laboratory) from 1977 to 1982. These reports, which were formally labeled as *Sandy Hook Laboratory Technical Series Reports*, but informally known as "Sandy Hook Bluebooks," summarized biological and fisheries data for 18 economically important species. The fact that the bluebooks continue to be used two decades after their publication persuaded us to make their successors – the 30 EFH source documents – available to the public through publication in the *NOAA Technical Memorandum NMFS-NE* series.

JAMES J. HOWARD MARINE SCIENCES LABORATORY
HIGHLANDS, NEW JERSEY
SEPTEMBER 1999

JEFFREY N. CROSS, CHIEF
ECOSYSTEMS PROCESSES DIVISION
NORTHEAST FISHERIES SCIENCE CENTER

Contents

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INTRODUCTION

Lopholatilus chamaeleonticeps (Goode and Bean 1879) (Figure 1) is the largest and longest lived of the tilefishes (Malacanthidae); it reaches 30 kg, grows to 120 cm TL, and lives over 45 years (Bigelow and Schroeder 1953; Turner *et al.* 1983; Turner 1986). The first recorded major catch of the species occurred in 1879 in 38 m of water south of Nantucket shoals (Collins 1884; Dooley 1978); it was identified as a new species at that time (Goode and Bean 1880).

Tilefish have a "unique spatial and temporal behavior" (Warner 1987). Their habitat is a relatively restricted band, approximately 80-540 m deep and 8-17^{o}C, known as the "warm belt" (Verrill 1882) on the outer continental shelf and upper slope of the northwest Atlantic coast. Within this band, tilefish are more abundant near the 15^{o}C isotherm which occurs between 100-240 m (Bigelow and Schroeder 1953; Freeman and Turner 1977; Dooley 1978), which includes the shelf break (120-145 m) (Stanley *et al.* 1972).

Tilefish are most abundant from Georges Bank to Key West, Florida and throughout much of the Gulf of Mexico (Matlock *et al.* 1991). They are occasionally reported from as far north as Banquereau Bank (44^{o}26’ N, 57^{o}13’ W) at depths between 50-150 m off Nova Scotia (Markle *et al.* 1980; Scott and Scott 1988) and off the coast of Surinam, but not in the Caribbean Sea (Bigelow and Schroeder 1953; Dooley 1978). Their distribution, which appears discontinuous, may be controlled by temperature, depth, and the availability of shelter or fine, semi-consolidated sediments that support their shelter burrows (Grossman *et al.* 1985; Jones *et al.* 1989; Matlock *et al.* 1991). A sibling species (*L. villarii*) occurs in the South Atlantic from Brazil to Argentina; the distributions of these species are not known to overlap (Freeman and Turner 1977; Dooley 1978).

Dooley (1978) speculated that tilefish recently colonized the outer continental shelf off southern New England because there are no reported catches of the species in the deep-water, longline cod fishery prior to 1879 (although the fishery probably was focused in shallower water because of the time and effort required to retrieve the gear by hand). Freeman and Turner (1977) suggest that tilefish are not restricted to a specific burrow, but may move within a local area (based on how quickly a fishing site can stop or start being productive). They noted that larger fish are less abundant at depths greater than 238 m, which is also true of the population south of Cape Hatteras (Low *et al.* 1983). The mean size of tilefish was greatest at intermediate depths (approximately 200-240 m) for both the northern and southern stocks (Low *et al.* 1983).

LIFE HISTORY

EGGS

Tilefish eggs are non-adhesive and buoyant (Bigelow and Schroeder 1953; Freeman and Turner 1977). Eggs that were fertilized artificially and reared at 22.0-24.6^{o}C hatched in 40 hours (Fahay and Berrien 1981).

LARVAE

The larvae were not identified in ichthyoplankton samples until recently. Newly hatched larvae are 2.6 mm long and well formed at 5.0 mm; the largest pelagic larva found was 8.7 mm TL. Larvae occur in the plankton from July to September over the outer continental shelf in the Middle Atlantic Bight. The center of abundance lies between Hudson and Baltimore canyons (Fahay and Berrien 1981).

If post-larval tilefish are primarily sedentary and non-migratory, except perhaps seasonally off southern New England (Freeman and Turner 1977; Grimes *et al.* 1987), then the recruitment of tilefish to support or re-establish local populations is dependent on larval settlement (Bumpus 1899). The habitat criteria for larval tilefish settlement and the transition to juveniles are unknown. If transitional tilefish larvae and early juveniles are unable to excavate burrows, they may be dependent on other sources of shelter.

JUVENILES (≤ 50 CM TL)

The smallest juveniles collected in bottom trawls were 15.5 mm SL (Fahay and Berrien 1981). Early juveniles (51-82 mm) were collected at 100-200 m during April-July along the outer edge of the Middle Atlantic Bight shelf (Bigelow and Schroeder 1953; Dooley 1978). The smallest fish collected in the Northeast Fisheries Science Center (NEFSC) bottom trawl surveys was approximately 140 mm [see Reid *et al.* (1999) for methods]. Bigelow and Schroeder (1953) reported that 60-90 mm specimens were collected off southern New England in April and 100-105 mm specimens were collected in July. Freeman and Turner (1977) suggested that particular juvenile size classes favor certain areas; some of these areas were avoided by the long-line fishery because of the low market value of small fish at that time.

Juveniles often occupy simple vertical shaft burrows in semi-lithified clay (Able *et al.* 1982). According to Freeman and Turner (1977), divers observed tilefish using American lobster (*Homarus americanus*) pots as shelter; in deeper waters, red crab (*Chaceon quinquedens*) traps may also be used. Anthropogenic material, such as ship wrecks and other solid structures, are also used (e.g., Cooper *et al.* 1987b), possibly by juveniles that have not found or excavated burrows.

ADULTS (> 50 CM TL)

Tilefish are shelter-seeking and adults have been observed and photographed using rocks, boulders, and the scour depressions beneath them, exposed rocky ledges, and horizontal and vertical burrows in semi-lithified clay outcrops on the upper slopes, flanks, and shoulders of submarine canyons such as Oceanographer Canyon (southern Georges Bank) and Hudson Canyon (off New Jersey) (Valentine *et al.* 1980; Able *et al.* 1982, 1987b). Tilefish burrows can be tubular or funnel-shaped, up to 5 m wide at the mouth, and several meters deep. The main burrow often contains a complex of smaller burrows created and used by decapod crustaceans (Able *et al* 1982; Grimes *et al.* 1986). The hydrographical, geological, and biological characteristics of this habitat were described by Valentine *et al.* (1980). The complex of burrows in clay outcrops along the slopes and walls of submarine canyons, and elsewhere on the outer continental shelf, have been called "pueblo" habitat, because of their similarity to human structures in the southwestern United States (Cooper and Uzmann 1977).

Twichell *et al.* (1985) speculated that the largest burrows are the product of a lifetime of the activities of individual tilefish. They gradually widen and deepen the burrows as they grow. Burrows are modified by decapod crustaceans, which sometimes join adjacent burrows with their activities, or collapse part or all of a burrow complex (Able *et al*. 1982; Twichell *et al.* 1985; Grimes *et al.* 1986). Able *et al.* (1987a) suggested that sidescan sonar could be used to assess the occurrence and density of burrows and other shelter on the seafloor (and possibly to estimate tilefish density). Using sidescan imagery, Grimes *et al.* (1986) estimated that the density of burrows was about 2,500/km^2 near Hudson Canyon and as high as 13,000/km^2 in the South Atlantic region (Barans and Stender 1993), but lower (approximately 1,600/km^2) in the Gulf of Mexico (Matlock *et al.* 1991). Able *et al.* (1987b) reported that the density of burrows varied more than ten-fold among different areas inhabited by tilefish.

Tilefish are important modifiers or creators of habitat on the outer continental shelf (Able *et al.* 1982). Twichell *et al.* (1985) suggest that the burrowing habitats of tilefish and their associated crustaceans significantly alter the topography and that the irregular, hummocky topography found on either side of Hudson Canyon may be the product of tilefish activity. They also discuss how creation, expansion, and use of burrows, vertical pits, and horizontal pueblos in the semi-lithified clay enhances the erosion of the exposed clay. Grimes *et al*. (1987) suggest that since each generation of tilefish may excavate a new burrow, the habitat modification and erosion caused by tilefish is significant. It is reasonable to assume that small tilefish will use an existing burrow if it is in good shape and unoccupied. The current, relatively high fishing levels and low adult population levels may have reduced the need of recruiting tilefish to create new burrows and reduced erosion rates.

The initial methods of burrow excavation are not completely known, although several hypotheses have been proposed, including the activities of galatheid crabs and tilefish (Grimes *et al.* 1986, 1987). According to Cooper *et al.* (1987b), tilefish are a "tertiary borer and nestler that further enlarge excavations and occupy existing burrows"; they believe that the burrows are started by smaller crustaceans. Grimes *et al.* (1986) and Able *et al.* (1993) conclude that tilefish maintain the burrows and burrow associates. The use of burrow, pueblo, and intermixed habitats was described by Able *et al*. (1982) and Grimes *et al*. (1986). Tilefish are relatively inactive and usually only one tilefish occurs in a burrow (Able *et al.* 1982), although several tilefish were observed using boulders off southern New England (Grimes *et al*. 1987). There seems to be no preference for shelter size or shape. Some fish appear to be residents of certain burrows or shelter sites and retreated to these shelters when disturbed by researchers (Grimes *et al.* 1983, 1986). Tilefish may move away from their shelter to feed and their feeding activity may organize the activity of other species in the habitat; thus tilefish fit the definition of a "keystone" species (Grimes *et al.* 1986).

Tilefish are not unique in their modification of sediments. Stanley (1971) and Auster *et al.* (1995) reported depressions in sediments made by fish (e.g., red hake, *Urophycis chuss*) and crustaceans on the outer continental shelf that were used by other species for shelter.

Tilefish habitat in the northern Middle Atlantic Bight (Georges Bank to just south of Hudson Canyon) occurs on the shelf between 100-200 m, at 9-14^{o}C, and contains rock or clay boulders, or clay outcrops with burrows (Grimes *et al.* 1986). In the southern part of the Bight, Levy *et al.* (1988) found tilefish using rocky ledge or burrow shelter south to Norfolk Canyon, off Virginia. Some of the biogenic habitat (cavernous hollows in clay) and poorly identified fish noted by Stanley (1971) in early video explorations in Wilmington Canyon (off Delaware) may include tilefish and their burrows. Tilefish were collected by trawl southwest of Norfolk Canyon in March during the winter fishery off Virginia and North Carolina in the early 1930s (Pearson 1932). The shelf area off southern New England and on Georges Bank may be used seasonally or if suitable temperatures persist through the coolest hydrographic periods (Grimes *et al.* 1986).

Tilefish habitat is used by other fish and invertebrates, especially crustaceans, including rare species (Williams 1988), those new to science (Bowman 1986), and those whose known range may extend in this habitat; e.g., yellowfin bass, *Anthias nicholsi* (Grimes *et al.* 1986; Bowman 1986; Cooper *et al.* 1987b). Several of these community members are of interest to fisheries, including American lobster, conger eel (*Conger* *oceanicus*), ocean pout (*Macrozoarces americanus*), cusk (*Brosme brosme*), redfish (*Sebastes* spp.), and hake (*Urophycis* spp.) (Grimes *et al.* 1986; Hood *et al.* 1988). Near Norfolk Canyon, tilefish overlap with the smaller blueline or blackline tilefish *Caulolatilus* sp. (Pearson 1932), with which it may share burrows (Able *et al.* 1987b). Some of the larger fish and lobster that co-exist with tilefish in their burrows compete with tilefish for food; e.g., conger eel (Freeman and Turner 1977; Levy *et al.* 1988).

The relatively flat seafloor among the tilefish burrows and in submarine canyons can be inhabited by species typical of unstructured, open bottom, such as Jonah crab (*Cancer borealis*), red crabs, skates (*Raja* spp.), dogfish (*Squalus sp.*), witch flounder (*Glyptocephalus cynoglossus*), Gulf Stream flounder (*Citharichthys arctifrons*), goosefish (*Lophius americanus*), shortnose greeneye (*Chlorophthalmus agassizi*), armored searobin (*Peristedion miniatum*), and faun cusk-eel (*Lepophidium profundorum*). These species are caught on longlines with tilefish or have been trawled, dredged, and observed during surveys (Goode 1881; Collins 1884; Bumpus 1899; Haedrich *et al.* 1975, 1980; Cooper *et al.* 1987a). The armored searobin may be confined to the same Middle Atlantic Bight shelf break "warm zone" as tilefish; it was also found dead during the great tilefish mortality event of 1882 (Collins 1884; Bigelow and Schroeder 1953).

Middle Atlantic Bight tilefish of both sexes grow about 10 cm/yr to age 4 after which growth rates slow and males grow faster than females (Turner *et al.* 1983; Turner 1986). Males grow larger than females (Freeman and Turner 1977; Morse 1981; Turner *et al.* 1983); the maximum size of females was 100 cm FL and the maximum size of males was 112 cm FL, but females tended to be older than males (Turner *et al.* 1983).

REPRODUCTION

The length at sexual maturity of tilefish collected off New Jersey in 1971-1973 was 60-65 cm TL in females and 65-70 cm TL in males (Morse 1981). Idelberger (1985) reported that 50% of females were mature at about 50 cm FL. This finding is consistent with studies of the South Atlantic stock, where some males delayed participating in spawning for 2-3 years when they were 10-15 cm longer (Erickson and Grossman 1986). Grimes *et al.* (1988) reported that in the late 1970s and early 1980s, both sexes were sexually mature at about 48-61 cm FL and 5-7 years of age; the mean size at 50% maturity varied with the method used and between sexes. Grimes *et al.* (1986) estimated that 50% of the females were mature at about 48 cm FL using a visual method and about 58 cm FL using a histological method. For males, the visual method estimated 50% maturity at 61 cm FL while the histological method estimated 50% maturity at 52 cm FL. The visual method is consistent with NEFSC estimates for other species (O'Brien *et al.* 1993).

Grimes *et al*. (1988) reported that the mean size and age of maturity in males (but not females) was reduced after 4-5 years of heavy fishing effort. This may be evident when comparing their findings (in late 1970s-early 1980s) with those of Morse (1981) for the early 1970s which was near the beginning of the renewed fishing effort for the species and which estimated maturity at a larger size. Although Morse used total length and Grimes used fork length, the shallow caudal indentation (forking) in tilefish probably does not account for all of the ~5-10 cm difference in length for visually estimated maturity.

Tilefish are not thought to be schooling fishes, but they do aggregate in their preferred habitat (Freeman and Turner 1977). Spawning behavior is unknown, but may be pair specific; female and male pairs are often observed sharing a burrow and pair-bonding behavior was reported by Grimes *et al.* (1986). Pair bonding would insure that a male was available to fertilize the eggs that are periodically released by the female. Mating may be socially mediated with dominant males controlling access to several females within a restricted area (Grimes *et al.* 1988) and may explain delayed maturity in some males. Idelberger (1985) suggested that the size and color of the dorsal head flap might play a role in females selecting a mate.

Idelberger (1985), Erickson *et al.* (1985), and Grimes *et al.* (1988) classified tilefish as serial or fractional spawners from March to November with a peak in activity between May and September. This encompasses the July-August spawning period reported by Collins (1884), Bigelow and Schroeder (1953), Freeman and Turner (1977), and Morse (1981). Dooley (1978) observed "ripe" females in February-June (locations not stated, but possibly South Atlantic).

Grimes *et al.* (1988) estimated that females 53-91 cm produce 195 x 10^3 to 10 x 10^6 eggs; the mean fecundity for 49 fish was 2.28 x 10^6. This fecundity range is consistent with estimates by Morse (1981) and Erickson and Grossman (1986). However, these authors noted that with serial or fractional spawners there is some doubt whether all of the eggs in the ovaries are released during a single seasonal spawning cycle. Residual eggs could be resorbed during the winter.

Dooley (1978) suggested the possibility of a sex change at a small size based on a high ratio of females to males among smaller individuals and the fact that the largest fish are mostly males. Idelberger (1985), Erickson and Grossman (1986), and Grimes *et al.* (1988) found weak histological evidence for such a change. Turner *et al.* (1983) suggested that the ratio is the product of differential growth and mortality rates between the sexes.

FOOD HABITS

Nothing is known about the diets and feeding habits of tilefish larvae, but they probably prey on zooplankton. Dooley (1978) terms the post-larval stage "omnivorous" because Linton (1901), Bigelow and Schroeder (1953), and Freeman and Turner (1977) reported benthic organisms, such as crabs (spider, galatheids, pagurids), dominated their diets; they also ate conger eels, Atlantic hagfish (*Myxine glutinosa*), other fish, bivalve mollusks (*Yoldia* spp.), polychaetes, holothurians (*Thyone* spp.), and sea anemones (Table 1). They also eat near-bottom or pelagic prey such as salps (*Salpa zonaria*), squid, hyperiid amphipods, small spiny dogfish (*Squalus acanthias*), Atlantic mackerel (*Scomber scombrus*), Atlantic herring (*Clupea harengus*), and silver hake (*Merluccius bilinearis*). Human trash (potato peels, meat bones, and shiny hardware) were also eaten (Collins 1884; Freeman and Turner 1977). Tilefish stomachs examined off Georgia also contained non-benthic myctophid fish, butterfish (*Peprilus triacanthus*), deep-sea shrimp, and benthic spotted hake (*Urophycis regia*) (Dooley 1978). The NEFSC food habits database included data from nine juvenile tilefish, which ate primarily echinoderms (brittlestars) and unidentified crustaceans (Figure 2). Freeman and Turner (1977) reported that juveniles ate more echinoderms and mollusks than larger tilefish. Cooper *et al.* (1987b) called tilefish the apex predator of the "pueblo village" submarine canyon community.

In terms of availability of potential benthic prey, Wigley and Theroux (1981) and Theroux and Grosslein (1987) found that polychaetes dominated the biomass of the benthic fauna at the shelf break (~200 m) and upper slope from Georges Bank to North Carolina. Brittlestars (Ophiuroidea) were important in slightly shallower depths from western Georges Bank to the Hudson Canyon, and crustaceans were important on Georges Bank. However, the biomass on the upper slope was generally < 25 g/m^2 and this was usually substantially less than that found on the outer continental shelf.

Freeman and Turner (1977) and Low *et al.* (1983) reported that tilefish are visual daytime feeders, but Grimes *et al.* (1986, 1987) reported that tilefish were most active at night (~2000-0800 hrs). Tilefish appear to be attracted to the bait on longline hooks at some distance from their shelters (Grimes *et al.* 1982) suggesting that food detection is more than visual and tilefish may be effective scavengers on fresh material like many deep-sea megafauna. Freeman and Turner (1977) noted that there was no evidence that feeding is inhibited during spawning, which is consistent with an extended, serial spawning strategy.

In the winter, the shelf edge south of New Jersey supports several populations of wintering fish; e.g., black sea bass (*Centropristis striata*), scup (*Stenotomus chrysops*), butterfish, spotted hake, summer flounder (*Paralichthys dentatus*), small pelagic fishes, and squid (Pearson 1932) that may be a seasonal source of prey for tilefish.

PREDATION

Able *et al.* (1982) and Grimes *et al.* (1986) concluded that a primary function of tilefish burrows was predator avoidance. The NEFSC food habits database notes only goosefish as a predator. Grimes *et al.* (1982, 1987) reported attacks on hooked tilefish that they attribute to dusky sharks (*Carcharhinus obscurus*), but it is not known if free-swimming tilefish are attacked by this or other sharks, as suggested by Freeman and Turner (1977). Stillwell and Kohler (1992) did not find tilefish in the stomachs of sandbar shark (*C. plumbeus*) collected offshore in the Middle Atlantic Bight. Freeman and Turner (1977) reported that small juvenile tilefish are sometimes preyed on by spiny dogfish and conger eels, but by far the most important predator of small tilefish was cannibalism by larger tilefish. They also reported that sea lampreys (*Petromyzon marinus*) parasitize tilefish, especially in the winter and spring.

There are no recent studies of tilefish diseases and parasites, but Linton (1901) found that they were infected with a variety of parasites and Freeman and Turner (1977) reported nematodes in about 75% of the fish they examined, with the frequency of occurrence increasing with fish size. Low levels of toxic metal and organic contaminants have been found in several tissues of individuals from the Middle Atlantic Bight population, although the source of the contaminants is unknown (Steimle *et al.* 1996).

Hoenig (1983) used longevity estimates of 40-50 years for "unexploited" tilefish population in a regression model to predict total annual mortality M = 0.09-0.11. Shepherd (1998) noted that M is now estimated at 0.15.

MIGRATION

Based on a few tagging studies and the decade or so needed to re-colonize the southern New England grounds after the great mortality of 1882, it appears tilefish migrate little or not at all (Freeman and Turner 1977; Grimes *et al.* 1983, 1986). The seasonal variability in the presence of a band of warm water near Nantucket Shoal and southern Georges Bank during the winter/spring suggests that there is some migration along the outer shelf within the preferred habitat or, alternatively, that tilefish may reduce their activity or hibernate in their burrows at low water temperatures.

STOCK STRUCTURE

Two tilefish stocks have been identified in United States waters based on morphometric and electrophoretic similarities: in the Middle Atlantic Bight and south of Cape Hatteras into the Gulf of Mexico (Katz *et al.* 1983). Sulak and Ross (1996) reported that the ichthyofauna on the upper continental slope off Cape Hatteras was less diverse than on the upper slope off Virginia, and that individuals of many species off Cape Hatteras were smaller and less active than their conspecifics off Virginia. This community (which they termed "Lilliputian") was associated with low oxygen at the sediment surface and a high flux of particulate organic carbon from surface waters. This upper slope, hypoxic area may be the cause of tilefish stock separation. Management of the stock south of Cape Hatteras is covered by the South Atlantic Fishery Management Council's Snapper Grouper Fishery Management Plan.

HABITAT CHARACTERISTICS

Tilefish habitat is restricted to the continental shelf break south of the Gulf of Maine. The following description, based largely on Warner (1987), applies to juveniles and adults. The outer continental shelf, shelf break, and upper slope (approximately 100-500 m) that contain suitable habitat for tilefish are the product of several processes. The topography developed during repeated cycles of glacial advance and retreat that caused major changes in sea levels. The outer shelf of the Middle Atlantic Bight slopes gently (1-2^{o}) and is generally flat except for relict submerged river valleys (e.g., the Hudson Shelf Valley leading to the Hudson Canyon), submerged beach fronts, and submarine canyons. At the edge of the continental shelf, the slope increases to 5-7^{o} and greater in the current-washed canyons, where there are near vertical walls. Sediments on the outer shelf-upper slope in the area used by tilefish are medium to fine sands and silt, with isolated areas of exposed clays and other consolidated sediment near the heads or along the sides of submarine canyons. Off southern New England, glacial erratic boulders randomly occur and coarser sediments are found in the current-washed channels of many canyons. The topography on either side of Hudson Canyon is irregular and hummocky (Twichell *et al.* 1995).

Current patterns and water mass dynamics at the shelf break are partially affected by wind, Rossby waves moving upslope, and lateral variation in the location of the Gulf Stream and its loops and gyres. Residual water mass movement on the shelf and upper slope is to the southwest. A "warm belt" (9-14^{o}C) occurs at the shelf break where shelf and slope water meet. The width and linear extent of this band varies seasonally; it extends beyond Nantucket Shoal and along southern Georges Bank in the summer and fall, but retreats to off Long Island in the winter and spring (Colton and Stoddard 1973).

Flagg (1987) summarized the hydrography of the shelf for southern Georges Bank and his description applies south to Virginia (Schmitz *et al.* 1987). Seasonal fluctuations in bottom temperatures affect the water column down to about 200 m on the continental shelf (including shallow parts of Georges Bank) and shelf break. There is a persistent cold pool or band of residual winter bottom water (usually < 10^{o}C) along the mid-outer shelf that parallels the shelf break. Beyond the warm band at the shelf break (> 500 m), the bottom temperature on the slope declines gradually to about 4^{o}C. There is a seasonally variable pycnocline on the outer shelf at about 50 m that deepens to 70-100 m at the shelf break; salinities above the pycnocline tend to be < 35 ppt and below the pycnocline, in the tilefish warm band, they are approximately 35-36 ppt. Dissolved oxygen (DO) at the shelf break varies seasonally between 3-7 ml/L in the winter and 3-5 ml/L in the summer; the lowest values occur in the oxygen minimum zone around 200-400 m. Movement of Gulf Stream gyres and meandering loops over the slope temporarily affect hydrographic conditions and biological communities at the shelf break.

The oceanographical, geological, and biological changes that occur at the shelf break, and the specialized community that exists in this zone, has been described as a unique ecotone with the characteristics of an edge effect (enhanced productivity and diversity), although the boundaries and environmental sensitivity of this zone/community are still in question (Church *et al.* 1984; Warner 1987). Warner *et al.* (1983) considered tilefish a good indicator species for delineating the shelf break "warm belt" community and for monitoring the sensitivity of this ecosystem to disturbance (e.g., oil and gas development).

EGGS

Tilefish eggs collected during the NEFSC Marine Resources Monitoring, Assessment and Prediction (MARMAP) program surveys [see Reid *et al*. (1999) for methods] were associated with mean water column (to 200 m) temperatures of 8-19^{o}C with a trend following the seasonal rise in temperatures (Figure 3). This egg-temperature distribution suggests that Fahay and Berrien (1981) hatched eggs at a slightly higher than normal temperature (22.0-24.6^{o}C vs. < 19.0^{o}C). The hatching time they measured (40 hrs) may be longer under cooler conditions where eggs were collected.

The depths over which the eggs were collected during the NEFSC MARMAP surveys ranged from approximately 80-1250 m; most eggs were collected between 80-800 m (Figure 3). The November data was for one tow in deep water off Chesapeake Bay and suggests an unusual situation.

LARVAE

Tilefish larvae were rarely collected during the NEFSC MARMAP surveys. The survey data suggest that larvae prefer a narrow range of fairly warm temperatures (approximately 13-18^{o}C) and relatively shallow depths (approximately 50-150 m) (Figure 4).

JUVENILES

The NEFSC groundfish surveys collected few juvenile tilefish in more than 30 years of operation. Spring trawl collections contained the highest number of samples (91). Approximately 24% of the collections occurred at bottom temperatures below the limit (> 8^{o}C) reported in previous studies; most of these low temperature data came from surveys in the 1970s. The maximum temperature of juvenile occurrence in the NEFSC trawl surveys (approximately 15^{o}C) was also lower than the preferred maximum (approximately 18^{o}C) reported in previous studies (Figure 5; Table 2). Temperature data from other seasons were within the range of the spring collections, with a weak mode at 9-11^{o}C (Figure 5). This suggests that juveniles are more tolerant of low temperatures than adults, which could help recruits survive in marginal habitat conditions.

The depth range of juveniles collected in the spring during NEFSC bottom trawl surveys was 90-264 m; most were collected at < 170 m (Figure 5); however, the maximum depth of the NEFSC trawl surveys was 366 m (see Reid *et al.* 1999). The juvenile tilefish depth of capture in other seasons was similar to that for spring.

ADULTS

Except for the spring, there are insufficient data on adult tilefish in the NEFSC bottom trawl surveys to estimate their bottom temperature and depth preferences. One adult (2% of total) was collected at 6.5^{o}C (Figure 5) which is below the published temperature preference range (approximately 8-18^{o}C). The maximum temperature at which adult tilefish were collected during the NEFSC bottom trawl surveys was lower (approximately 14^{o}C) than the maximum reported in previous studies (Table 2). The association of adult tilefish with temperature was similar to juveniles with a weak mode at 10-11^{o}C (Figure 5).

In the spring of 1882, an estimated 1.5 billion tilefish weighing over 7 million tons were found dead and dying in surface waters offshore between Nantucket Shoal and Maryland. This was followed by a collapse of the fishery and the population (Collins 1884; Bumpus 1899; Bigelow and Schroeder 1953; Dooley 1978). Many other organisms associated with the tilefish habitat also died (Bigelow and Schroeder 1953), including armored searobin, "red snappers," galatheid crabs, and deep-water spider and hermit crabs (Collins 1884). The mortality is presumed due to thermal shock from a rapid drop in temperature, which may have been caused by meanders of the Gulf Stream or unusually heavy sea ice off Nova Scotia associated with upwelling of the deep, cold Labrador Current; undersea volcanism was also suggested (Collins 1884; Bumpus 1899; Bigelow and Schroeder 1953; Dooley 1978). Collins (1884) reported no evidence of disease or excessive parasite infestations; most freshly dead or dying fish had empty stomachs and their air bladders extruding from their mouths. Some fish found at the surface off southern New England during the event were identified by seamen as cod and hake (Collins 1884), which are moderately cold tolerant. This observation suggests that if temperature change was the cause, it was probably rapid.

The depth range of adults collected in the spring was 105-274 m with a weak mode at about 140 m; most fish were collected shallower than 210 m (Figure 5). Data for adult tilefish from other seasons were consistent with the spring with a mode at 160-170 m (all from winter collections), which is consistent with previous studies, although tilefish have been collected to 540 m (Table 2).

GEOGRAPHICAL DISTRIBUTION

EGGS

Based on the NEFSC MARMAP surveys (1978-1987), tilefish eggs were collected from March to November on the outer continental shelf from North Carolina to southern Georges Bank; the highest densities were found from Hudson Canyon to Block Canyon (south of Rhode Island) (Figure 6). In March, a few eggs were collected between these canyons. From April to October, eggs were collected broadly on the outer shelf. In November, eggs were only collected off Chesapeake Bay (Berrien and Sibunka 1999).

LARVAE

From the NEFSC MARMAP surveys, the center of larval abundance lies between Toms Canyon (just south of Hudson Canyon) and the "Mud Patch" (south of Nantucket Island) (Figure 7). Larvae were also collected off North Carolina and on eastern Georges Bank. However, this distribution is based on only those 12 tows that contained larvae over the entire survey period [see Reid *et al*. (1999) for methods].

JUVENILES

The NEFSC bottom trawl surveys collected few juvenile tilefish. Those that were caught occurred mostly off southern New England in all seasons except summer (Figure 8).

ADULTS

The NEFSC bottom trawl surveys also collected few adult tilefish. Those that were caught occurred along the continental shelf break between Nantucket Shoals and Hudson Canyon primarily in spring (Figure 8).

Warner (1987) generated a series of relative CPUE maps for the fishery from Toms Canyon (south of Hudson Canyon) to Hydrographer Canyon (on western Georges Bank) for 1973-1982 (Figure 9). Because the fishery concentrated on areas with the highest catches (apparent abundance), the resulting data are biased and probably underestimate the distribution of the stock. At the time of this analysis, the fishery was still expanding and all areas of tilefish abundance may have not been located or reported. The eastern expansion noted in this time series was due mostly to the expansion of the fishery and not the tilefish stock. Effort in the tilefish fishery (used here as a surrogate for tilefish relative abundance) is associated with topographically rough bottom (Figure 10).

Chang (1990) examined commercial landings data for 1977-1988 when the tilefish fishery was mature and found that tilefish were more widely distributed (Figure 11) than during the early period of the fishery analyzed by Warner (1987). The highest landings in the mature fish were concentrated south of Martha's Vineyard and near Hudson Canyon, especially in the winter and spring (Figure 11).

STATUS OF THE STOCKS

The fishery for tilefish began in 1879, but collapsed shortly thereafter with the mass mortalities of 1882. It began to recover in the late 1890s with an abundance of young fish (Bumpus 1899) and by 1915 the species was again being fished and promoted by United States Bureau of Commercial Fisheries (Bigelow and Schroeder 1953; Dooley 1978). The reported fishery landings have been highly variable with peaks in 1914-1915, the late 1920s, mid-1950s, and mid-1970s. Catches were reduced or minimal in the early 1930s, during World War II, during 1961-1972 (Freeman and Turner 1977), and low but relatively stable since 1984 (Shepherd 1998). Most of the tilefish harvest until recently came from the Middle Atlantic Bight stock. In the early 1980s, recreational and commercial fisheries also developed for the stock south of Cape Hatteras (Low *et al.* 1983; Hightower and Grossman 1988; Parker and Mays 1998).

Shepherd (1998) notes low landings and a significant decline in CPUE of the northern stock since about 1981 as evidence of over-exploitation (Figure 12). Some of the variability in early landings was probably due to a decline in consumer demand and a corresponding reduction in fishing effort (Bigelow and Schroeder 1953). Turner *et al.* (1983) also noted variability in stock recruitment during the 1970s. The resurgence of this offshore fishery in the early 1970s, partly as a recreational fishery (Morse 1981; Grimes *et al.* 1980, 1986), may be a response to the decline of inshore fisheries because of habitat degradation and overfishing (McHugh 1977). Barans and Stender (1993) reported similar declines in stock size and mean individual size as the South Atlantic Bight fishery developed, and harvests have also declined since the late 1980s (Parker and Mays 1998).

According to Turner (1986), the effects of fishing have been "drastic" and that stock size has been reduced by half to two-thirds, a level that continued into the mid-1990s (Shepherd 1998). High fishing mortality has truncated the size structure of the population; fewer large fish (> 70 cm) have been landed (Grimes *et al.* 1980; Turner *et al.* 1983).

RESEARCH NEEDS

- Are tilefish protogynous (a size-related sex change from female to male) at pre-maturation (Dooley 1978; Idelberger 1985; Grimes *et al.* 1988)? If so, how is it affected by the social structure of a local population (sex ratio of mature fish) and how is that affected by fishing?
- Do tilefish off southern New England and Georges Bank leave suitable habitats during the winter and where do they go (Grimes *et al.* 1986)?
- Assume that the boundaries of tilefish habitat are flexible and dictated by physical (sediments, shelter, temperature), biological (burrow builders, prey, competition, recruitment), and fishery (stock size, harvest intensity, and population size structure) processes. Can a probabilistic model be developed that identifies the size and shape of suitable habitat (after Warner 1987)?
- Are adult male tilefish territorial? If so, how does the removal by the fishery of large, dominant males effect the social structure of a local population (Grimes *et al.* 1988)?
- If vertical burrows, the primary habitat of tilefish according to Able *et al.* (1982) and Grimes *et al.* (1986), are filled with loose sediments because of intensive trawling (Churchill 1989), offshore sediment disposal, or a major storm, can the burrows be cleared and reused by the tilefish? By other organisms?
- What degree of symbiosis or mutualism exists between tilefish and other developers/users of burrow habitats; e.g., galatheid crabs (Grimes *et al.* 1987)?
- Do tilefish form long-term associations with individuals of the opposite sex (pair bonds) (Grimes *et al.* 1986)? How does harvesting affect the social

structure and breeding potential of the population?

- Peak activity and feeding in tilefish has been reported to be daytime (Freeman and Turner 1977) or nighttime (Grimes *et al.* 1987). Peak activity and feeding are usually coincident (for energetic reasons) unless feeding grounds are well away from resting grounds; why the difference in conclusions?
- The Katz *et al.* (1983) study of stock identification between the Middle and South Atlantic Bights did not examine tilefish between Toms Canyon (south of Hudson Canyon) and the border between North Carolina and South Carolina. Do tilefish from near Cape Hatteras (e.g., Norfolk Canyon) support separating the population into two biologically distinct stocks?
- More information on the age structure of the population in different years is needed to improve estimates of mortality rate and to determine sexual differences in mortality rate (Turner *et al.* 1983).
- The attributes of habitat that trigger larval tilefish settlement and juvenile transition are unknown. These are especially important for recruitment and maintenance of local, non-migratory populations.
- The range of environmental parameters for tilefish egg survival and development are unknown.
- Are tilefish affected by the relatively low levels of anthropogenic contaminants that are in their tissues (Steimle *et al.* 1996)?
- Do juvenile tilefish aggregate in certain areas? If so, where and what are the habitat characteristics (Freeman and Turner 1977)?
- Does the oxygen minimum band on the upper slope affect tilefish distribution?
- Is tilefish cannibalism caused by inadequate shelter habitat for small juveniles or the territoriality of adults? If so, can juvenile shelter and survival be increased artificially?
- Do juveniles tolerate lower temperatures than adults?

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Table 1. Food items of tilefish, *Lopholatilus chamaeleonticeps*, in the Middle Atlantic Bight [from Freeman and Turner (1977)].

MOLLUSCA (mollusks)
Gastropoda (univalve mollusks)
    Unidentified
Pelecypoda = Bivalvia (bivalve mollusks)
    Protobranchia
        Nuculanidae
            Naculana acuta
    Pteroconchidae
        Mytilidae
            Musculus discors
        Pectinidae
            Cyclopecten nanus
    Eudesmodontida
        Pandoridae
            Pandora inflata
Cephalopoda (squids, octopuses)
    Unidentified

ANNELIDA (segmented worms)
Polychaeta (sandworms, tube worms)
    Eunicida
        Lumbrinereidae
            Unidentified

ARTHROPODA (joint-footed animals)
Crustacea (crabs, barnacles, lobsters)
    Stomatopoda
        Lysiosquillidae
            Heterosquilla armata
    Isopoda
        Cirolanidae
            Cirolana polita
        Unidentified isopoda
    Decapoda
        Crangonidae
            Crangon septemspinosa
        Nephropsidae
            Homarus americanus
        Galatheidae
            Munida iris
        Paguridae
            Catapagurus sherreri
        Calappidae
            Acanthocarpus alexandri
        Majidae
            Euprognatha rastellifera
            Callodes robustus
        Cancridae
            Cancer borealis
            Cancer irroratus
            Cancer sp.
    Unidentified decapods
Unidentified crustaceans

ECHINODERMATA (echinoderms)
Stelleroides = Asteroidea (starfishes)
    Unidentified
Ophiuroida (brittle stars)
    Ophiurida
        Amphiuridae
            Axiognathus squamata
            Amphiura centiculata

CHORDATA (chordates)
Tunicata = Urochordata (tunicates)
    Ascidiacea (ascidians)
        Unidentified ascidian
Agnathostomata
    Agnatha (jawless fishes)
        Myxinidae
            Myxine glutinosa (Atlantic hagfish)
Gnathostomata (jawed vertebrates)
    Chondrichthyes (cartilaginous fishes)
        Squalidae
            Squalus acanthias – spiny dogfish
    Osteichthyes (bony fishes)
        Clupeidae
            Brevoortia tyrannus – Atlantic menhaden
            Clupea harengus – Atlantic herring
        Myctophidae
            Ceratoscopelus maderensis – "lantern fish"
        Congridae
            Conger oceanicus – conger eel
        Ophichtidae
            Ophichthus cruentifer – margined snake eel
        Gadidae
            Merluccius albidus – offshore hake
        Serranidae
            Hemanthias aureorubens – streamer bass
        Branchiostegidae
            Lopholatilus chamaeleonticeps - tilefish
        Scombridae
            Scomber scombrus – Atlantic mackerel
        Scorpaenidae
            Helicolenus dactylopterus – blackbelly rosefish
        Ammodytidae
            Ammodytes americanus – American sand lance
        Stromateidae
            Peprilus triacanthus - butterfish
        Peuronectidae
            Paralichthys oblongus – fourspot flounder
            Limanda ferruginea – yellowtail flounder
        Lophiidae
            Lophius americanus - goosefish

SIPUNCULOIDEA (peanut worms)
Unidentified

Table 2. Summary of life history and habitat characteristics for tilefish, *Lopholatilus chamaeleonticeps.*

Life Stage	Time of Year	Size and Growth	Geographic Location	Habitat	Substrate	Temperature
Eggs	Serial spawning March-Nov; peaks April-Oct	1.16-1.25 mm	Shelf break; Georges Bank to Cape Hatteras	Water column, 80-800 m	Water column	8-19°C
Larvae	Feb-Oct; peaks July–Oct	2.6 to ~9.0 mm	Outer continental shelf; Georges Bank to Cape Hatteras	Water column, 50-150 m	Water column	13-18°C
Juveniles **(≤ 50 cm)**	All year; may leave Georges Bank in winter	~15-500 mm	Shelf break, submarine canyon walls and flanks; Georges Bank to Cape Hatteras	Rough bottom, shelter, small burrows, 80-540 m	Rocky, stiff clay, human debris	~8-18°C
Adults **(> 50 cm)**	All year; but may leave Georges Bank in winter	Females: 50-~100 cm; Males: 50-~120 cm	Shelf break, submarine canyon walls and flanks; Georges Bank to Cape Hatteras	Rough bottom, shelter, larger burrows, 80-540 m	Rocky, exposed ledges, stiff clay	~8-18°C

Life Stage	Salinity	Dissolved Oxygen	Prey	Predators	Notes
Eggs	~34-36 ppt	~4-8 ml/L			
Larvae	~33-35 ppt	~4-8 ml/L			
Juveniles **≤ 50 cm**	~33-36 ppt	~3-6 mg/L	Decapod crustaceans, small fish, benthic epifauna, human trash.	Tilefish, goosefish, sharks, dogfish, and conger eel.	
Adults **> 50 cm**	~33-36 ppt	~3-6 mg/L	Juvenile tilefish, other fish, decapods, benthic epifauna	Sharks, lampreys	Pair-bonding possible.

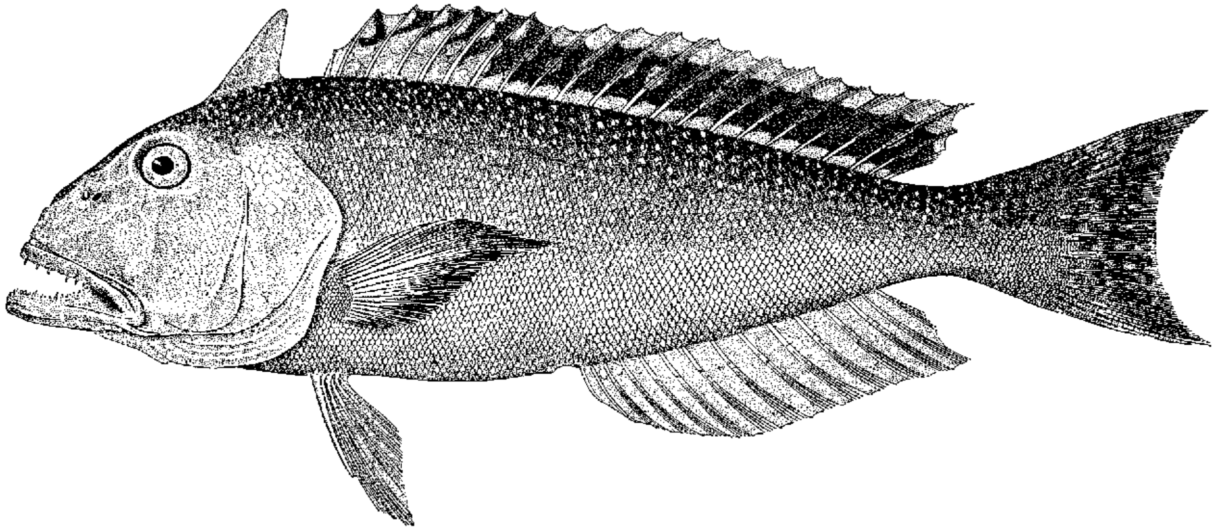


Figure 1. The tilefish, *Lopholatilus chamaeleonticeps* (from Goode 1884).

1973-1980

21-50 cm
(n=9)

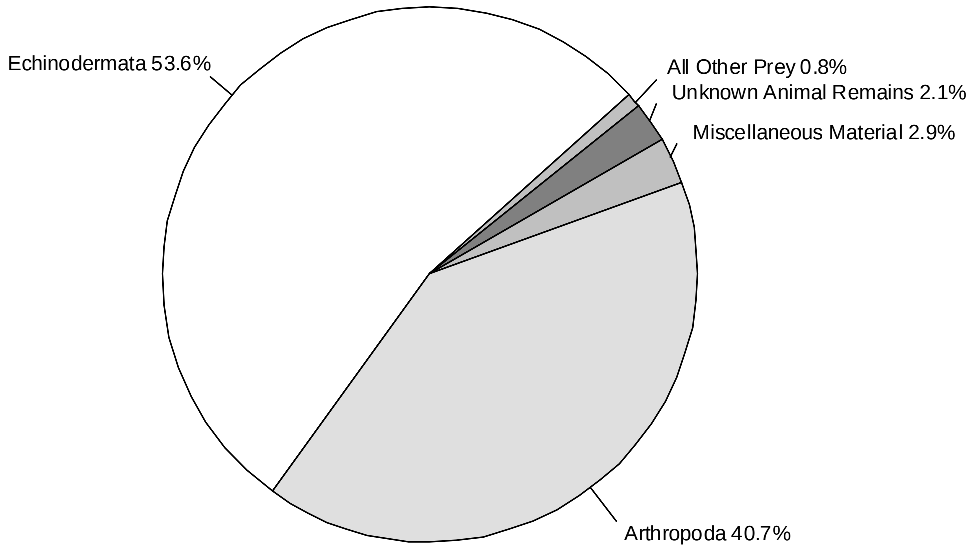


Figure 2. Abundance (percent volume) of the major prey taxa in the diet of juvenile tilefish collected during NEFSC bottom trawl surveys [see Reid *et al.* (1999) for details]. Echinodermata are mostly brittlestars (*Amphiura* sp.) and Arthropoda are crustaceans. The category "animal remains" refers to unidentifiable animal matter.

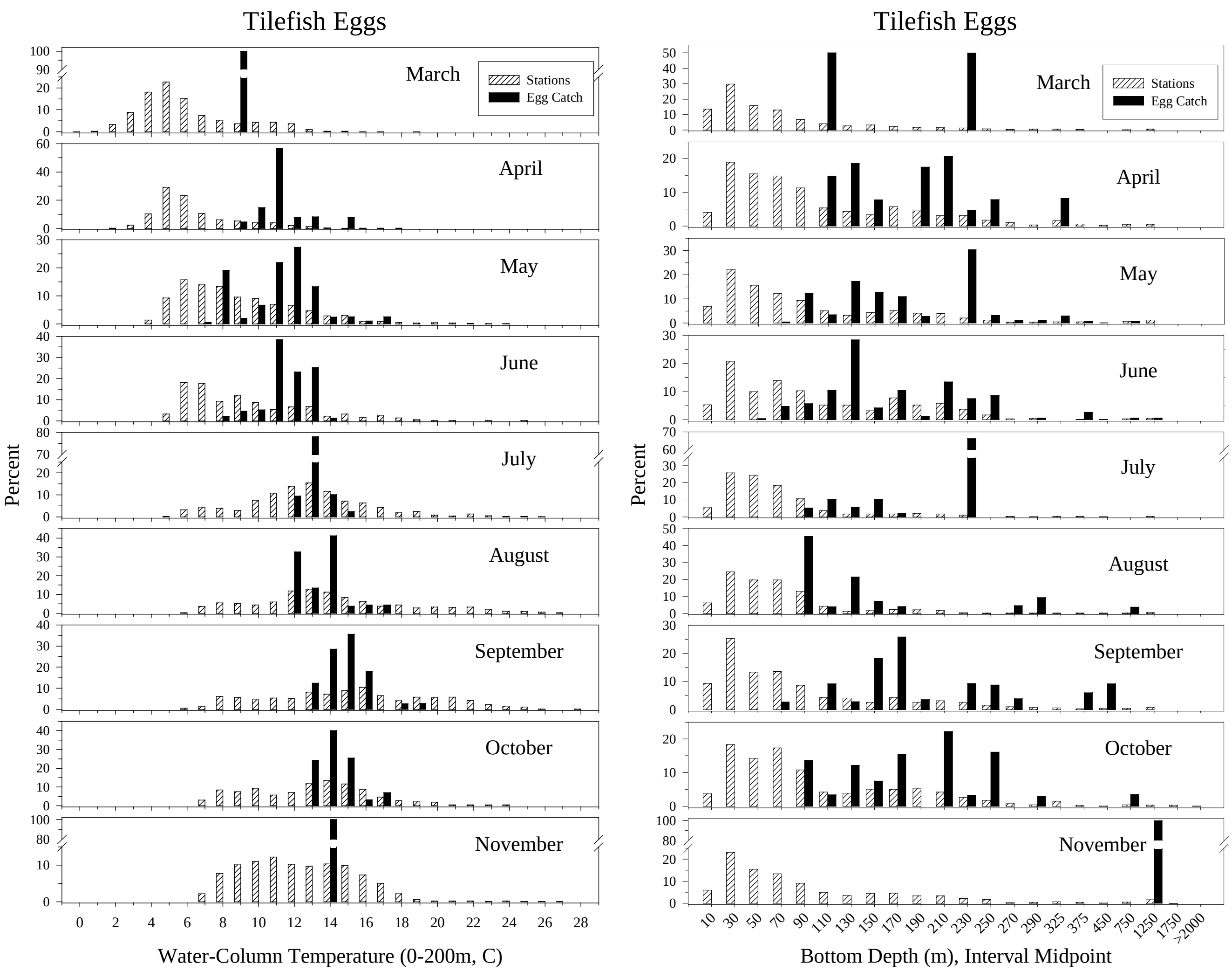


Figure 3. Abundance of tilefish eggs relative to water column temperature (to a maximum of 200 m) and bottom depth from NEFSC MARMAP ichthyoplankton surveys (1978-1987, all years combined). Open bars represent the proportion of all stations surveyed, while solid bars represent the proportion of the sum of all standardized catches (number/10 m^2).

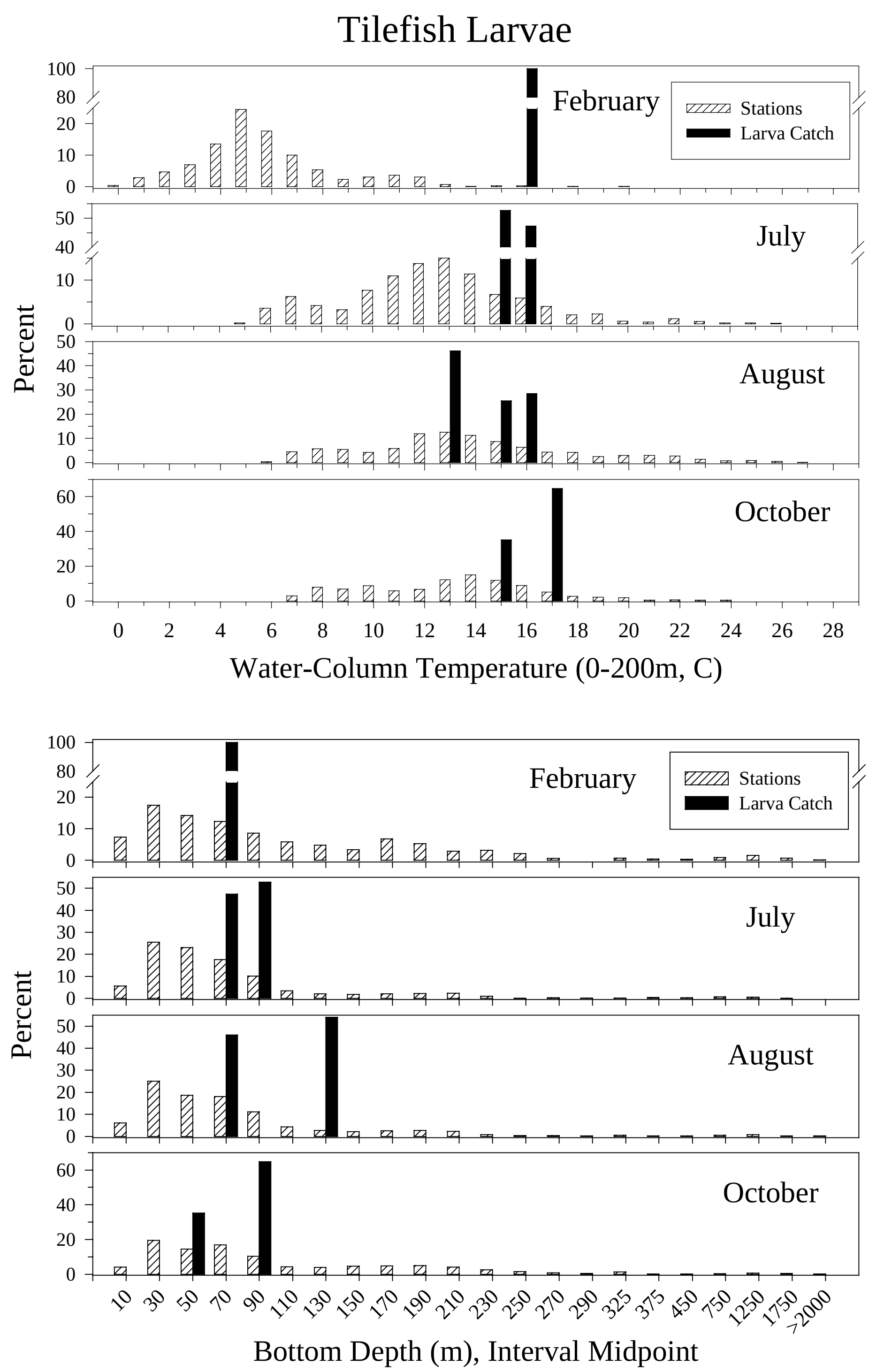


Figure 4. Abundance of tilefish larvae relative to water column temperature (to a maximum of 200 m) and bottom depth from NEFSC MARMAP ichthyoplankton surveys (1977-1987, all years combined. Open bars represent the proportion of all stations surveyed, while solid bars represent the proportion of the sum of all standardized catches (number/10 m^2).

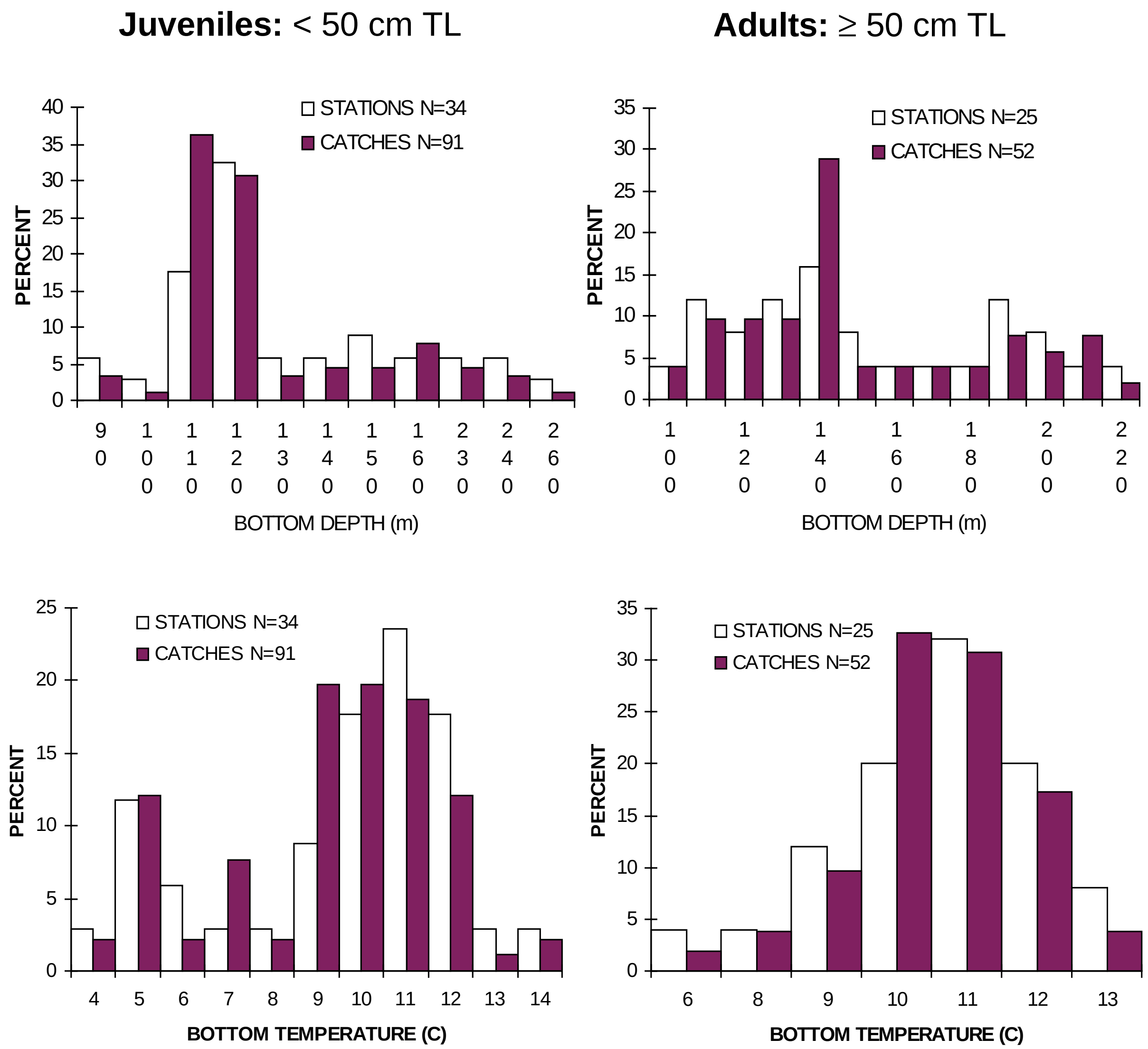


Figure 5. Abundance of juvenile and adult tilefish relative to bottom water temperature and depth based on NEFSC spring bottom trawl surveys. Open bars represent the proportion of all stations surveyed, while solid bars represent the proportion of the sum of all standardized catches (number/10 m^2).

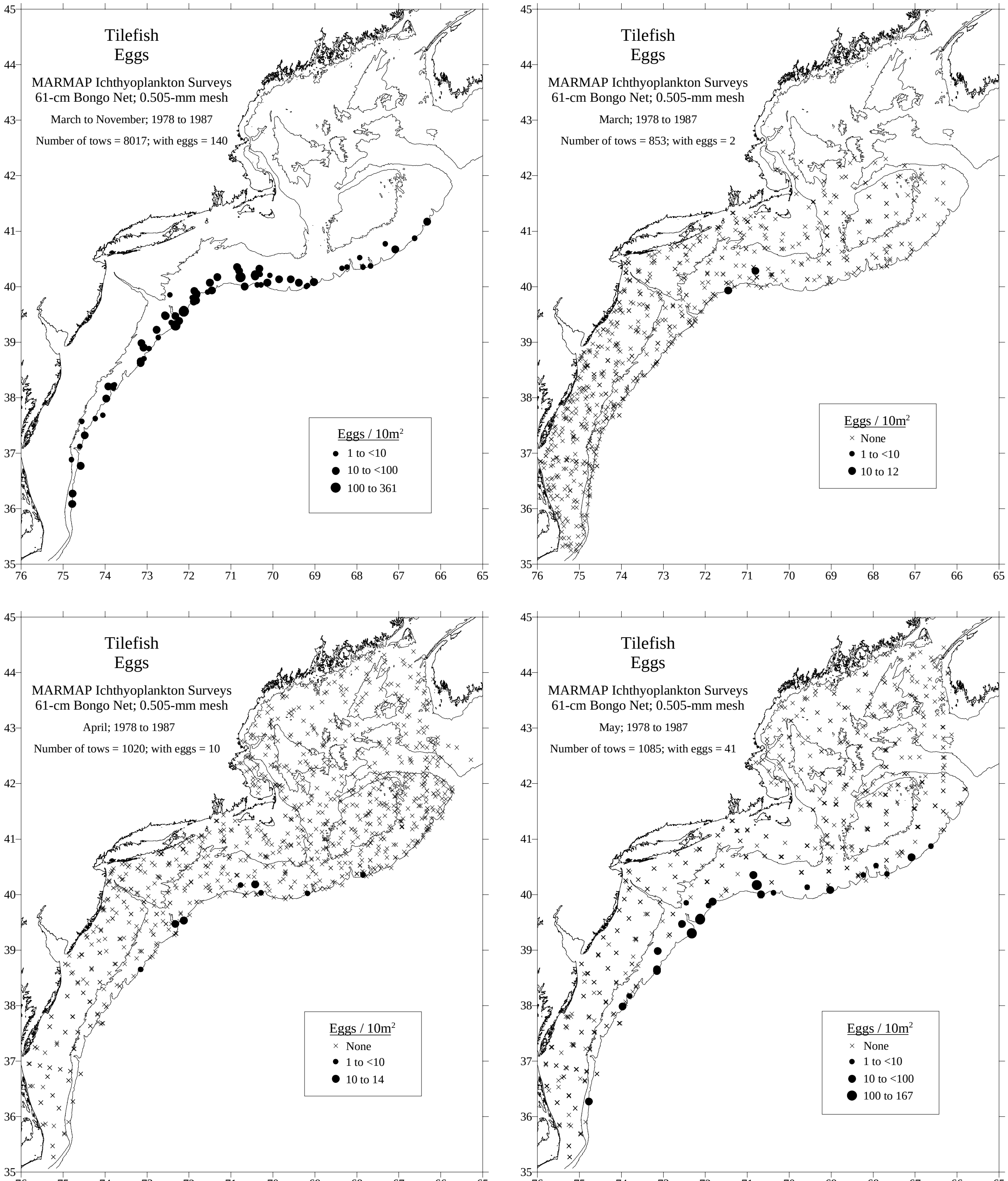
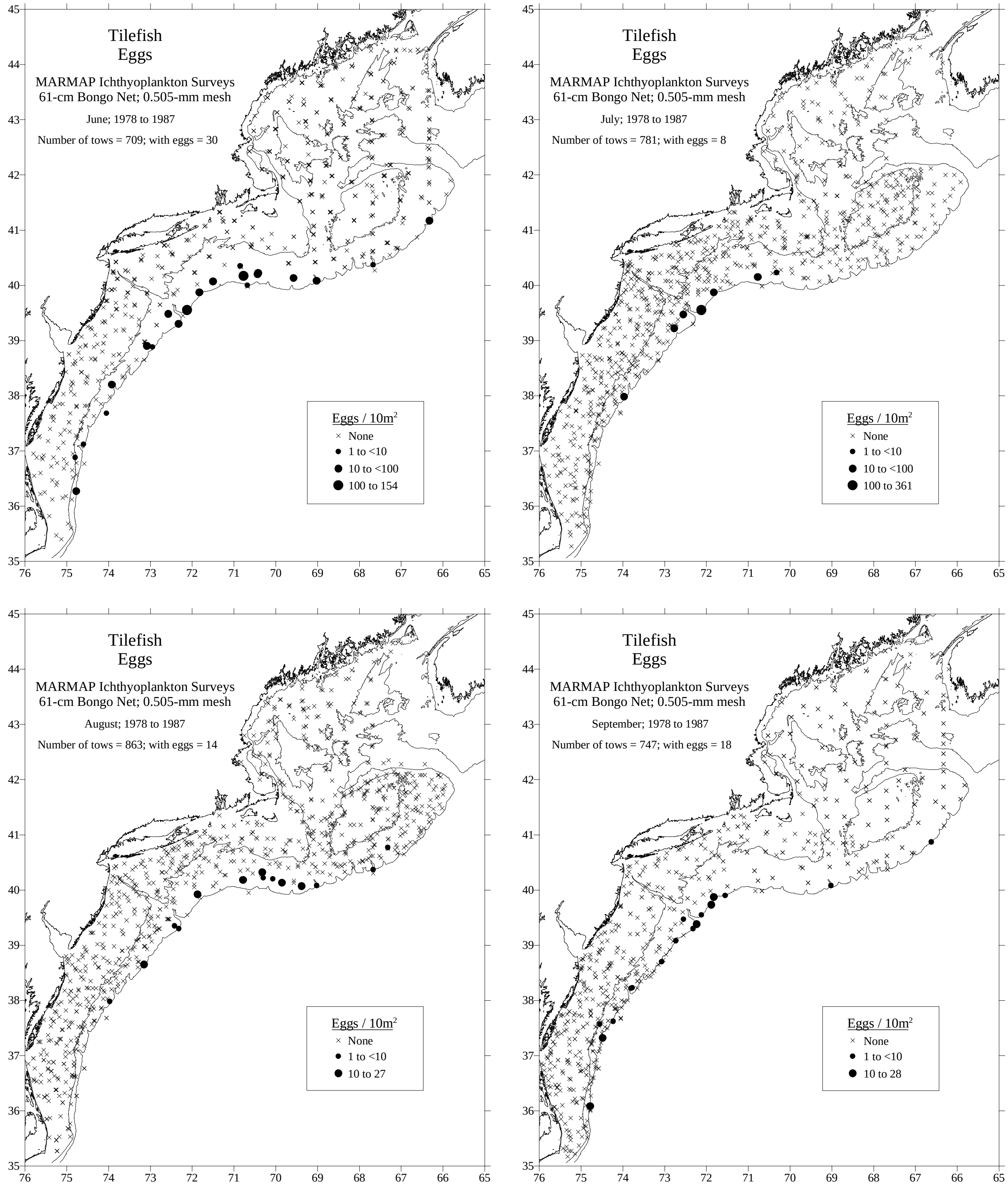


Figure 6. Distribution and abundance of tilefish eggs collected during NEFSC MARMAP ichthyoplankton surveys, March to November, 1978-1987 [see Reid *et al.* (1999) for details].



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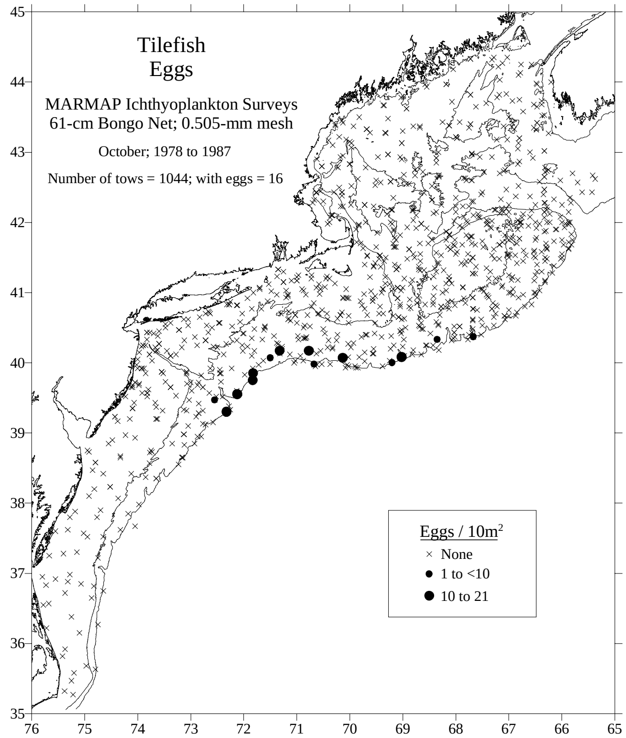

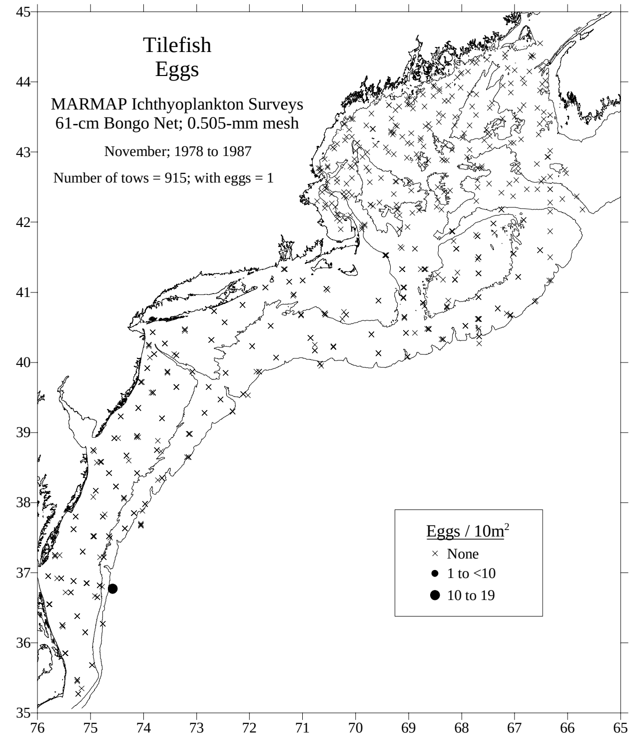

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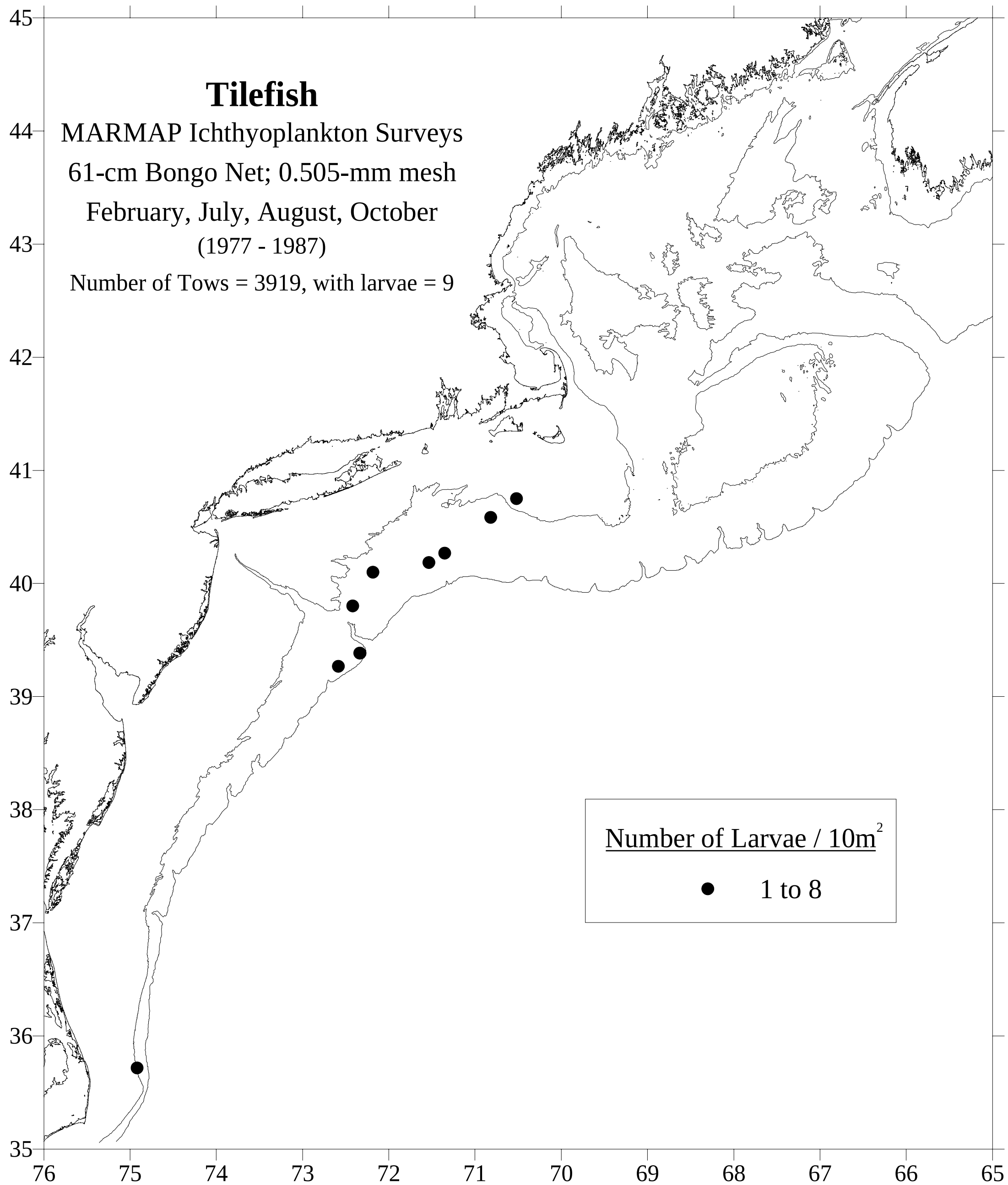


Figure 7. Distribution and abundance of tilefish larvae collected during NEFSC MARMAP ichthyoplankton surveys from 1977-1987 [see Reid *et al.* (1999) for details].

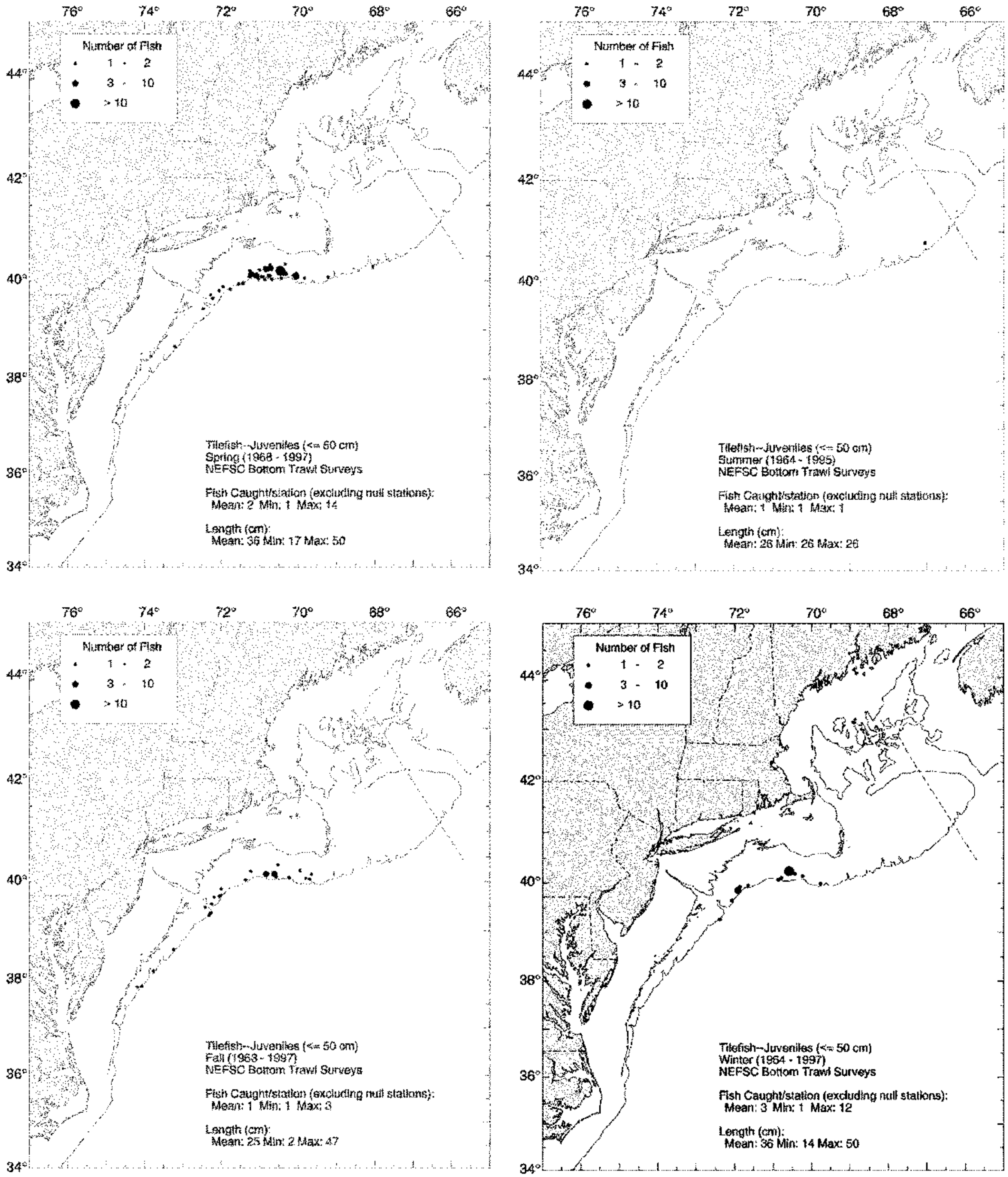
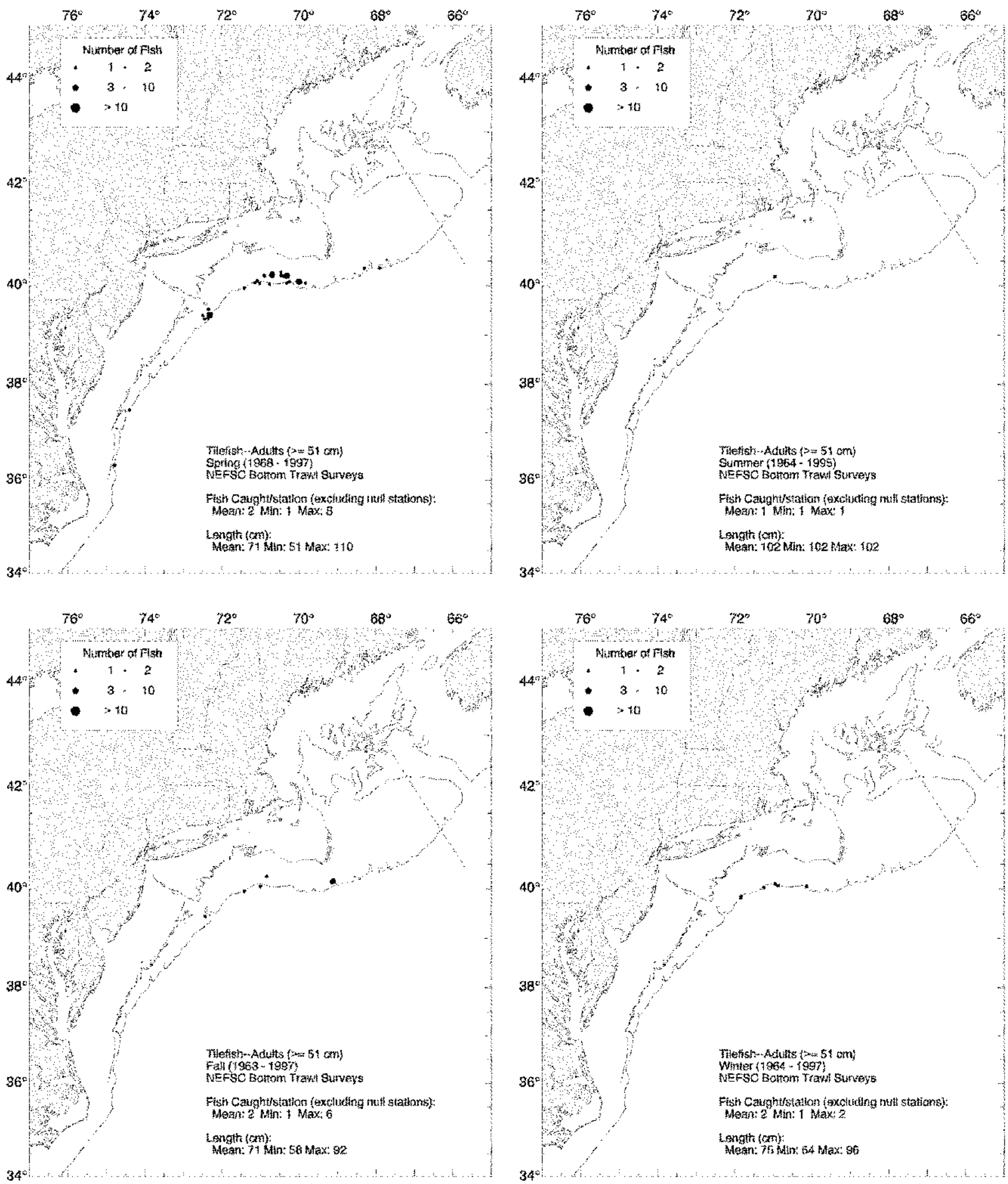


Figure 8. Seasonal distribution and abundance of juvenile and adult tilefish collected during NEFSC bottom trawl surveys [1963-1997, all years combined; see Reid *et al.* (1999) for details].



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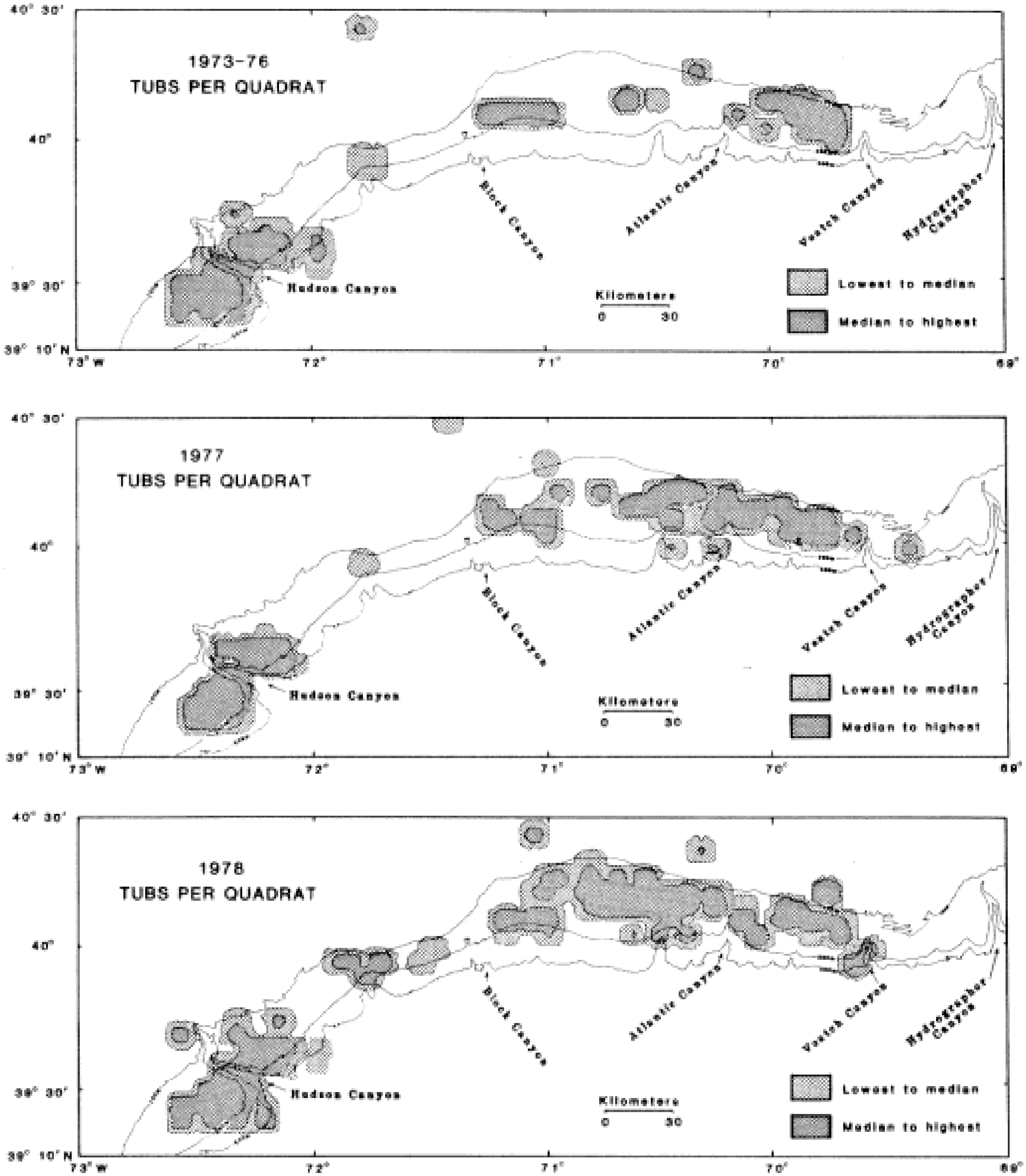
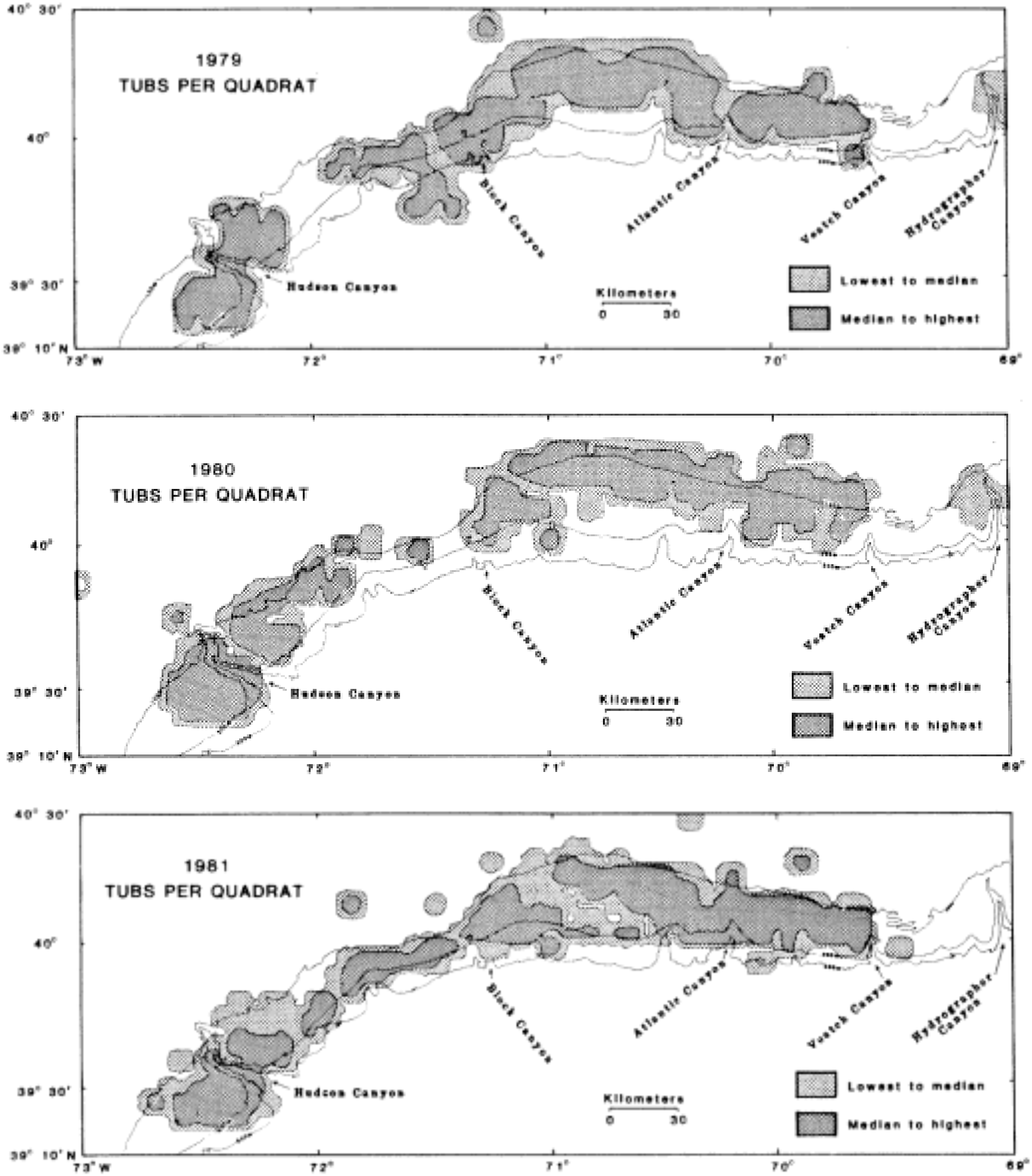


Figure 9. Tilefish distribution and relative abundance, 1973-1982, based on the long-line fishery effort; i.e. tubs of gear deployed within areas as surrogates for total catch; 1-43 tubs deployed = low-medium effort, 44-387 tubs deployed = medium-high effort (from Warner 1987).



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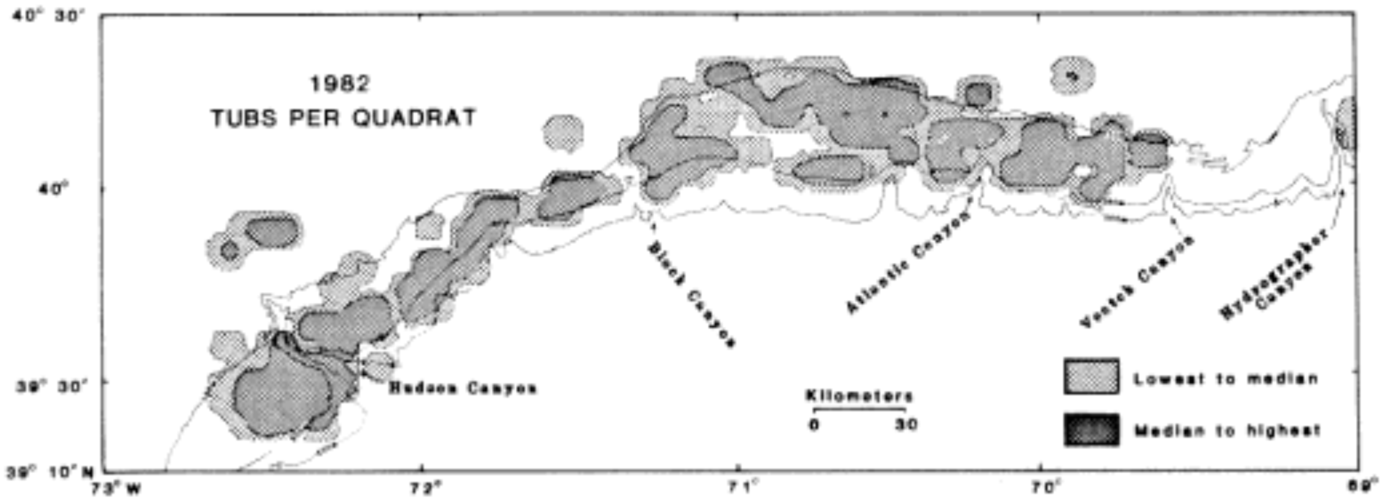

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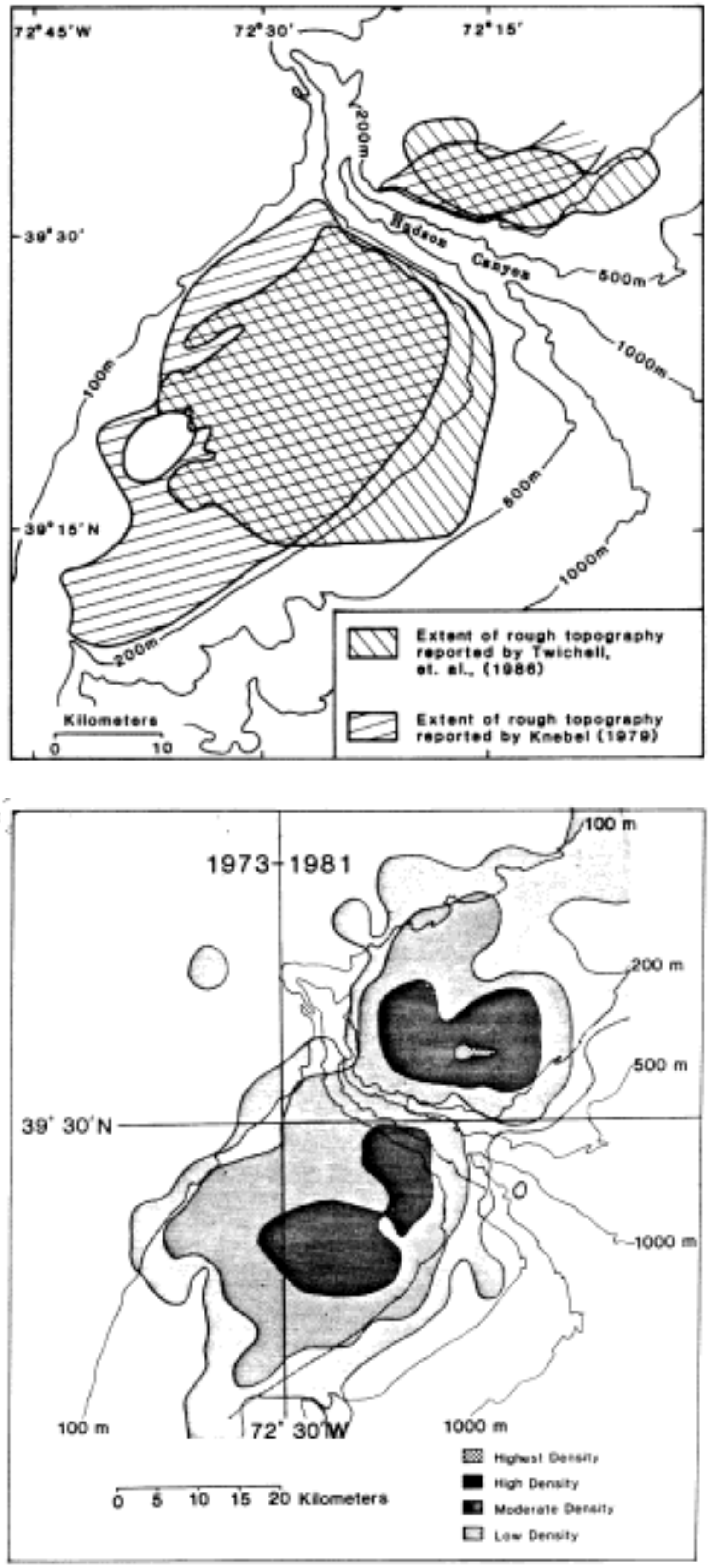
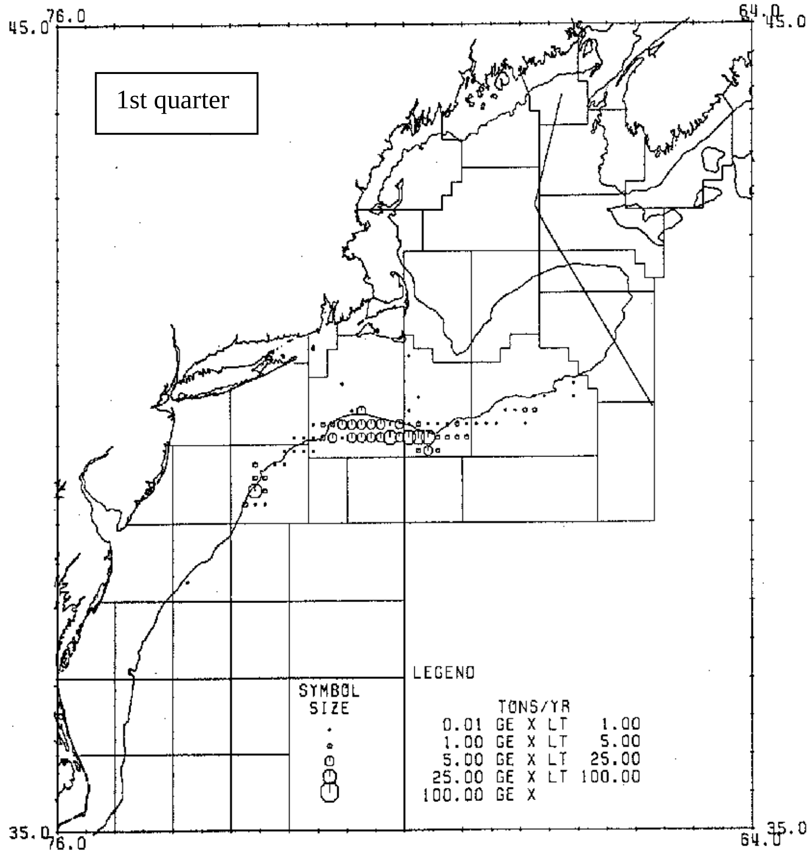


Figure 10. Comparison of “rough bottom” topography on either side of Hudson Canyon with 1973-1981 tilefish fishing effort (from Warner 1987).



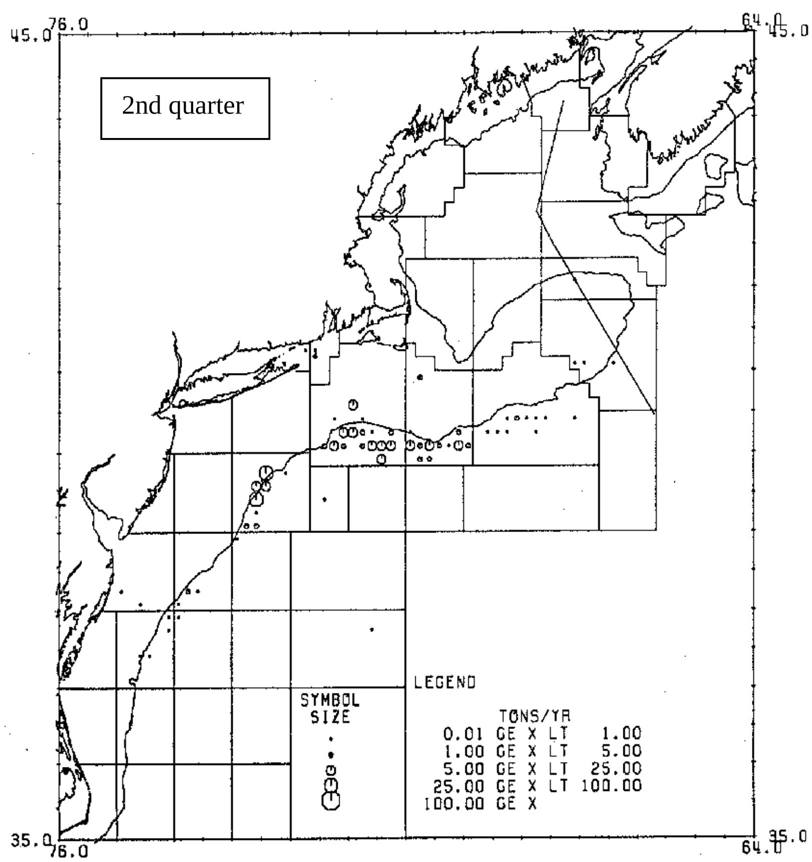
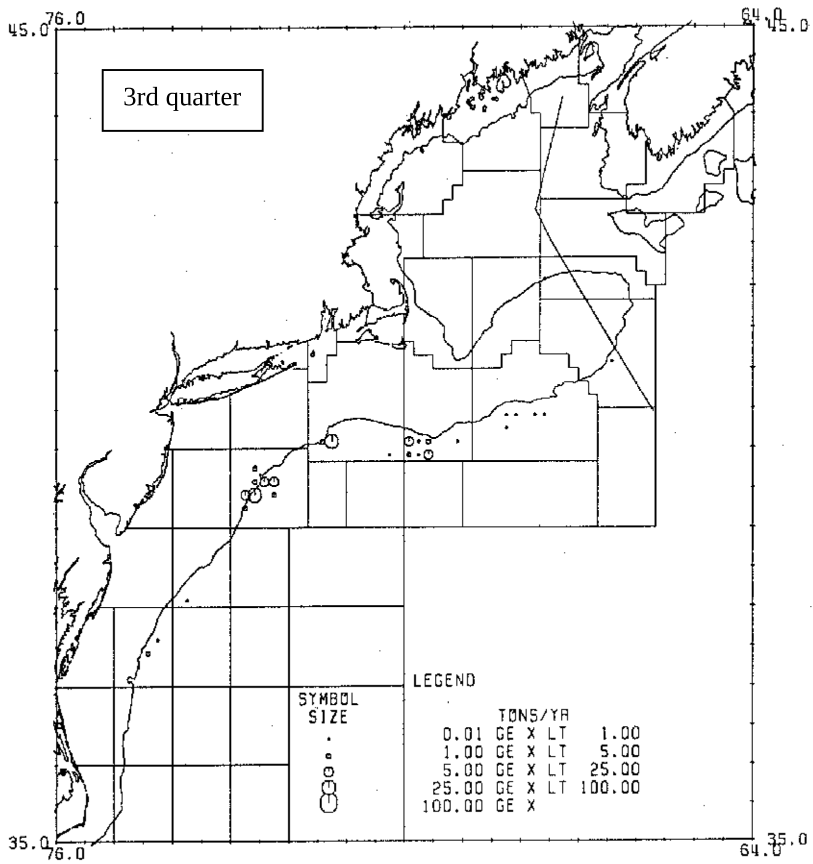
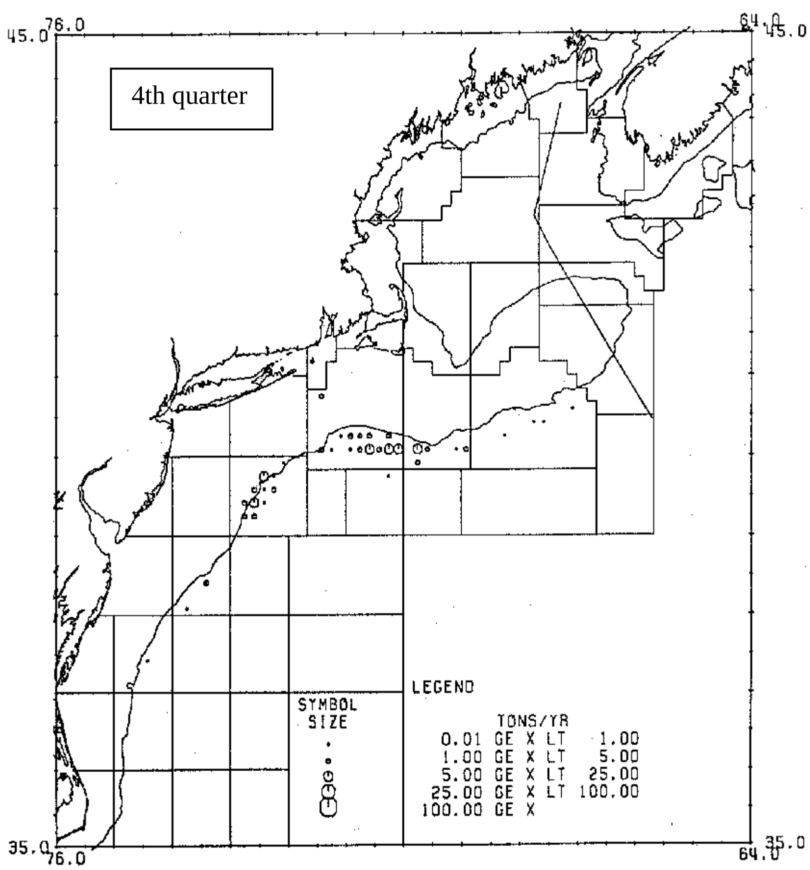


Figure 11. Commercial weighout distributions of tilefish by seasonal quarters in the Middle Atlantic Bight and Georges Bank for 1977-1988 (from Chang 1990). 1st = January-March, 2nd = April-June, 3rd = July-September, 4th = October-December. Symbols indicate a range and GE = Greater/Equal, LT = Less Than.





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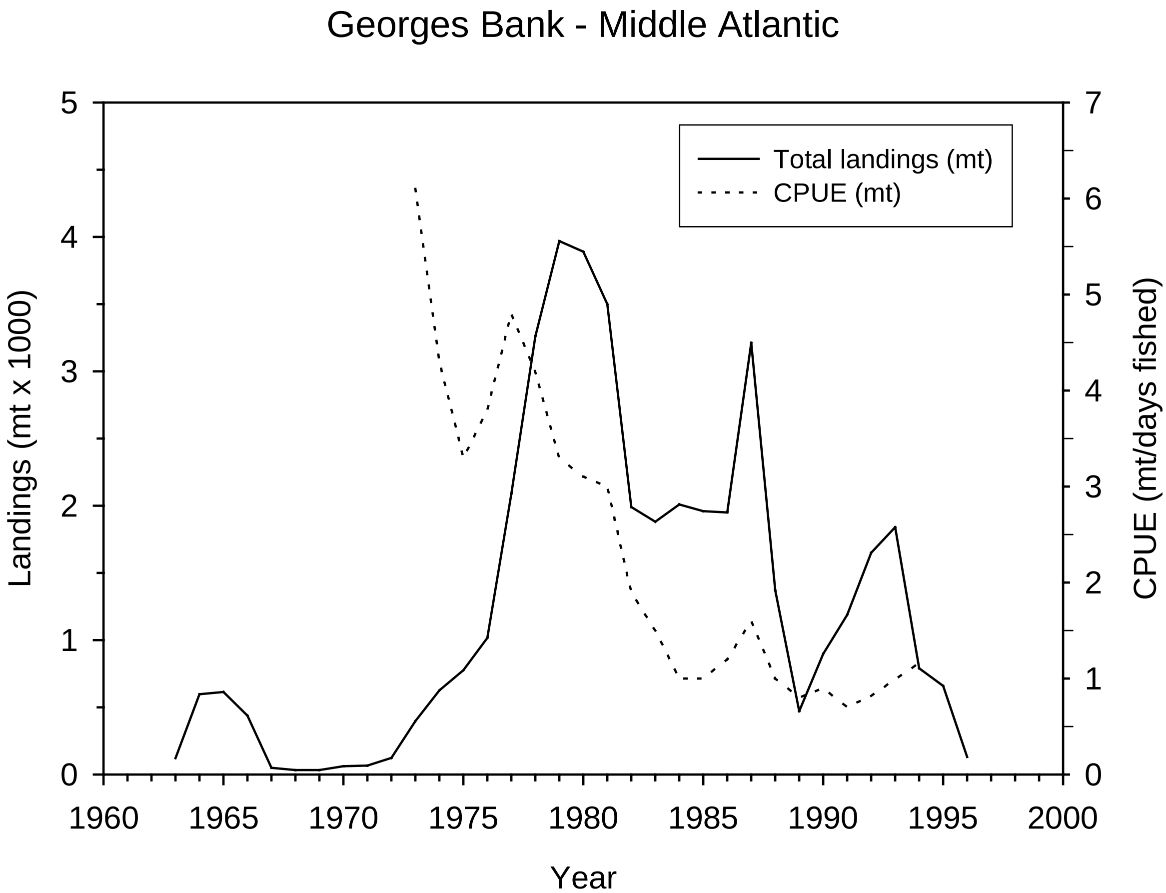

Figure 12. Commercial landings and catch-per-unit-effort data (from the NEFSC bottom trawl surveys) for tilefish from Georges Bank and the Middle Atlantic Bight.

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NOAA Technical Memorandum NMFS-NE-181

Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat

U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts

January 2004

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NOAA Technical Memorandum NMFS-NE-181

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Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat

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January 2004

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Publication Date: This document was both submitted and accepted on January 6, 2004, for issuance in this series. Consequently, the issue number (*i.e.*, 181) and publication date (*i.e.*, January 2004) were assigned at that time. Subsequent to that time, some new information was added and some existing information was revised. These actions explain why some post-January 2004 data, as well as some 2005 literature citations, appear in a document with a January 2004 publication date.

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[a]Nelson, J.S.; Crossman, E.J.; Espinosa-Pérez, H.; Findley, L.T.; Gilbert, C.R.; Lea, R.N.; Williams, J.D. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. 6th ed. *Amer. Fish. Soc. Spec. Publ.* 29; 386 p.

[b]Robins, C.R. (chair); Bailey, R.M.; Bond, C.E.; Brooker, J.R.; Lachner, E.A.; Lea, R.N.; Scott, W.B. 1991. World fishes important to North Americans. *Amer. Fish. Soc. Spec. Publ.* 21; 243 p.

[c]Turgeon, D.D. (chair); Quinn, J.F., Jr.; Bogan, A.E.; Coan, E.V.; Hochberg, F.G.; Lyons, W.G.; Mikkelsen, P.M.; Neves, R.J.; Roper, C.F.E.; Rosenberg, G.; Roth, B.; Scheltema, A.; Thompson, F.G.; Vecchione, M.; Williams, J.D. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. 2nd ed. *Amer. Fish. Soc. Spec. Publ.* 26; 526 p.

[d]Williams, A.B. (chair); Abele, L.G.; Felder, D.L.; Hobbs, H.H., Jr.; Manning, R.B.; McLaughlin, P.A.; Pérez Farfante, I. 1989. Common and scientific names of aquatic invertebrates from the United States and Canada: decapod crustaceans. *Amer. Fish. Soc. Spec. Publ.* 17; 77 p.

[e]Rice, D.W. 1998. Marine mammals of the world: systematics and distribution. *Soc. Mar. Mammal. Spec. Publ.* 4; 231 p.

[f]ISO [International Organization for Standardization]. 1981. ISO standards handbook 3: statistical methods. 2nd ed. Geneva, Switzerland: ISO; 449 p.

Contents

Tables

Figures

Acronyms

ASMFC	=	Atlantic States Marine Fisheries Commission
EEZ	=	exclusive economic zone
EFH	=	essential fish habitat
FMP	=	fishery management plan
FVTR	=	fishing vessel trip report
GIS	=	geographical information system
GOM	=	Gulf of Maine
HF	=	heavily fished
LF	=	lightly fished
MAB	=	Mid-Atlantic Bight
MAFMC	=	Mid-Atlantic Fishery Management Council
MBW	=	Maine Bottom Water
MIW	=	Maine Intermediate Water
MSA	=	Magnuson-Stevens Fishery Conservation and Management Act
MSW	=	Maine Surface Water
NEFMC	=	New England Fishery Management Council
NMFS	=	(NOAA) National Marine Fisheries Service
NOAA	=	(U.S. Department of Commerce) National Oceanic and Atmospheric Administration
PSI	=	pounds per square inch (lb/in^2)
TMS	=	10-minute square (of latitude or longitude) (10′ square)
UF	=	unfished

PREFACE

This document was conceived in 2001 by the Northeast Region Essential Fish Habitat Steering Committee. At that time, committee members were Louis Chiarella and Dianne Stephan (NOAA Fisheries Service's Northeast Regional Office, Gloucester, MA), Tom Hoff (Mid-Atlantic Fishery Management Council, Dover, DE), Robert Reid (Northeast Fisheries Science Center (NEFSC), Highlands, NJ), Michael Pentony (New England Fishery Management Council, Newburyport, MA), and Carrie Selberg (Atlantic States Marine Fisheries Commission). An early draft that included habitat characterization information, the spatial distribution of fishing activity by gear type, and a summary of relevant gear-effects studies, was prepared to assist a panel of academic and fishing industry experts that met in October 2001 to assess the habitat impacts of commercial fishing gear in the region. Following the workshop, these chapters were revised and updated, and new chapters describing fishing gear and practices and assessing the vulnerability of habitats utilized by federally managed fish and invertebrate species to fishing were added.

Seven authors collaborated in the preparation of this document. Louis Chiarella prepared the original gear descriptions, relying partially on information compiled by Michael Pentony. Additional information was later added to this section by David Stevenson. Dianne Stephan prepared the habitat characterization chapter, in collaboration with Robert Reid and David Stevenson. David Stevenson prepared the gear distribution maps and summaries, using data provided by Kurt Wilhelm, and summarized the relevant gear-effects literature. Korie Johnson (NOAA Fisheries Service's Office of Habitat Conservation, Silver Spring, MD) assisted with the literature review. Dianne Stephan, Louis Chiarella, Robert Reid, and David Stevenson collaborated on the habitat vulnerability evaluations. John McCarthy, a contractor at the Howard Laboratory (Highlands, NJ), assisted with text formatting and the preparation of tables and figures. Meredith Lock, also a contractor at the Howard Laboratory, helped with literature review and document assembly. Vince Guida (NEFSC, Highlands, NJ) provided some habitat characterization information. Thomas Noji (NEFSC, Highlands, NJ), David Mountain (NEFSC, Woods Hole, MA), and Peter Colosi (Northeast Regional Office, Gloucester, MA) commented on an early draft. David Packer (NEFSC, Highlands, NJ) and Jon Gibson (NEFSC, Woods Hole, MA) edited the document.

1. INTRODUCTION

This document was developed to provide assistance in meeting the Essential Fish Habitat (EFH) mandates of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the NOAA Fisheries Service's Northeast Region (hereafter just "Northeast Region" or "the region") which ranges from Maine to North Carolina. The 1996 amendments to the MSA require that federal fishery management plans (hereafter just "FMPs") minimize, to the extent practicable, adverse effects on EFH caused by fishing [MSA Section 303(a)(7)]. Pursuant to the EFH regulations [50 CFR 610.815(a)(2)], FMPs must include an evaluation of the potential adverse effects of fishing on EFH, including the effects of fishing activities regulated under other federal FMPs. The evaluation should consider the effects of each fishing activity on each type of habitat found within EFH, and provide conclusions as to whether and how each fishing activity adversely affects EFH. FMPs must describe each fishing activity, and must review and discuss all available and relevant information such as information regarding the intensity, extent, and frequency of any adverse effect on EFH, the type of habitat within EFH that may be adversely affected, and the habitat functions that may be disturbed. The evaluation should also consider the cumulative effects of multiple fishing activities on EFH. Additionally, FMPs must identify any fishing activities that are not managed under the MSA that may adversely affect EFH. Such activities may include fishing managed by state agencies or other authorities. However, regional fishery management councils (hereafter just "councils") are not required to take action to minimize adverse effects from non-MSA fishing activities. In completing this evaluation, councils are expected to use the best scientific information available, as well as other appropriate information sources.

This document emphasizes those fishing gears directly managed by the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC). Much of the information included in earlier drafts of this document was incorporated into recent environmental impact statements and amendments to NEFMC FMPs for Atlantic sea scallops, groundfish, and monkfish (goosefish) (NEFMC 2003a,b, 2004), and into an environmental impact statement that evaluated the effects of gears used in the Atlantic herring fishery on EFH (NOAA/NMFS 2005). The information in this document relates strictly to the direct physical and biological effects of fishing on benthic habitat; it does not include resource population effects or ecosystem-level effects that are caused by the removal of targeted species or bycatch.

The information used in this document includes descriptions of benthic habitats and species assemblages (fish and invertebrates) in four subregions of the Northeast U.S. Shelf Ecosystem, descriptions of 37 gear types used in state and federal waters in the region, and the extent and distribution of fishing activity for the major commercial fishing gears used in the region during 1995-2001. In addition, this document summarizes the results of 73 scientific studies that form the basis for understanding the effects of fishing on benthic marine habitats in the region, and evaluates the vulnerability of benthic EFH to fishing for 47 species of federally managed fish and invertebrate species in the region. Conclusions reached by a panel of experts that met in October 2001 for the purpose of evaluating habitat effects in the Northeast Region (NREFHSC 2002) were also incorporated. A preliminary draft of this document was distributed to the workshop panelists to assist them in conducting their evaluation.

2. HABITAT CHARACTERIZATION OF THE NORTHEAST U.S. SHELF ECOSYSTEM

The Northeast U.S. Shelf Ecosystem includes a broad range of habitats with varying physical and biological properties. From the cold waters of the Gulf of Maine (GOM) south to the more tempered climate of the Mid-Atlantic Bight (MAB), oceanographic and biological processes interact to form a network of expansively to narrowly distributed habitat types. This chapter provides a portion of the background information needed to evaluate the effects of fishing on benthic habitats in the region by: 1) reviewing habitat functions and associations; 2) describing four regional systems and their associated physical and benthic biological features; 3) covering the habitat aspects of coastal and estuarine features; and 4) describing benthic invertebrate communities in New England and the MAB, and their distribution in relation to depth and sediment type.

HABITAT FUNCTIONS AND ASSOCIATIONS

From a biological perspective, habitats provide living things with the basic life requirements of nourishment and shelter. Habitats may also provide a broader range of benefits to the ecosystem, such as the way seagrasses physically stabilize the substrate and help recirculate oxygen and nutrients. This section, however, focuses on how benthic marine habitats provide food and shelter for federally managed species in the Northeast Region.

The spatial and temporal variation of prey abundance influences the survival, recruitment, development, and spatial distribution of organisms at every trophic level above primary producers. For example, the abundance and distribution of planktonic organisms greatly influence the growth, survival, and distribution of fish larvae. In addition, the migratory behavior of juvenile and adult fish is directly related to seasonal patterns of prey abundance and changes in environmental conditions, especially water temperature. Prey supply is particularly critical for the starvation-prone, early-life-history stages of fish.

The availability of food for planktivores is highly influenced by oceanographic properties. The seasonal warming of surface waters in temperate latitudes produces vertical stratification of the water column which isolates sunlit surface waters from deeper, nutrient-rich water, leading to reduced primary productivity. In certain areas, upwelling, induced by wind, storms, and tidal mixing, inject nutrients back into the photic zone, stimulating primary production. Changes in primary production from upwelling and other oceanographic processes affect the amount of organic matter available for other organisms higher up in the food web, and thus influence their abundance and distribution. Some of the organic matter produced in the photic zone sinks to the bottom and provides food for benthic organisms. In shallower water, benthic macroalgae and microalgae also contribute to primary production. Recent research on benthic primary productivity indicates that benthic microalgae may contribute more to primary production than has been originally estimated (Cahoon 1999).

Benthic organisms provide an important food source for many fish species. Bottom-dwelling sand lances are eaten by many fish, and benthic invertebrates are the main source of nutrition for many demersal fish. Temporal and spatial variations in benthic community structure affect the distribution and abundance of bottom-feeding fish. Likewise, the abundance and species composition of benthic communities are affected by a number of environmental factors, including temperature, sediment type, and the availability of organic matter.

A number of recent studies have focused on the habitat associations of juvenile demersal fish. In shallow, coastal waters of the Northeast Region, effects of physical habitat factors and prey availability on the abundance and distribution of young-of-the-year flounder (various species) have been investigated in nearshore and estuarine habitats in Connecticut, New Jersey, and North Carolina (Rountree and Able 1992; Howell *et al.* 1999; Walsh *et al.* 1999; Manderson *et al.* 2000; Phelan *et al.* 2001; Stoner *et al.* 2001). There are few comparable studies of more open, continental shelf environments. In the Northeast Region, Steves *et al.* (1999) identified depth, bottom temperature, and time of year as primary factors delineating settlement and nursery habitats for juvenile silver hake and yellowtail flounder in the MAB. Also, in a series of publications, Auster *et al.* (1991, 1995, 1997) correlated the spatial distributions of juvenile benthic fish (*e.g.,* silver hake) with changes in microhabitat type on sand bottom at various open shelf locations in Southern New England.

In addition to providing food sources, another important functional value of benthic habitat is the shelter and refuge from predators provided by structure. Three-dimensional structure is provided by physical features such as boulders, gravel and cobble, sand waves and ripples, and mounts, burrows and depressions created by organisms. Structure is also provided by emergent epifauna such as sponges, bryozoans, anemones, mussels, tunicates, and corals.

The importance of benthic habitat complexity was discussed by Auster (1998) and Auster and Langton (1999). They developed a conceptual model that compared fishing gear effects across a gradient of habitat types. Based on this model, habitat value increases with increased structural complexity, from the lowest value in flat sand and mud to the highest value in piled boulders. The importance of habitat complexity to federally managed species is a key issue in the Northeast Region. Whether, and to what degree, the removal of emergent epifauna from gravel and rocky bottom habitats affects the survival of juvenile Atlantic cod and other species is of particular concern. Field studies (in the northeastern United States and eastern

Canadian waters, and other locations), laboratory experiments, and modeling studies have addressed the issue of removal of emergent epifauna. Because of the importance of this issue in the Northeast Region, this research is summarized below.

The first field study linking survival of juvenile Atlantic cod and haddock to habitat type on Georges Bank was by Lough *et al.* (1989). Using submersibles, they observed that recently settled age-0 juvenile Atlantic cod (and haddock), <10 cm long, were primarily found in pebble-gravel habitat at 70-100 m depths on eastern Georges Bank. They hypothesized that the gravel enhanced survival through predator avoidance; coloration of the fish mimicked that of the substrate, and from the submersible the fish were very difficult to detect against the gravel background. The authors considered increased prey abundance to be another, but less likely, explanation for the concentration of these fish on gravel. Presence of emergent epifauna, and any effects of epifauna on survival of the juveniles, were not noted.

Gregory and Anderson (1997), using submersibles in 18-150 m depths in Placentia Bay, Newfoundland, similarly found that the youngest Atlantic cod observed (age 1, 10-12 cm long) were primarily associated with low-relief gravel substrate; their mottled color appeared to provide camouflage in the gravel. Older juveniles (ages 2-4) were most abundant in higher relief areas with coarser substrate (*e.g.,* submarine cliffs). No selection by juvenile Atlantic cod for substrates with macroalgae cover was seen, and emergent epifauna was not mentioned.

In the first study suggesting an added value of emergent epifauna on Georges Bank gravel, Valentine and Lough (1991) observed from submersibles that attached epifauna was much more abundant in areas of eastern Georges Bank that had not been fished (due to the presence of large boulders). They felt the increased bottom complexity provided by the epifauna might be an important component of fisheries habitat, but both trawled and untrawled gravel habitats were considered important for survival of juvenile Atlantic cod.

Other field studies on the relationship between juvenile Atlantic cod abundance and habitat complexity have been in shallower inshore waters, and results may not be directly applicable to conditions on offshore banks like Georges Bank. In 2-12 m depths off the Newfoundland coast, Keats *et al.* (1987) found [in contrast to Gregory and Anderson (1997), above] juvenile Atlantic cod to be much more abundant in macroalgae beds than in adjacent areas which had been grazed bare by sea urchins. This was true of 1-yr-old fish (7.8-12.5 cm) as well as older, larger (12.6-23.5 cm) juveniles. The larger fish fed on fauna associated with the macroalgae, so enhanced food supply was a probable benefit of the increased complexity. The smallest 1-yr-olds fed on plankton, and it was unlikely their growth was affected by presence of macroalgae.

Tupper and Boutilier (1995a) examined four habitat types (sand, seagrass, cobble, and rock reef) in St. Margaret's Bay, Nova Scotia, and reported that Atlantic cod settlement was equal in all habitats, but survival and juvenile densities were higher in the more complex habitats. Growth rate was highest in seagrass beds, but predator (larger Atlantic cod) efficiency was lowest, and juvenile survival highest, on rock reef and cobble. The authors considered the different habitats to provide a tradeoff between enhanced foraging success and increased predation risk. In another study in St. Margaret's Bay, Tupper and Boutilier (1995b) found that Atlantic cod settling on a rocky reef inhabited crevices in the reef, and defended territories around the crevices. Fish that settled earlier and at larger sizes grew more quickly and had larger territories. Size at settlement and timing of settlement were thus considered important in determining competitive success of individuals.

Habitat associations of juvenile Atlantic cod were also examined by Gotceitas *et al.* (1997) using SCUBA divers in Trinity Bay, and beach seines in Trinity, Notre Dame, and Bonavista Bays, Newfoundland. In both types of surveys, almost all age-0 Atlantic cod were found in eelgrass beds as opposed to less structurally complex areas, and eelgrass was suggested to be an important habitat for these fish. Older juveniles were more abundant on mud, sand, and rocky bottoms than in eelgrass.

A seining study by Linehan *et al.* (2001) in Bonavista Bay, Newfoundland, found age-0 Atlantic cod (<10 cm long) to be more abundant in vegetated (eelgrass) than in unvegetated habitats, both day and night. However, potential predators of juvenile Atlantic cod were also most abundant in eelgrass. Tethering experiments with age-0 Atlantic cod at six sites in 0.7-20 m depths indicated that predation increased with depth, being about three times higher at deeper sites. At shallow sites, predation was generally higher in unvegetated sites than in eelgrass.

Habitat use of age-0 and -1 Atlantic cod in state waters off eastern Massachusetts is discussed by Howe *et al.* (2000), based on analysis of 22 yr (1978-1999) of data from spring and fall trawl surveys by the Massachusetts Division of Marine Fisheries. Results showed the survey area is important for Atlantic cod settlement, with at least two pulses of newly settled fish found in most years. Spatial distribution patterns of young Atlantic cod were clear, stable, and strongly related to depth. In spring, just-settled Atlantic cod were most abundant in depths <27 m; in fall these age-0 Atlantic cod were found in 9-55 m depths, but were concentrated in 27-55 m. Age-1 Atlantic cod were more abundant in deeper waters (18-55 m in spring, 37-55 m in fall). Habitat complexity per se was not the primary focus of this analysis, and some of the most complex (*e.g.,* rocky) habitats could not be sampled by the survey. However, the greater abundance of just-settled fish in shallower waters was thought to be linked to the higher complexity of these habitats. It was postulated that high densities of age-0 fish indicated areas of high productivity and preferred habitat. Given the abundance of juvenile Atlantic cod in these surveys, eastern Massachusetts waters were recommended as a coastal "Habitat Area of Particular Concern" for the GOM Atlantic cod stock.

Kaiser *et al.* (1999) analyzed beam trawl catch data from a number of stations in the English Channel and reported that small gadoid species were present in deeper (>30 m), structurally complex habitats with rocks, soft corals, bryozoans, hydroids, and sponges, and were absent in shallow water habitats which were inhabited by several species of flounder. Most of the structure-forming benthic species that were present in deeper water were also present in shallow water, but at reduced abundances, and the total biomass of sessile epibenthic species was higher in shallow water. These results suggest that depth and the amount of cover provided by certain types of emergent epifauna (*e.g.,* sponges) were the most important factors affecting habitat utilization by gadoid (and flounder) species.

Information on the effects of habitat complexity on juvenile Atlantic cod survival is also available from several laboratory studies. Gotceitas and Brown (1993) compared substrate preferences of juvenile Atlantic cod (6-12 cm) for sand, gravel-pebble, and cobble, before and after introduction of a larger Atlantic cod. Before the predator was introduced, small Atlantic cod preferred sand or gravel-pebble over cobble. In the presence of the predator, they chose cobble if available, and the cobble reduced predation. The experiment did not test effects of emergent epifauna on substrate choices or survival. Gotceitas *et al.* (1995) conducted a similar study, but with 3.5-8 cm Atlantic cod in a tank with one of two combinations of three substrates: 1) sand, gravel, and 30-cm long strips of plastic to simulate kelp (*Laminaria* sp.); or 2) sand, cobble, and "kelp." Based on the authors' earlier study, cobble was considered to provide a "safe" habitat that reduced predation. Responses to introduction of two kinds of larger Atlantic cod were tested: fish that actively attempted to eat the smaller Atlantic cod, versus "passive" predators that showed no interest in the smaller fish. In the presence of passive predators, small Atlantic cod preferred sand substrates and avoided kelp. When exposed to an active predator, they hid in cobble if available or kelp if there was no cobble. Both cobble and kelp significantly reduced predation, and small Atlantic cod appeared able to modify their behavior based on the varying risk presented by different predators.

Fraser *et al.* (1996) tested responses of age-0 (5.2-8.2 cm) and age-1 (10.2-13.5 cm) Atlantic cod to predators (3-yr old Atlantic cod), using the same tanks as Gotceitas *et al.* (1995), but with only two substrate choices: sand versus gravel, and sand versus cobble. With no predator present, age-0 or -1 Atlantic cod by themselves preferred sand to gravel or cobble, but if both age-0 and -1 fish were in the tank, the smaller fish tended to avoid the larger ones and to increase use of gravel/cobble. When a predator was introduced, both age-0 and -1 Atlantic cod hid in cobble if available; in the sand/gravel trials, they attempted to flee from the predator. In the predator's presence, the avoidance of age-1 Atlantic cod by age-0 Atlantic cod disappeared; overall, however, there was some indication of habitat segregation between age-0 and age-1 Atlantic cod.

Gotceitas *et al.* (1997) again used the same experimental system to compare use of sand, gravel, and cobble substrates, as well as three densities of eelgrass, by age-0 Atlantic cod (3.5-10 cm) in the presence and absence of a predator (age-3 Atlantic cod). With no predator, the small Atlantic cod preferred sand and gravel to cobble. When a predator was introduced and cobble was present, age-0 fish hid in the cobble or in dense eelgrass (720 stems/m^2) if present. With no cobble, they hid in all three densities of eelgrass. Age-0 Atlantic cod survival (time to capture and number of fish avoiding capture) was highest in cobble or eelgrass 1000 stems/m^2. In other combinations, time to capture increased with both presence and density of vegetation.

Borg *et al.* (1997) conducted a laboratory study of habitat choice by two size groups of juvenile Atlantic cod (7-13 and 17-28 cm TL) on sandy bottoms with different vegetation types. Four habitats, typical of shallow soft bottom on the west coast of Sweden, were tested in six combinations. During daylight, fish preferred vegetation to bare sand, while at night -- when juvenile Atlantic cod feed in open, sandy areas -- no significant choice was made. Both size classes preferred *Fucus* kelp, the most complex habitat that was tested.

Lindholm *et al.* (1999) tested effects of five habitat types, representing a gradient of complexity, on survival of age-0 Atlantic cod (7-10 cm) in the presence of age-3 conspecifics. Substrates were sand, cobble, sparse short sponge, dense short sponge, and tall sponge. Sponge presence significantly reduced predation compared to that on sand, with density of sponges being more important than sponge height. Increasing habitat complexity reduced the distance from which a predator could react to the prey. The authors concluded that alteration of seafloor habitat by fishing could lower survival of juvenile Atlantic cod. (There was no significant increase in survival in epifauna compared to bare cobble, however.)

In a mesocosm experiment, Isakkson *et al.* (1994) compared the foraging efficiency of Atlantic cod on three different prey species on bare sand and eel grass with varying percent cover of filamentous algae. Foraging efficiency of Atlantic cod on sand shrimp (*Crangon crangon*) and green crabs was greatest in unvegetated substrate. Survival of these two prey species was significantly enhanced by the addition of moderate amounts of algal cover to sand substrates. Shore shrimp (*Palaemon adspersus*) were equally susceptible to predation in all habitat types.

The effects of habitat complexity on post-settlement survival of juvenile Atlantic cod have been examined via modeling (Lindholm *et al.* 2001). Data from the Lindholm *et al.* (1999) laboratory study described above were used to assign maximum values for juvenile mortality in the least complex habitats, and in the most complex habitats. Twelve runs of a dynamic monthly model were made, with the first run (month) representing settlement of the Atlantic cod. Results indicated that reduction of habitat complexity by fishing had significant negative effects on survival of juvenile Atlantic cod, and that preservation of complexity through use of marine protected areas could reduce these negative effects.

Elsewhere and for other species, Charton and Ruzafa (1998) correlated increased habitat complexity (numbers of rocky boulders) in the Mediterranean with higher numbers and abundances of reef fish. There is evidence provided by laboratory experiments that habitat complexity can benefit fish that inhabit open, sandy habitats by providing refuge from bottom currents in the troughs between sand ripples (Gerstner 1998; Gerstner and Webb 1998).

In some situations, other habitat characteristics may be equally or more important than complexity. As discussed above, Lough *et al.* (1989) hypothesized that gravel substrate enhanced survival of juvenile Atlantic cod because the coloration of these juveniles mimicked the substrate. In a similar example, American plaice adults are thought to use gravel-sand sediments as a coloration refuge (Scott 1982). It is apparent that in identifying habitat value, a broad range of characteristics associated with habitat structure and function, which may vary by species and life stage, must be considered. Evaluations cannot be limited to individual aspects such as substrate type. Unfortunately, the amount of information available for individual parameters is limited, especially quantitative information necessary for multivariate analyses. Further development of multivariate relationships between biological, chemical, and physical habitat features will increase our understanding of the marine environment and advance the evidence of direct links between habitat conditions and fishery productivity.

REGIONAL SYSTEMS

The Northeast U.S. Shelf Ecosystem (Figure 2.1) has been described as including the area from the GOM south to Cape Hatteras, extending from the coast seaward to the edge of the continental shelf, including the slope sea offshore to the Gulf Stream (Sherman *et al.* 1996). The continental slope includes the area east of the shelf, out to a depth of 2000 m. Four distinct subregions comprise the Northeast Region: the GOM, Georges Bank, the MAB, and the continental slope. Occasionally, another subregion, Southern New England, is described; however, we incorporated discussions of any distinctive features of this area into the sections describing Georges Bank and the MAB.

The GOM is an enclosed coastal sea, characterized by relatively cold waters and deep basins, with a patchwork of various sediment types. Georges Bank is a relatively shallow coastal plateau that slopes gently from north to south and has steep submarine canyons on its eastern and southeastern edge. It is characterized by highly productive, well-mixed waters and strong currents. The MAB is comprised of the sandy, relatively flat, gently sloping continental shelf from Southern New England to Cape Hatteras, NC. The continental slope begins at the continental shelf break and continues eastward with increasing depth until it becomes the continental rise. It is fairly homogenous, with exceptions at the shelf break, some of the canyons, the Hudson Shelf Valley, and in areas of glacially rafted hard bottom.

Pertinent physical and biological characteristics of each of these subregions are described subsequently in this section. The first portion of each description summarizes oceanographic and geologic features, and the second portion summarizes biological features. Source references used to describe the general physical features of these subregions are not cited in the following text, but include Backus 1987; Schmitz *et al*. 1987; Tucholke 1987; Wiebe *et al*. 1987; Cook 1988; Reid and Steimle 1988; Stumpf and Biggs 1988; Abernathy 1989; Townsend 1992; Mountain *et al*. 1994; Beardsley *et al*. 1996; Brooks 1996; Sherman *et al*. 1996; Dorsey 1998; Kelley 1998; NEFMC 1998; and Steimle *et al*. 1999b. In some cases, recent or specific research results are cited in the text. References used in the biological summaries are also cited in the text.

Gulf of Maine

Physical Features

Although not obvious in appearance, the GOM is actually an enclosed coastal sea, bounded on the east by Browns Bank, on the north by the Nova Scotian (Scotian) Shelf, on the west by the New England states, and on the south by Cape Cod and Georges Bank (Figure 2.2). The GOM was glacially derived, and is characterized by a system of deep basins, moraines, and rocky protrusions with limited access to the open ocean. This geomorphology influences complex oceanographic processes that result in a rich biological community.

The GOM is topographically unlike any other part of the continental border along the U.S. Atlantic coast. The GOM's geologic features, when coupled with the vertical variation in water properties, result in a great diversity of habitat types. It contains 21 distinct basins separated by ridges, banks, and swells. The three largest basins are Wilkinson, Georges, and Jordan (Figure 2.2). Depths in the basins exceed 250 m, with a maximum depth of 350 m in Georges Basin, just north of Georges Bank. The Northeast Channel between Georges Bank and Browns Bank leads into Georges Basin, and is one of the primary avenues for exchange of water between the GOM and the North Atlantic Ocean.

High points within the Gulf include irregular ridges such as Cashes Ledge which peaks at 9 m below the surface, as well as lower flat-topped banks and gentle swells. Some of these rises are remnants of the continental shelf that was left after most of it was removed by the glaciers. Other rises are glacial moraines, and a few such as Cashes Ledge are outcroppings of bedrock. Very fine sediment particles created and eroded by the glaciers have collected in thick deposits over much of the GOM, particularly in its deep basins (Figure 2.3). These mud deposits blanket and obscure the irregularities of the underlying bedrock, forming topographically smooth terrains. Some shallower basins are covered with mud as well, including some in coastal waters. In the rises between the basins, other materials are usually at the surface. Unsorted glacial till covers some morainal areas, as on Sewell Ridge to the north of Georges Basin and on Truxton Swell to the south of Jordan Basin. Sand predominates on some high areas, and gravel, sometimes with boulders, predominates on others.

Coastal sediments exhibit a high degree of smallscale variability. Bedrock is the predominant substrate along the western edge of the GOM north of Cape Cod in a narrow band out to a depth of about 60 m. Rocky areas become less common with increasing depth, but some rock outcrops poke through the mud covering the deeper seafloor. Mud is the second-most common substrate on the inner continental shelf. Mud predominates in coastal valleys and basins that often abruptly border rocky substrates. Many of these basins extend without interruption into deeper water. Gravel, often mixed with shell, is common adjacent to bedrock outcrops and in fractures in the rock. Large expanses of gravel are not common, but do occur near reworked glacial moraines and in areas where the seafloor has been scoured by bottom currents. Gravel is most abundant at depths of 20-40 m, except in eastern Maine where a gravel-covered plain exists to depths of at least 100 m. Bottom currents are stronger in eastern Maine where the mean tidal range exceeds 5 m. Sandy areas are relatively rare along the inner shelf of the western GOM, but are more common south of Casco Bay, especially offshore of sandy beaches.

An intense seasonal cycle of winter cooling and turnover, springtime freshwater runoff, and summer warming influences oceanographic and biologic processes in the GOM. The Gulf has a general counterclockwise nontidal surface current that flows around its coastal margin (Figure 2.4). This current is primarily driven by fresh, cold Scotian Shelf water that enters over the Scotian Shelf and through the Northeast Channel, and freshwater river runoff, which is particularly important in the spring. Dense, relatively warm, and saline slope water entering through the bottom of the Northeast Channel from the continental slope also influences gyre formation. Counter-clockwise gyres generally form in Jordan, Wilkinson, and Georges Basins, and in the Northeast Channel as well. These surface gyres are more pronounced in spring and summer; with winter, they weaken and become more influenced by the wind.

Stratification of surface waters during spring and summer seals off a mid-depth layer of water that preserves winter salinity and temperatures. This cold layer of water is called “Maine Intermediate Water” (MIW), and is located between the more saline Maine Bottom Water (MBW) and the warmer, stratified Maine Surface Water (MSW). The stratified MSW is most pronounced in the deep portions of the western GOM. Tidal mixing of shallow areas prevents thermal stratification and results in thermal fronts between the stratified areas and cooler mixed areas. Typically, mixed areas include Georges Bank, the southwest Scotian Shelf, eastern Maine coastal waters, and the narrow coastal band surrounding the remainder of the Gulf.

The Northeast Channel provides an exit for cold MIW and outgoing MSW, while it allows warmer, more saline slope water to move in along the bottom and spill into the deeper basins. The influx of water occurs in pulses, and appears to be seasonal, with lower flow in late winter and a maximum in early summer.

GOM circulation and water properties can vary significantly from year to year. Notable episodic events include shelf-slope interactions such as the entrainment of shelf water by Gulf Stream rings (see the “Continental Slope/Physical Features” section), and strong winds that can create currents as high as 1.1 m/s over Georges Bank. Warm-core Gulf Stream rings can also influence upwelling and nutrient exchange on the Scotian Shelf, and affect the water masses entering the GOM. Annual and seasonal inflow variations also affect water circulation.

Internal waves are episodic and can greatly affect the biological properties of certain habitats. Internal waves can shift water layers vertically, so that habitats normally surrounded by cold MIW are temporarily bathed in warm, organic-rich surface water. On Cashes Ledge, it is thought that deeper nutrient rich water is driven into the photic zone, providing for increased productivity. Localized areas of upwelling interaction occur in numerous places throughout the Gulf.

Benthic Biological Features

Based on 303 benthic grab samples collected in the GOM during 1956-1965, Theroux and Wigley (1998) reported that, in terms of numbers, the most common groups of benthic invertebrates in the GOM were annelid worms (35%), bivalve mollusks (33%), and amphipod crustaceans (14%). Biomass was dominated by bivalve mollusks (24%), sea cucumbers (22%), sand dollars (18%), annelids (12%), and sea anemones (9%). Watling (1998) used numerical classification techniques to separate benthic invertebrate samples into seven bottom assem-blages. Distribution was determined from both quantita-tive soft-bottom sampling and qualitative hard-bottom sampling. These assemblages are identified in Table 2.1, and their distribution is indicated in Figure 2.5. This classification system considers predominant taxa, substrate types, and seawater properties. (See the last section of this chapter for more information on benthic invertebrate communities in New England.)

An in-depth review of GOM habitat types has been prepared by Brown (1993). Although still preliminary, this classification system is a promising approach. It builds on a number of other schemes, including Cowardin *et al.* (1979), and tailors them to Maine's marine and estuarine environments. A significant factor that is included in this system, but has been neglected in others, is the amount of "energy" in a habitat. Energy could be a reflection of wind, waves, or currents present. This is a particularly important consideration in a review of fishing gear effects since it indicates the natural disturbance regime of a habitat. The amount and type of natural disturbance are in turn an indication of the habitat's resistance to, and recoverability from, disturbance by fishing gear. Although this work appears to be complete in its description of habitat types, unfortunately, the distributions of many of the habitats are unknown.

Demersal fish assemblages for the GOM and Georges Bank were part of broadscale geographic investigations conducted by Gabriel (1992) and Mahon *et al.* (1998). Both of these studies and a more limited study by Overholtz and Tyler (1985) found assemblages that were consistent over space and time in this region. In her analysis, Gabriel (1992) found that the most persistent feature over time in assemblage structure from Nova Scotia to Cape Hatteras was the boundary separating assemblages between the GOM and Georges Bank, which occurred at approximately the 100-m isobath on northern Georges Bank. Overholtz and Tyler (1985) identified five assemblages for this region (Table 2.2). The GOM deep assemblage included a number of species found in other assemblages, with the exception of American plaice and witch flounder, which were unique to this assemblage. Gabriel's approach did not allow species to co-occur in assemblages, and classified these two species as unique to the deepwater GOM - Georges Bank assemblage. Results of these two studies are compared in Table 2.2. Auster *et al.* (2001) went a step further and related species clusters on Stellwagen Bank to different substrate types in an attempt to use fish distribution as a proxy for seafloor habitat distribution. They found significant associations for 12 of 20 species, including American plaice (fine substrate) and haddock (coarse substrate). Species clusters and associated substrate types are given in Table 2.3.

Georges Bank

Physical Features

Georges Bank is a shallow (3-150 m depth), elongate (161-km wide by 322-km long) extension of the continental shelf that was formed by the Wisconsinian glacial episode. It is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. The Great South Channel lies to the west. Natural processes continue to erode and rework the sediments on Georges Bank. It is anticipated that erosion and reworking of sediments will reduce the amount of sand available to the sand sheets, and cause an overall coarsening of the bottom sediments (Valentine and Lough 1991).

Glacial retreat during the late Pleistocene deposited the bottom sediments currently observed on the eastern section of Georges Bank, and the sediments have been continuously reworked and redistributed by the action of rising sea level, and by tidal, storm, and other currents (Figure 2.6). The strong, erosive currents affect the character of the biological community. Bottom topography on eastern Georges Bank is characterized by linear ridges in the western shoal areas; a relatively smooth, gently dipping seafloor on the deeper, easternmost part; a highly energetic peak in the north with sand ridges up to 30 m high and extensive gravel pavement; and steeper and smoother topography incised by submarine canyons on the southeastern margin (see the "Continental Slope" section for more on canyons). The interaction of several environmental factors, including availability and type of sediment, current speed and direction, and bottom topography, has formed seven sedimentary provinces on eastern Georges Bank (Valentine and Lough 1991) which are described in Table 2.4 and depicted in Figure 2.6. The gravel-sand mixture is usually a transition zone between coarse gravel and finer sediments.

The central region of the bank is shallow, and the bottom is characterized by shoals and troughs, with sand dunes superimposed upon them. The two most prominent elevations on the ridge and trough area are Cultivator and Georges Shoals. This shoal and trough area is a region of strong currents. The dunes migrate at variable rates, and the ridges may also move. In an area that lies between the central part and Northeast Peak, Almeida *et al.* (2000) identified high-energy areas between 35 and 65 m deep where sand is transported on a daily basis by tidal currents, and a low-energy area >65 m deep that is affected only by storm currents.

The area west of the Great South Channel, known as Nantucket Shoals (Figure 2.2), is similar in nature to the central region of the bank. Currents in these areas are strongest where water depth is shallower than 50 m. This type of traveling dune-and-swale morphology is also found in the MAB, and further described in that section of this document. The Great South Channel separates the main part of Georges Bank from Nantucket Shoals. Sediments in this region include gravel pavement and mounds, some scattered boulders, sand with storm generated ripples, and scattered shell and mussel beds. Tidal and storm currents range from moderate to strong, depending upon location and storm activity (pers. comm.; Page C. Valentine, U.S. Geological Survey, Woods Hole, MA).

Oceanographic frontal systems separate water masses of the GOM and Georges Bank from oceanic waters south of the bank. These water masses differ in temperature, salinity, nutrient concentration, and planktonic communities, which influence productivity and may influence fish abundance and distribution. Currents on Georges Bank include a weak, persistent clockwise gyre around the bank, a strong semidiurnal tidal flow predominantly northwest and southeast, and very strong, intermittent storm-induced currents, which all can occur simultaneously (Figure 2.4). Tidal currents over the shallow top of Georges Bank can be very strong, and keep the waters over the bank well mixed vertically. This results in a tidal front that separates the cool waters of the well-mixed shallows of the central bank from the warmer, seasonally stratified shelf waters on the seaward and shoreward sides of the bank. The clockwise gyre is instrumental in distribution of the planktonic community, including larval fish. For example, Lough and Potter (1993) describe passive drift of Atlantic cod and haddock eggs and larvae in a southwest residual pattern around Georges Bank. Larval concentrations are found at varying depths along the southern edge between 60 and 100m.

Benthic Biological Features

Amphipod crustaceans (49%) and annelid worms (28%) numerically dominated the contents of 211 sediment samples collected on Georges Bank during 1956-1965 (Theroux and Wigley 1998). Biomass was dominated by sand dollars (50%) and bivalve mollusks (33%). Theroux and Grosslein (1987) utilized the same database to identify four invertebrate assemblages: Western Basin, Northeast Peak, central Georges Bank, and southern Georges Bank. (See the last section of this chapter for more information on benthic invertebrate communities in New England.) They noted that it is impossible to define discrete boundaries between assemblages because of the considerable intergrading that occurs between adjacent assemblages; however, the assemblages are distinguishable. Their assemblages are associated with those identified by Valentine and Lough (1991) in Table 2.4.

The Western Basin assemblage (Theroux and Grosslein 1987) is found in the upper Great South Channel region at the northwestern corner of the bank, in comparatively deep water (150-200 m) with relatively slow currents and fine bottom sediments of silt, clay, and muddy sand. The fauna is comprised mainly of small burrowing detritivores and deposit feeders, and carnivorous scavengers. Representative organisms include bivalve mollusks (*Thyasira flexuosa, [En]ucula tenuis,* and *Musculus discors*), annelids (*Nephtys incisa, Paramphinome pulchella, Onuphis opalina,* and *Sternaspis scutata*), the brittle star *Ophiura sarsi*, the amphipod *Haploops tubicola*, and the red deepsea crab (*[Chaceon] quinquedens*). Valentine and Lough (1991) did not identify a comparable assemblage; however, this assemblage is geographically located adjacent to Assemblage 5 as described by Watling (1998) (Table 2.1; Figure 2.5)

The Northeast Peak assemblage is found along the Northern Edge and Northeast Peak, which varies in depth and current strength, and includes coarse sediment consisting mainly of gravel and coarse sand with interspersed boulders, cobbles, and pebbles. The fauna tends to be sessile (coelenterates, brachiopods, barnacles, and tubiferous annelids) or free-living (brittle stars, crustaceans, and polychaetes), with a characteristic absence of burrowing forms. Representative organisms include amphipods (*Acanthonotozoma serratum* and *Tiron spiniferum*), the isopod *Rocinela americana*, the barnacle *Balanus hameri*, annelids (*Harmothoe imbricata, Eunice pennata, Nothria conchylega,* and *Glycera capitata*), the sea scallop *Placopecten magellanicus*, brittle stars (*Ophiacantha bidentata* and *Ophiopholis aculeata*), and soft corals (*Primnoa resedaeformis* and *Paragorgia arborea*).

The Central Georges Bank assemblage occupies the greatest area, including the central and northern portions of the bank in depths <100 m. Medium-grained shifting sands predominate this dynamic area of strong currents. Organisms tend to be small to moderately large with burrowing or motile habits. Sand dollars (*Echinarachnius parma*) are most characteristic of this assemblage. Other representative species include mysids (*Neomysis americana* and *Mysidopsis bigelowi*), the isopod *Chiridotea tuftsi*, the cumacean *Leptocuma minor*, the amphipod *Protohaustorius wigleyi*, annelids (*Sthenelais limicola, Goniadella gracilis,* and *Scalibregma inflatum*), gastropods (*[Euspira] heros* and *Nassarius trivittatus*), the starfish *Asterias vulgaris*, the shrimp *Crangon septemspinosa*, and the crab *Cancer irroratus*.

The Southern Georges Bank assemblage is found on the southern and southwestern flanks at depths from 80 to 200 m, where fine-grained sands and moderate currents predominate. Many southern species exist here at the northern limits of their range. The dominant fauna includes amphipods, copepods, euphausiids, and the starfish genus *Astropecten*. Representative organisms include amphipods (*Ampelisca compressa, Erichthonius rubricornis,* and *Synchelidium americanum*), the cumacean *Diastylis quadrispinosa,* annelids (*Aglaophamus circinata, Nephtys squamosa,* and *Apistobranchus tullbergi*), crabs (*Euprognatha rastellifera* and *Catapagurus sharreri*) and the shrimp *Munida iris*.

Along with high levels of primary productivity, Georges Bank has been historically characterized by high levels of fish production. Several studies have attempted to identify demersal fish assemblages over large spatial scales. Overholtz and Tyler (1985) found five depth-related demersal fish assemblages for Georges Bank and the GOM that were persistent temporally and spatially (Table 2.2). Depth and salinity were identified as major physical influences explaining assemblage structure. Gabriel (1992) identified six assemblages which are compared with the results of Overholtz and Tyler (1985) in Table 2.2. Mahon *et al.* (1998) found similar results.

Mid-Atlantic Bight

Physical Features

The MAB includes the shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream (Figure 2.1). Like the rest of the continental shelf, the topography of the MAB was shaped largely by sea - level fluctuations caused by past ice ages. The shelf's basic morphology and sediments derive from the retreat of the last ice sheet, and the subsequent rise in sea level. Since that time, currents and waves have modified this basic structure.

Shelf and slope waters of the MAB have a slow southwestward flow that is occasionally interrupted by warm-core rings or meanders from the Gulf Stream. On average, shelf water moves parallel to bathymetry isobars at speeds of 5-10 cm/s at the surface and 2 cm/s or less at the bottom. Storm events can cause much more energetic variations in flow. Tidal currents on the inner shelf have a higher flow rate of 20 cm/s that increases to 100 cm/s near inlets.

Slope water tends to be warmer than shelf water because of its proximity to the Gulf Stream, and tends to be more saline. The abrupt gradient where these two water masses meet is called the shelf-slope front. This front is usually located at the edge of the shelf and touches bottom at about 75-100 m depth of water, and then slopes up to the east toward the surface. It reaches surface waters approximately 25-55 km further offshore. The position of the front is highly variable, and can be influenced by many physical factors. Vertical structure of temperature and salinity within the front can develop complex patterns because of the interleaving of shelf and slope waters; *e.g.,* cold shelf waters can protrude offshore, or warmer slope water can intrude up onto the shelf.

The seasonal effects of warming and cooling increase in shallower, nearshore waters. Stratification of the water column occurs over the shelf and the top layer of slope water during the spring-summer and is usually established by early June. Fall mixing results in homogenous shelf and upper slope waters by October in most years. A permanent thermocline exists in slope waters from 200 to 600 m deep. Temperatures decrease at the rate of about 0.02°C/m, and remain relatively constant except for occasional incursions of Gulf Stream eddies or meanders. Below 600 m, temperature declines, and usually averages about 2.2°C at 4000 m. A warm, mixed layer approximately 40-m thick resides above the permanent thermocline.

The "cold pool" is an annual phenomenon particularly important to the MAB. It stretches from the GOM along the outer edge of Georges Bank and then southwest to Cape Hatteras. It becomes identifiable with the onset of thermal stratification in the spring and lasts into early fall until normal seasonal mixing occurs. It usually exists along the bottom between the 40- and 100-m isobaths, and extends up into the water column for about 35 m, and to the bottom of the seasonal thermocline. The cold pool usually represents about 30% of the volume of shelf water. Minimum temperatures for the cold pool occur in early spring and summer, and range from 1.1 to 4.7°C.

The shelf slopes gently from shore out to between 100 and 200 km offshore where it transforms to the slope (100-200 m of water depth) at the shelf break. In both the Mid-Atlantic and on Georges Bank, numerous canyons incise the slope, and some cut up onto the shelf itself (see the subsequent "Continental Slope" section). The primary morphological features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges and swales (Figures 2.7 and 2.8).

Most of these structures are relic except for some sand ridges and smaller sand-formed features. Shelf valleys and slope canyons were formed by rivers of glacier outwash that deposited sediments on the outer shelf edge as they entered the ocean. Most valleys cut about 10 m into the shelf, with the exception of the Hudson Shelf Valley that is about 35 m deep. The valleys were partially filled as the glacier melted and retreated across the shelf. The glacier also left behind a lengthy scarp near the shelf break from Chesapeake Bay north to the eastern end of Long Island (Figures 2.7 and 2.8). Shoal retreat massifs were produced by extensive deposition at a cape or estuary mouth. Massifs were also formed as estuaries retreated across the shelf.

The sediment type covering most of the shelf in the MAB is sand, with some relatively small, localized areas of sand-shell and sand-gravel. On the slope, silty sand, silt, and clay predominate.

Some sand ridges (Figure 2.7) are more modern in origin than the shelf's glaciated morphology. Their formation is not well understood; however, they appear to develop from the sediments that erode from the shore face. They maintain their shape, so it is assumed that they are in equilibrium with modern current and storm regimes. They are usually grouped, with heights of about 10 m, lengths of 10-50 km, and spacing of about 2 km. Ridges are usually oriented at a slight angle towards shore, running in length from northeast to southwest. The seaward face usually has the steepest slope. Sand ridges are often covered with smaller similar forms such as sand waves, megaripples, and ripples. Swales occur between sand ridges. Since ridges are higher than the adjacent swales, they are exposed to more energy from water currents, and experience more sediment mobility than swales. Ridges tend to contain less fine sand, silt, and clay, while relatively sheltered swales contain more of the finer particles. Swales have greater benthic macrofaunal density, species richness, and biomass due, in part, to the increased abundance of detrital food and the physically less rigorous conditions.

Sand waves are usually found in patches of 5-10 with heights of about 2 m, lengths of about 50-100 m, and spacing of about 1-2 km. Sand waves are primarily found on the inner shelf, and often observed on sides of sand ridges. Sand waves may remain intact over several seasons. Megaripples occur on sand waves or separately on the inner or central shelf. During the winter storm season, these megaripples may cover as much as 15% of the inner shelf. They tend to form in large patches and usually have lengths of about 3-5 m with heights of about 0.5-1 m. Megaripples tend to survive for less than a season. They can form during a storm and reshape the upper 50-100 cm of the sediments within a few hours. Ripples are also found everywhere on the shelf, and appear or disappear within hours or days, depending upon storms and currents. Ripples usually have lengths of about 1-150 cm and heights of a few centimeters.

Sediments are uniformly distributed over the shelf in this region (see Figure 2.3). A sheet of sand and gravel varying in thickness from 0 to10 m covers most of the shelf. The mean bottom flow from the constant southwesterly current is not fast enough to move sand, so sediment transport must be episodic. Net sediment movement is in the same southwesterly direction as the current. The sands are mostly medium-to-coarse grains, with finer sand in the Hudson Shelf Valley and on the outer shelf. Mud is rare over most of the shelf, but is common in the Hudson Shelf Valley. Occasionally, relic estuarine mud deposits are re-exposed in the swales between sand ridges. Fine sediment content increases rapidly at the shelf break, which is sometimes called the "mud line," and sediments are 70-100% fines on the slope.

The northern portion of the MAB is sometimes referred to as Southern New England. Most of this area was discussed under Georges Bank; however, one other formation of this region deserves note. The "Mud Patch" is located just southwest of Nantucket Shoals and southeast of Long Island and Rhode Island (Figure 2.3). Tidal currents in this area slow significantly, which allows silts and clays to settle out. The mud is mixed with sand, and is occasionally resuspended by large storms. This habitat is an anomaly of the outer continental shelf.

Artificial reefs are another significant Mid-Atlantic habitat, formed much more recently on the geologic time scale than other regional habitat types. These localized areas of hard structure have been formed by shipwrecks, lost cargoes, disposed solid materials, shoreline jetties and groins, submerged pipelines, cables, and other materials (Steimle and Zetlin 2000). While some of materials have been deposited specifically for use as fish habitat, most have an alternative primary purpose; however, they have all become an integral part of the coastal and shelf ecosystem. It is expected that the increase in these materials has had an effect on living marine resources and fisheries, but these effects are not well known. In general, reefs are important for attachment sites, shelter, and food for many species, and fish predators such as tunas may be attracted by prey aggregations, or may be behaviorally attracted to the reef structure. The overview by Steimle and Zetlin (2000) used NOAA hydrographic surveys to plot rocks, wrecks, obstructions, and artificial reefs, which together were considered a fairly complete list of nonbiogenic reef habitat in the Mid-Atlantic estuarine and coastal areas (Figure 2.9).

Benthic Biological Features

Wigley and Theroux (1981) reported on the faunal composition of 563 bottom grab samples collected in the MAB during 1956-1965. Amphipod crustaceans and bivalve mollusks accounted for most of the individuals (41% and 22%, respectively), whereas mollusks dominated the biomass (70%). Three broad faunal zones related to water depth and sediment type were identified by Pratt (1973). The "sand fauna" zone was defined for sandy sediments (1% or less silt) that are at least occasionally disturbed by waves, from shore out to the 50-m depth (Figure 2.10). The "silty sand fauna" zone occurred immediately offshore from the sand fauna zone, in stable sands containing a small amount of silt and organic material. Silts and clays become predominant at the shelf break, line the Hudson Shelf Valley, and support the "silt-clay fauna." (See the "Regional Benthic Invertebrate Communities/Mid-Atlantic Bight" section of this chapter for more information on benthic invertebrate communities in the MAB and their relation to depth and sediment type).

Building on Pratt's work, the Mid-Atlantic shelf was further divided by Boesch (1979) into seven bathymetric/morphologic subdivisions based on faunal assemblages (Table 2.5). Sediments in the region studied (Hudson Shelf Valley south to Chesapeake Bay) were dominated by sand with little finer materials. Ridges and swales are important morphological features in this area. Sediments are coarser on the ridges, and the swales have greater benthic macrofaunal density, species richness, and biomass. Faunal species composition differed between these features, and Boesch (1979) incorporated this variation in his subdivisions (Table 2.5). Much overlap of species distributions was found between depth zones, so the faunal assemblages represented more of a continuum than distinct zones.

Demersal fish assemblages were described at a broad geographic scale for the continental shelf and slope from Cape Chidley, Labrador, to Cape Hatteras, North Carolina (Mahon *et al.* 1998), and from Nova Scotia to Cape Hatteras (Gabriel 1992). Factors influencing species distribution included latitude and depth. Results of these studies were similar to an earlier study confined to the MAB continental shelf (Colvocoresses and Musick 1984). In this latter study, there were clear variations in species abundances, yet the authors demonstrated consistent patterns of community composition and distribution among demersal fishes of the Mid-Atlantic shelf. This is especially true for five strongly recurring species associations that varied slightly from spring to fall (Table 2.6). The boundaries between fish assemblages generally followed isotherms and isobaths. The assemblages were largely similar between the spring and fall collections, with the most notable change being a northward and shoreward shift in the temperate group in the spring.

Steimle and Zetlin (2000) described representative epibenthic/epibiotic, motile epibenthic, and fish species associated with sparsely scattered reef habitats that consist mainly of manmade structures (Table 2.7).

Continental Slope

Physical Features

The continental slope extends from the continental shelf break, at depths between 60-200 m, eastward to a depth of 2000 m. The width of the slope varies from 10-50 km, with an average gradient of 3-6°; however, local gradients can be nearly vertical. The base of the slope is defined by a marked decrease in seafloor gradient where the continental rise begins.

The morphology of the present continental slope appears largely to be a result of sedimentary processes that occurred during the Pleistocene, including, 1) slope upbuilding and progradation by deltaic sedimentation principally during sea-level low stands; 2) canyon cutting by sediment mass movements during and following sea-level low stands; and 3) sediment slumping.

The slope is cut by at least 70 large canyons between Georges Bank and Cape Hatteras (Figure 2.11), and by numerous smaller canyons and gullies, many of which may feed into the larger canyon systems. The New England Seamount Chain, including Bear, Mytilus, and Balanus Seamounts, occurs on the slope southeast of Georges Bank. A smaller chain (Caryn, Knauss, etc.) occurs in the vicinity in deeper water.

A "mud line" occurs on the slope at a depth of 250-300 m, below which fine silt and clay-size particles predominate (Figure 2.3). Localized coarse sediments and rock outcrops are found in and near canyon walls, and occasional boulders occur on the slope because of glacial rafting. Sand pockets may also be formed because of downslope movements.

Gravity-induced, downslope movement is the dominant sedimentary process on the slope, and includes slumps, slides, debris flows, and turbidity currents, in the order from thick cohesive movement to relatively nonviscous flow. Slumps may involve localized, short, downslope movements by blocks of sediment. However, turbidity currents can transport sediments thousands of kilometers.

Submarine canyons are not spaced evenly along the slope, but tend to decrease in areas of increasing slope gradient. Canyons are typically "v" shaped in cross section, and often have steep walls and outcroppings of bedrock and clay. The canyons are continuous from the canyon heads to the base of the continental slope. Some canyons end at the base of the slope, but others continue as channels onto the continental rise. Larger and more deeply incised canyons are generally significantly older than smaller ones, and there is evidence that some older canyons have experienced several episodes of filling and re-excavation. Many, if not all, submarine canyons may first form by mass-wasting processes on the continental slope, although there is evidence that some canyons were formed because of fluvial drainage (*e.g.,* Hudson Canyon).

Canyons can alter the physical processes in the surrounding slope waters. Fluctuations in the velocities of the surface and internal tides can be large near the heads of the canyons, leading to enhanced mixing and sediment transport in the area. Shepard *et al.* (1979) concluded that the strong turbidity currents initiated in study canyons were responsible for enough sediment erosion and transport to maintain and modify those canyons. Since surface and internal tides are ubiquitous over the continental shelf and slope, it can be anticipated that these fluctuations are important for sedimentation processes in other canyons as well. In Lydonia Canyon, Butman *et al.* (1982) found that the dominant source of low-frequency current variability was related to passage of warm-core Gulf Stream rings rather than the atmospheric events that predominate on the shelf.

The water masses of the Atlantic continental slope and rise are essentially the same as those of the North American Basin [defined in Wright and Worthington (1970)]. Worthington (1976) divided the water column of the slope into three vertical layers: deepwater (colder than 4°C), the thermocline (4-17°C), and surface water (warmer than 17°C). In the North American Basin, deepwater accounts for two-thirds of all water, the thermocline for about one-quarter, and surface water the remainder. In the slope water north of Cape Hatteras, the only warm water occurs in the Gulf Stream and in seasonally influenced summer waters.

The principal cold water mass in the region is the North Atlantic Deep Water. North Atlantic Deep Water is comprised of a mixture of five sources: Antarctic Bottom Water, Labrador Sea Water, Mediterranean Water, Denmark Strait Overflow Water, and Iceland-Scotland Overflow Water. The thermocline represents a straightforward water mass compared with either the deepwater or the surface water. Nearly 90% of all thermocline water comes from the water mass called the Western North Atlantic Water. This water mass is slightly less saline northeast of Cape Hatteras due to the influx of southward flowing Labrador Coastal Water. Seasonal variability in slope waters occurs only in the upper 200 m of the water column.

In the winter months, cold temperatures and storm activity create a well-mixed layer down to about 100-150 m, but summer warming creates a seasonal thermocline overlain by a surface layer of low-density water. The seasonal thermocline, in combination with reduced storm activity in the summer, inhibits vertical mixing and reduces the upward transfer of nutrients into the photic zone.

Two currents found on the slope, the Gulf Stream and Western Boundary Undercurrent, together represent one of the strongest low-frequency horizontal flow systems in the world. Both currents have an important influence on slope waters. Warm- and cold-core rings that spin off the Gulf Stream are a persistent and ubiquitous feature of the Northwest Atlantic Ocean. The Western Boundary Undercurrent flows to the southwest along the lower slope and continental rise in a stream about 50 km wide. This boundary current is associated with the spread of North Atlantic Deep Water, and forms part of the generally westward flow found in slope water. North of Cape Hatteras, it crosses under the Gulf Stream in a manner not yet completely understood.

Shelf and slope waters of the Northeast Region are intermittently affected by the Gulf Stream. The Gulf Stream begins in the Gulf of Mexico and flows northeastward at an approximate rate of 1 m/s (2 knots), transporting warm waters north along the eastern coast of the United States, and then east towards the British Isles. Conditions and flow of the Gulf Stream are highly variable on time scales ranging from days to seasons. Intrusions from the Gulf Stream constitute the principal source of variability in slope waters off the Northeast Continental Shelf.

The location of the Gulf Stream's shoreward, western boundary is variable because of meanders and eddies. Gulf Stream eddies are formed when extended meanders enclose a parcel of seawater and pinch off. These eddies can be cyclonic, meaning they rotate counterclockwise and have a cold core formed by enclosed slope water (cold-core ring), or anticyclonic, meaning they rotate clockwise and have a warm core of Sargasso Sea water (warm-core ring). The rings are shaped like a funnel, wider at the top and narrower at the bottom, and can have depths of over 2000 m. They range in approximate size from 150 to 230 km in diameter. There are 35% more rings and meanders near Georges Bank than in the Mid-Atlantic region. A net transfer of water on and off the shelf may result from the interaction of rings and shelf waters. These warm- or cold-core rings maintain their identity for several months until they are reabsorbed by the Gulf Stream. The rings and the Gulf Stream itself have a great influence over oceanographic conditions all along the continental shelf.

Benthic Biological Features

Polychaete annelids represent the most important slope faunal group in terms of numbers of individuals and species (Wiebe *et al.* 1987). Ophiuroids (brittle stars) are considered to be among the most abundant slope organisms, but this group is comprised of relatively few species. The taxonomic group with the highest species diversity is the peracarid crustaceans (which include amphipods, cumaceans, and isopods). Some species of the slope are widely distributed, while others appear to be restricted to particular ocean basins. The ophiuroids and bivalve mollusks appear to have the broadest distributions, while the peracarid crustaceans appear to be highly restricted because they brood their young, and lack a planktonic stage of development. In general, gastropods do not appear to be very abundant; however, past studies are inconclusive since they have not collected enough individuals for largescale community and population studies. (See the "Regional Benthic Invertebrate Communities" section of this chapter for more information on benthic invertebrate communities on the continental slope.)

In general, slope-inhabiting benthic organisms are strongly zoned by depth and/or water temperature, although these patterns are modified by the presence of topography, including canyons, channels, and current zonations (Hecker 1990). Moreover, at depths of <800 m, the fauna is extremely variable and the relationships between faunal distribution and substrate, depth, and geography are less obvious (Wiebe *et al.* 1987). The fauna occupying hard surface sediments is not as dense as in comparable shallow water habitats (Wiebe *et al.* 1987), but there is an increase in species diversity from the shelf to the intermediate depths of the slope. Diversity then declines again in the deeper waters of the continental rise and plain. Hecker (1990) identified four megafaunal zones on the slope of Georges Bank and Southern New England (Table 2.8).

One group of organisms of interest because of the additional structure they can provide for habitat and their potential long life span are the alcyonarian soft corals. Soft corals can be bush or treelike in shape; species found in this form attach to hard substrates such as rock outcrops or gravel. These species can range in size from a few millimeters to several meters, and the trunk diameter of large specimens can exceed 10 cm. Other alcyonarians found in this region include sea pens and sea pansies (Order Pennatulacea), which are found in a wider range of substrate types. In their survey of Northeast U.S. Continental Shelf macrobenthic invertebrates, Theroux and Wigley (1998) found alcyonarians (including the soft corals *Alcyonium* sp., *Acanella* sp., *Paragorgia arborea,* and *Primnoa reseda*, and the sea pens) in limited numbers in waters deeper than 50 m, and mostly at depths from 200 to 500 m. Alcyonarians were present in each of the geographic areas identified in the study (Nova Scotia, GOM, Southern New England Shelf, Georges Slope, and Southern New England Slope) except Georges Bank. However, *Paragorgia* and *Primnoa* have been reported in the Northeast Peak region of Georges Bank (Theroux and Grosslein 1987). Alcyonarians were most abundant by weight in the GOM, and by number on the Southern New England Slope (Theroux and Wigley 1998). In this study, alcyonarians other than sea pens were collected only from gravel and rocky outcrops. Theroux and Wigley (1998) also found stony corals (*Astrangia danae* and *Flabellum* sp.) in the Northeast Region, but they were uncommon. In similar work on the Mid-Atlantic shelf, the only alcyonarians encountered were sea pens (Wigley and Theroux 1981). The stony coral *Astrangia danae* was also found, but its distribution and abundance were not discussed, and are assumed to be minimal.

As opposed to most slope environments, canyons may develop a lush epifauna. Hecker *et al.* (1983) found faunal differences between the canyons and slope environments. Hecker and Blechschmidt (1979) suggested that faunal differences were due at least in part to increased environmental heterogeneity in the canyons, including greater substrate variability and nutrient enrichment. Hecker *et al.* (1983) found highly patchy faunal assemblages in the canyons, and also found additional faunal groups located in the canyons, particularly on hard substrates, that do not appear to occur in other slope environments. Canyons are also thought to serve as nursery areas for a number of species (Cooper *et al.* 1987; Hecker 2001). The canyon habitats in Table 2.9 were classified by Cooper *et al.* (1987).

Most finfish identified as slope inhabitants on a broad spatial scale (Colvocoresses and Musick 1984; Overholtz and Tyler 1985; Gabriel 1992) (Tables 2.2 and 2.6) are associated with canyon features as well (Cooper *et al.* 1987) (Table 2.9). Finfish identified by broad studies that were not included in Cooper *et al.* (1987) include offshore hake, fawn cusk-eel, longfin hake, witch flounder, and armored searobin. Canyon species (Cooper *et al.* 1987) that were not discussed in the broadscale studies include squirrel hake, conger eel, and tilefish. Cusk and ocean pout were identified by Cooper *et al.* (1987) as canyon species, but classified in other habitats by the broadscale studies.

Coastal and Estuarine Features

Coastal and estuarine features such as salt marshes, mud flats, rocky intertidal zones, sand beaches, and submerged aquatic vegetation are critical to inshore and offshore habitats and fishery resources of the Northeast. For example, coastal areas and estuaries are important for nutrient recycling and primary production, and certain features serve as nursery areas for juvenile stages of economically important species. Salt marshes are found extensively throughout the region. Tidal and subtidal mud and sand flats are general saltmarsh features and also occur in other estuarine areas. Salt marshes provide nursery and spawning habitat for many fish and invertebrate species. Saltmarsh vegetation can also be a large source of organic material that is important to the biological and chemical processes of the estuarine and marine environment.

Rocky intertidal zones are high-energy, periodically submerged environments found in the northern portion of the Northeast system. Sessile invertebrates and some fish inhabit rocky intertidal zones. A variety of algae, kelp, and rockweed are also important habitat features of rocky shores. Fishery resources may depend on particular habitat features of the rocky intertidal zone that provide important levels of refuge and food.

Sandy beaches are most extensive along the Northeast coast. Different zones of the beach present suitable habitat conditions for a variety of marine and terrestrial organisms. For example, the intertidal zone presents suitable habitat conditions for many invertebrates, and transient fish find suitable conditions for foraging during high tide. Several invertebrate and fish species are adapted for living in the high-energy subtidal zone adjacent to sandy beaches.

REGIONAL BENTHIC INVERTEBRATE COMMUNITIES

New England

Theroux and Wigley (1998) reported the results of an extensive, 10-yr benthic sampling program in New England. A total of 1,076 bottom grab samples were collected during spring, summer, and fall during 1956-1965 on the continental shelf and slope in Southern New England, Georges Bank, and the GOM. Twenty-eight percent of the samples (303) were collected in the GOM, 20% (211) on Georges Bank, 32% (344) in Southern New England, and 12% (133) on the slope in Southern New England and on Georges Bank. Results were summarized according to major taxonomic groups, principal species, depth ranges, sediment types, ranges of bottom water temperatures, and the sediment organic carbon content. Results presented here are for major taxa by depth range and sediment type. Detailed information for the individual subregions is not presented in this document. Distribution and abundance information for the Mid-Atlantic region is compiled in an earlier publication (Wigley and Theroux 1981) and is summarized in the next section of this chapter.

The density and biomass of all taxa exhibited similar patterns (Figure 2.12). Both were generally higher in coastal GOM waters, on the southern and eastern areas of Georges Bank (including the Northeast Peak), on most of the Southern New England shelf, and south of Long Island. Density and biomass were lower in deeper water of the GOM, on the north-central part of Georges Bank, on the western side of the Great South Channel, on the continental slope and rise, and in portions of Southern New England. Very high biomass was reported in Rhode Island coastal waters, in Cape Cod Bay, and at the southern end of the Great South Channel. Total biomass (mean wet weight per square meter) was about twice as high on the Southern New England shelf and on Georges Bank as in the GOM and over 10 times higher than on the continental slope. Echinoderms and mollusks dominated the biomass in the GOM, on Georges Bank, and in Southern New England. Crustaceans and annelids dominated the density in Southern New England and on Georges Bank; annelids and mollusks dominated in the GOM.

Depth Influence

Analysis of faunal composition by major taxonomic groups in eight different depth ranges reveals a pronounced decline in density at the shelf break, particularly between 100-200 m (Figure 2.13). Density declined very little between 25 and 100 m, and by 60% between 100 and 200 m. Density continued to decline at successively greater depths, but very slowly per meter increase in depth. The relative changes in biomass on the shelf were more pronounced (Figure 2.14). Biomass declined by 50% between 25-100 m and by 55% between 100-200 m.

On the shelf (down to 100 m), crustaceans (mostly amphipods) were numerically the most abundant taxon, with annelids accounting for 20-29% of the organisms; in just the 0-24 m depth range, mollusks accounted for 23%. Bivalve mollusks made up over half the biomass in the 0-24 and 50-99 m depth ranges, and 33% in the 25-49 m range. Echinoderms (sand dollars and sea urchins) dominated the biomass in the intermediate depth range (25-49 m) on the shelf. Between 100 and 499 m, annelids were the most numerous taxon, but echinoderms dominated the biomass. Mollusks accounted for 36-46%, and annelids for 12-39%, of the organisms in deeper water (500-4000 m), with a diminishing proportion of annelids and an increasing proportion of “other” organisms. Biomass on the shelf rise was composed of a variety of taxa.

Sediment Influence

Theroux and Wigley (1998) classified sediments sampled in the New England region into six categories: gravel, glacial till, shell, sand, sand-silt, and silt-clay. Four of these sediment types were well sampled (148-455 samples); shell and till sediments were poorly sampled (6-22 samples) and will not be included in the discussion that follows, even though the data are included in Figure 2.15. Total numbers and biomass were highest in sand and lowest in silt-clay, with intermediate values in gravel and sand-silt. Amphipods dominated numerically in gravel (42%) and sand (56%), but annelids were also numerous (25-33%). Annelids, crustaceans, and mollusks made up nearly equal proportions, by number, of the sand-silt samples, and mollusks and annelids dominated, by number, the silt-clay samples. Mollusks accounted for 50% of the biomass in gravel; the remainder was composed primarily of annelids, crustaceans (mostly barnacles and crabs), sea anemones, sponges, and tunicates. Bivalve mollusks accounted for about half (48%) of the biomass in sand, but echinoids were also important (33%). Bivalve mollusks were also the dominant taxon in biomass in sand-silt (42%), but less so in silt-clay (20%) where 50% of the biomass was composed of echinoderms, mostly sea cucumbers. Annelids made up 15% and 19% of the biomass in sand-silt and silt-clay sediments, respectively.

Important Fauna

Theroux and Wigley (1998) described the geographic distribution of 24 genera and species of benthic invertebrates in New England that were selected because of their common occurrence, regional ubiquity, or distinctive distribution patterns. Information summarizing the importance of these genera and species as prey for fish and their sediment associations is given in Table 2.10.

Mid-Atlantic Bight

Wigley and Theroux (1981) reported the results of an extensive 10-yr benthic sampling program in the MAB, an area extending from Cape Cod to Cape Hatteras and including Southern New England (which was also included in the more recent report by Theroux and Wigley (1998) for New England). A total of 667 bottom grab samples were collected during spring, summer, and fall, primarily between 1962 and 1965, on the continental shelf, slope, and rise. A nearly equal number of samples were collected in each of three subregions: Southern New England (Cape Cod to Montauk Point, Long Island), the New York Bight (Montauk Point to Cape May, New Jersey), and the Chesapeake Bight (Cape May to Cape Hatteras). Results were summarized according to major taxonomic groups, depth ranges, sediment types, ranges of bottom water temperatures, and the sediment organic carbon content. Results presented here are for major taxa by depth range and sediment type. Detailed information for the individual subregions is not presented in this document.

Over the entire MAB, arthropods (mostly amphipods) numerically made up 46% of the benthic fauna, followed by mollusks (25%, mostly bivalves) and annelids (21%). Biomass was dominated by mollusks (71%).

Among subregions, there was some variation in the densities of the major taxa; the proportion of amphipods diminished from north to south, while the proportion of mollusks increased. There was no variation in biomass, though; mollusks dominated the biomass in all three subregions.

From a geographic perspective, total density generally declined from shallow inshore areas to deeper areas on the slope, and from north to south. There were some small areas of low and high density on the mid-shelf in the southern half of the region, and there was a large area of high density in Southern New England and south of Long Island (Figure 2.16). Biomass (mostly mollusks) was more variable, with areas of high and low biomass scattered throughout the region (Figure 2.17).

Depth Influence

Total density was about the same in the shallowest depth interval (0-24 m) as it was at 50-99 m, and then declined by 61% between 50 and 200 m, and continued to decline, although not as rapidly (per unit change in depth) in deeper water (Figure 2.18). Mollusks (mostly bivalves) were numerically more abundant in the shallowest depth range (0-24 m), and amphipods in the next two deeper shelf depth ranges (25-49 and 50-99 m). The density of amphipods declined dramatically in the deeper water (100-199 m), as did annelids but less so, while the density of mollusks remained the same and that of echinoderms (brittle stars) increased. On a percentage basis, annelids, mollusks, and echinoderms made up nearly equal proportions, by number, of the benthic fauna between 100 and 200 m. Annelids were the most numerous taxon between 200 and 500 m, as were mollusks in deeper water.

Total biomass (mean grams per square meter) was lower in all depth ranges in the MAB than in New England, and declined by about 78% between shallow water (0-24 m) and the 100-199 m depth interval (Figure 2.18). The rate of decline generally diminished in deeper water. The high biomass in the 0-24 m depth range was due to the prevalence of bivalve mollusks, which were not nearly as abundant in deeper shelf waters, but still accounted for 58-65% of the biomass in depths <100 m. A variety of echinoderms (sand dollars, sea cucumbers, brittle stars, and starfish) accounted for 45% of the biomass between 100 and 200 m, where bivalve mollusks still made up 21% and sea anemones 19%. Sand dollars, sea cucumbers, and brittle stars (with annelids) still dominated the biomass between 200 and 500 m, and annelids were the taxon which accounted for most of the biomass between 500 and 1000 m. Echinoderms and echiurid worms dominated the biomass of the sparse fauna of the continental rise.

Sediment Influence

Sediments in the MAB were classified into eight categories: gravel, sand-gravel, shell, sand-shell, sand, silty sand, silt, and clay. Figure 2.19 was derived for this document from data given in Wigley and Theroux (1981), and excludes the results for two poorly sampled sediment types: gravel and shell. Sample sizes for the other six groups ranged from 18 (sand-gravel) to 285 (sand). Total density was highest in sand-gravel and sand-shell, moderately high in sand and silty sand, and low in silt and clay. Total biomass was highest in silty sand, moderate in sand-gravel and sand, and low in sand-shell, silt, and clay.

Amphipods dominated the sand-gravel and sand sediment types numerically, while mollusks were the most numerous taxon in the other four substrates. Almost all of the mollusks in sand-gravel, sand-shell, and sand were bivalves, but gastropods were also important in silty sand. Annelids, hydroids, and bryozoans were numerically important components of the sand-gravel fauna. Annelids were also common in sand, silty sand, sand-gravel, silt, and clay substrates. Bivalve mollusks dominated the biomass in all six substrates. Other taxa with abundant biomass were barnacles in sand-gravel, and sand dollars in sand-shell and sand.

Important Fauna

Wigley and Theroux (1981) described the geographic distribution of 24 genera and species of benthic invertebrates in the MAB that were selected because of their common occurrence or distinctive distribution patterns. Ten of them were also described in the New England region (see earlier): they are the annelids *Sternaspis scutata* and *Scalibregma inflatum,* the mollusks *Arctica islandica, Cerastoderma pinnulatum,* and *Cyclocardia borealis,* the arthropods *Leptocheirus pinguis, Cirolana* spp., *Crangon septemspinosa,* and *Pagurus* spp., and the echinoderm *Echinarachnius parma*. Information summarizing the habitat associations of the other 14 genera and species is given in Table 2.11.

Table 2.1. Gulf of Maine benthic assemblages as identified by Watling (1998). (Geographical distribution of assemblages is shown in Figure 2.4.)

Benthic Assemblage	Benthic Community Description
1	Comprises all sandy offshore banks, most prominently Jeffreys Ledge, Fippennies Ledge, and Platts Bank; depth on top of banks ~70 m; substrate usually coarse sand with some gravel; fauna characteristically sand dwellers with an abundant interstitial component
2	Comprises the rocky offshore ledges, such as Cashes Ledge, Sigsbee Ridge, and Three Dory Ridge; substrate either rock ridge outcrop or very large boulders, often with covering of very fine sediment; fauna predominantly sponges, tunicates, bryozoans, hydroids, and other hard-bottom dwellers; overlying water usually cold MIW
3	Probably extends all along coast of GOM in water depths <60 m; bottom waters warm in summer and cold in winter; fauna rich and diverse, primarily polychaetes and crustaceans, probably consists of several (sub-) assemblages due to heterogeneity of substrate and water conditions near shore and at mouths of bays
4	Extends over soft bottom at depths of 60-140 m, well within the cold MIW; bottom sediments primarily fine muds; fauna dominated by polychaetes, shrimp, and cerianthid anemones
5	Mixed assemblage comprising elements from the coldwater fauna as well as a few deeper water species with broader temperature tolerances; overlying water often a mixture of MIW and MBW, but generally colder than 7°C most of year; fauna sparse, diversity low, dominated by a few polychaetes, with brittle stars, sea pens, shrimp, and cerianthids also present
6	Comprises fauna of deep basins; bottom sediments generally very fine muds, but may have a gravel component in offshore morainal regions; overlying water usually 7-8°C, with little variation; fauna shows some bathyal affinities but densities are not high, dominated by brittle stars and sea pens, and sporadically by a tube-making amphipod
7	True upper slope fauna that extends into the Northeast Channel; water temperatures are always >8°C and salinities are at least 35 ppt; sediments may be either fine muds or a mixture of mud and gravel

Table 2.2. Comparison of two studies of demersal fish assemblages of Georges Bank and Gulf of Maine. (Species associated with the comparable habitats of both studies are listed opposite each other in bold type.)

Overholtz and Tyler (1985)		Gabriel (1992)	
Assemblage	**Species**	**Species**	**Assemblage**
Slope and Canyon	**Offshore hake** **Blackbelly rosefish** **Gulf Stream flounder** Fourspot flounder, goosefish, silver hake, white hake, red hake	**Offshore hake** **Blackbelly rosefish** **Gulf Stream flounder** Fawn cusk-eel, longfin hake, armored sea robin	Deepwater
Intermediate	**Silver hake** **Red hake** **Goosefish** Atlantic cod, haddock, ocean pout, yellowtail flounder, winter skate, little skate, sea raven, longhorn sculpin	**Silver hake** **Red hake** **Goosefish** Northern shortfin squid, spiny dogfish, cusk	Combination of Deepwater Gulf of Maine - Georges Bank and Gulf of Maine - Georges Bank Transition
Shallow	**Atlantic cod** **Haddock** **Pollock** Silver hake White hake Red hake Goosefish Ocean pout **Yellowtail flounder** **Windowpane** **Winter flounder** **Winter skate** **Little skate** **Longhorn sculpin** Summer flounder Sea raven, sand lance	**Atlantic cod** **Haddock** **Pollock** **Yellowtail flounder** **Windowpane** **Winter flounder** **Winter skate** **Little skate** **Longhorn sculpin**	Gulf of Maine - Georges Bank Transition Zone (*see below also*) Shallow Water Georges Bank-Southern New England
Gulf of Maine-Deep	**White hake** **American plaice** **Witch flounder** **Thorny skate** Silver hake, Atlantic cod, haddock, cusk, Atlantic wolffish	**White hake** **American plaice** **Witch flounder** **Thorny skate** Redfish	Deepwater Gulf of Maine - Georges Bank
Northeast Peak	**Atlantic cod** **Haddock** **Pollock** Ocean pout, winter flounder, white hake, thorny skate, longhorn sculpin	**Atlantic cod** **Haddock** **Pollock**	Gulf of Maine - Georges Bank Transition Zone (*see above also*)

Table 2.3. Substrate associations with five finfish aggregations on Stellwagen Bank, Gulf of Maine. (Numerical data are mean number of fish per research vessel survey tow for 10 dominant species in each aggregation (Auster et al 2001).)

SUBSTRATE TYPE					
Coarse		**Wide Range**		**Fine**	
Species	**Mean**	**Species**	**Mean**	**Species**	**Mean**
Northern sand lance	1172.0	American plaice	63.3	American plaice	152.0
Atlantic herring	72.2	Northern sand lance	53.0	Acadian redfish	31.3
Spiny dogfish	38.4	Atlantic herring	28.5	Silver hake	29.5
Atlantic cod	37.4	Silver hake	22.4	Atlantic herring	28.0
Longhorn sculpin	29.7	Acadian redfish	16.0	Red hake	26.1
American plaice	28.0	Atlantic cod	14.0	Witch flounder	23.8
Haddock	25.7	Longhorn sculpin	9.5	Atlantic cod	13.1
Yellowtail flounder	20.2	Haddock	9.1	Haddock	12.7
Silver hake	7.5	Pollock	7.9	Longhorn sculpin	12.5
Ocean pout	9.0	Red hake	6.2	Daubed shanney	11.4
No. tows = 83		**No. tows = 159**		**No. tows = 66**	
Haddock	13.1			Silver hake	275.0
Atlantic cod	7.3			American plaice	97.1
American plaice	5.3			Atlantic mackerel	42.0
Silver hake	3.3			Pollock	41.1
Longhorn sculpin	2.0			Alewife	37.2
Yellowtail flounder	1.9			Atlantic herring	32.0
Spiny dogfish	1.6			Atlantic cod	18.1
Acadian redfish	1.6			Longhorn sculpin	16.8
Ocean pout	1.3			Red hake	15.2
Alewife	1.1			Haddock	13.2
No. tows = 60				**No. tows = 20**	

Table 2.4. Sedimentary provinces and associated benthic landscapes of Georges Bank. (Provinces as defined by Valentine *et al.* (1993) and Valentine and Lough (1991) with additional information from Page C. Valentine (pers. comm., U.S. Geological Survey, Woods Hole, MA). Benthic assemblages as assigned by Theroux and Grosslein (1987). See text for further discussion on benthic assemblages.)

Sedimentary Province (province no.)	**Depth Range (m)**	**Description**	**Benthic Assemblage**
Northern Edge / Northeast Peak (1)	40-200	Dominated by gravel with portions of sand, common boulder areas, and tightly packed pebbles; bryozoa, hydrozoa, anemones, and calcareous worm tubes are abundant in areas of boulders; strong tidal and storm currents	Northeast Peak
Northern Slope and Northeast Channel (2)	200-240	Variable sediment type (gravel, gravel-sand, and sand) and scattered bedforms; this is a transition zone between the northern edge and southern slope; strong tidal and storm currents	Northeast Peak
North /Central Shelf (3)	60-120	Highly variable sediment types (ranging from gravel to sand) with rippled sand, large bedforms, and patchy gravel lag deposits; minimal epifauna on gravel due to sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones	Central Georges
Central and Southwestern Shelf - shoal ridges (4)	10-80	Dominated by sand (fine and medium grain) with large sand ridges, dunes, waves, and ripples; small bedforms in southern part; minimal epifauna on gravel due to sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones	Central Georges
Central and Southwestern Shelf - shoal troughs (5)	40-60	Gravel (including gravel lag) and gravel-sand between large sand ridges; patchy large bedforms, strong currents; minimal epifauna on gravel due to sand movement; epifauna in sand areas includes amphipods, sand dollars, and burrowing anemones	Central Georges
Southeastern Shelf (6)	80-200	Rippled gravel-sand (medium- and fine-grained sand) with patchy large bedforms and gravel lag; weaker currents; ripples are formed by intermittent storm currents; epifauna includes sponges attached to shell fragments and amphipods	Southern Georges
Southeastern Slope (7)	400-2000	Dominated by silt and clay with portions of sand (medium and fine), with rippled sand on shallow slopes and smooth silt-sand deeper	None

Table 2.5. Mid-Atlantic habitat types (as described by Pratt (1973) and Boesch (1979)), with characteristic macrofauna (as identified in Boesch (1979))			
Habitat Type [after Boesch (1979)]	**Description**		
	Depth (m)	**Characterization (Pratt (1973) faunal zone)**	**Characteristic Benthic Macrofauna**
Inner shelf	0-30	Coarse sands with finer sands off MD and VA (sand zone)	Polychaetes: *Polygordius, Goniadella,* and *Spiophanes*
Central shelf	30-50	(sand zone)	Polychaetes: *Spiophanes* and *Goniadella* Amphipod: *Pseudunciola*
Central and inner shelf swales	0-50	Occurs in swales between sand ridges (sand zone)	Polychaetes: *Spiophanes, Lumbrineris,* and *Polygordius*
Outer shelf	50-100	(silty sand zone)	Amphipods: *Ampelisca vadorum* and *Erichthonius* Polychaetes: *Spiophanes*
Outer shelf swales	50-100	Occurs in swales between sand ridges (silty sand zone)	Amphipods: *Ampelisca agassizi, Unciola,* and *Erichthonius*
Shelf break	100-200	(silt-clay zone)	Not given
Continental slope	>200	(none)	Not given

Table 2.6. Major recurrent demersal finfish assemblages of the Mid-Atlantic Bight during spring and fall (as determined by Colvocoresses and Musick (1984))					
Season	**Species Assemblage**				
	Boreal	**Warm Temperate**	**Inner Shelf**	**Outer Shelf**	**Slope**
Spring	Atlantic cod Little skate Sea raven Goosefish Winter flounder Longhorn sculpin Ocean pout Silver hake Red hake White hake Spiny dogfish	Black sea bass Summer flounder Butterfish Scup Spotted hake Northern searobin	Windowpane	Fourspot flounder	Shortnose greeneye Offshore hake Blackbelly rosefish White hake
Fall	White hake Silver hake Red hake Goosefish Longhorn sculpin Winter flounder Yellowtail flounder Witch flounder Little skate Spiny dogfish	Black sea bass Summer flounder Butterfish Scup Spotted hake Northern searobin Smooth dogfish	Windowpane	Fourspot flounder Fawn cusk eel Gulf Stream flounder	Shortnose greeneye Offshore hake Blackbelly rosefish White hake Witch flounder

Table 2.7. Mid-Atlantic reef types, location, and representative flora and fauna (as described in Steimle and Zetlin (2000))

Location (Type)	Representative Flora and Fauna		
	Epibenthic/Epibiotic	**Motile Epibenthic Invertebrates**	**Fish**
Estuarine (oyster reefs, blue mussel beds, other hard surfaces, semi-hard clay, and *Spartina* peat reefs)	Eastern oyster, barnacles, ribbed mussel, blue mussel, algae, sponges, tube worms, anemones, hydroids, bryozoans, common Atlantic slipper snail, jingleshell (*Anomia* sp.), northern stone coral, sea whips, tunicates, caprellid amphipods, and wood borers	Xanthid crabs, blue crab, Atlantic rock crabs, portly spider crab, juvenile American lobster, and sea stars	Gobies, spot, striped bass, black sea bass, white perch, oyster toadfish, scup, black drum, Atlantic croaker, spot, sheepshead porgy, pinfish, juvenile and adult tautog, pinfish, northern puffer, cunner, sculpins, juvenile and adult Atlantic cod, rock gunnel, conger eel, American eel, red hake, ocean pout, white hake, and juvenile pollock
Coastal (exposed rock/soft marl, harder rock, wrecks and artificial reefs, kelp, and other materials)	Boring mollusks (piddocks), red algae, sponges, anemones, hydroids, northern stone coral, soft coral, sea whips, barnacles, blue mussel, northern horse mussel, bryozoans, skeleton and tubiculous amphipods, polychaetes, jingle shell, and sea stars	American lobster, Jonah crab, Atlantic rock crab, portly spider crab, sea stars, urchins, and squid egg clusters	Black sea bass, pinfish, scup, cunner, red hake, gray triggerfish, black grouper, smooth dogfish, summer flounder, scad, bluefish, amberjack, Atlantic cod, tautog, ocean pout, conger eel, sea raven, rock gunnel, and radiated shanny
Shelf (rocks and boulders, wrecks and artificial reefs, and other solid substrates)	Boring mollusks (piddocks), red algae, sponges, anemones, hydroids, stone coral, soft coral, sea whips, barnacles, blue mussel, northern horse mussel, bryozoans, amphipods, and polychaetes	American lobster, Jonah crabs, Atlantic rock crab, portly spider crabs, sea stars, urchins, and squid egg clusters (with addition of some deepwater taxa at shelf edge)	Black sea bass, scup, tautog, cunner, gag, sheepshead, porgy, round herring, sardines, amberjack, Atlantic spadefish, gray triggerfish, mackerels, small tunas, spottail pinfish, tautog, Atlantic cod, ocean pout, red hake, conger eel, cunner, sea raven, rock gunnel, pollock, and white hake
Outer shelf (reefs and clay burrows including "pueblo village community")			Tilefish, white hake, and conger eel

Table 2.8. Faunal zones of the continental slope of Georges Bank and Southern New England (from Hecker (1990))

Zone	Approximate Depth (m)	Gradient	Current	Fauna
Upper slope	300-700	Low	Strong	Dense filter feeders: Scleratinians (*Dasmosmilia lymani, Flabellum alabastrum*), and quill worm (*Hyalinoecia* sp.)
Upper middle slope	500-1300	High	Moderate	Sparse scavengers: red deepsea crab (*Chaceon quinqueidens*), northern cutthroat eel, common grenadier (*Nezumia*), alcyonarians (*Acanella arbuscula* and *Eunephthya florida*) in areas of hard substrate
Lower middle slope/transition	1200-1700	High	Moderate	Sparse suspension feeders: cerianthids and sea pen (*Distichoptilum gracile*)
Lower slope	>1600	Low	Strong	Dense suspension and deposit feeders: ophiurid (*Ophiomusium lymani*), cerianthids, and sea pens

Table 2.9. Habitat types for the canyons of Georges Bank, including characteristic fauna. (Faunal characterization is from Cooper *et al.* (1987) and is for depths <230 m only.)

Habitat Type	Geologic Description	Canyon Locations	Most Commonly Observed Fauna
I	Sand or semiconsolidated silt substrate (claylike consistency) with <5% overlay of gravel. Relatively featureless except for conical sediment mounds	Walls and axis	Cerianthid, pandalid shrimp, white colonial anemone, Jonah crab, starfishes, portunid crab, greeneye, brittle stars, mosaic worm, red hake, fourspot flounder, shellless hermit crab, silver hake, and Gulf Stream flounder
II	Sand or semiconsolidated silt substrate (claylike consistency) with >5% overlay of gravel. Relatively featureless	Walls	Cerianthids, galatheid crab, squirrel hake, white colonial anemone, Jonah crab, silver hake, sea stars, ocean pout, brittle stars, shell-less hermit crab, and greeneye
III	Sand or semiconsolidated silt (claylike consistency) overlain by siltstone outcrops and talus up to boulder size. Featured bottom with erosion by animals and scouring	Walls	White colonial anemone, pandalid shrimp, cleaner shrimp, rock anemone, white hake, sea stars, ocean pout, conger eel, brittle stars, Jonah crab, American lobster, blackbelly rosefish, galatheid crab, mosaic worm, and tilefish
IV	Consolidated silt substrate, heavily burrowed/excavated. Slope generally >5º and <50º. Termed "pueblo village" habitat	Walls	Sea stars, blackbelly rosefish, Jonah crab, American lobster, white hake, cusk, ocean pout, cleaner shrimp, conger eel, tilefish, galatheid crab, and shell-less hermit crab
V	Sand dune substrate	Axis	Sea stars, white hake, Jonah crab, and goosefish

Table 2.10 Habitat associations, and importance as prey for fish, of 24 select genera and species of benthic invertebrates in New England. (Source: Theroux and Wigley (1998).)

Phylum	Genus/Species	Description
Annelida	*Aphrodita hastata*	Polychaete often found in Atlantic cod, haddock, and red hake stomachs; commonly inhabits mud bottoms, or mixed bottoms with high mud content
	Scalibregma inflatum	Polychaete that is an important food source for many demersal fish; inhabits silty sand substrates
	Sternaspis scutata	Burrowing polychaete eaten by winter flounder; commonly inhabits silty sediments
Mollusca	*Arctica islandica* (ocean quahog)	Small- to medium-sized individuals preyed upon by Atlantic cod; usually inhabits muddy sand bottoms, very abundant in some localities on the continental shelf such as the southern part of Georges Bank
	Astarte undata (wavy astarte)	Most abundant at mid-shelf depths (50-99 m) in sand and till substrates; not a major prey item of demersal fishes
	Cerastoderma pinnulatum (northern dwarf cockle)	Infrequently found in fish stomachs; prefers sandy substrates, but is also found in other types of substrate
	Cyclocardia borealis (northern cyclocardia)	Broadly distributed throughout the region, prefers sand and till substrates; not common in fish diets
	Modiolus modiolus (northern horsemussel)	Largest and most common mussel offshore of New England, prefers sand and sand-shell substrates
	Placopecten magellanicus (sea scallop)	Most abundant on coarse sandy bottoms; juveniles eaten by some demersal fishes, principally haddock and ocean pout
	Buccinum spp.	Four species of whelk of which *B. undatum* (waved whelk) is by far the most common, typically found at mid- to lower shelf depths in sand and coarser-grained sediments
	Neptunea [lyrata] decemcostata (wrinkle whelk)	Typically inhabits hard bottoms ranging from coarse sand to gravels at mid- to lower shelf depths
Arthropoda	*Ampelisca agassizi*	Tube-dwelling amphipod, the most abundant species of amphipod in the southwestern half of the region, preferring a sandy substratum; a common prey item in the diet of many demersal fish
	Leptocheirus pinguis	Another tube-dwelling amphipod abundant on sandy shelf substrates; very important prey species for demersal fish
	Unciola irrorata	Another tube-dwelling amphipod important in sands of Georges Bank; an important prey species for demersal fish
	Crangon septemspinosa (sevenspine bay shrimp)	Found in sandy sediments in inshore and shelf waters, very abundant in certain localities; an important prey item for nearly all demersal fishes
	Homarus americanus (American lobster)	Widely distributed from inshore bays to offshore canyons, inhabits a variety of substrates
	Hyas coarctatus (Arctic lyre crab)	Common throughout the region on muddy and pebbly bottoms
	Pagurus spp. (hermit crabs)	Seven species ubiquitous throughout the region in nearly all substrate types; preyed upon by demersal fishes
	Cirolana spp. (isopods)	At least three species, common on muddy and sandy bottoms in the GOM and on Georges Bank
Echinodermata	*Asterias vulgaris* (northern or purple starfish)	One of the most common species of starfish in the region, normally found on sandy bottoms; juveniles occasionally found in fish stomachs
	Leptasterias spp.	Several species of starfish that are common inhabitants on sandy bottoms, very abundant in certain locations; small specimens occasionally preyed upon by some species of demersal fish
	Echinarachnius parma (northern sand dollar)	Most abundant member of the urchin family in the New England region, especially in some locations on Georges Bank, lives on sand; a common prey item for flounders, haddock, and Atlantic cod
	Strongylocentrus droebachiensis (green sea urchin)	Another ubiquitous echinoid, a hard-bottom dweller; preyed upon by haddock and American plaice
	Ophiura spp. (brittle stars)	At least three species, widely distributed and occur in most sediment types; common in diets of haddock and American plaice

Table 2.11 Habitat associations of 14 of 24 (see Table 2.10 for information on the other 10) select genera and species of benthic invertebrates in the Mid-Atlantic Bight. (Source: Wigley and Theroux (1981).)

Phylum	Genus/Species	Description
Annelida	*Hyalinoecia tubicola*	Tube-dwelling polychaete that inhabits the shelf break at depths >200 m
Pogonophora	*Siboglinum ekmani*	Tube-dwelling species found in deep water on the continental slope and rise
Mollusca	*Thyasira* spp. (cleftclams)	Five species of small bivalves most commonly found in offshore waters and in fine-grained bottom sediments
	Lucinoma blakean[um] (Blake lucine)	Bivalve most common in outer continental shelf waters
	Ensis directus (razor clam)	Sand-dwelling species found in shallow inshore waters and on the continental shelf
	Polinices spp. (moon snails)	Two species found on sandy sediments on the continental shelf
	Alvania spp. (alvanias)	At least two species of small gastropods usually associated with silt-clay bottom sediments, found on the continental shelf and slope in Southern New England and on the slope further south
Arthropoda	*Ampelisca* spp.	Six species of tube-dwelling amphipods found inshore and on the shelf, very abundant in some localities
	Phoxocephalus holbolli	Amphipod that characteristically inhabits fine sand sediments on the continental shelf
	Trichophoxus epistomus	Widely distributed burrowing amphipod that inhabits sand and silty sand sediments on the shelf
	Cancer spp. (rock crabs)	Two species that inhabit a variety of bottom sediments throughout the Mid-Atlantic shelf
Echinodermata	*Echinocardium cordatum* (sea potato)	Burrowing heart urchin that usually inhabits sand sediments in moderately shallow water, found only in the southern part of the region
	Astropecten spp.	Two species of burrowing sea stars that are common in silty sand bottom sediments on the northern half of the Mid-Atlantic shelf
	Amphilimna olivacea	Brittle star that inhabits moderately deep water in Southern New England along the outer continental shelf and upper slope

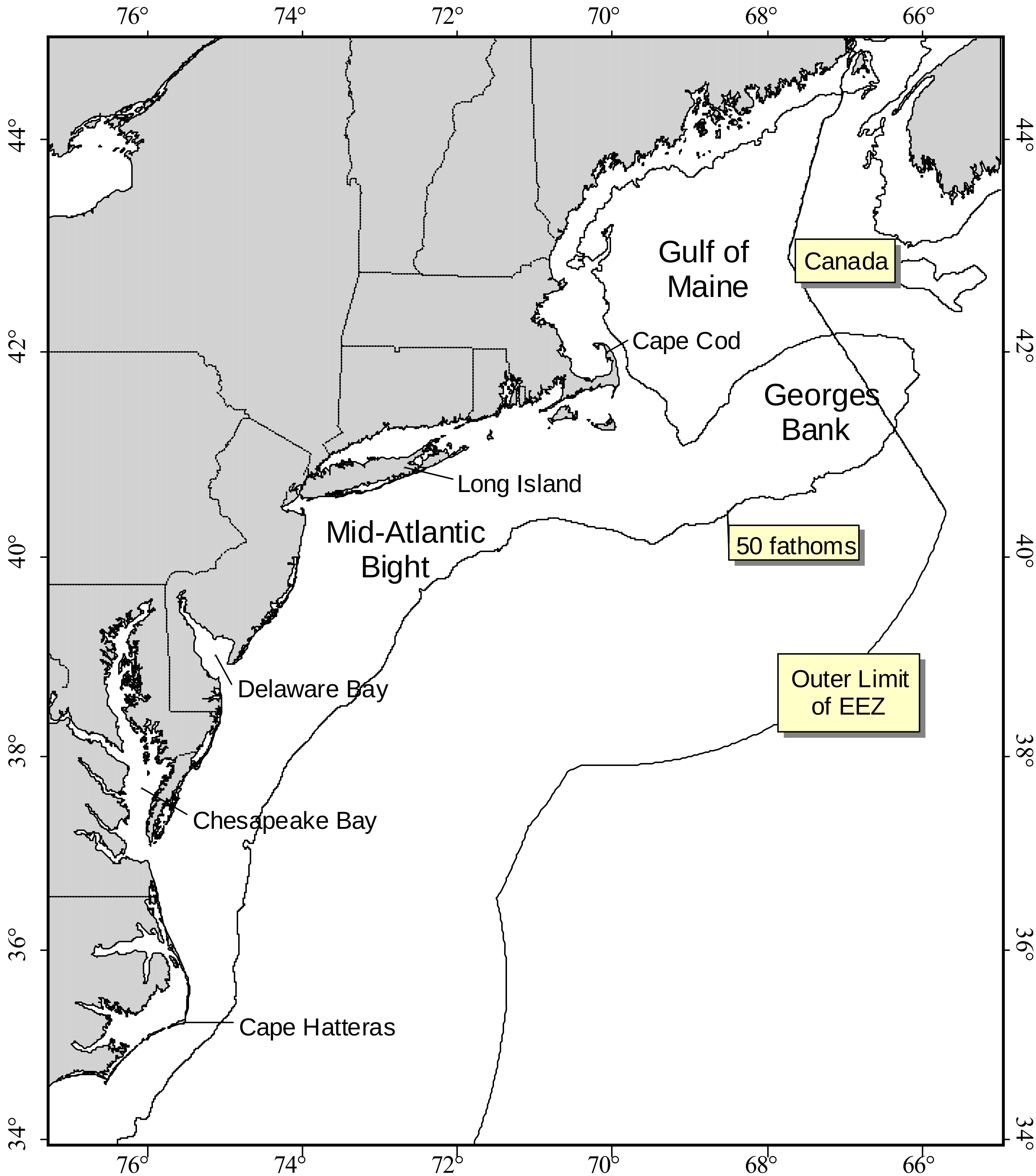


Figure 2.1. Northeast U.S. Shelf Ecosystem, showing the boundaries of the continental shelf (50-fathom line), the EEZ (200-mi limit), and the three principal systems (Gulf of Maine, Georges Bank, and Mid-Atlantic Bight).

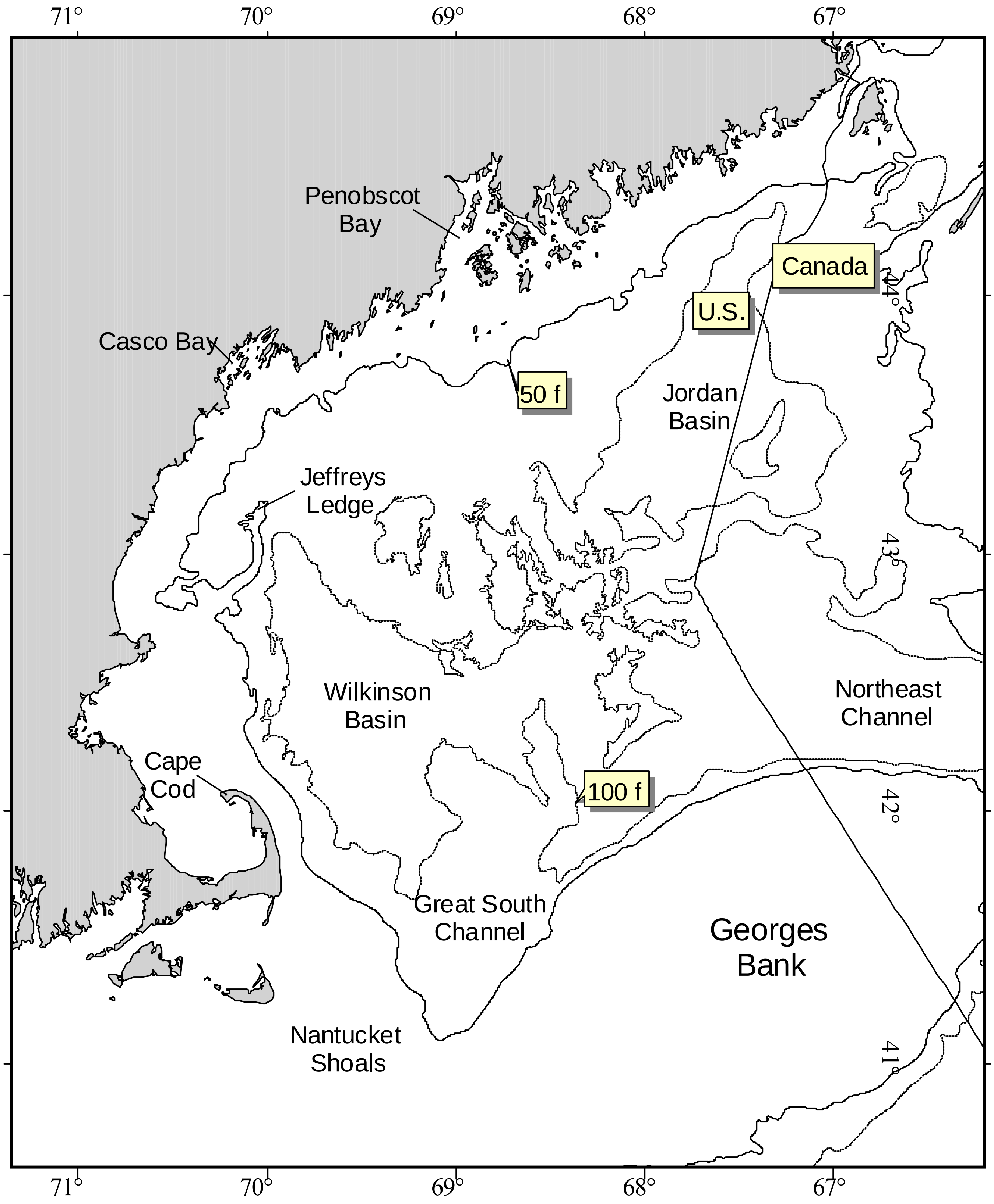


Figure 2.2. Gulf of Maine, showing the 50-fathom and 100-fathom lines of the continental shelf, the boundary between the U.S. Canadian EEZs, and the principal physiographic features.

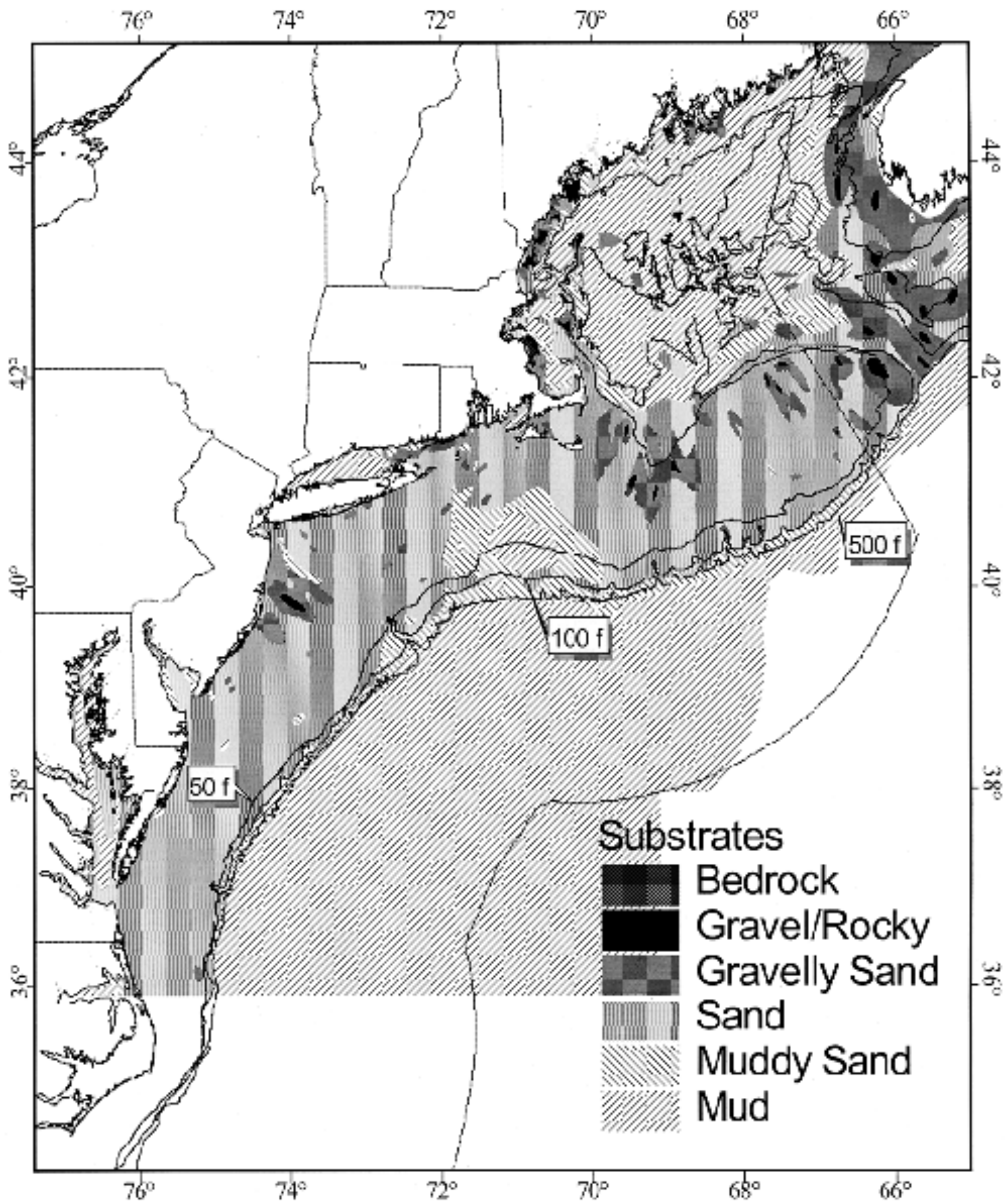


Figure 2.3. Northeast Region sediments. (Modified from Poppe, Schlee, Butman, *et al.* (1989), and Poppe, Schlee, and Knebel (1989).)

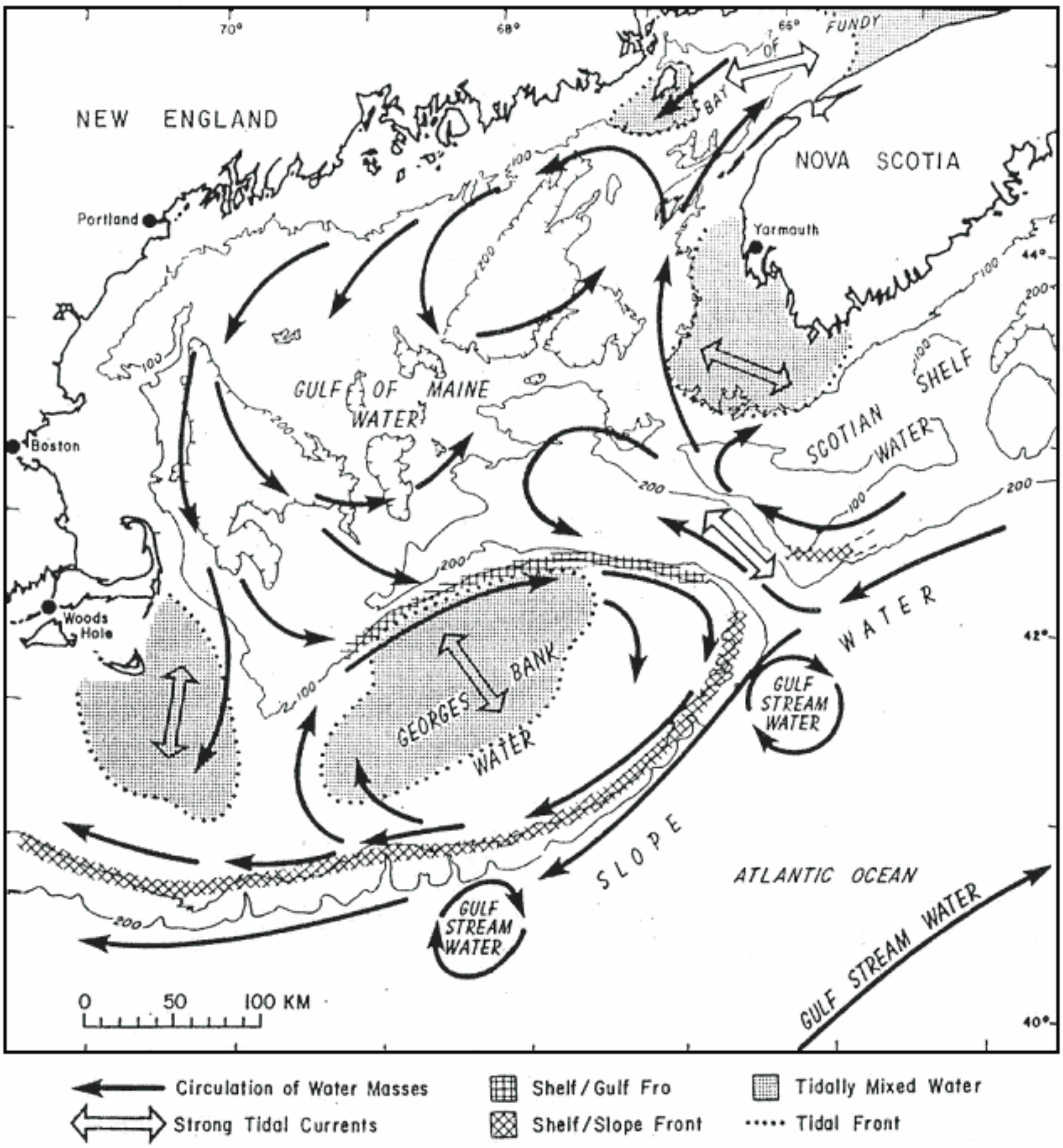


Figure 2.4. Water mass circulation patterns in the Georges Bank - Gulf of Maine region. (Depth in meters. Source: Valentine and Lough (1991).)

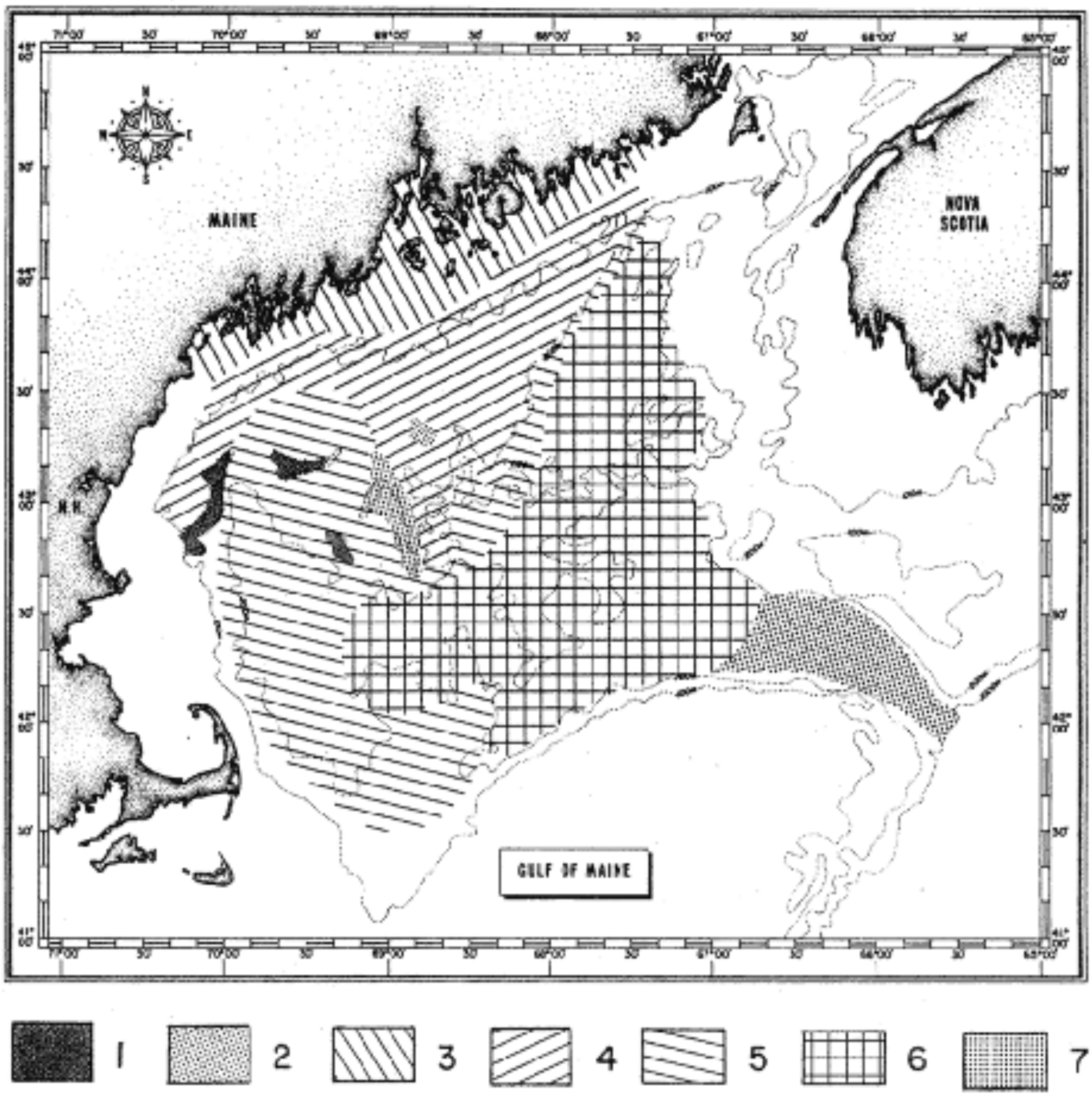


Figure 2.5. Distribution of the seven major benthic assemblages in the Gulf of Maine. (1 = sandy offshore banks; 2 = rocky offshore ledges; 3 = shallow (<50 m) temperate bottoms with mixed substrate; 4 = boreal muddy bottom, overlain by Maine Intermediate Water, 50-160 m (approximate); 5 = cold deep water, species with broad tolerances, muddy bottom; 6 = deep basin warm water, muddy bottom; and 7 = upper slope water, mixed sediment. Source: Watling (1998).)

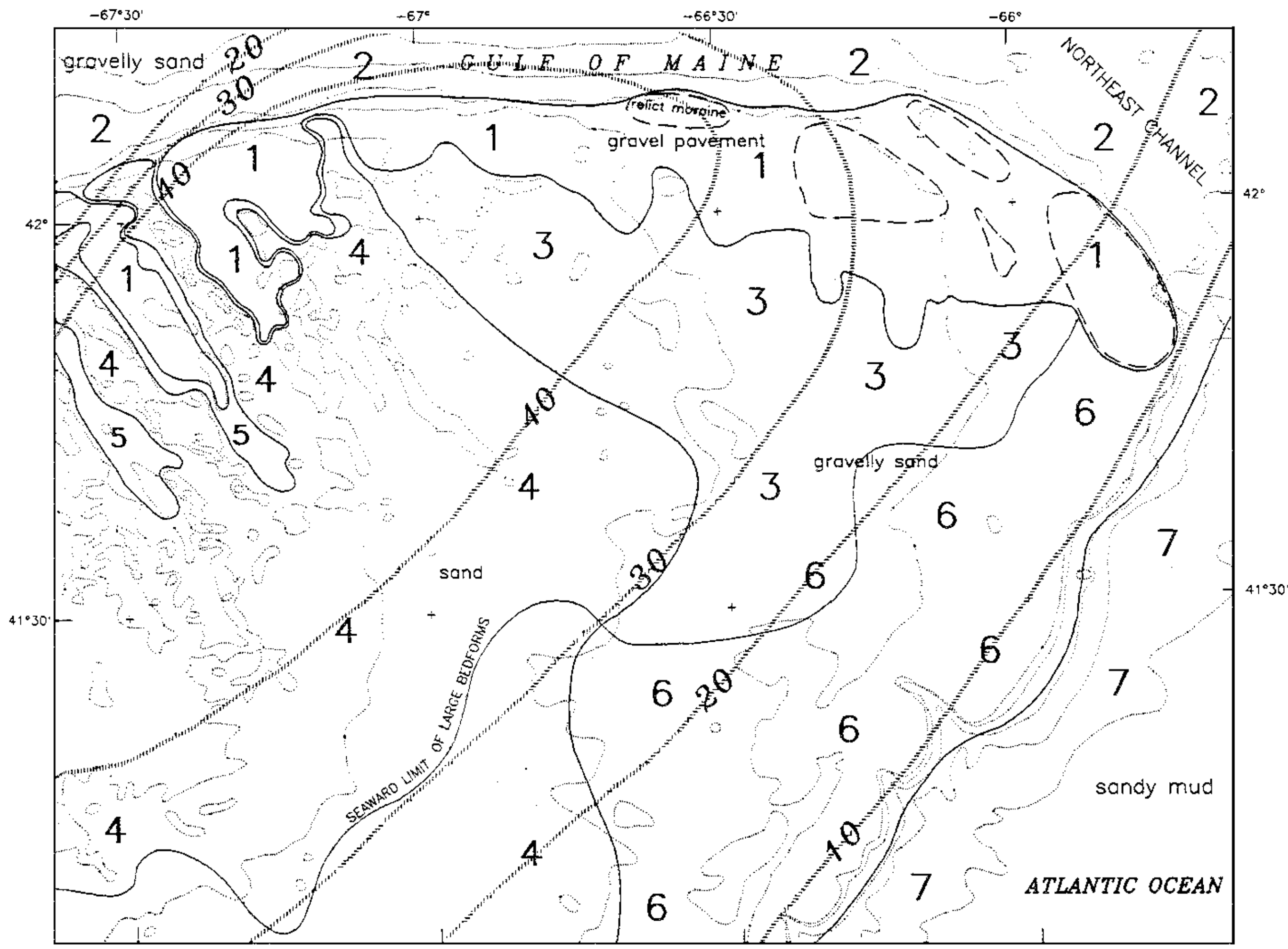


Figure 2.6. Sedimentary provinces of eastern Georges Bank. (Numbered 1-7. Based on criteria of seafloor morphology, texture, sediment movement and bedforms, and mean tidal bottom current speed (shown as hatched-line contours ranging between 10 and 40 cm/s). Relict moraines (bouldery seafloor) are enclosed by dashed lines. See Table 2.4 for descriptions of provinces. Source: Valentine and Lough (1991).)

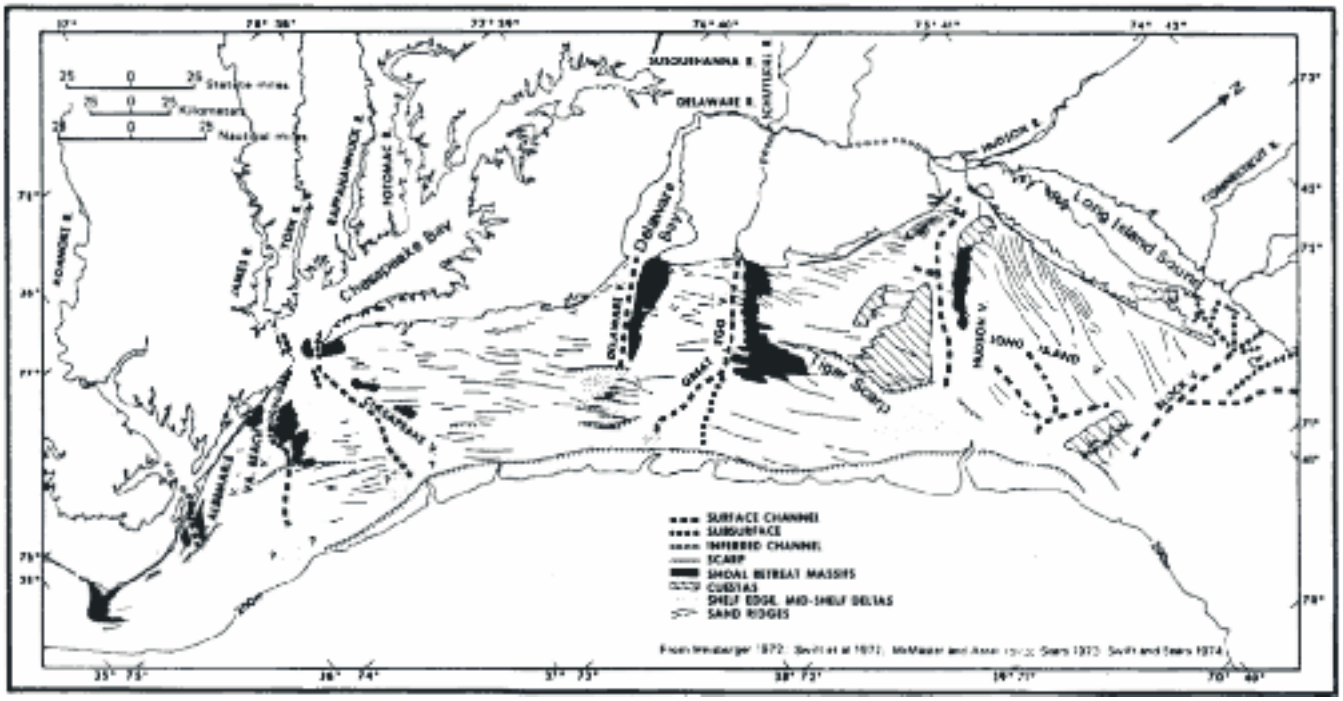


Figure 2.7. Mid-Atlantic Bight submarine morphology. (Source: Stumpf and Biggs (1988).)

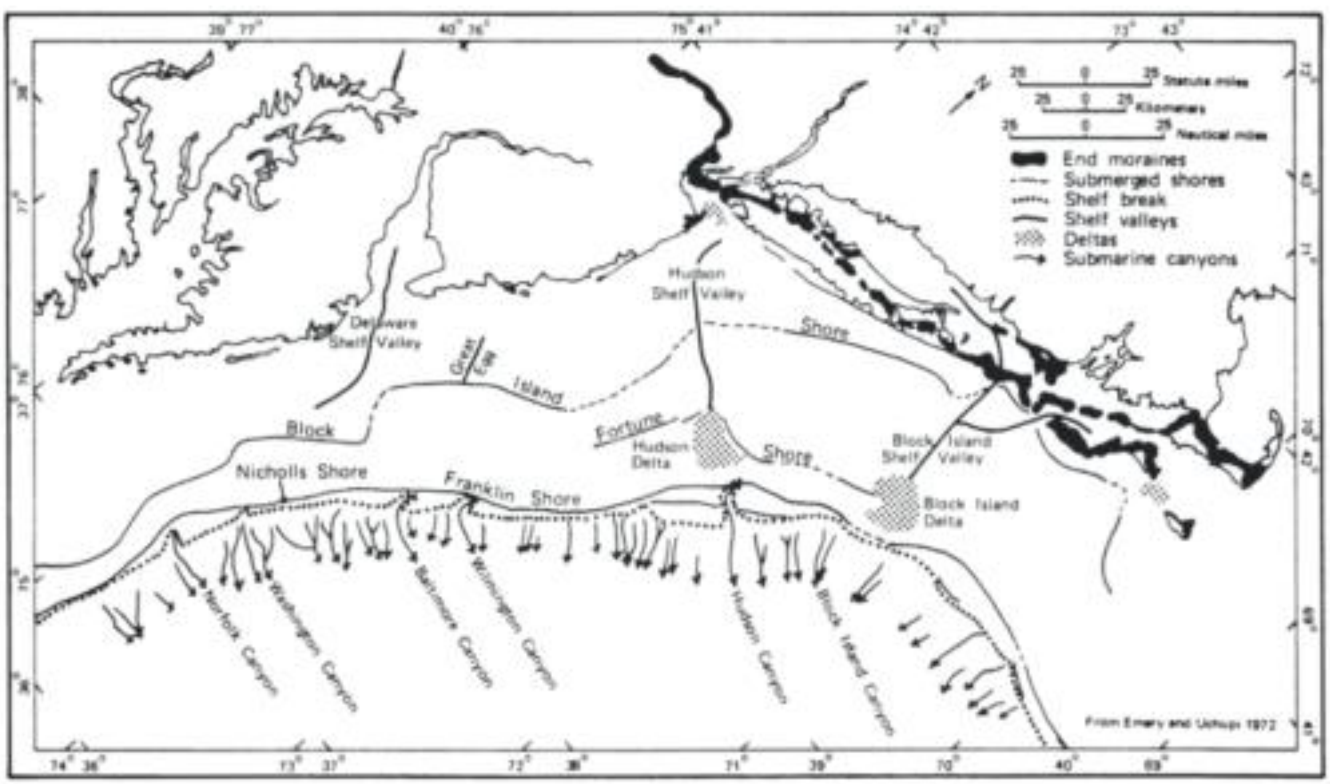


Figure 2.8. Major features of the Mid-Atlantic and Southern New England continental shelf. (Source: Stumpf and Biggs (1988).)

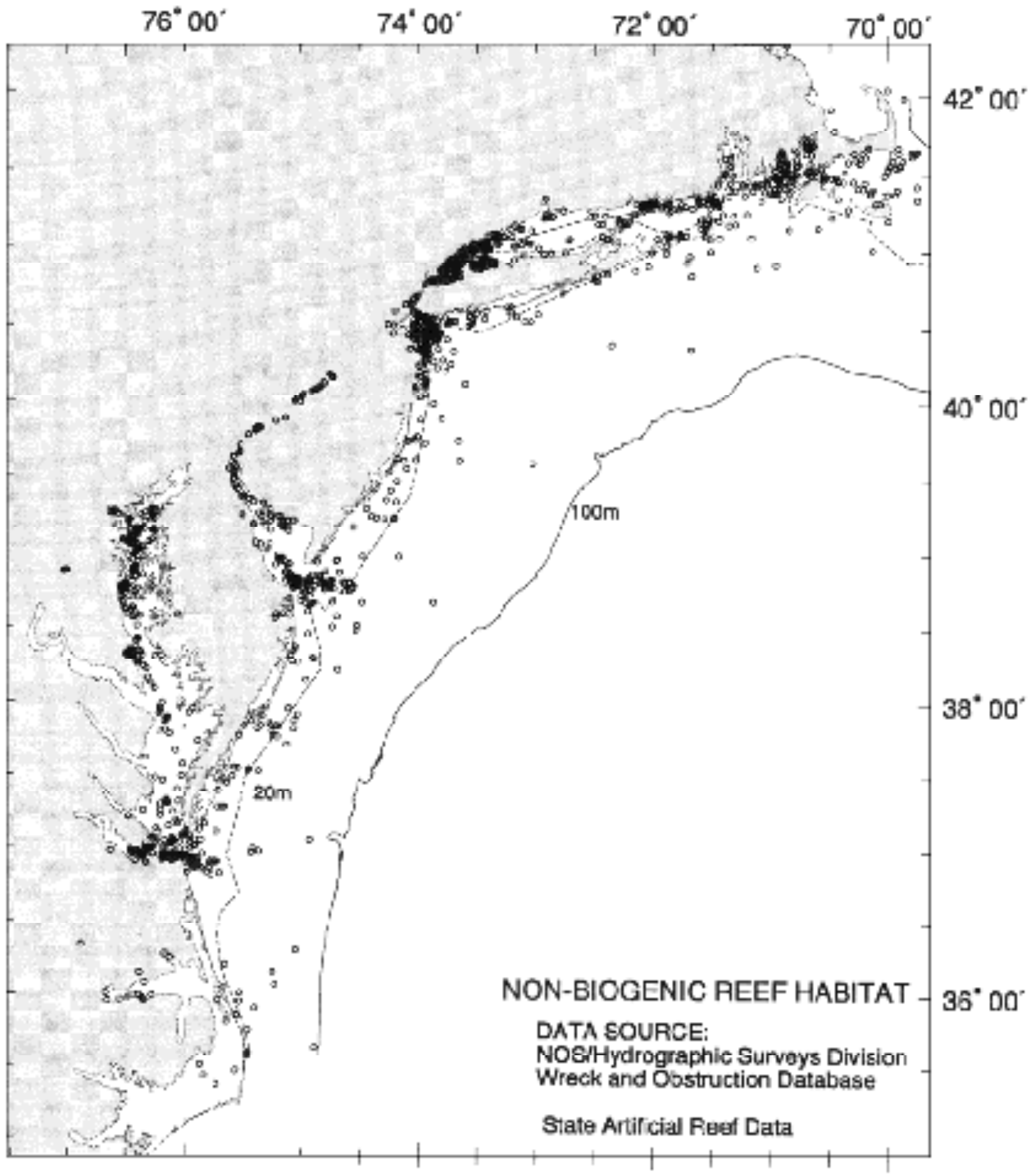


Figure 2.9. Summary of all reef habitats (except biogenic, such as mussel or oyster beds) in the Mid-Atlantic Bight. (Source: Steimle and Zetlin (2000).)

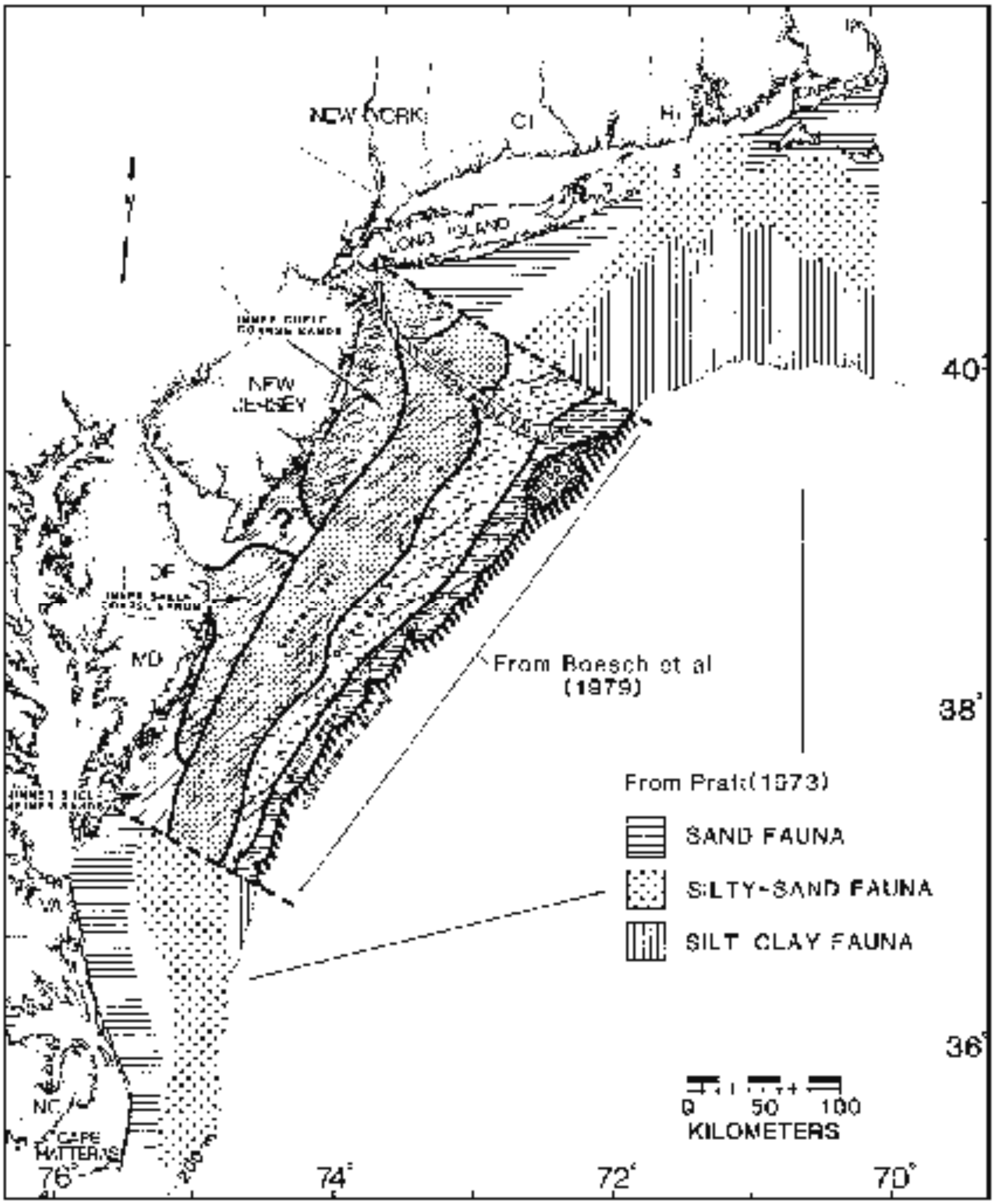


Figure 2.10. Schematic representation of major macrofaunal zones on the Mid-Atlantic shelf. (Approximate location of ridge fields indicated. Source: Reid and Steimle (1988).)

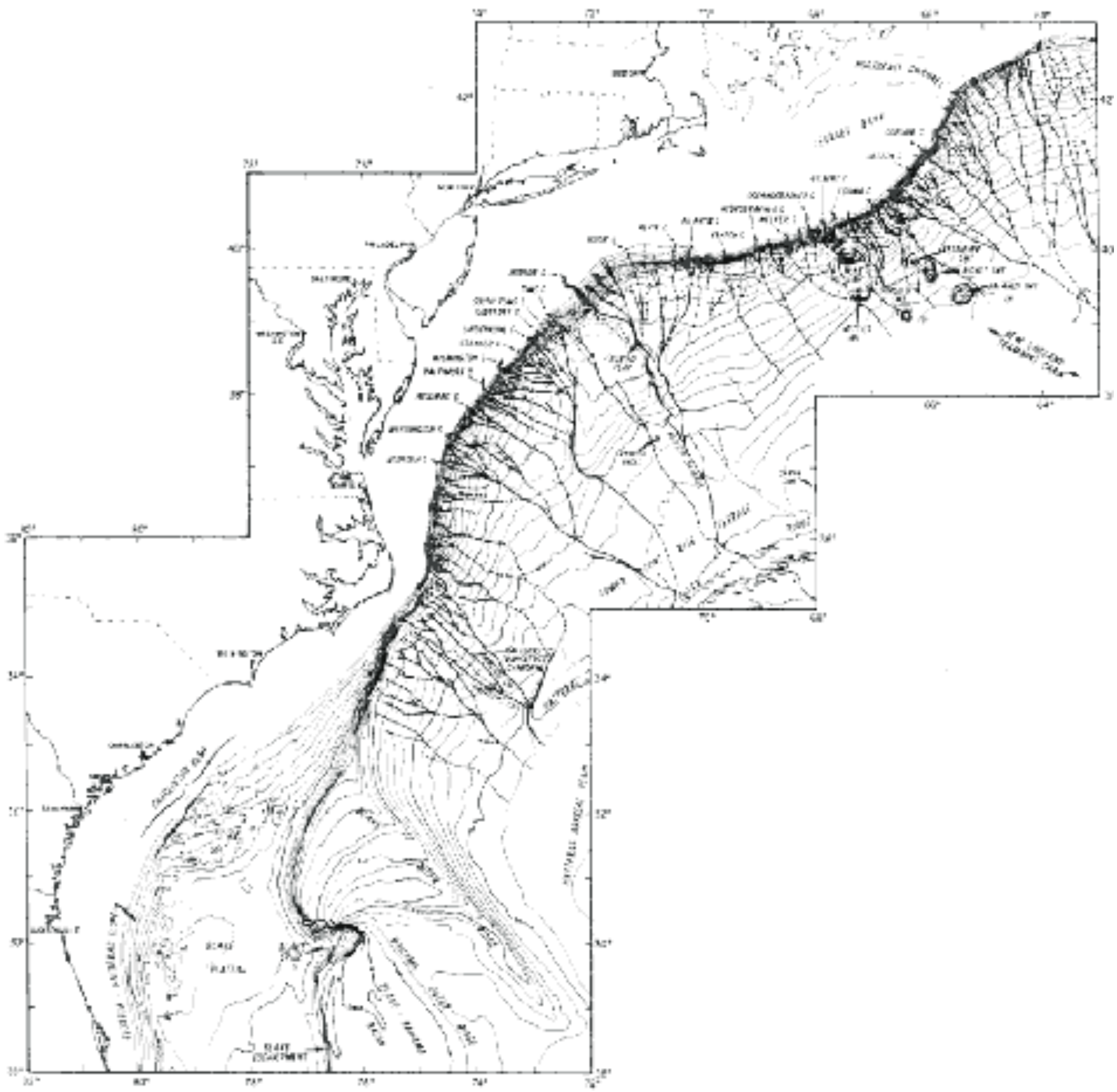
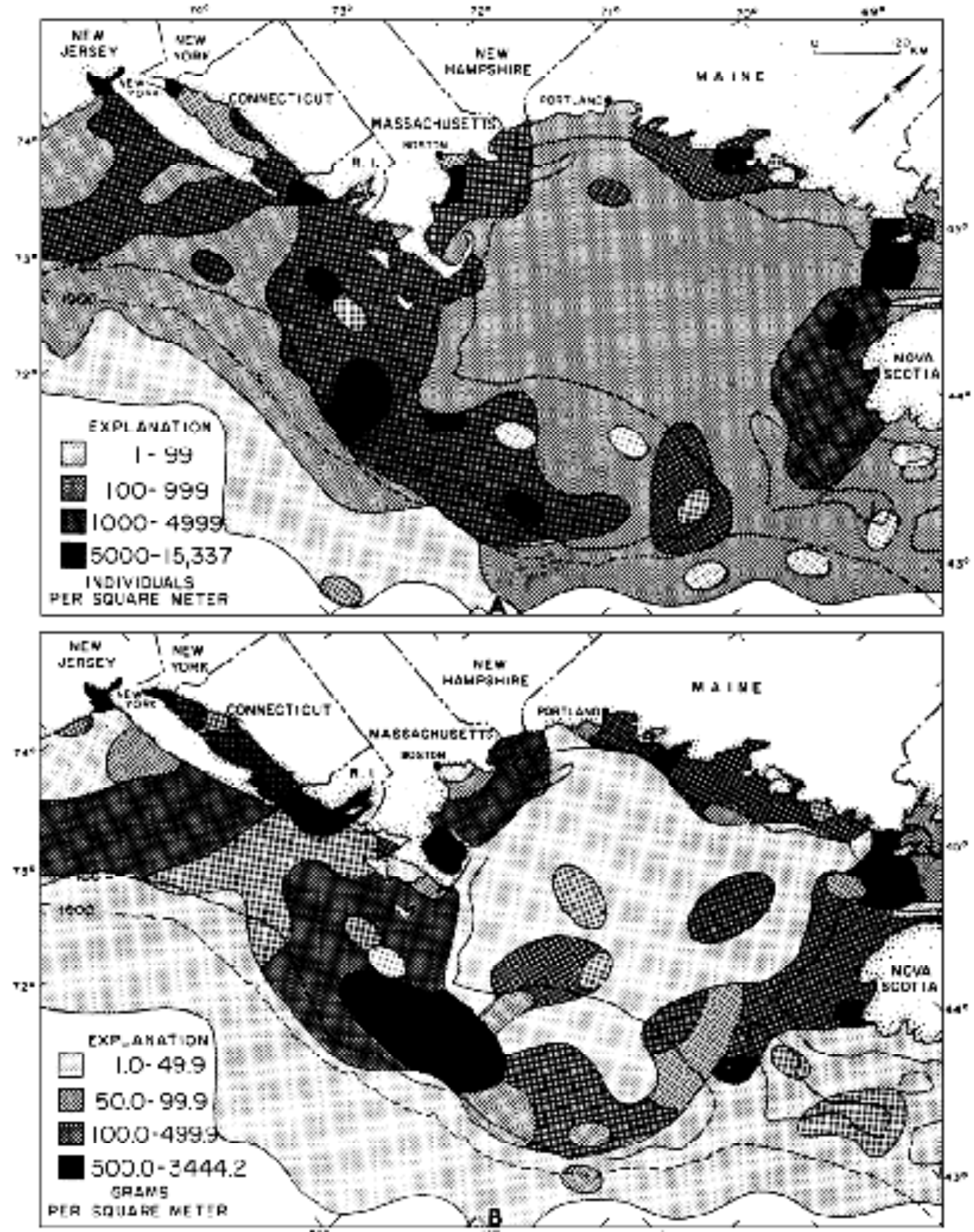


Figure 2.11. Bathymetry of the U.S. Atlantic continental margin. (Contour interval is 200 m below 1000 m of water depth, and 100 m above 1000 m of water depth. Axes of principal canyons and channels are shown by solid lines (dashed where uncertain or approximate). Source: Tucholke (1987).)



ALL TAXA COMBINED

Figure 2.12. Geographic distribution of the density (top) and biomass (bottom) of all taxonomic groups of benthic invertebrates in the New England region, 1956-1965. (Source: Theroux and Wigley (1998).)

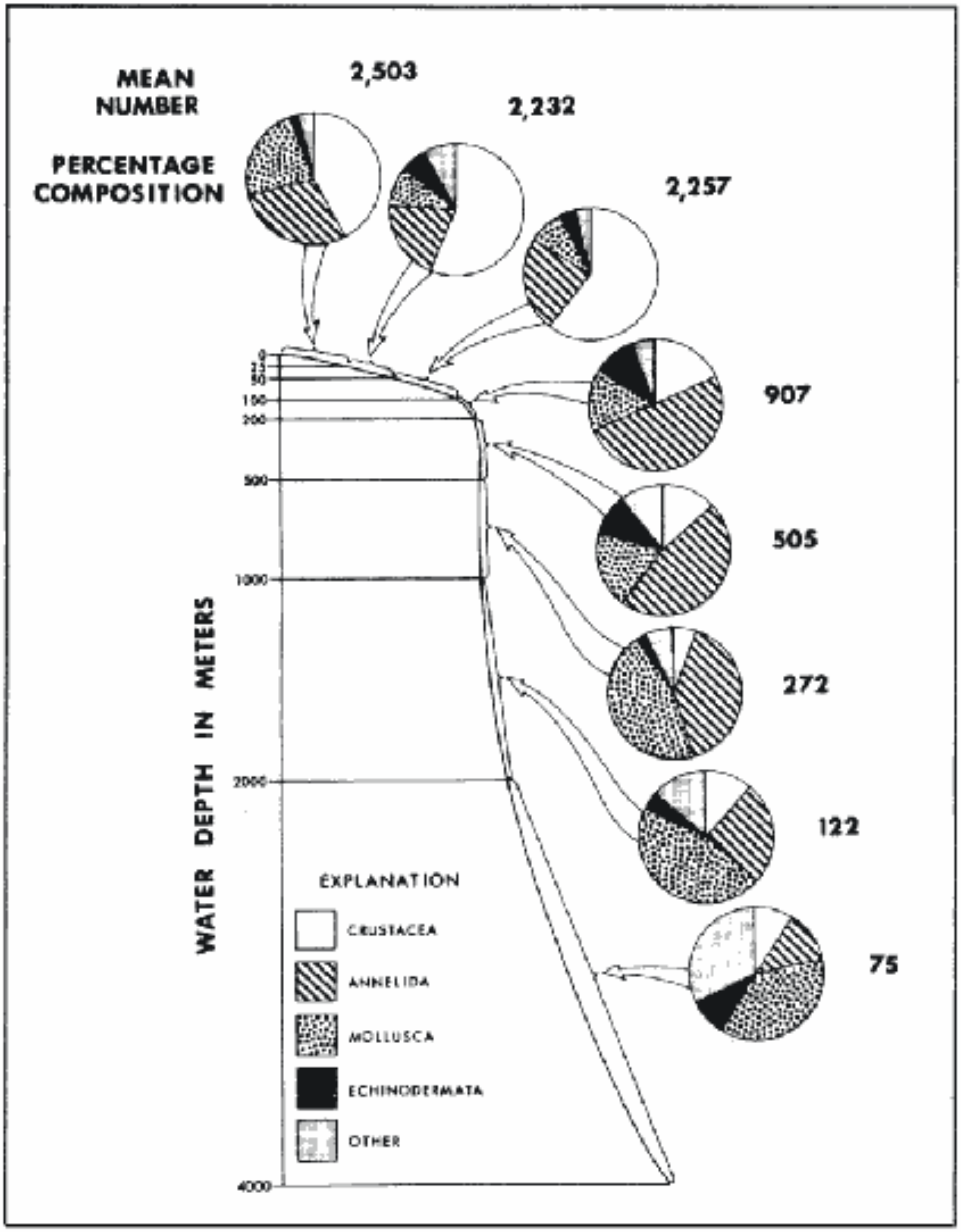


Figure 2.13. Percentage composition (by number of individuals) and density (as mean number of individuals per square meter of bottom area) of the major taxonomic groups of New England benthic invertebrate fauna in relation to water depth. (Source: Theroux and Wigley (1998).)

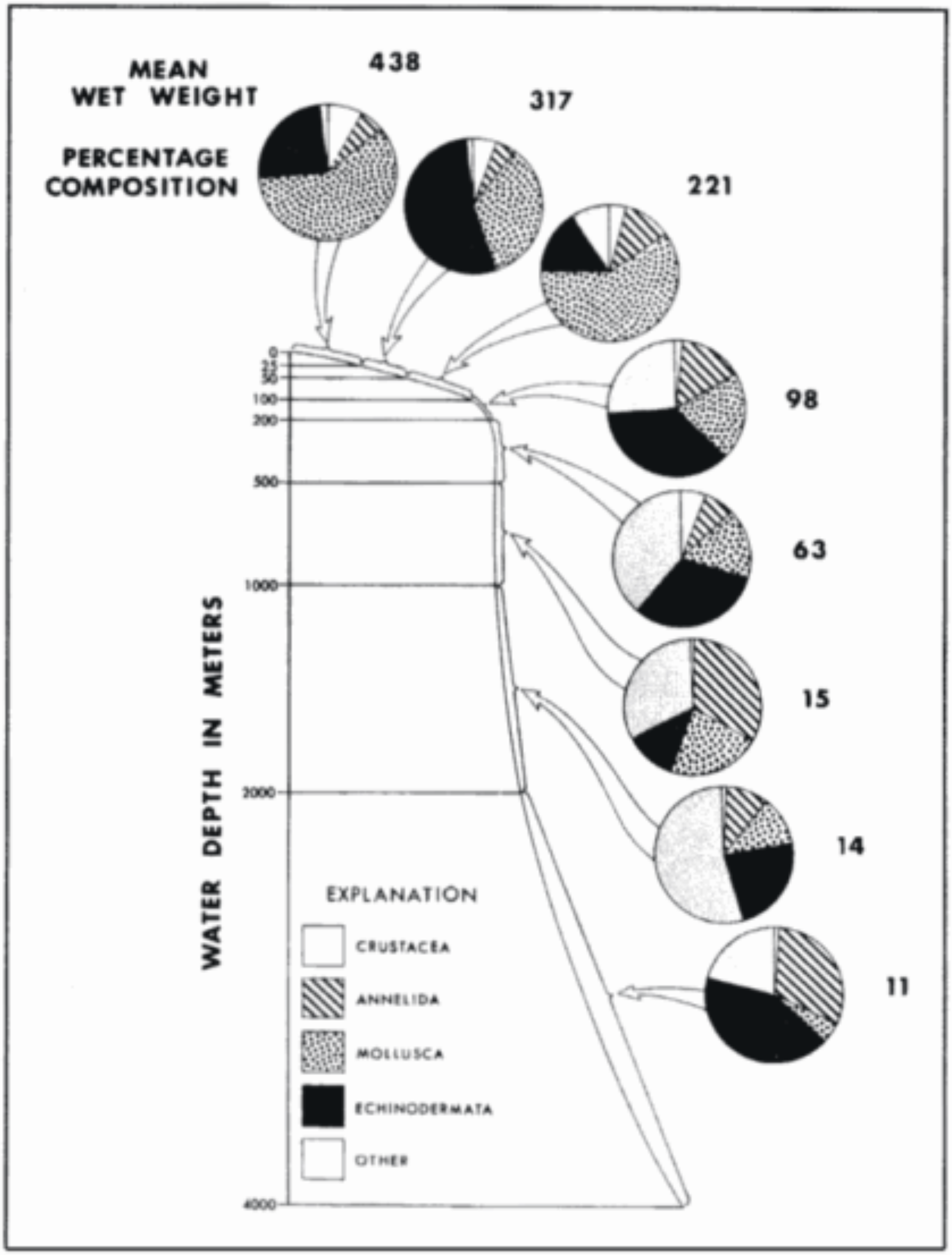


Figure 2.14. Percentage composition (by wet weight) and biomass (as mean wet weight in grams of individuals per square meter of bottom area) of the major taxonomic groups of New England benthic invertebrate fauna in relation to water depth. (Source: Theroux and Wigley (1998).)

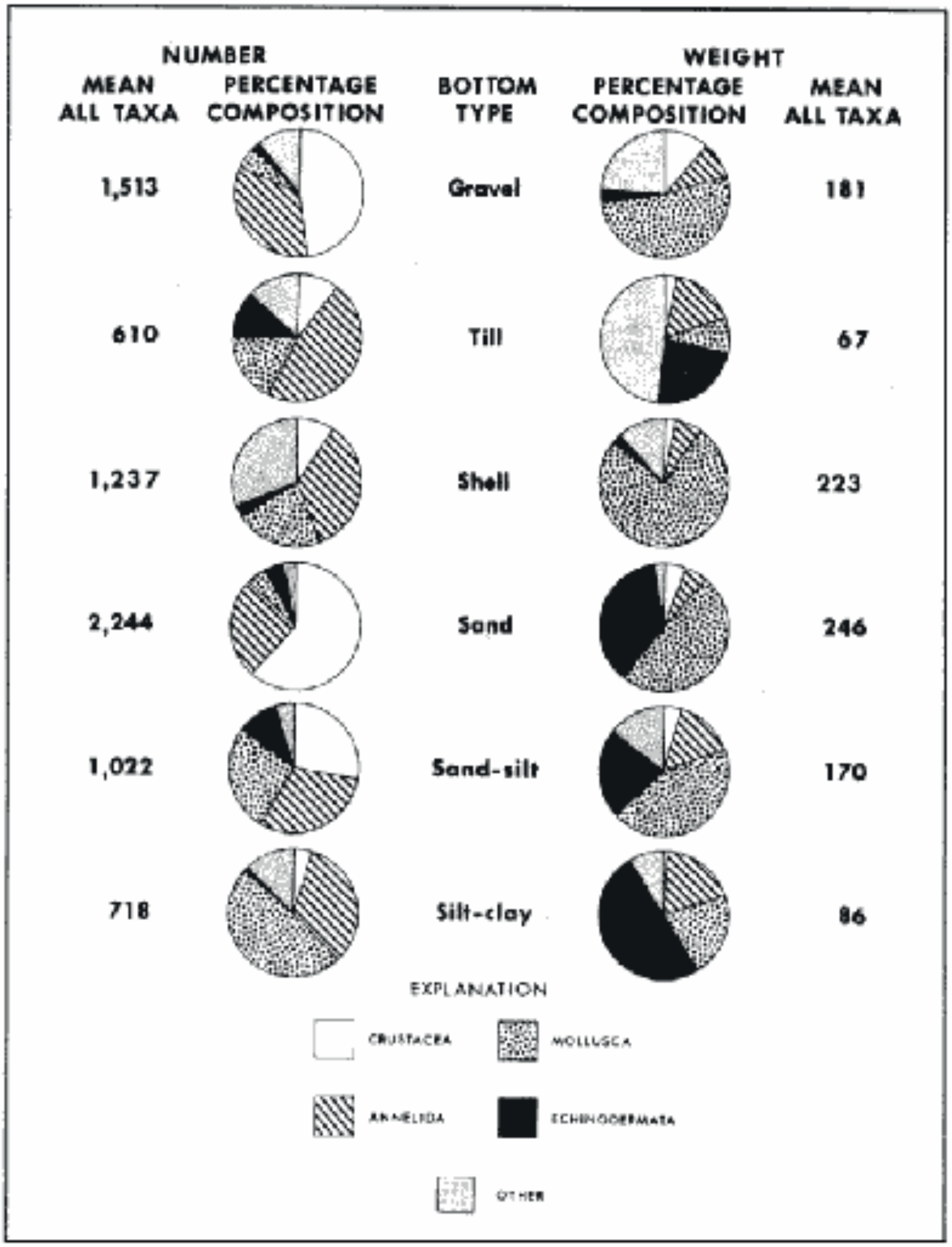


Figure 2.15. Percentage composition (by number of individuals and by wet weight) and density and biomass (as mean number and wet weight (in grams), respectively, of individuals per square meter of bottom area) of the major taxonomic groups of New England benthic invertebrate fauna in relation to bottom type. (Source: Theroux and Wigley (1998).)

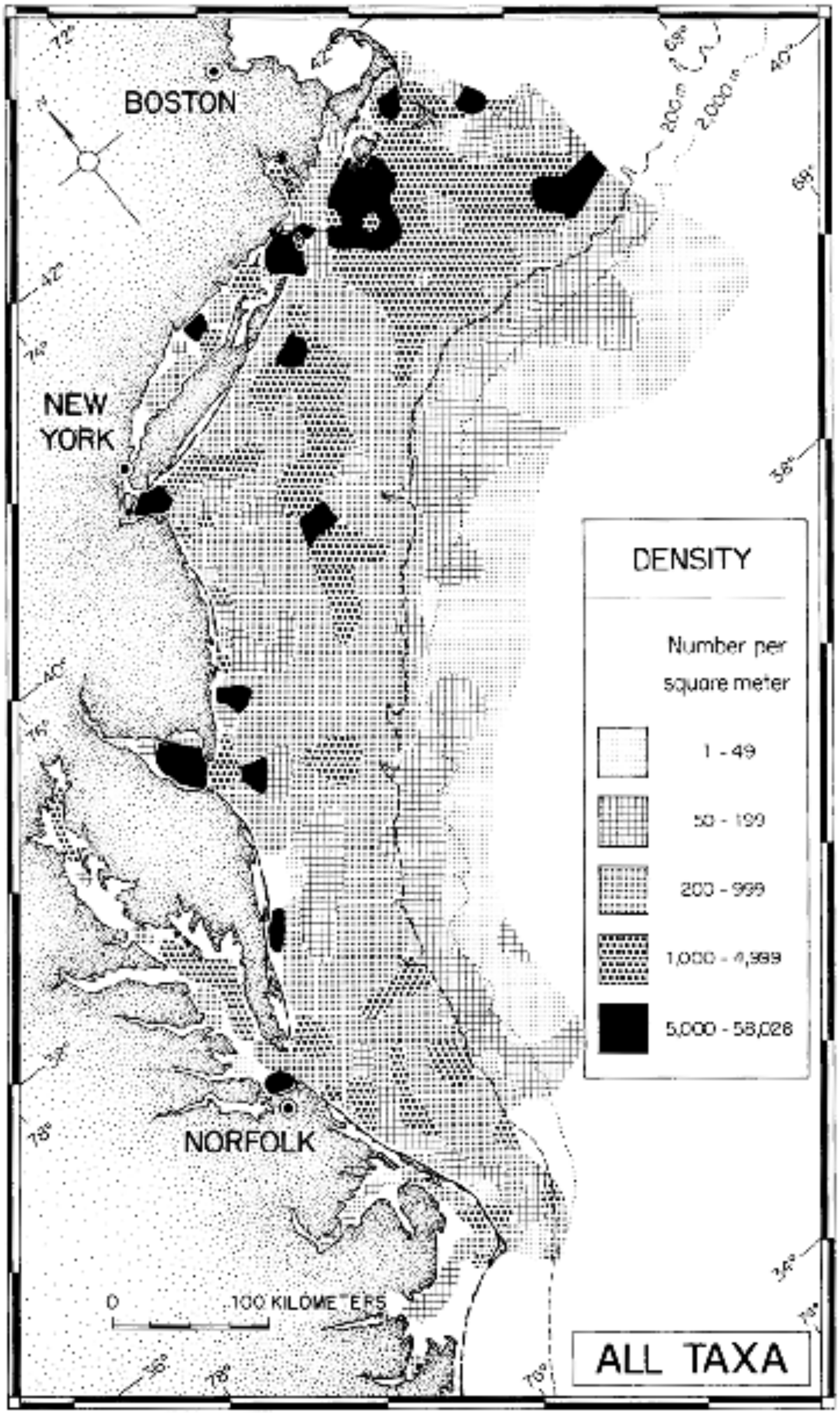


Figure 2.16. Geographic distribution of the density (as mean number of individuals per square meter) of all taxonomic groups of benthic invertebrates in the Mid-Atlantic region, 1956-1965. (Source: Wigley and Theroux (1981).)

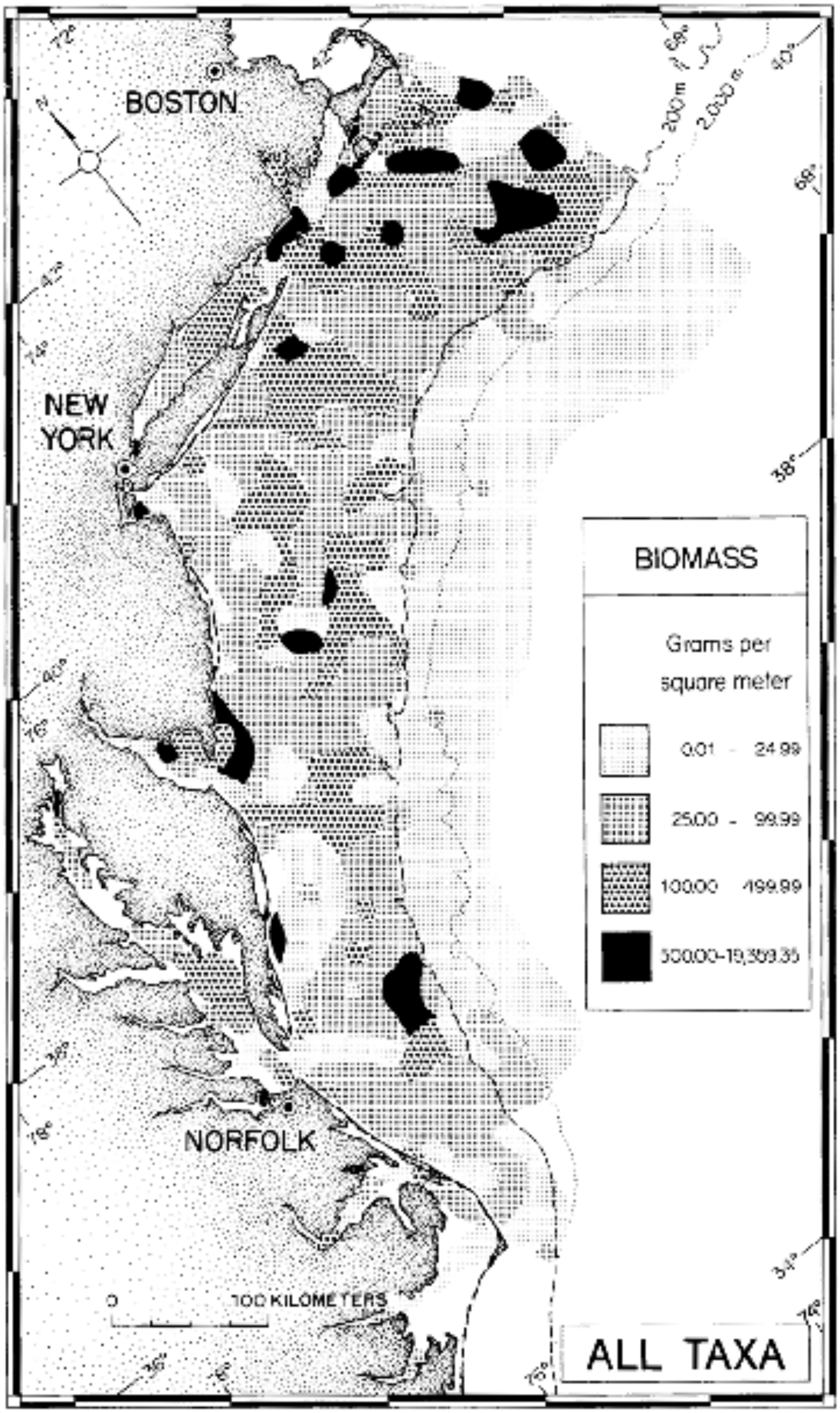


Figure 2.17. Geographic distribution of the biomass (as mean wet weight in grams per square meter) of all taxonomic groups of benthic invertebrates in the Mid-Atlantic region, 1956-1965. (Source: Wigley and Theroux (1981).)

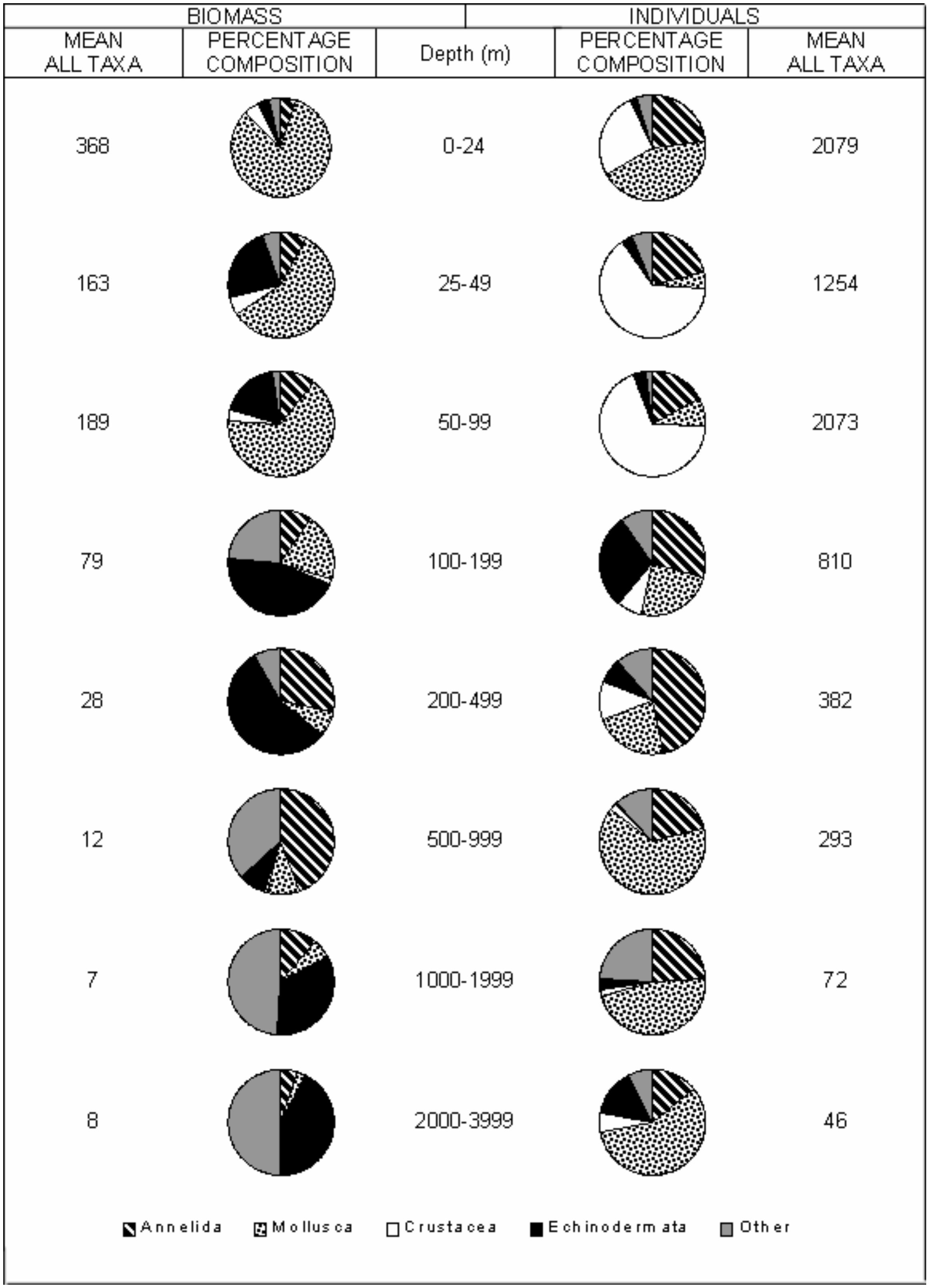


Figure 2.18. Percentage composition (by number of individuals and by wet weight) and density and biomass (as mean number and wet weight (in grams), respectively, of individuals per square meter of bottom area) of the major taxonomic groups of Mid-Atlantic benthic invertebrate fauna in relation to water depth. (Source: Wigley and Theroux (1981).)

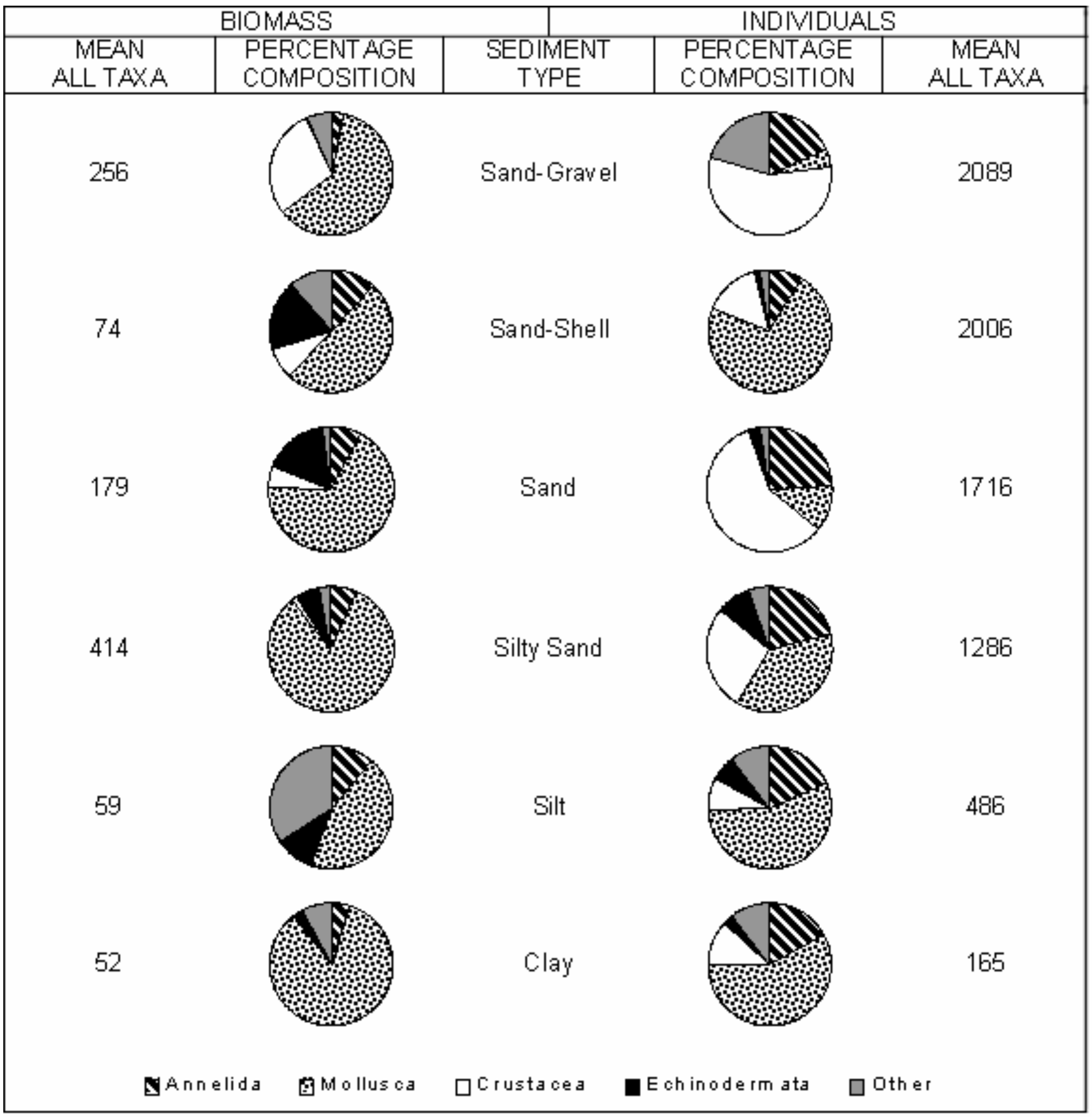


Figure 2.19. Percentage composition (by number of individuals and by wet weight) and density and biomass (as mean number and wet weight (in grams), respectively, of individuals per square meter of bottom area) of the major taxonomic groups of Mid-Atlantic benthic invertebrate fauna in relation to bottom type. (Source: Wigley and Theroux (1981).)

3. FISHING GEAR AND PRACTICES USED IN THE NORTHEAST REGION

The geographical area of responsibility of the Northeast Region also falls variously within the jurisdiction of the New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Council (MAFMC), as well as the individual states from Maine to North Carolina which are represented by the Atlantic States Marine Fisheries Commission (ASMFC). These organizations are responsible for the management of many different fisheries, extending from the upper reaches of rivers and estuaries to the outer limit of the Exclusive Economic Zone, located 200 mi offshore, well beyond the edge of the continental shelf (Figure 2.1). In addition, some federally managed species that are found at certain times of year in the Northeast Region are managed by the South Atlantic Fisheries Management Council.

Fishing gear types used to land 1% or more of any species managed by either the NEFMC or MAFMC are listed in Table 3.1, and gear types that contributed 1% or more of any individual state's total landings for federally and state-managed species are listed in Table 3.2. Although certain gear types used in state waters are not managed by the federal government, they may adversely impact EFH that is designated in nearshore, estuarine, and riverine areas. Consequently, Table 3.3 lists all fishing gear types and harvesting techniques that are identified in Tables 3.1 and 3.2, and indicates whether they are used in estuaries, coastal waters (0-3 mi), or offshore waters (3-200 mi). Since the seafloor is the location of the habitat types most susceptible to gear disturbances, Table 3.3 also indicates which gear types and harvesting techniques contact the bottom, and which ones are regulated under a federal fishery management plan (FMP). This document considers a gear to be regulated under a federal FMP if it is typically utilized to harvest fish under a federal vessel or operators permit. Most of the gear types listed in Table 3.3 are described in this chapter of the document.

Unless otherwise noted by reference in the following descriptions, the information used to describe gear types and fishing practices in the Northeast Region was obtained from four primary sources: Sainsbury (1996), DeAlteris (1998), Everhart and Youngs (1981), and the report of a panel of science and fishing industry representatives on the effects of fishing gear on marine habitats in the region (NREFHSC 2002). Information regarding the use of fishing gears in state waters within the region was extracted from Stephan *et al*. (2000). The gear descriptions in this document are based on information that was available to the authors and, in some cases, are incomplete.

BOTTOM-TENDING MOBILE GEAR

Bottom Trawls

Trawls are classified by their function, bag construction, or method of maintaining the mouth opening. Function, in turn, may be defined by the part of the water column where the trawl operates (*e.g.*, bottom) or by the species that it targets (Hayes 1983). Bottom trawls are designed to be towed along the seafloor and to catch a variety of demersal fish and invertebrate species. Mid-water trawls are designed to catch pelagic species in the water column, and do not normally contact the bottom. They are described under "Pelagic Gear" later in this chapter. Three general types of bottom trawl, are used in the Northeast Region, but one of them, the bottom otter trawl, accounts for nearly all commercial bottom trawling activity.

Otter Trawls

There is a wide range of otter trawl types used in the Northeast Region because of the diversity of fisheries prosecuted and bottom types encountered in the region. The specific gear design is often a result of the target species (*e.g.*, whether they are found on or off the bottom) as well as the composition of the bottom (*i.e.*, smooth versus rough and soft versus hard). Bottom otter trawls are used to catch a variety of species throughout the region and account for a higher proportion of the catch of federally managed species than any other gear type in the region (Tables 3.1 and 3.2).

There are three components of the otter trawl that come in contact with the seafloor: the doors, the ground cables and bridles which attach the doors to the wings of the net, and the sweep which runs along the bottom of the net mouth. The footrope of the net is attached to the sweep. Bottom trawls are towed at a variety of speeds, but average about 5.6 km/hr (3 knots).

Use of this gear in the region is managed under several federal FMPs. Bottom trawling is also subject to a variety of state regulations throughout the region.

Doors

The traditional otter board or door is a flat, rectangular wood structure with steel fittings and a steel "shoe" along the leading and bottom edges that prevents damage and wear of the door as it drags over the bottom. Wooden trawl doors are still in use in the Northeast Region, but they have been largely replaced by heavier, more efficient, steel doors. Two types of steel doors commonly used in the region are the V-shaped "Thyboron" door and the cambered (or curved) "Bison" door (pers. comm.; Alan Blott, National Marine Fisheries Service, North Kingstown, RI). Either type of door can be slotted to allow some water to flow through the door, further increasing its efficiency. Steel "shoes" can be added at the bottom of the door to aid in keeping it upright and take the wear from bottom contact. The sizes and weights of trawl doors used in the Northeast Region vary according to the size and type of trawl, and the size and horsepower of the vessel. Large steel doors (4-5 m^2) weigh between 700 kg and 1 mt.

It is the location on each door at which the towing cable, or "warp," is attached that creates the towing angle, which in turn creates the hydrodynamic forces needed to push the door outward and downward, thus spreading the wings of the net. The nontraditional designs increase the spreading force of the door by increasing direct pressure on the face of the door and/or by creating more suction on the back of the door. On fine-grained sediments, the doors also function to create a silt cloud that aids in herding fish into the mouth of the net. On rocky or more irregular bottom, trawl doors impact rocks in a jarring manner and can jump distances of 1-2 m (Carr and Milliken 1998).

Ground Cables and Bridles

Steel cables are used to attach the doors to the wings of the net. A ground cable runs along the bottom from each door to two other cables (*i.e.*, the upper and lower "bridles") that diverge to attach to the top and bottom of the net wing. The lower bridle also contacts the bottom. In New England, fixed rubber disks ("cookies") or rollers are attached to the ground cables and lower bridles to assist the passage of the trawl over the bottom. For bottom trawling, in very general terms, bridles vary in length from 9 to 73 m (30 to 240 ft), while ground cables vary from 0 to 73 m (0 to 240 ft), depending upon bottom conditions, towing speed, and fish behavior.

Sweeps

Two types of sweep are used on smooth bottom in New England (Mirarchi 1998). In the traditional chain sweep, loops of chain are suspended from a steel cable, with only 2-3 links of the chain touching bottom. Contact of the chain with the bottom reduces the buoyancy of the trawl so that it skims just a few inches above the bottom to catch species such as squid and scup that swim slightly above the bottom. The other type of New England smooth-bottom sweep is used to catch flounder. Instead of a cable, it uses a heavy chain with rubber cookies stamped from automobile tires. This latter type of sweep is always in contact with the bottom. The cookies vary in diameter from 10 to 41 cm (4 to 16 in) and do not rotate (Carr and Milliken 1998).

On rough bottoms, roller and rockhopper sweeps are used (Carr and Milliken 1998). In the roller sweeps, vertical rubber rollers as large as 91 cm (36 in) in diameter are placed at intervals along the sweep. In fact, however, only the "rollers" that are located at or near the center of the sweep actually "roll" over the bottom; because the sweep is shaped in a curve, the others are oriented at increasing angles to the direction of the tow and do not rotate freely as they are dragged over the bottom (pers. comm.; Alan Blott, National Marine Fisheries Service, North Kingstown, RI). In New England, roller sweeps have been largely replaced with "rockhopper" sweeps that use larger fixed rollers, and are designed to "hop" over rocks as large as 1 m in diameter. Small rubber "spacer" disks are placed between the larger rubber disks in both types of sweep. Rockhopper gear is no longer used exclusively on hard-bottom habitats, but is actually quite versatile and is used in a variety of habitat types (Carr and Milliken 1998). The range of footrope/headrope lengths for bottom trawls used in the New England inshore day-boat fleet is 18/12 m (60/40 ft) for smaller (12-m or 40-ft) vessels, and increases up to 42/36 m (140/120 ft) for larger vessels (21 m/70 ft or larger) (pers. comm.; Alan Blott, National Marine Fisheries Service, North Kingstown, RI).

Factors Affecting Area Swept by Bottom Otter Trawls

The area of bottom that is contacted by a bottom otter trawl during a tow is a function of the linear distance covered (a product of the speed of the net over the bottom and the duration of the tow) and the width of the tow path. The width of the tow path is the distance between the doors (*i.e.*, across the mouth of the net) and varies according to the force exerted on the doors, the ground cables, the sweep, and the net as it is towed over the bottom. Nets towed at higher speeds, or that offer more resistance to being towed through the water and over the bottom, are swept back in a more pronounced parabolic shape than nets towed at slower speeds, or nets that offer less resistance. Mirarchi (1998) has estimated that on smooth bottom and at a towing speed of 5.6 km/hr (3 knots), the linear distance between the doors is equal to roughly one-third of the total length of the ground cables, the bridles, and the sweep. Thus, a bottom trawl with a 30-m (100-ft) sweep and 75-m (250-ft) bridles and ground cables on either side of the net would sweep an area 60 m (200 ft) wide.

Some Specific Types of Otter Trawl Used in the Region

A number of different types of bottom otter trawl used in the Northeast Region are specifically designed to catch certain species of fish, on specific bottom types, and at particular times of year. Some of the major differences in bottom trawl design are described here, but these descriptions are not very specific because there are many variations of each basic trawl type, and because detailed information on all the different types of bottom trawl used in the region are lacking. Furthermore, the performance of any bottom trawl (*i.e.*, how it "behaves" as it is towed over the bottom), and the degree to which it contacts and disturbs the bottom during any tow, are affected by a number of factors such as how much trawl wire is set out (relative to the depth), the bottom type and topography, the amount of bottom current, etc.

Flatfish trawls, described by Mirarchi (1998), are designed with a low net opening between the headrope and the footrope and more ground rigging (i.e, rubber cookies and chain) on the sweep. This type of trawl is designed so that the sweep will follow the contours in the bottom, and to get fish like flounders -- that lie in contact with the seafloor -- up off the bottom and into the net. It is used on smooth mud and sand bottoms. A high-rise or fly net with larger mesh has a wide net opening and is used to catch demersal fish that rise higher off the bottom than flatfish (NREFHSC 2002).

Bottom otter trawls used to catch species like scup and squid that swim over the bottom are rigged very lightly, with loops of chain suspended from the sweep (Mirarchi 1998). This gear is designed to skim along the seafloor with only two or three links of each loop of chain touching the bottom (details are described above). This type of trawl is also used on smooth bottoms.

Bottom otter trawls that are used on "hard" bottom (*i.e.*, gravel or rocky bottom), or mud or sand bottom with occasional boulders, are rigged with rockhopper gear. The purpose of the "ground gear" in this case is to get the sweep over irregularities in the bottom without damaging the net. The purpose of the sweep in trawls rigged for fishing on smooth bottoms is to herd fish into the path of the net (Mirarchi 1998).

Small-mesh trawls are used in the Northeast Region to capture northern and southern shrimp, silver hake (whiting), butterfish, and squid. Bottom trawls used to catch northern shrimp in the GOM are smaller than most fish trawls. Footropes range in length from 12 m to over 30 m (40-100 ft), but most are 15-27 m (50-90 ft). Regulations require that northern shrimp trawls may not be used with ground cables, and that the "legs" of the bridles not exceed 27 m (90 ft). These regulations were implemented in order to reduce the amount of area swept during a tow, thus reducing the bycatch of groundfish species. Northern shrimp trawls are also required to have Nordmore grates in the funnel of the net which reduce the retention of groundfish that enter the net. There has been a trend in recent years towards the use of heavier, larger roller and/or rockhopper gear in this fishery (ASMFC 2004).

The raised-footrope trawl was designed especially for fishing for silver hake, red hake, and dogfish. It was designed to provide vessels with a means of continuing to fish for small mesh species without catching groundfish. Raised-footrope trawls can be rigged with or without a chain sweep. If no sweep is used, drop chains must be hung at defined intervals along the footrope. In trawls with a sweep, chains connect the sweep to the footrope. Both configurations are designed to make the trawl fish about 0.45-0.6 m (1.5-2 ft) above the bottom (Carr and Milliken 1998). Although the doors of the trawl still ride on the bottom, underwater video and observations in flume tanks have confirmed that the sweep in the raised-footrope trawl has much less contact with the seafloor than does the traditional cookie sweep that it replaces (Carr and Milliken 1998).

An important consideration in understanding the relative effects of different otter trawl configurations is their weight in water relative to their weight in air. Rockhopper gear is not the heaviest type of ground gear used in this region since it loses 80% of its weight in water (*i.e.*, a rockhopper sweep that weighs 1000 lb on land may only weigh 200 lb in water). Plastic-based gear has the smallest weight-in-water to weight-in-air ratio (approximately 5%). For the same reasons, steel doors are much heavier in water than wooden doors.

Pair Trawls

Bottom pair trawls are towed over the bottom by two vessels, each towing one warp of the net. The mouth of the net is kept open by the outward pull provided by the two boats, so that no otter boards are required. By utilizing the combined towing power of the two vessels, and as no otter boards are needed, a larger net may be worked than would be possible by a single vessel. Alternatively, two vessels of low horsepower can combine to use this method efficiently. Bottom pair trawls are effective at catching demersal species such as cod and flatfish as well as small pelagic species.

This gear is rigged more simply than an otter trawl, with the warps being connected directly to the bridles from each wing of the net. Normally, a greater warp length/water depth ratio than for otter trawling is required because there are no doors to increase the drag of the gear in the water. The additional "scope" allows the warps to tend the bottom for some distance ahead of the bridles, creating a mud cloud that herds fish into the opening of the net. In some operations, ground cables may be rigged ahead of the bridles with weights placed at the connection to the warps.

Pair trawling for groundfish species managed by the NEFMC is currently prohibited.

Danish and Scottish Seines

Danish or long seining, or "anchor dragging," was developed in the 1850s prior to the advent of otter trawling. The Danish seine is a bag net with long wings that includes long warps set out on the seafloor enclosing a defined area. As the warps are retrieved, the enclosed triangular area reduces in size. The warps dragging along the bottom herd the fish into a smaller area, and eventually into the net mouth. The gear is deployed by setting out one warp, then the net, and finally the other warp. On retrieval of the gear, the vessel is anchored. This technique of fishing is aimed at specific schools of fish located on smooth bottom.

In contrast to Danish seining, if the vessel tows ahead while retrieving the gear, then this is referred to as Scottish seining or "fly-dragging." This method of fishing is considered more appropriate for working small areas of smooth bottom, surrounded by rough bottom.

Scottish and Danish seines have been used experimentally in U.S. demersal fisheries. Space conflicts with other mobile and fixed gears have precluded the further development of this gear in the United States, as compared to northern Europe.

This activity is managed under federal FMPs.

Hydraulic Clam Dredges

Atlantic Surfclam and Ocean Quahog Fishery

Hydraulic clam dredges have been used in the Atlantic surfclam fishery for over five decades, and in the ocean quahog fishery since its inception in the early 1970s. The typical dredge is 3.7 m (12 ft) wide and about 6.7 m (22 ft) long, and uses pressurized water jets to wash clams out of the seafloor. Towing speed at the start of the tow is about 4.6 km/hr (2.5 knots), and declines as the dredge accumulates clams. The dredge is retrieved once the vessel speed drops below about 2.8 km/hr (1.5 knots), which can be only a few minutes in very dense beds. However, a typical tow lasts about 15 min. The water jets penetrate the sediment in front of the dredge to a depth of about 20-25 cm (8-10 in) and help to "drive" the dredge forward.The water pressure that is required to fluidize the sediment varies from 50 lb/in^2 (psi) in coarse sand to 110 psi in finer sediments. The objective is to use as little pressure as possible since too much pressure will blow sediment into the clams and reduce product quality. The "knife" (or "cutting bar") on the leading bottom edge of the dredge opening is 14 cm (5.5 in) deep for surfclams and 9 cm (3.5 in) for ocean quahogs. The knife "picks up" clams that have been separated from the sediment and guides them into the body of the dredge ("the cage").

Hydraulic clam dredges can be operated in areas of large-grain sand, fine sand, sand with small-grain gravel, sand with small amounts of mud, and sand with very small amounts of clay. Most tows are made in large-grain sand. Surfclam/quahog dredges are not fished in clay, mud, pebbles, rocks, coral, large gravel >0.5 in, or seagrass beds.

Use of this gear in the region is managed under federal FMPs, and is also regulated in state waters in the Mid-Atlantic region, especially in shallow waters where submerged aquatic vegetation grows.

Softshell Clam Fishery

Hydraulic dredges are also used in the softshell (*Mya arenaria*) fishery in state waters of Maryland and Virginia. In this fishery, the dredge manifold and blade are located just forward of an escalator, or conveyor belt, that carries the clams to the deck of the vessel. Escalator dredges are typically operated from 15-m (49-ft) vessels in water depths of 2-6 m (7-20 ft). This gear cannot be operated in water depths less than one-half the length of the escalator.

Use of the escalator dredge is not managed under federal FMPs. This gear is subject to many of the same state laws and regulations that apply to surfclam and ocean quahog dredges in state waters.

Sea Scallop Dredges

The New Bedford-style scallop dredge is the primary gear used in the Georges Bank and Mid-Atlantic sea scallop fishery, and is very different than dredges utilized in Europe and the Pacific because it has no teeth on its leading edge.

The forward edge of the New Bedford-style dredge includes a cutting bar which rides above the surface of the substrate, creating turbulence that stirs up the substrate and kicks objects (including sea scallops) up from the surface of the substrate into the bag. Shoes on the cutting bar ride along the substrate surface. A sweep chain is attached to each shoe and to the bottom of the ring bag (Smolowitz 1998). The bag, which is made of metal rings with chafing gear on the bottom and of twine mesh on the top, drags on the substrate when fished. Tickler chains run from side to side between the frame and the ring bag, and, in hard-bottom scalloping, a series of rock chains run from front to back to prevent large rocks from getting into the bag. New Bedford-style dredges are typically 4.3 m (14 ft) wide; one or two of them are towed by single vessels at speeds of 4-5 knots (7.4-9.3 km/hr). New Bedford-style dredges used along the Maine coast are smaller. Dredges used on hard bottoms are heavier and stronger than dredges used on sand. Towing times are highly variable, depending on the density of marketable-sized sea scallops at any given location. Tows can be as short as 10 min or as long as 1 hr (pers. comm.; Ron Smolowitz, industry advisor to NEFMC Habitat Committee, Falmouth, MA).

In the Northeast Region, scallop dredges are used in high- and low-energy sand environments, and high-energy gravel environments. Although gravel exists in low-energy environments of deepwater banks and ridges in the GOM, the fishery is not prosecuted there.

The leading edge of scallop dredges used in Europe, Australia, and New Zealand to catch other species of scallop that "dig" into the bottom have teeth that dig into the substrate. A very limited amount of scallop dredging with toothed dredges takes place along the U.S. and Canadian coast of the GOM. These toothed dredges are used by smaller vessels that are not able to tow a New Bedford-style dredge fast enough (4-5 knots) to effectively catch scallops.

The use of scallop dredges in federal waters of the Northeast Region is managed under federal FMPs.

Other Nonhydraulic Dredges

Quahog Dredges

Mahogany quahogs (a colloquial name for ocean quahogs in New England) are harvested in eastern Maine coastal waters using a dredge that is essentially a large metal cage on skis, with 15-cm (6-in) long teeth projecting at an angle off the leading bottom edge (pers. comm.; Pete Thayer, Maine Department of Marine Resources, West Boothbay Harbor, ME). The teeth rake the bottom and lift the quahogs into the cage.

This fishery takes place in small areas of sand and sandy mud found among bedrock outcroppings in depths of 9-76 m (30-250 ft) in state and federal coastal waters north of 43°20' N latitude. These dredges are used on small boats (approximately 9-12 m (30-40 ft) long). Because water pressure is not used to dislodge the clams from the seafloor, all the power required to pull these dredges forward is provided by the boat's engine.

This dredging activity is managed under a federal FMP. Maine state regulations limit the length of the cutter bar to 91 cm (36 in).

Oyster, Crab, Mussel, and Whelk Dredges

The oyster dredge is a toothed dredge consisting of a steel frame 0.5-2.0 m (2-7 ft) wide, a tow chain or wire attached to the frame, and a bag to collect the catch. The teeth are 5-10 cm (2-4 in) in length. The bag is constructed of rings and chain links on the bottom to reduce the abrasive effects of the seafloor, and of twine or webbing on top. In the Northeast Region, oyster dredges are used in state waters from Connecticut to North Carolina to harvest the eastern oyster (*Crassostrea virginica*).

Blue crabs (*Callinectes sapidus*) are harvested with dredges (or "scrapes") similar to oyster dredges in state waters in New York, New Jersey, Delaware, Virginia, and North Carolina. Stern-rig dredge boats (approximately 15 m (49 ft) long) tow two dredges in tandem from a single chain warp. The dredges are equipped with 10-cm (4-in) long teeth that rake the crabs out of the bottom.

Dredges are also used to harvest blue mussels (*Mytilus edulis*) in state waters of Maine and Massachusetts, and to harvest channeled and knobbed whelks (*Busycon canaliculatus* and *B. carica*, respectively) in New York, Delaware, and Virginia.

These dredging activities are not managed under federal FMPs. The design and use of crab and shellfish dredges are subject to various restrictions in state waters.

Bay Scallop Dredges

The bay scallop (*Argopecten irradians*) dredge may be 1.0-1.5 m (3.3-4.9 ft) wide and about twice as long. The simplest bay scallop dredge can be just a mesh bag attached to a metal frame that is pulled along the bottom. For bay scallops that are located on sand and pebble bottom, a small set of raking teeth is set on a steel frame, and skids are used to align the teeth and the bag. Bay scallop dredges are used in state waters of Massachusetts, Rhode Island, New York, and North Carolina.

This dredging activity is not managed under federal FMPs.

Sea Urchin Dredges

Similar to a simple bay scallop dredge, the sea urchin dredge is designed to avoid damaging the catch. It has an upturned, sled-like shape at the front that includes several automobile leaf springs tied together with a steel bar. A tow bail is welded to one of the springs and a chain mat is rigged behind the mouth box frame. The frame is fitted with skids or wheels. The springs act as runners, enabling the sled to move over rocks without hanging up. The chain mat scrapes up the urchins. The bag is fitted with a cod-end for ease of emptying. This gear is generally used in depths up to 27.5 m (90 ft). Sea urchin dredges are used in state waters in the GOM to harvest green sea urchins (*Strongylocentrotus drobachiensis*).

This dredging activity is not managed under federal FMPs.

Seines

Beach Haul Seines

The beach seine resembles a wall of netting of sufficient depth to fish from the sea surface to the seafloor, with mesh small enough that the fish do not become "gilled." A floatline runs along the top to provide floatation, and a leadline with a large number of attached weights runs along the bottom to ensure that the net maintains good contact with the bottom. Tow lines are fitted to both ends.

The use of a beach seine generally starts with the net on the beach. One end is pulled away from the beach, usually with a small skiff or dory, and is taken out and around and finally back to shore. Each end of the net is then pulled in towards the beach, concentrating the fish in the middle of the net. The middle of the net is eventually brought onshore as well, and the fish are removed. This gear is generally used in relatively shallow inshore areas.

This activity is not managed under federal FMPs.

Long Haul Seines

The long haul seine is set and hauled in shallow estuarine and coastal areas by one or two boats. The net is a single wall of small-mesh netting (*i.e.*, <5 cm (2 in) as stretched mesh) that is usually >400 m (1310 ft) long and about 3 m (10 ft) deep. In a single-boat operation, one end of the net is attached to a pole driven into the bottom, and the net is set in a circle. After closing the circle, the net is hauled into the boat, reducing the size of the circle, and concentrating the fish. Finally, the live fish are brailed or dipnetted out of the net. In two-boat operations, the net is set as the boats travel in opposite directions, in a circle, from the same starting point. When the net is all out, the boats turn on the same course and pull the seine for some distance before they come together to close the net.

This activity is not managed under federal FMPs.

Stop Seines

The stop-seine fishery evolved from the traditional weir fishery for Atlantic herring in Maine (see "Trap Nets" later in this chapter) and involves the setting of nets across a cove with a narrow entrance after the herring enter, thus blocking their escape. Once the fish are "shut off," the fishermen wait until the fish enter a small "pocket" in the net. Once they enter the pocket, they are removed with a small purse seine and transferred to boats called "carriers" which bring the catch ashore (NOAA/NMFS 2005). This gear is not used much any more (ASMFC 1999a).

This activity is not managed under federal FMPs.

BOTTOM-TENDING STATIC GEAR

Pots

Pots are small, portable, rigid traps that fish and invertebrates enter through small openings, with or without enticement by bait, but can only leave with difficulty. They are used to capture lobsters, crabs, black sea bass, eels, and other bottom-dwelling species seeking food or shelter. Pot fishing can be divided into two general classifications: 1) inshore potting in estuaries, lagoons, inlets, and bays in depths up to about 75 m (250 ft); and 2) offshore potting using larger and heavier vessels and gear in depths up to 730 m (2400 ft) or more.

Lobster Pots

Originally, pots used to harvest American lobster (*Homarus americanus*) were constructed of wooden laths with single, and later, double, funnel entrances made from net twine. Today, almost all of the pots are made from coated wire mesh. They are rectangular and are divided into two sections, the "kitchen" and the "parlor." The kitchen has an entrance on both sides of the pot and is baited. Lobsters enter either chamber then move to the parlor through a long, sloping tunnel to the parlor. Escape vents are installed in both areas of the pot to minimize the retention of sublegal-sized lobsters. Rock crabs (*Cancer* spp.) are also harvested in lobster pots.

Lobster pots are fished as either a single pot per buoy, two or three pots per buoy, or strung together in "trawls" of up to 100 pots. Single pots are often used in rough, hard-bottom areas where lines connecting pots in a trawl line tend to foul on bottom structure. They are fished in trawls on flatter types of bottom. The area of bottom that comes in contact with a single trap during the setting and hauling process is small, but the cumulative effect of several million pots being set and hauled several times a week may be significant (Smolowitz 1998). The total number of traps used in the lobster fishery increased from just over one million in 1970 to over four million in 1998 (ASMFC 2000). According to NREFHSC (2002), important features of lobster pots and their use are the following:

- About 95% of lobster pots are made of plastic-coated wire.
- Pots in trawls are connected by "mainlines" which either float off the bottom, or, in areas where they are likely to become entangled with marine mammals, sink to the bottom.
- Soak time depends on season and location — usually 1-3 days in inshore waters in warm weather, but up to several weeks in colder waters.
- Offshore pots are larger (>1.2 m (4 ft) long) and heavier [~45 kg (100 lb)] than inshore pots, with an average of about 40 pots per trawl. They are usually deployed for 1 wk at a time.

Although the offshore component of the fishery is regulated under federal rules, American lobster is not managed under a federal FMP.

Fish Pots

Fish pots used to catch black sea bass, ocean pout, and scup (Table 3.1) are similar in design to lobster pots, and are usually fished singly or in trawls of up to 25 pots and in shallower waters than offshore lobster pots or red deepsea crab pots. Pots may be set and retrieved 3-4 times per day when fishing for scup.

Atlantic hagfish (*Myxine glutinosa*) pots are 55-gal plastic barrels with 3-6 entrance funnels and several rows of approximately 1-cm (3/8-in) escape holes. They are set 45-63 m (150-210 ft) apart to depths of 90-282 m (300-930 ft). Small boats fish 20-40 traps in a string, hauling several times per trip, and larger vessels fish 80-200 traps in a string, hauling 1-2 times per day. Soak time varies from 6 to 24 hr. The captain of a 26-m (85-ft) hagfish boat reported that he sets and hauls 1,000 traps (five sets of 200 traps) on each 5-day trip (NEFSC 2004).

Cylindrical pots are typically used for capturing American eels (*Anguilla rostrata*) in rivers and estuaries; however, half-round and rectangular pots are also used. They are hauled and set in a manner similar to that of lobster pots.

The use of fish pots in the black sea bass, scup, and ocean pout fisheries is managed under federal FMPs. Atlantic hagfish and American eel fishing activities in the region are not managed under federal FMPs.

Crab Pots

Crab pots are used in inshore coastal and estuarine waters in the Mid-Atlantic states to catch blue crabs (*Callinectes sapidus*). These pots typically consist of wire mesh. A horizontal wire partition divides the pot into an upper and lower chamber. The lower chamber is entered from all four sides through small wire tunnels. The partition bulges upward in a fold about 20 cm (8 in) high for about one-third of its width. In the top of the fold are two small openings that give access to the upper chamber. These crab pots are always fished as singles, and are hauled by hand in small boats, or by a pot hauler in larger boats. They are generally fished after an overnight soak, except early and late in the season. These pots are also effective for American eels. This activity is not managed under a federal FMP.

For red deepsea crabs (*Chaceon quinquedens*), the traditional-style pots are wood and wire traps that are 1.2 m long, 0.75 m wide, and 0.5 m high (48 x 30 x 20 in) with a top entry. A second style of pot used in this fishery is conical in shape, 1.3 m (4 ft) in diameter, and 0.45 m (22 in) high with a top-entry funnel. According to information provided in the 2002 red crab FMP (NEFMC 2002), vessels use an average of 560 pots that are deployed in trawls of 75-180 pots per trawl along the continental slope at depths of 400-800 m (1300-2600 ft). The pots are transported to and from the fishing grounds during each trip and are generally hauled daily. The vessels are large, typically measuring 27-46 m (90-150 ft) long. There are six vessels engaged in this fishery, which is managed by the NEFMC.

Whelk Pots

Wood and wire pots are used in southern Massachusetts waters to catch whelks, primarily the channeled whelk (pers. comm.; Frank Germano, Massachusetts Division of Marine Fisheries, New Bedford, MA). The pots are fished singly or in trawls with as many as 40 pots to a trawl in depths of 1.5-27 m (5-90 ft). They are set mostly on sandy bottom, often in or near seagrass beds. They are open at the top and baited, mostly with horseshoe crabs. Whelk pots are also used in coastal waters off New Jersey, Delaware, Maryland, and Virginia.

This activity is not managed under federal FMPs.

Trap Nets

A trap net is generally a largescale device that uses the seabed and sea surface as boundaries for the vertical dimension. The gear is installed at a fixed location for a season, and is passive, as the animals voluntarily enter the gear. Trap nets are used in nearshore areas through which fish regularly move or congregate. They are of varying size and configuration and rely for their effectiveness on preventing fish from leaving the trap once they have entered it. They are made of a leader or fence that directs fish into the trap, and a heart, or parlor, that leads fish via a funnel into the bay or trap section where the fish are held until they are harvested by the fishermen. Four specific types of trap net are described in this document.

Fish Pound Nets

Pound nets are constructed of netting that is attached to piles or stakes driven into the seafloor. Pound nets have three sections: the leader, the heart, and the pound. The leader (there may be more than one) may be as long as 400 m (1300 ft), and is used to direct fish into the heart(s) of the net. One or more hearts are used to further funnel fish into the pound and prevent escapement. The pound, which may be as large as a 15-m (49-ft) square, holds the fish until the net is emptied. The pocket usually has a netting floor; the fish are concentrated for “brailing” (a “brailer” is a very large dip net) by gradually bringing the sidewalls and bottom netting into boats working inside the pocket. These nets are generally fished in waters <50 m (160 ft) deep. A number of federally managed species are harvested in pound nets (Table 3.1).

This activity is not managed under a federal FMP.

Fyke Nets

Constructed of a series of wood or metal hoops covered with netting, fyke nets are 2.5-5.0 m (8.2-16.4 ft) long. There are usually two wings of netting at the entrance which are attached to upright stakes and give the overall net a "Y-shape." (Fyke nets that don't have wings are also called hoop nets). There are one or more funnels inside the net that direct fish to the rear of the net (the "car") where they become trapped. Occasionally, a long leader is used to direct fish to the entrance. Fish are removed by lifting the car out of the water and loosening a rope securing the rear of the car. These nets are generally fished in shallow water and used in river fisheries.

Fyke net fishing activity is not managed under a federal FMP.

Weirs

A weir is a simple maze that intercepts species that migrate along the shoreline. Weirs are used in the juvenile Atlantic herring fishery in eastern Maine and New Brunswick (Bay of Fundy) where the tides are extreme. At low tide, closely spaced wooden stakes are driven into the bottom. In the traditional style of weir, brush is interwoven between the stakes to form a barrier. Traps formed of netting have largely replaced the wooden weirs. The fish encounter the lead that they follow to deeper water, finally passing into an enclosure or "pound." Once they are concentrated in the "pocket," the fish are removed with a small purse seine. There are very few weirs currently in use in Maine (ASMFC 1999a).

This activity is not managed under a federal FMP.

Floating Traps

In New England, much of the shoreline and shallow subtidal environment is rocky, and stakes cannot be driven into the bottom. Therefore, a floating trap can be designed to fish from top to bottom, and be built to suit the individual location. The webbing of such traps is supported at the sea surface with floats, and held in place on the seafloor with large anchors. The net is usually somewhat "T-shaped," with the long portion of the net (*i.e.*, the leader) designed to direct fish into a box of net at the top of the T. The leader is often made fast to a ring bolt ashore. The catch, design elements, and scale of these floating traps are similar to pound nets.

This activity is not managed under a federal FMP.

Bottom Gill Nets

A gill net is a large wall of netting which may be set at or below the surface, on the seafloor, or at any depth between. They are equipped with floats at the top and lead weights along the bottom. Bottom gill nets are anchored or staked in position. Fish are caught as they try to pass through the net meshes. Gill nets are highly selective because the species and sizes of fish caught are highly dependant on the mesh size of the net. They are used to catch a wide range of species, including many federally managed species (Table 3.1).

Sink/Anchor Gill Nets

Gill nets have three components: leadline, netting, and floatline. Leadlines used in New England are 30 kg (65 lb) per net; leadlines used in the Mid-Atlantic are slightly heavier. The netting is monofilament nylon, and the mesh size varies depending on the target species. Nets are anchored at each end, using materials such as pieces of railroad track, sash weights, or Danforth anchors. Anchors and leadlines have the most contact with the bottom. Individual gill nets are typically 91 m (300 feet) long and 3.6 m (12 ft) high. Strings of nets may be set out in straight lines, often across the current, or in various other configurations (*e.g.*, circles), depending upon bottom and current conditions. Bottom gillnet fishing occurs in the Northeast Region in nearshore coastal and estuarine waters as well as offshore on the continental shelf.

In New England, bottom gill nets are fished in strings of 5-20 nets attached end to end. They are fished in two different ways, as "standup" and "tiedown" nets (Williamson 1998). Standup nets are used to catch Atlantis,c cod, haddock, pollock, and hake and are soaked for 12-24 hr. Tiedown nets are set with the floatline tied to the leadline at 1.8-m (6-ft) intervals, so that the floatline is close to the bottom, and the net forms a limp bag between each tie. They are left in the water for 3-4 days, and are used to catch flounders and goosefish (monkfish). Bottom gill nets in New England are set in relation to changes in bottom topography or bottom type where fish are expected to congregate. Other species caught in bottom gill nets in New England are spiny dogfish, and skates (Table 3.1).

In the Mid-Atlantic, sink gill nets are fished singly or in strings of just 3-4 nets (pers. comm.; Glenn Salvador, National Marine Fisheries Service, Lewes, DE). The Mid-Atlantic fishery is more of a "strike" type fishery in which nets are set on schools of fish or around distinct bottom features and retrieved the same day, sometimes more than once. They catch species such as bluefish, Atlantic croaker, striped bass, spot, mullet, spiny and smooth dogfish and skates.

The use of sink gill nets in federal waters is managed under federal FMPs. The use of gill nets is restricted or prohibited in some state waters in the region.

Stake Gill Nets

Generally, stake gill nets are used inshore. A small boat is used to set the net across a tidal flow, and to lift it at slack tide for removing fish. Wooden or metal stakes run from the surface of the water into the sediment and are placed every few meters along the net to hold it in place. When the net is lifted, the stakes remain in place. Stake gill nets are used in the Mid-Atlantic states to catch red drum, bluefish, king mackerel, and Spanish mackerel (Table 3.1).

These activities are not managed under federal FMPs.

Run-Around Gill Nets

The run-around gill net is used in shallow, nearshore areas to encircle schools of fish. They are set rapidly from the stern of small, fast boats. The leadline contacts the bottom, thus preventing the fish from escaping. Run-around gill nets are used in the Northeast Region to catch red drum (Table 3.1).

Use of this type of gill net is not managed under federal FMPs.

Bottom Longlines

A longline is a long length of line, often several miles long, to which short lengths of line ("gangions") carrying baited hooks are attached. Longlining for bottom species on continental shelf areas and offshore banks is undertaken for a wide range of species. The two primary federally managed species caught with this gear in 2004 in the Northeast Region were golden tilefish and redfish (Table 3.1). Bottom longlines are also referred to as "trot" lines and are used in the Mid-Atlantic states to harvest blue crabs.

Bottom longline fishing in the Northeast Region is conducted with hand-baited gear that is stored in tubs ("tub trawls") before the vessel goes fishing, and with vessels equipped with automated "snap-on" or "racking" systems. The gangions are 38 cm (15 in) long and 0.9-1.8 m (3-6 ft) apart. The mainline, hooks, and gangions all contact the bottom. In the Cape Cod (Massachusetts) longline fishery, up to six individual longlines are strung together, for a total length of about 460 m (1500 ft), and are deployed with 9-11 kg (20-24 lb) anchors. Each set consists of 600-1200 hooks. In tub trawls, the mainline is parachute cord; stainless steel wire and monofilament nylon gangions are used in snap-on systems (Leach 1998). The gangions are snapped to the mainline as it pays off a drum, and removed and rebaited when the wire is hauled. In New England, longlines are usually set for only a few hours at a time in areas with attached benthic epifauna. Longlines used for tilefish are deployed in deep water, may be up to 40 km (25 mi) long, are stainless steel or galvanized wire, and are set in a zigzag fashion .

These activities are managed under federal FMPs.

PELAGIC GEAR

Mid-Water Trawls

Mid-water trawls are used to capture pelagic species throughout the water column. For nets used on single boats, the net is spread horizontally with two large metal doors positioned in front of the net. A common type of type of mid-water trawls used in the Atlantic herring and Atlantic mackerel fisheries is the "rope" trawl. The forward portion of these nets is constructed of a series of ropes that extend back to very large meshes in the forward portion of the net that become progressively smaller toward the rear of the net. In the second type of net, instead of ropes, the large meshes begin immediately in the forward portion of the net. The large opening of the net functions to "herd" schooling fish toward the rear of the net (see *www.gma.org*, the website of the Gulf of Maine Research Institute). Once the net is deployed, changes in its position in the water column (height above the bottom) are made by increasing or decreasing the speed of the vessel or by bringing in or letting out trawl wire (NOAA/NMFS 2005). An electronic sonar system mounted in the mouth of the net allows the fisherman to continually monitor the size of the net opening and the height of the net above the bottom during each tow. In most cases, two heavy weights (*e.g.*, "balls"of heavy chain each weighing 1000-5000 pounds) are attached forward of the net to cables that extend from the net opening to the trawl doors. This is done while fishing in deep water to get the net closer to the bottom without using as much trawl wire. Schools of fish are located by means of directional sonar systems. Mid-water trawls may occasionally contact the bottom if the target species remain near the bottom (NOAA/NMFS 2005).

Tows typically last for several hours and catches are large. The fish are usually removed from the net while it remains in the water alongside the vessel by means of a suction pump. In some cases, the fish are removed from the net by repeatedly lifting the cod end aboard the vessel until the entire catch is in the hold.

The use of mid-water trawls is managed under federal FMPs.

Paired Mid-Water Trawls

Mid-water trawls that are towed by two vessels are called "pair" trawls. Pair trawls used in the Atlantic herring fishery are designed identically as single boat mid-water trawls, but do not have doors, since the net is spread by the two vessels. Pair trawls are also used to catch Atlantic mackerel (Table 3.1). The nets can be towed more efficiently by two vessels because of their combined towing power and because there are no doors. Pelagic pair trawling has proved particularly successful in catching fish schooling near the surface or in shallower areas where noise from the two vessels herds fish into the path of the net. Noise produced by a single vessel as it passes over a school of fish (especially herring, which are very sensitive to underwater sound) often causes fish to escape capture. Pelagic pair trawls may occasionally contact the bottom (NOAA/NMFS 2005).

Pelagic pair trawling is managed under federal FMPs.

Purse Seines

The purse seine is a deep, nylon-mesh net with floats on the top and lead weights on the bottom. Rings are fastened at intervals to the leadline, and a purseline runs completely around the net through the rings. A school of fish is encircled with the net, then the net is pursed by drawing in a cable that runs through all the rings until the fish are forced to the surface and into a small enough pocket in the net that they can be transferred to the vessel. Purse seines vary in size according to the species fished, the mesh size, the size of the vessel, and the depth to be fished. Purse seines are currently used in the Northeast Region to catch Atlantic herring, Atlantic menhaden, and several species of tuna.

In the herring fishery, one end of the net remains in the vessel and the other end is attached to a power skiff that is deployed from the stern of the vessel and remains in place while the vessel encircles a school of fish with the net. Most purse seines used in the New England herring fishery range from 30 to 50 m deep (NOAA/NMFS 2005). If the depth of the net exceeds the depth of the water where it is set, the leadline can contact the bottom when the nets are first set out, before they are "pursed." Purse seining is a year-round pursuit in the GOM, but is most active in the summer when herring are more abundant in coastal waters. It is done at night, when herring are feeding near the surface. This fishing technique is less successful when fish remain in deeper water and when they do not form "tight" schools. Herring fishermen rely on directional sonar systems to locate schools of fish.

In the menhaden fishery, small airplanes are used to locate schools of menhaden. When a school is located, two purse boats, each carrying half of the net, encircle the school and close the net. The mother ship then comes alongside and pumps the fish aboard. A few small vessels have only one purse boat. The typical menhaden purse seine net ranges in length from 300 to 430 m (980 to 1410 ft), and is 20-27 m (66-89 ft) deep (ASMFC 1999b).

Use of herring and tuna purse seines is managed under federal FMPs, but the menhaden fishery is managed by the ASMFC.

Drift Gill Nets

Drift gill nets are designed to float from the sea surface and extend downward into the water column, and are used to catch pelagic fish. In this case, the buoyancy of the floatline exceeds the weight of the leadline. Drift gill nets may be anchored at one end or set out to drift, usually with the fishing vessel attached at one end. This gear does not come in contact with the bottom.

The use of drift gill nets is managed under federal FMPs.

Pelagic Longline Gear

Pelagic or subsurface longlining is a technique used mostly in the open ocean to catch highly migratory species of tuna, swordfish, and sharks. The gear is typically set at depths from the surface to around 330 m (1080 ft). It can also be set with a mainline hanging in arcs below buoy droplines to fish a series of depths. The length of the mainline can be up to 108 km (67 mi), depending on the size of the vessel. If the mainline is set at a fixed depth, then the leader (*i.e.*, gangion) lengths vary from 2 to 40 m (7 to 131 ft), thus ensuring that the hooks are distributed over a range of depths. If a line-shooter is used to set the mainline in a catenary shape, then the gangions are usually a single minimal length, thus again ensuring that the hooks are distributed over a range of depths. Each gangion typically contains a baited hook and chemical night stick to attract the fish. Traditional or circle hooks may be used. Swordfish vessels typically fish 20-30 hooks per 1.6 km (1 mi) of mainline, which is between 5 and 54 km (3 and 34 mi) long. This gear does not contact the bottom.

The use of pelagic longlines to catch highly migratory species is regulated by the National Marine Fisheries Service (NMFS).

Troll Lines

Trolling involves the use of a baited hook or lure maintained at a desired speed and depth in the water. Usually, 2-4 or even more lines are spread to varying widths by the use of outrigger poles connected to the deck by hinged plates. Line retrieval is often accomplished by means of a mechanized spool. Each line is weighted to reach the desired depth and may have any number of leaders attached, each with a hook and bait or an appropriate lure. Troll lines are used to catch a variety of pelagic species in the region, including king mackerel (Table 3.1). This gear does not contact bottom habitats.

This activity is managed under federal FMPs.

OTHER GEAR

Rakes

A bull rake is manually operated to harvest northern quahogs (*Mercenaria mercenaria*), or hard clams, and consists of a long shaft with a rake and basket attached. The length of the shaft can vary, but usually does not exceed three times the water depth. The length and spacing of the teeth, as well as the openings of the basket, are regulated to protect juvenile clams from harvest. Rakes are typically fished off the side of a small boat. They are used in estuarine waters throughout the region.

This activity is not managed under federal FMPs.

Tongs

Tongs are used to harvest shellfish in shallow water. There are two principal types: shaft tongs and patent tongs. Manually operated shellfish tongs are used in nearshore and estuarine waters throughout the region, primarily to harvest hard clams and eastern oysters.

Shaft tongs are a scissorlike device with a rake and basket at the end of each shaft. The fisherman stands on the edge of the boat and progressively opens and closes the baskets on the bottom, gathering the shellfish into a mound. The tongs are closed a final time, brought to the surface, and the catch emptied on the culling board for sorting. The length of the shaft must be adjusted for water depth. Oysters are traditionally harvested with shaft tongs in water depths up to 6 m (20 ft), with the shaft tongs themselves being 8 m (26 ft) long.

Patent tongs are also used to harvest hard clams and oysters. They are opened and closed with a drop latch or with a hydraulic ram, and require a mechanized vessel with a mast or boom and a winch.

This activity is not managed under federal FMPs. Patent tongs are regulated by state fisheries agencies according to weight, length of teeth, and bar spacing in the basket.

Line Fishing

Hand Lines/Rod and Reel

The simplest form of hook-and-line fishing is the hand line, which may literally be fished "by hand" or using a rod and reel. The gear consists of a line, sinker, leader, and at least one hook. The line is usually stored on a small spool and rack and varies in length. The sinkers vary from stones to cast lead. The hooks vary from single to multiple arrangements in "umbrella" rigs. An attraction device must be incorporated into the hook, usually a natural bait or an artificial lure. Hand lines can be fished in such as manner as to hit bottom and bounce, or to be carried by currents until retrieved.

Hand lines and rods and reels are used in the Northeast Region to catch a variety of demersal and pelagic species (federally managed species are listed in Table 3.1), including species of tuna, sharks, billfish, and swordfish.

This activity is managed under federal FMPs.

Mechanized Line Fishing

Mechanized line-hauling systems have been developed to allow more lines to be worked by smaller crews, and to use electrical or hydraulic power to work the lines on the spools or jigging machines. These reels, often termed "bandits," are mounted on the vessel bulwarks and have a spool around which the mainline is wound. Each line may have a number of branches and baited hooks, and the line is taken from the spool over a block at the end of a flexible arm. Hooks and sinkers can contact the bottom, depending upon how the gear is used.

Jigging machine lines are generally fished in waters up to 600 m (1970 ft) deep. Jigging refers to the action of jerking a line with several unbaited hooks up in the water to snag a fish in its body. Jigging is commonly used to catch squid.

This gear is used to catch a variety of demersal and pelagic species, including highly migratory species of tuna, sharks, and swordfish. The use of this gear is managed under federal FMPs.

Hand Hoes

Intertidal flats are harvested for baitworms (*Glycera dibranchiata* and *Nereis* spp.) and softshell clams by using handheld hoes. These hoes are short-handled, rakelike devices that are often modified gardening tools (Creaser *et al*. 1983). Baitworm hoes have 5-7 tines which are 21-22 cm (8.3-8.7 in) long when used for bloodworms, and which are 34-39 cm (13-15 in) long when used for sandworms. Clam hoes in Maine typically have 4-5 tines which are 15 cm (6 in) long (Wallace 1997).

This activity is not managed under federal FMPs.

Diving

Divers, either free diving or using SCUBA, harvest a variety of benthic invertebrate species -- including sea urchins, scallops, and quahogs -- in relatively shallow coastal and inshore waters throughout the region. Often, a support vessel is used to transport the diver(s) to the fishing site and carry the catch to shore. Divers often use small rakes or hoes to scrape animals off rocks or dig them out of the seafloor. Generally, the catch is placed in bags that are either towed to the surface by the boat or floated to the surface using an air source and a lift bag.

This activity is not managed under federal FMPs.

Spears and Harpoons

Spears with long shafts (gigs) are used by fishermen in small boats to catch fish in shallow water, and by divers. Harpoons are used offshore to fish for certain highly migratory species.

The use of spears in state waters is not managed under federal FMPs, but the use of harpoons in the tuna fishery is managed by NMFS.

Table 3.1. Percentage of landings (1% or more by weight) by fishing gear type for federally managed species and species groups in the Northeast Region in 2004. (Does not include highly migratory species, *i.e.*, tuna, sharks, swordfish, and billfish.)

	Species and Species Groups																		
Gear	**American Plaice**	**Atlantic Cod**	**Atlantic Halibut**	**Atlantic Herring**	**Atlantic Mackerel**	**Atlantic Surfclam**	**Barndoor Skate**	**Black Sea Bass**	**Bluefish**	**Butterfish**	**Clearnose Skate**	**Cobia**	**Goosefish**	**Haddock**	**Hake, Red & White**	**King Mackerel**	**Little Skate**	**Longfin Inshore Squid**	**Northern Shortfin Squid**
By hand																			
Dip net																			
Dredge, clam						6.6													
Clam dredge, hydraulic																			
Dredge, other						2.6				1.5			2.0				1.0	2.7	1.3
Dredge, sea scallop													2.1						
Dredge, surfclam + ocean quahog						90.2													
Gill net, drift									1.0										
Gill net, fixed or anchored, sink	1.8	30.0	13.2		9.5			1.7	44.4	4.1	66.2	28.4	53.7	2.3	6.3				
Gill net, other														2.5	5.6				
Gill net, run-rround																			
Gill net, set/stake									14.4			34.9				19.8			
Handline		3.9						5.1	3.5			14.0		3.2	3.5	5.1			
Haul seine, beach																			
Haul seine, long																			
Longline, bottom		1.6	3.9											3.3	1.6				
Longline, pelagic												4.4							
Pot/trap, lobster, inshore																			
Pot/trap, lobster, offshore																			
Pots + traps, crab, other																			
Pots + traps, fish								3.7											
Pots + traps, other								28.0	1.1										
Pound net, fish									1.4	7.1		3.7							
Pound net, other		1.0						1.2	1.4	1.1		2.2		1.2					
Purse seine, herring				2.5															
Purse seine, other				9.3															
Rake, other																		1.8	
Trawl, otter, bottom, fish	92.5	58.5	60.3	29.8	8.8			41.8	13.8	69.3	32.3	1.3	35.8	82.4	21.0		98.2	83.3	93.4
Trawl, otter, bottom, scallop								1.4											
Trawl, otter, bottom, other								2.0	2.0			2.4							
Trawl, otter, midwater				30.0	43.0			2.4		1.2								3.4	
Trawl, midwater, paired				25.1	38.1							2.2							
Troll line, other				2.2						1.0					50.6	66.3		1.5	
Troll and handline, combined																7.2			
Unknown	4.4	3.0	20.7				100	10.2	14.8	13.4	1.5	4.6	4.3	4.5	5.4			5.7	4.4

Table 3.1. Percentage of landings (1% or more by weight) for federally managed species and species groups by fishing gear type in the Northeast Region in 2004. (Does not include highly migratory species, *i.e.*, tuna, sharks, swordfish, and billfish.)

	Species and Species Groups																		
Gear	**Ocean Pout**	**Ocean Quahog**	**Offshore Hake, Unclassified**	**Pollock**	**Red Deepsea Crab**	**Red Drum**	**Red Hake**	**Redfish**	**Rosette Skate**	**Scup**	**Sea Scallop**	**Silver Hake**	**Skates**	**Smooth Skate**	**Spanish Mackerel**	**Spiny Dogfish**	**Squids, Unclassified**	**Summer Flounder**	**Thorny Skate**
By hand			17.1																
Dip net																			
Dredge, clam																			
Clam dredge, hydraulic		3.3																	
Dredge, other			3.9				2.4				56.7	11.2						1.3	
Dredge, sea scallop											33.9								
Dredge, surfclam + ocean quahog		96.6																	
Gill net, drift						1.4													
Gill net, fixed or anchored, sink				37.5		7.9			4.2	2.9			17.7	97.6	3.4	75.1		1.3	46.7
Gill net, other						1.5							8.0			2.6			
Gill net, run-around						3.3													
Gill net, set/stake						79.8									79.2				
Handline	12.2							2.3		4.5						2.2		1.5	
Haul seine, beach						1.2													
Haul seine, long						2.7													
Longline, bottom	6.2				1.8			78.4					1.1	1.7		1.5			
Longline, pelagic																			
Pot/trap, lobster, inshore	3.0																1.6		
Pot/trap, lobster, offshore																			
Pots + traps, crab, other					18.7														
Pots + traps, fish	7.1																		
Pots + traps, other	3.3				79.5			3.7		1.8									
Pound net, fish														13.7					
Pound net, other										13.7			6.2						
Purse seine, herring																			
Purse seine, other																			
Rake, other																			
Trawl, otter, bottom, fish	63.7		46.2	59.2			84.7	12.5	95.8	54.0	6.2	76.9	62.1		1.0	13.7	71.3	81.2	51.9
Trawl, otter, bottom, scallop											1.2								
Trawl, otter, bottom, other										1.2							1.9		
Trawl, otter, midwater																			
Trawl, midwater, paired																			
Troll line, other										1.7						1.6			
Troll and handline, combined																			
Unknown	2.9		32.0	1.1			10.2	3.2		15.8	1.5	10.4	3.7		1.1	1.6	23.6	7.5	

Table 3.1. Percentage of landings (1% or more by weight) for federally managed species and species groups by fishing gear type in the Northeast Region in 2004. (Does not include highly migratory species, *i.e.*, tuna, sharks, swordfish, and billfish.)

	Species and Species Groups							
Gear	**Tilefish**	**White Hake**	**Windowpane**	**Winter Flounder**	**Winter Skate**	**Witch Flounder**	**Yellowtail**	**ALL SPECIES**
By hand								0.05
Dip net				1.0				0.02
Dredge, clam								0.56
Clam dredge, hydraulic								0.18
Dredge, other							1.6	5.78
Dredge, sea scallop								3.03
Dredge, surfclam + ocean quahog								12.82
Gill net, drift								0.01
Gill net, fixed or anchored, sink	6.5	24.2	1.5	4.6	9.7	1.2	2.8	5.87
Gill net, other								0.21
Gill net, run-around								0.00
Gill net, set/stake								0.23
Handline	3.6							0.35
Haul seine, beach								0.00
Haul seine, long								0.02
Longline, bottom	60.9	1.4						0.36
Longline, pelagic								0.00
Pot/trap, lobster, inshore								0.01
Pot/trap, lobster, offshore								0.03
Pots + traps, crab, other								0.10
Pots + traps, fish								0.04
Pots + traps, other								0.61
Pound net, fish							4.8	0.05
Pound net, other			1.6	9.5				0.68
Purse seine, herring								0.61
Purse seine, other								2.25
Rake, other								0.07
Trawl, otter, bottom, fish	19.2	71.5	91.2	76.2	82.7	89.8	81.7	35.81
Trawl, otter, bottom, scallop								0.19
Trawl, otter, bottom, other								0.39
Trawl, otter, midwater								14.29
Trawl, midwater, paired								12.16
Troll line, other								0.74
Troll and handline, combined								0.01
Unknown	9.4	2.3	3.9	6.6	6.9	7.1	8.1	2.41

Table 3.2. Percentage of landings for all species (1% or more of state total landings by weight) by fishing gear type for states in the Northeast Region in 2004

	STATE										
Gear	**ME**	**NH**	**MA**	**RI**	**CT**	**NY**	**NJ**	**MD**	**DE**	**VA**	**NC**	**ALL**
By hand									4.6			
Diving gear, urchins	1.7											
Dredge, clam						11.1						
Dredge, clam, hydraulic					6.6							
Dredge, crab									9.5			
Dredge, other	4.1		5.5	2.3		4.9	5.0			2.7		3.6
Dredge, oyster									1.8			
Dredge, sea scallop			3.7		11.2		1.8			1.1		1.5
Dredge, surfclam + ocean quahog			6.6	2.7	6.5	5.5	33.0	14.7				6.5
Dredge, sea urchin	1.1											
Dredge, whelk									10.4			
Gill net, fixed or anchored, sink	1.4	14.5	8.2	3.8	1.7	3.6	2.8	1.3		2.6	15.0	
Gill net, drift								1.5	5.3			4.1
Gill net, set/stake									10.0		10.5	
Handline			1.0			1.2			1.4			
Longline, bottom						3.1						
Longline, pelagic											3.4	
Pot/trap, lobster, inshore	23.6			1.5	2.9							3.8
Pot/trap, lobster, onshore, wire			3.7									
Pot/trap, lobster, offshore	1.9											
Pots + traps, blue crab							1.8	45.8	47.6	4.8	15.5	3.9
Pots + traps, eel									3.2			
Pots + traps, other	1.7	1.1	2.7	2.4					2.1			1.1
Pots + traps, whelk									1.1			
Pound net, fish								10.1		2.8	16.8	1.3
Pound net, other			1.1	1.5								4.0
Purse seine, herring	1.9	1.0										
Purse seine, menhaden							6.8			73.7		25.2
Purse seine, other	7.4	1.0								8.1		
Rakes, other				1.4		2.9			1.1			
Tongs and grabs, other						3.2						
Trawl, otter, bottom, fish	11.8	69.3	29.7	65.4	37.1	42.4	22.4	2.0		1.4		18.6
Trawl, otter, bottom, other											28.4	
Trawl, otter, bottom, shrimp	1.0	1.5									3.6	
Trawl, otter, midwater	17.5	3.7	15.8	3.6			7.6					7.3
Trawl, midwater, paired	4.1	5.9	16.6	6.7			12.2					6.2
Troll line, other					2.9	1.0					1.7	
Trot line with bait								20.9				
Unknown	17.4		2.4	6.0	28.2	18.6	2.9					4.8

Table 3.3. Fishing gears and techniques used in the Northeast Region, categorized by the waters in which they are used, by whether or not they contact the bottom, and by whether or not their use is regulated by federal FMPs. (Includes all gears that accounted for 1% or more of any state's total landings, and all gears that harvested any amount of any federally managed species, based upon 2004 landings data and an ASMFC report on gear impacts to submerged aquatic vegetation (Stephan *et al.* 2000).)

	Water Type			**Contacts Bottom**	**Federally Regulated**
Gear	**Estuary or Bay**	**Coastal (0-3 mi)**	**Offshore (3-200 mi)**		
By hand	X	X			X
Diving	X	X	X		
Dredge, clam	X	X	X	X	X
Dredge, crab	X	X		X	
Dredge, mussel	X	X		X	
Dredge, oyster	X			X	
Dredge, bay scallop	X			X	
Dredge, sea scallop		X	X	X	X
Dredge, sea urchin		X	X	X	
Dredge, whelk	X			X	
Floating trap	X	X		X	X
Fyke and hoop net, fish	X	X		X	
Gill Net, drift			X		X
Gill Net, run-around	X			X	
Gill Net, sink/anchor	X	X	X	X	X
Gill Net, stake	X	X	X	X	X
Handline	X	X	X		X
Haul seine, beach	X	X		X	
Haul seine, long	X	X		X	
Haul seine, long (Danish)		X	X	X	X
Hoe	X			X	
Longline, bottom		X	X	X	X
Longline, pelagic		X	X		X
Otter trawl, bottom, crab	X	X	X	X	
Otter trawl, bottom, fish	X	X	X	X	X
Otter trawl, bottom, scallop		X	X	X	X
Otter trawl, bottom, shrimp	X	X	X	X	X
Otter trawl, midwater		X	X		X
Pots and traps, crab, blue	X	X		X	
Pots and traps, crab, other	X	X	X	X	X
Pots and traps, eel	X	X		X	
Pots and traps, fish	X	X	X	X	X
Pots and traps, lobster, inshore	X	X		X	
Pots and traps, lobster, offshore			X	X	X
Pots and traps, whelk	X	X		X	
Pound nets, crab	X	X		X	
Pound nets, fish	X	X		X	
Purse seines, herring		X	X		X
Purse seines, menhaden		X	X		
Purse seines, tuna		X	X		X
Rakes	X			X	
Reel, electric or hydraulic		X	X		X
Rod and reel	X	X	X		X
Scottish seine		X	X	X	X
Scrapes	X			X	
Spears	X	X	X		
Stop seines	X			X	
Tongs and grabs, oyster	X			X	
Tongs, patent, clam, other	X			X	
Tongs, patent, oyster	X			X	
Trawl, midwater, paired		X	X		X
Troll line, other		X	X		X
Trot lines, with bait		X	X		X
Weirs	X			X	

4. GEOGRAPHIC DISTRIBUTION OF FISHING ACTIVITY BY GEAR TYPE

The information in this section of the document was compiled as part of an overall effort to determine the potential effects of fishing on benthic marine habitats in the Northeast Region. The objective of this information compilation was to calculate the spatial distribution of fishing activity by the principal gear types used in regional commercial fishing operations. The data used in these calculations were extracted from the NOAA Fisheries Service fishing vessel trip report (FVTR) and clam logbook databases for the years 1995-2001. The clam logbook program was implemented in 1991, and the FVTR data collection program in 1994, to monitor the geographic distribution of catches of federally regulated species in the region. Both data collection systems are mandatory, and the data are collected by fishermen. This is the first time that either of these databases has been utilized for estimating the spatial distribution of fishing activity throughout the region.

Previous attempts to determine the spatial distribution of fishing activity in the Northeast Region have been restricted to a single gear type -- bottom otter trawls -- and have described trawling activity that occurred during the mid-1980s and early 1990s, before the closing of three areas on Georges Bank to all gear used to catch groundfish, including bottom trawls and scallop dredges. These closures, which were implemented in December 1994 (see Figure 4.1) as part of an overall effort to restore depleted groundfish stocks, greatly affected the subsequent distribution of trawling and dredging operations in the region. Additional year-round groundfish closures (also shown in Figure 4.1) were established in the western GOM in May 1998, and in the vicinity of Cashes Ledge in the central GOM in August 2001.

Earlier analyses of bottom trawling activity in the region relied on information collected by NOAA Fisheries Service port agents who interviewed fishermen after their vessels returned to port. Interviews were conducted for about 60% of all trips. Data from interviewed trips included the number of days (to the nearest 0.1 day) that a vessel trawled in each 10' "square" (TMS) of latitude and longitude. (A TMS represents 10' (*i.e.*, one-sixth of a degree) of latitude along each side, and 10' of longitude along the top and bottom. Because of the curvature of the earth's surface, TMSs north or south of the Equator are actually rectangles that diminish in size as the meridians of longitude converge at the poles. Within the range of latitudes in the Northeast Region, TMSs range in size from 109.65 km^2 in the south to 94.20 km^2 in the north. Because the projection used to display the FVTR and clambook data in this document is a Mercator projection, the TMSs in Figures 4.2-4.13 appear to be the same size.) Interview information (average numbers of days fishing per trip) was applied to the noninterviewed trips, but the estimated fishing time for these trips was assigned to 30' squares. (One 30' square is one-half of a degree of latitude and longitude on each side, and contains nine TMSs.) Churchill (1989) used data from all trips made in 1985 to estimate the percentage of area trawled in individual 30' squares between Cape Cod and North Carolina, using an average trawl width (door to door, while underway) of 40 m, and an average towing speed of 5.5 km/hr. These same methods were applied to data collected by port agents in 1993 for Georges Bank and the GOM (analysis by Churchill in NRC 2002).

A more recent analysis of 1991-1993 data for interviewed and noninterviewed bottom trawl trips was prepared for a National Research Council report on trawling and dredging effects (NRC 2002). In this case, the results for 10' and 30' squares were combined in one map, and displayed as low, medium, and high numbers of days of fishing per 10' square. No attempt was made to estimate the area swept by the gear within each square. This analysis was flawed by the fact that the extrapolated 30'-square fishing effort estimates were assigned to the single 10' square at the center of each 30' square. This biases the results and produces a "checkerboard" effect in the mosaic of 10' squares.

METHODS

Data Analysis

The geographic distribution of fishing activity during 1995-2001 was calculated by TMS for 12 commonly used, bottom-tending gear types in the Northeast Region. Data reported south of Cape Hatteras (35°N) and north of 45°N latitude in the GOM were excluded from analysis. Data for gear used mostly in state waters and/or for gear that is not well represented in the FVTR or clam logbook databases (*e.g.*, mussel and sea urchin dredges, nonhydraulic quahog dredges, Danish seines, shrimp pots) or for gear that does not normally contact the bottom (*e.g.*, purse seines, mid-water trawls, pelagic longlines, floating gill nets) were not analyzed.

The FVTR and clam logbook data are provided by vessels operating with federal permits and participating in the following fisheries: Northeast multispecies, sea scallop, surf clam and ocean quahog, goosefish, summer flounder, scup, black sea bass, squid, Atlantic mackerel, butterfish, spiny dogfish, bluefish, Atlantic herring, and tilefish. There is no requirement for vessels permitted in just the offshore lobster fishery to report or log their activities. However, vessels permitted in both the offshore lobster and Northeast multispecies fisheries must report on their lobster fishing activity. Consequently, the data for lobster pots were provided by those vessels with multispecies and offshore lobster permits.

Vessels that operate strictly within state waters (0-3 mi from shore) are not required to have a federal permit, and therefore do not submit trip reports. For this reason, fishing trips in nearshore TMSs that include a significant proportion of state waters are under-represented in the data.

Permit holders are required to fill out a FVTR form or make a logbook entry for each trip made by the vessel (*i.e.*, each time the vessel leaves and returns to port). Fishermen report the general location where most of their fishing effort occurs during a trip, and the date and time that the vessel leaves and returns to port. (Fishermen are also asked to answer questions regarding the quantity and size of gear used during a trip, how many tows or sets were hauled, and what was the average tow or soak time. However, because this information is either not reported at all, or is reported in an inconsistent manner, it is not reliable and was not used in this analysis.) Fishermen are also given the choice of reporting the location of a trip as a point (*i.e.*, latitude and longitude) or simply assigning it to a statistical area (these areas are quite large and include many TMSs). Only trips that were reported as a point location and therefore could be assigned to a TMS were included in this analysis. Most trips are reported this way, but not all (Table 4.1).

For most of the analyzed, mobile, bottom-tending gear (*i.e.*, scallop dredges and three types of otter trawl), fishing activity was calculated as the total number of days absent from port during the 7-yr period. Days absent for each scallop dredge and otter trawl trip were calculated based on the date and time of departure from, and return to, port in hours, and were then converted to fractions of 24-hr days. Days-absent calculations for trawl and scallop dredge vessels are clearly preferable to simply summing the number of trips, but overestimate actual fishing time since they include travel time and any other non-fishing-related activity while the vessels are away from port. For clam dredges, fishing activity was calculated as the actual hours spent fishing during the 7-yr period, and was then converted to fractions of 24-hr days. For fixed gear (*i.e.*, bottom longlines, sink gill nets, and five types of pots), fishing activity was calculated as the total number of trips during the 7-yr period.

This method of compiling the data by TMS was considered to be preferable to plotting individual trip locations as point data, since many trips, especially for vessels using mobile gear, last for many days and can extend over fairly large areas. For these trips, even data compiled by TMS only approximate the actual spatial distribution of fishing activity throughout the region. For trips of shorter duration that do not extend over large areas, the figures in this document are more representative of actual fishing activity distributions. For this reason, and because some fishing trips in the FVTR database are not assigned to a point location and could not be included in this analysis, the values associated with each TMS are not provided in this document.

Data Portrayal

The calculated data have been portrayed in Figures 4.2-4.13 using geographical information systems (GIS) software (ArcView 3.2, ESRI, Inc.). These geographic portrayals of the relative nature of fishing activity for each gear type were achieved by ranking the TMSs in order from those with the most fishing activity to those with the least activity. TMSs were categorized according to the cumulative percentage of the overall activity (*i.e.*, the total number of days or trips during the 7-yr time period) which they represented.

Those TMSs which had the most activity and which cumulatively accounted for 50% of the overall activity were assigned to a "high" or 50th percentile category. Those TMSs which cumulatively accounted for the next 25% of overall activity were assigned to a "medium" or 75th percentile category. Those TMS which cumulatively accounted for the next 15% of overall activity were assigned to a "low" or 90th percentile category. For the 9 of the 12 gear types that had <100,000 trips or days of fishing reported during the 7-yr period, just the 50th, 75th, and 90th percentile categories were portrayed. For the three gear types that had >100,000 trips or days of fishing reported during the 7-yr period, the 95th percentile category was also portrayed. Exclusion of extreme "low end" data (*i.e.*, those TMSs which would fall into a higher percentile category than 90th or 95th, as appropriate) eliminated a large number of spatially misreported trips from the figures.

Fishing activity categories in the figures are labeled according to the range in the number of days or trips that were reported within each TMS. Tables 4.2 and 4.3 show the ranges, the total amount of fishing activity represented by all the TMSs in each category, and the total amount of fishing activity (100% of the frequency distribution of days or trips) throughout the region for each gear type.

RESULTS

Bottom Otter Trawls -- Fish

Most of the reported otter trawl activity during 1995-2001 was directed at the capture of fish (Figure 4.2) rather than shrimp or scallops (Figures 4.3 and 4.4). There was more than twice as much fishing activity reported for this gear than for scallop dredges (Table 4.2). Bottom otter trawling for fish was widespread in coastal and offshore waters throughout most of the Northeast Region, easily accounting for more TMSs than any other gear (Figure 4.14). Areas of highest activity were located in southwestern and central portions of the GOM, along the western side of the Great South Channel (east of Cape Cod), north of Closed Area I and on the northern part of Georges Bank west of Closed Area II, in coastal waters of Rhode Island and Long Island, in the mid-shelf region of

Southern New England, and along the edge of the shelf, especially along the 40th parallel of N latitude between 70º and 73º W longitude and in the Hudson Canyon area. Bottom trawling was prohibited in the three groundfish closed areas on Georges Bank during the entire 1995-2001 period, and was absent, or nearly so, in a large area of the continental shelf off southern New Jersey, Maryland, and Virginia. The distribution of fish trawling activity among TMSs within the range fished by this gear was intermediate [*i.e.*, it was neither heavily concentrated nor widely dispersed (Figure 4.15)].

Bottom Otter Trawls -- Shrimp

Shrimp trawling was localized in two areas: the coastal waters of the GOM between Cape Ann and Penobscot Bay, and in nearshore waters of North Carolina, particularly inside the barrier islands (Figure 4.3). Shrimp trawling was reported within a relatively small number of TMSs (Figure 4.14), and was evenly distributed among those TMSs (Figure 4.15). The total number of reported days at sea was also fairly low (Table 4.2).

Bottom Otter Trawls -- Sea Scallops

Scallop trawling was conducted on the outer Mid-Atlantic shelf, primarily between 40º and 37ºN (Figure 4.4). The total number of reported days absent from port and the total number of "populated" TMSs were low (Table 4.2; Figure 4.14). Scallop trawling was concentrated in a small proportion of the total number of TMSs where this gear was used (Figure 4.15).

Scallop Dredges

Scallop dredges were used primarily in a broad area of the Mid-Atlantic shelf from Long Island to Virginia, in Massachusetts Bay (north of Cape Cod) and the Great South Channel, in localized TMSs on Georges Bank northeast of Closed Area I and west of the northern portion of Closed Area II, and in a larger area on the southeast flank of the bank that included the southern portion of Closed Area II that was opened to limited scallop dredging in 1999 (Figure 4.5). Some scallop dredging was also reported from eastern Maine coastal waters. No active scallop dredging was reported in shallow open areas on Georges Bank, in Southern New England, nor in inner shelf waters of the MAB. Some scallop dredging also occurred in portions of the other two closed areas on Georges Bank that were temporarily opened to this gear during 1995-2001. Compared to the other gear types, the number of TMSs with reported scallop dredging covered an area of intermediate size (Figure 4.14), and fishing activity was fairly evenly distributed among TMSs (Figure 4.15).

Hydraulic Clam Dredges

The largest area of intensive hydraulic clam dredging activity was located off the central New Jersey coast, with smaller areas extending north and east to Southern New England and south to the Delmarva Peninsula (Fig. 4.6). The total number of TMSs within which clam dredging took place during 1995-2001 was low (Figure 4.14), and fishing was concentrated in a relatively small proportion of those TMSs (Figure 4.15).

Bottom Longlines

Longline trips during 1995-2001 were reported primarily in TMSs in the western GOM (Massachusetts Bay) and along the western side of the Great South Channel (Figure 4.7). A few trips were reported in deep water along the edge of the shelf, in Rhode Island and central Maine coastal waters, and in offshore locations of the GOM. The total number of TMSs within which bottom longlines were used was relatively low (Figure 4.14), and fishing was evenly distributed among those TMSs (Figure 4.15).

Bottom Gill Nets

Bottom gill net trips were reported in the western GOM and along the western side of the Great South Channel, extending as far north as Cape Ann and Jeffreys Ledge, and in a few TMSs in the outer gulf (Figure 4.8). Gill nets were also used in Rhode Island coastal waters, along the outer shore of Long Island, off northern New Jersey, the Delmarva Peninsula, and in North Carolina. Gill net fishing activity was highest in the western GOM and the Great South Channel in areas that were also actively fished with longlines, bottom trawls, and scallop dredges. The total area fished, as represented by TMSs within which any amount of fishing activity was reported, was relatively large (Figure 4.14), and fishing was well distributed among those TMSs (Figure 4.15).

Lobster Pots

The lobster pot fishery is the most active fixed-gear fishery in the Northeast Region. During 1995-2001, there were almost three times as many trips reported for this gear than for bottom gill nets, the second-most actively used bottom-tending fixed gear (Table 4.3). Fishing activity for this gear is under-reported to a greater degree than for the other gears because nonfederally permitted vessels (which are active in this fishery) are not required to submit reports. Lobster pot trips were reported primarily in coastal waters of the GOM from the Canadian border to Cape Cod, in Rhode Island coastal and inner-shelf waters, and in the New York Bight (Fig. 4.9). Fewer trips were made to more offshore locations in Southern New England, along the edge of the shelf, on eastern Georges Bank, and along the U.S.-Canada border north of the bank. Lobster pots were deployed in a very large number of TMSs within the region (Figure 4.14), and because of the large number of low-activity TMSs (which are not shown in Figure 4.9), their use was very evenly distributed among those TMSs (Figure 4.15).

Fish Pots

Most fish pot trips were reported on the south shore of Massachusetts and Rhode Island, Long Island, and off southern New Jersey, Delaware, and Maryland (Fig. 4.10). Other areas where fewer trips were reported were located on Jeffreys Ledge in the western GOM, east of Long Island and south of Nantucket and Martha's Vineyard, along the outer edge of the continental shelf in the southern MAB, and off the entrance to Chesapeake Bay. Fish pot trips were reported from a small number of TMSs during 1995-2001 (Figure 4.14), and the even-ness of their distribution among TMSs was intermediate between the heavily concentrated (*e.g.*, crab and hagfish pots) and more evenly dispersed (*e.g.*, lobster pots) fixed gears (Figure 4.15).

Whelk Pots

Most fishing activity was reported in Nantucket Sound and inshore waters of southern Massachusetts, in a single TMS south of Rhode Island, and in coastal waters of southern New Jersey and the Delmarva Peninsula, extending south to North Carolina (Fig. 4.11). Fishing with this gear was reported within a very small number of TMSs (Figure 4.14), and was less evenly distributed among TMSs than fishing with fish pots, but more evenly distributed than crab or hagfish pot trips (Figure 4.15).

Crab Pots

Crab pot trips were reported in a small number of TMSs in deep water along the edge of the shelf from eastern Georges Bank all the way to Cape Hatteras, in a single TMS south of Nantucket, in several nearshore locations in the GOM, Nantucket Sound, Cape May , and in inshore waters behind the North Carolina barrier islands (Fig. 4.12). Very few trips were reported (Table 4.3). Fishing was very spread out among a few isolated TMSs (Figure 4.14), but was highly concentrated within those few TMSs (Figure 4.15).

Hagfish Pots

Hagfish pots were used exclusively in the southwestern GOM, in both shallow and deep water (Figure 4.13). Only a few trips were reported within a small number of TMSs (Table 4.3; Figure 4.14), and fishing activity was very un-evenly distributed among TMSs (Figure 4.15).

Table 4.1. Total number of trips by gear type in the FVTR database for 1995-2000, before and after removing trips that did not meet the criteria established for analysis (see text), and the percentage of analyzed trips (information for 2001 was not available)

Gear Type	Reported Trips	Analyzed Trips	Percent Analyzed
Bottom gill net	86,580	66,096	76.3
Bottom longline	18,261	13,614	74.6
Lobster pot	241,725	171,564	71.0
Fish pot	13,323	9,779	73.4
Crab pot	1,609	1,050	65.3
Whelk pot	2,448	1,700	69.4
Bottom otter trawl (fish)	218,668	174,617	79.9
Bottom otter trawl (shrimp)	43,353	30,865	71.2
Bottom otter trawl (scallops)	1,952	1,702	87.2
Scallop dredge	32,248	23,206	72.0
TOTAL	660,167	494,193	74.8

Table 4.2. Fishing activity reported by federally-permitted fishing vessels using mobile, bottom-tending gears in the Northeast Region (35-45ºN) during 1995-2001. (Data shown as ranges in number of 24-hr days per 10′ square (TMS) of latitude and longitude, and as cumulative number of 24-hr days (in parentheses), associated with percentiles of total reported fishing activity that are mapped in Figures 4.2-4.6. Number in last column is the total number of days at sea in all TMSs in the region for that gear type, as calculated from the time absent from port for each reported trip. Note: Not all trips in fishing vessel trip database could be assigned to TMSs (see Table 4.1).)

Gear	**Activity Metric**	**Percentile of Fishing Activity**				
		50%	**75%**	**90%**	**95%**	**100%**
Otter trawls (fish)	Days absent from port	603-5,058 (175,907)	333-602 (263,176)	136-331 (315,582)	63-135 (333,105)	348,841
Otter trawls (shrimp)	Days absent from port	409-1,677 (11,837)	137-399 (17,986)	32-136 (21,591)	---	23,891
Otter trawls (scallops)	Days absent from port	183-653 (5,888)	66-175 (8,816)	16-66 (10,596)	---	11,720
Scallop dredges	Days absent from port	732-3,371 (78,831)	338-724 (118,850)	95-333 (142,493)	34-93 (150,392)	157,507
Hydraulic clam dredges	Days fishing	133-517 (8,027)	64-126 (11,990)	31-63 (14,412)	---	15,951

Table 4.3. Fishing activity reported by federally-permitted fishing vessels using fixed gear in the Northeast Region (35-45ºN) during 1995-2001. (Data shown as ranges in number of trips per 10′ square (TMS) of latitude and longitude, and as cumulative number of trips (in parentheses) associated with percentiles of total reported fishing activity that are mapped in figures 4.7-4.13. Number in last column is the total number of trips reported in all TMSs in the region for that gear type. Note: Not all trips in fishing vessel trip database could be assigned to TMSs (see Table 4.1).)

Gear	**Activity Metric**	**Percentile of Fishing Activity**				
		50%	**75%**	**90%**	**95%**	**100%**
Bottom longlines	Trips	412-1,269 (8,211)	129-314 (12,345)	11-126 (14,914)	---	16,483
Bottom gill nets	Trips	520-3,831 (43,194)	167-511 (65,220)	50-167 (78,156)	---	86,403
Lobster pots	Trips	2,084-10,895 (115,726)	816-2,009 (173,326)	161-759 (208,362)	45-160 (219,906)	230,300
Fish pots	Trips	120-434 (4,740)	41-118 (7,088)	9-39 (8,523)	---	9,423
Whelk pots	Trips	109-260 (1,172)	21-86 (1,859)	8-20 (2,235)	---	2,471
Crab pots	Trips	89-227 (678)	13-44 (1,093)	2-13 (1,312)	---	1,450
Hagfish pots	Trips	50-323 (1,202)	22-49 (1,822)	8-21 (2,195)	---	2,430

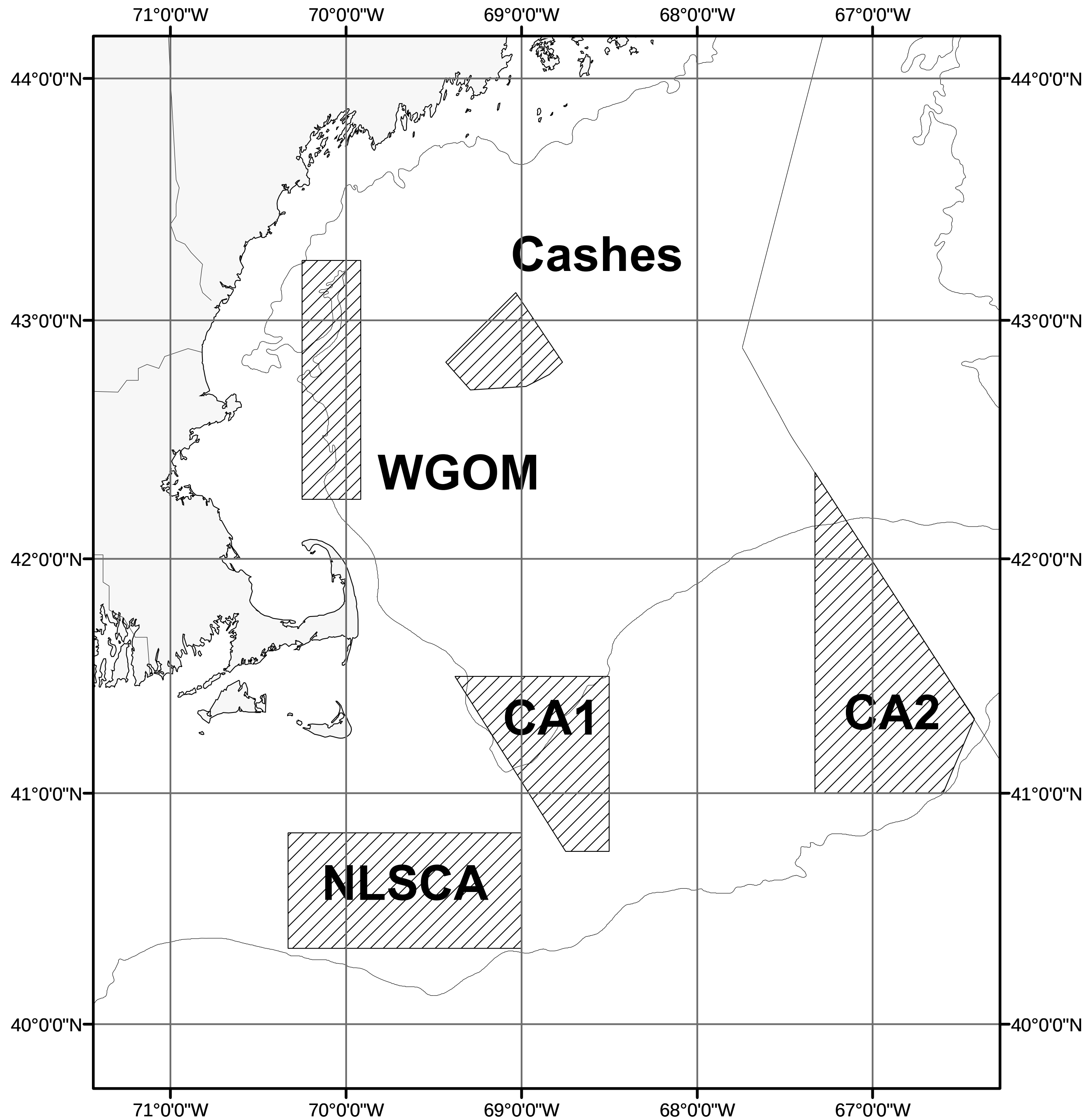


Figure 4.1. Location of five year-round groundfish closed areas in the Gulf of Maine - Georges Bank region. (Cashes = Cashes Ledge; WGOM = western Gulf of Maine; NLSCA = Nantucket Lightship Closed Area; CA1 = Closed Area I; and CA2 = Closed Area II.)

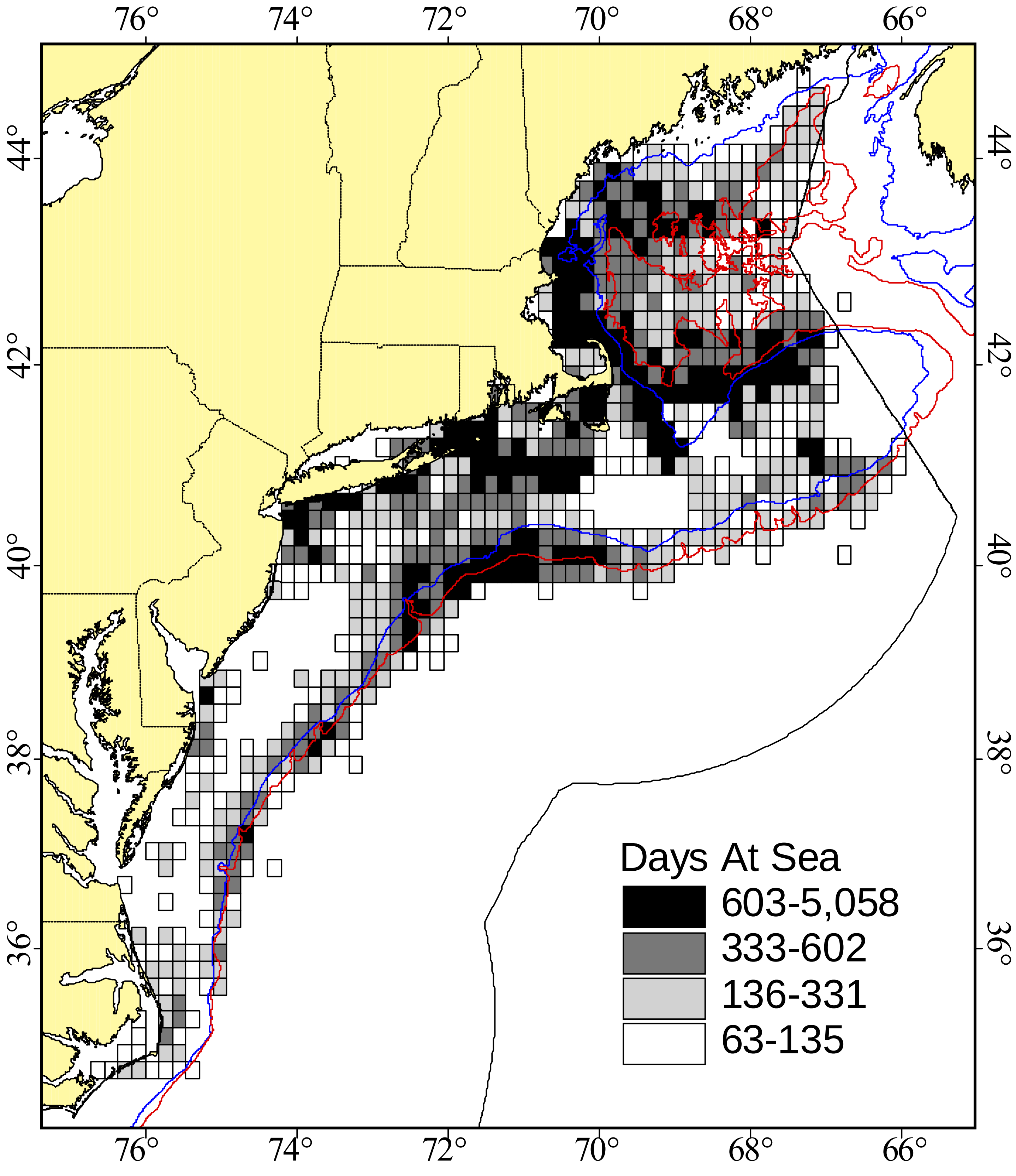


Figure 4.2. Bottom otter trawl (fish) fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), low (90% cumulative), or very low (95% cumulative) category of fishing activity level (*i.e.*, number of 24-hr days absent from port). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.2 for the ranges of fishing activity associated with each cumulative percentage category.)

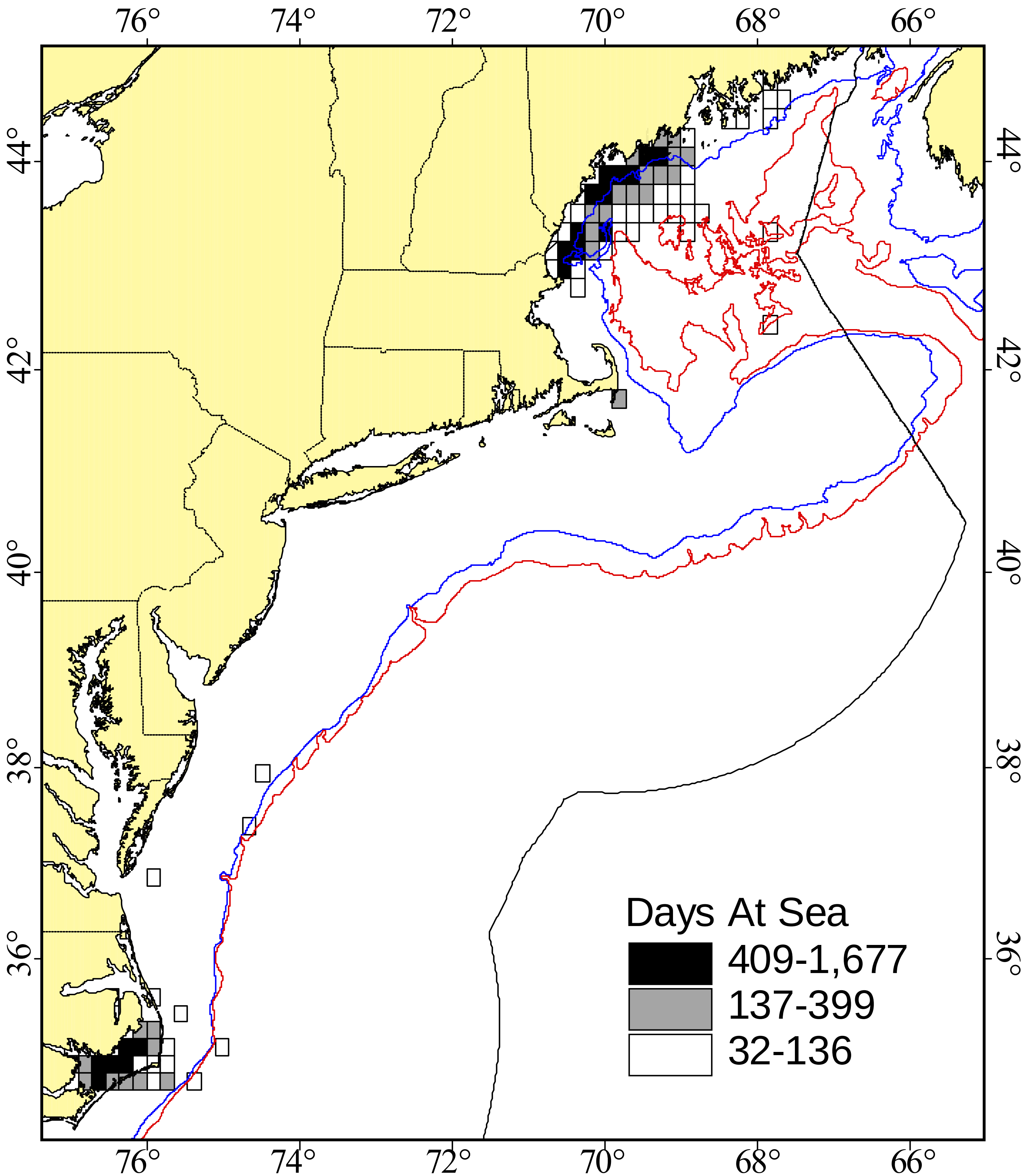


Figure 4.3. Bottom otter trawl (shrimp) fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of 24-hr days absent from port). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.2 for the ranges of fishing activity associated with each cumulative percentage category.)

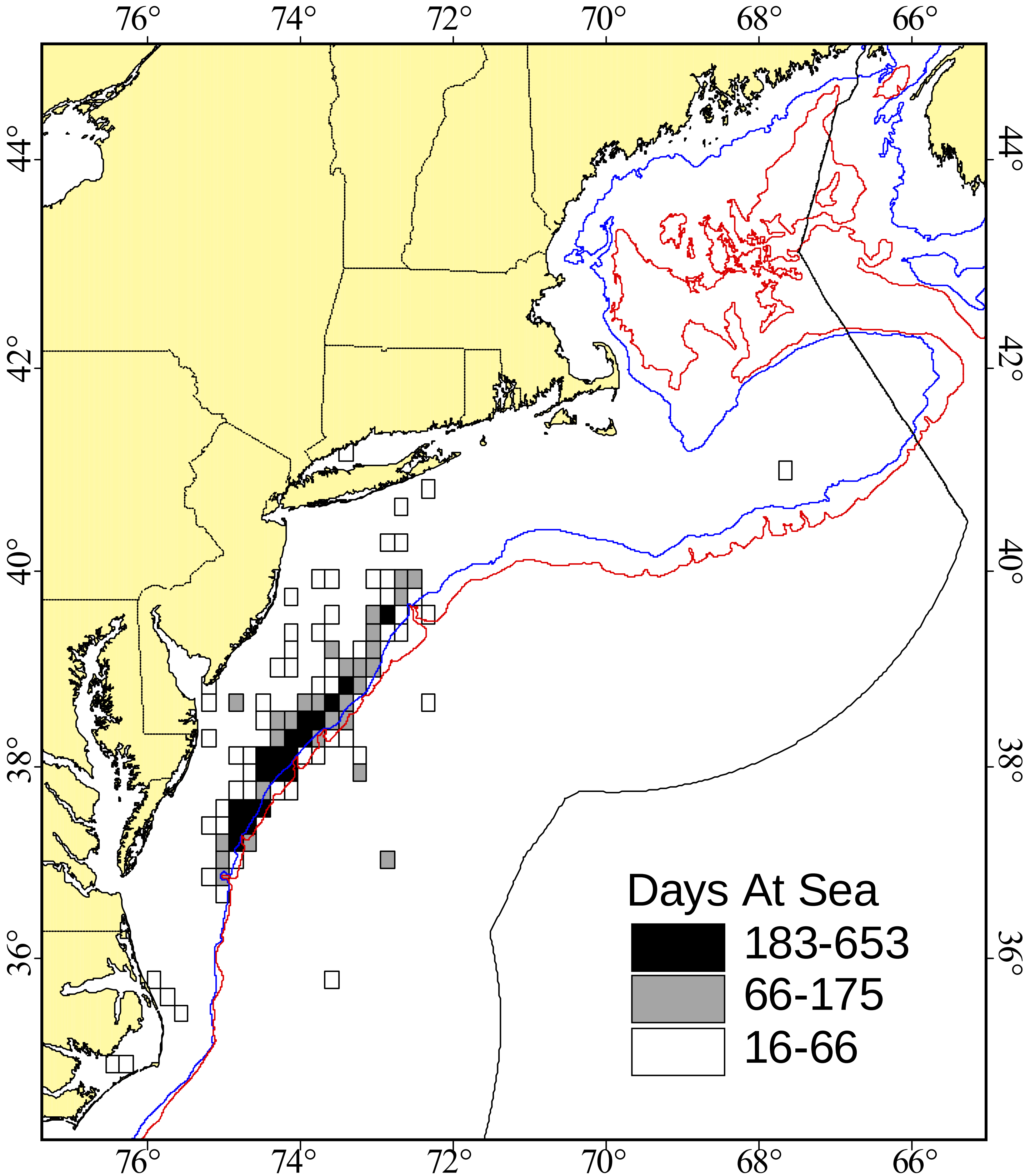


Figure 4.4. Bottom otter trawl (scallop) fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of 24-hr days absent from port). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.2 for the ranges of fishing activity associated with each cumulative percentage category.)

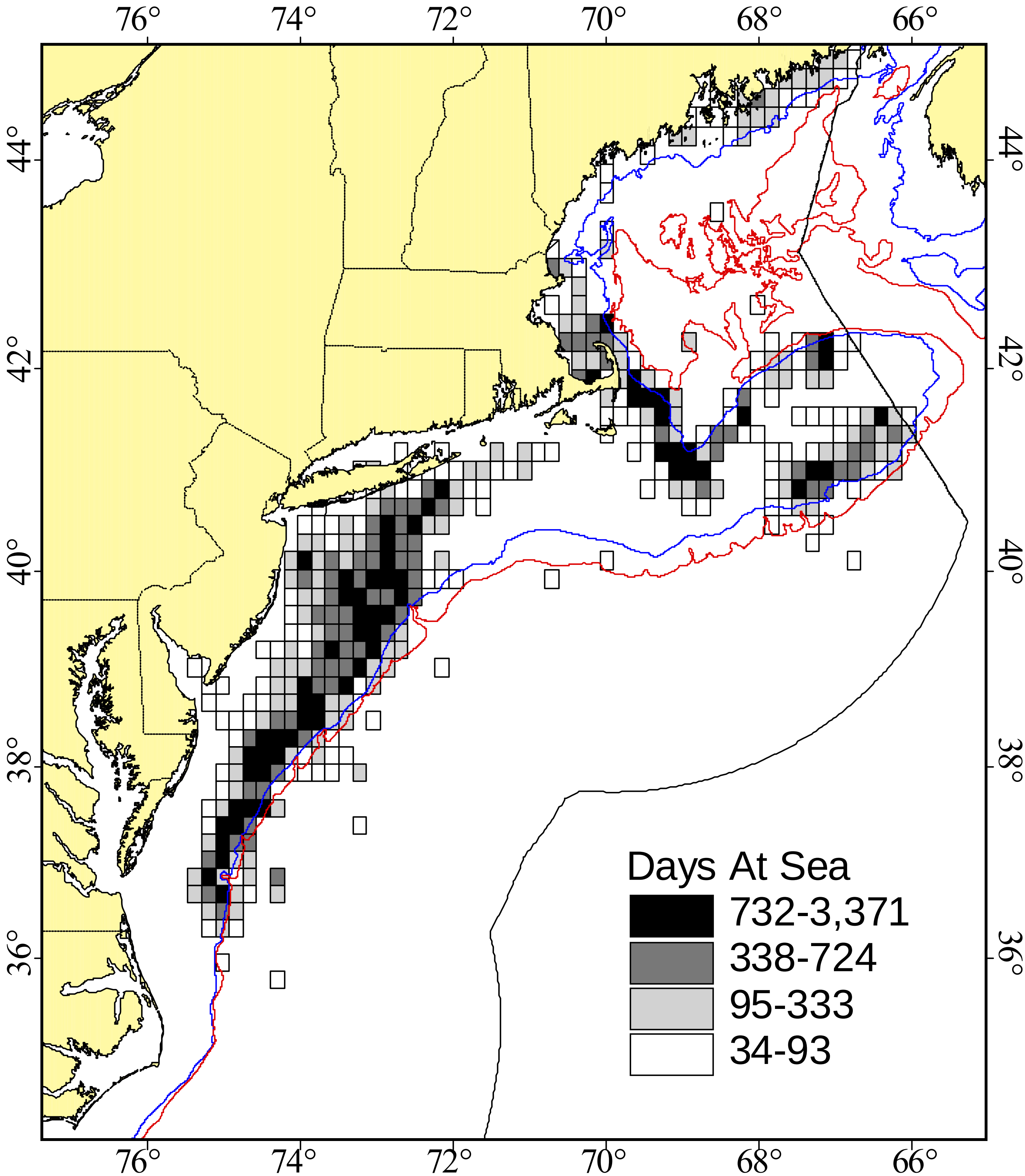


Figure 4.5. Scallop dredge fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), low (90% cumulative), or very low (95% cumulative) category of fishing activity level (*i.e.*, number of 24-hr days absent from port). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.2 for the ranges of fishing activity associated with each cumulative percentage category.)

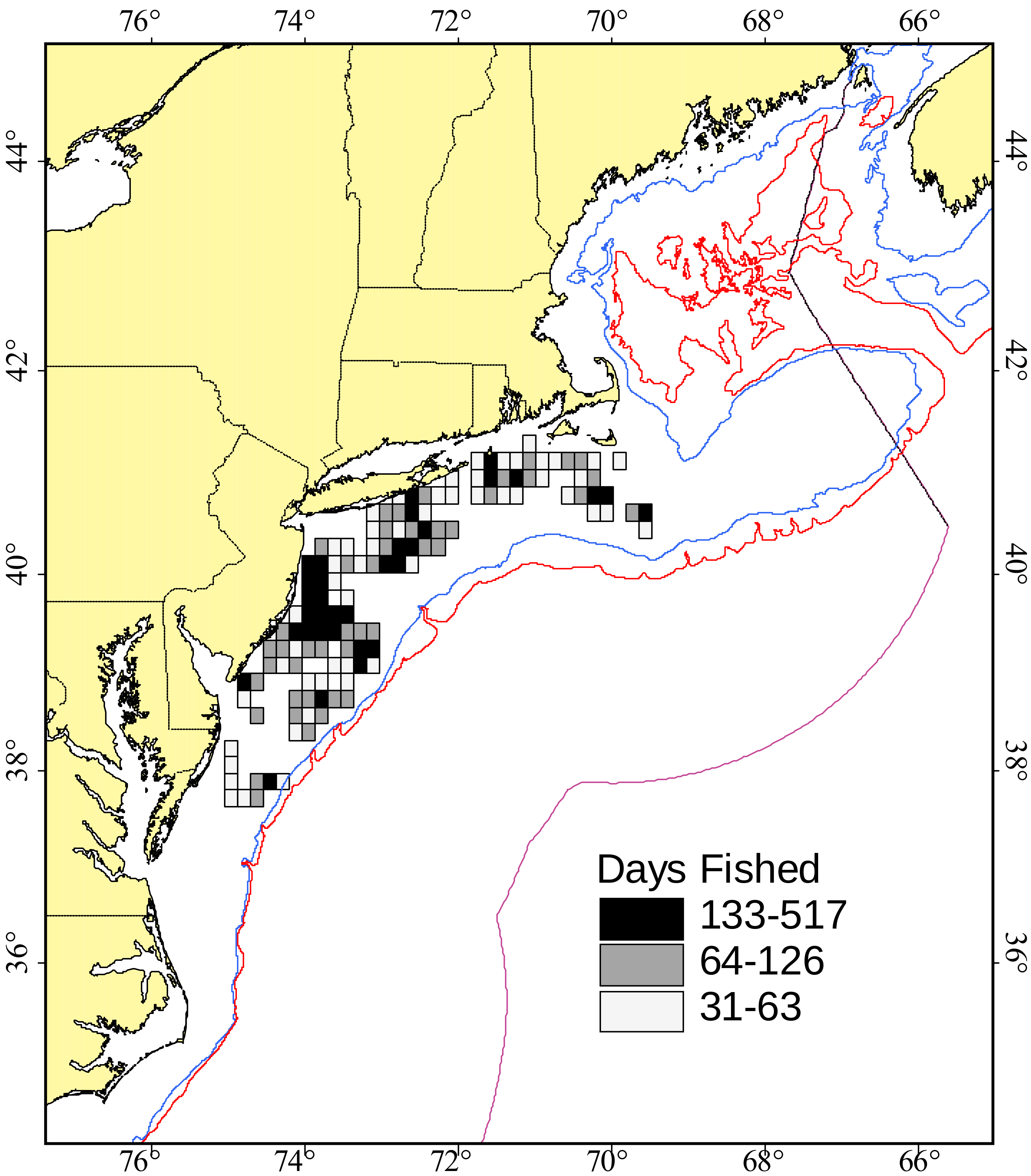


Figure 4.6. Hydraulic clam dredge fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of 24-hr days of fishing). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.2 for the ranges of fishing activity associated with each cumulative percentage category.)

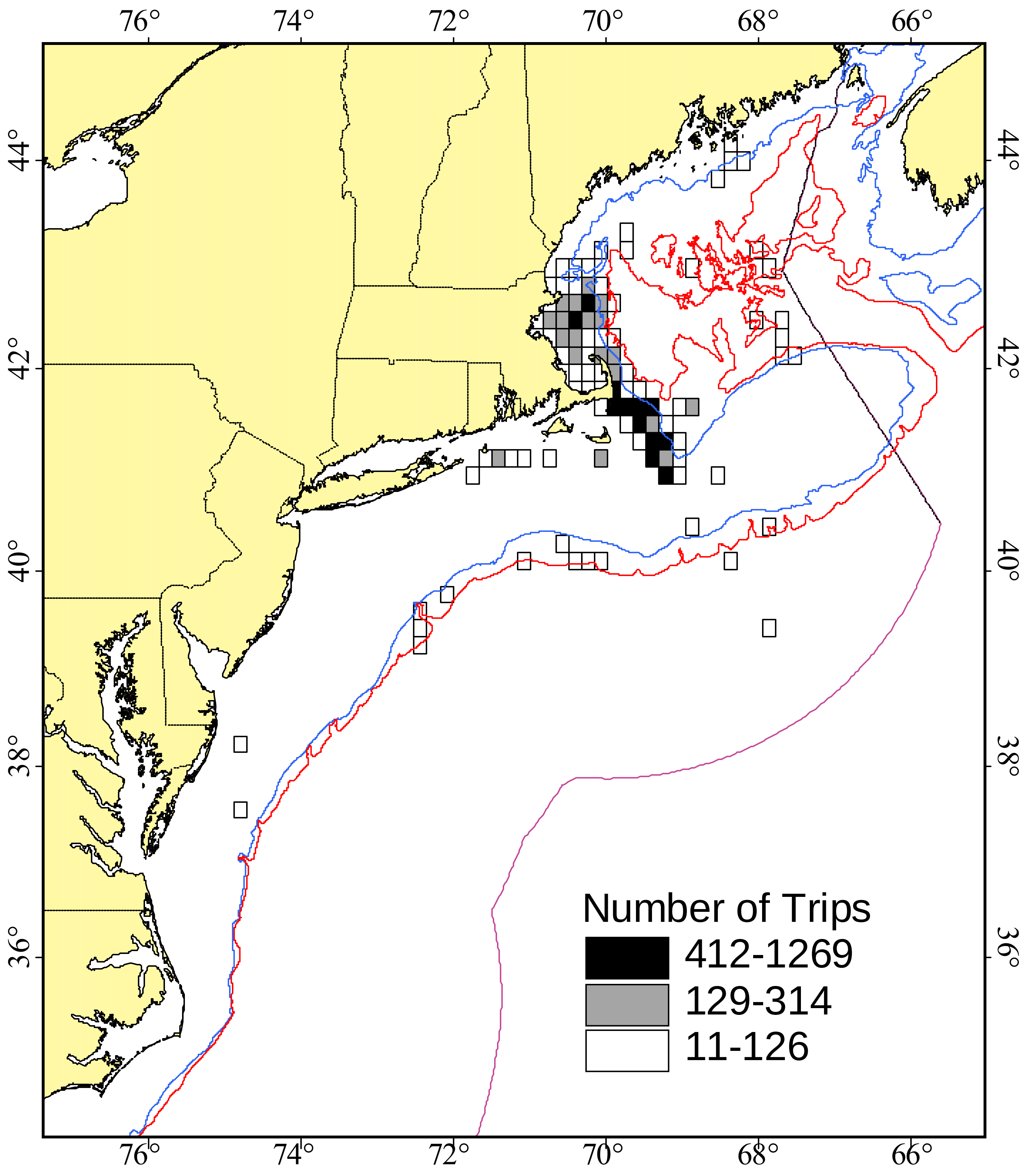


Figure 4.7. Bottom longline fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

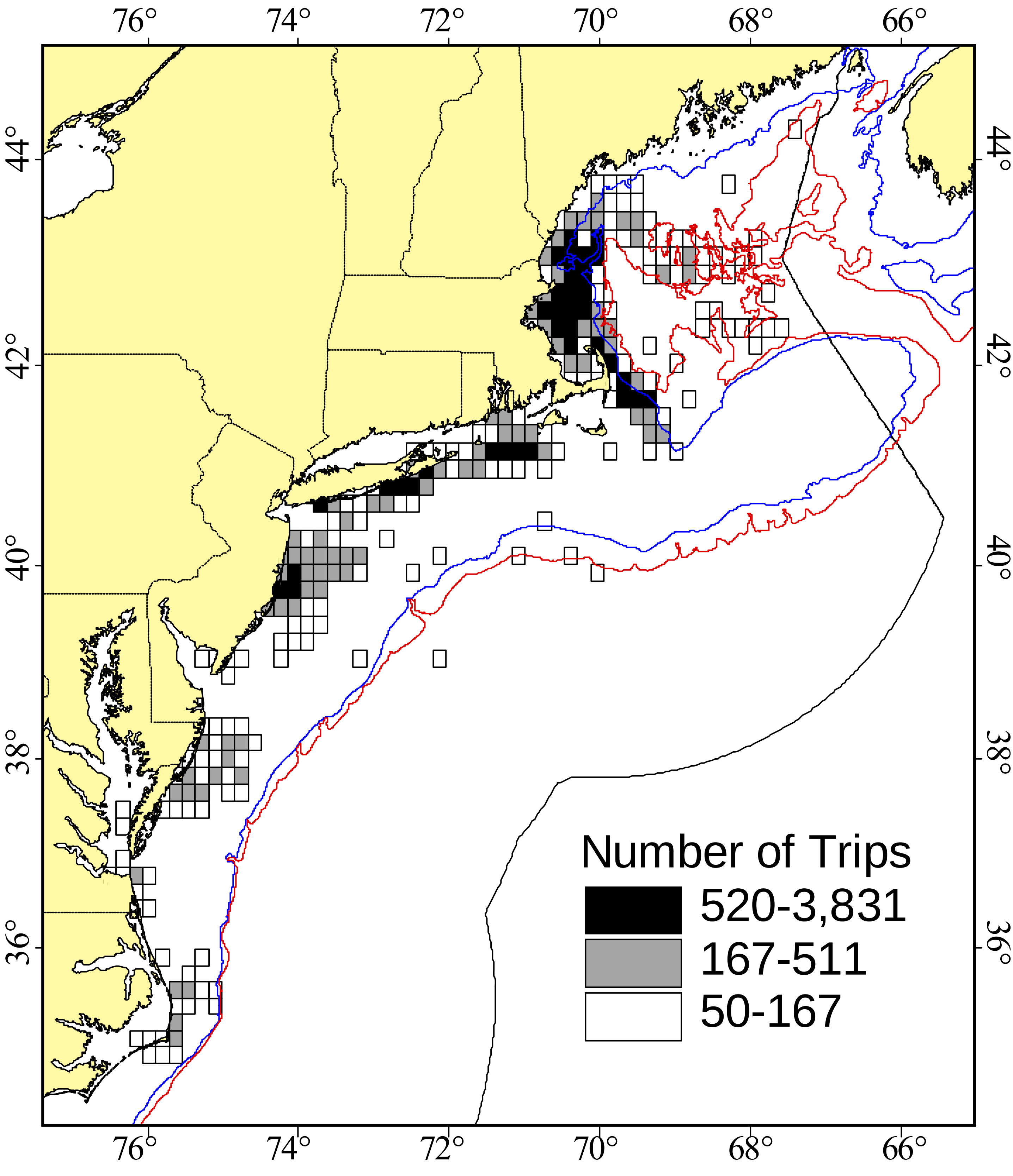


Figure 4.8. Bottom gill net fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

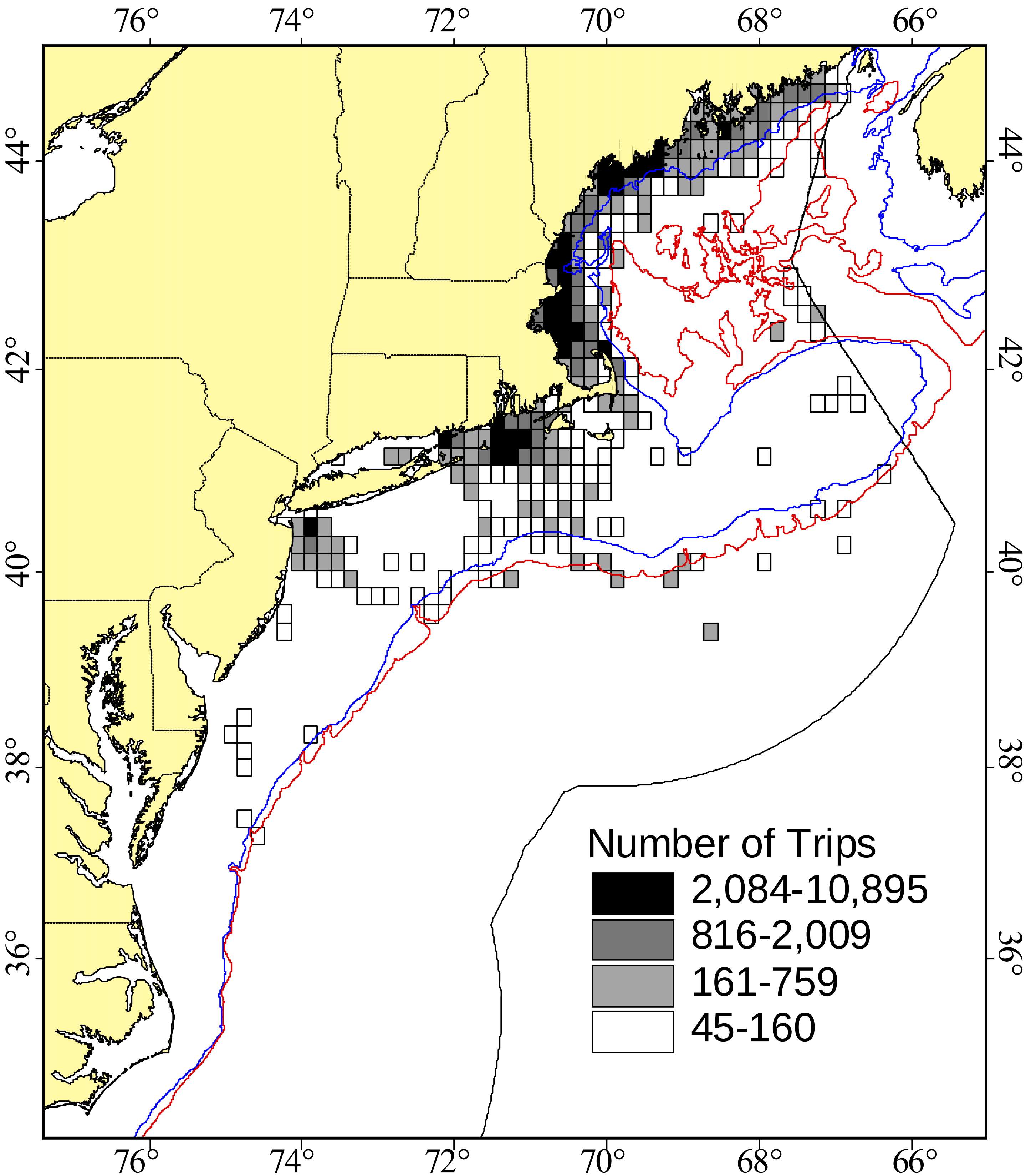


Figure 4.9. Lobster trap or pot fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), low (90% cumulative), or very low (95% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

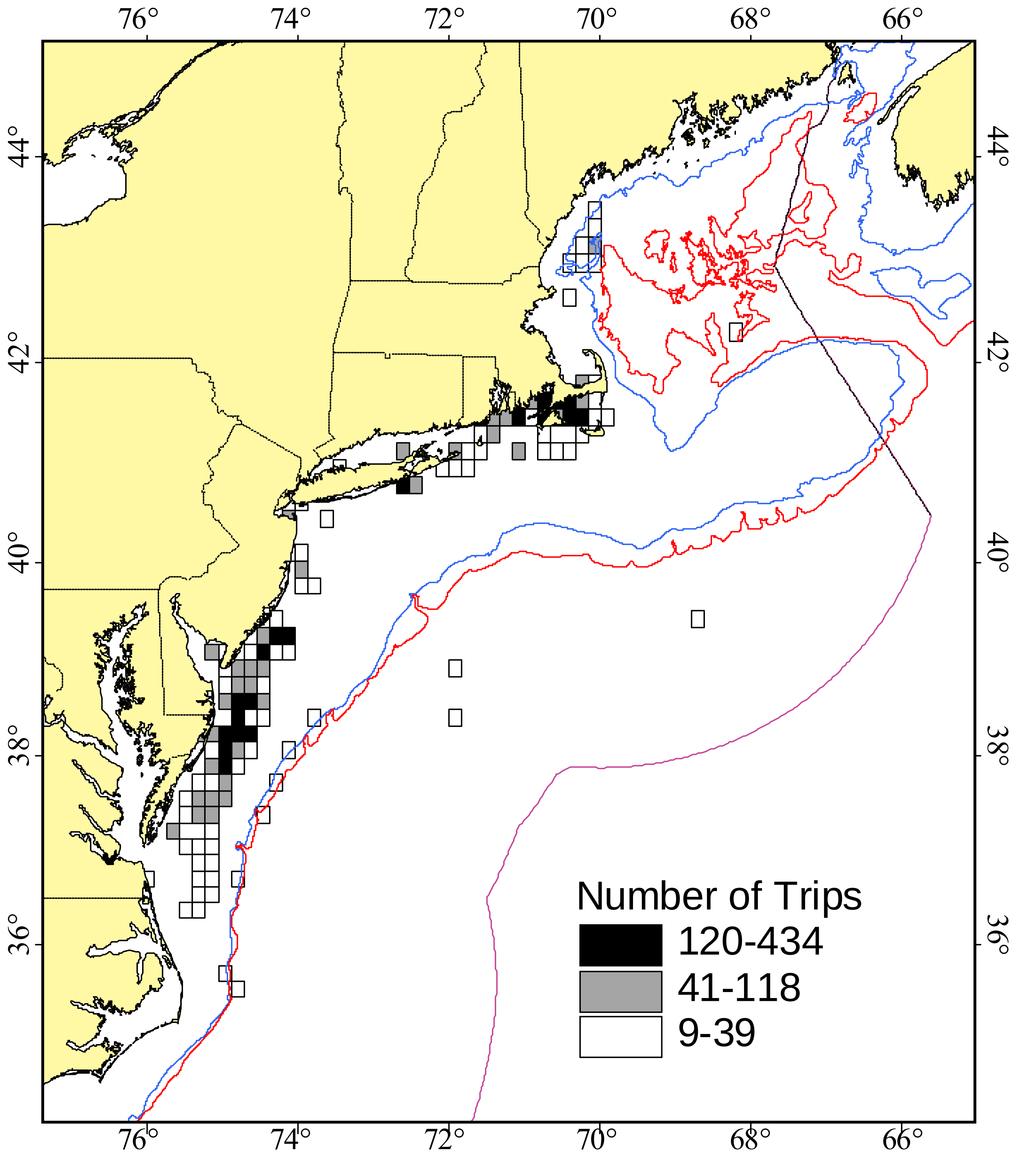


Figure 4.10. Fish pot fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

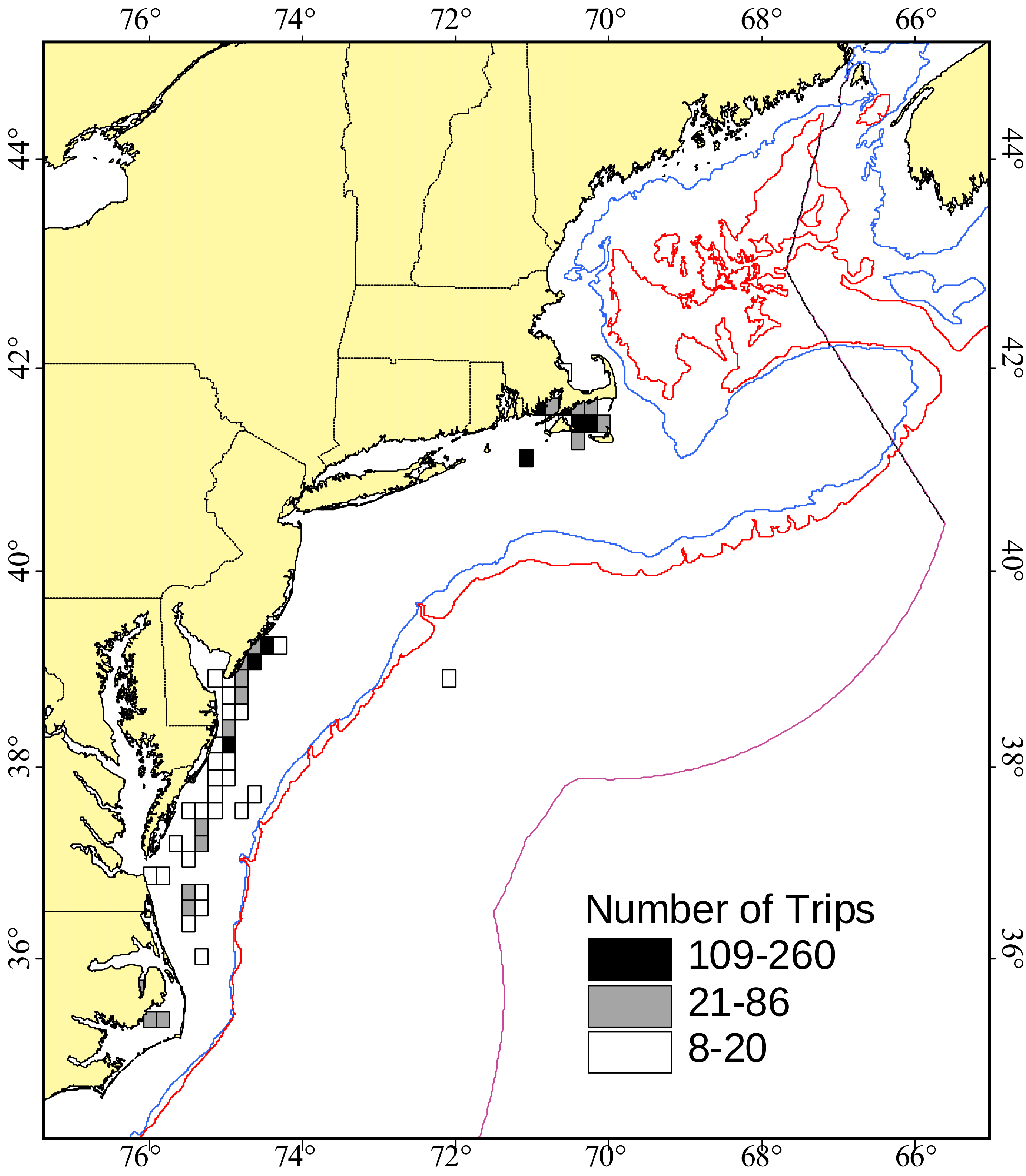


Figure 4.11. Whelk pot fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

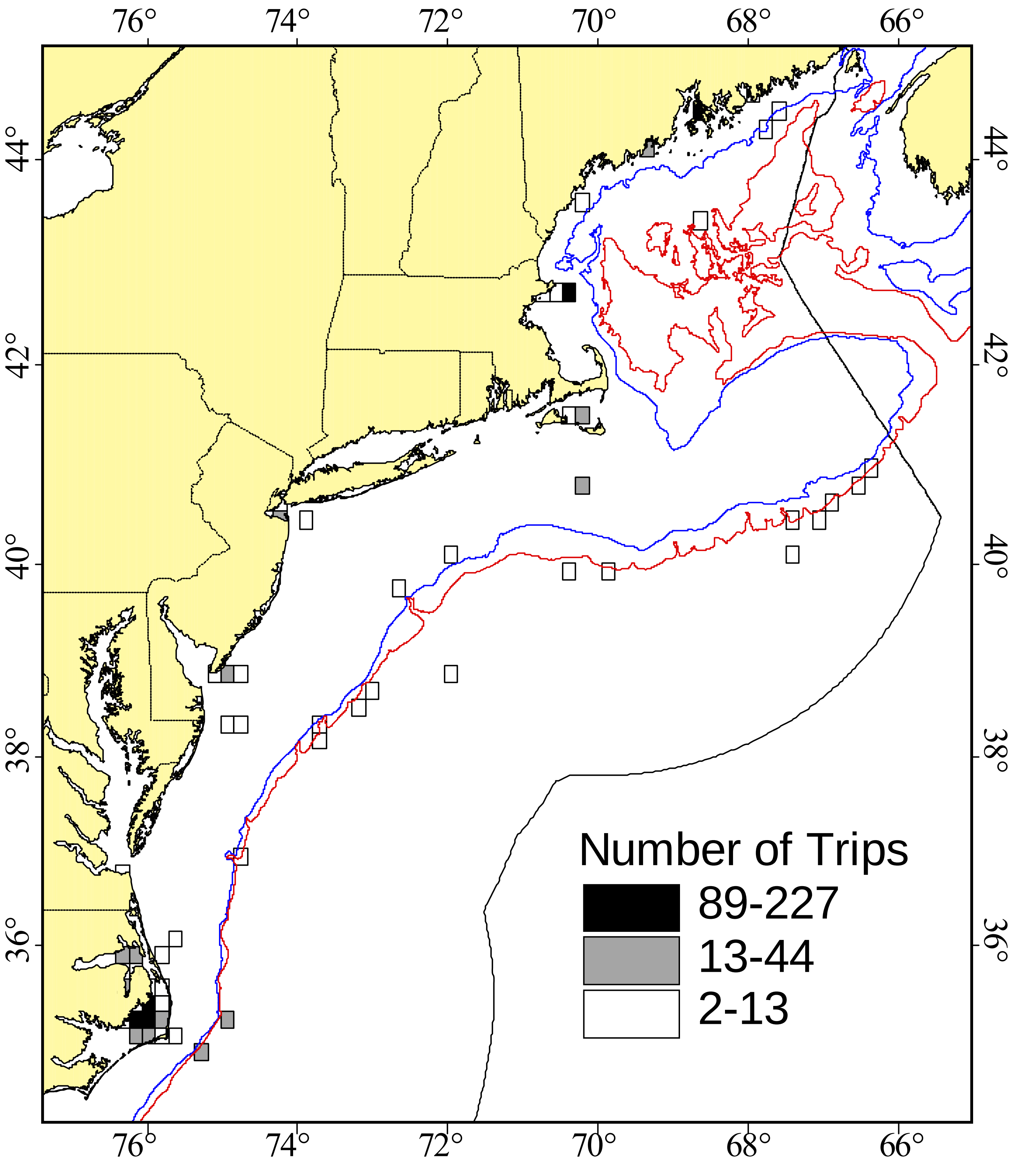


Figure 4.12. Crab pot fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

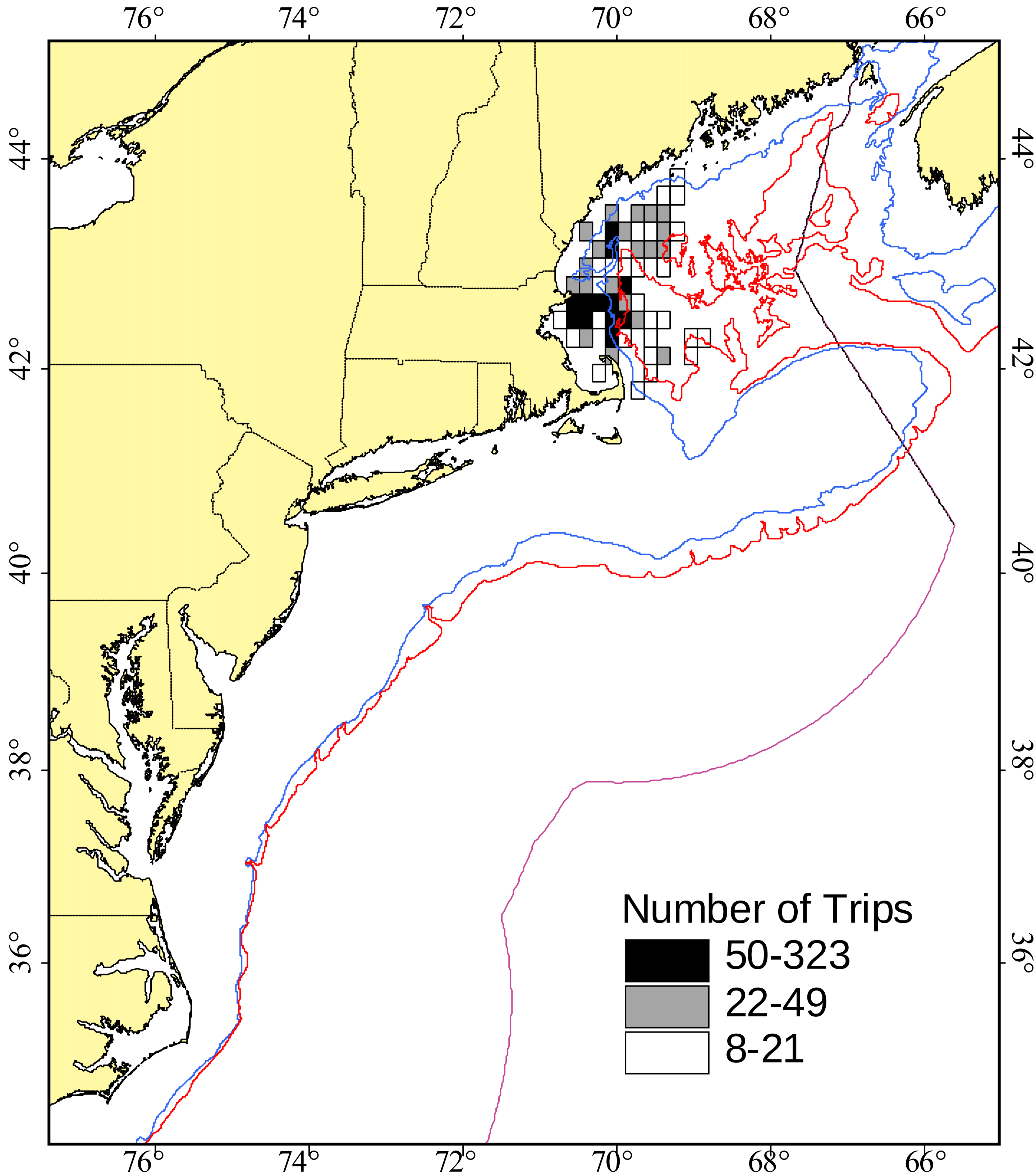


Figure 4.13. Hagfish pot fishing activity in the Northeast Region during 1995-2001. (Each TMS is associated with either a high (50% cumulative), medium (75% cumulative), or low (90% cumulative) category of fishing activity level (*i.e.*, number of trips). See the text for further explanation of cumulative percentages, or "percentiles," and Table 4.3 for the ranges of fishing activity associated with each cumulative percentage category.)

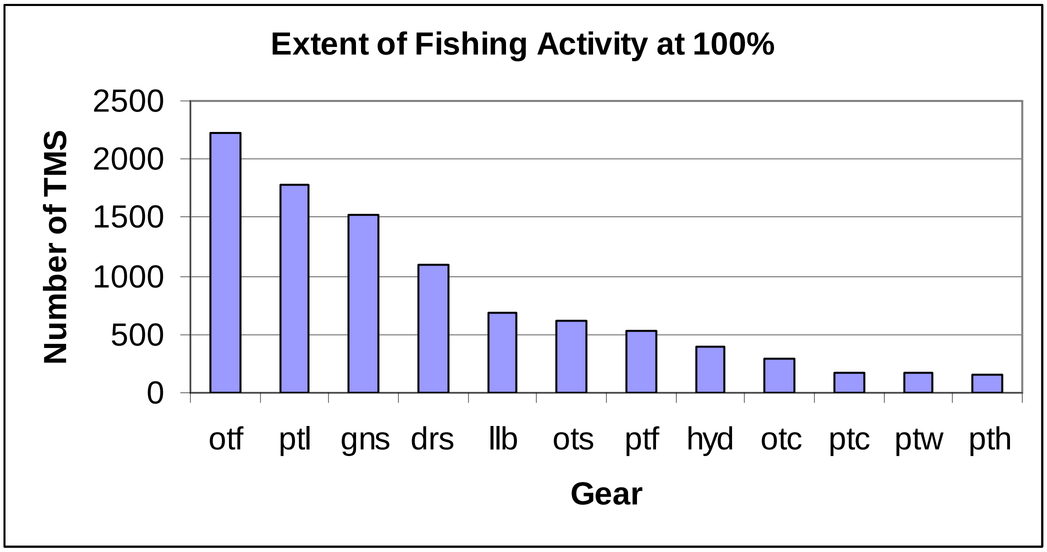


Figure 4.14. Number of 10' squares (TMSs) within which any amount of fishing activity was reported (*i.e.*, the 100th percentile) during 1995-2001 by gear type. (Note: Important to show because the maps stop at the 90th or 95th percentile, and do not show the full extent of fishing activity (*i.e.*, TMSs with just a small amount of activity, as well as TMSs with activity that is misreported by fishermen). Key: drs = New Bedford-style scallop dredge; gns = sink gill net; hyd = hydraulic clam dredge; llb = bottom longline; otc = otter trawl (scallop); otf = otter trawl (fish); ots = otter trawl (shrimp); ptc = pots & traps (crab); ptf = pots & traps (fish); pth = pots & traps (hagfish); ptl = pots & traps (lobster); and ptw = pots & traps (whelk).)

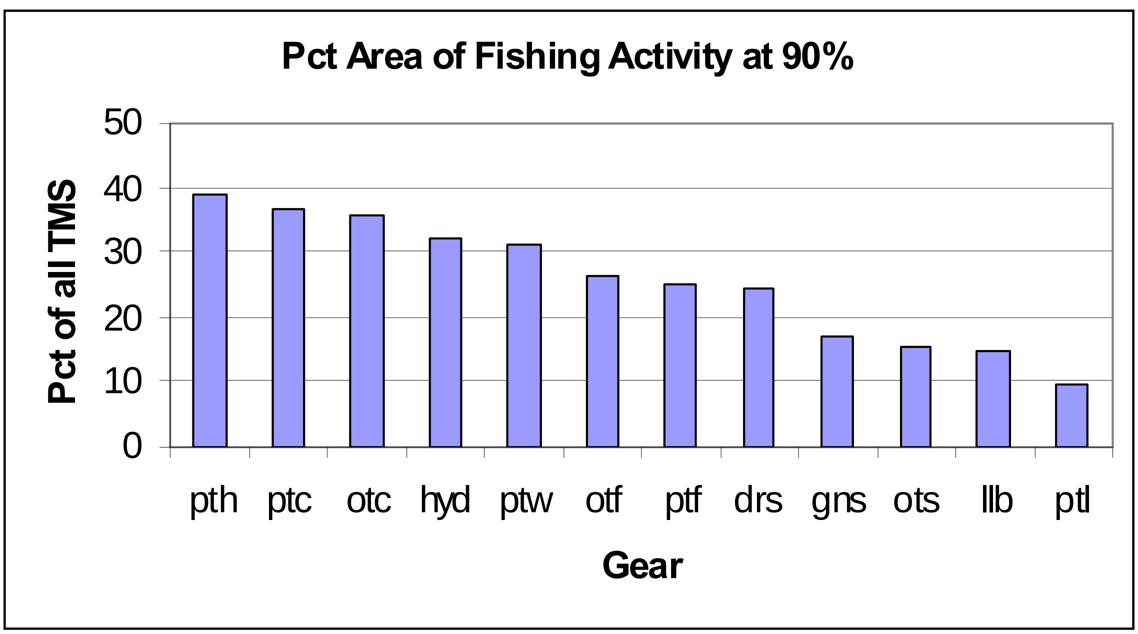


Figure 4.15. Proportion of area fished [all 10' squares] at the 90th percentile, an index of how evenly distributed the days or trips were among 10' squares, during 1995-2001 by gear type. (Note: For gears at the high end, most of the fishing activity was concentrated in a relatively small percentage of the total area fished (aggregated), and for gears at the low end, fishing activity was more evenly dispersed among TMSs. Key: drs = New Bedford-style scallop dredge; gns = sink gill net; hyd = hydraulic clam dredge; llb = bottom longline; otc = otter trawl (scallop); otf = otter trawl (fish); ots = otter trawl (shrimp); ptc = pots & traps (crab); ptf = pots & traps (fish); pth = pots & traps (hagfish); ptl = pots & traps (lobster); and ptw = pots & traps (whelk).)

5. REVIEW OF LITERATURE ON FISHING GEAR EFFECTS

Seventy-three publications were included in the gear-effects literature review. An attempt was made to include all available, relevant, English language scientific publications in order to determine the effects on benthic marine habitat types of the principal commercial fishing gears used in the Northeast Region. Habitat types were defined by the predominant substrate. Gear types that were selected were those that are currently used in the region, or those that are used elsewhere but were judged to have similar effects as gears that are used in the region. Gears that are used strictly in state waters to harvest species that are not federally managed were not included.

This review details individual scientific studies and summarizes what is known about each combination of gear and substrate type. Both peer-reviewed and non-peer-reviewed publications were included, but the emphasis was on the former. Information summarized in this review was based, in all cases, on primary source documents. An attempt was made to include all relevant publications available through early 2002.

This document differs in several important ways from other recent reviews of the gear-effects literature (Jennings and Kaiser 1998; Auster and Langton 1999; Collie *et al.* 2000) and from recent broadscale assessments of the effects of commercial fishing gear on benthic marine habitats and ecosystems (Dayton *et al*. 2002; NRC 2002). Rather than emphasizing general conclusions that apply to combined gear types (*e.g.*, "reduction of habitat complexity by mobile bottom-tending gear"), this document provides detailed summaries, in text and tabular format, of individual studies of relevance to the Northeast Region. The intention was to provide enough information in each summary for the reader to understand where and how the research was conducted and what the principal results were. Each such summary table contains information on location, depth, substrate, effects, recovery, and the methodological approach. No attempt was made to critically evaluate the research approach or the validity of the results, unless there were issues (*e.g.*, a failure to replicate treatment sites, not enough samples) identified as problems by the authors themselves. Most of the studies summarized in this document were also summarized in less detail in an earlier NMFS report that included gear types not used in the Northeast Region (Johnson 2002).

METHODS

The review is organized by combinations of gear and substrate types. Nine of the seventy-three reviewed studies included information for more than one gear type, or for one gear type in more than one substrate or study area, and were therefore summarized in more than a single gear/substrate category. In all, there were 80 descriptions for seven gear types and five substrates (Tables 5.1-5.3). Cases in which the effects of more than one gear type were evaluated in a single study and could not be distinguished were categorized as multiple gears. The same approach was used for studies conducted in mixed substrates that could not be defined as mud, sand, gravel/rock, or biogenic.

Over half (65%) of the descriptions in this document are for otter trawls and scallop dredges, and all but one are for different kinds of mobile bottom-tending gears. Thirty-four of the studies were done in sandy substrate, twelve in mud, seven in different types of biogenic substrate, five in gravel and rocky bottom, and twenty-two in mixed substrate. Most studies were peer reviewed, and most were published after 1990. Geographically, 21 were conducted in the northeastern United States (North Carolina to Maine), 19 elsewhere in North America (United States and Canada), 28 in Europe and Scandinavia, and 12 in Australia and New Zealand.

Individual Studies

Within each gear/substrate subsection, individual studies are described in one to two paragraphs that include the following information, when available:

- citation (authors and date of publication)
- location of study
- depth
- substrate type and/or composition
- detailed information on gear used, especially for otter trawls
- type of study (observational or experimental)
- whether experiments were set up to test for time and location effects
- type(s) of organisms sampled (infauna versus epifauna)
- duration and intensity of fishing (number of tows, duration of each fishing event, total duration of fishing disturbance, frequency of fishing events, etc.)
- timing of sampling or observations (how often, how long before or after fishing, etc.)
- timing and frequency of sampling or observations to determine recovery
- whether study was done in a commercially exploited or unexploited area
- if unexploited, for how long and what gears were excluded

Details that were not generally included were descriptions of sampling gears and procedures, sample processing information (*e.g.,* the mesh size used to sieve grab samples), taxonomic categories used (families, groups of species, individual species), and data analysis procedures (*e.g.,* statistical tests). General conclusions, when they are included, were the own statements of the respective study's author(s); neither speculations regarding the study in question nor any restatements made by the authors regarding anybody else's research were included. Results which are described as "significant" are results that were statistically significant. To avoid confusion, the term was not used in any other context.

Each gear/substrate category also includes a table summarizing the setting (location, depth, and sediment type), general methods, and primary results of each study. The listing of results in these tables is divided into an effects column and a recovery column. Results summarized in the tables include positive and negative results (*e.g.,* increases and decreases in abundance caused by fishing, as well as instances when there were no detectable effects of fishing). Blank cells in the recovery column indicate that the study was not designed to provide information on recovery times. Information in the last column includes the nature of the research (experimental or observational), whether or not the study area was being commercially fished at the time of the study, and how the experimental fishing was conducted (single or multiple tows, discrete or repeated disturbance events, and, if known, the average number of tows to which any given area of bottom was exposed).

Summaries

This section also summarizes results for all studies combined in each gear/substrate category. Each such summary begins with an introductory paragraph that includes general information, such as:

- the number of studies that examined physical and biological effects
- how many studies were done in different geographic areas and depth ranges
- how many studies examined recovery of affected habitat features
- the number of studies performed in areas that were closed to commercial fishing versus areas that were commercially fished at the time of the study
- how many studies involved single versus multiple tows
- how many studies were conducted either during a single discrete time period or during a more prolonged period of time that was intended to simulate actual commercial fishing activity

Physical and biological effects for each gear/substrate category are summarized in separate paragraphs. When necessary, biological effects are presented separately for single disturbance and repeated disturbance experimental studies, and for observational studies.

RESULTS

Otter Trawls

Otter Trawls -- Mud (Table 5.4)

1. Ball *et al.* (2000) sampled benthic macrofauna before and 24 hr after trawling at a heavily fished site within an offshore prawn (*Nephrops*) trawl fishing ground in the Irish Sea and at an unfished "pseudo-control" site near a shipwreck at the same depth (75 m) that had not been fished for about 50 yr. Sediments were sandy silt. No information on the duration of experimental trawling or the type of net used was provided.

Due to few organisms and low biomass, and to the resulting high intersample variance, it was not possible to quantitatively evaluate the short-term effects of trawling at the fished site. There were, however, considerably fewer species and individuals, and lower species diversity and richness, in the commercially trawled area than near the shipwreck.

At the shipwreck site, the number of species, number of individuals, and biomass decreased with increasing distance from the wreck. High intersample variance in biomass estimates near the wreck impeded comparisons with the trawled site. Sixty-nine species found at the wreck site were not found at the experimental fishing site. These included polychaetes, crustaceans, bivalve mollusks, gastropods, and echinoderms. Large specimens of some mollusks and echinoderms were most common near the wreck, whereas only juveniles of these species were sampled in the trawled area.

2. Brylinsky *et al.* (1994) examined physical and biological effects of 18-24 m wide flounder trawls with 180-270 kg doors, 29-cm-diameter rubber rollers, and no tickler chains in an intertidal estuary in the upper Bay of Fundy, Nova Scotia. The study area was commercially fished for flounder by trawlers. Four trawling experiments were conducted at two sites in 6-8 m of water (at high tide) in 1990 and 1991. Repeated tows were made during a single day at each site, but not over the same bottom area. Samples of macrobenthos, meiofauna, and chlorophyll were collected at each site at variable intervals for 1.5-4 mo after trawling. One site had sand overlain with several centimeters of silt; the other site had siltier sediment to a depth of at least 10 cm. The study area is a high-energy environment, owing to the extreme tidal range (average 11 m with a maximum of 16 m) and tidal currents that frequently exceed 2 knots.

Trawl doors made furrows 1-5 cm deep and berms that were visible for at least 2-7 mo. The rollers compressed sediments. The amount of disturbance varied markedly and seemed to be influenced primarily by the kind of sediment and the type of door used, being more pronounced in the finer sediments and when heavier doors were used. Benthic diatoms (measured as chlorophyll *a*) decreased in door furrows at some stations, but recovered within 1-3 mo. No significant effects were observed on macrobenthos, which was dominated by polychaetes. The numbers of nematodes in door furrows were reduced, but only for 1-1.5 mo, and may only have been displaced by the doors. Benthic taxa such as mollusks, crustaceans, and echinoderms that are known to be more susceptible to trawling were not present in the study site.

3. DeAlteris *et al.* (1999) analyzed data from a 1995 sidescan sonar survey to locate and map trawl tracks in shallow sand and mud sediments in lower Narragansett Bay, Rhode Island. At the deeper (14-m) mud-bottom site, trawl doors produced smooth tracks 5-10 cm deep with berms on the inside edge that were 10-20 cm high.

The longevity of hand-dug trenches (dug to simulate tracks left by trawl doors) was monitored using SCUBA divers. The trenches were observed unchanged for the duration of the study (>60 days), and were occupied by Atlantic rock crabs. Natural erosion at this site was predicted to occur <5% of the time.

4. Drabsch *et al.* (2001) used divers to sample benthic infauna before and after experimental trawling in an area of South Australia (Gulf of St. Vincent) where little or no fishing had occurred for 15 yr. Three study sites were used (one in mud and two in sand), with adjacent trawled and control corridors at each site. (See "Otter Trawls -- Sand, 4. Drabsch *et al*. (2001)" for a summary of results at the two sandy study sites.) Two series of 10 adjacent tows were made in a single trawl corridor at the mud treatment site during 1 day in October 1999 using triple prawn trawls with two doors (1x2 m, 200 kg each) and a combined sweep length of about 20 m. Bottom sediments at the mud study site were fine silt sediments and the depth was 20 m.

Trawl doors left tracks, and the footline and net smoothed topographic features and removed 28% of the epifauna (not differentiated between mud and sand substrates). Remaining epifauna in the trawled corridor showed signs of damage. Total infaunal abundance and the abundance of one family of polychaetes (Ctenodrilidae) were significantly reduced 1-wk after trawling. No significant changes were evident for any other taxon.

5. Frid *et al.* (1999) examined the long-term effects of fishing with prawn (*Nephrops norvegicus*) otter trawls by comparing changes over 27 yr on macrobenthic communities at a lightly fished (LF) and a heavily fished (HF) location off the northeastern coast of England (North Sea). Fishing activity within the statistical area that includes both sites was divided into three periods of low (1971-1981), high (1982-1989), and moderate (1990-1997) fishing effort. The depth at the HF site was 80 m, and the substrate was predominantly (>50%) silt-clay. Grab samples were collected at the HF site every year during January. Benthic taxa in the samples were divided into two groups that were predicted to respond negatively (*i.e.*, decreased number of individuals, or "abundance") or positively (*i.e.*, increased abundance) to increased trawling activity, based on published accounts.

The total abundance of taxa in the positive response group conformed to predictions by increasing significantly between the periods of low and high fishing effort, and then declining when fishing effort dropped to moderate levels. The total abundance of taxa in the negative response group did not vary significantly between time periods. Errant polychaetes were the only taxonomic group in the negative response group to increase significantly at high fishing effort. Starfish and brittle stars were more abundant at high fishing effort, but not significantly. Sea urchins, as predicted, decreased in abundance (to zero) at high fishing effort. Sedentary annelids and large bivalve mollusks were taxa in the negative response group that did not decrease in abundance. Benthic macrofaunal abundance at the HF site was low at the beginning of the time series when phytoplankton production was also low, but once fishing effort increased, there was no longer any correlation between the two. (See "Otter Trawls -- Sand, 5. Frid *et al*. (1999)" for a summary of results at the LF site that had a sandy substrate.)

6. Hansson *et al.* (2000) examined the effects of trawling on clay bottom habitats at 75-90 m depths in a Swedish fjord. The benthic infauna was collected 1-5 mo before trawling began at three experimental sites and three control sites, and during the last 5 mo of a 1-yr trawling experiment. All sites were located in an area that had been closed to fishing for 6 yr. The otter trawl that was used was a commercial shrimp trawl with a 14-m ground rope with 20 kg of lead distributed along it, and 125-kg otter boards. Eighty hauls were made at each treatment site during a 1-yr period starting in December 1996, at a frequency of two hauls per week. It was estimated that any given area was passed over 24 times by the trawl during the experiment.

For 61% of the species sampled, abundances tended to be negatively affected by trawling (*i.e.*, abundances decreased more or increased less in the trawled sites compared to the control sites during the experiment). Total biomass decreased significantly at all three trawled sites, and the total number of individuals decreased significantly at two trawled sites, but in both cases significant reductions were also observed at one of the control sites; thus, these changes could not be attributed solely to trawling. Total abundance and biomass at trawled sites was reduced by 25% and 60%, respectively, compared to 6% and 32% in control sites. Individual phyla responded differently to trawling. Echinoderm (mostly brittle star)abundance decreased significantly, polychaete abundance was not affected although some families increased and some families decreased, and amphipod and mollusk abundances were not affected.

7. Mayer *et al.* (1991) examined the immediate effects of a single tow with an otter trawl on mud substrate at a depth of 20 m in a bay on the coast of Maine. The trawl had an 18-m footrope with an attached tickler chain and 90-kg doors. Sediment core samples (to a sediment depth of 18 cm) were taken inside and outside the drag line the day after trawling, and were analyzed for porosity, chlorophyll, pheophytin, total organic matter, protein, extracellular proteolytic activity, and beryllium-7.

Downcore profiles were similar between the dragged and control sites, indicating that trawling did not "plow" the bottom and bury surficial sediments. The trawl doors did produce furrows several centimeters deep, and the chain and net caused a very thin, and inconsistent, planing of surficial features. A high value of beryllium-7 in surficial sediments at the control site, but not at the trawled site, indicated that fine sediments were dispersed laterally, away from the area of dragging.

8. Pilskaln *et al.* (1998) collected large infaunal worms in sediment traps deployed 25-35 m above the bottom in two deep (250-m) basins in the GOM during 1995.

Many more worms were collected in Wilkinson Basin, which is located in a more heavily trawled area in the Gulf, than in Jordan Basin, which is located in a region of the Gulf with very little trawling activity. Higher abundance coincided with seasons of greater trawling activity in the southwestern GOM.

The authors concluded that the worms are dislodged and suspended in the near-bottom water column by trawling because there was no other reason why they would leave their natural habitat in the bottom. They also noted that the resuspension of fine sediment by bottom trawls releases nutrients such as nitrogen and silica from bottom sediments.

9. Sanchez *et al.* (2000) examined the effects of otter trawling in a commercially trawled area with muddy substrate (depth 30-40 m) in the northwest Mediterranean Sea off the coast of Spain. A commercial otter trawl was towed repeatedly during daylight for 1 day (3.5 hr of towing) at one site and during a 23-hr period (7 hr of towing) at a second site in July 1997, so that each trawl wayline was swept entirely either once or twice. Infaunal grab samples were collected prior to fishing and at various times after fishing (up to a maximum of 150 hr) in each trawl wayline and at unfished sampling locations adjacent to each wayline.

A number of taxa (mostly families) were significantly more abundant in the lightly trawled wayline than in the adjacent untrawled area after 150 hr, primarily due to decreased abundance outside the wayline. The total numbers of individuals and taxa were also significantly reduced outside, but not inside, the lightly trawled wayline 150 hr after trawling. There were no differences in the number of taxa or individuals inside and outside the more intensively trawled wayline after 72 hr.

The percentage composition of abundance of major taxa (*i.e.*, polychaetes, crustaceans, and mollusks) was similar in both trawled waylines and in the control locations throughout the experiment, and trawling produced no changes in community structure in either wayline. Sidescan sonar images of the trawl waylines showed furrows left by the trawl doors that remained visible throughout the experiment.

10. Sparks-McConkey and Watling (2001) investigated the effects of trawling on geochemical sediment properties and benthic infauna in Penobscot Bay, Maine. The study site was selected because it was deep (60 m) and bottom sediments were not exposed to storm events or tidal scouring. Sediment particle size was homogeneous spatially and temporally within the study area. There had been no commercial trawling in the area for 20 yr. Trawling was conducted at two stations in December 1997 with a 12-m commercial silver hake net that was modified (increased mesh size and decreased diameter of float rollers) to reduce effects to the seafloor. Four tows were made at each station during 1 day. An attempt was made to tow the same area of bottom each time. Sampling was conducted at the experimental stations and at seven reference stations for a year before trawling, and 5 days, 3.5 mo, and 5 mo after trawling. An underwater video camera was used to verify that post-trawl grab samples were taken in trawl tracks.

Trawling caused immediate and significant reduction in porosity, an increase in the food value of surface sediments (upper 2 cm), and stimulated chlorophyll production, but none of these properties were any different at the trawled stations after 3.5 and 5 mo. Trawling also had immediate and significant effects on benthic infauna, reducing the number of individuals and species, reducing taxonomic diversity, and increasing species dominance. There were no longer any significant differences in any of these parameters after 3.5 mo when mobile species recruited to the benthos. Four polychaete species were significantly less abundant at the trawled stations 5 days after trawling, but three of them were present in equal densities at treatment and control stations 3.5 mo later. Two species of bivalve mollusks were reduced in abundance by trawling, one of them for 3.5 mo. Nemerteans were significantly more abundant at the trawled stations during all three post-trawl sampling dates.

11. Tuck *et al.* (1998) conducted experimental trawling in a sea loch in Scotland that had been closed to fishing for over 25 yr. Trawling was conducted 1 day/mo (for 7.5 hr) for 16 mo in a single treatment site (95% silt-clay, depth 30-35 m) starting in January 1994. Infaunal surveys were completed in the trawled site and a nearby reference site prior to, after 5, 10, and 16 mo of disturbance, and, once trawling ended, after 6, 12, and 18 mo of recovery.

Trawl doors produced furrows in the sediment, which were still evident in sidescan sonar images after 18 mo.

Trawling had no effect on sediment characteristics, but bottom "roughness" in the trawled area increased during the disturbance period and declined during the recovery period.

There were no significant differences in the number of infaunal species in the experimental and reference sites prior to the beginning of the experiment or during the first 10 mo of disturbance, but there were more species in the trawled site after 16 mo of disturbance and throughout the recovery period. In contrast, there were significantly more individuals in the trawled site before trawling began. This difference was maintained after 10 and 16 mo of fishing, and after 6 and 12 mo of recovery, but after 18 mo, there was no difference between the two sites. Taxonomic diversity and evenness indices were significantly lower in the experimental site for the first 22 mo of the experiment, but after 12 mo of recovery there were no longer any differences. Some species (primarily opportunistic polychaetes) increased significantly in abundance in the trawled plot in response to the disturbance, while others (*e.g.,* bivalve mollusks) declined significantly in abundance relative to the reference area. Biomass was significantly higher in the control site before trawling started, but not during the rest of the experiment. Two different measures of community structure were applied. One of them indicated that the two sites became significantly different after only 5 mo of disturbance and remained so throughout the experiment. According to the other one, the treatment site reached a similar condition to the reference site at the end of the recovery period. Trawling effects on epifauna could not be evaluated in this study because organisms were present in very low densities and because the trawl was not equipped with a net, thus any effects on epifauna would have been underestimated.

Summary

Results of 11 studies are summarized. All of the studies were conducted during 1991-2001, five in North America, five in Europe, and one in Australia. One study was performed in an intertidal habitat, one in very deepwater (250 m), and the rest in a depth range of 14-90 m. Eight of them were experimental studies and three were observational. Two studies examined only physical effects, six assessed only biological effects, and three examined both physical and biological effects. One study evaluated geochemical sediment effects.

In this habitat type, biological evaluations focused on infauna: all nine biological assessments examined infaunal organisms, and four of them included epifauna. Habitat recovery was monitored on five occasions. Two studies evaluated the long-term effects of commercial trawling, one by comparing benthic samples from a fishing ground with samples collected near a shipwreck, while another evaluated changes in macrofaunal abundance during periods of low, moderate, and high fishing effort during a 27-yr period. Four of the experimental studies were done in closed or previously untrawled areas and three in commercially fished areas. One study examined the effects of a single tow, and six involved multiple tows. Five studies restricted trawling to a single event (*e.g.,* 1 day) and two examined the cumulative effects of continuous disturbance.

Physical Effects

Trawl doors produce furrows up to 10-cm deep and berms 10-20 cm high on mud bottom. Evidence from three studies (2, 3, 9) indicates that there is a large variation in the duration of these features (2-18 mo). There is also evidence that repeated tows increase bottom roughness (11), fine surface sediments are resuspended and dispersed (7), and rollers compress sediment (2). A single pass of a trawl did not cause sediments to be turned over (7), but single and multiple tows smoothed surface features (4, 7).

Biological Effects -- Single-Disturbance Experimental Studies

Three single-event studies (1, 2, 9) were conducted in commercially trawled areas. Experimental trawling in intertidal mud habitat disrupted diatom mats and reduced the abundance of nematodes in trawl door furrows, but recovery was complete after 1-3 mo (2). There were no effects on infaunal polychaetes (2). In a subtidal mud habitat (30-40 m deep), the benthic infauna was not affected (9). There were no obvious effects on macrofauna at a deeper (75 m) site, but there were fewer organisms and species there than at an unexploited site near a shipwreck (1).

In two assessments performed in areas that had not been affected by mobile bottom gear for many years (4, 10), effects were more severe. Total infaunal abundance (4, 10) and the abundance of individual polychaete (4, 10) and bivalve mollusk (10) species declined immediately after trawling.

In one of these studies (10), there were also immediate and significant reductions in the number of species and species diversity. Other effects included reduced porosity, increased food value, and increased chlorophyll production in surface sediments. Most of these effects lasted <3.5 mo.

In the other study (4), two tows removed 28% of the epifauna on mud and sand substrate (not differentiated), and epifauna in all trawled quadrats showed signs of damage. These results were not reported separately for mud bottom.

Biological Effects -- Repeated-Disturbance Experimental Studies

Two studies of the effects of repeated trawling were conducted in areas that had been closed to fishing for 6 yr (6) and >25 yr (11). In one study (6), multiple tows were made weekly for a year, and in the other (11), monthly for 16 mo.

In one case (6), 61% of the infaunal species sampled tended to be negatively affected, but significant reductions were only noted for brittle stars.

In the other case (11), repeated trawling had no significant effect on the numbers of infaunal individuals or biomass. In this study, the number of infaunal species increased by the end of the disturbance period. Some species (*e.g.,* polychaetes) increased in abundance, while others (*e.g.,* bivalve mollusks) decreased. Community structure was altered after 5 mo of trawling, and (because of mixed results from the analyses) if it did fully recover, then it did not do so until at least 18 mo after trawling ended.

Biological Effects -- Observational Studies

An analysis of benthic sample data collected from a fishing ground over a 27-yr period of high, medium, and low levels of fishing effort showed an increased abundance of organisms belonging to taxa that were expected to increase at higher disturbance levels, whereas those that were expected to decrease did not change in abundance (5). Trawling in deepwater apparently dislodged infaunal polychaetes, causing them to be suspended in near-bottom water (8).

Otter Trawls -- Sand (Table 5.5)

1. Ball *et al.* (2000) sampled benthic macrofauna at a lightly fished inshore prawn trawl fishing ground in the Irish Sea before and 24 hr after trawling and at an unfished (for about 50 yr) "pseudo-control" site near a shipwreck. Sediments at these two sites were muddy sand, and the depth was 35 m. No information on the duration of experimental trawling or the type of net used was provided.

There were no obvious short-term effects of experimental trawling. Chronic effects, as indicated by differences between the fished site and the wreck site before experimental trawling began, were similar in kind, but less pronounced than at the heavily fished, mud-bottom offshore site (see "Otter Trawls -- Mud, 1. Ball *et al.* (2000)"). Mean numbers of species and total numbers of individuals for both infaunal and epifaunal species were higher at the unfished wreck site, as were indices of species diversity and richness. High intersample variance in biomass estimates near the wreck impeded comparisons with the trawled site. Fifty-eight species found at the inshore wreck site were not found at the experimental fishing site. These species included predatory and tube-dwelling polychaetes as well as a number of bivalve mollusks and echinoderms. Other types of polychaetes were more common at the fished site.

2. Bergman and Santbrink (2000) calculated mortality rates for a number of sedentary and relatively immobile megafauna (*i.e.*, >1 cm in maximum dimension) caught or damaged by a flatfish otter trawl at six commercially exploited sites in the southern North Sea during 1992-1995. The substrate at two deeper sites (40-50 m) was silty sand (3-10% silt), and at four shallower sites (<30-40 m) was sand (1-5% silt). At each site, benthic invertebrates were sampled before and 24-48 hr after trawling in four corridors with a dredge that was designed to sample relatively large, relatively low-abundance , infaunal and epifaunal species. The fishing gear was a commercial flatfish trawl that measured 35-55 m between the doors (15-20 m between the wings) when underway, with 20 m of net (32 m with bridles) in contact with the seafloor, 20-cm roller gear, and 8-10 cm mesh in the cod-end. Three corridors were trawled in silty sand substrate and one in sandy substrate. The surface of each corridor was trawled on average 1.5 times.

Mortalities were calculated as the percent reduction from initial density after a single trawl tow, and ranged from <0.5 to 52% for nine species of bivalve mollusks, from 16 to 26% for a sea urchin, from 3 to 30% for a crustacean, and from 2 to 33% for other species. Overall, mortality rates for six species ranged from 20 to 50%, and for 10 other species were < 20%. Significant before-and-after differences were detected on only 11 of 54 occasions. Some species experienced higher mortalities in the silty sand substrate and some in the sandy substrate.

3. DeAlteris *et al.* (1999) used divers to determine that simulated (*i.e.*, dug by the divers) trawl door tracks only lasted 1-4 days at a 7-m deep sandy site in Narragansett Bay, Rhode Island. Natural erosion at this site was predicted to occur on a daily basis, much more rapidly than in deeper water with a mud substrate (see "Otter Trawls -- Mud, DeAlteris *et al.* (1999)" for a summary of the mud-bottom results).

4. Drabsch *et al.* (2001), in addition to sampling a mud-bottom site in South Australia before and after trawling (see "Otter Trawls -- Mud, Drabsch *et al.* (2001)"), also sampled two additional sites (20-m depth) with medium-coarse sand sediments and shell fragments. Trawling effects were evaluated at one of the sites 1 wk after fishing, and at the second site 3 mo after fishing.

Trawl doors left tracks in the sediment, and the footline and net smoothed topographic features and removed epifauna. In contrast to results obtained at the mud-bottom site, trawling at the sand-bottom sites did not significantly affect infaunal abundance. The only significant change to infauna that could be attributed to trawling was a reduction in density of one order of crustaceans (Tanaidaceae) 1 wk after trawling. Three months after trawling, infaunal abundance had declined dramatically in both the treatment and reference sites, and there were no significant differences between them.

5. Frid *et al.* (1999) examined the long-term effects of fishing with prawn otter trawls in the North Sea by comparing changes on macrobenthic communities at an LF sand-bottom site and an HF mud-bottom site during three time periods when fishing effort was either low, moderate, or high (see "Otter Trawls -- Mud, Frid *et al*. (1999)" for results at the HF site). The LF site was located in 55 m of water and had a predominantly sand substrate (20% silt-clay). Benthic taxa collected at the LF site were divided into two groups that were predicted to respond either negatively (decreased abundance) or positively (increased abundance) to increased trawling activity, based on published accounts.

Fluctuations in macrofaunal abundance at the LF site were correlated with the abundance of phytoplankton 2 yr previously, indicating that benthic organisms were more abundant when greater amounts of organic matter were available to stimulate benthic production and vice-versa. There was no correlation with changes in fishing effort and no change in the proportions of organisms in the positive and negative response groups over time.

6. Gibbs *et al.* (1980) sampled benthic epifauna and infauna prior to and immediately after 1 wk of repeated experimental trawling (with a 10-m otter trawl with 1-m x 0.5-m flat otter boards and chain spiders) in a shallow estuary in New South Wales, Australia, during October 1975. The experimental trawling was conducted before the opening of a 6-mo-long prawn fishing season. Additional samples were collected at the end of the season. Grab samples were taken over muddy sand (0-30 % mud-clay) at three sites within the fishing grounds in Botany Bay and at an unfished control site in Jervis Bay, located about 200 km south of Botany Bay.

Trawl footropes lightly skimmed the bottom and disturbed very little sand. Trawling did create a plume of sand, but after repeated trawls, the seafloor was only slightly modified. Community diversity indices were not significantly different among the three study sites and the control site before and immediately after experimental trawling or after the fishing season. The authors therefore concluded that there were no detectable effects of trawling.

7. Gilkinson *et al.* (1998) studied the effects of trawl door scouring on several species of infaunal bivalve mollusks by observing an otter door model deployed in a test tank with a sand bottom, designed to simulate the sediment of the northeastern Grand Banks.

The trawl door created a berm in the sediment (average height 5.5 cm) with an adjacent 2-cm-deep scour furrow. All 42 bivalve mollusks within the scour path were displaced, but only two were damaged.

8. Hall *et al.* (1993) sampled benthic infauna from a fishing ground in the North Sea using distance from a shipwreck as a proxy for changes in trawling intensity. The sediment was coarse sand and the depth was 80 m. The benthic infauna was sampled at intervals along three transects that started 5 m from the wreck and extended to 350 m from the wreck.

Infaunal community structure was closely related to grain size and organic carbon content that varied within concentric rings or linear waves of coarser and finer sand, but not to distance from the wreck. The authors concluded that the observed differences in infaunal abundance did not appear to be consistent with an effect of fishing disturbance, which would most likely not follow the same pattern of fluctuating high and low intensity at increasing distance from the wreck. Epifaunal taxa were not included in this analysis.

9. McConnaughey *et al.* (2000) examined chronic trawling effects on epifauna in a high-energy sandy habitat in the eastern Bering Sea, Alaska. Samples were collected in 1996 just inside and outside an area that had been closed to trawling since 1959, using an otter trawl modified to improve the catch and retention of large epibenthic organisms. The small-mesh net had a 34-m footrope with a tickler chain and a hula skirt, and 1-mt steel V-doors with 55-m paired dandylines (bridles). Each lower dandyline had a 0.6-m chain extension connected to the lower wing of the net to improve bottom-tending characteristics. Sampling sites were selected along the outside edge of the closed area where commercial trawling is intense, and inside the closed area within 1 nmi of the intensely trawled sites. The bottom in the study area was 44-52 m deep, had sand ripples and strong rotary tidal currents, and was well within the depth range affected by storm waves.

Sedentary taxa (*e.g.,* anemones, whelk eggs, soft corals, stalked tunicates, bryozoans, and sponges) were more abundant in the unfished (UF) area than in the heavily fished (HF) area. Differences (*i.e.*, UF>HF) were significant for sponges and anemones. Mixed nonsignificant responses were observed within motile groups (*e.g.,* crabs, starfish, and buccinid whelks) and infaunal bivalve mollusks. Species diversity of sedentary epifaunal taxa was significantly higher in the UF area, owing to the greater dominance of a starfish in the HF area. Attached epifauna (*e.g.,* sponges, anemones, soft corals, and stalked tunicates) had a significantly more patchy distribution in the HF area.

10. Moran and Stephenson (2000) conducted an experimental study of otter trawling effects on an unexploited area with dense macrobenthos at depths of 50-55 m on the continental shelf of northwest Australia. No information on bottom type was provided, but it was presumed to be sand (see Sainsbury *et al.* 1997). A video camera mounted on a sled was used to survey attached epifauna (>20 cm in maximum length) before and after individual trawling events in experimental and control sites. There were four trawling events scheduled at 2-day intervals. During each trawling event, four tows were required to cover the area of each of two experimental blocks so that any unit area of bottom was trawled once. Trawled and control sites were surveyed before and after each trawling event and on alternate days during trawling.

Mean density of benthos declined exponentially (and significantly) with increasing tow numbers, with four tows reducing density by about 50%, and a single tow reducing density by about 15%. This estimated removal rate is much lower than what was estimated by Sainsbury *et al.* (1997) for sponges in the same general location (89%, see below). The authors believe this disparity may be explained by the fact that the trawl used in their study was lighter, with 20-cm disks separated by 30-60 cm long spacers of 9-cm diameter, and may have lifted over some benthic organisms rather than removing them. In addition, sponges are more susceptible to removal than other benthic organisms.

11. Sainsbury *et al.* (1997) reported the results of surveys on the continental shelf (<200 m) in northwestern Australia that documented a shift in the dominance of fish species from those (*Lethrinus* and *Lutjanus*) that occur predominantly within habitats that contain large epibenthic organisms to those (*Nemipterus* and *Saurida*) that favor open sandy habitats, in conjunction with the development of a commercial stern and pair trawling fishery. Five years after trawl closure areas were implemented (in response to these shifts in species dominance), there were increased catch rates of *Lutjanus* and *Lethrinus*, increased abundances of small benthos (<25 cm), and no changes in abundances of large benthos. The abundance of these fishes and of both the large and small benthos continued to decrease in the area left open to trawling.

These results increased the probability placed on a habitat limitation model and decreased the probability of an intraspecific control model (Sainsbury 1991), indicating that changes in species abundance and composition were at least in part a result of the damage inflicted on the epibenthic habitat by demersal trawling gear. Video observations provided by a camera mounted on a trawl showed that during those encounters with the groundline where the outcome was observable, sponges >15 cm were removed from the substrate 89% of the time. The groundline consisted of a 15-cm-diameter rubber roller made from rubber disks packed together and threaded on the groundline, with 14-cm spacers between packs of disks.

Grand Banks, Newfoundland: A number of investigators (see next three summaries) have examined the physical and biological effects of sustained otter trawling in a relatively deep sand habitat (120-146 m) in a 100-nmi^2 area of the Grand Banks, Newfoundland, that was closed to commercial trawling in 1992. Analysis of fishing effort records indicated that it had not been fished intensively since the early 1980s (Kulka 1991). (A 1990 estimate of the intensity of seafloor disturbance by otter trawling in the study area was <8% per year per unit of bottom area, or one set every 12 yr).

Sediments at this site were moderately to well sorted, fine to medium-grained sand. The seafloor is smooth and relatively stable with no evidence of wave- induced ripples. However, interannual variations in grain size and acoustic properties were observed during the study, possibly caused by winter storms (Schwinghamer *et al.* 1998).

Twelve experimental trawl tows (31-34 hr of total trawling) were made in three 13-km long corridors with an Engel 145 otter trawl with 1250-kg oval otter boards and 46-cm diameter rock hopper gear during a 5-day period in late June - early July of 1993, 1994, and 1995. Since the width of the trawl opening (60 m) was considerably less than the width of the disturbance zones created (120-250 m), the average experimental trawling intensity was estimated to be 3-6 sets per year per unit of bottom area.

Physical and biological effects of trawling were evaluated in two of the three experimental corridors. The corridors were sampled just before and just after (within a few hours or days) the experimental trawling ended, as well as 1 yr later. Additionally two reference corridors -- each located parallel to an experimental corridor -- were sampled just before the experimental trawling. Samples were also collected in the reference and experimental corridors in September 1993, 2 mo after trawling.

12. Kenchington *et al.* (2001) analyzed the effects of otter trawling at the Newfoundland study site on benthic infauna and epifauna collected in grab samples in two of the three experimental corridors.

The most prominent feature of the sample data was a significant natural decline in the total number of individuals (or total abundance), the number of species, and the numbers and biomass of several selected species in both the trawled and untrawled corridors between July 1993 and July 1995. The total abundance declined by 50% during the 2-yr period.

There were also significant effects of trawling on the mean total abundance per sample of all taxa and on the individual abundances of 15 taxa (mostly polychaetes), but only in 1994. In that year, immediate declines in abundance for these 15 taxa ranged from 33 to 67%. There were no significant trawling-induced changes in total biomass at any point during the experiment. Likewise, none of the community indices (taxonomic diversity and evenness) showed a significant effect of trawling in any of the years, and the only change in community structure that could be attributed to trawling occurred in 1994. Recovery for species that were affected by trawling in 1994 required <1 yr. Within this time frame, however, the actual recovery period could not be determined.

The authors concluded that there was no consistent, long-term effect that could be attributed to trawling, and that the effects of otter trawling on benthic infauna and infauna in this relatively stable, deepwater sand habitat were limited and short-term. When trawling disturbance was indicated, it appeared to mimic natural disturbance.

13. Prena *et al.* (1999) examined trawl bycatch and the effects of trawling on benthic epifauna, using an Engel 145 otter trawl. The epifauna (and some infauna) were collected with an epibenthic sled in two reference corridors before trawling, and in two experimental corridors before and after trawling (see earlier).

There was a significant reduction in trawl bycatch biomass during the first six sets (15-17 hr) due primarily to a decline in snow crabs, and a relatively constant level of such biomass during the last six sets due to snow crabs migrating into the trawled corridors to feed on dead and damaged organisms.

Epifaunal biomass was lower (by 24%on average) in trawled corridors than in reference corridors in all 3 yr, and remained relatively constant with time, whereas biomass in reference corridors was highly variable from year to year. There were significant trawling and year effects on total epifaunal biomass, and significant trawling effects on mean individual epifaunal biomass, indicating that individuals in the trawled corridors had a smaller average size.

At the species level, the biomass of five of the nine dominant epifaunal species (a sand dollar, brittle star, soft coral, snow crab, and sea urchin) was significantly lower in the trawled corridors than in the reference corridors. There was also a general trend of greater damage to benthic invertebrates in the trawled corridors, especially for three species of brittle star, sea urchin, and sand dollar. There were no significant effects on the abundance of four dominant mollusk species.

14. Schwinghamer *et al.* (1998) sampled surface sediments (top 2 cm) and conducted video and acoustic surveys at the Newfoundland study site before, during, and after trawling in two experimental corridors. Tracks and berms left by the trawl doors increased bottom relief and roughness. In 1993, door tracks 5 cm deep and 1 m wide were still clearly visible in sidescan sonar records after 2 mo, but they were not visible at the beginning of trawling in 1994. Tracks made in 1994 were faintly visible at the beginning of trawling in 1995.

On a small scale, trawling suspended and dispersed sediment, flattened the seafloor, and removed biogenic mounds and organic matter deposited in depressions. Seafloor topography recovered within 1 yr. Sediment grain size varied significantly between corridors and among years, but there was no evidence that it was affected by trawling.

Large, epibenthic organisms (*e.g.,* basket stars, snow crabs, and brittle stars) were readily visible in experimental and reference corridors, but tended to be arranged in linear features parallel to the axis of trawling in the experimental corridors.

The authors concluded that even at a depth of 120-146 m, natural disturbances such as bioturbation and storms might cause more pronounced physical changes to the bottom than those caused by trawling.

Summary

Results of 14 studies are summarized. One of them was described in a 1980 publication; the rest have been published since 1993. Six studies were conducted in North America (three in a single long-term experiment on the Grand Banks), four in Australia, and four in Europe. Ten were experimental studies. Eight of them were done in depths <60 m, one at 80 m, and four in depths >100 m. One study examined just the physical effects of trawling, nine examined just the biological effects, and four examined both. Six of the biological studies were restricted to epifauna, two were restricted to infauna, and five included both epifauna and infauna.

The only experiment that was designed to monitor recovery was the one on the Grand Banks, although surveys conducted in Australia documented changes in the abundance of benthic organisms in an area after 5 yr of fishery closures, and in an area after 15 yr of little or no fishing activity. Two studies compared benthic communities in trawled areas of sandy substrate with those in undisturbed areas near a shipwreck. Six studies were performed in commercially exploited areas, five were performed in closed areas, and two compared closed and open areas; one was done in a test tank.

All the experimental studies examined the effects of multiple tows (up to six per unit area of bottom), and the study in Australia assessed the effects of 1-4 tows on emergent epifauna. Trawling in four studies was limited to a single event (*i.e.*, 1 day to 1 wk), whereas the Grand Banks experiment was designed to evaluate the immediate and cumulative effects of annual 5-day trawling events in a closed area over a 3-yr period.

Physical Effects

A test tank experiment showed that trawl doors produce furrows in sandy bottom that are 2 cm deep, with a berm 5.5 cm high (7). In sandy substrate, trawls smoothed seafloor topographic features (4, 14), and resuspended and dispersed finer surface sediment, but had no lasting effects on sediment composition (14).

Trawl door tracks lasted up to 1 yr in deep water (14), but only for a few days in shallow water (3). Seafloor topography in deep water recovered within a year (14).

Biological Effects -- Single-Disturbance Experimental Studies

Three single-event studies (1, 2, 6) were conducted in commercially trawled areas. In one of these studies (2), otter trawling caused high mortalities of large (>1 cm) sedentary and/or immobile epifaunal species. In another study (6), there were no effects on benthic community diversity. Neither of these studies investigated effects on total abundance or biomass. In the third study (1), there were no obvious effects on macrofauna, but there were fewer organisms and species there than at an unexploited site near a shipwreck.

Two studies (4, 10) were performed in unexploited areas. In one study (10), single tows reduced the density of attached epifauna (>20 cm) by 15%, and four tows reduced it by 50%. In the other study (4), two tows removed 28% of the epifauna on mud and sand substrate, and the epifauna in all trawled quadrats showed signs of damage. (These results were not reported separately for sand bottom.) In this latter study, total infaunal abundance was not affected, but the abundance of one family of polychaetes was reduced.

Biological Effects -- Repeated-Disturbance Experimental Studies

Intensive experimental trawling on the Grand Banks reduced the total biomass of epibenthic organisms and the biomass and average size of a number of epibenthic species (13). Significant reductions in total infaunal abundance and in the abundance of 15 selected taxa (mostly polychaetes) were detected during only 1 of 3 yr, and there were no effects on biomass or taxonomic diversity (12).

Biological Effects -- Observational Studies

Changes in benthic macrofaunal abundance in a lightly trawled location in the North Sea were not correlated with historical changes in fishing effort (5). Changes in infaunal community structure at increasing distances from a shipwreck in the North Sea were related to changes in sediment grain size and organic carbon content (8).

The Alaska study (9) showed that the epifauna attached to sand was more abundant inside a closed area, significantly so for sponges and anemones. A single tow in a closed area in Australia removed 89% of the large sponges in the trawl path (11).

Otter Trawls -- Gravel/Rocky Substrate (Table 5.6)

1. Auster *et al.* (1996) observed bottom conditions during a July 1987 submersible dive at a depth of 94 m near the northern end of Jeffreys Bank, in a gravel area where there were large (>2-m diameter) boulders. A thin layer of mud covered the gravel and boulders, and the rock surfaces supported large numbers of erect sponges, sea spiders, bryozoans, hydroids, anemones, crinoid sea feathers, and ascidians. Smaller mobile fauna, including several species of crustaceans, snails, and scallops, was also abundant.

When the area was resurveyed in August 1993, much of the mud veneer was gone and there was evidence that boulders had been moved. Abundance of erect sponges was greatly reduced, and most of the associated epifaunal species were not present. The authors attributed this disturbance to otter trawling which was occurring in the area during the second survey, and which was conducted in this area only after 1987, when modifications to fishing gear allowed fishermen to trawl rocky, boulder habitat in the GOM.

2. Freese *et al.* (1999) documented the effects of single tows with a bottom trawl in an area that had been exposed to very little or no commercial trawling since the 1970s in the eastern Gulf of Alaska. The trawl was a 42.5-m "Nor'easter" otter trawl with 0.6-m diameter rubber tire groundgear attached to the footrope, and with 0.45-m diameter rockhopper disks and steel bobbins along the wings. Eight tows were made on predominantly pebble substrate (some cobble and boulders were also present) at depths of 206-274 m in August 1996. Quantitative video transects, using a two-man submersible, were made down the center of each trawl path within 2-5 hr after each tow, and in adjacent reference areas.

The trawl moved 19% of the boulders (median size of 0.75 m) it encountered. On less compact substrate, tire gear left a series of furrows that were 1-8 cm deep. On compact substrate (*i.e.*, with a greater percentage of cobble), the tire gear left no furrows, but the trawl removed an overlying layer of silt.

Single tows caused significant decreases in the density of undamaged vase sponges, morel sponges, sea whips, and anemones. Nonsignificant reductions in the density of undamaged organisms were also observed for finger sponges, brittle stars, sea urchins, and one species of sea cucumber. None of the five groups of motile invertebrates showed a significant reduction in density because of trawling. In fact, arthropods and mollusks were more abundant in the trawled areas.

Trawling also caused considerable damage to sponges and sea whips. More than 50% of the vase sponges and sea whips in the trawl transects were either damaged or removed from the substrate. Morel sponges were also damaged, but damage could not be quantified because this species is much more brittle and friable than the vase sponges, and specimens crushed by the trawl were completely torn apart and scattered. Some finger sponges were also knocked over onto the substrate. Brittle stars were also damaged, but reticulate anemones and motile invertebrates were not.

Observations of fishes made during this study showed that rockfish (*Sebastes* spp.) use cobble-boulder and epifaunal invertebrates for cover.

3. Dolah *et al.* (1987) assessed the effects of a single trawl tow on attached sponges and corals in an unexploited area on the coast of Georgia, in the southeastern United States. The bottom (depth 20 m) was smooth rock with a thin layer of sand and an extensive sessile invertebrate growth. The trawl was a 40/54 fly net with a 12.2-m headrope and a 16.5-m footrope equipped with six 30-cm rubber rollers separated by numerous 15-cm diameter rubber disks, and was attached to 1.8x1.2-m China-V doors using 30.5-m leglines.

Densities of three of the most abundant large sponges, three dominant soft corals, and one hard coral were determined by divers before trawling, immediately after trawling, and 12 mo after trawling, both inside and outside the trawl path. Sponges and soft corals <10 cm high were not counted, but all hard corals were counted. In addition, the degree of damage was evaluated.

The trawl damaged some specimens of all species, sponges more notably than corals. Immediately after trawling, undamaged sponges were less abundant, significantly so in two transects that had higher pre-trawl sponge densities. Damage was noted for 31.7% of the sponges that remained in the trawled transects immediately after trawling. Most of the reduction in, and damage to, sponges was for the most abundant species, a barrel sponge. For the other large sponges -- vase sponges and finger sponges -- there were no significant differences in density between sampling periods, although there was some evidence of trawl damage. Twelve months after trawling, sponges in the trawled quadrats were at pre-trawl densities or higher, and all damaged sponges had regenerated new tissue.

Total abundance of soft corals declined in the trawl alley immediately after trawling, and a few damaged specimens were found, but effects were minimal compared to the sponges. There were no differences between pre-trawl and post-trawl density estimates for fan and whip corals. The more abundant stick coral was less abundant immediately after trawling, but had recovered completely 12 mo later.

Divers counted 30% fewer undamaged stony corals in the trawled quadrats immediately after trawling, although the reduction was not significant. Of the seven colonies of stony coral affected by the trawl, four were moderately to heavily damaged, and three were only slightly damaged. Twelve months later, stony corals were more abundant than they were before trawling, and no damage could be detected.

Summary

Three studies of otter trawl effects on gravel and rocky substrate are summarized in this document. All three were conducted in North America. Two were done in glacially affected areas in depths of about 100-300 m using submersibles, and the third was done in a shallow coastal area in the southeastern United States.

One study involved observations made in a gravel/boulder habitat 6 yr apart (*i.e.*, before and after trawling affected the bottom). The other two were experimental studies of the effects of single trawl tows. One of these experimental studies was done in a relatively unexploited gravel habitat, and the other on a smooth rock substrate in an area not affected by trawling.

Two studies examined effects to the seafloor and on attached epifauna and one only examined effects on epifauna. There were no assessments of effects on infauna. Recovery was evaluated in one case for 1 yr.

Physical Effects

Trawling displaced boulders and removed mud covering boulders and rocks (1). Rubber tire groundgear left furrows 1-8 cm deep in less compact gravel sediment (2).

Biological Effects

Trawling in gravel and rocky substrate reduced the abundance of attached benthic organisms (*e.g.,* sponges, anemones, and soft corals) and their associated epifauna (1, 2, 3), and damaged sponges, soft corals, and brittle stars (2, 3). Sponges were more severely damaged by a single pass of a trawl than soft corals, but 12 mo after trawling all affected species, including one species of stony coral, had fully recovered to their original abundance, and there were no signs of damage (3).

Otter Trawls -- Mixed Substrates (Table 5.7)

1. The Canadian Department of Fisheries and Oceans (DFO 1993) conducted a sidescan sonar survey in the Bras D'Or Lakes system in Nova Scotia to document the physical effects of various mobile fishing gears 1 yr after the area was closed to mobile gear. Water depths ranged from 10 to 500 m, and bottom sediments included rich organic mud, clay, pebbly mud, well sorted sand, gravel, and boulders.

Otter doors left parallel marks in the sediments, with spoil ridges or berms faintly visible along their inner margins, and fainter marks between the two door marks apparently produced by the trawl footgear. These marks were seen predominantly in muddy sediments.

2. Engel and Kvitek (1998) compared a lightly fished (LF) and a heavily fished (HF) area off central California with similar sediments (gravel, sand, silt-clay) and depths (180 m) using still photographs and videotapes taken from a submersible in October 1994, and grab samples collected during 1994, 1995, and 1996. There were no differences in sediment composition between the two study sites. They estimated that any square meter of bottom area in the HF area was exposed to 12 times more trawling effort during 1989-1996 than any square meter of bottom area in the LF area.

Results indicated that the HF area had significantly more trawl tracks, shell fragments, and exposed sediment, significantly fewer rocks and biogenic mounds, and significantly less flocculent material. Based on the 1994 video transects, the densities of all six large invertebrate epifauna were higher in the LF area, significantly so for sea pens, starfish, sea anemones, and sea slugs. Based on the grab samples, the number of polychaete species was higher in the LF area in 1994 and 1996, and the densities of nematodes, oligochaetes, and brittle stars were higher in the HF area in all 3 yr (although differences, in most cases, were insignificant). No consistent (or significant) differences were detected for crustaceans, mollusks, or nemerteans. One polychaete species that was the most important prey item for three species of flounder was more abundant in the HF area in all 3 yr, significantly so in 1994 and 1996.

The authors concluded that trawling reduces habitat complexity and biodiversity, while increasing opportunistic infauna and prey important in the diet of some commercially important fish species, but that, since the study lacked controls, there was no way to be sure that the observed differences between the two areas were, in fact, due to differences in trawling intensity.

3. Smith *et al.* (1985) reported that diver observations and videotapes showed minor surface sediment disturbance (<2.5 cm deep) within the sweep path of an otter trawl with 6-ft (1.8-m) doors and 3/8-in (1-cm) footrope chain in Long Island Sound. Sediments in the study area were described as sand with mud and clay.

Much of the observed disturbance was created by turbulence suspending small epifaunal organisms, silt, and flocculent material as the net passed, rather than by direct physical contact of the net with the bottom. Trawl door tracks (<5 cm deep in sand; 5-15 cm deep in mud) were the most notable evidence of trawl passage. These tracks were soon obscured by the effect of tidal currents, but attracted mobile predators. Alteration of existing lobster burrows was minor and appeared easily repairable by resident lobsters. The use of roller gear of unspecified size on mud bottom left shallow scoured depressions; the use of spacers between disks reduced such scouring.

Summary

Three studies of the effects of otter trawls on mixed substrates are summarized. All three were conducted in North America and relied on sidescan sonar and/or observations made by divers or from a submersible.

One study (2) combined submersible observations and benthic sampling to compare the physical and biological effects of trawling in both a lightly fished and heavily fished location in California. Both locations had the same depth and a variety of sediment types. The other two studies were a survey of seafloor features produced by trawls in a variety of bottom types (1), and primarily an examination of the physical effects of single trawl tows on sand and mud bottom (3).

Physical Effects

Trawl doors left tracks in sediments that ranged from <5 cm deep in sand to 15 cm deep in mud (1, 3). In mud, fainter marks were also made between the door tracks, presumably by the footgear (1).

A heavily trawled area had fewer rocks, shell fragments, and biogenic mounds than a lightly trawled area (2).

Biological Effects

The heavily trawled area in California had lower densities of large epifaunal species (*e.g.,* sea slugs, sea pens, starfish, and anemones) and higher densities of brittle stars and infaunal nematodes, oligochaetes, and one species of polychaete (2). There were no differences in the abundance of mollusks, crustaceans, or nemerteans between the two areas. However, since this was not a controlled experiment, these differences could not be attributed to trawling.

Single trawl tows in Long Island Sound attracted predators and suspended epibenthic organisms into the water column (3).

New Bedford-Style Scallop Dredges

New Bedford-Style Scallop Dredges -- Sand (Table 5.8)

1. Auster *et al.* (1996) mapped Stellwagen Bank (GOM) in 1993 (depth 20-55 m) using sidescan sonar, and showed it to be covered by large expanses of sand, gravelly sand, shell deposits, and gravel. Waves produced by large storms from the northeast create ripples in coarse sand measuring 30-60 cm between crests and 10-20 cm high, and deposit large sheets of fine sand with low sand waves 15-35 m between crests. The troughs of these sand waves are filled with shell debris.

Gear tracks produced by trawls and scallop dredges could be distinguished in the sonar images. Examination of gear tracks in sonar images showed that scallop dredges disturb sand ripples and disperse shell deposits.

2. Langton and Robinson (1990) analyzed visual and photographic observations made during submersible transects on an offshore bank in the GOM (Fippennies Ledge) in July 1986 and June 1987. There was little evidence of scallop dredging at the dive site in 1986, but it was heavily dredged sometime between the 1986 and 1987 submersible observations (Langton and Robinson 1988). Depth near the study transects (southeastern end of the ledge) ranged from 80 to 100 m. In the areas of highest sea scallop density, the surficial sediments were usually sand with occasional shell hash and small rocks. Where there were tubes formed by amphipods or polychaetes, the sediment surface was visually a more silty organic sand. Grain size analysis revealed that the upper 5 cm of sediment was uniform throughout the area, and averaged 84% sand, with some gravel.

Dredged areas observed in 1987 were clearly distinguishable from undredged, or not recently dredged, areas. The most obvious result of dredging was a change from organic silty sand to gravelly sand. This was apparently due to the disruption of amphipod tube mats. Occasionally, piles of rock and scallop shells were observed, apparently deposited there when dredges were emptied at the surface.

Densities of three dominant megafaunal species (sea scallops, burrowing anemones, and a tube-dwelling polychaete) declined significantly between 1986 and 1987, apparently because of dredging.

3. Watling *et al.* (2001) evaluated the geochemical and biological effects of scallop dredging in an estuary (Damariscotta River, Maine). The study site was located on an unexploited side of the estuary in a shallow (15 m), silty sand area with a low density of sea scallops. Bottom samples for sediment chemistry, microbiology, and fauna were collected by divers in a control and an experimental plot before and after intensive dredging (23 tows in 1 day) using a 2-m-wide chain-sweep dredge towed at 2 knots. Sampling of benthic macrofauna (primarily infauna) was conducted 4 and 5 mo before dredging, immediately before and after (1 day) dredging, and 4 and 6 mo after dredging, by divers with push cores.

The immediate effects of dredging were the loss of fine material from the top few centimeters of the sediment surface, and a reduction in its food value (significant reductions in enzymatically hydrolysable amino acids and total microbial biomass). There was little discernible difference in the number of macrofauna taxa present after dredging, but the numbers of individuals were greatly (and significantly) reduced. Some taxa (families) showed little difference between the control and treatment site the day after dredging, while others were reduced in abundance. Significant reductions were noted for one family each of polychaetes (Nephtyidae) and amphipods (Photidae).

In the experimental plot, fine sediments still had not been restored 6 mo after dredging, whereas the food value of the sediments had completely recovered after 6 mo. Total macrofaunal abundance was still significantly lower 4 mo afterwards, but after 6 mo there was no longer any significant difference in the number of individuals in the two plots. Some taxa recovered sooner than others.

Summary

Three studies of the effects of New Bedford-style scallop dredges on sand substrate are summarized, and all were performed since 1990. One was conducted in an estuary on the Maine coast (3) and two on offshore banks in the GOM (1, 2). Two of them were observational in nature, but didn't include any direct observations of dredge effects. The other one was a controlled experiment conducted in an unexploited area in which a single dredge was towed repeatedly over the same area of bottom during 1 day.

One study examined physical effects and two examined physical and biological effects. One of them included an analysis of geochemical effects to disturbed silty sand sediments.

Physical Effects

Dredging disturbed physical and biogenic benthic features [sand ripples and waves (1), shell deposits (1), and amphipod tube mats (2)], caused the loss of fine surficial sediment (3), and reduced the food quality of the remaining sediment (3). Sediment composition was still altered 6 mo after dredging, but the food quality of the sediment had recovered by then.

Biological Effects

There were significant reductions in the total number of infaunal individuals in the estuarine location immediately after dredging and reduced abundances of some taxa (particularly one family each of polychaetes and amphipods), but no change in the number of taxa (3). Total abundance was still reduced 4 mo later, but not after 6 mo.

The densities of two megafaunal species (a tube-dwelling polychaete and a burrowing anemone) on an offshore bank were significantly reduced after commercial scallop vessels had worked the area (2).

New Bedford-Style Scallop Dredges -- Mixed Substrates (Table 5.9)

1. Caddy (1968) described diver observations of dredge effects in shallow sea scallop beds in the Northumberland Strait (Gulf of St. Lawrence, Canada). The depth was about 20 m and the sediments ranged in texture from mud to clean sand. Fishing operations were conducted with a 2.4-m-wide, offshore chain-sweep scallop dredge (no teeth) that was modified to reduce its weight by replacing the forward drag bars with chains. The dredge weighed 0.36 mt (800 lb) out of the water. Divers attached to the dredge made direct observations during two 5-min tows that were made at about 2 knots.

The lateral skids, located at each end of the pressure plate produced two parallel furrows approximately 3 cm deep; a series of smooth ridges between them were caused by the rings in the chain belly of the dredge. Dislodged pieces of dead shell were more evident within the drag tracks than on the surrounding bottom.

2. Caddy (1973) used a two-man submersible to observe the effects of a 2.4-m-wide, chain-sweep dredge (no teeth, weight 0.6 mt or 1300 lb out of the water) and a gang of three 0.8-m-wide, Alberton-style, toothed dredges in a previously dredged area of Chaleur Bay in the Gulf of St. Lawrence (Canada). (See "Toothed Scallop Dredges -- Mixed Substrates, 4. Caddy (1973)" for a summary of the toothed-dredge results.) Observations were made inside and outside dredge tracks within 1 hr of each tow. Depth varied from 40 to 50 m, and the substrate was sand overlaid by glacial gravel, 1-10 cm in diameter, with occasional boulders up to 60 cm in diameter embedded in the gravel.

Dredging suspended fine sediments and reduced visibility from 4-8 m to <2 m within 20-30 m of the track, but the silt cloud dispersed within 10-15 min of the tow, coating the gravel in the vicinity of the track with a thin layer of fine silt. The chain-sweep dredge left a flat track that increased in depth from just below the sediment surface to several centimeters deep at the end (tows were 0.8-1.2 km long). Over areas of sand and fine gravel, marks were left by individual belly rings, and the tow bar left a narrow depression in the center of the track. The edge of the track was sometimes marked by an impression left by the lateral skids.

Gravel fragments were less frequent inside the track, and many were overturned. Rocks 20-40 cm in diameter were dislodged every 10-30 m of track. Some boulders were overturned and others were plowed along, leaving a groove several meters long. Empty holes left by some of the rocks were evident.

3. Mayer *et al.* (1991) investigated the effects of scallop dredging at a shallow (8 m) nearshore site on the Maine coast with a mixed mud, sand, and shell hash substrate. The site was dragged with a New Bedford-style, chain-sweep dredge (presumably once, although no information was provided), and core samples were collected before dredging and 1 day after dredging inside and outside the dragged track.

Dredging lowered the substrate by 2 cm and tilled the sediment to a depth of 9 cm, causing finer material (sand and mud) to be injected into the lower 5-9 cm of the sediment profile, and increasing mean sediment grain size to >5 cm. (No statistical tests were performed with these data). Organic matter profiles were strongly affected by dredging. Total organic carbon and nitrogen at the new sediment-water interface were markedly reduced in concentration after dredging, and carbon concentrations in the 5-9 cm sediment depth interval were considerably higher in the dredged site.

A diatom mat on the surface of the sediment was disrupted by the dredge and partially buried. The microbial community of the surface sediments increased in biomass following dredging.

Summary

Three studies have been conducted on mixed glacially derived substrates, two of them over 20 yr ago and one 10 yr ago. All were done in the Northwest Atlantic (one in the United States and two in Canada) at depths of 8-50 m.

Two observational studies examined physical effects and one experimental study examined effects on sediment composition to a sediment depth of 9 cm. The experimental study evaluated the immediate effects of a single dredge tow. None of these studies evaluated habitat recovery or biological effects, although one (3) examined geochemical effects.

Physical Effects

Direct observations in dredge tracks in the Gulf of St. Lawrence documented a number of physical effects to the seafloor, including bottom features produced by dredge skids, rings in the chain bag, and the tow bar (1, 2). Gravel fragments were moved and overturned, and shells and rocks were dislodged or plowed along the bottom (2).

Sampling 1 day after a single dredge tow revealed that surficial sediments were resuspended and lost, and that the dredge tilled the bottom, burying surface sediments and organic matter to a depth of 9 cm, increasing the mean grain size of sediments to >5 cm, and disrupting a surface diatom mat (3). Microbial biomass at the sediment surface increased because of dredging (3).

Toothed Scallop Dredges

Toothed Scallop Dredges -- Sand (Table 5.10)

Port Phillip Bay, Australia: The physical and biological effects of toothed scallop dredges were evaluated at three sites in a large, relatively low-energy, predominantly tidal embayment in southeast Australia in 1991 that had been commercially dredged for *Pecten fumatus* since 1963. Habitat-related objectives of these studies were to test whether dredging alters turbidity and sedimentation patterns in the bay, to evaluate the physical effects of dredging on the seafloor, and to determine the magnitude and direction of changes to the benthic community caused by dredging. These studies were described in four separate publications (see below).

Depths at the three sites were similar (about 15 m), but each site had different sediments and was exposed to different current strengths and wave characteristics. Sediments at the three sites were: 1) fine and very fine sand with 15% silt-clay (St. Leonards); 2) medium fine sand with 7% silt-clay (Dromana); and 3) muddy sand with shell fragments and 30% silt-clay (Portarlington).

Three large (0.36-km^2) experimental plots (one per site) located within larger (20-30 km^2) areas which were closed to dredging in 1991 were dredged repeatedly by a fleet of 5-7 commercial dredge vessels using 3-m-wide "Peninsula"-style box dredges fitted with cutter bars that did not extend below the skids. Experimental dredging intensity at Portarlington (716 tows in 4 days during a 3-wk period) was equivalent, on average, to four tows per unit of area, and duplicated heavy commercial dredging intensity, based on historical levels of fishing effort in the bay. Dredging at the other two sites was less intensive (382 and 459 tows, and an average of two tows per unit of area) and limited to 2- or 3-day periods. The amount of commercial dredging activity in the bay declined dramatically after 1987 (Currie and Parry 1996), so the study sites had been virtually undisturbed for 4 yr when the research was conducted.

Black and Parry (1994[1], 1999[2]) and **Currie and Parry (1996[3], 1999b[4])** evaluated the physical effects of experimental dredging in Port Phillip Bay by using a variety of field sampling techniques at all three sites. Turbidity levels and dredge penetration depths were measured immediately after dredging. Visually apparent changes to the seafloor were assessed by divers with video cameras at various times before and after dredging. The last observations were made at St. Leonards 11 mo after dredging, at Portarlington 7 mo after dredging, and at Dromana 5 days after dredging.

Dredging disturbed the top 1-2 cm of sediment, but sometimes penetrated up to 6 cm in softer sediments. Turbidity plumes extending 1-2 m into the water column were created immediately behind the dredge, reaching turbidity levels within 2-16 sec after dredging which were 2-3 times greater than the turbidity caused by storms. Dredging-related turbidity levels returned to natural storm levels after about 9 min at sites which were 60 and 80 m downcurrent of the nearest boundary of the experimental dredging plots.

Video observations showed that the sediment plume was entrained across the full width of the dredge, mostly by the cutterbar. As the dredge traveled across the rough seafloor, the cutterbar trimmed off the high regions, creating turbulent pulses of sediment. Smaller sediment plumes were also produced by the skids.

Dredging at one of the experimental sites had a graderlike effect on the seafloor, flattening low-relief mounds produced by burrowing callianassid shrimp, and filling in depressions between them. Parallel tracks up to 2.5 cm deep were produced by the dredge skids. The mounds reformed after 6 mo. Flat areas between the mounds were still visible after 6 mo, but 11 mo after dredging there were no visible differences in topography between the control plot and the dredged plot. The tracks were still visible a month after dredging, but not after 6 mo.

At one of the other two sites (*i.e.*, Dromana), small parallel sand ripples in part of the dredged plot were obliterated by dredging, but reformed immediately following a storm that occurred 5 days after the area was dredged. Mounds were reformed 7 mo after dredging, but were still smaller than in the control plot.

Currie and Parry (1996[3], 1999b[4]) evaluated the biological effects of dredging on benthic infauna in Port Philip Bay. At the most intensively sampled site (St. Leonards), grab samples were collected in both a dredged plot and an adjacent control plot on three occasions before dredging, immediately after dredging, and at 3 wk and at 3.5, 5, 8, and 14 mo after dredging. Sampling at the other two sites was intended to evaluate very short-term biological effects, and was limited to the dredged plots: grab samples were taken 8 days before and 2 days after dredging at Dromana, and 10 days before and 1 day after dredging at Portarlington. In addition, a plankton net was attached to the top of the dredge to sample animals thrown up by the dredge during each tow at St. Leonards.

At the St. Leonards site, there was a significant decrease in the number of infaunal species in the dredged plot relative to the control plot 3 wk after dredging that persisted for 14 mo, but there was no effect on the total number of individuals.

In the 3.5 mo following dredging, six of the ten most common benthic species showed significant decreases in abundance of 28-79% on at least one-half of the experimental plot; most species decreased in abundance by

20-30%. At the other two sites (Portarlington and Dromana), two and three of the ten most common species, respectively, were significantly reduced in abundance within 1-2 days after dredging, but reduced sampling intensity limited the statistical power of the tests. Of the six species whose abundance was reduced significantly over the first 3.5 mo at the St. Leonards site, two were affected for 3.5 mo, two for 8 mo, and two for 14 mo. Dredging effects at this site became undetectable for most species following their annual recruitment; most species recruited within 6 mo, but a few still had not recruited after 14 mo.

Species that occurred on or near the sediment surface (*e.g.,* tube-dwelling amphipods) were released into the water column right away, whereas species inhabiting deeper sediments (*e.g.,* burrowing polychaetes) were dislodged as dredging continued. More mobile, opportunistic species inhabiting surface sediments increased in abundance during the 3.5 mo after dredging, perhaps because the removal of other species increased their food supply. Dissimilarity measures between the two plots increased after dredging, reaching a maximum 3 wk after dredging, and suggesting that there were delayed effects on community structure such as increased predation of infaunal organisms that were uncovered by dredging.

Although this research clearly demonstrates that there were biological effects of scallop dredging to benthic habitats in Port Phillip Bay, the reductions in density caused by dredging were small compared to natural changes in population densities during the year (Currie and Parry 1996). Furthermore, changes to infauna caused by dredging in 1991 were smaller than the cumulative changes to infaunal community structure in Port Philip Bay over the preceding 20 yr (Currie and Parry 1999b). Currie and Parry (1999a) also concluded that changes to benthic community structure (species composition) caused by dredging in the bay were small compared with natural differences between study areas.

5. Butcher *et al.* (1981) documented diver observations of scallop dredging in Jervis Bay, New South Wales, Australia, over large-grained firm sand shaped in parallel ridges at depths >13 m. The dredge design was not described, but had teeth that extended up to 5 cm below the leading edge of the dredge.

Dredging flattened sand ridges and produced a sediment plume extending up to 5 m into the water column that settled out within 15 min. Dredge paths were clearly visible, and "old" dredge paths could be seen.

6. Eleftheriou and Robertson (1992) examined the incremental effects of repeated scallop dredge tows in Firemore Bay, a shallow sandy bay in Loch Ewe on the west coast of Scotland in July-August 1985. The depth at the study site was about 5 m, and the sediment was well sorted sand. It was a high-energy environment exposed to wave action. Fishing (divers and beam trawls) took place in the bay during the 1970s and 1980s.

A 1.2-m-wide, Newhaven-style scallop dredge with nine, 12-cm-long teeth was towed 25 times over the same track during a 7-day period (*i.e.*, two tows on day 2, two on day 3, eight on day 4, and thirteen on day 8). The chain bag was removed from the dredge so that all organisms that passed through the mouth of the dredge were returned to the bottom for observation.

Grab samples were collected in the dredge track before and after each set of tows. Qualitative assessments of the epifaunal and large-specimen infaunal community were conducted by divers using still cameras. There was no control (undredged site) in this study, and thus no means to statistically evaluate the effects of location or natural changes on the abundance or composition of the benthic community in the bay that could have occurred during the course of this study.

Dredge teeth penetrated the bottom 3-4 cm. Dredging created furrows, eliminated natural bottom features, and dislodged large shell fragments and small stones. Sediments in this location are well-mixed by wave action to a depth below 3-4 cm, thus the dredge had no effect on the vertical distribution of grain size, organic carbon, or chlorophyll *a*. Grooves and furrows created by the dredge were eliminated shortly after dredging, the length of time depending on wave action and tidal conditions.

Infaunal invertebrates that were adapted to the stresses of a high-energy environment (*e.g.,* amphipods and bivalve mollusks) were not affected in any significant way. Sedentary polychaetes declined in abundance after 12 tows, then increased after 25 tows. Small crustaceans -- mostly cumaceans – increased in abundance after the first two tows and between tows four and twenty-five. There were no significant changes in biomass of the different infaunal taxa.

Organisms such as small infaunal crustaceans, crabs, and starfish were attracted to, and fed on, dead and damaged organisms left behind the dredge. Visual counts of living, damaged, and dead epifaunal organisms before and after each dredging event indicated some damage and mortality to organisms such as sea urchins, starfish, scallops, and crabs. Razor clams were dug up by the dredge and lay partially buried with their valves gaping and large numbers of sand lances (*Ammodytes* spp.) were killed. The plowing effect of the dredge buried, damaged, or chased away organisms such as brittle stars, burrowing anemones, and swimming crabs.

7. Thrush *et al.* (1995) conducted an experimental study of scallop dredging at two sites 14 km apart in the Mercury Bay area of the Coromandel Peninsula in New Zealand in 1991. One site was a commercial scallop fishing ground and the other site was not. The sediment at both sites was coarse sand, but was more poorly sorted and had a large fraction of shell hash at the exploited site. The depth was about 24 m at each site.

At each site, half of a plot measuring 70x20 m was dredged (five parallel tows in 1 day) using a 2.4-m-wide box dredge with 10-cm-long teeth on the lower leading edge of the dredge. Divers collected core samples and made visual observations in the dredged and undredged halves of each plot before dredging, within 2 hr after dredging, and 3 mo after dredging. Results from the two sites were treated separately because the macrobenthic communities were distinctly different. Both sites were dominated by small, short-lived benthic species.

At both sites, the dredge broke down the natural surface features (*e.g.,* emergent tubes and sediment ripples), and the teeth created grooves approximately 2-3 cm deep.

Dredging produced changes in benthic community structure that persisted for 3 mo at both sites. Significant differences in the numbers of individuals and taxa and in the densities of common macrofauna (both infauna and epifauna) were apparent immediately after dredging. The initial community-level responses at both sites were negative; there were significantly lower total densities and numbers of taxa in the dredged half-plots than in the adjacent reference half-plots.

The responses noted 3 mo later were more complex, with differences between the two sites. Effects were more pronounced and more often negative at the previously unexploited site where total density remained significantly lower in the dredged half-plot 3 mo after dredging. Six of the 13 most common taxa at this site were significantly less abundant in the dredged half-plot plot 2 hr after dredging, and five of them (*i.e.*, two phoxocephalid amphipods and three polychaetes) were still less abundant 3 mo later.

In contrast, there was a significant recovery in total density in the dredged half-plot at the exploited site after 3 mo, to the point that the total densities in the adjacent half-plots at that site were the same. Four of the thirteen most common taxa at this site were significantly less abundant 2 hr after dredging, and three of them (*i.e.*, ostracods and two species of bivalve mollusks) still had not recovered 3 mo later. Four taxa that were negatively affected 2 hr after dredging at the exploited site were more abundant in the dredged half-plot than in the control half-plot 3 mo after dredging.

The authors concluded that the differences in the recovery processes at the two sites were likely related to differences in the initial community composition and to differing environmental characteristics.

Summary

Seven studies of the effects of toothed scallop dredges on sandy bottom habitat are summarized in this document, six of them for box dredges in Australia and New Zealand, and one for Newhaven-style dredges in Scotland (6). All of the studies except one (5) were published during the 1990s. Four of the Australian studies (1-4) were done in the same location (Port Phillip Bay), at three sites that had not been disturbed by commercial dredging for 4 yr prior to the beginning of the studies. All were performed in relatively shallow water (5-24 m). Five of these studies were controlled experiments, and two (5, 6) were observational in nature. Three studies (1, 2, 5) examined just physical effects, and four evaluated both physical and biological effects. One study (7) compared effects at commercially exploited and unexploited sites with different benthic communities.

The Australian experimental studies (1-4) simulated commercial dredging activity, whereas the New Zealand study (7) evaluated the effects of multiple side-by-side tows, and the Scottish study (6) examined the incremental effects of multiple tows on the same area of bottom. In all cases, experimental dredging was limited to a single event that never lasted for more than 1 wk. In those studies (3, 4, 7) in which recovery was monitored, it ranged from 3 mo (7) to 14 mo (3, 4).

Physical Effects

Physical effects included sediment plumes (which lasted up to 15 min), the smoothing of the seafloor, tracks made by dredge skids, and furrows up to 4 cm deep created by the dredge teeth (1-7). Dredging disturbed bottom sediments to a maximum depth of 6 cm (1, 2). At a shallow, high-energy site, there was no effect on sediment composition, and dredge tracks were obliterated within a few days (6). At a deeper, less-exposed site, sand ripples that had been smoothed by dredging reformed within 5 days (4), biogenic mounds were restored after 6-7 mo (3, 4), and dredge tracks that were still visible after 1 mo had disappeared after 6 mo (4).

Biological Effects

Biological effects were variable and depended on the degree of natural disturbance, how well individual species were adapted to sediment disturbance, and whether a single dredge tow or multiple tows were made over the same area of bottom.

Two studies conducted at the St. Leonards site in the relatively low-energy, enclosed Port Phillip Bay in Australia showed that the abundance of most infaunal species was reduced by 20-30% during the first 3.5 mo after the area was dredged repeatedly during a 3-day period (3, 4). There were no effects of dredging on the total number of individuals, but there were significantly fewer species in the dredged plot 3 wk after dredging. Dredging significantly reduced the densities of six of the ten most common infaunal taxa, and increased the abundance of more mobile, opportunistic species within the first 3.5 mo of the experiment. (Two and three of the ten most common taxa were significantly reduced in abundance 1-2 days after dredging at two other sites in the bay [4]).

Research at the St. Leonards site also revealed that the surface-dwelling infauna is released into the water column right away, whereas burrowing organisms are released during later dredge tows. Most of the affected species at the St. Leonards site recovered within 8 mo, but some were still less abundant after 14 mo.

At two slightly deeper, open coastal sites in New Zealand, single tows resulted in immediate and significant decreases in the number of macrobenthic individuals and species (7). The immediate effects of dredging at an unexploited site were more pronounced and, for individual taxa, more often negative (significant reductions in six of the thirteen most common taxa) than at the site that was located in a commercial scallop dredging ground (significant reductions in four of 13 taxa). In addition, at the exploited site, total abundance was the same in the dredged and control half-plots 3 mo after dredging, but at the unexploited site, total density was still significantly higher in the control half-plot.

Repeated dredge tows in a very shallow, high-energy location in Scotland significantly increased the abundance of certain species of small infaunal crustaceans, and initially reduced but then increased the abundance of sedentary polychaetes (6). Taxa that are adapted to dynamic environments (*e.g.*, amphipods and bivalve mollusks) were not significantly affected. Dredging also caused considerable damage and mortality to large epifauna and infauna in this study.

Toothed Scallop Dredges -- Biogenic Substrate (Table 5.11)

Hall-Spencer and Moore (2000a) described the effects of scallop dredging on maerl beds, a biogenic substrate which is derived from living calcareous rhodophytes. These beds take hundreds to thousands of years to accumulate because the growth rates of the macroalgae are very slow and are particularly vulnerable to damage from mobile bottom fishing gear (Hall-Spencer and Moore 2000b).

Single tows were made at depths of 10-15 m along three 100-m transects in an area in the Clyde Sea (Scotland) that had been commercially dredged for 40 yr, and as well as along three 100-m transects in an area of the Clyde Sea that had been previously undredged. Tows used a gang of three Newhaven dredges with 10-cm-long, spring-loaded teeth mounted 8 cm apart on a horizontal metal bar that was held off the seafloor by a rubber roller at each end. Immediate effects of dredging were noted and one transect at each site was monitored by divers 2-4 times a year over the following 4 yr.

Video recordings showed, at both sites, that the rollers and chain rings were in contact with the bottom while the dredge teeth projected fully into the maerl substratum (10 cm) and harrowed the seafloor, creating a cloud of suspended sediment. Rocks and boulders <1 m^3 in diameter were dislodged and overturned, and cobbles were often wedged between the teeth and dragged through the sediment. Dredges created 2.5-m-wide tracks along which natural bottom features (*e.g.,* crab pits and burrow mounds) were erased. Sand and silt was brought to the sediment surface, and living maerl was buried. Dredge tracks remained visible for 0.5-2.5 yr depending on depth and exposure to wave action.

Most megafauna on or within the top 10 cm of the maerl was either caught in the dredges or left damaged in the dredge track. Large, fragile organisms (*e.g.,* sea urchins and starfish) were usually broken on impact, whereas strong-shelled organisms (scallops, gastropods) usually passed into the dredge intact. Deep-burrowing species escaped dredge damage. Predatory species (*e.g.,* whelks, crabs, and brittle stars) rapidly aggregated in the dredge track to feed.

Recovery rates for affected benthic species also varied considerably. Species with regular recruitment and rapid growth recovered quickly, as did mobile epibenthic species that migrated into test plots soon after dredging. Slow-growing species and/or infrequently recruiting sessile organisms remained depleted on test plots at the undredged site 4 yr after dredging occurred, whereas the previously dredged macrobenthic community returned to pre-experimental status within 2 yr.

Summary

The immediate physical and biological effects of single dredge tows were evaluated on maerl substrate in Scotland. Recovery was monitored over 4 yr.

Dredging penetrated the seafloor to a depth of 10 cm, suspending sediment, overturning boulders, erasing bottom features, and burying living maerl in dredge tracks. Some dredge tracks were only visible for 6 mo, while others remained visible for 2.5 yr, depending on depth and exposure to wave action.

Most of the megafauna in the top 10 cm of substrate was either caught in the dredge or left damaged in the dredge track. Large, fragile organisms were most vulnerable. Recovery of the epibenthic community was complete at a previously dredged site within 2 yr, but some species at an unexploited site still had not recovered after 4 yr. Slow-growing species, and species that infrequently recruited to the benthos, took much longer to recover than species with regular recruitment patterns and faster growth rates.

Toothed Scallop Dredges -- Mixed Substrates (Table 5.12)

1. Bradshaw *et al.* (2002) compared historical and recent benthic sample data from seven sites located south and west of the Isle of Man (in the Irish Sea) exposed to different amounts of fishing effort since the late 1930s. Sample data were available for 1938-1952 when scallop dredging in the area was very limited, and for the 1990s. Some of these data were analyzed earlier by Hill *et al.* (1999).

Analysis of sediment samples indicated that five of the sites were predominantly sand, and two were gravel. No depth information was provided. Fishing disturbance for each site was evaluated in terms of: 1) total fishing effort by a sample fleet during 1981-1993, and that effort's inverse coefficient of variation (*i.e.*, higher values indicate a more even distribution of fishing disturbance from year to year); 2) the number of years since fishing began; and 3) a fishermen's ranked index of total fishing effort at each site since the start of the fishery. Smallscale (*e.g.,* grab) and largescale (*e.g.,* trawls) samples were pooled for each site so that the analysis would include the greatest possible range of infaunal and epifaunal animals.

There was a significant temporal effect across all sites, and at two sites where spatial and temporal replicate samples were available, the historical samples were distinct from the recent samples. Taxa that decreased in abundance between the two time periods included species of brittle stars, hydroids, upright and encrusting bryozoans, encrusting worms, and barnacles. Taxa that increased in abundance between the two time periods included large-bodied tunicates, mobile crustaceans (shrimp, spider crabs, and squat lobsters) and robust scavengers (whelks, hermit crabs, and starfish). Taxa that became more abundant, on average, scored higher in terms of life history characteristics that would increase their ability to survive dredging (highly mobile, deep burrowers, scavengers, mud/sand sediment preference, robust body types, and good regeneration and recolonization powers) than those that became less abundant (sessile, shallow burrowers/nest builders, suspension or filter feeders, shell/stone substrate preference, fragile body types, and poor regeneration and recolonization powers).

For individual sites, mean faunal similarities between the two time periods decreased significantly as the fishermen's index of effort and the number of years since fishing began increased. Similarly, the proportion of species "lost" between the two sampling periods increased significantly as the number of years of fishing increased. Faunal similarities and proportions of lost species between time periods were not significantly related to increased fishing effort, as estimated from fishermen's logbooks. These results suggested to the authors that it was the length of time over which fishing occurred, rather than absolute levels of effort, which was important in structuring benthic communities.

For all sites, there was also no clear evidence of a relationship between changes in taxonomic diversity and fishing effort, although taxonomic distinctness -- probably the best indicator of changes in biodiversity – decreased over time at two of the most heavily fished sites.

2. Bradshaw *et al.* (2000) analyzed density estimates of epibenthic animals made during diver surveys in the undisturbed portion of a 2-km^2 area near the Isle of Man, in the Irish Sea, that was closed to commercial fishing by towed gear in 1989. The entire area adjacent to and inside the closed area had been heavily dredged for 50 yr prior to the closure. Depth in the study area ranged from about 25 to 40 m, and the seafloor was a mixture of gravel, sand, and mud. The diver surveys started in 1989, the year the area was closed, and were repeated in 1990 and then in every other year until 1998.

A number of epifaunal species increased significantly in abundance over the 9-yr period, including brittle stars, a spider crab, scallops, hermit crabs, and one species of starfish. The most significant changes occurred in the fifth, seventh, and ninth years after the area was closed.

3. Bradshaw *et al.* (2001) assessed the effects of scallop dredging on benthic communities inhabiting mixed substrates in the closed area described in the preceding review [Bradshaw *et al*. (2000)]. Two experimental plots inside the closed area were each dredged every 2 mo or so from January 1995 to 1998, using two sets of four, spring-loaded, Newhaven scallop dredges towed 10 times along a single dredge track. Two control plots were established inside the closed area. Three additional plots were located outside the closed area in a commercial scallop dredging ground. Grab samples were collected twice a year starting in 1995 in all seven plots.

After the first 6 mo of experimental dredging, benthic community structure in the experimental plots was more similar to the commercially dredged plots, and less similar to the control plots, than it had been before dredging began. This trend continued over the next 3 yr of the experiment. However, none of these differences were significant, nor were there any clear trends for particular species or groups of species.

Dredging also had no significant effect on total species numbers or richness, but there was evidence that dredging reduced benthic community heterogeneity. Sessile epifaunal organisms were considered to be especially sensitive to dredging disturbance and were analyzed separately; one dataset (March 1998) revealed that encrusting bryozoans, encrusting sponges, and small ascidians were more common in dredged plots, while upright forms such as bryozoans and hydroids were more common in the undredged plots.

4. Caddy (1973) used a two-man submersible to observe the effects of 0.8-m-wide toothed dredges in Chaleur Bay, Gulf of St. Lawrence, in August 1971. A gang of three dredges was attached to a common steel towing bar. The upper and lower edges of each dredge mouth were armed with blunt teeth 4 cm long. Observations were made inside and outside dredge tracks within 1 hr of each tow. Depth varied from 40 to 50 m, and the substrate was sand overlaid by glacial gravel and cobble, 1-10 cm in diameter, with occasional boulders up to 60 cm across embedded in the gravel.

Tracks left by these dredges were shallow with a flat floor. Gravel was sparser inside than outside the track, and dislodged boulders were commonly observed. Tooth marks were seen over sandy bottom. Spoil ridges were left between adjacent dredges, and piles of small rocks were seen at intervals along the track. Small rocks were also "bulldozed" along in front of the dredge.

5. The Canadian Department of Fisheries and Oceans (DFO 1993) conducted a sidescan sonar survey in the Bras D'Or Lakes system in Nova Scotia to document the physical effects of various mobile fishing gears 1 yr after the area was closed to mobile gear. Water depths ranged from 10 to 500 m.

Dredge tracks consisting of a series of parallel furrows made by the dredge teeth were observed in gravelly bottoms and occasionally in silty bottoms. On the older or degraded dredge tracks, the furrows left by the teeth were not always resolved. In a soft bottom area, berms were visible at the outer edges of the dredge track. Similar berms were not seen in harder bottom areas.

6. Kaiser, Hill, *et al.* (1996) compared the immediate effects of beam trawling and scallop dredging on large epibenthic fauna on a heavily fished scallop ground off the southwest coast of the Isle of Man, adjacent to the closed area studied by Bradshaw *et al.* (2001). Three parallel waylines, 500 m apart and 1 nmi long, were established: one was fished 10 times with a 4-m commercial beam trawl fitted with an 80-mm diamond-mesh cod-end, one was left undisturbed, and one was fished 10 times with two gangs of four Newhaven spring-toothed dredges. The benthos in all three waylines was surveyed using a 2.8-m beam trawl with a 40-mm square-mesh cod-end before, and 24 hr after, fishing.

Prior to fishing, there were no significant differences between the epibenthic communities on the three waylines. Both gears greatly reduced the abundance of most species and altered community structure, but there were no significant differences in community structure between the two experimental waylines after fishing. The scallop dredges caught a lower proportion of nontarget species.

7. Kaiser, Ramsay, *et al.* (2000) examined the structure of infaunal and epifaunal benthic communities exposed to either high or low scallop dredging activity, based on fishing effort data, in the Irish Sea between 1986 and 1996. Samples were collected with an anchor dredge, a grab sampler, and a small beam trawl from five sites subjected to low fishing effort, and from five sites subjected to high fishing effort. Only large infaunal organisms (>10 mm) were retained in sediment samples since they were judged more sensitive to physical disturbance. The study area was located south of the Isle of Man, in the Irish Sea, in the center of one of the most heavily fished scallop grounds in Europe, in gravel and coarse sand sediments.

After accounting for habitat effects (caused by variations in median sediment grain size and depth), the only significant response to increased fishing was a higher number of epifaunal organisms. There were no significant effects on the number or diversity of epifaunal species nor on any of the community indices for infauna.

Benthic communities in the heavily fished areas were dominated by higher abundances of smaller-bodied species, whereas the less intensely fished areas were dominated by lower abundances of larger-bodied species. Species with higher mean densities or catch rates in the low-effort sites included a soft coral, two species of sea urchin, a bivalve mollusk, and two gastropods. Species that were more abundant in the high-effort sites included three species of brittle star and a sea urchin.

8. Veale *et al.* (2000) compared samples of epibenthic organisms collected with a gang of four Newhaven type spring-toothed scallop dredges in 1995 on 13 commercial fishing grounds in the Irish Sea that had been exposed to different amounts of fishing effort during the preceding 60 yr. The dredges were equipped with short teeth (76 mm) and small belly rings (57 mm). Annual estimates of fishing effort were available from detailed, high-resolution fishermen's logbooks. Depths ranged from 20 to 67 m, and sediment types were generally coarse sand and gravel, overlain with pebbles, cobbles, and dead shell.

Of all environmental parameters examined (including depth and bottom hardness and texture), a combination of long- and short-term fishing effort best explained the observed differences in dredge bycatch assemblages across sampling sites. Species diversity and richness, total number of species, and total number of individuals all decreased significantly with increasing fishing effort. Total abundance, biomass, and production, and the production of most of the major individual taxa investigated, decreased significantly with increasing effort. Species that were more abundant at the high-effort sites included starfish, soft corals, spider crabs, and the crab *Cancer pagurus*. Spider crabs and soft corals were also more abundant at the medium-effort sites.

Summary

This section summarizes the results of eight studies that assessed the effects of toothed scallop dredges on mixed glacially derived substrates. All but one (4) of these studies were done since 1993. Six of them were conducted in the Irish Sea and two in eastern Canada. The Canadian studies (4, 5) examined physical effects to the seafloor, and the Irish Sea studies evaluated effects on benthic infauna and epifauna.

Two of the Irish Sea studies (2, 6) were experimental. One study (1) compared benthic sample data collected at sites exposed to variable amounts of historical fishing effort, and another (3) involved diver surveys in a closed area. One of the two experimental studies (6) evaluated the effects of a discrete scallop dredging and beam trawling event on large epifauna in a commercially exploited area, and the other (2) examined the incremental effects of repeated, bimonthly tows over a 3-yr period in a closed area.

Physical Effects

Physical effects of scallop dredging in mixed substrates included furrows made by the teeth, shallow, flat tracks with spoil ridges or berms at the edges, dislodged boulders, and the "bulldozing" of small rocks by the dredge (4, 5). No information on recovery times was available.

Biological Effects

In the closed area study (3), 6 mo of experimental dredging (total of 30-40 tows per dredge track with eight dredges on three or four different occasions) following a 6-yr period with no dredging altered benthic community structure, but not significantly. There were no trends in the abundance of individual species or number of species, but there was evidence of reduced benthic community heterogeneity. Three years after dredging began, upright species were less abundant, and encrusting species were more abundant. (These changes may have occurred earlier, but this could not be verified). A number of epifaunal species increased significantly in abundance in the closed area 5-9 yr after the area was closed (2).

Experimental dredging in commercial fishing grounds in the Irish Sea altered the community structure of large epifaunal populations (6), while areas exposed to 10 yr of high fishing effort were characterized by significantly higher numbers of epifaunal organisms (7). Chronic exposure to high fishing effort did not significantly affect infaunal communities, and there were no significant effects of increased scallop dredging activity on the number of epifaunal species or species diversity, but there was a shift from benthic communities dominated by greater numbers of larger species to fewer numbers of smaller species (7).

Sites exposed to low fishing activity during the late 1930s to early 1950s, and high fishing activity during the 1990s, were characterized by fewer "disturbance-vulnerable" species and more "disturbance-tolerant" species (1). Furthermore, faunal differences and the percentage of species "lost" between the low- and high-effort time periods increased as the number of years since fishing began increased. Overall, there was no clear evidence of reduced species diversity between the two time periods.

Invertebrate bycatch collected in dredges at high-effort sites was composed of significantly fewer species and individuals than at low and medium-effort sites, and total abundance, biomass, and production, and the production of individual taxa declined significantly with increasing fishing effort (8).

Other Nonhydraulic Dredges

Other Nonhydraulic Dredges -- Biogenic Substrate (Table 5.13)

1. Fonseca *et al.* (1984) conducted research near Beaufort, North Carolina, in 1982 to determine the effects of small, hand-pulled, bay scallop dredges on eelgrass. Two, 65-cm-wide, lightweight dredges (no teeth on the dredge foot) were fixed to a single tow bar. Two study sites were selected, an exposed site with compacted silty sand sediments (19.8% silt-clay), and a protected site where sediments were less compact and had a slightly higher silt-clay content (22.3%). Three small quadrats at each site were dredged 15 times, three were dredged 30 times, and three were not dredged at all.

There was a significant decrease in both the number of eelgrass shoots and the biomass of eelgrass leaves with increasing dredging effort at each site. Both shoot number and leaf biomass were reduced to zero at the soft bottom site after 30 dredge pulls, but the hard-bottom site lost more biomass than the soft-bottom site because the initial biomass there was higher. The proportional reduction in shoot number was greater at the soft-bottom site.

The authors concluded that intensive scallop dredging for bay scallops with this gear or with the heavier dredges that are pulled by powerboats has the potential for immediate as well as long-term reduction of eelgrass nursery habitat.

2. Langan (1998) conducted a study in 1994 to determine the effects of dredge harvesting on an eastern oyster population and its associated benthic community in the Piscataqua River, which divides the states of New Hampshire and Maine. An oyster bed approximately 18 acres in size in the river channel is divided nearly equally by the border between the two states. Maine allowed commercial harvesting of oysters, but New Hampshire did not, for many years prior to the study. The dredge used on the Maine side of the river was 30 in (76 cm) wide, weighed approximately 27 kg, had blunt 8-mm teeth, and had a chain-mesh bag. Commercial dredging on the Maine side of the river (with one dredge, about twice a week) had continued for 5 yr prior to the study. A limited number of benthic samples were collected by divers on each side of the river on one sampling occasion. Turbidity was measured during a single dredge tow.

No significant differences were found in the number, species richness, or diversity of epifaunal or infaunal invertebrates between the two areas. The concentration of suspended sediment in near-bottom water during the dredge tow was slightly more than double the ambient level 10 m behind the dredge, and dropped off to the ambient level 110 m behind the dredge.

3. Lenihan and Peterson (1998) conducted a study in the Neuse River estuary in North Carolina to determine if the loss of eastern oysters from the river was in part due to the lowering of oyster reefs by oyster dredges. Eight, 1-m-tall, oyster-shell reefs were constructed in two depths (3 and 6 m). Nineteen months later, four of the eight reefs were dredged by a commercial dredge vessel for 1 wk until the catch of market-sized oysters in each haul declined to near zero and remained constant. The height of harvested and unharvested reefs was measured 3 days before dredging started and 2 days after dredging stopped.

Dredging reduced the mean height of the 1-m reefs by 29±6 cm. Unharvested reefs lost only 1±1 cm of height over the 1-wk duration of the experiment.

4. Riemann and Hoffmann (1991) assessed the effects on the water column of mussel dredging in a shallow eutrophic sound (Limfjord) in Denmark that had a mean depth of 7 m and a maximum depth of 15 m. Suspended particulate matter, oxygen, and nutrient (phosphorus and ammonia nitrogen) levels were measured at a number of stations throughout the water column at a dredged and a control site before dredging, immediately afterwards, and 30 and 60 min later. No information on sediment type was given. Dredging was performed for 15 min with a 2-m-wide mussel dredge weighing about 100 kg.

Average suspended particulate matter increased significantly immediately after dredging, but returned to pre-dredge levels 60 min later. Particulate matter also increased markedly on a day with high wind velocity. Oxygen decreased significantly immediately after dredging, particularly near the bottom. Average ammonia content also increased after dredging, but large horizontal variations prevented detailed interpretation of these increases.

Summary

Four studies are summarized. Three studies were conducted on the U.S. Atlantic coast, and one was conducted in Denmark. All studies were performed in shallow water, two in rivers and two in coastal waters with a maximum depth of 15 m. Two studies evaluated biological effects, one examined physical effects, and one examined geochemical effects in the water column. Three studies were experimental and one was observational.

Physical and Biological Effects

These studies showed that dredging lowered the height of oyster reefs (3) and, in a shallow enclosed fjord, temporarily increased water column turbidity and lowered dissolved oxygen concentrations, especially near the bottom (4). There were no detectable effects after 5 yr of oyster dredging on benthic invertebrate abundance, species richness, or diversity (2). Repeated tows with hand-hauled bay scallop dredges significantly reduced eelgrass biomass (1).

Hydraulic Clam Dredges

Hydraulic Clam Dredges -- Mud (Table 5.14)

Hall and Harding (1997) evaluated the effects of experimental suction dredging on intertidal infaunal communities in Auchencairn Bay, on the north side of the Solway Firth, on the west coast of Scotland. Sediments were 60-90% silt-clay in the inner bay and 25-60% silt-clay in the middle and outer bay. Commercial dredging for the cockle *Cerastoderma edule* in the bay was prohibited 4.5 mo before experimental dredging began. Core samples were collected in control plots prior to each dredge tow, and in experimental plots immediately after, and 1, 4, and 8 wk after each dredge tow.

Dredge tracks could not be seen after the first day. The total number of infaunal individuals and species increased in both plots over time, but were significantly lower in the experimental plots than in the control plots immediately after dredging and after 4 wk. Species diversity also increased significantly over time, but was not significantly different in the two plots at any point during the experiment. Three of the five dominant species were significantly reduced by dredging over the course of the study. By the end of the study (8 wk), much of the difference between dredged and control sites had been lost.

Summary

Results of a single experimental study are summarized. It examined the physical and biological effects of individual suction dredge passes in an intertidal mud habitat, and monitored recovery for 8 wk.

Dredging produced dredge tracks that disappeared after 1 day. There were significant reductions in the total number of infaunal individuals and species that lasted 4 wk, and three out of five dominant species were reduced in abundance during the entire 8-wk duration of the experiment. However, infaunal community structure recovered nearly completely by the end of the experiment.

Hydraulic Clam Dredges -- Sand (Table 5.15)

1. Hall *et al.* (1990) studied the physical and biological effects of a commercial escalator dredge used to harvest razor clams (*Ensis* spp.) in a shallow sea loch (Loch Gairloch) on the west coast of Scotland in November 1989. The depth at the study site was 7 m, and the sediment was fine sand. The study site was located near a recently dredged area, but was not exploited itself. Experimental and control plots were visually inspected and sampled by divers immediately after dredging and 40 days later. Each experimental plot was dredged intensively for approximately 5 hr in order to simulate commercial fishing activity.

After dredging, the experimental plots were criss-crossed by shallow trenches (0.5 m wide and 0.25 m deep) interspersed with larger holes (up to 3.5 m wide and 0.6 m deep) that were presumably produced when the dredge remained stationary for a brief period. Sediment in the holes and trenches was "almost fluidized," and sediment in the fished area had a significantly higher median particle size than sediment in the control plots. After 40 days, however, none of these features remained.

The number of infaunal species and individuals were reduced in the experimental plots immediately after dredging (significantly, for individuals), but there were no detectable differences between experimental and control plots 40 days later. There were no significant differences in the abundance of individual species in the control and experimental plots on either sampling occasion.

The authors concluded that dredging caused a short-term, nonselective reduction in the numbers of all infaunal species and that recovery from physical effects was accelerated by a series of winter storms and considerable sediment disturbance in the study area. No attempt was made to assess the mortality of: 1) large polychaetes and crustaceans that were observed to be retained on the wire-mesh conveyor belt or that fell off the end of the belt, or 2) ocean quahogs that were often cracked by the dredge.

2. Kaiser, Edwards, *et al.* (1996) investigated the effects of suction dredging for cultivated manila clams (*Tapes philippinarum*) [since reclassified and renamed as Japanese littleneck clam (*Venerupis philippinarum*)] on a muddy sand intertidal flat in southeastern England during December 1994. Samples of benthic infauna and sediment were collected prior to, 3 hr after, and 7 mo after harvest in one cultivated plot and in nearby control locations.

There were significantly higher densities of infaunal organisms in the cultivated plot versus the control plots prior to dredging, but no differences in the number of species or in four indices of taxonomic diversity. During dredging, large amounts of fine sand were resuspended by the dredge, exposing the underlying clay. Immediately after dredging, there were significant reductions in the mean numbers of infaunal species and individuals in the cultivated plot, resulting in levels that were statistically the same as in the control plots. Crustaceans and bivalve mollusks were particularly affected. Seven months later there were no significant differences between the benthic community in the harvested plot and in the control plots, and the proportion of fine sand in the harvested plot had increased significantly, indicating that recovery from the effects of clam cultivation and harvesting was complete.

3. MacKenzie (1982) sampled the benthic invertebrate assemblages of three ocean quahog beds with contrasting fishing histories located about 65 km east of Cape May, New Jersey, in the MAB, during October 1978. One bed had never been fished, one had been actively fished for 2 yr, and one had been fished for about a year but then abandoned 4-5 mo prior to this study. All three beds were in very-fine-to-medium sand sediments in 37 m of water. Commercial dredging was conducted with cage dredges in this area. Sampling was limited to a total of 30 grab samples from all three sites.

No significant differences were found in numbers of invertebrate individuals or species, nor in species composition, between the recently abandoned and never dredged sites, or between the actively dredged and never dredged sites. Hydraulic dredging thus did not appear to have any lasting effect on the invertebrate populations in these beds. Comparison of samples from the recently abandoned and never dredged sites also indicated that hydraulic jetting of the bottom re-sorts bottom sediments, leaving shell fragments on the surface and coarser sediments at the bottom of dredge tracks.

4. Maier *et al.* (1995) assessed the effects of escalator dredges in four muddy sand tidal creeks in South Carolina by comparing pre- and post-dredging turbidity levels and benthic infaunal assemblages. Turbidity was monitored 2 wk before, during, and 2 wk after dredging at one location, and during and immediately after dredging at another. Infaunal samples were collected 3 wk before and 2 wk after dredging in a creek that had been commercially dredged 5 yr prior to the study, and in a creek that had never been dredged before.

Turbidity was elevated near the dredge and immediately downstream while it was operating, but the sediment plumes only persisted for a few hours. Sampling failed to detect any significant changes in the abundance of dominant infaunal taxa, or in the total numbers of individuals, after dredging.

5. Medcof and Caddy (1971) utilized divers and a submersible to compare the physical effects of a hydraulic cage dredge in shallow-water (7-12 m) sand inlets in southern Nova Scotia, Canada.

On sand and sand-mud habitats, hydraulic dredges left smooth tracks with steeply cut walls that averaged 20 cm deep, and then slowly filled in by slumping. The hydraulic dredge raised a sediment cloud that seldom exceeded 0.5 m high and usually settled within 1 min. Dredge tracks were still easily recognizable after 2-3 days.

6. Meyer *et al.* (1981) observed the effects of a small (1.2-m-wide) hydraulic clam cage dredge in an Atlantic surfclam bed located near Rockaway Beach on the south shore of Long Island, New York. The study was conducted in 1977, 3 yr after the area was closed to commercial clamming. The sediment in the study area was fine-to-medium sand covered with a 7.5-cm-thick layer of silt, and the maximum water depth was 30 m. The study area was exposed to strong bottom currents that caused considerable movement of sand. As part of a larger study to evaluate gear performance, the effects of dredging on bottom substrate and fauna were assessed by divers during, immediately after, and 2 and 24 hr after, a single 2-min tow.

The dredge formed trenches that were initially rectangular, as wide as the dredge, and over 20 cm deep. Mounds of sand 15-35 cm wide and 5-15 cm high were formed on either side of the trench. The dredge raised a cloud of silt 0.5-1.5 m high, which settled within 4 min. Slumping of the trench walls began immediately after the tow and became more apparent with time. Two hours after dredging, slumping of the trench walls had rounded the depression. After 24 hr, the dredge track was less distinct, appearing as a series of shallow depressions, and was difficult to recognize.

The dredging attracted predators, with lady and Atlantic rock crabs preying on damaged clams, and with starfish, horseshoe crabs, and moon snails attacking exposed but undamaged clams. By 24 hr after dredging, the abundance of predators appeared to have returned to normal, and the most obvious evidence of dredging was whole and broken clam shells without meat.

7. Pranovi and Giovanardi (1994) studied the effects of a 2.7-m-wide hydraulic cage dredge in 1.5-2 m depths in the Venice Lagoon (Italy, Adriatic Sea). Divers collected samples of sediment and benthic organisms from experimentally dredged and control areas at two sites located inside and outside a commercial fishing ground immediately after experimental dredging and every 3 wk for 2 mo. A single tow was made at each site.

The dredge created 8-10 cm deep furrows, one of which was clearly visible 2 mo later. In this study, sediment grain size was not significantly affected by dredging, although portions of the fishing ground which had been predominantly silt and clay 15 yr earlier had a considerably higher sand content at the time of the study. Hydraulic dredging in this area often cracks the shells of bivalve mollusks.

Inside the fishing ground, total numbers and biomass of benthic infauna and epifauna were significantly reduced in the experimental plot immediately following dredging. Densities, especially of small species and epibenthic species, recovered 2 mo later, but biomass did not. Inside the fishing ground, there were also fewer species in the dredged area than in the control area immediately after, and 3 and 6 wk after, dredging, but no differences 2 mo afterwards. Outside the fishing ground, immediately after passage of the dredge, there were no significant faunal differences between dredged and undredged areas.

8. Tuck *et al.* (2000) examined in March 1998 the effects of hydraulic dredging on the seafloor and benthic community in a shallow (2-5 m) site that is located in the Outer Hebrides (Sound of Ronay) on the west coast of Scotland, and that was closed to commercial dredging. Sediments in the study area consisted of moderately well sorted medium or fine sand, and tidal currents reached speeds as high as 3 knots. Divers collected core samples and made observations and video recordings before, during, and immediately after dredging inside and outside six dredge tracks, and then returned to re-examine the site 5 days and 11 wk after dredging. The dredge was a commercial dredge that is used to harvest razor clams and that employs a hollow blade that protrudes 0.3 m into the sediment and that has holes to direct pressurized water forward into the sediment.

Immediately after dredging, the track had distinct vertical walls and a depth similar to the dredge blade. However, once the dredge was hauled, the sidewalls collapsed and the tracks had a flat-bottomed “V” shape. The sediment within the base of the tracks was fluidized to a depth of approximately 0.3 m and within both sidewalls to approximately 0.15 m. The tracks were still clearly visible after 5 days, but less pronounced, and the depth of fluidized sediment remained the same. After 11 wk, the tracks were no longer visible, but 0.2 m of sand was still fluidized. Immediately after fishing, there was significantly less silt in the sediments inside the tracks than outside, but there was no difference after 5 days.

Numerically, the infauna at the study site was dominated by polychaetes. There was a significant decrease in the proportion of polychaetes, and an increase in amphipods, in the dredge tracks within 5 days of dredging, but not after 11 wk. Bivalve mollusks -- other than razor clams -- were not affected by dredging. Within a day of dredging, the total number of species and individuals was significantly lower in the dredge tracks, but there was no difference after 5 days. Dredging had an immediate positive and negative effect on the abundance of a number of individual species. For some species, the effect persisted for 5 days, but no effects were detected 11 wk after dredging. Owing to the strong currents, there was a very sparse epifauna in the area; the only observed effect of dredging was the attraction of crabs into the area to scavenge on material disturbed by the dredge.

Summary

Results of eight hydraulic dredge studies in sandy substrates are summarized. Five studies examined the effects of “cage” dredges of the type used in the Northeast Region of the United States (3, 5-8), two examined the effects of escalator dredges, and one examined the effects of suction dredges. Three of them were published prior to 1990, and five since then. Four were performed in North America, one in the Adriatic Sea, and three in the United

Kingdom. One study was conducted on the U.S. continental shelf at a depth of 37 m, five in shallower nearshore waters (1.5-12 m), and two in intertidal environments. Three studies were observational in nature (3, 5, 6), and five were controlled experiments (1, 2, 4, 7, 8).

Three studies (2, 3, 7) compared effects in commercially dredged and undredged areas, and four (1, 4, 6, 8) were conducted in previously undredged areas. Six studies examined the effects of individual dredge passes (2, 4-8), one evaluated the effects of repeated passes in the same area during a short period of time (1), and one compared infaunal communities in an actively dredged, a recently abandoned, and an never dredged location (3). Seven studies examined physical and biological effects, and one was limited to physical effects (5). All of the biological studies examined effects to infauna. Recovery was evaluated in four cases for periods ranging from 40 days to 7 mo (1, 2, 7, 8).

Physical Effects

Hydraulic clam dredges created steep-sided trenches 8-30 cm deep that started deteriorating immediately after they were formed (1, 5-8). Trenches in a shallow, inshore location with strong bottom currents filled in within 24 hr (6). Trenches in a very shallow, protected, coastal lagoon were still visible 2 mo after they were formed (7).

Hydraulic dredges also fluidized sediments in the bottom and sides of trenches (1, 8), created mounds of sediment along the edges of the trench (6), resuspended and dispersed fine sediment (1, 2, 4-6, 8), and caused a re-sorting of sediments that settled back into trenches (3). In one study (8), sediment in the bottom of trenches was initially fluidized to a depth of 30 cm, and in the sides of the trench to 15 cm. After 11 wk, sand in the bottom of the trench was still fluidized to a depth of 20 cm. Silt clouds only last for a few minutes or hours (4-6).

Complete recovery of seafloor topography, sediment grain size, and sediment water content was noted after 40 days in a shallow sandy environment that was exposed to winter storms (1).

Biological Effects

Some of the larger infaunal organisms (*e.g.,* polychaetes and crustaceans) retained on the wire mesh of the conveyor belt used in an escalator dredge, or that drop off the end of the belt, presumably die (1). Benthic organisms that are dislodged from the sediment, or damaged by the dredge, temporarily provided food for foraging fish and invertebrates (6, 8). Predator densities returned to normal within 24 hr in one study (6).

Hydraulic dredging caused an immediate and significant reduction in the total number of infaunal organisms in three studies (1, 2, 8), and in the number of both infaunal and epifaunal organisms in a fourth study (7). There were also significant immediate reductions in the number of species of infauna in two cases (2, 8), and in the number of species and biomass of both infauna and epifauna in a third case (7).

In one study using a hydraulic cage dredge, polychaetes were the most affected in the short term (7); in another study using a suction dredge, crustaceans and bivalve mollusks were the most affected in the short term (2). Two studies of the effects of escalator dredging failed to detect any reduction in the abundance of individual taxa (1, 4). In one of them (4), dredging did not reduce the number of infaunal organisms. Evidence from the study conducted off the New Jersey coast indicated that the number of infaunal organisms and species, and the species composition, were the same in actively dredged and never dredged locations (3).

Recovery times for infaunal communities were estimated in four studies. Three of these studies (1, 7, 8) were conducted in very shallow (1.5-7 m) water, and one (2) in an intertidal environment. Total infaunal abundance and species diversity had fully recovered only 5 days after dredging in a location where tidal currents reach maximum speeds of 3 knots (8). In the latter study, all species which had been initially reduced due to dredging had recovered after 11 wk. In another study, total abundance recovered 40 days after dredging (when the site was first revisited) at a site exposed to winter storms (1). Total infaunal abundance, but not biomass, recovered within 2 mo at a commercially exploited site, but not at a nearby unexploited site (7). Full recovery at the intertidal site was noted when it was first revisited 7 mo after it was suction dredged (2). Actual recovery times at this site and at one of the exposed subtidal sites (1) may have been much quicker than 7 mo and 40 days.

Hydraulic Clam Dredges -- Mixed Substrates (Table 5.16)

Murawski and Serchuk (1989) used manned submersibles to observe effects of hydraulic dredging on sand, mud, and gravel bottom habitats in a number of offshore locations in the MAB between Delaware Bay and Long Island (water depths not reported).

They reported that hydraulic cage dredges penetrate deeper into the sediments and, on a per-tow basis, result in greater short-term disruption of the benthic community and underlying sediments than do scallop dredges (no data were provided). In coarse gravel, the sides of hydraulic dredge trenches soon collapsed, leaving little evidence of dredge passage. There was also a transient increase in bottom-water turbidity. In finer-grained, hard-packed sediments, tracks persisted for several days after dredging.

Nonharvested benthic organisms (*e.g.,* sand dollars, crustaceans, and polychaetes) were substantially disrupted by the dredge. Sand dollar assemblages appeared to recover quickly, but short-term reductions in infaunal biomass were considered likely. Numerous predatory fish (*e.g.,* red hake, spotted hake, and skates) and invertebrates (Atlantic rock crabs and starfish) were observed consuming broken quahogs in and near dredge tracks. Densities of crabs and starfish were estimated to be two-and-a-half times higher in dredge tracks than in nearby undredged areas within 1 hr of experimental tows, and >10 times higher 8 hr after dredging. Presumably, the benthic infauna "tilled up" by the dredge was also being consumed, since not all predators observed foraging in the dredge paths were eating damaged shellfish.

Summary

An in situ evaluation of hydraulic dredge effects in sand, mud, and coarse gravel in the MAB indicated that trenches fill in quickly -- within several days in fine sediment, and more rapidly than that in coarse gravel. Dredging dislodged benthic organisms from the sediment, attracting predators.

Hydraulic Clam Dredges -- Biogenic Substrate (Table 5.17)

1. Godcharles (1971) experimentally evaluated the physical effects of escalator dredging in seagrass (*Thallasia testudinum* and *Syringodium filiforme*) beds, *Caulerpa* algae beds, and bare sand bottoms (depth not given) in Tampa Bay, Florida, in 1968. Dredging was conducted with a commercial dredge at six sites. Water jets penetrated sediments to a maximum depth of 45 cm and left trenches that varied from 15 to 45 cm deep.

Trenches were deeper in shallow areas where propeller wash scoured loose sediments from trenches and prevented redeposition of suspended sediments. The proportion of fine sediment in some trenches decreased immediately after passage of the dredge. Virtually all attached vegetation in the path of the dredge was uprooted, leaving open bottom areas.

Trenches in grass beds remained visible the longest (up to 86 days), while those in sandy areas filled in immediately. Most fluidized sediments hardened within 1 mo, but some spots were still soft 500 days after dredging. Differences in silt-clay content between tracks and undisturbed areas became negligible after a year, but seagrasses had still not recolonized disturbed areas. New algal growth was noted in some dredged areas after 86 days, and after 1 yr, dredge tracks were completely covered.

2. Orth *et al.* (1998) assessed damage to submerged aquatic vegetation caused by escalator dredges in Chincoteague Bay, Virginia, during 1996, 1997, and 1998.

They reported a large number of circular "scars" in the vegetation, with 70-100% seagrass cover outside the scarred areas, and an abrupt reduction to 15% or less at the scar edge. The percent cover of seagrass was low across the scar except for an abrupt increase in cover at the center, where seagrass had not been disturbed.

There were no measurable differences in percent cover estimates in the scarred portions of areas that were dredged during the 3 yr of observation, indicating that revegetation was proceeding very slowly. There were two factors that the authors believed were delaying revegetation: an increase in depth of 10-20 cm in the dredge tracks, and large holes inside the unvegetated portions of the scars made by organisms such as foraging cownose rays. The authors concluded that even the most lightly effected areas would require a minimum of 5 yr to fully recover.

Summary

Two studies were performed in the southeastern United States in shallow, subtidal, vegetated habitats. One study was a controlled experiment that compared the effects of escalator dredges in vegetated (seagrass and algae) and unvegetated areas; the other study evaluated damage to seagrass beds caused by commercial escalator dredging.

In the experimental study (1), water jets penetrated sand substrate to a maximum depth of 45 cm, created trenches up to 30 cm deep, uprooted vegetation, and decreased the proportion of fine sediments in dredge tracks. Recovery times were extremely variable. In some cases, trenches were visible for only 1 day, and in other cases for 3 mo. In most cases, sediments hardened within 1 mo, but in some tracks, sediments were still fluidized 500 days after dredging. After 1 yr, sediment composition in dredge tracks had returned to normal, but seagrass had not recolonized disturbed areas.

In the observational study (2), there were no signs of recovery of seagrass in commercially dredged areas 3 yr after dredging.

Pots and Traps

Pots and Traps -- Mixed Substrates (Table 5.18)

Eno *et al.* (2001) evaluated the effects of crab and lobster pots on attached epibenthic megafauna (sponges, bryozoans, ascidians, soft corals, and tube worms) at three locations in Great Britain: one each off Scotland, Wales, and England.

Off the west coast of Scotland (Badentarbet Bay), the effects of dropping pots onto sea pens were observed by divers in a soft-mud, pot fishing ground for Norway lobster (*Nephrops* sp.) in 1995. In addition, three experiments were conducted to assess sea pen survival and recovery following dragging, uprooting, and smothering by lobster pots. In one experiment, divers dragged pots over marked areas of the seafloor and recorded the fate of sea pens for 3 days after the disturbance. In the second experiment, groups of sea pens removed from the seafloor by the pots were relocated to an undisturbed location, and their behavior and survival were observed over a 4-day period. In the third experiment, 60 pots were dropped onto individual or small groups of sea pens and then removed after 24 or 48 hr to simulate the effects of smothering that would occur during commercial operations.

Video observations at the Scottish site showed that the pressure wave created by pots as they sink to the bottom was sufficient to bend sea pens away from the pot just before contact. Results of the three experiments revealed that all sea pens were able to fully recover from pot impact. Furthermore, all sea pens recovered from the effects of dragging within 24-72 hr. Uprooted sea pens reinserted themselves into the sediment, providing the peduncle gained contact with the mud surface. Following smothering for either 24 or 48 hr, it took 72-96 and 96-144 hr, respectively, for all three species of sea pen to fully recover an upright position.

At five coastal sites in Lyme Bay, southwest England, SCUBA divers assessed the immediate effects of pot hauling in different habitats at depths of 14-20 m in September and October 1995. Habitats varied from exposed limestone slabs and bedrock covered by sediment, to large boulders with mixtures of various rocky substrates interspersed with coarse sediment. A variety of fragile epifaunal species, including a sea fan and Ross coral, were present. Two lines of three pots were deployed at each site. Divers videorecorded pots as they landed on the seafloor, and as they were hauled back, and then videorecorded back along the path of each pot after its removal.

There were very few signs of effect on epifaunal species at any of the five sites. Gorgonians (soft corals) were frequently seen to bend under the weight of pots, then spring back once the pots had passed. When pots were hauled back along the bottom, a track was left in the sediments.

At Greenala Point, Wales, and in Lyme Bay, the effects of potting on selected epibenthic species were quantified by diver observations at sites with rocky substrates, water depths <23 m, and fragile epifaunal species. Common epifaunal species included a sea fan and a colonial emergent bryozoan. A commercial pot fishery for crabs (*Cancer pagurus*) and lobsters (*Homarus gammarus*) was carried out in these two locations. Each location was divided into two control and two experimental plots. Pots were set in the experimental plots and hauled every 2 or 3 days for 4 wk, such that at least 30 pots and 10 anchor weights landed in each experimental plot over the course of the study.

At the Greenala Point site, the abundance of four sponge species increased significantly in the experimental plots after 4 wk of potting, but not in the control plots. At the Lyme Bay site, one species of sponge, an ascidian, and a bryozoan increased significantly in abundance in the experimental plots only.

Summary

Observations and experiments were carried out in a single study conducted at three coastal locations in Great Britain to evaluate the effects of crab and lobster pot fishing on attached epibenthic megafauna. Sea pens underneath pots were bent over and some were uprooted when pots were dragged over mud sediments, but they fully recovered within 72-144 hr after pots left on the bottom for 24 or 48 hr were removed. When pots were dragged over the bottom they left tracks, but 4 wk of simulated commercial pot fishing had no negative effect on the abundance of attached benthic epifauna. In fact, seven taxa (five sponges, an ascidian, and a bryozoan) increased in abundance after 4 wk of fishing..

Multiple Gear Types

Multiple Gear Types -- Sand (Table 5.19)

1. Almeida *et al.* (2000) surveyed the southern half of Closed Area II on Georges Bank in June 1999, 4.5 yr after that area was closed to gear used to catch groundfish (bottom trawls, scallop dredges, longlines, and gill nets). This portion of the closed area ranges in depth from slightly <50 m to slightly >90 m, the substrate is sand, and there are sand ripples and bedforms in the shallower, northwest, "high-energy" portion of the survey area where bottom tidal currents are stronger. These features are generally absent from the deeper (>65 m), "low-energy," southeast portion of the survey area. Still photographs and video imagery were used to assess the relative abundance of seven microhabitats at a series of paired stations just inside and outside the closed area boundary.

No significant differences were found for any microhabitat type except for the emergent sponge epifauna (*e.g., Suberites ficus* and *Polymastia* sp.) microhabitat type that was more abundant inside the closed area.

2. Kaiser, Spencer, *et al.* (2000) sampled infauna and epifauna with a 2-m beam trawl and an anchor dredge along the south Devon coast in England of three high-fishing-effort areas open to all fishing (otter trawl, beam trawl, scallop dredge, and pots), in two medium-fishing-effort areas open to mobile gear for 6 mo out of the year and to pots year-round, and in one low-fishing-effort area only open to pots. Sampling within each of the six areas was distributed among three sites. At each trio of sites, sediments followed a gradient from fine sand to medium sand to coarse-medium sand. Fine-sand sites (inshore) were located in 15-17 m depths. The medium sand and coarse-medium sand sites (offshore) were located in 53-70 m depths.

For epifauna, there were significant habitat effects (*i.e.*, depth and substrate) on the numbers of species and individuals, and on two indices of species diversity, but there were no significant fishing effort effects (high versus low) on any of these parameters. In general, however, as fishing disturbance increased, less mobile, larger-bodied, and more fragile epifaunal species decreased in abundance, while mobile, more resilient species increased in abundance. Areas closed to draggers had higher abundances of emergent fauna (*i.e.*, soft corals and hydroids) that increased habitat complexity.

For infauna, there were significant habitat effects (*i.e.*, depth and substrate) on the number of species and on one index of species diversity between the two offshore sites, but no consistent fishing effort effects across all three sites, and only one significant fishing effort effect (on species diversity) between the two deeper offshore sites (*i.e.*, greater effect at the coarse-medium sand sites). Infaunal biota in the three different habitats were affected to different extents by increasing levels of fishing. In particular, the deeper, medium-coarse sand habitat seemed most severely affected by fishing. Several infaunal species in this habitat had significantly lower biomasses and abundances.

Areas subjected to low fishing effort were dominated by epifaunal and infaunal species with relatively high biomass, whereas areas subjected to high fishing effort had fewer high-biomass species and greater abundances of smaller-bodied species.

Summary

The results of two observational studies of multiple gear types on sand habitats (at depths that varied from 15 to >90 m) are summarized. A recent study in U.S. waters on eastern Georges Bank (1) compared the amount of cover provided by different habitat types inside and outside an area closed to trawls, dredges, longlines, and gill nets for 4.5 yr. Another recent study (2) compared sandy shallow and deepwater sites on the south coast of England that were exposed to low, medium, and high levels of fishing effort by mobile and fixed gears.

On Georges Bank, the only significant difference was a higher abundance of emergent sponges inside the closed area (1). On the south coast of England, low-effort areas that were closed to trawls and dredges had more emergent epifauna (soft corals and hydroids) and were dominated by relatively high-biomass epifauna and infauna, whereas high-effort areas fully exposed to fixed and mobile gears had higher abundances of small-bodied organisms (2). Deep (53-70 m), coarse-medium sand, offshore sites were more affected by fishing than deep, medium sand, offshore sites, or shallow (15-17 m), fine-sand, inshore sites (2).

Multiple Gear Types -- Gravel/Rock (Table 5.20)

1. Collie *et al.* (1997) sampled two relatively shallow (42-47 m) and four relatively deep (80-90 m) gravel sites in U.S. and Canadian waters on the northern edge of eastern Georges Bank during two cruises in 1994. Bottom substrates at the sites were predominantly pebble-cobble with or without encrusting organisms, with some overlying sand. The sites were classified as disturbed (D) or undisturbed (U) by bottom-tending mobile gear based on the number of dredge and trawl tracks in sidescan sonar images, the presence or absence of large boulders and epifauna in bottom photographs, and 1993 records of scallop dredging effort in TMSs of latitude and longitude in U.S. waters on the bank. There were three U sites and one D site in deep water, and one U and one D site in shallow water.

Quantitative samples of epibenthic organisms (>10 mm) were collected with a 1-m-wide naturalist dredge fitted with a 6.4-mm square-mesh liner. Organisms such as colonial sponges, bryozoans, hydroids, and the tube-dwelling polychaete *Filograna implexa* that were not quantitatively sampled by the dredge were excluded from analysis.

There were significant effects of fishing and depth combined on total density, biomass, and an evenness diversity index based on abundance, as well as some evidence of a gradient in abundance, biomass, and species diversity from deep undisturbed sites (high values) to shallow disturbed sites (low values). However, because of the significant depth effects and depth-disturbance interactions, fishing disturbance alone was not a significant factor.

Cluster analysis identified a group of six species that were abundant at U sites, rare or absent at D sites, and not affected by depth. This group included two species of shrimp, a tube-dwelling polychaete, a nemertean, horse mussels, and a bloodstar. Six other species groups were defined by either depth or some combination of depth and disturbance level, or included species that were ubiquitous.

2. Collie *et al.* (2000), in a follow-up publication, analyzed video images and still photographs recorded at five of the six study sites surveyed in the two 1994 research cruises to George Bank (*i.e.*, one of the deep U sites was not included).

In the videotapes, the U sites at both depths had slightly coarser sediments (higher frequency of pebble-gravel than sand-gravel); in the still photos, there was a higher frequency of sand and cobble in U sites and a lower frequency of pebbles. Bottom photos showed a high percent cover of colonial hydroids and bryozoans at one of the deep U sites, and of the rock encrusting polychaete *Filograna implexa,* at both deep U sites. In contrast, at the D sites, the gravel was free of epifaunal cover, and few animals were visible. Statistical analysis confirmed that the

U sites had a significantly higher percent cover of *Filograna implexa*. However, cover provided by this species was also significantly greater in deeper water than in shallow water.

Emergent hydroids and bryozoans were significantly more abundant at the deep U sites than they were at the shallow U site. Overall, the percent cover of all emergent epifauna was significantly higher at the deep sites, but there was no significant disturbance effect.

Summary

Two recent observational studies of mobile gear effects on sediments and epifauna in gravel bottom habitat on the northern edge of eastern Georges Bank (42-90 m) are summarized. Study sites were distinguished by depth and the presence or absence of fishing disturbance. Sediments in undisturbed sites were slightly coarser with more sand and cobble. There were significantly more organisms, higher biomass, and greater species diversity at the undisturbed sites in both depths, but there were also significantly higher values in disturbed and undisturbed deep sites than in disturbed and undisturbed shallow sites.

Percent cover of an encrusting colonial polychaete was also significantly higher at the deep sites and at the undisturbed sites. Emergent hydroids and bryozoans were significantly more abundant in deep undisturbed sites, and at shallow disturbed sites. Overall, emergent epifauna was more abundant in deep water, but there was no significant disturbance effect.

Multiple Gear Types -- Mixed Substrates (Table 5.21)

1. Auster *et al.* (1996) used a remotely operated vehicle (ROV) in July 1993 to compare conditions inside and outside an inshore area (depth 30-40 m) in the GOM that was closed to mobile fishing gear in 1983. On sand-shell bottom, video transects indicated that habitat complexity was provided mostly by sea cucumbers attached to shell and other biogenic debris, and by bottom depressions created by mobile fauna. Both of these habitat features were significantly less common outside the closed area, a difference that was attributed to the incidental exploitation of sea cucumbers and the harvest of lobsters, sea scallops, crabs, and white hake -- all animals that produce depressions.

On cobble-shell bottom, habitat complexity was provided mostly by emergent epifauna (*i.e.*, hydroids, bryozoans, sponges, and serpulid worms) and sea cucumbers. These species were less common outside the closed area. Their reduced abundance was attributed to removal by mobile fishing gear.

Cleared swaths in epifaunal cover were observed at the border of the closed area and were presumed to be caused by scallop dredges and trawl doors.

Auster *et al.* (1996) also conducted sidescan sonar surveys and ROV observations of Stellwagen Bank (GOM) in 1993 (depth 20 -55 m). The sonar images showed that showed large expanses of sand, gravelly sand, shell deposits, and gravel. The authors reported that waves produced by large storms from the northeast create ripples in coarse sand that measure 30-60 cm between crests and 10-20 cm in height, and deposit large sheets of fine sand with low sand waves 15-35 m between crests. The troughs of these sand waves are filled with shell debris (mostly ocean quahogs). Examination of the sonar images also showed scallop dredge and trawl tracks that disturbed sand ripples and dispersed shell deposits.

The ROV observations on Stellwagen Bank's crest (32-43 m deep) indicated that aggregations of emergent hydrozoans were missing, and that benthic microalgal cover was disturbed in gear tracks. Observations on the crest of the bank in July 1994 showed that an ascidian species was widely distributed, but was not present in otter trawl tracks.

2-4. Reise (1982), Riesen and Reise (1982), and Reise and Schubert (1987) compared invertebrate surveys in the Wadden Sea (Netherlands) made between 1869 and 1986. Bottom sediments in these areas currently range from mud to coarse sand and some pebbles. The area is made up of tidal flats, shallow subtidal banks, and channels that reach depths of 23 m. Surveys were completed using oyster dredges and grabs.

During the time period encompassed by the various surveys, abundant oyster reefs were overexploited, seagrass beds were lost to a natural epidemic, and *Sabelleria* reefs were destroyed by heavy trawl gear. The area is now dominated by soft sediments and mussel beds, which prior to 1920 were restricted to very shallow water. Comparisons show that 28 mollusk and amphipod species (including eight associated with oyster beds, eight with *Sabelleria*, and seven with seagrasses) have declined in abundance. Twenty-three species (many of them polychaetes) that were missing or rare in earlier surveys were common in 1986. The epifauna was more abundant in the 1920s, and the infauna was more abundant in the 1980s.

5. Thrush *et al.* (1998) tested 10 predictions regarding the effects of increasing fishing pressure on benthic communities in the Hauraki Gulf, New Zealand. Core, grab, and suction dredge samples were taken from 18 stations exposed to varying levels of commercial fishing effort by otter trawls, Danish seines, and toothed scallop dredges. Additional data were obtained from video images using an ROV, and from sediment samples collected by divers. Sediments ranged from sand (<1% silt and clay) to mud (nearly 50% silt-clay) and depths from 17 to 35 m.

After accounting for the effects of location, depth, and sediment characteristics (grain size and organic matter content), 15-20% of the variability in macrofauna (>0.5 mm) community composition was attributed to fishing pressure.

Most of the predictions were supported by analysis of the core-sample data; fewer predictions were supported by other sample types. Three predicted results of increasing fishing pressure were confirmed at P<0.05: decreased density of large epifauna (video transects), decreased species diversity and richness (core samples), and decreased density of echinoderms (cores). Four additional predictions were confirmed at P<0.10: decreased number of individuals (grabs), increased density of small opportunistic species (cores), decreased density of long-lived surface dwellers (cores), and increased density of deposit feeders (cores). The large members of the epifauna were also less abundant in grab samples collected from more heavily fished sites (P<0.10).

Results, in some cases, were not consistent among sample types. Species diversity and richness, for example, were not even identified as significant model variables in the grab sample data, nor was the number of individuals in the core samples, and deposit feeders collected in grab samples were significantly less abundant at sites exposed to increased fishing pressure.

Two predictions were contradicted by the results of this study: the ratio of polychaetes to mollusks (in cores) decreased rather than increased with greater fishing pressure, and the ratio of small to large individuals, for one common species of sea urchin, increased rather than decreased (also in cores). Further, scavengers (large, mobile benthic organisms such as crabs and starfish) were predicted to increase with increasing fishing pressure, but there was no evidence from this study that they responded either positively or negatively to changes in fishing intensity.

6. Valentine and Lough (1991) used sidescan sonar and a submersible to describe the effects of scallop dredges and bottom trawls on sand and gravel habitats on eastern Georges Bank. They noted that the most evident signs of disturbance occurred on gravel pavement where they observed long, low mounds of gravel that presumably had been produced by trawling and dredging. In some areas, the seafloor was covered by trawl and dredge tracks.

Gravel areas that were not accessible to bottom-tending mobile gear (due to the presence of large boulders) had a biologically diverse community with abundant attached organisms. Conversely, the attached epifaunal community was sparse, and the bottom was smoother, in areas that had been disturbed by dredging and trawling.

Summary

Six observational studies of the effects of multiple gear types on mixed substrates are summarized. Surveys were conducted in the GOM inside and outside an inshore area closed to mobile fishing gear, and in an offshore area that was disturbed by mobile fishing gear (1). A series of three publications examined long-term (100+ yr) changes in benthic habitats and communities in the Wadden Sea, some of which were attributed to fishing (2-4). A study in New Zealand (5) tested 10 predictions of how increasing fishing activity affects benthic communities by comparing benthic samples and underwater video footage from areas exposed to varying degrees of commercial fishing effort. A sixth study (6) examined areas on eastern Georges Bank that were affected by mobile bottom gear.

Significant increases were observed in the abundance of sea cucumbers and emergent epifauna, and in the number of bottom depressions created by organisms such as lobsters, sea scallops, and crabs, on sand-cobble-shell substrate inside the GOM closed area (1). Sidescan sonar and ROV surveys of Stellwagen Bank revealed evidence that otter trawls and New Bedford-style scallop dredges disturb sand waves and ripples, disperse shell deposits, remove emergent epifauna, and disturb microalgal cover (1). Disturbed sand and gravel areas of Georges Bank were characterized by trawl and dredge tracks, sparse epifauna, mounds of gravel presumably produced by fishing gear, and smoother bottom (6). In the New Zealand study (5), there were four significant effects of increased fishing activity by bottom trawls, Danish seines, and toothed scallop dredges in mud and sand substrates that were consistent across all sampling methods. These effects were reduced density of large epifauna, echinoderms, and long-lived surface-dwelling organisms, and an increased density of small, opportunistic species. The loss of biogenic reefs and changes in benthic community composition (fewer mollusk and amphipod species and more polychaete species) in the Wadden Sea were in part attributed to fishing activity (2-4).

Table 5.1. Number of studies included in this review, by gear and substrate type. (PR = peer-reviewed; NPR = non-peer-reviewed.)

Gear	**Substrate**	**1990-2002**			**Pre-1990**			**Total**
		PR	NPR	Total	PR	NPR	Total	
Otter Trawls	Mud	9	2	11	0	0	0	11
	Sand	10	2	12	1	0	1	13
	Gravel/Rock	2	0	2	1	0	1	3
	Mixed	1	1	2	0	1	1	3
	All	22	5	27	2	1	3	30
NB Scallop Dredges	Sand	3	0	3	0	0	0	3
	Mixed	1	0	1	2	0	2	3
	All	4	0	4	2	0	2	6
Toothed Scallop Dredges	Sand	6	0	6	0	1	1	7
	Biogenic	1	0	1	0	0	0	1
	Mixed	6	1	7	1	0	1	8
	All	13	1	14	1	1	2	16
Hydraulic Clam Dredges	Mud	1	0	1	0	0	0	1
	Sand	4	1	5	2	1	3	8
	Biogenic	0	1	1	0	1	1	2
	Mixed	0	0	0	0	1	1	1
	All	5	2	7	2	3	5	12
Other Dredge	Biogenic	2	1	3	1	0	1	4
Multiple Gears	Sand	2	1	3	0	0	0	3
	Gravel/Rock	2	0	2	0	0	0	2
	Mixed	2	1	3	3	0	3	6
	All	7	1	8	3	0	3	11
Lobster Pots	Mixed	1	0	1	0	0	0	1
Total	**All**	**53**	**11**	**64**	**11**	**5**	**16**	**80**

Table 5.2. Number of studies included in this review, by substrate type. (PR = peer-reviewed; NPR = non-peer-reviewed.)							
Substrate	**1990-2002**			**Pre-1990**			**Total**
	PR	NPR	Total	PR	NPR	Total	
Mud	10	2	12	0	0	0	12
Sand	25	4	29	3	2	5	34
Gravel/Rock	4	0	4	1	0	1	5
Biogenic	3	2	5	1	1	2	7
Mixed Substrate	11	3	14	6	2	8	22
Total	**53**	**11**	**64**	**11**	**7**	**18**	**80**

Table 5.3. Number of studies included in this review, by geographical area. (PR = peer-reviewed; NPR = non-peer-reviewed.)					
Gear	**Northeast Region**	**Other North America**	**Europe and Scandinavia**	**Australia and New Zealand**	**Total**
Bottom Otter Trawl	7	10	8	5	30
New Bedford Scallop Dredge	4	2	0	0	6
Toothed Scallop Dredge	0	2	8	6	16
Hydraulic Clam Dredge	2	5	5	0	12
Other Dredge	3	0	1	0	4
Multiple Gears	5	0	5	1	11
Lobster Pot	0	0	1	0	1
Total	**21**	**19**	**28**	**12**	**80**

Table 5.4. Effects of otter trawls on mud substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Ball *et al.* 2000	Irish Sea	75 m	Sandy silt	Reduced infaunal and epifaunal richness, diversity, number of species, and individuals in fishing ground compared to wreck site, but no obvious effects on macrofauna 24 hr after trawling.		Experimental trawling in heavily fished prawn fishing ground, unfished area near a shipwreck used as control.
2	**Brylinsky *et al.* 1994**	Bay of Fundy, Nova Scotia, Canada	Intertidal	Silt and coarse sand overlain with silt	Door tracks in sediment, rollers compressed sediment; S decrease in nematodes and benthic diatoms in door tracks, no effects on larger infaunal organisms (mostly polychaetes).	Furrows visible 2-7 mo; nematodes recovered in 1-1.5 mo, diatoms in about 1-3 mo.	Four trawling experiments (repeated tows during a single day) at two locations in a trawled area, effects evaluated for 1.5-4 mo.
3	DeAlteris *et al.* 1999	Narragansett Bay, Rhode Island, USA	14 m	Mud	Doors produced tracks 5-10 cm deep and adjacent berm 10-20 cm high.	No changes in hand dug trenches for >60 days.	Diver observations.
4	**Drabsch *et al.* 2001**	Gulf of St. Vincent, South Australia	20 m	Fine silt	Trawl door tracks, smoothing of topographic features; S decrease in total infaunal abundance and one group of polychaetes, damaged epifauna.		Experimental trawling (two tows per unit of area in 1 day) in area with no trawling for 15 yrs (one site); effects evaluated after 1 wk.
5	**Frid *et al.* 1999**	Northeast England (North Sea)	80 m	Silt-clay	S increase in total number of individuals in taxa predicted to increase at high fishing effort and number of errant polychaetes; no effect of increasing effort on total number of individuals expected to decrease, but S decline in sea urchins.		Related changes in benthic fauna in a heavily trawled location to low, high, and moderate fishing activity and to changes in phytoplankton production over 27 yr.
6	**Hansson *et al.* 2000**	Fjord on the west coast of Sweden	75-90 m	Clay	Abundance of 61% infaunal species negatively affected and S reductions in abundance of brittle stars during last 5 mo of disturbance period; S reductions in total biomass at 3 of 3 trawled sites and 1 of 3 control sites, and in number of individuals at 2 of 3 trawled sites and 1 of 3 control sites; abundance of polychaetes, amphipods, and mollusks not affected.		Experimental trawling for 1 yr (two tows per wk, twenty-four tows per unit of area) in area closed to fishing for 6 yr (three treatment and three control sites); effects evaluated during last 5 mo of experiment.
7	**Mayer *et al.* 1991**	Maine coast, USA	20 m	Mud	Dispersal of fine surface sediment; doors made furrows several cm deep; some planing of surface features, but no plowing of bottom or burial of surface sediments.		Experimental trawling (single tow); examined immediate effects on sediment composition and food value to sediment depth of 18 cm.
8	**Pilskaln *et al.* 1998**	Gulf of Maine, USA	250 m	Mud	Greater abundance of suspended infaunal polychaetes in more heavily trawled area.		Deployed sediment traps in fishing grounds 25-35 m above substrate.
9	**Sanchez *et al.* 2000**	Coast of Spain, Mediterranean Sea	30-40 m	Mud	Door tracks in sediment; no change in number of infaunal individuals or taxa, or in abundance of individual taxa; no changes in community structure.	Door tracks still clearly visible after 150 hr.	Experimental trawling in trawled area at two sites swept once and twice in a single day; effects evaluated after 24, 72, 102, and 150 hr.

Table 5.4 (cont.). Effects of otter trawls on mud substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
10	**Sparks-McConkey and Watling 2001**	Penobscot Bay, Maine, USA	60 m	Mud	S decline in porosity, increased food value, and increased chlorophyll production of surface sediments; S reductions in number of infaunal individuals and species, species diversity, and abundances of 6 polychaete and bivalve species, S increase in nemerteans.	All geochemical sediment properties and all but one polychaete/bivalve species recovered within 3.5 mo, nemerteans still more abundant after 5 mo.	Experimental trawling (four tows in 1 day) in untrawled area; pre-trawl sampling of sediments and infauna for a year; recovery monitored for 5 mo.
11	**Tuck *et al.* 1998**	West coast of Scotland	30-35 m	Fine silt	Tracks in sediment, increased bottom roughness; no effect on sediment characteristics; S increase in number of infaunal species at end of 16 mo disturbance period and during 18 mo recovery period; no change in biomass or number of individuals at end of recovery period; S increase in polychaetes, S decrease in bivalves; mixed results of analyses of community structure, S reduction in diversity during first 22 mo.	Door tracks still evident after 18 mo; bottom roughness recovered after 6 mo; nearly complete recovery of infaunal community within 12 mo, complete after 18 mo.	Experimental trawling for 1 day/mo (one and a half tows per unit of area) for 16 mo in area closed to fishing for >25 years; recovery monitored after 6, 12, and 18 mo.

Table 5.5. Effects of otter trawls on sand substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Ball *et al.* 2000	Irish Sea	35 m	Muddy sand	Lower number of infaunal and epifaunal species and individuals, and lower species diversity and richness, compared to wreck site.		Experimental trawling in a heavily fished fishing ground; unfished area near a shipwreck used as control.
2	Bergman and van Santbrink 2000	Southern North Sea (Dutch coast)	<30-50 m	Silty sand and sand	High (20-50%) mortalities for six sedentary and/or immobile megafaunal (>1 cm) species, <20% for 10 others, from a single pass of the trawl; S effects on 11 of 54 occasions.		Experimental trawling (one- and-a-half tows per unit of area) in commercially trawled area; effects assessed after 24-48 hr.
3	**DeAlteris *et al.* 1999**	Narragansett Bay, Rhode Island, USA	7 m	Sand	No tracks found.	Hand dug trenches not visible after 1-4 days.	Diver observations.
4	**Drabsch *et al.* 2001**	Gulf of St. Vincent, South Australia	20 m	Coarse sand with shells	Trawl door tracks; smoothing of topographic features; removal of, and damage to epifauna; no S effects on total infaunal abundance; S reduction in density for one order of crustaceans 1 wk of trawling.		Experimental trawling (two tows per unit area) in area with no trawling for 15 yr; effects assessed after 1 wk (site one) and 3 mo (site two).
5	**Frid *et al.* 1999**	Northeast England (North Sea)	55 m	Sand	Total abundance of benthic macrofauna increased as phytoplankton abundance increased; no correlation with fishing effort.		Related changes in benthic fauna in a lightly trawled location to low, high, and moderate fishing activity, and to changes in phytoplankton production over 27 yr.
6	**Gibbs *et al.* 1980**	Botany Bay, New South Wales, Australia	Shallow estuary	Sand with 0-30% silt-clay	Sediment plume; no consistent effects on benthic community diversity; very little disturbance of seafloor.		Sampling before, immediately after, and 6 mo after 1 wk of experimental trawling in a fished location; control area located 200 km away.
7	**Gilkinson *et al.* 1998**	Test tank to simulate Grand Banks of Newfoundland		Sand	Trawl door created 5.5-cm berm adjacent to 2-cm furrow; bivalves displaced, but little damage.		Observed effects of commercial otter door model in test tank.
8	**Hall *et al.* 1993**	North Sea	80 m	Coarse sand	Abundance of infauna related to changes in sediment type and organic content, not distance from shipwreck.		Sampled infauna at increasing distance from a shipwreck (proxy for increasing fishing effort).
9	**McConnaughey et al. 2000**	Eastern Bering Sea, Alaska	44-52 m	Sand with ripples	Reduced abundance (S for sponges and anemones); more patchy distribution; S decrease in species diversity of sedentary epifauna; mixed responses of motile taxa and bivalves.		Compared abundance of epifauna caught in small-mesh trawl inside and outside an area closed to trawling for almost 40 yr.

Table 5.5 (cont.). Effects of otter trawls on sand substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
10	**Moran and Stephenson 2000**	Northwest Australia	50-55 m	Not given, presumed to be sand	Single tow reduced density of macrobenthos (>20 cm) by 15%, 4 tows by 50%.		Video surveys before and after four experimental trawling events (one tow per unit area) at 2-day intervals in unexploited area.
11	**Sainsbury et al. 1997**	Northwest Australia	<200 m	Calcareous sands	Decreased abundance of benthic organisms and fish associated with large epifauna; removal of attached epifauna (single tow removed 89% of sponges >15 cm).	Increased catch rates of fish associated with large epifauna and small (<25 cm) benthos within 5 yr; recovery of large epifauna takes >5 yr.	Compared historical survey data (before and after fishing started) to data collected in area that remained open to commercial trawlers and to area closed for 5 yr.
12	**Kenchington *et al.* 2001**	Grand Banks, Newfoundland	120-146 m	Fine to medium grain sand	S short-term reductions in total abundance and abundance of 15 infaunal and epifaunal taxa (mostly polychaetes) in only 1 of 3 yr; no short-term effects on biomass or taxonomic diversity; no long-term effects.	Benthic organisms that were reduced in abundance in 1994 had recovered a yr later.	Experimental trawling (3-6 tows per unit of area) in closed area 1, 2, and 3 yrs after closure; lightly exploited for >10 yrs; effects evaluated within several hours or days after trawling and after 1 yr.
13	**Prena et al. 1999**	Grand Banks, Newfoundland	120-146 m	Fine to medium grain sand	24% average decrease in epibenthic biomass; S reductions in total and mean individual epifaunal biomass, and biomass of five of nine dominant species; damage to echinoderms.		Experimental trawling (3-6 tows per unit of area) in closed area 1, 2 and 3 yr after closure, lightly exploited for >10 yr.
14	**Schwinghamer et al. 1998**	Grand Banks, Newfoundland	120-146 m	Fine and medium grain sand	Tracks in sediment; increased bottom roughness; sediment resuspension and dispersal; smoothing of seafloor and removal of flocculated organic material; organisms and shells organized into linear features.	Tracks last up to 1 yr; recovery of seafloor topography within 1 yr.	Experimental trawling (3-6 tows per unit area) in closed area 1, 2 and 3 yr after closure, lightly exploited for >10 yr.

Table 5.6. Effects of otter trawls on gravel/rock substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Auster *et al.* 1996**	Jeffreys Bank, Gulf of Maine	94 m	Gravel/boulder with thin mud veneer.	Gravel base exposed; boulders moved; reduced abundance of erect sponges and associated epifaunal species; changes attributed to trawling.		Submersible and video observations in same location in 1987 and 1993.
2	**Freese *et al.* 1999**	Gulf of Alaska	206-274 m	93% pebble, 5% cobble, 2% boulder.	Boulders displaced; groundgear left furrows 1-8 cm deep in less compact sediment; layer of silt removed in more compact sediment; S reductions in abundance of sponges, anemones, and sea whips; damage to sponges, sea whips and brittle stars.		Video observations from a submersible 2-5 hr after single trawl tows in area exposed to little or no commercial trawling for about 20 yr.
3	**Dolah *et al.* 1987**	Georgia, SE U.S. coast	20 m	Smooth rock with thin layer of sand and attached epifauna.	Damage to sponges and corals, mostly to sponges; S reductions in density of undamaged barrel sponges in high-density transects; no S effects on densities of vase sponges, finger sponges, or stony corals.	Full recovery of damaged organisms and density within 12 mo.	Experimental study using diver counts of large sponges and corals before, immediately after, and 12 mo after, a single tow of a "roller" trawl in an unexploited area.

Table 5.7. Effects of otter trawls on mixed substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	DFO 1993	Bras d'Or Lakes, Nova Scotia, Canada	10–500 m	Mud, sand, gravel, and boulders	Trawl doors left parallel marks (furrows and berms), fainter marks from footgear, primarily in mud.		Sidescan sonar survey after area was closed to mobile gear for 1 yr.
2	**Engel and Kvitek 1998**	California, USA	180 m	Gravel, sand, silt, and clay	S fewer rocks and biogenic mounds, S less flocculent material, and S more exposed sediment and shell fragments in HF area; lower densities of large epibenthic taxa in HF area (S for sea pens, starfish, anemones, and sea slugs); higher densities of nematodes, oligochaetes, brittle stars and one species of polychaete in HF area; no differences between areas for crustaceans, mollusks, or nemerteans.		Used a submersible and grab samples (3 yr) to compare lightly trawled and heavily trawled commercial fishing sites with same sediments and depth.
3	Smith *et al.* 1985	Long Island Sound, New York, USA	Not given	Sand and mud	Tracks in sediment (<5 cm in sand, 5-15 cm in mud); attraction of predators; suspension of epibenthic organisms.	Tracks "naturalized" by tidal currents.	Video and diver observations.

Table 5.8. Effects of New Bedford-style scallop dredges on sand substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Auster *et al.* 1996**	Stellwagen Bank, Gulf of Maine, USA	20-55 m	Coarse sand	Smoothing of sand ripples and low sand waves; dispersal of shell deposits in wave troughs.		Examined gear tracks in sidescan sonar images.
2	**Langton and Robinson 1990**	Fippennies Ledge, Gulf of Maine, USA	80-100 m	Gravelly sand with some gravel, shell hash, and small rocks	Coarser substrate; disruption of amphipod tube mats; piles of small rocks and scallop shells dropped from surface; S reductions in densities of tube dwelling polychaete and burrowing anemone.		Submersible observations made 1 yr apart, before and after commercial dredging of area.
3	**Watling *et al.* 2001**	Damariscotta River, Maine, USA	15 m	Silty sand	Loss of fine surficial sediments; lowered food quality of sediment; reduced abundance of some taxa; no changes in number of taxa; S reductions in total number of individuals 4 mo after dredging.	No recovery of fine sediments, full recovery of benthic fauna and food value within 6 mo.	Experimental study (23 tows in 1 day); effects on macrofauna (mostly infauna) evaluated 1 day and 4 and 6 mo after dredging in an unexploited area.

Table 5.9. Effects of New Bedford-style scallop dredges on mixed substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Caddy 1968**	Northumberland Strait, Gulf of St. Lawrence, Canada	20 m	Mud and sand	Drag tracks (3 cm deep) produced by skids; smooth ridges between them produced by rings in drag belly; dislodged shells in dredge tracks.		Diver observations of physical effects of two tows.
2	**Caddy 1973**	Chaleur Bay, Gulf of St. Lawrence, Canada	40-50 m	Gravel over sand, with occasional boulders	Suspended sediment; flat track, marks left by skids, rings, and tow bar; gravel fragments less frequent (many overturned); rocks dislodged or plowed along bottom.		Submersible observations of tow tracks made <1 hr after single dredge tows.
3	**Mayer *et al.* 1991**	Coastal Gulf of Maine, USA	8 m	Mud, sand, and shell hash	Lowered sediment surface by 2 cm, injected organic matter and finer sediment into lower 5-9 cm; increased mean grain size in upper 5 cm; disruption of surface diatom mat; increased microbial biomass at sediment surface.		Experimental study, compared dredged and undredged sites before and 1day after a single dredge tow.

Table 5.10. Effects of toothed scallop dredges on sand substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1,2	**Black and Parry 1994, 1999**	Port Phillip Bay, SE Australia (three sites)	15 m	Sand (7-30% silt-clay)	Sediment plume; maximum depth of disturbance 4-6 cm into bottom; cutterbar trims off high regions of seafloor.	Turbidity returned to normal storm levels within 9 min.	Experimental dredging for 2-4 days (two to four tows per unit area) in three areas with no commercial dredging for 4 yrs.
3,4	**Currie and Parry 1996, 1999b**	Port Phillip Bay, SE Australia (St. Leonards site)	15 m	Fine/very fine sand	Flattening of low-relief biogenic mounds; depressions filled in; parallel tracks produced by skids; S fewer species after 3 wks; most species 20-30% less abundant 3.5 mo after dredging; S reduced abundance of 6 of 10 most common infaunal species within first 3.5 mo (S increase for one species); no effect on total number of individuals; surface-dwelling organisms released into water column right away, burrowing organisms as dredging continued; increased abundance of more mobile, opportunistic species within first 3.5 mo.	Mounds reformed after 6 mo; tracks visible after 1 mo, but not after 6 mo; most species recovered within 8 mo, but some had not after 14 mo.	Experimental dredging for 3 days (2 tows per unit of area) in an area with no commercial dredging for 4 yr; recovery of infauna monitored at 5 intervals during 14 mo; seafloor changes at 8 days and at 6 and 11 mo.
4	**Currie and Parry 1999b**	Port Phillip Bay, SE Australia (Dromana site)	15 m	Medium-fine sand	Removal of small, parallel sand ripples; S reductions in abundance of three of ten most common infaunal species within 2 days.	Ripples reformed after 5 days following storm.	Experimental dredging for 2 consecutive days (2 tows per unit of area) in an area with no commercial dredging for 4 yr; effects on infauna evaluated after 2 days, seafloor changes after 5 days.
		Port Phillip Bay, SE Australia (Portarlington site)	15 m	Muddy sand with shell fragments	Flattening of biogenic mounds; S reductions in abundance of 2 of 10 most common infaunal species within 1 day.	Mounds reformed 7 months after dredging, but were still smaller than in undredged area.	Experimental dredging for 4 days (four tows per unit area) in an area (Portarlington) with no commercial dredging for 4 yrs; effects on infauna evaluated after 1 day, seafloor changes after 7 mo.
5	Butcher *et al.* 1981	Jervis Bay, New South Wales, Australia	>13 m	Sand	Sediment plume up to 5 m off bottom, flattening of sand ridges.	Sediment plume settled out within 15 min.	Diver observations.
6	**Eleftheriou and Robertson 1992**	Firemore Bay, Loch Ewe, Scotland	5 m	Well-sorted sand	Dredge eliminated natural bottom features; teeth created 3-4 cm deep furrows; no effect on sediment characteristics; damage or mortality of larger epifauna, razor clams, and sand lance, attraction of predators; increase in some species of small infaunal crustaceans; initial reduction in polychaetes followed by increase; no effect on taxa adapted to dynamic environment (*e.g.*, amphipods, bivalves).	Grooves and furrows no longer visible shortly after dredging, duration depended on wave and current action.	Evaluation of incremental effects of dredging (25 tows in 1 wk) at a single site (no control).
7	**Thrush *et al.* 1995**	Mercury Bay, New Zealand	24 m	Coarse sand	Breaking down of surface sediment features; grooves 2-3 cm deep created by teeth; S declines in abundance of 6 of 13 most common taxa at unexploited site, and 4 of 13 most common taxa at exploited site; S reductions in total number of individuals and taxa at both sites.	General recovery of macrobenthic abundance at previously exploited site after 3 mo, but not at unexploited site.	Experimental dredging (5 parallel tows in 1 day) at a previously exploited and an unexploited site with different benthic communities; biological effects evaluated within 2 hr and 3 mo after dredging.

Table 5.11. Effects of toothed scallop dredges on biogenic substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.

Reference	Location	Depth	Sediment	Effects	Recovery	Approach
Hall-Spencer and Moore 2000a	Clyde Sea, Scotland	10-15 m	Live bottom (maerl) with some cobble and boulders	Disturbance of seafloor to 10 cm; overturned boulders; suspended sediment; erasure of bottom features and burial of living maerl in dredge tracks; most megafauna in top 10 cm either caught in dredge or left damaged in dredge track (large, fragile organisms more vulnerable); rapid aggregation of predatory species in track.	Dredge tracks remained visible for 0.5-2.5 yrs; some recovery rates of large epibenthic species variable, some recovering quickly, but others at unexploited site had not recovered 4 yr after dredging; macrobenthic community at previously exploited site recovered within 2 yr.	Observations of the effects of single dredge tows at a previously dredged and undredged site; immediate effects and recovery (after 4 yr) evaluated by divers using video cameras.

Table 5.12. Effects of toothed scallop dredges on mixed substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Bradshaw *et al.* 2002**	Isle of Man, Irish Sea	Not given	Sand and gravel	More vulnerable taxa less abundant in recent samples, less vulnerable taxa more abundant; faunal differences and proportion of species "lost" between time periods increased significantly as number of years since fishing began increased; no effect of increases in total effort; no clear evidence over all sites for reduced species diversity.		Recent benthic sample data collected at 7 sites exposed to varying amounts of fishing effort compared with data collected 50-60 yr ago, when scallop fishing was very limited.
2,3	**Bradshaw *et al.* 2000, 2001**	Isle of Man, Irish Sea	25-40 m	Gravel, sand, and mud	6 mo of experimental dredging in closed area altered community structure, no trends in abundance of individual species; no S effects on number of species, but community heterogeneity was reduced; encrusting species were more abundant and upright species less abundant in dredged plots than in control plots after 3 yr.	S increases in abundance of several epifaunal species in undredged portion of closed area 5-9 yr after closure.	Continuous experimental dredging (10 tows every 2 mo for 3 yr) in an area closed to commercial fishing for 6 yr; semi-annual grab sampling inside and outside closed area, and biannual diver surveys of epibenthic animals in closed area.
4	**Caddy 1973**	Chaleur Bay, Gulf of St. Lawrence, Canada	40-50 m	Gravel over sand, with occasional cobble and boulders.	Shallow, flat tracks; tooth marks in sand; boulders dislodged and small rocks "plowed" by dredge; spoil ridges at edges of track.		Submersible observations and photographs of tow tracks made <1 hr after dredging.
5	DFO 1993	Bras d'Or Lakes, Nova Scotia, Canada	10-500 m	Gravel and mud	Furrows left by dredge teeth; berms at outer edges of dredge track.		Sidescan sonar survey 1 yr after area was closed to mobile gear.
6	**Kaiser, Hill *et al.* 1996**	Irish Sea, southwest of Isle of Man	Not given	Not given, assume mixed substrates	Reduced abundance of most large epibenthic species; same effects on community structure as beam trawls, but lower bycatch.		Experimental study of effects of dredging (10 tows) and beam trawling on large epifauna; sampling with small-mesh (40mm) beam trawl both before and 24 hr after fishing.
7	**Kaiser, Ramsay *et al.* 2000**	Irish Sea	Not given	Coarse sand and gravel	S more epifaunal organisms in areas exposed to high fishing effort, no effects on infauna or on diversity or number of epifaunal species; shift from communities dominated by more larger-bodied to fewer smaller-bodied organisms.		Compared benthic communities in areas exposed to 10 yr of low and high fishing effort.
8	**Veale *et al.* 2000**	Irish Sea	20-67 m	Coarse sand or gravel, often overlain with pebbles, cobbles and dead shell.	S decreases in epibenthic species diversity and total number of species and individuals with increasing fishing effort; total abundance, biomass, and production and production of most taxa S decreased with increasing effort.		Compared dredge bycatch from fishing grounds exposed to varying amounts of fishing effort during previous 60 yr.

Table 5.13. Effects of other nonhydraulic dredges on biogenic substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Fonseca *et al.* 1984**	Beaufort, North Carolina, USA	Very shallow, subtidal	Silty sand with eelgrass	S reduction in number of eelgrass shoots and leaf biomass with increased dredging intensity at each of two sites, one hard bottom and one soft bottom.		Experimental study with lightweight toothless dredge; two levels of disturbance.
2	Langan 1998	Piscataqua River, Maine-NH, USA	Not given	Oyster bed	No detectable differences in the number of benthic invertebrates, species richness, or diversity; turbidity of near-bottom water doubled 10 m behind dredge.	Turbidity returned to normal 110 m behind dredge.	One-time sampling of benthic invertebrates in dredged and undredged sides of the river; turbidity measured during a single dredge tow.
3	**Lenihan and Peterson 1998**	Neuse River, North Carolina, USA	3 and 6 m	Oyster reefs	Dredging lowered mean height of 1 m reefs by ~30%.		Experimental study where 4 of 8 oyster-shell reefs were dredged for 1 wk to remove all market-sized oysters; sampled 3 days before and 2 days after dredging..
4	**Riemann and Hoffmann 1991**	Limfjord, Denmark	Mean depth 7 m, maximum 15 m	Not given (presumed mussel bed)	S increase in suspended particulate matter; S reduction in oxygen immediately after dredging, especially near the bottom.	Turbidity returned to normal within 1 hr.	Water column sampling of physical and chemical attributes with a 2-m mussel dredge before and after dredging (maximum 1 hr) at an experimental and a control site.

Table 5.14. Effects of hydraulic clam dredges on mud substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

Reference	Location	Depth	Sediment	Effects	Recovery	Approach
Hall and Harding 1997	Auchencairn Bay, Solway Firth, Scotland	Intertidal	Mud	Dredge tracks; S reductions in number of infaunal species and individuals persisted for 4 wk; 3 of 5 dominant species reduced in abundance throughout experiment (8 wk).	Nearly complete recovery of infaunal community after 8 wk, but some effects remained; dredge tracks not seen after first day.	Experimental study of the effects of single suction dredge passes in a commercially harvested area; recovery monitored 1, 4, and 8 wk after dredging.

Table 5.15. Effects of hydraulic clam dredges on sand substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Hall *et al.* (1990)**	Loch Gairloch, Scotland	7 m	Fine sand	Shallow trenches (25 cm deep) and large holes; sediment "almost fluidized"; median sediment grain size S higher in fished area; S reductions in numbers of infaunal organisms; no effect on abundance of individual species; some mortality (not assessed) of large polychaetes and crustaceans retained on conveyor belt or returned to sea surface.	Complete recovery of physical features and benthic community after 40 days; filling of trenches and holes accelerated by winter storms.	Experimental study in unexploited area to evaluate effects of simulated commercial escalator dredging activity; recovery evaluated after 40 days.
2	**Kaiser, Edwards *et al.* (1996b)**	SE England	Intertidal	Muddy sand	Resuspension and loss of fine sand from sediment surface; S reductions in total number of infaunal species and individuals.	Complete recovery of sediments and benthic community within 7 mo.	Experimental study; effects of suction dredging for cultivated clams evaluated after 3 hr and 7 mo.
3	**MacKenzie, 1982**	East of Cape May, New Jersey, USA	37 m	Very fine to medium sand	Resorting of sediments (coarser at bottom of dredge track); no effect on number of infaunal individuals or species, nor on species composition.		Comparison of actively fished, recently fished, and never fished areas on the continental shelf; dredging conducted with hydraulic cage dredges.
4	Maier *et al.* 1995	South Carolina, USA	Tidal creeks	Muddy sand	Turbidity plumes; no S effects on abundance of dominant infaunal taxa or total number of individuals.	Turbidity plumes persisted for a few hours.	Before and after study of commercial escalator dredging effects in four tidal creeks. Turbidity monitored 2 wk before, during, and 2 wk after dredging at one location, and during and immediately after dredging at another. Infaunal samples collected 3 wk before and 2 wk after dredging in a creek that had been commercially dredged 5 yr prior to the study and in a creek that had never been dredged before.
5	Medcof and Caddy 1971	Southern Nova Scotia, Canada	7-12 m	Sand and sand-mud	Smooth tracks with steep walls, 20 cm deep; sediment cloud.	Sediment plume lasted 1 min; dredge tracks still clearly visible after 2-3 days.	SCUBA and submersible observations of the effects of individual tows with a cage dredge.
6	**Meyer *et al.* 1981**	Long Island, New York, USA	11 m	Fine to medium sand, covered by silt layer	>20-cm-deep trench; mounds on either side of trench; silt cloud, attraction of predators.	Trench nearly indistinct, and predator abundance normal, after 24 hr; silt settled in 4 min.	SCUBA observations during and following a single tow with a cage dredge in a closed area; effects evaluated after 24 hr.
7	**Pranovi and Giovanardi 1994**	Venice Lagoon, Adriatic Sea, Italy	1.5-2 m	Sand	8-10 cm deep trench; S decrease in total abundance, biomass, and diversity of benthic macrofauna in fishing ground; no S effects outside fishing ground.	After 2 mo, dredge tracks still visible; densities (especially of small species and epibenthic species) in fishing ground recovered, biomass did not.	Experimental dredging with a cage dredge (single tows) in previously dredged and undredged areas in coastal lagoon; recovery monitored every 3 wk for 2 mo.
8	**Tuck *et al.* 2000**	Sound of Ronay, Outer Hebrides, Scotland	2-5 m	Medium to fine sand	Steep-sided trenches (30 cm deep); sediments fluidized up to 30 cm; S decrease in number of infaunal species and individuals within a day of dredging; S decrease in proportion of polychaetes and S increase in proportion of amphipods 5 days after dredging; S increases in abundance of some species and S decreases in abundance of other species.	Trenches no longer visible but sand still fluidized after 11 wk; species diversity and total abundance recovered within 5 days; proportions of polychaetes and amphipods, and abundances of individual species, returned to pre-dredge levels after 11 wk.	Experimental dredging with cage dredge (individual tows at 6 sites) in area closed to commercial dredging, effects evaluated 1 day, 5 days, and 11 wk after dredging.

Table 5.16. Effects of hydraulic clam dredges on mixed substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

Reference	Location	Depth	Sediment	Effects	Recovery	Approach
Murawski and Serchuk 1989	Mid-Atlantic Bight, USA	Not given	Sand, mud, and coarse gravel	Trench cut; temporary increase in turbidity, disruption of benthic organisms in dredge path; attraction of predators.	Trenches filled quickly in coarse gravel, but took several days in fine sediments.	Submersible observations following hydraulic cage dredge tows.

Table 5.17. Effects of hydraulic clam dredges on biogenic substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Godcharles 1971	Tampa Bay, Florida, USA	Not given	Open sand, sand with seagrass, and sand with algae	Water jets penetrate to 45 cm, create trenches 15-45 cm deep; uprooted vegetation; decreased proportion of fine sediment in some dredge tracks.	Trenches lasted longer (up to 86 days) in grass beds, filled in immediately in open sand; most sediments hardened within 1 mo, some spots still soft 500 days after dredging; sediment composition returned to normal after 1 yr, but seagrass still had not recovered; new algal growth after 86 days, complete after a year.	SCUBA observations and sediment sampling before and after experimental escalator dredging in undisturbed sand, seagrass, and algae bottom habitats; recovery monitored for 16+ mo.
2	Orth *et al.* 1998	Chincoteague Bay, Virginia, USA	Not given	Seagrass beds	Circular "scars" left by dredges; loss of grass and large holes in dredge track.	No revegetation 3 yr after disturbance; recovery estimated to take at least 5 yr in lightly disturbed areas, longer in heavily disturbed areas.	Field observations of commercial escalator dredging effects over a 3-yr period.

Table 5.18. Effects of pots and traps on mixed substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

Reference	Location	Depth	Sediment	Effects	Recovery	Approach
Eno *et al.* 2001	Badentarpet Bay, west coast of Scotland	Not given	Soft mud	Bending and smothering of sea pens underneath pots; uprooting of some sea pens when pots are dragged over bottom.	Sea pens recover from effects of pot dragging within 24-72 hr, re-assume upright posture within 72-144 hr of pot removal, and re-root as long as "foot" remains in contact with bottom.	Diver observations and experiments to assess effects on, and recovery of, sea pens following dragging, uprooting, and smothering by lobster pots left on bottom for 24 or 48 hr.
Eno *et al.* 2001	Greenale Pt., Wales, and Lyme Bay, southwest England	14-20 m	Varied – from bedrock to boulders to coarse sediment – and interspersed.	Soft corals bent by pots, but spring back; pots leave tracks in bottom when hauled; increased abundance of 4 species of sponges, an ascidian, and a bryozoan in experimental plots after 4 wk, no changes in abundance of other epibenthic species.		Diver observations and experiments to assess effects of 4 wk of simulated commercial pot fishing on attached epifauna at two study sites.

Table 5.19. Effects of multiple gears on sand substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	Almeida *et al.* 2000	Eastern Georges Bank, USA	<50->90 m	Sandy	Microhabitat associated with two species of sponges more abundant inside closed area; no S differences for six other microhabitat types.		Analysis of still photos and video imagery inside and outside area closed to trawls, dredges, longlines, and gill nets 4.5 yr after it was closed.
2	**Kaiser, Spencer *et al.* 2000**	South Devon coast, England	15-70 m	Fine, medium, and coarse sand	No S effect of high fishing effort on numbers of infaunal or epifaunal species or individuals; in high-effort areas there were: 1) a lower reduced abundance of larger, less mobile, and emergent epifauna; 2) a higher abundance of more epifauna; and 3) fewer high-biomass species of epifauna and infauna; infauna in deeper coarse-medium sand habitat most affected by fishing.		Compared benthic communities in areas of high, medium, and low fishing effort by fixed and mobile gears; each area with three sites (shallow, fine sand, deep medium sand, and deep coarse-medium sand).

Table 5.20. Effects of multiple gears on gravel/rock substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1,2	**Collie *et al.* 1997, 2000**	Northern edge, eastern Georges Bank, U.S. and Canada	42-90 m	Pebble-cobble "pavement" with some overlying sand	S higher total densities, biomass, and species diversity in undisturbed sites, but also in deeper water (*i.e.*, effects of fishing could not be distinguished from depth effects); 6 species abundant at U sites, rare or absent at D sites; percent cover of tube-dwelling polychaetes, hydroids, and bryozoans S higher in deepwater, but no disturbance effect.		Benthic sampling, video, and still photos in 2 shallow (42-47 m) and 4 deep (80-90 m) sites disturbed (D) and undisturbed (U) by trawls and scallop dredges.

Table 5.21. Effects of multiple gears on mixed substrate habitat: summary of published studies. (S = statistically significant; citations in bold print are peer-reviewed publications.)

No.	Reference	Location	Depth	Sediment	Effects	Recovery	Approach
1	**Auster *et al.* 1996**	Coastal Gulf of Maine, USA	30-40 m	Sand-shell	S more sea cucumbers and bottom depressions inside closed area.		ROV and video observations inside and outside an area closed to mobile gear for 10 yr.
1	**Auster *et al.* 1996**	Coastal Gulf of Maine, USA	30-40 m	Cobble-shell	S more emergent epifauna inside closed area.		ROV and video observations inside and outside an area closed to mobile gear for 10 yr.
1	**Auster *et al.* 1996**	Stellwagen Bank, Gulf of Maine, USA	20-55 m	Sand with gravel and shell	Disturbed sand ripples and sand waves; dispersed shell deposits; absence of epifauna and reduced microalgal cover in trawl and dredge tracks.		Sidescan sonar survey and ROV observations.
2,3,4	**Reise 1982; Riesen and Reise 1982; Reise and Schubert 1987**	Wadden Sea, The Netherlands	<23 m	Mud, coarse sand, and some pebbles	Loss of oyster and *Sabellaria* reefs; decrease in abundance of 28 species (mollusks and amphipods); 23 "new" species (many of them polychaetes).		Compared benthic surveys conducted during time period when oysters were overexploited and trawl fishery developed on *Sabellaria* reefs (1869-1986).
5	**Thrush *et al.* 1998**	Hauraki Gulf, New Zealand	17-35 m	Mud and sand	S reductions in density of large epifauna, echinoderms, and long-lived surface dwellers; S increases in density of small, opportunistic species; some predictions contra-indicated by results; 15-20% variability in macrofaunal community composition attributed to fishing pressure.		Tested 10 predictions of the effects of increasing fishing intensity on benthic community structure by comparing samples and video images from 18 stations exposed to varying degrees of commercial fishing pressure by bottom trawls, Danish seines, and scallop dredges.
6	Valentine and Lough 1991	Eastern Georges Bank		Sand and gravel	Trawl and dredge tracks in sediments; sparse epifauna, gravel mounds, and smoother bottom in disturbed areas.		Sidescan sonar and submersible observations of area presumed to be disturbed by trawls and scallop dredges.

6. VULNERABILITY OF ESSENTIAL FISH HABITAT TO BOTTOM-TENDING FISHING GEARS

INFORMATION NEEDS AND SOURCES

This section evaluates potential adverse effects of bottom-tending fishing gears on benthic EFH in the Northeast Region. These gears are regulated by the MSA and the EFH final rule, 50 *CFR* 600.815(a)(2)(i). The EFH final rule recommends that the evaluation consider the effects of each fishing activity on each type of habitat found within the EFH for any affected species and life stage. The EFH rule further recommends that the following information be reviewed in making an evaluation: 1) intensity, extent, and frequency of any adverse effects on EFH; 2) the types of habitat within EFH that may be adversely affected; 3) habitat functions that may be disturbed; and 4) conclusions regarding whether and how each fishing activity adversely affects EFH.

The EFH final rule requires that EFH designations be based on the best available information. This information may fall into four categories that range from the least specific (Level 1) to the most specific (Level 4). These categories are defined as follows:

Level 1: Presence/absence data are available to describe the distribution of a species (or life history stage) in relation to potential habitats for portions of its range.

Level 2: Quantitative data (*i.e.*, density or relative abundance) are available for the habitats occupied by a species or life history stage.

Level 3: Data are available on habitat-related growth, reproduction, and/or survival by life history stage.

Level 4: Data are available that directly relate the production rates of a species or life history stage to habitat type, quantity, and location.

Existing EFH designations in the Northeast Region are based primarily on Level 2 information. This level of information is inadequate for making definitive determinations of the consequences of fishing-related habitat alterations on EFH for any species or life stage in the region because the habitat alterations caused by fishing cannot be linked to any known effect on species productivity. Therefore, this section of the document qualitatively evaluates the vulnerability of benthic EFH for each species and life history stage in the region to the effects of bottom-tending fishing gear. Vulnerability is defined as the likelihood that the functional value of benthic EFH would be adversely affected by fishing. Further, given the limited nature of the information available for this qualitative evaluation, emphasis was placed on the identification of potential adverse effects of fishing on benthic EFH.

Information used to perform these evaluations included: 1) the EFH designations adopted by the Mid-Atlantic, New England, and South Atlantic Fishery Management Councils; 2) the results of a Fishing Gear Effects Workshop convened in October 2001 (NREFHSC 2002); 3) the information provided in this document, including the results of existing scientific studies, and the geographic distribution of fishing gear use in the Northeast Region; and 4) the habitats utilized by each species and life stage as indicated in their EFH designations and as supplemented by other references. In most cases, habitat utilization was determined from the information provided in the EFH Source Documents (*NOAA Technical Memorandum NMFS-NE* Issues 122-152, 163, and 173-179), with additional information from Collette and Klein-MacPhee (2002).

EVALUATION METHODS AND RESULTS

Vulnerability of EFH to bottom-tending fishing gear was ranked as none, low, moderate, or high, based on a matrix analysis of three primary components: 1) benthic life stages of FMP-regulated species; 2) habitat function and sensitivity; and 3) gear usage. The matrix analysis initially ranked each habitat for its susceptibility to disturbance and each gear for its potential adverse effects, and then subsequently combined those two rankings with available information on the habitat usage by species/life stages and the distribution of gear usage, in order to obtain the EFH vulnerability rankings.

These evaluations are summarized in Table 6.1. Note in Table 6.1 that: 1) species and life stages for which EFH vulnerability was “not applicable” are not included; and 2) pots, traps, sink gill nets, and bottom longlines -- to which the EFH of all species and life stages showed “low” vulnerability -- are also not included.

The rationale for these evaluations is outlined by species in Tables 6.2-6.45, and was based on the authors’ following three assumptions. First, the habitat’s value to each species and life stage was characterized to the extent possible based on its function in providing shelter, food, and/or the right conditions for reproduction. For example, if the habitat provided shelter from predators for juvenile or other life stages, gear effects that could reduce shelter were of greater concern than other effects. Second, in cases where a food source was closely associated with the benthos (*e.g.,* infauna), the ability of a species to use alternative food sources (*e.g.,* generalist versus specialist species) was evaluated. Third, since benthic prey populations may also be adversely affected by fishing, gear effects that could reduce the availability of prey for bottom-feeding species or life stages were of greater concern than if the species or life stages were piscivorous.

The information in Tables 6.2-6.45 includes for each life stage the geographical extent of EFH, its depth range, its seasonal occurrence, and a brief EFH description that includes -- for benthic life stages -- substrate characteristics. The information presented in columns 2-5 of these tables is derived from EFH text descriptions and maps that originally appeared in the NEFMC Omnibus EFH Amendment (NEFMC 1998) and several FMPs prepared by the NEFMC and MAFMC. Additional information, where available, is provided at the bottom of each table to explain the rationale that was used in making the gear-specific EFH vulnerability rankings. EFH descriptions of depth, seasonal occurrence, and habitats (columns 3-5 in Tables 6.2-6.45) are not always consistent among life stages of an individual species. Spawning American plaice adults, for example, are described as occurring from March through June, but their eggs are described as occurring from December through June on Georges Bank (Table 6.2). In addition, the information in columns 3-5 in some cases does not completely agree with the information provided in the rationale.

The rest of this section details the methods that were used to perform the evaluations and assign the rankings.

Life Stages

Five life stages were evaluated: eggs, larvae, juveniles, adults, and spawning adults. Adult and spawning adult life stages were in most cases combined for evaluation purposes due to the difficulty in distinguishing between the two. In some cases (*e.g.,* pelagic life stages that are not vulnerable to bottom-tending fishing gear effects), a vulnerability ranking was not applicable.

Habitat Scoring and Ranking

Habitat rank was determined from four criteria that were qualitatively evaluated for each life stage based on existing information. Each evaluation resulted in a score based on predefined scoring criteria.

The first three criteria were related to habitat function, and included shelter, food, and reproduction. The fourth criterion was habitat sensitivity. Scoring of these criteria was determined as follows:

Shelter (scored from 0 to 2): If the life stage is not dependent on bottom habitat to provide shelter, then it was scored a 0. Almost every life stage evaluated has some dependence on the bottom for shelter, so, with the exception of a few egg stages, 0 was seldom selected. If the life stage has some dependence on unstructured or noncomplex habitat for shelter, then it was scored a 1. For example, flatfishes that rely primarily on cryptic coloration for predator avoidance, or on sand waves for refuge from bottom currents, were scored a 1. If the life stage has a strong dependence on complex habitats for shelter, then it was scored a 2. For example, juvenile Atlantic cod and haddock, which rely heavily on structure or complex habitat for predator avoidance, were scored a 2.

Food (scored from 0 to 2): If the life stage is not dependent on benthic prey, then it was scored a 0. For example, eggs were always scored a 0, as were life stages that fed exclusively on plankton. If the life stage utilizes benthic prey for part of its diet, but is not exclusively a benthic feeder, then it was scored a 1. For example, species feeding opportunistically on crabs as well as squid or fish were scored a 1. If the life stage feeds exclusively on benthic organisms and cannot change its mode of feeding, then it was scored a 2.

Reproduction (scored from 0 to 1): Limited knowledge of spawning behavior and habitat usage for many species made this the most difficult category to assess. In the opinion of the authors, the available information was insufficient to evaluate this criterion beyond a simple yes or no, resulting in a scoring of 0 or 1 for this factor. While this two-level scoring instead of three-level scoring may have unavoidably undervalued reproduction for some species in the overall scoring, it was decided that this was better than attempting to make finer distinctions that were unsupportable based on available evidence.

A score of 0 was selected for nonreproductive life stages (larvae and juveniles), and for species that are known to spawn in the water column and have only pelagic early life stages. A score of 1 was selected for species where a known association with the bottom exists for one or more aspects of the reproductive cycle.

Habitat Sensitivity (scored from 0 to 2): This criterion does not evaluate the function of the habitat, but instead accounts for its overall relative sensitivity to disturbance. The type of benthic habitat (defined primarily in terms of depth, energy regime, and substrate) inhabited by each species and life stage was based primarily upon its EFH designation.

If a habitat was not considered sensitive to disturbance, then it was scored a 0. However, a score of 0 was not used for any benthic habitat type. If the habitat was considered to have a low sensitivity to disturbance, then it was scored a 1. For example, habitats that are high-energy environments without structural complexity, or that have rapid recovery rates, were scored a 1 (*e.g.,* high-energy sand environments). If the habitat type was considered highly sensitive to disturbance, then it was scored a 2. For example, habitats that are structurally complex (*e.g.*, those supporting epibenthic communities or those with boulder piles), or that have very slow recovery rates (*e.g.*, low-energy deepwater environments), were scored a 2.

These scores were based on existing conceptual models that show a direct relationship between higher structural complexity of the habitat, longer recovery time, and increased vulnerability to disturbance (NREFHSC 2002; NRC 2002).

Habitat rank was defined as the sum of the scores for the four habitat criteria (shelter + food + reproduction + habitat sensitivity). Another way to characterize the habitat rank is the relative vulnerability of the habitat to non-natural physical disturbance. The habitat ranks ranged from 0 to 7, with 7 being the most vulnerable.

Gear Types, Scoring, and Ranking

Five fishing gear classifications were evaluated: otter trawls, New Bedford-style scallop dredges, hydraulic clam dredges, pots and traps, and sink gill nets and bottom long lines. The pot/trap and net/line gear types were considered to have the least effect of the five gear types evaluated. The panel of experts that met in October 2001 ranked their concerns over effects from fixed bottom-tending gear well below their concerns over the effects from mobile bottom-tending gear (NREFHSC 2002). Based on the limited information available (Eno *et al.* 2001; NREFHSC 2002), the vulnerability of all EFH for all benthic species and life stages to pot and trap usage was considered to be low. Similarly, there is little scientific information that evaluates the effects of sink gill nets and bottom longlines on benthic marine habitats, and none evaluates these effects in the Northeast Region. Consequently, like pots and traps, the vulnerability of all EFH for all benthic species and life stages to sink gill net and bottom longline usage was considered to be low. These rankings should be revisited as more information on gear effects becomes available.

The greatest concern is for the vulnerability of benthic EFH to mobile bottom-tending gears (see Chapters 3 and 4). In the northeastern United States, these gear types include various types of bottom otter trawls, New Bedford-style scallop dredges, and hydraulic clam dredges. Otter trawls are responsible for most of the fisheries landings throughout the Northeast Region, and are used in a variety of substrates, depths, and areas. Scallop dredges are used in sand and gravel substrates. Hydraulic clam dredges are used only in sand, shell, and small gravel within well-defined areas .

Rather than rate the relative effects of these three gear types on EFH, they were treated as having similar effects. The criterion for each gear type was <u>based on the spatial distribution of gear use</u> (scored from 0 to 2) in areas designated as EFH for a given species and life stage. If the gear is not currently used within the EFH area, then it was scored a 0. If the gear is currently used in only a small portion of the EFH area, then it was scored a 1. If the gear is currently used in more than a small portion of the EFH area, then it was scored a 2.

The spatial distribution of fishing activity for each gear was determined from reports of the number of days absent from port, or the days fishing, for individual TMSs of latitude and longitude during 1995-2001 (see Chapter 4). Maps of TMSs designated as EFH are available in NEFMC (1998) and in various fishery management plans developed by the Mid-Atlantic and South Atlantic Fishery Management Councils, and have not been reproduced for this document.

The gear rank assesses the overall effect on EFH from fishing with bottom trawls, scallop dredges, and clam dredges. This gear rank was defined as the product of the habitat rank and the gear distribution score. This relationship was chosen in order to ensure that the EFH vulnerability from gears not used in a particular habitat (*i.e.*, gear distribution = 0) would be 0, or, no effect.

EFH Vulnerability Ranking

Based on natural breaks in the frequency distribution of the gear rankings, the following vulnerability categories were defined:

0 = no vulnerability to the gear. This score could only be attained if the gear was not used in the habitat (gear distribution = 0).

1-6 = low vulnerability to the gear. This score generally occurred where the gear has minimal overlap with EFH (gear distribution = 1) and habitat rank was <7. Additionally, low vulnerability scores occurred in habitats with high gear overlap (gear distribution = 2) and habitat rank was 3.

7-9 = moderate vulnerability to the gear. This score typically occurred where gear overlap with EFH was high (gear distribution = 2) and habitat rank was 4, or, overlap with EFH was low (gear distribution = 1) and habitat rank was 7.

10-14 = high vulnerability to the gear. This score occurred only if the gear overlap with EFH was high (gear distribution = 2) and the habitat rank was 5.

Table 6.1. EFH vulnerability matrix analysis for benthic life stages of federally managed fish and invertebrate species in the Northeast U.S. Shelf Ecosystem

Species and Species Groups[a]	Habitat Criteria Scores				Habitat Rank[f]	Gear Distribution Scores[g]			Gear Rank[h]			EFH Vulnerability Category[i]		
	Shelter[b]	Food[c]	Repro-duction[d]	Habitat Sensitivity[e]		Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge
American Plaice (A)	1	2	1	1	5	2	2	0	10	10	0	High	High	None
American Plaice (J)	1	2	0	1	4	2	2	0	8	8	0	Mod	Mod	None
Atlantic Cod (A)	1	1	0	2	4	2	2	1	8	8	4	Mod	Mod	Low
Atlantic Cod (J)	2	1	0	2	5	2	2	0	10	10	0	High	High	None
Atlantic Halibut (A)	1	1	1	1	4	2	2	0	8	8	0	Mod	Mod	None
Atlantic Halibut (J)	1	2	0	1	4	2	2	0	8	8	0	Mod	Mod	None
Atlantic Herring (E)	0	0	1	1	2	2	2	0	4	4	0	Low	Low	None
Atlantic Herring (SA)	0	0	1	1	2	2	2	0	4	4	0	Low	Low	None
Atlantic Surfclam (A)	1	0	1	1	3	2	2	2	6	6	6	Low	Low	Low
Atlantic Surfclam (J)	1	0	0	1	2	2	2	2	4	4	4	Low	Low	Low
Barndoor Skate (A)	1	1	1	1	4	2	2	1	8	8	4	Mod	Mod	Low
Barndoor Skate (J)	1	2	0	1	4	2	2	1	8	8	4	Mod	Mod	Low
Black Sea Bass (A)	2	1	0	2	5	2	2	2	10	10	10	High	High	High
Black Sea Bass (J)	2	1	0	2	5	2	2	2	10	10	10	High	High	High
Clearnose Skate (A)	1	1	1	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Clearnose Skate (J)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Golden Deepsea Crab (J,A)	1	1	1	2	5	1	0	0	5	0	0	Low	None	None
Goosefish (A)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Goosefish (J)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Haddock (A)	1	2	0	2	5	2	2	1	10	10	5	High	High	Low
Haddock (J)	2	2	0	2	6	2	2	1	12	12	6	High	High	Low
Little Skate (A)	1	1	1	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Little Skate (E)	0	0	1	1	2	2	2	2	4	4	4	Low	Low	Low
Little Skate (J)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Ocean Pout (A)	2	2	1	2	7	2	2	2	14	14	14	High	High	High
Ocean Pout (E)	2	0	1	2	5	2	2	2	10	10	10	High	High	High
Ocean Pout (J)	2	2	0	2	6	2	2	2	12	12	12	High	High	High
Ocean Quahog (A)	1	0	1	1	3	2	2	2	6	6	6	Low	Low	Low
Ocean Quahog (J)	1	0	0	1	2	2	2	2	4	4	4	Low	Low	Low
Offshore Hake (A)	1	1	0	1	3	2	1	0	6	3	0	Low	Low	None
Offshore Hake (J)	1	1	0	1	3	2	1	0	6	3	0	Low	Low	None
Pollock (A)	1	1	1	1	4	2	2	1	8	8	4	Mod	Mod	Low
Pollock (J)	1	1	0	1	3	2	2	1	6	6	3	Low	Low	Low
Red Deepsea Crab (A)	1	1	1	2	5	1	0	0	5	0	0	Low	None	None
Red Deepsea Crab (J)	1	1	0	2	4	1	0	0	4	0	0	Low	None	None
Red Drum (A)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low

Table 6.1. EFH vulnerability matrix analysis for benthic life stages of federally managed fish and invertebrate species in the Northeast U.S. Shelf Ecosystem

Species and Species Groups[a]	Habitat Criteria Scores				Habitat Rank[f]	Gear Distribution Scores[g]			Gear Rank[h]			EFH Vulnerability Category[i]		
	Shelter[b]	Food[c]	Repro-duction[d]	Habitat Sensitivity[e]		Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge
Red Drum (J)	2	1	0	2	5	1	0	0	5	0	0	Low	None	None
Red Hake (A)	1	2	0	1	4	2	2	1	8	8	4	Mod	Mod	Low
Red Hake (J)	2	2	0	2	6	2	2	2	12	12	12	High	High	High
Redfish (A)	1	1	0	2	4	2	2	0	8	8	0	Mod	Mod	None
Redfish (J)	2	1	0	2	5	2	2	0	10	10	0	High	High	None
Rosette Skate (A)	1	1	1	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Rosette Skate (J)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Scup (A)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Scup (J)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Sea Scallops (A)	1	0	1	1	3	2	2	2	6	6	6	Low	Low	Low
Sea Scallops (J)	1	0	0	1	2	2	2	2	8	8	8	Low	Low	Low
Silver Hake (A)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Silver Hake (J)	1	1	0	2	4	2	2	2	8	8	8	Mod	Mod	Mod
Smooth Skate (A)	1	2	1	1	5	2	2	0	10	10	0	High	High	None
Smooth Skate (J)	1	2	0	1	4	2	2	0	8	8	0	Mod	Mod	None
Spiny Dogfish (A)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Spiny Dogfish (J)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Summer Flounder (A)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Summer Flounder (J)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Thorny Skate (A)	1	1	1	1	4	2	2	0	8	8	0	Mod	Mod	None
Thorny Skate (J)	1	2	0	1	4	2	2	0	8	8	0	Mod	Mod	None
Tilefish (A)	2	2	0	1	5	2	1	0	10	5	0	High	Low	None
Tilefish (J)	2	2	0	1	5	2	1	0	10	5	0	High	Low	None
White Hake (A)	1	1	0	1	3	2	2	0	6	6	0	Low	Low	None
White Hake (J)	1	2	0	1	4	2	2	0	8	8	0	Mod	Mod	None
Windowpane Flounder (A)	1	0	0	1	2	2	2	2	4	4	4	Low	Low	Low
Windowpane Flounder (J)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Winter Flounder (A)	1	1	1	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Winter Flounder (E)	0	0	1	1	2	2	2	2	4	4	4	Low	Low	Low
Winter Flounder (J)	1	1	0	1	3	2	2	2	6	6	6	Low	Low	Low
Winter Skate (J)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Winter Skate (A)	1	1	1	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Witch Flounder (A)	1	2	0	1	4	2	1	1	8	4	4	Mod	Low	Low
Witch Flounder (J)	1	2	0	1	4	2	1	0	8	4	0	Mod	Low	None
Yellowtail Flounder (A)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod
Yellowtail Flounder (J)	1	2	0	1	4	2	2	2	8	8	8	Mod	Mod	Mod

Table 6.1. EFH vulnerability matrix analysis for benthic life stages of federally managed fish and invertebrate species in the Northeast U.S. Shelf Ecosystem

Species and Species Groups[a]	Habitat Criteria Scores				Habitat Rank[f]	Gear Distribution Scores[g]			Gear Rank[h]			EFH Vulnerability Category[i]		
	Shelter[b]	Food[c]	Repro-duction[d]	Habitat Sensitivity[e]		Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge

a Life Stages: (E) = egg, (J) = juvenile, (A) = adult, and (SA) = spawning adult.
b Shelter Scores: 0 = no dependence; 1 = lower dependence, not reliant on complex structure; and 2 = strong dependence, reliant on complex structure.
c Food Scores: 0 = no dependence on benthic prey; 1 = includes benthic prey; and 2 = relies exclusively on benthic prey.
d Reproduction Scores: 0 = no dependence (*e.g.*, spawns in water column, or life stage not reproductive); and 1 = dependence (*e.g.*, spawns on or over bottom).
e Habitat Sensitivity Scores: 0 = not sensitive; 1 = low sensitivity (*i.e.*, no habitat structural/complexity issues, and rapid recovery rates) such as high-energy sand habitats; and 2 = high sensitivity (*i.e.*, habitat structural/complexity issues, and slow recovery rates) such as deepwater/low energy habitats.
f Habitat Rank: = Σshelter score + food score + reproduction score + habitat sensitivity score.
g Gear Distribution Scores: 0 = gear not utilized in this habitat; 1 = gear operates in a small portion of this habitat; and 2 = gear operates in much of this habitat.
h Gear Rank (*i.e.*, overall effect on EFH of this particular gear) = habitat rank x gear distribution score.
i EFH Vulnerability Category was assigned from gear ranks as follows: 0 = none, 1-6 = low vulnerability, 7-9 = moderate vulnerability, 10-14 = high vulnerability.

Table 6.2. American plaice EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, and estuaries from Passamaquoddy Bay to Saco Bay, and from Massachusetts Bay to Cape Cod Bay	30-90	All year in GOM, December to June on GB; peaks in April and May for both areas	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, SNE, and estuaries from Passamaquoddy Bay to Saco Bay, and from Massachusetts Bay to Cape Cod Bay	30-130	Between January and August, with peaks in April and May	Surface waters	NA	NA	NA	NA	NA
Juveniles	GOM and estuaries from Passamaquoddy Bay to Saco Bay, and from Massachusetts Bay to Cape Cod Bay	45-150		Bottom habitats with fine-grained sediments or a substrate of sand or gravel	M	M	0	L	L
Adults	GOM, GB, and estuaries from Passamaquoddy Bay to Saco Bay, and from Massachusetts Bay to Cape Cod Bay	45-175		Bottom habitats with fine-grained sediments or a substrate of sand or gravel	H	H	0	L	L
Spawning adults	GOM, GB, and estuaries from Passamaquoddy Bay to Saco Bay, and from Massachusetts Bay to Cape Cod Bay	<90	March through June	Bottom habitats of all substrate types	H	H	0	L	L

Rationale: American plaice (*Hippoglossoides platessoides*) juveniles, adults, and spawning adults are concentrated in the GOM, where they occupy a variety of habitat types with substrates of gravel or fine-grained sediments including sand. Plaice avoid rocky and hard-bottom areas and prefer fine, sticky but gritty sand mixtures and mud, as well as oozy mud in deep basins (Klein-MacPhee 2002d). Plaice have been caught a considerable distance off the bottom, and move off the bottom at night (Klein-MacPhee 2002d). They feed primarily on epibenthic invertebrates (mostly echinoderms and amphipods), so there is a potential that prey resources may be adversely affected by otter trawls and scallop dredges, particularly in areas of lower energy and expected slower habitat recovery. EFH vulnerability to these gears was rated as high for adults and moderate for juveniles primarily because spawning occurs on the bottom. Since hydraulic clam dredges do not typically operate in the GOM, vulnerability for this gear was rated as none.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.

b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.3. Atlantic cod EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, eastern portion of continental shelf off SNE, and following estuaries: Englishman/ Machias Bay to Blue Hill Bay, Sheepscot R., Casco Bay, Saco Bay, Great Bay, Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	<110	Begins in fall, peaks in winter and spring	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, eastern portion of continental shelf off SNE and following estuaries: Passamaquoddy Bay to Penobscot Bay, Sheepscot R., Casco Bay, Saco Bay, Great Bay, Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	30-70	Spring	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB, eastern portion of continental shelf off SNE and following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	25-75		Bottom habitats with a substrate of cobble or gravel	H	H	0	L	L
Adults	GOM, GB, SNE, middle Atlantic south to Delaware Bay and following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, Boston Harbor, Cape Cod Bay, and Buzzards Bay	10-150		Bottom habitats with a substrate of rocks, pebbles, or gravel	M	M	L	L	L
Spawning adults	GOM, GB, SNE, middle Atlantic south to Delaware Bay and following estuaries, Englishman/ Machias Bay to Blue Hill Bay; Sheepscot R., Massachusetts Bay, Boston Harbor, and Cape Cod Bay	10-150	Spawn during fall, winter, and early spring	Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel	M	M	L	L	L

Rationale: Atlantic cod (*Gadus morhua*) are distributed regionally from Greenland to Cape Hatteras , from nearshore to depths >400 m. In U.S. waters, they are concentrated on GB and in the GOM, on rough bottom from 10-150 m (Fahay *et al*. 1999; Klein-MacPhee 2002a). Eggs and larvae are pelagic, so EFH vulnerability is not applicable. Juvenile cod are found mostly in nearshore shoal waters or on offshore banks. Cobble is preferred over finer grained sediments, and this life stage appears to use benthic structure and cryptic coloration to escape predation (Fahay *et al*. 1999). Juvenile cod may benefit, perhaps strongly, from physical and biological complexity (Lindholm *et al*. (2001); see discussion in Chapter 2 of this document). Otter trawls and scallop dredges have been shown to reduce habitat complexity (see Chapter 5), therefore EFH vulnerability to these gear types was rated as high since the gear may affect the functional value of EFH for this life stage. Vulnerability to clam dredges was rated as none since this gear is not operated in juvenile cod EFH (see Chapter 4). Adults and spawning adults occupy a variety of hard-bottom habitat types, including rock, pebbles, and gravel, and tend to avoid finer sediments. Cod eat a wide variety of prey, including fish, decapod crustaceans, amphipods, and polychaetes (Fahay *et al.* 1999). Although adult cod are primarily found on rough bottom, the scientific literature does not indicate that this habitat type serves the same function as it does for juvenile cod. Based on the variable diet and lack of evidence for direct functional value of benthic habitat, EFH vulnerability to otter trawls and scallop dredges was rated as moderate. Adult cod may use areas where clam dredges operate, such as the nearshore waters of New Jersey, on a seasonal basis. Clam dredges operate only in sand (NREFHSC 2002), and the recovery of benthic communities from the effects of clam dredging in nearshore, sandy habitats is rapid (Table 5.15). Clam beds are not chronically disturbed by dredging since the population of clams, which are benthic infauna, must recover before fishing is again profitable (NREFHSC 2002). Based on this information and the rationale described for otter trawls and scallop dredges, habitat vulnerability for hydraulic clam dredges was rated as low. EFH vulnerability for adults applies to spawning adults as well.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.4. Atlantic halibut EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	**New Bedford-Style Scallop Dredge**	**Hydraulic Clam Dredge**	**Pots and Traps**	**Sink Gill Nets and Bottom Longlines**
Eggs	GOM, GB		Between late fall and early spring, peaks in November and December	Pelagic waters to the seafloor	0	0	0	0	0
Larvae	GOM, GB			Surface waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB	20-60		Bottom habitats with a substrate of sand, gravel, or clay	M	M	0	L	L
Adults	GOM, GB	100-700		Bottom habitats with a substrate of sand, gravel, or clay	M	M	0	L	L
Spawning adults	GOM, GB	<700	Between late fall and early spring, peaks in November and December	Bottom habitats with a substrate of soft mud, clay, sand, or gravel; rough or rocky bottom locations along slopes of the outer banks	M	M	0	L	L

Rationale: Atlantic halibut (*Hippoglossus hippoglossus*) are found in the temperate, boreal and subarctic Atlantic, south to New Jersey, and were once common from Nantucket Shoals to Labrador (Klein-MacPhee 2002d). They have been found at depths from 25-1000 m, but 700-900 m is probably the deepest they are found in any numbers. Atlantic halibut eggs are bathypelagic and are fertilized on the bottom (Cargnelli, Griesbach, and Morse 1999; Klein-MacPhee 2002d). Since eggs occur close to, but not on the bottom, scallop dredges, otter trawls, and hydraulic clam dredges are not expected to affect the functional value of the habitat for this life stage, and EFH vulnerability was rated as none. Juvenile, adult and spawning adult halibut occupy a variety of habitat types north of Nantucket Shoals. Adults are not found on soft mud or on rock bottom (Cargnelli, Griesbach, and Morse 1999). Spawning is occasionally associated with complex habitats. Juvenile halibut feed mostly on annelid worms and crustaceans, then transition to a diet of mostly fish as adults (Klein-MacPhee 2002d). EFH vulnerability to scallop dredges and otter trawls was rated as moderate for juveniles and adults. EFH vulnerability for clam dredges was rated as none since this gear type does not operate in halibut EFH (see Chapter 4 of this document).

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.5. Atlantic herring EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB and following estuaries: Englishman/Machias Bay, Casco Bay, and Cape Cod Bay	20-80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, shell fragments, and aquatic macrophytes, tidal currents 1.5-3 knots	L	L	0	L	L
Larvae	GOM, GB, SNE and following estuaries: Passamaquoddy Bay to Cape Cod Bay, Narragansett Bay, and Hudson R./ Raritan Bay	50-90	Between August and April, peaks from September to November	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB, SNE and Middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Cape Cod Bay, Buzzards Bay to Long Island Sound, Gardiners Bay to Delaware Bay	15-135		Pelagic waters and bottom habitats	NA	NA	NA	NA	NA
Adults	GOM, GB, SNE and middle Atlantic south to Cape Hatteras and following estuaries: Passamaquoddy Bay to Great Bay, Massachusetts Bay to Cape Cod Bay, Buzzards Bay to Long Island Sound, Gardiners Bay to Delaware Bay, and Chesapeake Bay	20-130		Pelagic waters and bottom habitats	NA	NA	NA	NA	NA
Spawning adults	GOM, GB, SNE and middle Atlantic south to Delaware Bay and Englishman/Machias Bay Estuary	20-80	July through November	Bottom habitats with a substrate of gravel, sand, cobble, and shell fragments, also on aquatic macrophytes	L	L	0	L	L

Rationale: Atlantic herring (*Clupea harengus*) is a coastal pelagic species ranging from Labrador to Cape Hatteras in the western Atlantic (Reid *et al*. 1999; Munroe 2002). For pelagic life stages (larvae, juveniles, adults) EFH vulnerability to bottom-tending fishing gears is not applicable. Atlantic herring eggs are laid in high-energy, benthic habitats on gravel, sand, or rocky substrates, and on macrophytes (Reid *et al*. 1999; Munroe 2002). These habitats are less susceptible to fishing gear impacts since they have evolved under a high-energy disturbance regime (strong bottom currents). Vulnerability of herring egg EFH to scallop dredges and otter trawls is considered low. Although these gears may directly affect the eggs, only the effect of the gear on the functional value of the habitat was considered for this evaluation. EFH vulnerability from clam dredges was considered to be none since this gear does not operate in areas of herring egg EFH. Spawning adults are closely associated with the bottom. Effects on the functional value of habitat from mobile gears are unknown, and were rated as low since spawning occurs on the bottom. EFH vulnerability from clam dredges was rated as none for the reasons described above. Spawning could be disrupted by noise associated with these gears, but this issue was not addressed as a habitat-related issue.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.6. Atlantic mackerel EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Continental shelf from Maine through Cape Hatteras, also includes the following estuaries: Great Bay to Cape Cod Bay, Buzzards Bay to Long Island Sound, Gardiners Bay, and Great South Bay	0-15		Pelagic waters	NA	NA	NA	NA	NA
Larvae	Continental shelf from Maine through Cape Hatteras, also includes the following estuaries: Great Bay to Cape Cod Bay, Buzzards Bay to Long Island Sound, Gardiners Bay, and Great South Bay	10-130		Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Continental shelf from GOM through Cape Hatteras, also includes the following estuaries: Passamaquoddy Bay, Penobscot Bay to Saco Bay, Great Bay, Massachusetts Bay to Cape Cod Bay, Narragansett Bay, Long Island Sound, Gardiners Bay to Hudson R./ Raritan Bay	0-320		Pelagic waters	NA	NA	NA	NA	NA
Adults	Continental shelf from GOM through Cape Hatteras, also includes the following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay to Long Island Sound, Gardiners Bay to Hudson R./ Raritan Bay	0-380		Pelagic waters	NA	NA	NA	NA	NA

Rationale: All life stages of Atlantic mackerel (*Scomber scombrus*) are pelagic, so their EFH is not vulnerable to bottom-tending fishing gear, and vulnerability was categorized as “not applicable.”

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.7. Atlantic salmon EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	The following rivers from Connecticut to Maine: Connecticut, Pawcatuck, Merrimack, Cocheco, Saco, Androscoggin, Presumpscot, Kennebec, Sheepscot, Ducktrap, Union, Penobscot, Narraguagus, Machias, East Machias, Pleasant, St. Croix, Denny's, Passagassawaukeag, Aroostook, Lamprey, Boyden, and Orland rivers, and Turk, Hobart and Patten Streams, and the following estuaries and embayments for juveniles and adults: Passamaquoddy Bay to Muscongus Bay, Casco Bay to Wells Harbor, Massachusetts Bay, Long Island Sound, and Gardiners Bay to Great South Bay. EFH includes all aquatic habitats in the watersheds of the above listed rivers, including all tributaries to the extent that they are currently or were historically accessible for salmon migration.	30-31	Between October and April	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	NA	NA	NA	NA	NA
Larvae			Between March and June for alevins/fry	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	NA	NA	NA	NA	NA
Juveniles		10-61		Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries, water velocities of 30-92 cm/s	NA	NA	NA	NA	NA
Adults				Oceanic adult Atlantic salmon are primarily pelagic and range from waters of the continental shelf off SNE north throughout the GOM, dissolved oxygen >5 ppm for migratory pathway	NA	NA	NA	NA	NA
Spawning adults		30-61	October and November	Bottom habitats with a gravel or cobble riffle (redd) above or below a pool in rivers	NA	NA	NA	NA	NA

Rationale: Atlantic salmon (*Salmo salar*) eggs and larvae are found in riverine areas where the fishing gears under consideration are not used, so EFH vulnerability is not applicable. It is important to note that these life stages are particularly vulnerable to non-fishing-related impacts such as point-source discharges and polluted runoff. Juveniles and adults are pelagic in nature, and vulnerability of EFH to bottom-tending fishing gear is not applicable for these life stages.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.8. Atlantic surfclam EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Eastern edge of GB and the GOM throughout Atlantic EEZ	0-60, low density beyond 38		Throughout substrate to a depth of 3 ft within federal waters, burrow in medium to coarse sand and gravel substrates, also found in silty to fine sand, but not in mud	L	L	L	L	L
Adults	Eastern edge of GB and the GOM throughout Atlantic EEZ	0-60, low density beyond 38	Spawn summer to fall	Throughout substrate to a depth of 3 ft within federal waters	L	L	L	L	L

Rationale: Atlantic surfclams (*Spisula solidissima*) are found in sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Cargnelli *et al*. 1999a). They burrow into substrates from fine to coarse sandy gravel, and are not found in mud. Although clam dredges remove clams from the sediment, the habitat's functional value is probably not affected. Juvenile and adult EFH vulnerability was therefore rated as low for all mobile gears. Surfclam eggs and larvae are pelagic, therefore EFH vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.9. Barndoor skate EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Eastern GOM, GB, SNE, Mid-Atlantic Bight to Hudson Canyon	0-750, mostly <150		Bottom habitats with mud, gravel, and sand substrates	M	M	L	L	L
Adults	Eastern GOM, GB, SNE, Mid-Atlantic Bight to Hudson Canyon	0-750, mostly <150		Bottom habitats with mud, gravel, and sand substrates	M	M	L	L	L

Rationale: Barndoor skate (*Dipturus laevis*) occur from Newfoundland south to Cape Hatteras, but are most abundant on GB and in the GOM. They are found on soft mud, sand, and gravel (Packer *et al*. 2003a). Barndoor skate feed on invertebrates usually associated with the bottom, including polychaetes, gastropods, and bivalves, as well as squid and fish. Smaller individuals feed primarily on polychaetes, copepods, and amphipods, while larger individuals capture larger and more active prey (McEachran 2002, Packer *et al*. 2003a). A single fertilized egg is encapsulated in a leathery capsule known as a "mermaids purse." The young hatch in late spring or early summer, and are thought to be about 18-19 cm in length, although very little information is available on this life stage (Packer *et al*. 2003a). Juvenile EFH was considered to be moderately vulnerable to otter trawls and scallop dredges because of the closer association of juveniles to a benthic invertebrate diet. Adult EFH vulnerability to otter trawls and scallop dredges was rated as moderate due primarily to their reproductive habits. EFH vulnerability to clam dredges was rated as low for juveniles and adults because this gear is not extensively used in EFH.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.10. Black sea bass EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Continental shelf and estuaries from SNE to North Carolina; also includes Buzzards Bay	0-200	May to October	Water column of coastal Mid-Atlantic Bight and Buzzards Bay	NA	NA	NA	NA	NA
Larvae	Pelagic waters over continental shelf from GOM to Cape Hatteras; also includes Buzzards Bay	<100	May to November, peak June to July	Habitats for transforming (to juveniles) larvae are near coastal areas and into marine parts of estuaries between Virginia and NY; when larvae become demersal, found on structured inshore habitat such as sponge beds	H	H	H	L	L
Juveniles	Demersal waters over continental shelf from GOM to Cape Hatteras, also includes the following estuaries: Buzzards Bay to Long Island Sound, Gardiners Bay, Barnegat Bay to Chesapeake Bay, Tangier/Pocomoke Sound, and James R	1-38	Found in coastal areas (April to December, peak June to November) between Virginia and Massachusetts, but winter offshore from New Jersey south; in estuaries in summer and spring	Rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, offshore clam beds, and shell patches may be used during wintering	H	H	H	L	L
Adults	Demersal waters over continental shelf from GOM to Cape Hatteras, also includes the following estuaries: Buzzards Bay, Narragansett Bay, Gardiners Bay, Great South Bay, Barnegat Bay to Chesapeake Bay, Tangier/Pocomoke Sound, and James R	20-50	Wintering adults (November to April) offshore, south of New York to North Carolina; inshore, in estuaries from May to October	Structured habitats (natural and man-made), sand and shell substrates preferred	H	H	H	L	L

Rationale: Black sea bass (*Centropristis striata*) are found in coastal waters of the northwest Atlantic, from Cape Cod south to Cape Canaveral (Klein-MacPhee 2002e). Occasionally they stray as far north as the Bay of Fundy (GOM). Juveniles are common in high-salinity estuaries. Adults and juveniles are found in estuaries from Massachusetts south to the James River, Virginia (Stone *et al.* 1994). Black sea bass larvae are pelagic, but then become demersal and occupy structured inshore habitat such as sponge beds, eelgrass beds, shellfish beds, shell patches, and other rough bottoms (Steimle, Zetlin, Berrien, and Chang 1999) and offshore shell patches including clam beds (Able and Fahay 1998). The availability of structure limits successful post-larval and/or juvenile recruitment (Steimle, Zetlin, Berrien, and Chang 1999). Juveniles are diurnal visual predators that feed on benthic invertebrates and small fish. Adults are also structure oriented, and are thought to use structure as shelter during the day, but may stray off it to hunt at night. Each of these life stages is associated with structure that may be vulnerable to fishing gear impacts, so vulnerability was rated as high for all mobile gears. It is important to note that structured habitats comprised of wrecks or other artificial reefs prone to damage by mobile gear may be avoided by fishermen. This is true of high-relief natural areas as well. Black sea bass eggs are pelagic, so vulnerability to EFH is not applicable. Although larvae are pelagic, they do become demersal as they transition into juveniles. Therefore, larvae were rated the same as juveniles.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.11. Bluefish EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	North of Cape Hatteras--over continental shelf from Montauk Point south to Cape Hatteras; south of Cape Hatteras--over continental shelf through Key West, Florida	Mid-shelf depths	April to August	Pelagic waters	NA	NA	NA	NA	NA
Larvae	North of Cape Hatteras--over continental shelf from Montauk Point south to Cape Hatteras; south of Cape Hatteras--over continental shelf through Key West, the slope sea, and Gulf Stream between latitudes 29°N and 40°N; includes Narragansett Bay	> 15	April to September	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	North of Cape Hatteras--over continental shelf from Nantucket Island south to Cape Hatteras; south of Cape Hatteras--over continental shelf through Key West, the slope sea, and Gulf Stream between latitudes 29°N and 40°N; also includes the following estuaries: Penobscot Bay to Great Bay, Massachusetts Bay to James R., Albemarle Sound to St. Johns R.		North Atlantic estuaries from June to October; mid-Atlantic estuaries from May to October; South Atlantic estuaries from March to December	Pelagic waters	NA	NA	NA	NA	NA
Adults	North of Cape Hatteras--over continental shelf from Cape Cod Bay south to Cape Hatteras; south of Cape Hatteras--found over continental shelf through Key West: also includes the following estuaries: Penobscot Bay to Great Bay, Massachusetts Bay to James R., Albemarle Sound to Pamilco/Pungo R., Bougue Sound, Cape Fear R., St. Helena Sound, Broad R., St. Johns R., and Indian R.		North Atlantic estuaries from June to October; mid-Atlantic estuaries from April to October; South Atlantic estuaries from May to January	Pelagic waters	NA	NA	NA	NA	NA

Rationale: All life stages of bluefish (*Pomatomus saltatrix*) are pelagic, so their EFH is not vulnerable to bottom-tending fishing gears, and vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.12. Butterfish EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Over continental shelf from GOM through Cape Hatteras; also estuaries, including Massachusetts Bay to Long Island Sound, Gardiners Bay, Great South Bay, and Chesapeake Bay	0-1829	Spring and summer	Pelagic waters	NA	NA	NA	NA	NA
Larvae	Over continental shelf from GOM through Cape Hatteras; also estuaries, including Boston Harbor, Waquoit Bay to Long Island Sound, Gardiners Bay to Hudson R./Raritan Bay, Delaware Bay, and Chesapeake Bay	10-1829	Summer and fall	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Over continental shelf from GOM through Cape Hatteras; also estuaries, including Massachusetts Bay, Cape Cod Bay to Delaware inland bays, Chesapeake Bay, York R., and James R.	10-365 (most <120)	Winter--shelf; spring to fall--estuaries	Pelagic waters (larger individuals found over sandy and muddy substrates)	NA	NA	NA	NA	NA
Adults	Over continental shelf from GOM through Cape Hatteras; also estuaries, including Massachusetts Bay, Cape Cod Bay to Hudson R./Raritan Bay, Delaware Bay and inland bays, York R., and James R.	10-365 (most <120)	Winter--shelf; summer to fall--estuaries	Pelagic waters (schools form over sandy, sandy silt, and muddy substrates)	NA	NA	NA	NA	NA

Rationale: All life stages of butterfish (*Peprilus triacanthus*) are pelagic, so their EFH is not vulnerable to bottom-tending fishing gear, and vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.13. Clearnose skate EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	GOM, along shelf to Cape Hatteras ; includes the estuaries from Hudson River/Raritan Bay south to the Chesapeake Bay mainstem	0 – 500, mostly < 111		Bottom habitats with substrate of soft bottom along continental shelf, and rocky or gravelly bottom	M	M	M	L	L
Adults	GOM, along shelf to Cape Hatteras ; includes the estuaries from Hudson River/Raritan Bay south to the Chesapeake Bay mainstem	0 – 500, mostly < 111		Bottom habitats with substrate of soft bottom along continental shelf, and rocky or gravelly bottom	M	M	M	L	L

Rationale: Clearnose skate (*Raja eglanteria*) occur in the GOM, but are most abundant from Cape Hatteras north to Delaware Bay. They are found over soft bottoms of mud and sand, as well as on rocky or gravelly bottoms. They have been captured from shore out to depths of 330 m, but are most abundant at depths less than 111 m (Packer *et al*. 2003b). Adults and juveniles feed on polychaetes, amphipods, decapod crustaceans, mollusks, and fish. Like barndoor skates, crabs and benthic invertebrates are more important for smaller, younger individuals, and the importance of fish in the diet increases with age (McEachran 2002; Packer *et al*. 2003b). A single fertilized egg is encapsulated in a leathery case. Eggs are deposited in the spring or summer, and hatch 3 mo later. Juvenile EFH was considered moderately vulnerable to otter trawls, scallop dredges, and clam dredges because of the close association of juveniles to a benthic invertebrate diet. Adult EFH vulnerability to otter trawls, scallop dredges, and clam dredges was rated as moderate due primarily to the species' reproductive habits.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.14. Cobia EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
All life stages	South Atlantic and Mid-Atlantic Bights			Sandy shoals of capes and offshore bars; high-profile rock bottoms and barrier island oceanside waters from surf zone to shelf break, but from the Gulf Stream shoreward; also high salinity bays, estuaries, seagrass habitat	NA	NA	NA	NA	NA

Rationale: All life stages of cobia (*Rachycentron canadum*) are pelagic, so their EFH is not vulnerable to bottom tending fishing gear, and vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.15. Golden deepsea crab EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
All life stages	Chesapeake Bay to the south through the Florida Straight (and into the Gulf of Mexico)	290-570		Continental slope in flat areas of foraminifera ooze, on distinct mounds of dead coral, ripple habitat, dunes, black pebble habitat, low outcrop, and soft bioturbated habitat	L	0	0	L	L

Rationale: The golden deepsea crab (*Chaceon fenneri*) inhabits the continental slope of Bermuda and the southeastern United States from Chesapeake Bay south through the Florida Straight and into the Gulf of Mexico (SAFMC 1998). Although similar to the red deepsea crab, less is known about this species. They are categorized as opportunistic scavengers, and are found in depths from 290-570 m on substrates of foraminiferon ooze, dead coral mounds, deep ripple habitat, dunes, and black pebble habitat. Scallop dredges and clam dredges do not operate in golden crab EFH due to depth, so EFH vulnerability was rated as none. Most otter trawling operates in depths less than 200 m so EFH vulnerability was rated as low for this gear type.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.16. Goosefish EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, SNE, middle Atlantic south to Cape Hatteras	15-1000	March to September	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, SNE, middle Atlantic south to Cape Hatteras	25-1000	March to September	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Outer continental shelf in the middle Atlantic, mid-shelf off SNE, all areas of GOM	25-200		Bottom habitats with substrates of a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud	L	L	L	L	L
Adults	Outer continental shelf in the middle Atlantic, mid-shelf off SNE, outer perimeter of GB, all areas of GOM	25-200		Bottom habitats with substrates of a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud	L	L	L	L	L
Spawning adults	Outer continental shelf in the middle Atlantic, mid-shelf off SNE, outer perimeter of GB, all areas of GOM	25-200	February to August	Bottom habitats with substrates of a sand-shell mix, algae-covered rocks, hard sand, pebbly gravel, or mud	L	L	L	L	L

Rationale: Goosefish (*Lophius americanus*), are demersal anglerfish found from Newfoundland south to Florida, but are common only north of Cape Hatteras (Steimle, Morse, and Johnson 1999). Juveniles are primarily found at depths between 40 and 75 m, while adults are concentrated between 50-100 m. In the GOM, adults occur primarily between the depths of 130-260 m. Occasionally, adults are seen at the surface. Both juveniles and adults (including spawning adults) occur on substrates ranging from mud to gravelly sand, algae, and rocks. A goosefish has been observed digging depressions in the bottom substrate with its pectoral fins until its back was almost flush with the surrounding bottom (Caruso 2002). The goosefish is a sight predator that uses its highly modified first dorsal fin as an angling apparatus to lure small fishes towards its mouth (Caruso 2002). Goosefish eat a wide array of prey items, but mainly fish and cephalopods. Goosefish have been reported to ingest a variety of seabirds. There are no indications in the literature that any goosefish life stage is habitat limited or that the functional value of its habitat could be adversely affected by fishing. Vulnerability of adult and juvenile EFH to mobile fishing gear was rated as low. Goosefish eggs and larvae are pelagic, and vulnerability to bottom-tending fishing gear is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.17. Haddock EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GB southwest to Nantucket Shoals, coastal areas of GOM, and the following estuaries: Great Bay, Massachusetts Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay	50-90	March to May, peaks in April	Surface waters	NA	NA	NA	NA	NA
Larvae	GB southwest to Delaware Bay, and the following estuaries: Great Bay, Massachusetts Bay, Boston Harbor, Cape Cod Bay, Buzzards Bay, and Narragansett Bay	30-90	January to July, peaks in April and May	Surface waters	NA	NA	NA	NA	NA
Juveniles	GB, GOM, and middle Atlantic south to Delaware Bay	35-100		Bottom habitats with a substrate of pebble and gravel	H	H	L	L	L
Adults	GOM, GB, Nantucket Shoals, and the Great South Channel	40-150		Bottom habitats with a substrate of broken ground, pebbles, smooth hard sand, and smooth areas between rocky patches	H	H	L	L	L
Spawning adults	GOM, GB, Nantucket Shoals, and the Great South Channel	40-150	January to June	Bottom habitats with a substrate of pebble, gravel, or gravelly sand	H	H	L	L	L

Rationale: Haddock (*Melanogrammus aeglefinus*) are found from Greenland to Cape Hatteras and are common throughout the GOM, Georges Bank, and SNE (Cargnelli, Griesbach, Berrien, *et al.* 1999; Klein-MacPhee 2002a). Juveniles older than 3 mo and adults are demersal and generally found in waters from 10-150 m in depth. Juveniles are usually found in waters shallower than 100 m. Haddock spawn over pebble and gravel substrate, and avoid ledges, rocks, kelp, and soft mud (Cargnelli, Griesbach, Berrien, *et al*. 1999). Haddock eggs and larvae are pelagic, and EFH vulnerability to fishing gear is not applicable. Juvenile haddock, like juvenile cod, may benefit, perhaps strongly, from physical and biological complexity (see discussion in Chapter 2). In general, haddock have a stronger benthic affinity than cod (Klein-MacPhee 2002a). Juvenile haddock are chiefly found over pebble and gravel substrates (Cargnelli, Griesbach, Berrien, *et al*. 1999). Once demersal, they feed on benthic fauna, and their primary prey items are crustaceans and polychaetes. The habitat complexity that appears to be important to juvenile haddock can be reduced by otter trawls and scallop dredges, and benthic prey may be affected (see Chapter 5). Juvenile haddock EFH are considered highly vulnerable to these two gear types. Vulnerability to clam dredges was rated as low since there is some use of this gear in juvenile EFH. Adult haddock are found on broken ground, gravel, pebbles, clay, smooth sand, and sticky sand of gritty consistency, with a preference for smooth areas around rock patches (Klein-MacPhee 2002a). They feed indiscriminately on benthic invertebrates, and occasionally on fish. Adults (including spawning adults) occupy a variety of habitat types that might be affected by otter trawls and scallop dredges. Adults may be less closely linked to complex habitats then juveniles, but there is still some association. Haddock are expected to be more strongly linked to benthic habitats than cod, since haddock primarily feed on benthic invertebrates, while cod are primarily piscivorous. Benthic prey resources for haddock may be adversely affected by scallop dredges or otter trawls in areas of lower energy and expected slower habitat recovery. Overall, adult EFH vulnerability to these gear types was rated as high. Clam dredges operate only in sand, and the associated recovery period is short (Table 5.15). Moreover, clam dredging is not expected to create a chronic disturbance in these areas since the population of clams, which are benthic infauna, must recover before fishing is again profitable; therefore, habitat vulnerability for clam dredges was rated as low.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.18. King mackerel EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
All life stages	South Atlantic and Mid-Atlantic Bights			Sandy shoals of capes and offshore bars; high-profile rock bottoms and barrier island oceanside waters from surf zone to shelf break, but from the Gulf Stream shoreward, also high salinity bays, estuaries, seagrass habitat	NA	NA	NA	NA	NA

Rationale: All life stages of king mackerel (*Scomberomorus cavalla*) are pelagic, so their EFH is not vulnerable to bottom-tending fishing gear, and vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.19. Little skate EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GB to Cape Hatteras; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	<27		Bottom habitats with sandy substrate	L	L	L	L	L
Juveniles	GB to Cape Hatteras; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0-137, mostly 73-91		Bottom habitats with sandy or gravelly substrate or mud	M	M	M	L	L
Adults	GB to Cape Hatteras; includes the estuaries from Buzzards Bay south to the Chesapeake Bay mainstem	0-137, mostly 73-91		Bottom habitats with sandy or gravelly substrate or mud	M	M	M	L	L

Rationale: Little skate (*Leucoraja erinacea*) range from Nova Scotia to Cape Hatteras, and are most abundant on GB and in coastal waters south to the mouth of Chesapeake Bay. They have been found at depths up to 500 m, but are most common at depths less than 111 m (Packer *et al*. 2003c). In SNE, juveniles and adults have been associated with microhabitat features including biogenic depressions and flat sand during the day (Auster *et al*. 1991, 1995). They are generally found on sandy or gravelly bottoms, but also occur on mud. They co-occur with winter skate, and are more active at night, although they appear to feed throughout the day and night. The most important prey are amphipods and decapod crustaceans, followed by polychaetes (Packer *et al*. 2003c). Prey items of minor importance include bivalves, isopods, and fish. Similar to barndoor and clearnose skates, the use of fish as a food source increases with increasing size. Smaller skates eat more amphipods, and larger skate consume more decapod crustaceans (Packer *et al*. 2003c). A single fertilized egg is encapsulated in a leathery case that is deposited on sandy substrate. The cases have sticky filaments that adhere to bottom substrates. In one study, eggs deposited in the late spring and early summer required 5 to 6 mo to hatch. Other studies have shown incubation to exceed 1 yr. When the young hatch, they are considered juveniles and are fully developed asuring from 93-102 mm in total length (Packer *et al*. 2003c). Vulnerability of juvenile EFH to mobile bottom gear was characterized as moderate because of the species dependence on benthic organisms in its diet. Vulnerability of adult EFH to mobile bottom geargears was characterized as moderate due to its reproductive habits. Little skate is the only skate species in which EFH has been designated for eggs. Although bottom-tending mobile gears may have adverse effects upon the eggs themselves, this was not considered to be a habitat impact. Since the bottom substrate appears to provide an attachment point for the eggs, the EFH vulnerability to mobile gear was rated as low instead of none.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.20. Longfin inshore squid EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Over continental shelf from GOM through Cape Hatteras	0-213	Inshore spring to fall; offshore in winter	Pelagic waters	NA	NA	NA	NA	NA
Adults	Over continental shelf from GOM through Cape Hatteras	0-305	Inshore March to October; offshore in winter	Pelagic waters	NA	NA	NA	NA	NA

Rationale: Longfin inshore squid (*Loligo pealeii*) is a pelagic schooling species. It is distributed in continental shelf and slope waters from Newfoundland to the Gulf of Venezuela (Cargnelli, Griesbach, McBride, *et al*. 1999). Most life stages of longfin inshore squid are pelagic; however, encapsulated eggs are laid in masses, called "mops," that are attached to structures such as rocks and algae on substrates of sand, mud, or on hard-bottom in depths <50m (Cargnelli, Griesbach, McBride, 1999). As of this writing, EFH has not been designated for longfin inshore squid eggs.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.21. Northern shortfin squid EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Over continental shelf from GOM through Cape Hatteras	0-182	Carried northward by Gulf Stream	Pelagic waters	NA	NA	NA	NA	NA
Adults	Over continental shelf from GOM through Cape Hatteras	0-182	Offshore late fall; spawn December to March	Pelagic waters	NA	NA	NA	NA	NA

Rationale: All stages of northern shortfin squid (*Illex illecebrosus*) are pelagic, so their EFH is not vulnerable to bottom tending fishing gear, and vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.22. Ocean pout EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, SNE, middle Atlantic south to Delaware Bay, and the following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, and Cape Cod Bay	<50	Late fall and winter	Bottom habitats, generally hard-bottom sheltered nests, holes, or crevices where they are guarded by parents	H	H	H	L	L
Larvae	GOM, GB, SNE, middle Atlantic south to Delaware Bay, and the following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, and Cape Cod Bay	<50	Late fall to spring	Bottom habitats in close proximity to hard-bottom nesting areas	H	H	H	L	L
Juveniles	GOM, GB, SNE, middle Atlantic south to Delaware Bay, and the following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, Boston Harbor, and Cape Cod Bay	<80		Bottom habitats, often smooth bottom near rocks or algae	H	H	H	L	L
Adults	GOM, GB, SNE, middle Atlantic south to Delaware Bay, and the following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, Boston Harbor, and Cape Cod Bay	<110		Bottom habitats; dig depressions in soft sediments which are then used by other species	H	H	H	L	L
Spawning adults	GOM, GB, SNE, middle Atlantic south to Delaware Bay, and the following estuaries: Passamaquoddy Bay to Saco Bay, Massachusetts Bay, and Cape Cod Bay	<50	Late summer to early winter, peaks in September and October	Bottom habitats with a hard-bottom substrate, including artificial reefs and shipwrecks	H	H	H	L	L

Rationale: Ocean pout (*Zoarces americanus*) is a demersal species found in the western Atlantic from Labrador south to Cape Hatteras (Steimle, Morse, Berrien, Johnson, and Zetlin 1999). It can occur in deeper waters south of Cape Hatteras, and has been found as deep as 363 m (Klein-MacPhee and Collette 2002a). It is found in most estuaries and embayments in the GOM, and is caught by the NEFSC trawl surveys in greatest abundance off SNE (Steimle, Morse, Berrien, Johnson, and Zetlin 1999). Ocean pout eggs are laid in nests in crevices, on hard-bottom, or in holes and protected by the female parent for 2.5-3 mo until they hatch (Klein-MacPhee and Collette 2002a). Potential impacts to habitat from otter trawls, scallop dredges, and clam dredges include knocking down boulder piles, removing biogenic structure, and filling in bottom depressions, which may disturb nests and/or leave these areas less suitable for nests. In addition, fishing may frighten parents from nests leaving eggs susceptible to predation. Egg EFH is therefore considered to have a high vulnerability to all bottom-tending mobile gears. Ocean pout have a relatively short larval stage, and some authors (Klein-MacPhee and Collette 2002a) suggest that there is no larval stage (Steimle, Morse, Berrien, Johnson, and Zetlin 1999). Since the NEFMC designated EFH for this life stage, it is considered here. Larvae (hatchlings) remain near the nest site; however, there is little information on their use of habitats. Larvae do not appear to be as closely associated with the bottom as eggs or juveniles; however, it is anticipated that loss of structure may impact larvae to some degree. Larval EFH was determined to have high vulnerability to mobile bottom-tending gears. Juvenile pout are found under rocks, shells and algae, in coastal waters and are closely associated with the bottom (Steimle, Morse, Berrien, Johnson, and Zetlin 1999). They feed on benthic invertebrates such as gammarid amphipods and polychaetes. It is expected that loss of structure may significantly impact juvenile EFH. Vulnerability of juvenile EFH to all mobile gears was considered high. Adult pout are found in sand and gravel in winter and spring, and in rocky/hard substrate areas for spawning and nesting (Klein-MacPhee and Collette 2002a). They create burrows in soft sediments, and their diet consists mainly of benthic invertebrates including mollusks, crustaceans, and echinoderms. Because of the strong benthic affinity of ocean pout, it is anticipated that vulnerability of adult EFH to all mobile gears is high.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.23. Ocean quahog EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Eastern edge of GB and GOM throughout the EEZ	8-245		Throughout substrate to a depth of 3 ft within federal waters; occurs progressively farther offshore between Cape Cod and Cape Hatteras	L	L	L	L	L
Adults	Eastern edge of GB and GOM throughout the EEZ	8-245	Spawn May to December with several peaks	Throughout substrate to a depth of 3 ft within federal waters; occurs progressively farther offshore between Cape Cod and Cape Hatteras	L	L	L	L	L

Rationale: Ocean quahog (*Arctica islandica*) juveniles are found in offshore sandy substrate, and may survive in muddy intertidal areas (Cargnelli *et al.* 1999b). Adults are found in similar offshore habitats, just below the surface of the sediment, usually in medium- to fine-grained sand. Although clam dredges remove clams from the sediment, the habitat's functional value is probably not affected. Juvenile and adult EFH vulnerability was therefore rated as low for all mobile gears. Ocean quahog eggs and larvae are pelagic, therefore EFH vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.24. Offshore hake EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Outer continental shelf of GB and SNE south to Cape Hatteras	<1250	Observed all year and primarily collected at depths from 110-270 m	Pelagic waters	NA	NA	NA	NA	NA
Larvae	Outer continental shelf of GB and SNE south to Chesapeake Bay	<1250	Observed all year and primarily collected at depths from 70-130m	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	Outer continental shelf of GB and SNE south to Cape Hatteras	170-350		Bottom habitats	L	L	0	L	L
Adults	Outer continental shelf of GB and SNE south to Cape Hatteras	150-380		Bottom habitats	L	L	0	L	L
Spawning adults	Outer continental shelf of GB and SNE south to the Middle Atlantic Bight	330-550	Spawn throughout the year	Bottom habitats	L	L	0	L	L

Rationale: Offshore hake (*Merluccius albidus*) are distributed over the continental shelf and slope of the Northwest Atlantic, ranging from the Grand Banks south to the Caribbean and Gulf of Mexico (Chang, Berrien, Johnson, and Zetlin 1999; Klein-MacPhee 2002f). Juveniles and adults are found in deeper waters, and are most abundant at depths between 150-380 m. They are an important component in the slope community off Florida, and are reportedly caught near the outer edge of the Scotian Shelf, and on the slopes of deep basins in the GOM and the continental slope from the southeastern edge of GB south. Because of their depth preference, very little is known about the offshore component of the stock. Moreover, offshore hake are similar in appearance to silver hake, and may have been misidentified in earlier studies. They are taken commercially as bycatch in the silver hake fishery. No information is available on substrate preferences for juveniles and adults. Eggs and larvae are pelagic, and EFH vulnerability to fishing gears is not applicable. Juvenile and adult offshore hake appear to feed at or near the bottom, and are primarily piscivorous (feeding particularly on clupeids, anchovies, and lanternfishes), but they also eat crustaceans and squid (Klein-MacPhee 2002f). There is evidence of adult diel vertical migration. Only limited information exists about this species, and none of it indicates that offshore hake have a very strong bottom affinity, or that impacts from fishing gear would affect the functional value of their habitat. Although spawning occurs near the bottom, the actual use of benthic habitat during spawning is unknown. The vulnerability of adult and juvenile EFH to otter trawls and scallop dredges is expected to be low. Vulnerability to clam dredges was rated as none since the gear does not operate in the EFH of this species.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.25. Pollock EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, and the following estuaries: Great Bay to Boston Harbor	30–270	October to June, peaks November to February	Pelagic waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, and the following estuaries: Passamaquoddy Bay, Sheepscot R., and Great Bay to Cape Cod Bay	10–250	September to July, peaks December to February	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB, and the following estuaries: Passamaquoddy Bay to Saco Bay, Great Bay to Waquoit Bay, Long Island Sound, and Great South Bay	0–250		Bottom habitats with aquatic vegetation or a substrate of sand, mud, or rocks	L	L	L	L	L
Adults	GOM, GB, SNE, and middle Atlantic south to New Jersey, and the following estuaries: Passamaquoddy Bay, Damariscotta R., Massachusetts Bay, Cape Cod Bay, and Long Island Sound	15–365		Hard-bottom habitats, including artificial reefs	M	M	L	L	L
Spawning adults	GOM, SNE, and middle Atlantic south to New Jersey, including Massachusetts Bay	15–365	September to April, peaks December to February	Bottom habitats with a substrate of hard, stony, or rocky bottom; includes artificial reefs	M	M	L	L	L

Rationale: Pollock (*Pollachius virens*) range from the Hudson straits to North Carolina (Klein-MacPhee 2002a), and are most common on the Scotian Shelf, Georges Bank, the Great South Channel, and GOM (Cargnelli, Griesbach, Packer, Berrien, Johnson, *et al.* 1999). They segregate into schools by size, and avoid water warmer than about 15ºC (Klein-MacPhee 2002a). They are active fish that live at any depth between the bottom and the surface, depending upon food supply. They are associated with coastal areas and offshore shoals, and are found from shore out to depths of about 325 m, but are most common from 75-175 m (Cargnelli, Griesbach, Packer, Berrien, Johnson, *et al.* 1999). Juveniles frequently occupy the rocky intertidal zone, which may serve as a nursery area (Klein-MacPhee 2002a). Neither adults nor juveniles are selective in substrate type. Pollock are opportunistic, and the diet of both juveniles and adults consists mainly of euphausiid crustaceans, but fish, other crustaceans and squid, are also eaten (Cargnelli, Griesbach, Packer, Berrien, Johnson, *et al.* 1999; Klein-MacPhee 2002a). Adults spawn over broken bottom and the slopes of offshore banks, and eggs are pelagic. Based on food habits, and the distribution and behavior of pollock, vulnerability of juvenile EFH to benthic mobile gear was characterized as low. Since pollock spawn on the bottom, the vulnerability of adult EFH to otter trawls and scallop dredges was rated as moderate. EFH vulnerability from clam dredges was rated as low for juveniles and adults since there is limited use of this gear in pollock EFH. Pollock eggs and larvae are pelagic, so EFH vulnerability to fishing gear is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.26. Red deepsea crab EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Southern flank of GB and south to Cape Hatteras	200-400		Attached to the underside of the female crab until hatched--see spawning adults	NA	NA	NA	NA	NA
Larvae	Southern flank of GB and south to Cape Hatteras	200-1800	January to June	Water column from surface to seafloor	NA	NA	NA	NA	NA
Juveniles	Southern flank of GB and south to Cape Hatteras	700-1800		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites	L	0	0	L	L
Adults	Southern flank of GB and south to Cape Hatteras	200-1300		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites	L	0	0	L	L
Spawning adults	Southern flank of GB and south to Cape Hatteras	200-1300		Bottom habitats of continental slope with a substrate of silts, clays, and all silt-clay-sand composites	L	0	0	L	L

Rationale: Red deepsea crab (*Chaeceon* (*Geryon*) *quinquedens*) are found on the outer continental shelf and slope of the western Atlantic from Nova Scotia into the Gulf of Mexico (Steimle *et al*. 2001). They are found on the bottom, chiefly in water depths of 200-1800. EFH depth range for juveniles is from 700-1800 m, and for adults is from 200-1300 m. They are found on substrates ranging from silt and clay to hard substrates. Red crab are opportunistic benthic feeders/scavengers, with a diet of epifauna and other opportunistically available items (Steimle *et al*. 2001). Post-larval juveniles feed on a wide variety of infaunal and epifaunal benthic invertebrates. Small crabs eat sponges, hydroids, gastropods, and other organisms. Larger crabs eat similar small benthic fauna and larger prey including demersal and midwater fishes. The only fishery using mobile bottom gear that operates in red crab EFH is the goosefish trawl fishery (NEFMC 2002). The vulnerability of adult and juvenile red crab EFH to otter trawls was characterized as low because of their opportunistic feeding habits. Vulnerability to scallop dredges and clam dredges was rated as none since those gears do not operate in red crab EFH. Larval red crabs are pelagic and EFH vulnerability is not applicable. The "habitat" for eggs is the female carapace, therefore EFH vulnerability for this life stage is also not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.27. Red drum EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Larvae	Along the Atlantic coast from Virginia through the Florida Keys	<50		Estuarine wetlands are especially important (flooded saltmarshes, brackish marsh, tidal creeks, mangrove fringe, seagrasses)	NA	NA	NA	NA	NA
Juveniles	Along the Atlantic coast from Virginia through the Florida Keys	<50	Found throughout Chesapeake Bay from September to November	Utilize shallow backwaters of estuaries as nursery areas and remain until they move to deeper water portions of the estuary associated with river mouths, oyster bars, and front beaches	L	0	0	L	L
Adults	Along the Atlantic coast from Virginia through the Florida Keys	<50	Found in Chesapeake in spring and fall, and also along eastern shore of VA	Concentrate around inlets, shoals, and capes along the Atlantic coast; shallow bay bottoms or oyster reef substrate preferred, also nearshore artificial reefs	L	L	L	L	L

Rationale: Red drum (*Sciaenops ocellatus*) are distributed in estuarine and coastal waters depending upon their stage of maturity (McGurrin 1994). Juvenile red drum are found in shallow estuarine backwaters, and as they grow, they move to deeper areas. Submerged aquatic vegetation (SAV) is particularly important habitat for juvenile drum. Subadult and adult red drum are found on estuarine bay bottoms or oyster reefs, and in nearshore coastal waters including the beach zone out to several miles from shore. Juvenile and adult red drum have a varied diet. Smaller juveniles eat copepods and mysids, while larger individuals eat decapod crustaceans (crabs and shrimp), fish, and plant material (McGurrin 1994). Although SAV is an important habitat for juvenile red drum, EFH vulnerability to otter trawls was rated as low since its use in SAV is limited. Scallop dredges and hydraulic clam dredges usually are not used in juvenile red drum EFH; therefore, EFH vulnerability for these gears was rated as none. Since red drum feed on a variety of organisms, and adults are found in many habitat types, vulnerability of adult EFH to mobile bottom gear was rated as low. Red drum eggs and larvae are pelagic; therefore, EFH vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.28. Red hake EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Sheepscot R., Great Bay to Cape Cod Bay, Buzzards Bay, and Narragansett Bay		May to November, peaks in June and July	Surface waters of inner continental shelf	NA	NA	NA	NA	NA
Larvae	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Sheepscot R., Massachusetts Bay to Cape Cod Bay; Buzzards Bay, Narragansett Bay and Hudson R./ Raritan Bay	<200	May to December, peaks in September and October	Surface waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay, Massachusetts Bay to Cape Cod Bay, Buzzards Bay to Connecticut. R., Hudson R./ Raritan Bay, and Chesapeake Bay	<100		Bottom habitats with substrate of shell fragments, including areas with an abundance of live sea scallops	H	H	H	L	L
Adults	GOM, GB, continental shelf off SNE, and middle Atlantic south to Cape Hatteras and the following estuaries: Passamaquoddy Bay to Saco Bay, Great Bay, Massachusetts Bay to Cape Cod Bay, Buzzards Bay to Connecticut R., Hudson R./Raritan Bay, Delaware Bay, and Chesapeake Bay	10-130		Bottom habitats in depressions with a substrate of sand and mud	M	M	L	L	L
Spawning adults	GOM, southern edge of GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Sheepscot R., Massachusetts Bay, Cape Cod Bay, Buzzards Bay, and Narragansett Bay	<100	May to November, peaks in June and July	Bottom habitats in depressions with a substrate of sand and mud	M	M	L	L	L

Rationale: Red hake (*Urophycis chuss*) is a demersal species that ranges from southern Newfoundland to North Carolina, and is most abundant between GB and New Jersey (Steimle, Morse, Berrien, and Johnson 1999). They occur at depths between 35-980 m, and are most common between 72-124 m (Klein-MacPhee 2002a). Larvae, juveniles, and adults have been found in estuaries from Maine south to Chesapeake Bay (NEFMC 1998). Eggs and larvae are pelagic, and EFH vulnerability to bottom-tending fishing gear is not applicable. Juvenile red hake are found in live sea scallops or empty scallop shells, and are associated with other objects such as other shells, sponges, and rocks (Klein-MacPhee 2002a). Shelter appears to be a critical habitat requirement for this life stage (Able and Fahay 1998), and physical complexity, including biogenic structure other than scallop shells, may be important (Auster *et al*. 1991, 1995). Their diet consists mainly of amphipods and other infauna and epifauna. Juvenile red hake EFH is considered highly vulnerable to all three mobile gear groups. Adult red hake feed mainly on euphausiids, and consume other invertebrates and fish (Klein-MacPhee 2002a). They are found mainly on soft bottoms (sand and mud) where they create depressions or use existing depressions. They are also found on shell beds, but not on open, sandy bottom. Otter trawls and scallop dredges operate in these soft bottom and shell bed areas and have been shown to affect the structural components of these habitats. Offshore in Maryland and northern Virginia, adult red hake are found on temperate reefs and hard-bottom areas. There is a potential that otter trawls could operate in hard-bottom areas and adversely affect the functional value of these reef habitats. Vulnerability of red hake EFH to otter trawls and scallop dredges was assessed as moderate. Clam dredges would not typically operate in these hard-bottom areas, or in the softer sediments with which red hake are usually associated in the northern extent of their range, but there is some overlap between adult EFH and clam dredge use in sandy habitats. EFH vulnerability to clam dredges was characterized as low.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.29. Redfish EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Viviparous (eggs are retained in mother, released as larvae)				NA	NA	NA	NA	NA
Larvae	GOM and southern GB	50-270	March to October, peak in August	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOM and southern edge of GB	25-400		Bottom habitats with a substrate of silt, mud, or hard-bottom	H	H	0	L	L
Adults	GOM and southern edge of GB	50-350		Bottom habitats with a substrate of silt, mud, or hard-bottom	M	M	0	L	L
Spawning adults	GOM and southern edge of GB	5-350	April to August	Bottom habitats with a substrate of silt, mud, or hard-bottom	M	M	0	L	L

Rationale: There are four species of redfish in the Northeast Region. They are *Sebastes fasciatus* (Acadian redfish), *S. mentella* (deepwater redfish), *S. norvegicus* (golden redfish), and *Helicolenus dactylopterus* (blackbelly rosefish). These four species are difficult to discriminate at all life stages, hence they are usually combined (Pikanowski *et al*. 1999). Acadian redfish range from Iceland to New Jersey, and deepwater redfish occur from the GOM north. Where the species overlap, the deepwater redfish occurs in deeper water. They range in depth from 25-592 m (Klein-MacPhee and Collette 2002b), with adults most common from 125-200 m, and juveniles from 75 to 175 m (Pikanowski *et al*. 1999). In general, information about redfish is very limited. Females bear live young and larvae are pelagic, so habitat vulnerability is not applicable to eggs or larvae. Redfish are found chiefly on silt, mud, or hard-bottom and rarely over sand (Pikanowski *et al*. 1999). On the Scotian Shelf, they are strongly associated with a fine-grained, silt-clay bottom (Klein-MacPhee and Collette 2002b), as well as with deposits of gravel and boulders (Pikanowski *et al*. 1999). It is hypothesized that redfish do not prefer a particular bottom type, but may be more exposed to predation over a featureless bottom due to their sedentary nature. There is limited evidence that juveniles use anemones and boulders for cover (Pikanowski *et al.* 1999). Early demersal-phase Acadian redfish have been observed to occur primarily in piled boulder habitats, while late-juvenile redfish occur in both piled boulder, gravel, and dense cerianthid anemone habitats (Auster, Lindholm, and Valentine 2003). Acadian redfish have also been observed in association with deepwater corals and sponges in the GOM (Auster 2005). Habitat vulnerability from otter trawls and scallop dredges in boulder habitats is high since gear can overturn boulders and reduce the number of crevices, as well as dislodge cerianthid anemones from the bottom. Redfish are benthic during the day, and become more active at night when they rise off the bottom, following the vertical migration of their primary euphausiid prey (Pikanowski *et al*. 1999). They also eat some benthic fish. Adult EFH was determined to be moderately vulnerable to impacts from otter trawls and scallop dredges. Clam dredges do not operate in areas of redfish EFH, so vulnerability was rated as none.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.30. Rosette skate EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Nantucket Shoals and southern edge of GB to Cape Hatteras	33-530, mostly 74-274		Bottom habitats with soft substrate, including sand/mud bottoms, mud with echinoid and ophiuroid fragments, and shell and pteropod ooze	M	M	M	L	L
Adults	Nantucket Shoals and southern edge of GB to Cape Hatteras	33-530, mostly 74-274		Bottom habitats with soft substrate, including sand/mud bottoms, mud with echinoid and ophiuroid fragments, and shell and pteropod ooze	M	M	M	L	L

Rationale: Rosette skate (*Leucoraja garmani virginica*) is a deeper water species that occurs along the outer shelf and continental slope from Nantucket Shoals to the Dry Tortugas, Florida. North of Cape Hatteras, it is most abundant in the southern section of the Chesapeake Bight. It occurs on soft bottoms, including sand and mud, at depths from 33-530 m, and is most common between 74-274 m (Packer *et al*. 2003d). Major prey items include polychaetes, copepods, cumaceans, amphipods, *Crangon*, crabs, squid, octopods, and small fishes. A single fertilized egg is encapsulated in a leathery case. Egg cases are found in mature females most frequently in the summer (Packer *et al*. 2003d). Information on rosette skate is very limited. Because of the limited information available, the apparent dependence of the juveniles of this species on benthic organisms in its diet, and the reproductive habits of the adults, EFH vulnerability to mobile bottom gear was characterized as moderate.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.31. Scup EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	SNE to coastal Virginia, including the following estuaries: Waquoit Bay to Long Island Sound, Gardiners Bay, and Hudson R./Raritan Bay	(<30)	May to August	Pelagic waters in estuaries	NA	NA	NA	NA	NA
Larvae	SNE to coastal Virginia, including the following estuaries: Waquoit Bay to Long Island Sound, Gardiners Bay, and Hudson R./Raritan Bay	(<20)	May to September	Pelagic waters in estuaries	NA	NA	NA	NA	NA
Juveniles	Continental shelf from GOM to Cape Hatteras, including the following estuaries: Massachusetts Bay, Cape Cod Bay to Long Island Sound, Gardiners Bay to Delaware inland bays, and Chesapeake Bay	(0-38)	Spring and summer in estuaries and bays	Demersal waters north of Cape Hatteras; inshore on various sand, mud, mussel, and eelgrass bed substrates	M	M	M	L	L
Adults	Continental shelf from GOM to Cape Hatteras, including the following estuaries: Cape Cod Bay to Long Island Sound, Gardiners Bay to Hudson R./Raritan Bay, Delaware Bay, Delaware inland bays, and Chesapeake Bay	(2-185)	Wintering adults (November to April) are usually offshore, south of New York to North Carolina	Demersal waters north of Cape Hatteras; inshore estuaries on various substrate types	L	L	L	L	L

Rationale: Scup (*Stenotomus chrysops*) is a temperate species that occurs primarily from Massachusetts to South Carolina, although it has been reported as far north as the Bay of Fundy and Sable Island Bank (Steimle, Zetlin, Berrien, Johnson, and Chang 1999a). Scup are primarily benthic feeders that use a variety of habitat types. Juveniles forage on epibenthic amphipods, other small crustaceans, polychaetes, mollusks, and fish eggs and larvae. They occur over a variety of substrates, and are most abundant in areas without structure. Limited observations of scup have shown periodic use of seafloor depressions for cover (Auster *et al*. 1991, 1995). Adults are found on soft bottoms or near structures. During the summer, they are closer inshore and are found on a wider range of habitats. In the winter, they congregate offshore in areas that are expected to serve as a thermal refuge (Klein-McPhee 2002c), particularly in deeper waters of the outer continental shelf and around canyon heads. Smaller adults feed on echinoderms, annelids, and small crustaceans. Larger scup consume more squids and fishes. Since juvenile scup are primarily benthic feeders, their EFH was rated as moderately vulnerable to impacts from mobile bottom gear. EFH vulnerability for adults was rated as low since there is less of a reliance on benthic prey items.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.

b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.32 Sea scallop EFH -- vulnerability to effects of bottom-tending fishing and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, SNE, middle Atlantic south to Virginia-North Carolina border, and the following estuaries: Passamaquoddy Bay to Sheepscot R., Casco Bay, Massachusetts Bay, and Cape Cod Bay		May through October, peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and in GOM	Bottom habitats	L	L	L	L	L
Larvae	GOM, GB, SNE, middle Atlantic south to Virginia-North Carolina border, and the following estuaries: Passamaquoddy Bay to Sheepscot R., Casco Bay, Massachusetts Bay, and Cape Cod Bay			Pelagic waters	NA	NA	NA	NA	NA
				Bottom habitats with a substrate of gravelly sand, shell fragments, pebbles, or on various red algae, hydroids, amphipod tubes, and bryozoans	L	L	L	L	L
Juveniles	GOM, GB, SNE, middle Atlantic south to Virginia-North Carolina border, and the following estuaries: Passamaquoddy Bay to Sheepscot R., Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110		Bottom habitats with a substrate of cobble, shells, and silt	L	L	L	L	L
Adults	GOM, GB, SNE, middle Atlantic south to Virginia-North Carolina border, and the following estuaries: Passamaquoddy Bay to Sheepscot R., Casco Bay, Great Bay, Massachusetts Bay, and Cape Cod Bay	18-110		Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	L	L	L	L	L
Spawning adults	GOM, GB, SNE middle Atlantic south to Virginia-North Carolina border, and the following estuaries: Passamaquoddy Bay to Sheepscot R., Casco Bay, Massachusetts Bay, and Cape Cod Bay	18-110	May through October, peaks in May and June in middle Atlantic area, and in Sept. and Oct. on GB and in GOM	Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand	L	L	L	L	L

Rationale: Juvenile and adult sea scallops (*Placopecten magellanicus*) are found on the continental shelf of the Northwest Atlantic, from the Gulf of St. Lawrence south to Cape Hatteras, typically between 18 and 110 m, but also as shallow as 2 m in estuaries and embayments along the Maine coast, and as deep as 384 m (Packer, Cargnelli, *et al.* 1999). In the GOM, populations have been reported at depths of 170-180 m. Scallops are rarely found at depths <55 m in "southern areas." Scallop eggs are slightly heavier than seawater and are thought to remain on the bottom during development, but bottom habitats have no known functional value for eggs, and therefore, their vulnerability to fishing was rated as low for all gear types. There are four pelagic larval stages, and EFH vulnerability to fishing gear impacts for these larval stages is not applicable. However, the last larval stage is benthic; at this stage, larvae settle to the bottom (as "spat") and attach to hard surfaces (Packer, Cargnelli, *et al.* 1999). Settlement occurs in areas of gravelly sand with shell fragments. Spat are very delicate and do not survive on shifting sand bottoms. The availability of suitable surfaces on which to settle appears to be a primary requirement for successful reproduction (Packer, Cargnelli, *et al.* 1999). There is a close association between the bryozoan *Eucratea loricata* and spat. *Eucratea* attach to adult scallops, and have been found to contain large numbers of spat. EFH for benthic-phase larvae was given a low rating for vulnerability to all three mobile gear types because any disturbance of the bottom they would cause would most likely redistribute bottom sediments suitable for settlement (gravel, pebbles, shell fragments), but not reduce their availability. Juveniles are found mainly on gravel, small rocks, shells, and silt. During their second growing season (5-12 mm), sea scallops become mobile and leave the original substrate on which they settled, and then re-

<table>
<tr><td colspan="10">Table 6.32 Sea scallop EFH -- vulnerability to effects of bottom-tending fishing and rationale for evaluations</td></tr>
<tr><th rowspan="2">Life Stage</th><th rowspan="2">Geographic Area of EFH[a]</th><th rowspan="2">Depth (m)</th><th rowspan="2">Seasonal Occurrence</th><th rowspan="2">EFH Description</th><th colspan="5">EFH Vulnerability[b]</th></tr>
<tr><th>Otter Trawl</th><th>New Bedford-Style Scallop Dredge</th><th>Hydraulic Clam Dredge</th><th>Pots and Traps</th><th>Sink Gill Nets and Bottom Longlines</th></tr>
<tr><td colspan="10">attach to shells and bottom debris. Otter trawls, scallop dredges, and hydraulic clam dredges are used in bottom habitats occupied by juvenile scallops, but the disturbance of the seafloor caused by these gears does not adversely affect the functional value of the habitat and, therefore, the vulnerability of juvenile scallop EFH to mobile benthic gears was rated as low. The same conclusion was reached for fixed gear which cause negligible disturbance to the seafloor. Juveniles and adults are found in benthic habitats with at least some water movement, which is critical for feeding, oxygen and removal of waste; optimal growth for adults occurs at 10 cm/sec (Packer, Cargnelli, et al. 1999). Adult scallops inhabit coarse substrates, usually gravel, shell, and rock. Because fine clay particles interfere with feeding activity, scallops are not usually found on muddy bottom. No scientific information exists that indicates mobile fishing gears have a negative impact on the functional value of adult scallop EFH. The vulnerability of adult scallop EFH to mobile benthic gears was therefore rated as low.</td></tr>
<tr><td colspan="10">a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.</td></tr>
</table>

Table 6.33. Silver hake EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Merrimack R. to Cape Cod Bay	50–150	All year, peaks June to October	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Massachusetts Bay to Cape Cod Bay	50–130	All year, peaks July to September	Surface waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Passamaquoddy Bay to Casco Bay, and Massachusetts Bay to Cape Cod Bay	20–270		Bottom habitats of all substrate types	M	M	M	L	L
Adults	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Passamaquoddy Bay to Casco Bay, and Massachusetts Bay to Cape Cod Bay	30–325		Bottom habitats of all substrate types	L	L	L	L	L
Spawning adults	GOM, GB, continental shelf off SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Massachusetts Bay and Cape Cod Bay	30–325		Bottom habitats of all substrate types	L	L	L	L	L

Rationale: Silver hake or whiting (*Merluccius bilinearis*) range from Newfoundland south to Cape Fear, NC, and are most common from Nova Scotia to New Jersey (Morse *et al*. 1999). They are distributed broadly, and are found from nearshore shallows out to a depth of 400 m (Klein-MacPhee 2002f). All life stages have been found in estuaries from Maine to Cape Cod Bay (Morse *et al*. 1999). The vertical movement of silver hake is governed chiefly by their pursuit of prey; both juveniles and adults show a vertical migration off the bottom at night when feeding activity is greatest. In the Mid-Atlantic Bight, juvenile silver hake have been found in greater densities in areas with greater amphipod tube cover (Auster *et al*. 1997). Further, silver hake size distributions in sand wave habitats are positively correlated with sand wave period (*i.e.*, the spacing between sand waves), suggesting energetic or prey capture benefits in particular sand wave environments (Auster, Lindholm, Schaub, *et al.* 2003). Juveniles are primarily found on silt or sand substrate, and feed mainly on crustaceans, including copepods, amphipods, euphausiids, and decapod crustaceans (Morse *et al*. 1999). The vulnerability of juvenile EFH to mobile gear was rated as moderate because of the potential connection between structure and habitat suitability for this life stage. Adult silver hake rest on the bottom in depressions by day, primarily over sand and pebble bottoms, and rarely in rockier areas. In the Mid-Atlantic Bight, adults were found on flat sand, sand wave crests, shell, and biogenic depressions, but were most often found on flat sand. At night, adults feed on anchovies, herring, lanternfish, and other fishes (Klein-MacPhee 2002f). Piscivory increases with size for this species. Vulnerability of adult silver hake EFH to the three mobile gear types was rated as low because of silver hake's piscivorous food habits and preference for higher energy sand environments which recover quickly from fishing gear impacts (see Chapter 5 of this document). Eggs and larvae of this species are pelagic, so habitat vulnerability to fishing gear is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.34. Smooth skate EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b] Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Offshore banks of GOM	31–874, mostly 110-457		Bottom habitats with a substrate of soft mud (silt and clay), sand, broken shells, gravel, and pebbles	M	M	0	L	L
Adults	Offshore banks of GOM	31–874, mostly 110-457		Bottom habitats with a substrate of soft mud (silt and clay), sand, broken shells, gravel, and pebbles	H	H	0	L	L

Rationale: Smooth skate's (*Malacoraja senta*) center of abundance is the GOM. It occurs along the Atlantic coast from the Gulf of St. Lawrence south to South Carolina, at depths between 31-874 m (Packer *et al*. 2003e). It is most abundant between 110-457 m. Analysis of NEFSC trawl survey data found juvenile skate most abundant between depths of 100 -300 m during 1963-1969. Smooth skate are found mostly over soft mud and clay of the GOM's deepwater basins, but also over the gulf's offshore banks with substrates of sand, shell, and/or gravel (Packer *et al*. 2003e). The diet of smooth skate is generally limited to epifaunal crustaceans, with decapod shrimp and euphausids as the most common prey, followed by amphipods and mysids. The diet shifts from amphipods and mysids to decapod crustaceans as smooth skate grow (Packer *et al*. 2003e). The diet of smooth skate is more restricted than that of other skate species (McEachran 2002). The vulnerability of juvenile smooth skate EFH to otter trawls and scallop dredges was characterized as moderate because of the dietary habits of this species. The vulnerability of adult EFH was rated as high for otter trawls and scallop dredges because of the benthic diet as well as the reproductive habits of the species. Vulnerability to clam dredges was considered to be none for juveniles and adults since this gear is not used in the GOM.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.35 Spanish mackerel EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b] Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
All life stages	South Atlantic and Mid-Atlantic Bights			Sandy shoals of capes and offshore bars; high-profile rock bottoms and barrier island oceanside waters from surf zone to shelf break, but from the Gulf Stream shoreward	NA	NA	NA	NA	NA

Rationale: All life stages of Spanish mackerel (*Scomberomorus maculatus*) are pelagic, so their EFH is not vulnerable to bottom-tending fishing gear, and vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.36. Spiny dogfish EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Juveniles	Across the continental shelf from GOM to Cape Hatteras, and south of Cape Hatteras through Florida; also includes the following estuaries: Passamaquaddy Bay to Saco Bay; Massachusetts Bay, and Cape Cod Bay	10-390		Continental shelf waters and estuaries	L	L	L	L	L
Adults	Across the continental shelf from GOM to Cape Hatteras, and south of Cape Hatteras through Florida; also includes following estuaries: Passamaquaddy Bay to Saco Bay, Massachusetts Bay, and Cape Cod Bay	10-450		Continental shelf waters and estuaries	L	L	L	L	L

Rationale: The spiny dogfish (*Squalus acanthias*) is a coastal shark with a circumboreal distribution, and is one of the most abundant sharks in the western North Atlantic (McMillan and Morse 1999). Female dogfish are viviparous, so EFH designations were limited to juveniles and adults. Smaller dogfish have been reported to feed primarily on crustaceans, with an increase in piscivory in larger individuals (Burgess 2002). Fish, mainly schooling pelagic species, constitute 50% of their diet. Their voracious and opportunistic feeding behavior was emphasized by McMillan and Morse (1999). Since neither of these life stages appears to be closely tied to benthic organisms, the vulnerability of their EFH to mobile gear was rated as low.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.37. Summer flounder EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description		EFH Vulnerability[b]: Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	Over continental shelf from GOM to Florida	30-70 in fall; 110 in winter; 9-30 in spring	October to May	Pelagic waters; heaviest concentrations within 9 mi of shore off New Jersey and New York		NA	NA	NA	NA	NA
Larvae	Over continental shelf from GOM to Florida; also includes the following estuaries: Waquoit Bay to Narragansett Bay, Hudson R./Raritan Bay, Barnegat Bay, Chesapeake Bay, Rappahannock R., York R., James R., Albemarle Sound, Pamlico Sound, and Neuse R. to Indian R.	10-70	Mid-Atlantic Bight from September to February; southern part of range from November to May at depths of 9-30 m	Pelagic waters; larvae most abundant 19-83 km from shore		NA	NA	NA	NA	NA
Juveniles	Over continental shelf from GOM to Florida; also includes the following estuaries: Waquoit Bay to James R., and Albemarle Sound to Indian R.	0.5–5 in estuary		Demersal waters, on muddy substrate but prefer mostly sand; found in the lower estuaries in flats, channels, salt marsh creeks, and eelgrass beds	HAPC	H	0	0	NA	NA
					Non-HAPC	L	L	L	0	0
Adults	Over continental shelf from GOM to Florida; also includes the following estuaries: Buzzards Bay, Narragansett Bay, Connecticut R. to James R., Albemarle Sound to Broad R.; St. Johns R., and Indian R.	0-25	Shallow coastal and estuarine waters during warmer months; move offshore on outer continental shelf at depths of 150 m in colder months	Demersal waters and estuaries	HAPC	H	0	0	NA	NA
					Non-HAPC	L	L	L	0	0

Rationale: Summer flounder (*Paralichthys dentatus*) occur in the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida, with the center of their range located in the Mid-Atlantic Bight (Packer, Griesbach, *et al*. 1999). Juvenile summer flounder are opportunistic feeders, and their diet includes fish, mysids, and some other crustaceans (Packer, Griesbach, *et al*. 1999). There are gradual changes in the diet of summer flounder, with fish becoming more important as a food source as individuals get older and larger. Adults are also opportunistic feeders, with fish and crustaceans making up a significant portion of their diet. Eelgrass and macroalgae beds have been designated as habitat areas of particular concern (HAPC) for adult and juvenile summer flounder. Stephan *et al*. (2000) determined that otter trawls could result in below-ground impacts to submerged aquatic vegetation (SAV), which, of all the impacts to SAV possible from fishing gear, was ranked as the impact of greatest concern. Based on potential impacts to SAV, the vulnerability of the summer flounder HAPC to otter trawls was rated as high. Sea scallop and surfclam/quahog dredges are not used in estuaries where SAV is found. Fixed, bottom-tending gears, such as pots, traps, and sink gillnets, may be used in inshore SAV beds, but if so, their use is not federally-regulated. Thus, the vulnerability of juvenile and adult HAPCs to the effects of these gear types is not applicable. Since adults and juveniles are both opportunistic feeders, the vulnerability of EFH that is not designated as HAPC was rated as low for bottom trawls and dredges. Summer flounder eggs and larvae are pelagic, so EFH vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.38. Thorny skate EFH--vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	**New Bedford-Style Scallop Dredge**	**Hydraulic Clam Dredge**	**Pots and Traps**	**Sink Gill Nets and Bottom Longlines**
Juveniles	GOM and GB	18-2000, mostly 111-366		Bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud	M	M	0	L	L
Adults	GOM and GB	18-2000, mostly 111-366		Bottom habitats with a substrate of sand, gravel, broken shell, pebbles, and soft mud	M	M	0	L	L

Rationale: Thorny skate (*Amblyraja radiata*) range from Greenland south to South Carolina. In the Northeast Region, this species is most commonly seen in the GOM and on the Northeast Peak and in the northern portion of the Great South Channel of GB. It is one of the most common skates in the GOM, and occurs over a wide variety of bottom substrates, including sand, gravel, and broken shell to mud (Packer *et al*. 2003f). It is found at depths ranging from 18-1200 m, and is reported to be most common between 50-350 m. A single fertilized egg is encapsulated in an egg case. Females with fully formed egg cases have been captured year-round, though the percentage of mature females with egg cases is higher in the summer (Packer *et al*. 2003f). The primary prey of thorny skates are polychaetes and decapod crustaceans, followed by amphipods and euphausiids. Fish and mysids are also consumed in lesser quantities. According to a survey from Nova Scotia to Cape Hatteras, thorny skate prey varies with skate size. Skates less than 40 cm total length feed mostly on amphipods, skates greater than 40 cm fed on polychaetes and decapod crustaceans, and fishes were a major dietary component for skates larger than 70 cm. In general, with increasing size, mysids decreased in the diet while fishes increased (Packer *et al*. 2003f). Since juvenile thorny skate appear to be more reliant on benthic invertebrates, vulnerability of EFH to otter trawls and scallop dredges for this life stage was characterized as moderate. For adults, EFH vulnerability to otter trawls and scallop dredges was characterized as moderate because of their reproductive habits. EFH vulnerability to clam dredges was rated as none for juveniles and adults since there is no overlap between thorny skate EFH and areas in which clam dredges are used.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.39. Tilefish EFH--vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	U.S./Canadian boundary to Virginia/North Carolina boundary (shelf break: GB to Cape Hatteras)	76-365	Serial spawning from March to November; peaks during April to October	Water column	NA	NA	NA	NA	NA
Larvae	U.S./Canadian boundary to Virginia/North Carolina boundary (outer continental shelf: GB to Cape Hatteras)	76-365	February to October; peaks during July to October	Water column	NA	NA	NA	NA	NA
Juveniles	U.S./Canadian boundary to Virginia/North Carolina boundary (shelf break, submarine canyon walls, and flanks: GB to Cape Hatteras)	76-365	All year; may leave GB in winter	Rough bottom, small burrows, and sheltered areas; substrate rocky, stiff clay, human debris	H	L	0	L	L
Adults	U.S./Canadian boundary to Virginia/North Carolina boundary (shelf break, submarine canyon walls, and flanks: GB to Cape Hatteras)	76-365	All year; may leave GB in winter	Rough bottom, small burrows, and sheltered areas; substrate rocky, stiff clay, human debris	H	L	0	L	L

Rationale: Tilefish (*Lopholatilus chamaeleonticeps*) are restricted to the continental shelf break south of the Gulf of Maine (Steimle, Berrien, Johnson and Chang 1999). They occupy a number of habitats, including scour basins around rocks or other rough bottom areas that form burrow-like cavities, and pueblo habitats in clay substrate. The dominant habitat type is a vertical burrow in a substrate of semi-hard silt-clay, 2 - 3 m deep and 4 - 5 m in diameter with a funnel shape. These burrows are excavated by tilefish, secondary burrows are created by other organisms, including lobsters, conger eels, and galatheid crabs. Tilefish are visual daytime feeders on galatheid crabs, mollusks, shrimps, polychaetes, and occasionally fish. Mollusks and echinoderms are more important to smaller tilefish. Little is known about juveniles of the species. A report to the Mid-Atlantic Fishery Management Council (Able and Muzeni 2002), based upon a review of archived video surveys in areas of tilefish habitat, did not find visual evidence of direct impacts to burrows due to otter trawls. The Northeast Region EFH Steering Committee Workshop (NREFHSC 2002) concluded that there was the potential for a high degree of impact to the physical structure of hard clay outcroppings (pueblo village habitat) by trawls that would result in permanent change to a major physical feature which provides shelter for tilefish as well as their benthic prey. Although Able and Muzeni's (2002) review did not offer any evidence of this type of negative effect, their sample size for this habitat type was very small. Due to the tilefish's reliance on structured shelter and benthic prey, as well as the benthic prey's reliance on much of the same habitat, and the need for further study, the vulnerability of tilefish EFH to otter trawls was ranked as high. Clam dredges operate in shallow, sandy waters typically uninhabited by tilefish, so EFH vulnerability was rated as none for this gear. Scallop vessel monitoring data (Section 4) indicate that scallop dredges operate to a small extent in areas overlapping tilefish EFH; therefore, EFH vulnerability to scallop dredges was ranked as low. Tilefish eggs and larvae are pelagic; therefore, EFH vulnerability is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.40. White hake EFH-vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, SNE, and the following estuaries: Great Bay to Cape Cod Bay		August to September	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, southern edge of GB, SNE to middle Atlantic, and the following estuaries: Massachusetts Bay to Cape Cod Bay		May in mid-Atlantic area, August and September in GOM, GB area	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOM, southern edge of GB, SNE to middle Atlantic, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Cape Cod Bay	5-225	May to September	Pelagic stage--pelagic waters; demersal stage--bottom habitat with seagrass beds or substrate of mud or fine-grained sand	M	M	0	L	L
Adults	GOM, southern edge of GB, SNE to middle Atlantic, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Cape Cod Bay	5-325		Bottom habitats with substrate of mud or fine-grained sand	L	L	0	L	L
Spawning adults	GOM, southern edge of GB, SNE to middle Atlantic	5-325	April to May, southern part of range; August to September, northern part of range	Bottom habitats with substrate of mud or fine-grained sand in deepwater	L	L	0	L	L

Rationale: White hake (*Urophycis tenuis*) adults co-occur geographically with red hake, and their habits are similar, but white hake are distributed in a wider range of depths and temperatures (Chang, Morse, *et al*. 1999; Klein-MacPhee 2002a). They are found from Labrador south to North Carolina, and occasionally stray as far as Florida and Iceland. They inhabit coastal estuaries and occur across the continental shelf to the submarine canyons along the upper continental shelf, and in the basins of the GOM. Adult distribution in the region is focused in the GOM and along the southern slope of Georges Bank. All life stages are found in estuaries near the GOM (NEFMC 1998). Most pelagic juveniles cross the shelf and enter estuaries from Canada south to the Mid-Atlantic Bight, although some may also settle to the bottom in unknown shelf habitats (Klein-MacPhee 2002a). Demersal juveniles are found in nearshore waters out to a depth of about 225 m (Chang, Morse, *et al*. 1999). Eelgrass is an important habitat for juveniles, but its functional importance is unknown; this life stage is not necessarily dependent upon structure (Able and Fahay 1998). Young-of-the-year white hake feed mainly on shrimp, mysids, and amphipods. Since otter trawls and scallop dredges can negatively impact eelgrass (Stephan *et al*. 2000) in estuaries, vulnerability of juvenile white hake EFH to these gears was characterized as moderate. Hydraulic clam dredges are not utilized in estuaries of the GOM, so vulnerability to this gear was rated as none. Adults prefer benthic deposits of fine-grained sediments (Chang, Morse, *et al*. 1999). They feed primarily on fish, cephalopods, and crustaceans. Since they are not benthivores and have not been documented to use benthic habitats for cover, EFH vulnerability to otter trawls and scallop dredges was characterized as low. Clam dredges are not operated in areas of adult EFH, and vulnerability to this gear was rated as none.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.41. Windowpane EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GOM, GB, SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Delaware inland bays	<70	February to November, peaks May and October in middle Atlantic, July to August on GB	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Delaware inland bays	<70	February to November, peaks May and October in middle Atlantic, July to August on GB	Pelagic waters	NA	NA	NA	NA	NA
Juveniles	GOM, GB, SNE, middle Atlantic south to Cape Hatteras, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Chesapeake Bay	1-100		Bottom habitats with substrate of mud or fine-grained sand	L	L	L	L	L
Adults	GOM, GB, SNE, middle Atlantic south to Virginia/North Carolina border, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Chesapeake Bay	1-75		Bottom habitats with substrate of mud or fine-grained sand	L	L	L	L	L
Spawning adults	GOM, GB, SNE, middle Atlantic south to Virginia/North Carolina border, and the following estuaries: Passamaquoddy Bay to Great Bay, and Massachusetts Bay to Delaware inland bays	1-75	February to December, peak in May in middle Atlantic	Bottom habitats with substrate of mud or fine-grained sand	L	L	L	L	L

Rationale: Windowpane flounder (*Scophthalmus aquosus*) is distributed in coastal waters from the Gulf of St. Lawrence to Florida, and are most abundant on GB and in the New York Bight (Klein-MacPhee 2002b). Windowpane are abundant in estuaries from Maine through Chesapeake Bay (NEFMC 1998). They are a shoal-water fish, with a depth range of up to 200 m, but are most abundant in waters less than 50 m deep. Both juveniles and adults are found on muddy sediments in the GOM, and fine, sandy sediments on GB and in New England and the Mid-Atlantic Bight. Mysids are the main prey item of juveniles (Klein-MacPhee 2002b). Adults have been shown to feed exclusively on nekton and show little need for bottom structure (Chang, Berrien, Johnson, and Morse 1999). EFH vulnerability to the three types of mobile gear was rated as low for both these life stages. Windowpane eggs and larvae are pelagic, so EFH vulnerability to fishing gear is not applicable for these two life stages.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.42. Winter flounder EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GB, inshore areas of GOM, SNE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware inland bays	<5	February to June, peak in April on GB	Bottom habitats with a substrate of sand, muddy sand, mud, and gravel	L	L	L	L	L
Larvae	GB, inshore areas of GOM, SNE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware inland bays	<6	March to July, peak in April and May on GB	Pelagic and bottom waters	L	L	L	L	L
Juveniles	GB, inshore areas of GOM, SNE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	0.1–10 (1-50, age 1+)		Bottom habitats with a substrate of mud or fine-grained sand	L	L	L	L	L
Adults	GB, inshore areas of GOM, SNE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Chincoteague Bay	1-100		Bottom habitats including estuaries with substrates of mud, sand, gravel	M	M	M	L	L
Spawning adults	GB, inshore areas of GOM, SNE, middle Atlantic south to Delaware Bay and the following estuaries: Passamaquoddy Bay to Delaware inland bays	<6	February to June	Bottom habitats including estuaries with substrates of mud, sand, gravel	M	M	M	L	L

Rationale: Winter flounder (*Pseudopleuronectes americanus*) range from Labrador to Georgia, and are most abundant from the Gulf of St. Lawrence to Chesapeake Bay (Klein-MacPhee 2002d). Juveniles and adults are found in waters less than 100 m deep, and most are found from shore to 30 m. They range far upstream in estuaries, and have been found in freshwater. Winter flounder lay demersal adhesive eggs in shallow water less than 5 m in depth, with the exception of spawning areas on GB and Nantucket shoals (Pereira *et al*. 1999). Substrates include sand, muddy sand, mud, and gravel, with sand the most common. Although otter trawls, scallop dredges, and clam dredges may affect the eggs directly, this was not considered a habitat impact. Since there is no indication that the eggs rely on any structure, egg EFH vulnerability to these three gears was rated as low. Since early stage larvae are associated with the bottom and are at times demersal (Able and Fahay 1998), larval EFH vulnerability to all gears was also rated as low instead of none. Juvenile and adult winter flounder are found on mud and sand substrates, and adults are seen on cobble, rocks, and boulders (Pereira *et al*. 1999). Both life stages can be opportunistic feeders, however, their main prey items are infaunal invertebrates. Because of their reliance on infauna and their ability to use alternative food supplies, EFH vulnerability to the three mobile gear types for these life stages was ranked as moderate.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.43. Winter skate EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	**New Bedford-Style Scallop Dredge**	**Hydraulic Clam Dredge**	**Pots and Traps**	**Sink Gill Nets and Bottom Longlines**
Juveniles	Cape Cod Bay, GB, SNE shelf through Mid-Atlantic Bight to North Carolina; includes estuaries from Buzzards Bay south to Chesapeake Bay	0-37, mostly <111		Bottom habitats with substrate of sand and gravel or mud	M	M	M	L	L
Adults	Cape Cod Bay, GB SNE shelf through Mid-Atlantic Bight to North Carolina; includes estuaries from Buzzards Bay south to Chesapeake Bay	0-371, mostly <111		Bottom habitats with substrate of sand and gravel or mud	M	M	M	L	L

Rationale: Winter skate (*Leucoraja ocellata*) are found from Newfoundland south to Cape Hatteras. They are most abundant on GB and in coastal waters south to the mouth of the Hudson River. They are found over substrates of sand, gravel, and mud, in depths from shore out to 371 m, and are most common in <111 m of water (Packer *et al*. 2003g). Females deposit single fertilized eggs in egg capsules, which are deposited on the bottom during summer in the northern portion of the range. Deposition has been reported to extend through January off SNE. Young are fully developed at hatching (Packer *et al*. 2003g). Polychaetes and amphipods are the most important prey items, followed by decapod crustaceans, isopods, bivalves, and fish. In general, crustaceans make up over 50% of the diet for skate smaller than 61 cm, and fish and bivalves are a major component of the diet for skates larger than 79 cm (Packer *et al*. 2003g). Crustaceans generally declined in importance with increasing skate size, while polychaetes increased, until skates reached 81 cm. Since juvenile winter skate appear to be more reliant on benthic invertebrates, vulnerability of EFH to mobile gear for this life stage was characterized as moderate. For adults, EFH vulnerability to mobile gear was characterized as moderate because of their reproductive habits.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.44. Witch flounder EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	**New Bedford-Style Scallop Dredge**	**Hydraulic Clam Dredge**	**Pots and Traps**	**Sink Gill Nets and Bottom Longlines**
Eggs	GOM, GB, continental shelf off SNE, and middle Atlantic south to Cape Hatteras	Deep	March to October	Surface waters	NA	NA	NA	NA	NA
Larvae	GOM, GB, continental shelf off SNE, and middle Atlantic south to Cape Hatteras	Deep	March to November, peaks from May to July	Surface waters	NA	NA	NA	NA	NA
Juveniles	GOM and outer continental shelf from GB south to Cape Hatteras	50-450		Bottom habitats with fine-grained substrate	M	L	0	L	L
Adults	GOM and outer continental shelf from GB south to Chesapeake Bay	25-300		Bottom habitats with fine-grained substrate	M	L	L	L	L
Spawning adults	GOM and outer continental shelf from GB south to Chesapeake Bay	25-360	March to November, peaks from May to August	Bottom habitats with fine-grained substrate	M	L	L	L	L

Rationale: Witch flounder (*Glyptocephalus cynoglossus*) range from Newfoundland south to Cape Hatteras. In U.S. waters, this species is common throughout the GOM, and is found in the deeper areas of and adjacent to GB and along the continental shelf edge and upper slope (Cargnelli, Griesbach, Packer, Berrien, Morse, *et al.* 1999, Klein-MacPhee 2002d). Juvenile and adult witch flounder are found mainly over fine muddy sand, or mud. Their diet is comprised mainly of polychaetes, and they feed on other invertebrates as well (Cargnelli , Griesbach, Packer, Berrien, Morse, *et al.* 1999). Since these life stages occur in areas of lower natural disturbance and rely on infauna, EFH vulnerability to impacts from otter trawls were rated as moderate. Impacts from scallop dredging may be less severe, since scallop dredges are not usually used in muddy habitat; however, vessel trip reports indicated scallop dredging in areas of witch flounder EFH (see Chapter 4 of this document). Therefore, vulnerability to scallop dredges was rates as low. Juvenile EFH vulnerability to clam dredges was rated as none since clam dredges are not used in mud or in water depths where juvenile witch flounder are primarily found. However, EFH vulnerability to clam dredges for adults was rated as low since clam dredges do operate in adult EFH. Eggs and larvae of witch flounder are pelagic, so vulnerability of EFH to fishing gear impacts is not applicable.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

Table 6.45. Yellowtail flounder EFH -- vulnerability to effects of bottom-tending fishing gears and rationale for evaluations

Life Stage	Geographic Area of EFH[a]	Depth (m)	Seasonal Occurrence	EFH Description	EFH Vulnerability[b]				
					Otter Trawl	New Bedford-Style Scallop Dredge	Hydraulic Clam Dredge	Pots and Traps	Sink Gill Nets and Bottom Longlines
Eggs	GB, Massachusetts Bay, Cape Cod Bay, SNE continental shelf south to Delaware Bay, and the following estuaries: Passamaquoddy Bay to Saco Bay; Great Bay to Cape Cod Bay	30-90	Mid-March to July, peaks in April to June in SNE	Surface waters	NA	NA	NA	NA	NA
Larvae	GB, Massachusetts Bay, Cape Cod Bay, SNE continental shelf, middle Atlantic south to Chesapeake Bay, and the following estuaries: Passamaquoddy Bay to Cape Cod Bay	10-90	March to April in New York Bight; May to July in SNE and southeastern GB	Surface waters	NA	NA	NA	NA	NA
Juveniles	GB, GOM, SNE continental shelf south to Delaware Bay, and the following estuaries: Sheepscot R., Casco Bay, Massachusetts Bay to Cape Cod Bay	20-50		Bottom habitats with substrate of sand or sand and mud	M	M	M	L	L
Adults	GB, GOM, SNE continental shelf south to Delaware Bay, and the following estuaries: Sheepscot R., Casco Bay, Massachusetts Bay to Cape Cod Bay	20-50		Bottom habitats with substrate of sand or sand and mud	M	M	M	L	L
Spawning adults	GB, GOM, SNE continental shelf south to Delaware Bay, and the following estuaries: Massachusetts Bay to Cape Cod Bay	10-125		Bottom habitats with substrate of sand or sand and mud	M	M	M	L	L

Rationale: Yellowtail flounder (*Limanda ferruginea*) are found from the Gulf of St. Lawrence south to the Chesapeake Bay (Johnson *et al*. 1999; Klein-MacPhee 2002d). They are most abundant on the western half of GB, western GOM, east of Cape Cod, and off SNE (Johnson *et al*. 1999). Their usual depth range is from 10-100 m (Klein-MacPhee 2002d). Juveniles and adults are found in some New England estuaries, while eggs and larvae are found more frequently in these habitats (NEFMC 1998). Yellowtail eggs and larvae are pelagic, so EFH vulnerability is not applicable. Yellowtail flounder feed mainly on benthic macrofauna, primarily amphipods and polychaetes (Johnson *et al*. 1999). Adults eat mostly crustaceans while juveniles focus on polychaetes. Both life stages are found on substrates of sand or sand and mud. Vulnerability of juvenile and adult EFH to the three types of mobile gear was rated as moderate because of the potential effect of these gears on infaunal yellowtail prey.

a EFH Geographic Areas: GOM = Gulf of Maine; GB = Georges Bank; and SNE = Southern New England.
b EFH Vulnerability Category (derived from the matrix analysis in Table 6.1): NA = not applicable; 0 = no vulnerability; L = low vulnerability; M = moderate vulnerability; and H = high vulnerability.

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APPENDIX H. DESCRIPTION OF SPECIES LISTED AS ENDANGERED AND THREATENED WHICH INHABIT THE MANAGEMENT UNIT OF THE FMP

(References mentioned in the text below are listed in section 11.0 in Volume 1 of this document)

North Atlantic Right Whale

Right whales have occurred historically in all the world's oceans from temperate to subarctic latitudes. NMFS recognizes three major subdivisions of right whales: North Pacific, North Atlantic, and Southern Hemisphere. NMFS further recognizes two extant subunits in the North Atlantic: eastern and western. A third subunit may have existed in the central Atlantic (migrating from east of Greenland to the Azores or Bermuda), but this stock appears to be extinct (Waring et al. 2002).

The north Atlantic right whale has the highest risk of extinction among all of the large whales in the worlds oceans. The scarcity of right whales is the result of an 800-year history of whaling that continued into the 1960s (Klumov 1962). Historical records indicate that right whales were subject to commercial whaling in the North Atlantic as early as 1059. Between the 11th and 17th centuries, an estimated 25,000-40,000 right whales may have been harvested. The size of the western north Atlantic right whale population at the termination of whaling is unknown, but the stock was recognized as seriously depleted as early as 1750. However, right whales continued to be taken in shore-based operations or opportunistically by whalers in search of other species as late as the 1920's. By the time the species was internationally protected in 1935, there may have been fewer than 100 western north Atlantic right whales in the western Atlantic (Hain 1975; Reeves et al. 1992; Waring et al. 2002).

Right whales appear to prefer shallow coastal waters, but their distribution is also strongly correlated to the distribution of their prey (zooplankton). In both the northern and southern hemispheres, right whales are observed in the lower latitudes and more coastal waters during winter where calving takes place, and then tend to migrate to higher latitudes during the summer. The distribution of right whales in summer and fall in both hemispheres appears linked to the distribution of their principal zooplankton prey (Winn et al. 1986). They generally occur in Northwest Atlantic waters west of the Gulf Stream and are most commonly associated with cooler waters (21ºC). They are not found in the Caribbean and have been recorded only rarely in the Gulf of Mexico.

Right whales feed on zooplankton through the water column, and in shallow waters may feed near the bottom. In the Gulf of Maine they have been observed feeding on zooplankton, primarily copepods, by skimming at or below the water's surface with open mouths (NMFS 1991; Kenney et al. 1986; Murison and Gaskin 1989; and Mayo and Marx 1990). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Waring et al. 2000). New England waters include important foraging habitat for right whales and at least some portion of the North Atlantic right whale population is present in these waters throughout most months of the year. They are most abundant in Cape Cod Bay between February and April (Hamilton and Mayo 1990; Schevill et al. 1986; Watkins and Schevill 1982) and in the Great South Channel in May and June (Payne et al. 1990) where they have been observed feeding predominantly on copepods, largely of the genera Calanus and Pseudocalanus (Waring et al. 2002). Right whales also frequent Stellwagen Bank and Jeffrey's Ledge, as well as Canadian waters including the Bay of Fundy and Browns and Baccaro Banks, in the spring and summer months. Mid-Atlantic waters are used as a migratory pathway from the spring and summer feeding/nursery areas to the winter calving grounds off the coast of Georgia and Florida.

NMFS designated right whale critical habitat on June 3, 1994 (59 FR 28793) to help protect important right whale foraging and calving areas within the U.S. These include the waters of Cape Cod Bay and the Great South Channel off the coast of Massachusetts, and waters off the coasts of southern Georgia and northern Florida. In 1993, Canada's Department of Fisheries declared two conservation areas for right whales; one in the Grand Manan Basin in the lower Bay of Fundy, and a second in Roseway Basin between Browns and Baccaro Banks (Canadian Recovery Plan for the North Atlantic Right Whale 2000).

The northern right whale was listed as endangered throughout its range on June 2, 1970 under the ESA. The current population is considered to be at a low level and the species remains designated as endangered (Waring et al. 2002). A Recovery plan has been published and currently is in effect (NMFS 1991). This is a strategic stock because the average annual fishery-related mortality and serious injury from all fisheries exceeds the PBR.

The western North Atlantic population of right whales was estimated to be 291 individuals in 1998 (Waring et al. 2002). The current population growth rate of 2.5% as reported by Knowlton et al. (1994) suggests the stock may be showing signs of slow recovery. The best available information makes it reasonable to conclude that the current death rate exceeds the birth rate in the western North Atlantic right whale population. The nearly complete reproductive failure in this population from 1993 to 1995 and again in 1998 and 1999 suggests that this pattern has continued for almost a decade, though the 2000/2001 season appears the most promising in the past 5 years, in terms of calves born. Because no population can sustain a high death rate and low birth rate indefinitely, this combination places the North Atlantic right whale population at high risk of extinction. Coupled with an increasing calving interval, the relatively large number of young right whales (0-4 years) and adults that are killed, by human-related factors, the likelihood of extinction is high. The recent increase in births gives rise to optimism, however these young animals must be provided with protection so that they can mature and contribute to future generations in order to be a factor in stabilizing of the population.

Right whales may be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries. However, the major known sources of anthropogenic mortality and injury of right whales clearly are ship strikes and entanglement in commercial fishing gear. Waring et al. (2002) give a detailed description of the annual human related mortalities of right whales.

Humpback Whale

The humpback whale was listed as endangered throughout its range on June 2, 1970. This species is the fourth most numerically depleted large cetacean worldwide. Humpback whales calve and mate in the West Indies and migrate to feeding areas in the northwestern Atlantic during the summer months. Six separate feeding areas are utilized in northern waters after their return (Waring et al. 2002). Only one of these feeding areas, the GOM, lies within U.S. waters and is within the action area of this consultation. Most of the humpbacks that forage in the GOM visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Sightings are most frequent from mid-March through November between 41º N and 43º N, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffreys Ledge (CeTAP 1982b), and peak in May and August. Small numbers of individuals may be present in this area year-round. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, by targeting fish schools and filtering large amounts of water for their associated prey. Humpback whales have also been observed feeding on krill (Wynne and Schwartz 1999).

Various papers (Barlow and Clapham 1997; Clapham et al. 1999) summarized information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales. These photographs identified reproductively mature western North Atlantic humpbacks wintering in tropical breeding grounds in the Antilles, primarily on Silver and Navidad Banks, north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico (Waring et al. 2002). In general, it is believed that calving and copulation take place on the winter range. Calves are born from December through March and are about 4 meters at birth. Sexually mature females give birth approximately every 2 to 3 years. Sexual maturity is reached between 4 and 6 years of age for females and between 7 and 15 years for males. Size at maturity is about 12 meters.

Humpback whales use the mid-Atlantic as a migratory pathway, but it may also be an important feeding area for juveniles. Since 1989, observations of juvenile humpbacks in the mid-Atlantic have been increasing during the winter months, peaking January through March (Swingle et al. 1993). Biologists speculate that non-reproductive animals may be establishing a winter feeding range in the mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Swingle et al. (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months. Those whales using this mid-Atlantic area that have been identified were found to be residents of the GOM and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding stocks in the mid-Atlantic region. A shift in distribution may be related to winter prey availability. Studies conducted by the Virginia Marine Science Museum indicate that these whales are feeding on, among other things, bay anchovies and menhaden. In concert with the increase in mid-Atlantic whale sightings, strandings of humpback whales have increased between New Jersey and Florida since 1985. Strandings were most frequent during September through April in North Carolina and Virginia waters, and were comprised primarily of juvenile humpback whales of no more than 11 meters in length (Wiley et al. 1995). Six of 18 humpbacks for which the cause of mortality was determined were killed by vessel strikes. An additional humpback had scars and bone fractures indicative of a previous vessel strike that may have contributed to the whale's mortality. Sixty percent of those mortalities that were closely investigated showed signs of entanglement or vessel collision.

New information has recently become available on the status and trends of the humpback whale population in the North Atlantic. Although current and maximum net productivity rates are unknown at this time, the population is apparently increasing. It has not yet been determined whether this increase is uniform across all six feeding stocks (Waring et al. 2002). For example, the overall rate of increase has been estimated at 9.0% (CV=0.25) by Katona and Beard (1990), while a 6.5% rate was reported for the Gulf of Maine by Barlow and Clapham (1997) using data through 1991. The rate reported by Barlow and Clapham (1997) may roughly approximate the rate of increase for the portion of the population within the action area.

Estimating abundance for the Gulf of Maine stock has proved problematic. Three approaches have been investigated: mark-recapture estimates, minimum population size, and line-transect estimates. Most of the mark recapture estimates were affected by heterogeneity of sampling, which was heavily focused on the southwestern Gulf of Maine. However, an estimate of 652 (CV=0.29) derived from the more extensive and representative YONAH sampling in 1992 and 1993 was probably less subject to this bias. The second approach uses photo-identification data to establish the minimum number of humpback whales known to be alive in a particular year, 1997. By determining the number of identified individuals seen either in that year, or in both a previous and subsequent year, it is possible to determine that at least 497 humpbacks were alive in 1997. This figure is also likely to be negatively biased, again because of heterogeneity of sampling. A similar calculation for 1992 (which would correspond to the YONAH estimate for the Gulf of Maine) yields a figure of 501 whales (Waring et al. 2002).

In the third approach, data were used from a 28 July to 31 August 1999 line-transect sighting survey conducted by a ship and airplane covering waters from Georges Bank to the mouth of the Gulf of St. Lawrence. Total track line length was 8,212 km. However, in light of the information on stock identity of Scotian Shelf humpback whales noted above, only the portions of the survey covering the Gulf of Maine were used; surveys blocks along the eastern coast of Nova Scotia were excluded. Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and g(0), the probability of detecting a group on the track line. Aerial data were not corrected for g(0) (Palka 2000). These surveys yielded an estimate of 816 humpbacks (CV = 0.45). However, given that the rate of exchange between the Gulf of Maine and both the Scotian Shelf and mid-Atlantic region is not zero, this estimate is likely to be somewhat conservative. Accordingly, inclusion of data from 25% of the Scotian Shelf survey area (to reflect the match rate of 25% between the Scotian Shelf and the Gulf of Maine) gives an estimate of 902 whales (CV=0.41). Since the mark-recapture figures for abundance and minimum population size given above falls above the lower bound of the CV of the line transect estimate, and given the known exchange between the Gulf of Maine and the Scotian Shelf, we have chosen to use the latter as the best estimate of abundance for Gulf of Maine humpback whales (Waring et al. 2002).

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the lognormally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Gulf of Maine humpback whales is 902 (CV=0.41). The minimum population estimate for this stock is 647 (Waring et al. 2002).

As detailed below, current data suggest that the Gulf of Maine humpback whale stock is steadily increasing in size. This is consistent with an estimated average trend of 3.2% (SE=0.005) in the North Atlantic population overall for the period 1979–1993 (Stevick et al. 2001), although there are no other feeding-area-specific estimates. Barlow and Clapham (1997) applied an interbirth interval model to photographic mark-recapture data and estimated the population growth rate of the Gulf of Maine humpback whale stock at 6.5% (CV=0.012). Maximum net productivity is unknown for this population, although a theoretical maximum for any humpback population can be calculated using known values for biological parameters (Brandão et al. 2000, Clapham et al. 2001b). For the Gulf of Maine, data supplied by Barlow and Clapham (1997) and Clapham et al. (1995) gives values of 0.96 for survival rate, 6y as mean age at first parturition, 0.5 as the proportion of females, and 0.42 for annual pregnancy rate. From this, a maximum population growth rate of 0.072 is obtained according to the method described by Brandão et al. (2000). This suggests that the observed rate of 6.5% (Barlow and Clapham 1997) was close to the maximum for this stock. Clapham et al. (2001a) updated the Barlow and Clapham (1997) analysis using data from the period 1992 to 2000. The estimate was either 0% (for a calf survival rate of 0.51) or 4.0% (for a calf survival rate of 0.875). Although confidence limits are not available (because maturation parameters could not be estimated), both estimates of population growth rate are outside the 95% confidence intervals of the previous estimate of 6.5% for the period 1979 to 1991 (Barlow and Clapham 1997). It is unclear whether this apparent decline is an artifact resulting from a shift in distribution; indeed, such a shift occurred during exactly the period (1992-95) in which survival rates declined. It is possible that this shift resulted in calves born in those years imprinting on (and thus subsequently returning to) areas other than those in which intensive sampling occurs. If the decline is a real phenomenon it may be related to known high mortality among young-of-the-year whales in the waters of the U.S. Mid-Atlantic states. However, calf survival appears to have increased since 1996, presumably accompanied by an increase in population growth. In light of the uncertainty accompanying the more recent estimate of population growth rate for the Gulf of Maine, for purposes of this assessment the maximum net productivity rate was assumed to be the default value for cetaceans of 0.04 (Barlow et al. 1995). Current and maximum net productivity rates are unknown for the North Atlantic population overall (Waring et al. 2002). As noted above, Stevick et al. (2001) calculated an average population growth rate of 3.2% (SE=0.005) for the period 1979–1993.

PBR is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 647. The maximum productivity rate is the default value of 0.04. The “recovery” factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because this stock is listed as an endangered species under the ESA. PBR for the Gulf of Maine humpback whale stock is 1.3 whales (Waring et al. 2002).

The major known sources of anthropogenic mortality and injury of humpback whales include entanglement in commercial fishing gear and ship strikes. Based on photographs of the caudal peduncle of humpback whales, Robbins and Mattila (1999) estimated that at least 48% --- and possibly as many as 78% --- of animals in the Gulf of Maine exhibit scarring caused by entanglement. Several whales have apparently been entangled on more than one occasion. These estimates are based on sightings of free-swimming animals that initially survive the encounter. Because some whales may drown immediately, the actual number of interactions may be higher. In addition, the actual number of species-gear interactions is contingent on the intensity of observations from aerial and ship surveys.

For the period 1996 through 2000, the total estimated human-caused mortality and serious injury to the Gulf of Maine humpback whale stock is estimated as 3.0 per year (USA waters, 2.4; Canadian waters, 0.6). This average is derived from two components: 1) incidental fishery interaction records, 2.8 (USA waters, 2.2; Canadian waters, 0.6); and 2) records of vessel collisions, 0.2 (USA waters, 0.2; Canadian waters, 0). There were additional humpback mortalities and serious injuries that occurred in the southeastern and Mid-Atlantic states that could not be confirmed as involving members of the Gulf of Maine stock (Waring et al. 2002). These records represent an additional minimum annual average of 1.6 human-caused mortalities and serious injuries to humpbacks over the time period, of which 1.0 per year are attributable to incidental fishery interactions and 0.6 per year are attributable to vessel collisions (Waring et al. 2002).

As with right whales, human impacts (vessel collisions and entanglements) are factors which may be slowing recovery of the humpback whale population. There is an average of four to six entanglements of humpback whales a year in waters of the southern Gulf of Maine and additional reports of vessel-collision scars (unpublished data, Center for Coastal Studies). Of 20 dead humpback whales (principally in the mid-Atlantic, where decomposition did not preclude examination for human impacts), Wiley et al. (1995) reported that 6 (30%) had major injuries possibly attributable to ship strikes, and 5 (25%) had injuries consistent with possible entanglement in fishing gear. One whale displayed scars that may have been caused by both ship strike and entanglement. Thus, 60% of the whale carcasses which were suitable for examination showed signs that anthropogenic factors may have contributed to, or been responsible for, their death. Wiley et al. (1995) further reported that all stranded animals were sexually immature, suggesting a winter or migratory segregation and/or that juvenile animals are more susceptible to human impacts.

An updated analysis of humpback whale mortalities from the Mid-Atlantic states region has recently been produced by Barco et al. (2002). Between 1990 and 2000, there were 52 known humpback whale mortalities in the waters of the U.S. Mid-Atlantic states (summarized by Barco et al. 2002). Length data from 48 of these whales (18 females, 22 males and 8 of unknown sex) suggested that 39 (81.2%) were first-year animals, 7 (14.6%) were immature and 2 (4.2%) were adults. However, sighting histories of 5 of the dead whales indicate that some were small for their age, and histories of live whales further indicate that the population contains a greater percentage of mature animals than is suggested by the stranded sample. In their study of entanglement rates estimated from caudal peduncle scars, Robbins and Mattila (2001) found that males were more likely to be entangled than females. The scarring data also suggested that yearlings were more likely than other age classes to be involved in entanglements. Finally, female humpbacks showing evidence of prior entanglements produced significantly fewer calves, suggesting that entanglement may significantly impact reproductive success. Humpback whale entanglements also occur in relatively high numbers in Canadian waters. Reports of collisions with fixed fishing gear set for groundfish around Newfoundland averaged 365 annually from 1979 to 1987 (range 174-813). An average of 50 humpback whale entanglements (range 26-66) were reported annually between 1979 and 1988, and 12 of 66 humpback whales that were entangled in 1988 died (Lien et al. 1988). Volgenau et al. (1995) also summarized existing data and concluded that in Newfoundland and Labrador, cod traps caused the most entanglements and entanglement mortalities (21%) of humpbacks between 1979 and 1992. They also reported that gillnets are the gear that has been the primary cause of entanglements and entanglement mortalities (20%) of humpbacks in the Gulf of Maine between 1975 and 1990.

Humpback whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries.

Fin Whale

Fin whales inhabit a wide range of latitudes between 20-75°N and 20-75°S (Perry et al. 1999). Fin whales spend the summer feeding in the relatively high latitudes of both hemispheres, particularly along the cold eastern boundary currents in the North Atlantic and North Pacific Oceans and in Antarctic waters (IWC 1992). Most migrate seasonally from relatively high-latitude Arctic and Antarctic feeding areas in the summer to relatively low-latitude breeding and calving areas in the winter (Perry et al. 1999).

As in the case of right and humpback whales, fin whale populations were heavily affected by commercial whaling. However, commercial exploitation of fin whales occurred much later than for right and humpback whales. Although some fin whales were taken as early as the 17th century by the Japanese using a fairly primitive open-water netting technique (Perry et al. 1999) and were hunted occasionally by sailing vessel whalers in the 19th century (Mitchell and Reeves 1983), wide-scale commercial exploitation of fin whales did not occur until the 20th century when the use of steam power and harpoon- gun technology made exploitation of this faster, more offshore species feasible. In the southern hemisphere, over 700,000 fin whales were landed in the 20th century. More than 48,000 fin whales were taken in the North Atlantic between 1860 and 1970 (Perry et al. 1999). Fisheries existed off of Newfoundland, Nova Scotia, Norway, Iceland, the Faroe Islands, Svalbard (Spitsbergen), the islands of the British coasts, Spain and Portugal. Fin whales were rarely taken in U.S. waters, except when they ventured near the shores of Provincetown, MA, during the late 1800's (Perry et al. 1999).

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. Based on the catch history and trends in Catch Per Unit Effort, an estimate of 3,590 to 6,300 fin whales was obtained for the entire western North Atlantic (Perry et al. 1999). Hain et al. (1992) estimated that about 5,000 fin whales inhabit the Northeastern U.S. continental shelf waters. The latest (Waring et al. 2002) SAR gives a best estimate of abundance for fin whales of 2,814 (CV = 0.21). The minimum population estimate for the western North Atlantic fin whale is 2,362. This is currently an underestimate, as too little is known about population structure, and the estimate is derived from surveys over a limited portion of the western North Atlantic. There is also not enough information to estimate population trends.

In the North Atlantic today, fin whales are widespread and occur from the Gulf of Mexico and Mediterranean Sea northward to the edges of the arctic pack ice (Waring et al. 2002). A number of researchers have suggested the existence of fin whale subpopulations in the North Atlantic. Mizroch et al. (1984) suggested that local depletions resulting from commercial overharvesting supported the existence of North Atlantic fin whale subpopulations. Others have used genetics information to provide support for the belief that there are several subpopulations of fin whales in the North Atlantic and Mediterranean (Bérubé et al. 1998). In 1976, the IWC's Scientific Committee proposed seven stocks for North Atlantic fin whales. These are: (1) North Norway; (2) West Norway-Faroe Islands; (3) British Isles-Spain and Portugal; (4) East Greenland-Iceland; (5) West Greenland; (6) Newfoundland-Labrador; and (7) Nova Scotia (Perry et al. 1999). However, it is uncertain whether these stock boundaries define biologically isolated units (Waring et al. 2002). The NMFS has designated one stock of fin whale for U.S. waters of the North Atlantic where the species is commonly found from Cape Hatteras northward.

During 1978-1982 aerial surveys, fin whales accounted for 24% of all cetaceans and 46% of all large cetaceans sighted over the continental shelf between Cape Hatteras and Nova Scotia (CeTAP 1982a). Underwater listening systems have also demonstrated that the fin whale is the most acoustically common whale species heard in the North Atlantic (Clark 1995). The single most important area for this species appeared to be from the Great South Channel, along the 50 meter isobath past Cape Cod, over Stellwagen Bank, and past Cape Ann to Jeffrey's Ledge (Hain et al. 1992).

Despite our broad knowledge of fin whales, less is known about their life history as compared to right and humpback whales. Age at sexual maturity for both sexes ranges from 5-15 years. Physical maturity is reached at 20-30 years. Conception occurs during a 5 month winter period in either hemisphere. After a 12 month gestation, a single calf is born. The calf is weaned between 6 and 11 months after birth. The mean calving interval is 2.7 years, with a range of between 2 and 3 years (Agler et al. 1993). Like right and humpback whales, fin whales are believed to use northwestern North Atlantic waters primarily for feeding and migrate to more southern waters for calving. However, the overall pattern of fin whale movement consists of a less obvious north-south pattern of migration than that of right and humpback whales. Based on acoustic recordings from hydrophone arrays, Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda, and into the West Indies. However, evidence regarding where the majority of fin whales winter, calve, and mate is still scarce. Some populations seem to move with the seasons (e.g., one moving south in winter to occupy the summer range of another), but there is much structuring in fin whale populations that what animals of different sex and age class do is not at all clear. Neonate strandings along the U.S. mid-Atlantic coast from October through January suggest the possibility of an offshore calving area.

The overall distribution of fin whales may be based on prey availability. This species preys opportunistically on both invertebrates and fish. The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally available. In the western North Atlantic fin whales feed on a variety of small schooling fish (i.e., herring, capelin, sand lance) as well as squid and planktonic crustaceans. As with humpback whales, fin whales feed by filtering large volumes of water for their prey through their baleen plates. Photo identification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and between years (Seipt et al. 1990).

As discussed above, fin whales were the focus of commercial whaling, primarily in the 20th century. The IWC did not begin to manage commercial whaling of fin whales in the North Atlantic until 1976. In 1987, fin whales were given total protection in the North Atlantic with the exception of a subsistence whaling hunt for Greenland. The IWC set a catch limit of 19 whales for the years 1995-1997 in West Greenland. All other fin whale stocks had a zero catch limit for these same years. However, Iceland reported a catch of 136 whales in the 1988/89 and 1989/90 seasons, and has since ceased reporting fin whale kills to the IWC (Perry et al. 1999). In total, there have been 239 reported kills of fin whales from the North Atlantic from 1988 to 1995.

The major known sources of anthropogenic mortality and injury of fin whales include ship strikes and entanglement in commercial fishing gear. However, many of the reports of mortality cannot be attributed to a particular source. Of 18 fin whale mortality records collected between 1991 and 1995, four were associated with vessel interactions, although the proximal cause of mortality was not known. The following injury/mortality events are those reported from 1996 to the present for which source was determined. These numbers should be viewed as absolute minimum numbers; the total number of mortalities and injuries cannot be estimated but is believed to be higher since it is unlikely that all carcasses will be observed. In general, known mortalities of fin whales are less than those recorded for right and humpback whales. This may be due in part to the more offshore distribution of fin whales where they are either less likely to encounter entangling gear, or are less likely to be noticed when gear entanglements or vessel strikes do occur. Fin whales may also be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources due to trophic effects resulting from a variety of activities including the operation of commercial fisheries. The fin whale was listed as endangered throughout its range on June 2, 1970 under the ESA. Hain et al. (1992) estimated that about 5,000 fin whales inhabit the northeastern U.S. continental shelf waters. Waring et al. 2002 present a more recent estimate of 2,814 (CV=0.21) fin whales based on aerial and shipboard surveys of the area from Georges Bank to the mouth of the Gulf of S. Lawrence in 1999.

Sei Whale

Sei whales are a widespread species in the world’s temperate, subpolar and subtropical and even tropical marine waters. However, they appear to be more restricted to temperate waters than other balaenopterids (Perry et al. 1999). The IWC recognized three stocks in the North Atlantic based on past whaling operations as opposed to biological information: (1) Nova Scotia; (2) Iceland Denmark Strait; (3) Northeast Atlantic (Donovan 1991 in Perry et al. 1999). Mitchell and Chapman (1977) suggested that the sei whale population in the western North Atlantic consists of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock. The Nova Scotian Shelf stock includes the continental shelf waters of the northeastern U.S., and extends northeastward to south of Newfoundland. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia and east to longitude 42° (Waring et al. 2002). This is the only sei whale stock within the action area.

Sei whales became the target of modern commercial whalers primarily in the late 19th and early 20th century after stocks of other whales, including right, humpback, fin and blues, had already been depleted. Sei whales were taken in large numbers by Norway and Scotland from the beginning of modern whaling. More than 700 sei whales were killed off of Norway in 1885, alone. Small numbers were also taken off of Spain, Portugal and in the Strait of Gibraltar beginning in the 1920’s, and by Norwegian and Danish whalers off of West Greenland from the 1920’s to 1950’s (Perry et al. 1999). In the western North Atlantic, sei whales were originally hunted off of Norway and Iceland; from 1967-1972, sei whales were also taken off of Nova Scotia (Perry et al. 1999). A total of 825 sei whales were taken on the Scotian Shelf between 1966 and 1972, and an additional 16 were taken from the same area during the same time by a shore based Newfoundland whaling station (Perry et al. 1999). The species continued to be exploited in Iceland until 1986 even though measures to stop whaling of sei whales in other areas had been put into place in the 1970’s (Perry et al. 1999). There is no estimate for the abundance of sei whales prior to commercial whaling. Based on whaling records, approximately14,295 sei whales were taken in the entire North Atlantic from 1885 to 1984 (Perry et al. 1999).

Sei whales winter in warm temperate or subtropical waters and summer in more northern latitudes. In the northern Atlantic, most births occur in November and December when the whales are on the wintering grounds. Conception is believed to occur in December and January. Gestation lasts for 12 months and the calf is weaned at 6-9 months when the whales are on the summer feeding grounds. Sei whales reach sexual maturity at 5-15 years of age. The calving interval is believed to be 2-3 years (Perry et al. 1999).

Sei whales occur in deep water throughout their range, typically over the continental slope or in basins situated between banks. In the northwest Atlantic, the whales travel along the eastern Canadian coast in autumn, June and July on their way to and from the Gulf of Maine and Georges Bank where they occur in winter and spring. Within the action area, the sei whale is most common on Georges Bank and into the Gulf of Maine/Bay of Fundy region during spring and summer, primarily in deeper waters. Individuals may range as far south as North Carolina. It is important to note that sei whales are known for inhabiting an area for weeks at a time then disappearing for year or even decades; this has been observed all over the world, including in the southwestern GOM in 1986. The basis for this phenomenon is not clear.

Although sei whales may prey upon small schooling fish and squid in the action area, available information suggests that calanoid copepods and euphausiids are the primary prey of this species. There are occasional influxes of sei whales further into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy. However, there is no evidence to demonstrate interspecific competition between these species for food resources. There is very little information on natural mortality factors for sei whales. Possible causes of natural mortality, particularly for young, old or otherwise compromised individuals are shark attacks, killer whale attacks, and endoparasitic helminths. Baleen loss has been observed in California sei whales, presumably as a result of an unknown disease (Perry et al. 1999).

There are insufficient data to determine trends of the sei whale population. Because there are no abundance estimates within the last 10 years, a minimum population estimate cannot be determined for NMFS management purposes (Waring et al. 2002). Abundance surveys are problematic not only because this species is difficult to distinguish from the fin whale but more significant is that too little is known of the sei whale's distribution, population structure and patterns of movement; thus survey design and data interpretation are very difficult.

Few instances of injury or mortality of sei whales due to entanglement or vessel strikes have been recorded in U.S. waters. Entanglement is not known to impact this species in the U.S. Atlantic, possibly because sei whales typically inhabit waters further offshore than most commercial fishing operations, or perhaps entanglements do occur but are less likely to be observed. A small number of ship strikes of this species have been recorded. The most recent documented incident occurred in 1994 when a carcass was brought in on the bow of a container ship in Charlestown, Massachusetts. Other impacts noted above for other baleen whales may also occur. Due to the deep-water distribution of this species, interactions that do occur are less likely to be observed or reported than those involving right, humpback, and fin whales that often frequent areas within the continental shelf (Waring et al. 2002).

Blue Whale

Like the fin whale, blue whales occur worldwide and are believed to follow a similar migration pattern from northern summering grounds to more southern wintering areas (Perry et al. 1999). Three subspecies have been identified: *Balaenoptera musculus musculus, B.m. intermedia*, and *B.m. brevicauda* (Waring et al. 2002). Only *B. musculus* occurs in the northern hemisphere. Blue whales range in the North Atlantic extends from the subtropics to Baffin Bay and the Greenland Sea. The IWC currently recognizes these whales as one stock (Perry et al. 1999).

Blue whales were intensively hunted in all of the world's oceans from the turn of the century to the mid-1960s. Blue whales were occasionally hunted by sailing vessel whalers in the 19th century. However, development of steam-powered vessels and deck-mounted harpoon guns in the late 19th century made it possible to exploit them on an industrial scale. Blue whale populations declined worldwide as the new technology spread and began to receive widespread use (Perry et al. 1999). Subsequently, the whaling industry shifted effort away from declining blue whale stocks and targeted other large species, such as fin whales, and then resumed hunting for blue whales when the species appeared to be more abundant (Perry et al. 1999). The result was a cyclical rise and fall, leading to severe depletion of blue whale stocks worldwide (Perry et al. 1999). In the North Atlantic, Norway shifted operations to fin whales as early as 1882 due to the scarcity of blue whales (Perry et al. 1999). In all, at least 11,000 blue whales were taken in the North Atlantic from the late 19th century through the mid-20th century. Blue whales were given complete protection in the North Atlantic in 1955 under the International Convention for the Regulation of Whaling. However, Iceland continued to hunt blue whales until 1960. There are no good estimates of the pre-exploitation size of the western North Atlantic blue whale stock but it is widely believed that this stock was severely depleted by the time legal protection was introduced in 1955 (Perry et al. 1999). Mitchell (1974) suggested that the stock numbered in the very low hundreds during the late 1960's through early 1970's (Perry et al. 1999). Photo-identification studies of blue whales in the Gulf of St. Lawrence from 1979 to 1995 identified 320 individual whales. The NMFS recognizes a minimum population estimate of 308 blue whales for the western North Atlantic (Waring et al. 2002).

Blue whales are only occasional visitors to east coast U.S. waters. They are more commonly found in Canadian waters, particularly the Gulf of St. Lawrence where they are present for most of the year, and other areas of the North Atlantic. It is assumed that blue whale distribution is governed largely by food requirements. In the Gulf of St. Lawrence, blue whales appear to predominantly feed on *Thysanoessa raschii* and *Meganytiphanes norvegica*. In the eastern North Atlantic, *T. inermis* and *M. norvegica* appear to be the predominant prey.

Compared to the other species of large whales, relatively little is known about this species. Sexual maturity is believed to occur in both sexes at 5-15 years of age. Gestation lasts 10-12 months and calves nurse for 6-7 months. The average calving interval is estimated to be 2-3 years. Birth and mating both occur during the winter season, but the location of wintering areas is speculative (Perry et al. 1999). In 1992 the U.S. Navy and contractors conducted an extensive blue whale acoustic survey of the North Atlantic and found concentrations of blue whales on the Grand Banks and west of the British Isles. One whale was tracked for 43 days during which time it traveled 1,400 nautical miles around the general area of Bermuda (Perry et al. 1999).

There is limited information on the factors affecting natural mortality of blue whales in the North Atlantic. Ice entrapment is known to kill and seriously injure some blue whales, particularly along the southwest coast of Newfoundland, during late winter and early spring. Habitat degradation has been suggested as possibly affecting blue whales such as in the St. Lawrence River and the Gulf of St. Lawrence where habitat has been degraded by acoustic and chemical pollution. However, there is no data to confirm that blue whales have been affected by such habitat changes (Perry et al. 1999).

Entanglement in fishing gear, and ship strikes are believed to be the major sources of anthropogenic mortality and injury of blue whales. However, confirmed deaths or serious injuries from either are few. In 1987, concurrent with an unusual influx of blue whales into the Gulf of Maine, one report was received from a whale watch boat that spotted a blue whale in the southern Gulf of Maine entangled in gear described as probable lobster pot gear. A second animal found in the Gulf of St. Lawrence apparently died from the effects of an entanglement. In March 1998, a juvenile male blue whale was carried into Rhode Island waters on the bow of a tanker. The cause of death was determined to be due to a ship strike, although not necessarily caused by the tanker on which it was observed, and the strike may have occurred outside the U.S. EEZ (Waring et al. 2002). No recent entanglements of blue whales have been reported from the U.S. Atlantic. Other impacts noted above for other baleen whales may occur.

Sperm Whale

Sperm whales inhabit all ocean basins, from equatorial waters to polar regions (Perry et al. 1999). In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. The sperm whales that occur in the western North Atlantic are believed to represent only a portion of the total stock (Blaylock et al. 1995). Total numbers of sperm whales off the USA or Canadian Atlantic coast are unknown, although eight estimates from selected regions of the habitat do exist for select time periods. The best estimate of abundance for the North Atlantic stock of sperm whales is 4,702 (CV=0.36) (Waring et al. 2002). The minimum population estimate for the western North Atlantic sperm whale is 3,505 (CV=0.36). Sperm whales present in the Gulf of Mexico are considered by some researchers to be endemic, and represent a separate stock from whales in other portions of the North Atlantic. However, NMFS currently uses the IWC stock structure guidance which recognizes one stock for the entire North Atlantic (Waring et al. 2002).

The International Whaling Commission estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC 1971). However, estimates of the number of sperm whales taken during this time are difficult to quantify since sperm whale catches from the early 19th century through the early 20th century were calculated on barrels of oil produced per whale rather than the actual number of whales caught (Perry et al. 1999). With the advent of modern whaling the larger rorqual whales were targeted. However as their numbers decreased, greater attention was paid to smaller rorquals and sperm whales. From 1910 to 1982 there were nearly 700,000 sperm whales killed worldwide from whaling activities (Clarke 1954). Whale catches for the southern hemisphere is 394,000 (including revised Soviet figures). Sperm whales were hunted in America from the 17th century through the early 20th century. In the North Atlantic, hunting occurred off of Iceland, Norway, the Faroe Islands, coastal Britain, West Greenland, Nova Scotia, Newfoundland/Labrador, New England, the Azores, Madeira, Spain, and Spanish Morocco (Waring et al. 1998). Some whales were also taken off the U.S. Mid-Atlantic coast (Reeves and Mitchell 1988; Perry et al. 1999), and in the northern Gulf of Mexico (Perry et al. 1999). There are no catch estimates available for the number of sperm whales caught during U.S. operations (Perry et al. 1999). Recorded North Atlantic sperm whale catch numbers for Canada and Norway totaled 1,995 from 1904 to 1972. All killing of sperm whales was banned by the IWC in 1988. However, at the 2000 meetings of the IWC, Japan indicated it would include the take of sperm whales in its scientific research whaling operations. Although this action was disapproved of by the IWC, Japan has reported the take of 5 sperm whales from the North Pacific as a result of this research.

Sperm whales generally occur in waters greater than 180 meters in depth. While they may be encountered almost anywhere on the high seas, their distribution shows a preference for continental margins, sea mounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves 1983). Sperm whales in both hemispheres migrate to higher latitudes in the summer for feeding and return to lower latitude waters in the winter where mating and calving occur. Mature males typically range to much higher latitudes than mature females and immature animals but return to the lower latitudes in the winter to breed (Perry et al. 1999). Waring et al. (2002) suggest sperm whale distribution is closely correlated with the Gulf Stream edge. Like swordfish, which feed on similar prey, sperm whales migrate to higher latitudes during summer months, when they are concentrated east and northeast of Cape Hatteras. In the U.S. EEZ, sperm whales occur on the continental shelf edge, over the continental slope, and into the mid-ocean regions, and are distributed in a distinct seasonal cycle; concentrated east-northeast of Cape Hatteras in winter and shifting northward in spring when whales are found throughout the mid-Atlantic Bight. Distribution extends further northward to areas north of Georges Bank and the Northeast Channel region in summer and then south of New England in fall, back to the mid-Atlantic Bight (Waring et al. 2002).

Sperm whale distribution may be linked to their social structure as well as distribution of their prey (Waring et al. 2002). Sperm whale populations are organized into two types of groupings: breeding schools and bachelor schools. Older males are often solitary (Best

1979). Breeding schools consist of females of all ages, calves and juvenile males. In the Northern Hemisphere, mature females ovulate April through August. During this season one or more large mature bulls temporarily join each breeding school. A single calf is born after a 15-month gestation. A mature female will produce a calf every 4-6 years. Females attain sexual maturity at a mean age of nine years, while males have a prolonged puberty and attain sexual maturity at about age 20 (Waring et al. 2002). Bachelor schools consist of maturing males who leave the breeding school and aggregate in loose groups of about 40 animals. As the males grow older they separate from the bachelor schools and remain solitary most of the year (Best 1979). Male sperm whales may not reach physical maturity until they are 45 years old (Waring et al. 2002). The sperm whales prey consists of larger mesopelagic squid (e.g., *Architeuthis* and *Moroteuthis*) and fish species (Perry et al. 1999). Sperm whales, especially mature males in higher latitude waters, have been observed to take significant quantities of large demersal and mesopelagic sharks, skates, and bony fishes (Clarke 1962, 1980).

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Because of their generally more offshore distribution and their benthic feeding habits, sperm whales are less subject to entanglement than right or humpback whales.

Documented takes primarily involve offshore fisheries such as the offshore lobster pot fishery and pelagic driftnet and pelagic longline fisheries. The NMFS Sea Sampling program recorded three entanglements (in 1989, 1990, and 1995) of sperm whales in the swordfish drift gillnet fishery prior to permanent closure of the fishery in January 1999. All three animals were injured, found alive, and released. However, at least one was still carrying gear. Opportunistic reports of sperm whale entanglements for the years 1993-1997 include three records involving offshore lobster pot gear, heavy monofilament line, and fine mesh gillnet from an unknown source. Sperm whales may also interact opportunistically with fishing gear. Observers aboard Alaska sablefish and Pacific halibut longline vessels have documented sperm whales feeding on longline caught fish in the Gulf of Alaska (Perry et al. 1999). Behavior similar to that observed in the Alaskan longline fishery has also been documented during longline operations off South America where sperm whales have become entangled in longline gear, have been observed feeding on fish caught in the gear, and have been reported following longline vessels for days (Perry et al. 1999).

Sperm whales are also struck by ships. In May 1994 a ship struck sperm whale was observed south of Nova Scotia (Waring et al. 2002). A sperm whale was also seriously injured as a result of a ship strike in May 2000 in the western Atlantic. Due to the offshore distribution of this species, interactions that do occur are less likely to be reported than those involving right, humpback, and fin whales that more often occur in nearshore areas. Other impacts noted above for baleen whales may also occur.

Due to their offshore distribution, sperm whales tend to strand less often than, for example, right whales and humpbacks. Preliminary data for 2000 indicate that of ten sperm whales reported to the stranding network (nine dead and one injured) there was one possible fishery interaction, one ship strike (wounded with bleeding gash on side) and eight animals for which no signs of entanglement or injury were sighted or reported. No sperm whales have stranded or been reported to the stranding network as of February 2001.

Atlantic Bottlenose dolphin

Most of the information which follows concerning Atlantic bottlenose dolphin was excerpted from the most recent stock assessment for this species (Waring et al. 2002). The coastal morphotype of the Atlantic bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, around peninsula Florida and along the Gulf of Mexico coast. Within the western North Atlantic, the stock structure of coastal bottlenose dolphins is complex. Scott et al. (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, NY, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-88 and observed density patterns along the US Atlantic coast. The continuous distribution of dolphins along the coast seemed to support this hypothesis. It was recognized that bottlenose dolphins were resident in some estuaries; these were considered to be separate from the coastal migratory animals. However, recent studies suggest that the single coastal migratory stock hypothesis is incorrect and that there is likely a complex mosaic of stocks. For example, year-round resident populations have been reported at a variety of sites in the southern part of the range, from Charleston, South Carolina (Zolman 1996) to central Florida (Odell and Asper 1990); seasonal residents and migratory or transient animals also occur in these areas (summarized in Hohn 1997). In the northern part of the range the patterns reported include seasonal residency, year-round residency with large home ranges, and migratory or transient movements (Barco and Swingle 1996, Sayigh et al. 1997). Communities of dolphins have been recognized in embayments and coastal areas of the Gulf of Mexico (Wells et al. 1996; Scott et al. 1990; Weller 1998) so it is not surprising to find similar situations along the Atlantic coast (Waring et al. 2002).

Recent genetic analyses of samples from Jacksonville, FL, southern South Carolina (primarily the estuaries around Charleston), southern North Carolina, and coastal Virginia, using both mitochondrial DNA and nuclear microsatellite markers, indicate that a significant amount of the overall genetic variation can be explained by differences between the groups (NMFS 2001). These results indicate a minimum of four populations of coastal bottlenose dolphins in the Northwest Atlantic and reject the null hypothesis of one homogeneous population of bottlenose dolphins. Integration of the preliminary results from genetics, photo-identification, satellite telemetry, and stable isotope studies confirms a complex mosaic of stocks of coastal bottlenose dolphins in the western North Atlantic (Waring et al. 2002). As an interim measure, pending additional results, seven management units within the range of the “coastal migratory stock” have been defined. The true population structure is likely more than the seven units identified in Waring et al. (2002); research efforts continue in an attempt to identify that structure.

Earlier aerial (CeTAP 1982a) and shipboard (NMFS unpublished data) surveys north of Cape Hatteras identified two concentrations of bottlenose dolphins, one inshore of the 25 m isobath and the other offshore of the 25 m isobath. The lowest density of bottlenose dolphins was observed over the continental shelf, with higher densities along the coast and near the continental shelf edge. It was suggested that the coastal morphotype is restricted to waters < 25 m in depth north of Cape Hatteras (Kenney 1990). There was no apparent longitudinal discontinuity in bottlenose dolphin herd sightings during aerial surveys south of Cape Hatteras in the winter (Blaylock and Hoggard 1994). NMFS surveys conducted from 1992-1998 show a clustering of bottlenose dolphins nearshore and then additional bottlenose dolphins in the offshore areas. Unfortunately, the morphotype of bottlenose dolphins (WNA offshore or WNA coastal) cannot be determined from the air so attributing each sighting to a specific morphotype is not possible. There is also a potential for confusing immature spotted dolphins, with few or no spots dorsally, with bottlenose dolphins where the two species co-occur. In 1995, NMFS conducted two aerial surveys along the Atlantic coast (Blaylock 1995; Garrison and Yeung 2001). One survey was conducted during summer 1995 between Cape Hatteras, NC, and Sandy Hook, NJ, and included three replicate surveys. The second survey was conducted during winter 1995 between Cape Hatteras, NC, and Ft. Pierce, FL. A distributional analysis identified a significant spatial pattern in bottlenose dolphin sightings as a function of distance from shore (Garrison 2001a). During the northern (summer) surveys, the significant spatial boundary occurred at 12 km from shore. During the southern (winter) survey, the significant spatial boundary occurred at 27 km from shore. The gap in sightings best defines, for the time being, the eastern extent of the coastal morphotype for purposes of habitat definition and abundance estimates. NMFS continues to collect biopsy samples from Tursiops throughout the possible range of the coastal morphotype so that stock boundaries can be confirmed or modified on the basis of a more comprehensive data set (Waring et al. 2002).

The 1995 aerial surveys were conducted to estimate population size of the hypothesized single coastal migratory stock (Blaylock 1995; Garrison and Yeung 2001). The summer aerial survey was conducted between July 1 and August 14, 1995, covering Cape Hatteras, NC, to Sandy Hook, NJ, (35.23ºN-40.5ºN), and from the mainland shore to the 25 m isobath. This survey provided coverage and abundance estimates for the Northern Migratory (NM) and Northern North Carolina (NNC) management units. However, coverage of the NNC unit was incomplete as the surveys did not cover the region south of Cape Hatteras, NC, to Cape Lookout, NC. Abundance was estimated for each stratum pooling across the three replicate surveys. The winter survey was conducted between January 27 and March 6, covering from Fort Pierce, FL, to Cape Hatteras, NC, from the mainland shore to 9.25 km (5 Nautical Miles) beyond the inshore edge of the Gulf Stream or <200 km offshore. This survey included coverage of the NNC, Southern North Carolina (SNC), South Carolina (SC), Georgia (GA), Northern Florida (NFL) and Central Florida (CFL) management units. However, the coverage of the NNC management unit was incomplete and did not include the region north of Cape Hatteras, NC. These abundance estimates also include NM unit animals that have migrated south of the NC/VA border during winter. Abundance for each management unit was estimated using line transect methods and the program DISTANCE (Buckland et al. 1993) for both the winter and summer surveys. There was no significant difference between the abundance estimates for the combined NM and NNC management units in summer and the combined NM, NNC, and SNC stocks in winter. Another set of aerial surveys was conducted parallel to the coastline from the North Carolina/South Carolina border to the Maryland/Delaware border during 1998 and 1999 to document the distribution of dolphins and fishing gear in nearshore waters (Hohn et al. unpubl. data). These strip/ transect surveys were conducted weekly, weather permitting, over 12 months in most of North Carolina and for six months (May to December) in Virginia and Maryland. In retrospect, they provide seasonal coverage of the Southern North Carolina, Northern North Carolina, and Northern Migratory management units. The strip transect surveys cannot be used directly for abundance estimation because they did not follow the design constraints of line transect survey methods and covered only a small proportion of the habitat of coastal bottlenose dolphin. The density of dolphins near the coastline is high relative to habitats farther offshore, and the use of density estimates in this region to calculate overall abundance would likely result in significant positive bias. However, these surveys do provide information on the relative abundance of dolphins between regions that may be used to supplement the abundance estimates from the line transect surveys conducted in 1995 (Garrison and Hohn 2001). Both sets of aerial surveys covered ocean coasts only. An abundance estimate was generated for bottlenose dolphins in estuarine waters of North Carolina using mark-recapture methodology (Read et al. 2003). It is possible to post-stratify the mark-recapture estimates consistent with management unit definitions (Palka et al. 2001). Abundance estimates for each management unit are the sum of estimates, where appropriate, from the recent analyses. Estimated overall abundance was 9,206 from summer surveys and 19,459 from winter surveys. However, for consistency with achieving the goals of the MMPA, such as maintaining marine mammals as functioning components of their ecosystems, it is more appropriate to establish abundance estimates for each management unit. Abundance for each management unit was estimated by post-stratifying sightings and effort data consistent with geographic and seasonal management unit boundaries (Garrison and Yeung 2001; Palka et al. 2001). Although these estimates are improved relative to previous abundance estimates for coastal bottlenose dolphins, potential biases remain. The aerial survey estimates are not corrected for g(0), the probability of detecting a group on the track line as a function of perception bias and availability bias. The exclusion of g(0) from the abundance estimate results in a negative bias of unknown magnitude. A positive bias may occur if the longitudinal boundaries have been extended too far offshore resulting in offshore dolphins being included in the abundance estimates for the coastal morphotype or if estuarine dolphins were over-represented in coastal waters during the time of the survey. Further uncertainties in the abundance estimates result from incomplete coverage of some seasonal management units during the line transect surveys. While the strip transect surveys were used to supplement the survey coverage, uncertainties associated with that analysis also introduce uncertainty in the overall abundance estimate (Garrison and Hohn 2001).

The minimum population size (NMIN) for each management was calculated by Waring et al. (2002) according to he Potential Biological Removal (PBR) Guidelines (Wade and Angliss 1997): $NMIN= N/\exp(0.842\times[\ln(1+[CV(N)]2)]½)$. It was recognized that these estimates may be negatively biased because they do not include corrections for g(0) and, for some of the managements units, do not include the entire spatial range of the unit during that season. The strip transect surveys compensate for some of the abundance omitted during line-transect survey; nonetheless, for some management units the entire range was not covered. There are insufficient data to determine the population trend for this stock (Waring et al. 2002).

In addition, Current and maximum net productivity rates are not known for the WNA coastal morphotype. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow et al. 1995; Waring et al. 2002).

PBR is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor is assumed to be 0.50, the default for depleted stocks and stocks of unknown status. At least part of the range-wide stock complex is depleted; for the remainder, status is unknown. For consistency with achieving the goals of the MMPA, such as maintaining marine mammals as functioning components of their ecosystems, it is more appropriate to establish separate PBRs for each management unit.

Total estimated average annual fishery-related mortality or serious injury resulting from observed fishing trips during 1996-2000 was 233 bottlenose dolphins (CV=0.16) in the mid-Atlantic coastal gillnet fishery (Waring et al. 2002). The management units affected by this fishery would be the NM, NNC, and SC. An estimated 24 (CV=0.89) were taken in the shark drift gillnet fishery off the coast of Florida during 1999-2000, affecting the Central and Northern Florida management units. No estimates of mortality from observed trips are available for any of the other fisheries that interact with WNA coastal bottlenose dolphins. Therefore, the total average annual mortality estimate is considered to be a lower bound of the actual annual human-caused mortality and serious injury (Waring et al. 2002).

Bottlenose dolphins are known to interact with commercial fisheries and occasionally are taken in various kinds of fishing gear including gillnets, seines, long-lines, shrimp trawls, and crab pots (Read 1994; Wang et al. 1994) especially in near-shore areas where dolphin densities and fishery efforts are greatest. There are nine Category II commercial fisheries that interact with WNA coastal bottlenose dolphins in the 2001 MMPA List of Fisheries (LOF), six of which occur in North Carolina waters. Category II fisheries include the mid-Atlantic coastal gillnet, NC inshore gillnet, mid-Atlantic haul/beach seine, NC long haul seine, NC stop net, Atlantic blue crab trap/pot, Southeast Atlantic gillnet, Southeastern U.S. Atlantic shark gillnet and the Virginia pound net (see 2001 List of Fisheries, 66 FR 42780, August 15, 2001; Waring et al. 2002). The mid-Atlantic haul/beach seine fishery also includes the haul seine and swipe net fisheries. There are five Category III fisheries that may interact with WNA coastal bottlenose dolphins. Three of these are inshore gillnet fisheries: the Delaware Bay inshore gillnet, the Long Island Sound inshore gillnet, and the Rhode Island, southern Massachusetts, and New York Bight inshore gillnet. The remaining two are the shrimp trawl and mid-Atlantic menhaden purse seine fisheries. There have been no takes observed by the NMFS observer programs in any of these fisheries (Waring et al. 2002).

The mid-Atlantic coastal gillnet fishery is actually a combination of small-vessel fisheries that target a variety of fish species, including bluefish, croaker, spiny and smooth dogfish, kingfish, Spanish mackerel, spot, striped bass, and weakfish (Steve et al. 2001). These fisheries operate in different seasons targeting different species in different states throughout the range of the coastal morphotype. Most nets are set gillnets without anchors and are fished close to shore. Anchored set gillnets or drift gillnets are used in some fisheries (e.g., monkfish or dogfish). A comprehensive description of coastal gillnet gears and fishing effort in North Carolina is available in Steve et al. (2001). This fishery has the highest documented level of mortality of WNA coastal bottlenose dolphins; the North Carolina sink gillnet fishery is its largest component in terms of fishing effort and observed takes. Bycatch estimates are available for the period 1996-2000 (Waring et al. 2002). Of 12 observed mortalities from 1995-2000, 5 occurred in sets targeting spiny or smooth dogfish and another in a set targeting “shark” species, 2 occurred in striped bass sets, 2 occurred in Spanish mackerel sets, and the remainder were in sets targeting kingfish, weakfish, or "finfish" (Rossman and Palka 2001; Waring et al. 2002).

The shark gillnet fishery operates in Federal waters from southern Florida to southern Georgia. The fishery is defined by vessels using relatively large mesh nets (>10 inches) and net lengths typically greater than 1500 feet. The fishery primarily uses drifting nets that are set overnight; however, recently it has been employing a small number of shorter duration “strike” sets that encircle targeted schools of sharks. Since 1999, the Atlantic Large Whale Take Reduction Plan restricted the activities of the fishery to waters south of 27°51’ N latitude during the critical right whale season from 15 November – 31 March and mandated 100% observer coverage during this period. During the remainder of the year, these vessels generally operate north of Cape Canaveral, FL and there is little observer coverage of the fleet. The fishery potentially interacts with the Georgia, Northern Florida, and Central Florida management units of coastal bottlenose dolphin. During an observer program in 1993 and 1994 and limited observer coverage during the summer of 1998, no takes of bottlenose dolphin were observed (Trent et al. 1997; Carlson and Lee, 2000). However, takes resulting in mortality were observed in the Central Florida management unit during 1999 and 2000. Total bycatch mortality for this management unit has been estimated for 1999 and 2000 (Garrison 2001b).

A beach seine fishery operates along northern North Carolina beaches targeting striped bass, mullet, spot, weakfish, sea trout, and bluefish. The fishery operates on the Outer Banks of North Carolina primarily in the spring (April through June) and fall (October through December). It uses two primary gear types: a “beach anchored gill net” and a “beach seine.” Both systems utilize a small net anchored to the beach. The beach seine system also uses a bunt and a wash net that are attached to the beach and are in the surf (Steve et al. 2001). The North Carolina beach seine fishery has been observed since April 7, 1998 by the NMFS fisheries sampling program (observer program) based at the Northeast Fisheries Science Center. Through 2001, there were 101 sets observed during the winter season (Nov-Apr) and 65 sets observed during the summer season (May-Oct).

A total of 2 coastal bottlenose dolphin takes were observed, 1 in May 1998 and 1 in December 2000. The beach seine observer data are currently being reviewed but estimates of mortality are not yet available (Waring et al. 2002).

Between 1994 and 1998, 22 bottlenose dolphin carcasses (4.4 dolphins per year on average) recovered by the Stranding Network between North Carolina and Florida’s Atlantic coast displayed evidence of possible interaction with a trap/pot fishery (i.e., rope and/or pots attached, or rope marks). Additionally, at least 5 dolphins were reported to be released alive (condition unknown) from blue crab traps/pots during this time period. In recent years, reports of strandings with evidence of interactions between bottlenose dolphins and both recreational and commercial crab-pot fisheries have been increasing in the Southeast Region (McFee and Brooks 1998). The increased reporting may result from increased effort towards documenting these marks or increases in mortality (Waring et al. 2002).

Data from the Chesapeake Bay suggest that the likelihood of bottlenose dolphin entanglement in pound net leads may be affected by the mesh size of the lead net (Bellmund et al. 1997), but the information is not conclusive. Stranding data for 1993-1997 document interactions between WNA coastal bottlenose dolphins and pound nets in Virginia. Two bottlenose dolphin carcasses were found entangled in the leads of pound nets in Virginia during 1993-1997, for an average of 0.4 bottlenose dolphin strandings per year. A third record of an entangled bottlenose dolphin in Virginia in 1997 may have been applicable to this fishery. This entanglement involved a bottlenose dolphin carcass found near a pound net with twisted line marks consistent with the twine in the nearby pound net lead rather than with monofilament gillnet gear. Given that other sources of annual serious injury and mortality estimates (e.g., observer data) are not available, the stranding data (0.4 bottlenose dolphins per year) were used as a minimum estimate of annual serious injury and mortality and this fishery was classified as a Category II fishery in the 2001 List of Fisheries (Waring et al. 2002).

The shrimp trawl fishery operates from North Carolina through northern Florida virtually year around, moving seasonally up and down the coast. One bottlenose dolphin was recovered dead from a shrimp trawl in Georgia in 1995 (Southeast USA Marine Mammal Stranding Network unpublished data), and another was taken in 1996 near the mouth of Winyah Bay, SC, during a research survey. No other bottlenose dolphin mortality or serious injury has been previously reported to NMFS (Waring et al. 2002).

The Atlantic menhaden purse seine fishery targets the Atlantic menhaden in Atlantic coastal waters. Smith (1999) summarized menhaden fishing patterns by the Virginia-North Carolina vessels from 1985-1996. Most of the catch and sets during that time occurred within three miles of the shore. Between 1994 and 1997, menhaden were processed at only three facilities, two in Reedville Beach, VA, and one in Beaufort, NC. Each of the Virginia facilities had a fleet of 9-10 vessels while the Beaufort facility is supported by 2-6 vessels. Since 1998, only one plant has operated in Virginia and the number of vessels has been reduced to ten in Virginia and two in North Carolina (Vaughan et al. 2001). The fishery moves seasonally, with most effort occurring off of

North Carolina from November-January and moving northward to southern New England during warmer months. Menhaden purse seiners have reported an annual incidental take of 1 to 5 bottlenose dolphins, although observer data are not available (Waring et al. 2002).

From 1997-1999, 995 bottlenose dolphins were reported stranded along the Atlantic coast from New York to Florida (Hohn and Martone 2001; Hohn et al. 2001; Palka et al. 2001). Of these, it was possible to determine whether a human interaction had occurred for 449 (45%); for the remainder it was not possible to make that determination. The proportion of carcasses determined to have been involved in a human interaction averaged 34%, but ranged widely from 11-12% in Delaware and Georgia to 49% and 53% in Virginia and North Carolina, respectively.

The nearshore habitat occupied by the coastal morphotype is adjacent to areas of high human population and in the northern portion of its range is highly industrialized. The blubber of stranded dolphins examined during the 1987-88 mortality event contained anthropogenic contaminants in levels among the highest recorded for a cetacean (Geraci 1989). There are no estimates of indirect human-caused mortality resulting from pollution or habitat degradation.

The coastal migratory stock is designated as depleted under the MMPA. From 1995-2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the WNA and, therefore, the entire stock was listed as depleted. The management units in this report now replace the single coastal migratory stock. A re-analysis of the depletion designation on a management unit basis needs to be undertaken. In the interim, because one or more of the management units may be depleted, all management units retain the depleted designation. In addition, mortality in multiple units exceeded PBR (Waring et al. 2002). There are no rigorous results that would provide reliable information on current abundance relative to historical abundance. All prior estimates cover only part of the range of management units spatially or temporally, include the offshore morphotype, or are otherwise compromised. Population trends cannot be determined due to insufficient data. Over the past five years, estimated average annual mortality exceeded PBR in the mid-Atlantic gillnet fisheries for the northern migratory and northern NC management units during summer and for the NC mixed management units in winter (Waring et al. 2002).

The species is not listed as threatened or endangered under the Endangered Species Act, but because, as noted above, the stock is listed as depleted under the MMPA it is a strategic stock. This stock is also considered strategic under the MMPA because fishery-related mortality and serious injury exceed the potential biological removal level.

Leatherback Sea Turtle

Leatherback turtles are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). The leatherback sea turtle is the largest living turtle and ranges farther than any other sea turtle species, exhibiting broad thermal tolerances (NMFS and USFWS, 1995). Evidence from tag returns and strandings in the western Atlantic suggests that adults engage in routine migrations between boreal, temperate and tropical waters (NMFS and USFWS, 1992). In the U.S., leatherback turtles are found throughout the action area of this consultation. Located in the northeastern waters during the warmer months, this species is found in coastal waters of the continental shelf and near the Gulf Stream edge, but rarely in the inshore areas. However, leatherbacks may migrate close to shore, as a leatherback was satellite tracked along the mid-Atlantic coast, thought to be foraging in these waters. A 1979 aerial survey of the outer Continental Shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Shoop and Kenney (1992) also observed concentrations of leatherbacks during the summer off the south shore of Long Island and off New Jersey. Leatherbacks in these waters are thought to be following their preferred jellyfish prey. This aerial survey estimated the leatherback population for the northeastern U.S. at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina).

Compared to the current knowledge regarding loggerhead populations, the genetic distinctness of leatherback populations is less clear. However, genetic analyses of leatherbacks to date indicate female turtles nesting in St. Croix/Puerto Rico and those nesting in Trinidad differ from each other and from turtles nesting in Florida, French Guiana/Suriname and along the South African Indian Ocean coast. Much of the genetic diversity is contained in the relatively small insular subpopulations. Although populations or subpopulations of leatherback sea turtles have not been formally recognized, based on the most recent reviews of the analysis of population trends of leatherback sea turtles, and due to our limited understanding of the genetic structure of the entire species, the most conservative approach would be to treat leatherback nesting populations as distinct populations whose survival and recovery is critical to the survival and recovery of the species. Further, any action that appreciably reduces the likelihood for one or more of these nesting populations to survive and recover in the wild, would appreciably reduce the species' likelihood of survival and recovery in the wild.

Leatherbacks are predominantly a pelagic species and feed on jellyfish (i.e., *Stomolophus, Chryaora*, and *Aurelia* (Rebel 1974)), cnidarians (*medusae, siphonophores*) and tunicates (*salps, pyrosomas*). Time-Depth-Recorder data recorded by Eckert et al. (1996) indicate that leatherbacks are night feeders and are deep divers, with recorded dives to depths in excess of 1000 meters. However, leatherbacks may come into shallow waters if there is an abundance of jellyfish nearshore. Leary (1957) reported a large group of up to 100 leatherbacks just offshore of Port Aransas, Texas associated with a dense aggregation of *Stomolophus*. Leatherbacks also occur annually in places such as Cape Cod and Narragansett Bays during certain times of the year, particularly the fall.

Although leatherbacks are a long lived species (> 30 years), they are somewhat faster to mature than loggerheads, with an estimated age at sexual maturity reported as about 13-14 years for females, and an estimated minimum age at sexual maturity of 5-6 years, with 9 years reported as a likely minimum (Zug and Parham 1996) and 19 years as a likely maximum (NMFS 2001). In the U.S. and Caribbean, female leatherbacks nest from March through July. They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and thus, can produce 700 eggs or more per nesting season (Schulz 1975). The eggs will incubate for 55-75 days before hatching. The habitat requirements for post-hatchling leatherbacks are virtually unknown (NMFS and USFWS 1992).

Anthropogenic impacts to the leatherback population are similar to those discussed above for the loggerhead sea turtle, including fishery interactions as well as intense exploitation of the eggs (Ross 1979). Eckert et al. (1996) and Spotila et al. (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Zug and Parham (1996) attribute the sharp decline in leatherback populations to the combination of the loss of long-lived adults in fishery related mortality, and the lack of recruitment stemming from elimination of annual influxes of hatchlings because of intense egg harvesting.

Poaching is not known to be a problem for U.S. nesting populations. However, numerous fisheries that occur in both U.S. state and Federal waters are known to negatively impact juvenile and adult leatherback sea turtles. These include incidental take in several commercial and recreational fisheries. Fisheries known or suspected to incidentally capture leatherbacks include those deploying bottom trawls, off-bottom trawls, purse seines, bottom longlines, hook and line, gill nets, drift nets, traps, haul seines, pound nets, beach seines, and surface longlines (NMFS and USFWS 1992). At a workshop held in the Northeast in 1998 to develop a management plan for leatherbacks, experts expressed the opinion that incidental takes in fisheries were likely higher than is being reported.

Leatherback interactions with the southeast shrimp fishery are also common. Turtle Excluder Devices (TEDs), typically used in the southeast shrimp fishery to minimize sea turtle/fishery interactions, are less effective for the large-sized leatherbacks. Therefore, the NMFS has used several alternative measures to protect leatherback sea turtles from lethal interactions with the shrimp fishery. These include establishment of a Leatherback Conservation Zone (60 FR 25260). NMFS established the zone to restrict, when necessary, shrimp trawl activities from off the coast of Cape Canaveral, Florida to the Virginia/North Carolina Border. It allows the NMFS to quickly close the area or portions of the area to the shrimp fleet on a short-term basis when high concentrations of normally pelagic leatherbacks are recorded in more coastal waters where the shrimp fleet operates. Other emergency measures may also be used to minimize the interactions between leatherbacks and the shrimp fishery. For example, in November 1999 parts of Florida experienced an unusually high number of leatherback strandings. In response, the NMFS required shrimp vessels operating in a specified area to use TEDs with a larger opening for a 30-day period beginning December 8, 1999 (64 FR 69416) so that leatherback sea turtles could escape if caught in the gear.

Leatherbacks are also susceptible to entanglement in lobster and crab gear, possibly as a result of attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, attraction to the buoys which could appear as prey, or the gear configuration which may be more likely to wrap around flippers. The total number of leatherbacks reported entangled from New York through Maine from all sources for the years 1980 - 2000 is 119; out of this total, 92 of these records occurred from1990-2000. Entanglements are also common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. It is unclear how leatherbacks become entangled in such gear. Prescott (1988) reviewed stranding data for Cape Cod Bay and concluded that for those turtles where cause of death could be determined (the minority), entanglement in fishing gear is the leading cause of death followed by capture by dragger, cold stunning, or collision with boats.

Spotila et al. (1996) describe a hypothetical life table model based on estimated ages of sexual maturity at both ends of the species' natural range (5 and 15 years). The model concluded that leatherbacks maturing in 5 years would exhibit much greater population fluctuations in response to external factors than would turtles that mature in 15 years. Furthermore, the simulations indicated that leatherbacks could maintain a stable population only if both juvenile and adult survivorship remained high, and that if other life history stages (i.e., egg, hatchling, and juvenile) remained static. Model simulations indicated that an increase in adult mortality of more than 1% above background levels in a stable population was unsustainable. As noted, there are many human-related sources of mortality to leatherbacks; a tally of all leatherback takes anticipated annually under current biological opinions completed for the NMFS June 30, 2000, biological opinion on the pelagic longline fishery projected a potential for up to 801 leatherback takes, although this sum includes many takes expected to be nonlethal. Leatherbacks have a number of pressures on their populations, including injury or mortality in fisheries, other Federal activities (e.g., military activities, oil and gas development, etc.), degradation of nesting habitats, direct harvest of eggs, juvenile and adult turtles, the effects of ocean pollutants and debris, lethal collisions, and natural disturbances such as hurricanes (which may wipe out nesting beaches).

Spotila et al. (1996) recommended not only reducing mortalities resulting from fishery interactions, but also advocated protection of eggs during the incubation period and of hatchlings during their first day, and indicated that such practices could potentially double the chance for survival and help counteract population effects resulting from adult mortality. They conclude, "stable leatherback populations could not withstand an increase in adult mortality above natural background levels without decreasing . . . the Atlantic population is the most robust, but it is being exploited at a rate that cannot be sustained and if this rate of mortality continues, these populations will also decline."

Estimated to number approximately 115,000 adult females globally in 1980 (Pritchard 1982) and only 34,500 by 1995 (Spotila et al. 1996), leatherback populations have been decimated worldwide, not only by fishery related mortality but, at least historically, primarily due to intense exploitation of the eggs (Ross 1979). On some beaches nearly 100% of the eggs laid have been harvested (Eckert et al. 1996). Eckert et al. (1996) and Spotila et al. (1996) record that adult mortality has also increased significantly, particularly as a result of driftnet and longline fisheries. Spotila et al. (2000) states that a conservative estimate of annual leatherback fishery-related mortality (from longlines, trawls and gillnets) in the Pacific during the 1990s is 1,500 animals. He estimates that this represented about a 23% mortality rate (or 33% if most mortality was focused on the East Pacific population).

Nest counts are currently the only reliable indicator of population status available for leatherback turtles. The status of the leatherback population in the Atlantic is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the U.S.. Recent information suggests that Western Atlantic populations declined from 18,800 nesting females in 1996 (Spotila et al. 1996) to 15,000 nesting females by 2000. Eastern Atlantic (i.e., off Africa, numbering ~ 4,700) and Caribbean (4,000) populations appear to be stable, but there is conflicting information for some sites and it is certain that some populations (e.g., St. John and St. Thomas, U.S. Virgin Islands) have been extirpated (NMFS and USFWS 1995). It does appear, however, that the Western Atlantic population is being subjected to mortality beyond sustainable levels, resulting in a continued decline in numbers of nesting females.

Loggerhead Sea Turtle

The loggerhead sea turtle occurs throughout the temperate and tropical regions of the Atlantic, Pacific and Indian Oceans (Dodd 1998). The loggerhead turtle was listed as "threatened" under the ESA on July 28, 1978, but is considered endangered by the World Conservation Union (IUCN) and under the Convention on International Trade in Endangered Species of Flora and Fauna (CITES). Loggerhead sea turtles are found in a wide range of habitats throughout the temperate and tropical regions of the Atlantic. These include open ocean, continental shelves, bays, lagoons, and estuaries (NMFS& FWS 1995).

Since they are limited by water temperatures, sea turtles do not usually appear on the summer foraging grounds in the Gulf of Maine until June, but are found in Virginia as early as April. They remain in these areas until as late as November and December in some cases, but the large majority leaves the Gulf of Maine by mid-September. Loggerheads are primarily benthic feeders, opportunistically foraging on crustaceans and mollusks (NMFS and USFWS 1995). Under certain conditions they also feed on finfish, particularly if they are easy to catch *(e.g.,* caught in gillnets or inside pound nets where the fish are accessible to turtles).

A Turtle Expert Working Group (TEWG 2000), conducting an assessment of the status of the loggerhead sea turtle population in the Western North Atlantic (WNA), concluded that there are at least four loggerhead subpopulations separated at the nesting beach in the WNA. However, the group concluded that additional research is necessary to fully address the stock definition question. The four nesting subpopulations include the following areas: northern North Carolina to northeast Florida, south Florida, the Florida Panhandle, and the Yucatan Peninsula. Genetic evidence indicates that loggerheads from Chesapeake Bay southward to Georgia appear nearly equally divided in origin between

South Florida and northern subpopulations. Additional research is needed to determine the origin of turtles found north of the Chesapeake Bay.

The TEWG (1998) analysis also indicated the northern subpopulation of loggerheads is stable or declining. A recovery goal of 12,800 nests has been assumed for the Northern Subpopulation, but TEWG (1998) reported nest number at around 6,200 (TEWG 1998). More recently, the addition of nesting data from the years 1996, 1997 and 1998, did not change the assessment of the TEWG that the number of loggerhead nests in the Northern Subpopulation is stable or declining (TEWG 2000). Since the number of nests has declined in the 1980's, the TEWG concluded that it is unlikely that this subpopulation will reach this goal given this apparent decline and the lack of information on the subpopulation from which loggerheads in the WNA originate. Continued efforts to reduce the adverse effects of fishing and other human-induced mortality on this population are necessary.

The most recent 5-year ESA sea turtle status review (NMFS and USFWS 1995) highlights the difficulty of assessing sea turtle population sizes and trends. Most long-term data comes from nesting beaches, many of which occur extensively in areas outside U.S. waters. Because of this lack of information, the TEWG was unable to determine acceptable levels of mortality. This status review supports the conclusion of the TEWG that the northern subpopulation may be experiencing a decline and that inadequate information is available to assess whether its status has changed since the initial listing as threatened in 1978. NMFS and USFWS (1995) concluded that loggerhead turtles should remain designated threatened but noted that additional research will be necessary before the next status review can be conducted.

Hawksbill Sea Turtle

The following is a summary of information on the Hawksbill sea turtle made available by NMFS at the following website:
http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.html

The hawksbill occurs in tropical and subtropical seas of the Atlantic, Pacific and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean, with representatives of at least some life history stages regularly occurring in southern Florida and the northern Gulf of Mexico (especially Texas); in the Greater and Lesser Antilles; and along the Central American mainland south to Brazil. Within the U.S., hawksbills are most common in Puerto Rico and its associated islands, and in the U.S. Virgin Islands. In the continental U.S., the species is recorded from all the gulf states and from along the eastern seaboard as far north as Massachusetts, with the exception of Connecticut, but sightings north of Florida are rare.

The hawksbill is a small to medium-sized sea turtle. In the U.S. Caribbean, nesting females average about 62-94cm in straight carapace length. Weight is typically to 80 kg in the wider Caribbean, with a record weight of 127 kg. Hatchlings average about 42 mm straight carapace length and range in weight from 13.5-19.5 g. The following characteristics distinguish the hawksbill from other sea turtles: two pairs of prefrontal scales; thick, posteriorly overlapping scutes on the carapace; four pairs of coastal scutes; two claws on each flipper; and a beak-like mouth. The carapace is heart-shaped in very young turtles, and becomes more elongate or subovate with maturity. Its lateral and posterior margins are sharply serrated in all but very old individuals.

Hawksbills utilize different habitats at different stages of their life cycle. Posthatchling hawksbills occupy the pelagic environment, taking shelter in weedlines that accumulate at convergence points. Hawksbills reenter coastal waters when they reach approximately 20-25 cm carapace length. Coral reefs are widely recognized as the resident foraging habitat of juveniles, subadults and adults. This habitat association is undoubtedly related to their diet of sponges, which need solid substrate for attachment. The ledges and caves of the reef provide shelter for resting both during the day and night. Hawksbills are also found around rocky outcrops and high energy shoals, which are also optimum sites for sponge growth. Hawksbills are also known to inhabit mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent. In Texas, juvenile hawksbills are associated with stone jetties.

Hawksbills utilize both low- and high-energy nesting beaches in tropical oceans of the world. Both insular and mainland nesting sites are known. Hawksbills will nest on small pocket beaches, and, because of their small body size and great agility, can traverse fringing reefs that limit access by other species. They exhibit a wide tolerance for nesting substrate type. Nests are typically placed under vegetation.

The hawksbill turtle's status has not changed since it was listed as endangered in 1970. It is a solitary nester, and thus, population trends or estimates are difficult to determine. The decline of nesting populations is accepted by most researchers. In 1983, the only known apparently stable populations were in Yemen, northeastern Australia, the Red Sea, and Oman. Commercial exploitation is the major cause of the continued decline of the hawksbill sea turtle. There is a continuing demand for the hawksbill's shell as well as other products including leather, oil, perfume, and cosmetics. Prior to being certified under the Pelly Amendment, Japan had been importing about 20 metric tons of hawksbill shell per year, representing approximately 19,000 turtles. A negotiated settlement was reached regarding this trade on June 19, 1992. The hawksbill shell commands high prices (currently $225/kilogram), a major factor preventing effective protection.

Incidental catch of hawksbill turtles during fishing operations is an unquantified and potentially significant source of mortality. Gill nets, longlines and shrimp trawls all take turtles in Gulf of Mexico waters. The extent to which hawksbills are killed or debilitated after becoming entangled in marine debris are unknown, but it is believed to be a serious and growing problem. Hawksbills have been reported entangled in monofilament gill nets, "fish nets", fishing line and rope. Hawksbill turtles eat a wide variety of debris such as plastic bags, plastic and styrofoam pieces, tar balls, balloons and plastic pellets. Effects of consumption include interference in metabolism or gut function, even at low levels of ingestion, as well as absorption of toxic byproducts.

Kemp’s Ridley Sea Turtle

The Kemp's ridley is probably the most endangered of the world's sea turtle species. The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). Estimates of the adult population reached a low of 1,050 in 1985, but increased to 3,000 individuals in 1997. First-time nesting adults have increased from 6% to 28% from 1981 to 1989, and from 23% to 41% from 1990 to 1994, indicating that the ridley population may be in the early stages of growth (TEWG 1998). More recently the TEWG (2000) concluded that the Kemp's Ridley population appears to be in the early stages of exponential expansion. While the number of females nesting annually is estimated to be orders of magnitude less than historical levels, the mean rate of increase in the annual number of nests has accelerated over the period 1987-1999. Preliminary analyses suggest that the intermediate recovery goal of 10,000 nesting females by 2020 may be achievable (TEWG 2000).

Juvenile Kemp's ridleys inhabit northeastern US coastal waters where they forage and grow in shallow coastal areas during the summer months. Juvenile ridleys migrate southward with autumnal cooling and are found predominantly in shallow coastal embayments along the Gulf Coast during the late fall and winter months.

Ridleys found in mid-Atlantic waters are primarily post-pelagic juveniles averaging 40 cm in carapace length, and weighing less than 20 kg. After loggerheads, they are the second most abundant sea turtle in Virginia and Maryland waters, arriving in there during May and June and then emigrating to more southerly waters from September to November. In the Chesapeake Bay, ridleys frequently forage in shallow embayments, particularly in areas supporting submerged aquatic vegetation (Lutcavage and Musick 1985). The juvenile population in Chesapeake Bay is estimated to be 211 to 1,083 turtles.

The model presented by Crouse et al. (1987) illustrates the importance of subadults to the stability of loggerhead populations and may have important implications for Kemp's ridleys. The vast majority of ridleys identified along the Atlantic Coast have been juveniles and subadults. Sources of mortality in this area include incidental takes in fishing gear, pollution and marine habitat degradation, and other man-induced and natural causes. Loss of individuals in the Atlantic, therefore, may impede recovery of the Kemp's ridley sea turtle population. Sea sampling data from the northeast otter trawl fishery and southeast shrimp and summer flounder bottom trawl fisheries has recorded takes of Kemp's ridley turtles.

Green Sea Turtle

Green sea turtles are more tropical in distribution than loggerheads, and are generally found in waters between the northern and southern 20°C isotherms. In the western Atlantic region, the summer developmental habitat encompasses estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and the North Carolina sounds, and south throughout the tropics (NMFS 1998). Most of the individuals reported in U.S. waters are immature (NMFS 1998). Green sea turtles found north of Florida during the summer must return to southern waters in autumn or risk the adverse effects of cold temperatures.

There is evidence that green turtle nesting has been on the increase during the past decade. For example, increased nesting has been observed along the Atlantic coast of Florida on beaches where only loggerhead nesting was observed in the past (NMFS 1998). Recent population estimates for the western Atlantic area are not available. Green turtles are threatened by incidental captures in fisheries, pollution and marine habitat degradation, destruction/disturbance of nesting beaches, and other sources of man-induced and natural mortality.

Juvenile green sea turtles occupy pelagic habitats after leaving the nesting beach. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats, and enter benthic foraging areas, shifting to a chiefly herbivorous diet (NMFS 1998). Post-pelagic green turtles feed primarily on sea grasses and benthic algae, but also consume jellyfish, salps, and sponges. Known feeding habitats along U.S. coasts of the western Atlantic include shallow lagoons and embayments in Florida, and similar shallow inshore areas elsewhere (NMFS 1998).

Sea sampling data from the scallop dredge fishery and southeast shrimp and summer flounder bottom trawl fisheries have recorded incidental takes of green turtles

Shortnose Sturgeon

Shortnose sturgeon occur in large rivers along the western Atlantic coast from the St. Johns River, Florida (possibly extirpated from this system), to the Saint John River in New Brunswick, Canada. The species is anadromous in the southern portion of its range (i.e., south of Chesapeake Bay), while northern populations are amphidromous (NMFS 1998). Population sizes vary across the species' range with the smallest populations occurring in the Cape Fear and Merrimack Rivers and the largest populations in the Saint John and Hudson Rivers (Dadswell 1979; NMFS 1998).

Shortnose sturgeon are benthic and mainly inhabit the deep channel sections of large rivers. They feed on a variety of benthic and epibenthic invertebrates including mollusks, crustaceans (amphipods, chironomids, isopods), and oligochaete worms (Vladykov and Greeley 1963; Dadswell 1979). Shortnose sturgeon are long-lived (30 years) and mature at relatively old ages. In northern areas, males reach maturity at 5-10 years, while females reach sexual maturity between 7 and 13 years.

In the northern part of their range, shortnose sturgeon exhibit three distinct movement patterns that are associated with spawning, feeding, and overwintering periods. In spring, as water temperatures rise above 8°C, pre-spawning shortnose sturgeon move from overwintering grounds to spawning areas. Spawning occurs from mid/late April to mid/late May. Post-spawned sturgeon migrate downstream to feed throughout the summer.

As water temperatures decline below 8°C again in the fall, shortnose sturgeon move to overwintering concentration areas and exhibit little movement until water temperatures rise again in spring (NMFS 1998). Young-of-the-year shortnose sturgeon are believed to move downstream after hatching (NMFS 1998) but remain within freshwater habitats. Older juveniles tend to move downstream in fall and winter as water temperatures decline and the salt wedge recedes. Juveniles move upstream in spring and feed mostly in freshwater reaches during summer.

Shortnose sturgeon spawn in freshwater sections of rivers, typically below the first impassable barrier on the river (e.g., dam). Spawning occurs over channel habitats containing gravel, rubble, or rock-cobble substrates (NMFS 1998). Environmental conditions associated with spawning activity include decreasing river discharge following the peak spring freshet, water temperatures ranging from 9^oC to 12^oC (44.6^oF to 53.6^oF), and bottom water velocities of 0.4 - 0.7 m/sec (NMFS 1998).

Atlantic salmon

The recent ESA-listing for Atlantic salmon covers the wild population of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S.-Canada border. These include the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot Rivers and Cove Brook. Atlantic salmon are an anadromous species with spawning and juvenile rearing occurring in freshwater rivers followed by migration to the marine environment. Juvenile salmon in New England rivers typically migrate to sea in May after a two to three year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn from mid October through early November. While at sea, salmon generally undergo an extensive northward migration to waters off Canada and Greenland. Data from past commercial harvest indicate that post-smolts overwinter in the southern Labrador Sea and in the Bay of Fundy. The numbers of returning wild Atlantic salmon within the Gulf of Maine Distinct Population Segment (DPS) are perilously small with total run sizes of approximately 150 spawners occurring in 1999 (Baum 2000). Although capture of Atlantic salmon has occurred in commercial fisheries (usually otter trawl or gillnet gear) or by research/survey, no salmon have been reported captured in the Atlantic surfclam and ocean quahog fisheries.

Smalltooth sawfish

NMFS issued a final rule to list the DPS of smalltooth sawfish in the U.S. as an endangered species on April 1, 2003. Smalltooth sawfish are tropical marine and estuarine fish that have the northwestern terminus of their Atlantic range in the waters of the eastern U.S.. In the U.S., smalltooth sawfish are generally a shallow water fish of inshore bars, mangrove edges, and seagrass beds, but larger animals can be found in deeper coastal waters. In order to assess both the historic and the current distribution and abundance of the smalltooth sawfish, a status review team collected and compiled literature accounts, museum collection specimens, and other records on the species. This information indicated that prior to around 1960, smalltooth sawfish occurred commonly in shallow waters of the Gulf of Mexico and eastern seaboard up to North Carolina, and more rarely as far north as New York. Subsequently their distribution has contracted to peninsular Florida and, within that area, they can only be found with any regularity off the extreme southern portion of the state. The current distribution is centered in the Everglades National Park, including Florida Bay (NMFS 2003).

Smalltooth sawfish have declined dramatically in U.S. waters over the last century, as indicated by publication and museum records, negative scientific survey results, anecdotal fishermen observations, and limited landings per unit effort (NMFS 2003). The fact that documented smalltooth sawfish catch records have declined during the twentieth century despite tremendous increases in fishing effort underscores the population reduction in the species. While NMFS lacks time-series abundance data to quantify the extent of the DPS's decline, the best available information indicates that the abundance of the U.S. DPS of smalltooth sawfish is at an extremely low level relative to historic levels.

The smalltooth sawfish continues to face threats from: (1) loss of wetlands, (2) eutrophication, (3) point and non point sources of pollution, (4) increased sedimentation and turbidity, (5) hydrologic modifications, and (6) incidental catch in fisheries (NMFS 2003). Commercial bycatch has played the primary role in the decline of this species. While Federal, state, and interjurisdictional laws, regulations, and policies lead to overall environmental enhancements indirectly aiding smalltooth sawfish, very few have been applied specifically for the protection of smalltooth sawfish. Based on the species' low intrinsic rate of increase resulting from their slow growth, late maturation, and low fecundity, population recovery potential for the species is limited and the species is at risk of extinction. Current protective measures and conservation efforts underway to protect the smalltooth sawfish are confined to: actions directed at increasing general awareness of this species and the risks it faces; possession prohibitions in the state waters of Florida and Louisiana; and research being pursued by the Mote Marine Laboratory's Center for Shark Research. There are no Federal or state conservation plans for the smalltooth sawfish.

Seabirds

Most of the following information about seabirds is taken from the Mid-Atlantic Regional Marine Research Program (1994) and Peterson (1963). Fulmars occur as far south as Virginia in late winter and early spring. Shearwaters, storm petrels (both Leach's and Wilson's), jaegers, skuas, and some terns pass through this region in their annual migrations. Gannets and phalaropes occur in the Mid-Atlantic during winter months. Nine species of gulls breed in eastern North America and occur in shelf waters off the northeastern US. These gulls include: glaucous, Iceland, great black-backed, herring, laughing, ring-billed, Bonaparte's and Sabine's gulls, and black-legged caduceus. Royal and sandwich terns are coastal inhabitants from Chesapeake Bay south to the Gulf of Mexico. The Roseate tern is listed as endangered under the ESA, while the least tern is considered threatened (Safina pers. comm.). Tilefish are not important prey for the Common and Roseate terns (Safina *et al*. 1988 and 1990).

In addition, the bald eagle is listed as threatened under the ESA and is a bird of aquatic ecosystems. Piping plover are listed as threatened and their critical habitat includes prairie alkali wetlands and surrounding shoreline; river channels and associated sandbars and islands; and reservoirs and inland lakes and their sparsely vegetated shorelines, peninsulas, and islands. These areas provide primary courtship, nesting, foraging, sheltering, brood-rearing and dispersal habitat for piping plovers.

Like marine mammals, seabirds are vulnerable to entanglement in commercial fishing gear. Human activities such as coastal development, habitat degradation, and the presence of organochlorine contaminants are considered the major threats to some seabird populations.

APPENDIX I. PORT PROFILES

Defining What Constitutes a Community

Before beginning with the profiles a few words are necessary about how community is defined in this document. By National Standard 8 requirements, a fishing community must be a geographic entity. Generally speaking, we use any geographic unit that the U.S. Census recognizes as a "place". This includes cities, towns, and some townships, boroughs or other small administrative entities. However, it must be smaller than a county. Occasionally a town may be unincorporated and not have been surveyed as a "Census Designated Place" or CDP. In this case, there are no available census data for the entity. Unless it appears as important in terms of landings or residence of permit holders, such an entity will be aggregated into the next largest available census place. In this document the port/town is the most basic unit of analysis. Because in some cases there is a port which serves as the base for fishing activity but most fishermen do not reside directly in that port town, both owner's home address and primary port of landing for a vessel are discussed. Further, many small towns within the same county share social and economic networks as well as cultural characteristics, making it useful to discuss them as a unit. Thus relevant county and state data will also be highlighted.

NEFSC has been working on these profiles since 2004. Depending on the date when the first draft of each profile was written, the most recent landings data may range from 2003-2005. Rather than constantly update to the most recent year, we are waiting until a full set is complete (likely fall 2007) to update all the profiles with full year 2006 landings data. Thus, there is inconsistency in the years used for landings. For fully comparable landings data, see the Affected Human Environment section.

These profiles are constructed almost solely using secondary data, for reasons of both time and cost. A groundtruthing process of selected communities is in process, and during the summer of 2007 the profiles will be sent to government and fishing association representatives within each community for review.

- All census data (including those found in figures) are from the American Factfinder page of the Census for that community from the 2000 Census (see http://factfinder.census.gov/home/saff/main.html).
- Reference maps reproduced here are located at the upper right of each community's Factfinder page.
- Occasional comparative data from 1990 can be found at http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_tabId=DEC2&_submenuId=datasets_1&_lang=en&_ts=190737473449.
- Data on religious affiliation from the American Religion Data Archive can be found at http://www.thearda.com/.
- Official poverty thresholds can be reviewed at http://www.census.gov/hhes/www/poverty/threshld/thresh00.html.
- All landings data are from the NMFS Landing Database (informally known as "the weighout"). Permit data are from the NMFS Northeast Regional Office permit database.
- Other data are referenced via endnotes within the text.

Choosing Which Communities to Profile

The ports profiled for this Amendment are any ports/communities that appeared as important due to their total landings or value of tilefish, their dependence on tilefish relative to other species, or the number of tilefish dealers present, as detailed in the Affected Human Environment section. They are: Montauk, Hampton Bays, Mattituck, Freeport and Greenport, NY; Long Beach/Barnegat Light, Pine Beach, Middletown, and Pt. Pleasant, NJ; Gloucester and New Bedford, MA; and Point Judith and Newport, RI. In addition, Sea Isle City, NJ appears as important in the Social Impact section, where rather than combined data from 2000-2005, only 2005 data are used. (While 2000-2005 combined data give a more holistic picture of the community historically, it is assumed that impacts will follow the most current available landings data.) See Table 1 below.

Table 1: Communities Profiled

State	**County**	**Port**
New York	*Suffolk*	Montauk
		Hampton Bays/Shinnecock
		Mattituck
		Freeport
		Greenport
New Jersey	*Ocean*	Long Beach/Barnegat Light
		Pine Beach
		Point Pleasant/Point Pleasant Beach
	Monmouth	Belford/Middletown
	Cape May	Sea Isle City
Massachusetts	*Essex*	Gloucester
	Bristol	New Bedford
Rhode Island	*Newport*	Newport
	Washington	Point Judith

NEW YORK

SUFFOLK COUNTY

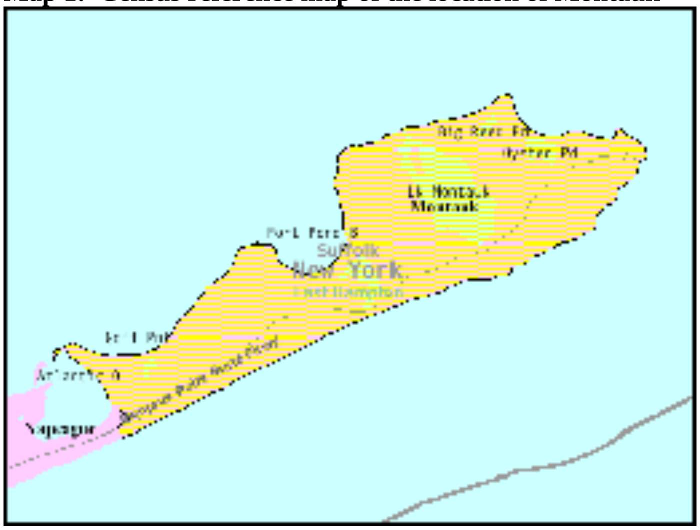
MONTAUK

People and Places

Regional orientation

Montauk (41.00°N, 71.57°W) is located in Suffolk County at the eastern tip of the South Fork of Long Island in New York. It is situated between the Atlantic Ocean to the south, and Block Island Sound to the north. See
Map 1 below.

Map 1: Census reference map of the location of Montauk



Historical/Background information

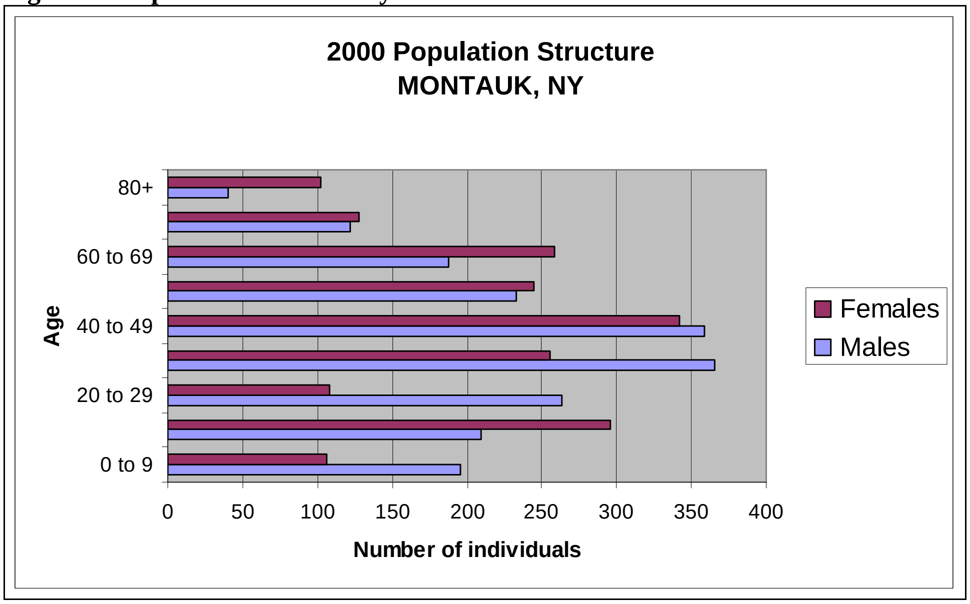
Montauk was originally inhabited by the Montauket tribe, who granted early settlers permission to pasture livestock here, essentially the only function of this area until the late 1800s. The owner of the Long Island Railroad extended the rail line here in 1895, hoping to develop Montauk “the first port of landing on the East Coast, from which goods and passengers would be transported to New York via the rail. While his grandiose vision was not fulfilled, the rail provided the necessary infrastructure for the transportation of seafood, and Montauk soon became the principal commercial fishing port on the East End. In the early 1900s, the railroad also brought recreational fishermen to the area from the city by the car-load aboard the ‘Fishermen’s Special’, depositing them right at the dock where they could board sportfishing charter and party boats.” Montauk developed into a tourist destination around that time, and much of the tourism has catered to the sportfishing industry.[1]

Demographics

According to Census 2000 data, Montauk had a total population of 3,851, up 28.3% from 1990. Of this total in 2000, 48.7% were female and 51.3% were male. The median age was 39.3 years and 77.4% of the population was 21 years or older while 17.7% were 62 or older. See Figure 1 below.

Montauk’s age structure showed large variation between sexes in different age groups. It is important to note that the differences appear dramatic because this population is small. In the age group including people from 20 to 29 years old, there were more than twice as many males as females in Montauk. A similar pattern exists in the 30 to 39 year age group. This is probably because males come to the area to work after high school for demanding labor jobs such as landscaping and construction. Females do not traditionally seek after these types of jobs that are available in Montauk.

Figure 1: Population structure by sex in 2000



The majority of the population of Montauk in 2000 was white (86.6%), with 1.2% of residents Black or African American, 0.6% Native American, 1.1% Asian, 0.1% Pacific Islander or Hawaiian, and 10.5% listed as "other". (See Figure 2 below.) A reported 23.9% of the total population was Hispanic/Latino. (See Figure 3 below.) Residents linked their heritage to a number of ancestries including: Irish (26.5%), German (17.3%) and Italian (13.1%). With regard to region of birth, 61.1% were born in New York, 11.1% were born in a different state and 27.0% were born outside of the U.S. (including 21.2% who were not United States citizens).

Figure 2: Racial Structure in 2000

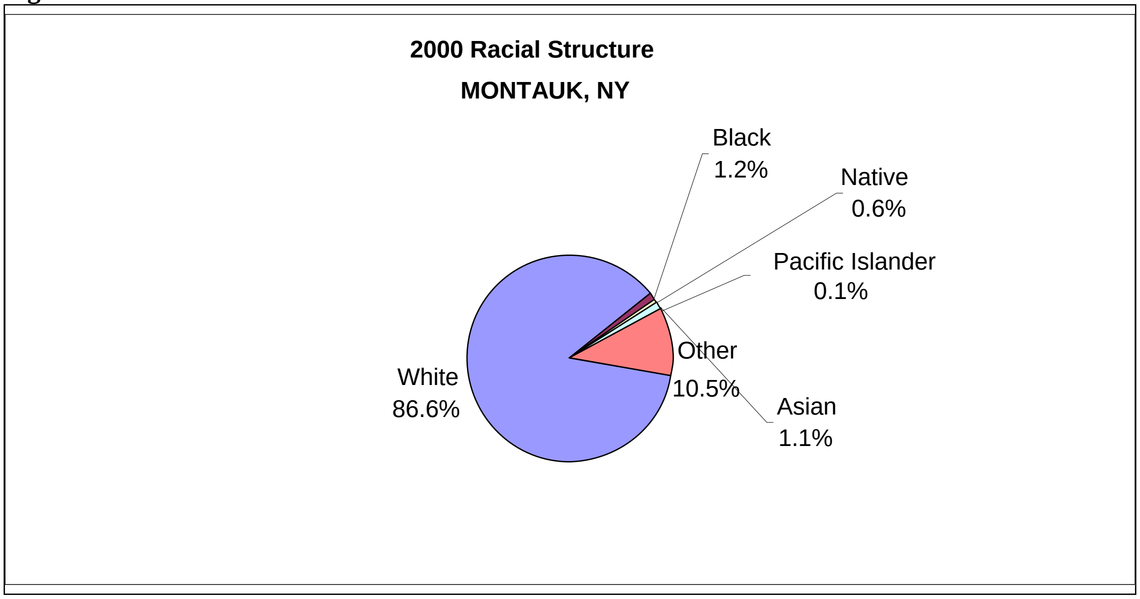
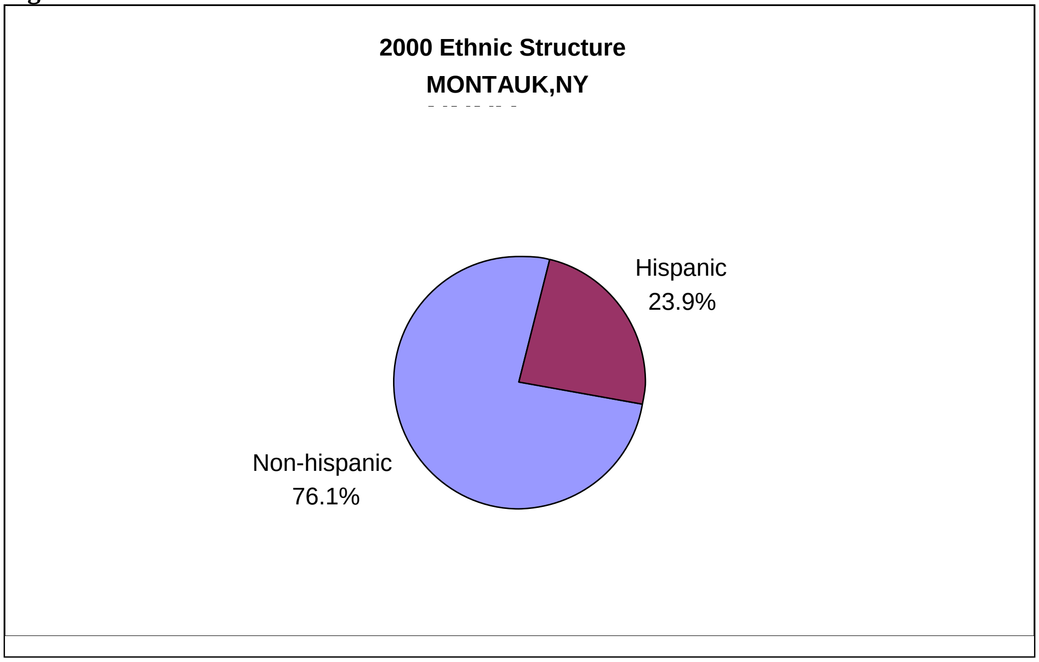


Figure 3: Ethnic Structure in 2000



For 69.7% of the population 5 years old and higher in 2000, only English was spoken in the home. This leaves 30.3% in homes where a language other than English was spoken; of these 15.6% of the population spoke English less than 'very well' and 25% spoke Spanish.

Of the population 25 years and over, 84% were high school graduates or higher and 24.8% had a bachelor's degree or higher. Again of the population 25 years and over, 7.6% did not reach ninth grade, 8.4% attended some high school but did not graduate, 31.9% completed high school, 19.6% had some college with no degree, 7.8% received their associate degree, 17.0% earned their bachelor's degree, and 7.8% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Suffolk County was Catholic with 72 congregations and 734,147 adherents. Other prominent congregations in the county were Jewish (48 with 100,000 adherents), United Methodist (47 with 22,448 adherents), Episcopal (40 with 16,234 adherents), Evangelical Lutheran Church (26 with 19,378 adherents), and Muslim (9 with 12,139). The total number of adherents to any religion was up 3.8% from 1990.

Issues/Processes

Some fishermen are concerned about the accuracy of their assigned historical landings by species for fisheries (often used for promulgating new regulations), as the method used to land fish in New York varies from that in most other states. Called the "box method" it involves fish being boxed at sea, then landed at a consignment dock and from there shipped to Fulton Fish Market in New York City. Prior to the implementation of dealer electronic reporting, NMFS port agents counted the number of boxes landed from each vessel and received a species breakdown from the dock manager (who did not open the boxes but rather based the breakdown on his knowledge of the vessel's general fishing patterns). This system allowed greater potential for accidental mis-reporting. Now, the boxes are landed at the consignment dock and immediately shipped to Fulton, where the dealer opens the boxes and reports the landings. (Further, individual fishermen report using VTR, logbooks and other methods.)

While this method is more accurate in terms of the number and type of fish landed, it can still lead to another type of accidental reporting error. That is, landings are assigned to the incorrect state. This can have inequitable effects on states should an allocation scheme be developed, such as the one for summer flounder, that bases a state's allocation on the landings of a particular species in that state.

The docks make money by charging $10-12 per box (2007 prices) and by selling fuel. Catch limits and trip limits reduce the number of boxes to be shipped, and have made it very difficult for the docks to stay in business. New York is losing much of its infrastructure, and many of the docks have closed or changed hands in recent years.[2]

Inlet Seafood, the largest seafood packing operation in the state, recently expanded their facility and to include a restaurant and convenience store, which met with considerable opposition from those living in the surrounding neighborhood, concerned about a resulting increase in traffic.[3] There are very strict zoning regulations in the town, which make it very difficult for any industry located on the waterfront to expand.[4] There was also a bill proposed recently to limit beach access by vehicles in areas where coastal erosion is a problem, which would restrict access to many of the spots favored by surf casters in Montauk.[5] There is also concern that recent regulations reducing allowable catches of certain species by recreational fishermen will have a negative impact on the party and charter fishing industry.[6]

The Long Island Power Authority is seeking permission to construct a wind farm off Long Island, a proposal which has met with opposition from commercial fishermen in Montauk and elsewhere on the island, because the turbines will block access to a highly productive squid fishery.[7] The lobstermen working out of Montauk have seen their industry decline largely because of the prevalence of shell disease in lobsters taken from Long Island Sound.[8]

Cultural attributes

Montauk has several annual festivities that celebrate sport fishing and one that celebrates commercial fishing. The Blessing of the Montauk Fleet takes place in June. The Grand Slam Fishing Tournament has been in Montauk since 2002. The Harbor Festival at Sag Harbor, which is located next to Montauk, is celebrated in September. There is also a Redbone Fishing Tournament, the Annual Striped Bass Derby (13th year in 2005), and the Annual Fall Festival (24th year in 2005), which is includes shellfish related activities such as a clam chowder festival and clam shucking.[9] There is also a monument in Montauk dedicated to over 100 commercial fishermen from the East End who have lost their lives at sea over the years.[10]

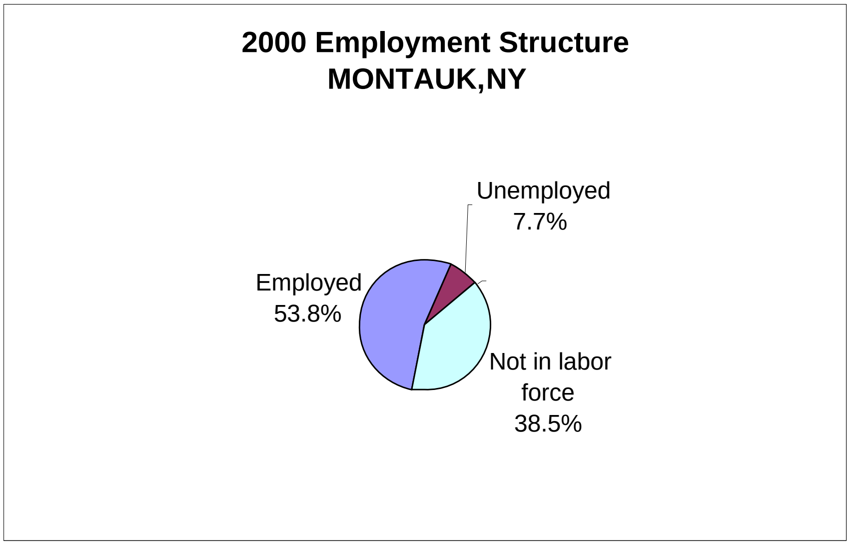
Infrastructure

Current Economy

The majority of the employers in Montauk are seasonal and dependent on the tourist industry, including restaurants and hotels. Probably the largest seasonal employer is Gurney's Inn, which is a resort hotel, spa, and conference center, open year round, with 350 employees during the summer months.[11] "With the exception of a few resorts and retail businesses, (Inlet Seafood) is one of the only full-time, year-round employers in Montauk, employing between four and six dock workers, a secretary, and a manager. All of the employees live in Montauk or East Hampton, but housing is a problem due to the high cost of living in the area. Labor turnover is low due to the ability of the dock to provide equitable wages and predictable pay throughout the year. The dock does compete with landscaping and construction companies for labor, especially from among immigrant populations. All of the dock workers are immigrants from Central and South America".[12] Many of the fishermen have had to learn Spanish to communicate with the dock workers. This has been a dramatic change within the last 5 years, said NMFS port Agent Erik Braun. He also stated that there are no new fishermen starting up, and the children of fishermen, even those that are doing well, are not encouraged to enter into this business.[13] The marinas here also employ a large number of people, including Montauk Marine Basin, with 21 employees during the summer months.[14]

According to the U.S. Census 2000, 61.5% (1,944 individuals) of the total population 16 years of age and over were in the labor force, of which 7.7% were unemployed and no residents were in the Armed Forces. See Figure 4 below.

Figure 4: Employment Structure in 2000



According to Census 2000 data, jobs in the census grouping which includes agriculture, forestry, fishing and hunting, and mining accounted for 103 positions or 6.1% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 314 positions or 18.5% of jobs. Arts, entertainment, recreation, accommodation and food services (20.3%), construction (18.5%) and retail trade (10.1%) were the primary industries.

Median household income in Montauk was $42,329 (up from 32.9% from 1990) and per capita income was $23,875. For full-time year round workers, men made approximately 41.6% more per year than women.

The average family in Montauk consists of 2.90 persons. With respect to poverty, 8.3% of families (up from 0% in 1990) and 10.6% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 40.0% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Montauk had a total of 4,815 housing units of which 33.1% were occupied and 61.7% were detached one unit homes. Less than 10% (9.4%) of these homes were built before 1940. There were a number of mobile homes/vans/boats in this area, accounting for 4.0% of the total housing units; 84.1% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $290,400. Of vacant housing units, 62.9% were used for seasonal, recreational, or occasional use, while of occupied units 34.3% were renter occupied.

Governmental

Montauk is an unincorporated village within East Hampton Township. The Town Board runs the town.[15] The town was established in 1788. Although Montauk is not incorporated, there is one incorporated village situated within the East Hampton's borders, the Village of East Hampton, and part of a second village, Sag Harbor.[16]

Fishery involvement in government

The Town Board of East Hampton organized a “Fishing Committee” to represent the fishing industry’s interests in the development of the town’s comprehensive plan.[17]

Institutions

Fishing associations

The Long Island Commercial Fishing Association, located in Montauk, promotes commercial fishing throughout Long Island.[18] The Montauk Tilefish Association (MTA) "is a registered non-profit organization whose objective is to provide an organizational structure for making collective decisions for its members. The MTA also provides members protections under the Fishermen's Collective Marketing Act" (p. 195). Further, it "has worked to create and foster a fisheries management regime that is efficient and encourages resource stewardship at the local level. Other important outcomes from this collaboration include fresher fish for the market and a more stable operating environment. (p. 192)".[19]

<u>Fishery assistance centers</u>

No fishery assistance centers were identified through secondary sources.

<u>Other fishing-related institutions</u>

The New York Seafood Council, located in Hampton Bays, is a non-profit membership organization made up of individuals, businesses, and organizations involved in the fishing industry whether through harvesting, processing, distribution or service. The council has over 200 members and their primary goal is to promote seafood and the seafood industry.[20]

The Montauk Boatmen's and Captain's Association has a membership of over 100 captains of charter and party boats, and is one of the only organized, politically active charter boat associations in New York.[21] The Montauk Surfcasters Association is an organization of surf fishermen with over 900 members who wish to preserve their access to surf casting on the East End beaches of Long Island. They hold beach clean-ups and educate the public about the proper use of the beach.[22]

Physical

The fishing fleet is located in Lake Montauk, which opens to the north onto Block Island Sound. "Montauk is connected to points west via Route 27, and the Metropolitan Transportation Authority's Long Island Rail Road."[23] On the easternmost tip of Long Island, Montauk is roughly 117 miles from New York City, but only about 20 miles by boat from New London, CT. There is one small airport in Montauk, and Long Island Islip MacArthur Airport is 67 miles away.[24] During the summers, a ferry service runs between Montauk and New London on weekends, daily to Block Island, RI, and occasionally to Martha's Vineyard.[25] There are also three different ferry services that run between New London and nearby Sag Harbor.[26] Most fish landed in Montauk is sold at the Fulton Fish Market in New York City.[27]

The infrastructure needed for a commercial and sport fishing fleet is available in the village,[28] including docks with off-loading facilities and other services that commercial fishermen need to land their catch.[29] Montauk used to have five docks used by the commercial fishing industry for packing out fish, but they now only have two.[30] Inlet Seafood Company, a corporation owned by six Montauk fishermen,[31] includes a dock with unloading and other services, and is the largest fish packing facility in the state.[32] There is another dock servicing commercial fishermen, but this dock is barely surviving financially.[33] There are also at least fourteen marinas used by the sportfishing industry.[34]

Involvement in Northeast Fisheries

Commercial

The village of Montauk is the largest fishing port in the state of New York. As noted in the History/Background section, Montauk's main industry has been fishing since colonial times, and it continues to be an important part of its economy and traditions.[35] Montauk is the only port in New York still holding on to a commercial fishing industry. [36]Montauk's location naturally provides a large protected harbor on Lake Montauk and is close to important fishing grounds for both commercial and recreational fishermen.

Montauk has a very diverse fishery, using a number of different gear types and catching a variety of species; in 1998, there were a total of 90 species landed in Montauk.[37] According to NMFS Landings Data, the top three valued fisheries in 2003 were Squid ($2.3million), Silver Hake ($2.1million), and Golden Tilefish ($2.1million). In 2003, the landings values for most species categories were lower than or about equal to the average values for 1997-2004. The biggest exceptions are the "other" category and monkfish, both of which saw large increases in value in 2003. Overall, the value of fish landed in Montauk saw a slight decrease from 1997-2003, while the value of fish landed by vessels homeported in Montauk saw a slight increase for the same time period. (See Table 3 below.) Significant increases from the eight-year average were apparent in 2003 for tilefish and for monkfish.

There used to be a number of longline vessels that fish out of Montauk, including 4-5 fishing for tilefish and up to 8 fishing for tuna and swordfish. Additionally, a number of longline vessels from elsewhere in New York State and New Jersey would sometimes land their catch at Montauk.[38] Today there are 3 tilefish longliners in Montauk, one of which has bought out a fourth.[39] There are also 35-40 trawlers based in Montauk, with a number of others that unload their catch here, and between 10-15 lobster vessels.[40] The six owners of Inlet Seafood each own 1-2 trawlers.[41] There are also a number of baymen working in the bays around Montauk catching clams, scallops, conch, eels, and crab as well as some that may fish for bluefish and striped bass. However, these baymen may move from one area to another depending on the season and fishery, and as a result may not be a part of the permanent fleet here.[42]

Landings by Species

Table 2: Dollar value of Federally Managed Groups of landing in Montauk

	Average from 1997-2004	**2003 only**
Squid, mackerel, butterfish	2,801,956	2,468,112
Other	2,774,332	1,174,834
Smallmesh groundfish[43]	1,995,959	2,287,420
Summer flounder, scup, black sea bass	1,305,416	1,494,652
Tilefish	982,492	2,083,544
Largemesh groundfish[44]	686,748	473,652

Lobster	538,379	325,764
Monkfish	246,137	629,210
Bluefish	75,915	61,472
Skate	27,228	30,634
Dogfish	10,996	3,249
Scallop	3,980	784
Herring	368	39
Red crab	4	0
Surfclam, ocean quahog	1	0

Vessels by Year

Table 3: All columns represent vessel permits or landings value combined between 1997-2003

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	165	89	9,222,288	13,556,572
1998	146	88	9,652,978	12,080,693
1999	158	98	10,863,508	12,124,707
2000	166	103	10,286,306	13,139,382
2001	160	103	12,302,916	13,231,619
2002	153	99	11,981,882	11,131,789
2003	152	104	12,405,663	11,033,366

Recreational

Montauk is the home port of a large charter and party boat fleet, and a major site of recreational fishing activity.[45] The facilities supporting the recreational fishing industry include six bait and tackle shops and 19 fishing guide and charter businesses.

According to one website there are at least 27 fishing charters in Montauk. Montauk has been called the "sport fishing capital of the world", and even has its own magazine dedicated to Montauk sportfishing.[46] Between 2001- 2005, there were 122 charter and party vessels making 18,345 total trips registered in logbook data by charter and party vessels in Montauk carrying a total of 185,164 anglers.

Subsistence

No information for subsistence fishing in Montauk has been found using secondary sources.

Future

The comprehensive plan for the town of East Hampton recognizes the importance of the commercial and recreational fishing industries here, and includes a commitment to supporting and retaining this traditional industry.[47] There has been discussion of developing a large wholesale seafood market on Long Island similar to the Fulton Fish Market so that fish caught here could be sold directly on Long Island rather than being shipped to New York.[48]

Nonetheless Erik Braun, the port agent for this part of New York, was not hopeful about the future of the fishing industry. He said there are no new fishermen getting into commercial fishing, and that even those who have done well are not encouraging their children to get into the industry. Much of the fishing infrastructure is disappearing, and those who own docks can make much more by turning them into restaurants. Montauk is the one port still holding on to a commercial fishing industry, however.[49]

HAMPTON BAYS/SHINNECOCK

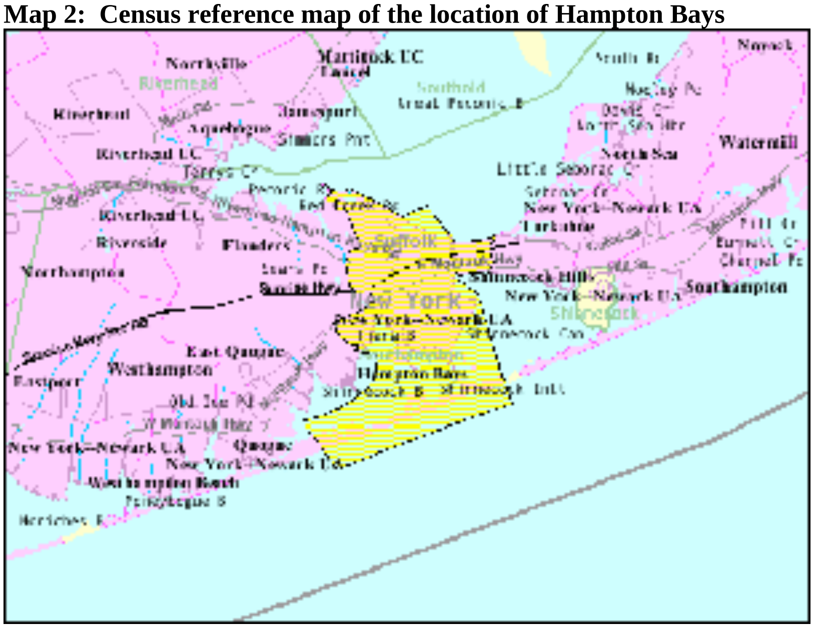
People and Places

Regional orientation

Hampton Bays and Shinnecock here are considered to be the same community. Shinnecock is the name of the fishing port located in Hampton Bays on the barrier island next to Shinnecock Inlet, and does not actually refer to a geopolitical entity. Fishermen use either port name in reporting their catch, but they are considered to be the same physical place.

The hamlet of Hampton Bays is located on the southern coast of Long Island, NY in the town of Southampton. It is roughly 30 miles from Montauk, NY on the eastern tip of Long Island, and about 90 miles from New York City.[50] Southampton is a very large township, encompassing 128 square miles. [51] Hampton Bays is the most populous of eighteen unincorporated hamlets within Southampton.[52] Hampton Bays is on the west side of Shinnecock Bay, a bay protected from the Atlantic by a barrier island and accessed through Shinnecock Inlet. The Shinnecock Canal connects Shinnecock Bay with Great Peconic Bay to the north, allowing vessels to pass between the southern and northern sides of Long Island without having to travel east around Montauk.[53]

Map 2: Census reference map of the location of Hampton Bays



Historical/Background information

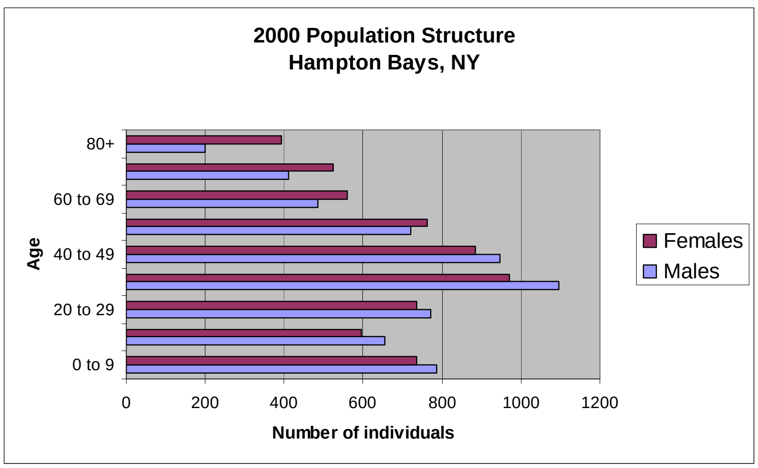
The first inhabitants of this area were Native Americans from the Shinnecock tribe, people who still reside in Southampton today on the Shinnecock Reservation. The first European settlers arrived here in 1640, from Lynn, Massachusetts. Sag Harbor in Southampton was an important whaling port early on, and along with agriculture was the town's primary industry. Starting in the 18th century, residents would dig inlets between Shinnecock Bay and the Atlantic Ocean to allow water in the Bay to circulate, and to increase fish and shellfish productivity in the bay. The Shinnecock Canal, connecting Shinnecock Bay with Peconic Bay, was built in 1892.[54] During the 1870s, as the Long Island Railroad running between New York City and Montauk was completed, the communities in Southampton became important tourist destinations where New York City residents built their summer homes, and it retains this distinction today as a vacation destination for New Yorkers. The population of Southampton grows considerably during the summer months, and at its peak is nearly triple the winter population.[55]

Demographics

According to Census 2000 data, Hampton Bays had a total population of 12,236, up 55.0% from 7,893 in 1990. Of this total in 2000, 50.4% were female and 49.6% were male. The median age was 38.8 years and 76.3% of the population was 21 years or older while 19.1% were 62 or older. See Figure 5 below.

Hampton Bays' age structure showed the majority of residents to be in the 30-39 and 40-49 year old age categories. There is a relatively even distribution of men and women in all age categories. A slight dip in the number of 10-19 year olds probably indicates students leaving for college at this time, but there is nothing to demonstrate significant migration either in or out of Hampton Bays.

Figure 5: Population structure by sex in 2000



The majority of the population of Hampton Bays in 2000 was white (92.8%), with 1.1% of residents Black or African American, 0.4% Native American, 0.9% Asian, and 0.1% Pacific Islander or Hawaiian. (See Figure 6 below.) A total of 12.5% of the total population was Hispanic/Latino. (See Figure 7below.) Residents linked their heritage to a number of ancestries including: Irish (25.7%), Italian (21.6%), German (17.3%), and English (11.6%). With regard to region of birth, 74.7% were born in New York, 10.8% were born in a different state and 13.4% were born outside of the U.S. (including 8.7% who were not United States citizens).

Figure 6: Racial Structure in 2000

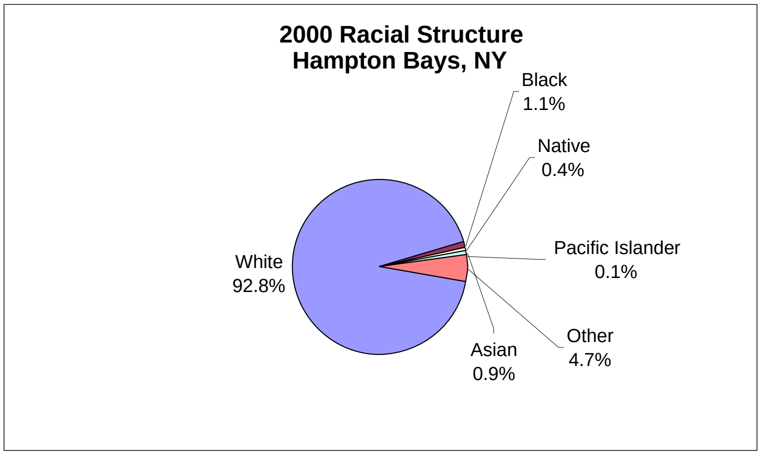
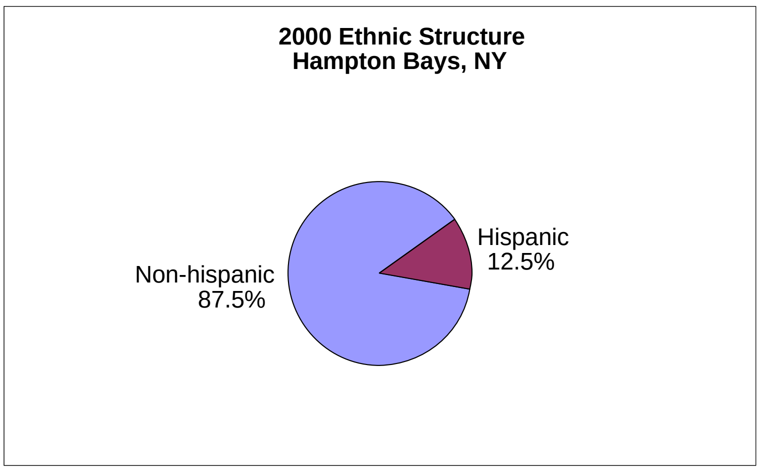


Figure 7: Ethnic Structure in 2000



For 82.8% of the population 5 years old and higher in 2000, only English was spoken in the home, leaving 17.2% in homes where a language other than English was spoken, and including 9.2% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 86.6% were high school graduates or higher and 25.9% had a bachelor's degree or higher. Again of the population 25 years and over, 5.3% did not reach ninth grade, 8.0% attended some high school but did not graduate, 33.2% completed high school, 20.8% had some college with no degree, 6.7% received their associate degree, 16.0% earned their bachelor's degree, and 9.9% received either their graduate or professional degree.

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Issues/Processes

The population of the town of Southampton has been growing steadily, and a number of seasonal home owners are choosing to live here year round. This is changing the population structure and dynamics of the town, and is likely to cause house prices to increase in an area where affordability is already a problem. The area around Shinnecock Inlet is one where much growth is expected to occur.[56] As in many other coastal communities with a fishing industry, the soaring costs of waterfront property make it very difficult for fishermen and others in the industry to afford or retain necessary waterfront property for water access.[57] Most of the infrastructure at Shinnecock has disappeared in the last few years; where there were at one time three docks for commercial fishermen to pack out at, now only one remains.

Some fishermen are concerned about the accuracy of their assigned historical landings by species for fisheries (often used for promulgating new regulations), as the method used to land fish in New York varies from that in most other states. Called the "box method" it involves fish being boxed at sea, then landed at a consignment dock and from there shipped to Fulton Fish Market in New York City. Prior to the implementation of dealer electronic reporting, NMFS port agents counted the number of boxes landed from each vessel and received a species breakdown from the dock manager (who did not open the boxes but rather based the breakdown on his knowledge of the vessel's general fishing patterns). This system allowed greater potential for accidental mis-reporting. Now, the boxes are landed at the consignment dock and immediately shipped to Fulton, where the dealer opens the boxes and reports the landings. Further, individual fishermen report using VTR, logbooks and other methods.

While this method is more accurate in terms of the number and type of fish landed, it can still lead to another type of accidental reporting error. That is, landings are assigned to the incorrect state. This can have inequitable effects on states should an allocation scheme be developed, such as the one for summer flounder, that bases a state's allocation on the landings of a particular species in that state.

The docks make money by charging $10-$12 per box (2007 prices) and by selling fuel. Catch limits and trip limits reduce the number of boxes to be shipped, and have made it very difficult for the docks to stay in business. New York is losing much of its infrastructure, and many of the docks have closed or changed hands in recent years.[58]

In recent years some vessels have been repossessed, which signifies a great change in a fishery where there was always money to be made at one time. The rest of the fleet is aging badly, but fishermen cannot afford new vessels.[59]

As in many other areas of Long Island where clams and other shellfish are a significant part of the fishing industry, water quality is a consistent problem in the increasingly populated shallow bays where the clams are dug.[60] The bays have had several problems with algal blooms of *Aureococcus anophagefferens*, or brown tide, which killed off bay scallop populations here, and is believed to be related to nutrient depletion in the bay.[61]

Shinnecock Inlet needs to be dredged consistently because of siltation to allow commercial fishermen and recreational vessels to pass in and out of the inlet into the Atlantic Ocean, which is a costly process.[62] The Long Island Power Authority is seeking permission to construct a wind farm off Long Island, a proposal which has met with opposition from commercial fishermen in Hampton Bays and elsewhere on the island, because the turbines will block access to a highly productive squid fishery.[63]

Cultural attributes

Sportfishing tournaments are a popular event in this area.[64]

Infrastructure

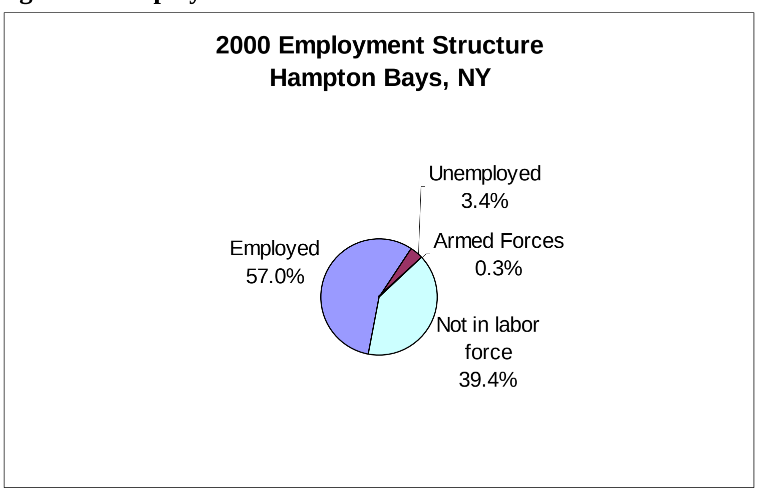
Current Economy

The largest employer in Southampton Town is Southampton Hospital, which employs over 100 people. Other significant sources of employment for residents are in businesses related to tourism or the second home industry, including landscaping, pool maintenance, and construction.[65]

Many employers in the fishing industry have noted the difficulty in attracting employees here when many can make more money in the landscaping business, which has a high demand for laborers, particularly from April through November.[66] Erik Braun said there has been an influx of Hispanic dock workers, and many of the fishermen have had to learn Spanish to communicate with them. This has been a dramatic change within the last 5 years, he said. He also stated that there are no new fishermen starting up, and the children of fishermen, even those that are doing well, are not encouraged to enter into this business.[67]

According to the U.S. Census 2000, 60.6% (6028 individuals) of the total population 16 years of age and over were in the labor force, of which 3.4% were unemployed and 0.3% were in the Armed Forces. See Figure 8 below.

Figure 8: Employment Structure in 2000



According to Census 2000 data, jobs in the census grouping which includes agriculture, forestry, fishing and hunting, and mining accounted for 95 positions or 1.7% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 789 positions or 13.9% of jobs. Educational, health and social services (20.3%), construction (18.9%), and retail trade (14.4%) were the primary industries.

Median household income in Hampton Bays in 2000 was $50,161 (up 40.0% from $35,736 in 1990) and per capita income was $27,027. For full-time year round workers, men made approximately 56.6% more per year than women.

The average family in Hampton Bays consisted of 3.0 persons. With respect to poverty, 6.7% of families (up from 2.4% in 1990) and 10.7% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 23.2% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine)[68].

In 2000, Hampton Bays had a total of 6,881 housing units of which 70.9% were occupied and 86.3% were detached one unit homes. Less than 10% (7.1%) of these homes were built before 1940. There were a few mobile homes in this area, accounting for 1.7% of the total housing units; 93.9% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $178,000. Of vacant housing units, 84.3% were used for seasonal, recreational, or occasional use. Of occupied units 29.8% were renter occupied.

Governmental

A five-person Town Board governs the town of Southampton. There is one supervisor, elected to a two-year term, and the rest of the board is elected to staggered four-year terms.[69]

<u>Fishery involvement in the government</u>

In addition to the Town Board, the town of Southampton has a Board of Trustees made up of five elected members, which is responsible for governing the laws of the waters and bay bottoms. Their jurisdiction includes boating activities, shellfishing licenses, shoreline protection, and docks and other marine infrastructure. The laws of the Board of Trustees are enforced by the Bay Constables.[70]

Institutional

<u>Fishing associations</u>

The New York Seafood Council, located in Hampton Bays, is a non-profit organization made up of individuals, businesses, and organizations involved in the fishing industry whether through harvesting, processing, distribution or service. The council has over 200 members and their primary goal is to promote seafood and the seafood industry.[71] The Southampton Town Baymen's Association serves the interests of the inshore watermen utilizing Shinnecock Bay and the other bays within the town of Southampton. Also relevant to this area is the Long Island Commercial Fishing Association, which promotes commercial fishing throughout Long Island.[72] The Shinnecock Co-op dock was in operation for 30 years, but went bankrupt and closed two years ago.[73] There was also an organization called the Concerned Wives of Shinnecock Fishermen, that ceased to exist about 15 years ago.[74]

<u>Other fishing related organizations</u>

The Shinnecock Marlin and Tuna Club is a recreational fishing club that sponsors tournaments. They also represent the interests of sportfishermen at meetings and fight for the improvement of Shinnecock Inlet and the preservation of local waters.[75]

Physical

Hampton Bays is strategically positioned on Shinnecock Bay, protected from the Atlantic by a barrier island and accessed through Shinnecock Inlet. This allows fishermen access to both productive coastal and offshore fishing, and its proximity to markets in New York City is also important.[76] The Francis Gabreski Airport in Westhampton Beach is 10 miles away, Long Island Islip MacArthur Airport is 36 miles away, and JFK International Airport is 77 miles from Hampton Bays[77]. The Long Island Railroad stops in Hampton Bays and travels directly into New York City, approximately 90 miles away. Roughly 80% of the finfish landed in Hampton Bays/Shinnecock is sold at Fulton's Fish Market in New York City.[78]

The commercial fishing industry for Hampton Bays/Shinnecock is located on a thin strip of sand on the barrier island by Shinnecock Inlet, allowing the vessels to easily pass out of the Inlet into the sea, physically isolated from the rest of the town. Until recently (2005), there were three docks in Shinnecock including the Shinnecock Fish Dock, the fishermen's cooperative dock, which provided labor, ice, boxes, and trucking for its members, as well as low-cost fuel, and one private dock.[79] These docks are still present, but only the private dock is still operating and packing out fish. The other docks are abandoned; vessels still tie up to them but cannot receive any services. The cooperative dock has been turned into a restaurant.[80]

The majority of marinas and other infrastructure for recreational fishing as well as recreational boating within the town of Southampton are located in the Hampton Bays area alongside the Shinnecock Canal.[81] The Shinnecock Canal County Marina is a publicly-owned marina along the canal, [82] but it does not allow commercial vessels to tie up here.[83] There are at least two bait and tackle shops located in Hampton Bays, and several others within Southampton.[84] There are also six fish retail markets located in Hampton Bays.[85]

Involvement in Northeast Fisheries

Commercial

Hampton Bays/Shinnecock is generally considered the second largest fishing port in New York after Montauk. The combined ports of Hampton Bays/Shinnecock had more landings of fish and shellfish in 1994 than at any other commercial fishing port in New York. Combined landings of surfclams and ocean quahogs were worth roughly $1.6 million in 1994, and squid was at the time the most valuable species here.[86] A 1996 report from the New York Seafood Council listed the following vessels for the combined port of Hampton Bays/Shinnecock: 30-35 trawlers, 2-8 clam dredge vessels, 1-2 longline vessels, 1-3 lobster boats, 4-5 gillnetters, as well as 10-15 fulltime baymen and at least 100 part-time baymen.[87] As of 2005 there was one longline vessel here and many of the trawlers were gone.[88]

Hampton Bays/Shinnecock had at one time a significant surfclam and ocean quahog fishery, evident in the 1997 data, which by 2003 had completely disappeared. (See Table 4 and Table 6 below.) Oles notes that surf clam and ocean quahog landings in the past had been from transient vessels landing their catch here.[89] The level of home port fishing declined over the period from 1997 – 2003 for vessels listed with either Hampton Bays or Shinnecock as their home port, as did the combined landings for the port. See Table 5 and Table 7 below. (Shinnecock saw a slight increase in landings, but Hampton Bays saw a sharp decrease which is just a difference in reporting). In 2003, the value of landings by species was either less than or roughly equal to the eight year average for 1997-2004, with the exception of the "other" category and of tilefish, which was much higher in 2003 than the eight-year average.

The highest valued species landed in Hampton Bays in 2003 was loligo squid, which brought in $1,731,568. Summer flounder was worth $ 840,875 and silver hake (whiting) was worth $752,227. The most important fishery for vessels with Shinnecock listed as the home port in 2003 was tautog, which brought in $15,484.

There are a number of baymen who work in Shinnecock Bay, through permits granted by the town of Southampton, fishing for eels, conch, razor clams, scallops, and oysters, among other species.[90] The Shinnecock Indians had an aquaculture facility for cultivating oysters in the bay, but the oyster beds were largely destroyed through pollution and nutrient-loading; they are once again starting to recreate the oyster beds.[91]

Hampton Bays

Landings by Species

Table 4: Dollar value by Federally Managed Groups of landings for Hampton Bays

	Average from 1997-2004	2003 only
Squid, mackerel, butterfish	2,701,881	1,788,942
Smallmesh groundfish[92]	1,195,042	774,054
Summer flounder, scup, black sea bass	1,042,305	1,334,308
Monkfish	640,950	467,556
Largemesh groundfish[93]	542,073	337,619
Tilefish	256,131	651,623
Bluefish	206,929	211,820
Scallop	151,810	164,842
Skate	78,524	56,353
Dogfish	60,702	2,849
Lobster	22,842	16,407
Herring	71	23
Other	1,049,426	705,905

Vessels by Year

Table 5: All columns represent vessel permits or landings value combined between 1997-2003

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	22	38	3,369,876	9,165,830
1998	24	30	4,141,886	9,658,169
1999	24	32	4,040,706	8,442,274
2000	22	31	3,242,978	9,471,461
2001	20	36	2,543,274	9,219,923
2002	18	35	2,139,557	8,290,341
2003	16	33	1,495,549	6,512,301

Shinnecock

Landings by Species

Table 6: Dollar value by Federally Managed Groups of landings for Shinnecock

Species	Average from 1997-2004	2003 only
Surfclam, ocean quahog	70,831	0
Bluefish	2	19
Other	7,748	16,139

Vessels by year

Table 7: All columns represent vessel permits or landings value combined between 1997-2003

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	43	0	4,825,722	588,841
1998	36	0	3,898,164	13,523
1999	34	0	5,132,086	3,100
2000	36	0	5,118,783	1,270
2001	37	0	5,055,134	1,560
2002	33	0	4,857,274	4,202
2003	33	0	3,795,887	16,158

Recreational

Recreational fishing is an important part of the tourist industry in Hampton Bays. The marinas here are well positioned for both inshore fishing in Shinnecock Bay and offshore fishing, and there are numerous charter and party boats that go fishing in both areas.[94] Many of those who own second homes in Southampton also own private boats for recreational fishing, and this contributed substantially to the marinas and other marine industries.[95] A website dedicated to fishing striped bass lists a number of locations in Hampton Bays for catching striped bass from on shore.[96] One report estimated the value of recreational fishing at between $32 million and $66.8 million for the town of Southampton, which far exceeds the value of commercial fishing here. Recreational shellfishing is a popular activity in the area; at one time it was estimated that 50 percent of shellfishing in Southampton was done recreationally, both by residents and tourists.[97]

Subsistence

Bryan Oles noted in his report on the Hampton Bays/Shinnecock community that the recreational fishery has shifted from one focused on bagging as many fish as possible for consumption to one focused on catch-and-release, as many of those fishing in the area can easily afford to buy fish.[98]

Future

The master plan for the Town of Southampton includes a commitment to preserving the town's fisheries by protecting the industry from growth and development pressures,[99] recognizing the importance of fisheries to both the economy and character of the area.[100] The Master Plan, adopted in 1999, includes a plan to expand the town's commercial fishing dock.[101]

"The resilience of the commercial fishing industry in Hampton Bays is threatened by the cumulative effects of fisheries management and the forces of gentrification that are sweeping the area".[102] One potentially positive note for the fishing industry is that the barrier island and beach where the commercial fishing industry is located are owned by Suffolk County and cannot be developed, so there is less direct competition for space here.[103]

Erik Braun, the port agent for this part of New York, was not hopeful about the future of the fishing industry. He said there are no new fishermen getting into commercial fishing, and that even those who have done well are not encouraging their children to get into the industry. The fleet is badly aging and much of it is in disrepair. Much of the infrastructure here is also gone, and those who own docks can make much more by turning them into restaurants.[104]

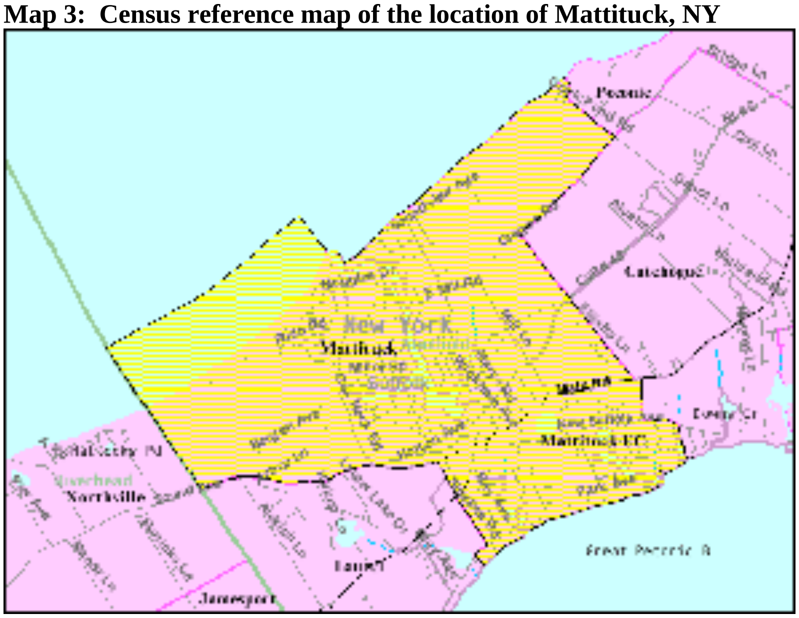
MATTITUCK

People and Places

Regional orientation

Mattituck (40.99°N, 72.54°W) is located in the township of Southold, Suffolk County on Long Island, New York. Mattituck borders Great Peconic Bay on one side and Long Island Sound on the other.[105] See Map 3 below.

Map 3: Census reference map of the location of Mattituck, NY



Historical/Background information

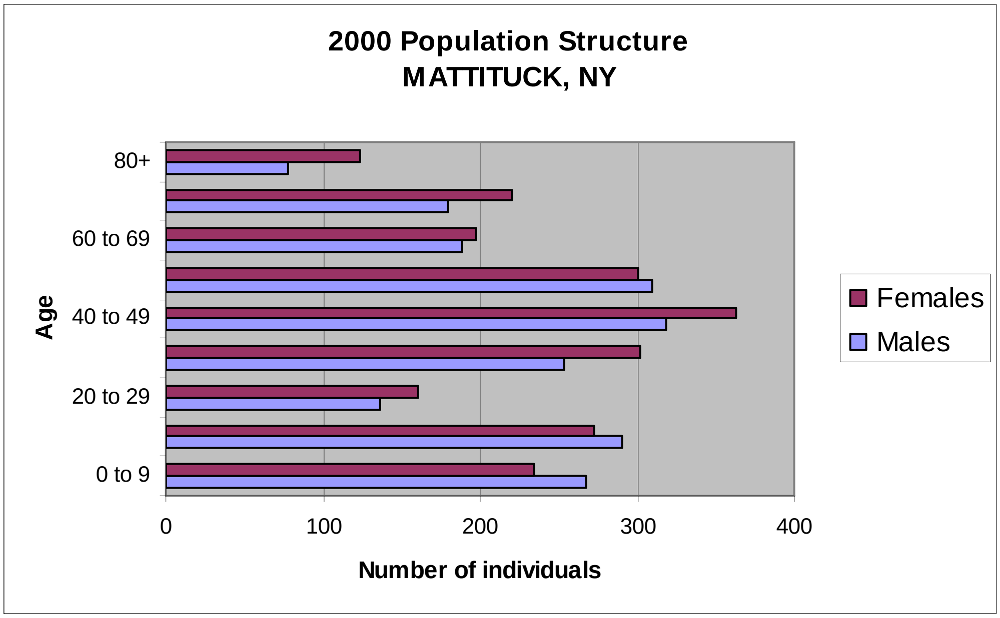
Mattituck is the second-largest of ten hamlets in the township of Southold, which encompasses Laurel, Cutchogue, New Suffolk, Peconic, Southold, Greenport, East Marion, Orient, Mattituck and Fishers Island.[106] Europeans searching for turpentine arrived in Southold in approximately 1638[107]. Southold and Southampton are the oldest English settlements in New York, officially settled in 1640[108]. Much of the town was acquired from Native Americans in the Aquebogue Purchase in 1648-49.[109] Corchaug Indians, who were the first residents of the area, sold land to Theophilus Eaton, governor of New Haven, CT and was established by Charter to the New Haven Colony of Connecticut in 1658 when the Colony of Southold bought the land from Connecticut.[110] Mattituck itself was settled in 1662 by English colonists. The colonists pastured flocks and herds, and raised corn, wheat, and rye. The colony had a minister, teacher, a blacksmith, carpenter, cooper, weaver, and miller.[111] The area became a significant farming area, contributing fresh corn, potatoes, cabbage and similar crops to New York City markets.[112] Oysters have been raised in Great Peconic Bay since the early 1900s.[113] Today Mattituck is known as a scenic community on Long Island.

Demographics

The total population of the township of Southold in 2000 was 20,599 according to the Census; this number more or less doubles in the summer months.[114] According to Census 2000 data, Mattituck, New York CDP has a total population of 4,198, up from 3,849 in 1990. Of this 2000 total, 48.2% were males and 51.8% were females. The median age was 42.5 years and 73.9% of the population was 21 years or older while 21.3% were 62 or older.

Mattituck's age structure showed the largest percentage of the population fell within the 40-49 age bracket, followed by 50-59 and 30-39. (See Figure 9 below.) There were a large number of children as well, indicating that Mattituck is a community of young families. As in many fishing communities, Mattituck experienced a decline in population in the 20-29 age bracket, as young people left the community to go to college or in search of jobs.

Figure 9: Population structure by sex in 2000



The majority of the population in 2000 was White (96.6%), with 1.2% Black, 1.0% citing two or more races, and 0.6% other. (See Figure 10.) Hispanics were identified as 2.5% of the population. (See Figure 11.) Residents traced their backgrounds to a number of different ancestries including: Irish (30.5%), German (27.1%), Polish (17.3%), Italian (14.6%), and English (13.5%). With regard to region of birth, 84.7% were born in New York, 9.8% were born in a different state and 0.6% were born outside of the U.S. (including 1.7% who were not United States citizens).

Figure 10: Racial Structure in 2000

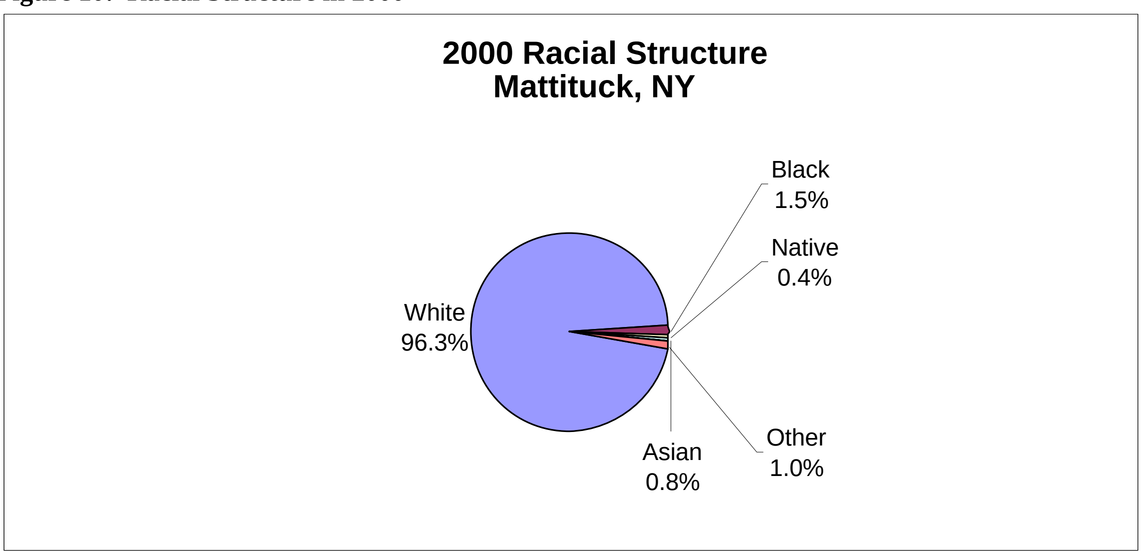
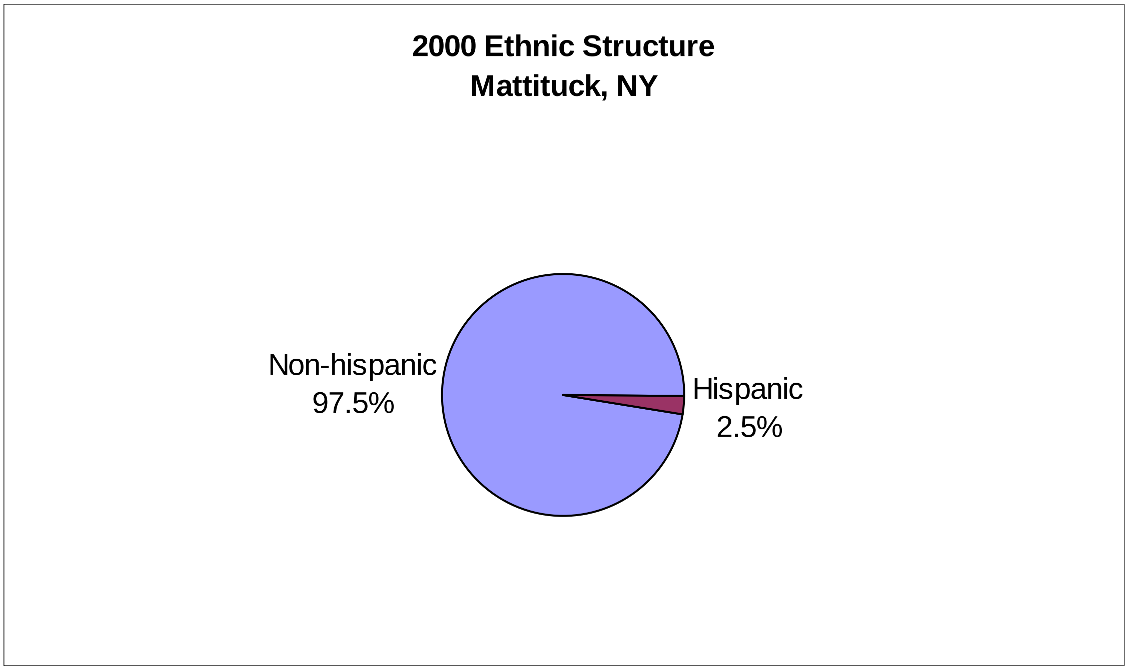


Figure 11: Ethnic Structure in 2000



For 91.9% of the population in 2000, only English was spoken in the home, leaving 8.1% in homes where a language other than English was spoken, including 1.9% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 91.4% had graduated high school, and 34.8% had a Bachelors Degree. Again of the population 25 years and over, 2.9% did not reach ninth grade, 5.7% attended some high school but did not graduate, 27.1% completed high school, 21.3% had some college with no degree, 8.2% received their associate degree, 17.7% earned their bachelor's degree, and 17.1% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Suffolk County was Catholic with 72 congregations and 734,147 adherents. Other prominent congregations in the county were Jewish (48 with 100,000 adherents), United Methodist (47 with 22,448 adherents), Episcopal (40 with 16,234 adherents), Evangelical Lutheran Church (26 with 19,378 adherents), and Muslim (9 with 12,139 adherents). The total number of adherents to any religion was up 3.8% from 1990. Five churches are listed for Mattituck; two are Roman Catholic, and the others are Church of Christ, Lutheran, and Presbyterian.[115]

Issues/Processes

As in many other areas of Long Island where clams and other shellfish are a significant part of the fishing industry, water quality is a consistent problem in the increasingly populated shallow bays where the clams are dug.[116] The bays have had several problems with algal blooms of *Aureococcus anophagefferens*, or brown tide, which killed off bay scallop populations here, and is believed to be related to nutrient depletion in the bay.[117] The Mattituck Inlet channel needs to be dredged frequently.[118]

Mattituck has difficulty providing sufficient affordable housing for its residents.[119] The town of Southold has instituted a program to assist its residents with rising housing costs.[120]

Some fishermen are concerned about the accuracy of their assigned historical landings by species for fisheries (often used for promulgating new regulations), as the method used to land fish in New York varies from that in most other states. Called the "box method" it involves fish being boxed at sea, then landed at a consignment dock and from there shipped to Fulton Fish Market in New York City. Prior to the implementation of dealer electronic reporting, NMFS port agents counted the number of boxes landed from each vessel and received a species breakdown from the dock manager (who did not open the boxes but rather based the breakdown on his knowledge of the vessel's general fishing patterns). This system allowed greater potential for accidental mis-reporting. Now, the boxes are landed at the consignment dock and immediately shipped to Fulton, where the dealer opens the boxes and reports the landings. Further, individual fishermen report using VTR, logbooks and other methods.

While this method is more accurate in terms of the number and type of fish landed, it can still lead to another type of accidental reporting error. That is, landings are assigned to the incorrect state. This can have inequitable effects on states should an allocation scheme be developed, such as the one for summer flounder, that bases a state's allocation on the landings of a particular species in that state.

The docks make money by charging $10-$12 per box (2007 prices) and by selling fuel. Catch limits and trip limits reduce the number of boxes to be shipped, and have made it very difficult for the docks to stay in business. New York is losing much of its infrastructure, and many of the docks have closed or changed hands in recent years.[121]

Cultural attributes

An annual Blessing of the Fleet and BBQ is held at the Matt-a-Mar Marina in Mattituck Inlet for the fishing fleet. Mattituck also has an annual Strawberry Festival and a Street Fair.[122] Mattituck is located in the Long Island Wine Region with over 30 vineyards.[123]

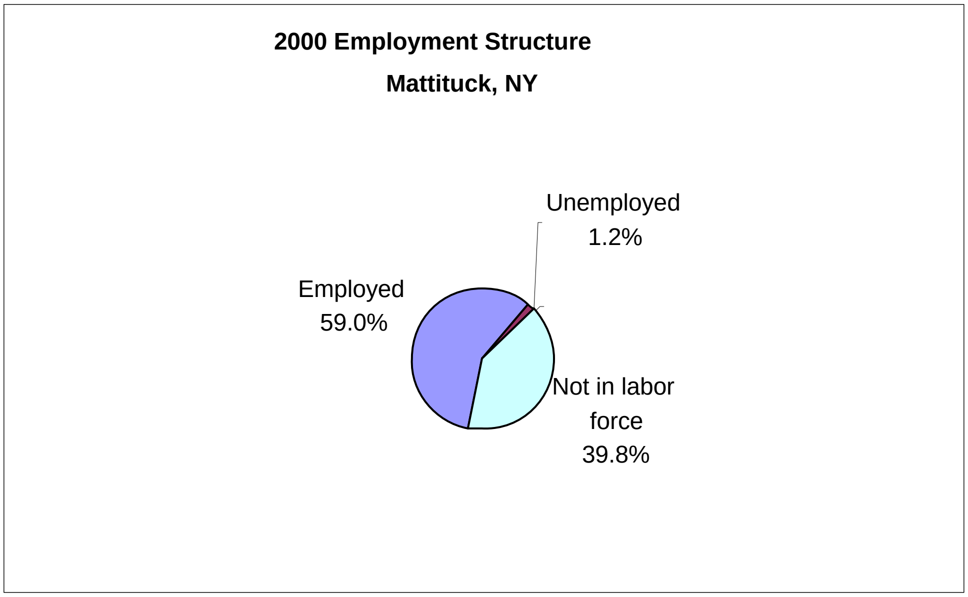
Infrastructure

Current Economy

Southold's Department of Public Works estimates that the largest employers in the town of Southold where Mattituck residents might work are Northfork Bank, Mattituck School District, the Town of Southold, and Greenport Hospital.[124]

According to the U.S. Census 2000, 60.2% (2,025 individuals) of the total population 16 years of age and over were in the labor force, of which 1.2% were unemployed and no residents were in the Armed Forces. See Figure 12 below.

Figure 12: Employment Structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 59 or 3.0% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 124 or 6.3% of the labor force. Educational, health and social services (25.1%), retail trade (11.3%), construction (8.9%), public administration (8.9%), and professional, scientific, management, administrative, and waste management services (8.6%) were the primary industries.

Median household income in Mattituck was $55,353 (up 52.0% from $36,415 in 1990) and median per capita income was $26,101. For full-time year round workers, men made approximately 23.3% more per year than women.

The average family in Mattituck consisted of 2.97 persons. With respect to poverty, 4.5% of families (up from 4.4% in 1990) and 5.6% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 23.2% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Mattituck had a total of 2,319 housing units, of which 71.5% were occupied and 96.7% were detached one unit homes. Only 20.6% of these homes were built before 1940. Mobile homes were reported as 0.6% of housing units; 100% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $203,900. Of vacant housing units, 76.9% were used for seasonal, recreational, or occasional use. Of occupied units, 14.3% were renter occupied.

Government

The township of Southold is governed by a six-member town council and a town clerk. The town offices are located in the hamlet of Southold.[125]

Government involvement in fisheries

The township of Southold has developed a local waterfront revitalization program concerned with, among other goals, protecting water dependent uses, maintaining and strengthening a stable commercial fishing fleet, promoting the sustainable use of living marine resources, enhancing community character, preserving open space, preserving public access, and making use of the coastal location. The town has two Marine Use zoning types in place. Mattituck Inlet and Creek were identified as two places within the town most suitable for water-dependent uses.[126]

The town of Southold also has a Fishers Island Harbor Committee[127] and as of 2004 had a shellfish advisory committee to address issues relating to the town's numerous shellfish beds[128].

Institutional

<u>Fishing associations</u>

Fishermen in Mattituck have recently formed the Mattituck Fisheries Association.[129] The Long Island Commercial Fishing Association promotes commercial fishing throughout Long Island.[130]

<u>Fishing assistance centers</u>

No information on fishing assistance centers in Mattituck was found in secondary sources at this time.

<u>Other fishing related organizations</u>

The North Fork Captain's Association represents charter boats on Long Island's North Fork. [131] The Peconic Estuary Program is charged with developing and implementing a comprehensive management plan for the Peconic Estuary, designated as an "estuary of national significance". This alliance is a collaborative of local, state, and federal government agencies, businesses, environmental and citizen groups, and academic institutions working together to promote the environmental health of this natural resource.[132]

Physical

Suffolk County occupies the easternmost portion of Long Island, in the southeastern portion of New York State. The eastern end of the county splits into two peninsulas, known as the North Fork and the South Fork. The county is surrounded by water on three sides, including the Atlantic Ocean and the Long Island Sound. To the north is the Long Island Sound, and the State of Connecticut is on the opposite shore. To the east is Block Island Sound. The south boundary is the Atlantic Ocean. Several airports are located in the area, including Long Island MacArthur Airport in Ronkonkoma, Republic Airport in East Farmingdale and Francis S. Gabreski Airport in Westhampton Beach.[133] Mattituck also has its own small airport. Mattituck is about 13 miles from Greenport, 18 miles from Hampton Bays, and 85 miles from New York City by car. Long Island Airport is about a 40 mile drive.[134] The Long Island Railroad connects Mattituck with New York City and other points along Long Island.[135] The Hampton Jitney bus service carries passengers from along Long Island's North Fork to New York City, including a stop in Mattituck.[136] The Cross Sound Ferry travels between nearby Orient Point and New London, CT.[137]

Fishing operations in Mattituck are based out of Mattituck Creek, which opens onto Long Island Sound via Mattituck Inlet and is protected by a jetty.[138] There are a total of five marinas in

Mattituck providing a total of 200 slips. Most of these are for recreational use, but there are some slips used commercially at the mouth of the inlet. Until recently, commercial vessels tied up at Peterson's Marina, at the mouth of the inlet.[139] However, this property was recently purchased by the state's Department of Environmental Conservation, and so the commercial fleet has dispersed to the other nearby marinas around the inlet.[140] Mattituck Fishing Station, in the inlet, offers boat rentals and a bait-and-tackle shop. Mattituck Inlet Marina and Shipyard is a full service repair and maintenance facility. Matt-a-Mar Marina is located in Mattituck Inlet and Strong's Marina, located on the south side of Mattituck in James Creek off Great Peconic Bay, is primarily used by recreational vessels, and offers storage, repairs and fuel, as well as hosting fishing tournaments. Mattituck has two public boat launching ramps located at the head of the inlet.[141] Mattituck Creek today has one packing house; many of the fishermen pack their own fish or go to the packing house in Greenport.[142]

Involvement in Northeast Fisheries

Commercial

Mattituck is known primarily as a lobstering port; the lobster boats work on Long Island Sound. There are also some otter trawls here.[143] Jim McMahon of the Public Works Department estimates there are 3-4 trawlers and 20-25 commercial lobster vessels working out of Mattituck Inlet and four fishing-related businesses. He also noted that about 3-4 of these vessels had recently been refitted for surf clamming.[144] Mattituck is the center of commercial fishing for the township of Southold. Most of the fish caught here is shipped to the Fulton Fish Market in New York City, and what is left is consumed locally. The Mattituck Inlet contains highly productive shellfish beds, from which both hard and soft clams as well as oysters are harvested commercially.[145] There is a small hand rake clam fishery here. [146] The famous bluepoints oysters of Long Island are grown for part of their lifetime in the Mattituck Creek before being transferred to Great South Bay where they grow large enough to be sold.[147]

The most valuable federal species in Mattituck in 2003 was summer flounder, worth $94,707, followed by scup ($71,006) and lobster ($60,748). (See Table 8.) The value brought in from both the lobster and the summer flounder, scup, and black sea bass categories was much higher in 2003 than the 1997-2004 average values. Some other species categories, such as butterfish, mackerel, and squid, and the largemesh groundfish fishery, saw their values decline in 2003. Overall, in 2003 the level of landings in Mattituck was at its highest point for the seven years for which data is provided, and generally the landings seem to have increased over the time period with the exception of 2002, when they dropped considerably from the 2001 landings values. The number of vessels home ported in Mattituck as well as the number of vessels owned by Mattituck residents have been relatively steady in this time period. (See Table 9.) The value of fishing to home ported vessels, however, saw a jump from $56,000 in 2001 to $170,000 in 2002, then down to $130,000 in 2003. Mattituck had a much more significant fishery before 1992, when some area closures along Long Island reduced the size of the dragger fleet.[148]

Landings by Species

Table 8: Dollar value by Federally Managed Groups of Landings in Mattituck

	Average from 1997-2004	**2003 only**

Summer flounder, scup, black sea bass	102,933	221,216
Lobster	39,652	60,748
Other	33,522	37,781
Squid, mackerel, butterfish	24,264	9,209
Largemesh groundfish[149]	21,550	14,967
Bluefish	18,384	22,597
Skate	739	627
Dogfish	509	194
Smallmesh groundfish[150]	269	1,380
Herring	175	0
Monkfish	131	100
Tilefish	1	0

Vessels by Year

Table 9: All columns represent Federal Vessels Permits or Landings Value combined between 1997-2003

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	4	3	30,304	169,429
1998	3	3	38,948	286,569
1999	4	3	36,384	233,472
2000	4	3	45,703	202,653
2001	4	3	56,844	354,686
2002	7	4	170,784	192,721
2003	6	4	130,518	368,819

Recreational

Fishing is a popular leisure time activity in Suffolk County. Bluefish, rainbow trout, as well as an assortment of other types of fish reside in ponds, rivers, and ocean waters.[151] Especially in March, April and May, Mattituck is a popular port among open and charter boat anglers, and offers boat rentals as well.[152] Mattituck has a small fleet of charter fishing boats. [153] The Captain Bob Fishing Fleet is one company that provides both party and charter boat excursions.[154] Jamesport Bait and Tackle is located in Mattituck.[155] Shellfishing is also a popular activity here; the Mattituck Inlet contains a number of extremely productive shellfish beds, producing both hard and soft clams and oysters, all of which are harvested recreationally.[156] Scallops, clams, oysters, mussels, crabs, and eels are all taken in the creeks and inlets around Mattituck.[157]

Subsistence

No information from secondary sources has been obtained at this time on subsistence fishing.

Future

The township of Southold has identified Mattituck Inlet and Creek as an area where the town's maritime activity should be focused, and thus this area will be a target for infrastructure improvements from the town, including new infrastructure for commercial fishing. Specifically, the town wishes to promote the provision of “commercial fishing support facilities, including docks and dock space; off-loading areas; gear storage space; commercially-priced fuel and service yards; ice and refrigeration; road access to commercial fishing docks; affordable housing for fishery industry personnel; and fish processing facilities”.[158] No information has been obtained directly at this time on peoples’ perspectives of the future in Mattituck.

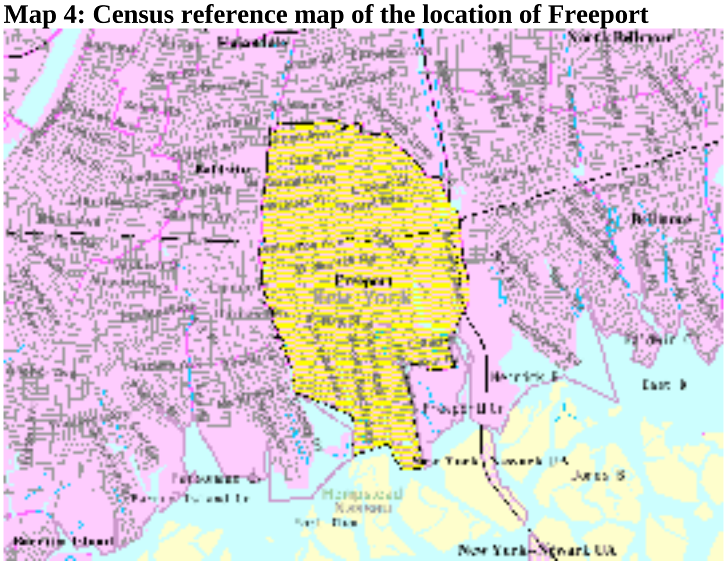
FREEPORT, NY

People and Places

Regional orientation

Freeport, New York (40.65°N, 73.58°W) is located on Long Island in Nassau County. It is a village within the town of Hempstead, and located on the south side of Long Island on Oyster Bay, which is separated from the Atlantic Ocean by a barrier island. There are several canals in the village which grant access to the bay and the ocean beyond.[159] See Map 4 below.

Map 4: Census reference map of the location of Freeport



Historical/Background information

Freeport was incorporated in 1892[160], and is the second largest village in the State of New York.[161] The village got its name because at one time merchant vessels could unload their cargo here and avoid having to pay the fees charged in New York City. There is a long history of commercial fishing in Freeport; around the time of the Civil War, a million bushels of oysters were being harvested annually from the waters around Freeport.[162] In the 1940s, Freeport began to advertise itself as the “boating and fishing capital of the East”.[163] After WWII, Freeport became a bedroom community for New York City.[164] Today the Freeport waterfront has been revitalized. Woodcleft Road, which had massive flooding problems, was raised, and now a number of restaurants, shops, and an open air market can be found along this area now known as

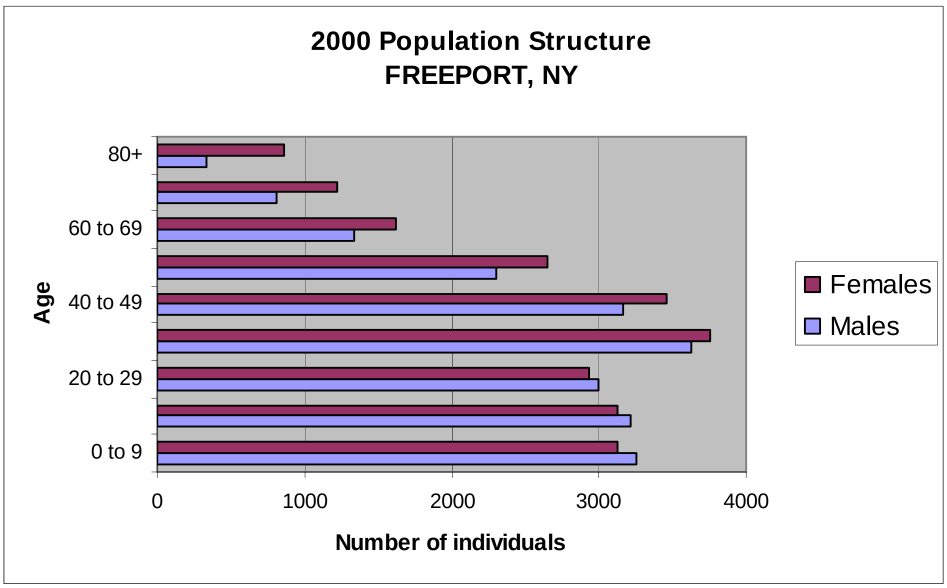
"Nautical Mile". This same area is where both the commercial and party/charter fishing fleets are located.[165]

Demographics

According to Census 2000 data, Freeport, New York had a total population of 43,783, up 9.4% 1990. Of this total in 2000, 51.9% were female and 48.1% were male. The median age was 34.6 years and 69.7% of the population was 21 years or older while 12.6% were 62 or older.

The graph for Freeport's population structure in 2000 presents a picture of a community of young families. The largest percentage of the population was between 30-39 years of age, followed by 40-49, 0-9, and 10-19. (See Figure 13.) The population declines rapidly after age 60. Unlike many fishing communities, Freeport does not experience much of a decline for the 20-29 year old age category, probably because of the large number of job opportunities in the area.

Figure 13: Population structure by sex in 2000



The majority of the population of Freeport in 2000 was white (44.3%), with 32.8% of residents Black or African American, 1.1% Native American, 1.7% Asian, 0.2% Pacific Islander or Hawaiian, and 20.0% listed as "other". (See Figure 14 below.) A total of 33.5% of the population is Hispanic/Latino. (See Figure 15 below.) Residents linked their heritage to a number of ancestries including: Italian (9.1%), Irish (8.8%), German (7.5%), West Indian (7.0%), and "other ancestries" (55.2%). With regard to region of birth, 59.0% were born in New York, 9.4% were born in a different state and 29.9% were born outside of the U.S. (including 18.9% who were not United States citizens).

For 63.2% of the population 5 years old and higher in 2000, only English was spoken in the home, leaving 36.8% in homes where a language other than English was spoken, and including 20.6% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 73.1% were high school graduates or higher and 20.5% had a bachelor's degree or higher. Again of the population 25 years and over, 13.2% did not reach ninth grade, 13.7% attended some high school but did not graduate, 26.7% completed high school, 19.1% had some college with no degree, 6.8% received their associate degree, 11.7% earned their bachelor's degree, and 8.8% received either their graduate or professional degree.

Figure 14: Racial Structure in 2000

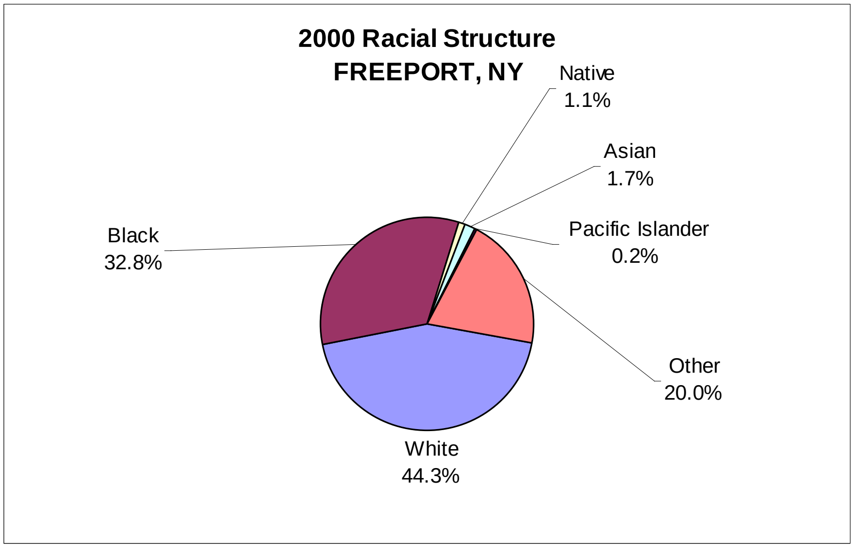
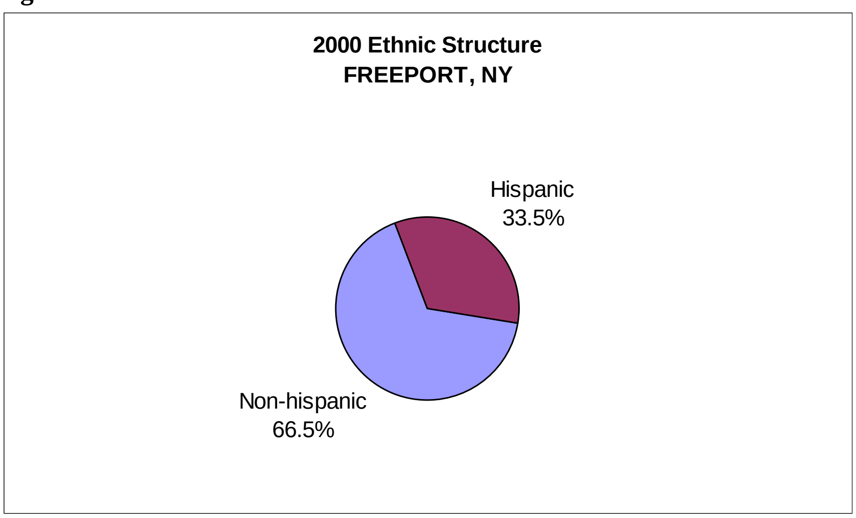


Figure 15: Ethnic Structure in 2000



Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of adherents in Nassau County was Catholic with 67 congregations and 694,389 adherents. Other prominent congregations in the county were Jewish (141 with 207,000 adherents), Evangelical Lutheran Church (39 with 19,528 adherents), United Methodist (40 with 17,284 adherents), Episcopal (42 with 16,153 adherents), and Muslim (9 with 11,164 adherents). The total number of adherents to any religion was down 6.6% from 1990. There are 30 houses of worship listed for the village of

Freeport; one Jewish, one Hare Krishna temple, four Catholic, and the rest Protestant. Five are specifically Hispanic or note Spanish services.[166]

Issues/Processes

Many fishermen in Freeport feel they are simply a tourist attraction, and that, despite zoning the some of the waterfront as designated for marine industrial use, the community has no real interest in the industry's viability other than having a few fishing vessels around to be able to define the port as a "working waterfront" and apply for redevelopment grants. Many disagree with the assertion by town officials that they are benefiting the industry. Currently an increase in businesses such as waterfront restaurants combined with increased enforcement of use ordinances is forcing commercial fishing businesses into smaller and smaller spaces, and eliminating their parking. The fishermen's use of public space is highly restricted. Commercial fishermen frequently have to schedule their work to avoid peak tourist times.[167]

Cultural attributes

Freeport hosts a Nautical Festival each year, highlighting the past and present of maritime industries in Freeport.[168] Freeport used to have a Seafood Festival but it no longer takes place.[169] The South Street Seaport Museum runs the Long Island Marine Education Center in Freeport.[170]

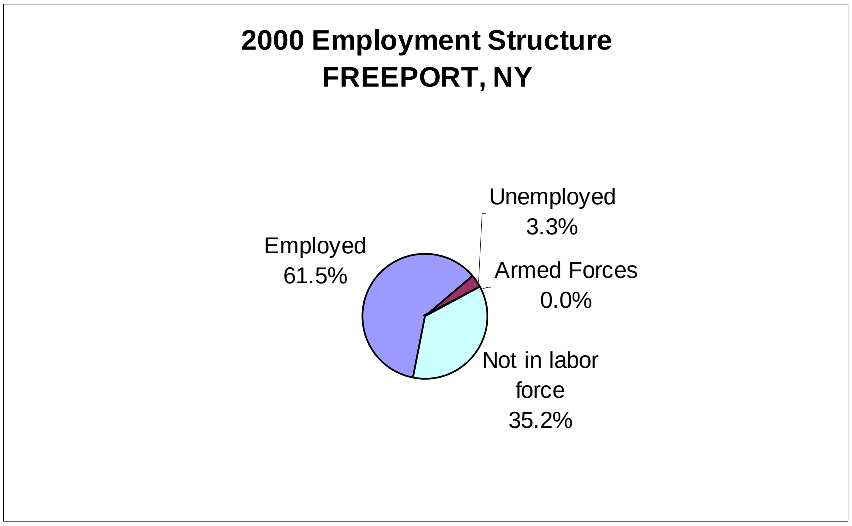
Infrastructure

Current Economy

It is estimated that the seafood wholesalers along Woodcleft Canal in Freeport employ about 70 people. Freeport is a short commute into New York City, so many residents likely work there. Because this area is highly urbanized, there are numerous other employment opportunities for fishermen.[171]

According to the U.S. Census 2000, 64.8% (21,673 individuals) of the total population 16 years of age and over were in the labor force, of which 3.3% were unemployed and 0.02% (7 individuals) were in the Armed Forces. See Figure 16 below.

Figure 16: Employment Structure in 2000



According to Census 2000 data, jobs in agriculture, forestry, fishing and hunting, and mining accounted for 23 positions or 0.1% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 988 positions or 4.8% of jobs. Educational, health and social services (22.1%), retail trade (12.0%), professional, scientific, management, administrative, and waste management services (9.4%), and manufacturing (9.0%) were the primary industries.

Median household income in Freeport in 2000 was $55,948 (up 27.3% from $43,948 in 1990) and per capita income was $21,288. For full-time year round workers, men made approximately 17.6% more per year than women.

The average family in Freeport consisted of 3.65 persons. With respect to poverty, 8.0% of families (up from 5.4% in 1990) and 10.6% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 26.5% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Freeport had a total of 13,819 housing units, of which 97.7% were occupied and 62.7% were detached one unit homes. More than one quarter (26.1%) of these homes were built before 1940. There were a few mobile homes, boats, RVs, vans, etc. in this area, accounting for 0.1% of the total housing units; 83.9% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $179,900. Of vacant housing units, 14.6% were used for seasonal, recreational, or occasional use. Of occupied units 34.8% were renter occupied.

Governmental

The village of Freeport is governed by a mayor and a board of four trustees.[172]

Fishery involvement in the government

The town of Hempstead (within which Freeport is located) has a shellfish management program through the Department of Conservation and Waterways, run by the Bay Constables. A permit is required to harvest shellfish.[173] Freeport is a New York State Local Waterfront Revitalization Program community, through the state's Coastal Management Program; the community has prepared a comprehensive land and water use plan for its waterfront.[174] There is special zoning for marine residences (which have adjacent docks), marine businesses, marine industries, marine apartments and marine commerce.[175]

Institutional

Fishing associations

The Freeport Tuna Club is dedicated to promoting rod and reel fishing and protecting the interests of rod and reel fishermen targeting a variety of species. They have over 200 members and participate in and sponsor numerous fishing tournaments.[176] Also relevant to this area is the Long Island Commercial Fishing Association, which promotes commercial fishing throughout Long Island.[177] Some fishermen from Freeport are involved in the Long Island Commercial Fishing Association. [178]

Fishery assistance centers

No fishery assistance centers could be found at this time.

Other fishing related organizations

The Freeport Boatman's Association is not a political organization but rather a business organization, currently consisting of 11 independently owned charter boats. The association owns a small marina. [179] Operation SPLASH (Stop Pollution Littering And Save our Harbors) is a non-profit organization based in Freeport addressing waterfront pollution.[180]

Physical

The Long Island Rail Road runs between Freeport and New York City, as does the Long Island bus.[181] JFK Airport is 11 miles from Freeport, La Guardia Airport is 17 miles away, and Long Island MacArthur Airport is 27 miles away. Freeport is about 25 miles from Brooklyn, 32 miles from Manhattan, and 63 miles from Hampton Bays by car. A number of large highways run through or near Freeport, including NY-27 and the Meadowbrook Parkway, which goes to nearby Jones Beach. Both provide easy access to New York City and the rest of Long Island.[182]

From Freeport, the Atlantic Ocean is accessible through Jones Inlet, about three miles away. This proximity makes Freeport a desirable base for recreational and commercial fisheries alike. Most of the commercial fishing industry in Freeport is located in Woodcleft Canal, along the section known as "Nautical Mile". Bordering Woodcleft Street, there are today three commercial docks for unloading catch, three wholesalers, which also do some minor processing, and three seafood retail businesses. There is one additional dock where bait is unloaded, packed, and then sold wholesale. In nearby Point Lookout, there is a large packing house (Point Lookout Fish Dock[183]) and a large surfclam and ocean quahog processing facility (Doxsee Sea Clam[184]); many vessels unload their catch here.[185] The Guy Lombardo Marina in Freeport is operated by the Town of Hempstead Department of Conservation and Waterways, and has 252 boat slips. There is also a fishing pier located at the marina,[186] and two other fishing piers located elsewhere in Freeport.[187]

Involvement in Northeast Fisheries

Commercial

Freeport has traditionally had a highly diverse fishery, targeting squid, whiting, flounder, fluke, bluefish, weakfish, butterfish, striped bass, lobster, soft and hard clams, eels, and green crabs, among other species. Most fishing boats in Freeport are day boats or smaller bay boats. It was estimated in 2003 that "about 40 commercial vessels dock in Freeport, including four draggers, one skimmer clam dredge, three hydraulic surfclam dredgers, five lobster boats and about two dozen baymen's boats." The surfclam boats fish primarily in state waters, and thus their landings do not appear in federal landings data. Many of these fishermen, particularly the baymen, are retired or part-timers who fish to make some money on the side. Two boats are dedicated entirely to catching bait, which they then sell to the recreational fishing vessels.[188] Many fishing boats move back and forth between Freeport and Point Lookout and so are all coded by NMFS as "Freeport".[189] Generally fishing boats from Freeport offload their catch at Point Lookout. Much of the fish caught by Freeport vessels eventually ends up in Fulton Fish Market.[190]

The Town of Hempstead provides permits for the commercial harvesting of shellfish, as noted above under *Government*. In 2003 the three most valuable federally permitted species landed in Freeport were scup ($212,293), loligo squid ($188,352), and lobster ($93,627). (See Table 10 below.) The butterfish, mackerel, and squid category has the highest average values for 1997-2004 at just under $500,000, but in 2003 the value was less than half of this amount. The value of the smallmesh groundfish, largemesh groundfish, and other categories were all considerably lower in 2003 than the 1997-2004 average values. However, the value for summer flounder, scup, and black sea bass was slightly higher in 2003 than the average value, and the value of lobster has also increased considerably. The number of vessels home ported in Freeport declined steadily between 1997-2003, from 34 vessels in 1997 to 22 vessels in 2003. (See Table 11 below.) Likewise, the level of fishing for home ported vessels declined along with the number of vessels. The value of landings for Freeport is considerably higher than the value for home ported vessels, indicating vessels from elsewhere are landing here. Landings value also saw a steady decline over this time period, from over $2.5 million in 1997 to just over $800,000 in 2003.

Landings by Species

Table 10: Dollar value by Federally Managed Groups of landings for Freeport

	Average from 1997-2004	**2003 only**
Squid, mackerel, butterfish	487,726	204,731
Summer flounder, scup, black sea bass	272,906	321,441
Smallmesh groundfish[191]	191,022	93,693
Other	128,148	46,144
Largemesh groundfish[192]	95,226	28,336
Bluefish	30,504	17,152
Lobster	29,169	93,627
Monkfish	27,699	7,452
Scallop	3,226	60
Skate	1,995	1,976
Dogfish	1,440	60

Tilefish	328	20
Red crab	10	0

Vessels by Year

Table 11: All columns represent vessel permits or landings value combined between 1997-2003

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	34	26	377,644	2,549,167
1998	30	20	350,352	1,489,147
1999	28	22	310,483	1,436,696
2000	29	21	373,040	1,597,158
2001	23	18	284,273	1,044,999
2002	22	19	181,900	1,019,769
2003	22	17	163,368	814,692

Recreational

Freeport's focus has shifted since the early 2000s from commercial to recreational fishing with an influx of tourists. There are an estimated 21 party and charter fishing vessels in Freeport. Many of the charter vessels are larger than 55' and can carry a number of passengers, as opposed to the traditional "six-pack" charter fishing boat. The recreational fishing industry has a relationship with the commercial industry, in that the recreational fishermen buy their bait from the commercial vessels. The community also has numerous marinas and fishing stations.[193] The Freeport Boatmen's Association was founded in 1935, and is the largest charter fleet in the New York Area. [194] Captain Lou's Fleet features two large party boats.[195] The Miss Freeport V operates another large charter boat.[196] Other charter fishing businesses include Bottom Line Charters[197], the Codfather[198], and numerous others.[199] The Freeport Tuna Club in Freeport hosts and participates in numerous fishing tournaments, for tuna as well as numerous other species.[200] Recreational shellfishing for mussels and hard clams is common in the waters around Freeport.[201]

Subsistence

It has been reported that both commercial and recreational fishermen in Freeport typically use some portion of their catch for home consumption.[202]

Future

Redevelopment of Freeport's waterfront is likely to continue, with both positive and negative consequences for the fishermen who use this area. Fishermen are concerned about future disappearance of fishing infrastructure from the waterfront as property prices escalate, particularly brought about by the recent redevelopment of the "Nautical Mile". [203] The "Nautical Mile", as noted above, is an area containing a combination of restaurants, live music/entertainment, open-air bars, work boats, and fish markets.

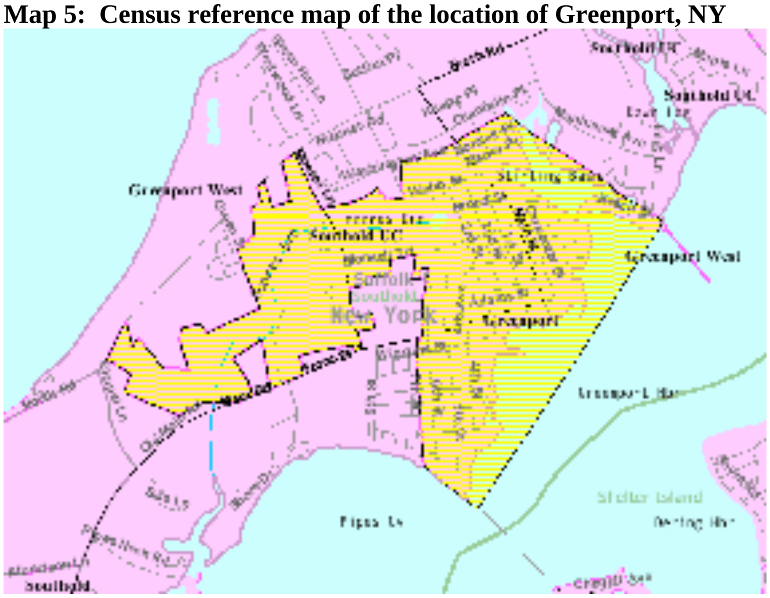
GREENPORT, NY

People and Places

Regional orientation

Greenport (41.10°N, 72.36°W) is located in the township of Southold, Suffolk County on Long Island, New York. Greenport is on the North Fork of the east end of Long Island, and borders on Shelter Island Sound across from Shelter Island, in Peconic Bay. See Map 5 below.

Map 5: Census reference map of the location of Greenport, NY



Historical/Background information

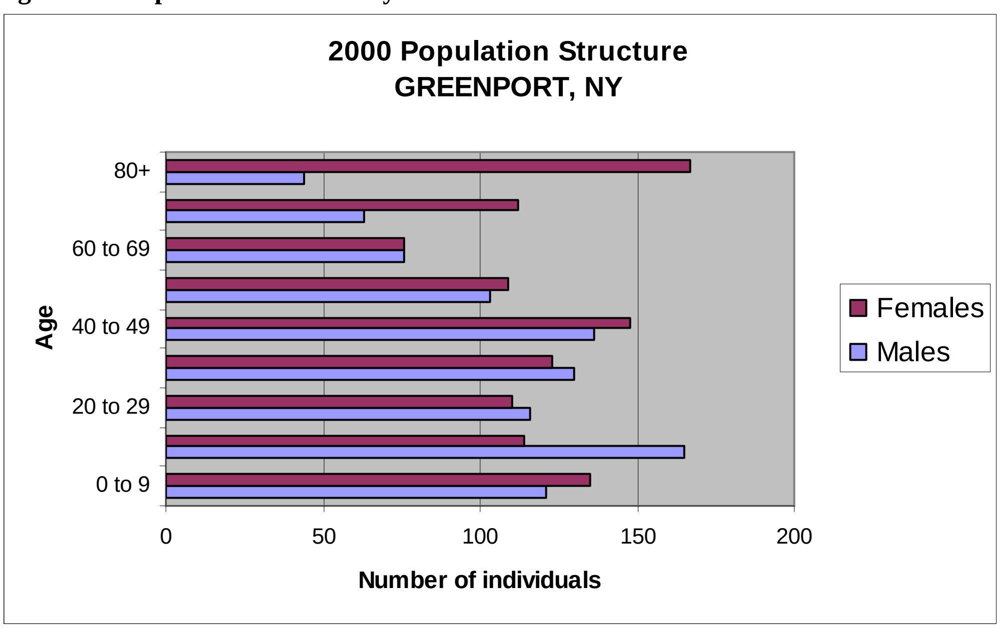
Greenport is one of ten hamlets, and the only incorporated village, in the township of Southold, which encompasses Laurel, Cutchogue, New Suffolk, Peconic, Southold, Greenport, East Marion, Orient, Mattituck and Fishers Island.[204] Europeans searching for turpentine arrived in Southold in approximately 1638[205]. Southold and Southampton are the oldest English settlements in New York, officially settled in 1640[206]. Much of the town was acquired from Native Americans in the Aquebogue Purchase in 1648-49.[207] Greenport itself was first settled in 1682, and was originally comprised of two settlements; Stirling and Green Hill. The two merged in 1831 and adopted the name Greenport. Greenport became the second village incorporated in the State of New York in 1838. Greenport became an important whaling port around this time, and as its prominence grew, the Long Island Railroad was extended to Greenport, making it an important stop on the rail-steamboat route between Boston and New York. A number of boat yards were built in Greenport to support the whaling industry; later, as commercial whaling declined, commercial fishing took its place, keeping the shipyards in business. The shipyards also did well during Prohibition, building ships for both the rum-runners and the Coast Guard stationed here. In addition to this important maritime history, Greenport has long been home to numerous writers, actors, and other artists.[208] Oysters have been raised in Great Peconic Bay since the early 1900s. During the mid-1900s there were several oyster and scallop shucking houses present in Greenport employing dozens of residents.[209] At one time there were as many as fourteen oyster houses here. The menhaden fishery was also significant from the mid-1800s through the mid-1900s; with a number of vessels fishing menhaden and a number of menhaden processing plants producing animal feed and fertilizer.[210] The Village of Greenport has been designated as a historic maritime area.[211]

Demographics

The total population of the township of Southold in 2000 was 20,599, and this number more or less doubles in the summer months.[212] According to Census 2000 data, Greenport Village had a total population of 2,048, down 1.0% from a reported population of 2,070 in 1990. Of this 2000 total, 46.6% were males and 53.4% were females. The median age was 40.3 years and 72.4% of the population was 21 years or older while 24.8% were 62 or older.

Greenport's population structure was rather unusual. The most populous age group listed was females over the age of 80; there were also a large number of females in the 70-79 age category. Males declined over these same two age categories. (See **Figure 17** below.) This points to an aging population here, and possibly indicates that Greenport may be a retirement community. The other significant population group was males between the ages of 10-19. Generally, there are a lot of children and young people in Greenport as well; this community doesn't see the same decline in the 20-29 age category that many fishing communities experience.

Figure 17: Population structure by sex in 2000



The majority of the population in Greenport in 2000 was White (75.7%), with 15.7% Black or African American, 0.4% Asian, 0.5% American Indian or Alaskan Native, 0.7% Pacific Islander or Hawaiian, and 6.9% other. (See Figure 18 below.) Hispanics were identified as 17.2% of the population (see Figure 19 below) -- although town officials suspect this population is actually much higher due to undocumented illegal immigrants[213]. Residents trace their backgrounds to a number of different ancestries including: German (15.1%), Irish (14.4%), English (14.3%), Polish (8.9%), and "other ancestries" (38.6%). With regard to region of birth, 67.3% were born in New York, 17.8% were born in a different state and 13.4% were born outside of the U.S. (including 11.2% who were not United States citizens).

Figure 18: Racial Structure in 2000

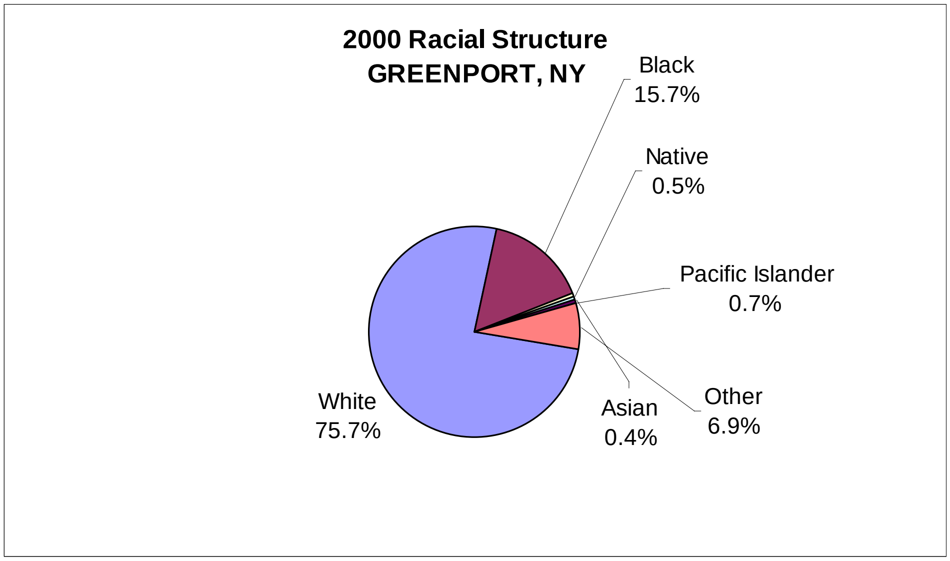
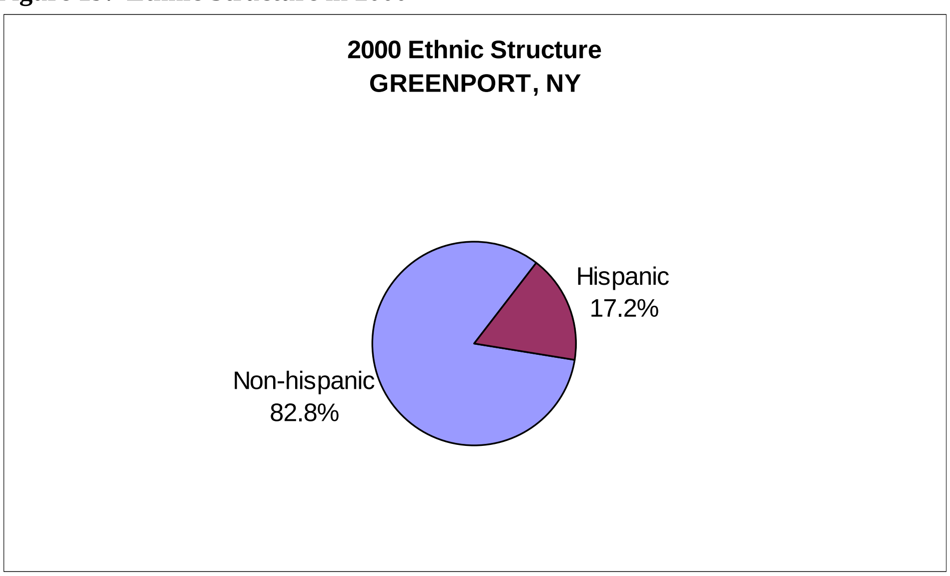


Figure 19: Ethnic Structure in 2000



For 82.0% of the population in 2000, only English was spoken in the home, leaving 18.0% in homes where a language other than English was spoken, including 10.8% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 72.2% had graduated from high school, and 19.4% had a Bachelors Degree. Again of the population 25 years and over, 11.8% did not reach ninth grade, 16.0% attended some high school but did not graduate, 33.4% completed high school, 14.6% had some college with no degree, 4.9% received their associate degree, 12.1% earned their bachelor's degree, and 7.3% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Suffolk County was Catholic with 72 congregations and 734,147 adherents. Other prominent congregations in the county were Jewish (48 with 100,000 adherents), United Methodist (47 with 22,448 adherents), Episcopal (40 with 16,234 adherents), Evangelical Lutheran Church (26 with 19,378 adherents), and Muslim (9 with 12,139 adherents). The total number of adherents to any religion was up 3.8% from 1990. Eight houses of worship are listed in Greenport, including a synagogue, a Greek Orthodox church, a Catholic church and 5 different Protestant churches.[214]

Issues/Processes

Many commercial fishermen from Greenport have gone out of business entirely in recent years, and have difficulty finding decent jobs after they leave, because of a lack of skills. Few children of fishermen are choosing to pursue this career.[215] The town of Southold has instituted a program to assist its residents with rising housing costs.[216] It is estimated that the Hispanic population in Greenport (and elsewhere on Long Island) is much greater than what census data indicate, due to the likely presence of illegal immigrants. Officials wish to conduct a survey of undocumented immigrants here in order to better serve their needs.[217]

As in many other areas of Long Island where clams and other shellfish are a significant part of the fishing industry, water quality is a consistent problem in the increasingly populated shallow bays where the clams are dug.[218] The bays have had several problems with algal blooms of *Aureococcus anophagefferens*, or brown tide, which killed off bay scallop populations here, and is believed to be related to nutrient depletion in the bay.[219]

Some fishermen are concerned about the accuracy of their assigned historical landings by species for fisheries (often used for promulgating new regulations), as the method used to land fish in New York varies from that in most other states. Called the "box method" it involves fish being boxed at sea, then landed at a consignment dock and from there shipped to Fulton Fish Market in New York City. Prior to the implementation of dealer electronic reporting, NMFS port agents counted the number of boxes landed from each vessel and received a species breakdown from the dock manager (who did not open the boxes but rather based the breakdown on his knowledge of the vessel's general fishing patterns). This system allowed greater potential for accidental mis-reporting. Now, the boxes are landed at the consignment dock and immediately shipped to Fulton, where the dealer opens the boxes and reports the landings. Further, individual fishermen report using VTR, logbooks and other methods.

While this method is more accurate in terms of the number and type of fish landed, it can still lead to another type of accidental reporting error. That is, landings are assigned to the incorrect state. This can have inequitable effects on states should an allocation scheme be developed, such as the one for summer flounder, that bases a state's allocation on the landings of a particular species in that state.

The docks make money by charging $10-$12 per box (2007 prices) and by selling fuel. Catch limits and trip limits reduce the number of boxes to be shipped, and have made it very difficult for the docks to stay in business. New York is losing much of its infrastructure, and many of the docks have closed or changed hands in recent years.[220]

Cultural attributes

The annual Greenport Maritime Festival features a clam chowder competition, pirate events, whale boat races, a children's fishing competition, and many other events in a celebration of the area's maritime heritage. Tens of thousands of visitors descend upon the village for this event, and the main streets are closed.[221] The East End Seaport Museum and Maritime Foundation sponsors this annual event. The museum promotes the rich maritime heritage of Long Island's East End through exhibits, events, and the maintenance of the Bug Light. The Museum has a number of displays relating to the maritime heritage of the area, including exhibits on the menhaden and oyster fisheries.[222] Greenport also has a monument dedicated to commercial fishermen lost at sea.[223]

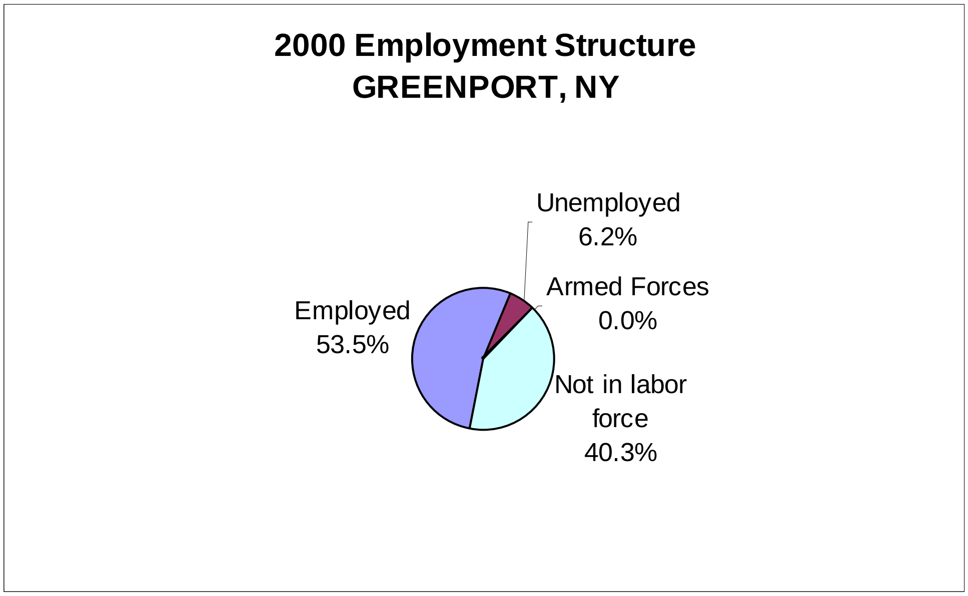
Infrastructure

Current Economy

Southold's Department of Public Works estimates that the largest employers in the town of Southold where Greenport residents might work are Northfork Bank, Mattituck School District, the Town of Southold, and Greenport Hospital.[224]

According to the U.S. Census 2000, 59.7% (977 individuals) of the total population 16 years of age and over were in the labor force, of which 6.2% were unemployed and no residents were in the Armed Forces. See Figure 20 below.

Figure 20: Employment Structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 4 or 0.5% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 81 or 9.3% of the labor force. Educational, health and social services (21.7%), retail trade (15.1%), arts, entertainment, recreation, accommodation and food services (11.5%), and professional, scientific, management, administrative, and waste management services (9.7%) were the primary industries.

Median household income in Greenport was $31,675 (an increase of 23.9% from $25,562 in 1990) and median per capita income was $17,595. For full-time year round workers, men made approximately 66.2% more per year than women.

The average family in Greenport consisted of 3.10 persons. With respect to poverty, 21.2% of families (up from 9.8% in 1990) and 19.7% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 48.2% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Greenport had a total of 1,075 housing units, of which 72.2% were occupied and 60.9% were detached one unit homes. Almost three-quarters (70.5%) of these homes were built before 1940. There were no mobile homes, boats, RVs, vans, etc. listed; 91.1% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $151,400. Of vacant housing units, 79.2% were used for seasonal, recreational, or occasional use. Of occupied units, 44.8% were renter occupied.

Government

Greenport is an incorporated village within the town of Southold. Greenport is governed by a mayor.[225] The township of Southold is governed by a six-member town council and a town clerk. The town offices are located in the hamlet of Southold.[226]

<u>Government involvement in fisheries</u>

The township of Southold has developed a local waterfront revitalization program concerned with, among other goals, protecting water dependent uses, maintaining and strengthening a stable commercial fishing fleet, promoting the sustainable use of living marine resources, enhancing community character, preserving open space, preserving public access, and making use of the coastal location. The town has two Marine Use zoning types in place.[227] Greenport is a New York State Local Waterfront Revitalization Program community, through the state's Coastal Management Program; the community has prepared a comprehensive land and water use plan for its waterfront.[228]

The town of Southold also has a Fishers Island Harbor Committee[229] and as of 2004 had a shellfish advisory committee to address issues relating to the town's numerous shellfish beds[230].

Institutional

<u>Fishing associations</u>

The Long Island Commercial Fishing Association promotes commercial fishing throughout Long Island.[231] There is also a Greenport Baymen's Association that is not very active. [232]

<u>Fishing assistance centers</u>

No information on fishing assistance centers in Greenport was found at this time.

Other fishing related organizations

The North Fork Captain's Association represents charter boats on Long Island's North Fork. [233] The Peconic Estuary Program is charged with developing and implementing a comprehensive management plan for the Peconic Estuary, designated as an "estuary of national significance". This alliance is a collaborative of local, state, and federal government agencies, businesses, environmental and citizen groups, and academic institutions working together to promote the environmental health of this natural resource.[234]

Physical

Suffolk County occupies the easternmost portion of Long Island, in the southeastern portion of New York State. The eastern end of the county splits into two peninsulas, known as the North Fork and the South Fork. The county is surrounded by water on three sides, including the Atlantic Ocean and the Long Island Sound. To the north is the Long Island Sound, and the State of Connecticut is on the opposite shore. To the east is Block Island Sound. The south boundary is the Atlantic Ocean. Several airports are located in the area, including Long Island MacArthur Airport in Ronkonkoma, Republic Airport in East Farmingdale and Francis S. Gabreski Airport in Westhampton Beach.[235] Mattituck also has its own small airport. Greenport is about 13 miles from Mattituck, 30 miles from Montauk, 32 miles from Hampton Bays, and 98 miles from New York City by car. Long Island Airport is about a 45 mile drive.[236] The Long Island Railroad connects Greenport with New York City and other points along Long Island.[237] The Hampton Jitney bus service carries passengers from along Long Island's North Fork to New York City, including a stop in Greenport.[238] The Cross Sound Ferry travels between nearby Orient Point and New London, CT.[239] The North Ferry also travels between Greenport and Shelter Island.[240]

Fishing operations in Greenport are based out of Greenport Harbor, which opens onto Shelter Island Sound. One packing house remains in Greenport, with a retail market, commercial packing facility, and a private dock. This business also handles some of the fish from Mattituck, Shelter Island, and Orient Point. Greenport has two town-owned docks, one for larger vessels and one for smaller vessels; additionally, some of the commercial vessels use private marinas and docks. There are four marinas in Greenport where commercial vessels haul out: Greenport Yacht and Shipbuilding, Sterling Harbor, Brewers, and Douglas Marine.[241] The Townsend Manor Marina in Greenport Harbor is geared primarily towards transient boaters.[242] Preston's, established in 1880, is located in Greenport, and calls itself the most famous chandlery in America, although today they sell few items of use to commercial fishing.[243] Lewis Marine Supply is based in Greenport,[244] and North Fork Welding in Greenport manufactures scallop dredges.[245] There are two bait and tackle shops located here.[246]

Involvement in Northeast Fisheries

Commercial

Today commercial fishing in Greenport is a shadow of what it once was. Vessels still working here include about four pound-netters, some of whom also gillnet, three inshore bay draggers, two of which are full-time, and a handful of bay clammers.[247] Oystering has been taking place commercially in the Peconic Bay since the early 1900s; traditionally the waters off

Greenport were one of the primary spots for oystering.[248] The Widow's Hole Oyster Company maintains this tradition today, cultivating and harvesting oysters in Greenport's waters and selling them to restaurants in Manhattan and elsewhere.[249]

The most valuable federal landings in Greenport in 2003 were striped bass ($242,802) followed by scup ($133,791) and summer flounder ($127,837). (See Table 12 below.) Generally, both the small mesh groundfish and butterfish, mackerel, and squid categories had the highest average values for 1997-2004, but these landings seem to have fallen off considerably in 2003; both are only a fraction of these average values in 2003. The summer flounder, scup, and black sea bass category, and the "other" category, of which striped bass would be a part, were both more valuable in 2003 than the eight-year average values. The large mesh groundfish category also seems to have experienced a tremendous decline over this time period. Overall, the level of landings in Greenport fell considerably from a high of over $4 million in 1998 to a low of $672,000 in 2002. The level of home port fishing and the number of home ported vessels saw similar declines. (See Table 13 below.) This is consistent with reports that commercial fishing has been in a constant decline here.[250] For each year the level of landings in Greenport was higher than the level of home port fishing, indicating that some vessels come from elsewhere to land their catch here.

Landings by Species

Table 12: Dollar value by Federally Managed Groups of Landings in Greenport

	Average from 1997-2004	2003 only
Smallmesh groundfish[251]	678,430	24,891
Squid, mackerel, butterfish	492,699	27,248
Summer flounder, scup, black sea bass	294,394	323,213
Other	247,920	294,058
Bluefish	124,754	95,808
Largemesh groundfish[252]	124,260	18,784
Lobster	35,708	27,702
Monkfish	31,916	426
Scallop	2,234	0
Dogfish	2,197	311
Tilefish	1,031	255
Skate	777	237
Herring	5	42

Vessels by Year

Table 13: All columns represent Federal Vessels Permits or Landings Value combined between 1997-2003 for Greenport

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	11	4	1,748,927	3,929,942
1998	13	7	2,357,017	4,144,883

1999	9	7	1,549,806	3,336,463
2000	10	5	1,446,580	2,137,087
2001	8	5	1,200,996	1,003,369
2002	8	5	1,056,708	672,513
2003	9	5	738,673	812,975

Recreational

Fishing is a popular leisure time activity in Suffolk County. Bluefish, rainbow trout, as well as an assortment of other fish reside in ponds, rivers, and ocean waters.[253] The North Fork Captain's Association lists three charter vessels in Greenport.[254]

Shellfishing is also a popular activity here; the Mattituck Inlet contains a number of extremely productive shellfish beds, producing both hard and soft clams and oysters, all of which are harvested recreationally.[255] Scallops, clams, oysters, mussels, crabs, and eels are all taken in the creeks and inlets around Greenport.[256]

Subsistence

No information from secondary sources has been obtained at this time on subsistence fishing.

Future

The Village of Greenport is has been designated as a historic maritime area, and Town of Southold is dedicated to preserving traditional maritime uses and the maritime character of the village. The township of Southold has identified Greenport as an area where the town's maritime activity should be focused, and thus this area will be a target for infrastructure improvements from the town, including new infrastructure for commercial fishing. Specifically, the town wishes to promote the provision of "commercial fishing support facilities, including docks and dock space; off-loading areas; gear storage space; commercially-priced fuel and service yards; ice and refrigeration; road access to commercial fishing docks; affordable housing for fishery industry personnel; and fish processing facilities".[257] There is some discussion at the moment of developing Greenport as a port for boats servicing an offshore LNG (Liquefied Natural Gas) plant, which coincides with the village's intent to maintain a working waterfront.[258] No information has been obtained directly at this time on peoples' perspectives of the future in Greenport.

NEW JERSEY

OCEAN COUNTY

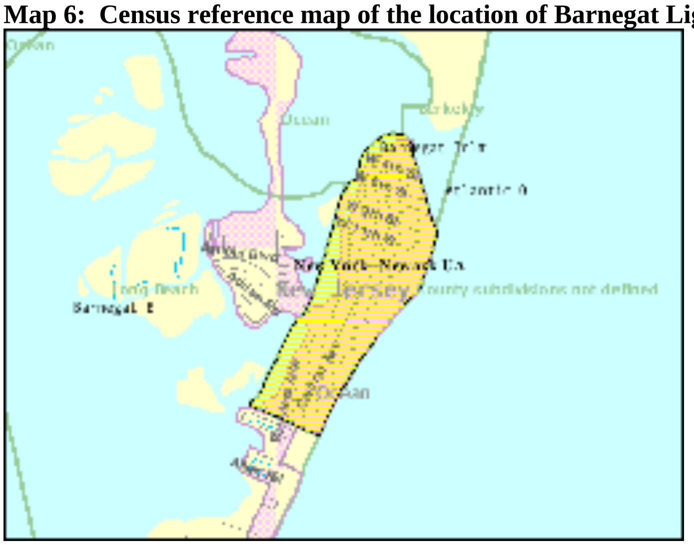
LONG BEACH/BARNEGAT LIGHT

People and Places

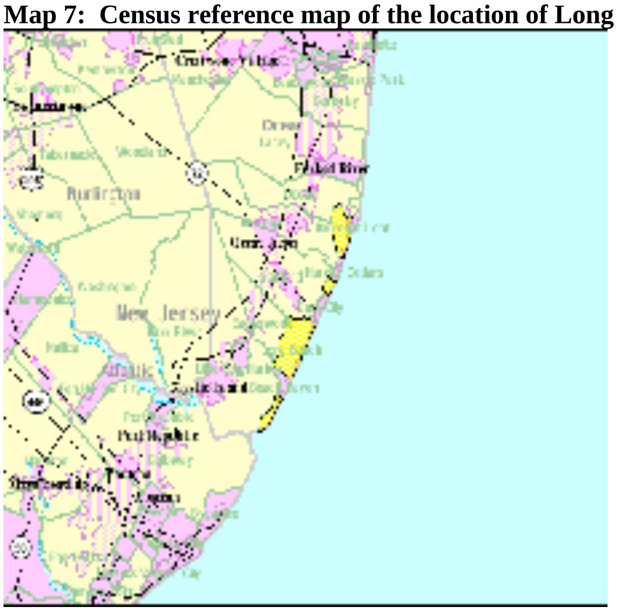
Regional orientation

Long Beach Island is an 18-mile barrier beach on New Jersey's eastern shore, about 4 to 6 miles from mainland New Jersey,[259] within Ocean County. It is made up of the Township of Long Beach (39.69°N, 74.14°W), along with five independent boroughs: Barnegat Light, Beach Haven, Harvey Cedars, Ship Bottom, and Surf City. The city of Barnegat Light (39.75°N, 74.11°W) is a major commercial port, while much of the rest of the island specializes in recreational fishing. Barnegat Light is 16.2 miles from Toms River, NJ, 67.2 miles from Jersey City, NJ, and 67.2 miles from New York, NY. Barnegat Light contains 0.7 square miles of land area.[260] See Map 6 and Map 7 below.

Map 6: Census reference map of the location of Barnegat Light



Map 7: Census reference map of the location of Long Beach



Historical/Background information

The Dutch explorer Captain Cornelius Jacobsen May landed on Long Beach Island in the early 1600s. The island was long known for its many shipwrecks from the strong tides here, so a number of lifesaving stations were constructed along its length, including the Barnegat Light lighthouse. Long Beach Island was at one time an important fishing and whaling center, although it was accessible only by boat. Later it became a hunting and fishing playground for wealthy gentlemen. The island became more accessible in 1886 when a railroad trestle was built connecting it with the mainland. Long Beach Island consists of a number of communities[261]; in 1899 several of these communities were combined into the township of Long Beach; the rest remained as independent boroughs.[262]

Barnegat Light is one of the 11 municipalities on Long Beach Island. A small town of less than one square mile in area, it is found at the northern tip of the barrier island. The town is named after the lighthouse located here, which has guided ships along the New Jersey coast for generations.

Until the 1995 construction of a jetty by the Army Corps of Engineers, boats on the other side of the island had to pass through one of several narrow and often dangerous inlets. This difficulty limited the growth of maritime industries along this part of the New Jersey shore, in contrast with the tourism industry, which has taken advantage of the area's numerous sandy beaches. Along with the jetty, the Corps project also produced a three-quarter-mile beach and a fishing pier, further developing the tourist appeal of Barnegat Light. Commercial and recreational fishing have a long tradition in this area, and both industries are still strong today.[263]

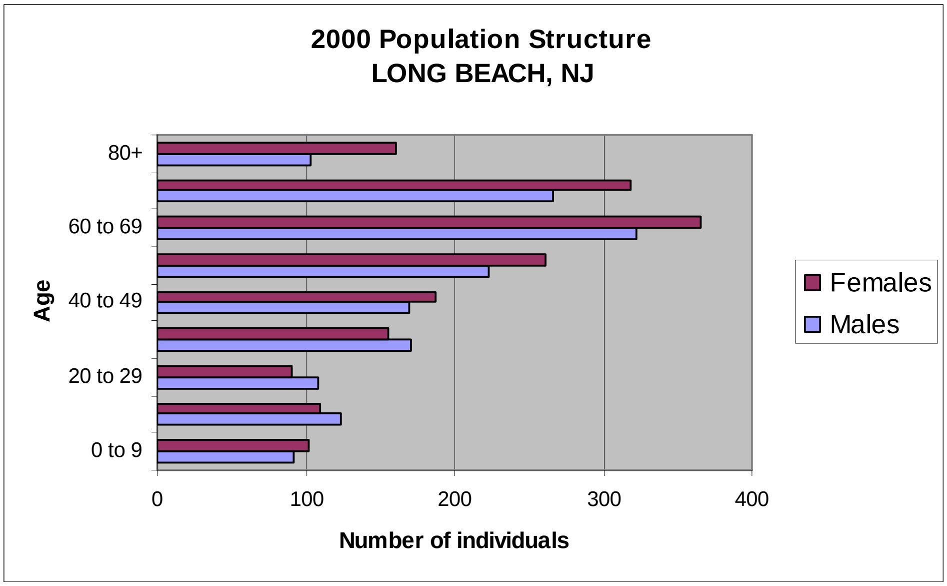
Demographic Profile

Long Beach Township

According to Census 2000 data, Long Beach had a total population of 3,329, down 3.6% from 3,452 in 1990. Of this total in 2000, 52.6% were female and 47.4% were male. The median age was 57.3 years and 86.6% of the population was 21 years or older while 42.7% were 62 or older. The population here can swell to more than 100,000 on a hot summer day.[264]

Long Beach's age structure in 2000 showed an aging population, with a preponderance of residents in the 60 to 69 years age group, followed by the 70-79 years age group, indicating a large retirement population. There were few residents here under the age of 30, and more women over the age of 80 than in any category from age 0-40. See Figure 21 below.

Figure 21: Population structure by sex in 2000



The majority of the population of Long Beach in 2000 was white (98.5%), with 0.4% of residents Black or African American, 0.1% Native American, 0.4% Asian, and 0.1% Pacific Islander or Hawaiian. (See Figure 22 below.) Only 2.1% of the total population was Hispanic/Latino. (See Figure 23 below.) Residents linked their heritage to a number of ancestries including: Irish (25.0%), German (24.5%), English (16.5%), Italian (14.7%), and Polish (10.3%). With regard to region of birth, 56.8% were born in New Jersey, 39.2% were born in a different state and 3.7% were born outside of the U.S. (including 1.4% who were not United States citizens).

Figure 22: Racial Structure in 2000

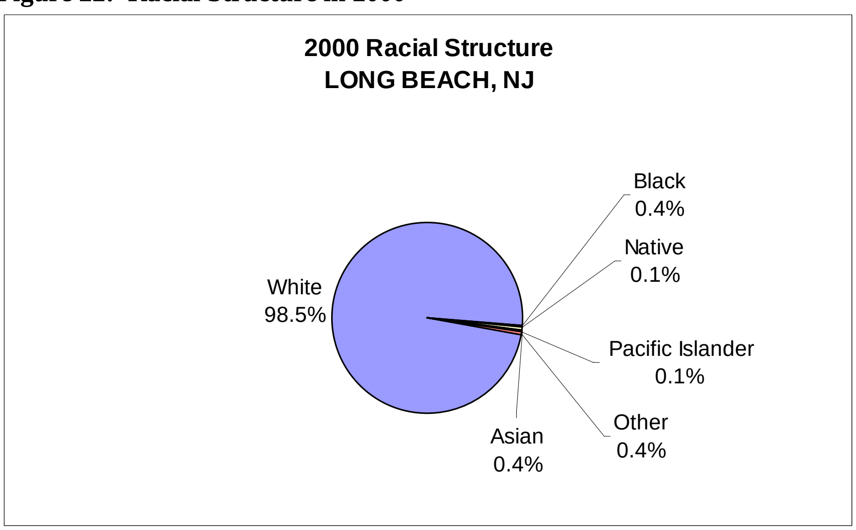
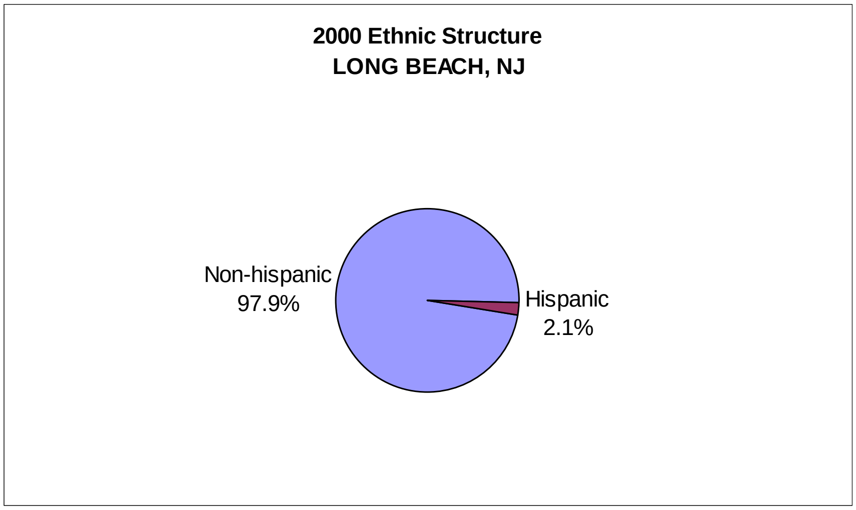


Figure 23: Ethnic Structure in 2000



For 92.4% of the population 5 years old and higher in 2000 only English was spoken in the home, leaving 7.6% in homes where a language other than English was spoken, including 1.8% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 92.0% were high school graduates or higher and 36.7% had a bachelor's degree or higher. Again of the population 25 years and over, 2.0% did not reach ninth grade, 5.9% attended some high school but did not graduate, 28.8% completed high school, 21.8% had some college with no degree, 4.7% received their associate degree, 23.9% earned their bachelor's degree, and 12.8% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Ocean County was Catholic with 33 congregations and 212,482 adherents. Other prominent congregations in the county were Jewish (35 with 11,500 adherents), and The United Methodist Church (28 with 9,534 adherents). The total number of adherents to any religion was up 21.9% from 1990.

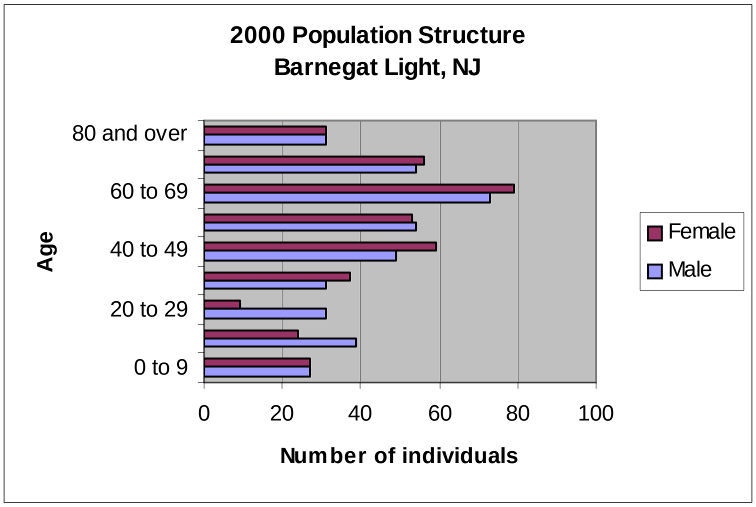
There are seventeen houses of worship listed on Long Beach Island, including six in Long Island Township, of which four are Catholic and one is Jewish, and the rest are Protestant.[265]

Barnegat Light

According to Census 2000 data, Barnegat Light had a total population of 764, up 13.2% from 1990. Of this total in 2000, 49.1% were female and 50.9% were male. The median age was 54.9 years and 83.9% of the population was 21 years or older while 39.5% were 62 or older.

Barnegat Light's age structure showed a preponderance of 60 to 69 years age group, indicating a large retirement population. In a perhaps related phenomenon, the age group of 20-29 is very small, with almost no females. (See Figure 24 below.) Among the already small numbers of children and young people, young females are apparently almost uniformly leaving the community after high school.

Figure 24: Population structure by sex in 2000



The majority of the population of Barnegat Light in 2000 was white (98.3%), with 0.5% of residents Black or African American, no Native Americans, 0.3% Asian, and 0.3% Pacific Islander or Hawaiian. (See Figure 25 below.) Only 0.8% of the total population was Hispanic/Latino. (See Figure 26 below.) Residents linked their heritage to a number of ancestries including: Irish (28%), German (23.2%), English (17.4%), and Italian (14.6%). With regard to region of birth, 55.7% were born in New Jersey, 39.8% were born in a different state and 3.2% were born outside of the U.S. (including 0.4% who were not United States citizens).

Figure 25: Racial Structure in 2000

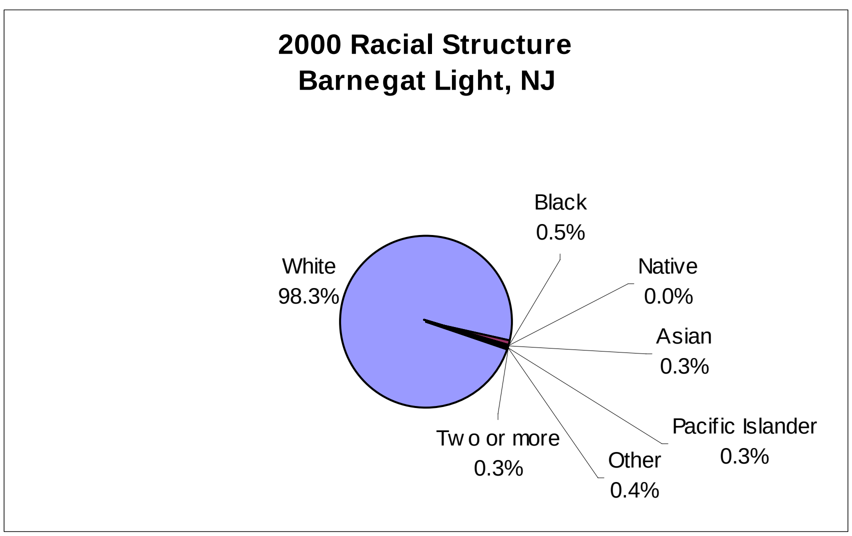
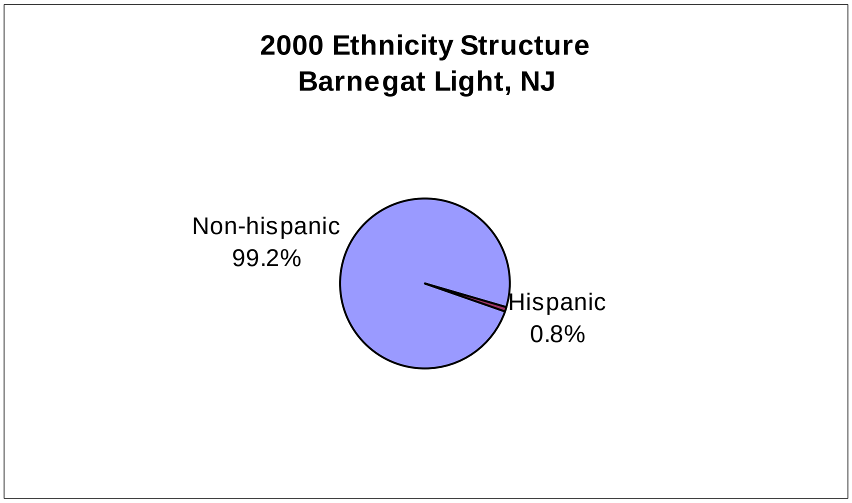


Figure 26: Ethnic Structure in 2000



For 92.7% of the population 5 years old and higher in 2000 only English was spoken in the home, leaving 7.3% in homes where a language other than English was spoken, including 1.5% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 92.1% were high school graduates or higher and 38.9% had a bachelor's degree or higher. Again of the population 25 years and over, 2% did not reach ninth grade, 5.9% attended some high school but did not graduate, 29.3% completed high school, 17% had some college with no degree, 6.9% received their associate degree, 21.5% earned their bachelor's degree, and 17.4% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Ocean County was Catholic with 33 congregations and 212,482 adherents. Other prominent congregations in the county were Jewish (35 with 11,500 adherents), and The United Methodist Church (28 with 9,534 adherents). The total number of adherents to any religion was up 21.9% from 1990.

Issues/Processes

As of 2006 the Army Corps of Engineers wishes to begin a beach nourishment project on Long Beach Island to restore the eroding beaches here, but is meeting with resistance from homeowners, who are concerned that the planned dunes will obstruct their water view, and that more beach space will mean more beach goers in front of their homes. The government would require easements from property owners to access the shore for construction, and the home owners are reluctant to provide them. If the beach nourishment project does not take place, the beach and the waterfront homes may soon be lost.[266]

One emerging trend (as of 2006) on Long Beach Island and in other similar summer resort areas is that as real estate prices soar, many year-round residents are selling their homes for bigger homes on the mainland, tempted by the large price they can get. These homes are bought up by those using them as summer homes. The result is dwindling year-round populations on places like Long Beach Island, and a resulting loss in year-round businesses and students in local schools.[267]

Like many other coastal communities, Barnegat Light must deal with the forces of rapidly increasing home prices and the resulting gentrification. Because the community is physically so small, there is very little land area for development, and the development of condominiums or other properties generally involves land in existing use. The high housing costs are encouraging many families to move to the mainland, and many of those employed in the commercial fishing industry now do not reside in Barnegat Light.[268]

Some beach areas on Long Beach are closed during the summers for piping plover nesting; local anglers complain this restricts them from prime beach area from which to cast.[269]

Cultural attributes

There are a number of events throughout the summer held all over Long Beach Island. Long Beach Island Surf Fishing Tournament is an annual competition that has been held for over fifty years. It takes place throughout most of October and November, with cash prizes and trophies being awarded in angling competitions for bluefish and striped bass, and includes a popular surfcasting seminar. Chowderfest is an annual event that is held in Beach Haven in early October and features a competition between all the restaurants on Long Beach Island as they vie for the honor of creating the tastiest chowder.[270] The Alliance for a Living Ocean hosts beach seining events and the annual FantaSea Festival to educate the public about the coastal resources surrounding Long Beach Island.[271] Barnegat Light holds an annual Blessing of the Fleet in the Barnegat Light Yacht Basin each June to pray for the community's commercial fishermen.[272]

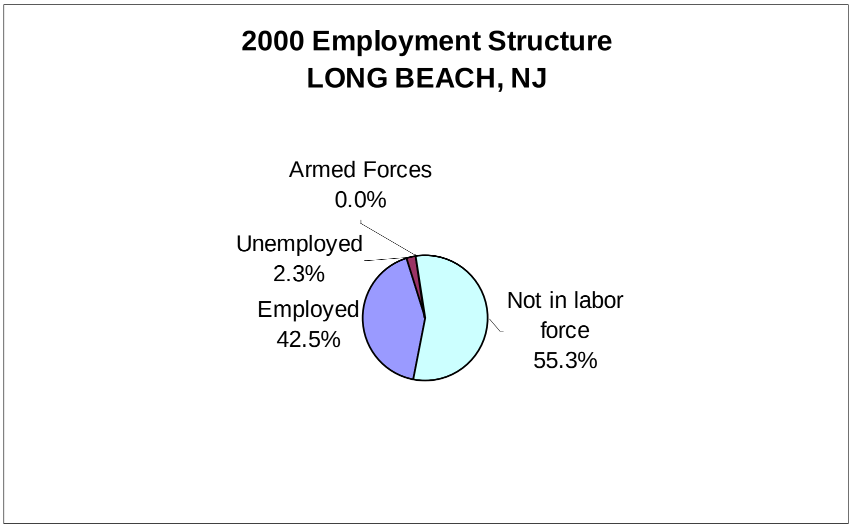
Infrastructure

Current Economy

Long Beach Township

Tourism and real estate are the two major industries in Long Beach.[273] Total property values on the island exceed $11 billion.[274] According to the U.S. Census 2000, 44.7% (1,351 individuals) of the total population 16 years of age and over were in the labor force, of which 2.3% were unemployed and no residents were in the Armed Forces. It should be noted that 55.3% of the population 16 and over were not in the labor force at all. (See Figure 27 below.) This high percentage relative to other locations further reinforces the nature of Long Beach as a retirement community.

Figure 27: Employment structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 10 positions or 0.8% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 141 positions or 11.0% of the labor force. Educational health and social services (18.2%), arts, entertainment, recreation, accommodation and food services (17.1%), construction (14.6%), and retail trade (11.5%) were the primary industries.

Median household income in Long Beach was $48,697 (up 53.3% from $31,775 in 1990) and median per capita income was $33,404. For full-time year round workers, men made approximately 33.2% more per year than women. The average family in Long Beach consisted of 2.50 persons. With respect to poverty, 3.8% of families (down from 4.2% in 1990) and 5.1% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 18.4% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

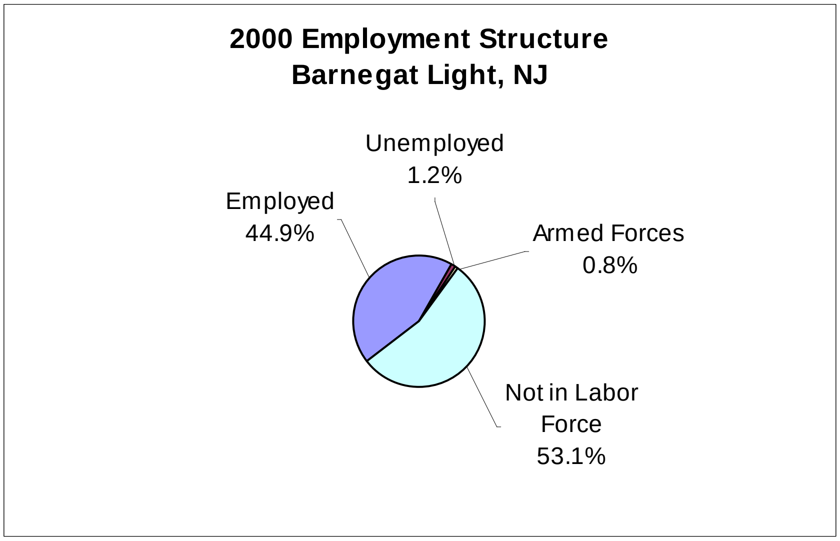
In 2000, Long Beach had a total of 9,023 housing units of which 18.4% were occupied and 74.1% were detached one unit homes. Only 5.0% of these homes were built before 1940. There were a number of mobile homes/vans/boats in this area, accounting for 4.3% of the total housing units; 88.6% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $334,400. Of vacant housing units, 83.3% were used for seasonal, recreational, or occasional use. Of occupied units, 13.9% were renter occupied.

Barnegat Light

The small businesses of Barnegat Light are very reliant on the summer tourist economy and the year round fishing industry. The town relies heavily on its commercial fishing industry year round, but in winter it becomes the economic mainstay for the town –employing as many as 150 local people to work at the marinas.[275] The most significant sources of employment in the town are the fishing industry and real estate.[276]

According to the U.S. Census 2000, 46.9% (305 individuals) of the total population 16 years of age and over are in the labor force, of which 1.2% are unemployed and 0.8% are in the Armed Forces. It should be noted that 53.1% of the population 16 and over are not in the labor force at all. (See Figure 28 below.) This high percentage relative to other locations further reinforces the nature of Barnegat Light as a retirement community.

Figure 28: Employment structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 24 positions or 8.2% of all jobs. Self employed workers, a category where fishermen might be found, accounts for 55 positions or 18.8% of the labor force. Educational health and social services (16.8%), arts, entertainment, recreation, accommodation and food services (11%), construction (10.3%), finance, insurance, real estate and rental and leasing (10.3%), and professional, scientific, management, administrative and waste management services (9.2%) were the primary industries.

Median household income in Barnegat Light was $52,361 (up 17.3% from 1990) and median per capita income was $34,599. For full-time year round workers, males made approximately 17.6% more per year than females. The average family in Barnegat Light consists of 2.6 persons. With respect to poverty, 2.6% of families (down from 4.2% in 1990) and 4.7% of individuals earn below the official U.S. Census poverty threshold ($8,794), while 33.7% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Barnegat Light had a total of 1,207 housing units of which 30.7% were occupied and 88.4% were detached one unit homes. Only 3.6% of these homes were built before 1940. There are a number of mobile homes/vans/boats in this area, accounting for 0.2% of the total housing units; 86.4% of detached units have between 2 and 9 rooms. In 2000, the median cost for a home in this area was $299,400. Of vacant housing units, 93.4% were used for seasonal, recreational, or occasional use. Of occupied units, 12.1% were renter occupied.

Governmental

The township of Long Beach is located in Ocean County and is governed by a board of three commissioners, one of whom is the mayor.[277] An elected mayor and a six-person borough council run Barnegat Light's local governance.[278]

Fishery involvement in government

The local government is not directly involved in the fishing industry in Barnegat Light. However, the mayor himself owns several scallop boats.[279] The Barnegat Bay National Estuary Program is one of 28 estuaries of "national significance" designated and federally funded by the U.S. EPA (Environmental Protection Agency). It is a partnership of federal, state, and municipal agencies as well as non-profit organizations and businesses working together to protect this estuary.[280]

Institutional

Fishing associations

The Beach Haven Charter Fishing Association represents charter boats in the borough of Beach Haven and around Long Beach Island.[281] Blue Water Fishermen's Association is located in Barnegat Light. This association is made up of tuna and swordfishermen as well as others involved in the commercial fishery of highly migratory species.[282]

Fishery assistance centers

No fishing assistance centers were identified through secondary sources in this research.

Other fishing related organizations

The Alliance for a Living Ocean on Long Beach Island is focused on promoting and maintaining clean water and a healthy coastal environment. They host a number of educational events including eco tours, beach walks, and seining, and also hold an annual festival.[283]

The Jersey Coast Anglers Association (JCAA) located in nearby Toms River NJ, is an association of more than 75 saltwater fishing clubs, with a combined membership exceeding 30,000.[284] The Recreational Fishing Alliance, a national lobbying group, is headquartered near Barnegat Light.[285]

Physical

Long Beach Island is a barrier island with the Atlantic Ocean on one side, and Barnegat Bay and Little Egg Harbor on the other. Ocean County has three general aviation airports: Eagles Nest Airport at West Creek, Lakewood Airport at Lakewood, and Robert J. Miller Airpark in Berkeley Township. But none of these has regularly scheduled service[286] Barnegat Light is at 52 miles from Atlantic City International Airport, 72 miles from Trenton Mercer Airport, 78 miles from the Philadelphia International Airport and 98 miles from the Newark Liberty International Airport. Toms River is 29 miles from Long Beach and Atlantic City is 47 miles away. New York City is about 102 miles by car. Route 72 is the only road connecting Long Beach Island with the New Jersey mainland; it connects Ship Bottom with Beach Haven West and Manahawkin.

Long Beach Island has a number of bait and tackle shops including Jingles Bait and Tackle, Surf City Bait and Tackle[287], and Fisherman's Headquarters.[288] There are also a number of marinas located along the island.[289] Sportsman's Marina bills itself as a fishing and crabbing marina, and also offers boat rentals.[290] Ocean County lists seven marinas in Long Beach Township and at least 30 more along the island.[291] Hagler's Marina is one in Brant's Beach with 66 slips offering gas, bait, tackle, ice, and supplies; another is Escape Harbor Marina. There are also four boat ramps listed for Long Beach Island.[292]

Barnegat Light is one of the most important fishing ports in Ocean County. Barnegat Light port has a significant offshore longline fishery, targeting tuna species (especially yellow fin and big eye) for most of the year, and swordfish part of the year.

Docking is available through five marinas in Barnegat Light. The two largest docks have 36 full-time resident commercial boats, working year round, as well as recreational vessels and transient vessels. One of these two largest docks is completely occupied by commercial boats; the owners are also commercial fishermen. These commercial boats include seven scallopers, ten longliners that fish for tuna, swordfish, and tilefish, and about nine inshore-fishing net boats. The dock also has three offloading stations. The second of the largest docks accommodates ten commercial boats, fifteen charter boats, and twenty-five recreational vessels. The three remaining docks can each accommodate approximately 30- 35 boats, most of which are recreational boats and charter boats. Most of the recreational and sport fishing boats that utilize this port are here for part of the year, usually from May or June through early October.[293]

Involvement in Northeast Fisheries

Commercial

Barnegat Light, on the north end of Long Beach Island, is one of New Jersey's largest commercial fishing ports. However, to avoid confidentiality issues due to a small number of dealers, all Barnegat Light/Long Beach landings are combined.

Located adjacent to the formerly infamous Barnegat Inlet, Barnegat Light's two commercial docks host a range of vessels from small, local day boats to globe spanning longliners. Several fishermen in Barnegat Light pioneered the deep water tilefish fishery back in the 1970s, successfully marketing this fish as the "poor man's lobster". "Barnegat Light is the home port of many members of the East Coast's longline fleet. Targeting several species of tuna as well as swordfish, on their several week or longer trips Barnegat Light longliners routinely fish from the high seas from hundreds to thousands of miles away. Barnegat Light is also home to several state-of-the-art scallop vessels and a fleet of smaller, inshore gillnetters."[294] The scallop fleet is made up both of larger vessels which may spend several days at sea at a time, fishing for scallops throughout the Mid-Atlantic, and several vessels which engage in "day trip" scalloping closer to the coast. The day trips can also be an important means for full-time scallopers and some other fishermen to subsidize their catch, as scallop vessels do not need to use their days at sea to fish for scallops inshore.[295]

The most valuable fisheries in Barnegat Light in 2003 were sea scallops ($9,493,730), monkfish ($4,389,185), and swordfish ($715,289), according to NMFS landings data. (See Table 14 below.) Both scallop and monkfish catches were above the 7-year average in 2003. Tilefish was also an important species in 2003, with an increase in value from the 1997-2003 average. Overall, the value of the catch, both that of vessels with their home port in Barnegat Light and those landing their catch here, increased over the 7-year period (1997-2003). (See Table 15 below.) The number of vessels in Barnegat Light also increased over the same period.

Viking Village, one of Barnegat Light's two commercial docks, is one of the largest suppliers of fish and seafood on the Eastern Seaboard. Each year over 4 million pounds of seafood are packed out over the commercial dock of Viking Village and shipped locally and internationally. Viking Village is homeport to seven scallopers, ten longliners and about nine inshore-fishing net boats, which fish blues, weakfish, monkfish, dogfish and shad. Each boat is independently owned and uses Viking Village for pack-out, marketing and sale of the catch. Some local restaurants and seafood dealers purchase products from Viking Village directly, including Wida's, Surf City Fishery, Beach Haven Fishery and Cassidy's Fish Market. Viking Village and the boats docked there employ about 200 people.[296] There are also a number of bait and tackle retailers located in town, such as Barnegat Light Bait and Tackle[297] and Eric's Bait and Boat[298].

Landings by Species

Table 14: Dollar value of Federally Managed Groups of landings in Barnegat Light

Species	Average from 1997-2003	2003 only
Scallop	5,498,710	9,493,730
Monkfish	3,287,025	4,389,185
Bluefish	255,794	210,437
Dogfish	197,054	0
Tilefish	150,205	626,946
Skate	111,925	74,534
Squid, mackerel, butterfish	63,815	20,138
Summer flounder, scup, black sea bass	57,945	71,825
Largemesh groundfish[299]	4,559	519
Smallmesh groundfish[300]	1,871	333
Lobster	1,010	0
Herring	11	0
Other	2,544,127	1,494,125

Vessels by year

Table 15: All columns represent vessel permits or landings value combined between 1997-2003.

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	43	28	6,144,679	10,303,886
1998	38	27	6,054,709	10,171,814
1999	54	32	11,127,349	12,124,531
2000	65	38	14,417,637	14,594,799
2001	71	39	14,709,246	14,387,998
2002	72	38	14,657,863	14,568,116
2003	81	39	16,623,969	16,381,772

Recreational

Just a glance at the large number of marinas, charter operations, bait and tackle shops, and boat ramps on Long Beach Island makes it clear that recreational fishing is important here (see above). Between 2001- 2005, there were 40 charter and party vessels making 7,189 total trips registered in logbook data by charter and party vessels in Long Beach carrying a total of 172,212 anglers (NMFS VTR data). Hot Tuna Charters is one charter boat in Long Beach that specifically targets tuna, and offers both inshore and canyon fishing.[301] Jersey Girl Sport Fishing is another charter company with both inshore trolling and wreck fishing for tuna, skipjack, mahi mahi, seabass, croaker, fluke, porgies, and more.[302] The Beach Haven Charter Fishing Association represents several different boats in Beach Haven and Long Beach.[303] Many recreational and charter fishing boats can be found in Barnegat Light, along with marinas, boat rental facilities, and bait and tackle shops.[304]

Subsistence

No information has been obtained at this time through secondary sources on subsistence fishing.

Future

As of 2005 the New Jersey State Department of Transportation had plans to build a second bridge alongside the existing one to Long Beach Island, to address the poor structural conditions of the existing bridge. This would not affect the amount of traffic able to travel to the island.[305] Also as of 2005, if the necessary easements are signed by property owners on the island, the Army Corps of Engineering will soon begin a $75 million beach renourishment project expected to last 50 years.[306] Information has not yet been obtained regarding people's perception of the future in Long Beach.

PINE BEACH, NJ

People and Places

Regional orientation

The borough of Pine Beach (39.93°N, 74.17°W) is located within Berkeley Township, Ocean County, New Jersey on the Toms River, and occupies just 1.62 square kilometers of land.[307] See Map 8 below.

Map 8: Census reference map of the location of Pine Beach within New Jersey

Historical/Background information

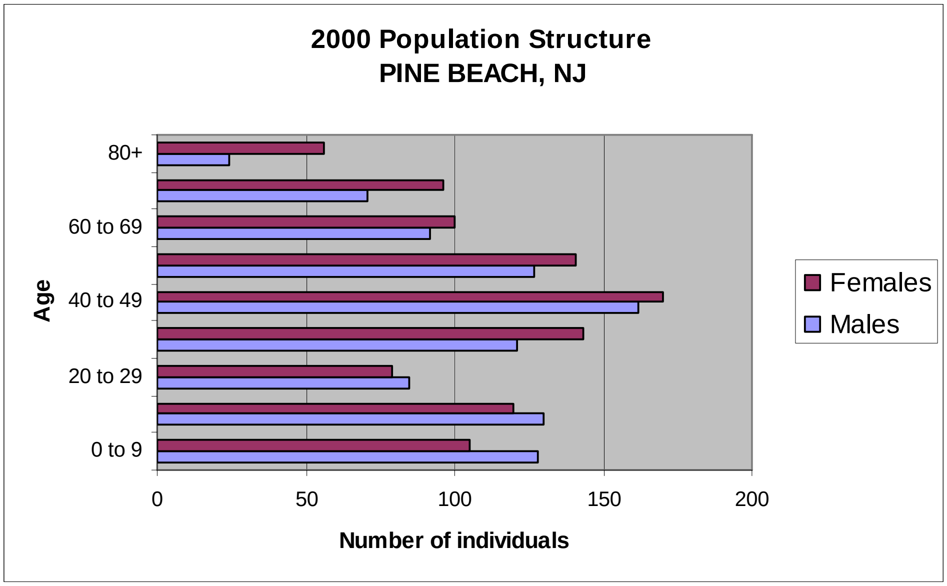
Pine Beach borough is located in Berkeley Township. Berkeley Township was first settled in 1750. Many of the early settlers subsisted on farming, fishing, and oystering; in addition, other early industries located here included salt works, saw mills, and shipping. Originally part of Dover Township, Berkeley Township was incorporated in 1875.[308] The community of Pine Beach came about in 1908 when Robert Horton, while vacationing nearby, learned that the stretch of land that is now Pine Beach was for sale. Horton purchased the property and created the Pine Beach Improvement Company, with the goal of creating a summer colony of waterfront cottages. The railroad between Philadelphia and Bay Head ran directly through Pine Beach, bringing prospective property buyers directly to the area; by 1910 there were 22 homes and a 75-room hotel here. In 1925 Pine Beach became a borough within Berkeley Township, with its own municipal government, after residents complained about the municipal services they were provided with.[309] Today Pine Beach still has the feel of a summer community, where residents and visitors swim, boat, and fish, but today most residents live here year round.[310] Roughly 72% of the land in Berkeley Township is located within the New Jersey Pinelands National Reserve.[311]

Demographics

According to Census 2000 data, Pine Beach had a total population of 1,950, down 0.2% from 1,954 in 1990. Of this total in 2000, 51.8% were female and 48.2% were male. The median age was 41.6 years and 74.6% of the population was 21 years or older while 20.5% were 62 or older.

The population structure for Pine Beach showed a preponderance of 40-49 year olds, followed by 50-59 year olds and 30-39 year olds. (See Figure 29 below.) There were also a large number of children, indicating that Pine Beach has a number of young families. As in many similar communities of this size, there is a decline in population for the 20-29 age bracket, as young people leave to go to college or in search of jobs.

Figure 29: Population structure by sex in 2000



The majority of the population of Pine Beach in 2000 was white (98.4%), with 0.3% of residents Black or African American, 0.2% Native American, 0.7% Asian, and no residents listed as Pacific Islander or Hawaiian. (See Figure 30 below.) Only 2.4% of the total population was Hispanic/Latino. (See Figure 31 below.) Residents linked their heritage to a number of ancestries: German (29.2%), Irish (27.7%), Italian (25.2%) and English (12.6%). With regard to region of birth, 70.1% were born in New Jersey, 26.6% were born in a different state and 2.6% were born outside of the U.S. (including 0.9% who were not United States citizens).

Figure 30: Racial Structure in 2000

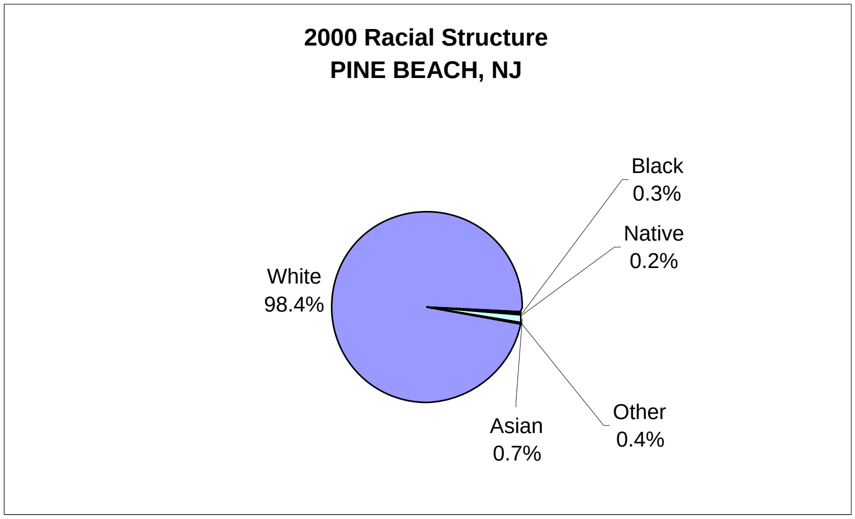
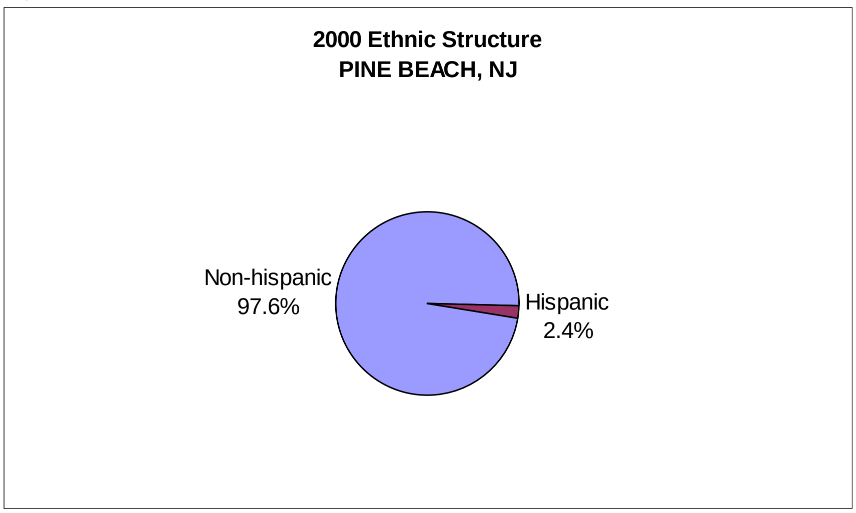


Figure 31: Ethnic Structure in 2000



For 94.8% of the population 5 years old and higher in 2000, only English was spoken in the home, leaving 5.2% in homes where a language other than English was spoken, and including 1.3% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 90.7% were high school graduates or higher and 32.6% had a bachelor’s degree or higher. Again of the population 25 years and over, 1.7% did not reach ninth grade, 7.6% attended some high school but did not graduate, 31.0% completed high school, 19.9% had some college with no degree, 7.2% received their associate degree, 21.1% earned their bachelor’s degree, and 11.5% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of adherents in Ocean County was Catholic with 33 congregations and 212,482 adherents. Other prominent congregations in the county were --Jewish (35 congregations with 11,500 adherents), United Methodist (28 with 9,534 adherents) Episcopal (12 with 5,539 adherents), and Evangelical Lutheran Church in America (11 with 6,731 adherents). The total number of adherents to any had religion increased 21.9% from 1990.

Issues/Processes

The Barnegat Bay Shellfish Restoration Program is working to restore oyster beds in the Toms River where oysters have traditionally been harvested; in 2006 their goal was to raise 1.2 million clams, which would provide a substrate to which oysters could attach themselves.[312]

Cultural attributes

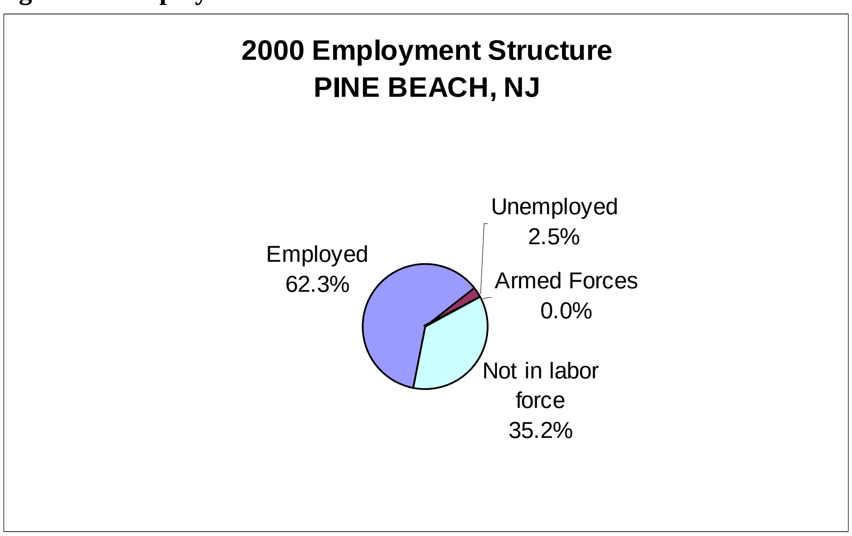
The Pine Beach Yacht Club has historically been the town's social center.[313] There is a Clean Communities Day-Beach Sweep.[314] Nearby Toms Rivers is home to the Toms River Maritime Museum.[315]

Current Economy

Many Pine Beach residents are likely to work in Toms River, which is only about a five-minute drive. The largest employer in Toms River is the Community Medical Center with 2,870 full- and part-time employees. Many other residents work in the offices of doctors and other health care professionals. The Toms River school district is the second-largest employer in Toms River, with about 2,200 employees; Pine Beach, Beachwood and South Toms River are all included in the school district. The third-largest employer is the Ocean County government, based in Toms River, with 1,550 full- and part-time workers.[316] Ocean County has a $3 billion-a-year tourism economy.[317]

According to the U.S. Census 2000, 64.8% (1,015 individuals) of the total population 16 years of age and over were in the labor force, of which 2.5% were unemployed and no residents were in the Armed Forces. See Figure 32 below.

Figure 32: Employment Structure in 2000



According to Census 2000 data, jobs in agriculture, forestry, fishing and hunting, and mining accounted for 4 positions or 0.4% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 54 positions or 5.5 % of jobs. Educational, health, and social services (28.8%), retail trade (13.2%), and construction (10.5%) were the primary industries.

Median household income in Pine Beach in 2000 was $57,336 (up 45.2% from $39,500 in 1990) and per capita income was $26,487. For full-time year round workers, men made approximately 47.6% more per year than women.

The average family in Pine Beach in 2000 consisted of 3.01 persons. With respect to poverty, 2.5% of families (down from 2.7% in 1990) and 3.5% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 19.0% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Pine Beach had a total of 872 housing units of which 88.0% were occupied and 94.2% were detached one unit homes. A total of 17.9% of these homes were built before 1940. Mobile homes accounted for 0.2% of the total housing units; 89.6% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $149,100. Of vacant housing units, 66.6% were used for seasonal, recreational, or occasional use, while of occupied units 11.5% were renter occupied.

Governmental

Pine Beach has a mayor and a six-member borough council on which members serve three-year terms.[318] The borough is located within Berkeley Township, which itself is governed by a mayor and a seven-member council.[319]

Fisheries involvement in government

Pine Beach requires residents to purchase a crabbing badge to harvest crabs[320].

Institutional

Fishing associations

No information on fishing associations in Pine Beach was found through secondary sources at this time.

Fishing assistance centers

No information was collected through secondary sources on fishing assistance centers for Pine Beach.

Other fishing related organizations

No information on fishing related institutions was found through secondary sources at this time.

Physical

Pine Beach is roughly two miles from Toms River, 13 miles from Barnegat Light, 42 miles from Atlantic City, and 60 miles from New York City. The Garden State Parkway travels close by Pine Beach, and Route 9 runs through the community. Atlantic City International

Airport is about 40 miles from Pine Beach and Trenton Mercer Airport is about 42 miles away. The New Jersey Transit commuter train runs between Bay Head, about 20 miles from Pine Beach, and New York City, as well as other communities throughout New Jersey.[321] There are also buses that run between Toms River and Atlantic City and Newark.[322]

Pine Beach has one boat ramp, accessible for a fee[323], and there are other access points in Toms River and other nearby towns.[324] The Pine Beach Yacht Club boasts a 20-slip marina that accommodates boats up to 10.5' beam and 32' length, as well as boat ramp and an electric hoist that can launch boats to1,200 pounds[325].

Involvement in Northeast Fisheries

Commercial

Pine Beach has little commercial fishing activity. Of the ten years for which data are provided here (1997-2006), there were landings in Pine Beach in only three years: 2000, 2003, and 2005. (See Table 16 below.) There were no vessels listing Pine Beach as their home port during that period. Between 2001-2003, there was one vessel owner residing in Pine Beach. (See Table 17 below.) In 2003, the most valuable landings were of summer flounder, worth $9,955, followed by loligo squid ($1,280) and scup ($642). The most valuable species on average was tilefish.

Landings by Species

Table 16: Dollar value of Federally Managed Groups of landing in Pine Beach

	Average from 1997-2006	2003 only
Tilefish	7,006	0
Summer founder, scup, black sea bass	1,542	10,657
Other	212	755
Squid, mackerel, butterfish	164	1,314
Bluefish	67	535
Smallmesh groundfish[326]	41	281
Largemesh groundfish[327]	16	0
Skate	4	28

Vessels by Year

Table 17: All columns represent vessel permits or landings value combined between 1997-2005

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	0	0	0	0
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	1,718
2001	0	1	0	0
2002	0	1	0	0
2003	0	1	0	13,570

2004	0	0	0	0
2005	0	0	0	57,127

Recreational

Some websites listing Pine Beach as a tourist destination mentioned fishing as one activity in the community, but no other information about recreational fishing could be found. The Pine Beach Yacht Club also mentions fishing from their facilities.[328]

Subsistence

No information about subsistence fishing could be found at this time.

Future

The borough is planning to develop a waterfront park and River Walk along the Toms River, which would include a municipal dock and boat basin.[329] There is also a proposal in the works for the state to assist in providing affordable coastal housing in Pine Beach.[330]

POINT PLEASANT/POINT PLEASANT BEACH

People and Places

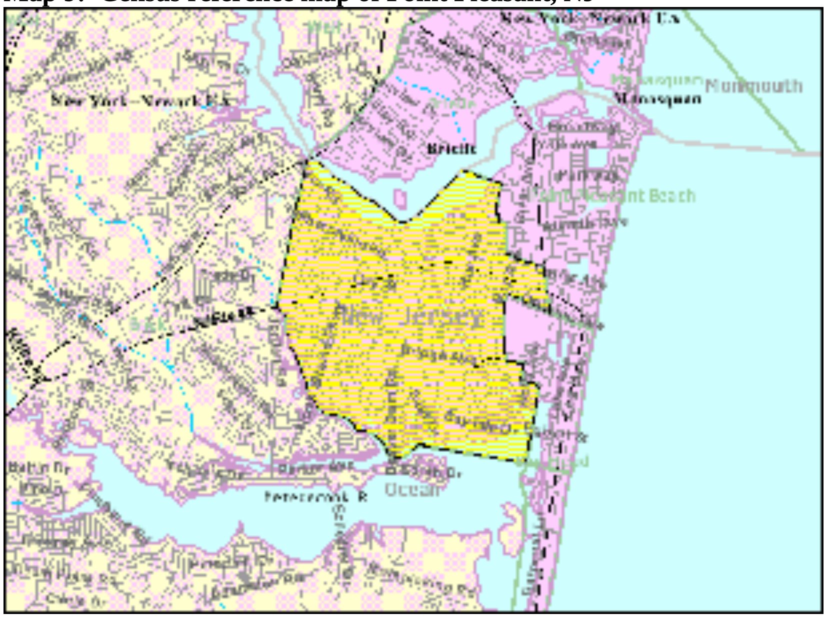
Regional orientation

Because of the close relation between Point Pleasant and Point Pleasant Beach with regard to the commercial and recreational fishing industries, they are being considered here as a single community. The community of Point Pleasant, New Jersey (40.08°N, 74.07°W) encompasses the adjacent boroughs of Point Pleasant and Point Pleasant Beach, and is located in Ocean County. It is 16 miles from Toms River, NJ, 41.6 miles from Trenton, NJ, 66.8 miles from New York, NY. See Map 9 and Map 10 below.

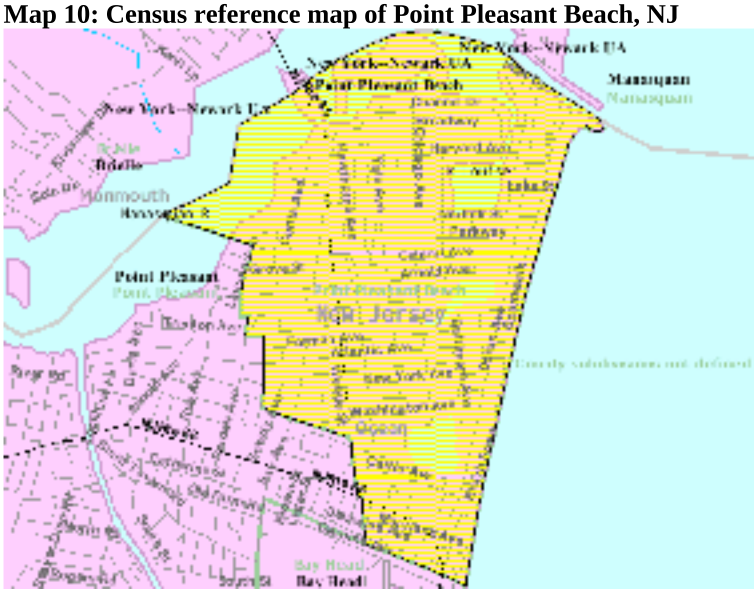
Historical/Background information

The first community in the Point Pleasant area was called Lovelandtown, and was made up of settlers who fished, clammed, hunted, and otherwise subsisted from bay environment. The first of the Lovelands probably arrived in the 1810s, and were proficient in boat building, fishing, decoy carving, guiding and gunning.[331] Over the years, Point Pleasant has transitioned from an existence as a summer resort town to becoming a family and community of about 19,000 year-round residents.[332] Point Pleasant Beach, NJ, located 1.5 miles from Point Pleasant, is known as a destination for recreational fishermen. Some of the most popular areas to fish are the Manasquan Inlet Wall, which produces fish year round as it connects the Atlantic to the Manasquan River, the Manasquan River, and the "Canal" connecting the Manasquan River to the upper Barnegat Bay.[333] Point Pleasant supports a large recreational fishing fleet,[334] and a small commercial fleet targeting fluke, squid, silver and red hake, and scallops (mostly in local waters) and surfclams. Though the surfclam fishery was pioneered here and surfclams continue to be landed, there are no longer any processing plants in Point Pleasant.[335]

Map 9: Census reference map of Point Pleasant, NJ



Map 10: Census reference map of Point Pleasant Beach, NJ



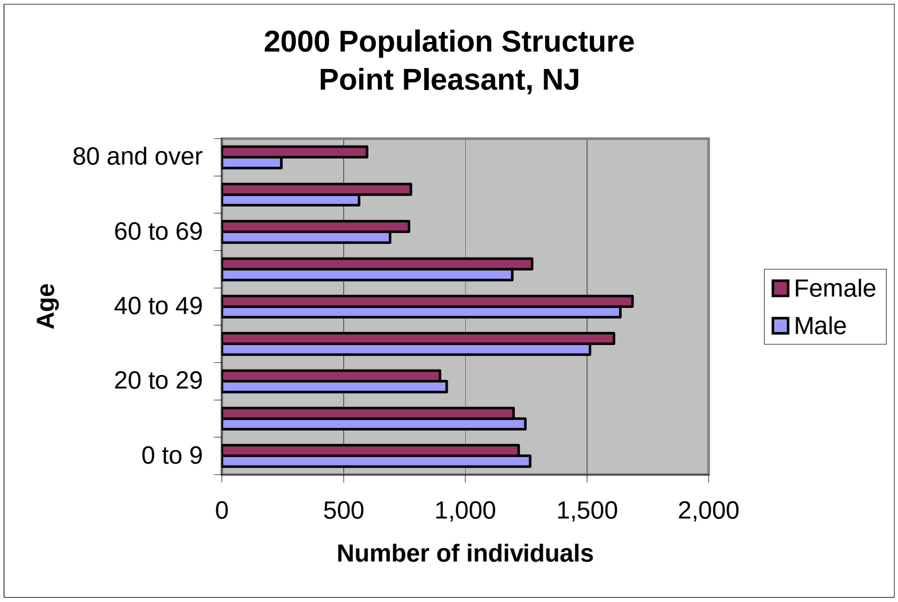
Demographic Profile

<u>Point Pleasant</u>

According to Census 2000 data, Point Pleasant had a total population of 19,306, up 6.2% from the reported population in 1990. Of this total in 2000, 50.9% were female and 49.1% were male. The median age was 39.4 years and 73.5% of the population was 21 years or older while 17.2% were 62 or older.

Point Pleasant's age structure showed a preponderance of the 30 to 49 years age group. The age group of 20-29 was smaller compared to the other age groups, showing that apparently young people are leaving the community after high school. See Figure 41 below.

Figure 33: Population structure by sex in 2000



The majority of the population of Point Pleasant was white (97.8%) with 0.3% of residents Black or African American, 0.1% Native American, 0.5% Asian, and no Pacific Islander or Hawaiians. (See Figure 34 below.) Only 2.4% of the total population was Hispanic/Latino. (See Figure 35 below.) Residents linked their heritage to a number of ancestries including: Irish (32.7%), Italian (25.2%), German (21.5%), English (10%), and Polish (10%). With regard to region of birth, 79.7% were born in New Jersey, 16.5% were born in a different state and 3.1% were born outside of the U.S. (including 1.1% who were not United States citizens).

Figure 34: Point Pleasant's Racial Structure in 2000

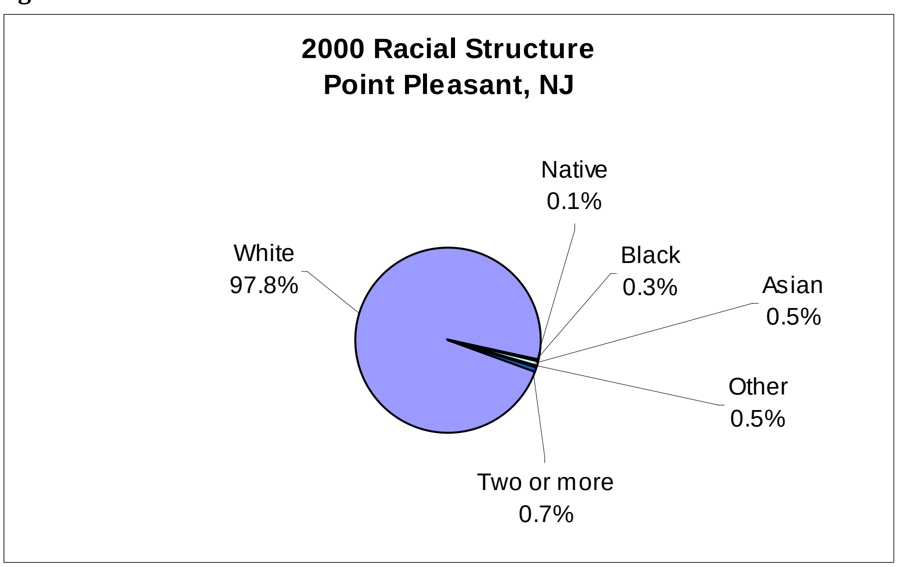
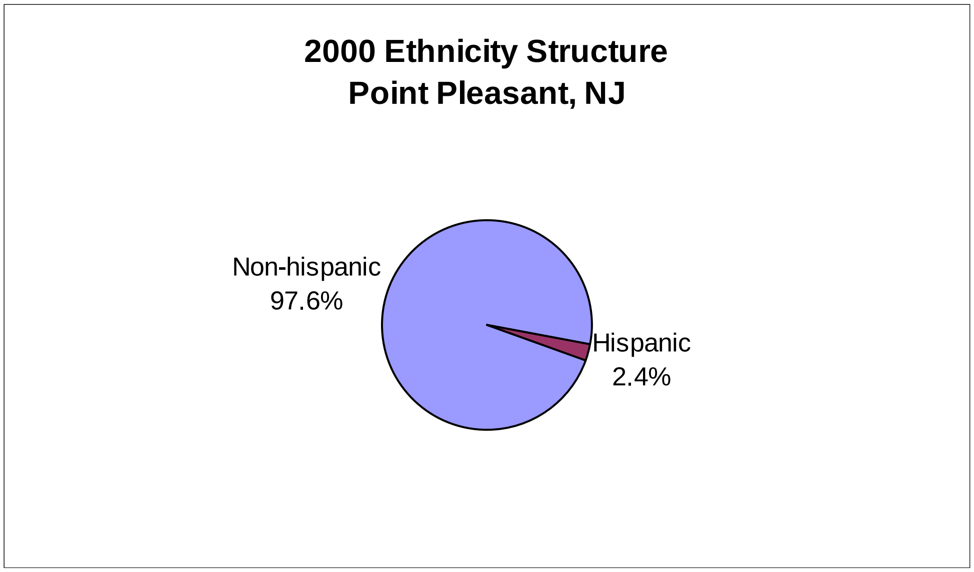


Figure 35: Point Pleasant's Ethnic Structure in 2000



For 94.5% of the population 5 years old and higher in 2000 only English was spoken in the home, leaving 5.5% in homes where a language other than English was spoken, including 0.9% of the population who spoke English less than 'very well'.

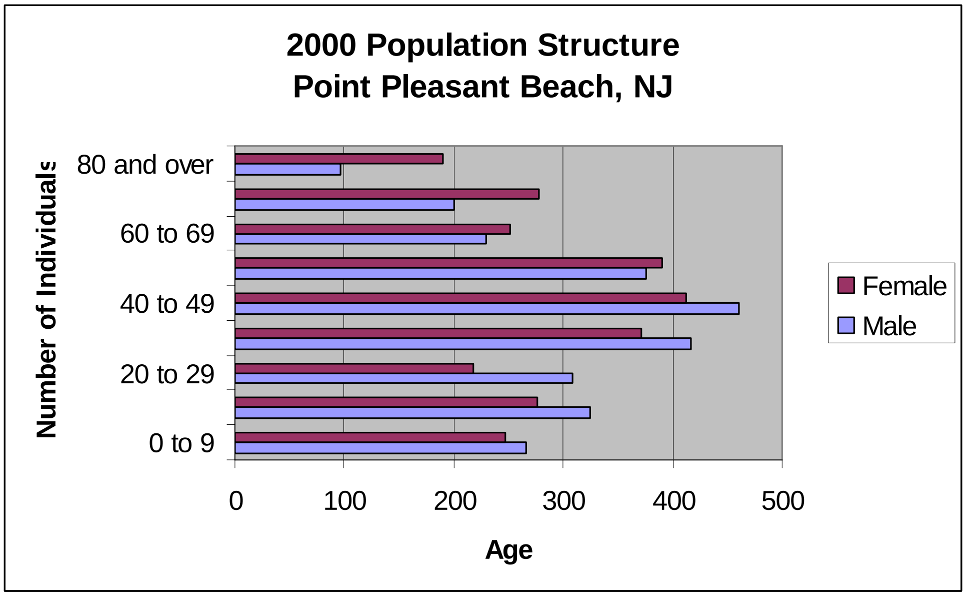
Of the population 25 years and over, 88.5% were high school graduates or higher and 27.8% had a bachelor's degree or higher. Again of the population 25 years and over, 2.6% did not reach ninth grade, 8.8% attended some high school but did not graduate, 34.7% completed high school, 20.2% had some college with no degree, 5.8% received their associate degree, 20.1% earned their bachelor's degree, and 7.7% received either their graduate or professional degree.

Point Pleasant Beach

According to Census 2000 data, Point Pleasant Beach has a total population of 5,314, up 4.0% from 1990. Of this total in 2000, 49.6% were female and 50.4% were male. The median age was 42.6 years and 78.1% of the population was 21 years or older while 21.6% were 62 or older.

Point Pleasant Beach's age structure was similar to that of Point Pleasant in that it showed a preponderance of those in the 30 to 59 year age group, and again like Point Pleasant the age group of 20-29 was small compared to the other age groups, showing that apparently young people are leaving the community after high school. (See Figure 36 below.) The median age, however, was three years older, and a higher percentage of the population was over 62, indicating that Point Pleasant Beach may be more of a retirement community.

Figure 36: Population structure by sex in 2000



Like Point Pleasant, the majority of the population of Point Pleasant Beach in 2000 was white (95.9%) with 0.5% of residents Black or African American, 0.3% Native American, 1.0% Asian, and no Pacific Islanders or Hawaiians. (See Figure 37 below.) Only 4.4% of the total population was Hispanic/Latino. (See Figure 46 below.) Residents linked their heritage to a number of ancestries including: Irish (28.5%), Italian (22.2%), German (19.5%), English (13.8%), and Polish (8.4%). With regard to region of birth, 68.6% were born in New Jersey, 24.7% were born in a different state and 5.8% were born outside of the U.S. (including 3.4% who were not United States citizens).

Figure 37: Racial Structure in 2000

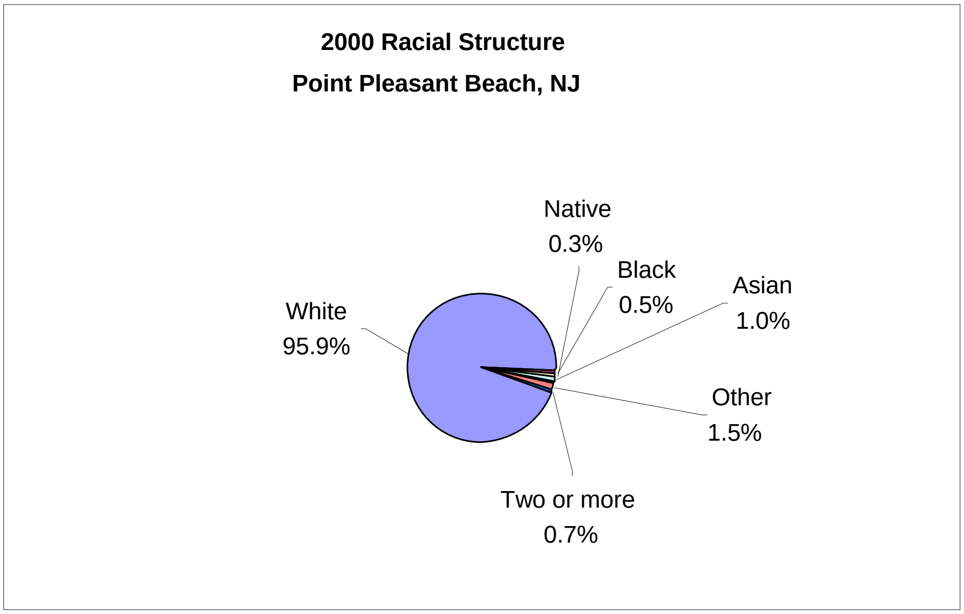
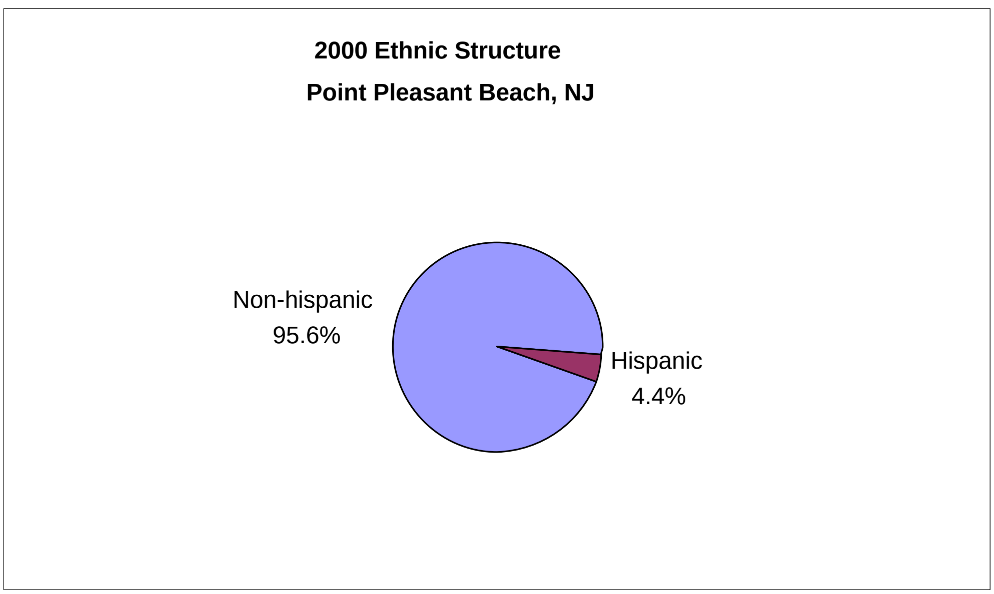


Figure 38: Ethnic Structure in 2000



For 90.5% of the population 5 years old and higher in 2000 only English was spoken in the home, leaving 9.5% in homes where a language other than English was spoken, including 3.4% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 87.1% were high school graduates or higher and 34.1% had a bachelor's degree or higher. Again of the population 25 years and over, 3.8% did not reach ninth grade, 9.1% attended some high school but did not graduate, 24.3% completed high school, 21.3% had some college with no degree, 7.5% received their associate degree, 22.5% earned their bachelor's degree, and 11.6% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Ocean County was Catholic with 33 congregations and 212,482 adherents. Other prominent congregations in the county were Jewish (35 with 11,500 adherents), and The United Methodist Church (28 with 9,534 adherents). The total number of adherents to any religion was up 21.9% from 1990.

Issues/Processes

In 2005 a Virginia company was pushing to open the waters off New Jersey for pursuing menhaden with seine nets, an idea to which recreational fishermen are strongly opposed. Menhaden are a favorite bait fish for striped bass fishermen, and menhaden are also an important food source for striped bass.[336]

There were also been discussions in 2004 about further limiting the catch of certain recreationally targeted species, including striped bass[337] and winter flounder, greatly concerning those involved in the recreational fishing business, whether as party boat captains or bait sellers. The Recreational Fishing Alliance has played a large role in lobbying the Atlantic States Marine Fisheries Commission and the State to minimize restrictions for the economic health of the recreational fishery.[338]

Cultural attributes

Festival of the Sea is an event held every September since 1975, where area restaurants present local seafood dishes.[339] The Greater Point Pleasant Charter Boat Association holds the yearly two-day Mako Mania, considered by many to be the premier shark-fishing tournament in New Jersey.[340]

Infrastructure

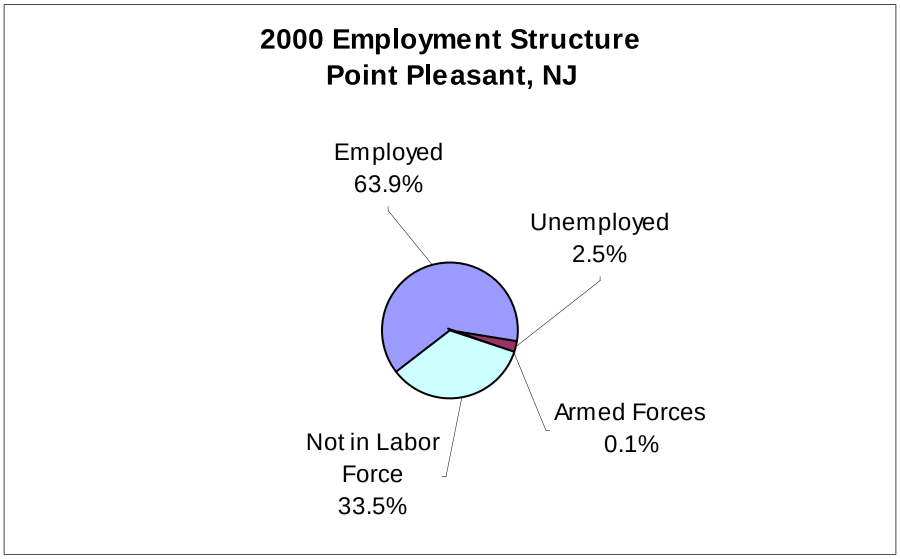
Current Economy

The majority of the docks, bait and tackle shops, and other infrastructure for the commercial fishing industry are located in Point Pleasant Beach. However, because real estate is likely to be much more expensive within the borough of Point Pleasant Beach, the majority of fishermen are likely to live in the borough of Point Pleasant. Point Pleasant, located along the Manasquan Inlet, is also in itself an important destination for recreational fishing, with numerous boats docked in Point Pleasant along the river.

<u>Point Pleasant:</u>

According to the U.S. Census 2000, 66.5% (10,113 individuals) of the total population 16 years of age and over were in the labor force, of which 2.5% were unemployed and 0.1% were in the Armed Forces. See Figure 39 below.

Figure 39: Employment structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 31 positions or 0.3% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 619 positions or 6.4% of jobs. Educational health and social services (23.4%), retail trade (12.4%), construction (10.9%), professional, scientific, management, administrative and waste management services (9.3%), arts, entertainment, recreation, accommodation and food services (8.2%), and finance, insurance, real estate and rental and leasing (7%) were the primary industries.

Median household income in Point Pleasant was $55,987 (up 27.1% from 1990) and median per capita income was $25,715. For full-time year round workers, men made approximately 54.5% more per year than women.

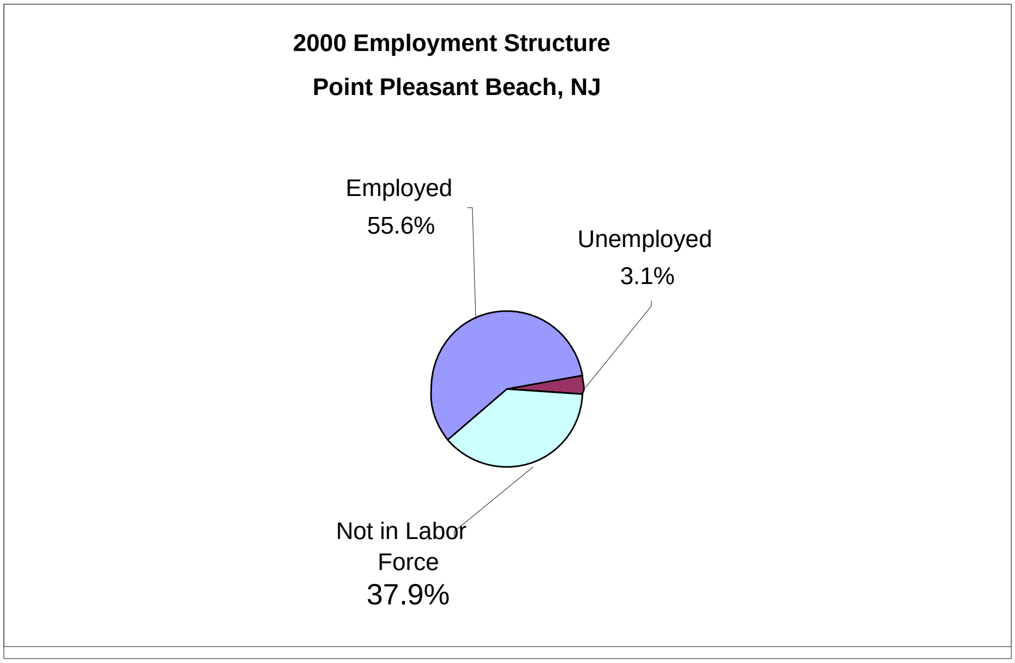
The average family in Point Pleasant consisted of 3.06 persons. With respect to poverty, 2% of families (up from 1.6% in 1990) and 3.2% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 15.9% of families in 2000 earned less than $35,000 per year(the poverty threshold for a family of nine).

In 2000, Point Pleasant had a total of 8,350 housing units of which 90.5% were occupied and 83.1% were detached one unit homes. Only 8% of these homes were built before 1940. There were no mobile homes/vans/boats listed as housing units; 92.2% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $160,100. Of vacant housing units, 63.4% were used for seasonal, recreational, or occasional use. Of occupied units 20.2% were renter occupied.

<u>Point Pleasant Beach</u>

According to the U.S. Census 2000, 58.7% (2,617 individuals) of the total population 16 years of age and over were in the labor force, of which 3.1% were unemployed and none were in the Armed Forces. See Figure 48 below.

Figure 40: Employment structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 65 positions or 2.6% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 104 positions or 4.4% of jobs. Educational health and social services (19.2%), arts, entertainment, recreation, accommodation and food services (14.6%), retail trade (11.8%), public administration (10.2%), professional, scientific, management, administrative and waste management services (9.4%), and finance, insurance, real estate and rental and leasing (7.2%) were the primary industries.

Median household income in Point Pleasant Beach was $51,105 (up 48.9% from $34,799 in 1990) and median per capita income was $27,853. For full-time year round workers, men made approximately 8.0% more per year than women (significantly different than in Point Pleasant).

The average family in Point Pleasant Beach consisted of 2.96 persons. With respect to poverty, 5% of families (up from 1.6% in 1990) and 6.1% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 18.3% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Point Pleasant Beach had a total of 3,558 housing units, of which 65.1% were occupied and 68.5% were detached one unit homes. A total of 28.4% of these homes were built before 1940. Mobile homes/vans/boats accounted for none of the total housing units; 83.9% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $223,600. Of vacant housing units, 76.2% were used for seasonal, recreational, or occasional use. Of occupied units 37.1% were renter occupied.

Much of the economy of Point Pleasant and Point Pleasant Beach is based on tourism, and a substantial segment of the tourist population travel to this area to fish. Even during the winter, Point Pleasant will sometimes maintain some tourism during years when fish are more plentiful during the winter months.[341] The largest employers in Point Pleasant Beach are mostly related to the tourist industry: Jenkinson's Beach and Boardwalk (with a beach, amusement rides, aquarium, night club, and restaurants), Meridian Health Center, Food Town, Chef's International (restaurant chain), and motels.[342] The most significant sources of employment in Point Pleasant, by contrast, are banks and car dealerships.[343]

Governmental

The City of Point Pleasant operates under the Council/Manager form of government. There are six members of Council, in addition to the Mayor. The Mayor has a four-year term, and the Council has staggered three-year terms.[344]

Fishery involvement in government

No information has been found from secondary sources at this time on fishery involvement in government.

Institutional

Fishing associations

The Fishermen's Dock Cooperative on Channel Drive in Point Pleasant Beach is one of two active fishing cooperatives in New Jersey. Incorporated as a cooperative in the early 1950s, the "Co-op" is an integral part of the waterfront community of Point Pleasant Beach. The Co-op markets its members' catch, and offers them fuel, packing, and ice at a discounted rate. Becoming a member of the Co-op is difficult; it requires a vacancy and proof of being an able fishermen, as well as the purchase of a share in the Co-op.[345] Many existing members of the Co-op are the sons of the original founders, and some are third or fourth generation fishermen.[346]

Garden State Seafood Association in Trenton is a statewide organization of commercial fishermen and fishing companies, related businesses and individuals working in common cause to promote the interests of the commercial fishing industry and seafood consumers in New Jersey.[347]

Fishery assistance centers

No information from secondary sources has been obtained at this time on fishery assistance centers.

Other fishing related organizations

The Greater Point Pleasant Charter Boat Association in Township was formed in 1981. Its goals are: "A) to enhance the recreational fishing industry on the Manasquan River, B) to aid in the improvement of the coastal fishery and collectively voice concerns on marine conservation and environmental issues".[348]

The Manasquan River Watershed Association is a non-profit organization focused on protecting and restoring the Manasquan River through public education, restoration, and regional planning initiatives.[349]

Physical

Point Pleasant is within easy reach of Newark Airport and Port Newark/Elizabeth and only a bridge crossing away from both New York and Philadelphia.[350] Because of its large recreational fishing component, there are many bait and tackle stores in town.[351, 352]

Involvement in Northeast Fisheries

Commercial

The fleet of the Fishermen's Dock Co-op is comprised mostly of smaller draggers, up to about 80 feet in length. They fish mostly in the New York Bight, in mixed trawl fisheries. "They primarily target fluke, silver hake and squid but in the past have also had significant landings of winter flounder, bluefish, monkfish and scallop. While most of the Co-op member's harvest is sold to wholesale markets in the Mid-Atlantic States and Southern New England, a significant amount makes its way directly to consumers via the seafood market and restaurant adjacent to the dock."[353] Members of the Co-op recently got together to raise $1 million for necessary repairs to their dock.[354]

The development of the shellfishery here has been very important to maintaining a commercial fishing industry in Point Pleasant. Point Pleasant Beach was listed as the eighth largest commercial fishing port on the East Coast in 2003. The top three landed species by value in Point Pleasant for 2003 were: ocean quahog ($7,929,464), surfclam ($4,826,702), and sea scallop ($4,327,226). The values of the sea scallop fishery and the combined ocean quahog and surfclam fisheries were much higher in 2003 than the 8-year average. (See Table 18 below.) Other fisheries have declined in both the commercial and recreational sectors resulting from both a decrease in catches and an increase in regulation, and facilities previously used for processing finfish are now used for offloading and trucking quahogs and surfclams. The ocean quahogs and scallops as well as most of the surfclams are trucked away elsewhere for shucking, as Point Pleasant no longer has a processing plant here with the exception of a small facility where some surfclams are shucked by hand. Otter trawls and gillnetting continue to be important for this fleet as well, and other important species include monkfish, *Loligo* squid, and summer flounder.[355] Despite declining catches in some areas, the overall value of this fishery increased for both home-ported vessels (see Table 19 below) and the value of landings brought into Point Pleasant from 1997-2003.

Landings by Species

Table 18: Dollar value by Federally Managed Groups of landings in Point Pleasant

	Average from 1997-2004	2003 only
Surfclam, ocean quahog	8,344,537	12,756,166
Scallop	2,599,891	4,327,226
Monkfish	1,648,313	1,299,920
Summer flounder, scup, black sea bass	1,374,423	2,381,773
Lobster	678,319	414,007
Squid, mackerel, butterfish	562,825	289,133
Largemesh groundfish[356]	305,682	423,301
Smallmesh groundfish[357]	290,207	47,867

Dogfish	166,111	0
Bluefish	93,333	75,439
Skate	35,779	40,014
Tilefish	271	165
Other	776,393	794,550

.

Vessels by Year

Table 19: All columns represent vessel permits or landings value combined between 1997-2003

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	59	18	5,833,943	16,905,177
1998	53	15	7,794,779	16,712,151
1999	56	16	9,938,174	17,862,091
2000	63	18	9,082,901	17,769,138
2001	65	19	7,493,107	18,924,389
2002	65	20	8,055,053	19,655,021
2003	58	22	10,061,787	22,849,561

Recreational

Point Pleasant is the most important community in New Jersey for recreational fishing. Fishermen travel from all over the state and beyond to fish from the numerous party and charter boats, from their own private recreational boats, or to participate in surf-fishing from several key spots. The New Jersey Department of Environmental Protection, Division of Fish and Wildlife, which licenses party and charter boats, lists 29 for Point Pleasant and Point Pleasant Beach,[358] but in some cases fishermen may own a charter license but rarely if ever use their boat for charter trips.[359] There are at least 18 charter boats listed as members of the Greater Point Pleasant Charter Boat Association.[360] Between 2001- 2005, there were 40 charter and party vessels making 8,032 total trips registered in NMFS logbook data by charter and party vessels in Point Pleasant carrying a total of 161,601 anglers.

Subsistence

Some owners of charter and party boats claim that before the bag limits for recreational fishing were increased, many of their clientele were coming fishing primarily as a means of consumption rather than sport, but that the clientele has shifted to represent more tourists fishing for the fun of it.[361]

Future

No information has been obtained at this time on future plans or people’s perception of the future in Point Pleasant.

Monmouth County

BELFORD (MIDDLETOWN)

People and Places

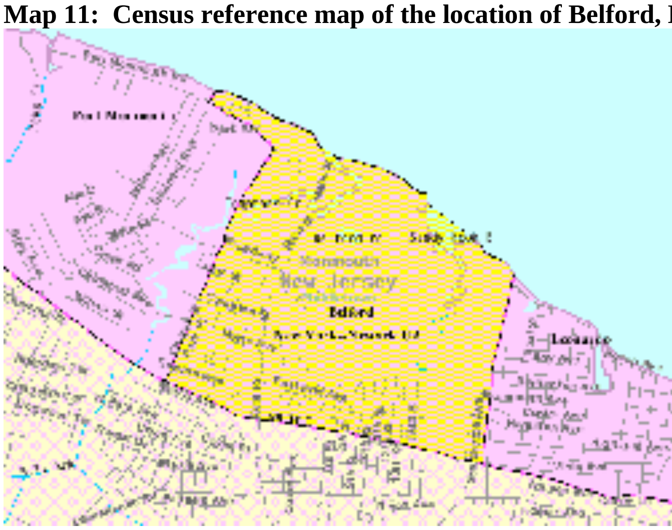
Regional orientation

The community of Belford, New Jersey (40.42° N, 74.09°W) is located on the Bayshore in the township of Middletown, in Monmouth County. Belford lies along Sandy Hook Bay (part of the Raritan Bay complex), and occupies 1.3 square miles of land.[362] See Map 11 and Map 12.

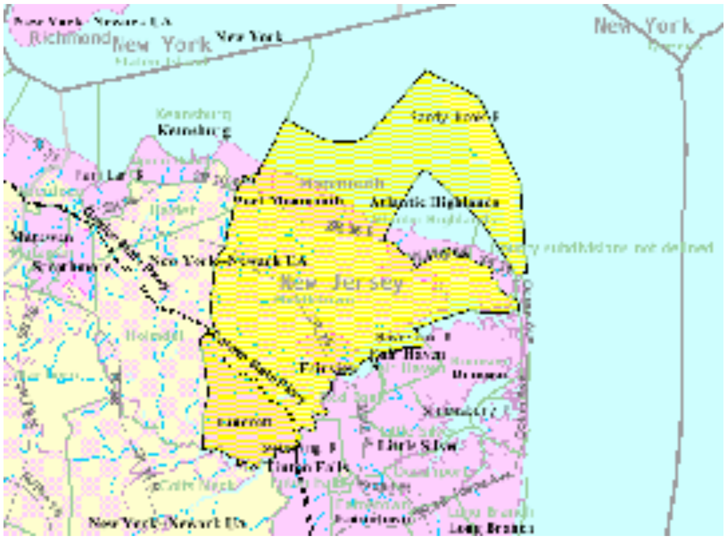
Historical/Background information

Fishing has been a long tradition in this area; the Lenni Lenape Indians fished in the bay here before white settlers arrived and the Dutch were fishing here in the 1600s.[363] Belford is part of the township of Middletown, which was first established as a township in 1664.[364] Middletown has 12 distinct villages, including North Monmouth, Port Monmouth, Belford, and Leonardo.[365] The area known today as Belford, along with what is now Port Monmouth, was originally known as Shoal Harbor. Shoal Harbor was relatively isolated until the mid-1800s when the construction

Map 11: Census reference map of the location of Belford, NJ



Map 12: Census reference map of the location of Middletown, NJ



of a road here as well as a nearby railroad opened this area up allowing farmers and fishermen to sell their wares in New York City and other areas.[366] Belford was officially established in 1891 when a rail station was built here, separating from Port Monmouth.[367] A menhaden processing plant was built in Belford in the late 1800s, which operated until 1982[368]; this was once the town's largest employer.[369] The presence and stench of the menhaden plant helped maintain Belford as a relatively unchanged fishing port while the rest of the shore around it was subject to intense development and tourism. Belford has notoriously been home to pirates, blockaders, rum runners, and even through the 1980s, fish poachers.[370] There is a long tradition among some Belford fishermen of not obeying fisheries regulations.[371] Some consider Belford to be the longest continuously operating fishing village on the East Coast.[372]

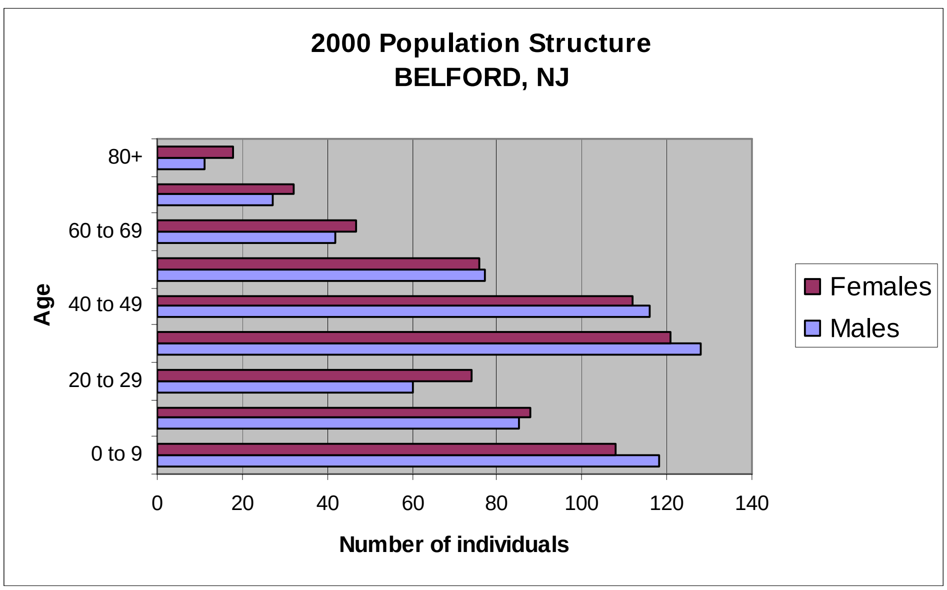
Demographics

Belford CDP

According to Census 2000 data, Belford had a total population of 1,340; 1990 population data was unavailable for Belford for comparison. Of this total in 2000, 50.4% were female and 49.6% were male. The median age was 35.8 years and 69.6% of the population was 21 years or older while 11.8% were 62 or older.

The population structure for Belford indicates that this is a community of young families. The largest percentages of residents were between 30-39 and 40-49 years of age. (See Figure 41 below.) There were also a large number of children between the ages of 0-9, and a significant decline in the number of residents over the age of 60. Like many fishing communities, Belford's population showed a dip in the number of residents between the ages of 20-29 and even in the 10-19 age bracket, as young people left to go to school or in search of jobs. This is more prevalent for males than for females for the 20-29 age bracket.

Figure 41: Population structure by sex in 2000



The majority of the population of Belford in 2000 was white (97.2%), with 0.3% of residents Black or African American, 0.4% Native American, 0.7% Asian, and 0.1% of residents listed as Pacific Islander or Hawaiian. (See Figure 42 below.) Only 4.7% of the total population was Hispanic/Latino. (See Figure 43 below.) Residents linked their heritage to a number of ancestries including: Irish (44.0%), Italian (38.2%) German (23.6%), and Polish (8.6%).[373] With regard to region of birth, 63.2% were born in New Jersey, 32.3% were born in a different state and 2.7% were born outside of the U.S. (including 0.4% who were not United States citizens).

Figure 42: Racial Structure in 2000

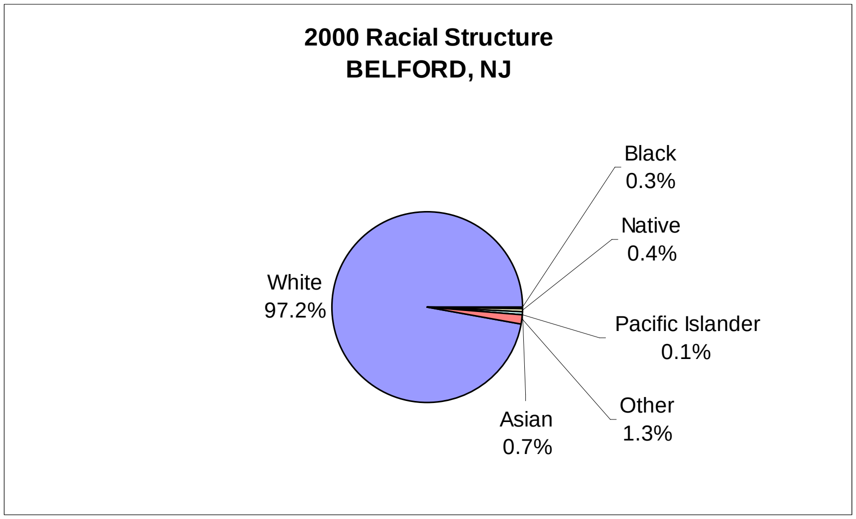
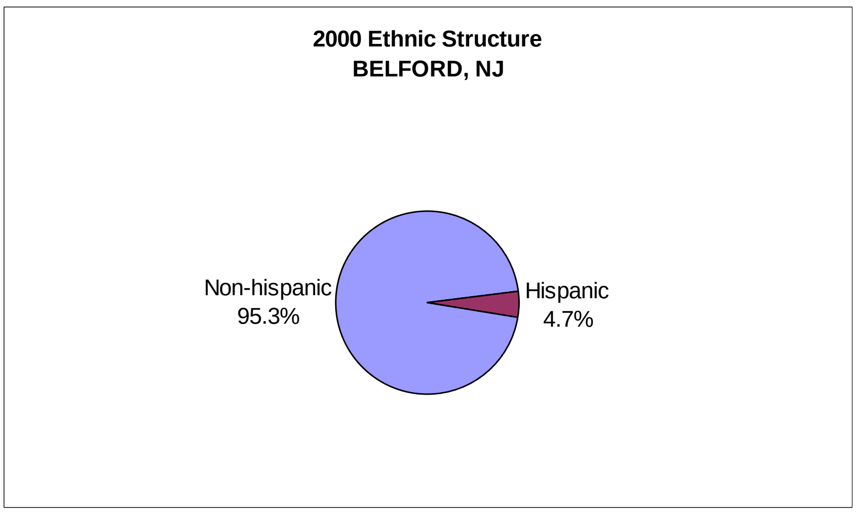


Figure 43: Ethnic Structure in 2000



For 90.0% of the population 5 years old and higher in 2000, only English was spoken in the home, leaving 10.0% in homes where a language other than English was spoken, and including 3.0% of the population who spoke English less than 'very well'.

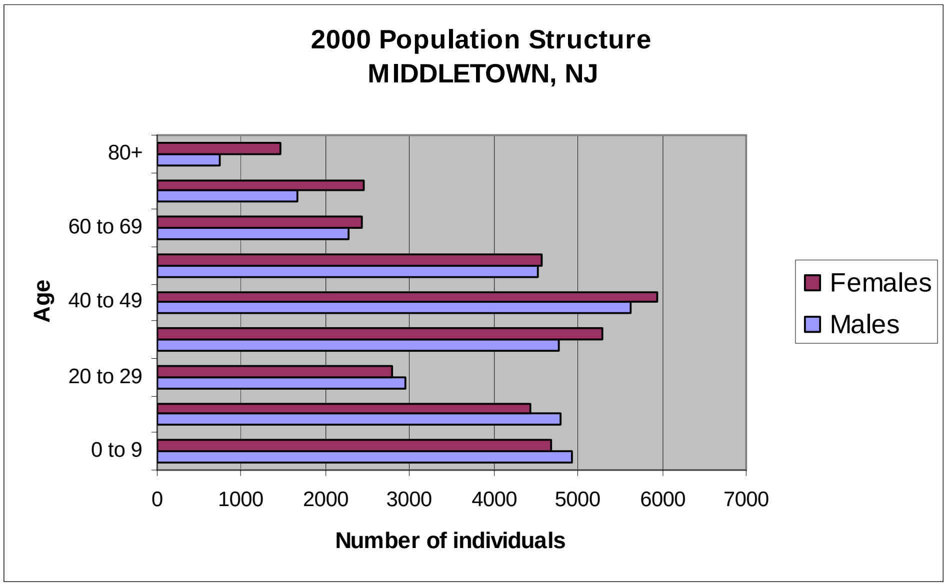
Of the population 25 years and over, 89.7% were high school graduates or higher and 16.8% had a bachelor's degree or higher. Again of the population 25 years and over, 1.0% did not reach ninth grade, 9.3% attended some high school but did not graduate, 41.6% completed high school, 24.3% had some college with no degree, 7.0% received their associate degree, 13.3% earned their bachelor's degree, and 3.4% received either their graduate or professional degree.

MIDDLETOWN

According to Census 2000 data, Middletown township had a total population of 66,327, down 2.7% from 1990. Of this total in 2000, 51.4% were female and 48.6% were male. The median age was 38.8 years and 70.8% of the population was 21 years or older while 15.0% were 62 or older.

The population structure for Middletown indicates that this is a community of young families. The largest percentages of residents are between 40-49 years and 30-39 years of age. There are also a large number of children between the ages of 0-19, and a significant decline in the number of residents over the age of 60. (See Figure 44 below.) Like many communities, Middletown's population has a dip in the number of residents between the ages of 20-29, as young people leave to go to school or in search of jobs.

Figure 44: Population structure by sex in 2000



The majority of the population of Middletown in 2000 was white (94.6%), with 1.4% of residents Black or African American, 0.2% Native American, 2.9% Asian, and 0.1% of residents listed as Pacific Islander or Hawaiian. (See Figure 45 below.) Only 3.4% of the total population was Hispanic/Latino. (See Figure 46 below.) Residents linked their heritage to a number of ancestries including: Irish (32.9%), Italian (28.9%), German (17.4%), English (8.8%), and Polish (8.7%). With regard to region of birth, 58.7% were born in New Jersey, 34.1% were born in a different state and 6.4% were born outside of the U.S. (including 2.5% who were not United States citizens).

Figure 45: Racial Structure in 2000

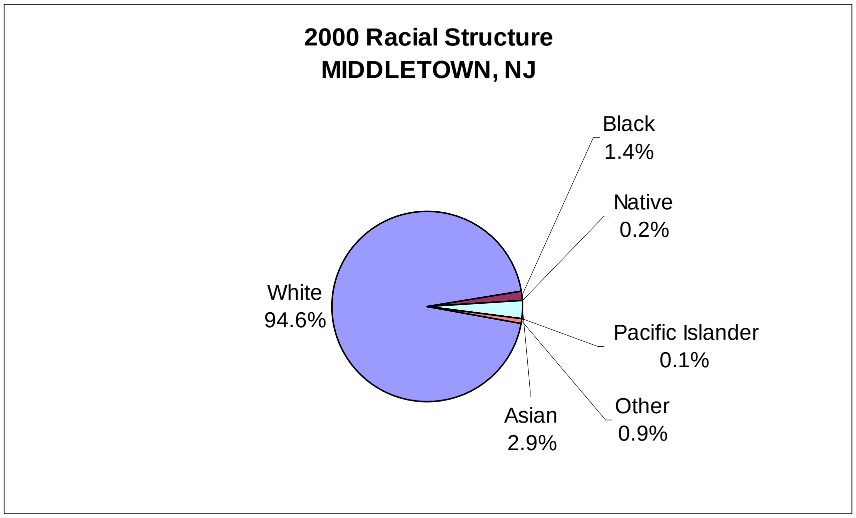
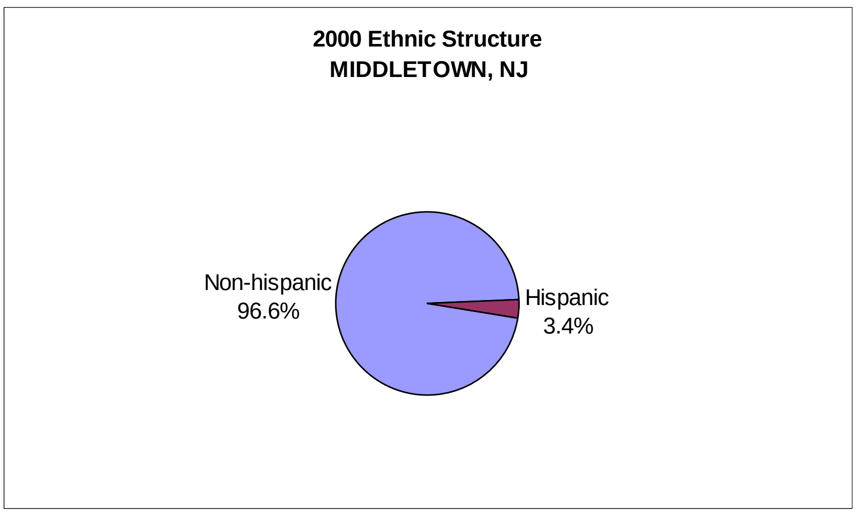


Figure 46: Ethnic Structure in 2000



For 91.1% of the population 5 years old and higher in 2000, only English was spoken in the home, leaving 8.9% in homes where a language other than English was spoken, and including 2.3% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 90.7% were high school graduates or higher and 35.0% had a bachelor's degree or higher. Again of the population 25 years and over, 2.7% did not reach ninth grade, 6.5% attended some high school but did not graduate, 29.2% completed high school, 19.7% had some college with no degree, 6.9% received their associate degree, 22.4% earned their bachelor's degree, and 12.6% received either their graduate or professional degree.

Although religious percentages are not available through the U.S. Census, according to the American Religion Data Archive in 2000 the religion with the highest number of congregations and adherents in Monmouth County was Catholic with 50 congregations and 289,183 adherents. Other prominent congregations in the county were Jewish (42 with 65,000 adherents), United Methodist (47 with 12,992 adherents), and

Muslim (5 with 9,455 adherents). The total number of adherents to any religion increased 38.9% from 1990 to 2000.

Issues/Processes

The promised clam depuration plant and renovation of the cooperative and other fishing infrastructure in Belford, which may be of great benefit to the fishing community here, have been continuously postponed, and fishermen are concerned that condominiums will be built on the property instead. The project was being headed by the Bayshore Economic Development Corporation, which later became surrounded with controversy and had some of its state funding cut off.[374]

As Belford becomes more accessible to commuters to New York City and elsewhere, and as housing is increasingly scarce around the city, many people are moving to Belford and forcing up the price of homes. The resulting increase in property taxes may force some residents who have lived in Belford their entire lives to relocate.[375] Belford represents some of the last untouched waterfront real estate in New Jersey within commuting distance to New Jersey, and development pressures here are increasing.[376]

There is frequently conflict between menhaden purse seine vessels from Belford and recreational fishermen, who criticize the vessels for catching large amounts of oysters and sport fish species along with the menhaden. For this and other reasons, there is frequently animosity between recreational and commercial fishermen. [377]

Cultural attributes

The site of the Belford Fisherman's Co-op has an interpretive exhibit about the commercial fishing industry here.[378] Monmouth County wishes to promote the co-op as a regional tourist attraction.[379] The Leonardo Party and Pleasure Boatman's Association hosts fishing tournaments out of the Leonardo State Marina.[380]

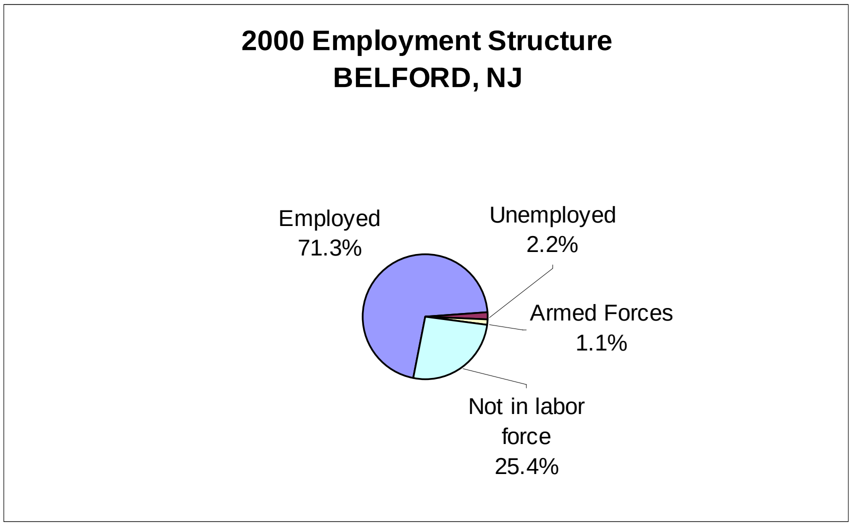
Current Economy

The largest employers in the township of Middletown are the following: AT&T (3,300+ employees[381]), Food Circus Supermarkets, Inc. (1,263 employees), Brookdale Community College (737 employees), and T&M Associates (200 employees). There are many other large employers throughout Monmouth County where Middletown residents are likely to be employed.[382] Additionally, many of Middletown's residents commute to work in New York City.[383]

<u>Belford CDP</u>

According to the U.S. Census 2000, 76.4% (799 individuals) of the total population 16 years of age and over were in the labor force, of which 2.2% were unemployed and 1.1% were in the Armed Forces. See Figure 47 below.

Figure 47: Employment Structure in 2000



According to Census 2000 data, in Belford jobs in the census grouping which includes agriculture, forestry, fishing and hunting, and mining accounted for 17 positions or 2.3% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 46 positions or 6.2% of jobs. Construction (17.5%), educational, health, and social services (16.5%), professional, scientific, management, administrative, and waste management services (12.8%), and manufacturing (8.9%) were the primary industries.

Median household income in Belford in 2000 was $66,964 (1990 population data was unavailable for Belford) and per capita income was $25,412. For full-time year round workers, men made approximately 47.9% more per year than women.

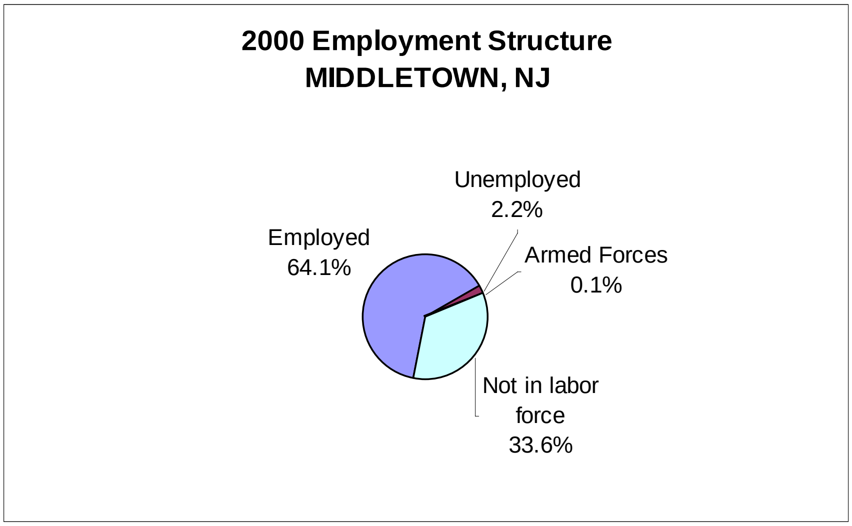
The average family in Belford consisted of 3.29 persons. With respect to poverty, 1.3% of families (1990 population data was unavailable for Belford) and 3.2% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 14.4% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Belford had a total of 548 housing units, of which 95.2% were occupied and 94.2% were detached one unit homes. More than one-third (35.9%) of these homes were built before 1940. No mobile homes, boats, RVs, vans, etc. were found for Belford; 96.4% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $146,000. Of vacant housing units, 4.5% were used for seasonal, recreational, or occasional use, while of occupied units 13.5% were renter occupied.

Middletown

According to the U.S. Census 2000, 66.4% (33,789 individuals) of the total population 16 years of age and over were in the labor force, of which 2.2% were unemployed and 0.1% were in the Armed Forces. See Figure 48 below.

Figure 48: Employment Structure in 2000



According to Census 2000 data, in Middletown jobs in the census grouping which includes agriculture, forestry, fishing and hunting, and mining accounted for 95 positions or 0.3% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 1,587 positions or 4.9 % of jobs. Educational, health, and social services (18.6%), finance, insurance, real estate, and rental and leasing (13.4%), professional, scientific, management, administrative, and waste management services (12.6%), and retail (12.0%) were the primary industries.

Median household income in Middletown in 2000 was $75,566 (up 38.6% from $54,503 in 1990) and per capita income was $34,196. For full-time year round workers, men made approximately 67.7% more per year than women.

The average family in Middletown consisted of 3.27 persons. With respect to poverty, 1.9% of families (similar to 1.8% in 1990) and 3.1% of individuals earned below the official U.S. Census poverty threshold ($8,794), while 11.3% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Middletown had a total of 23,841 housing units, of which 97.5% were occupied and 80.6% were detached one unit homes. Just over ten percent (12.1%) of these homes were built before 1940. Mobile homes, boats, RVs, vans, etc. accounted for 0.1% of housing; 80.0% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $210,700. Of vacant housing units, 12.3% were used for seasonal, recreational, or occasional use, while of occupied units 13.6% were renter occupied.

Governmental

Middletown is governed by a five-member township committee, which includes the mayor, who is designated for one year by the other members. Each committee member serves a three-year term. Belford is one of about a dozen villages within the township of Middletown.[384]

Fisheries involvement in government

In 2006 the Town of Middletown was awarded a $75,000 Smart Future planning grant from the state to study ways to improve the economic vitality of the fishing industry in Belford.[385]

Institutional

Fishing associations

"Belford is believed to have the oldest continually operating fishing cooperative on the east coast. It was founded in 1953… The Belford Seafood Cooperative handles members' catches, purchases fish from non-members, arranges for the sale and transportation of the fish, and leases a lot of the docks to the fishermen." [386]

Fishing assistance centers

No information was collected on fishing assistance centers for Belford.

Other fishing related organizations

The Leonardo Party and Pleasure Boatman's Association hosts fishing tournaments.[387] The NY/NJ Baykeeper is working to protect and preserve the Hudson/Raritan Estuary for the benefit of both natural and human communities.[388] The organization worked unsuccessfully in conjunction with the Belford fishermen in an attempt to prevent the construction of the New York City ferry dock in Belford.

Physical

Belford is located within the shelter of Sandy Hook.[389] The Belford Seafood Cooperative "includes the Pirate's Cove Restaurant and retail fish establishments, as well as a net house, the dock, and the boats. There is also a wholesale and retail lobster facility nearby called Shoal Harbor Lobster. The co-op is on Compton's Creek, which runs directly into Raritan Bay. A relatively new wastewater facility and a brand-new ferry terminal share the creek with the fishermen." When the New York City ferry was put into place in Compton Creek, the creek was widened and more bulkheads were put in, providing more docking space for fishing vessels. [390] The town of Middletown has at least three marinas and a boat ramp. Bayshore Waterfront Park has a fishing pier and a marina.[391] The Leonardo State Marina, located in the village of Leonardo, has 179 berths, a bait and tackle shop, fuel, and a boat ramp. There are both charter and party boats found here.[392]

The township of Middletown has a NJ Transit rail station and several NJ transit bus stops. Route 36 runs through Belford, and the Garden State Parkway and Route 35 run through Middletown.[393] Belford is about 30 miles from Point Pleasant, 35 miles from Newark, and about 44 miles from New York City. The nearest airport is Newark Liberty International Airport. In 2002 ferry service between Belford and Pier 11 in Manhattan began operation. There are 500 parking spaces available at the Belford Ferry terminal. The commute takes about 40 minutes.[394]

Involvement in Northeast Fisheries

Commercial

Belford is listed as one of the six major commercial fishing ports in the state of New Jersey.[395] Belford has a tradition of fishing for menhaden that dates back to the

1800s, when a processing plant was constructed here. Although the plant is no longer in existence, today menhaden are still pursued from Belford with trawlers fitted with purse seines.[396] Menhaden have experienced a resurgence recently (2006), primarily for use as bait.[397] The commercial fishing activity is based out of Compton Creek. Commercial catches all go through the Belford Seafood Cooperative, which sells most of its product to Fulton Fish Market and to other markets along the East Coast. There are about 20-30 vessels associated with the Co-op, including about 14-15 draggers, about 12 lobster boats, and a number of crabbing boats. There are about 40 vessels in total located in Belford. Much of the fishing here is done less than a mile from shore; this is primarily a baymen's port. Shoal Harbor Lobster, also located in Belford, is an independent wholesaler; the lobsters sold here come from many different places.[398] They provide all lobsters sold in A&P Supermarkets in New Jersey and Long Island.[399] Shoal Harbor sells some lobsters from local vessels; they used to have their own boats but they sold them. There are 4 employees at this business.[400]

The data reaffirm that most fishing in Middletown takes place from Belford itself (See Table 20 and Table 21.). The number of vessels listed for Belford is relatively consistent, with a high of 36 in 2004. The level of landings and the value of home port fishing, while somewhat variable, displayed a relatively steady trend, with 2005 being the most valuable year in both categories. (See Table 22 below.) In 2005 landings in Belford brought in over $3.5 million. For each year, the level of home port fishing is just slightly less than the level of landings for Belford, which likely indicates that almost every vessel landing its catch in Belford is also home ported here. In 2003 the most valuable species landed in Belford was summer flounder (worth $1,165,436), followed by winter flounder ($259,551) – listed below within the large mesh groundfish category, and scup ($161,271). Overall, the value of the summer flounder, scup, and black sea bass was higher in 2003 than the 1997- June 2006 average values, but most other landings categories were less than the average values in 2003. In particular, lobster landings seem to have experienced a large decline in 2003.

Middletown had a very small level of landings in 2003 ($1,873), all of which was summer flounder. Most years saw few if any landings listed for Middletown; 2005 however had more than $10,000 in landings here. In only one year, 2001, were there any landings attributed to home ported vessels in Middletown, in no year from 1997-2005 were there more than three vessels home ported here. (See Table 23 below.) There are, however, from 5-11 vessels with owners living in Middletown, with the high of 11 in 2005. This indicates that many of the vessels fishing out of Middletown have owners living elsewhere within the township.

Landings by Species

Table 20: Dollar value of Federally Managed Groups of landing in Belford

BELFORD	Average from 1997-June 2006	2003 only
Sumer flounder, scup, black sea bass	949,161	1,348,597
Lobster	342,225	8,176
Largemesh groundfish[401]	240,329	278,728
Squid, mackerel, butterfish	176,819	99,987
Smallmesh groundfish[402]	117,915	57,317

Surfclam, ocean quahog	68,532	88,295
Bluefish	53,582	66,834
Monkfish	32,255	18,411
Dogfish	24,571	0
Skate	13,948	8,203
Scallop	5,922	0
Herring	459	138
Tilefish	128	225
Other	428,601	224,161

Table 21: Dollar value of Federally Managed Groups of landing in Middletown

MIDDLETOWN	Average from 1997- June 2006	2003 only
Summer flounder, scup, black sea bass	1,828	1,873
Other	130	0
Tilefish	86	0

Vessels by Year

Table 22: All columns represent vessel permits or landings value combined between 1997-2005 for Belford

BELFORD Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	36	15	3,052,183	2,471,414
1998	31	14	2,834,484	2,895,386
1999	31	14	3,005,290	3,001,243
2000	35	15	2,506,481	2,576,257
2001	33	15	2,284,268	2,389,588
2002	33	14	1,830,612	2,389,009
2003	35	18	2,069,945	2,199,072
2004	36	19	2,713,595	2,829,252
2005	33	16	3,341,873	3,525,737

Table 23: All columns represent vessel permits or landings value combined between 1997-2005 for Middletown

MIDDLETOWN Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)*	Level of fishing landed port ($)
1997	0	5		0
1998	0	6		0
1999	0	5		0
2000	1	6		2,140
2001	3	6		759
2002	2	7		1,216
2003	2	10		1,873
2004	3	11		3,291
2005	3	11		10,305

* Only 2001 shows any landings for vessels with a home port of Middletown. Data cannot be shown for reasons of confidentiality.

Recreational

Recreational fishing is important to the Bayshore region; there are a number of bait and tackle shops and marinas located here. However, there is little recreational fishing in Belford itself.[403] Port Monmouth has a fishing pier and marina at Bayshore Waterfront Park.[404] Leonardo State Marina has a bait and tackle shop as well as both charter and party boats which leave from here.[405] The Leonardo Party and Pleasure Boatman's Association hosts fishing tournaments out of the Leonardo State Marina.[406]

Subsistence

No information about subsistence fishing could be found through secondary sources at this time.

Future

The Middletown Master Plan recognizes the importance of Belford as a fishing community and expresses a determination to maintain this character. There is a proposed fishing center for Belford called the Bayshore Technology Center, which would include a research and development facility, a fish farming center, and a clam depuration plant. The goals of the technology center would be to create jobs, promote growth in the Bayshore's commercial fishing industry, and secure the future of the Cooperative.[407] There are also plans in the works to refurbish the cooperative itself.[408] These plans have recently been stalled, but the town has just received a grant from the state to begin working on this project itself.[409] The township and county have been making major infrastructure improvements in and around Belford to roads, bridges, etc. in an effort to revitalize the community and to draw people from elsewhere.[410]

The community of Belford, despite its proximity to many large urban centers, had been relatively isolated and underdeveloped. However, recently ferry service began between Belford and New York City, and a large upscale condominium development was built, bringing an influx of people to the community. Fishermen anticipate the community will change a great deal. The town has expressed a desire to maintain fishing here, but commercial fishermen perceive this as referring to only recreational fishing activity. There is concern that the new residents won't like the sight and smell of the fisherman's co-op, and the resulting conflict will harm the fishing industry. Many fishermen believe the proposed construction of a clam depuration plant could boost the industry; currently all clams taken from the bay need to be purified to rid them of pollution, and the depuration plants in nearby communities don't have the capacity to take many clams from Belford.[411]

CAPE MAY COUNTY

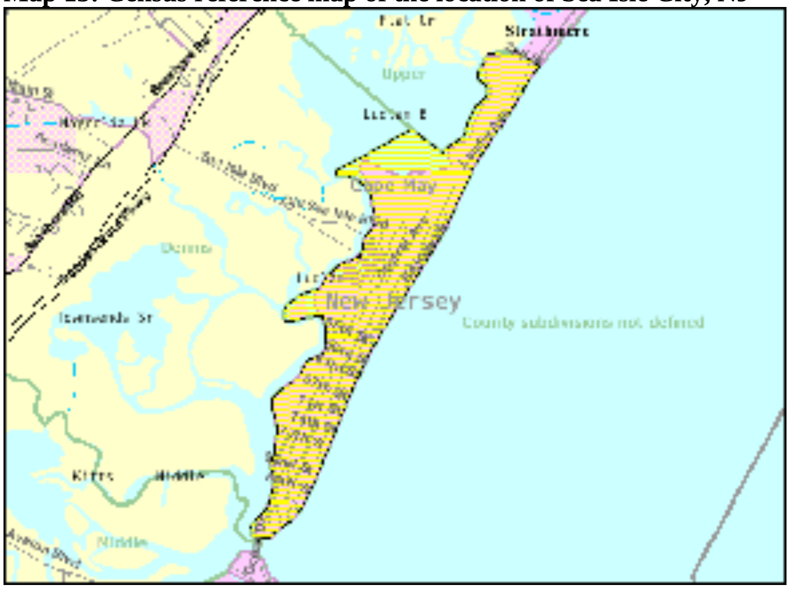
SEA ISLE CITY

People and Places

Regional orientation

Sea Isle City (39.15°N, 74.70°W) is located along the Atlantic coast in Cape May County, New Jersey. It has an area of 2.5mi^2 of which 2.2mi^2 is land and 0.9mi^2 is water.[412] On its landward borders are the Townships of Upper, Dennis, and Middle, as well as the Borough of Avalon. See Map 13 below.

Map 13: Census reference map of the location of Sea Isle City, NJ



Historical/Background information

The barrier island of Sea Isle City was sold to Joseph Ludlum in 1692 by a Quaker group, the West Jersey Proprietors, and named Ludlum's Island. For nearly a century before its sale, Ludlum Island was covered in various types of trees and grasses, which supported the only residents, grazing livestock. Ludlum divided the land into three sections, Ludlam's Island, Townsend's Inlet, and Corsen's Inlet before its sale in 1880 to a developer, Thomas Landis.[413]

Thomas Landis transformed Ludlum Island into a vacationland modeled off of Venice, Italy. The island was connected to mainland New Jersey with roads and rail lines, and became a "Sea and Sand Family Vacationland"[414], which is how it is known today.[415] Many hotels and restaurants were built on near the beachfront providing for a development in tourism. Today, the town serves as a year round residency comprised mainly of middle-aged to elderly residents, and a summer vacationland for tourists. Sea Isle City is sometimes referred to as a "fishermen's paradise" because of the large number of charter boats and the amount of fishing which occurs here.[416]

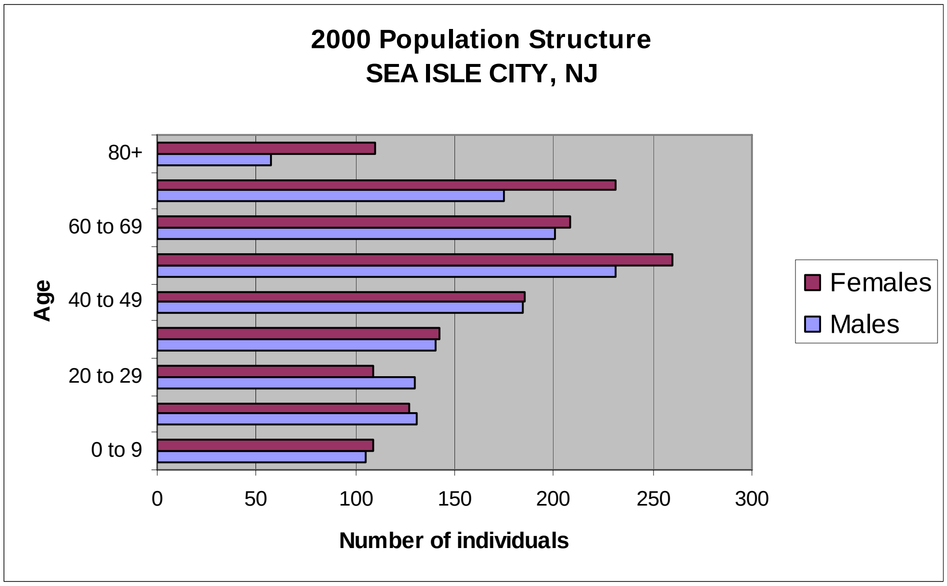
Demographic Profile

According to the Census 2000 data, Sea Isle City has a total population of 2,835, up 66.8% from a reported population of 1,700 in 1990. Of this total in 2000, 47.8% are males and 52.2% are females. The median age is 51.3 years and 82.5% of the population is 21 years or older while 32.0% are 62 or older.

The population structure for Sea Isle City clearly shows an aging population, with the vast majority of residents in their 50s, 60s, and 70s, with quite a few residents in the 80+ category as well. Like many small communities, the population takes a dip for the

20-29 age category, but the number of children in the 0-9 and 10-19 age categories is small to begin with. (See Figure 49 below.) This paints a picture of Sea Isle City as largely a retirement community. The male population subtly decreases as age groups increase by decade, but females have an increase in the 70-79 age category.

Figure 49: Population structure by sex in 2000



The vast majority of the population of Sea Isle City is white (98.8%), with 0.3% Black or African American, 0.4% Native American or Alaskan, 0.4% Asian, no Pacific Islanders or Native Hawaiians, and 0.1% of some other race. (See Figure 51 below.) Only 1.1% of the total population identified themselves as Hispanic/Latino. (See Figure 51 below.) Residents link their heritage to a number of European ancestries including the following: Irish (38.9%), German (24.1%), Italian (22.4%), and English (12.7%). With regard to region of birth, 35.2% of residents were born in New Jersey, 61.0% were born in a different state, and 0.4% were born outside the U.S. (all are US citizens).
:

Figure 50: Racial Structure in 2000

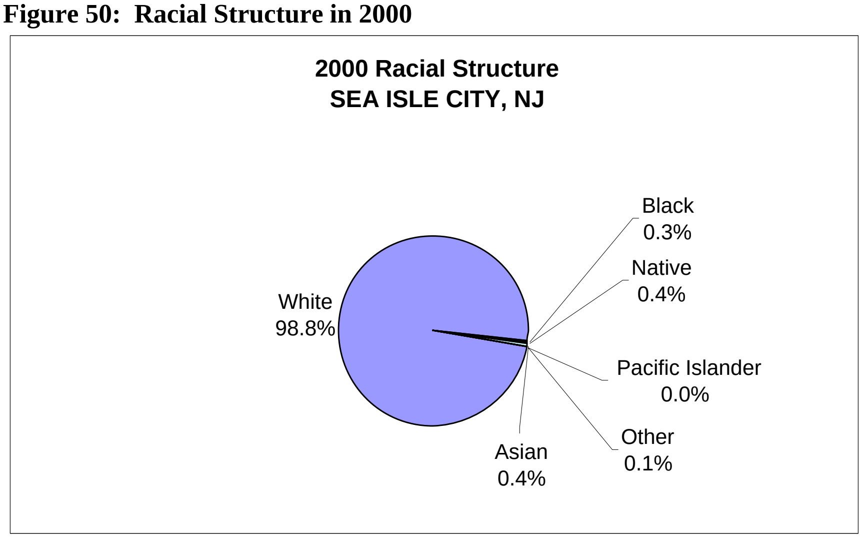
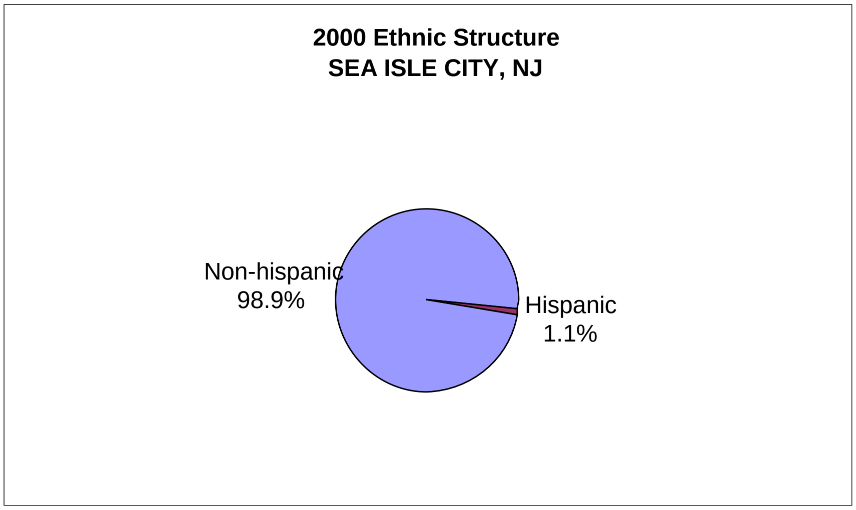


Figure 51: Ethnic Structure in 2000



For 92.4% of the population, only English is spoken in the home, leaving 7.6% in homes where a language other than English is spoken, including 1.2% of the population who speak English less than 'very well' according to the 2000 Census.

Of the population 25 years and over, 85.2% are high school graduates or higher and 28.3% have a bachelor's degree or higher. Again of the population 25 years and over, 3.4% did not reach ninth grade, 11.4% attended some high school but did not graduate, 32.8% completed high school, 17.1% had some college with no degree, 7.0% received their associate degree, 18.5% earned their bachelor's degree, and 9.8% received either their graduate or professional degree.

Although religious percentages are not available through U.S. Census data, according to the American Religion Data Archive in 2000 the religions with the highest number of congregations in Cape May County included Catholic (15 with 32,307 adherents), United Methodist (25 with 5,133 adherents), Episcopal (6 with 1,588 adherents) and Evangelical Lutheran Church in America (6 with 2,142 adherents). The total number of adherents to any religion was up 15% from 1990. The churches listed in Sea Isle City are the Messiah Lutheran Church, St. Joseph's Catholic Church, Trinity Community Church, and United Methodist Church.[417]

Issues/Processes

Offshore wind farms have been proposed in four locations off of Cape May County, and fishermen are concerned about the impact wind turbines could potentially have on the fish or on their access to the fisheries.[418]

Cultural attributes

The Annual Cape May Country Fishing Tournament has been held for 69 years is the longest continuously running tournament on the East Coast.[419]

Infrastructure

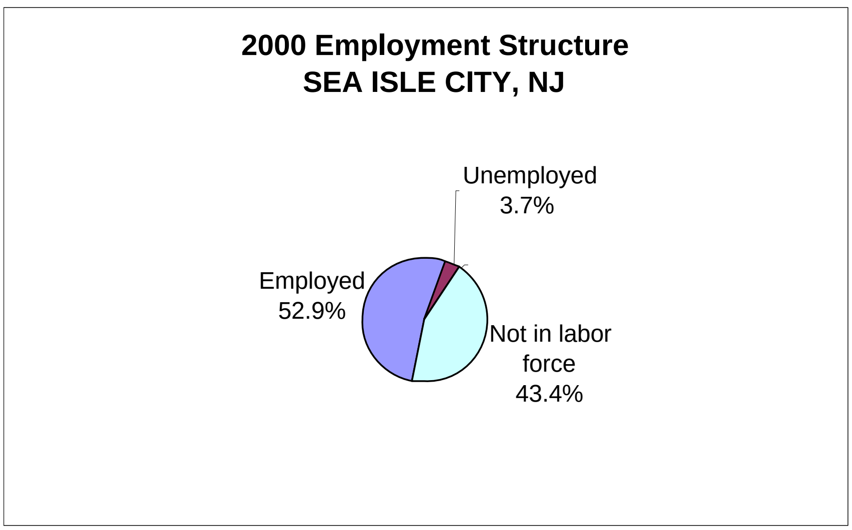
Current Economy

The largest industry in Cape May County is tourism, responsible for 91.5% of the county's employment, or 32,570 jobs, and 12% of the State's tourism dollars.[420] Smaller employers in the area are mostly small businesses involved in the summer tourist industry. Larger employers include hotels or casinos, but are generally located north of Sea Isle City, near Atlantic City.

As far as private employers, the tenth largest employer (140 employees) in Cape May County is Snow's/Doxsee Inc.,[421] with an 86,000 square-foot plant in Cape May that produces clam products including chowder, soups, canned clams, clam juice, and seafood sauces. Snow's/Doxsee is the only domestic manufacturer to harvest its own clams, and the company maintains the largest allocation for fishing and harvesting ocean clams in the United States.[422] Cold Spring Fish and Supply employs 500 people, and is the third largest private employer in the county. Other private employers in Cape May County include Burdette Tomlin Memorial Hospital (1,100), Acme Markets (600), WaWa (485), Holy Redeemer Visiting Nurse (250), and Super Fresh (250).[423]

Of the total population over 16 years of age and over, 1,372 or 56.6% are in the labor force, 3.7% are unemployed, and none are in the armed forces. The fact that 43.4% of the population over the age of 16 is not in the labor force reinforces the idea that Sea Isle City serves as a retirement area to many. See Figure 52 below.

Figure 52: Employment structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for no jobs. Self employed workers, a category where fishermen might be found, accounts for 89 or 6.9% of the labor force. Finance, insurance, real estate and rental and leasing (9.4%), educational, health and social services (19.4 %), retail trade (13.3%), professional, scientific, management, administrative, and waste management services (5.1%), and construction (7.1%) were the primary industries.

Median household income in Sea Isle City is $45,708 (up 7.1% from $32,218 in 1990) and median per capita income is $28,754. For full-time year round workers, males made approximately 25.6% more per year than females.

The average family in Sea Isle City consists of 2.07 persons. With respect to poverty, 6.4% of families (up from 2.0% in 1990) and 7.6% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 31.6% of families in Sea Isle City in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Sea Isle City had a total of 6,640 housing units of which 19.8% are occupied and 20.7% are detached one unit homes. Approximately five percent (4.9%) of these homes were built before 1940. There are a few mobile homes and no boats, RVs, vans, etc. listed for Sea Isle City accounting for 0.2% of the total housing units; 44.1% of detached units have between 2 and 9 rooms. In 2000, the median cost for a home in this area was 280,100. Of vacant housing units, 73.5% were used for seasonal, recreational, or occasional use. Of occupied units, 23.1% were renter occupied.

Governmental

A three-chair Board of Commissioners governs Sea Isle City.[424]

<u>Fishery involvement in government</u>

The Cape May County Planning Board supports the commercial fishing industry through a comprehensive plan that promotes land-use policies that are beneficial to the industry, and opposes projects that have potential for harming its economic or environmental condition.[425]

Institutional

<u>Fishing associations</u>

Garden State Seafood Association in Trenton is a statewide organization of commercial fishermen and fishing companies, related businesses and individuals working in common cause to promote the interests of the commercial fishing industry and seafood consumers in New Jersey.[426] The Cape May County Party and Charter Boat Association is an organization of small recreational fishing boats located along the coast of Southern New Jersey, and includes many boats located in Sea Isle City.[427]

<u>Fishery assistance centers</u>

"In an effort to maintain a healthy and safe fishing industry the Board of Chosen Freeholders along with the State of New Jersey developed the Cape May County Revolving Fishing Loan Program. This program was instituted in 1984 and is designed to help commercial, charter and party boat fishermen with low interest loans for safety and maintenance of fishing vessels. More than $2.5 million has been loaned out to help strengthen the local fishing industry."[428]

<u>Other fishing related organizations</u>

Information on additional fishing related institutions in Sea Isle City are unavailable through secondary data or do not exist.

Physical

Sea Isle City is accessible via the Garden State Parkway South, Exit 17 to Sea Isle Boulevard (East).[429] In proximity to major cities it is 66.4 miles from Philadelphia, PA and 31.7 miles from Vineland, NJ. Closer in-state areas include Avalon (4.1mi), Stone Harbor (7.8mi), Cape May Court House (9.8mi), and Ocean City (11.0mi). The nearest public-use airports are Woodbine Muni (8mi), Ocean City Muni (10mi), and Cape May County Airport (18mi). Hospitals closest to Sea Isle City are Burdete Tomlin Memorial Hospital (11mi), Shore Memorial Hospital (14mi), and Atlantic City Medical Center (24mi).[430]

There are various marinas in Sea Isle City, including Larson's Marina and Minmar Marina (Sea Isle Blvd), Pier 88 Marina (88th St), Municipal Marina (82nd St), and Sunset Pier (86th St). Boat towing is available from North Star Marine, which is located on Landis Avenue.[431]

Involvement in Northeast Fisheries

Commercial

Sea Isle City has a small commercial fishing port, which is entirely dependent on a highly dynamic inlet for access to the sea. There is a small offshore longline fishery out of Sea Isle City for tuna and swordfish, as well as offshore pot fisheries for lobster, conch, and black sea bass, and gillnetting for monkfish.[432]

The most significant landings category in Sea Isle City is the "other" category, which reflects the longlining for tuna and swordfish, as well as the conch fishery. Swordfish was the most valuable species in 2003, worth $194,888, followed by lobster ($165,368) and black sea bass ($129,905). (See Table 24 below.) Both the lobster landings and the "other" category landings were lower in 2003 than the 1997-2006 average value. The landings in 2003 overall were the lowest out of any year from 1997-2005, at under $1 million. The highest landings for this time period occurred in 2001, when landings were at over $1.8 million for Sea Isle City. In most years, the landings here were much higher than the level of home port fishing, meaning vessels are coming from elsewhere to land their catch in Sea Isle City. The number of home ported vessels here remained relatively consistent; 18 vessels in 1997 were down to 14 in 2002, but back to 18 in 2005. (See Table 25 below.)There were many more vessels home ported here than there are vessels with owners that live in Sea Isle City; most fishers likely live elsewhere because of the high price of purchasing a home here.

Landings by Species

Table 24: Dollar value by Federally Managed Groups of Landings in Sea Isle City

	Average from 1997-2006	**2003 only**
Other	757,531	429,452
Lobster	258,400	165,368
Summer flounder, scup, black sea bass	125,037	144,479
Monkfish	34,988	28,082
Butterfish, mackerel, squid	8,950	104
Scallop	7,233	0
Skate	3,079	488
Bluefish	1,872	61
Tilefish	1,714	20
Dogfish	1,560	0
Largemesh groundfish	1,006	1,388
Smallmesh groundfish	191	0

Vessels by Year

Table 25: All columns represent vessel permits or landings value combined between 1997-2005

Year	# Vessels home ported	# vessels (owner's city)	Level of fishing home port ($)	Level of fishing landed port ($)
1997	18	9	1,001,242	1,062,428
1998	15	10	716,079	1,193,105
1999	15	8	665,568	1,646,613
2000	14	8	786,404	1,498,227
2001	16	6	1,408,851	1,801,031
2002	14	5	649,801	1,047,161
2003	15	5	465,846	769,442
2004	15	5	813,972	1,617,976
2005	18	4	813,345	1,280,831

Recreational

Recreational fishing is available near-shore and deep-sea. Many Recreational boats that depart from Sea Isle City are members of the Cape May County Party and Charter Boat Association. The *Capt. Robbins*, under Captain John Sullivan, departs from Ludlum Landing Road and fishes for Sea Bass, Blackfish and Flounder, spring through fall.[433] The *Starfish*, Capt. Bob Rush Jr., offers day and night fishing for Bluefish, Flounder, Sea Bass, Weakfish, and Shark, as well as nature cruises where it nets many benthic and pelagic species.[434] The charter boat *Ursula*, run by Capt. John Pratt, offers whale watching and sightseeing tours.[435] Surfcasting is also popular in Sea Isle City, at beach locations at 93rd Street and North of 20th Street, and fishing piers at 59th Street and Sounds Avenue.[436]

Subsistence

Information on subsistence fishing in Sea Isle City is either unavailable through secondary data collection or the practice does not exist.

Future

Sea Isle City, like most places of the New Jersey Shore, experiences severe annual coastal zone erosion. Erosion and other coastal hazards threaten the physical structure and livelihood of communities, pressing for continued development of coastal zone management.[437] Further information on future plans or changes in Sea Isle City have not been found through secondary data.

MASSACHUSETTS

ESSEX COUNTY

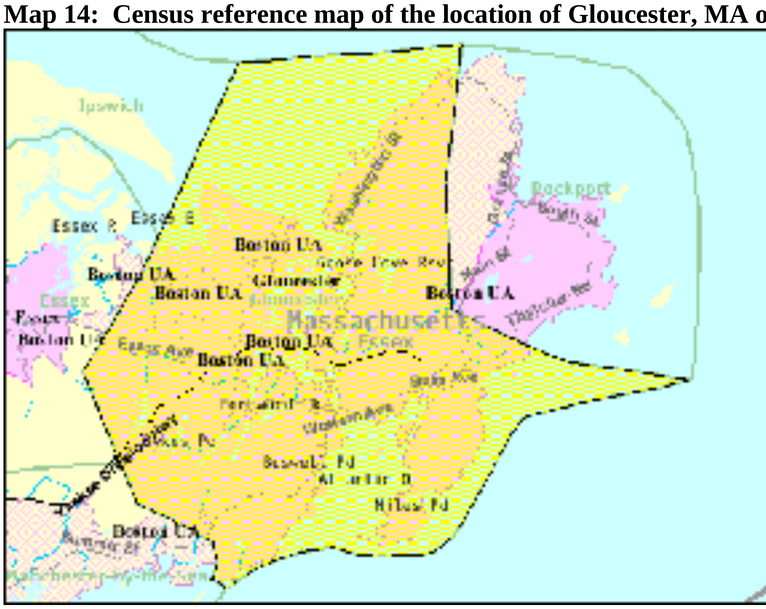
GLOUCESTER

People and Places

Regional orientation

The city of Gloucester (42.62°N, 70.66°W) is located on Cape Ann, on the northern east coast of Massachusetts. It is 30 miles northeast of Boston and 16 miles northeast of Salem. The area encompasses 41.5 square miles of territory, of which 26 square miles is land. See Map 14 below.

Map 14: Census reference map of the location of Gloucester, MA on Cape Ann



Historical/Background information

The history of Gloucester has revolved around the fishing and seafood industries since its settlement in 1623. Part of the town's claim to fame is being the oldest functioning fishing community in the United States. It was established as an official town in 1642 and later became a city in 1873. By the mid 1800s Gloucester was regarded by many to be the largest fishing port in the world. Unfortunately, with so many fishermen going to sea there were many deaths during the dangerous voyages. At least 70 fishermen died at sea in 1862 and the annual loss peaked at 249 in 1879. The construction of memorial statues and an annual memorial to fishermen demonstrates that the high death tolls are still in the memory of the town's residents.

In 1924 a town resident developed the first frozen packaging device, which allowed Gloucester to ship its fish around the world without salt. The town is still well-known as the home of Gorton's frozen fish packaging company, the nation's largest frozen seafood company.

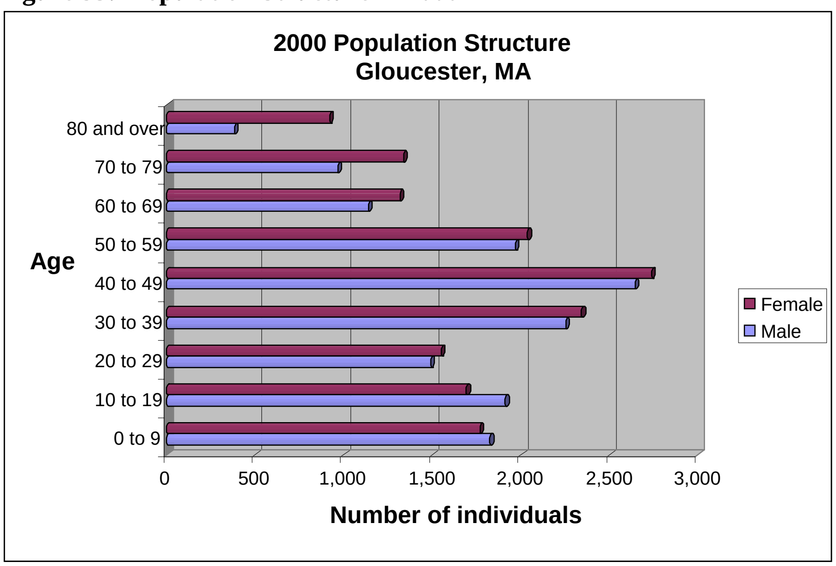
As in many communities, after the U.S. passed and enforced the Magnuson Act and foreign vessels were prevented from fishing within the country's EEZ (Exclusive Economic Zone), Gloucester's fishing fleet soon increased -- only to decline with the onset of major declines in fish stocks and subsequent strict catch regulations. For more detailed information regarding Gloucester's history see Hall-Arber et al. (2001).[438]

Demographic Profile

According to Census 2000 data, Gloucester had a total population of 30,273, up from a reported population of 28,716 in 1990. Of this total in 2000, 52.1% were female and 47.9% were male, with the age structure between genders very similar to the U.S. average – with a peak between ages 40 to 49. Gloucester has a much low percentage between the ages of 20-29 and a higher percentage between 40-49 years. (See Figure 53 below.) This may be an indication of out-migration after high school graduation for college or work since the fishing industry is not as strong as it was in the past.

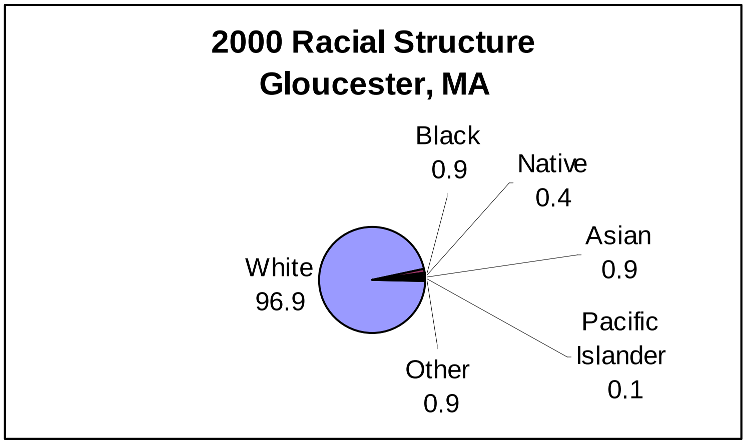
The median age for Gloucester in the year 2000 was 40.1 years and 75.2% of the population was 21 years or older while18.1% of the population was 62 or older.

Figure 53: Population Structure in 2000



The majority of the population of Gloucester in 2000 was white (96.9%), with 0.9% Black or African American, 0.4% Native American, 0.9% Asian and 0.1% Pacific Islander or Hawaiian. (See Figure 54 below.) Of the total population, 1.5% were Hispanic/Latino. (See Figure 55 below.) Residents linked their heritage to a number of European ancestries including: English (15.1%), Irish (20.1%), Italian (21.9%) and Portuguese (9.8%). With regard to region of birth, 77.4% were born in Massachusetts, 16.2% were born in a different state and 5.3% were born outside the U.S (of whom 2.6% who were not U.S. citizens).

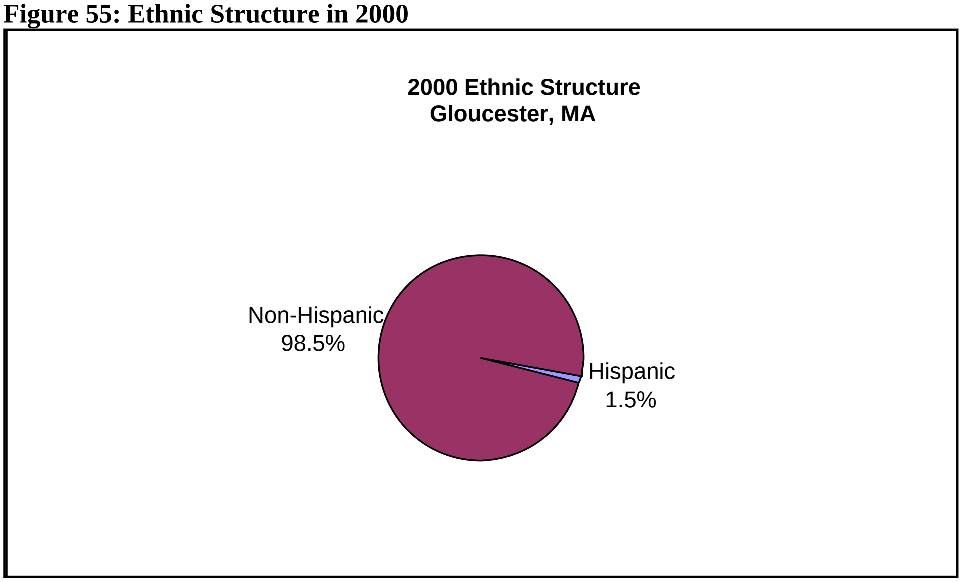
Figure 54: Racial Structure in 2000



According to Griffith and Dyer (1996)[439]: "Probably 80 percent of Gloucester's fishermen are Italian (mostly Sicilian). Although large immigration flows ended in the mid-1970's, there are at least 26 vessels (out of approximately 200) on which only Italian is spoken. Even among the fishermen who arrived at a very young age, Italian is often the first and virtually only language spoken. Some of these men depend on their wives to communicate with the English-speaking population when necessary."

According to the U.S. Census 2000, for 89.7% of the population only English was spoken in the home, leaving 10.3% in homes where a language other than English was spoken (a much larger percentage than the U.S. average), including 3.6% of the population who spoke English less than 'very well'. Further, Doeringer et al. (1986:6) noted with regard to both Gloucester and New Bedford: "[m]any workers are geographically immobile because of close ties to community and family -- ties that are reinforced in some ports by the presence of a large number of recent immigrants, many of whom lack facility in English."[440]

Figure 55: Ethnic Structure in 2000



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Of the population 25 years and over in 2000, 85.7% were high school graduates or higher and 27.5% had a bachelor's degree or higher. Again of the population 25 years and over, 5.2% did not reach ninth grade, 9.2% attended some high school but did not graduate, 25.9% completed high school, 31.5% had some college with no degree, 8.7% received their associate degree, 17.2% earned their bachelor's degree, and 10.2% received either their graduate or professional degree.

Although the religion percentages are not available through U.S. Census data, according to the American Religion Data Archives in 2000, the religion with the highest number of congregations and adherents in Essex County was Catholic with 70 congregations and 362,900 adherents. Other prominent congregations in the county were United Church of Christ (49 with 15,358 adherents), United Methodist (31 with 8,713 adherents), Jewish (29 with 21,700 adherents), Episcopal (28 with 14,064 adherents) and American Baptist (24 with 5,291 adherents). The total number of adherents to any religion was up 4.1% from 1990.

Issues/Processes

As regulations have tightened fishermen have been concerned that they will go out of business. It is interesting, however, that Gloucester has gained some business from Gulf of Maine vessels which land here due to closures in the Gulf of Maine.

Cultural attributes

Gloucester demonstrates dedication to its fishing culture through numerous social events, cultural memorial structures, and organizations. St. Peter's Fiesta, celebrated since 1927, is in honor of the patron saint of fishermen. It is put on by the St. Peter's Club, an organization that facilitates social interactions for fisherman. The celebration lasts for five days at the end of June each year. Festivities for this celebration include a seine boat race and a greasy pole competition, but the parade carrying a statue of St. Peter around the town and a blessing of the Italian-American fishing fleet are the foci of the festival. [441]

The Seafood Festival in September was started in 1994 to promote seafood in Gloucester. As the fishing industry dropped due to catch declines, the town saw this celebration and educational forum as a way to show the world that fishing is still very important to them and that it is surviving the catch restrictions and stock depletions.[442]

This year (2004) marks the 20th anniversary of the Gloucester Schooner Festival, which is sponsored by Gorton's Seafood.[443] "The Gloucester Schooner Festival celebrates the major contribution of the classic fishing schooner to the history of Gloucester. The events feature the last remaining of these great old vessels and their replicas, as they compete in the Mayor's Race for the Esperanto Cup, a trophy from the first International Fishermen's Races sailed in 1920."[444] Two other festivals that celebrate area's fishing culture are the Gloucester Seaport Festival and the Essex Clamfest.

Other indications of the fishing culture in Gloucester include its annual Fishermen's Memorial Service, an annual tradition to honor fishermen lost at sea. The earliest recording of this ceremony was in the mid 1800s. In the 1960s this service stopped due to the closure of Fishermen's Union Hall (the organization previously in charge of it), but in 1996 the Gloucester Mayor asked residents to revive the tradition.

Now there is a committee that documents the ceremony's speeches and ceremonial walk from the American Legion Square to the Fishermen's Monument each year, so that the tradition is not lost in the future.[445]

Interesting infrastructure that demonstrates the significance of fishing history in this city include "Our Lady of Good Voyage Church" built in 1893 and the recent opening of the Gloucester Maritime Heritage Center, which provides visitors and the city residents with information of the historic and current fishing industry. The statue named "The Man at the Wheel" was built in memory of the 5,300 fishermen that died at sea[446]. In 2001 a new statue dedicated to fishermen's wives was built by The Gloucester Fishermen's Wives Association.

Infrastructure

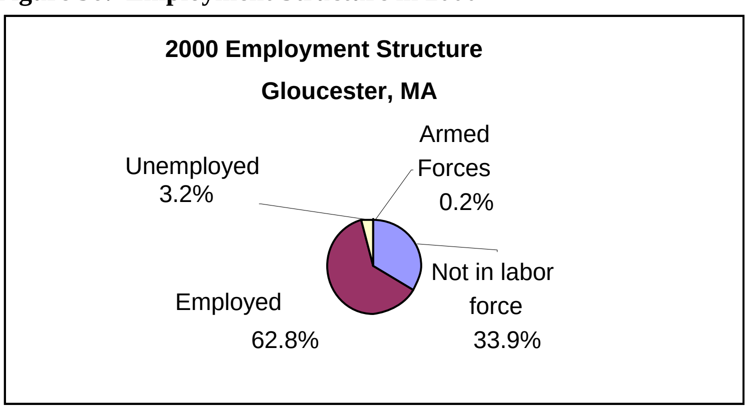
Current Economy

Gloucester Seafood Display Auction, opened in 1997 by the Cuilla family, quickly grew to become the largest open display auction of fresh seafood in North America as of 2000. This allows buyers to purchase fish directly from the boats rather than having to rely on fish brokers, as they did in the past.

Cape Pond Ice employing 30 people in the busy summer season of 2004, was started in 1848. It is the only ice business remaining in Gloucester, and provides other ice services, such as vegetable transport and ice sculptures to offset the declining business from the fishing industry.[447] B&N Gear is the only bottom trawl gear seller in town (Finch 2004). Gorton's employs approximately 500 people, but it is important to note that at least as of 2000, the company had been processing and packaging only imported fish since the mid 1990s.

According to the U.S. Census 2000 website, 66.1% (24,397 individuals) of the population 16 years or older was in the labor force, with 3.2% unemployed and 0.2% in the Armed Forces. See Figure 56 below.

Figure 56: Employment Structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 382 or 2.5% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 1,319 or 8.6% of the labor force. Educational, health and social services (20.2%), manufacturing (16.7%), retail trade (10.8%) and entertainment, recreation, accommodation and food services (9.2%) were the primary industries.

Major employers that provide over 100 jobs in Gloucester include the following businesses with the number of employees in parentheses: Varian Semi Conductor Equipment Associates (950), Gorton's (500), Battenfeld Gloucester Engineering (400), Shaw's Supermarkets (350), Addison Gilbert Hospital (325), NutraMax Products (220), and Seacoast Nursing and Retirement (160).

The median household income in 2000 was $47,772 (a considerable increase from 1990 when the median household income was $32,690) and median per capita income in 2000 was $25,595. For full-time year round workers, men made approximately $10,899 more per year than women.

The average family in Gloucester in 2000 consisted of 3.0 persons. With respect to poverty, 7.1% of families (up from 6.7% in 1990) and 8.8% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 26% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Gloucester had a total of 13,958 housing units, of which 90.2% were occupied and 54.3% were detached one unit homes. Just over half (53.9%) of these homes were built before 1940. Mobile homes accounted for only 0.1% of the total housing units; 88.7% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $204,600. Of vacant housing units, 70.4% were used for seasonal, recreational, or occasional use. Of occupied units, 40.3% were renter occupied.

Governmental

Gloucester's city government is run by an elected mayor and city council.

Fishery involvement in government

The Gloucester Fisheries Commission is the only municipal-level government sector focused on fisheries, but it is currently inactive. However, NOAA Fisheries, Fisheries Statistics Office, has two port agents based here. Port agents sample fish landings and provide a 'finger-on-the-pulse' of their respective fishing communities.[448]

Institutional

Fishing associations:

Both the Gloucester Fishermen's Association and Gloucester Lobstermen's Association are located in Gloucester. The Massachusetts Fishermen's Partnership, established in Gloucester in 1995, is an organization for fishermen of any sector within the Massachusetts fishing industry.[449]

Fishery assistance centers

The Gloucester Fishermen and Family Assistance Center was established in 1994. Currently it is run and funded by grants from the Department of Labor. "In an effort to help fishermen, their families, and other fishing workers to transition to new work, Massachusetts applied for and received grants from the U. S. Department of Labor to set up career centers. National Emergency Grants (NEG) fund centers in Gloucester, New Bedford and Cape Cod and the Islands to provide re-employment and re-training services to those individuals who can no longer make an income from fishing and fishing related businesses."[450]

The Gloucester Fishermen's Wives Association (GFWA) was founded in 1969 by the wives of Gloucester fishermen. In 2001 they constructed a memorial statue to the fishermen's wives of Gloucester.[451]

Other fishing related organizations

Northeast Seafood Coalition is located in Gloucester.

Physical

There are several ways to access Gloucester and to travel within the city. Cape Ann Transportation Authority (CATA) is the bus system that runs from Gloucester to Rockport. State Routes 128, 127, and 133 are highway system providing access within and to the city. The neighboring town of Beverly has a small municipal airport with three asphalt runways. Amtrak and MBTA (Massachusetts Bay Transportation Authority) trains provide public transportation from Gloucester to the Boston area.[452]

Gloucester has been a full service port for the commercial fishing industry in the region; however, this status would be jeopardized if one or more of the facilities went out of business. Thus far it has provided all the necessary facilities for fishermen in the town, and even facilities needed for neighboring fishing communities. Offloading facilities are located within the city at Capt. Vince and the Gloucester Seafood Display Auction. There are nine lobster buyers that are either based in or come to Gloucester for purchasing. Fishermen can purchase necessary equipment and have it repaired in town by either Gloucester Marine Railways or Rose Marine, both of which can provide haul out service for large vessels. There are three other facilities that provide services for vessels under 40ft. Gloucester has a choice of nine gear and supply shops in town.[453] Harbor plans in 2006 have been formulated to maintain the necessary fishing infrastructure.[454] There are at least 11 locations that provide long-term mooring space and seven for temporary mooring space. At least four facilities provide a place for fishermen to purchase fuel.[455] Some of the 10 fishing charter and party boats may be captained by part-time fishermen that needed a new seasonal income.[456]

Involvement in Northeast Fisheries

Commercial

Although there are threats to the future of Gloucester's fishery (see "History" above and "Future" below), the fishing industry remains strong in terms of recently reported landings. Gloucester's commercial fishing industry had the 13th highest landings in pounds (78.5 million) and the nation's ninth highest landings value in 2002 ($41.2 million). In 2003 recorded state landings totaled 11.6 million pounds, with catches of lobster, cod, and haddock at 2.0 million, 4.7 million, and 2.6 million pounds landed, respectively.[457] (See Table 26 below.) In 2002 Gloucester had the highest landings value of lobster in Massachusetts with the state-only landings worth $2 million and the combined state and federal landings recorded from federally permitted vessels was just over $10 million.

Gloucester's federally managed group with the highest landed value was largemesh groundfish with nearly $18 million in 2003. (See Table 27 below.) The number of vessels home-ported (federal) increased slightly from 1997 to 2003, but there was a slight reduction for the years 1998, 1999, and 2000. (See Table 28 below.)

Landings by Species: State-Only Permits

Table 26: Landings in Pounds for state-only permits

Catch	**Pounds landed in 2003**
Cod**	4,727,220
Haddock**	2,576,252
Lobster***	2,035,442
Monkfish	587,186
Pollock	503,396
Crab***	178,842
White hake	171,061
Skate	155,138
Winter flounder	151,782
Atlantic mackerel	136,441
Yellowtail flounder	125,855
Soft shell clam*	89,558
Bluefish**	63,446
Red hake	37,016
Striped Bass**	35,475
Gray sole (Witch)	25,639
Sea herring	23,800
Dab (Plaice)	15,754
Cusk	8,672
Wolffish	5,964
Razor clam*	3,148
Conch*	1,430
Menhaden	700
Whiting	642
Redfish	528
Periwinkles*	400
Bay scallop*	350
Fluke**	115
Mussels*	100
Halibut	38
Grand Total	11,661,391

Asterisks indicate data sources: MA DMF has 2 gear-specific catch reports: Gillnet & Fish Weirs. All state-permitted fish-weir and gillnet fishermen report landings of all species via annual catch reports.

NOTE: Data for these species do not include landings from other gear types (trawls, hook & line, etc.) and therefore should be considered as a subset of the total landings. (Massachusetts Division Marine Fisheries).
***** All state-permitted fishermen catching shellfish in state waters report landings of all shellfish species to us via annual catch reports. NOTE: These data do not include landings from non-state-permitted fishermen (federal permit holders fishing outside of state waters), nor do they include landings of ocean quahogs or sea scallops.)
****** These species are quota-managed and all landings are therefore reported by dealers via a weekly reporting phone system (IVR).
******* All lobstermen landing crab or lobster in MA report their landings to us via annual catch reports.

Landings by Species: Federal Permits

Table 27: Dollar value of landings by species in Gloucester.

	Average from 1997-2003	**2003 only**
Largemesh groundfish	15,161,180	17,998,475
Lobster	5,184,888	8,985,389
Monkfish	2,887,704	3,554,682
Herring	1,931,691	2,906,675
Smallmesh groundfish	774,099	386,194
Squid, mackerel, butterfish	685,701	938,745
Scallop	586,629	574,314
Dogfish	399,375	24,824
Red crab	159,996	0
Skate	73,011	103,222
Surf clam, ocean quahog	24,565	3,821
Bluefish	19,722	11,326
Tilefish	6,071	0
Summer flounder, scup, black sea bass	1,435	251
Other	3,340,668	2,307,546

Vessels by Year

Table 28: All columns represent vessel permits or landings value combined between 1997 and 2003

Year	**# vessels home ported**	**# vessels (owner's city)**	**Home port value (in millions of $)**	**Landed port value (in millions of $)**
1997	277	216	15	23
1998	250	196	18	28
1999	261	199	18	26
2000	261	202	20	42
2001	295	230	19	38
2002	319	247	21	41
2003	301	225	22	28

Recreational

Gloucester is home to roughly a dozen fishing charter companies and party boats fishing for bluefin tuna, sharks, striped bass, bluefish, cod, and haddock. Between 2001-

2005, there were 50 charter and party vessels making 4,537 total trips registered in logbook data by charter and party vessels in Gloucester carrying a total of 114,050 anglers.

Subsistence

Information on subsistence fishing in Gloucester is either unavailable through secondary data collection or the practice does not exist.

Future

The Massachusetts Department of Housing and Community Development recognize that the fishing industry is changing. The city must adapt to these major economic changes. Although the city is preparing for other industries, such as tourism, they are also trying to preserve both the culture of fishing and the current infrastructure necessary to allow the fishing industry to continue functioning. The city is also currently working with the National Park Service to plan an industrial historic fishing port, which would include a working fishing fleet.[458] This would preserve necessary infrastructure for the fishing industry and preserve the culture to further develop tourism around fishing.

According to newspaper articles[459] and city planning documents, residents have conflicting visions for the future of Gloucester. Many argue that the fishing industry is in danger of losing its strength. For example an anthropological investigation of the fishing infrastructure in Gloucester[460] found that the port is in danger of losing its full-service status if some of the businesses close down. With stricter governmental regulations on catches to rebuild declining and depleted fish stocks, many residents are choosing to find other livelihood strategies, such as tourism or other businesses. In 1996 the NMFS piloted a vessel buyback program to decrease the commercial fishing pressure in the northeast. Of the 100 bids applying to be bought by the government, 65 were from Gloucester fishermen.[461] This could be taken as an indication that these fishermen do not see any future in fishing for themselves in the Northeast. NMFS adjusted this program to just buy back permits rather than vessels. Massachusetts had the highest sale of permits, though the number of Gloucester permits could not be obtained at this time.[462]

On the other hand, there are fishermen who claim the fishing and seafood industries will remain strong in the future, despite the pessimistic forecasts. The Gloucester Seafood Festival and Forum is one example of celebrating and promoting Gloucester seafood industry.[40]

BRISTOL COUNTY

NEW BEDFORD

People and Places

Regional Orientation

New Bedford is the fourth largest city in the commonwealth of Massachusetts. It is situated on Buzzard Bay, located in the southeastern section of the state. New Bedford is bordered by Dartmouth on the west, Freetown on the north, Acushnet on the east, and Buzzards Bay on the south. It is 54 miles south of Boston, 33 miles southeast of

Providence, Rhode Island, and approximately 208 miles from New York City.[463] See Map 15 below.

Map 15: Census reference map of location of New Bedford, MA

Historical/Background information

New Bedford, originally part of Dartmouth, was settled by Plymouth colonists in 1652. Fishermen established a community in 1760 and developed it into a small whaling port and shipbuilding center within the next five years. By the early 1800s New Bedford had become one of the world's leading whaling ports. Over one half of the U.S. whaling fleet, which totaled more than 700 vessels, was registered in New Bedford by the mid 1800s.

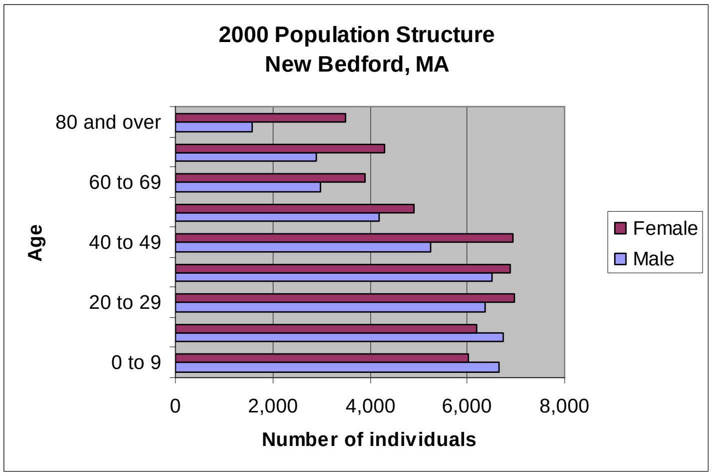
The discovery of petroleum greatly decreased the demand for sperm oil, bringing economic devastation to New Bedford and all other whaling ports in New England. The last whale ship sailed out of New Bedford in 1925.[464] In attempts to diversify the economy, the town manufactured textiles until the southeast cotton boom in the 1920s. Since then, New Bedford has continued to diversify its economy, but the city is still a major commercial fishing port.[465] It consistently ranks in the top two ports in the U.S. for landed value.

Demographics

According to Census 2000 data, New Bedford had a total population of 93,768, down from the reported population of 99,922 in 1990. Of this population 47.1% were males and 52.9% were females. The median age was 35.9 years and 71.2 % of the population was 21 years or older while 18.9% was 62 or older.

New Bedford's age structure by sex shows a higher number of females in each age group between 20 and over 80 years. (See Figure 57 below.) There is no drop in the 20-29 age group (as occurs in many smaller fishing communities), which could be due to New Bedford's proximity to Boston (several universities) and the local sailing school, and the Northeast Maritime Institute.

Figure 57: Population structure by sex in 2000



New Bedford's racial composition in 2000 was 79% white, 9.1% other, 6.1% claiming two or more races, and 4.5% Black or African American. (See

Figure 58 below.) In addition, Hispanic/Latinos made up 10.2% of the population. (See Figure 59 below.) In terms of ancestry, the residents of New Bedford trace their backgrounds to several countries, but most of all to Portugal. In 2000 the most common ancestries were Portuguese (41.2%), Sub-Saharan African (9.1%) and Cape Verdean (8.9%). Cape Verdeans are Portuguese speakers.

Figure 58: Racial Structure in 2000

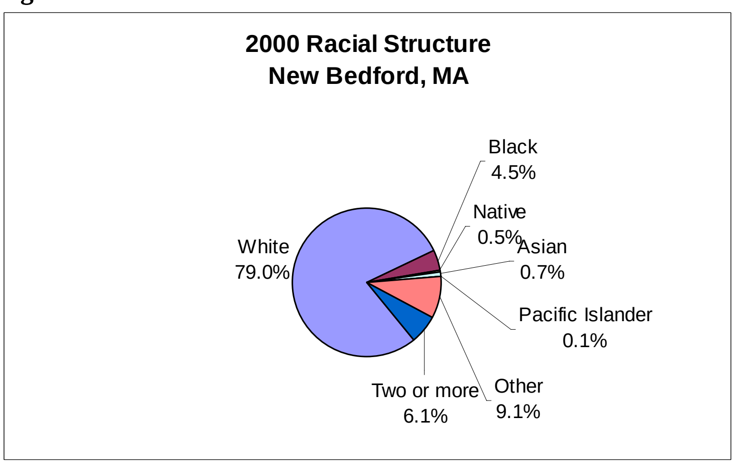
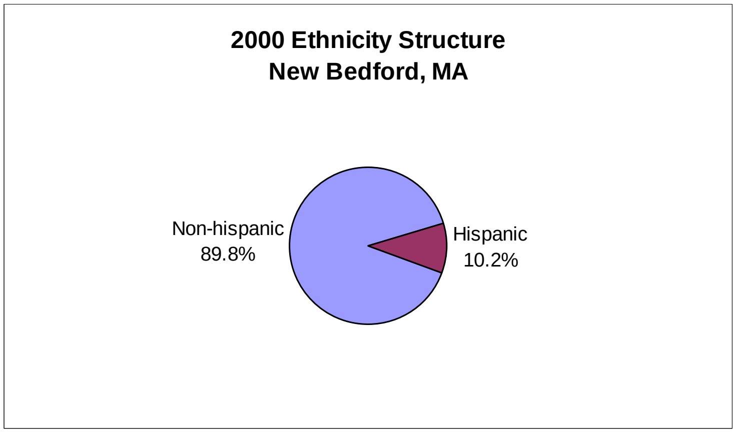


Figure 59: Ethnic structure in 2000



For 62.2% of the population in 2000, only English was spoken in the home, leaving 37.8% in homes where a language other than English was spoken, including 17.3% of the population who spoke English less than 'very well' according to the 2000 Census.

Of the population 25 years and over, 57.6% were high school graduates or higher and 10.7% had a bachelor's degree or higher. Again of the population 25 years and over, 24.3% did not reach ninth grade, 18.1% attended some high school but did not graduate, 27.7% completed high school, 13.9% had some college with no degree, 5.3% received their associate degree, 7.5% earned their bachelor's degree, and 3.2% received either their graduate or professional degree.

Although religious percentages are not available through U.S. Census data, according to the American Religious Data Archive, in 2000 the religion with the highest number of congregations and adherents in the Bristol County was Catholic with 85 congregations and 268,434 adherents. Other prominent congregations in the county were United Methodist (17 with 3,583 adherents), United Church of Christ (19 with 5,728 adherents) and Episcopal (18 with 5,100 adherents). The total number of adherents to any religion was up 9.4% from 1990.

Issues/Processes

New Bedford struggles with a highly contaminated harbor and harbor sediment. New Bedford Harbor is contaminated with metals and organic compounds, including polychlorinated biphenyls (PCBs).[466] Because of the high concentrations of PCBs in the sediment, New Bedford Harbor was listed by the U.S. EPA as a Superfund site in 1982 and cleanup is underway. Significant levels of these pollutants have accumulated in sediments, water, fish, lobsters, and shellfish in the Harbor and adjacent areas. New Bedford is also the only major municipality in the Buzzards Bay area to discharge significant amounts of untreated combined sewage, industrial waste, and storm water from combined sewer overflows.[467]

The pollution problem not only affects health and the ecosystem but has a large impact on New Bedford's economy. For example, closures of fishing areas in the harbor have caused economic losses in the millions for the quahog landings alone. Closure of the lobster fishery has resulted in an estimated loss of $250,000 per year and the finfish industry and recreational fishing have been negatively affected as well.[468] In addition to contaminated harbor sediments, numerous brownfield properties are located in proximity to the port, especially on the New Bedford side.[469]

Another issue is crews. According to a 2002 newspaper article, fishing vessel owners complain of a shortage of crewmen. They attribute this scarcity to low unemployment rates that have kept laborers from the docks. Many choose to bypass work that government statistics place among the most dangerous jobs in the country. Many crewmembers are either inexperienced or come from foreign countries. Both present safety issues, according to one fisherman, because inexperienced crew get hurt more often and foreign crew have significant language barriers that impede communication. Additionally, those willing to work sometimes struggle with alcohol and drug dependency. Ship captains routinely have applicants roll up their shirt sleeves to check for traces of heroin use.[470]

Cultural attributes

In September 2007, New Bedford will host the fourth annual Working Waterfront Festival, dedicated to the commercial fishing industry in New Bedford. This festival is a chance for the commercial fishing industry to educate the public about its role in the community and in providing seafood to consumers, through boat tours, demonstrations, and contests. The annual Blessing of the Fleet is held as part of the Working Waterfront Festival.[471]

The New Bedford community celebrates its maritime history with a culmination of activities in the New Bedford Summerfest. The Summerfest is held annually in July in conjunction with the New Bedford State Pier and the New Bedford National Whaling Historical Park. Summerfest also includes the Cape Verdean Recognition Day Parade and the Cape Verdean American Family Festival.[472]

The community has taken an active role in the remembrance of its maritime heritage. The Azorean Maritime Heritage Society, the New Bedford Whaling Museum and the New Bedford Whaling National Historical Park have cooperated to raise awareness of the maritime history of the Azorean community on both sides of the Atlantic.[473]

The New Bedford Whaling museum was established by the Old Dartmouth Historical Society in 1907 to tell the story of American whaling and to describe the role that New Bedford played as the whaling capital of the world in the nineteenth century. Today the whaling Museum is the largest museum in America devoted to the history of the American whaling industry and its greatest port.[474]

The New Bedford Whaling National Historical Park, created in 1996, commemorates the heritage of city as a whaling port. The park is spread over 13 city blocks and includes a visitor center, the New Bedford Whaling Museum, and the Rotch-Jones-Duff House and Garden Museum.[475]

Infrastructure

Current Economy

The New Bedford Economic Development Council (NBEDC), Inc was established in 1998 to improve the city's economic development by helping to attract business and job opportunities to the city. The NBEDC also provides small business funds and offers financial support (in loans) for new businesses or those who want to expand. One of their loan funds is specifically targeted at fishermen.[476]

With a federal grant and local funds, the city and the Harbor Development Council (HDC) in 2005 began construction on a $1 million, 8,500-square foot passenger terminal at State Pier to support passenger ferry service. The HDC received a federal grant for more than $700,000 to construct the passenger terminal and to improve berthing at the New Bedford Ferry Terminal[477].

The Community Economic Development Center is a non-profit organization vested in the economic development of the local community. The organization is unique in that it is involved with fisheries management. The center is currently engaged in a research project to better understand the employment status in the fishing industry. The center is a liaison for migrant workers and other newcomers to the community to have access to the benefits provided by the city. In the past the center at one time had a re-training program for displaced fishermen to move into aquaculture.

According to the U.S. Census 2000, 57.7% (42,308 individuals) of the total population 16 years of age and over were in the labor force, of which 5.0% were unemployed and 0.2% were in the Armed Forces. See Figure 60 below.

Figure 60: Employment structure in 2000

According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 407 or 1.1% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 1,485 or 3.9% of the labor force. Educational, health and social services (20.9%), manufacturing (20.7%), retail trade (12.1%), entertainment, recreation, accommodation and food services (7.4%), and construction (7.1%) were the primary industries. According to a 1993 survey, major employers that provide over 100 jobs in New Bedford include the following businesses with the number of employees in parentheses: Acushnet Company (1,600), Cliftex (1,400), Aerovox (800), Calish Clothing (750), and Polaroid (465).[478]

Median household income in New Bedford in 2000 was $27,569 (an increase from $22,647 in 1990) and median per capita income was $15,602. For full-time year round workers, men made approximately $9,110 more per year than women.

The average family in New Bedford in 2000 consisted of 3.01 persons. With respect to poverty, 17.3% of families (up slightly from 16.8% in 1990) and 20.2% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 48.8% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, New Bedford had a total of 41,511 housing units of which 92.0% were occupied and 30.2% were detached one unit homes. Approximately half (49.9%) of these homes were built before 1940. Mobile homes in this area accounted for 0.3% of the total housing units; 95.0% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $113,500. Of vacant housing units, 0.3% were used for seasonal, recreational, or occasional use. Of occupied units 56.2% were renter occupied.

Governmental

New Bedford was incorporated as a town in 1787 and as a city in 1847. The city of New Bedford features a Mayor and a City Council.[479]

Fishery involvement in government

The Harbor Planning Commission includes representatives from the fish-processing and harvest sectors of the industry. NOAA Fisheries, Fisheries Statistics Office, has two port agents based here. Port agents sample fish landings and provide a 'finger-on-the-pulse' of their respective fishing communities.[480]

Institutional

Fishing associations

There are a variety of fishing associations which aid the fishing industry in New Bedford, including the American Dogfish Association, the American Scallop Association and the Commercial Anglers Association. New Bedford also is home to a Fishermen's Wives Association which began in the early 1960s. Additionally, New Bedford has the Offshore Mariner's Wives Association which includes a handful of participants that organize the "Blessing of the Fleet."

Fishing assistance centers

Shore Support has been the primary fishing assistance center in New Bedford since 2000,[481] though the New Bedford Fishermen and Families Assistance Centers are also available as is the Trawlers Survival Fund.

Other fishing related organizations

There are several other fishing related organizations and associations that are vital to the fishing industry such as the Fisheries' Survival Fund (Fairhaven), the New Bedford Fishermen's Union, the New Bedford Seafood Coalition, the New Bedford Seafood Council and the Offshore Mariner's Association.

Physical

The New Bedford Municipal Airport is located 2 miles NW of the city. Interstate 195 and State routes 24 and 140 provide access to the airports, ports, and facilities of Providence and Boston. The Consolidated Rail Corporation (Conrail) provides services into New Bedford.[482]

Involvement in Northeast Fisheries

Commercial

In the 1980s fishermen reaped high landings and bought new boats. Then in the 1990s they experienced a dramatic decrease in groundfish catches, a vessel buyback program, and strict federal regulations in attempts to rebuild the depleted fish stocks. A new decade brought more changes for the fishing industry.[483] By 2000 and 2001 New Bedford was the highest value port in the U.S. (generating $150.5 million in dockside revenue).[484] According to the federal commercial landings data, New Bedford's most successful fishery in the past seven years has been scallops, followed by groundfish. Both were worth significantly more in 2003 than the 1997-2004 average values, and the total value of landings for New Bedford generally increased over the same time period. See Table 29, Table 30 and Table 31 below.

New Bedford contains approximately 44 fish wholesale companies,[485] 75 seafood processors and some 200 shore side industries. [486] Maritime International has one of the largest U.S. Department of Agriculture-approved cold treatment centers on the East Coast. Its terminal receives approximately 25 vessels a year, most carrying about 1,000 tons of fish each.[487]

Landings by species – State Only Permits

Table 29: Landings in pounds for state-only permits

Species	Pounds landed
Cod**	6,311,413
Haddock**	5,949,880
Lobster***	1,168,884
Scup**	593,394
Fluke**	480,165
Crab***	315,395
Loligo squid**	207,769
Striped bass**	189,055
Quahog (littleneck)*	147,249
Monkfish	137,300
Conch*	136,276
Skate	121,522
Quahog (cherrystone)	113,341
Black sea bass**	113,071
Pollock	65,500
Quahog (chowder)*	64,999
Bluefish**	44,045
Quahog (mixed)*	11,513
Red hake	10,100
Cusk	1,880
Illex squid**	1,305
Soft shell clam*	985

Dab (Plaice)	870
Dogfish**	537
Winter flounder	500
Yellowtail flounder	383
Gray sole (witch)	200

Asterisks indicate data sources: MA DMF has 2 gear-specific catch reports: Gillnet & Fish Weirs. All state-permitted fish-weir and gillnet fishermen report landings of all species via annual catch reports. NOTE: Data for these species do not include landings from other gear types (trawls, hook & line, etc.) and therefore should be considered as a subset of the total landings. (Massachusetts Division Marine Fisheries).
***** All state-permitted fishermen catching shellfish in state waters report landings of all shellfish species to us via annual catch reports. NOTE: These data do not include landings from non-state-permitted fishermen (federal permit holders fishing outside of state waters), nor do they include landings of ocean quahogs or sea scallops.)
****** These species are quota-managed and all landings are therefore reported by dealers via a weekly reporting phone system (IVR).
******* All lobstermen landing crab or lobster in MA report their landings to us via annual catch reports.

Landings by species – Federal Permits

Table 30: Dollar value by species landed in New Bedford

Species	1997-2004 Average	2003
Scallops	68,458,919	102,785,405
Largemesh groundfish[488]	29,234,009	38,101,563
Monkfish	9,860,316	7,461,998
Surfclam, ocean Quahog	6,292,742	7,584,792
Other	4,469,666	3,946,386
Lobster	4,145,961	5,545,729
Skates	1,554,432	1,775,930
Squid, mackerel, butterfish	1,337,329	1,606,276
Summer flounder, scup, black sea bass	1,124,292	1,124,486
Red crab	925,401	1,563,422
Smallmesh groundfish[489]	617,155	2,135,623
Herring	398,074	2,553,863
Dogfish	108,169	171
Bluefish	9,211	13,439
Tilefish	2,310	1,483

Vessels by Year

Table 31: Vessel permits and landed value between 1997 and 2003

Year	# Vessels home ported	# vessels (owner's city)	Home port value ($)	Landed port value($)
1997	244	162	80,472,279	103,723,261
1998	213	137	74,686,581	94,880,103
1999	204	140	89,092,544	129,880,525
2000	211	148	101,633,975	148,806,074
2001	226	153	111,508,249	151,382,187

2002	237	164	120,426,514	168,612,006
2003	245	181	125,788,011	166,680,126

Recreational

While fishing in New Bedford Harbor is discouraged[490], a number of companies in New Bedford offer the public recreational fishing excursions including boat charters.[491]

Subsistence

Information on subsistence fishing in New Bedford is either unavailable through secondary data collection or the practice does not exist.

Future

For several years work was underway to construct the New Bedford Oceanarium that would include exhibits on New Bedford's history as a whaling and fishing port, and was expected to revitalize the city's tourist industry and create jobs for the area. The Oceanarium project failed to receive its necessary funding in 2003 and 2004, and while the project has not been abandoned, it seems unlikely the Oceanarium will be built anytime in the near future.

According to a 2002 newspaper article, many fishermen believe that based on the quantity and ages of the specimens they catch – the fish are coming back faster than studies indicate. While most admit that regulations have worked, they believe further restrictions are unnecessary and could effectively wipe out the industry. "If they push these regs too hard, the whole infrastructure of fishing here could collapse," according to a New Bedford fishermen.[492]

RHODE ISLAND

WASHINGTON COUNTY

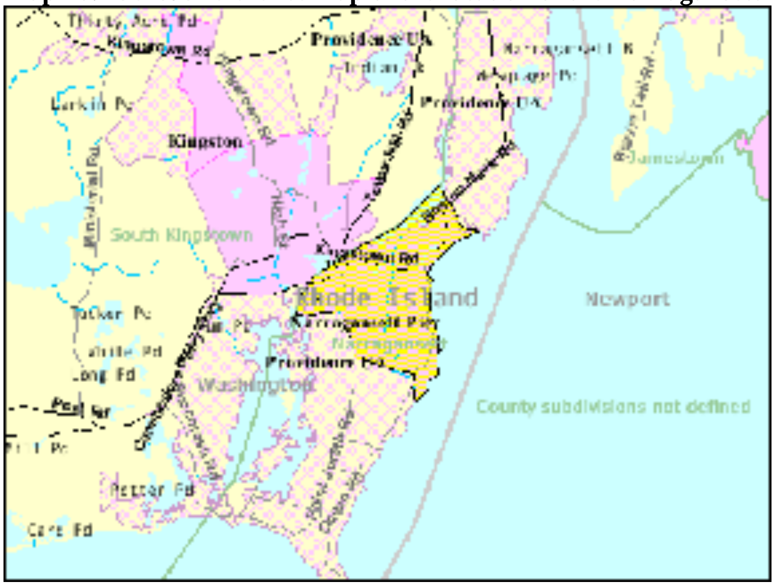
POINT JUDITH/NARRAGANSETT

People and Places

Regional orientation

Narragansett (41.45°N, 71.45°W) is located in Washington County 30 miles south of Providence. Point Judith is located in Washington County 4 miles south of Narragansett along Highway 108 near Galilee State Beach, located at the western side of the mouth of Rhode Island Sound, within the Census Designated Place (CDP) of Narragansett Pier. Point Judith itself is not a CDP or incorporated town, and as such has no census data associated with it. Thus, this profile provides census data from Narragansett Pier CDP and other data from both Point Judith itself and Narragansett. See Map 16 below.

Map 16: Census reference map of the location of the Narragansett Pier CDP



Historical/Background information

The land now called Narragansett was originally inhabited by the Algonquin Indians until 1659 when a group of Connecticut colonists purchased it. Over the next half-century, the Rhode Island, Connecticut and Massachusetts colonies all vied for control of Narragansett until the British crown placed the area under the control of Rhode Island.

By the 1660s, settlers put the fertile soil to use by developing agriculture in the area. Soon the area's economy depended on the export of agricultural products to markets such as Boston, Providence, and Newport. At this time, Point Judith was connected to the sea by a deep, wide breachway, which was used to ship the agricultural goods to market.

In the early 1800's Narragansett, like the rest of the country, experienced rapid industrial growth, particularly in the textile industry. By the mid 1800's the resort tourism industry developed in Narragansett including the once popular Narragansett Casino. However, most of the tourism resorts were destroyed in a fire in the early 1900s.[493]

By the 1800's many farmers began to supplement their income by fishing for bass and alewife, or digging oysters. Eventually, the Port of Galilee was established in the mid 1800's as a small fishing village. By the early 1900's Point Judith's Port of Galilee became one of the largest fishing ports on the east coast. This was largely due to a series of construction projects that included dredging the present breachway and stabilizing it with stone jetties and the construction of three miles of breakwater that provided refuge from the full force of the ocean. By the 1930's wharves were constructed to facilitate large ocean-going fishing vessels.[494] At this point the port became important to the entire region's economy.[495]

Today, Point Judith is not only an active commercial fishing port but supports a thriving tourism industry that includes restaurants, shops, whale watching, recreational fishing, and a ferry to Block Island.

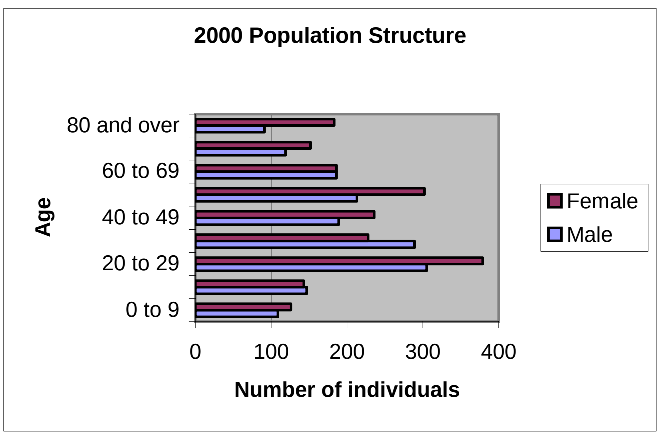
Demographics

No Census data are available for Point Judith itself, but they are available for the county subdivision “Naraganssett Pier CDP” which includes Point Judith. As Point Judith is not actually a residential area, and those who fish from Point Judith live in surrounding communities, this actually is more representative of the “fishing community” than would be any data on Point Judith alone.

According to Census 2000 data, Narragansett Pier CDP had a total population of 3,671, down from a reported population of 3,721 in 1990. Of this 2000 total, 46.3% were males and 53.7% were females. The median age was 44.5 years and 82.4% of the population was 21 years or older while 25.3% were 62 or older.

This area had an unusually high percentage of the population in the 20-29 year age group, especially for males. (See Figure 61 below.) This may have to do with particular employment opportunities for this age group, as well as the presence of the nearby University of Rhode Island.

Figure 61: Population structure by sex in 2000



The majority of the population in 2000 was White (94.0%), with 0.4% Black, 1.7% Native American, 0.1% Asian, no Pacific Islanders or Native Americans, 0.8% other and 1.6% two or more races. (See Figure 62 below.) Hispanics were identified as 1.9% of the population. (See Figure 63 below.) Residents traced their backgrounds to a number of different ancestries: Hungarian (28.3%), Italian (18.8%) and English (17.8%). With regard to region of birth, 60.3% were born in Rhode Island, 36.6% were born in a different state and 3.2% were born outside of the U.S. (including 1.0% who were not United States citizens).

For 93.3% of the population in 2000, only English was spoken in the home, leaving 6.7% in homes where a language other than English was spoken, including 1.2% of the population who spoke English less than ‘very well’.

Figure 62: Racial Structure in 2000

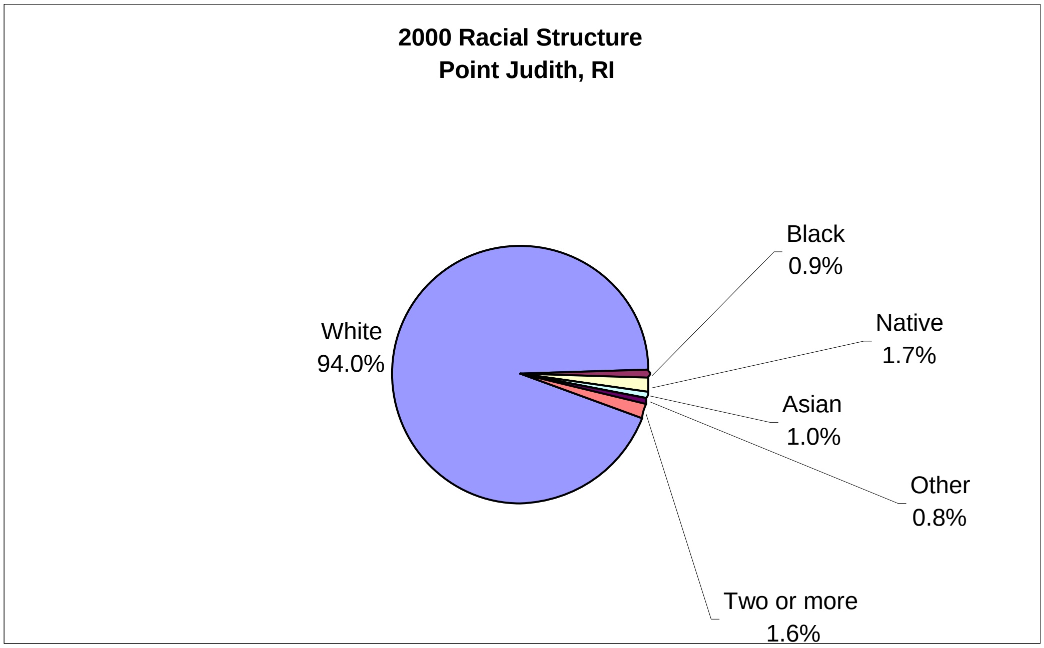
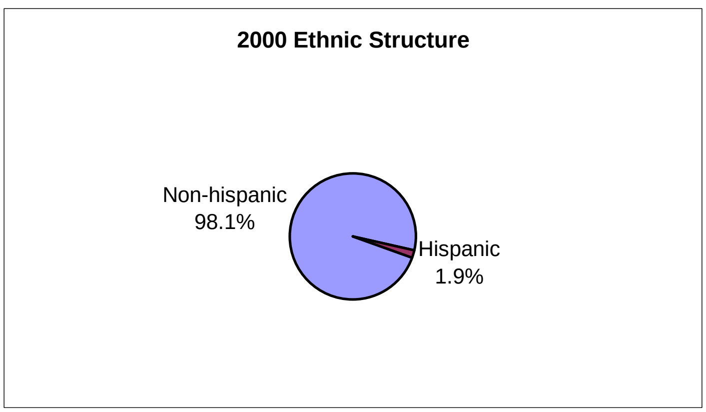


Figure 63: Ethnic Structure in 2000



Of the population 25 years and over in 2000, 21.1% had graduated high school, 18.6% had a Bachelors Degree and 15.5% a Masters Degree. Again of the population 25 years and over, 3.6% did not reach ninth grade, 8.9% attended some high school but did not graduate, 21.1% completed high school, 20.1% had some college with no degree, 6.9% received their associate degree, 18.6% earned their bachelor's degree, and 20.8% received either their graduate or professional degree.

Although religious percentages are not available through U.S. Census data, according to the American Religion Data Archive the religions with the highest number of congregations in Washington County in 2000 included American Baptist Churches (15 with 3,022 adherents), Catholic (20 with 58,668 adherents) and Episcopal (10 with 4,720 adherents). The total number of adherents to any religion was up 57.3% from 1990.

Issues/Processes

Not unlike many fishing communities in the Northeast, increasingly stringent fishing regulations could jeopardize the viability of Point Judith as a fishing port. Specifically, Point Judith processing companies have difficulty handling drastic deviations in the number of landings, commonly due to the lifting or expanding of quotas, as well as sudden changes in what species are landed. Additionally, the boom in tourism at Point Judith has had an adverse effect on the commercial fishing industry. Not only do fishermen battle parking issues but shore front rents for fish processing companies and the cost of dockage and wharfage for vessels have increased.[496]

Cultural attributes

The Narragansett/ Point Judith community celebrates its maritime history with the Blessing of the Fleet, an event that is sponsored by the Narragansett Lion's Club. The festival includes the Blessing of the Fleet Road Race of 10 miles of the surrounding area, a Seafood Festival, and rides at Veteran's Memorial Park that last the throughout the weekend.[497] The 2004 Blessing of the Fleet included approximately 20 commercial and 70 recreational vessels and gathered an estimated crowd of 200 to 300 to view the passing.

Infrastructure

Current Economy

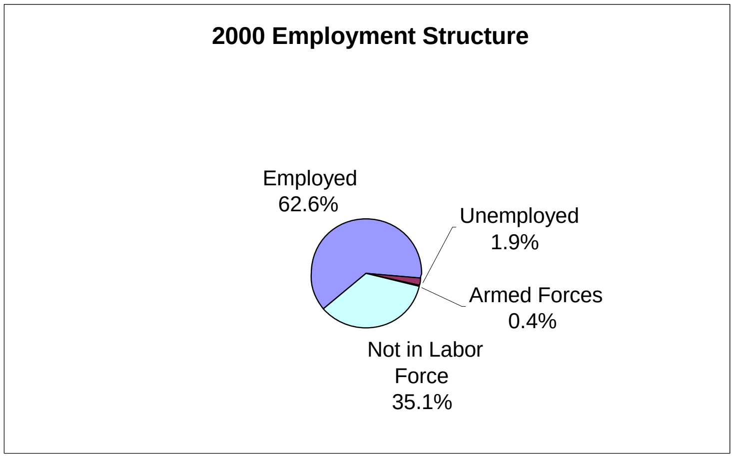
Besides an active fishing port Point Judith supports a thriving tourism industry that includes restaurants, shops, whale watching, recreational fishing, and a ferry to Block Island.[498] It also has a number of fish processing companies that do business locally, nationally, and internationally. Point Judith's largest fish processors are the Town Dock Company[499] and the Point Judith Fishermen's Company – a subsidiary of M. Slavin & Sons based in NY. [500]

Town Dock came to Point Judith in 1980 and is now one of the largest seafood processing companies in Rhode Island. Its facility supports unloading, processing, and freezing facilities under one roof and services "over half of the port's boats (approximately 30 full time deep sea fishing trawlers) as well as a large day-boat fleet . . . and handle[s] all the southern New England and Mid-Atlantic species of fish including Squid, Monkfish, Flounder, Whiting, Scup, Butterfish, and Fluke."[501]

The Point Judith Fishermen's Company (with approximately 15 employees) unloads boats and processes squid which are then taken by M. Slavin & Sons to sell wholesale at the Fulton Fish Market in NY.[502]

Seven smaller processors are also located in the Point Judith area: American Mussel Processors, Inc., Deep Sea Fish of RI, Ocean State Lobster Co., MC Fresh Inc., Narragansett Bay Lobster Co., Inc., South Pier Fish Company, and Sea Fresh America.[503] In 2003, Paiva's Shellfish quit the fillet business and relocated to Cranston as a wholesaler.[504] Economic history up to 1970 can be found in Poggie and Gersuny (1978).[505]

Figure 64: Employment structure in 2000



According to the U.S. Census 2000, 64.0% of the total population 16 years of age and over were in the labor force, of which 1.9% are unemployed and 0.4% were in the Armed Forces. (See Figure 64 above.) Also, jobs with agriculture, forestry, fishing and hunting accounted for 31 jobs (1.6% of the labor force). Self employed workers, a category where fishermen might be found, accounted for 171 jobs or 8.6% of the labor force. Educational, health and social services (30.9%), professional, scientific, management, administrative, and waste management services (12.1%), manufacturing (10.9%) and arts, entertainment, recreation, accommodation and food services (10.3%) were the primary industries.

Median household income in Narragansett Pier CDP in 2000 was $39,918 (up from $31,853 in 1990) and median per capita income was $26,811. For full-time year round workers, men made approximately $4,934 more per year than women.

The average family in Narragansett Pier CDP consisted of 2.7 persons. With respect to poverty, 8.8% of families (up from 2.7% in 1990) and 14.1% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 31.3% of families in 2000 earned less than $35,000 per year (the poverty threshold for a family of nine).

In 2000, Narragansett Pier CDP had a total of 2,067 housing units, of which 82.1% were occupied and 52.7% were detached one unit homes. Only a quarter of these homes were built before 1940. No mobile homes or boats were reported as housing units; 85.2% of detached units have between 2 and 9 rooms. In 2000, the median cost for a home in this area was $195,500. Of vacant housing units, 45.2% were used for seasonal, recreational, or occasional use. Of occupied units, 25.6% were renter occupied.

Government

Narragansett's form of government is a town manager and a five-member town council, headed by a council president. Narragansett was established in 1888 and incorporated in 1901.[506]

Fishery involvement in government

There is a town Harbor Management Commission.[507] NOAA Fisheries, Fisheries Statistics Office, has a port agent based here. Port agents sample fish landings and provide a 'finger-on-the-pulse' of their respective fishing communities.[508]

Institutional

<u>Fishing associations</u>

Point Judith Fishermen's Cooperative was purchased in 1994 and is now run as an independent fish marketing organization.[509] Rhode Island Seafood Council, a not-for-profit organization established in 1976, promotes quality seafood products. The American Seafood Institute was established in 1982 in conjunction with the Rhode Island Seafood Council and provides assistance to the fishing industry in exporting product overseas.[510]

<u>Fishing assistance centers</u>

The Bay Company was developed under the Rhode Island Marine Trade Education Initiative and attempts to link academia to the marine industry to improve productivity and economic viability.[511]

Physical

Besides a ferry that runs from Block Island to Point Judith there is no public transportation to Point Judith. From Block Island it is possible to take another ferry to Montauk, NY.[512] Pt. Judith is about an hour from T.F. Green Airport outside of Providence and not quite 2 hours from Logan Airport in Boston. It is about a 15 min. drive to I-95. Buses to other New England destinations are available at T.F. Green airport.[513] Point Judith also boasts a lighthouse, and docking facilities for both commercial and charter vessels.[514]

Involvement in Northeast Fisheries

Commercial

The number of commercial vessels in port in 2003 was 224.[515] Vessels ranged from 45-99 feet, with most being groundfish trawlers. Of these, 55 are between 45 and 75 feet, and 17 over 75 feet.[516] In 2001, Point Judith was ranked 16th in value of landings by port (fourth on the East Coast).[517] The state's marine fisheries are divided into three major sectors: shellfish, lobster, and finfish. The shellfish sector includes oysters, soft shell clams, and most importantly, quahogs. The lobster sector is primarily comprised of the highly valued American lobster with some crabs as well. The finfish sector targets a variety of species including winter, yellowtail and summer flounder, tautog, striped bass, black sea bass, scup, bluefish, butterfish, squid, whiting, skate, and dogfish. A wide range of gear including otter trawl nets, floating fish traps, lobster traps, gill nets, fish pots, rod and reel, and clam rakes are used to harvest these species. The state currently issues about 4,500 commercial fishing licenses.[518]

Over the 7 year period from 1997-2003, the value of landings in Point Judith varied but seemed to show a declining trend from a high of just over $51 million to a low of $31 million. The landings value of most species categories was lower in 2003 than the eight year average for 1997-2004, with the notable exception of the summer flounder/scup/black sea bass category. (See Table 32, Table 33 and Table 34 below.)

Landings by species

Table 32: Dollar value of landings by species in Point Judith

	Average from 1997-2004	2003 only
Lobster	11,183,490	8,909,290
Squid, mackerel, butterfish	9,939,082	8,199,698
Summer flounder, scup, black sea bass	3,766,712	4,200,556
Smallmesh groundfish	2,881,562	1,998,379
Monkfish	2,669,547	2,211,878
Largemesh groundfish	2,275,901	2,058,342
Other	1,919,901	2,077,514
Skate	580,759	632,957
Herring	476,874	361,180
Scallop	241,949	276,634
Bluefish	94,839	67,811
Tilefish	71,295	174,305
Dogfish	51,622	3,323
Red crab	11,991	0

Vessels by Year

Table 33: Narragansett Pier: All columns represent Federal Vessel Permits or Landings Value between 1997 and 2003

Year	# vessels home ported	# vessels (owner's city)	Home port value ($)	Landed port value ($)
1997	21	61	5,629,991	0
1998	25	55	5,926,038	0
1999	27	60	7,650,042	0
2000	32	61	7,902,294	0
2001	30	62	6,194,920	0
2002	29	53	7,935,212	0
2003	30	52	9,314,990	0

Table 34: Point Judith: All columns represent Federal Vessel Permits or Landings Value between 1997 and 2003

Year	# vessels home ported	# vessels (owner's city)	Home port value ($)	Landed port value ($)
1997	160	0	27,391,809	47,529,746
1998	150	0	26,944,185	42,614,448
1999	154	0	28,674,140	51,144,479
2000	152	0	26,009,364	41,399,853
2001	156	0	23,926,615	33,550,542
2002	150	0	22,079,497	31,341,472
2003	143	0	25,253,827	32,536,928

Recreational

Rhode Island marine waters also support a sizable recreational fishing sector. While complete data on this component is lacking, it is estimated that in the year 2000, some 300,000 saltwater anglers, most from out-of-state, made 1 million fishing trips.[519] This indicates that the recreational component is significant both in terms of the associated revenues generated (support industries) and harvesting capacity. Between 2001- 2005, there were 66 charter and party vessels making 7,709 total trips registered in logbook data by charter and party vessels in Point Judith carrying a total of 96,383 anglers (MRFSS data). A 2005 survey by the RI Dept. of Environmental Management showed Point Judith to be the most popular site in the state for shore based recreational fishing.[520]

Subsistence

No information has been obtained through secondary sources at this time on subsistence fishing.

Future

No information was collected on plans for the future of Point Judith. But, Point Judith fishermen are not very positive about the future of Point Judith as a fishing port. Besides the main concern of stringent fishing regulations Point Judith fishermen also must contend with the ever increasing tourism at the port. This has caused parking issues and rent increases.

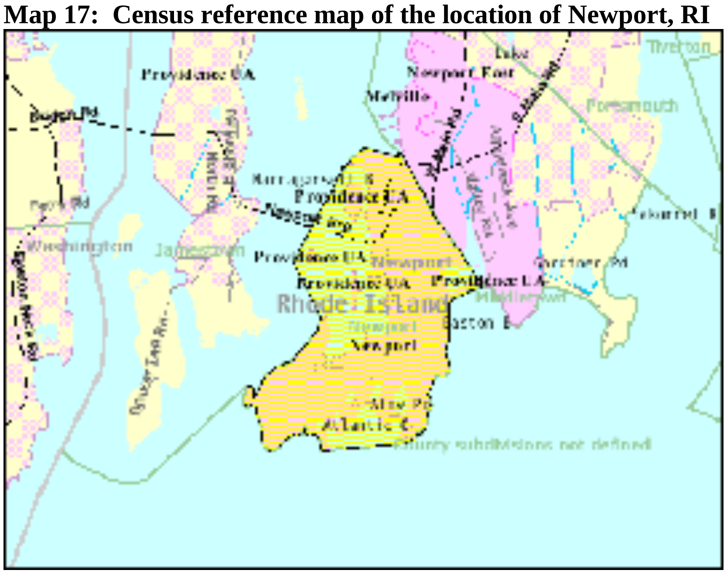
NEWPORT, RI

People and Places

Regional Orientation

Newport, Rhode Island (41.50°N, 71.30°W) is located at the southern end of Aquidneck Island. Newport is 11.3 miles from Narragansett Pier, 59.7 miles from Boston, MA, and 187 miles from New York City. See Map 16 below.

Map 17: Census reference map of the location of Newport, RI



Historical/Background information

English settlers founded Newport in 1639.[521] Although Newport's port is now largely dedicated to tourism and recreational boating, it has had a long commercial fishing presence. In the mid 1700s Newport was one of the five largest ports in colonial North America and until Point Judith's docking facilities were developed it was the center for fishing and shipping in Rhode Island.[522]

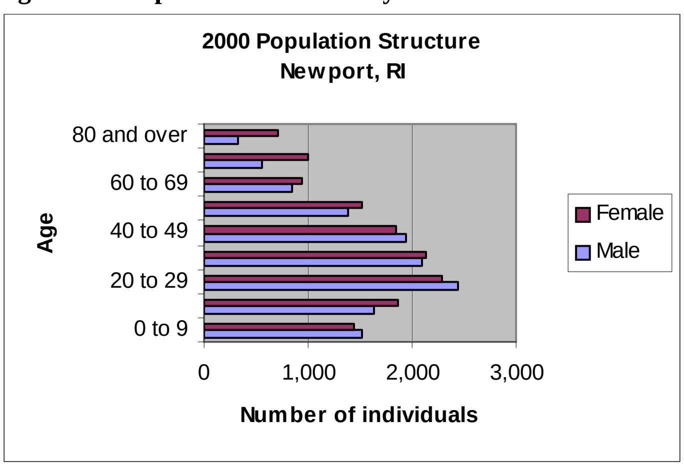
Between 1800 and 1930, the bay and inshore fleet dominated the fishing industry of Newport. Menhaden was the most important fishery in Newport and all of Rhode Island until the 1930s when the fishery collapsed. At this time the fishing industry shifted to groundfish trawling. The use of the diesel engine, beginning in the 1920s, facilitated fishing farther from shore than was done in prior years.[523]

Demographics

According to Census 2000 data, Newport had a total population of 26,475, down from 28,227 in 1990. Of this 2000 total, 51.8% were female and 48.2% were male. The median age for Newport in the year 2000 was 34.9 years and 73.4% of the population was 21 years or older while 14.8% of the population was 62 or older.

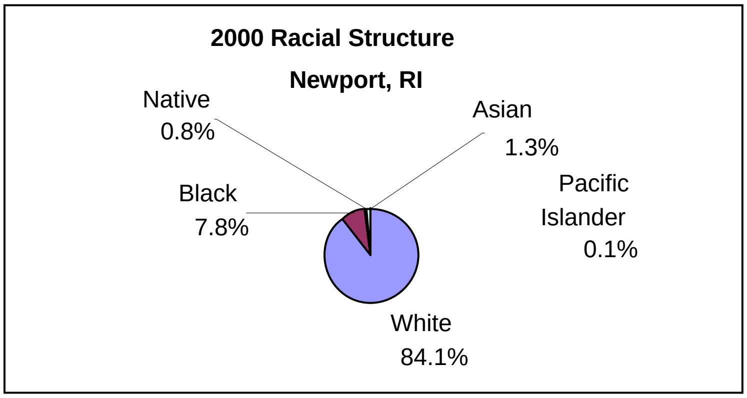
Unlike many fishing communities, Newport's age structure was skewed to some degree to the younger age groups; the largest percentage of the population is to be found in the age group from 20 to 29, which in part reflects the presence of the nearby naval base. Gender balance is fairly even until age 70 and above. See Figure 65 below.

Figure 65: Population structure by sex in 2000



The majority of the population of Newport in 2000 was white (84.1%), with 7.8% Black or African American, 0.8% Native American, 1.3% Asian, and 0.1% Pacific Islander or Hawaiian. (See Figure 66 below.) Of the total population 5.5% were Hispanic/Latino. (See Figure 67 below.) Residents linked their heritage to a number of ancestries including: Irish (27.8%), English (12.9%), Italian (11.4%) and Portuguese (7.3%). With regard to region of birth, 45.6% were born in Rhode Island, 46.7% were born in a different state and 5.6% were born outside of the U.S. (including 2.9% who were not United States citizens).

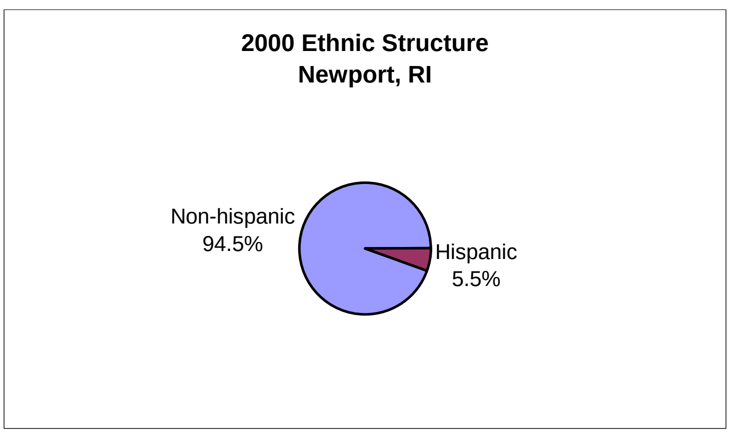
Figure 66: Racial Structure in 2000



For 90.4% of the population in 2000, only English was spoken in the home, leaving 9.6% in homes where a language other than English was spoken, including 3.6% of the population who spoke English less than 'very well'.

Of the population 25 years and over, 21.4% were high school graduates or higher and 26.3% had a bachelor's degree or higher. Again of the population 25 years and over, 4.5% did not reach ninth grade, 8.4% attended some high school but did not graduate, 21.4% completed high school, 18.7% had some college with no degree, 5.5% received their associate degree, 26.3% earned their bachelor's degree, and 15.1% received either their graduate or professional degree.

Figure 67: Ethnic Structure in 2000



Although religious percentages are not available through U.S. Census data, according to the American Religion Data Archive the religions with the highest number of congregations in Newport County in 2000 included Catholic (13 with over 68,668 adherents), Episcopal (10 with 4,720 adherents), and American Baptist (15 with 3,022 adherents). The total number of adherents to any religion was up 57.3% from 1990. Newport has a wide variety of houses of worship, including: Assembly of God, Baha'I, Baptist, Christian Science, Congregational, Episcopal, Friends, Greek Orthodox, Jewish, Lutheran, Methodist, Mormon, Non-Denominational, Pentecostal, Presbyterian, Roman Catholic and Unitarian Universalist.[524]

Issues/Processes

Like other fishing communities, Newport must cope with increasingly strict regulations for many species. In addition, pollution impacts, increased tourism, increasing property values, and competition with recreational vessels for limited wharf space have restricted fishing industry infrastructure and led to declines in Newport's fleet.[525]

Cultural attributes

One of the major events for the city is Tall Ships Rhode Island. The event includes tours of historic national and international Tall Ships, an international marketplace, and family entertainment.[526] The Great Chowder Cook Off and the Taste of Rhode Island festivals both celebrate the region's past and present ties with the fishing industry, at least indirectly, through a celebration of the state's culinary heritage. For a weekend in September, the city celebrates Irish music, culture, cuisine, and crafts along the waterfront with the Newport Waterfront Irish Festival.[527]

Newport Kids Fest - Maritime Fair is another event that remembers the city's maritime history. The event is hosted by the Museum of Yachting and features maritime related activities such as knot tying, lobster races, model boat kits, coast guard safety, and navigation.[528] The annual Blessing of the Fleet takes place in early December as part of the Christmas in Newport festival, and includes a parade by both commercial and recreational vessels decorated for the holidays.[529]

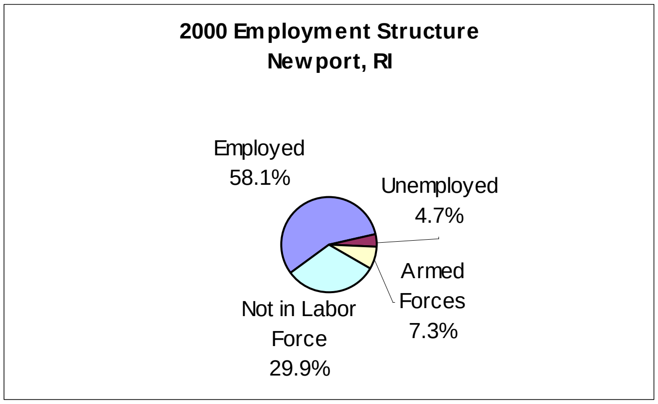
Infrastructure

Current Economy

Aquidneck Lobster Co., Dry Dock Seafood, International Marine Industries Inc., Long Wharf Seafood, Neptune Trading Group Ltd., Parascandolo and Sons Inc., and Omega Sea are wholesalers and retailers of seafood in Newport.[530] Parascandolo and Sons Inc. own a privately operated pier used primarily by the large mesh multispecies fleet.

According to the U.S. Census 2000, 70.1% (15,266 individuals) of the total population 16 years of age and over were in the labor force, of which 4.7% were unemployed and 7.3% were in the Armed Forces. See Figure 68 below.

Figure 68: Employment structure in 2000



According to Census 2000 data, jobs with agriculture, forestry, fishing and hunting accounted for 91 or 0.7% of all jobs. Self employed workers, a category where fishermen might be found, accounted for 1,056 or 8.3% of the labor force. Educational, health and social services (19.9%), arts, entertainment, recreation, accommodation and food services (18.6%), professional, scientific, management, administrative, and waste management services (12.3%), retail trade (10.9%), and manufacturing (7.2%) were the primary industries.

The median household income in 2000 was $40,669 (up from $30,534 in 1990) and median per capita income was $25,441. For full-time year round workers, men made approximately $10,288 more per year than women.

The average family in Newport in 2000 consisted of 2.86 persons. With respect to poverty, 12.9% of families (up from 10.0% in 1990) and 14.4% of individuals earned below the official U.S. Census poverty threshold ($8,794), and 32.4% of families in 2000 earned less than $35,000 per year(the poverty threshold for a family of nine).

In 2000, Newport had a total of housing 13,266 units of which 87.4% were occupied and 37.3% were detached one unit homes. Approximately half (54.4%) of these homes were built before 1940. Mobile homes and boats accounted for none of the total housing units; 88.9% of detached units had between 2 and 9 rooms. In 2000, the median cost for a home in this area was $161,700. Of vacant housing units, 51.7% were used for seasonal, recreational, or occasional use. Of occupied units, 58.1% were renter occupied.

Governmental

The city of Newport is governed through a Council/City Manager form of government. There are seven members; one representative is elected from the City's four voting wards and three are elected at-large, all for two year terms. The Mayor is elected by the Council from among the three at-large councilors.[531]

Fisheries involvement in the government

The city's Department of Parks, Recreation, & Tourism is charged with overseeing, among other things, Easton Beach and Newport Harbor.[532]

Institutional

Fishing associations

There are several fishing associations which aid the fishing industry in Newport. The Ocean State Fishermen's Association is located in nearby Barrington; the Rhode Island Commercial Fishermen's Association, as well as the Rhode Island Lobstermen's Association, are in nearby Wakefield; and the Massachusetts Lobstermen's Association is in nearby Scituate, Massachusetts. The State Pier 9 Association and Atlantic Offshore Fishermen's Association are involved in the Newport's fishing industry.[533]

Other fishing related organizations

The Rhode Island Seafood Council is located in nearby Charlestown[534]. The local Seamen's Church Institute is an organization that brings soup around to the docks for workers and fishermen.[535]

Physical

There are several ways to access Newport and to travel within the city. The Rhode Island Public Transit Authority (RIPTA) buses, and state highway systems provide public access to the city. RIPTA trolleys are generally used to visit Newport. RIPTA's Providence/Newport Water Ferry in Narragansett Bay connects Providence's Point Street Landing and Newport's Perrotti Park.[536] The Rhode Island state airport, the Theodore Francis Green airport is located in Providence. There are three Amtrak stations in Rhode Island, in Kingston, Westerly and Providence.

As for fishing infrastructure, Newport has the State pier #9 which is the only state owned facility for commercial fishing in Newport Harbor, providing dockage for approximately 60 full-time fishing vessels primarily used by the lobster fleet.[537] There are also multiple marinas and moorings.[538]

Involvement in Northeast Fisheries

Commercial

Both the value of landings and the value to home ported vessels in Newport increased over the period from 1997-2003. Of the federal landed species, lobster had the highest value in 2003 and for the average between 1997-2004. The second most important species in 2003 was loligo squid ($1,106,117) followed by monkfish ($1,085,465). See Table 35 and Table 36 below.

The South of Cape Cod midwater trawl fleet (pair and single) consists of eight vessels with principal ports of New Bedford, MA; Newport, RI; North Kingstown, RI; and Point Judith, RI. This sector made 181 trips and landed 17,189 mt of herring in 2003. Maine had the highest reported landings (46%) in 2003, followed by Massachusetts (38%), New Hampshire (8%), and Rhode Island (7%).[539]

Landings by species

Table 35: Dollar value by Federally Managed Groups of Landings in Newport

	Average from 1997-2004	**2003 only**
Lobster	2,673,397	2,979,110

Squid, mackerel, butterfish	1,356,231	1,810,918
Largemesh groundfish	1,108,761	1,692,614
Monkfish	841,475	1,085,465
Summer flounder, scup, black sea bass	643,446	868,455
Scallop	308,642	1,390
Smallmesh groundfish	207,901	191,590
Dogfish	30,961	4,532
Skate	28,326	52,569
Red crab	19,451	0
Bluefish	11,311	21,155
Tilefish	6,482	12,325
Herring	5,961	919
Other	189,219	361,518

Vessels by year

Table 36: All columns represent Federal Vessel Permits or Landings Value between 1997 and 2003

Year	# Vessels home ported	# vessels (owner's city)	Home port value ($)	Landed port value ($)
1997	52	13	5,130,647	7,598,103
1998	52	16	6,123,619	8,196,648
1999	52	14	6,313,350	8,740,253
2000	59	14	6,351,986	8,296,017
2001	52	15	5,813,509	7,485,584
2002	55	17	6,683,412	7,567,366
2003	52	16	7,859,242	9,082,560

Recreational

There is a large recreational fishing sector in Rhode Island. URI SeaGrant reports an approximation of 300,000 saltwater anglers, most from out-of-state, made 1 million fishing trips in 2000.[540] Species targeted out of Newport include: striped bass, tuna, shark,[541] bluefish and fluke.[542] Charter options are numerous.[543]

Subsistence

Information on subsistence fishing in Newport is either unavailable through secondary data collection or the practice does not exist.

Future

From interviews collected for the “New England Fishing Communities” report, Hall-Arber and others found that fishermen fear that increasing tourism and cruise ships will cause the State Pier 9 to be used more for tourism than a harbor for commercial fishing, as the fishing industry is far from being a major economic input to Newport.[544] Until 1973, Newport was Rhode Island’s fishing and shipping center. For example, in

1971 over half of the state's total commercial fisheries landings were in Newport. In 1973 Point Judith became and presides as the most important commercial port.[545]

[1] http://www.montauksportfishing.com/mag2005.htm (accessed April 25, 2007)
[2] Erik Braun, NMFS port agent, E. Hampton, NY, personal communication, July 22, 2005
[3] http://www.easthamptonstar.com/20031127/news6.htm
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[443] http://www.schooner.org/tel/race1.htm
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APPENDIX J. PUBLIC COMMENT SUMMARY AND PUBLIC COMMENT LETTERS

Public Comments on
Amendment 1

Public Comment Period: December 28, 2007 - February 11, 2008

A Federal Register (FR) notice was published on December 28, 2007 [*Vol. 72, No. 248, Page 73799*] that announced the availability of the draft Amendment 1 document for public review and comment. Four meetings were held during the subsequent public comment period. The locations, dates, and times for these meetings were announced thru a separate FR notice [*Vol. 73, No. 9 / Monday, January 14, 2008*] as well as through mass mailing. The public hearings were held in Hampton, VA (January 30, 2008); Riverhead, NY (February 4, 2008); Warwick, RI (February 5, 2008); and Toms River, NJ (February 6, 2008) The Council's deadline for the receipt of public comments was set as February 11, 2008.

During the Amendment 1 public comment period, 91 individuals attended the public hearings and 45 offered public testimony on the amendment. In addition, a total of 214 written comments were received by the Council during this period. The individuals that provided comments during the public comment period represented commercial fishing interests, recreational fishing interests, fishing gear suppliers, environmental organizations, dock owners, public officials, fishing organizations/consultants to fishermen, and dealer and dock owners. Various individuals that provided oral comments during the public hearing process also restated opinions voiced at the public hearings in written letters; multiple submissions of comments were counted only once. A combination of oral and written testimony provided during the public comment period served to indicate and justify individual or group preferences for the management alternatives in Amendment 1. Table 1 provides an overview of the received comments during the public hearing process. The preferences for all alternatives presented in Amendment 1 are summarized in Table 2. The preferences for Alternative 1 (IFQ allocation) as indicated by Full-time tier 1, Full-time tier 2, and part-time vessel owners, captains, crewmembers, shore-side support, and fish dealers and dock owners directly involved in the tilefish fishery are presented in Table 3.

Comments Summary

After the public comment period ended, a brief summary of the comments was presented to the Council at its April 2008 meeting in Annapolis, MD. The following summarizes the comments received either through public hearing testimony or written letters. Comments are organized according to the issue they addressed. Only the issues under consideration in the final version Amendment 1 are included. Comments made in support of preferred alternatives are not elaborated on here since the analyses of impacts available in the main document address these in sufficient detail.

IFQ Program Issues

IFQ Allocation

Comment 1. 26 commenters indicated that they would support the implementation of an IFQ system but suggested that the Council consider using 1984-1998 data as stated in section 1.2.1.7 of the original FMP for allocation purposes. In addition, these individuals suggested that the current TAL allocation to existing tilefish permit categories (66% for Full-time tier 1; 15% for Full-time tier 2; and 19% for Part-time) be changed to 50%, 22%, and 28% for Full-time tier 1, Full-time tier 2, and Part-time, respectively.

Response: Section, 1.2.1.7 of the Tilefish FMP states that:

> "The compromise industry position that the Council also adopted is that when the tilefish fishery is rebuilt or at the end of the 10 year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered."

The NOAA supplementary administrative record (see Appendix B of Volume 2; page App B:8) also states the following:

> "Additional language supported by the industry was incorporated into the FMP. It reflected that when the tilefish fishery is rebuilt or at the end of the 10 year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered. This language sparked a lengthy debate among the Council members at the November meeting. The industry was advised that the Council could not guarantee such a prospective action as the membership of the Council would change as well as the circumstances of the fishery. Legal counsel also advised the membership that the Council could not bind itself to such an action. Industry understood that the Council would endeavor to pursue an amendment in the future to revisit the limited access system it had adopted once the resource had been rebuilt sufficiently. Interestingly, whatever consideration could be given to the historical participants in the future was limited due to the fact that a rebuilt tilefish fishery could support a quota of no larger than 4,000,000 pounds on a sustained basis. This equated to roughly a $10,000,000 fishery. The vessels that qualified for tier 1 and tier 2 had more than enough capacity to harvest this level of quota. In fact, in 1997, one of the vessels that qualified for tier 1 landed 703,516 pounds of tilefish."

Amendment 1 is not changing the formal qualifying period of entry into the limited access system. The same vessels that originally qualified for the existing limited entry program are able to obtain IFQ share allocations. In order to determine the universe of qualified vessels for IFQ eligibility under the various IFQ allocation alternatives discussed in this document, a tilefish limited access vessel owner needs to have been issued a valid tilefish limited access permit for the 2005 permit year (May 1 to April 30). An individual could also qualify to receive IFQ share allocation if they hold a valid Confirmation of Permit History (CPH). A vessel owner that has continually renewed their limited access tilefish vessel permit and/or been issued a valid CPH has clearly shown that he/she intends to continue to fish for tilefish, and/or re-enter the tilefish fishery at a future time.

When the original FMP was developed, the Council and NMFS selected landings data from 1988-1998 for allocation purposes because landings data prior to 1988 was not considered as complete because there were no requirement for vessel owners to report tilefish landings until mid-1990s and then only because tilefish was caught incidental to other species for which the vessel had a federal fishing permit. As such, landings data for the 1988-1998 period were not used for IFQ allocation purposes in Amendment 1.

Finally, the Council did not consider a reallocation of the TAL to each limited access permit categories in Amendment 1 (i.e. 66% for Full-time tier 1; 15% for Full-time tier 2; and 19% for Part-time). When the original FMP was developed, it was found that it was "fair and equitable to all fishermen" (National Standard 4). The limited entry categories and quota allocations were based on historical participation and were proposed by representatives of the vast majority of fishermen involved in the tilefish fishery.

Comment 2. One commenter stated that there were discrepancies between the IFQ alternatives in the draft documents used during the February 2007 Tilefish Committee meeting in Claymont, DE and the April 26, 2007 Tilefish Committee meeting with advisors in Secaucus, NJ. In addition, two commenters indicated that public notification during the development of the Tilefish FMP and Amendment 1 was poor.

The purpose of the February 2007 meeting was to review the FMAT (Fishery Management Action Team) progress regarding the development of Amendment 1 and to provide guidelines for future actions. In April 2007, we held a meeting of the Tilefish Committee with Advisors (expanded advisory group), to review the progress of the FMAT and to discuss and identify possible recommendations for preferred management measures to be presented to the Council at the June 2007 meeting. There were changes made to the DEIS (Draft Environmental Impact Statement) document between the February and April meetings. More specifically, the FMAT incorporated an additional alternative (1E) to the draft document in order to add in additional flexibility to the suite of IFQ allocation management measures presented in the DEIS. However, the Tilefish Committee and Advisors were provided with the updated DEIS document weeks before the meeting for review. In addition, copies of the DEIS document to be discussed at the April 2007 meeting were made available to the public at the meeting. Furthermore, at both of those meetings, PowerPoint presentations with the layout of the management measures for discussion were presented. As such, the changes to the DEIS were made clear during those meetings as well as all other meetings used to discuss the progress and development of the DEIS. At the April 2007 meeting, the Tilefish Committee made recommendations for preferred management measures to be presented to the Council at the June 2007 meeting. Once, they selected recommendations for preferred management measures, the Committee Chair asked the public to provide an insight on how they were planning to comment on these measures during the upcoming public hearing period if possible.

Regarding the public notification process during the development of the Tilefish FMP and Amendment 1, the Council followed all notification requirements needed when developing these documents.

Comment 3. One commenter asked if he could continue to land grey tilefish and golden tilefish under the 300 lb incidental permit if an IFQ system is implemented.

Response: The proposed IFQ system in Amendment 1 is only for the limited access permit categories (Full-time tier 1, Full-time tier 2, and part-time vessels). Vessels holding an incidental tilefish permit may continue to fish for golden tilefish under the incidental permit rules. The Tilefish FMP manages golden tilefish only. Currently, there is no management plan for other tilefish in the Northeast region. As such, there is no limit on the amount of grey tilefish allowed to be landed.

Comment 4. One commenter indicated that landings back to the early to mid-70s should be used for allocation purposes. This would reward the people that developed the fishery.

Response: See response to Comment 1.

Comment 5. One commenter asked where the average landings for the 2001-2005 period came from as one of the historical time allocation periods included in the document.

Response: The initial apportionment of the IFQ shares to qualifying permit holders would be based on historical landings from one of three proposed sets of time periods (i.e., average landings for years 1988-1998; average landings for years 2001-2005; and average landings for the best five years from 1997 through 2005). These time periods were developed by the FMAT and Tilefish Committee after reviewing information obtained during the scoping meetings and early development of Amendment 1.

Comment 6. One commenter indicated that he holds an incidental tilefish permit and would like to know if he could qualify for an IFQ allocation as a Part-time vessel under the proposed IFQ system proposed under Amendment 1.

Response: No. The proposed IFQ system in Amendment 1 is only for the limited access permit categories (Full-time tier 1, Full-time tier 2, and part-time vessels). Vessels holding an incidental tilefish permit may continue to fish for golden tilefish under the incidental permit rules if an IFQ system is implemented. Amendment 1 is not changing the structure of the vessels that qualified for the limited access fishery when the FMP was implemented. When the original FMP was developed, it was found that the vessels qualifying for limited access privilege and the associated quota allocations to each permit category were "fair and equitable to all fishermen."

IFQ Fee and Cost Recovery

Comment 7. One commenter asked what the cost of managing the fishery was under an IFQ system.

Response: Preliminary analyses show that the potential cost to manage the IFQ system would be approximately $94,000. However, the NMFS will not know with certainty what the overall cost directly related to management, data collection and analysis, and enforcement of the proposed IFQ program will be until the end of the first year of implementation. The Magnuson-Stevens Fishery Conservation and Management Act requires that a fee be established to recover the actual costs directly related to management, data collection and analysis, and enforcement of IFQ programs. Under section 304(d) (2) (A) of the Act, the Secretary is authorized to collect a fee to recover these costs. The fee shall not exceed 3-percent of the ex-vessel value of the fish harvested. The Council approved the implementation of an IFQ cost recovery program under Amendment 1 (3-percent fee). It is important to mention that while Amendment 1 could impose an initial default fee and cost recovery rate of 3-percent, this rate may change in subsequent years if the fee and cost recovery is lower than initially assessed.

Duration of the IFQ Program

Comment 8. One commenter suggested that the life of the IFQ system should not extend past 15 years or the life of the IFQ holder. Then, it should go into a lottery system to allow others (e.g., deckhands) to enter the system.

Response: IFQ privileges would be assigned for the duration of the IFQ program. The IFQ program would remain in effect until it is modified or terminated. The program may be modified after going through an administrative review of the operation of the program. As indicated above, the reauthorized Magnuson-Stevens Act of 2006 requires a formal program review five years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every seven years).

According to the reauthorized Magnuson-Stevens Act of 2006, a limited access privilege is a permit issued for a period of no more than 10 years. The permit can be renewed before the end of that period, unless it has been revoked, limited, or modified as provided by the Act (section 303A(c)(7)(f)). It is important to mention that while the limited access privilege permit needs to be renewed, the allocation of that permit does not necessarily have to change.

The proposed IFQ system in this document does not implement a sunset provision (A sunset provision requires IFQ programs and shares to end after a certain period of time). The Council believes that establishing a sunset provision could decrease the overall efficiency of the system. The quota share values are based on the present value of the stream of net revenues derived from owning the quota. Setting a sunset provision could decrease the number of years the program would be in place, thus, reducing the future stream of net revenues and increasing the uncertainty associated with the program.

The proposed IFQ system under Amendment 1 allows for transferability (temporary e.g., leasing, within fishing year or fishing season and permanent e.g., sale). As such, individuals that did not receive initial IFQ allocation could participate in the fishery in the future via leasing or buying IFQ shares. Furthermore, a proportion of the fees and recovered costs recovered via the fees and cost recovery program (up to 25%) go into a fund to facilitate the participation of future entrants.

Lastly, as required under the reauthorized Magnuson-Stevens Act of 2006, a formal program review five years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every seven years) will be implemented with Amendment 1. This measure would provide for an enforceable provision for regular review and evaluation of the performance of the IFQ program.

Comment 9. 26 commenters indicated that they would like to see a 12.5% share cap accumulation.

Response: The Amendment 1 Public Hearing Document contained a wide array of alternatives that would implement IFQ share accumulation caps (i.e., no cap limit; 49% cap; 37% cap; 25% cap; and 16.5% cap). The proposed 12.5% cap by these individuals was not part of the management measures for consideration presented in the Amendment 1 Public Hearing Document.

Commercial Vessel Logbook Reports

Comment 10. Several comments indicated that the Council needs to work with the NMFS to implement logbook reporting.

Response: Amendment 1 contained two alternatives that would implement new reporting requirements. Alternatives 10B (exempt longline tilefish vessels from current logbook record keeping requirements (VTR) and implement a specific logbook system for those longline vessels) and 10C (implement an electronic reporting system for commercial landings) were considered but rejected for further analysis because alternative 10B may be too burdensome to implement for all parties involved and currently there are no management system capabilities to implement alternative 10C.

However, the Service is working to develop the necessary systems and procedures to implement such data collection. Under the current regulations the Regional Administrator already has the authority to implement electronic reporting systems; therefore, this alternative is not needed. It is expected that when the necessary system and procedures to implement such a system are in place, NMFS may require that they are used in several fisheries as currently authorized by Federal regulations.

Hook Size Restrictions

Comment 11. One commenter indicated that while he understands that there will be no action at this time regarding the implementation of a hook size in the commercial fishery, he would like to stress that hooks are manufactured in Norway and it would need a phase-in period for changing hook sizes.

Response: Only one hook size restriction was considered but rejected for further analysis in Amendment 1. While studies have shown that hook size affects size selectivity in longline fisheries worldwide, a specific study is needed to determine hook size selectivity in the tilefish fishery, and to determine and account for catch rate changes with hook size in the commercial CPUE. Council staff and NEFSC scientists will continue to work with industry to develop research proposals with industry assistance to conduct this type of research.

It is important to mention that under the current FMP, hook size management measures can be added or modified under the framework adjustment process as soon as scientific information is available to justify such actions. This adjustment procedure allows the Council to add or modify management measures through a streamlined public review process at any time during the year. If a commercial hook size restriction were to be implemented in the future, the Council would take into consideration supply factors associated with any new required gear changes as well as current availability of gear being replaced in order to assess implementation dates for any new required gear changes.

Recreational Issues

Recreational Permits and Reporting Requirements

Comment 12. Several commenters indicated that there was no need to implement a recreational operator permit for this species specifically under preferred alternative 12B. Alternative 12B in the Public Hearing Draft would establish a party/charter tilefish vessel permit, a party/charter tilefish operator permit, and party/charter vessel reporting requirements.

Response: As indicated by staff during the public hearing meetings where this issue was discussed, it was not the intention of the FMAT or the Tilefish Committee to implement a tilefish operator permit. However, the intention of the FMAT and Tilefish Committee was to require the generic operator permit, along with a party/charter tilefish vessel permit when conducting for-hire tilefish fishing trips. These vessels are also to provide reporting requirements as specified in Amendment 1. At the April 2008 Council meeting, the Council approved to exclude the tilefish operator permit requirement from Amendment 1. However, any individual who operates a party/charter boat for the purpose of fishing recreationally for tilefish (i.e., possesses a valid recreational party/charter permit to fish for tilefish) must have an Operator's Permit issued by NMFS. Any vessel fishing recreationally with a party/charter boat permit must have on board at least one operator who holds a permit. That operator may be held accountable for violations of the fishing regulations and may be subject to a permit sanction. During the permit sanction period, the individual operator may not work in any capacity aboard a federally permitted fishing vessel.

Comment 13. One commenter questioned the measures that would implement reporting requirements for party/charter tilefish trips. He argued that party/charter vessels are already maintaining trip logs.

Response: While it is true that for-hire vessels are required to report recreational catch via VTR, it is possible that tilefish trips may not be reported under the current reporting requirements. Requiring that party/charter vessels report tilefish landings using logbooks is a valuable tool to manage the fishery. The collection of this information would provide valuable information to determine the number of vessels and level of activity in the recreational fishery.

Recreational Bag-size Limit

Comment 14. Several commenters indicated that we do not need a recreational bag-size limit. These individuals indicated that the number of recreational tilefish trips is limited by weather and sea conditions as the fish are found offshore in deep water. As such, recreational participation is very small.

Response: At the April 2008 Council meeting, the Council selected to establish an 8-fish recreational bag-size limit per person per trip (the highest limit among the alternatives implementing bag-size limits). The Council believes that this proactive alternative would maintain recreational effort at the upper range of the mean effort seen in the last 10 years. As additional information about this sector of the fishery is collected, recreational bag-size limits can be adjusted via the framework adjustment process.

Other Recreational Issues

Comment 15. Several commenters indicated that they would like to see a recreational allocation for the party/charter fishery separate from the total recreational allocation.

Response: The current FMP regulations allow for tilefish to be harvested by the recreational sector. When the FMP was first developed, the recreational participation in this fishery was very small and there was not a substantial directed recreational fishery. As such, a recreational allocation was not implemented. Recreational landings continue to be small today. Recreational catches have been low for the last two decades ranging from zero for most years to less than 5,000 pounds in 2003 according to MRFSS data. The Council will continue to monitor this sector of the fishery to assess the need for changes in the management system. Amendment 1 will implement permitting and reporting requirements for this sector of the fishery. It is anticipated that these requirements will enhance the understanding of this sector of the fishery.

Habitat Issues

Comment 16. One commenter urged the MAFMC to participate in the development of the Essential Fish Habitat Omnibus Amendment 2 that the NEFMC is developing.

Response: One MAFMC member represents the Council in the NEFMC Habitat Committee. In addition, a staff member (Senior Ecologist) of the MAFMC has been asked to directly participate in the development of Phase 2 of the Essential Fish Habitat Omnibus Amendment 2.

Comment 17. Several commenters indicated that Federal Court cases (NRDC v. Evans in 2003 and Hadaja v. Evans in 2003) stated that there was no scientific evidence to conclude that bottom tending mobile gear as having identifiable impacts on tilefish EFH.

Response: The impact of tending mobile gear on tilefish EFH discussed in Amendment 1 is based on new scientific information. While impacts to habitat from tilefish directed fishing are not anticipated, there may be potential for other fisheries using these bottom trawling gears to impact tilefish habitat and EFH. The Northeast Region EFH Steering Committee Workshop (NREFHSC 2002; Stevenson et al. 2004; see Appendix E for a detailed discussion) concluded that there was potential for a high degree of impact to the physical structure of hard clay outcroppings (pueblo village habitats) by trawls that would result in a change to the major physical feature that provides shelter for tilefish habitat.

Comment 18. One commenter suggested that if GRAs are put in place for bottom tending mobile gear, then, the potential GRAs should be for all commercial and recreational gear types.

Response: A detailed review of gear impacts of the tilefish fishery on EFH is presented in Appendix E. That review indicates that there was potential for a high degree of impact to the physical structure of hard clay outcroppings (pueblo village habitats) by trawls that would result in a change to the major physical feature that provides shelter for tilefish habitat associated with the use of bottom trawling gears. The dominant gear type in the tilefish fishery is bottom longlines set with hooks, which constitutes 89% of the landings and is not associated with impacts to bottom habitat or EFH.

Comment 19. Two commenters indicated that the practicability analysis seem to underestimate the monetary losses associated with potential GRA closures.

Response: The value of otter trawl landings from the proposed GRAs was generated using single point position from VTR. Fishermen are required to provide a single position from each tow but may actually travel over large areas of bottom during the many tows of the trip. If the VTR data is not properly filled out, then, using this data may underestimate revenues derived from specific closed areas.

Other Issues/Comments

Comment 20. One commenter was concerned that allowing the quota to go to a small group of people when the stock was not in good shape could be problematic in the future when the stock is rebuilt as bycatch problems could increase.

Response: Under Amendment 1, the incidental permit category would continue to operate as it currently operates (open access fishery). Under the current management system, trip limits are only imposed in the incidental permit category to achieve a "target" or soft quota. The trip limit may be reduced from one fishing year to the next for overages in the target quota percentage. Five percent of the overall annual quota will be taken off the top of the quota (before it is distributed among the longline vessels) and will be provided to the incidental category for this “target” quota with a trip limit of 300 pounds set initially. The 300 pound limit was chosen because in 1997 (total landings 3.9 million lb) and 1998 (total landings 2.9 million lb), 99% of the incidental landings were 300 pounds and below with an average of 100 pounds. This average is highly skewed because of the large number of trips reporting landings averaging 28 to 30 pounds. Based on 1998 data, only five non longline vessels made a total of 23 trips that landed more than 300 pounds of tilefish. The 300 pound trip limit is a compromise initially to balance the non directing fisheries’ honest bycatch needs while trying to minimize the regulatory discards, but not have the limit provide incentive for anyone to direct on tilefish.

When the tilefish fishery is fully recovered, a quota no larger than 4 million lb will be available. This overall landings level is very close to the total landings that occurred in 1997, one of the years that were used to derive the current incidental trip limit landings level. As such, it is likely that the current 300 lb incidental trip limit will continue to allow this sector of the fishery to operate at the incidental level. Furthermore, the framework adjustment process implemented in the FMP allows for a revision of the trip limits if needed.

Comment 21. One commenter indicated that CPUE was not a reliable way to manage the fishery.

Response: Tilefish are rarely captured in the NEFSC bottom trawl surveys, resulting in full reliance on fishery dependent bottom longline CPUE data as an index of abundance. The latest stock assessment (SAW 41; June 2005) was peer reviewed and it is considered the best available science for status determination and management purposes.

Comment 22. One commenter asked if there was a scoping meeting in New England during the development of Amendment 1.

Response: Two scoping meetings were held during the development of Amendment 1. One meeting was in Southampton (NY) and the other in Atlantic City, Egg Harbor Township (NJ). There were four public hearings held during the development of Amendmen1. These meetings took place in Hampton (VA), Riverhead (NY), Warwick (RI), and Toms River (NJ).

Public Hearings

The comments provided at the public hearings are encapsulated in the Comment Summary above. The following provides additional information on the dates, times, locations, and attendance at the hearings.

Hampton, VA
January 30, 2008

Hearing Officer Jack Travelstead opened the hearing at 7:05 pm. There were 30 people present in the audience. Staff in attendance: Dr. José Montañez, Rich Seagraves, Tom Hoff, Dan Furlong, and Jan Bryan. Council members in attendance: Scott Holder, Jeff Deem, Laurie Nolan, Jack Travelstead, Erling Berg, and Lee Anderson. Public in attendance: Greg DiDomenico, James Fletcher, Brooks Mountcastle, Jim Kendall, Brian Hooker, and Luke Nagenguard. Some of the speakers included: Luke Naganguard, Don Braddick, Benson Chiles, Greg DiDomenico, Jim Fletcher, Frank Green, and Jim Kendall. Hearing closed at 8:41 pm.

Riverhead, NY
February 4, 2008

Hearing Officer Laurie Nolan opened the hearing at 7:00 pm. There were 14 people present in the audience. Staff present was Dr. José Montañez and Kathy Collins. Some of the speakers included: Phil Curcio, Jim Kendall, Frank Green, James Gutowski, Dan Farnham, and Eric Lundvall. Hearing closed at 8:35 pm.

Warwick, RI
February 5, 2008

Hearing Officer Laurie Nolan opened the hearing at 7:00 pm. There were 11 people present in the audience. Timothy Cardiasmenos of NMFS, NERO and Barbara Rountree of NEFSC were present. Council staff present was Dr. José Montañez and Kathy Collins. Some of the speakers included: Gib Brogan, Phil Ruhle, Dan Farnham, Jim Kendall, Chris Brown, Bro Cote, Keith Larson, and Frank Green. Hearing closed at 8:42 pm.

February 6, 2008
Toms River, NJ

Hearing Officer Paul Scarlet opened the hearing at 7:00 p.m. There were 36 people present in the audience. Council member Ed Goldman was also present. Council staff present was Dr. José Montañez and Kathy Collins. Some of the speakers included: Alan Weiss, Lou Puskas, Rick Marks, Mike Paras, Steve Forsberg, Kristen Larson Panacek (for Ernie Panacek of Viking Village), David Arbeitman, Rick Mears, Dan Mears, Peter Dolan, Tony Bogan, Frank Green, Bob Maxwell, John DePersenaire, Jeff Gutman, Len Elliott, and James Gutowski. Hearing closed at 8:40 pm.

TABLES

Table 1. Overview of Received Comments During the Public Hearing Process.

Date	Location	# Commenters	# Public Attending
January 30	Hampton, Virginia	9	30
February 4	Riverhead, New York	7	14
February 5	Warwick, Rhode Island	9	11
February 6	Toms River, New Jersey	20	36

●A total of **214 written comments** were received by the Council. **75** comments came from fishermen; **6** comments came from fishing organizations/associations/groups (2 with multiple signatures [3, 15]); **3** comments came from consultants to fishermen; **1** comment came from a fish dealer; **1** comment came from a dock owner; **1** comment came from a fish dealer/dock owner; **4** comments came from conservation organizations (1 with multiple signatures [2]); **3** comments came from recreational interests; **1** comment came from a member of congress; and **119** comments came from other individuals (e.g., friends; family members; general public). A few letters represented the views of various individuals or unspecified number of commercial fishermen/members pertaining to a specific organization but were only signed by one individual; these comments were tabulated as one comment per letter.

●A total of **36 oral comments** were made during the public hearing process (not counting comments made by same individuals at multiple meetings). **20** comments came from fishermen; **7** comments came from recreational interests; **2** comments came from conservation organizations; **6** comments came from fishing organizations/consultants to fishermen; and **1** comment was made by a fishing gear supplier.

●Various individuals that provided oral comments during the public hearing process also provided written comments; multiple submissions of comments were counted only once.

●**1** of the written comments received by the Council came before the public hearing process started. In addition, **8** written comments arrived to the Council office after the closing comment date (February 11, 2008) but before the Council meet on April 10, 2008 to select preferred alternatives to be included in the FEIS and approximately **48** additional written comments arrived to the Council office after the Council had met at the April 10, 2008 meeting. In addition, **2** e-mails arrived at the Council office with no comments attached. Late comments were not tabulated.

Table 2. Enumeration of Preferences for Management Alternatives as Indicated During the Public Comment Period for Amendment 1.

Issue	# of comments in support of:						
IFQ Allocation	1D2	1D2A	1D4	**1E***	1F[a]	1D1A/ 1D4/1E	**Total**
	121	31	25	30	1	1[b]	209
Permanent IFQ Transferability of Ownership	2B	**2C***	2E				
	2	30	24				56
IFQ Leasing (Temporary Transferability of Ownership)	**3B***	3C					
	34	24					58
IFQ Share Accumulation	4A	4C	Oppose all options				
	1	30	24				55
Commercial Trip Limits (Part-Time Vessels)	**5A***						
	86						86
Fees and Cost Recovery	6A	6B	6C	6B/6C	No position		
	9	21	24	1	1		56
IFQ Program Review Process	**7B***	No position					
	55	1					56
IFQ Reporting Requirements	**8B***	No position					
	55	1					56
IVR Reporting Requirements	**9B***	No position					
	55	1					56
Commercial Vessel Logbook Reports	10A	10C[a]	No position		No comment		
	31	1	1		24		57

Bolded alternatives with an **asterisk (*)** are preferred alternatives.
[a] Considered but rejected for further analysis.
[b] Supports all three alternatives as long as equal allocation is implemented.
[c] Five individuals support alternative if tilefish is removed from the operator permit requirement.

Table 2 (Continued). Enumeration of Preferences for Management Alternatives as Indicated During the Public Comment Period for Amendment 1.

Issue	# of comments in support of:						
Hook Size Restrictions	11A	No position		No comment			**Total**
	27	1		32			60
Recreational Permits and Reporting Requirements	12A	**12B***					
	4	61[c]					65
Recreational Bag-Size Limits	**13A***	13B					
	34	29					63
Monitoring of Golden Tilefish Landings	14A	**14B***					
	23	25					48
Framework Adjustment Process	**15B***						
	49						49
EFH Designation	16A	**16B***					
	3	47					50
HAPC Designation	17A	**17C***	17D				
	1	49	2 (16A, 16B)				52
Measures to Reduce Gear Impact on EFH	18A	18B	18C				
	48	1	2				51
Management Measures for Collecting Royalties	**19A***						
	49						49

Bolded alternatives with an **asterisk (*)** are preferred alternatives.
[a] Considered but rejected for further analysis.
[b] Supports all three alternatives as long as equal allocation is implemented.
[c] Five individuals support alternative if tilefish is removed from the operator permit requirement.

Table 3. Enumeration of preferences for Alternative 1 (IFQ Allocation) as indicated by FTT1, FTT2, and PT vessel owners, captains, crewmembers, shore-side support, and fish dealers and dock owners directly involved in the tilefish fishery during the public comment period for Amendment 1.

Alternative	Total # of comments supporting alternative
1D2 (2001-2005)	12 (FTT2)
1D2A (equal allocation among vessels that landed during the 2001-2005 period)	20 (PT)
1D4 (equal allocation among vessels that qualified for limited access program; in addition want Council to use 1984-1998 for allocation purposes)	21 (4 FTT2 / 15 PT/ 2 Dock Owners)
1E* (2001-2005)	22 (21 FTT1 / 1 Dealer)
1F	- -
1D1A, 1D4, 1E (equal allocation among vessels that qualified for limited access program)	1 (PT)

Bolded alternative with an **asterisk (*)** is preferred alternative.

FTT1 = Full-time tier 1 permit category; FTT2 = Full-time tier 2 permit category; PT = Part-time permit category.

APPENDIX J (CONTINUED)
PUBLIC WRITTEN COMMENTS

SUBMITTED COMMENTS
2/6/08
TOMS RIVER, NJ

David Arbeitman
1126 Gowdy Ave #3
Pt Pleasant, NJ 08742

My name is David Arbeitman. I have owned and operated The Reel Seat Tackle Shop in Brielle, NJ for the past 26 years. I am also a recreational Tilefisherman. I would like to make the following comments.

With regards to Recreational Permits and Reporting Requirements, I am in favor of option 12A no action, maintain status quo.

Partyboat and charter boat operators are presently required to maintain trip logs which includes catch data and submit them within 30 days of the trip. Requiring further permits using better data collections as the reason amounts to nothing other then another fee. Have the tuna permits resulted in better data collecting? Besides, every time we fishermen, both recreational and commercial request the inclusion of catch data in determining quotas and allocations we are told this data is anecdotal. I guess a permit would change that.

With regards to Recreational Bag and Size limits, I agree with the council to take no action and maintain status quo. There are many factors to support this position. Because the fishery occurs so far offshore, the amount of trips is limited due to weather and sea conditions. Also, the number of anglers is limited on these trips because this is drift fishing and all anglers fish from one side of the boat. The fact that the fishing occurs in extremely deep water limits the recreational catch. The bottom line is recreational participation is limited and the catches are insignificant. It is inconceivable to think that the small number of recreational fishermen who enjoy this historical fishery which dates back to 1969 can catch enough fish to impact the Tilefish biomass.

Montanez, Jose L.

From: Supafo@aol.com

Sent: Thursday, February 07, 2008 6:43 PM

To: Info

Subject: Tilefish 1 Comments

I prefer alternatives 18a Steven Follett FV HeatherLynn Pt Jutith R.I.

WE ARE PROUD OF

FISHERMEN

UNITED NATIONAL FISHERMEN'S ASSOC.
123 APPLE RD. MANNS HARBOR, N.C. 27953
252
919-473-3287

RECEIVED
FEB - 8 2008
MID-ATLANTIC FISHERY COUNCIL

Mid-Atlantic Management Council
Room 2115 Federal Building
300 South New St.
Dover DE.19904

TILE Fish Comments:

Any tile fish area closed to trawl gear should be closed to all fishing recreational & commercial.

Any ITQ ALLOCATION, SECTOR or quota assignment of any type should carry a sunset provision.
A fisherman could hold for life and at death transfer to an immediate family member for life.
If the ITQ is sold prior to death of the person holding the ITQ. The ITQ (by what ever name) is only good for 15 years after the sale or transfer. The ITQ then goes into a lottery of persons showing operators permits and a history of being involved in commercial fishing. Allowing ITQ in perpetuity does not benefit the nation.
Recreational measures MUST place an exact limit on the number of vessels, operator licenses, length & horsepower restrictions to prevent over capacity, that may be / become involved in recreational fishing for or landing tile Fish.
CAN NOT ALLOW AN UNRESTRAINED INCREASE IN RECREATIONAL HARVEST OR ENTRY!
Must have recreational gear of barb-less hooks.

Please include my comments made at Newport News VA.

James Fletcher director 02-06-07
James Fletcher

Montanez, Jose L.

From: Frank Kearney [f.kearney3@verizon.net]
Sent: Sunday, February 10, 2008 6:52 AM
To: Info
Subject: Tilefish I Comments

I would like to comment on parts of Amendment I to the Tilefish Fishery Management Plan. As a recreational fisherman from Virginia, I would like to comment on the FMP.

12-Recreational Permits and Reporting Requirements:
I favor alternative 12B: Establish a party/charter tilefish vessel permit, a party/charter tilefish operator permit, and party/charter vessel reporting requirements.

13-Recreational Bag Limits:
I favor alternative 13B-Establish a 8-fish recreational bag-size limit per person per trip. At the present time in Virginia we have a bag limit of 7 fish.

Frank A. Kearney III
102 Boxwood Point Road
Hampton, VA 23669
Phone 757-723-7652
Fax 757-723-0592
Cell 757-880-2888

Montanez, Jose L.

From:	Furlong, Daniel T.
Sent:	Monday, February 11, 2008 10:27 AM
To:	Montanez, Jose L.
Subject:	FW: Comment to Amendment 1 to Tilefish

Here's another one.

-----Original Message-----
From: Agee James D NNVA [mailto:AgeeJD@SUPSHIP.NAVY.MIL]
Sent: Monday, February 11, 2008 10:06 AM
To: Info
Subject: Comment to Amendment 1 to Tilefish

As a recreational fishermen in the state of Virginia, I would like to comment to the management plan Amendment 1 to tile fish. I only want to comment to the two alternative that pertain to recreational fishermen. Alternative 12: I support option 12B the Preferred alternative.

Alternative 13: I support option 13B.

James D. Agee

702 Lake Dale Way

Yorktown, Va 23693

757-865-8022

JIM SAXTON
THIRD DISTRICT, NEW JERSEY
WWW.HOUSE.GOV/SAXTON
JOINT ECONOMIC COMMITTEE
RANKING MEMBER
NATURAL RESOURCES COMMITTEE
SUBCOMMITTEE:
FISHERIES, WILDLIFE AND OCEANS

ARMED SERVICES COMMITTEE
SUBCOMMITTEES:
AIR AND LAND FORCES
RANKING MEMBER
TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES

José
2/20/08

U.S. House of Representatives
Washington, DC 20515

February 11, 2008

Daniel T. Furlong
Executive Director
MAFMC
300 south New Street, Room 2115
Dover, DE 19904
via facsimile 302.674.5399

Dear Mr. Furlong:

Thank you for the opportunity to comment on the Public Hearing Document Amendment 1 to the Tilefish FMP. As you know, I am keenly aware of the new Magnuson-Stevens Act Limited Access Privilege Program (LAPP) requirements that Congress recently passed into law. In the 3rd District of New Jersey, which I represent, I have a number of constituents that are historic and present day tilefish-fishermen. I am very interested to see that they are treated fairly in the LAPP allocation process.

As you know, I contacted the Department of Justice (DOJ) in June 2007 to request guidance on antitrust, excessive geographic concentration, and allocation consolidation issues germane to the tilefish fishery. The DOJ promptly contacted Assistant Administrator Dr. William Hogarth (September 2007) who in turn contacted my office to assure me that the new LAPP requirements and those of National Standard 4 would be met.

My concerns are simple. The Tilefish IFQ program, to be consistent with MSA requirements, must recognize historic and current participation, and must not allow for an excessive or inequitable concentration of fishing privileges. The provisions of the Act are intended to prevent excessive consolidation, anti-competitive activities, and should promote social and economic benefits in small communities like Montauk, New York and Barnegat Light, New Jersey.

It has come to my attention that, among the options under consideration, a few closely related participants from one shore side facility have the potential to secure 66% of the entire East Coast tilefish harvest. This is exactly the type of allocation scheme that the M-SA's (See 16 U.S.C. 1853a) Section 303.A(5)(B) and (D) were intended to prevent. This may be even more critical now as this is the first LAPP to be implemented since reauthorization.

I strongly urge the MAFMC to carefully weigh all the options and provide access for fishermen in a manner that does not result in excessive geographic and other consolidation in harvesting or processing and ensure that LAPP share holders do not acquire excessive shares in the East Coast tilefish fishery.

Thank you for the opportunity to comment on the Public Hearing document for the Amendment 1 to the Tilefish FMP. I look forward to continuing to work with the MAFMC to ensure that the IFQ program for tilefish is fair & equitable for all participants. Please do not hesitate to contact my staff should you have any additional questions.

Sincerely,

J. Saxton

Jim Saxton
Member of Congress

Montanez, Jose L.

From: captainhappy@optonline.net

Sent: Monday, February 11, 2008 8:23 PM

To: Info

Cc: greenfluke@optonline.net; captainhappy@optonline.net

Subject: Tilefish plan

My name is Dave Aripotch. I own the F/V Caitlin& Mairead out of Montauk, N.Y.

My comments will be brief, ,just addressing a couple of items on the list.

- I think that the 3 biggest participants in the fishery, (Endorphan,Kimberly,+Seacapture) should be given ITQs to protect them from boats that opportunistically jump into the fishery.
- I am not overly happy with the fact that Tilefish became a longline only fish,and yes I know that we draggers are allowed a 300 lb bycatch, but if in doing so you protect the vessels that rely on tilefish, than so be it. If tilefish is given out to anybody that cries enough, then that's 3 or 4 more boats in the same catagory as us former fluke boats are in.
- I also see no new documentation, although its quoted often enough, to ban bottom trawling in any of the canyon areas. I feel there is no reason to have these GRAs.
- My last comment applies to royalties. In my opinion, the powers that be have done a poor job of managing the fisheries. I feel the government is way out of line asking fisherman to pay royalties for their quotas. Get the enviros to pay royalties.

Respectfully,
Dave Aripotch 02/11/08

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VIA FACSIMILE AND EMAIL
(302) 674-5399
info@mafmc.org

February 11, 2008

Daniel T. Furlong
Executive Director – MAFMC
300 South New Street, Rm. 2115
Dover DE. 19904

Re: Comments on Public Hearing Document – Amendment One to Tilefish FMP

This public comment concerning Amendment One to the Tilefish FMP is respectfully submitted on behalf of the Viking Fleet of Montauk, N.Y., the principals of which were one of the three sole pioneers in the tilefish fishery during the early 1970's and 1980's.

First and foremost, the Viking Fleet strenuously objects to the decided lack of direct public notification of the initial FMP process during the late 1990's, as well as the early Amendment process commencing soon thereafter. Although strictly speaking the legal requirement of Federal Register publication of these actions may or may not have been executed by the Council, the fact is that most (if not all) fishermen do not read the Federal Register, and would only have been aware of this process by direct mailing. In the case of the Viking Fleet, a direct mailing notice of these developments was not done, thus these historic participants in the tilefish fishery were denied participation in a regulatory process in which they have a great deal of economic interest. As a result, the Viking Fleet and its principals are essentially being forced out of a fishery they actually started! This state of affairs is untenable, and the inequities created will cause a severe economic loss to these, as well as other, historic tilefish participants. The Council should re-open the process to allow these historic participants to voice their concerns regarding earlier developments in this process, and to receive their fair share of this limited-access fishery.

Moreover, once the Viking principals did serendipitously learn of the development of the IFQ system in this fishery, certain irregularities in documentation during 2006-2007 actually caused them to advocate for a position that was directly against their interests at a public hearing meeting in Spring, 2007 in Secaucus, N.J. Due to the fact that they believed they had already been "cut out" of the opportunity to secure a part-time permit, the Viking principals went to Secaucus advocating for option "5.1.E." as it appeared in the December 2006 Draft version of the Amendment, which was the only version available to them prior to the meeting. This option

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would have eliminated all restrictions for initial IFQ eligibility, which was favorable to the Viking Fleet's known status at that time. However, unknown to them, the designation of this option was changed to option "5.1.F" just prior to the public meetings, while option "5.1.E" had been changed to an alternative which cut directly against their interests at the time (currently the preferred option). Thus, Viking representatives had inadvertently supported an option that was actually detrimental to them, an error due solely to this unannounced change in the documents.

This irregularity and the impacts caused by it should, in and of itself, be sufficient to cause the Council to backtrack the amendment process to this earlier point, in the interest of equity as well as legality. Scrupulous dedication to fairness and conscientiousness, as well as meticulous attention to such administrative details, is the legal obligation of the Council in its dealings with the interested public, in order to ensure that those interested are not damaged by the Council's rulemaking actions. For these reasons, the Viking Fleet requests that the Council reinstate current option "1.F. - Do not restrict initial eligibility for IFQ ownership" to "under consideration" status, with the possibility of inclusion in the final document.

Furthermore, given the aforementioned non-inclusive public notice concerning this amendment, the requirement that "a vessel owner must apply for an initial limited access tilefish permit before November 1, 2002..." (50 CFR 648.4(a)(12)(i)(3)(B)(1) - (2002)), is extremely unfair and must be waived with respect to the Viking Fleet and any others who are able to demonstrate *bona fide* landings that fall within the qualifying time period(s). Again, fishermen (and even most lawyers) do not habitually read the Federal Register; thus direct notice in this circumstance is essential to fairness and equity, ESPECIALLY when an arbitrary and unnecessary deadline is put into place that acts to cut off the rights of interested individuals who did not receive fair notice of the action.

Provision 1 – IFQ Allocation

With respect to allocation of the TAL among various limited access permit holder groups, the Viking Fleet stands in unity with the position expressed by the Historic Tilefish Coalition, to wit:

(comments continued next page)

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However, we have a very adamant position regarding the overall allocation of this resource. We strongly and respectfully request the Council reconsider the overall allocation structure based on the HTC's understanding that when the FMP was first adopted that the permit system would be revisited.

We also believe that if the Council stays on the current course it will be in jeopardy of violating National Standards 4 and 8 and especially the new LAPP requirements contained in the Magnuson-Stevens Act that were NOT mandatory when the FMP and current permit structure was first adopted.

The Council should take note that the NOAA Supplemental Administrative Record on tilefish contains the following language that is contained in the FMP Section 1.2.1.7:

> Additional language supported by the industry was incorporated in the FMP. It reflected that when the tilefish fishery is rebuilt or at the end of the 10-year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered.

Recognizing that a sitting Council is not technically bound to the actions of a prior Council, we still consider a deal to be a deal and the HTC only agreed to the original permit system because we fully expected to revisit it using the data from the time period specified in the FMP.

This is more critical now post-MSA reauthorization with an entire new slate of LAPP provisions. The council recognizes this and will have to deal with these new requirements regardless of the size of the fishery or number of participants.

On June 27, 2007, the Department of Justice formally contacted the NMFS regarding MSA guidance and standards to ensure that operators do not acquire excessive fisheries shares. On September 14, 2007, Assistant Administrator Dr. William Hogarth contacted NJ Congressman James Saxton to assure him that National Standard 4 and new Limited Access Privilege Programs (LAPP) provisions would apply. Copies of this correspondence were provided to the Council previously and we submit them again as part of our written comments. *See attachments*.

Based on all of these concerns, we request –

(1) The Council reconsider the data period to be 1984 through 1998; and
(2) The Council adjusts the initial overall IFQ allocation as follows:

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Full-Time Tier I	50% of the TAL
Full Time Tier II	22% of the TAL
Part-Time Category	28% of the TAL

The members of the HTC firmly believe this allocation structure is fair and prevents excessive geographic and other consolidation in harvesting or processing and ensures that IFQ shareholders do not acquire an excessive share or inequitable concentration of privileges as clearly specified under Magnuson Section 303(A), and (B), and (D), and National Standard 4. Furthermore, we believe this allocation structure should mitigate concerns regarding federal anti-trust laws that now clearly apply to new LAPP amendments.

We recommend the Council take a proactive approach by ensuring that no more than 50% (not 66%!) of the entire East Coast tilefish harvest is harvested by 3 or 4 closely related individuals whose entire catch is marketed by essentially one entity at Fulton Fish Market. This is a very real concern for all fishermen from other permit categories since the Council even recognizes the existing, elevated cooperation between the Full-Time Tier I participants who are said to currently have a "cooperative understanding" *(See Public Hearing document page 2)*. Clearly, the Council must act to protect all fishermen and the public with fair access to this resource.

(comments continued next page)

(The text of the preceding two pages are a direct excerpted quote from the comments submitted by the HTC, with thanks to that organization).

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<u>Provision 2 – Permanent IFQ Transferability of Ownership</u>

Regarding Permanent IFQ Transferability of Ownership, the Viking Fleet supports Option "2B – IFQ shares may be transferable among any interested party." This option would: 1) provide an alternative to those early participants that have been denied an opportunity to otherwise participate in the commercial harvest of tilefish; 2) would not defeat the purpose of the Amendment, because landings would still be strictly limited to the limitations of the IFQ interest transferred; 3) would optimize free market forces within the fishery, while still achieving TAL objectives.

<u>Provision 3 – IFQ Leasing (Temporary Transferability of Ownership)</u>

Regarding IFQ leasing, the Viking Fleet supports the preferred option, Option "3B – Annual IFQ allocations may be leased among any interested party."

<u>Provision 4 – IFQ Share Accumulation</u>

With respect to share accumulation by individual IFQ holders, the Viking Fleet again adopts in its entirety the stated position of the Historic Tilefish Coalition, to wit:

"We oppose all current options contained in the Public Hearing Document because they do not meet the new limited access requirements in the Magnuson Act. In fact, the least restrictive OPTION 4E still represents excessive shares (66% of the TAL) for individuals in the Full-Time Tier 1 Category. We cannot abide this allocation scheme."

"The Council's Public Hearing document even states on page 18 that 'concentration of shares in the hands of a relatively small number of individuals or entities could also lead to excessive market power for just a few entities. The concentration of market power could affect working conditions, process, and wages paid to crew, and could potentially harm participants in the fishery.' We wholeheartedly concur with the Council's concerns and recommend the Council consider an alternative that specifies individual share cap. As such, we recommend the Council should adopt an Individual Share Cap at 12.5%."

(Preceding quotes directly excerpted from the comments of the HTC, with thanks to that organization.)

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Provision 5 – Commercial Trip Limits

The Viking Fleet adopts the position of the HTC here as well...Option 5E – Status quo - No action, no commercial trip limits.

Provisions 6 through 11

The Viking Fleet has no position on these provisions of the Public Hearing document at this time.

Provision 12 – Recreational Reporting

The Viking fleet supports the preferred option "12B" with the added recommendation that party/charter tilefish permits be issued on a **limited entry basis based on historic participation** to avoid a "race for the fish" as inshore recreational opportunities continue to be diminished or eliminated in coming years.

Provision 13 – Recreational Bag Limits

The Viking Fleet supports option 13A – the "no action/ status quo" option with respect to recreational bag limits for tilefish. The recreational tilefish fishery is a *de minimis* fishery with virtually no discernible impact on tilefish stocks. Placing a bag limit on this fishery would effectively eliminate the fishery altogether, because customers would be reluctant to pay the relatively high fares required by this long-distance fishery for a limited bag. Combining this option with a limited entry scheme for party and charter boats would assure that landings would not increase significantly in the recreational fishery.

The Viking Fleet takes no position on the remaining Provisions 14 through 19 of the Public Hearing document at this time. We appreciate the opportunity to express our concerns and look forward to working with the Council on developing this Amendment.

Yours truly,

/s/
Philip L. Curcio
Counsel for Viking Fleet Montauk

Montanez, Jose L.

From: Bonnie Brady [greenfluke@optonline.net]
Sent: Monday, February 11, 2008 11:59 PM
To: Info
Subject: Tilefish FMP
Importance: High

Gentlemen & Ladies,

I am writing to you this evening representing the Long Island Commercial Fishing Association. We represent 11 different gear types in 15 ports, and have an executive board comprised of fishermen from every gear type found on Long Island. Our goals include the promotion of commercial fishing, the education of the public about commercial fishing past and present, and to be a voice representing commercial fishing's future on Long Island at the County, State and Federal level.

Our comments this evening have to do with two questions, regarding Habitat Areas of Particular Concern (HAPC) and gear restriction; specifically questions 17 and 18.

- For question number 17, LICFA supports 17C with, and only with, the following codicil. LICFA disagrees with the size of the areas surrounding the canyons being considered as too large; it encompasses too much open bottom outside of the canyon walls. The intent of 17C we believe here is to unfairly restrict the use of bottom trawls in those areas as GRAs, even though there is no data to support it; best available data shows there are no pueblo habitats or clay outcroppings present within those same areas.

The dollar value of the trawled species caught in that area is grossly underestimated by the single point positions written on VTRs of the vessels. Only one position is necessary for the VTR data, however many different points are used when towing within the same area of a trawler trip. Many of the tows take place entirely in an area without canyons or pueblo habitats, yet if 17C is enacted as written, further restrictions will be in place for trawlers without the scientific data to support such restrictions, thereby creating more negative impacts economically upon the trawler user-group.

Further investigation and study of specific areas of Habitat Areas of Particular Concern should take place before more restrictive GRAs are in place as to further mitigate negative economic inpacts while at the same time protecting fish populations. One should not supercede the other when both are able to coexist together with a more intensive scientific study of the area involved.

- Question 18-LICFA supports 18A as the only alternative. According to the council's own FMP notes, a practicability analysis (see section 7.18.6 of the DEIS) concluded that alternative 18B is not practicable because it does not contain any known areas of highly vulnerable tilefish habitat and it has a high economic value as a bottom trawling area. Two of the canyon GRAs included as options in alternative 18C also are not practicable (Wilmington and Hudson) because of their relatively high economic value as bottom trawling areas and Hudson Canyon indicates that it does not include any clay outcrops.

Thank you for your time and attention to this matter.
Sincerely,
Bonnie Brady
LICFA
516-527-3099

Cote Fisheries Inc.
P.O. Box 517
Marshfield, Ma 02050-0517
Tel/Fax (781) 834-8770/ (781 834-8766
Email a.cote@verizon.net

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

Tilefish 1 Comments
February 7,2008

In general I think that the establishment of an IFQ management system for the tilefish fishery would be a good option for helping to limit and reduce the over capacity issue and to possibly have an effect on the derby fishing that has been occurring. An IFQ management system for Tilefish will ultimately give more control for the permit holders to conduct the fishery to it most benefit to the vessels that hold the permits and the fishing quotas.

I recognize that the fishing years of 2001-2005 best represent the fishery as it exits today, but it must be acknowledged that Vessels have had to change their fishing practices due to all the fishery management decisions that have occurred since originally qualifying between the years 1988-1998. Because of vessels decisions to not fish in their tilefish category has created an incentive for the few that continued to harvest in their category to harvest at a higher level than they might have originally qualified for in the 1988-1998 qualifying years or if all vessels in each category fished until the TAC was caught. It appears that tier 1 vessels have already made adjustments within their category to all fish in an apparently equal status to limit one vessel over another assuming that they as a tier will catch their TAC. It also appears that as tier 2 vessels have operated on a first come first serve basis, which probably creates a derby style approach to fishing. The part time vessels of which has been downsized to basically 7 vessels who have benefited from the remaining part time vessels opting not to fish for whatever reason, have also created a derby style approach to fishing. The total TAC for each tier or category has been reached each year since its inception.

The problem as I see it is the tier 2 vessels and the part time vessels. The question is how the system incorporates all into one category that is fair to all who qualified regardless of how the fishery has changed in regard to the vessels fishing or not fishing. We started out with the same TAC as is being used today at the inception of the tier and category TAC approach. It would seem fair and equitable to all concerned if we acknowledged the 1988-1998 qualifications in fairly recognizing the values of all vessels IFQ's.

I support the IFQ system with the right to sell, lease or transfer of those fishing rights and fishing quota. I support the flexibility for all in making decisions in the way they operate through an IFQ system. I also support the initial qualifying years of 1988-1998 as representative of a vessel's effort in qualifying for
Allocation.

Alternative 1 -1D4
Alt 2- 2B
Alt 3-3B
Alt 4-4A
Alt 5- 5A
Alt 6- 6A
Alt 7-7B
Alt 8- 8BAlt 9- 9B
Alt 10- 10A

Alt 11- no comment
Alt 12- 12B
Alt 13- 13A (should seek additional information regarding the increased or potential for increased landings thru the recreational fishery)
Alt 14 – 14B
Alt 15 -15B
Alt 16 -16A
Alt 17-17C
Alt 18-18A
Alt 19 -19A

Thank you for the opportunity to comment on Amendment 1 to the Tilefish Fishery Management Plan.

Sincerely;
Bro Cote
FV William Bowe
Permit # 320683

Montanez, Jose L.

From: Peter Brown [seastar721@comcast.net]
Sent: Friday, February 08, 2008 4:51 PM
To: Info
Subject: Tilefish 1 Comments

Brown FishingCompany, Inc.
Peter M. Brown, President
PO Box 833
Monument Beach, MA 02553
508-759-0067 Tel.
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Seastar721@comcast.net

Daniel Furlong
Executive Director
Mid- Atlantic Council
300 South New St. Room 2115
Dover, DE 19904

February 7, 2008

Tilefish 1 Comments

Mr. Furlong,

I have read the Amendment 1 to the Tilefish plan and would like to comment on what I think some of the key issues of the plan are.
I am in favor of a IFQ management system for all permit tiers for this fishery. I think it allows the participants in the fishery to be able plan out their fishing year according to market, weather conditions and availability of Tilefish. I would support the following Alternatives as outlined in the plan, 1D1A, 1D4, and 1E. These alternatives are the most fair to all that qualified for this limited entry permit. Many of the other alternatives eliminate some permit holders from the fishery. My permit is a part time permit, which I was very glad to get, but I have not been going fishing for tilefish in recent years because by the time it would be right for me to go, the part time allocation is already used up. I do not want to be excluded from this fishery just because I haven't landed any tilefish in recent years. I did qualify for my permit by catching over 28,000 lbs. in one year back in 1989. The Tier 2 and Part Time permit category are definitely in a derby type fishing state where a few boat are fishing very hard to catch most or all the allocation. I'm sure you have noticed that a few boat's landing have increased dramatically in the last 5 years even though they had fairly small numbers for the qualifying process. I'm also sure it's these same few boats that would like to have the IFQ program based of the last 5 years. To me this is just not fair; we all had to qualify for our permits in the same way as the boats that have been fishing hard in the last 5 years. These boats have already been getting all the benefit of some of us not landing any tilefish in recent years. <u>I do not want to be excluded from this fishery</u>. This why I think that IFQs would work well for this fishery, at least I would have a percentage of the fishery and if I wanted to increase my percentage I could buy or lease another permit holder's IFQ who does not want to go, but at least we would have that choice with this plan.
I'm sure you can already tell that I am also in favor of being able to sell or at least lease your IFQ to another permit

holder. I would like to able to buy or lease someone's IFQ so I could go tile fishing again. I'm not sure if it should keep the lease-sale of IFQs is confined to tier that they are in or could be leased or should to any tier. Meaning for example, if you were a part time permit holder and wanted to lease or sell your IFQ you could only do that with another part time permit holder or could you lease or sell it to say a Tier 1 permit holder. If we do the later it could mean that a very few people might control all the allocation. It probably would be better to keep any transfers of IFQ with the permit tiers that they come from.

I am also in favor of creating a recreational permit and a bag limit for recreational fishing for tilefish. I hear and see anglers going after Tilefish, more and more, when they are out in the canyon areas. I have seen a number of sport fishing magazines showing how and where to catch tilefish. Many times these anglers and charter boats will take as much fish as they can get, which is wasteful. At least with a permit and a bag limit there would be some way to keep track of how many fish are being caught.

Thank you in advance for reading my comments, if there is any else I could be helpful with please to not hesitate to call me.

Sincerely,
Peter M. Brown

Vessel Name—Rachel Leah
Doc. Number—940212
Permit Number—330678
Part Time Tilefish Number 21

Habitat only

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

FEB 6 2008

ASSISTANT ADMINISTRATOR
FOR ENFORCEMENT AND
COMPLIANCE ASSURANCE

Patricia A. Kurkul
Regional Administrator
Northeast Region
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
One Blackburn Drive
Gloucester, MA 01930-2298

Dear Ms. Kurkul:

The U.S. Environmental Protection Agency has reviewed the Draft Environmental Impact Statement (DEIS) for Amendment 1 to the Tilefish Fishery Management Plan (CEQ No. 20070540) in accordance with our responsibilities under the National Environmental Policy Act and Section 309 of the Clean Air Act.

The DEIS evaluates the potential impacts of the following proposed changes to the Fishery Management Plan: fishery and gear modification management measures and reduction of bycatch and fishing discard measures for target and non-target fish species. Based on our review of the DEIS, we have no objections to the proposed action and we are rating the proposal as LO-Lack of Objections.

We appreciate the opportunity to review this DEIS. The staff contact for this review is Matthew Harrington and he can be reached at (202) 564-7148.

Sincerely,

Anne N. Miller

Anne Norton Miller
Director
Office of Federal Activities

cc: Steve Kokkinakis, NOAA Office of Strategic Planning

FEB 11 2008

NRDC

Natural Resources Defense Council
40 West 20th Street
New York, NY 10011
Tel: (212) 727-2700
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February 11, 2008

Mr. Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

Re: Comments on Draft Amendment 1 of Tilefish FMP

Dear Mr. Furlong:

On behalf of the Natural Resources Defense Council ("NRDC"), I submit the following comments regarding the habitat-related proposals in Draft Amendment 1 to the Tilefish Fishery Management Plan and Draft Environmental Impact Statement (collectively "Draft Amendment 1" or "Dr. Am. 1").

<u>Background</u>

The Magnuson-Stevens Act requires that Fishery Management Plans ("FMPs") "describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), *minimize to the extent practicable adverse effects on such habitat caused by fishing*, and identify other actions to encourage the conservation and enhancement of such habitat." 16 U.S.C. § 1853(a)(7) (emphasis added). The Tilefish FMP currently contains no measures to protect tilefish essential fish habitat ("EFH") from the adverse effects of the bottom trawling fishing gear used in the relevant fisheries.

As you know, NRDC has, for some time now, been particularly concerned about the adverse effects of bottom trawling, particularly in the *Loligo* fishery, on tilefish habitat. Tilefish exhibit strong structure dependence, spending much of their lives creating and inhabiting burrows in the sea floor. *See, e.g.,* Dr. Am. 1, App. F, 1999 NOAA EFH Source Document for Tilefish at 2-3. Tilefish stocks are also restricted to specific, identifiable portions of the continental shelf. *See, e.g., id.* Given these attributes, we continue to believe that protecting tilefish habitat is vital to ensuring the health and recovery of their population. Protection of tilefish habitat also provides benefits to other fish species and marine life that rely upon the burrows and other specific attributes of the habitat, including for shelter and protection.

As documented by the National Research Council and others, bottom trawling is known to reduce habitat complexity. The direct adverse effects of such trawling include loss of erect and sessile epifauna, smoothing of sedimentary bedforms and reduction of bottom roughness, and removal of taxa that produce structure. Trawl gear can crush, bury, or expose marine flora and fauna and reduce structural diversity.

As for adverse effects of bottom trawling on tilefish habitat specifically, a 2004 NOAA Fisheries' evaluation determined that "[d]ue to the tilefish's reliance on structured shelter and benthic prey, as well as the benthic prey's reliance on much of the same habitat, and the need for further study, the vulnerability of tilefish EFH to otter trawls was ranked as high." *See Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat,* NOAA Technical Memorandum NMFS-E-181 (2004) ("2004 NOAA EFH report"), at 129. In addition, Amendment 13 to the Northeast Multi-species FMP stated that "[a] report to the Mid-Atlantic Fishery Management Council (Able and Muzeni 2002) from a video survey in areas of tilefish habitat identified trawl tracks through these areas, and concluded that trawling caused a re-suspension of bottom sediments. The report noted that re-suspended sediments fill burrows in and/or cause physiological stress to tilefish that are present. No obvious structural impacts to the habitat were identified. However, due to the tilefish's reliance on structured shelter and the need for further study, the vulnerability of tilefish EFH to otter trawls was ranked as high." *See* Northeast Multispecies Amendment 13 SEIS, December 18, 2003, at II-1289; *see also* 2004 NOAA EFH report at 129 (discounting the failure of Able and Muzeni to identify structural impacts from bottom trawling, and noting that the review relied upon very small sample size).

NRDC has also historically strongly supported protection for the submarine canyons of the Mid-Atlantic and New England regions, in part because of their importance to tilefish. Most prominently, the tilefish burrows in and around Hudson Canyon, which in turn attract secondary burrowing and support a highly diverse community, were identified by fifteen leading marine scientists as a priority habitat area specifically meriting protection. *See* NRDC, *Priority Ocean Areas for Protection in the Mid-Atlantic –Findings of NRDC's Marine Habitat Workshop* (2001). But the reasons for protecting the submarine canyons go significantly beyond the value of the tilefish burrows. These canyons are dynamic environments supporting nurseries for a variety of fish and crustaceans. The canyons also contain rare hard and soft corals. Oceanographer and Lydonia canyons, for example, contain extensive numbers of these corals. Indeed, Oceanographer canyon is believed to contain between 20 to 50 percent of all deepwater corals on Georges Bank. Both Oceanographer and Lydonia are believed to serve as a larval source for other areas on the continental shelf.

The best available science also indicates that fauna that live in low natural disturbance regimes like the deepwater canyons are more vulnerable to fishing gear disturbance. Habitats consisting of unconsolidated sediments that experience high rates of natural disturbance can have more subtle responses to trawling than habitats characterized by boulders or pebbles. Epifaunal communities that stabilize sediments, reef-forming species, or fauna in habitats that experience low rates of natural disturbance have been observed to be particularly vulnerable. Likewise, softbodied, erect, sessile organisms are more vulnerable to mobile gear than are hard-bodied prostrate organisms.

The best available science also shows that trawling reduces habitat complexity as a result of the removal of sessile epifauna and the alteration of physical structure, such as rocks and cobble. Emergent epifauna, such as sponges, hydroids, and bryozoans, provide habitat for invertebrates and fishes. Disturbance of emergent epifauna is believed to increase the predation risk for juvenile fish. Decreased prey abundance increases the foraging time for juvenile fish, thus exposing them to higher predation risk.

Unfortunately, recovery of canyon megafaunal communities from disturbances is predicted to be considerably slower than that of slope assemblages. Based on aging data, deepwater corals in particular can be hundreds to thousands of years old, and are extremely slow to recover from harm. The vulnerability of these fish populations is further enhanced by the fact that many of these species are rare and restricted to relatively uncommon areas of exposed hard substrate. Loss of and harm to canyon populations of these organisms would represent a significant, long-term adverse impact. Since most of these species are sessile, and thus depend on "larval recruitment" to recolonize perturbed areas, loss of local canyon populations might represent loss of "stock" populations for recolonizations. For example, the larger coral and anemone populations of Oceanographer Canyon are considered to be valuable communities both as refuges and as suppliers of larvae to more disturbed areas in the region.

Comments on Draft Amendment 1's Habitat-Related Management Alternatives

1. Essential Fish Habitat Designation

NRDC supports Alternative 16A, which is to retain the current EFH designations for tilefish. Alternative 16B, which is designated as the preferred alternative, would revise the current EFH designations for tilefish to make them more restrictive. Most significantly, Alternative 16B relies on a significantly narrower temperature range (9-14 degrees C), as well as narrower depth range (100-300 m), for juvenile and adult tilefish then those used in the current EFH designations. Draft Amendment 1 states that revised EFH designations pursuant to Alternative 16B are "expected to provide the basis for more effective management measures to reduce the impacts of fishing on tilefish EFH in a smaller area of the outer continental shelf and slope." Dr. Am. 1 at xxxiv.

Alternative 16B's temperature and depth ranges are inconsistent, *i.e.*, more restrictive, then the temperature and depth ranges documented in the NOAA Fisheries Service's "Update Memo" to the tilefish EFH source document. *See* Dr. Am. 1, App. F, NOAA Fisheries Service, "Essential Fish Habitat Source Document Update Memo," May 2006 ("NOAA EFH Update Memo") at 15. Of the two EFH Designation alternatives, Alternative 16A is more consistent with the information provided in the NOAA EFH Update Memo, which represents the best available scientific information. Finally, we note that the possible future regulation of gear impacts on EFH should not play a role in the initial EFH designation.

2. HAPC Designation

Federal regulations provide that councils should establish habitat areas of particular concern (HAPCs) in particularly important portions of EFH using the following criteria:

(i) The importance of the ecological function provided by the habitat.

(ii) The extent to which the habitat is sensitive to human-induced environmental degradation.
(iii) Whether, and to what extent, development activities are, or will be stressing the habitat type.
(iv) The rarity of the habitat type.

50 C.F.R. § 600.815(a)(9).

Draft Amendment 1 sets out four alternatives for tilefish HAPC designation. Of the four provided alternatives, NRDC supports Alternative 17A. This alternative would maintain the current HAPC designation, which encompasses the portion of currently designated tilefish EFH within statistical areas 616 and 537. The existing HAPC designation is relatively consistent with the distributions of adult and juvenile tilefish described in the NOAA EFH Update Memo, as well as to data on tilefish landings by statistical area provided in Draft Amendment 1 (at App. E at 27). Accordingly, as discussed *infra*, given the habitat limitations and structure dependency of tilefish, as well as the broader ecological benefits of tilefish habitat structures, and the adverse effects of bottom trawling gear on such tilefish habitat structures, the existing tilefish HAPC designation (and, to a lesser extent, Alternative 17B, which would modify existing HAPC designation to account for more restrictive temperature and depth criteria) continues to satisfy the regulatory criteria for HAPC designation far better than alternatives 17C and 17D.

NRDC strongly opposes Alternative 17C, which is listed as the preferred alternative and would drastically reduce the tilefish HAPC to encompass only portions of four submarine canyons (Norfolk, Veatch, Lydonia, and Oceanographer). These areas do not encompass anything close to a significant portion of tilefish EFH or tilefish HAPC, based upon survey data, catch data, submersible data, and substrate type data. Moreover, these areas, while ecologically valuable, are not highly vulnerable to bottom trawling gear in relative terms – even Draft Amendment 1 itself states that significant bottom otter trawling likely does not occur on the steep slopes of the canyons themselves, but rather occurs only on the margins of the canyons. *See* Dr. Am. 1, App. E: 15. In sum, there is no reasonable basis for determining that it is only the specific tilefish habitat areas identified under Alternative 17C that are of "particular concern" pursuant to the applicable criteria. For similar reasons, NRDC also opposes Alternative 17D, which would reduce tilefish HAPC to encompass only portions of thirteen canyons.

Finally, to the degree the Council appears to be factoring in possible habitat management measures in determining the HAPC designation (*see, e.g.,* Dr. Am. 1 at xxxvi), this is inconsistent with the regulatory criteria and underlying purpose of the HAPC designation -- just as it was with respect to the EFH designation. The designation of both tilefish EFH and tilefish HAPC should be decoupled from any decision to regulate adverse impacts.

3. <u>Measures to Reduce Gear Impacts on EFH</u>

Federal regulations require councils to assess "the potential adverse effects of all fishing equipment types used in waters described as EFH. . . . Special consideration should be given to equipment types that will affect [HAPCs]." 50 C.F.R. § 600.815(a)(3)(ii). "Adverse effect" is defined as "***any*** impact which reduces quality and/or quantity of EFH. Adverse effects may include direct (e.g. contamination or ***physical disruption***), indirect (e.g., loss of prey, or reduction in species' fecundity), site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions." *Id.* § 600.810(a) (emphasis added).

Based on the assessment of fishing gears used in EFH and, especially, HAPCs, "Councils must act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing practice is having an identifiable adverse effect on EFH." *Id.* § 600.815(a)(3)(iii). NMFS had originally proposed to require minimization only of "substantial" adverse effects on EFH, but changed the threshold to "identifiable" to avoid setting too high a bar to EFH protection. 62 Fed. Reg. 66531, 66538 (Dec. 19, 1997). According to NMFS, "identifiable" impacts exclude only those that are "minimal" or "temporary." *Id.* When an adverse effect is found, whether measures to minimize it are practicable must be determined based on "whether, and to what extent, the fishing activity is adversely impacting EFH, including the fishery; the nature and extent of the adverse effect on EFH; and whether the management measures are practicable, taking into consideration the long and short-term costs as well as benefits to the fishery and its EFH. . . ." *Id.* § 600.815(a)(3)(iv).

Draft Amendment 1 sets out three alternatives as measures to reduce gear impacts on EFH. NRDC strongly supports Alternative 18B, which would create gear restricted areas (GRAs) prohibiting bottom trawling within the currently-designated tilefish HAPC. This alternative best minimizes the identified adverse effects of bottom trawling on designated tilefish HAPC. It would protect the most ecologically-significant portion of the upper continental slope (something barely touched on in Draft Amendment 1) and three canyons (Hudson, Block, and Atlantis) where there are tilefish habitats that have been determined to be highly vulnerable to bottom trawling. Besides tilefish, other species that have designated EFH for benthic life stages (at least one) within the GRA area (under both potential EFH depth ranges) that are moderately to highly vulnerable to bottom otter trawling are: Atlantic sea scallops, black sea bass, ocean pout, red hake, redfish, scup, skates (barndoor, clearnose, little, rosette, smooth, thorny, and winter), summer flounder, witch flounder, and yellowtail flounder. Dr. Am. 1 at 328. As discussed more *infra*, this alternative is practicable because only a fraction of area used for bottom trawling would be affected, and any short-term negative economic effect would be outweighed by long-term economic benefits resulting from the rebuilding of tilefish and other fisheries as a result of GRAs implementation.

As a less preferred alternative, NRDC also supports Alternative 18C, particularly if it encompasses GRAs in all or most of the identified submarine canyons. This alternative would protect a variety of species; species with designated EFH for life stages (at least one) within one or all of the GRA canyon areas (under both potential depth ranges) that are moderately to highly vulnerable to bottom otter trawling are: black sea bass, haddock, ocean pout, red hake, redfish, scup, skates (barndoor, clearnose, little, rosette, smooth, thorny, and winter), tilefish, witch flounder, and yellowtail flounder. Morevoer, Alternative 18C would protect significant assemblages of corals.

While the proposed closure of the submarine canyons would protect only tilefish habitat existing in and immediately around the canyons, a fraction of the tilefish habitat needing protection, this would be a positive step over the status quo. In addition, by closing all or the majority of canyon areas, different tilefish habitat types would be protected, including habitat types that are particularly threatened by bottom trawling gear; in other words, the GRAs would, and should, encompass tilefish habitat types in addition to the "pueblo village"-type habitat existing in certain canyons areas and which, while highly important habitat, is generally not bottom trawled. Indeed, Draft Amendment 1's discussion of possible gear measures inappropriately skews the discussion of benefits in favor of closures encompassing steep canyon wall tilefish habitat. Although there would likely be some benefit to such closures, particularly long-term benefits to protect against possible expansion of fisheries into these areas, there is limited support in the source material demonstrating that such areas are currently being adversely affected by fishing gear or constitute the majority of vulnerable tilefish habitat.

Regarding the possible economic impacts of the proposed area closures, Draft Amendment 1 initially, and correctly, points out that, in the event of a bottom trawling ban in a certain area, there will be a shift in fishing to open areas adjacent to area closure boundaries. However, Draft Amendment 1's "determination of practicability" discussion then proceeds to wholly rely upon "upper limit" or worst case assessments of economic impacts, in which no displacement of effort is assumed. Accordingly, in its current form, the economic impacts discussion relating to Alternatives 18B and 18C is highly biased and does nor present a meaningful understanding of possible economic impacts of the proposed GRAs.

* * *

Thank you in advance for consideration of our comments.

Respectfully yours,

Brad Sewell
Senior Attorney
Natural Resources Defense Council

cc: Patricia A. Kurkul, National Marine Fisheries Service e

ENVIRONMENTAL DEFENSE

finding the ways that work

February 11, 2008

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Management Council
Room 2115 Federal Building
300 S. New Street
Dover, DE 19904

Re: Tilefish 1 Comments

Dear Mr. Furlong,

On behalf of Environmental Defense and the more than 146,000 members in the Mid-Atlantic region of the United States, we respectfully submit for your consideration these comments on Amendment 1 to the Tilefish fishery management plan (FMP).

First, we applaud the Mid-Atlantic Fishery Management Council (Council) for proposing an Individual Fishing Quota Program in its Draft Amendment 1 to the Tilefish FMP. Limited Access Privilege Programs (LAPPs), as defined by the recently revised Magnuson-Stevens Fishery Conservation and Management Act (MSA) are critical to improving the health and prosperity of our nation's fisheries and fishing communities, ending overfishing and rebuilding depleted fish populations.

We strongly support and appreciate both the Council's initiative in and approach to developing a new LAPP for the Mid-Atlantic region. However, we advocate for an even stronger program - further improving the long-term economic and environmental stability of the fishery. Furthermore, we believe maintaining strong habitat protections for tilefish are critical to the long-term health of the species and the ecosystem.

We respectfully offer the following comments on specific provisions in the proposed Amendment 1.

Section A. Environmental Defense supports the Council's preferred alternatives for the following provisions:

5.1 Individual fishing quota, 5.1.E Alternative 1E, page 105. We agree with the Council that all three tiers should be included in the IFQ program and that any combination of historical landings data may be applied to determine allocation. Inclusiveness is often an important factor in economically successful IFQ programs. We believe that this option provides the Council with the greatest flexibility to determine the most appropriate allocations within each tier.

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New York, NY · Washington, DC · Oakland, CA · Boulder, CO · Austin, TX · Boston, MA · Project Offices: Los Angeles, CA · Sacramento, CA · Beijing, China

5.2 Permanent IFQ transferability of ownership, 5.2.C Alternative 2C, page 108. Transferability of shares is one of the major components of successful IFQ programs. Transferability most often enhances the economic performance of a fishery and enables fishermen to leave the fishery if they so desire, which tends to strengthen their conservation ethic. However, it is reasonable for transferability to be limited among shareholders for the first five years, then among other individuals.

5.3 IFQ leasing (temporary transfer of ownership), 5.3.B Alternative 3B, page 110. As with permanent IFQ transfers, allowing temporary transfers of ownership in IFQ programs permits greater economic efficiencies and flexibility. We concur that any interested party should be allowed to lease shares.

5.5 Commercial trip limits, 5.5.A Alternative 5A, page 115. An IFQ system should preclude the need to impose trip limits on fishing vessels. However, each component (full time and part time categories) of the tilefish commercial industry should be included in this program for it to be effective in eliminating derby fishing. We concur that no trip limits should be instituted.

5.7 IFQ Program Review Process, 5.7.B Alternative 7B, page 122. Program reviews are important oversight mechanisms and should be conducted on the program regularly to ensure that proper implementation and monitoring practices are being used and to assess the program's effectiveness in meeting its goals.

5.8 IFQ Reporting Requirements, 5.8.B Alternative 8B, page 123. A thorough evaluation of what changes to the current database are needed to support a possible IFQ is necessary, as effective reporting and monitoring are critical to the success of IFQ programs.

5.12 Recreational Permits and Reporting Requirement, 5.12.B Alternative 12B, page 128. Given the recent coastwide upward trend and interest in "deep drop" recreational fishing, effective management of both charter boat/headboat and other recreational mortality for tilefish will be increasingly important. In the worst case, expanding recreational and charter-boat-induced tilefish mortality could erode progress made in the commercial sector, and threaten the incentive framework created in the proposed IFQ.

Therefore, we support the development of an effective recreational fishing management program for tilefish for each recreational sector, including permitting, adequate monitoring, and prudent management measures in the interim while an allocation of total allowable catch and measures to implement it are developed. Specifically, we support the establishment of a charter boat/head boat permitting and reporting requirement, as stated in Alternative 12B, with the anticipation that such a program would lead to a total allowable harvest cap sooner rather than later for that sector. We support improved data collection for the non-charter boat recreational sector, as a basis for developing harvest caps for that sector as well.

5.15 Framework Adjustment Process, 5.15.B Alternative 15B, page 134. Because flexibility is an important element in IFQ programs, it is important to have a mechanism by which to make changes in a timely manner. Therefore, we concur with the preferred alternative.

Section B. Environmental Defense supports the following alternatives that are not preferred by the Council:

5.6 Fees and Cost Recovery, 5.6.B or 5.6.C Alternatives 6B or 6C, pages 116-121. We recommend either 6B or 6C, as alternative 6A is contrary to the MSA. While we do not have a specific preference as to which option is chosen, we do recommend a system that is enforceable, allows for a high rate of compliance and accurately tracks the cost recovery fees collected.

It is important that cost recovery at least be set at a level sufficient to pay for the additional management, data collection, monitoring and enforcement that would not have been incurred but for the IFQ program, while still maintaining its economic incentives and viability. In new IFQ programs fishermen can struggle to make ends meet, while in mature programs with conservation and economic recovery, fishermen can take on more cost recovery and share the dividend. For programs just getting underway, funds could be used to help defray the costs of capital equipment for enforcement and monitoring such as video monitoring, Vessel Monitoring Systems or real-time data reporting systems. For programs concerned with maintaining access to the fishery for new entrants, the reauthorized MSA allows for 25% of any fees collect to be set aside to aid entry level fishermen in purchasing quota. We recommend the Council look closely at cost recovery to ensure the use of these funds is closely tailored to the needs of the fishery.

5.9 IVR Reporting Requirements, 5.9.B Alternative 9B, page 124. Accurate reporting is a key element in successful IFQ programs, and we support reporting systems that increase accountability, ensure an accurate assessment of catch and bycatch (including non-target species), improve scientific understanding and are enforceable. We support 9B (the preferred alternative) but suggest that it be amended to require NMFS to provide a report to the Council on the compliance record of all shareholders using the 48 hour IVR reporting system one year out from the implementation of the IFQ program. We further recommend the Council make any necessary changes to ensure full compliance, accountability and accurate assessments of catch and bycatch. We would also like to see further consideration of more comprehensive monitoring and reporting systems to include: real-time reporting system from the vessels, video monitoring and VMS.

5.11 Hook Size Restriction, 5.11.A Alternative 5.11, pages 126-127. Given the very high mortality in fish retrieved from these depths, we support full retention in the tilefish fishery, for all sectors, and the development of technologies that best fit allowable gears to target fish populations. Appropriately-sized circle hooks in the recreational sectors seem like a reasonable interim measure. However, it is not clear to us that the largest fish are necessarily the best targets in this fishery, given their high reproductive value. We urge the Council to pursue further analysis of this issue and implement hook size restrictions as appropriate.

5.10 Commercial Log Book Reports, 5.10.C Alternative 10C, pages 125-126. As mentioned, accurate reporting of catch and bycatch, accountability and improving scientific understanding are important to the success of IFQ programs and we do not believe these will be achieved under status quo. We recommend the Council adopt 10C, an electronic reporting system for all commercial vessels and trigger the start of that alternative when VTR is up and running in late 2008. Detailed catch data is critical to establishing how well the IFQ program is working. The

Council should consider using fees from the cost recovery program to defray the cost of the system.

It is important for Council to begin obtaining catch data, not just landing data. Not only is this important to understanding if the IFQ program is working, it is needed to more accurately determine CPU and tilefish abundance and ultimately improve the tilefish stock assessment. It is important that the tilefish IFQ program not be designed to only reap benefits without absorbing some of the costs. Improved data collection is needed and should be an outcome of this IFQ program.

5.13 Recreational Bag-Size Limits. We support a reasonable and prudent interim bag limit, and we oppose the Council's preferred alternative of maintaining the no bag limit status quo.

5.16 EFH Designation, 5.16.A Alternative 16A, page 134. We strenuously object to the proposal to reduce the extent of tilefish EFH or narrow the definition. This proposed action mirrors a concerning national trend toward a reduction in the spatial extent of EFH without sound scientific justification. We strongly support alternative 16A, the no-action alternative, until such time as benthic substrates are adequately mapped. Similarly, we reject as scientifically indefensible the designation of EFH-HAPCs delineated based on the narrower temperature-mediated (i.e. tautological) depth ranges.

We are also concerned with the proposed restriction of EFH-HAPC designation to canyons in which pueblos have been observed (in the absence of extensive reconnaissance). It is very likely that such habitats occur in all 13 canyons (and probably elsewhere).

5.17 HAPC Designation, 5.17.D Alternative 17D, page 145. We strongly support the establishment of EFH-HAPCs in all 13 canyons at depths consonant with the existing EFH definition (alternative 17D, option A).

5.18 Measures to Reduce Gear Impact on EFH, 5.18C Alternative 18C, pages 148-156. We support the establishment of measures sufficient to eliminate fishing gear damage to concentrated tilefish pueblo habitats or clay outcroppings in these 13 canyons, through the delineation of gear-restriction areas where bottom-disturbing gears would be precluded. Specifically, we support alternative 18C, in all 13 canyons identified.

Thank you for your consideration of our views on this important issue. Feel free to contact us at 919-881-2914 or 843-737-4466 if you have any questions or wish to discuss.

Sincerely,

Dan Whittle

Dan Whittle
Director of Southeast Oceans Program

Eileen Dougherty

Eileen Dougherty
Fisheries Policy Specialist

marine fish conservation network

ACHIEVING HEALTHY OCEANS & PRODUCTIVE FISHERIES

DELIVERED VIA E-MAIL

February 11, 2008

Daniel T. Furlong, Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
info@mafmc.org

RE: Tilefish 1 Comments

Dear Mr. Furlong,

Thank you for the opportunity to comment on Amendment 1 to the Tilefish Fishery Management Plan. The Marine Fish Conservation Network is a national coalition of 190 environmental organizations, commercial and recreational fishing associations, aquariums, and marine science groups. The Network has a long been involved in advocacy on behalf of family fishermen and the marine environment vis-à-vis individual fishing quota programs, now referred to in federal law as limited access privilege programs.

In December 2006, Congress unanimously passed the Magnuson-Stevens Fishery Conservation and Management Act of 2006, authorizing the use of limited access privilege programs and more importantly enacting a comprehensive set of regulatory standards by which such programs may be promulgated.

The 2006 limited access privilege program amendments to the MSA were among the most significant and detailed changes to the law. Congress called on the National Marine Fisheries Service to write implementing regulations for this section of the reauthorized Act. NMFS is currently preparing such regulations and may have draft regulations out for public review sometime this year. In the meantime, it is critical that as regional councils prepare LAPP's, they inform the public of the letter and spirit of the new law.

To that end, the public would benefit from seeing clearly the requirements of the Act vis-à-vis limited access privilege programs and how the proposed tilefish program addresses those requirements. For example, sections two and three of the Public Hearing Summary Document discuss various options related to transferability but no mention is made of Section 303A(b) of the MSA which details the restrictions on permits issued under a LAPP.

The council should uphold the letter and spirit of the Magnuson-Stevens Act toward healthy oceans and productive fisheries for all Americans to enjoy. Limited access privileges are controversial because they can result in ownership of public resources being effectively turned over to a limited set of individuals or corporations. This has been the case in New Zealand where such systems have resulted in massive consolidation of ownership by a few corporations leaving most fishermen high and dry. Careful program design and close adherence to the new federal standards is essential to preventing such outcomes. To that end, the Network urges the council to clearly and strongly follow the new legal standards regulating limited access privilege programs.

- Prevent excessive consolidation;
- Restrict permits issued in such programs to ten years or less;
- Prohibit such permits from being construed as a right, title or interest;
- Ensure fair and equitable initial allocations;
- Include measures to assist entry-level and small vessel owner-operators, captains, crew and fishing communities to purchase quota shares;
- Adhere to the conservation standards of the Magnuson-Stevens Act (MSA), namely to prevent overfishing, quickly restore overfished stocks, minimize bycatch and protect essential fish habitat;

The Network also encourages the council to develop measurable benchmarks to review the program during the required periodic reviews. Such benchmarks have been absent from many similar programs worldwide and managers lack a useful tool to judge a program's efficacy.

The Network also is enclosing a few recent reports documenting problems observed in limited access privilege programs elsewhere as background information. These documents bring into high relief the unintended consequences of poorly designed programs. For example, the recent Bering Sea crab program resulted in massive high grading and discards of legal-sized male crabs, a first for the fishery.

Thank you for this opportunity to comment.

Sincerely,

A J DeFalco

Tony DeFalco
Director of Regional Operations

Enclosures

Fishery Data Series No. 06-23

Estimates of Red King Crab Bycatch during the 2005/2006 Bristol Bay Red King Crab Fishery with Comparisons to the 1999-2004 Seasons

by

David R. Barnard

and

Douglas Pengilly

May 2006

Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	\$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 06-23

ESTIMATES OF RED KING CRAB BYCATCH DURING THE 2005/2006 BRISTOL BAY RED KING CRAB FISHERY WITH COMPARISONS TO THE 1999-2004 SEASONS

By
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May 2006

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The Division of Sport Fish Fishery Data Series was established in 1987 for the publication of technically oriented results for a single project or group of closely related projects. Since 2004, the Division of Commercial Fisheries has also used the Fishery Data Series. Fishery Data Series reports are intended for fishery and other technical professionals. Fishery Data Series reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm This publication has undergone editorial and peer review.

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ABSTRACT

The 2005/2006 Bristol Bay red king crab *Paralithodes camtschaticus* fishery was the first fishery to be completed under the federal Crab Rationalization Program for Bering Sea/Aleutian Islands (BS/AI) king and Tanner crab fisheries. The Crab Rationalization Program replaced a competitive fishery regime with a system for allocating the harvest as quota shares (QS). Expected benefits of rationalization included a reduction in the bycatch of females and sublegal males that had occurred under the competitive fishery regime, although there were also concerns that rationalization could result in highgrading of legal males. We estimated the catch per pot lift of retained legal males, females, sublegal males, and non-retained legal males using data collected by observers during the 2005/2006 Bristol Bay red king crab fishery and compared those estimates with estimates for the 1999-2004 seasons. The results for the 2005/2006 season did not show a reduction in bycatch of females and sublegal males relative to the pre-rationalized fisheries, but did show an increase in the discard rate of captured legal males.

Key words: Alaska Department of Fish and Game, Bering Sea, Aleutian Islands, crab rationalization, Bristol Bay, red king crab *Paralithodes camtschaticus*, bycatch reduction, highgrading.

INTRODUCTION

The Fishery Management Plan (FMP) for the commercial king and Tanner crab fisheries of the Bering Sea and Aleutian Islands (BSAI) establishes a State-Federal cooperative management regime in which management is deferred to the State of Alaska with federal oversight (NPFMC 1998). In March 2005 new federal regulations were issued to establish the BSAI Crab Rationalization Program according to the provisions adopted by the North Pacific Fishery Management Council (NPFMC) in Amendments 18 and 19 to the FMP (NPFMC/NMFS 2006). Federal actions in 1998 had previously allocated 7.5% of the harvests from Bering Sea king and Tanner crab fisheries to a Community Development Quota (CDQ). The Crab Rationalization Program, however, established a quota system for allocating the entire harvest in each of the Bristol Bay red king crab *Paralithodes camtschaticus*, St. Matthew blue king crab *P. platypus*, Pribilof red and blue king crab, Bering Sea snow crab *Chionoecetes opilio*, Bering Sea Tanner crab *C. bairdi*, Eastern Aleutian Islands golden king crab *Lithodes aequispinus*, Western Aleutian Islands golden king crab, and Western Aleutian Islands red king crab fisheries. The 2005/2006 commercial fishery season was the first to be prosecuted under the new Crab Rationalization Program.

Prior to the 2005/2006 BSAI crab season, the commercial fleet participating in the "general" (i.e., non-CDQ) fisheries fished competitively towards that portion of the harvest not allocated to the CDQ program. The Alaska Department of Fish and Game (ADF&G) managed the competitive general fisheries by establishing a guideline harvest level (GHL) prior to the season, monitoring the harvest during the season, estimating the date and time that the harvest would attain the GHL, and closing the general fishery at that estimated date and time. After closure of the general fishery, the CDQ fishery for the season would open and participating vessels were allowed to fish until the CDQ allocation was harvested or until the regulatory season closing date. With implementation of the Crab Rationalization Program, ADF&G now establishes a total allowable catch (TAC) for each fishery according to State regulations and the National Marine Fisheries Service (NMFS) distributes the TAC as quota shares (QS), with 10% of the TAC allocated to the CDQ and the remaining 90% of the TAC allocated to qualifying vessels as individual fishing quotas (IFQs). ADF&G no longer manages the rationalized fisheries inseason; harvesters may harvest their QS at any time within the fishery seasons established in State regulations. Federal regulations also established other provisions for implementing the Crab Rationalization Program, including those for allocating processor shares to processors, those for governing the consolidation of quota shares by vessels through leasing or purchasing of IFQs, and those for governing the formation of vessel cooperatives.

Crab pots are the legal gear for the BSAI commercial crab fisheries and only males meeting or exceeding the minimum size limits established in State regulations can be harvested. Females, sublegal males, and non-targeted species are also captured by the crab pots and, although State regulations require harvesters to immediately return any captured females and undersized males to the sea, there remain concerns about the mortality due to handling suffered by the discarded crabs (NPFMC 2005). Under the pre-rationalized, competitive fishery regime that the general fishery was prosecuted, high levels of vessel participation relative to the GHL often resulted in fast-paced, "derby-style" fisheries. In an attempt to control fishery effort to the level that the fisheries could be managed inseason, per-vessel pot limits were instituted in State regulations for the Bering Sea king and Tanner crab fisheries. Pot limits varied among fisheries, among vessel size classes (within fisheries, pot limits for vessels $\leq$ 125 ft in length were 80% of those for larger vessels) and, in some fisheries, the pot limits varied positively with the preseason GHL; 250 pots per vessel was the maximum limit for any fishery and vessel size class.

Among the problems that the Crab Rationalization Program was intended to address was the need to "... develop a management program which slows the race for fish, [and] reduces bycatch and its associated mortalities..." (NPFMC's *BSAI Crab Rationalization Problem Statement*; quoted in NMFS 2004). Replacing the competitive fishery regime with a QS-based regime under the Crab Rationalization Program was expected to obviate the need to "race for fish." Eliminating or slowing the race for fish, in turn, was expected to result in longer soak times for the crab pots, thereby increasing the effectiveness of pot escape mechanisms (escape rings or minimum mesh sizes as required by State regulations) in allowing females or undersized males to escape prior to being handled on deck and discarded (NMFS 2004). To further facilitate use of increased soak times under the Crab Rationalization Program, the Alaska Board of Fisheries in March 2005 increased pot limits to 450 pots per vessel in the Bristol Bay red king, Bering Sea Tanner, and Bering Sea snow crab fisheries and to 250 pots per vessel in the St. Matthew blue king and Pribilof red and blue king crab fisheries, regardless of vessel size or TAC. Additionally, a slower-paced fishery was expected to allow harvesters more opportunity to move their gear to areas with fewer non-retainable or undesirable crabs. On the other hand, prior to implementation of the Crab Rationalization Program, there were concerns that a QS-based regime could allow for, or even promote, "highgrading" by harvesters; i.e., discarding legally retainable, but lower-valued, crabs in order to maximize the contribution of higher-valued crabs towards the harvested QS. The concern was specifically cited during development of the Crab Rationalization Program that harvesters may sort through captured legal males for retention of the largest, cleanest-shelled crabs and discard, with the associated handling mortality, the remaining legal crabs (NMFS 2004).

The Crab Rationalization Program has, in fact, slowed the pace of the BSAI crab fisheries. For example, the 2005/2006 Bristol Bay red king crab season was prosecuted towards the 18.329-million pound TAC over the 3-month period following the October 15, 2005 season opening date; the first delivery was made on October 20, 2005 and the last delivery was made on the day after the regulatory closure date of January 15, 2006 (F. Bowers, ADF&G, Dutch Harbor, personal communication). In contrast, the season lengths for the Bristol Bay red king crab general fisheries during 1996-2004 had all been less than one week, requiring only 3 to 5 days to harvest 7.5-million to 14.5-million pounds annually (Bowers et al. 2005).

In this report we provide information for beginning to assess the expectations and concerns relative to bycatch reduction and highgrading associated with the slower-paced rationalized fisheries. Using data collected by crab observers deployed on fishing vessels by ADF&G, we present estimates on the capture rates of female, sublegal male, and non-retained legal male crabs of the targeted species in the first fishery to have been completed under the Crab Rationalization Program, the 2005/2006 Bristol Bay red king crab fishery. We also compare those estimates with estimates for the 1999-2004 general and CDQ Bristol Bay red king crab fishery seasons and compare estimates of the size and shell-condition distributions for retained and non-retained legal males during the 2005/2006 Bristol Bay red king crab season.

METHODS

The data that we report on here was collected by observers deployed by ADF&G on vessels fishing for red king crabs during the 2005/2006 Bristol Bay season. We compared those data with summaries of data collected by observers during the general and CDQ fisheries of the pre-rationalized 1999-2004 Bristol Bay seasons, which were previously reported in annual summaries of ADF&G's Mandatory Shellfish Observer Database (Barnard 2001, Barnard and Burt 2004, Barnard et al. 2001, Burt and Barnard 2005, Burt and Barnard 2006, Moore et al. 2000, Neufeld and Barnard 2003). We limited our comparison with the pre-rationalized fisheries to the 1999-2004 seasons because the 1999 season was the first season for which catch rates of non-retained legal males were estimated from observer data. The general and CDQ fisheries were analyzed separately for the 1999-2004 because of the distinct natures of the general and CDQ fisheries in those seasons. The general fisheries during 1999-2004 opened on October 15 and remained open for 3-5 days, with GHLs ranging from 6.6-million pounds to 14.5-million pounds and 230 to 257 vessels participating annually (Bowers et al. 2005; Table 1). The CDQ fisheries during the 1999-2004 seasons opened after the closure of the general fishery with only 10 to 13 vessels participating and were prosecuted at a reduced pace relative to the general fishery until the CDQ allocation (ranging from 0.6-million to 1.2-million pounds) was harvested. We analyzed the 2005/2006 season as a single fishery, however, with no distinction made between the IFQ and CDQ fisheries because the IFQ and CDQ fisheries were prosecuted concurrently and some individual vessels simultaneously participated in both the IFQ and CDQ fishery.

Observer coverage levels varied over the seasons considered here and between the general and CDQ fisheries within the same season (Table 1). Catcher-processor vessels were required to have 100% observer coverage during all fisheries and seasons covered by this report. In the 1999 general fishery observers were deployed only on catcher-processor vessels. During the 2000-2004 general fisheries, however, observers were also randomly deployed on approximately 10% of the catcher-only vessels 75-125 ft in length and on approximately 10% of the catcher-only vessels >125 ft in length. Prior to the 2005/2006 season, the CDQ fisheries were prosecuted after the general fishery for the season had closed and observer coverage levels on catcher-only vessels were higher than in the general fishery. During the 1999 and 2000 CDQ fisheries, observers were deployed on 100% of the participating vessels. During the 2001-2004 CDQ fisheries observers were deployed on one catcher-only vessel per CDQ group, as well as on any participating catcher-processing vessels, resulting in 60% of the participating vessels carrying observers in each of those fisheries. Because the 2005/2006 Bristol Bay red king crab IFQ and CDQ fisheries were conducted concurrently and individual vessels could fish for multiple QSs (both IFQ and CDQ), no distinction was made between the IFQ and CDQ fisheries during the selection of vessels to carry observers. Twenty percent of the catcher-only vessels that pre-registered for the 2005/2006 season in each of the 75-125 ft and >125 ft size classes were randomly selected to carry observers. In actuality, fewer vessels fished than had pre-registered for the 2005/2006 season and observers were deployed on 27% of the 89 vessels that fished in the season, including the 4 catcher-processor vessels that received 100% observer coverage.

Three sources of data collected by observers were used in this analysis: data collected from randomly-selected pot lifts during the fishery; data collected from crabs sorted and retained by the vessel crew for delivery or processing; and data collected from confidential interviews with the captain of the vessel. The methods for obtaining these data are briefly described below; the ADF&G Shellfish Observer Manual (ADF&G 2003) provides detailed descriptions of crab observer sampling duties.

Observers were directed to randomly select 3 pot lifts each day during the 1999 season and 10 pot lifts per day during each of the 2000 to 2005/2006 seasons and to record information on the location, depth, soak time, and contents of each randomly-selected pot lift. Specifically, with regard to the data collected on red king crabs captured in randomly-selected pot lifts, observers recorded: the sex, carapace length (CL) in mm, and shell condition of each red king crab; the legal status relative to the minimum legal size of 6.5-in carapace width of each male; the fate of each legal male as either retained (i.e., for delivery or processing) or non-retained (i.e., discarded); and data on the reproductive condition (clutch fullness, egg development, and egg color) of each female. Although sex, CL, and legal status can be either objectively scored or directly measured, scoring of shell condition is a more subjective determination. Shell condition is recorded to provide an estimate of the time since a crab's last molt (ADF&G 2003, Donaldson and Byersdorfer 2005). Observers scored the shell condition of sampled red king crabs as either "new", "old" or "very old" on the basis of the presence and amount of abrasions, discoloration, and wear on the ventral surfaces, the presence and amount of epibionts on the dorsal surface, the color of the dorsal surface, and the degree of wear on spines and dactyls (ADF&G 2003). Observers consulted with the vessel crew and observed the sorting practices of the vessel crew to ascertain the characteristics of legal king crabs that were retained or non-retained. Observers gained further information on the characteristics needed to score legal males as either retained or non-retained by observing if the legal males that they had scored as retained or non-retained were treated as such by the vessel crew after the sampling of a pot lift was completed.

In addition to and independent of obtaining data on red king crabs in randomly-selected pot lifts, observers also sampled from the crabs that were sorted and retained by the vessel crew for delivery or processing. Observers deployed on catcher-only vessels were assigned to record the CL and shell condition from at least 100 randomly-selected retained red king crabs at the time of each delivery. Observers deployed on catcher-processor vessels were assigned to record the CL and shell condition from at least 100 randomly-selected retained red king crabs, prior to being processed, on a daily basis.

Observers also collected information on the fishing activities of their assigned vessel through daily interviews with the captain of the vessel. From the information collected during the daily interviews, the data used in this report were the number of pot lifts performed by the vessel for each day.

The data on red king crabs in randomly-selected pot lifts and on daily vessel effort from confidential interviews were used to estimate the catch per pot lift (CPUE) of female, sublegal male, retained legal male, and non-retained legal male red king crabs. CPUE was estimated using a weighted mean formula for stratified sampling (Burt and Barnard 2006). Briefly, each day an observed vessel fished (vessel-day) was considered a separate stratum and data within a vessel-day stratum was weighted by the vessel's effort (number of pot lifts) for that day relative to the vessel's total effort for the season. Hence data from pot lifts sampled on vessel-days with more effort were given greater weight in the estimates. Beginning in 2003, data were further stratified by vessel category to account for the differences between vessel size classes in pot limits and for the difference in observer coverage levels between catcher-only vessels and catcher-processor vessels. The 3 strata for vessel category were catcher-only vessels ≤125 ft, catcher-only vessels >125 ft, and catcher-processor vessels. For the 2005/2006 season vessels were stratified into only two vessel classes, catcher-only vessels and catcher-processor vessels. Catcher-only vessels were not stratified by size class in 2005/2006 because pot limits were no longer applied differentially by vessel size class. The total number of red king crabs by sex-size class caught by the entire fleet during a fishery was estimated by multiplying the estimated CPUEs by the total number of pot lifts for the entire fleet during the fishery. The value used for total fishery pot lifts in the 2005/2006 season (117,079) was a preliminary value provided by F. Bowers (ADF&G, Dutch Harbor, personal communication).

There is no other data source on bycatch during these fisheries that can be used to directly assess the accuracy of the CPUE estimates for females, sublegal males, and non-retained legal males that were obtained using data collected by observers from pot lift samples. However, the data recorded on fish tickets and on confidential interviews with vessel captains by observers and dockside samplers provide an independent data source for assessing the accuracy of the CPUE estimates for retained legal crabs. Data from fish tickets and confidential interviews are compiled annually to compute and report (e.g., Bowers et al. 2005) the actual fishery CPUE (i.e., the number of all live and dead crabs that were delivered or retained for processing during the season divided by the total number of pot lifts performed during the season by all participating vessels). The annually reported summaries of ADF&G's Mandatory Shellfish Observer Database provide comparisons for each observed fishery of the estimated CPUE of retained crabs with the actual fishery CPUE. Those comparisons show that the CPUE estimates of retained crabs are generally accurate; in particular, the CPUE estimates of retained crabs for each of the 1999-2004 Bristol Bay red king crab general fisheries have been within ± 9% of the actual fishery CPUE (Barnard and Burt 2004, Barnard et al. 2001, Burt and Barnard 2005, Burt and Barnard 2006, Moore et al. 2000, Neufeld and Barnard 2003).

Data collected from randomly-selected pot lifts were also used to compare the estimated size and shell-condition frequency distributions of captured male red king crabs across seasons and to estimate the size and shell-condition frequency distributions of captured legal, retained legal, and non-retained legal red king crabs during the 2005/2006 season. Additionally, for the 2005/2006 season only, the shell-condition data collected from legal males in randomly-selected pot lifts were compared on a vessel-by-vessel basis with the shell-condition data collected from samples of the crabs that were sorted and retained by the vessel crew for delivery or processing. The statistical significance of vessel-by-vessel differences between the shell-condition distributions of legal males in randomly-selected pot lifts and the shell-condition distribution of legal males sorted for delivery or processing was tested using methods for analyzing multiple independent contingency tables (Cox and Snell 1989).

RESULTS

The mean soak time of the pot lifts that were randomly selected for sampling by observers during the 2005/2006 season was 65 hours (Table 2). Of the seasons and fisheries considered here, that value was exceeded only by the mean soak time for pot lifts sampled during the 2004 CDQ fishery (67 hours) and is more than twice that for any of the general fisheries in the 1999-2004 seasons. The CPUE of retained legal males estimated from randomly-sampled pot lifts during the 2005/2006 season was 23.8 per pot lift (Table 2); by comparison, the actual fishery CPUE for the 2005/2006 season has been preliminarily determined to be 23.3 crabs per pot lift (F. Bowers, ADF&G, Dutch Harbor, personal communication). That value was higher than those for the 1999-2003 general fisheries, comparable to that for the 2004 general fishery, but lower than those for the 2003 and 2004 CDQ fisheries.

The estimated CPUE of discarded red king crabs (i.e., females, sublegal males, and non-retained legal males) for the 2005/2006 season was 49.8 crabs per pot lift, a value exceeded only by that for the 2004 CDQ from among those estimates that we report here (Table 2). Expressed as a percentage, discarded red king crabs were estimated to have comprised 68% of the total (i.e., retained and discarded) red king crabs captured during the 2005/2006 season, the second highest percentage estimated for any of the fisheries or seasons considered here (Figure 1). An estimated 5.831-million red king crabs were captured and discarded during the 2005/2006 season. That estimate is comparable to the highest estimate for total number of discarded red king crabs in any one season among the 1999-2004 seasons (general and CDQ fisheries combined), 5.807-million crabs in 2003 (Figure 2).

As in the 1999-2004 seasons, sublegal males were estimated to constitute the largest component (53%) of the discarded red king crab catch during the 2005/2006 season (Table 2, Figure 2). The size distribution of males in sampled pot lifts during the 2005/2006 season tracks well with those for the previous 5 seasons (Figure 3). In particular, a mode at approximately 98-mm CL in the size distribution for the 2003 season tracks to a mode at approximately 128-mm CL in the size distribution for the 2005/2006 season. Seventy-four percent of the non-retained males (60% of the sublegal males and all the non-retained legal males) in sampled pot lifts during the 2005/2006 season were ≥ 120-mm CL, the size used to identify mature male red king crabs for management of the Bristol Bay fishery (5 AAC 34.816 (b) (3); Figure 4). Females accounted for an estimated 35% of the red king crab bycatch during the 2005/2006 season and 87% of the females in sampled pot lifts during that season were classified as mature on the basis of the presence of eggs or empty egg cases.

Particularly notable in the CPUE estimates for the 2005/2006 season as compared to the 1999-2004 fisheries was the estimated CPUE of non-retained legal red king crabs (5.8 crabs per pot; Table 2) and their estimated contribution to the total legal males captured (20%), total non-retained red king crabs captured (12%), and total red king crabs captured (8%). The percentage of the total captured red king crabs that were non-retained legal males during the 2005/2006 season was markedly higher than the percentages estimated for any of the general fisheries during 1999-2004 and nearly twice the highest percentage estimated for the CDQ fisheries during 1999-2004 (Figure 1). An estimated 677-thousand legal male red king crabs were captured and discarded during the 2005/2006 season, whereas the highest estimate for total discarded legal males among any of the 1999-2004 seasons (general and CDQ fisheries combined) was 80-thousand crabs in the 2002 season (Figure 2).

Non-retention of the legal males captured by the pot lifts sampled by observers during the 2005/2006 season was correlated with shell condition. By comparison with all (retained and non-retained) legal males in the pot lifts sampled during the 2005/2006 season, crabs classified as new-shell were over-represented in the legal males scored as retained and crabs classified as old- and very-old-shell were highly over-represented in the legal males scored as non-retained (Table 3, Figure 5). There was also some association between non-retention of legal males and their size, with a tendency for higher proportions of the larger legal males in sampled pot lifts to be scored as non-retained than the smaller legal males (Figures 4 and 5). Among the legal males measured by observers in sampled pot lifts during the 2005/2006 season, 16% of the 12,453 that were 131-145 mm CL in size, 23% of the 34,617 that were 146-170 mm CL in size, and 31% of the 3,496 that were 171-195 CL mm in size were scored as non-retained. As a result, there was a slight difference in the mean size between the legal males in sampled pot lifts scored as retained (153.4-mm CL, n = 39,578) and non-retained (156.1-mm CL, n = 11,036); the 95% confidence interval for the difference in mean CL was 2.4 - 2.9 mm.

The tendency during the 2005/2006 season for legal males in new-shell condition to be over-represented in the retained catch as compared to all captured legal males (retained and non-retained) was also revealed by a vessel-by-vessel comparison of the shell-condition data collected from legal males in randomly-selected pot lifts with the shell-condition data collected from the legal males that were sorted and retained for delivery or processing by the vessel crew (Figure 6). For all but 2 of the 24 observed vessels, the percentage of legal males classified as new-shell by observers in the sample of the legal males that were sorted by the vessel crew for delivery or processing exceeded the percentage classified as new-shell in the sample of the legal males (regardless of scoring as retained or non-retained) contained in the randomly-selected pot lifts from the same vessel. For 18 of the 24 vessels the difference in new-shell percentages was 8% or greater and the average of the differences for the 24 vessels was 15%; the differences in new-shell percentages over the 24 vessels is statistically significant ($P \ll 0.001$, $z = 39.9$).

DISCUSSION

Data on soak time of randomly-selected pot lifts from observed vessels during the 1999 through 2005/2006 Bristol Bay red king crab fishery seasons were consistent with the increased soak times anticipated for a QS-based fishery regime under the Crab Rationalization Program. Mean soak time for sampled pot lifts sampled during the 2005/2006 season was more than double that for any of the 1999-2004 general fisheries and was, at 65 hours, comparable to that for the 2004 CDQ fishery. An experimental study conducted with commercial king crab pots in Bristol Bay has shown that increased soak times, in conjunction with the pot-escape mechanisms required in State regulations, result in a decrease in the ratio of non-legal to legal red king crabs captured (Pengilly and Tracy 1998). The actual catch or CPUE of non-retained crabs relative to retained legal crabs during a commercial red king crab fishery, however, also depends on other factors, such as the size-sex distribution of the red king crab population, where fishing is conducted relative to the spatial distribution of non-legal and legal crabs, and the sorting of legal crabs for retention or non-retention. Despite the longer soak times used in the 2005/2006 Bristol Bay red king crab season, estimates of CPUE and catch of non-retained red king crabs and of the percentage of the red king crabs that were captured but not retained were generally high relative to the general and CDQ fisheries of the preceding six seasons.

The estimated number of non-retained red king crabs for the 2005/2006 season (5.831-million) was higher than for any of the combined general and CDQ fisheries in the 1999-2004 seasons. That may be partly attributable to the TAC for the 2005/2006 season (18.329-million pounds) being higher than harvests during the 1999-2004 seasons (i.e., the highest combined general and CDQ harvest during 1999-2004 was 15.697-million pounds for the 2003 season; Bowers et al. 2005). However, the estimated catch of non-retained red king crabs as a percentage of the total red king crabs captured in the 2005/2006 season (68%) was amongst the highest of the estimates made for any of the fisheries (general or CDQ) since the 1999 season. Preseason data from the NMFS eastern Bering Sea trawl survey indicated that the abundance of sublegal males and mature females in the Bristol Bay red king crab population was relatively high in 2005 (J. Zheng, ADF&G, Juneau, personal communication) and that may account for the high bycatch of sublegal males and females during the 2005/2006 season. Most of the non-retained crabs sampled during the 2005/2006 season (74% of the males and 87% of the females) were mature or of the size used to identify maturity for management purposes.

The observer data from the 2005/2006 season was unique relative to the other seasons considered in the degree to which legal males contributed to the non-retained catch. For the first time since the annual estimation of the CPUE of non-retained legal males in the Bristol Bay red king crab fishery was initiated in 1999, legal males were estimated to account for a substantial portion of the total discarded red king crabs in the 2005/2006 season. The number of legal males estimated to have been captured and discarded during the 2005/2006 season (677-thousand crabs) represents 12% of the estimated total catch of non-retained red king crabs and 20% of the estimated total catch of legal males for the season. Prior to the 2005/2006 season, it had been noted that a "...small level of highgrading has been observed in the CDQ crab fisheries..., but this is not widespread" (NMFS 2004). The 2003 and 2004 Bristol Bay red king crab CDQ fisheries did, in fact, have higher estimates of CPUE for non-retained legal males than for those of the 1999-2004 general fisheries. By all measures, however, the catch rates of non-retained legal males during the 2005/2006 season were markedly higher than for the CDQ fisheries in previous seasons. Additionally, although the discard rates of legal males during the recent CDQ seasons were high relative to the general fisheries, the CDQ fisheries accounted for only 7.5% of the total harvest and a smaller percentage of the total effort for a season. Hence the catch of non-retained legal males in each of the complete (i.e., general and CDQ fisheries combined) 1999-2004 seasons was negligible in comparison to the 2005/2006 season.

Concerns that highgrading for the retention of only the largest, cleanest-shelled legal males would occur in rationalized fisheries (NMFS 2004) were only partially borne out by the data collected by observers during the 2005/2006 Bristol Bay red king crab season. Shell condition, specifically a strong preference for new-shell crabs over old-shell or very-old-shell crabs, was a more important correlate of retention or non-retention than size. In fact, the legal males in pot lift samples that were scored as non-retained tended to be slightly larger than the legal males in pot lift samples that were scored as retained. That size difference probably reflects a positive association between size and the proportion of males in old and very-old-shell conditions, coupled with the tendency to retain new-shell legal males and discard old and very-old shell legal males, rather than any selection for retention based on size.

The estimates of CPUE based on data collected from randomly-selected pot lifts are, in fact, estimates. Moreover, the estimated CPUEs of retained legal males and non-retained legal males are based on the scoring of sampled legal males as such by observers. Hence it is worth considering the accuracy of the CPUE estimates, particularly for the estimated CPUE of non-retained legal males for the 2005/2006 season. Two lines of evidence provide support for the validity of the CPUE estimate for non-retained legal males during 2005/2006. The first is the accuracy of the CPUE estimate for retained males. The CPUE estimate for retained legal males for the 2005/2006 season (23.8 crabs per pot lift) was within 2% of the actual fishery CPUE that has preliminarily determined from the reported deliveries, processing, and effort for the entire season (23.3 crabs per pot lift; F. Bowers, ADF&G, Dutch Harbor, personal communication). The second is the higher percentage of new-shell crabs in legal males that were retained for delivery or processing than in the legal males that were in randomly-selected pot lifts prior to sorting for retention by the vessel crew. Hence the data collected by observers on retained males, independently of the data that they collected on legal males from pot-lift samples, were consistent with a tendency for the harvesters to preferentially retain legal males in new-shell condition and to discard legal males in old- or very-old-shell condition.

In summary, the data collected by observers during the 2005/2006 Bristol Bay red king crab season provided no indication that the first fishery completed under the Crab Rationalization Program achieved the goal of reducing the bycatch and discarding of females and sublegal males. Instead, those data substantiated the concerns that a fully-rationalized, QS-based fishery regime could lead to increased discarding of captured legal males, concerns that had earlier gained some validity from results for previous CDQ fisheries. It is possible, but entirely conjectural, that the bycatch of sublegal males and females would have been higher during the 2005/2006 season if it had not been managed under a QS-based regime that allowed for longer soak times. However, relatively high abundance of sublegal males and mature females does not account for the estimated 12% of the discarded catch that were legal males. Moreover, the discarding of an estimated 20% of the captured legal males during the 2005/2006 season also likely had the effect of increasing the bycatch of females and sublegal males by increasing the number of pot lifts necessary to harvest the TAC.

Finally, note that we do not generalize these findings from the 2005/2006 Bristol Bay red king crab season to the four other fisheries that opened under the Crab Rationalization Program in the 2005/2006 season (i.e., the Bering Sea snow crab, Bering Sea Tanner crab, Eastern Aleutian Islands golden king crab, and Western Aleutian Islands golden king crab fisheries). Those fisheries were still being prosecuted and observer data from those fisheries were not fully available at the time of this report.

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TABLES AND FIGURES

Table 1.-Number of participating fishing vessels, number of observed fishing vessels, total number of pot lifts, and number of pot lifts sampled by observers during the 1999-2005/2006 Bristol Bay red king crab fisheries.

Season-Fishery	Number of Vessels	Number of Observed Vessels	Number of Total Pot Lifts	Number of Pot Lifts Sampled
1999-General	257	9	146,997	178
1999-CDQ	10	10	2,976	263
2000-General	246	21	98,694	673
2000-CDQ	11	11	4,663	428
2001-General	230	30	63,242	494
2001-CDQ	10	6	3,158	166
2002-General	242	28	68,328	487
2002-CDQ	10	6	3,909	251
2003-General	252	31	129,019	731
2003-CDQ	13	8	5,814	279
2004-General	251	29	90,972	536
2004-CDQ	12	8	5,359	226
2005/2006[a]	89	24	117,079	1,855

[a] IFQ and CDQ fisheries combined.

Table 2.-Estimated catch per pot lift (CPUE) with standard errors (in parentheses) of red king crabs by category (retained legal male, non-retained legal male, sublegal male, and female) from randomly-selected pot lifts sampled by observers during the 1999-2005/2006 Bristol Bay red king crab fisheries.

Season-Fishery	Retained Legal Males	Non-retained Legal Males	Sublegal Males	Females	Total Discarded [a]	Mean Soak Time (hr)
1999-General	13.4 (1.1)	<0.1 (<0.1)	6.1 (0.8)	0.2 (0.1)	6.3	25
1999-CDQ	[b]	[b]	[b]	[b]	[b]	36
2000-General	12.8 (1.3)	<0.1 (<0.1)	13.3 (1.7)	2.3 (0.8)	15.1	22
2000-CDQ	[b]	[b]	[b]	[b]	[b]	26
2001-General	18.4 (2.0)	<0.1 (<0.1)	24.7 (4.4)	12.2 (2.1)	36.9	24
2001-CDQ	[b]	[b]	[b]	[b]	[b]	34
2002-General	19.0 (1.4)	1.1 (<0.1)	21.3 (3.0)	0.7 (0.6)	23.1	18
2002-CDQ	[b]	[b]	[b]	[b]	[b]	45
2003-General	17.8 (1.5)	0.2 (0.1)	26.5 (3.4)	16.5 (3.1)	43.2	31
2003-CDQ	30.1 (3.3)	3.2 (0.8)	26.9 (4.7)	11.2 (2.5)	41.3	42
2004-General	23.1 (1.5)	0.1 (<0.1)	14.2 (2.5)	9.6 (6.2)	23.8	28
2004-CDQ	33.8 (2.1)	3.5 (0.5)	42.5 (3.9)	10.3 (1.3)	56.2	67
2005/2006 [c]	23.8 (1.6)	5.8 (0.9)	26.6 (3.7)	17.4 (2.0)	49.8	65

[a] Sum of CPUEs for non-retained legal male, sublegal male and female crabs.
[b] Confidential.
[c] IFQ and CDQ fisheries combined.

Table 3.-Relative frequency (percent) distributions of shell condition for all legal male, retained legal male, and non-retained legal male red king crabs sampled and scored as retained or non-retained by observers from randomly-selected pot lifts during the 2005/2006 Bristol Bay red king crab season.

Shell Condition	All Legal Males (n=50,614)	Retained Legal Males (n=39,578)	Non-retained Legal Males (n=11,036)
New	71.5%	82.9%	30.3%
Old	24.2%	15.1%	56.7%
Very old	4.3%	1.9%	13.0%

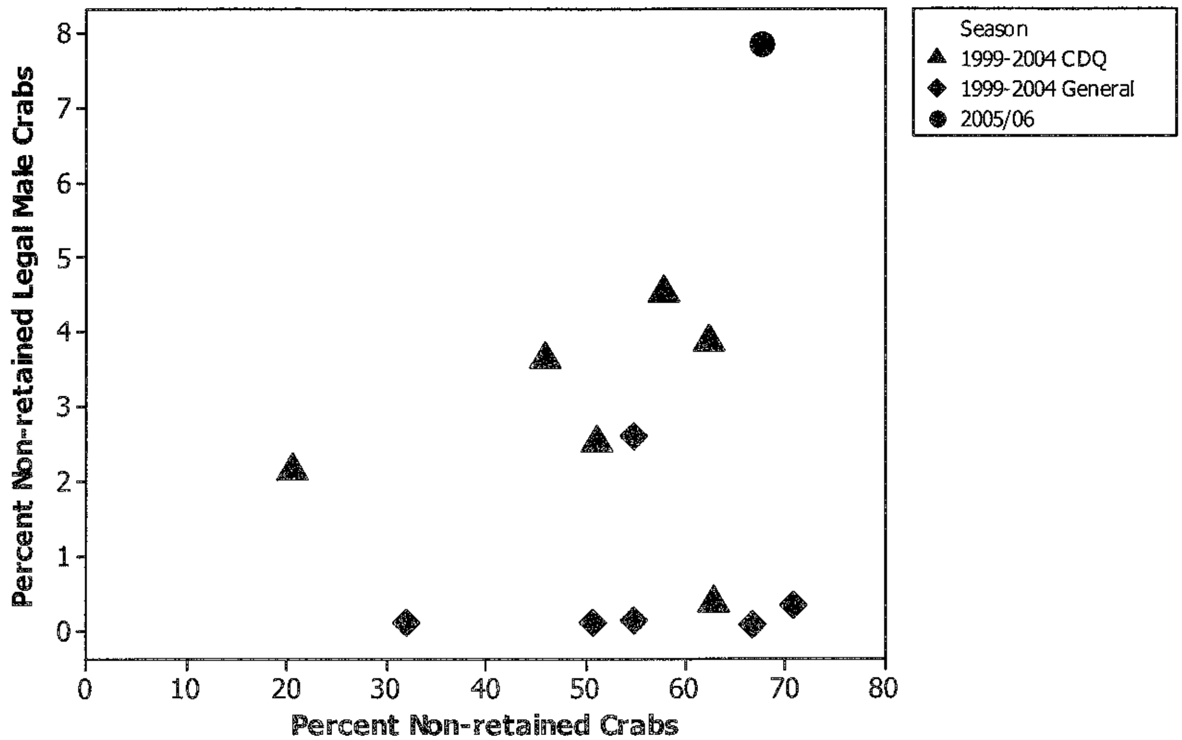


Figure 1.-Estimated percent of red king crabs captured during a Bristol Bay red king crab fishery season that were non-retained (females, sublegal males, and non-retained legal males; horizontal axis) versus the estimated percent of red king crabs captured during the same fishery season that were non-retained legal males (vertical axis) for the 2005/2006 Bristol Bay red king crab season, the 1999-2004 Bristol Bay red king crab CDQ fishery seasons, and the Bristol Bay red king crab general fishery seasons 1999-2004.

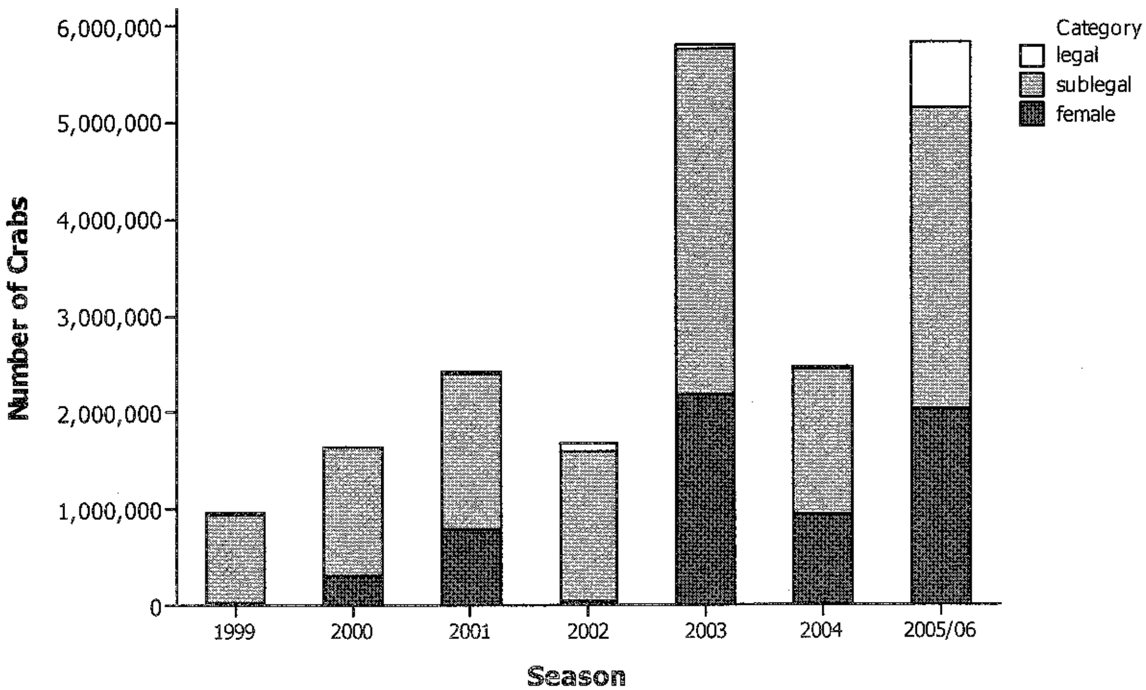


Figure 2.-Estimated numbers of discarded red king crabs by sex and by legal status of males during each of the 1999-2004 Bristol Bay red king crab seasons (general and CDQ fisheries combined) and the 2005/2006 Bristol Bay red king crab season.

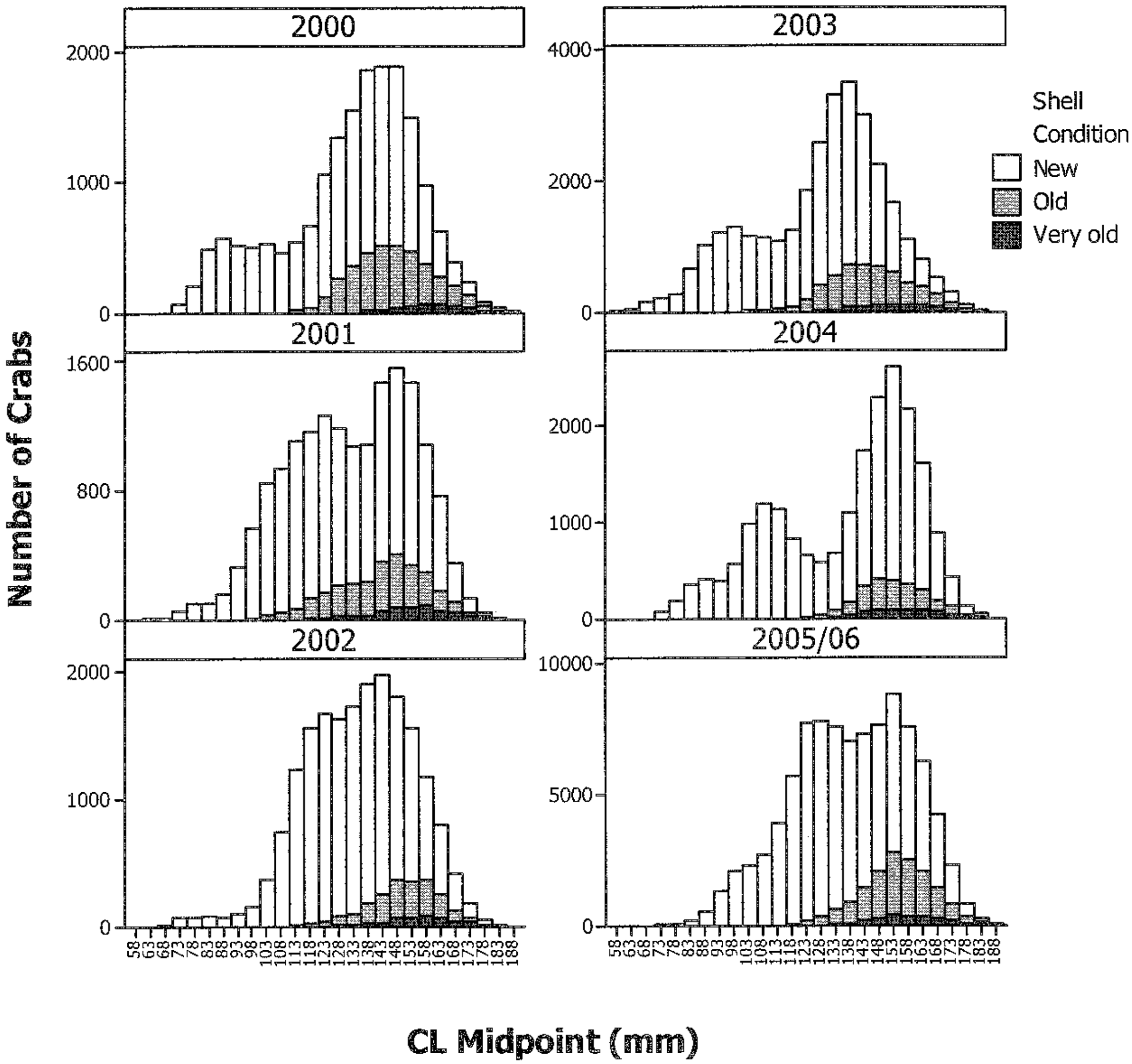


Figure 3.-Carapace length (CL) frequency distributions by shell condition for male red king crabs sampled from randomly-selected pot lifts during the 2000-2004 Bristol Bay red king crab general fisheries and the 2005/2006 Bristol Bay red king crab season.

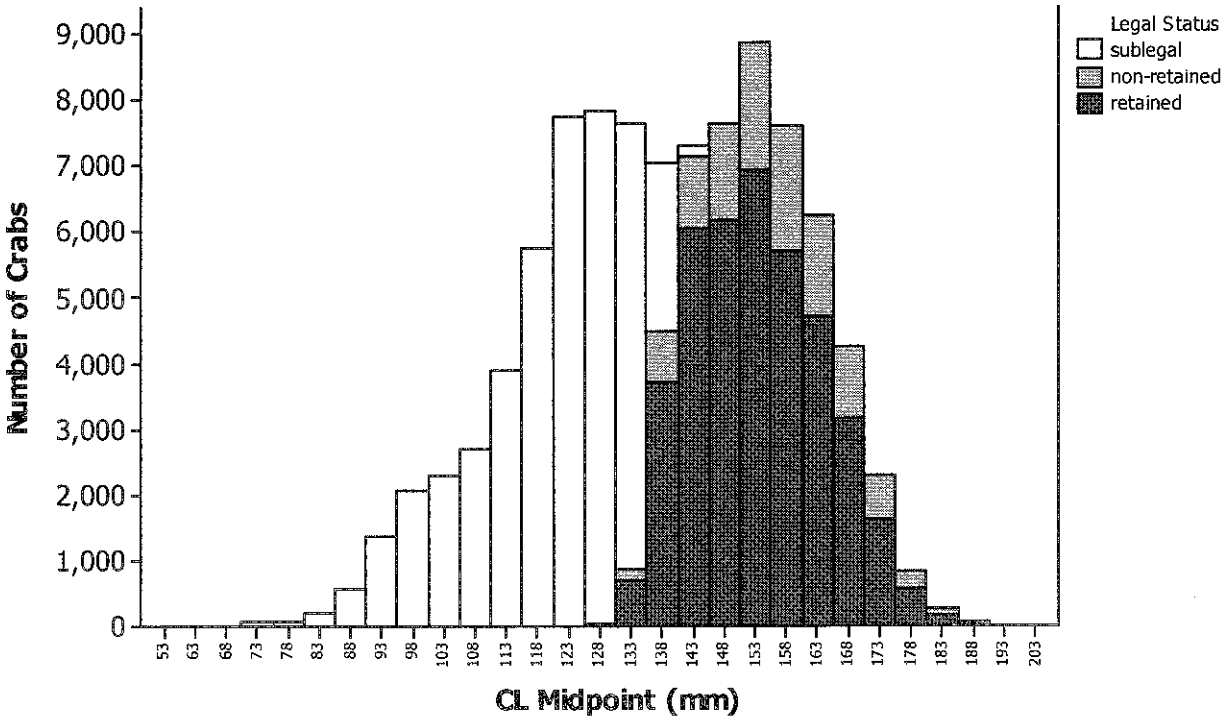


Figure 4.-Carapace length (CL) frequency distribution of sublegal male, non-retained legal male, and retained legal male red king crabs sampled by observers from randomly-selected pot lifts during the 2005/2006 Bristol Bay red king crab season.

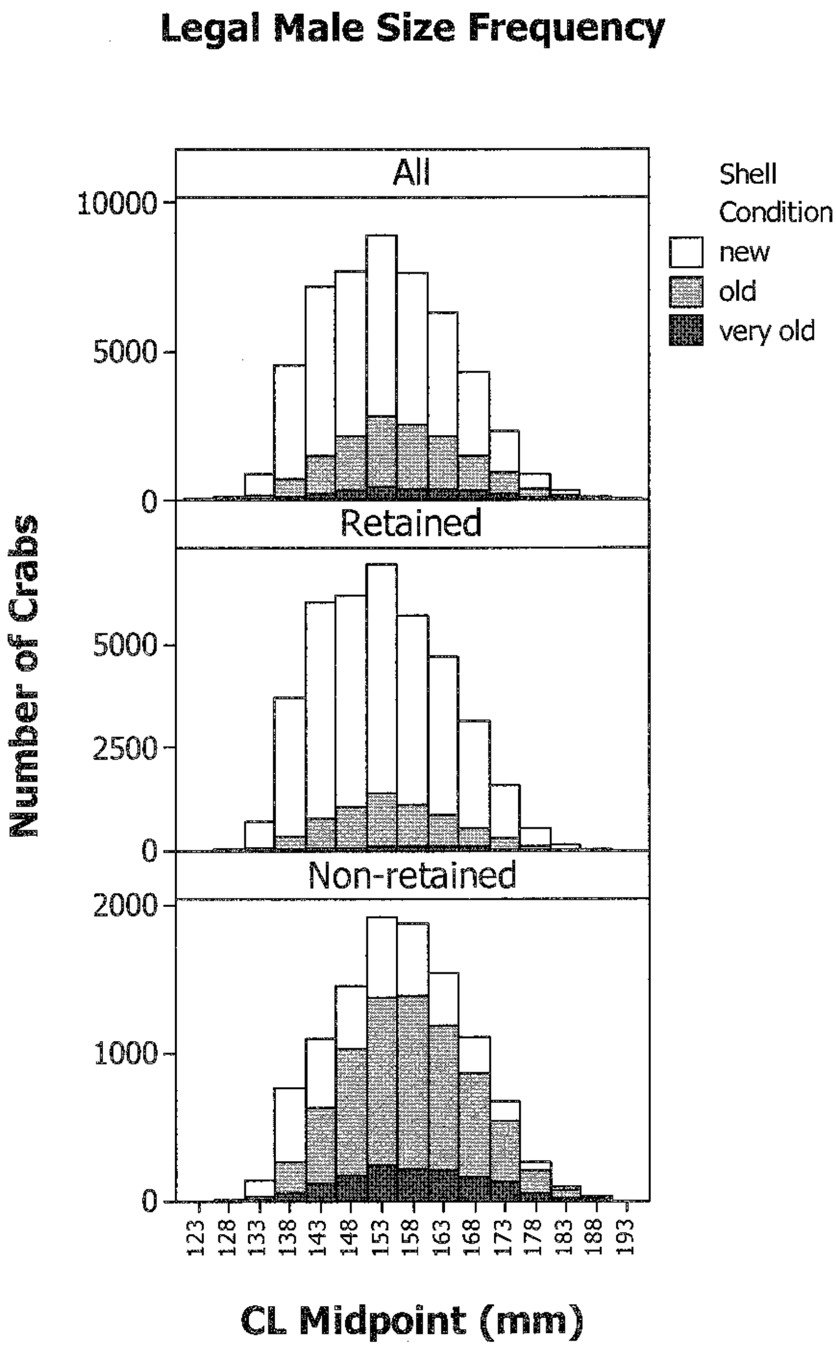


Figure 5.-Carapace length (CL) frequency distributions by shell condition for all legal male (top panel; n=50,614), retained legal male (middle panel; n=39,578), and non-retained legal male (bottom panel; n=11,036) red king crabs sampled and scored as retained or non-retained by observers from randomly-selected pot lifts during the 2005/2006 Bristol Bay fishery.

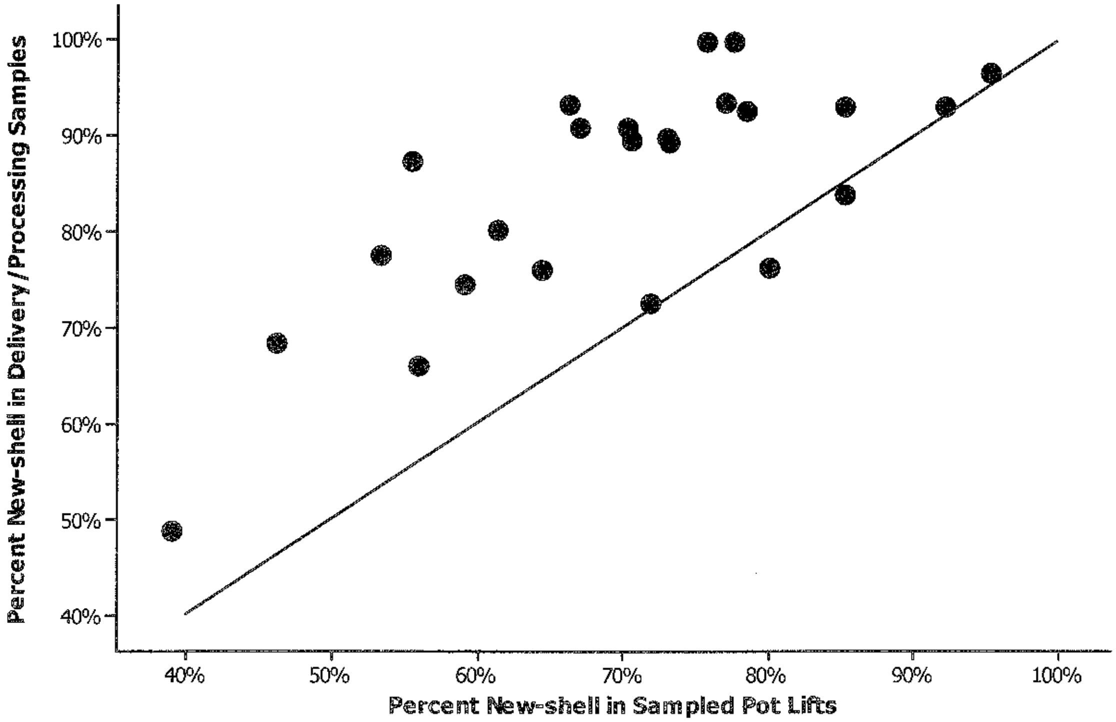
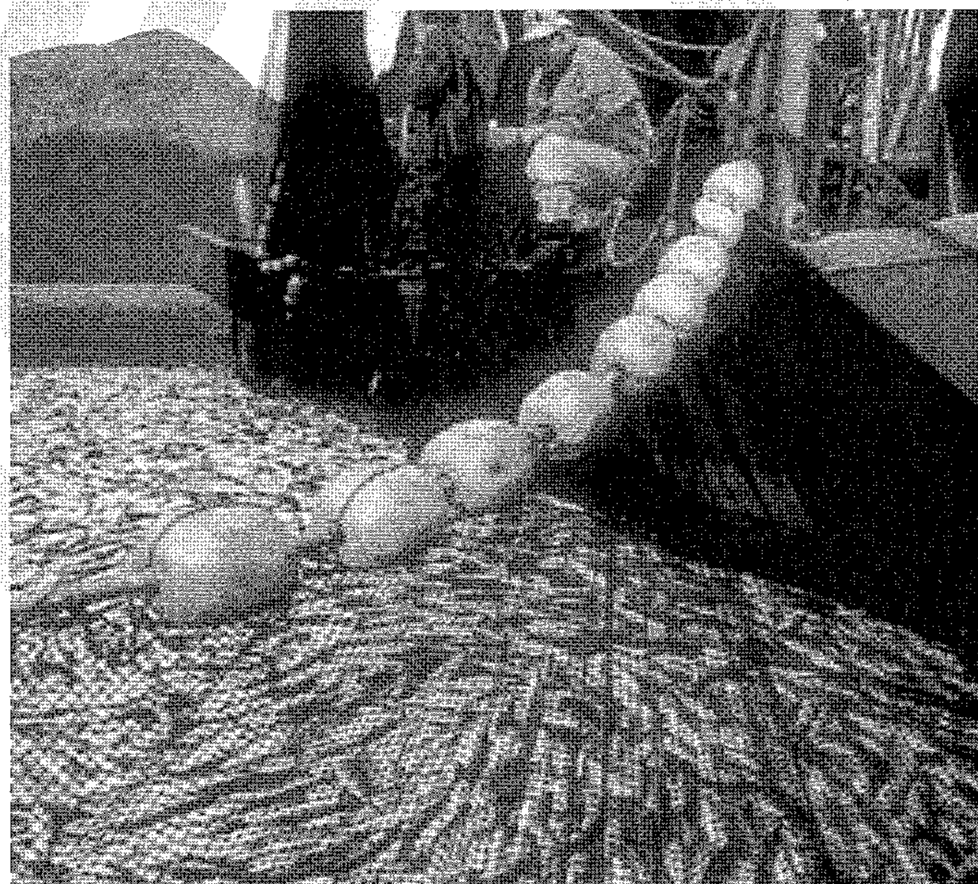


Figure 6.-Percent new-shell condition for legal male red king crabs in randomly-selected pot lifts from a vessel (horizontal axis) versus the percent new-shell condition in samples of the legal male red king crabs retained for delivery or processing by the same vessel (vertical axis) for each of the 24 fishing vessels that carried observers during the 2005/2006 Bristol Bay red king crab season; the line represents equal percent new-shell condition in the two sample types for the same vessel.

the working coast

building the conservation economy
news from ecotrust canada • fall/winter 2004

Canada-U.S. study finds fisheries privatization hurting B.C. First Nations and coastal communities



VANCOUVER–For the first time, a new study investigating the impacts of federal fisheries policies on communities and conservation in British Columbia has quantified what many in rural B.C. already know: the ownership of commercial fishing licences and quota is being consolidated in metropolitan areas. Rural coastal regions are losing their access to commercial fishing opportunities.

Published by Ecotrust Canada, a non-profit organization in Vancouver, B.C., and Ecotrust, its sister organization in Portland, Oregon, *Catch-22: Conservation, Communities and the Privatization of B.C. Fisheries* investigates the economic, social and ecological impacts of fisheries licensing policy.

"Fisheries contribute more than $600 million to the province's GDP," says Ecotrust Canada President Ian Gill. "Yet when I travel the coast

A fisherman now needs to be a millionaire to enter most fisheries.

I see fewer and fewer fishing boats in Masset, Bella Bella, Alert Bay and Ucluelet. Fish plants are closing. Communities are losing their connection to the sea. Yet there's still enormous wealth being harvested from marine ecosystems–just not by local people."

The report focuses, in part, on individual fishing quotas (IFQs) whereby an individual or company owns a preset portion of the total allowable catch. Quotas are bought, sold or traded like shares on a stock exchange. IFQs are considered a form of resource privatization.

DFO has implemented IFQs in the geoduck, halibut, sablefish, groundfish trawl and three shellfish fisheries. It is currently developing a controversial plan–opposed by many working fishermen and First Nations–to implement IFQs in B.C.'s salmon fishery.

"Many of the major reforms of Pacific fisheries in the 1990s represented a catch-22 for communities," the report concludes. Although the Department of Fisheries and Oceans cut the fishing fleet in half and reduced capital investment in vessels and equipment, many of the policy reforms caused inflationary trends in the capital value of commercial fishing licences and quota.

In the 1990s, salmon troll and gillnet licences doubled in value, the price of halibut quota jumped by 400 percent and sablefish quota by more than 600 percent. By 2003, the market value of licences and quotas for all B.C. fisheries was $1.8 billion. That's six times the capital investment in vessels and equipment.

"Individual fishing quotas create big winners and big losers," says Eric Enno Tamm, a researcher for Ecotrust Canada and *Catch-22* coauthor. "Those initially granted quotas by the government earn a windfall profit because

continued on page 2

INSIDE: read more about Catch-22

ecotrust canada

economy

REPORT *continued from page 1*

the public resource is given to them for free. But as the price of the quotas rise, poorer fishermen find it impossible to buy these expensive fishing privileges."

Not surprisingly, with fewer economic opportunities, lower incomes and less home equity, rural and aboriginal fishermen have less capital and thus are at a disadvantage in competing to buy expensive licences and quotas.

The report identifies how inflationary market values for fishing licences squeezed out many rural and Aboriginal fishermen from the industry. Using DFO's licensing database, the report shows that between 1994 and 2002 rural communities with a population of less than 10,000 have lost 45 percent of their fishing licences for salmon, groundfish and shellfish. The decline in urban areas was only 30 percent.

In B.C.'s resource-dependent coastal regions few locals own fishing quotas. Indeed, 44 percent of all ITQ licences in B.C. are owned by residents in metropolitan Vancouver and Victoria, compared to only two percent on the West Coast of Vancouver, three percent in the North Island and nine percent in the North Coast. The researchers used GIS (Geographic Information Systems) technology to map the distribution of licences by coastal region in B.C.

"There is too much money chasing too few fish," says Dr. Astrid Scholz, a resource economist for Ecotrust and *Catch-22* coauthor. "Growing capitalization in fishing licences and quota is causing the urbanization of fisheries as the resource is being bought up by those with the deepest pockets. This could threaten conservation by putting pressure on fishermen to increase catches to finance their large debt-loads."

The report calls for new measures to promote fisheries conservation, reduce overcapitalization and boost the economic viability of struggling fishing-dependent communities through new community-owned fishing quotas, modelled on a successful system in rural Alaska.

Download a copy of *Catch-22* at www.ecotrustcan.org/catch-22.shtml

catch-22 economic impacts

fishing for millionaires

IN THE 1990s, OTTAWA COMMITTED to reducing overcapitalization in the B.C. fishing industry in order to increase its economic viability and conserve fish stocks. Capitalization in the fishing industry takes two forms: investment in vessels and equipment, and investment in fishing licences and quotas.

Through licence buybacks and licensing policy reforms, Ottawa cut the salmon fishing fleet in half in the 1990s. In 1988, the Department of Fisheries and Oceans estimated the capital investment in vessels and equipment for the salmon fleet was about $777 million (in 2003 dollars). By 2003, the capital investment in the entire fishing fleet for all species was estimated to be $286 million.

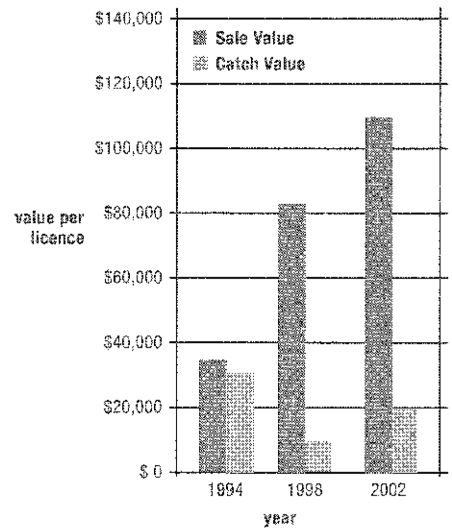
However, the decrease in the capital value of vessels and equipment was offset by the soaring capital value of licences and quota for most commercial fisheries. DFO policies that gave "windfall profits" to some fishermen and allowed for the consolidation and leasing of licences and quota, tax incentives and growing demand for allocations from First Nations and recreational fishermen, all contributed to an inflationary trend in licence and quota prices.

Between 1994 and 2002, the prices of troll and gillnet salmon licences doubled while catches declined significantly. Other fisheries experienced skyrocketing trends, too. The advertised price of halibut quota increased from $9 per pound in 1991 to $36 per pound in 2004. In fact, the quota fisheries such as halibut, sablefish and groundfish trawl are some of the most capital-intensive fisheries in B.C.

By 2003, the capital value of licences and quotas reached $1.8 billion. That's more than six times the capital value of all the vessels and equipment in the B.C. fishing fleet. In the past, the problem was too many fishermen chasing too few fish, but today it has become too much money chasing too few fish. Overcapitalization in licence and quota has become the problem, especially because of its effect on social equity.

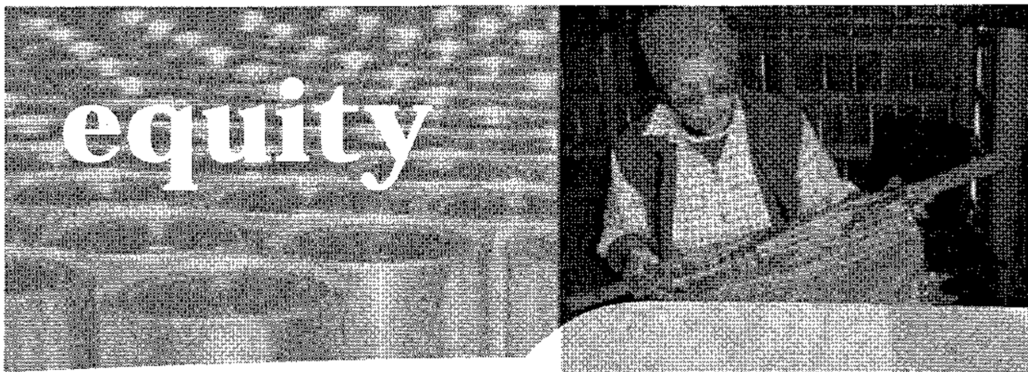
The extremely high market value of commercial fishing licences and quotas is well outside the reach of many rural working families, First Nations and younger fishermen. A fisherman now needs to be a millionaire to enter into most fisheries.

Value of Commercial Salmon Gillnet Licences in B.C., 1994–2002



DFO policy reforms in 1996 caused the sale value of commercial salmon licences to double while annual catches per licence declined. The market value of commercial fishing licences and quota has increased significantly in most B.C. fisheries.

In the past, the problem was too many fishermen chasing too few fish, but today it has become too much money chasing too few fish.



Many First Nations and rural regions see few benefits accruing from adjacent fisheries resources.

catch-22

social impacts

net loss to fishing-dependent communities

FISHERIES ARE EXTREMELY IMPORTANT and valuable to coastal communities and First Nations whose economies are dependent on adjacent natural resources and whose cultural identity is tied directly to fishing.

However, with catches declining in some fisheries and the prices of licences and quota soaring, many commercial fishermen have sold out either through government-funded licence retirement programs or by selling their licences to fellow fishermen.

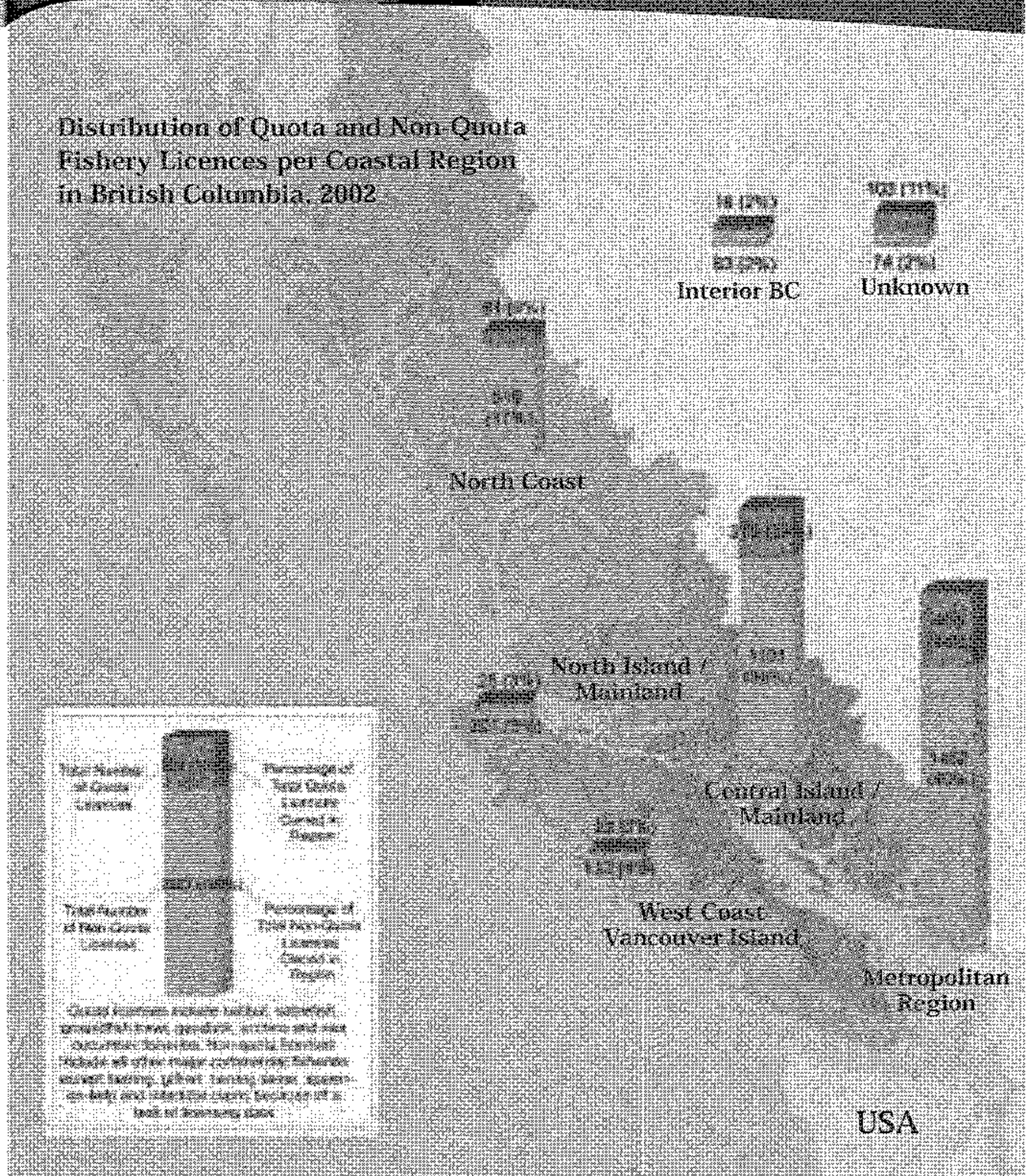
Not surprisingly, many of those fishermen who sold out were in rural and Aboriginal communities. Because of lower incomes, limited economic opportunities and lower property values, rural fishermen have less access to capital than their urban counterparts. They are at a disadvantage in competing to buy commercial fishing privileges.

First Nations people face even more obstacles, since their incomes are 35 percent lower than the B.C. average and unemployment rates are double. Additionally, many native people living on Indian reserves do not have fee-simple ownership of their homes and therefore cannot use home equity to borrow money to buy fishing licences or quotas.

As a result, both rural and Aboriginal individual ownership of commercial fishing licences and quota has declined precipitously. Between 1994 and 2002, rural communities with a population of less than 10,000 lost 540 licences in major fisheries such as groundfish, salmon and shellfish as a result of fleet downsizing and the sale of licences to urban areas. That's almost half (45 percent) of all licences for major fisheries owned by rural people.

Today, the most resource-dependent rural regions see few benefits accruing from adjacent fisheries. Local residents on the West Coast of Vancouver Island, for instance, only own two percent of all individual fishing quotas in B.C. The number is three percent in the North Island and nine percent in the North Coast. By contrast, residents of metropolitan Vancouver and Victoria own 44 percent of quotas. (See map on this page.)

In effect, fisheries policy, whether intentional or not, is skewed in favour of urban-based corporations and individuals with greater access to capital and economic opportunities. Those communities most dependent on fishing for their economic lifeblood are being squeezed out of B.C.'s fisheries.



Loss of Major Commercial Fishing Licences in Select B.C. Coastal Communities, 1994–2002

	Licenses in 1994	Licenses in 2002	Percent change
Ahousat	28	13	-54%
Alert Bay	58	45	-22%
Bamfield	26	8	-69%
Bella Bella	81	56	-31%
Campbell River	328	212	-35%
Comox	189	108	-43%
Kyuquot	25	5	-80%
Masset	49	36	-27%
Port Alberni	133	76	-43%
Port Hardy	185	80	-57%
Port McNeill	24	15	-38%
Prince Rupert	482	467	-3%
Sointula	115	81	-30%
Tofino	66	23	-65%
Ucluelet	80	32	-60%

ecology

Overcapitalization puts pressure on the fisheries resource since fishermen lobby for higher catches to finance their bigger debt-loads.

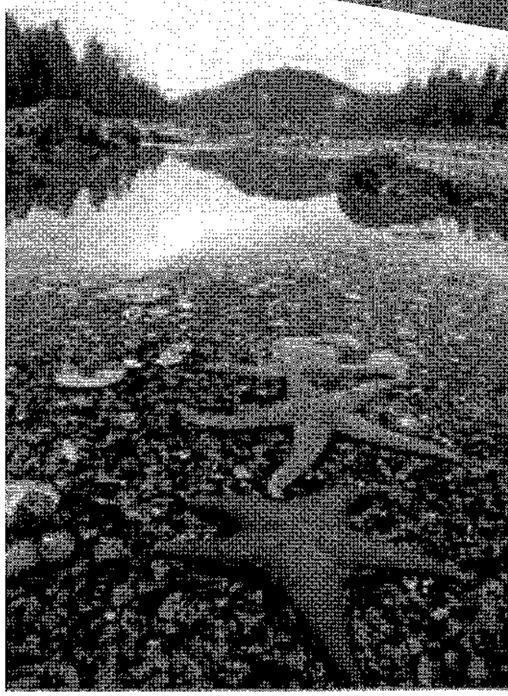
catch-22

ecological impacts

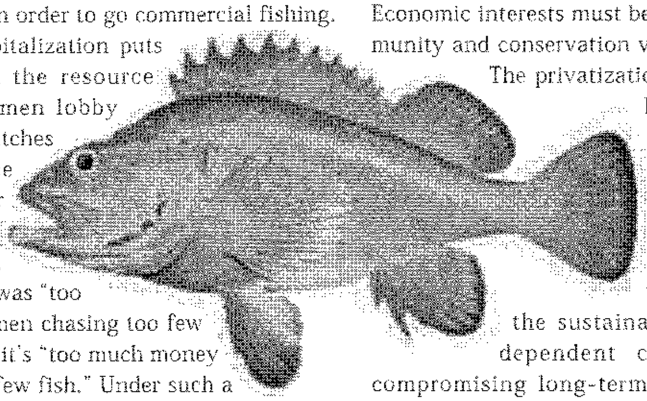
selling out conservation

THE CONSERVATION RECORD OF PRIVATIZING fisheries through individual fishing quotas (IFQs) is inconclusive. By giving fishermen a set individual quota, IFQs end the frenzied "race for fish." However, IFQs can induce bad behaviour by fishermen, including quota busting, poaching, throwing back small fish (high-grading) and misreporting catches. These problems can be solved in part by onboard and dockside observers, but that adds considerable costs to fishing.

The U.S. National Research Council has concluded that "IFQs are not a conservation tool, they're mainly an economic tool." They're about promoting economic efficiency. Setting a total allowable catch that is scientifically defensible and sustainable is one of the most important fisheries conservation measures. Privatizing fisheries through IFQs, however, raises some fundamental problems about how sustainable catch levels are set.



First, IFQs create windfall profits for those who initially receive them, but create huge debt for new entrants who must buy the expensive quotas in order to go commercial fishing. This overcapitalization puts pressure on the resource since fishermen lobby for higher catches to finance their bigger debt-loads. Previously, the problem was "too many fishermen chasing too few fish." Today, it's "too much money chasing too few fish." Under such a scenario, short-term economics will win out over long-term conservation as fishermen succumb to immediate financial pressures.



Second, as part of their attempts to privatize fishery resources, DFO has established co-management agreements with exclusive groups of licence and quota holders, which has increased the influence of these industry stakeholders. Conservation groups, communities, First Nations, and labour interests are marginalized, since fisheries management becomes increasingly focused on maximizing the narrow economic returns of licence and quota holders. Economic interests must be balanced by community and conservation values.

The privatization of B.C. fisheries has ultimately netted a Catch-22: DFO's solution has become the problem, worsening overcapitalization, undermining the sustainability of fishing-dependent communities and compromising long-term conservation for short-term economic efficiency. It is time for a serious re-examination of current policy and a move towards new solutions that work towards the long-term health and viability of fishing-dependent communities and fish stocks.

RECOMMENDATIONS

From the report, *Catch-22: Conservation, Communities and the Privatization of BC Fisheries.*

1) Public Registry
DFO should establish a public registry requiring individuals and companies to register all their leases, trades and sales of fishing licences and quota, and to fully disclose financial interests in these assets. The registry could help protect against corporate concentration and overcapitalization.

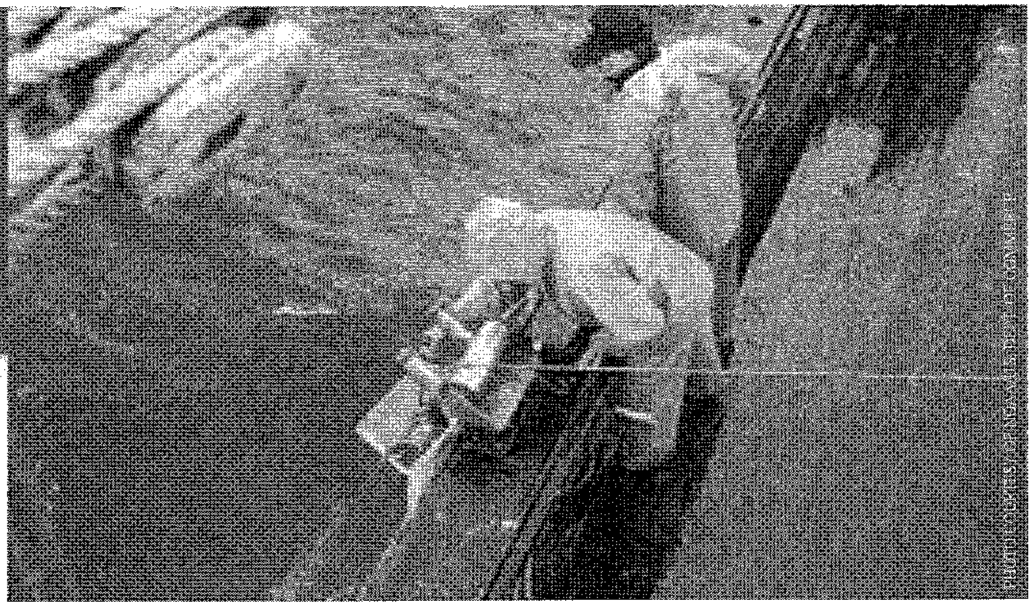
2) National Standards
DFO should establish national standards for fishing licence and quota programs that would reduce overcapitalization, protect working crews from bearing the costs of leases, address unresolved First Nations rights, ensure that fair economic benefits are shared amongst various stakeholders and limit excessive consolidation and corporate concentration in the industry.

3) Community Quota Entities
DFO should permit the establishment of and provide funding for Community Quota Entities, which would be non-profit societies established to hold fisheries licences and quota in trust for Aboriginal and fishing-dependent coastal communities. The CQEs would lease fishing privileges to local fishermen and facilitate new entrants into the industry.

4) Public Data
DFO should establish a comprehensive data-access policy that provides full and transparent access to biological and catch data and thereby rebuild trust in DFO science and ensure rigorous review of fisheries decision-making by independent scientists and the public. Furthermore, all fisheries data funded and collected by private companies as part of IFQ fisheries must be placed in the public domain.

5) Inclusive Decision-making
DFO must ensure that diverse interests are represented in fisheries co-management agreements and harvesting committees including licence and quota holders, labour, processors, coastal communities, First Nations, environmentalists and other citizen groups. Economic interests must be balanced by social and ecological values.

The "easiest and most direct way to help protect communities" under an individual fishing quota program is to allow the communities themselves to hold quota, states a report to the U.S. Congress.



Community quotas are helping sablefish fishermen (above) in rural Alaska.

the alaskan success

searching for solutions for B.C.'s fishing communities

"THERE HAS BEEN A DRAMATIC EROSION OF ability for communities to make their living from the sea." That was the conclusion reached by rural fishing communities which founded the Gulf of Alaska Coastal Communities Coalition in 1998.

"Our mission is to be an advocate for retaining, regaining or increasing commercial access to sustainable marine resources for smaller communities," says Gale K. Vick, executive director of the coalition.

In June 2001, the U.S. North Pacific Fishery Management Council recognized that a number of small communities in Alaska were "struggling to remain economically viable" and that the privatization of halibut and sablefish fisheries through individual fishing quotas (IFQs) had reduced rural participation in the valuable fisheries.

In a report to Congress this year, the U.S. General Accounting Office identified this problem and concluded that the "easiest and most direct way to help protect communities under an IFQ program is to allow the communities themselves to hold quota."

The Coastal Communities Coalition lobbied for community ownership of halibut and sablefish quota and the Fishery Management Council finally agreed to allow communities to buy fishing quotas.

In April 2004, U.S. federal fisheries regulations were amended to allow 42 rural communities with a population of less than 1,500 people to establish non-profit Community Quota Entities (CQEs) to hold and lease fishing quota for local residents. The Alaskan state government is providing each CQE with up to $2 million (U.S.) in loans to purchase quotas.

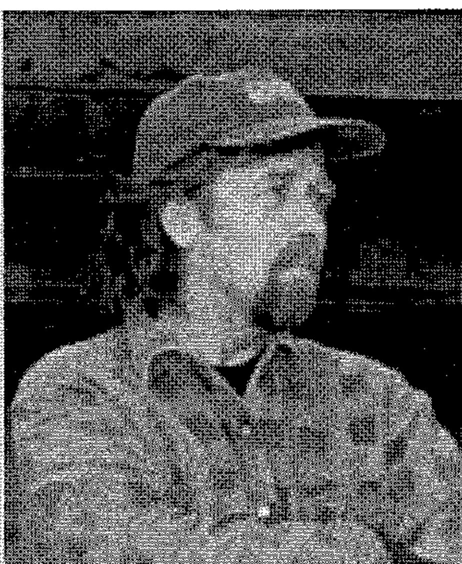
"The purpose for this legislation is to bring fishing quotas home to Alaska and provide an economic base for villages traditionally dependent on fishing," Alaskan Governor Frank H. Murkowski announced. "Some of our communities have been hard hit by the decline in salmon prices, and this program has the potential of bringing long term stability to those regions."

This program comes on the heels of Alaska's successful Community Development Quota (CDQ) program, which granted a portion of Alaska's pollock fishery to rural communities. Since 1992, the program has generated $110 million (U.S.) in wages, education and training benefits, $500 million (U.S.) in revenues and $260 million (U.S.) in asset value for six CDQ groups. The CDQ program has funded docks, harbours, seafood processing facilities, the acquisition of equity ownership in fisheries, and local economic development projects. The program has received widespread, bipartisan support in Alaska.

For more information about Alaska see:

Gulf of Alaska Coastal Communities Coalition: www.goac3.org

Alaska Department of Commerce, Community Quota Entities: http://www.commerce.state.ak.us/bsc/CDQ/cqe/cqe.htm



PROFILE: Fishing for a living in rural B.C.

SCOTT MACDONALD DEPENDS ON THE SEA to provide for his family in Port Albion, a rural area across the inlet from Ucluelet. For 20 years he worked in the commercial salmon fishery. But in 1996, he was forced to sell his fishing licence because of declining catches. "The salmon income dropped so quickly," he says. Property values plummeted too because of the depressed local economy, he adds, which limited his ability to tap his home equity to buy more fishing licences and quota.

"There was no way I could have afforded to gear up for other fisheries," he says. "I was trying to diversify, but I couldn't keep up. The financial pressures where mounting and I had to sell out."

Like many rural fishermen who wanted to stay in their communities, Macdonald looked to other fisheries for employment, especially those with licences that aren't so pricey. He worked on a shrimp trawler for a year or two, did fisheries stewardship work and then got into the kelp harvesting business, which only costs him about $500 per year in licensing fees. He is also the coordinator for a new, local goose barnacle fishery.

Today, MacDonald successfully ekes out a living from marine resources, but most of the area's lucrative fisheries—including herring, sablefish, halibut, groundfish and salmon—are well outside his financial means.

ecotrust canada

president's note

COMMERCIAL FISHING IS A DEFINING characteristic of B.C. coastal communities, but one that is being quickly whittled away by skewed policies that favour economic efficiency over social and ecological values. In the premiere issue of *The Working Coast*, Ecotrust Canada has mapped how rural fishermen and First Nations are losing commercial fishing opportunities as licences and quotas are being consolidated in metropolitan regions. It is a trend I've witnessed while travelling the coast over the past decade.

In 1994, we founded Ecotrust Canada as a non-profit organization whose mission is to build a *conservation economy* in coastal B.C. A conservation economy meets diverse human needs for meaningful work and good livelihoods; supports vibrant, healthy communities; and conserves and restores the environment. It is a vision that has yet to take hold in B.C. fisheries. That's why we've dedicated our first newsletter to describing the problem and providing some helpful recommendations to create a more sustainable resource, both for the fish and the communities that depend on them.

Forthcoming issues of *The Working Coast* will provide updates on the people and places that are bringing the conservation economy to life. From eco-forestry to energy, from Prince Rupert to Port Alberni, please send us comments or news to info@ecotrustcan.org

Best regards,

IAN GILL
President, Ecotrust Canada

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ecotrust index

The quirky and quintessential–a statistical snapshot of B.C.'s conservation economy

Number of cows in Canada infected with mad cow disease: 1

Number of jobs lost in Ucluelet surimi fish plant (which uses beef plasma) because of that cow: 350

Value of geoduck clams harvested in B.C.'s North Coast in 2002: $25 million

Number of geoduck fishing licences owned by residents in Prince Rupert in 2002: 0

Number of geoduck licences owned by residents in the ski resort of Whistler in 2002: 1

Probability that geoduck diving will be a demonstration sport at the 2010 Olympics in Whistler: 0

Average market value of a geoduck fishing licence in B.C.: $3 million

Price of "signature home" on Nicklaus North Golf Course in Whistler: $3 million

New homes built in Prince Rupert in 1995: 74

New homes built in Prince Rupert in 2003: 1

GDP value of B.C. wild fisheries in 2002: $545 million

GDP value of B.C. aquaculture in 2002: $205 million

Amount (in metric tonnes) of farmed salmon produced in B.C. in 2002: 85,000

Energy (in litres of diesel fuel) needed to produce one kilogram of Atlantic farmed salmon: 2.4

Energy (in litres of diesel fuel) needed annually for B.C. farm salmon production: 205 million

Estimated barrels of crude oil that could be extracted from the Queen Charlotte Basin: 1.3 billion

Estimated number of years that B.C salmon farms could run on this crude oil: 1,000

Estimated number of years the Haida have lived in the Queen Charlotte Basin: 12,000

Number of B.C. commercial fishing licences owned by Jimmy Pattison's Canfisco in 2002: 244

Estimated value of Jimmy Pattison's fishing licences and quota in 2003: $105 million

Estimated value of Jimmy Pattison's privately owned companies in 2003: $5.5 billion

Number of guests that can dine comfortably on Pattison's 150-foot yacht *Nova Spirit*: 30

Percentage of Aboriginal adults in Alert Bay who fished for food in the past 12 months: 34

Percentage of global production of seafood from aquaculture in 1970: 3.9

Percentage of global production of seafood from aquaculture in 2000: 27.3

Number of B.C. salmon gillnet licences owned by residents in Kyuquot in 2002: 0

Number of gillnet licences owned by residents in Valley Center, California in 2002: 1

Distance between Valley Center and BC's salmon fishing grounds (in miles): 1,500

Number of B.C. halibut licences owned by residents of Ahousat: 0

Number of B.C. halibut licences owned by residents of Brooks, Alberta: 1

Percentage of halibut licences owned or operated by First Nations in 1950: 28

Percentage of halibut licences owned or operated by First Nations in 2003: 12

Price of one pound of halibut in Toronto grocery store: $16.50

Price of one pound of commercial halibut quota: $36.00

Percentage of catch revenue from leased halibut quotas going to "arm chair" fishermen: ~70

Number of working fishermen on disability leave or killed in B.C. in 2003: 347

Number of "fishermen" injured or killed while sitting in arm chairs collecting quota revenue in 2003 (editor's estimate): 0

SOURCES: BC Stats; GSGislason & Associates Ltd., British Columbia Seafood Sector and Tidal Water Recreational Fishing: A Strengths, Weaknesses, Opportunities, and Threats (SWOT) Assessment; Worldwatch Institute, "Matters of Scale: September/ October 2003, Factory-Fish Farming"; Department of Fisheries and Oceans; Ecotrust Canada; Report on Business, April 2004; West Coast of Vancouver Island Aquatic Management Board; Peter Tyedmers, UBC School of Community and Regional Planning; Government of B.C.; Statistics Canada, 2001 Census, Aboriginal Population Community Profiles; Workers Compensation Board, Claim Statistics; Our Place at the Table: First Nations in the B.C. Fishery (2004), First Nation Panel on Fisheries, Aboriginal Fisheries Commission; Yachts International, May 2000; Whistler Real Estate Company, www.wrec.com; B.C. Offshore Oil and Gas Team, http://www.offshoreoilandgas.gov.bc.ca/; B.C. Ministry of Fisheries, Food and Agriculture; For conversion of crude oil to diesel fuel, see http://www.processassociates.com/process/basics/oil_vw.htm.

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February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

Submitted electronically via email to: info@mafmc.org

Re: Oceana Comments on Tilefish Amendment 1

Dear Mr. Furlong,

Oceana submits these comments in response to the draft tilefish amendment 1 document that is currently out for public comment. As you know Oceana has worked for many years to conserve and protect important marine habitat from the effects of fishing gears and other threats. The management alternatives in Tilefish amendment 1 are among the most progressive habitat conservation measures ever developed on the east coast to designate and protect unique, important and sensitive habitats.

Oceana strongly encourages the Council to use this amendment as a vehicle for widespread conservation of sensitive marine habitat and to designate a series of Habitat Areas of Particular Concern (HAPC) and Gear Restricted Areas (GRA) in the offshore canyons within the Mid-Atlantic and New England Fishery Management Council regions..

Tilefish HAPC-

The 2002 Essential Fish Habitat (EFH) Final Rule is very clear in both the authority and obligation of councils to designate HAPC's for important benthic habitat:

(8) *Identification of habitat areas of particular concern.*

FMP's *should* identify specific types or areas of habitat within EFH as habitat areas of particular concern based on one or more of the following considerations:

(i) The importance of the ecological function provided by the habitat.
(ii) The extent to which the habitat is sensitive to human-induced environmental degradation.

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(iii) Whether, and to what extent, development activities are, or will be, stressing the habitat type.
(iv) The rarity of the habitat type.[1]

The information provided in the amendment document clearly demonstrates that each of the areas proposed as HAPC in alternative 17D meets more than one of the EFH Final Rule requirements for HAPC designation- Ecological importance, Sensitivity, Exposure to Anthropogenic Stress, and Rarity (see EIS section 6.3.2-page 196-199). Especially relevant is the discussion of the vulnerability of these habitats to the effects of trawling (emphasis added):

> 'Specifically for tilefish, clay outcroppings (pueblo habitats) in canyons on the continental slope have been determined to be *highly vulnerable to permanent disturbance by bottom otter trawls* (see Appendix E and Table 6.39 in Appendix G) Environmental Impact Statement at xxxix'

Each of the 13 canyon areas described in alternative 17D should be designated as HAPC specifically for tilefish due to the presence of clay outcrop/pueblo village habitats and the importance and vulnerability of these habitats to the effects of fishing gears. The information provided in the Public Hearing Summary document clearly demonstrates that each of these canyons satisfies the requirements laid out by the Council as tilefish HAPC. Each area either contains known pueblo habitat or clay outcroppings.

> 'Norfolk, Veatch, and Lydonia canyons are noted as having tilefish "pueblo burrows" which are formed in exposed clay outcroppings in the canyon walls and the presence of clay outcroppings has also been noted in Oceanographer Canyon. The remaining nine canyons are steep enough to expose *clay outcrops* which could be utilized as pueblo habitat for tilefish (Washington, Baltimore, Wilmington, Hudson, Block, Atlantis, Hydrographer, Gilbert, and Heezen canyons), but only one of them (Hudson) has been surveyed. (PHD at 52)

Where these canyons areas satisfy both the federal guidelines for HAPC and Council guidance for tilefish HAPC the Mid-Atlantic Fishery Management Council should use this information to designate each of the 13 steep walled canyons as HAPC for tilefish.

[1] Essential Fish Habitat Final Rule. 67 Federal Register 2378 Thursday, January 17, 2002

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Coral/ Canyon Conservation-

Deep Sea Corals in the northeast region- The presence of deep sea corals in the canyons of New England the Mid-Atlantic have been documented for close to 30 years since the publishing of the work of Dr. Barbara Hecker documenting her explorations of these canyons by submersible. In the time since their first discovery, considerable study has shown that these corals are extraordinarily fragile and slow growing. The full extent of corals in the northeast region is discussed in the attached chapter of the NOAA report The State of Deep Coral Ecosystems of the United States which shows that corals are widespread in the canyons of the northeast region.

Threats to deep sea corals- Deep sea corals are extremely fragile. As such they are the most vulnerable marine habitats and, as such, are at great risk to the destructive effects of bottom-tending mobile fishing gears. A recent comprehensive report from the National Marine Fisheries Service has described the threats to corals:

> 'Bottom trawling is the largest potential threat to deep coral habitat for several reasons: the area of seafloor contacted per haul is relatively large, the forces on the seafloor from the trawl gear are substantial, and the spatial distribution of bottom trawling is extensive.'[2]

Compounding the effects of coral damage is the life history of corals which grow very slowly and are extremely long-lived - often living for centuries. The National Marine Fisheries Service report continues in its discussion of corals:

> 'In more complex habitats such as deep coral communities full recovery may require decades to centuries due to their slow growth rates.'[3]

Although the Atlantic canyons are not commonly fished, as fishing technology and design evolves and allows access to areas that have been previously unfishable, coral areas will be increasingly at risk to degradation.

---

[2] Lumsden SE, Hourigan TF, Bruckner AW, Dorr G (eds.) 2007. The State of Deep Coral Ecosystemsof the United States. NOAA Technical Memorandum CRCP-3. Silver Spring MD. Page 23 (http://www.nmfs.noaa.gov/habitat/dce.html)

[3] Ibid, p. 25

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Fisheries managers should take immediate action to protect each area known to support coral communities.

Coral Management and Conservation- The importance of coral conservation is highlighted in section 303(b) of the Magnuson-Stevens Reauthorization Act (MSRA) which gives new and explicit authority to the Regional Fishery Management Councils to identify and protect deep sea and coldwater coral areas independently from the EFH process which had hindered coral conservation in the past:

> (b) DISCRETIONARY PROVISIONS.—Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, may—
>
> (B) designate such zones in areas where deep sea corals are identified under section 408, to protect deep sea corals from physical damage from fishing gear or to prevent loss or damage to such fishing gear from interactions with deep sea corals, after considering long-term sustainable uses of fishery resources in such areas;[4]

National Marine Fisheries Service Habitat staff has informed the NEFMC that the current information available for each of the Atlantic canyons will satisfy the requirement for identification under section 408[5], giving the Council the ability to protect known corals immediately.

Gear Restricted Areas-

The Council should use the clear new authority under the MSRA to take immediate action to approve a comprehensive coral conservation action through the use of GRA's in each of the proposed 13 canyons to protect known deep sea or cold water coral habitat from the effects of bottom trawling, as provided for in alternative 18C.

The analysis provided in the Environmental Impact Statement confirms the efficacy of this approach to protect deep sea corals:

> 'This GRA (18C) would also provide some additional habitat protection to deepwater coral species that grow on hard substrates in the canyons. Two of the canyons included in this GRA alternative (Lydonia and

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[4] Magnuson-Stevens Reauthorization Act Section 303(b)

[5] Comments of Lou Chiarella to the New England Fishery Management Council Habitat Committee, February 4, 2008

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Oceanographer) have already been closed to vessels in the directed monkfish fishery in order to minimize the impacts of bottom trawling on EFH for other species besides monkfish, and to reduce impacts on highly vulnerable benthic organisms such as sponges and corals'.[6]

Council Coordination- Establishing GRA's in each of the 13 canyons is consistent with the 2007 actions of the New England Fishery Management Council (NEFMC) which found that 15 submarine canyons[7] in the New England and Mid-Atlantic region canyon and their coral communities satisfied each of the four criteria for HAPC designation- Ecological importance, Sensitivity, Exposure to Anthropogenic Stress, and Rarity. The NEFMC took action in June, 2007 to designate each canyon as HAPC affording these areas special attention in management decisions.

Although the New England Fishery Management Council will be working in the coming years to develop management actions to accompany the HAPC's designation for each of the canyons, the Mid-Atlantic Council should take action that is complimentary to this and designate these 13 of these areas as GRA in Tilefish amendment 1.

Modification of Proposed Gear Restricted Areas- The Environmental Impact Statement concludes that establishing GRA's in all 13 canyons may be impractical because of the effects on other fisheries, notably summer flounder, monkfish and *loligo* squid despite the fact that comments in public hearing has shown that very little if any bottom trawling takes place within the canyons[8]. These findings are the direct result of the areas proposed as GRA's being overly broad and including shallow areas in the GRA which may not be valuable burrow or coral habitat.

The areas proposed in the amendment 1 document are overly broad and may have unnecessary economic impacts by restricting fishing in areas that are neither tilefish burrow nor coral habitat. The Mid-Atlantic Fishery Management Council should take action to revise the boundaries of the proposed GRA's in alternative 18C to maximize the ecological benefit of the areas to be protected while minimizing the adverse economic effects of the GRA's.

The Council would be fully justified in this action and, in fact, the New England Fishery Management Council's development of HAPC was built upon the understanding that during the amendment process, areas to be managed could be reduced in size after public comment but could not be expanded without additional analysis or public hearing.

[6] Environmental Impact Statement at 328
[7] Heezen, Lydonia, Gilbert, Oceanographer, Hydrographer, Veatch, Alvin, Atlantis, Hudson, Toms, Hendrickson, Wilmington, Baltimore, Washington and Norfolk canyons.
[8] Environmental Impact Statement- table 46 and 48.

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Taking action to reduce the size of the GRA polygons to include only burrow/clay outcrop and coral habitat will minimize the effect of the area management of other fisheries and maximize the value of the areas closed to bottom-tending mobile gears.

Conclusion

In the last five years conservation of EFH and deep sea coral conservation have emerged as priorities for each Fishery Management Council in the United States. The Mid-Atlantic council should use the opportunity of tilefish amendment 1 to improve the management of tilefish through widespread HAPC designation in the offshore canyons of the Mid-Atlantic and New England.

The council should also take a proactive step and conserve the offshore canyon coral community through a comprehensive system of Gear Restricted Areas to minimize the 'largest potential threat to deep coral habitat'- bottom trawling.

Oceana thanks you for considering these comments.

Sincerely,

Gilbert A Brogan

Gib Brogan
Campaign Projects Manager
Oceana
Wayland, MA

STATE OF DEEP CORAL ECOSYSTEMS IN THE NORTHEASTERN US REGION: MAINE TO CAPE HATTERAS

David B. Packer[1], Deirdre Boelke[2], Vince Guida[1], and Leslie-Ann McGee[2]

I. INTRODUCTION

The U.S. Northeast Shelf Large Marine Ecosystem encompasses 260,000 square km and extends from the Gulf of Maine and Georges Bank southward through southern New England waters and the Middle Atlantic Bight to Cape Hatteras. It extends from the coast eastward to the edge of the continental shelf and slope and offshore to the Gulf Stream (Sherman et al. 1996). Some of the specific locations with known occurrences of deep corals include parts of the Gulf of Maine, Georges Bank, as well as a number of canyons that bisect the continental shelf and slope. Deep corals have also recently been collected from the New England Seamount chain; the seamounts are located off the continental shelf, rising above the abyssal plain, and they encompass more than 30 major volcanic peaks extending from Georges Bank southeast for about 1,100 km to the eastern end of the Bermuda Rise (Figure 5.1). Several recent surveys have taken place here, although most of the seamount chain is located outside the 200 nautical mile U.S. Exclusive Economic Zone (EEZ); however, Bear, Physalia, Mytilus, and Retriever Seamounts do occur within the EEZ.

In the U.S. Northeast Shelf Large Marine Ecosystem, deep corals have been noted since the surveys of Verrill in the 19th century (Verrill 1862, 1878a, 1878b, 1879, 1884) and as fisheries bycatch since that period. They also occur off Atlantic Canada on the continental slope and in submarine canyons, and are particularly abundant in the Northeast Channel (Verrill 1922; Deichman 1936; Breeze et al. 1997; MacIsaac et al. 2001; Mortensen and Buhl-Mortensen 2004; Gass and Martin Willison 2005; Mortensen et al. 2005). Many gorgonian corals such as *Paragorgia* have been regularly encountered by fishermen on hard substrate such as boulders, gravel, or rocky outcrops (e.g., Breeze et al. 1997; Leverette and Metaxas 2005).

This chapter summarizes the current knowledge of deep corals and deep coral communities for the U.S. Northeast Shelf Large Marine Ecosystem, including the diversity of coral species and their distribution, associated species, and habitat preferences. In addition, a summary of current stressors affecting these habitats, and existing conservation and management activities are presented. Gaps in our understanding of deep coral communities and a summary of research priorities that could help fill these gaps are highlighted as a key need to assist in identifying future actions to conserve and manage these vulnerable ecosystems.

However, it should be noted that to our knowledge the northeast region does not have the abundance of large, structure-forming deep corals and deep coral habitats that are present in other regions. Thus, we will confine our discussions to the major gorgonian species such as, for example, *Paragorgia arborea*, *Primnoa resedaeformis*, *Acanthogorgia armata*, and *Paramuricea grandis*, and others, as well as some of the more noteworthy alcyonaceans (soft corals) and scleractinians (stony corals).

II. GEOLOGICAL SETTING

This brief review of the pertinent geological characteristics of the regional systems of the U.S. Northeast Shelf Large Marine Ecosystem, as well as the subsequent section on the oceanographic characteristics, is based on several summary reviews. Literature citations are not included because these are generally

[1]NOAA Fisheries Service, Northeast Fisheries Science Center,
James J. Howard Marine Sciences Laboratory, Highlands, NJ 07732

[2]New England Fishery Management Council, 50 Water Street, Mill 2, Newburyport, MA 01950

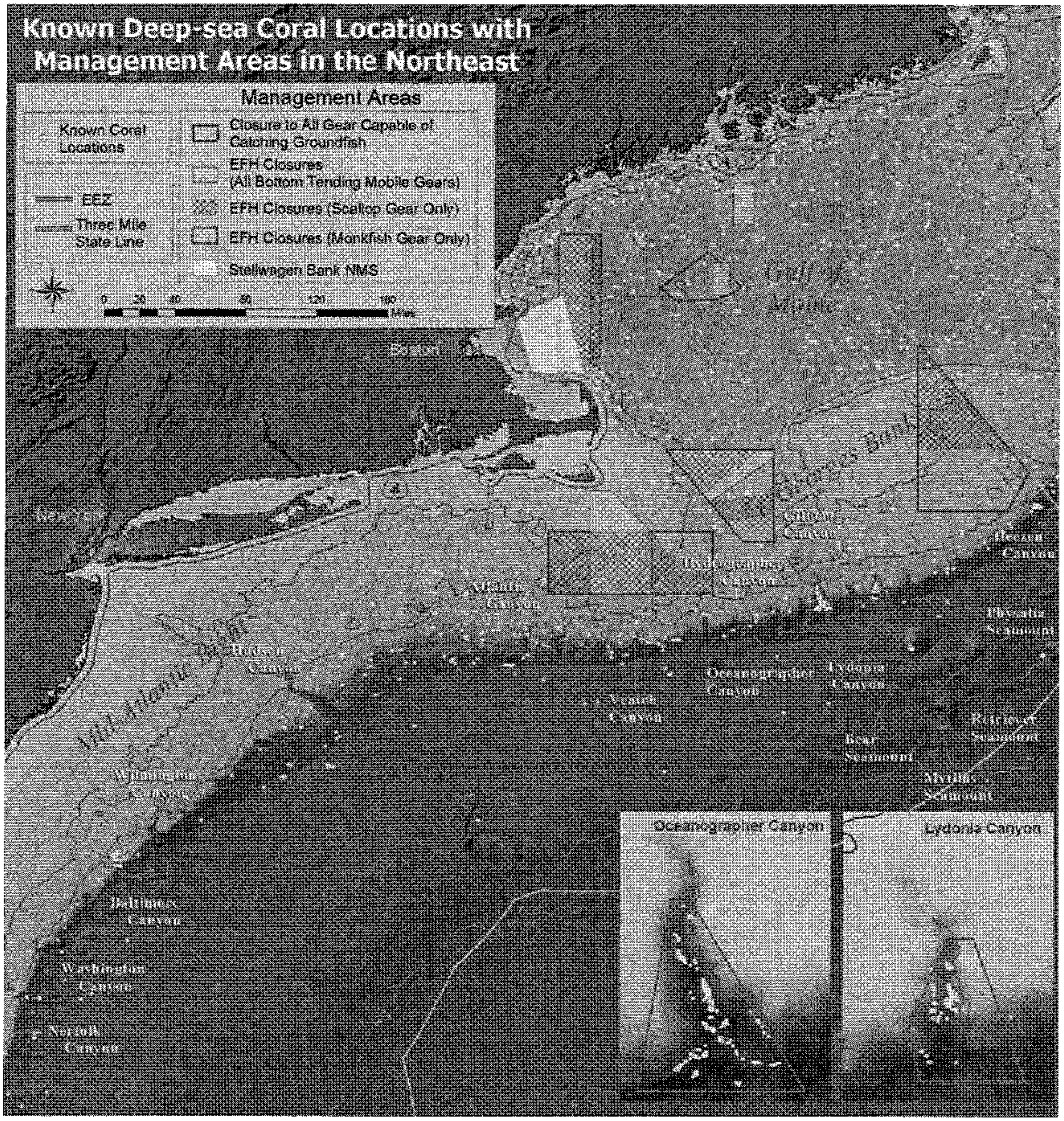


Figure 5.1 Coral Distribution - Deep coral data from the Theroux and Wigley (1998) and the Watling et al. (2003) databases represent known locations of stony, gorgonian, and true soft deep coral species from data ranging from (but not inclusive of) 1870 to the 1990s. This information does not represent all deep coral locations in this region as the U.S. Exclusive Economic Zone has not been extensively surveyed for deep corals. Also, certain deep coral points may no longer be present due to natural and human induced impacts that have occurred since the point was sampled. Essential Fish Habitat (EFH) Closed Areas prohibit the use of mobile bottom-tending gear indefinitely. Northeast Multispecies Closed Areas,indicated in the legend by "Closures to All Gear Capable of Catching Groundfish" prohibit the use of the gear capable of catching groundfish except in portions of the closed areas defined in the Special Access Program during certain times of the year (see NEFMC website). No fishing restrictions exist within the boundaries of the Stellwagen Bank NMS with the exception of the sliver that overlaps both the NEFMC Western Gulf of Maine Groundfish and Western Gulf of Maine Essential Fish Habitat Closed Areas. In addition to the EFH Closed Areas on Georges Bank and in southern New England, Lydonia and Oceanographer Canyons on the continental shelf-break are also considered EFH Closures and were implemented in the Monkfish FMP in 2005. Within these areas, trawling and gillnetting while on a monkfish (*Lophius americanus*, goosefish) days-at-sea (DAS) is prohibited indefinitely to protect the sensitive habitats therein, including deep coral and other structure-forming organisms.

accepted descriptions of the regional systems. Source references include, and more information can be found in: Backus and Bourne (1987), Schmitz et al. (1987), Tucholke (1987), Wiebe et al. (1987), Cook (1988), Stumpf and Biggs (1988), Townsend (1992), Conkling (1995), Brooks (1996), Sherman et al. (1996), Beardsley et al. (1997), Dorsey (1998), Packer (2003), Stevenson et al. (2004), Auster et al. (2005), and Babb (2005).

Gulf of Maine

The Gulf of Maine is a semi-enclosed continental shelf sea of 90,700 sq. km bounded on the east by Browns Bank, on the north by the Scotian Shelf, on the west by the New England states, and on the south by Cape Cod and Georges Bank. It is distinct from the Atlantic, an ecologically separate sea within a sea. The Gulf is characterized by a system of 21 deep basins, moraines, rocky ledges, and banks, with limited access to the open ocean. Sediments in the Gulf of Maine are highly variable and, when coupled with the vertical variation of water properties found in the Gulf, results in a great diversity of benthic habitat types and benthic organisms. Sand, silt, and clay are found throughout the Gulf, with the finer sediments generally found in the deeper basins. Rocky substrates (which include gravel, pebbles, cobbles, and boulders) are found primarily in the Northeast Channel, with other smaller, more variable rocky areas interspersed in the Gulf. Rocky outcrops form significant features, such as Cashes Ledge, and benthic fauna found on these include sponges, tunicates, bryozoans, and hydroids.

Of the 21 deep basins, Jordan (190 m), Wilkinson (190 m), and Georges Basins (377 m), are the largest basins and deepest habitats within the Gulf of Maine. Their great depths resulted from glacial erosion of relatively soft rocks. The bottom sediments of these deep basins are generally very fine, featureless muds, but some gravel may also be found; little or no sediment transport occurs here. Unique invertebrate communities are found on the seafloor, including deep corals, ophiuroids (brittle stars), tube building amphipods, burrowing anemones, and polychaete worms.

Georges Bank

Georges Bank is a shallow (3-150 m depth), elongate extension of the continental shelf that extends from Cape Cod, Massachusetts (Nantucket Shoals) to Nova Scotia (Scotian Shelf) and covers more than 40,000 km^2. It is characterized by a steep slope on its northern edge and a broad, flat, gently sloping southern flank. It is separated from the rest of the continental shelf to the west by the Great South Channel. The central region of the Bank is shallow. Bottom topography on the eastern Bank is characterized by linear ridges in the western shoal areas; relatively smooth, gently dipping sea floor on the deeper, eastern most part, and steeper and smoother topography incised by submarine canyons on the southeastern margin. The sediments vary widely, but are mostly sandy or silty, with coarse gravel and boulders at the northern margins.

At least 70 large submarine canyons occur near the shelf break along Georges Bank and the Mid-Atlantic down to Cape Hatteras, cutting into the slope and occasionally up into the shelf as well. The canyons are typically "v" shaped in cross section, and include features such as steep walls, exposed outcroppings of bedrock and clay, and tributaries. Most canyons may have been formed by mass-wasting processes on the continental slope; some, like the Hudson Canyon (Mid-Atlantic), may have formed because of fluvial drainage. The canyons exhibit a more diverse fauna, topography, and hydrography than the surrounding shelf and slope environments. The diversity in substrata types tends to make the canyons biologically richer than the adjacent shelf and slope.

As mentioned above, the New England Seamount chain extends southeast of Georges Bank for about 1,100 km, rising as much as 4,000 m above the Sohm Abyssal Plain. Of the four seamounts within the U.S. EEZ, Bear Seamount is the closest and rises from a depth of 2,000-3,000 m to a summit that is 1,100 m below the sea surface. The minimum depths of the others are: Physalia (1,848 m), Mytilus (2,269 m), and Retriever (1,819 m). Several other seamounts outside the U.S. EEZ are biologically significant because they rise to relatively shallow depths. Substrate types range from solid basalt to manganese crusts to rock and coral rubble to mixtures of basalt pebbles and sand to fine carbonate oozes. Sediments cover the summits with more exposed rock surfaces on the sides.

Mid-Atlantic Bight

The Mid-Atlantic Bight refers to the region of the continental shelf and slope waters from Georges Bank south to Cape Hatteras, and east to the Gulf Stream. Here the shelf topography is relatively smooth, as depth increases linearly from shore to shelf break, except near submarine canyons. The primary features of the shelf include shelf valleys and channels, shoal massifs, scarps, and sand ridges. The main physiographic feature within the Mid-Atlantic is the Hudson Shelf Valley and Canyon, extending from the inner-continental shelf, at about the 40 m isobath, onto the continental slope. Other significant physiographic features include several other major canyons between Cape May and Cape Charles (Norfolk, Baltimore, Washington, and Wilmington), and the unique oceanography and geology off Cape Hatteras. Sediments over the Mid-Atlantic shelf are fairly uniformly distributed, and are primarily composed of sand, with isolated patches of coarse-grained gravel and fine-grained silt and mud deposits. Sand and gravel deposits vary in thickness from 0-10 m. The sands are mostly medium to coarse grains, with fine sand, silt, and clay in the Hudson shelf valley and on the outer shelf. Mud is rare over most of the shelf, but is common in the Hudson valley. Fine sediment content increases rapidly at the shelf break, which is sometimes called the "mud line," and sediments are 70-100% fines on the slope. The continental slope off Cape Hatteras also receives exceptionally high fluxes of sediment and nutrients that are funneled off the shelf above, helping to account for the high abundance of infaunal organisms found there.

III. OCEANOGRAPHIC SETTING

Gulf of Maine

The Northeast Channel between Georges Bank and Browns Bank leads into Georges Basin, and is one of the primary avenues for water exchange between the Gulf of Maine and Atlantic Ocean. The Gulf has a general counterclockwise nontidal surface current that flows around the margin of the Gulf along the shore. This current is primarily driven by fresh, cold Scotian shelf water that enters from the north and through the Northeast Channel, and freshwater runoff from coastal rivers, which is particularly important in the spring. Dense, relatively warm and saline slope water entering through the Northeast Channel from the continental slope also influences gyre formation. Gulf circulation can vary significantly from year to year due to shelf-slope interactions such as the entrainment of shelf water by Gulf Stream rings, strong winds which can create fast moving currents, and annual and seasonal inflow variations. In the summer, the water in Jordan, Wilkinson, and Georges Basins becomes layered into warm, nutrient-poor surface water; cold, nutrient-rich intermediate water; and cool high-salinity bottom water.

Georges Bank

There is a persistent clockwise gyre around Georges Bank, a strong semidiurnal tidal flow predominantly northwest and southeast, and very strong, intermittent storm-induced currents, which can all occur simultaneously. Tidal currents over the shallow top of the Bank can be very strong, and keep the waters over the Bank well mixed vertically. This results in a tidal front that separates the cool waters of the well-mixed shallows from the warmer, seasonally stratified shelf waters on the seaward and shoreward sides of the Bank. The clockwise gyre is instrumental in distribution of the planktonic community, including larval fish. Georges Bank has a diverse biological community that is influenced by many environmental conditions and is characterized by high levels of primary productivity and, historically, high levels of fish production, which includes such species as *Gadus morhua* (Atlantic cod), *Melanogrammus aeglefinus* (haddock), and *Limanda ferruginea* (yellowtail flounder).

Mid-Atlantic Bight

The shelf and slope waters of the Mid-Atlantic Bight have a slow southwestward flow that is occasionally interrupted by warm core rings or meanders from the Gulf Stream. Slope water tends to be warmer and more saline than shelf water. The abrupt gradient where these two water masses meet is called the shelf-slope front. This front is usually located at the edge of the shelf and touches bottom at about 75-100 m depth of water, and then slopes up to the east toward the surface. It reaches surface waters approximately 25-55 km further offshore. The position of the front is highly variable, and can be influenced by many physical factors.

IV. STRUCTURE AND HABITAT-FORMING DEEP CORALS

As stated in the introduction, the northeast region does not appear to have an abundance of large, structure-forming deep corals and deep coral habitats. Thus, we will confine our discussions primarily to the major deep gorgonian corals as well as to some of the more noteworthy occurrences of alcyonaceans (soft corals) and scleractinians (stony corals), including solitary species or those found in shallower habitats. Records of gorgonians and soft corals are often combined into one database, so for convenience we will be discussing those two orders simultaneously. For a complete list of the deep coral species in this region, see Appendix 5.1.

a. *Stony Corals* (Class Anthozoa, Order Scleractinia)

Cairns and Chapman (2001) list 16 species of stony corals from the Gulf of Maine and Georges Bank to Cape Hatteras (Table 5.1) (See also Cairns 1981). Most of the stony corals in this region are solitary organisms and one species, *Astrangia poculata*, can occur in very shallow water, at depths of only a few meters. Moore et al. (2003, 2004) reported several species of solitary and colonial stony corals on Bear Seamount; one notable solitary species,

Table 5.1. Stony corals from the Gulf of Maine and Georges Bank to Cape Hatteras, based on Cairns and Chapman (2001). *Vaughanella margaritata* has been reported from Bear Seamount of the New England Seamount chain (Moore et al. 2003). Depth ranges are for the western Atlantic only. * = potentially structure-forming colonial species.

Taxon	Distribution	Coloniality	Attachment	Depth (m)
Astrangia poculata (Ellis & Solander, 1786)	Endemic to western Atlantic	colonial	attached	0-263
Caryophyllia ambrosia ambrosia Alcock, 1898	Widespread (cosmopolitan) distribution	solitary	free-living	1487-2286
Caryophyllia ambrosia caribbeana Cairns, 1979	Endemic to western Atlantic	solitary	free-living	183-1646
Dasmosmilia lymani (Pourtales, 1871)	Widespread (cosmopolitan) distribution	solitary	free-living	37-366
Deltocyathus italicus (Michelotti, 1838)	Amphi-Atlantic with a disjunct distribution	solitary	free-living	403-2634
Desmophyllum dianthus (Esper, 1794)	Widespread (cosmopolitan) distribution	solitary	attached	183-2250
Enallopsammia profunda (Pourtales, 1867)*	Endemic to western Atlantic	colonial	attached	403-1748
Enallopsammia rostrata (Pourtales, 1878)*	Widespread (cosmopolitan) distribution	colonial	attached	300-1646
Flabellum alabastrum Moseley, 1873	Amphi-Atlantic with contiguous distribution	solitary	free-living	357-1977
Flabellum angulare Moseley, 1876	Amphi-Atlantic with contiguous distribution	solitary	free-living	2266-3186
Flabellum macandrewi Gray, 1849	Amphi-Atlantic with contiguous distribution	solitary	free-living	180-667
Fungiacyathus fragilis Sars, 1872	Widespread (cosmopolitan) distribution	solitary	free-living	412-460
Javania cailleti (Duch. & Mich., 1864)	Widespread (cosmopolitan) distribution	solitary	attached	30-1809
Lophelia pertusa (L., 1758)*	Widespread (cosmopolitan) distribution	colonial	attached	146-1200
Solenosmilia variabilis Duncan, 1873*	Widespread (cosmopolitan) distribution	colonial	attached	220-1383
Vaughanella margaritata (Jourdan, 1895)	Endemic to northwestern Atlantic	solitary	attached	1267

Vaughanella margaritata, represents the first record of this species since its original description over 100 years ago, and is endemic to the northwest Atlantic (Cairns and Chapman 2001). Other recent expeditions to the New England and Corner Rise Seamounts have also found stony corals (Adkins et al. 2006; Watling et al. 2005; Shank et al. 2006).

b. Black Corals (Class Anthozoa, Order Antipatharia)

Antipatharians are predominantly tropical, but some species are known to occur in the northwest Atlantic. Bushy black coral (*Leiopathes* sp.) has been collected from 1643 m on Bear Seamount (Brugler 2005); it is also found in the collections of the Smithsonian Institution, having been collected in 1883 by the R/V *Albatross* from 1754 m near the same area off Georges Bank. Within the New England Seamount chain, very few associated species have been found living on *Leiopathes* sp. (Brugler 2005). Another black coral, *Cirrhipathes* sp., is also found in the Smithsonian Institution collections, and was also collected in 1883 by the R/V *Albatross* at 262 m off Virginia. Watling et al. (2005) collected at least 8 species of black coral from the seamounts during their 2004 expedition; Brugler and France (2006) observed and collected 15 species of black coral during their 2005 expedition to the New England and Corner Rise Seamounts, including 7 species that they did not previously observe on the seamounts.

c. Gold Corals (Class Anthozoa, Order Zoanthidea)

No records of species from this order have been found in this region.

d. Gorgonians (Class Anthozoa, Order Gorgonacea)

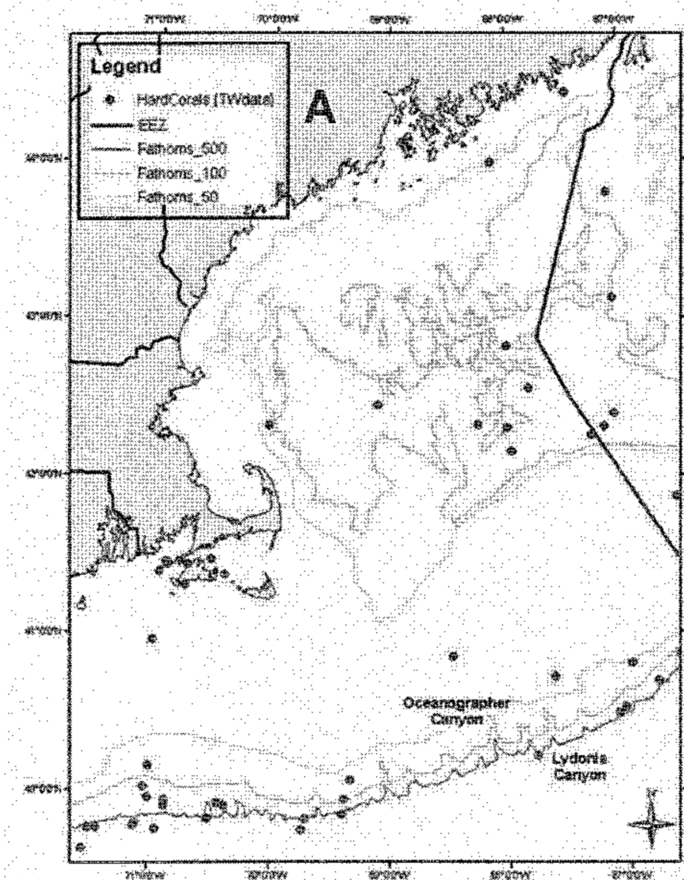
The Watling et al. (2003) database obtained records of both gorgonian and true soft coral occurrences from a variety of sources, including Verrill, Deichmann (1936), Hecker and collaborators [e.g.; Hecker (1980, 1990), Hecker and Blechschmidt (1980), Hecker et al. (1980, 1983); see descriptions below], Yale Peabody museum collections, the NEFSC benthic database of identified coral taxa, and observations from recent National Undersea Research Center (NURC) field studies [for further information, see Watling and Auster (2005)]. A total of 17 species in 7 families were recorded for the northeastern U.S. shelf and slope north of Cape Hatteras (Table 5.2). These 17 species in the seven gorgonian families (Acanthogorgiidae, Paramuriceidae, Anthothelidae, Paragorgiidae,

Table 5.2. List of gorgonians and soft corals known to occur on the northeastern U.S. continental shelf and slope north of Cape Hatteras, from Watling and Auster (2005), with taxonomic changes based on Integrated Taxonomic Information System (ITIS 2006) database/website and S. Cairns (Smithsonian Institution, Washington, D.C., pers. comm.).

Taxa	Species
Order Gorgonacea	
Acanthogorgiidae	*Acanthogorgia armata* Verrill, 1878
Paramuriceidae	*Paramuricea grandis* Verrill, 1883
	Paramuricea placomus (Linné, 1758)
	Paramuricea n. sp.
	Swiftia casta (Verrill, 1883)
Anthothelidae	*Anthothela grandiflora* (Sars, 1856)
Paragorgiidae	*Paragorgia arborea* (Linné, 1758)
Chrysogorgiidae	*Chrysogorgia agassizii* (Verrill, 1883)
	Iridogorgia pourtalesii Verrill, 1883
	Radicipes gracilis (Verrill, 1884)
Primnoidae	*Narella laxa* Deichmann, 1936
	Primnoa resedaeformis (Gunnerus, 1763)
	Thouarella grasshoffi Cairns, 2006
Isididae	*Acanella arbuscula* (Johnson, 1862)
	Keratoisis ornata Verrill, 1878
	Keratoisis grayi Wright, 1869
	Lepidisis caryophyllia Verrill, 1883
Order Alcyonacea	
Clavulariidae	*Clavularia modesta* (Verrill, 1874)
	Clavularia rudis (Verrill, 1922)
Alcyoniidae	*Alcyonium digitatum* Linné, 1758
	Anthomastus grandiflorus Verrill, 1878
	Anthomastus agassizii Verrill, 1922
Nephtheidae	*Gersemia rubriformis* (Ehrenberg, 1934)
	Gersemia fructicosa (Sars, 1860)
	Capnella florida (Rathke, 1806)
	Capnella glomerata (Verrill, 1869)

Table 5.3. Identity and distribution of Pennatulacea on the northeastern U.S. continental shelf and slope. NMNH = Smithsonian Natural Museum of Natural History; OBIS = Ocean Biogeographic Information System.

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
Anthoptilidae	*Anthoptilum grandiflorum*	Newfoundland to Bahamas, Lousiana, Chile, Hawaii, Antarctica, N. Europe	274-3651	U.S. NMNH collection, OBIS
	Anthoptilum murrayi	Lydonia Canyon to Puerto Rico, Hawaii, Aleutians, Japan, W. Africa, N. Europe	430-2491 (1538 m min in NE U.S.)	U.S. NMNH collection, OBIS
Kophobelemnidae	*Kophobelemnon stelliferum*	Newfoundland to South Carolina, Japan, W. Africa, N. Europe	393-2199 (1330 m min in NE U.S.)	U.S. NMNH collection, OBIS
	Kophobelemnon scabrum	Nova Scotia to Virginia	1977-2249	U.S. NMNH collection
	Kophobelemnon tenue	Massachusetts to Virginia	2491-4332	U.S. NMNH collection
Pennatulidae	*Pennatula aculeata*	Newfoundland to Virginia, California, Iberia, N. Africa	119-3316	U.S. NMNH collection, OBIS
	Pennatula grandis	New Jersey, Bay of Biscay	1850-2140	U.S. NMNH collection, OBIS
	Pennatula borealis	Newfoundland to North Carolina, California	219-2295	U.S. NMNH collection, OBIS
Protoptilidae	*Distichoptilum gracile*	Nova Scotia to North Carolina, W. Africa, N. Europe	1211-2844 (doubtful report at 59 m)	U.S. NMNH collection, OBIS
	Protoptilum abberans	Nova Scotia to Virginia	1483-2359	U.S. NMNH collection
	Protoptilum carpenteri	Massachusetts to North Carolina, W. Africa, N. Europe	1334-2194	U.S. NMNH collection, OBIS
Scleroptilidae	*Scleroptilum gracile*	Massachusetts to Virginia	2513-4332	U.S. NMNH collection
	Scleroptilum grandiflorum	Massachusetts to North Carolina, Panama, W. Africa	1502-2505	U.S. NMNH collection, OBIS
Umbellulidae	*Umbellula guntheri*	Massachusetts to Virginia, Louisiana	2683-3740 (3166 m min in NE U.S.)	U.S. NMNH collection
	Umbellula lindahlii	Massachusetts to the Virgin Islands, Louisiana, Suriname, N. Europe, Indian O.	549-3338 (1538 m min in NE U.S.)	U.S. NMNH collection, OBIS
Virgulariidae	*Balticina finmarchica*	Newfoundland to Massachusetts, NC (doubtful), the Virgin Islands, Alaska	37-2249 (229 m min in NE U.S.)	U.S. NMNH collection
	Stylatula elegans	New York-Florida, Iberia	20-812 (51 m min in NE U.S.)	U.S. NMNH collection, OBIS

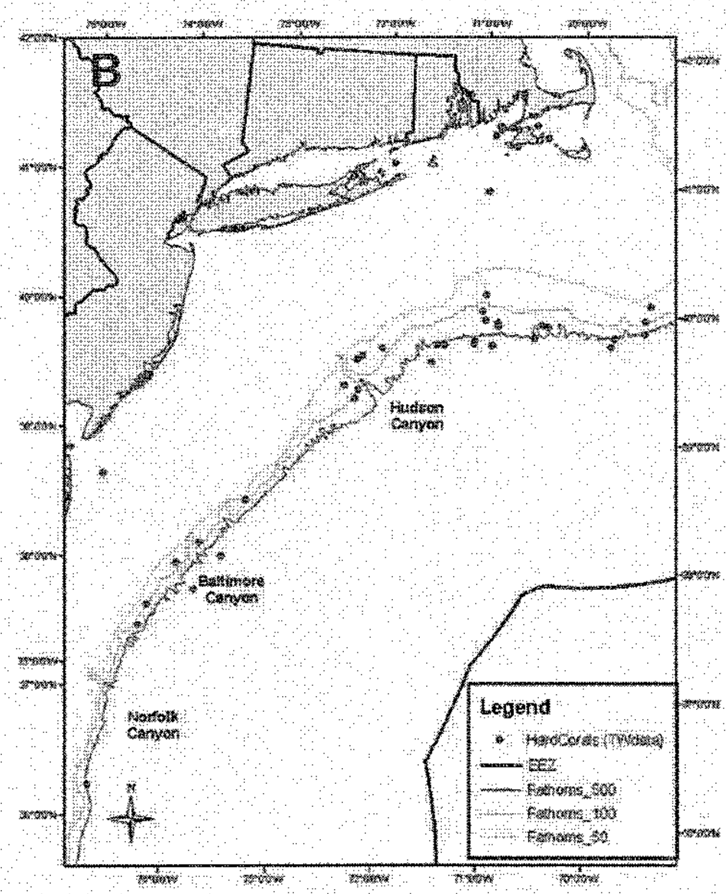


e. *True Soft Corals* (Class Anthozoa, Order Alcyonacea)

As stated above, the Watling et al. (2003) database obtained records of both gorgonian and true soft coral occurrences from a variety of sources, including Verrill, Deichmann (1936),Hecker and collaborators [e.g.; Hecker (1980, 1990), Hecker and Blechschmidt (1980), Hecker et al. (1980, 1983); see descriptions below], Yale Peabody museum collections, the NEFSC benthic database of identified coral taxa, and observations from recent National Undersea Research Center (NURC) field studies [for further information, see Watling and Auster (2005)]. A total of 9 species in 3 families were recorded for the northeastern U.S. shelf and slope north of Cape Hatteras (Table 5.2). Two species that were not common in the database, but apparently are very numerous in nearshore records, were the soft corals *Gersemia rubiformis* and *Alcyonium* species (Watling and Auster 2005). As with the gorgonians, it should be noted that, for a variety

Figure 5.2 A. Distribution of stony or hard corals (*Astrangia, Dasmosmilia*, and *Flabellum*) in the Gulf of Maine and Georges Bank. B) Distribution of stony or hard corals (*Astrangia*, *Dasmosmilia*, and *Flabellum*) in the Mid-Atlantic. Source credit: Theroux and Wigley (1998) database.

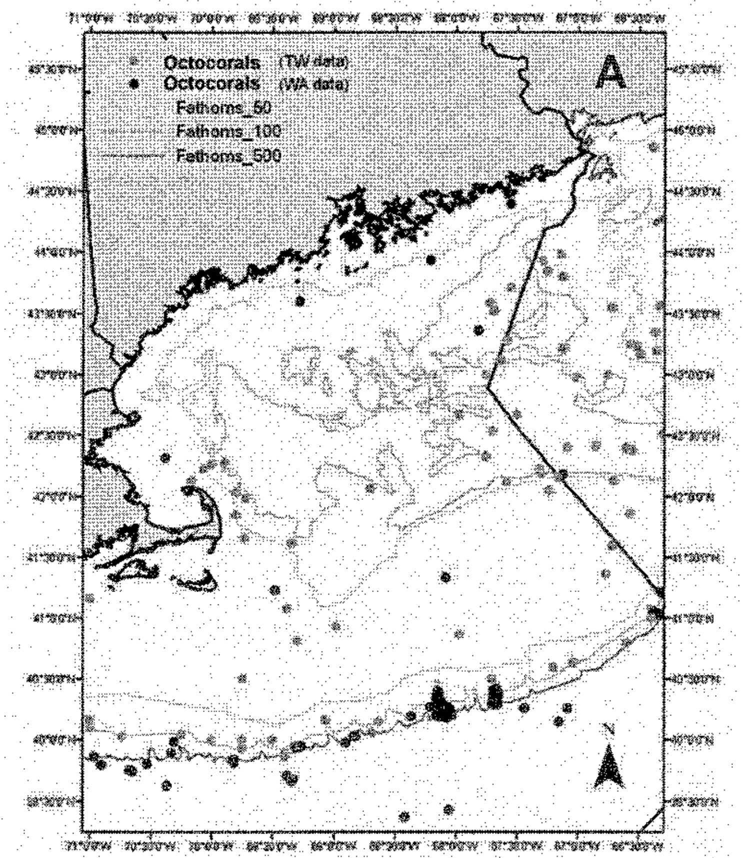
Chrysogorgiidae, Primnoidae, and Isiddae) are the best documented because of their larger sizes, as well as being most abundant in the deeper waters of the continental slope (Watling and Auster 2005). It should be noted that, for a variety of reasons, there is uncertainty about the accuracy of the identifications from these various surveys (Watling and Auster 2005), so these surveys should be interpreted with caution. Gorgonians have also been collected during recent expeditions to the New England and Corner Rise Seamounts (Moore et al. 2003, 2004; Watling et al. 2005, 2006).



of reasons, there is uncertainty about the accuracy of the identifications from these various surveys (Watling and Auster 2005), so these surveys should be interpreted with caution. Soft corals have also been collected during recent expeditions to the New England and Corner Rise Seamounts (Moore et al. 2003; Watling et al. 2005, 2006).

f. *Pennatulaceans* (Class Anthozoa, Order Pennatulacea)

Records of sea pens were drawn from Smithsonian Institution collections and the Theroux and Wigley benthic database. Nearly all materials from the former source were collected either by the U.S. Fish Commission (1881-1887) or for the Bureau of Land Management (BLM) by the Virginia Institute of Marine Sciences (1975-1977) and Battelle (1983-1986). These latter collections heavily favor the continental slope fauna. The Theroux and Wigley collections (1955-1974) were made as part of a regional survey of all benthic species (Theroux and Wigley 1998), heavily favoring the continental shelf fauna. A list of 17 sea pen species representing five families was compiled from these sources for the northeastern U.S. (Table 5.3). None commonly occur in shallow water, and only two species are known from the lower continental shelf depths (80-200 m) in this region: *Pennatula aculeata* (common sea pen) and *Stylatula elegans* (white sea pen). *P. aculeata* is common in the Gulf of Maine (Langton et al. 1990), and there are numerous records of *Pennatula* sp. on the outer continental shelf as far south as the Carolinas in the Theroux and Wigley database. *S. elegans* is abundant on the Mid-Atlantic coast outer shelf (Theroux and Wigley 1998). The other 15 sea pen species have been reported exclusively from the continental slope



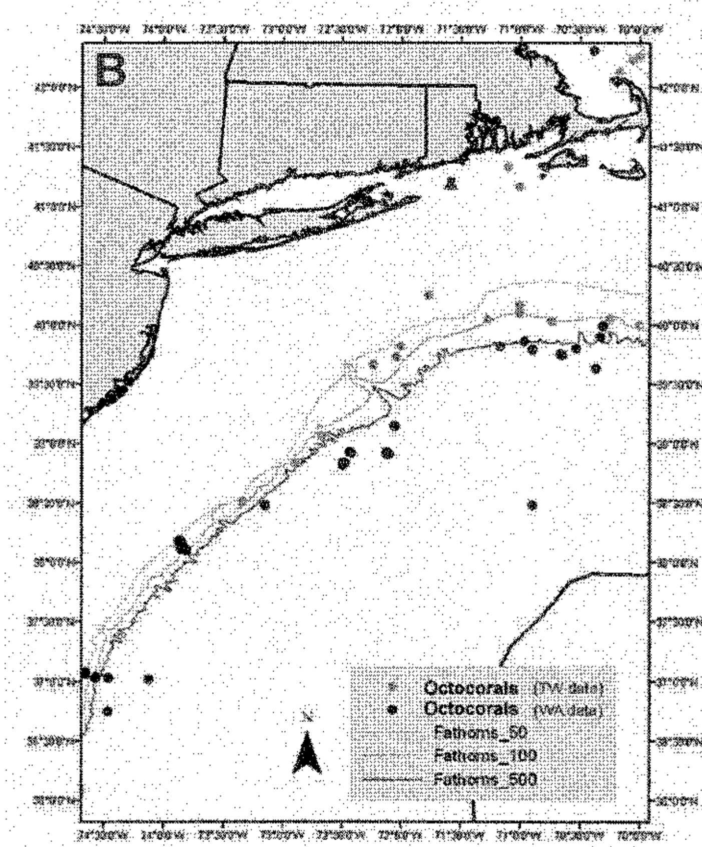
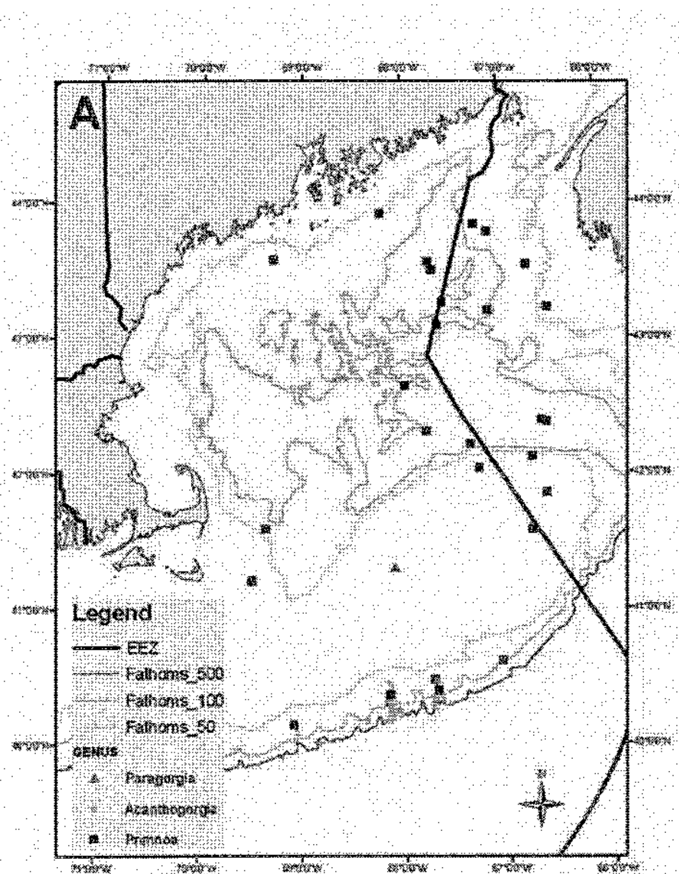


Figure 5.3 A) Distribution of gorgonians and soft corals in the Gulf of Maine and Georges Bank. B) Distribution of gorgonians and soft corals in the Mid-Atlantic. Source credits: Theroux and Wigley (1998) database, Watling et al. (2003) database.



V. SPATIAL DISTRIBUTION OF CORAL SPECIES AND HABITATS

General Distribution in the Gulf of Maine, Georges Bank, and Mid-Atlantic Bight

Theroux and Wigley (1998) described the distribution of deep corals in the northwest Atlantic, based on samples taken from 1956-1965. They often do not distinguish between taxonomic groups; e.g., stony corals such as *Astrangia* sp. and *Flabellum* sp. are lumped together with the various types of anemones in the subclass Zoantharia. The distributions of only the stony corals, specifically *Astrangia*, *Dasmosmilia*, and *Flabellum*, from the Theroux and Wigley (1998) database in the Gulf of Maine/Georges Bank, and Mid-Atlantic are depicted in Figures 5.2A and B, respectively. There appears to be a general lack of stony corals on Georges Bank (Figure 5.2A), but note their presence along the continental margin (Figure 5.2A and B).

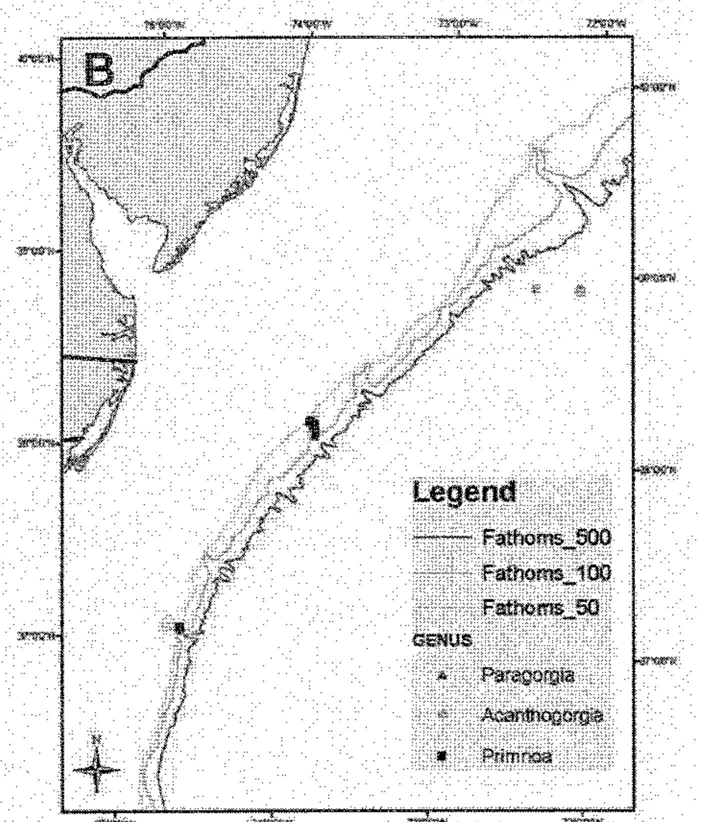
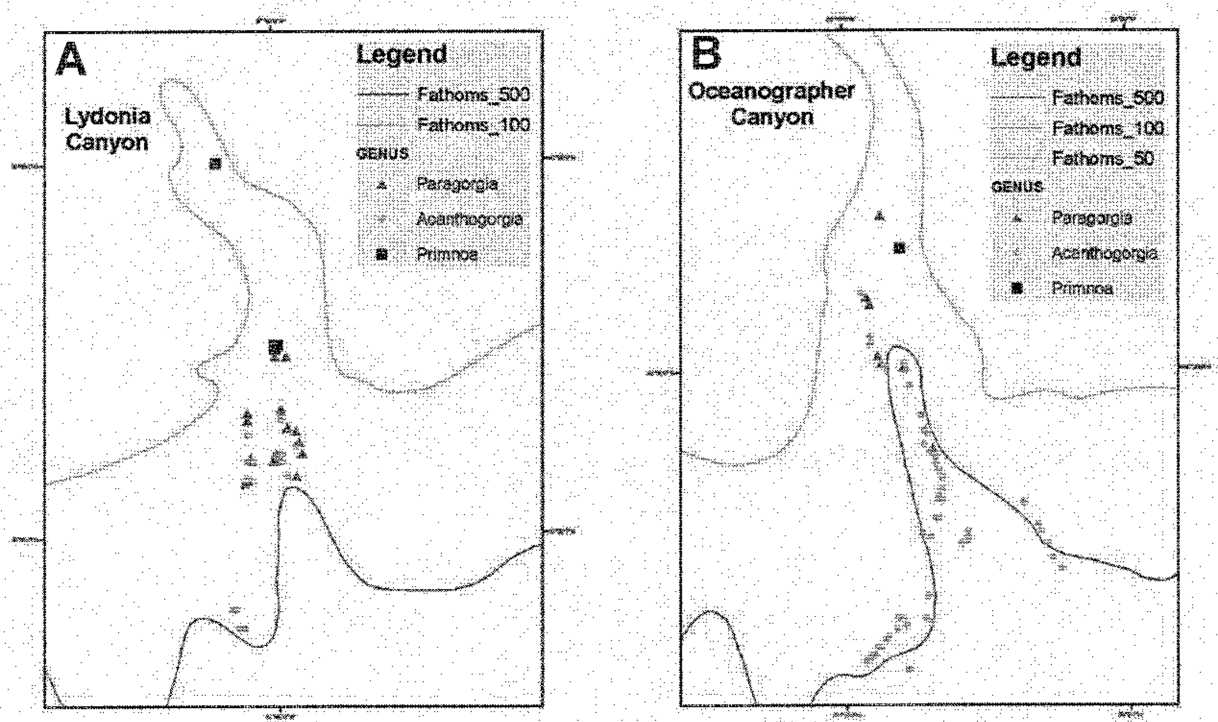


Figure 5.4 A) Distribution of the gorgonians *Acanthogorgia armata, Paragorgia arborea*, and *Primnoa resedaeformis* in the Gulf of Maine and Georges Bank. B) Distribution of the gorgonians *Acanthogorgia armata, Paragorgia arborea*, and *Primnoa resedaeformis* in the Mid-Atlantic. Source credit: Watling et al. (2003) database.

depths (200-4300 m). Unlike most other corals, sea pens live in muddy sediments, anchored in place by a swollen, buried peduncle. Some species are capable of retracting part or the entire colony into the sediment when disturbed.

g. Stylasterids (Class Hydrozoa, Order Anthothecatae, Suborder Filifera, Family Stylasteridae)

No records of species from this family have been found in this region (Cairns 1992).



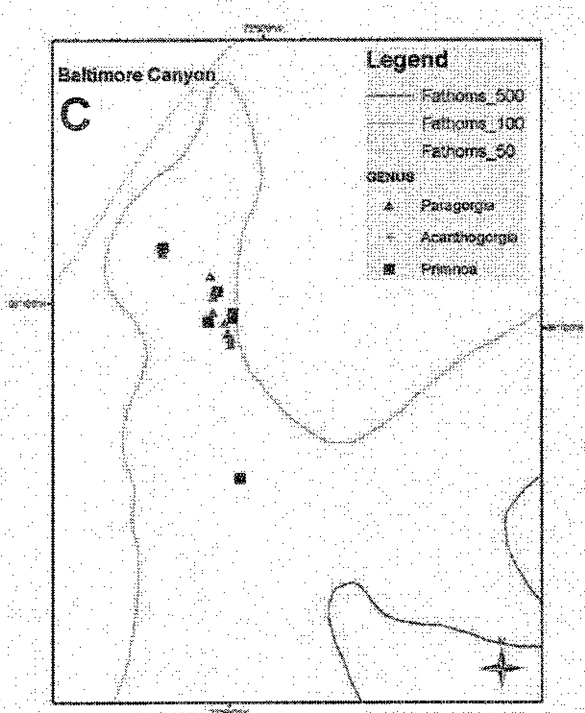


Figure 5.5 Distribution of the gorgonians *Acanthogorgia armata, Paragorgia arborea,* and *Primnoa resedaeformis* in A) Lydonia and B) Oceanographer Canyons (Gulf of Maine) and C) Baltimore Canyon (Mid-Atlantic). Source credit: Watling et al. (2003) database.

Theroux and Wigley (1998) also discussed the soft corals, gorgonians, as well as the sea pens. They were present along the outer margin of the continental shelf and on the slope and rise, and were sparse and patchy in all areas, particularly in the northern section. Theroux and Wigley (1998) found that they were not collected in samples taken at <50 m in depth, and were most abundant between 200-500 m. Figures 5.3A and B depict the distribution of gorgonians and soft corals in the Gulf of Maine, Georges Bank, and the Mid-Atlantic, based on the Theroux and Wigley (1998) database and the Watling et al. (2003) database. Identified species include gorgonians such as *Acanella* sp., *Paragorgia arborea*, *Primnoa reseda* [now *resedaeformis*, see Cairns and Bayer (2005)] and the soft coral *Alcyonium* sp. Gorgonians and soft corals were collected from gravel and rocky outcrops (Theroux and Wigley 1998).

Watling and Auster (2005) noted two distinct distributional patterns for the gorgonians and soft corals. Most are deepwater species that occur at depths >500 m; these include species of gorgoninans in the genera *Acanthogorgia*, *Acanella*, *Anthothela*, *Lepidisis*, *Radicipes*, and *Swiftia*, and soft corals in the genera *Anthomastus* and *Clavularia*. Other species occur throughout shelf waters to the upper continental slope and include the gorgonians *P. arborea*, *P. resedaeformis*, and species in the genus *Paramuricea*. *P. arborea* was described by Wigley (1968) as a common component of the gravel fauna of the Gulf of Maine, while Theroux and Grosslein (1987) reported *P. resedaeformis*, as well as *P. arborea*, to be common on the Northeast Peak of Georges Bank. Both species are widespread in the North Atlantic (Tendal 1992); *P. resedaeformis* has been reported south to off Virginia Beach, Virginia (37°03'N) (Heikoop et al. 2002).

Figures 5.4A and B depict the distribution of three major gorgonians: *Acanthogorgia armata*, *P. arborea*, and *P. resedaeformis* in the Gulf of Maine/Georges Bank and the Mid-Atlantic, respectively, based on the Watling et al. (2003) database. All three species occur in Lydonia and Oceanographer Canyons located off Georges Bank (Figure 5.4A), and Baltimore and Norfolk Canyons in the Mid-Atlantic (Figure 5.4B). Figure 5.1 shows the locations of the major submarine canyons off the New England/Mid-Atlantic U.S. coast. The majority of records for these three species come from Lydonia, Oceanographer, and Baltimore canyons (Figure 5.5A, B, and C respectively). In addition, *P. resedaeformis* was found throughout the Gulf of Maine and on the Northeast Peak of Georges Bank (Figure 5.4A), affirming Theroux and Grosslein's (1987) observations.

It should be noted that the distribution maps presented in this chapter, based on both the Theroux and Wigley (1998) and Watling et al. (2003) databases, show presence only; i.e., they only describe where deep corals that could be identified were observed or collected. Since all areas have not been surveyed and since some specimens were not identified, the true distributions of many of these species remain unknown. However, the combination of these two databases represents the best available georeferenced data on the presence of deep corals in this region.

Continental Margin/Slope and Submarine Canyons

Dr. Barbara Hecker and her colleagues surveyed the deep corals and epibenthic fauna of the continental margin and several canyons off the northeastern U.S. in the 1980s via submersible and towed camera sled (Hecker et al. 1980, 1983). Corals were denser and more diverse in the canyons, and some species, such as those restricted to hard substrates, were found only in canyons while the soft substrate types were found both in canyons and on the continental slope (Hecker and Blechschmidt 1980). The following is a summary of their findings for several of the prominent submarine canyons and continental slope areas; the surveys of other researchers are also included.

Lydonia Canyon

In the axis of Lydonia Canyon, deep corals were a major component of the fauna, and most were restricted to hard substrates (Hecker et al. 1980). The gorgonians *Paramuricea grandis* and *A. armata* were found in the axis and on the walls, with *P. grandis* being more common in the deeper part of the axis at depths >800 m. Other gorgonians on hard substrates occurring along the axis of the canyon included *P. arborea*, *P. resedaeformis*, and *Anthothela grandiflora*, as well as the soft coral *Trachythela* (now *Clavularia*) *rudis* (Hecker et al. 1980). The most abundant coral found was the soft coral *Eunephthya* (now *Capnella*) *florida*, which was most common farther up the east axis between 500-700 m. Several individuals of a closely related species, *Capnella glomerata*, occurred on both the east and west walls of the canyon. The solitary stony coral *Desmophyllum cristagalli* (= *dianthus*) was found on outcrops in the deeper part of the axis and in some areas of the west wall. Other stony corals found in the canyon include *Dasmosmilia lymani*, *Flabellum* sp., *Javania cailleti* and *Solenosmilia variabilis* (Hecker et al. 1983). The availability of suitable substrate appeared to be the most important factor in determining the distribution of the corals in Lydonia Canyon; for example, *D. dianthus* and *P. grandis*, which were common inhabitants of outcrops along the canyon axis, were also found on outcrops and boulders on the slope (Hecker et al. 1983).

Oceanographer Canyon

On the west flank of Oceanographer Canyon, glacial erratics and coral rubble provide hard substrate for the attachment of several species of coral, the most common being the gorgonian *A. armata* from 650-950 m (Hecker and Blechschmidt 1980; Hecker et al. 1980). *A. armata* and *P. grandis* were also found on the east flank, and on both the east and west walls along the axis. The soft coral *C. florida* was also abundant on the east flank. The most common species in the deeper zone was the gorgonian *P. grandis* (Hecker et al. 1980). Hecker and Blechschmidt (1980) and Valentine et al. (1980) also noted the presence of the *Paramuricea borealis* (now *P. grandis*), in Oceanographer Canyon; Valentine et al. (1980) observed their greatest abundance to be from 1100-1860 m, while Hecker and Blechschmidt (1980) observed that they were dominant from 950-1350 m. *A. armata* was most common on smaller cobbles, boulders, and coral rubble while *P. grandis* was usually found on large boulders or outcrops (Hecker and Blechschmidt 1980; Hecker et al. 1980). Other deep corals on hard substrates in Oceanographer Canyon included the soft coral *Anthomastus agassizii* in the axis and on both walls, the soft coral *Clavularia rudis* on the west wall, large colonies of the gorgonian *P. arborea* in the axis above 1000 m, and numerous individuals of the small encrusting gorgonian, *A. grandiflora*, along the axis. Valentine et al. (1980) also found *A. agassizii* in a zone of greatest abundance from 1100-1860 m, while Hecker and Blechschmidt (1980) found this species mostly from 950-1350 m on glacial erratics, outcrops, and coral rubble. The solitary stony coral, *D. dianthus*, was found throughout the axis between 1500-1600 m (Hecker and Blechschmidt 1980) and on the west flank. Deep corals restricted to soft substrates included the soft coral *Anthomastus grandiflorus* on the east flank (Hecker and Blechschmidt 1980; Hecker et al. 1980) and the gorgonian *Acanella arbuscula* on both walls (Hecker and Blechschmidt 1980; Hecker et al. 1980); *A. arbuscula* was found by Hecker and Blechschmidt (1980) mostly from 950-1350 m. The gorgonian *P. resedaeformis* is also found in the canyon, with a zone of greatest abundance from 300-1099 m (Valentine et al. 1980).

Baltimore Canyon

Compared to Lydonia and Oceanographer Canyons, Baltimore Canyon in the Mid-Atlantic had the fewest corals, perhaps due to the scarcity of exposed outcrops (Hecker et al. 1980). At depths >400 m, where the canyon axis constricts and bends, outcrops and talus blocks are exposed. Several corals restricted to hard substrates were found in this area by Hecker et al. (1980). Massive colonies of the gorgonian *P. arborea* were found on the large rock outcrops. Other corals found included the gorgonians *A. armata*, *P. resedaeformis*, *A. grandiflora*, *A. arbuscula*, and the soft corals *C. florida* and *A. agassizii* (Hecker et al. 1980, 1983). The solitary stony coral *D. lymani* occurred in dense localized patches near the head of Baltimore Canyon, but was absent from many other areas in the Canyon (Hecker et al. 1983). Other stony corals found included *Flabellum* sp. and *D. dianthus* (Hecker et al. 1983).

Other Canyons

Hecker and Blechschmidt (1980) surveyed the deep corals and epibenthic fauna of the several other canyons off the northeastern U.S. Discrete assemblages of corals were not identified. For a complete list of species found in the historical survey of Hecker and Blechschmidt (1980) and the Hecker et al. (1980) field study, see Appendix 5.2, which includes Opresko's (1980) list of octocorals and Hecker's (1980) list of scleractinians from those two surveys.

In Heezen Canyon, the gorgonian *A. arbuscula* and the soft coral *A. grandiflorus*, both found on soft substrates, occurred at 850-1050 m; the gorgonian *P. grandis* was common from 1450-1500 m; the soft coral *A. agassizii* and the stony coral *D. dianthus* were found from 1150-1500; *D. dianthus* was also found from 1500-1550 m. The walls of Corsair Canyon were heavily dominated by corals, all of which were restricted to soft substrates. The gorgonian *A. arbuscula* was prominent from 600-800 m, and the soft coral *A. grandiflorus* dominated from 800-1000 m. In Norfolk Canyon in the Mid-Atlantic, the stony coral *D. dianthus* and the gorgonian *A. armata* were found on hard substrate at 1050-1250 m; both were also observed in this canyon by Malahoff et al. (1982). Hecker and Blechschmidt (1980) also noted that the solitary stony coral *Flabellum* sp. was seen in high concentrations at 1300-1350 m depth in Norfolk Canyon, and the soft coral *A. grandiflorus* was found between 2150-2350 m.

Deep corals have been seen on the shelf around Hudson Canyon and in the head of the Canyon (see Appendix 5.2). For example, most recently a survey by Guida (NOAA Fisheries Service,

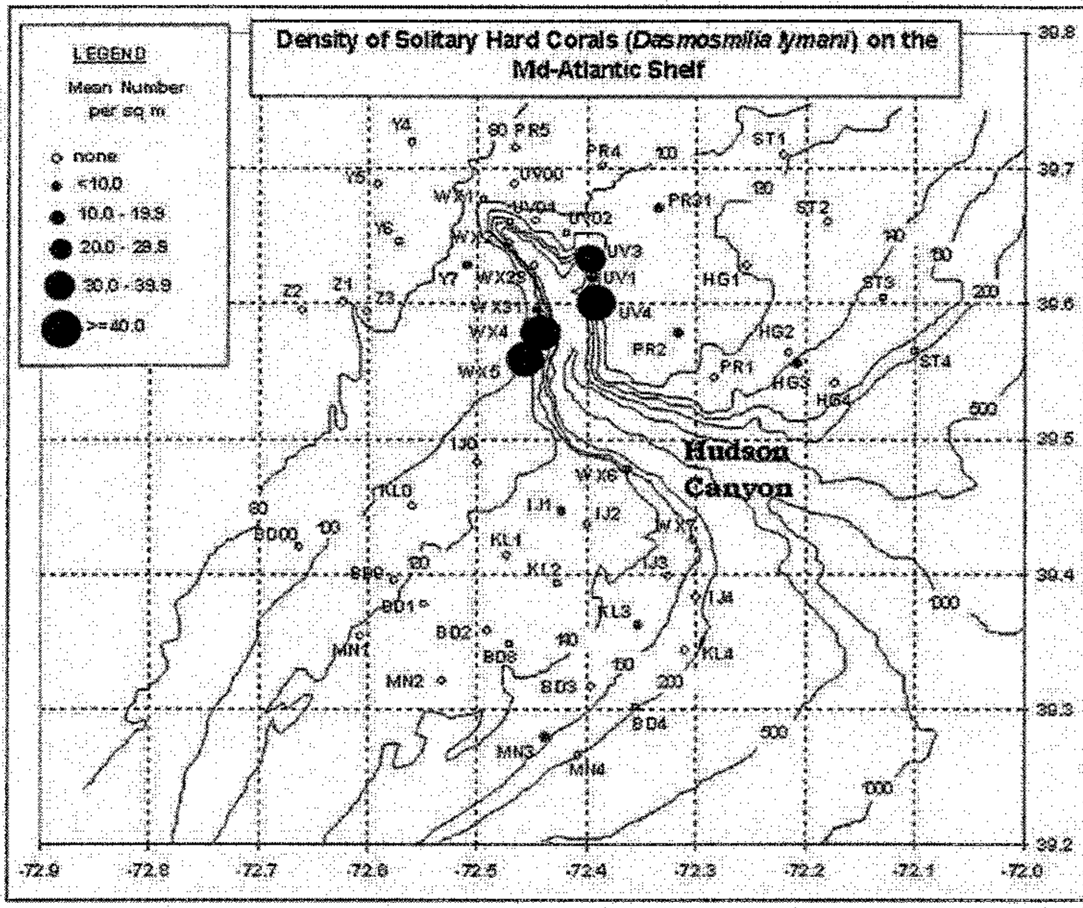


Figure 5.6. Distribution and approximate densities (polyps per square meter) of the solitary stony coral *Dasmosmilia lymani* in samples from the Mid-Atlantic shelf around Hudson Canyon (Guida, unpublished data). Data obtained from still photos and trawl samples taken during October and November 2001, 2002, 2005, August 2004, and March 2007.

NEFSC, James J. Howard Marine Sciences Laboratory, Highlands, NJ, unpublished data) of benthic habitats on the shelf around Hudson Canyon in 2001, 2002, and 2004 found the solitary stony coral *D. lymani* at a number of sites at depths of 100 to 200 m (Figure 5.6). They were particularly abundant in patches in a narrow band along the canyon's rim near its head at depths of 105-120 m; local densities within those patches exceeded 200 polyps m^{-2}, but densities elsewhere were much lower. However, the only evidence of deep corals occurring deep within the canyon itself comes from Hecker and Blechschmidt (1980), who found abundant populations of the soft coral *Eunephthya fruticosa* (same as *Gersemia fructicosa*?) only in the deeper portion of the canyon.

Other Areas of the Continental Slope

Hecker et al. (1983) surveyed an area called Slope III, a 25 mile wide section of the continental slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons. In the Mid-Atlantic they surveyed two slope areas; one, called Slope Area I, was flanked by Lindenkohl Canyon on the south and Carteret Canyon on the north, and the other, called Slope II, was about 70 miles north of Slope I, and was bounded by Toms Canyon to the south and Meys Canyon to the north. Deep corals found on Slope III included the solitary stony corals *D. lymani* and *D. dianthus*, the soft coral *A. agassizii*, and the gorgonian *P. grandis*. In the Mid-Atlantic, the solitary stony coral *D. lymani* occurred in very high abundances in both slope areas at depths <500 m. Other stony corals found on Slope I included *Flabellum* sp. and *D. dianthus*; those corals, as well as *S. variabilis*, were also found on Slope II. The gorgonians *P. grandis* and *A. arbuscula* and the soft coral *A. agassizii* were also present on both slopes.

Hecker (1990), in a later survey of the megafaunal assemblages at four locations on the continental slope south of New England [including two that were surveyed as part of the Hecker et al. (1983) study] found that the solitary stony corals *D. lymani* and *Flabellum* sp. dominated the fauna on the upper slope, although *D. lymani* was absent from their transect off Georges Bank. The gorgonian *A. arbuscula* and the soft coral *C. florida*, which dominated the fauna on the shallower section of the middle slope, were found only at their transect off Georges Bank; the soft coral *A. agassizii* was also found in dense populations there.

The New England Seamounts

Deep corals are one of the dominant members of the epifaunal communities on the New England Seamount chain (Auster et al. 2005). A 2004 exploratory cruise to the New England Seamount chain revealed significant deep coral assemblages, with 27 octocoral species, 8 black coral species, and 2 stony coral species collected (Watling et al. 2005), including possible new species of gorgonians from the Chrysogorgiidae and Paragorgiidae families (Eckelbarger and Simpson 2005). A 2005 cruise to the New England and Corner Rise Seamounts sampled 39 species of octocorals, including 7 that may be new to science, and observed and collected 15 species of black coral, including 7 species that the researchers have not previously observed on the seamounts (Brugler and France 2006; Watling et al. 2006). Distributions of several species (e.g., *Paragorgia* sp., *Lepidisis* spp., *Paramuricea* spp., as well as stony corals and black corals) are currently being quantified using videotapes and digital still images (Figure 5.7). Preliminary quantitative analyses of coral species distributions indicate that community composition differs considerably between seamounts, even at comparable depths. These differences correspond to biogeographical boundaries, or they may be due to species' responses to local habitat conditions, such as substratum type or flow. Substantial variation in faunal composition occurs between sites on a single seamount (P. Auster, pers. comm.).

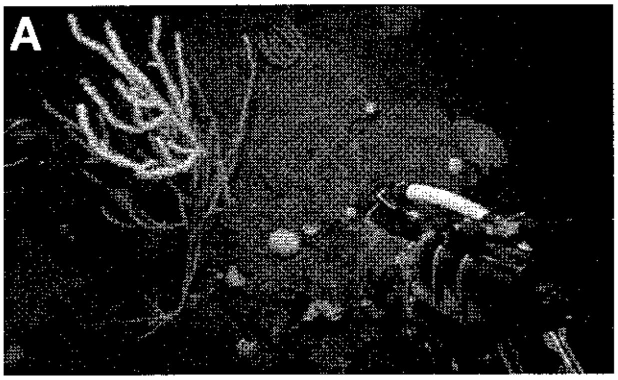
During surveys of Bear Seamount within the EEZ during 2000, Moore et al. (2003) noted the presence of several species of stony corals, including the solitary corals *Caryophyllia ambrosia*, *Flabellum alabastrum*, and, as discussed previously, *Vaughanella margaritata* and the colonial species *Lophelia pertusa*. *Desmophyllum cristagalli* (= *dianthus*) had been found on the Seamount during previous surveys. Gorgonians found by Moore et al. (2003) included *Paragorgia* sp., *Lepidisis* sp. *Swiftia* (?) sp., and *Acanthogorgia angustiflora*, although the latter species does not appear anywhere else in the deep coral records from this region. Although Moore et al. (2003) mentions that a species of *Primnoa* had been found on the Seamount during previous surveys, Cairns (Smithsonian Institution, Washington, D.C., pers. comm.) states that *Primnoa* does not occur on Bear Seamount; this record had originally been taken from Houghton et al. (1977), which is in error. Moore et al. (2003) also collected the soft coral *A. agassizii*.

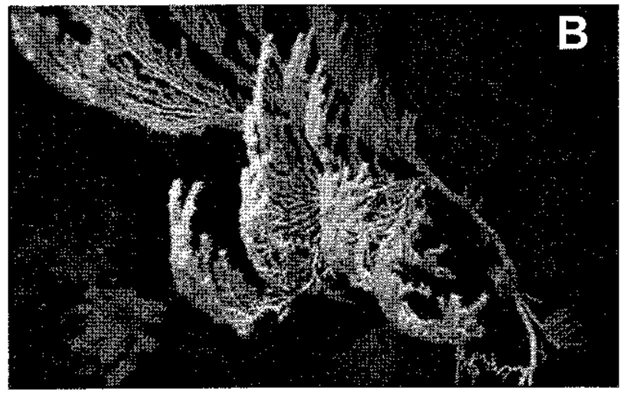
Deep coral collected on Bear Seamount during a follow-up cruise in 2002 by Moore et al. (2004) included the solitary stony corals *Caryophyllia cornuformis* (this species is not mentioned elsewhere) and *F. alabastrum* and the colonial stony corals *S. variabilis* and *Enallopsammia rostrata*. Gorgonians collected included *Paragorgia* sp., *Paramuricea* sp., *Keratoisis* sp., *Swiftia pallida* (this species is not mentioned elsewhere), *Lepidisis* sp., and *Radicipes gracilis*.

VI. SPECIES ASSOCIATIONS WITH DEEP CORAL COMMUNITIES

Commercial Fisheries Species

The role of deep corals as possible habitats for fishes has only recently been addressed in the literature. The corals *Primnoa*, *Lophelia*, and *Oculina* from other regions have been the most studied. Several studies have documented that certain fish commonly occur in the vicinity of corals more often than in areas without corals. In the northwest Atlantic, this has been noted for *Sebastes* sp. (redfish) in the Northeast Channel (Mortensen et al. 2005). Redfish may take advantage of structure on the bottom as a refuge from predation, as a focal point for prey, and for other uses. However, in a survey of habitats in the Jordan Basin in the Gulf of Maine containing coral assemblages (primarily from the genera *Paragorgia, Paramuricea,* and *Primnoa*), Auster (2005) found that densities of redfish were not significantly different between dense coral habitats and dense epifauna habitats, although the density of redfish in these two habitats was higher than in the outcrop-boulder





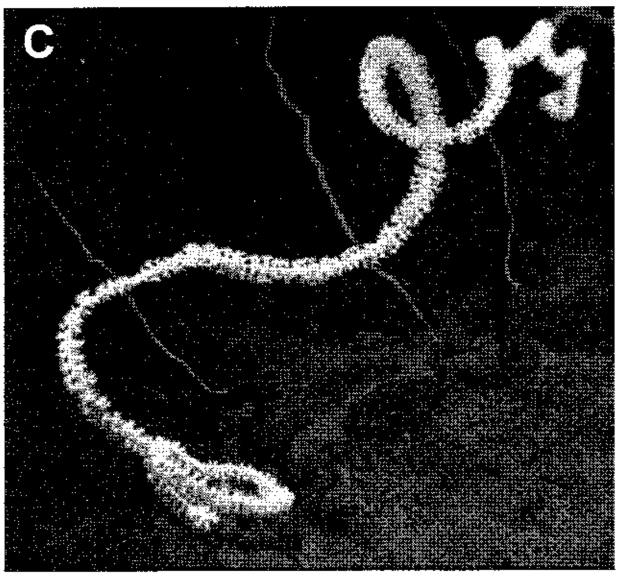


Figure 5.7. Photographic examples of variations in coral communities from the upper slope of Bear Seamount, near the summit. A) Bamboo coral (*Keratoisis* sp.) at left with globular sponge (bottom center), brisingid sea star (center top) and leafy sponge (center right). B) *Keratoisis* sp. C) *Lepidisis* sp. Photo credit: Deep Atlantic Stepping Stones Science Team, IFE, URI, and NOAA-OE

habitat containing sparse epifauna. While this study shows that a habitat without deep corals can support similar densities of fish to a habitat containing corals, Auster (2005) states that it is the actual distribution of each habitat type throughout a region that will ultimately determine the role such habitats play in the demography of particular species and communities. Deep coral habitats are fairly rare in the Gulf of Maine (Figs. 5.2A and 5.3A; Watling et al. 2003), but boulder-cobble habitats containing dense epifauna are not. Auster (2005) suggests that deep corals do have some effect on the distribution and abundance of fishes, but by themselves do not support high density, unique or high diversity fish communities. The corals do provide important structural attributes of habitat, but may not be functionally different than structures provided by other dense epifaunal assemblages.

In addition, variations in the morphological forms of the deep corals themselves within a landscape can affect how they will be used by fishes. For example, on the New England Seamounts, Auster et al. (2005) describes the gorgonian assemblage deep on the seamount flanks as a mixture of "tall and whip-like species and short fans with low density branching," with the taller species forming moderately dense stands, while near and on the seamount summits, the gorgonians (e.g., *Paragorgia* sp.) are often "large (~1 m wide) robust fans with high density branching" that are spread across the landscape. The form and density of the latter may have a different habitat value in terms of shelter or refuge from flow (Auster et al. 2005). Auster et al. (2005) did observe one fish species, *Neocyttus helgae*, that appeared to be associated with *Paragorgia* sp., perhaps utilizing them as a refuge from flow and as a foraging spot for prey associated with the coral, or perhaps they were foraging on the coral polyps themselves.

Invertebrates

There are few data available about invertebrate species associations with deep corals in this region; more is known about the species associations of deep corals and invertebrates from other regions [e.g., *Primnoa* off Alaska (Krieger and Wing 2002); *Lophelia pertusa* off Norway (Mortensen 2000)]. Off the northeastern U.S., Hecker et al. (1980) noted the frequent occurrence of shrimp on the largest gorgonians such as *Paragorgia arborea*, *Paramuricea grandis*, *Primnoa resedaeformis*, and the soft coral *Capnella florida*. An ophiuroid and an anemone appeared to have an association, possibly obligatory, as suggested by Hecker et al. (1980), with *Paramuricea grandis*. Hecker and Blechschmidt (1980) also noted several faunal associations in their study. The ophiuroids *Ophiomusium lymani* and *Asteronyx loveni* were often associated with corals; e.g., the latter with the gorgonian *A. arbuscula*. Pycnogonids were seen on the gorgonian *Paramuricea grandis*.

Current studies are looking at the species associations of the octocorals of the New England and Corner Rise Seamounts. Ophiuroids and marine scale worms were found to live commensally in and on the octocorals found on the seamounts (Watling 2005; Watling and Mosher 2006); specimens of octocorals, stony corals, and their associated species from the seamounts are also being used in population genetic studies that will assess, for example, the taxonomic relationships of the corals and associated species (Shank et al. 2006). Within the EEZ, Moore et al. (2003) noted the following invertebrates found in direct association with *Lophelia petusa* trawled from Bear Seamount: a large polychaete worm living in tubular spaces within the coral colony, the attached solitary stony coral, *Caryophyllia ambrosia*, small serpulid worm tubes, a thecate hydroid, and the gorgonian *Swiftia*.

VII. STRESSORS ON DEEP CORAL COMMUNITIES

Fishing Effects

Deep corals provide habitat for other marine life, increase habitat complexity, and contribute to marine biodiversity, and their destruction could have a significant impact on other marine species. Anecdotal data from submersible and ROV studies as well as reports from fisherman, who have brought them up as bycatch since the 19th century, suggests that deep corals have become less common or their distributions have been reduced due to the impacts of bottom fishing (Breeze et al. 1997; Watling and Auster 2005). Fishing has had significant effects on deep coral populations in other regions. Deep corals are especially susceptible to damage by fishing gear because of their often fragile, complex, branching form of growth above the bottom. Also, they grow and reproduce at very slow rates, with some estimated to be hundreds of years old (Lazier et al. 1999; Andrews et al. 2002; Risk et al. 2002), and recruitment rates may also be low (Krieger 2001), which makes their recovery from disturbances difficult over short time periods. Of the various fishing methods, bottom trawling has been found to be particularly destructive (Rogers 1999; Hall-Spencer et al. 2001; Koslow et al. 2001; Krieger 2001; Fosså et al. 2002; Freiwald 2002).

The effects of current and historic fishing efforts on deep coral and coral habitats in the northeastern U.S. have not been quantified. The types of fishing gear used here include fixed gear such as longlines, gillnets, and pots and traps, as well as trawls and dredges. Fixed gear can be lost at sea, where they can continue to damage corals. In Canada, longlines have been observed entangled in deep corals such as *Paragorgia* and *Primnoa* and may cause breakage (Breeze et al. 1997; Mortensen et al. 2005). Further, "ghost fishing" of nets entangled in coral reefs has been reported in the North Sea (ICES 2003). Bottom trawling was found to have a larger impact on deep corals per fishing unit of effort compared to longlining; e.g., damage to *Primnoa* off Alaska (Krieger 2001). The northeastern U.S. fisheries that have the highest likelihood of occurring near concentrations of known deep coral habitats (e.g., in canyon and slope areas) are the *Lophius americanus* (monkfish or goosefish) and *Lopholatilus chamaeleonticeps* (tilefish) fisheries, and the *Chaceon* (*Geryon*) *quinquedens* (red crab) and offshore *Homarus americanus* (lobster) pot fisheries.

Effects of other human activities

Invasive Species

Little is known about any existing or potential interactions between deep corals and invasive species. One invasive species that may be a threat in the northeast is the colonial tunicate ("sea squirt"), *Didemnum* sp. A. (Bullard et al. 2007). It is currently undergoing a massive population explosion and major range expansion and has become a dominant member of many subtidal communities on both coasts of North America. It was recently discovered on the northern edge of Georges Bank, and is found on hard gravel substrates, including, pebbles, cobbles, and boulders, and overgrows sessile and quasi-mobile epifauna (sponges, anemones, scallops, etc.). The species can occur on immobile sand substrates, but is not known to occur on mobile sand or mud substrate. On Georges Bank, *Didemnum* sp. A covers 50–90% of the substrate at numerous sites over a 230 km^2 area to a depth of 45-60 m (Bullard et al. 2007). *Didemnum* sp. A has the potential to spread rapidly by budding, and fragmentation of the mats could promote the rapid spread of the species. There are no known predators at this time, although there have been some observations of possible seastar predation (Bullard et al. 2007).

Didemnum sp. A may be a potential serious threat to deep coral that occur on hard substrates in the northeast, particularly for those corals, such as *Paragorgia* and *Primnoa*, which are known to occur on the gravel substrate of the Northeast Peak of Georges Bank. If the tunicate did colonize deep coral habitat, it could smother and kill the corals by overgrowth, or at least impede feeding (G. Lambert, University of Washington, Friday Harbor Laboratories, Seattle, WA, pers. comm.; P. Valentine, USGS, Woods Hole, MA, pers. comm.) However, Bullard et al. (2007) note that on cobble bottoms in Long Island Sound, the only epifaunal species that *Didemnum* sp. A did not appear to overgrow were the stony coral, *Astrangia poculata*, and the cerianthid anemone, *Ceriantheopsis americana*. In addition, depth, temperature, and larval dispersal may be limiting factors in the spread of the tunicate (G. Lambert, pers. comm.; P. Valentine, pers. comm.). It may be a shallow water species; so far, it has been found only at depths down to 81 m off New England on Georges, Stellwagen and Tillies Banks (Bullard et al. 2007), and even though it is found in a temperature range of -2°C to 24°C, its preferred range might be at temperatures >4°C or higher (G. Lambert, pers. comm.; P. Valentine, pers. comm.). *Didemnum* sp. A would probably have a difficult time getting from the present affected area into the submarine canyons located on the southern bank margin. The tadpole larvae that are born from sexual reproduction swim near the bottom (probably for only a few hours) before settling, so they cannot travel far on their own or by currents. However, because fragments of the colonies are viable, it could, in theory, be brought to the canyons on a boat hull or by the use of contaminated fishing gear (mobile or fixed) or the washing of contaminated boat decks (P. Valentine, pers. comm.). Even though the consensus is that *Didemnum* sp. A is probably a remote threat to deep corals, it has previously confounded researchers with its incredible rate of colonization and range expansion. So little is known about this tunicate that it is not possible to predict the limits of its further spread at this time (G. Lambert, pers. comm.). But *Didemnum* sp. A does has the potential to cause great ecological and economic damage. The species continues to expand its range and could eventually colonize large expanses of hard substrata throughout New England and eastern Canada (Bullard et al. 2007).

Other
There does not appear to be any specific current or pending oil and gas exploration/extraction, gas pipeline/communication cable, mineral mining, etc. projects that could pose a significant threat to the major deep coral species in this region; in addition, few of the coastal projects along the northeast coast of the U.S. are deep enough to affect them. There also doesn't appear to be any monitoring data or published studies from these types of projects in this region that show evidence of impacts to deep corals.

VIII. MANAGEMENT OF FISHERY RESOURCES AND HABITATS

Mapping and Research
Despite the aforementioned faunal surveys, our knowledge of the temporal and spatial distribution and abundance of deep corals off the northeastern U.S., as well as some aspects of their basic biology and habitat requirements, is severely limited, so their overall population status and trends are difficult to determine. [There is, however, more information on deep coral distribution and habitat requirements in Canadian waters; e.g., the Northeast Channel (Mortensen and Buhl-Mortensen 2004)]. NEFSC groundfish and shellfish surveys from the Gulf of Maine to Cape Hatteras have collected corals as part of their bycatch for several decades, but there are many data gaps (e.g., corals were not properly identified or quantified) which prevent using the data to clearly assess any long-term population trends.

There have been some recent, targeted surveys off of New England using trawls and remotely operated vehicles (ROVs). In 2003, 2004, and 2005, their were surveys of several seamounts in the New England and Corner Rise Seamount chains (the latter is approximately 400 km to the east of the New England Seamount chain, and nearly midway between the east coast of the U.S. and the Mid-Atlantic Ridge) funded by NOAA's Office of Ocean Exploration and National Undersea Research Program. The cruises were multidisciplinary in nature but the goals included studying the distribution and abundance of deep corals relative to the prevailing direction of currents; collecting specimens for studies of reproductive biology, genetics, and ecology; and studying species associations. Mike Vecchione (NEFSC, National Systematics Laboratory) conducted a multi-year study (2000-2005) exploring the faunal biodiversity of Bear Seamount. The multi-year program examined some of the temporal variability around the Seamount. Initial results on the biodiversity of deep corals by Moore et al. (2003) were discussed previously. Mike Fogarty (NEFSC) in spring 2004 explored the macrofaunal biodiversity of the upper continental slope south of Georges Bank from Oceanographer Canyon to Powell Canyon at depths from 400-1100 m, with the deepest stations corresponding to the shallowest depths sampled on the summit of Bear Seamount in the Vecchione survey.

Fishery Management Councils

Fishery management council jurisdiction in the northeast U.S. is primarily the responsibility of the New England Fishery Management Council (NEFMC). In addition to the 26 species under its sole management, the NEFMC shares responsibility over *Lophius americanus* (monkfish or goosefish) and *Squalus acanthias* (spiny dogfish) with the Mid-Atlantic Fishery Management Council (MAFMC). In 2005, the two Councils, with the NEFMC as the lead Council on the Monkfish Fishery Management Plan (FMP), approved the designation of Oceanographer and Lydonia Canyons (approximately 116 square nautical miles) as Habitat Closed Areas (HCA) and added these areas to the NEFMC's network of HCAs (or marine protected areas). These new HCAs are closed indefinitely to fishing with bottom trawls and bottom gillnets while on a monkfish day-at sea (DAS) in order to minimize the impacts of the directed monkfish fishery on Essential Fish Habitat (EFH[1]) in these deep-sea canyons and on the structure-forming organisms therein (Figures 5.1 and 5.8). Within these canyon habitats, a variety of species have been found which are known to provide structured habitat, including deep corals, and shelter for many species of demersal fish and invertebrates.

This action was implemented in May 2005 under Amendment 2 to the Monkfish Fishery Management Plan (FMP) (NEFMC 2004). EFH for some federally-managed species extends beyond the edge of the continental shelf and includes portions of the canyons.

The directed monkfish fishery is conducted with bottom trawls and bottom gillnets, primarily in coastal and offshore waters of the Gulf of Maine, on the northern edge of Georges Bank, and in coastal and continental shelf waters of southern New England, including offshore waters on the edge of the continental shelf and near the heads of several of the canyons. Although the current degree of overlap between the current monkfish fishing effort and the known presence of corals within the canyons is very small, one of the fishery management measures contained within Amendment 2, and which was approved by the Councils, would increase the probability that the offshore fishery for monkfish will expand in the future. Because there is documented evidence of deep corals in the canyons in the area that is identified for possible increased offshore fishing, these closures are intended as a precautionary measure to prevent any potential direct or indirect impacts of an expanded offshore monkfish fishery on EFH, offshore canyon habitats, and thus, deep corals.

Approximately 23 federally-managed species have been observed or collected within these proposed closure areas, and many of them have EFH defined as "hard substrates" at depths >200 m, which includes habitat or structure-forming organisms such as deep corals. Also, the EFH designations for juvenile and adult life stages of six of these managed species (*Sebastes* spp., redfish, is one of them) overlap with the two

[1] EFH is a provision of the Magnuson-Stevens Fishery Conservation and Management Act (1996). The EFH provision states: "One of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States." The definition of EFH in the legislation covers: "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation mandates that NOAA Fisheries and the Councils implement a process for conserving and protecting EFH.

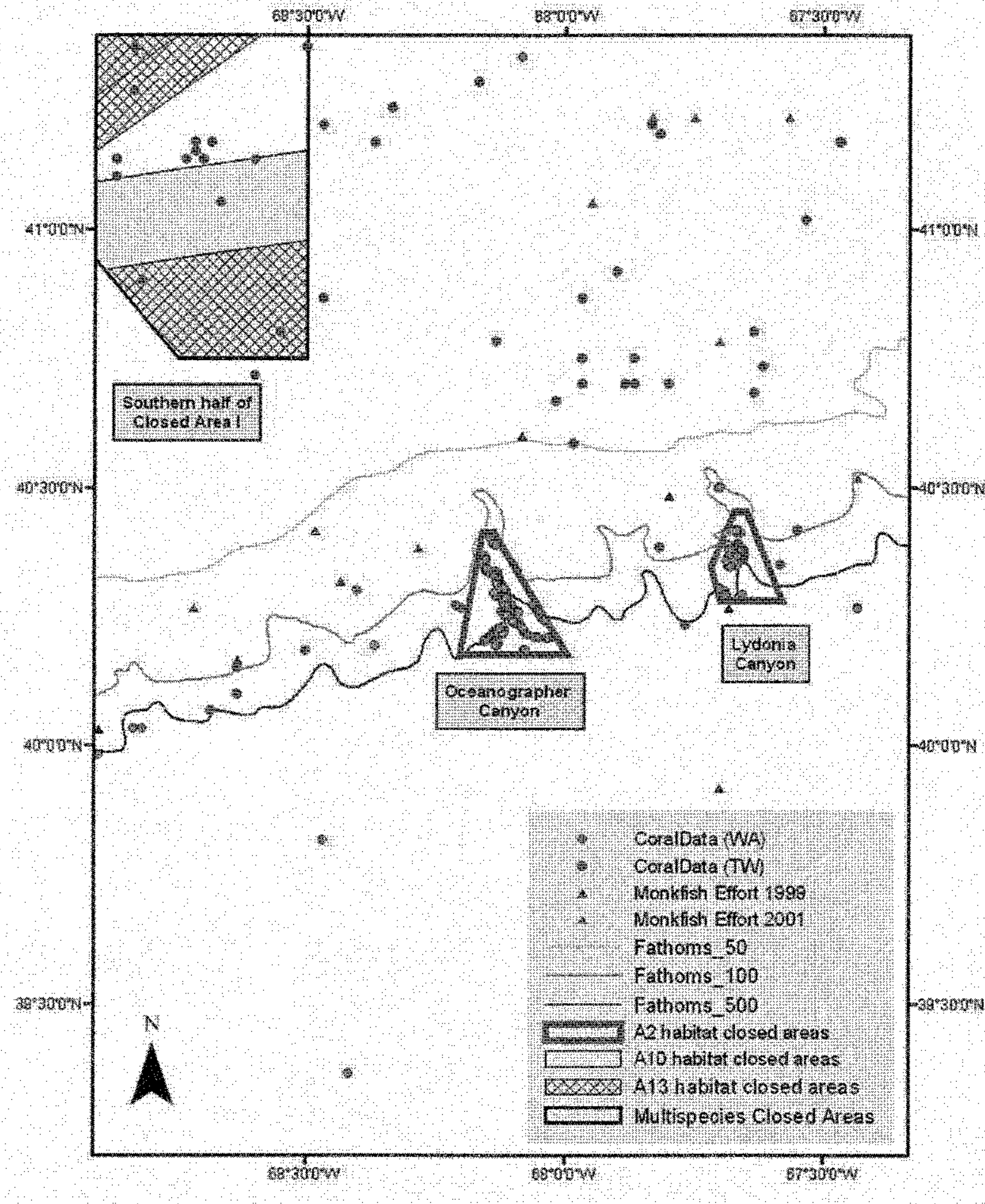


Figure 5.8. The Oceanographer and Lydonia Canyon Essential Fish Habitat closed areas, under Amendment 2 to the Monkfish Fishery Management Plan; locations of known alcyonaceans from the Theroux and Wigley (1998) and Watling et al. (2003) databases; and, 1999 and 2001 directed monkfish otter trawl trips. Source credit: 1999 and 2001 VTR).

closed areas, and EFH for all six of these species has been determined to be vulnerable to bottom trawling and perhaps also vulnerable to bottom gillnets. Although deep corals are not explicitly included in the EFH descriptions for any species in the northeast region, some deep corals are, of course, known to grow on hard substrates, and may themselves be considered a form of substrate. The rationale is that, since there are corals found within these proposed closed areas, this is indicative of areas of hard bottom. Also some coral species may provide the structural attributes of habitat similar to that provided by other dense epifaunal assemblages (as discussed above), and may be particularly vulnerable to damage or loss by trawling or gillnets. Thus, by avoiding any direct adverse impacts of bottom trawls and gillnets used in the monkfish fishery on EFH for the six species of fish and any indirect adverse impacts on hard bottom habitat and emergent epifauna, such as the deep corals, that grow in these habitats within the closed areas, adverse impacts of an expanded offshore fishery would be minimized to the extent practicable.

Protection of deep corals is a relatively new concept in this region and the NEFMC believes that there are several statutory and regulatory authorities that support the Councils' initiative to protect deep coral habitats. The NEFMC took this proactive and precautionary approach to protect these sensitive habitats through aggressive fishery management measures, which is based on sound ecological principles, as appropriate and necessary. In Amendment 2 to the Monkfish FMP, the Councils, for the same reasons and rationale discussed above, also considered a management alternative that would have closed all 12 steep-walled canyons along the continental shelf-break from the Hague Line in the north to the North Carolina/South Carolina border in the south. Although this management alternative was not ultimately chosen by the Councils for implementation due to the lack of readily available coral data and potential negative social and economic impacts, the Councils did feel that the science and data supported the closure of Oceanographer and Lydonia Canyons at that time as a precautionary measure. The Councils determined that protection of deep corals in all 12 canyons would be less certain than in just closing Lydonia and Oceanographer Canyons, until such time as additional surveys are conducted or evidence is examined which more thoroughly document the presence of corals in the other 10 canyons.

The New England Fishery Management Council alone has also indefinitely closed an additional 3,000+ square nautical miles, as Habitat Closed Areas, in the Gulf of Maine, Georges Bank, and southern New England to bottom-tending mobile fishing gear to protect EFH (Figure 5.1), which indirectly protects any deep corals in those areas. This initial suite of HCAs was created under both Amendment 10 to the Atlantic Sea Scallop Fishery Management Plan in 2003 and Amendment 13 to the Northeast Multispecies Fishery Management Plan in 2004 as "Level 3" closures, and are closed indefinitely to all bottom-tending mobile gear to protect EFH. The canyon habitat closures implemented under Amendment 2 to the Monkfish FMP should be viewed as an addition to the suite of HCAs, and in concert with the other HCAs, provides a large network of marine protected areas (MPAs) as compared to the relatively small size of the geographic region under management.

Lastly, under the current effort to update all of the EFH provisions of all of the NEFMC FMPs, the NEFMC has approved a set of new Habitat Areas of Particular Concern (HAPCs[2]) including many steep-walled canyons on the eastern seaboard extending from the Hague Line to the North Carolina/South Carolina border and Bear and Retriever Seamounts to protect sensitive EFH and the habitat and structure-forming organisms therein. These new HAPCs will need approval from the MAFMC before they can be implemented through final action sometime in late 2008. The MAFMC will likely take up the topic at one of their upcoming meetings

IX. REGIONAL PRIORITIES TO UNDERSTAND AND CONSERVE DEEP CORAL COMMUNITIES

Mapping

Deep corals have been largely unmapped off the northeastern U.S, particularly in the Mid-Atlantic. What is currently known about coral distribution

[2]HAPCs are a subset of the much larger area identified as EFH that play a particularly important ecological role in the life cycle of a managed species or that are rare and/or particularly sensitive or vulnerable to human-induced environmental degradation and development activities.

in this region is largely based on blind, random, or grid sampling with trawl gear, grab samplers, and drop cameras that was done twenty or more years ago. While the breadth of such surveys was vast, in most cases the density of data they generated is much too diffuse spatially and temporally to provide distributional data adequate for management purposes. Therefore, it is critical to identify, map, and characterize deep corals and their habitats, particularly in the canyons, utilizing more advanced technologies such as side-scan and multibeam sonars, manned submersibles and ROVs, towed camera sleds, etc. Low-resolution maps should be produced that cover large areas for purposes of identifying potential locations of deep corals, and high-resolution maps should be produced for site-specific areas where deep corals are known to exist (McDonough and Puglise 2003). Temporal/spatial changes in deep coral distribution and abundance need to be assessed, and long-term monitoring programs should be established.

Recently, Leverette and Metaxas (2005) developed predictive models to determine areas of suitable habitat for *Paragorgia arborea* and *Primnoa resedaeformis* along the Canadian Atlantic continental shelf and shelf break. Several environmental factors including slope, temperature, chlorophyll *a*, current speed and substrate were included in the analysis. Their results showed that the habitat requirements differed between the two gorgonians. *P. arborea* occurred predominantly in steeply sloped environments and on rocky substrates, while the habitat for *P. resedaeformis* was more broadly distributed and located in areas with high current speed, rocky substrates and a temperature range between 5-10°C. The use of predictive modeling to generate habitat suitability maps and to identify suitable habitat for deep coral in the northeastern U.S. would be an important step toward deep coral conservation.

Research

It was stated previously that there is uncertainty about the accuracy of the identifications of deep corals from the various historical surveys. Identifying deep corals is difficult, and their taxonomy is often in question, so as a first step, some basic taxonomic issues need to be worked out. Molecular genetics is one tool that could be used, and this line of research may provide insight into coral larval dispersal. Genetic studies may also be useful for comparing corals regionally, nationally, and on either side of the Atlantic. For example, DNA-sequencing technology is currently being used to determine whether the corals around the New England Seamounts are endemic, or simply populations of species with broader geographic distributions; e.g., whether the corals are dispersing from the New England Seamounts into the deep Gulf of Maine and submarine canyons off Georges Bank. However, it's important to note that there is a shortage of qualified coral taxonomists available to properly identify deep corals. With so few professional coral taxonomists, it will be difficult to make progress in deep coral mapping and distribution, for example. More students need to be trained in coral taxonomy at the graduate level, and more funding needs to be available for taxonomic research and to hire coral taxonomists at museums and universities.

In addition to taxonomy, basic life history studies on deep corals are needed in this region. There are fundamental questions on deep coral growth, physiology, reproduction, recruitment, recolonization rates, and feeding. Their habitat requirements need to be characterized. In addition, it is important to collect associated oceanographic, geologic, and other habitat parameter data in order to understand the physical parameters that affect the distribution and extent of deep coral habitats. Deep coral habitat biodiversity should be assessed, food web relationships need to be defined, and the role that the corals play in the life histories of associated species should be described and quantified. In terms of the latter, the possible role of deep corals as EFH for Federally managed species has to be determined. Finally, it is necessary to quantify the vulnerability or resilience of deep corals to various anthropogenic threats, especially from fishing, and to quantify the recovery rates of corals and coral habitats that have been injured or destroyed. Many of these recommendations for research on deep corals can be found in McDonough and Puglise (2003) and Puglise and Brock (2003).

The NEFSC needs to become more quantitative about their deep coral bycatch in the groundfish and shellfish surveys and fisheries observer program logs. Prior to the year 2000, for example, bycatch quantity in the NEFSC *Placopecten magellanicus* (Atlantic sea scallop) surveys were estimated by cursory visual inspection or "eyeballing" only (D. Hart, NOAA Fisheries Service, NEFSC, Woods Hole Laboratory, Woods Hole, MA, pers. comm.). The bycatch data for those surveys were divided up into 3 categories: substrate, shell, and other invertebrates; and the log sheets only recorded percent composition and total volume (bushels). In the fisheries observer program, the observers also log the presence of coral bycatch; however, they are lumped into one category ("corals and sponges"), and are not identified further. In addition, because the observer program observes thousands of trips every year in dozens of different fisheries, with each fishery having its own regulations for mesh size and configuration, a reported absence of coral at a location may simply be a function of the catchability of the gear used (D. Potter, Fisheries Sampling Branch, NOAA Fisheries Service, NEFSC, Woods Hole Laboratory, Woods Hole, MA, pers. comm.). This is also a problem with the NEFSC surveys; it is important to remember that fishing gear is not designed to "catch" corals. But at the very least, if there was an attempt made to properly identify coral bycatch from these two programs, one might come up with some form of presence data.

X. CONCLUSION

The overall quantity of deep coral habitat in the northeast region is unknown, and no systematic assessment of the distribution, abundance, and population dynamics of deep coral is available for this region. That, along with a dearth of information on their natural history, as well difficulties with their taxonomy, makes it difficult, if not impossible, to determine if there have been changes in deep coral occurrence or abundance over time. Nevertheless, even though there is no quantitative information on the extent of anthropogenic impacts to deep corals in this region, some of the areas where structure-forming deep corals are definitely known to occur (e.g., unique areas such as the submarine canyons and the New England Seamounts) are currently protected or under consideration for protection from bottom-tending fishing gear as EFH and Habitat Areas of Particular Concern.

Obviously, in order to better preserve and protect deep corals and deep coral habitat off the northeastern U.S., there needs to be 1) an increased mapping and survey effort at the Federal and academic level (including joint studies with Canada); 2) more basic research on deep coral taxonomy, life history, habitat requirements, species associations, etc.; and finally, 3) quantification on the susceptibility of deep corals to anthropogenic influences, particularly fishing.

XI. REFERENCES

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Appendix 5.1. List of deep coral species found in the waters off the Northeastern United States. ** = distribution information based on studies or surveys of a particular area of the Northeast Region, not on overall distribution.

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
Phylum Cnidaria				
Class Anthozoa				
Subclass Hexacorallia				
Order Scleractinia				
Family Caryophilliidae	*Caryophyllia ambrosia ambrosia* Alcock, 1898	Widespread (cosmopolitan) distribution; found on Bear Seamount	1487-2286	Cairns and Chapman 2001; Moore et al. 2003
	Caryophyllia ambrosia caribbeana Cairns, 1979	Endemic to western Atlantic	183-1646	Cairns and Chapman 2001
	Dasmosmilia lymani (Pourtales, 1871)	Widespread (cosmopolitan) distribution. Continental slope south of New England, Lydonia Canyon, continental shelf between Baltimore and Hudson Canyons, in Baltimore Canyon, and between 100-200 m on the shelf south of Hudson Canyon and in the head of Hudson Canyon	37-366	Hecker 1980; Hecker et al. 1983; Hecker 1990; Cairns and Chapman 2001; Guida (unpublished data)
	Deltocyathus italicus (Michelotti, 1838)	Amphi-Atlantic with a disjunct distribution	403-2634	Cairns and Chapman 2001
	Desmophyllum dianthus (Esper, 1794)	Widespread (cosmopolitan) distribution; found in several canyons (Corsair, Heezen, Lydonia, Oceanographer, Baltimore, Norfolk, near Hudson); continental slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons; in the Mid-Atlantic on the slope between Lindenkohl Canyon on the south and Carteret Canyon on the north; in the Mid-Atlantic on the slope bounded by Toms Canyon to the south and Meys Canyon to the north; Bear Seamount	183-2250	Hecker 1980; Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Malahoff et al. 1982; Cairns and Chapman 2001; Moore et al. 2003

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
	Lophelia pertusa (L. 1758)	Widespread (cosmopolitan) distribution; Oceanographer Canyon wall; Bear Seamount	146-1200; 700-1300	Hecker 1980; Hecker and Blechschmidt 1980; Hecker et al. 1980; Cairns and Chapman 2001; Moore et al. 2003
	Solenosmilia variabilis Duncan, 1873	Widespread (cosmopolitan) distribution; Lydonia canyon; on the slope bounded by Toms Canyon to the south and Meys Canyon to the north	220-1383	Hecker 1980; Hecker et al. 1983; Cairns and Chapman 2001
	Vaughanella margaritata (Jourdan, 1895)	Endemic to northwestern Atlantic; Bear Seamount	1267	Cairns and Chapman 2001; Moore et al. 2003
Family Dendrophylliidae	*Enallopsammia profunda* (Pourtales, 1867)	Endemic to western Atlantic	403-1748	Cairns and Chapman 2001
	Enallopsammia rostrata (Pourtales, 1878)	Widespread (cosmopolitan) distribution	300-1646	Cairns and Chapman 2001
Family Flabellidae	*Flabellum alabastrum* Moseley, 1873	Amphi-Atlantic with contiguous distribution; Canyons (Corsair, Heezen, Lydonia Oceanographer, Alvin, Baltimore, Norfolk) and slopes, Bear Seamount. some may be *F. angularis* or *F. moseleyi*	357-1977	Hecker 1980; Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Cairns and Chapman 2001; Moore et al. 2003
	Flabellum angulare Moseley, 1876	Amphi-Atlantic with contiguous distribution; see also *F. alabastrum*	2266-3186	Hecker 1980; Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Cairns and Chapman 2001; Moore et al. 2003
	Flabellum macandrewi Gray, 1849	Amphi-Atlantic with contiguous distribution; see also *F. alabastrum*	180-667	Hecker 1980; Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Cairns and Chapman 2001; Moore et al. 2003
	Javania cailleti (Duch. & Mich., 1864)	Widespread (cosmopolitan) distribution; Lydonia, Oceanographer Canyons	30-1809	Hecker 1980; Hecker et al. 1983; Cairns and Chapman 2001
Family Fungiacyathidae	*Fungiacyathus fragilis* Sars, 1872	Widespread (cosmopolitan) distribution	412-460	Cairns and Chapman 2001

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
Family Rhizangiidae	*Astrangia poculata* (Ellis & Solander, 1786)	Endemic to western Atlantic	0-263	Theroux and Wigley 1998; Cairns and Chapman 2001
Order Antipatharia				
Family Antipathidae	*Leiopathes* sp.**	Near and on Bear Seamount	1643, 1754	Brugler 2005
	Cirrhipathes sp.**	Off Virginia	262	Smithsonian Institution collections
Subclass Octocorallia				
Order Alcyonacea				
Family Alcyoniidae	*Alcyonium digitatum* Linne, 1758			Watling and Auster 2005
	Anthomastus agassizii Verrill, 1922 **	Hard substrates from Corsair Canyon to Hudson Canyon; outcrops in Corsair Canyon; in Heezen, Lydonia, Oceanographer Canyons; on slope near Alvin Canyon; on slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons; in Mid-Atlantic on slope flanked by Lindenkohl Canyon to south and Carteret Canyon to north and on slope bounded by Toms Canyon to south and Meys Canyon to north; Bear Seamount	750-1326	Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Opresko 1980; Valentine et al. 1980; Hecker 1990; Moore et al. 2003; Watling and Auster 2005
	Anthomastus grandiflorus Verrill, 1878 **	Soft substrates, highest densities in canyons; found in Corsair, Heezen, Oceanographer Canyons, seen near Hudson Canyon, Toms Canyon, in Baltimore Canyon, in axis of Norfolk Canyon	700-2600	Hecker and Blechschmidt 1980; Hecker et al. 1980; Opresko 1980; Watling and Auster 2005
Family Clavulariidae	*Clavularia modesta* (Verrill, 1874)			Watling and Auster 2005
	Clavularia rudis (Verrill, 1922)**	Found in axis of Heezen, Lydonia, Oceanographer Canyons	750-1099	Hecker and Blechschmidt 1980; Hecker et al. 1980; Opresko 1980; Watling and Auster 2005

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
Family Nephtheidae	*Capnella florida* (Rathke, 1806)**	Lydonia, Oceanographer, Baltimore Canyons; axis of Heezon Canyon; wall of Corsair Canyon; continental slope south of New England off Georges Bank	350-1500	Hecker and Blechschmidt 1980; Hecker et al. 1980; Opresko 1980; Hecker 1990; Watling and Auster 2005
	Capnella glomerata (Verrill, 1869)**	Several individuals found in Lydonia Canyon	200-561	Hecker et al. 1980; Opresko 1980; Watling and Auster 2005
	*Gersemia fruticosa*** (Sars, 1860)	Near and in deep portion of Hudson Canyon; at the mouth of Norfolk Canyon; seen near heads of Toms and Carteret Canyons (i.e., between Baltimore and Hudson Canyons)	600-3100	Hecker and Blechschmidt 1980; Opresko 1980; Watling and Auster 2005
	Gersemia rubriformis (Ehrenberg, 1934)			Watling and Auster 2005
Order Gorgonacea				
Family Acanthogorgiidae	*Acanthogorgia armata* Verrill, 1878 **	Found in many canyons (Corsair, Lydonia, Oceanographer, Alvin, near Hudson, Norfolk, Baltimore); seen on boulders or outcrops	350-1300	Hecker and Blechschmidt 1980; Hecker et al. 1980; Opresko 1980; Malahoff et al. 1982; Watling and Auster 2005
Family Anthothelidae	*Anthothela grandiflora* (Sars, 1856) **	Lydonia, Oceanographer, Baltimore Canyons	450-1150	Hecker et al. 1980; Opresko 1980; Watling and Auster 2005
Family Chrysogorgiidae	*Chrysogorgia agassizii* (Verrill, 1883)	Several individuals that may be *C. agassizii* found in the vicinity of Hudson Canyon.	2150	Watling and Auster 2005
	Iridogorgia pourtalesii Verrill, 1883			Watling and Auster 2005
	Radicipes gracilis (Verrill, 1884)			Watling and Auster 2005

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
Family Isididae	*Acanella arbuscula* (Johnson, 1862) **	Found in Corsair, Heezen, Oceanographer Canyons; on slope near Alvin, Baltimore Canyons; in Mid-Atlantic on slope flanked by Lindenkohl Canyon to south and Carteret Canyon to north and on slope bounded by Toms Canyon to south and Meys Canyon to north; continental slope south of New England off Georges Bank; seen on soft substrates	600-2000	Hecker and Blechschmidt 1980; Hecker et al.1980; Opresko 1980; Hecker 1990; Theroux and Wigley 1998; Watling and Auster 2005
	Keratoisis grayi Wright, 1869			Watling and Auster 2005
	Keratoisis ornata Verrill, 1878			Watling and Auster 2005
	Lepidisis caryophyllia Verrill, 1883**	Bear Seamount?		Moore et al. 2003; Watling and Auster 2005
Family Paragorgiidae	*Paragorgia arborea* (Linné, 1758) **	Found in Gulf of Maine, Georges Bank, and Canyons (Lydonia, Oceanographer, Baltimore, Norfolk); probably Bear Seamount	300-1100	Wigley 1968; Hecker and Blechschmidt 1980; Hecker et al. 1980; Opresko 1980; Theroux and Grosslein 1987; Theroux and Wigley 1998; Moore et al. 2003; Watling and Auster 2005
Family Plexauridae	*Paramuricea grandis* Verrill, 1883 **	Found in Gulf of Maine and canyons from Corsair to near Hudson, seen in Corsair, Heezen, Oceanographer, Lydonia Canyons; on slope near Alvin Canyon; on slope on the southwestern edge of Georges Bank, between Veatch and Hydrographer Canyons; in Mid-Atlantic on slope flanked by Lindenkohl Canyon to south and Carteret Canyon to north and on slope bounded by Toms Canyon to south and Meys Canyon to north	400-2200	Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Opresko 1980; Valentine et al. 1980; Watling and Auster 2005

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
	Paramuricea placomus (Linne, 1758) **	Gulf of Maine		Watling and Auster 2005
	Paramuricea n. sp.			Watling and Auster 2005
	Swiftia casta (Verril, 1883)**	Bear Seamount?		Moore et al. 2003; Watling and Auster 2005
Family Primnoidae	*Narella laxa* Deichmann, 1936			Watling and Auster 2005
	Primnoa resedaeformis Gunnerus, 1763) **	Found in Gulf of Maine, Georges Bank, and Canyons (Lydonia, Oceanographer, Baltimore, Norfolk), south to off Virginia Beach, VA; probably Bear Seamount	91-548	Hecker and Blechschmidt 1980; Hecker et al. 1980, 1983; Opresko 1980; Valentine et al. 1980; Theroux and Grosslein 1987; Theroux and Wigley 1998; Moore et al. 2003; Cairns and Bayer 2005; Watling and Auster 2005; Heikoop et al. 2002.
	Thouarella grasshoffi Cairns, 2006			Watling and Auster 2005
Order Pennatulacea				
Family Anthoptilidae	*Anthoptilum grandiflorum*	Newfoundland to Bahamas, Lousiana, Chile, Hawaii, Antarctica, N. Europe	274-3651	US NMNH collection, OBIS
	Anthoptilum murrayi	Lydonia Canyon to Puerto Rico, Hawaii, Aleutians, Japan, W. Africa, N. Europe	430-2491 (1538 m min in NE US)	US NMNH collection, OBIS
Family Kophobelemnidae	*Kophobelemnon stelliferum*	Newfoundland to South Carolina, Japan, W. Africa, N. Europe	393-2199 (1330 m min in NE US)	US NMNH collection, OBIS
	Kophobelemnon scabrum	Nova Scotia to Virginia	1977-2249	US NMNH collection
	Kophobelemnon tenue	Massachusetts to Virginia	2491-4332	US NMNH collection
Family Pennatulidae	*Pennatula aculeata*	Newfoundland to Virginia, California, Iberia, N. Africa	119-3316	US NMNH collection, OBIS
	Pennatula grandis	New Jersey, Bay of Biscay	1850-2140	US NMNH collection, OBIS
	Pennatula borealis	Newfoundland to North Carolina, California	219-2295	US NMNH collection, OBIS

Higher Taxon	Species	Distribution	Depth Range (m)	Reference
Family Protoptilidae	*Distichoptilum gracile*	Nova Scotia to North Carolina, W. Africa, N. Eurpoe	1211-2844 (doubtful report at 59 m)	US NMNH collection, OBIS
	Protoptilum abberans	Nova Scotia to Virginia	1483-2359	US NMNH collection
	Protoptilum carpenteri	Massachusetts to North Carolina, W. Africa, N. Europe	1334-2194	US NMNH collection, OBIS
Family Scleroptilidae	*Scleroptilum gracile*	Massachusetts to Virginia	2513-4332	US NMNH collection
	Scleroptilum grandiflorum	Massachusetts to North Carolina, Panama, W. Africa	1502-2505	US NMNH collection, OBIS
Family Umbellulidae	*Umbellula guntheri*	Massachusetts to Virginia, Louisiana	2683-3740 (3166 m min in NE US)	US NMNH collection
	Umbellula lindahlii	Massachusetts to the Virgin Islands, Louisiana, Suriname, N. Europe, Indian O.	549-3338 (1538 m min in NE US)	US NMNH collection, OBIS
Family Virgulariidae	*Balticina finmarchica*	Newfoundland to Massachusetts, NC (doubtful), the Virgin Islands, Alaska	37-2249 (229 m min in NE US)	US NMNH collection
	Stylatula elegans	New York-Florida, Iberia	20-812 (51 m min in NE US)	US NMNH collection, OBIS
** Distribution information based on studies of a particular area in the Northeast Region, not an overall distribution.				

Appendix 5.2. Deep coral species discussed in Hecker and Blechschmidt (1980), Opresko (1980) (octocorals), and Hecker (1980) (scleractinians), as well as Hecker et al. (1980). Species names are listed exactly as stated in the literature.

SPECIES	
SCLERACTINIANS: Stony corals	
Dasmosmilia lymani	Continental shelf between Baltimore and Hudson Canyons, in Baltimore Canyon, and between 100-200 m on the shelf south of Hudson Canyon and in the head of Hudson Canyon; soft substrates.
Desmophyllum cristagalli	Same as *D. dianthus*. Outcrops and underhangs at depths from 1000-1900 m. Seen on outcrops in Corsair Canyon. Found in Heezen Canyon. Seen in deeper parts of Lydonia Canyon, and on boulders or outcrops in Oceanographer Canyon, between 650-1600 m. Found on an outcrop near Hudson Canyon. Occasionally in axis of Norfolk Canyon.
Flabellum alabastrum	Canyons and slope from 600-2500 m; some may be *F. angulare* or *F. moseleyi*. Seen in Corsair Canyon. Found in Heezen and Oceanographer Canyons on soft substrate. Seen on deep continental slope near Alvin Canyon. Found on slope south of Baltimore Canyon. Found in deeper parts of the continental slope south of Norfolk Canyon and in axis of Norfolk Canyon on soft substrate.
Lophelia prolifera	Same as *L. pertusa*. West wall of Oceanographer Canyon at 1100 m; dead rubble also found on wall at depths from 700-1300 m.
Solenosmilia variabilis	Large colony recovered from the east flank of Lydonia Canyon.
Javania cailleti	One specimen recovered in axis of Oceanographer Canyon between 935-1220 m.
ALCYONACEANS: Soft corals	
Anthomastus grandiflorus	Soft substrates, highest densities in canyons. In the northern canyons found from 700-1500 m, southern canyons from 1500-2200 m, as deep as 2600 m. Found in Corsair, Heezen (west wall), and Oceanographer Canyons. Seen near Hudson Canyon, Toms Canyon, in Baltimore Canyon, and in axis of Norfolk Canyon. Frequently seen where a species of *Pennatula* was also common.
Anthomastus agassizii	Hard substrates from Corsair Canyon to Hudson Canyon from 750-1900 m. Seen on outcrops in Corsair Canyon. Found in Heezen Canyon. Seen in deeper parts of Lydonia Canyon. On boulders or outcrops in Oceanographer Canyon; 1057-1326 m. Seen on deep continental slope near Alvin Canyon. Seen near heads of Toms and Carteret Canyons (i.e., between Baltimore and Hudson Canyons).
Eunephthya fruticosa	Same as *Gersemia fructicosa* (?). Southern part of study area at depths from 2300-3100 m. Seen near Hudson Canyon around 2250-2500 m and at the mouth of Norfolk Canyon; populations found in deep portion of Hudson Canyon. Seen near heads of Toms and Carteret Canyons (i.e., between Baltimore and Hudson Canyons). Different form seen in Corsair and Heezen Canyons between 600-1200 m may be *E. florida* (see Opresko 1980) (Same as *Capnella florida*?)
Eunephthya florida	Same as *Capnella florida* (?). Found in Lydonia, Oceanographer, Baltimore Canyons, but only high abundances in Lydonia at 350-1500 m. Axis of Heezon Canyon between 1100-1200 m; wall of Corsair Canyon between 600-1000 m.
Eunephthya glomerata	Same as *Capnella glomerata* (?). Several individuals found in Lydonia Canyon at 200 m and 562 m depth.
Trachythela rudis	Same as *Clavularia rudis*. Axis of Heezen Canyon at 1100 m, Lydonia Canyon at 900 m, Oceanographer Canyon at 750 m and 900 m.

SPECIES	
GORGONACEANS Gorgonians	
Paragorgia arborea	Lydonia Canyon 300-900 m, Oceanographer Canyon around 300-1100 m, axis of Baltimore Canyon 400 m and 500 m, Norfolk Canyon 400-600.
Anthothela grandiflora	Found in Lydonia, Oceanographer, and Baltimore Canyons between 450-1149 m.
Acanthogorgia armata	Found in many canyons from 600-2500 m depth. Seen on boulders or outcrops in Corsair and Oceanographer Canyons; found in Lydonia and Oceanographer Canyons between 400-1299 m. Seen on deep continental slope near Alvin Canyon. Found on an outcrop near Hudson Canyon. Found at 350 m in Baltimore Canyon. Occasionally in axis of Norfolk Canyon on exposed outcrops.
Paramuricea grandis	Found from Corsair Canyon to Hudson Canyon between 750-2150 m. Found on wall and axis of Oceanographer Canyon; found at depths between 400-1349 m in Lydonia and Oceanographer Canyons.
Paramuricea borealis	Same as *P. grandis*, perhaps also *P. placomus* (?). Found from Corsair Canyon to a site near Hudson Canyon at depths of 700-2200 m on hard substrates. Seen on outcrops in Corsair Canyon. Found in Heezen Canyon. Seen in deeper parts of Lydonia Canyon. On boulders or outcrops in Oceanographer Canyon. Seen on deep continental slope near Alvin Canyon. Not seen in Norfolk Canyon.
Primnoa reseda	Same as *P. resedaeformis*. Found in Lydonia Canyon at 560 m, in Baltimore Canyon at 450 m, and Norfolk Canyon at 400 m.
Acanella arbuscula	On soft substrates from 600-1300 m depth in the north and 1500-2000 m depth in the south. Seen in Corsair, Heezen, and Oceanographer Canyons. Found in Oceanographer Canyon between 1046-1191 m. Seen on deep continental slope near Alvin Canyon. On slope just south of Baltimore Canyon. Northern and southern forms may be different species.
Chrysogorgia agassizii	Several individuals that may be *C. agassizii* were found at 2150 m in the vicinity of Hudson Canyon.

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Tuesday, February 05, 2008 11:15 AM
To: Montanez, Jose L.
Subject: FW: TILEFISH 1 COMMENTS

FYI / action as appropriate.

From: Susan Davison [mailto:lakeviewhr@alltel.net]
Sent: Tuesday, February 05, 2008 10:49 AM
To: Info
Subject: TILEFISH 1 COMMENTS

Daniel T Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New St. Room 2115
Dover, DE 19904

Dear Mr. Furlong,

I am a deckhand aboard the fishing vessel Bookie. Along with the other crew members on my boat we are very concerned about the influx of boats since the announcement in 2005 of a possible ITQ System. Ever since '05 all these boats have entered this fishery and in turn, fishing has drastically taken a turn for the worst. What we use to catch in 3 to 4 days takes un 10 to 11 days now. As you might expect expenses for fuel has greatly reduced out pay checks. This fishery was doing much better before the influx of boats which is my main point. I know we have lost a lot of permits for non participation. I would surely hope that you do the same in this fishery as in others and reduce the capacity and rid this fishery of these latent permits who have come into this fishery in 2005. The only option that addresses this issue properly is 1D2-2001-2005. If any boat has not fished during that period, they don't rely on it to survive as we do!!!! Ever since the inception of this plan everybody has had to report there landings. The proof is all on record who uses and relies on this fishery to survive. All I want is for NMFS and the MAMFC to deal with capacity and latent permits as it has in all other fisheries, and 1D2 does exactly that. Thank you for listening.

Sincerely,

Tony Davison
Mate on the F/V Bookie

1/28/08
JJM

To: Daniel T. Furlong, Executive Director
Mid-Atlantic Fishery Management Council

January 25, 2008

From: Arnold Leo, Consultant for Commercial Fisheries
Town of East Hampton

Re: Tilefish 1 Comments

Since I will be attending the ASMFC meeting in Alexandria, VA, on February 4 (the date of the Tilefish public hearing in Riverhead, L.I.), please enter this memo in the records as the position of the Town of East Hampton regarding the various issues raised in the Public Hearing Summary Document of Amendment 1 to the Tilefish FMP.

1. **IFQ Allocation**: We support adoption of Alternative 1E, basing IFQ's on the average landings for the period 2001-2005. This would be the most equitable way to allocate quota when establishing a limited-access fishery, since the fishermen presently involved have considerable investment in vessel and gear for the tilefish fishery.
2. **Permanent IFQ Transferability of Ownership**: Support 2C
3. **IFQ Leasing**: Support 3B
4. **IFQ Share Accumulation**: Support 4C. When there was an open access fishery, one boat was able to harvest 38 % of the TAL. Thus 4C is the fairest limit.
5. **Commercial Trip Limits**: Support 5A. With IFQ's, no need for trip limits.
6. **Fees and Cost Recovery**: Support 6A at present, but will comment further on this issue when more information is available.
7. **IFQ Program Review Process**: Support 7B
8. **IFQ Reporting Requirements**: Support 8B
9. **IVR Reporting Requirements**: Support 9B
10. **Commercial Vessel Logbook Reports**: No comment
11. **Hook Size Restrictions**: No comment at this time
12. **Recreational Permits and Reporting Requirements**: Support 12B
13. **Recreational Bag-Size Limits**: Support 13B. Equitable management of the species calls for a bag limit on the recreational catch. The commercial fishery is closely regulated under a quota system, and the recreational should likewise have limits. We support an 8-fish bag-size limit.
14. **Improve Monitoring of Golden Tilefish Landings Caught in the Mid-Atlantic Region**: Support 14B
15. **Framework Adjustment Process**: Support 15B
16. **Essential Fish Habitat (EFH) Designation**: Support 16B
17. **HAPC Designation**: Support 17C. Designating HAPC as the four canyons provides adequate protection to the habitats of particular concern.
18. **Measures to Reduce Gear Impact on EFH**: Support 18A. Not enough evidence at this time to impose new restrictions. Trawling has been conducted in these areas for a long time without causing problems with the tilefish populations.
19. **Management Measures for Collecting Royalties**: Support 19A

agleo@sover.net Tel. 631-324-7178

1/28/08

Mr. Daniel T. Furlong
Mid-Atlantic Fisheries Management Council

Dear Mr. Furlong,

I am writing this letter in response to a request for public comment on Amendment 1 to the Tilefish Fishery Management plan. I presently work on the F/V Kimberly which fishes for tilefish year round out of Montauk N.Y. The following is a list of the proposed management measures and my choice of alternatives along with a comment on some of the issues.

1. IFQ Allocation: Alternative 1E using the average landings from 2001 to 2005. I believe recent participation in the fishery should be considered especially during a rebuilding period.
2. Permanent IFQ Transferability of Ownership: Alternative 2E
3. IFQ Leasing: Alternative 3B
4. IFQ Share Accumulation: Alternative 4C. The Tilefish fishery is not a large fishery and does not support a large number of vessels. In fact, in 1997 the F/V Kimberly accounted for over 810,000 lbs. or 37% of the overall landings for this fishery while it was in an open access state. Therefor I think that 37% should be used as a cap for share accumulation.
5. Commercial Trip Limits: Alternative 5A
6. Fees and Cost Recovery: Alternative 6A.
7. IFQ Program Review Process: Alternative 7B
8. IFQ Reporting Requirements: Alternative 8B
9. IVR Reporting Requirements: Alternative 9B
10. Commercial Vessel Logbook Reports: Alternative 10A
11. Hook Size Restrictions: No comment
12. Recreational Permits and Reporting Requirements: Alternative 12B
13. Recreational Bag Limits: Alternative 13B. There are currently no recreational restrictions in place now as compared to a highly restricted commercial fishery with a hard quota in place to help rebuild this fishery. At a minimum there should be a bag limit in place but I believe that it should be the highest one out of the options available which would be 8 fish per person.
14. Improve Monitoring Of Golden Tilefish Landings: Alternative 14B
15. Framework Adjustment Process: Alternative 15B
16. EFH Designation: Alternative 16B
17. HAPC Designation: Alternative 17C
18. Measures To Reduce Gear Impact On EFH: Alternative 18A
19. Management Measures For Collecting Royalties: Alternative 19A

Thank you for considering my views on this matter.

Sincerely, Capt. David Lima
Capt. David [signature]

RECEIVED
JAN 30 2008
MID-ATLANTIC FISHERY COUNCIL

1/28/08

Mr. Daniel T. Furlong
Mid-Atlantic Fisheries Management Council

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Thank you for considering my views on this matter.

Sincerely,

Sean C. Bos

Mr. Daniel T. Furlong 1/28/08
Mid-Atlantic Fisheries Management Council

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Thank you for considering my views on this matter.

Sincerely, ADAM CRANDALL
Adam Crandall

1/28/08

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Thank you for considering my views on this matter.

Sincerely, Jonathon Baldi
JONATHON BALDI

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JAN 3 0 2008
MID-ATLANTIC FISHERY COUNCIL

Mr. Daniel T. Furlong 1/28/08
Mid-Atlantic Fisheries Management Council

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19. Management Measures For Collecting Royalties: Alternative 19A

Thank you for considering my views on this matter.

Sincerely,

Ransom H Bownes
Ransom H Bownes III

RECEIVED
FEB 11 2008
MID-ATLANTIC FISHERY COUNCIL

José
J 2/11/08

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

I AM WRITING THIS LETTER IN SUPPORT OF THE 2001-2005 TIME LINE OR OPTION 1D2 IN ALTERNATIVE 1 OF THE TILEFISH AMENDMENT 1.THIS TO ME SEEMS TO BE THE ONLY FAIR OPTION .IT IS CONSISTANT WITH THE COURSE THAT NMFS HAS ADDRESSED IN EVERY OTHER FISHERY. IT DEALS WITH ALL THE IMPORTANT ISSUES, SUCH AS REDUCING CAPACITY AND LATENT PERMITS WHILE SUPPORTING THE ACTUAL USERS WHO HAVE RELIED ON THE FISHERY TO SUPPORT THERE FAMILIES. THANK YOU FOR YOUR TIME

SINCERLY

José

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 IFQ Allocation: I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.

2 Permanent IFQ Transferability of Ownership: I support Alternative 2C

3 IFQ Leasing: I support Alternative 3B

4 IFQ Share Accumulation: I support Alternative 4C

5 Commercial Trip Limits: I support Alternative 5A

6 Fees and Cost Recovery: I support Alternative 6B. I do not feel the federally permitted dealer should be burdened with the task of the cost recovery payment to NMFS.

7 IFQ Program Review Process: I support Alternative 7B

8 IFQ Reporting Requirements: I support Alternative 8B

9 IVR Reporting Requirements: I support Alternative 9B

10 Commercial Reporting Requirements: No comment

11 Hook Size Restrictions: No comment

12 Recreational Permits and Reporting Requirements: I support Alternative 12B

13 Recreational Bag-Size Limits: I support Alternative 13B

14 Improve Monitoring of Golden Tilefish Landings Caught In The Mid-Atlantic Region: I support Alternative 14B

15 Framework Adjustment Process: I support Alternative 15B

16 Essential Fish Habitat Designation: I support Alternative 16B

17 HAPC Designation: I support Alternative 17C

18 Measures To Reduce Gear Impact On EFH: I support Alternative 18A

19 Management Measures For Collecting Royalties: I support Alternative 19A

Thank you,

Sincerely,

José
2/21/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

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4 **IFQ Share Accumulation:** I support Alternative 4C

5 **Commercial Trip Limits:** I support Alternative 5A

6 **Fees and Cost Recovery:** I support Alternative 6B

7 **IFQ Program Review Process:** I support Alternative 7B

8 **IFQ Reporting Requirements:** I support Alternative 8B

9 **IVR Reporting Requirements:** I support Alternative 9B

10 **Commercial Reporting Requirements:** No comment

11 **Hook Size Restrictions:** No comment

12 **Recreational Permits and Reporting Requirements:** I support Alternative 12B

13 **Recreational Bag-Size Limits:** I support Alternative 13B

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15 **Framework Adjustment Process:** I support Alternative 15B

16 **Essential Fish Habitat Designation:** I support Alternative 16B

17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

John Kingston

John Kingston

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FEB - 8 2008
MID-ATLANTIC FISHERY COUNCIL

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
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José

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Telephone: (302) 674-2331

I AM WRITING THIS LETTER IN SUPPORT OF THE 2001-2005 TIME LINE OR OPTION 1D2 IN ALTERNATIVE 1 OF THE TILEFISH AMENDMENT 1.THIS TO ME SEEMS TO BE THE ONLY FAIR OPTION .IT IS CONSISTANT WITH THE COURSE THAT NMFS HAS ADDRESSED IN EVERY OTHER FISHERY. IT DEALS WITH ALL THE IMPORTANT ISSUES, SUCH AS REDUCING CAPACITY AND LATENT PERMITS WHILE SUPPORTING THE ACTUAL USERS WHO HAVE RELIED ON THE FISHERY TO SUPPORT THERE FAMILIES. THANK YOU FOR YOUR TIME

2/6/08

SINCERLY

michael Klein

MICHAEL KLEIN
15 MAPLE ST.
WESTHAMPTON BEACH, NY 11978

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 IFQ Allocation: I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 - 2005.

2 Permanent IFQ Transferability of Ownership: I support Alternative 2E

3 IFQ Leasing: I support Alternative 3B

4 IFQ Share Accumulation: I support Alternative 4C

5 Commercial Trip Limits: I support Alternative 5A

6 Fees and Cost Recovery: I support Alternative 6B

7 IFQ Program Review Process: I support Alternative 7B

8 IFQ Reporting Requirements: I support Alternative 8B

9 IVR Reporting Requirements: I support Alternative 9B

10 Commercial Reporting Requirements: No comment

11 Hook Size Restrictions: No comment

12 Recreational Permits and Reporting Requirements: I support Alternative 12B

13 Recreational Bag-Size Limits: I support Alternative 13B

14 Improve Monitoring of Golden Tilefish Landings Caught In The Mid-Atlantic Region: I support Alternative 14B

15 Framework Adjustment Process: I support Alternative 15B

16 Essential Fish Habitat Designation: I support Alternative 16B

17 HAPC Designation: I support Alternative 17C

18 Measures To Reduce Gear Impact On EFH: I support Alternative 18A

19 Management Measures For Collecting Royalties: I support Alternative 19A

Thank you.

Sincerely,

Molly Nolan

Molly Nolan

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 **IFQ Allocation:** I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 - 2005.

2 **Permanent IFQ Transferability of Ownership:** I support Alternative 2E

3 **IFQ Leasing:** I support Alternative 3B

4 **IFQ Share Accumulation:** I support Alternative 4C

5 **Commercial Trip Limits:** I support Alternative 5A

6 **Fees and Cost Recovery:** I support Alternative 6B

7 **IFQ Program Review Process:** I support Alternative 7B

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17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

Jean Nolan

Jean Nolan

José

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February 1, 2008

Daniel T. Furlong
Executive Director
Mid Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, Delaware 19904-6790
Telephone: 302-674-2331

Re: "Tilefish 1 Comments"

I HAVE BEEN FISHING FOR TILEFISH MY ENTIRE CAREER ABOARD THE FISHING VESSEL BOOKIE. I WOULD LIKE TO EXPRESS MY CONCERNS ABOUT THE UP AND COMING AMENDMENT 1, ALTERNATIVE 1. THIS IS VERY IMPORTANT TO ME IN THAT I HAVE BEEN TILEFISHING WITH FRANK SINCE I WAS 17. ALL WE HAVE BEEN DOING SINCE MY EMPLOYMENT HAS BEEN TILEFISHING FULL TIME. DURING THE LAST THREE YEARS SINCE NMFS FIRST MENTIONED ITQ'S, ALL OF A SUDDEN ALL THESE OTHER BOATS CAME IN THE FISHERY. BECAUSE OF THIS INFLUX OF NEW VESSELS IN THE FISHERY, OUR SEASON HAS ENDED BY JUNE. THE ONLY REASON THE FISHERMAN WHO ARE NOW ONLY FISHING SINCE 2005 STARTED FISHING, IS SO THAT THEY CAN CASH IN ON SELLING THEIR ITQ. IF THESE NEW VOICES REALLY TILEFISHED FOR A LIVING, THEY WOULD HAVE LANDINGS SINCE THE INCEPTION OF THE CURRENT TILEFISH MANAGEMENT PLAN. THIS IS MY SOLE SOURCE OF INCOME AND IT TROUBLES ME THAT THESE BOATS CAN COME IN AND THINK THEY DESERVE AS MUCH OR MORE OF THE QUOTA THEN US. THATS WHY I AM SUPPORTING ALTERNATIVE 1D2-2001-2005 IN ALL CATAGORIES. THIS DOES THIS FISHERY THE MOST JUSTICE AND COINCIDES WITH EVERY CRITIA THAT NMFS HAS DONE IN ALL THE OTHER FISHERIES YOU HAVE MANAGED IN THE LAST 2 DECADES. IT REDUCES CAPACITY [WHICH THIS FISHERY DESPERATLY NEEDS] AND ALSO DEALS WITH THE LATENT PERMIT ISSUE WHICH ALSO HAS BEEN ADDRESSED IN EVERY OTHER FISHERY. WHY SHOULD THIS FISHERY BE ANY DIFFERENT. I FULLY SUPPORT AND AGREE WITH ALL THE OTHER PREFERRED ALTERNATIVES THAT THE COUNCIL HAS CHOSEN. THANK YOU FOR YOUR TIME.

SINCERELY : Dan Hancock
DAN HANCOCK
MATE ON THE F/V BOOKIE

Jose

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February 1, 2008

Daniel T. Furlong
Executive Director
Mid Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, Delaware 19904-6790
Telephone: 302-674-2331

Re: "Tilefish 1 Comments

I FISH ON THE F/V BOOKIE OUT OF HAMPTON BAYS, NY. I HAVE BEEN WITH FRANK GREEN FOR 22 YRS. WE STARTED OUT FISHING FOR TILEFISH IN 1985 WITH HIS FIRST BOAT. WE FISHED RIGHT UP TILL 1990 BEFORE THE BOAT WAS IN-OPERATABLE. HE THEN STARTED RUNNING A FEW DIFFERENT BOATS'. FINALLY HE WAS ABLE TO START RUNNING THE ENDORPHAN WITH AN OPTION TO BUY. AFTER A FEW YEARS OF RUNNING THE ENDORPHAN (WHICH IN TURN QUALFIED THAT BOAT FOR TIER 1) FRANK INSTEAD HE OPTED TO BUY THE BOOKIE. HE JUST MISSED THE TIME FRAME FOR TIER 1 BECAUSE HE CHOSE THE BOOKIE OVER THE ENDORPHAN BY 1 YR. IF IT WASN'T FOR HIS LANDINGS ON THE ENDORPHAN THAT BOAT WOULD NEVER HAVE MADE TIER 1 EITHER. MY POINT IS THAT OUR WHOLE CAREERS HAVE BEEN STRUCTURED AROUND TILEFISHING. NOW THAT WE ARE TALKING ABOUT ITQ'S TOO MANY BOATS' ARE COMING OUT OF THE WOODWORK CLAIMING THAT THEY NEED AND DEPEND ON THIS FISHERY, THESE CLAIMS ARE RIDICULOUS. IT IS TIME THAT NMFS DOES WHAT THEY HAVE BEEN DOING IN ALL THE OTHER FISHERIES **[REDUCE CAPACITY AND ELIMINATE THE LATENT PERMITS]** THIS FISHERY IS WAY TOO SMALL TO SUPPORT ALL THESE BOATS. THAT IS WHY I AM SUPPORTING 1D2 IN ALTERNATIVE 1. THIS ADDRESS'S ALL THE PROBLEMS ASSOCIATED WITH THIS FISHERY. THANK YOU

SINCERELY :

JOHN SCHEU
MATE ON THE F/V BOOKIE

Jose

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February 1, 2008

Daniel T. Furlong
Executive Director
Mid Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, Delaware 19904-6790
Telephone: 302-674-2331

Re: "Tilefish 1 Comments"

I AM A DECKHAND ABOARD THE FISHING VESSEL BOOKIE. ALONG WITH THE OTHER CREW MEMBERS ON MY BOAT WE ARE VERY CONCERNED ABOUT THE INFLUX OF BOATS SINCE THE ANNOUNCMENT IN 2005 OF A POSSIBLE ITQ SYSTEM. EVER SINCE '05 ALL THESE BOATS HAVE ENTERED THIS FISHERY AND IN TURN, FISHING HAS DRASTICLY TAKEN A TURN FOR THE WORST. WHAT WE USED TO CATCH IN 3 TO 4 DAYS TAKES US 10 TO 11 NOW. AS YOU MIGHT EXPECT EXPENSES FOR FUEL HAS GREATLY REDUCED OUR PAY CHECKS. THIS FISHERY WAS DOING MUCH BETTER BEFORE THE INFLUX OF BOATS WHICH IS MY MAIN POINT. I KNOW WE HAVE LOST A LOT OF PERMITS FOR NON PARTICAPATION. I WOULD SURELY HOPE THAT YOU DO THE SAME IN THIS FISHERY AS IN OTHERS AND REDUCE THE CAPACITY AND RID THIS FISHERY OF THESE LATENT PERMITS WHO HAVE COME INTO THIS FISHERY IN 2005. THE ONLY OPTION THAT ADDRESS'S THIS ISSUE PROPERLY IS 1D2-2001-2005. IF ANY BOAT HAS NOT FISHED DURING THAT PERIOD, HE DOESN'T RELY ON IT TO SURVIVE AS WE DO!!!!!! EVER SINCE THE INCEPTION OF THIS PLAN EVERYBODY HAS HAD TO REPORT THERE LANDINGS. THE PROOF IS ALL ON RECORD WHO USES AND RELIES ON THIS FISHERY. ALL I WANT IS FOR NMFS AND THE MAMFC TO DEAL WITH CAPACITY AND LATENT PERMITS AS IT HAS IN ALL OTHER FISHERIES. 1D2 DOES EXCATLY THAT. THANK YOU FOR LISTENING.

SINCERELY : [signature]

ALEC SATER
MATE ON THE F/V BOOKIE

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February 1, 2008

Daniel T. Furlong
Executive Director
Mid Atlantic Fishery Management Council
Room 2115 Federal Building
300 South New Street
Dover, Delaware 19904-6790
Telephone: 302-674-2331

Re: "Tilefish 1 Comments

I HAVE BEEN TILEFISHING ON THE F/V BOOKIE FOR OVER 12 YRS. TILEFISHING HAS ACCOUNTED FOR 95% OF MY INCOME FOR THAT PERIOD. THAT'S WHY I AM SUPPORTING 1D2 IN ALTERNATIVE 1. IT SEEMS THAT ALL THE ACTUAL USERS OF THE FISHERY ARE GOING TO SUPPORT THIS TIME LINE AND THE NON USERS [PEOPLE WITH NO PRESENT HISTORY 2001-2005] WOULD LIKE TO GO BACK AS FAR AS THEY CAN AND DO EQUAL SPLITS. I GUESS IF I HAD NO LANDINGS FOR THE LAST 5 TO 10 YEARS I WOULD WANT TO DO THE SAME. IS IT FAIR TO THE REAL USERS OF THIS INDUSTRY [NO]. ALL EQUAL SPLITS DO IS GIVE FISH TO BOATS WHO HAVEN'T CAUGHT THE FISH AND TAKE AWAY FISH FROM THE PEOLE WHO HAVE CAUGHT THE FISH. TO ME THIS IS COMPLETELY THE OPPOSITE OF WHAT NMFS HAS DONE IN ALL OTHER FISHERIES. TO CHOOSE ANYTHING OTHER THAN 1D2 WOULD BE PUNISHING PEOPLE WHO USE, RELY AND NEED THIS FISHERY FOR A LIVING AND GIVING IT PEOPLE WHO HAVE SHOWN THAT THEY ARE MAKING A LIVING IN OTHER FISHERIES AND ARE IN THIS FOR PURE FINANCIAL GAIN [TO SELL OR LEASE IT AN ITQ WITH NO INTENTION OF ACTUALLY TILEFISHING.]

I HOPE THE COUNCIL STAYS THE COURSE IT HAS ON THIS FISHERY AS IT HAS SHOWN ON OTHERS. REDUCE THE CAPACITY AND ELIMINATE LATENT PERMITS. 1D2 ACCOMPLIHES ALL THOSE OBJECTIVES. THANK YOU FOR YOUR TIME.

SINCERELY : Bruce Tuma
BRUCE TUMA
MATE ON THE F/V BOOKIE

Bruce Tuma
664 Spur Dr N.
Bayshore, N.Y. 11706

José

Mr. Daniel T. Furlong
Mid-Atlantic Fisheries Management Council

RECEIVED 1/28/08
FEB - 8 2008
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Dear Mr. Furlong,

I am writing this letter in response to a request for public comment on Amendment 1 to the Tilefish Fishery Management plan. I presently work on the F/V Kimberly which fishes for tilefish year round out of Montauk N.Y. The following is a list of the proposed management measures and my choice of alternatives along with a comment on some of the issues.

1. IFQ Allocation: Alternative 1E using the average landings from 2001 to 2005. I believe recent participation in the fishery should be considered especially during a rebuilding period.
2. Permanent IFQ Transferability of Ownership: Alternative 2E
3. IFQ Leasing: Alternative 3B
4. IFQ Share Accumulation: Alternative 4C. The Tilefish fishery is not a large fishery and does not support a large number of vessels. In fact, in 1997 the F/V Kimberly accounted for over 810,000 lbs. or 37% of the overall landings for this fishery while it was in an open access state. Therefor I think that 37% should be used as a cap for share accumulation.
5. Commercial Trip Limits: Alternative 5A
6. Fees and Cost Recovery: Alternative 6A.
7. IFQ Program Review Process: Alternative 7B
8. IFQ Reporting Requirements: Alternative 8B
9. IVR Reporting Requirements: Alternative 9B
10. Commercial Vessel Logbook Reports: Alternative 10A
11. Hook Size Restrictions: No comment
12. Recreational Permits and Reporting Requirements: Alternative 12B
13. Recreational Bag Limits: Alternative 13B. There are currently no recreational restrictions in place now as compared to a highly restricted commercial fishery with a hard quota in place to help rebuild this fishery. At a minimum there should be a bag limit in place but I believe that it should be the highest one out of the options available which would be 8 fish per person.
14. Improve Monitoring Of Golden Tilefish Landings: Alternative 14B
15. Framework Adjustment Process: Alternative 15B
16. EFH Designation: Alternative 16B
17. HAPC Designation: Alternative 17C
18. Measures To Reduce Gear Impact On EFH: Alternative 18A
19. Management Measures For Collecting Royalties: Alternative 19A

Thank you for considering my views on this matter.

Sincerely, Kurtis B Briand

Kurtis B Briand

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MID-ATLANTIC FISHERY COUNCIL

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

I AM WRITING THIS LETTER IN SUPPORT OF THE 2001-2005 TIME LINE OR OPTION 1D2 IN ALTERNATIVE 1 OF THE TILEFISH AMENDMENT 1.THIS TO ME SEEMS TO BE THE ONLY FAIR OPTION .IT IS CONSISTANT WITH THE COURSE THAT NMFS HAS ADDRESSED IN EVERY OTHER FISHERY. IT DEALS WITH ALL THE IMPORTANT ISSUES, SUCH AS REDUCING CAPACITY AND LATENT PERMITS WHILE SUPPORTING THE ACTUAL USERS WHO HAVE RELIED ON THE FISHERY TO SUPPORT THERE FAMILIES. THANK YOU FOR YOUR TIME

SINCERLY

R. Criegol

F/V Bay of Isles
570429

Offshore Fishery Inc.
P O Box 2242
Montauk N.Y. 11954

2/2/08

Mr. Daniel T. Furlong, Executive Director
Mid-Atlantic Fisheries Management Council
Room 2115 Federal Building
300 South Dover Street
Dover, DE 19904

Dear Mr. Furlong,

I am writing this letter in response to a request for public comment on Amendment 1 to the Tilefish Fishery Management plan. I own along with my husband the F/V Kimberly which is a 72' tilefish longliner that we purchased in 1991. The Kimberly has predominantly targeted tilefish year round for the past 16 years and currently has a full-time tier 1 permit. The following is a list of the proposed management measures and my choice of alternatives along with a comment on some of the issues.

1. IFQ Allocation: Alternative 1E using the average landings from 2001 to 2005. I believe recent participation in the fishery should be considered especially during a rebuilding period. Only 13 of the initial 31 limited access permitted vessels have been active in this fishery in that time line and therefore have shown economic dependence on the fishery.
2. Permanent IFQ Transferability of Ownership: Alternative 2E
3. IFQ Leasing: Alternative 3B
4. IFQ Share Accumulation: Alternative 4C. The Tilefish fishery is not a large fishery and does not support a large number of vessels. Since the fishery went into a limited access state in 2001 with an associated hard TAC, consolidation has occurred with two vessels each accounting for 25% of the fish landed each year. When you analyze the landings data from the initial open access qualifying period of 1988 to 1998 you will see that every year the most productive vessel lands at least 18% of the fish landed in the fishery for that year. In fact, for 7 of the 11 years one vessel accounted for at least <u>27%</u> with highs of <u>37% and 40%</u> of the overall landings for those years. For 4 of the 11 years two vessels accounted for at least <u>24% and up to 30% each</u> of the overall landings for those years. The largest amount of tilefish landed by one vessel was 810,911 lbs. in 1997. I believe that 37% should be used as a cap for share accumulation in this fishery because these vessels have consistently shown that they can harvest between 25% and 40% of the fish in a open access

system and presently harvest 25% of the quota . To chose anything less than 37% would unfairly limit these fisherman to less of a percentage than what they had been producing in an open access fishery.

5. Commercial Trip Limits: Alternative 5A
6. Fees and Cost Recovery: Alternative 6B.
7. IFQ Program Review Process: Alternative 7B
8. IFQ Reporting Requirements: Alternative 8B
9. IVR Reporting Requirements: Alternative 9B
10. Commercial Vessel Logbook Reports: No comment
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12. Recreational Permits and Reporting Requirements: Alternative 12B
13. Recreational Bag Limits: Alternative 13B. There are currently no recreational restrictions in place now as compared to a highly restricted commercial fishery with a hard quota in place to help rebuild this fishery. I believe that there should be a bag limit in place but I believe that the 8 fish per trip limit, which is the highest option available, would be too restrictive for the existing party/charter fleet because they operate 2 to 3 day trips and should be changed through a framework action to an 8 fish per person per day limit.
14. Improve Monitoring Of Golden Tilefish Landings: Alternative 14B
15. Framework Adjustment Process: Alternative 15B
16. EFH Designation: Alternative 16B
17. HAPC Designation: Alternative 17C. I disagree with the size of the areas surrounding all of the canyons being considered. The areas encompass too much open bottom outside of the canyon walls which could potentially restrict the use of bottom trawls in those areas if they are used as GRA's. The amount and therefore the dollar value of trawled species caught in these areas is grossly underestimated in the document specifically by using single point positions from the VTR's of these vessels to determine where the fish are caught. These vessels are required to supply a single position from just one tow but actually trawl over large areas of bottom during the many tows of their trip. Many of these tows absolutely take place on the open bottom around these canyons.
18. Measures To Reduce Gear Impact On EFH: Alternative 18A
19. Management Measures For Collecting Royalties: Alternative 19A

Thank you for considering my views on this matter.

Sincerely,

Susan J. Farnham
Offshore Fishery Inc.

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Offshore Fishery Inc.
P O Box 2242
Montauk N.Y. 11954

2/2/08

Mr. Daniel T. Furlong, Executive Director
Mid-Atlantic Fisheries Management Council
Room 2115 Federal Building
300 South Dover Street
Dover, DE 19904

Dear Mr. Furlong,

I am writing this letter in response to a request for public comment on Amendment 1 to the Tilefish Fishery Management plan. I own the F/V Kimberly which is a 72' tilefish longliner that I purchased in 1991 after 10 years of tilefishing on other vessels. The Kimberly has predominantly targeted tilefish year round for the past 16 years and currently has a full-time tier 1 permit. The following is a list of the proposed management measures and my choice of alternatives along with a comment on some of the issues.

1. IFQ Allocation: Alternative 1E using the average landings from 2001 to 2005. I believe recent participation in the fishery should be considered especially during a rebuilding period. Only 13 of the initial 31 limited access permitted vessels have been active in this fishery in that time line and therefore have shown economic dependence on the fishery.
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3. IFQ Leasing: Alternative 3B
4. IFQ Share Accumulation: Alternative 4C. The Tilefish fishery is not a large fishery and does not support a large number of vessels. Since the fishery went into a limited access state in 2001 with an associated hard TAC, consolidation has occurred with two vessels each accounting for 25% of the fish landed each year. When you analyze the landings data from the initial open access qualifying period of 1988 to 1998 you will see that every year the most productive vessel lands at least 18% of the fish landed in the fishery for that year. In fact, for 7 of the 11 years one vessel accounted for at least 27% with highs of 37% and 40% of the overall landings for those years. For 4 of the 11 years two vessels accounted for at least 24% and up to 30% each of the overall landings for those years. The largest amount of tilefish landed by one vessel was 810,911 lbs. in 1997. I believe that 37% should be used as a cap for share accumulation in this fishery because these vessels have consistently shown that they can harvest between 25% and 40% of the fish in a open access

system and presently harvest 25% of the quota . To chose anything less than 37% would unfairly limit these fisherman to less of a percentage than what they had been producing in an open access fishery.

5. Commercial Trip Limits: Alternative 5A
6. Fees and Cost Recovery: Alternative 6B.
7. IFQ Program Review Process: Alternative 7B
8. IFQ Reporting Requirements: Alternative 8B
9. IVR Reporting Requirements: Alternative 9B
10. Commercial Vessel Logbook Reports: No comment
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12. Recreational Permits and Reporting Requirements: Alternative 12B
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14. Improve Monitoring Of Golden Tilefish Landings: Alternative 14B
15. Framework Adjustment Process: Alternative 15B
16. EFH Designation: Alternative 16B
17. HAPC Designation: Alternative 17C. I disagree with the size of the areas surrounding all of the canyons being considered. The areas encompass too much open bottom outside of the canyon walls which could potentially restrict the use of bottom trawls in those areas if they are used as GRA's. The amount and therefore the dollar value of trawled species caught in these areas is grossly underestimated in the document specifically by using single point positions from the VTR's of these vessels to determine where the fish are caught. These vessels are required to supply a single position from just one tow but actually trawl over large areas of bottom during the many tows of their trip. Many of these tows absolutely take place on the open bottom around these canyons.
18. Measures To Reduce Gear Impact On EFH: Alternative 18A
19. Management Measures For Collecting Royalties: Alternative 19A

Thank you for considering my views on this matter.

Sincerely,

Dan Farnham, VP
Offshore Fishery Inc.

F/V Sea Capture, Inc.
P.O. Box 2124
Montauk, NY 11954

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is John Nolan . I am the owner of F/V Seacapture, a full-time tier 1 vessel. I have been a commercial fisherman for 47 years, and have been tile fishing full time since 1978. For the last 30 years, 100% of my income has come from tile fishing.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 **IFQ Allocation:** I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.

I believe the 2001-2005 timeline best represents the industry members who rely on the resource. We are managed with a small quota that cannot support 31 vessels. Using this timeline will address over capacity and latent effort.

2 **Permanent IFQ Transferability of Ownership**: I support Alternative 2E

3 **IFQ Leasing:** I support Alternative 3B

4 **IFQ Share Accumulation:** I support Alternative 4C

Prior to a Tilefish management plan, individual vessels fishing in an open access fishery landed up to 40% of the total landings. I believe share accumulation should be determined based on vessel performance during open access fishing. I support Alternative 4C: Limit IFQ share accumulation to 37% of the TAL.

5 **Commercial Trip Limits:** I support Alternative 5A

6 **Fees and Cost Recovery:** I support Alternative 6B

7 **IFQ Program Review Process:** I support Alternative 7B

8 **IFQ Reporting Requirements:** I support Alternative 8B

9 **IVR Reporting Requirements:** I support Alternative 9B

10 **Commercial Reporting Requirements:** No comment

11 **Hook Size Restrictions:** No comment

12 **Recreational Permits and Reporting Requirements:** I support Alternative 12B

13 **Recreational Bag-Size Limits:** I support Alternative 13B

While I am not certain that 8 fish is the correct number for a bag-limit, I feel some regulation needs to be in place. The commercial sector has been restricted in their landings by 50% in order to rebuild the tilefish stock. 15B will allow for adjustments to the bag-limit through a framework action. We have seen an increase in the recreational effort as the stock rebuilds, and we are told to expect more than what we've seen.

14 **Improve Monitoring of Golden Tilefish Landings Caught In The Mid-Atlantic Region:** I support Alternative 14B

15 **Framework Adjustment Process:** I support Alternative 15B

16 **Essential Fish Habitat Designation:** I support Alternative 16B

17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

John Nolan

NORTHEAST FISHERIES OF MONTAUK INC.
P.O. BOX 2124
MONTAUK N.Y. 11954

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MID-ATLANTIC FISHERY COUNCIL

2/6/08

Mr. Daniel T. Furlong, Executive Director
Mid-Atlantic management Council
Room 2115 Federal Building
300 South Dover Street
Dover , DE. 19904

RE: Tilefish Comments

Dear Mr. Furlong,

We are writing this letter in response to a request for public comment on Amendment 1 to the Tilefish Fishery Management Plan. As you are well aware, in 2001 the existing Tilefish FMP was put into place with three tiers of limited-access permits with each tier having access to a different percentage of the associated hard TAC that was set for the fishery. There were 4 permits issued to the full time tier 1 category and 66% of the overall directed fishery quota was issued to that category as a whole. Fearful of the economic loss due to a reduction in their allowable catch and the effects of what a derby fishery could do to their prices the participants of tier 1 went one step further and formed a cooperative agreement among themselves. This gentlemen's agreement distributed a portion of the 66% allocation to tier 1 individually to each permit based upon their average landings over the 1988 to 1998 qualifying period. It was agreed that each permit would individually receive 28.5%, 28.5%, 23% and 20% of the quota that was issued to the tier 1 category.

In early 2004 the owners of the 3 larger vessels started to realize that there was not enough quota for them to continue individually and that somehow they would have to consolidate the quota onto 2 vessels in order to remain viable in the fishery. It was in March of 2004 that we , Dan Farnham and John Nolan, formed Northeast Fisheries of Montauk Inc and purchased the F/V Restless and its fishing permits from David Krusa. We sold the vessel, kept the permit and then reallocated the quota in tier 1 based on a 40%, 40%, 20% split between the 3 remaining vessels. This split translated to 25%, 25% and 16% of the directed fishery TAC and is what the 3 vessels in tier 1 have landed since March of 2004.

The following is a list of the proposed management measures and our choice of alternatives along with a comment on some of the issues.

1. IFQ Allocation: Alternative 1E using the average landings from 2001 to 2005.

2. Permanent IFQ Transferability of Ownership: Alternative 2E

3. IFQ Leasing : Alternative 3B

4. IFQ Share Accumulation: Alternative 4C. The tilefish fishery is not a large fishery and does not support a large number of vessels. As we have stated above, out of necessity, consolidation has already taken place in this fishery and two vessels have been landing 25% of the TAC since 2004. Furthermore, the landings data from the qualifying period of 1988 to 1998 has shown that any one vessel can consistently account for between 25% and up to 40% of the entire landings of the fleet in any given year with a single vessel high of over 800,000 lbs. in one year. To chose anything less than 37% would unfairly limit these fishermen to less of a percentage of the overall landings than what they had been producing in an open access fishery.

5. Commercial Trip Limits: Alternative 5A

6. Fees And Cost Recovery: Alternative 6A

7. IFQ Program Review Process: Alternative 7B

8. IFQ Reporting Requirements: Alternative 8B

9. IVR Reporting Requirements. Alternative 9B

10. Commercial Vessel Logbooks Reports: No Comment

11. Hook Size Restrictions: No Comment

12. Recreational Permits And Reporting Requirements: Alternative 12B

13. Recreational Bag Limits: Alternative 13B. There are currently no recreational measures in place now as compared to a highly regulated commercial fishery with a hard TAC in place to help rebuild this fishery to a sustainable level. I believe that the 8 fish per trip limit would be too restrictive for the party boat fleet and should be changed at the first chance through a framework action to an 8 fish per person, per day limit for those trips that are longer than 1 day.

14. Improve Monitoring Of Golden Tilefish Landings: Alternative 14B

15. Frame Adjustment Process: Alternative 15B

16. EFH Designation: Alternative 16B

17. HAPC Designation: Alternative 17C

18. Measures To Reduce Gear Impact On EFH: Alternative 18A

19. Management Measures For Collecting Royalties: alternative 19A

Thank you for considering our views on this matter.

Sincerely,

Dan Farnham

John Nolan

February 1, 2008

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FEB - 8 2008
MID-ATLANTIC FISHERY COUNCIL

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 **IFQ Allocation:** I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.

2 **Permanent IFQ Transferability of Ownership:** I support Alternative 2E

3 **IFQ Leasing:** I support Alternative 3B

4 **IFQ Share Accumulation:** I support Alternative 4C

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9 **IVR Reporting Requirements:** I support Alternative 9B

10 **Commercial Reporting Requirements:** No comment

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13 **Recreational Bag-Size Limits:** I support Alternative 13B

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15 **Framework Adjustment Process:** I support Alternative 15B

16 **Essential Fish Habitat Designation:** I support Alternative 16B

17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

Vanessa Percy

Vanessa Percy

LOCKWOOD & WINANT
600 Food Center Drive
Bronx, New York 10474

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

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4 **IFQ Share Accumulation:** I support Alternative 4C

5 **Commercial Trip Limits:** I support Alternative 5A

6 **Fees and Cost Recovery:** I support Alternative 6B. I do not feel the federally permitted dealer should be burdened with the task of the cost recovery payment to NMFS.

7 **IFQ Program Review Process:** I support Alternative 7B

8 **IFQ Reporting Requirements:** I support Alternative 8B

9 **IVR Reporting Requirements:** I support Alternative 9B

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18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you for considering my comments when making the management decisions that will manage the tilefish resource in the future.

Sincerely,

Joseph R Gurrera
Owner/Operator

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

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Thank you.

Sincerely,

Lisa DeViglio

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MID-ATLANTIC FISHERY COUNCIL

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is Steven Doyle. I am a full-time year-round tilefish mate on F/V Seacapture. 100% of my income is earned fishing on F/V Seacapture.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

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19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

Stephen Doyle

Steven Doyle

Montauk Tile Fish Association
P.O. Box 2124
Montauk, New York 11954

February 4, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, room 2115
Dover DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

We are writing in response to your request for public comment on Amendment 1 to the Tilefish FMP.

We are an Association representing the 4 permits in the Tier 1, Full-time category of the Tilefish FMP. While we share the same opinions on this amendment, we are sole entities and operate in a competitive way.

Since implementation of the Tilefish FMP we have divided the quota allocation amongst our permits and harvest under a gentlemen's agreement. This amendment would solidify our agreement through the IFQ management method. We are in favor of that.

The following are our comments:

1 **IFQ ALLOCATION:** We support **Alternative 1E:** Average Landings 2001 – 2005 **(Preferred Alternative).**

We support the 2001 – 2005 timeline based on principle. It demonstrates who has been participating in the fishery and who is economically dependent on the resource in a reasonable five year timeline. There are presently 31 permits in the three categories. Since implementation of the plan 13 vessels have been active. Latent effort and capacity need to be addressed

2 **PERMANENT IFQ TRANSFERABILITY OF OWNERSHIP:** We support **Alternative 2E:** IFQ shares may only be transferred among IFQ share holders, other vessels maintaining a valid limited access commercial tilefish permit, or established tilefish fisherman (ie., captains, mates, and deckhands).

3 **IFQ LEASING:** We support **Alternative 3B:** Annual IFQ allocations may be leased among any interested party **(Preferred Alternative).**

4 **IFQ SHARE ACCUMULATION:** We support **Alternative 4C:** Limit IFQ share accumulation to 37 percent of the TAL.

During open access fishing in the 1988-1998 timeline one individual vessel harvested up to 40% of the total landings. This represents capability with no regulations in place, and therefore demonstrates a reasonable cap on accumulation of shares without being considered excessive.

5 **COMMERCIAL TRIP LIMITS:** We support **Alternative 5A:** No action (Maintain status quo management regarding trip limits) **(Preferred Alternative).**

6 **FEES AND COST RECOVERY:** We support **Alternative 6A:** No action.

7 **IFQ PROGRAM REVIEW PROCESS:** We support **Alternative 7B:** Allow for a formal and detailed review of the IFQ program five years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every seven years) **(Preferred Alternative).**

8 **IFQ REPORTING REQUIREMENTS:** We support **Alternative 8B:** Facilitation of an IFQ system administration if an IFQ program is implemented **(Preferred Alternative).**

9 **IVR REPORTING REQUIREMENTS:** We support **Alternative 9B:** The owner or operator of any vessel issued a limited access permit for tilefish must submit a tilefish catch report via the IVR system within 48 hours after offloading fish **(Preferred Alternative).**

10 **COMMERCIAL VESSEL LOGBOOK REPORTS:** No comment.

11 **HOOK SIZE RESTRICTIONS:** No comment.

12 **RECREATIONAL PERMITS AND REPORTING REQUIREMENTS:** We support **Alternative 12B:** Establish a party/charter tilefish vessel permit, a party/charter tilefish operator permit, and a party/charter vessel reporting requirements **(Preferred Alternative).**

13 **RECREATIONAL BAG-SIZE LIMITS:** We support **Alternative 13B:** Establish an 8-fish recreational bag-size limit per person per trip.

The tilefish stock is presently in a rebuilding period with restrictions on the commercial sector of a constant harvest strategy of 1,995,000 pounds live weight for ten years. This harvest level represents a 50% reduction in landings prior to implementation of the rebuilding plan. To allow another sector the privilege to harvest with no limits or accountability is wrong and not in compliance with the reauthorized Magnuson Stevens Act. Eight fish is the largest bag-size limit in this document. If, in time, this proves to be the wrong choice, **Alternative 15B** will allow for a change in the bag-size limit through a timely Framework action.

14 **IMPROVE MONITORING OF GOLDEN TILEFISH LANDINGS CAUGHT IN THE MID-ATLANTIC REGION:** We support **Alternative 14B:** Implement measures that would allow for golden tilefish caught in the management unit to be landed in the management unit only **(Preferred Alternative).**

15 **FRAMEWORK ADJUSTMENT PROCESS:** We support **Alternative 15B:** Expand the list of management measures identified to be added or modified via the framework adjustment process to include recreational measures and measures that facilitate the periodic review of the IFQ program.**(Preferred Alternative).**

This alternative allows for timely adjustments in the bag-size limits for the recreational sector.

16 **ESSENTIAL FISH HABITAT DESIGNATION:** We support **Alternative 16B:** Modify current EFH designation (**Preferred Alternative**).

17 **APC DESIGNATION:** We support **Alternative 17C:** Designate HAPC as four canyons (**Preferred Alternative**).

18 **MEASURES TO REDUCE GEAR IMPACT ON EFH:** We support **Alternative 18A:** No action.

19 **MANAGEMENT MEASURES FOR COLLECTING ROYALTIES:** We support **Alternative 19A:** No action (Collection of royalties would not be implemented for the initial, or any subsequent distribution of allocations in the tilefish IFQ program).

Thank you,

John Nolan   Dan Farnham   Bob Fallon

José

Frank A. Green F/V Bookie
146 Middlesex Avenue
Oakdale, NY 11769

2/11/08

February 8, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

"Tilefish 1 Comments"

Dear Mr. Furlong:

This letter is in response to the TILEFISH AMENDMENT 1 Public Comment. I represent boat #2, in Tier 2, the F/V Bookie. My vote is for **Alternative 1; 1D2.**

Alternative 1; 1D2 meets all standards and objectives NMFS has consistently supported past and present in every other fishery that it manages.

Alternative 1; 1D2 addresses over capitalization as stated in the Public hearing Document, page 2, 5th line up from the bottom, and I quote *"The purpose of the IFQ program in this amendment is to reduce overcapacity in the commercial fishery and to eliminate, to the extent possible, the problems associated with derby fishing."*

- To reduce over capacity in this fishery, a system wide time frame of 2001-2005 must be implemented, thus eliminating latent permits.
- Implementing the 2001/2005 time frame will be consistent with every other management system currently in place within NMFS.
- Simply implementing an IFQ system without identifying the current users (i.e., implementing a 2001-2005 timeframe) who have proven they are full time fishermen, who rely on tile fishing as their sole source of income, would not achieve the purpose and objective of Amendment 1.

Implementing **Alternative 1; 1D2** mirrors all other NMFS Management Plans because it;

- deals with the latent permit issue that has been addressed in every other fishery and desperately needs to be addressed in this one too.
- is consistent in its timeline going back 3 yrs from today's date, with a five year window of 2001-2005 proving that you use this resource and rely on it, as per other fishery management plans.
- reduces capacity in this fishery and problems associated with derby fishing.

- proves that if you have no landings during the years 2001/2005 you are not dependant on Tilefish and/or are currently active in another fishery full time.

- acknowledges too many boats for too small of a quota.

- Mirrors what NMFS did in the Multispecies Days at Sea using dates 1995-2000.

For nineteen straight years I have been full time tile fishing. During that time I lost my days at sea for Multispecies, my Lobster permits and my Scallop General Category. Why? because of control dates implemented to determine who needs and depends on the fisheries. The result ***"use it or lose it"***. That's a tough reality but a necessary one. I lost those permits because I was making a living full time Tile fishing. The same formula used for the control dates in the other management plans and/or amendments that eliminated the fisherman who did not rely on the resource, should also be used in the Tilefish fishery to eliminate those who clearly do not rely on it.

I lost those permits for non-participation (i.e., latent permit), completely consistent with all other fishery management plans. When you develop a timeline with your average landings it does 2 good things.

1. It shows you who is actually using the resource
2. It proves how much they depend on it.

When you look at the column for years 2001-2005 on table 4, Page 12 of the Support tables for Amendment 1, you can clearly see which boats rely on this fishery in a Full-time capacity in Tier 1 full time (4 vessels) and in the part-time (approximately 7 out of the 22 vessels). The average landings for Tier 2 full time in the 2001-2005 column are blank because only 2 out of the five vessels actually fished during that period and for confidentiality the landings are not listed. However for arguments sake, and for the sake of making my argument the below chart indicates the landings that are not shown in the 2001-2005 column. Please also note that the landings for boat #5 were landed at the end of '05 when it was announced that IFQ's were on the table at MAFMC. Then and only then did boat #5 initiate his privilege of landing tilefish as per the original Tilefish Management Plan.

Qualifying Tier 2 Vessels	Average Landings, 1988-1998	Average Landings, 2001-2005	Average Landings Best Five Years 1997-2005
#1		0	
#2		241,058	
#3		0	
#4		0	
#5		13,861	

Frank A. Green F/V Bookie
146 Middlesex Avenue
Oakdale, NY 11769

When you view the 2001-2005 column with respect to the other 2 columns on Page 12 you get a full understanding of who relies on this fishery. Clearly vessels #1, #3, #4 and #5 in Tier 2 completely stopped fishing at the inception of the Tilefish Management Plan. Those same vessels, back in 2000, were very well represented and were assured the right to participate in the rebuilding of the Tile fishery, why those vessels did not exercise that right remains a mystery, an anomaly if you will.

It is crystal clear why vessels #'s 1,3,4&5 in Tier 2 want Alternative 1D4, because it assures them fish percentages that they haven't caught in 10-20 years ago. Vessels #3 and 4 in Tier 2 would be allotted more fish in 1D4 than they have ever caught in any of the time frames on Page 12. That same alternative 1D4, if adopted would punish the part time fisherman who actually took advantage of their permit to fish at the inception of the management plan back in 2001. Specifically boats #'s 2, 7, 9, 10, 12, 15, and 20 in part time all continued the same effort that they portray in 1997-2005 and have stayed consistent. Those consistent fisherman would be raped, for lack of a better word, if 1D4 were adopted. Last but not least boat #2, in Tier 2 would be completely decimated, destroyed out of business with no other fishery to go to if 1D4 were adopted. 1D4 would throw away 12 consecutively consistent and present time years of effort of vessel #2 down the toilet, leaving him with 20% of his category.

All the vessels that clearly demonstrate that they have relied on this industry with no latency, specifically all vessels in Tier 1, boat #2 in Tier 2 and 6 vessels in part time, are all 100% in favor of the 2001-2005 timeline. Over 90% of the actual and real users of the fishery support the 2001-2005 timeline.

I would like to stress a few major points and problems about possibly going in the wrong direction if 1D4 is chosen. I think we all know that the 1D4 equal allocation across the board, supported by the Historical Tilefish Coalition of NJ, is nothing more smoke and mirrors, designed to allocate fish to the latent permit boats, boats that want to be allocated fish that they have no record of ever producing.

I would also like to note for the record that 90% of these landings were from 10 to 25 yrs ago. The column on the right is the % of fish they would receive over and above any recorded timeline if 1D4 were chosen. You will clearly be able to see that this is **EXCESSIVE SHARE ALLOCATION.** To give fish to boats that they never caught it and take it away from the people who did catch it and who depend on it, is **beyond unfair, it's a crime**.

The NJ Coalition is trying to convince the Council that the support of 1D4 is fair and equitable for everybody. However, I am confident that when the Council navigates through the smoke and mirrors of their presentation you will see that what 1D4 is really about is giving latent permitted boats fish they never caught, so that they can sell or lease back their permits to the real users of the industry.

Frank A. Green F/V Bookie
146 Middlesex Avenue
Oakdale, NY 11769

If the Council adopts the **1D2 option**, it will assure that no one will get any more percentage of quota then that which they actually caught. It will assure that no one will get more percentage than they are entitled to.

According to all the charts there are 6 part time boats that have considerable actual landings and have proven they rely on this fishery as I do, not at the same level, but they do. Those part time vessels have expressed concern and dismay to me about the coalition's attempt to go back 25yrs, which is supported by all the non-producers in part time. Decidedly, the downside of equal allocation in part time is that 4.5 % equates to 14,440lbs., which equates to one trip a year for every boat in part time. The cost to gear up to catch Tilefish makes the effort and expense to do so implausible. ***The Coalition is touting to the active participants in part time that 1D4 would be good for everybody, but in reality it would only be good for the 18 vessels with no landings during 2001-2005 time period. 1D4 would benefit 18 vessels with literally no landings during 2001-2005, and it would crunch and/or crush the percentages of the 12 vessels that actually did fish during 2001-2005.***

The vessels in part time, clearly, really using the fishery to subsidize their income, caught well over 4.5 %, they caught from 7.4% to upwards of 40%, why would they want to be cut back to 4.5%? How could anyone ask anyone else to take a hit like that? Option 1D4, is asking people to stop catching as much fish as they have been catching for well over 10 years, so that the people who couldn't be bothered fishing at all in the last ten years can benefit from an IFQ system, *and then, then,* if they still want to fish at the same capacity that they were, now they can lease back quota from people who haven't fished in the last ten years, NOW that is excessive!

It's a fact that those vessels with no landings want to lease their quota for .50 a lb. Certain part time fisherman are shocked and appalled and can't believe that these latent permit owners expect they can continue to sit at the dock, not put one hook in the water and collect .50 a lb. from the same fisherman who caught them all along without having to pay anyone .50lb. It sounds like there is some strong arming going on here with the leaders of that Coalition, which evidently isn't much of a coalition at all. That coalition ended in 1998 when the majority of the fisherman who made it up, stopped fishing ten years ago. They obviously think that they can rest on their laurels of their landings from 20 years ago at the expense of all the fisherman who stayed in the fishery. The fact that the coalition supports allowing individuals to own no more than 12.5 %, clearly does not respect the percentage necessary to make a living full time, and clearly intends to lease the permits indefinitely. In effect 1D4 would assure all fisherman couldn't own more than 12.5%, but latent permit holders could lease as much as 20,30,40 to 50% to full time fisherman who would be extorted into leasing it just to survive at his prior landings.

Now that you know all the latent permitted people want 1D4 (i.e., the something for nothing option), and have stated in the Public Comment meeting in NJ that they are opposed to option 1E, the council should consider the 2001-2005 timeline that the majority of the real users of the fishery agree on.

Frank A. Green F/V Bookie
146 Middlesex Avenue
Oakdale, NY 11769

The Coalition supports 1D4, equal shares, which only benefits all the people that left the fishery. 1D4 is detrimental to the fisherman who have been consistent in the fishery with no latency. Adopting 1D4 gives excessive allocation to at 13 latent vessels. The chart below shows just how excessive the allocation would be in 1D4. It exposes the amount of allocation they would receive that is over and above the total amount of tilefish **EVER CAUGHT IN THEIR ENTIRE HISTORY IN THIS FISHERY.**

TABLE 1

boat #	best timeline in lbs	equal share allocation		% of lbs over
Tier 2				
3	14,500	56,857		392% MORE
4	44,077	56,857		33% MORE
part time				
3	3,510	14,440		311% MORE
4	9,619	14,440		50% MORE
6	2,270	14,440		636%MORE
11	9,022	14,440		60%MORE
13	0000 NO LANDINGS	14,440	NO %	A COMPLETE GIFT
14	4,800	14,440		300%MORE
15	7,609	14,400		89%MORE
16	0,005????	14,440		2,888%MORE
17	1,887	14,440		665%MORE
18	5,951	14,440		142%MORE
19	2,587	14,440		458%MORE
21	3,025	14.440		377%MORE
22	5,498	14,440		162%MORE

If the part time users want equal shares that can be done in a legal agreement drawn up by lawyers and signed by them, just like Montauk did. When the amendment is passed they can transfer the quota accordingly and legally. **One timeline for everybody.** NMFS has all the recorded accurate data they need for that timeline. NO time consuming collection of data, which may not be true. If the Council goes forward with 1E, I would urge them to consider combining the votes of the 2 full time tiers who support 2001-2005. As for the other options as I have stated in every Public comment meeting in VA, NY, RI and NJ, they are as follows:

ALT. 1- 1D2, ALT.2-2C, ALT.3-3C, ALT.4- 4, ALT.5-5C, ALT.6-6C, ALT.7-7B, ALT.8-8B, ALT.9-9B, ALT.10 -NO COMMENT, ALT.11-NO COMMENT, ALT.12-12B, ALT.13-13A, ALT.14-14B, ALT.15-15B, ALT.16-16B, ALT.17-17C, ALT.18-18A, ALT.19-19A.

Frank A. Green F/V Bookie
146 Middlesex Avenue
Oakdale, NY 11769

In conclusion, I pray that MAFMC council members stay the course on fisheries management plans and stay consistent with this plan, as in other fisheries plans that deal with latent permits, reduce capacity and over capitalization. This fishery desperately needs these issues dealt with. Too many boats for too few fish. 1D2 accomplishes all these objectives.

Thank you for your time and consideration of my preferred option, **1D2.**

Sincerely:

Frank Green
F/V Bookie

José
J 2/11/08

Bob Fallon
F/V Endorphin
P.O. Box 2035
Montauk, NY 11954

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is Bob Fallon. I am the owner of F/V Endorphin, a full-time tier 1 vessel.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

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19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

Bob Fallon

Bob Fallon

José
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is Chris Payton. I am a full-time year-round tilefish first mate on F/V Endorphin.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

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17 **HAPC Designation:** I support Alternative 17C

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19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

Chris Payton

Chris Payton

José
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is Robert Freeman. I am a full-time year-round tilefish captain on F/V Seacapture. 100% of my income is earned fishing on F/V Seacapture.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 **IFQ Allocation:** I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.

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14 **Improve Monitoring of Golden Tilefish Landings Caught In The Mid-Atlantic Region:** I support Alternative 14B

15 **Framework Adjustment Process:** I support Alternative 15B

16 **Essential Fish Habitat Designation:** I support Alternative 16B

17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely, Robert Freeman

Robert Freeman

José
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is John Nolan III. I am a full-time year-round tilefish first mate/captain on F/V Seacapture. 100% of my income is earned fishing on F/V Seacapture.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1. **IFQ Allocation:** I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.
2. **Permanent IFQ Transferability of Ownership:** I support Alternative 2E
3. **IFQ Leasing:** I support Alternative 3B
4. **IFQ Share Accumulation:** I support Alternative 4C
5. **Commercial Trip Limits:** I support Alternative 5A
6. **Fees and Cost Recovery:** I support Alternative 6B
7. **IFQ Program Review Process:** I support Alternative 7B
8. **IFQ Reporting Requirements:** I support Alternative 8B
9. **IVR Reporting Requirements:** I support Alternative 9B
10. **Commercial Reporting Requirements:** No comment
11. **Hook Size Restrictions:** No comment
12. **Recreational Permits and Reporting Requirements:** I support Alternative 12B

13 **Recreational Bag-Size Limits:** I support Alternative 13B

14 **Improve Monitoring of Golden Tilefish Landings Caught In The Mid-Atlantic Region:** I support Alternative 14B

15 **Framework Adjustment Process:** I support Alternative 15B

16 **Essential Fish Habitat Designation:** I support Alternative 16B

17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

J Nolan

John Nolan III

Jose
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

[illegible]

Dear Mr. Furlong,

My name is Al Ellis. I am a full-time year round tilefish fisherman on F/V Seacapture.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 **IFQ Allocation:** I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.

2 **Permanent IFQ Transferability of Ownership:** I support Alternative 2E

3 **IFQ Leasing:** I support Alternative 3B

4 **IFQ Share Accumulation:** I support Alternative 4C

5 **Commercial Trip Limits:** I support Alternative 5A

6 **Fees and Cost Recovery:** I support Alternative 6B

7 **IFQ Program Review Process:** I support Alternative 7B

8 **IFQ Reporting Requirements:** I support Alternative 8B

9 **IVR Reporting Requirements:** I support Alternative 9B

10 **Commercial Reporting Requirements:** No comment

11 **Hook Size Restrictions:** No comment

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15 **Framework Adjustment Process:** I support Alternative 15B

16 **Essential Fish Habitat Designation:** I support Alternative 16B

17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely, Allen Ellis

Al Ellis

Jose
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

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2 Permanent IFQ Transferability of Ownership: I support Alternative 2C

3 IFQ Leasing: I support Alternative 3B

4 IFQ Share Accumulation: I support Alternative 4C

5 Commercial Trip Limits: I support Alternative 5A

6 Fees and Cost Recovery: I support Alternative 6B. I do not feel the federally permitted dealer should be burdened with the task of the cost recovery payment to NMFS.

7 IFQ Program Review Process: I support Alternative 7B

8 IFQ Reporting Requirements: I support Alternative 8B

9 IVR Reporting Requirements: I support Alternative 9B

10 Commercial Reporting Requirements: No comment

11 Hook Size Restrictions: No comment

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16 Essential Fish Habitat Designation: I support Alternative 16B

17 HAPC Designation: I support Alternative 17C

18 Measures To Reduce Gear Impact On EFH: I support Alternative 18A

19 Management Measures For Collecting Royalties: I support Alternative 19A

Thank you.

Scott Soper

Sincerely,

José
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

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17 HAPC Designation: I support Alternative 17C

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19 Management Measures For Collecting Royalties: I support Alternative 19A

Thank you.

Maureen Kingston

Sincerely,

José
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

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17 **HAPC Designation:** I support Alternative 17C

18 **Measures To Reduce Gear Impact On EFH:** I support Alternative 18A

19 **Management Measures For Collecting Royalties:** I support Alternative 19A

Thank you.

Sincerely,

Natalie Duane

Natalie Duane

José
2/11/08

February 1, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

RE: "TILEFISH 1 COMMENTS"

Dear Mr. Furlong,

My name is Kevin Walsh. I am a full-time year round tilefish fisherman on F/V Seacapture.

I am writing to comment on the alternatives in Amendment 1 to the Tilefish FMP.

1 IFQ Allocation: I support Alternative 1E, basing IFQ allocation on the average landings for the period 2001 – 2005.

2 Permanent IFQ Transferability of Ownership: I support Alternative 2E

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17 HAPC Designation: I support Alternative 17C

18 Measures To Reduce Gear Impact On EFH: I support Alternative 18A

19 Management Measures For Collecting Royalties: I support Alternative 19A

Thank you.

Sincerely,

Kevin Walsh

Kevin Walsh

Capt. Louis Puskas, Pres.
Viking Village
Barnegat Light, NJ 08006

April 25, 2007

To: Mid Atlantic Fishery Management Council

Re: Tilefish public meeting, April 26, 2007

Dear Members:

I moved to Barnegat Light, NJ in May 1957. I obtained a six passenger captain license and started sailing fishing charters.

I did all types of fishing, whatever my customers wanted. But I specialized in trolling for school-sized bluefin tuna. Bluefin tuna showed up about 10-30 miles off-shore of Barnegat Light in great schools around the 4th of July.

To get through the winter months when charters were scarce, I longlined for codfish along with many other captains and commercial fishermen. The codfish migrated down from the north in December in great numbers. They left around March.

Fishing was great. In 1963, I launched a new 48 foot Gracie II. My business grew. At the peak of my charter fishing career, I was sailing 250 charters a year.

In the late 60's/early 70's, disaster struck. The west coast tuna purse seiners moved in from California with their spotter planes and within five years the bluefin tuna were gone. Giant foreign factory trawlers also moved in off the east coast in the same time period. By 1972 we had no cod or bluefin left.

Because there were no bluefin tuna inshore, I started to take my charters to the offshore canyons to catch yellowfin tuna and marlin. One of my offshore charters wanted me to try bottom for tilefish. Even though I had been looking for them for six years, it wasn't until this trip in July of 1969 that I finally caught some. The late Nelson Beideman of Bluewater Fishermen's Association was my mate.

Christmas of 1971, Nelson came home from the Maine Maritime Academy that he was attending. One week after Christmas, Nelson agreed to go with me to the Hudson Canyon to see if we could catch tilefish on codfish longline gear. We had no hauler so we pulled the gear by hand. On three miles of gear, we landed 3000 lbs of tilefish. When we arrived at the dock the next day, there was a lot of excitement. It was as if we had struck gold, and we did. It wasn't long before at least six boats from Barnegat Light got into the tile fishery.

The offshore canyons in the winter can become a little nasty at times. March 1972 homeward bound from the Hudson canyon with a small catch of tilefish, the Gracee II caught fire 40 miles off Barnegat Light about midnight. Seventeen year old Kirk Larson and myself went into an inflatable life raft. Luckily we were spotted by a tanker in the morning who called the Coast Guard and we were rescued. Kirk is now around 52 years old and is the Mayor of Barnegat Light.

Two months after Gracee II, I bought a 65 foot steel boat called the Eaglet, renamed the Gracee III. I was still sailing charters in the summer and tilefishing in the winter. 1973 was my last year of charter fishing. During 1973 I took Bruce Freeman and

Steve Turner on several trips; they were working for the Marine Fishery Service. They took bottom water temperatures wherever I caught tilefish. They weighed and measured many fish also and recorded the age of the fish.

By 1973 I had made experimental tile sets from the Wilmington Canyon north to Lydonias and caught tilefish in every one

1974, I was full-time tile fishing and in 1975 myself and John Larson bought Viking Village where we marketed most of the tilefish caught by local boats. The boats were landing thousands of pounds.

By the mid 80's, the fish were smaller in size and the stock over-fished, so I started to fish more for swordfish in the summer and take the pressure off the tilefish stocks. Swordfishing was good and we also caught a lot of bigeye tunas. A few Barnegat Light boats also went out swordfishing. This left the tilefishery wide open for the Montauk fleet who then claimed ownership of the tilefish quota and increased their fishing efforts.

The swordfish industry also had its problems. The Japanese longliners were slaughtering the giant bluefin in the Gulf of Mexico and driving us off our own fishing grounds in the Mid-Atlantic.

We had many gear conflicts and losses. Finally, I was instrumental in organizing the American Tuna Action Committee. ATAC's goal was to have tuna included in the 200 mile limit which we didn't get, but we were able to compromise with Congressman Bill Forsythe to move the foreign longliners outside the 1000 fathom curve in the USA waters. Brue Freeman and I drafted up this curve. We also had the Japanese removed from the Gulf of Mexico.

While this lobbying was going on , myself and other Barnegat Light fisherman were swordfishing in the summer in order to give the tilefish a chance to recover. We didn't land enough tilefish poundage to qualify for full-time limited access tilefish permit applications. Myself, who put the tilefishery on the map, ended up with a part-time permit that all but shuts me out of the tilefishery. 3 people have 4 Permits [illegible] 66%

I don't think it is fair that ~~three~~ 4 Montauk boats have ~~practically ninety~~ percent of the tilefish quota. Now that the stocks have recovered, I'm asking that the quota be equally divided among the existing tilefish permit holders IFQ.

We all have boats and home mortgages to pay.

Sincerely,

Capt. Lou Puskas

Lou Puskas

SUBMITTED COMMENTS
AT THE PUBLIC HEARINGS
IN RIVERHEAD, NY
2/4/08

My name is James Gutowski from Barnegat Light NJ; I am a participant of the Historic Tilefish Coalition and further affiliated with Viking Village a federally permitted dealer and a Commercial Fish dock in Barnegat Light.
I appreciate the opportunity to provide comments to the council on the proposed alternatives in Amendment 1 to the Tilefish FMP.

IFQ Allocation

- Full time Tier2 category I support **1D4**, this is a change in my position from 1D3a with new light on the third vessel in the qualifying group being an active tile fishermen with historical landings wanting to participate in the fishery. It makes for the fairest choice.
- Part time category, again I support **1D4** it is the fairest choice considering the large amount of participants. Particularly when the majority of those show historical participation. All the qualifying vessels should receive allocation; again it makes for the fairest choice.
- Incidental category I support the status quo.
- Full time Tier1 category I do not have a position on IFQ allocation since I have no participants in the category however, I would like to voice some concerns regarding the overall allocation of this fishery:

When the FMP was first adopted the industry believed that the permit system would be revisited. Now this is even more critical with the new required limited access provisions in the MSA.I believe the current allocation is in jeopardy of violating National standard 4 and the new limited access provisions. I have included copies of a correspondence where as Dr William Hogarth Assistant Administrator assures NJ Representative Jim Saxton that National Standard 4 and the new limited access provisions will be met. My biggest concern is this IFQ allocation allows 3 or 4 closely related individuals 66% of the entire East Coast Tilefish harvest. My proposed request should mitigate these concerns for the council.

Full-Time Tier I	50% of the TAL
Full-Time Tier II	22% of the TAL
Part-Time Category	28% of the TAL

Permanent Transferability

- I support Option **2C** however, in case of a sale of the vessel in the first five years the permit and the IFQ shares would be permanently transferred to the new vessel owner.

Annual Leasing

- I support Option **3C** during the first 5 years only IFQ shareholders would be able to lease IFQ allocations, after this initial period other individuals should be eligible.

IFQ Share Accumulation

- I oppose all the current options, They do not meet the new limited access requirements of the MSA
- Page 18 of the public hearing documents states: concentration of shares in the hands of a relatively small number of individuals or entities could also lead to excessive market power for just a few entities. The concentration of market

power could affect working conditions, process, and wages paid to crew, and could potentially harm participants in the fishery."

- My recommendation would be an individual share cap of 12.5 % translating to 50% FTT1, 22%FTT2, and 28% Part-time.

Commercial Trip Limits
- I support Option **5A** Status Quo

Fees and Cost Recovery
- I support option **6C** IFQ shareholders pay via federally permitted dealers. With few dealers this would be a simple and cost effective method.

IFQ program review
- I support Option **7B** review IFQ program 5 years after implementation.

IFQ Reporting
- I support Option **8B** facilitation of an IFQ system administration. This option will help ensure that amounts of tilefish landed and prices are properly recorded and match IVR data to dealer data at the trip level.

IVR Reporting
- I support **9B** the owner or operator of any vessel issued a limited access permit for tilefish must submit a tilefish catch report via the IVR system within 48 hours after offloading fish.

Log Books
- I support **10A** status quo although I would like to see the council work with NMFS and industry to develop electronic logbook reporting currently in the experimental stages.

Hook Size
- I support no action until data is available to support alternatives on an effective hook size.

Recreational Reporting
- I support **12B** the owner or operator of any vessel issues a limited access permit for tilefish must submit a tilefish catch report via the IVR system within 48 hours after offloading fish.

Recreational Bag Limit
- I support **13A** NO ACTION to maintain the status quo and not require a recreational bag limit. But could be a framework able action in the future if catch limits increase.

Improve Monitoring of Landings
- I support **14A** No Action maintain the status quo management regarding the catch and reporting of tilefish. But could also become framework able if problems arise.

Framework Adjustment Process
- I support **15**[illegible] but would like to include 14B and 15B as future framework able actions.

EFH Designation
- I support **16B** modify current EFH Designation

HAPC Designation

- I support **17C** only because it is the lesser of the two evils, I have strong reservations about habitat designation.

Measurements to reduce gear impact on EFH

- I support **18A** No Action no GRA's

Management Measures for Collecting Royalties

- I Support **19A No Action,** Collection of royalties would not be implemented for the initial or any subsequent, distribution of allocations in the tilefish IQF program.

James M Gutowski

JIM SAXTON
3RD DISTRICT, NEW JERSEY
WWW.HOUSE.GOV/SAXTON
JOINT ECONOMIC COMMITTEE
RANKING MEMBER
NATURAL RESOURCES COMMITTEE
SUBCOMMITTEE:
FISHERIES, WILDLIFE AND OCEANS

ARMED SERVICES COMMITTEE
SUBCOMMITTEES:
AIR AND LAND FORCES
RANKING MEMBER
TERRORISM, UNCONVENTIONAL
THREATS AND CAPABILITIES

U.S. House of Representatives
Washington, DC 20515

June 27, 2007

Thomas O. Barrett
Assistant Attorney General
Main Justice Building
950 Pennsylvania Avenue, N.W.
Room 3109
Washington, D.C. 20530
via facsimile 202.616.2645

Dear Mr. Barrett:

I am writing to respectfully request guidance from your office to regarding potential antitrust, geographic concentration and allocation consolidation issues under a federal fisheries management plan amendment currently being developed in the Mid-Atlantic region. The Mid-Atlantic Fisheries Management Council (MAFMC) is in the process of crafting Amendment 1 to the Tilefish Fishery Management Plan (hereafter "AM#1"). The amendment is being developed to institute a formal Limited Access Privilege Program (LAPP) for the tilefish fishery. The MSA LAPP process requires consideration of both current and historic fishing participation by fishermen in various communities. The tilefish fishery was developed by fishermen from the State of New Jersey in the 70s and 80s and shifted to the State of New York in 1987. I am concerned the Council's initial allocation of shares in this fishery may vest a large proportion – in excess of 65 percent of the East Coast tilefish fishery – to a small number of operators and shore-side facilities and gives inadequate weight to historical participation in the fishery.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) was recently reauthorized (P.L. 109-479) with substantial changes to Section 303A titled "Limited Access Privilege Programs" (See 16 U.S.C. 1853a). Several MSA provisions are intended to prevent excessive consolidation and anti-competitive activities, and promote social and economic benefits in small communities.

Specifically, Section 303.A(5)(B) and (D) contain requirements to prevent excessive geographic and other consolidation in harvesting or processing and ensuring that LAPP share holders do not acquire an excessive or inequitable concentration of fishing privileges. The Act retains the application of anti-trust laws to prevent unfair methods of competition.

Based on the new LAPP requirements in the law, I am asking for your formal guidance on these issues in AM#1 before the Council commits to a course of action. I also want to ensure that you understand I am not asking for confidential business/ownership information or for such information to be made public.

Rather, I respectfully request your office examine the facts and provide guidance so the National Oceanic and Atmospheric Administration and the MAFMC do not adopt a LAPP that is inconsistent with MSA and antitrust law.

Thank you in advance for your assistance with this critical issue and I look forward to your timely response. Please do not hesitate to contact my staff should you have any additional questions.

Sincerely,

Jim Saxton

Jim Saxton
Member of Congress

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910
THE DIRECTOR

SEP 14 2007

The Honorable Jim Saxton
House of Representatives
Washington, D.C. 20515

Dear Representative Saxton:

Thank you for your letter to the Department of Justice's (DOJ) Antitrust Division on draft Amendment 1 to the fishery management plan (FMP) for tilefish. In your letter, you requested "formal guidance" on "potential antitrust, geographic concentration and allocation issues" raised by Amendment 1 to the tilefish FMP. While antitrust issues are the responsibility of DOJ, the fishery issues are governed by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and are therefore addressed by NOAA's National Marine Fisheries Service (NMFS). DOJ has asked that the NMFS prepare a response that addresses the geographic concentration and allocation issues.

The MSA prohibits excessive shares of harvesting privileges in fishery management actions, including limited access privilege (LAP) programs. National Standard 4, 16 U.S.C. § 1851(a)(4), requires that no "particular individual, corporation, or other entity acquires an excessive share of [fishing] privileges." MSA provisions at 16 U.S.C. § 1853a(c)(5) require that LAP programs include measures that prevent "excessive share" and "inequitable concentration" of harvest privileges, and that fishery management councils consider the basic social and cultural framework of a fishery "though procedures to address concerns over excessive geographic or other consolidation." More specifically, § 1853a(c)(5)(A) directs that LAP programs ensure "fair and equitable" initial allocations, taking into account (1) current and historical harvests, (2) employment, (3) investments, and (4) current and historical participation of communities.

FMP Amendment 1 for tilefish is still a proposal, with much work to be done. When the Mid-Atlantic Fishery Management Council completes its recommendations for a tilefish individual fishing quota (IFQ) program, NMFS will review the proposal, applying National Standard 4 and the LAP provisions.

I will continue to work with the Council to ensure that their preferred alternatives for this IFQ program conform to the provisions of the reauthorized MSA. If you have further questions, please contact Eric Webster, Director of NOAA's Office of Legislative Affairs, at (202) 482-4981.

Sincerely,

WTHogarth

William T. Hogarth, Ph.D.

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

SUBMITTED WRITTEN COMMENTS AT THE PUBLIC HEARING MEETING IN WARWICK, RI 2/5/08

Philip Ruhle
F/V Sea Breeze
Newport, R.I.

I am a part-time permit holder. I actively fished tilefish from 1982 thru 1989.

I find it extremely unfortunate to find that the MAFMC during the development of this plan, as with the original FMP has done what I consider an extremely poor job of public outreach. As a New England Council member and a member of the tilefish committee in 2006-2007, I was not notified of committee meetings held outside of council meetings.

I would support the development of the IFQ program, only in doing so, it adheres to all the provisions of the re authorized M.S.A.

As I have read through what the council is proposing, I am concerned that many of the provision's Congress has added are being minimized. I am very concerned that in the document in front of us, I find no mention or discussion of revisiting the status of historical participants in the allocation scheme. I refer to the supplemental administrative record for this F.M.P. The Administrative record clearly states the concerns of the historical participants and the understanding that this amendment would revisit the limited access system, with the 1984 to a 1998-time frame a consideration, understanding that a council cannot bind a future council action. What seems to be missing is any record of the council having discussed this issue.

I refer the council and committee to the SAW41 document pages 158, 159 and 163. These tables show data of when and where the fishery's historical facts are. They also show that in the 1980's, there were 20-30 vessels engaged with landings in five states and shows how the shift went to one state and seven vessels and a reflection of the resource.

In the late 1980's, the resource was in decline, shown by fish size and landings. Over the next few years, I and many other boats moved to other fisheries.

This is known as responsible fishing. When a stock is declining, stop. To not do so and to continue fishing on a stock that was in trouble is un responsible fishing. In the original FMP and in amendment one, the MAFMC and NMFS have once again rewarded un responsible fishing and penalized the responsible fishermen.

The council and the service should really think this over. In my mind, for these bodies to reward irresponsible fishing is wrong on many levels.

So I ask the council to look again at this amendment. In the context of the reauthorized LAPP MSA (16 USC 1853 A MSA 303 A) sect. 5a allocation.
1- Current and historical harvests
1v- The current and historical participation of fish communities
B- Concern's over excessive geographic or other consolidation in the harvesting or processing sections and all other provisions in the ACT.

I believe most of the alternatives in this document, fail to meet these provisions.

The use of any of the time lines in the alternatives does not consider historical participants.

In the part-time class alternative 1D4, equal allocation is the fairest at this point.

I do not wish to comment on the rest of the IFQ options, as I cannot support this plan as it has been drafted.

I noticed that for the original FMP that some of the tier one vessels had problems with their landings and history, and I wonder how many of the historical participants have actually verified their landings.Or has the tried verify the data.

5-Trip limits
Support the 15,000 trip limits only if it is re-evaluated annually.

b-7,8,9   ITQ

10-log books
Support status quo. As a member of the New England study fleet log book experiment, I can state that the electronic log book is not ready for prime time.

11- Hook size

Status quo until sufficient scientific research has been done.

12-Recreational reporting
Optional

12b-recreational reporting a must.

13- recreational bag limits
Option 13a

14-Improve monitor landing

14a-no action

15-Frame work adjustment

15b-add trip limit if necessary

16- EFH - ~~16a~~ ~~No Comment~~

17-HAPC

17a-Council preferred alternative is not scientifically sound. POOR DATA 3 YR [illegible] UNRELIABLE

18-Measures to require gear impact on EFH
All GRA's are expanded in area

18a-no action

19-IFQ

I would like to thank the council for the opportunity to comment on this amendment.

PO Box 695
Barnegat Light, NJ 08006

Captain Keith Larson

SUBMITTED COMMENTS
2/6/08
TOMS RIVER, NJ

February 6, 2008

National Marine Fisheries Service
Northeast Regional Office
One Blackburn Drive
Gloucester, MA 01930

Dear Sir or Madam:

My name is Keith Larson. I am here representing my family's fishing boats ;the MS Manya a full-time tier II, the Karen L and the Lucky 13, both with part-time permits. The MS Manya and Lucky 13 were originally on the Lori-L and the John De Wolf, both hiliners for tilefish in the 70's and 80's.

Section I

in the teir 2

We support an IFQ program to all permitted vessels. From 2001-2005, Tabled vessel#~~3~~ 2 was ~~lucky~~ able to accumulate 94% of the quota in that time frame because some of the other four permits were involved in other fisheries. But, between 1988 and 1998 Tabled vessel#2 was third highest in percentage caught and if we went back further in time, he may even be lower in catch. In 2006, 2007 and 2008, boats 4 & 5 have been tile fishing and it's not only boat#2 fishing since 2001.

Therefore, vessels #3, 4 and 5 are in agreement with 1D4 for an even split of the 20% each.

In the part-time category, we support 1D4 for some of the same reasons. That category is the fairest way to go to ensure some type of fishing capacity to certain historical participants. For example, Captain Lou Puskas, and our John De Wolf history.

In 1978, Capt. Lou Puskas caught 500,000 lbs of tilefish and 100,000 lbs of swordfish. The Karen L permit also qualifies for 1D2A that equals 14.3%, but we are still ~~fine~~ OK with two boats at 4.5% on 1D4. This is a loss of 5.3%!

We are very disappointed with the tier I vessels having 66% of the tilefish allocation. Tilefish is a public resource and should be split fairly between historical participants. We strongly stand behind Rick Marks and Jim Kendall's comments regarding reducing the tier I allocation from 66% to 50%, and transferring it over to the other 2 tiers. Tier 1=50% and tier 2= 22% and part-time = 28%.

I Don't like even doing here. Since the 2001 FMP tier 2 + part time permits holders are going to be Fighting over the 33% Leftovers

Section II

We support permanent transferability 2 C.

Section III

Annual leasing - We support 3C

Section IV.

We recommend share caps of 50% tier 1, 22% tier 2, and 28% part-time

Section V.

The preferred alternative

Section VI.

Fees & recovery - we support 6C

Section VII.

Logbooks- we support status quo, until John Hoey's electronic logbook is perfected

We support preferred alternatives 7,8,9,12,13,15,16,17, and 19

We support no action on 11,14,and 18

Keith Larson

Barnegat Light, NJ

Jose

RECEIVED
FEB 11 2008
MID-ATLANTIC FISHERY COUNCIL

Viking Village, Inc.

Commercial Seafood Producers
1801 Bayview Avenue • PO Box 458 • Barnegat Light, New Jersey 08006
609-494-0113 • FAX/609-361-9536 • www.vikingvillage.net

Comments to the Tilefish Ammendment 1 FMP

I am Ernie Panacek, manager of Viking Village commercial fishing dock in Barnegat Light, NJ. Since 1975, this facility has been owned and operated by John Larson and Louis Puskas. Both men pioneered the development of the Atlantic Tilefish fishery during those early years, including the marketing of this fish that most markets knew little about. This community thrived on this fishery for many years and helped develop Barnegat Light into a major fishing port on the U.S. east coast.

For the past 19 years as Dock Manager, I have witnessed a flourishing tilefish operation until about the early 1990's.At that time the stock was undergoing a cycle and juvenile tilefish were being caught and returned at very minimal prices to the fishermen. As a result, most Barnegat Light fishermen turned their attention to other species not only because of the price but also to ease the pressure on the juvenile tilefish.

It makes no sense to me to reward fishermen from other ports who continued to land these small fish during that period with a very large part of today's managed quota.

I am now working with the fishermen involved in the "Historical Tilefish Coalition" who are concerned with their future in the tilefish fishery and who earned their share of quota in today's proposed ITQ fishery from self-managed historical involvement.

Tilefish is important for the future of this dock and for this community, which is a major commercial fishing port. Viking Village and Lighthouse Marina located in Barnegat Light still maintain multiple dealer permits and depend on tilefish landings for viable operations during certain times of the year.

I support this group's position and views on the development of Amendment 1 to the Tilefish FMP and urge the Council to revisit the lopsided distribution of tilefish quota.

The Council needs to carefully consider the new limited access requirements in the recently re-authorized Magnuson-Stevens Act regarding excessive geographic consolidation, excessive shares, and anti-trust concerns, as well as National Standards 4 and 8 for community and economic and historic participation considerations.

I urge the Council to re-consider awarding 66% of the entire East Coast tilefish quota to one dock in Montauk, NY and one booth at Hunts Point Seafood Market when in fact this lopsided scenario creates an environment of monopolistic proportions and undermines the fair marketing of tilefish to the consumers who rely on our industry for access to this healthy fish.

Thank you for this opportunity to comment.

José
2/11/08

TO Daniel T. Furlong
Re: Tilefish I Comments
2/11/08
302-674-5399

My name is Len Elich from Barnegat Light NJ, and I am a participant in the historic Tile Fish Coalition. I have the following comments on Amendement1 to the Tilefish FMP.

IFQ Allocation
I support the development of an IFQ program for all participants; a program that maximizes the sharing by historic participation. I do not support rewarding excessive share to any one category, participant, or group of participants in a limited geographic area.

Full time tier2 I support 1d4. Even allocation it's fair to all qualifying vessels. Some of which took pressure off the fishery; not for economic reasons but to allow the fishery to rebuild.

Part Time I support 1d4. Again even allocation; it's the fairest choice considering the broad amount of qualifying vessels and their amount of historical participation. Rewarding "rush fishing" for IFQ allocation is the wrong approach.

Incidental I support the status quo.

Full Time tier1 I support 1d4, although I have no afflation with this category I remain consistent with even allocation.

I would also like to see the overall allocation revisited based on new requirements for fairness and recognition of historical participation in the Magnuson act along with the Acts NEW ITQ requirements related to excessive shares and geographical location.
The council should reconsider the data period to be 1984 through 1998 and adjust the IFQ allocation as follows:
Full time tier 1 - 50% of the TAL
Full time tier 2 - 22% of the TAL
Part-Time - 28% of the TAL

2. PERMANENT TRANSFERABILITY
We support OPTION 2C – the preferred alternative to allow transfers among IFQ share holders during the first 5 years and other individuals after that. We urge the Council to clarify that in the case of the sale of a vessel in the first 5 years, that the permit and IFQ shares also permanently transfer to the new vessel owner.

3. ANNUAL LEASING
I support OPTION 3C – whereby only tilefish IFQ shareholders would be permitted to lease annual IFQ allocations during the first 5 years and other individuals after that. We believe this will help the fishery stabilize during the initial period.

4. IFQ SHARE ACCUMULATION
I oppose all current options contained in the pubic hearing document because they are not fair and because they do not meet the new limited access requirements in the Magnuson Act.

The least restrictive OPTION 4E still awards excessive shares (66% of the total harvest) for the few individuals in the Full-Time Tier I Category. We cannot support this allocation scheme.

I recommend the Council consider an alternative that specifies BOTH INDIVIDUAL AND CATEGORY SHARE CAPS.

The Council should adopt an Individual Share Cap at 12.5% of the TAL.

The Council should adopt Category Share Caps as follows:
Full-Time Tier I 50% of the TAL
Full Time Tier II 22% of the TAL
Part-Time Category 28% of the TAL

6. FEES AND COST RECOVERY
I support OPTION 6C to pay fees through a federally permitted dealer.

10. LOG BOOKS
I support OPTION 10A to maintain the status quo. However, I also encourage the Council to work with NMFS and the industry to develop electronic logbook reporting for future consideration in the fishery.

I SUPPORT THESE PREFERRED ALTERNATIVES:
5. COMMERCIAL TRIP LIMITS
7. IFQ PROGRAM REVIEW
8. IFQ REPORTING
9. IVR REPORTING
12. RECREATIONAL REPORTING
13. RECREATIONAL BAG LIMITS
15. FRAMEWORK ADJUSTMENT PROCESS

16.EFH DESIGNATION
17. HAPC DESIGNATION
19. MANAGEMENT MEASURES FOR COLLECTING ROYALITIES

I SUPPORT THESE NO ACTION ALTERNATIVES:
11. HOOK SIZE
14. IMPROVE MONITORING OF LANDINGS
18. MEASURES TO REDUCE GEAR IMPACT ON EFH

Len Elich
20 Hay Road
Little Egg Harbor 08087

Len Elich

Jose
2/11/08

ORAL COMMENTS ON THE PUBLIC HEARING DOCUMENT
AMENDMENT 1 TO THE TILEFISH FMP
HISTORIC TILEFISH COALITION
JANUARY 30, 2008

Thank you for the opportunity to provide comments to the Council.
My name is Carl Bjornberg and I am a part of the Historic Tilefish Coalition.

We are tilefish fishermen, many from southern NJ, and even some who developed the Mid-Atlantic tilefish fishery through the mid-1980s. The fishermen in this coalition participated in the development of the FMP and were an active part of the negotiation that set the original tiered permit system with the understanding that this would be revisited during Amendment 1. Several members of this coalition have either Full-Time Tier II or Part-Time Category permits.

We have the following positions on Amendment 1 issues:

1. IFQ ALLOCATION

We support development of a comprehensive IFQ program for all permitted participants.

We support an IFQ program that maximizes the sharing of this resource by recognizing historic participation and does not reward excessive shares to any one category or any one participant or any one group of participants in a limited geographic area.

We support OPTION 1D4 for Full-time Tier II participants.

We support OPTION 1D4 for Part-Time participants.

We support status quo for the Incidental category.

We also have a very strong position regarding the overall allocation of this public resource.

We request the Council reconsider the overall allocation structure based on our understanding when the FMP was first adopted that a new permit structure would be considered, and based on the requirements for fairness and recognition of historic participation in the Magnuson Act, and based on the Act's new ITQ requirements related to excessive shares and excessive geographic consolidation.

We request –
(1) The Council reconsider the data period to be 1984 through 1998; and
(2) The Council adjust the overall IFQ allocation as follows:

Full-Time Tier I	50% of the TAL
Full Time Tier II	22% of the TAL
Part-Time Category	28% of the TAL

2. PERMANENT TRANSFERABILITY
We support OPTION 2C -- the preferred alternative to allow transfers among IFQ share holders during the first 5 years and other individuals after that. We urge the Council to clarify that in the case of the sale of a vessel in the first 5 years, that the permit and IFQ shares also permanently transfer to the new vessel owner.

3. ANNUAL LEASING
We support OPTION 3C – whereby only tilefish IFQ shareholders would be permitted to lease annual IFQ allocations during the first 5 years and other individuals after that. We believe this will help the fishery stabilize during the initial period.

4. IFQ SHARE ACCUMULATION
We oppose all current options contained in the pubic hearing document because they are not fair and because they do not meet the new limited access requirements in the Magnuson Act.

The least restrictive OPTION 4E still awards excessive shares (66% of the total harvest) for the few individuals in the Full-Time Tier I Category. We cannot support this allocation scheme.

We recommend the Council consider an alternative that specifies BOTH INDIVIDUAL AND CATEGORY SHARE CAPS.

The Council should adopt an Individual Share Cap at 12.5% of the TAL.

The Council should adopt Category Share Caps as follows:

Full-Time Tier I	50% of the TAL
Full Time Tier II	22% of the TAL
Part-Time Category	28% of the TAL

6. FEES AND COST RECOVERY
We support OPTION 6C to pay fees through a federally permitted dealer.

10. LOG BOOKS
We support OPTION 10A to maintain the status quo. However, we also encourage the Council to work with NMFS and the industry to develop electronic logbook reporting for future consideration in the fishery.

WE SUPPORT THESE PREFERRED ALTERNATIVES:

5. COMMERCIAL TRIP LIMITS
7. IFQ PROGRAM REVIEW
8. IFQ REPORTING
9. IVR REPORTING
12. RECREATIONAL REPORTING
13. RECREATIONAL BAG LIMITS

15. FRAMEWORK ADJUSTMENT PROCESS
16.EFH DESIGNATION
17. HAPC DESIGNATION
19. MANAGEMENT MEASURES FOR COLLECTING ROYALITIES

WE SUPPORT THESE NO ACTION ALTERNATIVES:
11. HOOK SIZE
14. IMPROVE MONITORING OF LANDINGS
18. MEASURES TO REDUCE GEAR IMPACT ON EFH

Carl G. Bjornberg Jr.
Captain/ Owner
C. Bjornberg, Inc.
F/V Bjorn II
P.O. Box 784
#3 E 15th St.
Barnegat Light, NJ
08006-0784
Ph# (609) 361-9687
Fax (609) 361-1636
February 7, 2008

Attention: Daniel T. Furlong
Mid-Atlantic Fishery Management Council

Dear Mr. Furlong,

My name is Carl Bjornberg owner/ operator of the F/V Bjorn II out of Barnegat Light, NJ. After serving in the U.S Navy aboard the aircraft carrier U.S.S. Kitty Hawk for six years I came back to my hometown of Barnegat Light and started tile fishing with Nelson 'Hammer' Beideman and Jimmy Vogel on the F/V Barbara Lee. This was the beginning of my tile fishing career.

From 1984 to the mid 1990's I strictly tile fished. My first boat the F/V Bjorn was a 46' fiberglass boat. It soon became apparent that it was not appropriate in size and strength (for fishing offshore) so I had a $750,000.00 steel 77' foot boat built by Miller Marine in Virginia in 1989. By the mid 1990's the tile fish caught were becoming smaller and the majority of the catch were small (4 lbs and under). The fish were not able to mature at this point to a sustainable population. It was at this time I decided to back off the tile fish in a conservation measure until I saw that the population recovered somewhat to a larger size.
Although I chose to back off from the tile fish other boats continued to pummel the remaining stock relentlessly (double crewing) without regard to protecting their future by using conservation methods. Little did we know their agenda was to accumulate landings and start a process to protect their "unfair" share. Then, these same boats get rewarded for their over fishing by being given the largest share of the quota. For 9 years they have continued to fish at a greater rate than when they had no restrictions. It is time that a more intense focus is placed on the lopsidedness of this tier system. While I, who made an attempt to do the right thing was placed in tier 2 to battle it out with a failing "gentleman's agreement" between three boats. But that was just a pipe dream. All it took was for one boat to ruin such an agreement and that is exactly what happened. So now we are derby fishing. That is not what we wanted but that is what we are forced into doing! Apparently this is the only way, in order to survive in this fishery. At this rate tier 2 will be shut down by May, maybe sooner. **This is called conservation at its finest.**

I look forward to an IFQ system so we can fish the tile fish fishery at any time during the year in regard to not flooding the market which in turn drives the price down, and putting extreme pressure on the tile population. When we can be assured of our individual quota each boat doesn't need to worry if the others in the tier will steal their share.

I was a full time tile fisherman and my landings from 1988 to 1998 will prove that that I was a contender. I had 33.8% of the tier 2 landings. I feel that the TOTAL poundage should be shared equally. There are only 30 permits in this fishery. This is a small fishery, why should only a few prosper (3 of 30), while others who have done the right thing are penalized.

Cordially,
Carl Bjornberg
Carl 'Bo' Bjornberg Jr.
F/V Bjorn II standing by

February 11, 2008

Daniel T. Furlong
Executive Director
MAFMC
300 South New Street, Room 2115
Dover, DE 19904
via facsimile 302.674.5399

<u>RE: COMMENTS ON THE PUBLIC HEARING DOCUMENT AMENDMENT 1 TO THE TILEFISH FMP</u>

Dear Dan:

Please accept these comments on the Amendment 1 Public Hearing Document to the Tilefish FMP from the HISTORIC TILEFISH COALITION (HTC). This group is comprised of tilefish fishermen, many from southern NJ, who developed the Mid-Atlantic tilefish fishery through the mid-1980s. Many of these participants continue to harvest tilefish to present day. The fishermen in this coalition participated in the development of the FMP and were an active part of the negotiation that set the original tiered permit system with the understanding that this would be revisited during Amendment 1. Several members of the HTC have either Full-Time Tier II or Part-Time Category permits.

The HTC appreciates the opportunity to provide the MAFMC with the following comments on the proposed alternatives contained in Amendment 1:

<u>1. IFQ ALLOCATION</u>
We support development of a comprehensive IFQ program that is as fair as possible for the majority of permitted participants – both current and historic.

<u>For Full-time Tier II participants we support OPTION 1D4</u>. This option is the fairest and rewards historic participants and those historic fishermen that maintained an active, recent interest in tilefish, as well as those fishermen that focused on tilefish primarily post-plan implementation.

<u>For Part Time participants we support OPTION 1D4</u>. The OPTION 1D2A is being supported by some in this permit category. We do not support this option because it is not equitable for most participants and rewards only speculative participation. For example, under 1D2A a fisherman that never landed a single pound of tilefish during 1988-1998 would be disproportionately rewarded under this alternative for landings achieved mostly post plan implementation.

<u>For Incidental participants we support STATUS QUO</u>.

Since we have no Full-time Tier I participants in our coalition we do not have a position on the option best suited for that category.

However, we have a very adamant position regarding the overall allocation of this resource. We strongly and respectfully request the Council reconsider the overall allocation structure based on the HTC's understanding that when the FMP was first adopted that the permit system would be revisited.

We also believe that if the Council stays on the current course it will be in jeopardy of violating National Standards 4 and 8 and especially the new LAPP requirements contained in the Magnuson-Stevens Act that were NOT mandatory when the FMP and current permit structure was first adopted.

The Council should take note that the NOAA Supplemental Administrative Record on tilefish contains the following language that is contained in the FMP Section 1.2.1.7:

> Additional language supported by the industry was incorporated in the FMP. It reflected that when the tilefish fishery is rebuilt or at the end of the 10-year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered.

Recognizing that a sitting Council is not technically bound to the actions of a prior Council, we still consider a deal to be a deal and the HTC only agreed to the original permit system because we fully expected to revisit it using the data from the time period specified in the FMP.

This is more critical now post-MSA reauthorization with an entire new slate of LAPP provisions. The council recognizes this and will have to deal with these new requirements regardless of the size of the fishery or number of participants.

On June 27, 2007, the Department of Justice formally contacted the NMFS regarding MSA guidance and standards to ensure that operators do not acquire excessive fisheries shares. On September 14, 2007, Assistant Administrator Dr. William Hogarth contacted NJ Congressman James Saxton to assure him that National Standard 4 and new Limited Access Privilege Programs (LAPP) provisions would apply. Copies of this correspondence were provided to the Council previously and we submit them again as part of our written comments. *See attachments.*

Based on all of these concerns, we request –

(1) The Council reconsider the data period to be 1984 through 1998; and
(2) The Council adjusts the initial overall IFQ allocation as follows:

Full-Time Tier I	50% of the TAL
Full Time Tier II	22% of the TAL
Part-Time Category	28% of the TAL

The members of the HTC firmly believe this allocation structure is fair and prevents excessive geographic and other consolidation in harvesting or processing and ensures that IFQ shareholders do not acquire an excessive share or inequitable concentration of privileges as clearly specified under Magnuson Section 303(A), and (B), and (D), and National Standard 4. Furthermore, we believe this allocation structure should mitigate concerns regarding federal anti-trust laws that now clearly apply to new LAPP amendments.

We recommend the Council take a proactive approach by ensuring that no more than 50% (not 66%!) of the entire East Coast tilefish harvest is harvested by 3 or 4 closely related individuals whose entire catch is marketed by essentially one entity at Fulton Fish Market. This is a very real concern for all fishermen from other permit categories since the Council even recognizes the existing, elevated cooperation between the Full-Time Tier I participants who are said to currently have a "cooperative understanding" *(See Public Hearing document page 2)*. Clearly, the Council must act to protect all fishermen and the public with fair access to this resource.

2. PERMANENT TRANSFERABILITY

We support OPTION 2C – the preferred alternative to allow transfers among IFQ share holders during the first 5 years and other individuals after that. However, we recommend the Council clarify that in the case of the sale of a vessel in the first 5 years that the permit and IFA shares also permanently transfer to the new vessel owner.

3. ANNUAL LEASING

We support OPTION 3C – whereby only tilefish IFQ shareholders would be permitted to lease annual IFQ allocations during the first 5 years and other individuals after that. We believe this will help the fishery stabilize during the initial period.

4. IFQ SHARE ACCUMULATION

We oppose all current options contained in the pubic hearing document because they do not meet the new limited access requirements in the Magnuson Act. In fact, the least restrictive OPTION 4E still represents excessive shares (66% of the TAL) for individuals in the Full-Time Tier I Category. We cannot abide this allocation scheme.

The Council's Public Hearing document even states on page 18 that "…concentration of shares in the hands of a relatively small number of individuals or entities could also lead to excessive market power for just a few entities. The concentration of market power could affect working conditions, process, and wages paid to crew, and could potentially harm participants in the fishery."

We wholeheartedly concur with the Council's concerns and recommend the Council consider an alternative that specifies individual share cap. As such, we recommend the Council should adopt an Individual Share Cap at 12.5%.

5. COMMERCIAL TRIP LIMITS

We support OPTION 5A – No action, preferred alternative to maintain status quo.

6. FEES AND COST RECOVERY

We support OPTION 6C – whereby the IFQ shareholder pays via a federally permitted dealer. We believe this will be the simplest and most cost effective process to implement this program. The necessary fees can easily be collected dockside and since there are relatively few permitted dealers, the amount of agency paperwork should be minimized which should reduce program administration costs.

7. IFQ PROGRAM REVIEW

We support OPTION 7B – The preferred alternative to allow for a formal and detailed review of the IFQ program 5 years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every 7 years).

8. IFQ REPORTING

We support OPTION 8B – the preferred alternative for facilitation of an IFQ system administration. This option will help ensure that amounts of tilefish landed and prices are properly recorded and match IVR data to dealer data at the trip level.

9. IVR REPORTING

We support OPTION 9B – the preferred alternative whereby the owner or operator of any vessel issues a limited access permit for tilefish must submit a tilefish catch report via the IVR system within 48 hours after offloading fish.

10. LOG BOOKS

We support OPTION 10A to maintain the status quo. However, we also encourage the Council to work with NMFS and the industry to develop electronic logbook reporting for future consideration in the fishery. Currently, several vessels are working with NMFS using experimental logbooks to determine their usefulness. It would be very helpful to have a CPUE using number of hooks soaked per time to monitor catch rate. Electronic logbooks may well reduce costs to manage this fishery. By making electronic logbooks a consideration under the research program the Council would be supporting industry efforts in this regard.

11. HOOK SIZE

We support taking NO ACTION until such time that sufficient data are available to make a reasoned determination about effective hook size. We encourage the Council to add hook size to the list of potential areas of research.

12. RECREATIONAL REPORTING

We support OPTION 12B – the preferred alternative to establish a party/charter tilefish vessel permit -- operator permit -- and reporting requirements. This will allow for data collection from a sector that is largely unknown.

13. RECREATIONAL BAG LIMITS
We support OPTION 13A – the preferred alternative for NO ACTION to maintain the status quo and not require a recreational bag limit. However, we encourage the Council in the future to closely examine the data collected in NUMBER 12 "RECREATIONAL REPORTING" to determine if a bag/size limit is necessary and what that limit should be. If required, the Council should move quickly, utilizing the Framework amendment process to implement the bag/size limit.

14. IMPROVE MONITORING OF LANDINGS
We support OPTION 14A – The NO ACTION alternative regarding the catch and reporting of tilefish. Some HTC fishermen feel that the other alternatives might cause an added imposition and safety issue if a vessel captain wishes to land his trip in a different management area from where he began his trip.

15. FRAMEWORK ADJUSTMENT PROCESS
We support OPTION 15B – The preferred alternative to expand the list of management measures that may be added or modified via the Framework process. This would include recreational measures and measures to facilitate the periodic review of the IFQ program.

16.EFH DESIGNATION
We support OPTION 16B – the preferred alternative that would modify the current tilefish EFH designated area, and would more accurately define the EFH for tilefish.

17. HAPC DESIGNATION
We support Option 17C – the preferred alternative that would designate portions of four canyons (Norfolk, Veatch, Lydonia, & Oceanographer canyons) as tilefish HAPC. However, we remain concerned that this is still a relatively broad designation and that the Council must ensure that the HAPC accurately reflects where tilefish burrows actually exist, not where we 'think' they may exist.

18. MEASURES TO REDUCE GEAR IMPACT ON EFH
We support OPTION 18A – The NO ACTION alternative that would not create GRAs in the tilefish EFH area. We also want to state for the record that in the future, the Council must use the best scientific information available to determine impacts of mobile gear on tilefish habitat. For MAFMC staff edification we note that Dr. Ken Able of Rutger's University used submersible gear to closely examine the before/after impacts of mobile gear on tilefish burrows. That information should be part of the deliberations if the MAFMC considers future actions to manage gear impacts on tilefish EFH/HAPC.

19. MANAGEMENT MEASURES FOR COLLECTING ROYALITIES
We support 19A – the preferred alternative for NO ACTION. The collection of royalties would only add additional financial burdens upon the IFQ shareholders. Royalties would

be fees beyond the IFQ cost recovery program. The IFQ cost recovery fees, which are authorized under section 304(d)(2)(A) of the Magnuson-Stevens Act, shall not exceed 3% of the ex-vessel value of the fish landed, and are intended to recover the costs associated with the IFQ programs.

Thank you for the opportunity to comment on Tilefish Amendment 1 Public hearing Document. We look forward to working with the MAFMC to ensure that the developing new IFQ program is consistent with the new LAPP requirements contained in the MSA.

Respectfully submitted (with attachments) for the owners/captains/crew of the vessels in the Historic Tilefish Coalition:

Jim Kendall
Jim Kendall
New Bedford Seafood Coalition
New Bedford, MA

Rick E. Marks, Principal
Robertson, Monagle & Eastaugh
Arlington, VA

JIM SAXTON
THIRD DISTRICT, NEW JERSEY
WWW.HOUSE.GOV/SAXTON
JOINT ECONOMIC COMMITTEE
RANKING MEMBER
NATURAL RESOURCES COMMITTEE
SUBCOMMITTEE:
FISHERIES, WILDLIFE AND OCEANS

ARMED SERVICES COMMITTEE
SUBCOMMITTEES:
AIR AND LAND FORCES
RANKING MEMBER
TERRORISM, UNCONVENTIONAL THREATS AND CAPABILITIES

U.S. House of Representatives
Washington, DC 20515

June 27, 2007

Thomas O. Barrett
Assistant Attorney General
Main Justice Building
950 Pennsylvania Avenue, N.W.
Room 3109
Washington, D.C. 20530
via facsimile 202.616.2645

COPY

Dear Mr. Barrett:

I am writing to respectfully request guidance from your office to regarding potential antitrust, geographic concentration and allocation consolidation issues under a federal fisheries management plan amendment currently being developed in the Mid-Atlantic region. The Mid-Atlantic Fisheries Management Council (MAFMC) is in the process of crafting Amendment 1 to the Tilefish Fishery Management Plan (hereafter "AM#1"). The amendment is being developed to institute a formal Limited Access Privilege Program (LAPP) for the tilefish fishery. The MSA LAPP process requires consideration of both current and historic fishing participation by fishermen in various communities. The tilefish fishery was developed by fishermen from the State of New Jersey in the 70s and 80s and shifted to the State of New York in 1987. I am concerned the Council's initial allocation of shares in this fishery may vest a large proportion – in excess of 65 percent of the East Coast tilefish fishery – to a small number of operators and shore-side facilities and gives inadequate weight to historical participation in the fishery.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) was recently reauthorized (P.L. 109-479) with substantial changes to Section 303A titled "Limited Access Privilege Programs" (See 16 U.S.C. 1853a). Several MSA provisions are intended to prevent excessive consolidation and anti-competitive activities, and promote social and economic benefits in small communities.

Specifically, Section 303.A(5)(B) and (D) contain requirements to prevent excessive geographic and other consolidation in harvesting or processing and ensuring that LAPP share holders do not acquire an excessive or inequitable concentration of fishing privileges. The Act retains the application of anti-trust laws to prevent unfair methods of competition.

Based on the new LAPP requirements in the law, I am asking for your formal guidance on these issues in AM#1 before the Council commits to a course of action. I also want to ensure that you understand I am not asking for confidential business/ownership information or for such information to be made public.

Rather, I respectfully request your office examine the facts and provide guidance so the National Oceanic and Atmospheric Administration and the MAFMC do not adopt a LAPP that is inconsistent with MSA and antitrust law.

Thank you in advance for your assistance with this critical issue and I look forward to your timely response. Please do not hesitate to contact my staff should you have any additional questions.

Sincerely,

Jim Saxton

Jim Saxton
Member of Congress

U. S. Department of Justice

Office of Legislative Affairs

Office of the Assistant Attorney General

Washington, D.C. 20530

September 4, 2007

The Honorable Jim Saxton
U.S. House of Representatives
Washington, DC 20515

COPY

Dear Congressman Saxton:

This responds to your letter, dated June 27, 2007, to the Department of Justice regarding a federal fisheries management plan amendment currently being developed by the Mid-Atlantic Fishery Management Council for implementation by the Department of Commerce. You have expressed concerns that the amendment may assign a large proportion of tilefish fishery shares to a small number of operators and have requested that the Department of Justice provide formal guidance with respect to this concern.

The Department appreciates having the benefit of your perspective on this matter. The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 empowers the Fishery Management Councils to develop standards under Limited Access Privilege (LAP) programs to ensure that operators do not acquire excessive fisheries shares. The Department has provided, and will continue to provide, guidance on competition issues to the National Marine Fisheries Service (NMFS) as it develops standards for determining excessive shares to ensure these standards are consistent with the goals of competition. We also have referred your letter to the Office of Sustainable Fisheries of the NMFS, in the Department of Commerce, which is developing guidance on the implementation of these standards for LAP programs. A copy of our referral letter is enclosed.

Please do not hesitate to contact this office if we can be of further assistance with this or any other matter.

Sincerely,

Brian A. Benczkowski
Principal Deputy Assistant Attorney General

Enclosure

U. S. Department of Justice

Office of Intergovernmental and Public Liaison

950 Pennsylvania Avenue, N.W., Room 1629 (202) 514-3465
Washington, D.C. 20530

September 4, 2007

COPY

William T. Hogarth
Assistant Administrator for Fisheries
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20910

Dear Dr. Hogarth:

Enclosed is a letter from Congressman Jim Saxton regarding development of Limited Access Privilege Program standards to ensure that fisheries operators do not acquire excessive fisheries shares. Since these standards are implemented by your agency, we are referring the letter to you for consideration. We have advised Congressman Saxton of this referral.

Thank you for your cooperation.

Sincerely,

Jennifer Korn
Director

Enclosure

José
2/11/08

February 11, 2008

Daniel T. Furlong
Executive Director
MAFMC
300 South New Street, Room 2115
Dover, DE 19904
via facsimile 302.674.5399

RE: COMMENTS ON THE PUBLIC HEARING DOCUMENT AMENDMENT 1 TO THE TILEFISH FMP

Dear Dan:

Please accept these comments on the Amendment 1 Public Hearing Document to the Tilefish FMP from the HISTORIC TILEFISH COALITION (HTC). This group is comprised of tilefish fishermen, many from southern NJ, who developed the Mid-Atlantic tilefish fishery through the mid-1980s. Many of these participants continue to harvest tilefish to present day. The fishermen in this coalition participated in the development of the FMP and were an active part of the negotiation that set the original tiered permit system with the understanding that this would be revisited during Amendment 1. Several members of the HTC have either Full-Time Tier II or Part-Time Category permits.

The HTC appreciates the opportunity to provide the MAFMC with the following comments on the proposed alternatives contained in Amendment 1:

1. IFQ ALLOCATION

We support development of a comprehensive IFQ program that is as fair as possible for the majority of permitted participants -- both current and historic.

For Full-time Tier II participants we support OPTION 1D4. This option is the fairest and rewards historic participants and those historic fishermen that maintained an active, recent interest in tilefish, as well as those fishermen that focused on tilefish primarily post-plan implementation.

For Part Time participants we support OPTION 1D4. The OPTION 1D2A is being supported by some in this permit category. We do not support this option because it is not equitable for most participants and rewards only speculative participation. For example, under 1D2A a fisherman that never landed a single pound of tilefish during 1988-1998 would be disproportionately rewarded under this alternative for landings achieved mostly post plan implementation.

For Incidental participants we support STATUS QUO.

Since we have no Full-time Tier I participants in our coalition we do not have a position on the option best suited for that category.

However, we have a very adamant position regarding the overall allocation of this resource. We strongly and respectfully request the Council reconsider the overall allocation structure based on the HTC's understanding that when the FMP was first adopted that the permit system would be revisited.

We also believe that if the Council stays on the current course it will be in jeopardy of violating National Standards 4 and 8 and especially the new LAPP requirements contained in the Magnuson-Stevens Act that were NOT mandatory when the FMP and current permit structure was first adopted.

The Council should take note that the NOAA Supplemental Administrative Record on tilefish contains the following language that is contained in the FMP Section 1.2.1.7:

> Additional language supported by the industry was incorporated in the FMP. It reflected that when the tilefish fishery is rebuilt or at the end of the 10-year rebuilding period, whichever occurs first, the Council shall seek an amendment to the limited entry program of the FMP to implement a revised limited entry system utilizing 1984 through 1998 landings data as the formal qualifying period for entry. For the purposes of all future tilefish FMP amendments, only landings between 1984 and 1998 will be considered.

Recognizing that a sitting Council is not technically bound to the actions of a prior Council, we still consider a deal to be a deal and the HTC only agreed to the original permit system because we fully expected to revisit it using the data from the time period specified in the FMP.

This is more critical now post-MSA reauthorization with an entire new slate of LAPP provisions. The council recognizes this and will have to deal with these new requirements regardless of the size of the fishery or number of participants.

On June 27, 2007, the Department of Justice formally contacted the NMFS regarding MSA guidance and standards to ensure that operators do not acquire excessive fisheries shares. On September 14, 2007, Assistant Administrator Dr. William Hogarth contacted NJ Congressman James Saxton to assure him that National Standard 4 and new Limited Access Privilege Programs (LAPP) provisions would apply. Copies of this correspondence were provided to the Council previously and we submit them again as part of our written comments. *See attachments.*

Based on all of these concerns, we request –

(1) The Council reconsider the data period to be 1984 through 1998; and
(2) The Council adjusts the initial overall IFQ allocation as follows:

Full-Time Tier I	50% of the TAL
Full Time Tier II	22% of the TAL
Part-Time Category	28% of the TAL

The members of the HTC firmly believe this allocation structure is fair and prevents excessive geographic and other consolidation in harvesting or processing and ensures that IFQ shareholders do not acquire an excessive share or inequitable concentration of privileges as clearly specified under Magnuson Section 303(A), and (B), and (D), and National Standard 4. Furthermore, we believe this allocation structure should mitigate concerns regarding federal anti-trust laws that now clearly apply to new LAPP amendments.

We recommend the Council take a proactive approach by ensuring that no more than 50% (not 66%!) of the entire East Coast tilefish harvest is harvested by 3 or 4 closely related individuals whose entire catch is marketed by essentially one entity at Fulton Fish Market. This is a very real concern for all fishermen from other permit categories since the Council even recognizes the existing, elevated cooperation between the Full-Time Tier I participants who are said to currently have a "cooperative understanding" *(See Public Hearing document page 2).* Clearly, the Council must act to protect all fishermen and the public with fair access to this resource.

2. PERMANENT TRANSFERABILITY

We support OPTION 2C – the preferred alternative to allow transfers among IFQ share holders during the first 5 years and other individuals after that. However, we recommend the Council clarify that in the case of the sale of a vessel in the first 5 years that the permit and IFA shares also permanently transfer to the new vessel owner.

3. ANNUAL LEASING

We support OPTION 3C – whereby only tilefish IFQ shareholders would be permitted to lease annual IFQ allocations during the first 5 years and other individuals after that. We believe this will help the fishery stabilize during the initial period.

4. IFQ SHARE ACCUMULATION

We oppose all current options contained in the pubic hearing document because they do not meet the new limited access requirements in the Magnuson Act. In fact, the least restrictive OPTION 4E still represents excessive shares (66% of the TAL) for individuals in the Full-Time Tier I Category. We cannot abide this allocation scheme.

The Council's Public Hearing document even states on page 18 that "...concentration of shares in the hands of a relatively small number of individuals or entities could also lead to excessive market power for just a few entities. The concentration of market power could affect working conditions, process, and wages paid to crew, and could potentially harm participants in the fishery."

We wholeheartedly concur with the Council's concerns and recommend the Council consider an alternative that specifies individual share cap. As such, we recommend the Council should adopt an Individual Share Cap at 12.5%.

5. COMMERCIAL TRIP LIMITS

We support OPTION 5A – No action, preferred alternative to maintain status quo.

6. FEES AND COST RECOVERY

We support OPTION 6C – whereby the IFQ shareholder pays via a federally permitted dealer. We believe this will be the simplest and most cost effective process to implement this program. The necessary fees can easily be collected dockside and since there are relatively few permitted dealers, the amount of agency paperwork should be minimized which should reduce program administration costs.

7. IFQ PROGRAM REVIEW

We support OPTION 7B – The preferred alternative to allow for a formal and detailed review of the IFQ program 5 years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequently than once every 7 years).

8. IFQ REPORTING

We support OPTION 8B – the preferred alternative for facilitation of an IFQ system administration. This option will help ensure that amounts of tilefish landed and prices are properly recorded and match IVR data to dealer data at the trip level.

9. IVR REPORTING

We support OPTION 9B – the preferred alternative whereby the owner or operator of any vessel issues a limited access permit for tilefish must submit a tilefish catch report via the IVR system within 48 hours after offloading fish.

10. LOG BOOKS

We support OPTION 10A to maintain the status quo. However, we also encourage the Council to work with NMFS and the industry to develop electronic logbook reporting for future consideration in the fishery. Currently, several vessels are working with NMFS using experimental logbooks to determine their usefulness. It would be very helpful to have a CPUE using number of hooks soaked per time to monitor catch rate. Electronic logbooks may well reduce costs to manage this fishery. By making electronic logbooks a consideration under the research program the Council would be supporting industry efforts in this regard.

11. HOOK SIZE

We support taking NO ACTION until such time that sufficient data are available to make a reasoned determination about effective hook size. We encourage the Council to add hook size to the list of potential areas of research.

12. RECREATIONAL REPORTING

We support OPTION 12B – the preferred alternative to establish a party/charter tilefish vessel permit -- operator permit -- and reporting requirements. This will allow for data collection from a sector that is largely unknown.

13. RECREATIONAL BAG LIMITS
We support OPTION 13A – the preferred alternative for NO ACTION to maintain the status quo and not require a recreational bag limit. However, we encourage the Council in the future to closely examine the data collected in NUMBER 12 "RECREATIONAL REPORTING" to determine if a bag/size limit is necessary and what that limit should be. If required, the Council should move quickly, utilizing the Framework amendment process to implement the bag/size limit.

14. IMPROVE MONITORING OF LANDINGS
We support OPTION 14A – The NO ACTION alternative regarding the catch and reporting of tilefish. Some HTC fishermen feel that the other alternatives might cause an added imposition and safety issue if a vessel captain wishes to land his trip in a different management area from where he began his trip.

15. FRAMEWORK ADJUSTMENT PROCESS
We support OPTION 15B – The preferred alternative to expand the list of management measures that may be added or modified via the Framework process. This would include recreational measures and measures to facilitate the periodic review of the IFQ program.

16.EFH DESIGNATION
We support OPTION 16B – the preferred alternative that would modify the current tilefish EFH designated area, and would more accurately define the EFH for tilefish.

17. HAPC DESIGNATION
We support Option 17C – the preferred alternative that would designate portions of four canyons (Norfolk, Veatch, Lydonia, & Oceanographer canyons) as tilefish HAPC. However, we remain concerned that this is still a relatively broad designation and that the Council must ensure that the HAPC accurately reflects where tilefish burrows actually exist, not where we 'think' they may exist.

18. MEASURES TO REDUCE GEAR IMPACT ON EFH
We support OPTION 18A – The NO ACTION alternative that would not create GRAs in the tilefish EFH area. We also want to state for the record that in the future, the Council must use the best scientific information available to determine impacts of mobile gear on tilefish habitat. For MAFMC staff edification we note that Dr. Ken Able of Rutger's University used submersible gear to closely examine the before/after impacts of mobile gear on tilefish burrows. That information should be part of the deliberations if the MAFMC considers future actions to manage gear impacts on tilefish EFH/HAPC.

19. MANAGEMENT MEASURES FOR COLLECTING ROYALITIES
We support 19A – the preferred alternative for NO ACTION. The collection of royalties would only add additional financial burdens upon the IFQ shareholders. Royalties would

be fees beyond the IFQ cost recovery program. The IFQ cost recovery fees, which are authorized under section 304(d)(2)(A) of the Magnuson-Stevens Act, shall not exceed 3% of the ex-vessel value of the fish landed, and are intended to recover the costs associated with the IFQ programs.

Thank you for the opportunity to comment on Tilefish Amendment 1 Public hearing Document. We look forward to working with the MAFMC to ensure that the developing new IFQ program is consistent with the new LAPP requirements contained in the MSA.

Respectfully submitted (with attachments) by the owners/captains/crew of the following vessels in the Historic Tilefish Coalition:

Robert Maxwell, F/V Spoopy II – Owner
Keith Heinrichs, F/V Kennedy Helen – Owner
Eric Lundvall, F/V Rayna & Kerstin – Owner
Carl Bjornberg, F/V Bjorn II – Owner
Mike Green, F/V Provider III, F/V Gipper – Owner
Phil Ruhle, F/V Sea Breeze, - Owner
Dwight Koyman, F/V Sea Hawk – Owner
Donald Roebuck, F/V Margret Holley – Owner
John Larson; F/V Ms. Manya, F/V Karen L, F/V Lucky Thirteen - Owner
Louis Puskas, F/V Olympic Javelin – Owner
Jim Murray, F/V Karen L – Captain
Paul Puskas, F/V Olympic Javelin – Captain
Len Elich, F/V Lucky Thirteen – Captain
Peter Dolan, F/V Ms. Manya – Captain
Keith Larson, F/V Ms. Manya, F/V Karen L, F/V Lucky Thirteen – Fleet Engineer

F/V RAYNA & KERSTIN

400 Wood St.
Little Egg Harbor, New Jersey 08087
(609) 618-5360
Capt.lars@verizon.net
Fax(609)812-0184

February 11, 2008

TILEFISH 1 COMMENTS
Daniel T. Furlong
Mid-Atlantic Fisheries Management Council
Room 2115 Federal Building
300 South New Street
Dover, Delaware 19904-6790

Dear Mr. Furlong and members of the Mid-Atlantic Council,

My name is Eric Lundvall . I am the owner of the F/V Rayna & Kerstin, Barnegat Light, New Jersey. My vessel holds a limited access part-time tilefish permit (permit # 310898).
I am part of the Historic Tilefish Coalition and agree with all of their comments on this amendment.

I strongly oppose any alternatives that would use recent landings from 1998 to date, which would include alternative 1D2, 1D2A, 1D3 and 1D3A. An ITQ based on the fore mentioned alternatives would reward ~~only those who had decided to " race to fish" on an over fished resource with the intention to gain a future~~ larger allocation for themselves by means of eliminating historical participants in the tilefish fishery.

The Tilefish Fishery Management Plan states: " It is important to note that the current Mid-Atlantic Council's policy is that landings after 1998 will not assure future access to or an allocation of the tilefish resource. The purpose of this policy is to prevent a rush to fish on this over fished resource, in the hopes of obtaining a larger future allocation."

Allocation alternative 1D4, an equal allocation would in my opinion be the most equitable choice for ~~participants in the part-time category and full-time tier II category~~.

To eliminate historical participants using the more recent post Tilefish FMP qualification period years would eliminate more than 2/3 of the part-time tilefish category (alternative 1D2 and 1D2A). These alternatives are supported and driven by pure greed of a small percentage of the participants and should not be considered.. It is difficult for me to imagine that a pioneer of the tilefish fishery, Capt. Lou Puskas and his vessel Olympic Javelin would lose their permit because of the approximately six part time permit holders supporting alternative 1D2A

My opinion is the same for Full Time Tier II, evidently one permit holder attempting to eliminate the other ~~four Tier 2 vessels with more recent landings from small over fished tilefish.~~ , ~~which the other permit~~ holders chose not to pursue untill the stocks had recovered and matured.

I have a very strong position regarding the overall allocation of this public resource. The Council should reconsider the data period to be 1984 through 1998; and adjust the overall IFQ allocations as follows: FULL -TIME TIER I 50% of the TAL, FULL -TIME TIER II 22% of the TAL and PART-TIME CATEGORY 28% of the TAL. This would be more in line with the Magnuson Act's new ITQ requirements related to excessive shares and excessive geographic consolidation.

My vessel counts on every one of the limited access permits that it holds to survive . I purchased that permit in September 2006 for $150,000. Uncertainty in the general category scallop fishery that I have been participating in played a big part in the decicion to buy that permit. Losing the tilefish permit not only would reduce the value of my veesel and permit , it would eliminate another fishery that I was planning (if there is such a thing in the fishing business) on to piece together a years pay for my family and crew.

~~Sincerely~~,

Eric L Lundvall

Eric L. Lundvall

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 16 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

The LightHouse Tilefish Group (LHTG) is a group of concerned, 3 tier, part time Tile fisherman. The group consists of: Tom Roth, Eric Svelling, Jim, Dan and Rick Mears. All five members own active fishing boats in the three tier permit category.

The LHTG supports the implementation of an IFQ.
LHTG supports transferability of ownership and quota share.
LHTG supports the equal distribution of 14.3% amongst the 7 most active permits as shown on table 37,1D2A.
LHTG opposes trip limits.

The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: JAMES D. MEARS

Address: 103 Temple Ave, Mountainside N.J. 08050

Phone #: 609-618-1757

additional comments:

Table 37. IFQ system options for full-time tier 1, full-time tier 2, and part-time permit holders[a]. Allocation percentages are the percentage of their group quota based on various landing histories and equal shares.

Alternative	1D1 Average Landings, 1988-1998	1D1A Equal % Based on 1D1	1D2 Average Landings, 2001-2005	1D2A Equal % Based on 1D2	1D3 Best 5 Years, 1997-2005	1D3A Equal % Based on 1D3	1D4 Equal Allocation
Qualifying Tier 1 Vessels							
1	14.3%	b	16.8%	b	15.5%	b	25%
2	23.2%	b	31.1%	b	30.0%	b	25%
3	32.2%	b	18.9%	b	24.5%	b	25%
4	30.3%	b	33.3%	b	30.0%	b	25%
Qualifying Tier 2 Vessels							
1	25.4%	b	0	0	1.9%	25%	20%
2	23.3%	b	94.6%	50%	75.0%	25%	20%
3	5.1%	b	0	0	0	0	20%
4	12.4%	b	0	0	11.4%	25%	20%
5	33.8%	b	5.4%	50%	11.6%	25%	20%
Qualifying Part-Time Vessels							
1	12.2%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
2	8.8%	6.3%	7.4%	14.3%	8.3%	8.3%	4.5%
3	2.7%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
4	7.5%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
5	26.8%	6.3%	0.0%	0.0%	4.0%	8.3%	4.5%
6	1.8%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
7	7.9%	6.3%	4.7%	14.3%	3.4%	8.3%	4.5%
8	5.8%	6.3%	0.0%	0.0%	10.9%	8.3%	4.5%
9	0.0%	0.0%	9.5%	14.3%	8.6%	8.3%	4.5%
10	0.0%	0.0%	40.2%	14.3%	29.0%	8.3%	4.5%
11	6.7%	6.3%	0.0%	0.0%	3.8%	8.3%	4.5%
12	0.0%	0.0%	21.5%	14.3%	15.6%	8.3%	4.5%
13	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%
14	3.7%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
15	0.0%	0.0%	3.5%	14.3%	2.6%	8.3%	4.5%
16	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%
17	1.7%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
18	4.6%	6.3%	0.0%	0.0%	0.9%	8.3%	4.5%
19	2.0%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
20	1.4%	6.3%	13.2%	14.3%	11.3%	8.3%	4.5%
21	2.4%	6.3%	0.0%	0.0%	0.0%	0.0%	4.5%
22	4.3%	6.3%	0.0%	0.0%	1.5%	8.3%	4.5%

[a]Maintain status quo quota management system for the incidental permit category.
[b]These allocation percentages would be the same as 1D4.
Source: Barbara Rountree (NMFS, NERO).

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 16 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

The LightHouse Tilefish Group (LHTG) is a group of concerned, 3 tier, part time Tile fisherman. The group consists of: Tom Roth, Eric Svelling, Jim, Dan and Rick Mears. All five members own active fishing boats in the three tier permit category.

The LHTG supports the implementation of an IFQ. LHTG supports transferability of ownership and quota share.

LHTG supports the equal distribution of 14.3% amongst the 7 most active permits as shown on table 37,1D2A.

LHTG opposes trip limits.

The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: GEORGE SVELLING

Address: 5 W 12th St BOX141 BARNEGAT LIGHT N.J 08006

Phone #: (609) 494-2653

additional comments:

Permit# 251671

I WORK ON FISHING VESSEL (GOGETTER)

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: JOHN B. PATTERSON JR

Address: POB #6, BARNEGAT LIGHT, N.J 08006

Phone #: 866.702.9500

additional comments: FISHING SHARES SHOULD BE BASED ON TIME FISHED IN THE PERMITTED CATEGORY, NOT JUST DUE TO HOLDING A PERMIT WHICH IS RARELY USED.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
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I support The LightHouse Tilefish Group:

Name: Eric Svelling

Address: P.O. BOX 956
BARNEGAT Light N.J. 08006

Phone #: 609-290-5231

additional comments: all the boats in tier III should receive a permit. The distribution of quota should go to the most active permits.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name:

Lee Lhota

Address:

780 C East Bay Ave
Manahawkin, NJ 08050

Phone #: 609-709-8393

additional comments:

I have worked on the Go Getter.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: Jordan LoPinto

Address: 128 Chestnut street Parkertown NJ, 08087

Phone #: (609) 442-0280

additional comments:

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name:
Anne Svelling
Address:
610 Green Ave., West Chester, PA 19380
Phone #:
additional comments:
These members are very professional fisherman who are passionate about this cause.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: Donald Milley

Address: 9 Collies Rd Box 63
Barnegat Light NJ 08006

Phone #: 609 4940123

additional comments:

As a deckhand on the F/V Gogetter I fully support the LHTG Donald Milley

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

The LightHouse Tilefish Group (LHTG) is a group of concerned, 3 tier, part time Tile fisherman. The group consists of: Tom Roth, Eric Svelling, Jim, Dan and Rick Mears. All five members own active fishing boats in the three tier permit category.

The LHTG supports the implementation of an IFQ.
LHTG supports transferability of ownership and quota share.
LHTG supports the equal distribution of 14.3% amongst the 7 most active permits as shown on table 37,1D2A.
LHTG opposes trip limits.

The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: TRISTAN FARINA , Triple T FAB.

Address: 27 ROBERT DR.
MANAHAWKIN NJ 08050

Phone #: (609) 597 - 5677

additional comments: I work on the FV Go Getter AnD other FV in BL.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

Dear Mr. Furlong,

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I support The LightHouse Tilefish Group:

Name: William J. Kunder

Address: 8 W. Mullica Rd Little Egg Harbor NJ 08087

Phone #: (609) 296-0313

additional comments:

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: Tom Roth - Thomas Roth

Address: 369 Beech Plains Rd
Buxton Me. 04093

Phone #:

additional comments: We Have come To depend on this ~~in~~ income. IT would be unfair not To be able To keep on doing so.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:
Name: JORGE ROCHA

Address:

Phone #: 609-892-6048
additional comments:

I WORK AT THE GOGETTE

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:
Name: Joan Moon

Address: 240 Broadturn Rd.
Scarborough Me 04074

Phone #: 207-885-5755
additional comments:

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 22 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

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I support The LightHouse Tilefish Group:

Name: Kelly Roth

Address: 369 Beech Plains Rd.
Buxton, Me. 04093

Phone #: 207-929-8618

additional comments:

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 22 2008
MID-ATLANTIC FISHERY COUNCIL

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I support The LightHouse Tilefish Group:

Name: John Roth [signature] 1/17/08

Address: 12 Salmon Falls Rd
Hollis ME 04042

Phone #: 914-325-1992

additional comments:

Jose

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 2 2 2008
MID-ATLANTIC FISHERY COUNCIL

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I support The LightHouse Tilefish Group:

Name: SAM RESCIGNO
Sam Rescigno

Address: 23 SOUTH UNION STREET
MANAHAWKIN N.J. 08050

Phone #: 609-978-0673

additional comments:

José

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 23 2008
MID-ATLANTIC FISHERY COUNCIL

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I support The LightHouse Tilefish Group:

Name: Edward Sulecki

Address: 1022 Whitecap Ave Manahawkin N.J. 08050

Phone #: (609) 597-3434

additional comments:
Barnegat Light Employee

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 24 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

The LightHouse Tilefish Group (LHTG) is a group of concerned, 3 tier, part time Tile fisherman. The group consists of: Tom Roth, Eric Svelling, Jim, Dan and Rick Mears. All five members own active fishing boats in the three tier permit category.

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The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: MATT DAY

Address: 603 GRANT Rd
SACO, ME 04072

Phone #: (207) 712-2726

additional comments:

José

RECEIVED
JAN 2 4 2008
MID ATLANTIC FISHERY COUNCIL

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: WinField Smith

Address: 1013 Vessel Ln
Manahawkin NJ 08050

Phone #: 609-713-1608

additional comments: I Am employed in Barnegat Light.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
FEB - 4 2008
MID-ATLANTIC FISHERY COUNCIL

José

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I support The LightHouse Tilefish Group:

Name: DoloRES SVELLING Dolores Svelling

Address: 5W 12 ST- PO BOX 141

Phone #: 609-494-2653

additional comments:

José

RECEIVED
FEB - 4 2008
MID-ATLANTIC FISHERY COUNCIL

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: Henry J. Ghigliotty

Address: 804 Bayview Ave. P.O. Bx 871
Barnegat Light, N.J. 08006

Phone #: 609-384-4141

additional comments:

These are hardworking young men and I am hoping that Mid-Atlantic Council will work for their best interest.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
FEB - 6 2008
MID-ATLANTIC FISHERY COUNCIL

José

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I support The LightHouse Tilefish Group:

Name: Bryan M. Masterson

Address: 87 Vincent ct
Little egg Harbor NJ. 08087

Phone #: (609) 812-5457

additional comments:
Crew Member F/V Frances Anne

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: Karen O'Reilly

Address: 27 Mizzen Dr.
Barnegat, NJ 08005

Phone #: 609-660-0684

additional comments: When making your decisions please keep in mind these men feed their families with their fishing. This isn't their sport. It's their only source of income. Maybe limit sport ~~fi~~ fishermen.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
FEB - 6 2008
MID-ATLANTIC FISHERY COUNCIL

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I support The LightHouse Tilefish Group:

Name: CHRIS KLEME

Address: 27 HAZLEW DRIVE BARNEGAT N.J. 08005

Phone #: HOME # (609) 666-0684 CELL # (609) 709-7043

additional comments:
I AM RICK MEARS BACK-UP CAPTAIN AND FIRST MATE I DEPEND AS DOES MY FAMILY ON THE WINTER, SPRING, TILEFISH SEASON IVE WORKED FOR RICK FOR 10 YEARS I DEPEND ON THIS FISHERY. THANK YOU

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

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I support The LightHouse Tilefish Group:

Name: Taryn O'Reilly

Address: 27 Mizzen Dr.
Barnegat, NJ 08005

Phone #: 609-660-0684

additional comments: please help my dad send me to college by supporting the above rules.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 2 8 2008
MID-ATLANTIC FISHERY COUNCIL

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I support The LightHouse Tilefish Group:

Name:
GARY R. MILLER Gary R Miller

Address:
2508 CENTRAL AVE,
BARNEGAT LIGHT, NEW JERSEY 08006

Phone #:
856 912 2967

additional comments:
I AM A NEIGHBOR OF ERIC SVELLING. HE IS ONE OF THE MOST HONEST AND HARD WORKING PEOPLE I KNOW.

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg.
300 S. New Street
Dover, Delaware 19904

1/16/08

José

RECEIVED
JAN 16 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

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I support The LightHouse Tilefish Group:
Name: R. J. Shackleton
Address: 5614 West Ave Beach Haven NJ 08008
Phone #
additional comments:

Received Time Jan. 14. 1:16PM

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 18 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

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The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: Dennis and Jill Bellotti

Address: 130 Benita Road, Waretown, NJ 08758

Phone #: 609-242-7001

additional comments:

JAN-28-2008 04:22 FROM:MEARS

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
FEB - 1 2008
MID-ATLANTIC FISHERY COUNCIL
José

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2/1/08

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I support The LightHouse Tilefish Group:

Name: Pete Berg F/V Monica

Address:

Phone #: 609-812-0551

additional comments:

JAN-28-2008 04:22 FROM:MEARS

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 3 1 2008
MID-ATLANTIC FISHERY COUNCIL

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I support The LightHouse Tilefish Group:

Name: DAN MEARS F/V MONICA

Address: P.O. BOX 324
BARNEGAT Lg, NJ, 08006

Phone #: 609-709-9264

additional comments:

IN THE PAST 8 YEARS MYSELF & CREW HAVE BECOME DEPENDENT ON THE INCOME GENERATED FROM TILEFISH. Dan Mears

José

2/9/08

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New St., Room 2115
Dover, DE 19904

Tilefish 1 Comments

My name is Rick Mears, I am the owner/operater of the Frances-Anne which holds a parttime tile permit. My family built this boat in 1979 for the Tile fishery. The boat fished Tile full time for 5 years then rigged for swordfish to give the Tilefish a break. We resumed Tilefishing around the spring of 2000 and have been fishing every winter and spring since. This has been a big part of our business and we are dependant on it. We would rather fish in the spring when the weather and market conditions are better, but with the derby style fishery we must fish the harsh winter conditions to compete for the avalible quota.

I would support an IFQ allocation for the Parttime Fishery if it is distributed fairly between the active vessels.

I support the 14.3% for the 7 most active permits option.

My vessel was passed over for the higher tier permits last time because our landings were too old, now we are the ones with the current landings and should be recognized like the tier 1+2 permits were before.

I dont feel any other options would allow the Parttime sector to fully utilize its quota. With fuel and gear costs at higher levels than ever, we could never afford to purchase IFQ shares from inactive permit holders to remain in the fishery. If the active boats cant continue to fish, we wont catch our quota and others will come looking for it.

The 7 most active permits are all original permit holders and caught there own landings. Most of the inactive permits have been transfered to new owners, some who never even caught a Tilefish. I cannot rationialize how the permits with zero or limited landings could get same IFQ as the active vessels who depend on this fishery.

Thank You,

Capt. Rick Mears

SUBMITTED WRITTEN COMMENT 2/6/08
TOMS RIVER, NJ

February 6, 2008

Dear Mr. Furlong:

My name is Dan Mears. I am the owner and operator of the Monica which has a part time tile permit. I started fishing for tile in the year 1978, the year I graduated from school. My father Don Mears started in the fishery in 1974. I fished up until the mid to late 80's, then switched over to sword fishing along with a lot of other guys to give tile a break. I made a couple of trips in the late 90's. Then, about when the tile plan came into effect, unfortunately, I only qualified for a part time permit. I have been active in the part time fishery since 2001 and have landed fish every year up until now.

There are 22 permits in the part time category and only 7 have been active since the plan went into effect. The 7 boats have become dependent on the income over the last seven years generated from catching tile fish. The remaining 15 boats have no landings in the 2001-2005 time frame. The 7 boats with landings in the 2001-2005 time frame support 12DA which would give each boat equal share of 14% each. I would support any further allocation into the part time category being split up with the remaining 15 boats. I feel any other option would keep the part time category from filling the quota due to high costs of fuel and gear. No one would be able to afford to lease IFQ. No one will spend the money to rig there boat up from scratch, to go out and catch 16,000 lbs. of tile fish, which is what everyone would get with the 1D4 option. I support all of the comments made by Rick Marks and Jim Kendell in reference to amendment one, other than allocation issues in the part time category.

Sincerely,

Dan Mears F/V MONICA

Dan Mears

J 056

RECEIVED
FEB 7 2007
MID-ATLANTIC FISHERY COUNCIL

To NMFS,

The LIGHTHOUSE TILEFISH GROUP is a group of concerned ~~Tier 3 fishermen~~ that pursue Tilefish. The members should include; Jim, Dan, and Rick Mears, Eric Svelling, and Tom Roth. These five fishermen and their boats represent 83% of the fishing activity that occurred in the Tier3 permit category between 2001 and 2005. The members of this group feel as though they can cooperate with each other in the pursuit of tilefish and a better Tilefish-Management Plan. The current FMP for Tilefish promotes a derby- style fishery that is counter productive in several ways.

1. Lack of cooperation amongst the Tier 3 permit category.

2. A Nov.1,opening is at the beginning of the winter season and more hazardous fishing conditions.

3.Lower prices for Tilefish occur when fishermen compete for the available quota.

The members of this group would like to see the FMP for Tilefish Tier 3 fishermen to be based on the participation of permit holders from 2001 -2005 fishing season. The development of ITQ's would be beneficial in several ways.

1.Would eliminate a derby style opening.

2.Would promote better fish prices.

3.Would eliminate the need to fish in hazardous fishing conditions.

The LIGHTHOUSE TILEFISH GROUP is being formed to help bring forward their ideas to NMFS for the better management of Tilefish. We look forward toward cooperation with NMFS in forming a better Tilefish FMP.

Thank you,

Eric Svelling 2-4-07

609-361-7916

To NMFS,

The LIGHTHOUSE TILEFISH GROUP is a group of concerned Tier 3 fishermen that pursue Tilefish. The members should include; Jim, Dan, and Rick Mears, Eric Svelling, and Tom Roth. These five fishermen and their boats represent 83% of the fishing activity that occurred in the Tier3 permit category between 2001 and 2005. The members of this group feel as though they can cooperate with each other in the pursuit of tilefish and a better Tilefish-Management Plan. The current FMP for Tilefish promotes a derby- style fishery that is counter productive in several ways.

1. Lack of cooperation amongst the Tier 3 permit category.

2. A Nov.1,opening is at the beginning of the winter season and more hazardous fishing conditions.

3.Lower prices for Tilefish occur when fishermen compete for the available quota.

The members of this group would like to see the FMP for Tilefish Tier 3 fishermen to be based on the participation of permit holders from 2001 -2005 fishing season. The development of ITQ's would be beneficial in several ways.

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Thank you,

James D Mears
February 5, 2007

Jose

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Thank you,

Tom Roth

J 056

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Thank you, Dan Mears

RECEIVED
FEB 20 2007
MID-ATLANTIC FISHERY COUNCIL

Jose
2/21/07

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Thank you,

Rick Mears

609 597 6192

Mr. Daniel T. Furlong
Mid-Atlantic Fishery Council
Rm. 2115 Fed. Bldg. ,300 S. New Street
Dover, Delaware 19904

RECEIVED
JAN 23 2008
MID-ATLANTIC FISHERY COUNCIL

Dear Mr. Furlong,

The LightHouse Tilefish Group (LHTG) is a group of concerned, 3 tier, part time Tile fisherman. The group consists of: Tom Roth, Eric Svelling, Jim, Dan and Rick Mears. All five members own active fishing boats in the three tier permit category.

The LHTG supports the implementation of an IFQ.
LHTG supports transferability of ownership and quota share.
LHTG supports the equal distribution of 14.3% amongst the 7 most active permits as shown on table 37,1D2A.
LHTG opposes trip limits.

The following people are supporters of The LightHouse Tilefish Group. They are the owners, deckhands, dockside workers, and family members that participate in Tilefishing.

I support The LightHouse Tilefish Group:

Name: Rick Mears

Address: 111 Laurel Hill Lane
West Creek, NJ 08092

Phone #: 609 - 597-6142

additional comments:

Owner/operator

F/V. Frances-Anne

PUBLIC COMMENT:

Jose

2/6/08

"Tilefish 1 Comments."

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331
Fax: (302) 674-5399
Email: INFO@MAFMC.ORG

Subject: **"Tilefish 1 Comments"**

Dear Mr. Furlong:

This letter is in support of the 2001-2005 time line or **Option 1D2** in the current Mid Atlantic Fishery Management Council Alternative up for Public Comment on Monday February 4, 2008 at the Riverhead Holiday Inn Express East End, as well as on February 5th, and 6th in Warwick RI, and Toms River, NJ respectively.

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Option 1D2 addresses important issues as reducing capacity to allow the Tilefish Fishery to rebound and eliminating latent permits which closes the door to the possibility of over fishing and to creating a situation where permit owners, not currently make a living from the species, from selling or leasing their permits for profit.

Option 1D2 supports the current participants in the fishery that have consistent landings during the period of 2001-2005 and who have proven that their sole source of income is based on the landings of Tilefish during this time period.

Thank you for your time and considering my vote in this matter.

Yours truly,

[illegible signature]
NAME
MATE F/V [illegible]
TITLE

2/5/2008

February 3, 2008

RECEIVED
FEB - 6 2008
MID-ATLANTIC FISHERY COUNCIL

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

Michele Bobeck
NAME

Engineer
TITLE

February 3, 2008

RECEIVED
FEB - 6 2008
MID-ATLANTIC FISHERY COUNCIL

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Robert L. Hayh

NAME

Fisherman

TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Thank you for your time and considering my vote in this matter.

Yours truly,

Gregory B. Lau

Electrical Inspector (& fisherman)

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Joseph Orth
NAME

Director of Marketing
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

NAME : Majdi El-Taher

TITLE: Field constructionEngineer/GPI

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

David Ledgerwood
NAME

President MultiVisionUSA, a GPI
Company

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

Carl van Krieken
NAME

TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

NAME: Frank J. Scheller

TITLE: Senior Vice President,
Greenman-Pedersen, Inc.

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

George Voiland, P.E.
NAME

Project Manager, GPI
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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SALVATORE M. CONSTANTINO
NAME

SENIOR DESIGNER
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

NAME: David Pacitto

TITLE:Assoc. V.P.

Montanez, Jose L.

From: Anthony Grosso [agrosso@gpinet.com]
Sent: Thursday, February 07, 2008 2:27 PM
To: Info
Subject: Tilefish Amendment Letter

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Anthony Grosso
NAME

Resident Engineer
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

Scott M. Deitche

NAME
NPDES Department Manager

TITLE

Montanez, Jose L.

From: James Shumaker [jcshu@comcast.net]
Sent: Thursday, February 07, 2008 3:17 PM
To: Info
Subject: "Tilefish 1 Comments"

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Jim Shumaker
NAME

Manager Construction Services
TITLE

February 3, 2008

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Thank you for your time and considering my vote in this matter.

Yours truly,

JOHN ABBOTT

NAME

TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Yours truly,

Mike Lewis
NAME

Project Administrator
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

Bob Grover
West Islip, NY
NAME

TITLE

February 7, 2008

"Tilefish Amendment 1"

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Yours truly,

Brian W. Mausert
NAME

Vice President / Director of Civil Design
TITLE

February 7, 2008

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Yours truly,

Steph B. Karl

Stephen B. Karl
NAME

Senior Vice President / Branch Manager
TITLE

February 3, 2008

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Yours truly,

Brian Jezioro
NAME

TITLE

Montanez, Jose L.

From: Duel Chavez [DChavez@gpinet.com]
Sent: Thursday, February 07, 2008 5:30 PM
To: Info
Subject: Tilefish 1 Comments

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Duel Chavez
NAME

Senior Designer

TITLE

Duel N. Chavez, Senior Designer

2/8/2008

GPI Southeast, Inc.
3559 Timberlane School Road
Tallahassee, FL 32312
Phone: 850-668-5211
Fax: 850-668-3106
E-mail: chavezd@evarnum.com

February 3, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Mathew William McCione
NAME

Project Manager
TITLE

February 3, 2008

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Yours truly,

Joshua C. McWinn
NAME

Utilities Designer
TITLE

February 3, 2008

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Yours truly,

Calvin M. Inscho
NAME

Bridge Technician
TITLE

February 3, 2008

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Yours truly,

Judy Von Urban

NAME

Bookkeeper

TITLE

February 7, 2008

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Yours truly,

Wade Felt
NAME

Project Manager
TITLE

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Thursday, February 07, 2008 11:11 AM
To: Montanez, Jose L.
Subject: FW: Tilefish 1 Comments

FYI.

-----Original Message-----
From: William Ferdinandsen [mailto:wferdinandsen@gpinet.com]
Sent: Thursday, February 07, 2008 11:00 AM
To: Info
Subject: Tilefish 1 Comments

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council

300 South New Street, Room 2115

Dover, DE 19904

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Yours truly,

William Ferdinandsen, PE

NAME

Professional Engineer

TITLE

February 7, 2008

"Tilefish Amendment 1"

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Yours truly,

Marc A. Halpin
NAME

Project Manager
TITLE

Montanez, Jose L.

From: Ed Kozik [ekozik@gpinet.com]
Sent: Thursday, February 07, 2008 11:58 AM
To: Info
Subject: Tilefish 1 Comments

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Edward T. Kozik
NAME

Project Manager
TITLE

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Sandy Griscom
NAME

Administrative Assistant
TITLE

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Richard I. Sperling
NAME

Vice President/CFO
TITLE

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Yours truly,

NAME
Scott W. Schmelzinger

TITLE Eng. Tech.

February 3, 2008

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Yours truly,

Dr. Cheryl Allen-Munley, PE, PP
NAME

Director, Transportation Planning
TITLE

February 3, 2008

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Yours truly,

MICHAEL M. DONAWAY
NAME

PROJECT SURVEYOR
TITLE

February 3, 2008

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Dear Mr. Furlong:

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Thank you for your time and considering my vote in this matter.

Yours truly,

Sandy Barry
NAME

Bookkeeper
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

Dear Mr. Furlong:

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Yours truly,

Jeffrey Bradford
NAME

Senior Surveyor
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Thank you for your time and considering my vote in this matter.

Yours truly,

Amy Norris
NAME

Receptionist
TITLE

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Thursday, February 07, 2008 11:13 AM
To: Montanez, Jose L.
Subject: FW: Tilefish Amendment Letter

FYI

-----Original Message-----
From: Gaye Ires [mailto:gires@gpinet.com]
Sent: Thursday, February 07, 2008 11:00 AM
To: Info
Subject: Tilefish Amendment Letter

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Yours truly,

Gaye Ires
NAME

Accounting Dept.
TITLE

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Yours truly,

NAME :
Jacqueline Aissa

TITLE: Civil Engineer Tech.

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Thursday, February 07, 2008 11:24 AM
To: Montanez, Jose L.
Subject: FW: Tilefish Amendment Letter (3).doc tilefish 1 comment

FYI

-----Original Message-----
From: Cheryl De Mase [mailto:cdemase@gpinet.com]
Sent: Thursday, February 07, 2008 11:15 AM
To: Info
Subject: Tilefish Amendment Letter (3).doc tilefish 1 comment

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong

Executive Director

Mid-Atlantic Fishery Management Council

300 South New Street, Room 2115

Dover, DE 19904

Telephone: (302) 674-2331

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Yours truly,

Cheryl DeMase

NAME

Receptionist

TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Yours truly,

Myoshi Simon
NAME

Administrative Coordinator
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Michael T. Colson
NAME

IT/Senior CAD Administrator
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Yours truly,

Barbara A. Doezema
NAME

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Joe Di Lauri
NAME

Transportation Planner
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Vanessa Cifuentes

NAME
Payroll Administrator

TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

Patrick B. McKinney
NAME

Director of IT MVUSA
TITLE

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Yours truly,

Deborah A. Rosenberg
NAME

Assistant Vice President
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Yours truly,

Rita C. Pope
NAME

Admin
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Helen Ambrosio
NAME

Admin. Asst.
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
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Yours truly,

Douglas Reese
NAME

Resident Engineer
TITLE

Montanez, Jose L.

From: Keith Giles [kgiles@gpinet.com]
Sent: Thursday, February 07, 2008 5:05 PM
To: Info
Subject: Tilefish Amendment 1
Attachments: Tilefish Amendment Letter.doc

February 7, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

RE: ***"Tilefish Amendment 1"***

Dear Mr. Furlong:

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Yours truly,

Keith E. Giles
Professional Engineer and Land Surveyor
86 Furnace Point Lane
P O Box 366
Westport, NY 12993

Montanez, Jose L.

From: Christer Ericsson [cericsson@gpinet.com]

Sent: Thursday, February 07, 2008 2:47 PM

To: Info

Subject: Tilefish 1 Comments

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904

Dear Mr. Furlong:

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Thank you

Christer Ericsson, P.E.
Senior Vice President

Greenman-Pedersen, Inc.
105 Central Street
Stoneham, MA 02180
781-279-5500 ext 3003
603-770-5637 (cell)

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Thank you for your time and considering my vote in this matter.

Yours truly,

NAME
Pamela Greco

TITLE: Marketing Assistant

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
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Thank you for your time and considering my vote in this matter.

Yours truly,

Carl Price
NAME

Project Manager
TITLE

Montanez, Jose L.

From: Alan Garri [agarri@gpinet.com]
Sent: Thursday, February 07, 2008 11:11 AM
To: Info
Subject: Tilefish 1 Comments
Attachments: Tilefish Amendment Letter.doc

Mr. Furlong,

Please review the attached letter indicating my support of Option 1D2 for the Tilefish Amendment 1.

Best regards,

Alan Garri, E.I.
Project Engineer

GPI Southeast, Inc
1414 SW Martin Luther King Jr. Avenue
Ocala , FL 34474-3129
Phone: 1-352-368-5055
Fax: 1-352-368-5063
agarri@gpinet.com
www.gpinet.com

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

Dear Mr. Furlong:

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Thank you for your time and considering my vote in this matter.

Yours truly,

Alan J. Garri E.I.
NAME

Project Engineer
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Yours truly,

Myoshi Simon
NAME

Administrative Coordinator
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

STEVEN J. MONTGOMERY

NAME

PROJECT MANAGER
CONSTRUCTION SERVICES

February 3, 2008

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Yours truly,

Marie D. Hallenbeck
NAME

Billing Clerk
TITLE

February 3, 2008

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Yours truly,

Elvira Lott
NAME

Administrator
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
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Yours truly,

Anthony Iandiorio

NAME

Accountant

TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

Linda Vasquez
NAME

Corporate Receptionist
TITLE

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Phil Trapani
NAME

Assistant Vice President
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Kurt Griffel
NAME

Assistant Vice President
TITLE

February 3, 2008

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Yours truly,

Joanne Peavey

Accounting Administrator

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Thursday, February 07, 2008 11:30 AM
To: Montanez, Jose L.
Subject: FW: Option 1D2

FYI

From: Gary Tinklenberg [mailto:gtinklenberg@ccclabs.com]
Sent: Thursday, February 07, 2008 11:27 AM
To: Info
Subject: Option 1D2

February 3, 2008

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Gary Tinklenberg

2/7/2008

NAME

Vice President, Corrosion Control
Consultants and Labs, Inc.

TITLE

February 3, 2008

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William K. Taylor
NAME

CADD Manager
TITLE

February 3, 2008

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Yours truly,

Kevin Cole
NAME

Project Manager / Engineer
TITLE

February 3, 2008

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Yours truly,

Stacey L. Russell-Samuels
NAME

Contact Administrator
TITLE

February 3, 2008

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Yours truly,

Steve Greenman
NAME

CEO
TITLE

Montanez, Jose L.

From: Sid Newbold [snewbold@gpinet.com]
Sent: Thursday, February 07, 2008 11:20 AM
To: Info
Subject: Tilefish 1 Comments

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,
Sid Newbold
Civil Engineer

February 3, 2008

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Yours truly,

Elliott Varnum
4575 Millwood Lane
Tallahassee, Fla. 32312

February 3, 2008

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Yours truly,

NAME : James H. Saunders Jr.

TITLE : Senior Designer

Montanez, Jose L.

From: Bill Blanchard [wblanchard@gpinet.com]
Sent: Thursday, February 07, 2008 11:30 AM
To: Info
Subject: Tilefish 1 Comments

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Bill Blanchard, P.E., PTOE
NAME

Project Engineer
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

____
Linda DeSimone,P.E.

____
TITLE Senior Structural Engineer

February 3, 2008

"Tilefish Amendment 1"

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Executive Director
Mid-Atlantic Fishery Management Council
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Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

Kerry D. Brown
NAME
ACA
V.P./Project Manager
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Yours truly,

Michael Rabkin, P.E.
NAME

Project Manager
TITLE

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Yours truly,

____

Chad R. Brazee
Civil Project Engineer
Greenman-Pedersen, Inc.

____

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Jean Cai
NAME

Engineer
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Dan Schmutz, M.S.
NAME

Vice President/Senior Environmental Scientist
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Ellen M. Levanti
NAME

General Counsel
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

Marc Bowen, PE
NAME

Vice President
TITLE

Montanez, Jose L.

From: Danny Metzger [dmetzger@gpinet.com]
Sent: Thursday, February 07, 2008 12:09 PM
To: Info
Subject: Tilefish Amendment Letter.doc

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Yours truly,

Danny S. Metzger
NAME

Senior Survey / CADD Technician
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Yours truly,

Walter M. Wysowaty, P.E.
NAME

Project Manager, Greenman-Pedersen, Inc.
TITLE

Montanez, Jose L.

From: Mike Krakosky [mkrakosky@gpinet.com]
Sent: Thursday, February 07, 2008 12:07 PM
To: Info
Subject: Tilefish 1 Comments

February 7, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Yours truly,

Michael J. Krakosky
Professional Engineer

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Casey Knapp
NAME

Civil Engineer
TITLE

February 3, 2008

"Tilefish Amendment 1"

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Yours truly,

NAME - KEITH HOWLAND

TITLE - COMPILER (ACA)

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Mid-Atlantic Fishery Management Council
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Yours truly,

Mr. Steven G. Kuda
NAME

Sr. V.P. Aerial Cartographics of America
TITLE

Montanez, Jose L.

From: Robert Leo [rleo@gpinet.com]
Sent: Friday, February 08, 2008 7:36 AM
To: Info
Subject: "Tilefish 1 Comments"

February 8, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Yours truly,

Robert Leo
Chief Inspector Williamsburg Bridge

Montanez, Jose L.

From: Gary Crozier [gcrozier@gpinet.com]
Sent: Friday, February 08, 2008 7:46 AM
To: Info
Subject: "Tilefish 1 Comments"

February 8, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Gary C. Crozier

NAME

Field Engineer
TITLE

Montanez, Jose L.

From: Clifford Krumm [ckrumm@gpinet.com]
Sent: Friday, February 08, 2008 8:05 AM
To: Info
Subject: FW: "Tilefish 1 Comments"

-----Original Message-----
From: Clifford Krumm [mailto:ckrumm@gpinet.com]
Sent: Thursday, February 07, 2008 11:22 AM
To: info@mafmc.org
Subject: "Tilefish 1 Comments"

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Clifford D. Krumm Jr.
Vice President

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

NAME

Vice President
TITLE

Montanez, Jose L.

From: Pat Bowen [pbowen@gpinet.com]
Sent: Friday, February 08, 2008 11:58 AM
To: Info
Cc: 'Steve Greenman'
Subject: Tilefish 1 Comments

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Patrick T. Bowen
NAME

Project Engineer
TITLE

February 3, 2008

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Yours truly,

Phyllis Andrews

Phyllis A. Andrews
Office Manager

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Thank you for your time and considering my vote in this matter.

Yours truly,

Frank D. Rea
NAME
Director of Coatings Services /
Chief Chemist
TITLE

Montanez, Jose L.

From: Kevin Donovan [kdonovan@gpinet.com]
Sent: Friday, February 08, 2008 11:48 AM
To: Info
Cc: sgreenman@gpinet.com
Subject: Tilefish 1 Comments

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

Dear Mr. Furlong:

This letter is in support of the 2001-2005 time line or **Option 1D2** in the current Mid Atlantic Fishery Management Council Alternative up for Public Comment on Monday, February 4, 2008, at the Riverhead Holiday Inn Express East End, as well as on February 5th and 6th in Warwick, RI, and Toms River, NJ, respectively.

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Yours truly,

Kevin J. Donovan
NAME

Project Manager
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
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Thank you for your time and considering my vote in this matter.

Yours truly,

Walter M. Janus
NAME

Project Manager
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
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Thank you for your time and considering my vote in this matter.

Yours truly,

Lorraine Finfrock
NAME

Office Engineer
TITLE

Montanez, Jose L.

From: Ralph Csogi [rcsogi@gpinet.com]
Sent: Friday, February 08, 2008 7:59 AM
To: Info
Subject: Tilefish 1 Comments

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

Ralph D. Csogi

NAME
Greenman-Pedersen, Inc.
Senior Vice President

TITLE

Montanez, Jose L.

From: Richard Huth [rhuth@gpinet.com]
Sent: Friday, February 08, 2008 8:30 AM
To: Info
Subject: Tilefish 1 Comments

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

Richard A. Huth
NAME

V.P., Land Surveyor
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

Matthew L. Martini, PLS, PP
NAME

Senior VP K&K
TITLE

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Monday, February 11, 2008 4:49 PM
To: Montanez, Jose L.
Subject: FW: "Tilefish 1 Comments"

Here's another one - is it C.O.B. yet?

-----Original Message-----
From: frank& jamie [mailto:fjgreen@verizon.net]
Sent: Monday, February 11, 2008 2:16 PM
To: Info
Subject: "Tilefish 1 Comments"

PUBLIC COMMENT:

"Tilefish 1 Comments."

Daniel T. Furlong

Executive Director

Mid-Atlantic Fishery Management Council

300 South New Street, Room 2115

Dover, DE 19904

Email: info@mafmc.org <mailto:info@mafmc.org>

Dear Mr. Furlong:

This letter is in support of the 2001-2005 time line, Option 1D2, in the current Mid Atlantic Fishery Management Council Alternative up for Public Comment.

After reviewing all the Alternatives in Amendment 1 of the Tilefish Management Plan, that is currently going through the Federal Public Comment Hearing phase, it is clear to me that Option 1D2 is the only option consistent with the course that National Marine Fisheries has addressed in every other fishery in fairness while reducing capacity.

Option 1D2 reduces capacity which will result in the successful rebound of the Tilefish Fishery. Option 1D2 eliminates latent permits, which closes the door to the possibility of over fishing and to preventing a situation where permit owners, not currently make a living from the species, cannot unfairly profit at the expense of others by selling or leasing their IFQ's for profit.

Option 1D2 supports the current participants in the fishery that have consistent landings during the period of 2001-2005 and who have proven that their sole source of income is based on the landings of Tilefish during this time period.

On a more personal note, choosing Option 1D2 is the only option that would allow my husband Frank Green on the F/V Bookie to continue to make a living and support his family. Choosing any other option, quite frankly, would result in us loosing everything, our income, our home, it would be catastrophic! Choosing Option 1D2 will fairly reward those individuals who depend on Tilefish as their sole source of income. This is no joke, this fishery should not be settled up with equal allocation just for the sake of making people happy. This fishery has to be set up so that the F/V Bookie, boat #2 in Tier 2, can continue to make a living in the same exact fashion that he has been doing, consistently, since the inception of the Tilefish Management Plan and that means the Council must choose Option 1D2 .

Thank you for your time and considering my vote in this matter.

Yours truly,

Jamie Green

F/V Bookie

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

John Simkulet
NAME

Structural Engineer
TITLE

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Yours truly,

Mr. Christopher J. O'Donnell
NAME

Resident Engineer – GPI/DRBA
TITLE

February 11, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Thank you for your time and considering my vote in this matter.

Yours truly,

Chad Anderson
NAME

Asst. Resident Engineer
TITLE

Montanez, Jose L.

From: Tammie Nicholas [tnicholas@gpinet.com]
Sent: Monday, February 11, 2008 7:33 AM
To: Info
Subject: Tilefish 1 Comments

February 11, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
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Yours truly,

Tammie Nicholas
NAME

Office Engineer
TITLE

--
Greenman-Pedersen, Inc.
http://www.gpinet.com

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
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Yours truly,

Mark Elder

NAME

Project Manager

TITLE

February 11, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Yours truly,

Joseph A Greenman
90 Shore Road
Babylon, NY 11702

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Thank you for your time and considering my vote in this matter.

Yours truly,

____
NAME Geoffrey J. Howie

____
TITLE Assistant Vice President

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

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Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
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Thank you for your time and considering my vote in this matter.

Yours truly,

Winona Leaman
NAME

Marketing/Business Development
TITLE

APPENDIX J (CONTINUED)
PUBLIC WRITTEN COMMENTS

COMMENTS RECEIVED AFTER CLOSE OF COMMENT PERIOD

C. Bjornberg, Inc.
F/V Bjorn II
P.O. Box 784
#3 E 15th St.
Barnegat Light, NJ
08006-0784
Ph# (609) 361-9687
Fax (609) 361-1636
May 28, 2008

Daniel T. Furlong
Executive Director
MAFMC

Dear Mr. Furlong,

Accompanying this cover letter is a 3 page petition with one hundred and one (101) signatures from friends, neighbors, and community members who wish to express their support for our family and our boat F/V Bjorn II. We cannot emphasize how much all these signatures mean. These signatures are those of doctors, lawyers, merchants, lifeguards, housewives, and colleagues.

We would appreciate you adding these comments to those you have already and hopefully continue to receive in the final comments that you are going to submit to NMFS.

The people who have signed these letters are very upset and dismayed that this can happen to a small hard working family.

In addition, the trickle down effect of all the businesses we are involved with i.e.: Viking Village Inc, Mid Atlantic Diesel Repair, Blue Water Fishing Tackle Co. Brown and Brown Flagship Insurance Co., etc. etc. are going to be negatively affected.

We can not stress to you enough about how Amendment I will force us out of business.

Cordially,

Carl and Chris Bjornberg

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council

F/V Bjorn II

The fishing vessel Bjorn II is going to be effectively eliminated from the Tilefish industry due to an unfair proposal, the Tilefish Amendment 1, by the Mid-Atlantic Fishery Management Council. This decision shows bias and an indiscriminant decision based on the selection of arbitrary fishing years that disregards the entire fishing history of Carl Bjornberg and his family owned boat.

I, the undersigned, know the owners personally: Carl Bjornberg Jr., Christin Bjornberg and their three children, 12 year old triplets, Britt, Kelsey, and Carl III. Fishing is what Carl and his family do. The rulings by the council ignores the 25 years of their hard work in the Tile Fishery. This proposal will bring such hardship to the Bjornberg family that they will be forced to give up their boat and business. In addition, not only will it negatively affect the Bjornbergs' and the four families that the F/V Bjorn supports, but all the other businesses that the Bjorn II is associated with. My signature represents an endorsement for the F/V Bjorn II and her owners to be given a fair and more equal share in the proposed amendment.

	Name	Address	Phone Number	Signature
1.	MARCELLA RANDAZZO	17 BUTLER RD HBH	494-7304	Marcella Randazzo
2.	BEN RANDAZZO	17 BUTLER RD HBH.	494 7304	Ben Randazzo
3.	Marie C. Stone	18 W. 6th St B.L.	494-3391	Marie C. Stone
4.	Jennifer Hewitt	119 Flipper Ave Manahawkin	9780887	J Hewitt
5.	FRANCIS S NOFAK	1905 CENTRAL AVE BL		Frank [illegible]
6.	JAKE D'Arcangelo	74 Bonita Pl [illegible]	609 661-4990	[illegible]
7.	Robert Palmer	50 Harbor Ln Loveladies	609-226-9556	[illegible]
8.	Dori A. [illegible]	6 E 13th St Barnegat Lgt	609-494-7158	
9.	Dottie Brad Zucchi	23 W St	609 361-2438	Dottie [illegible]
10.	FRANCO Zucchi	23 W St	609 709-9183	[illegible]
11.	MARK DWYER	28 EAST 10TH ST BARNEGAT LIGHT, NJ	856 816 2952	
12.	ALEX ROTH	6 W 17TH ST BARNEGAT LIGHT NJ		[illegible]
13.	Debbie Holden	1049 Mariner Ave Manahawkin NJ	609 597-0603	Debbie Holden
14.	Chris Caprio	105 N Ave Hammonton NJ	609-567-6129	Chris Caprio
15.	Jim MATTRAC	19 W 7th St BL	494-3346	[illegible]
16.	Charly Ken Menu	1226 Penn St Manhattan	973-8767	Charles Menu
17.	William S Patterson W.S.G.	7 W 26th St BARNEGAT Lt	494-8049	
18.	Karin Voris	2 West 8th St BL NJ 08006	609 494 2026	Karin Voris

Name Address Phone Number Signature

18. Marin J Connaughton 8 W 17 St 494 7162
19. Siobhan Lynch 601 Broadway 361.9688
20. TODD VARGA 201 Schooner Ave 290 5995
21. J WASHBURN 2205 CENTRAL AVE 6094947689
22. Howard Welch 8 W 26th St B.L. 609 494 7618
23. KAREN WELCH 8 W 26th ST. B.L. 609-494-7618
24. AUTUMN DORNISCH 1709 CENTRAL BL 6094943202 Autumn Dornisch
25. Elaine Kosar 30 Adrian Rd 609-494-4982 Elaine Kosar
26. JILL R. ODELL 45 Arnold Blvd. HBH 609-361-9876 Jill Odell
27. Sarah Walsh 15-4th St BL 609-4949696
28. Joe Jason 2350 Rt 10 Apt C, Parsippany NJ 973 2678279
29. Pam Fahy 31 W. 9th St, Barnegat Light, NJ 08006 609-361-8948 Pam Fahy
30. Jane O'Brien 1306 Central Ave PO Box 486 Barnegat Light NJ 08006
31. Roger J. HALBING 42 ARNOLD BLVD PO Box 961 Barnegat Light NJ. 08006
32. Samuel P Alloway 14 W 13th St Barnegat Light NJ 08006
33. David Mikos 2 W 8th St Barnegat Light N.J. 08006
34. DIANE T. STEVENS 2 W 4th ST BL, NJ 08006
35. Barbara Halbing 42 Arnold Blvd PO Box 961 Barnegat Lt NJ 08006 Barbara Halbing
36. JILL SASS 709 CENTRAL BARNEGAT LIGHT NJ Jill Sass
37. DAVID PROWSE 701 BROADWAY BARNEGAT LIGHT NJ
38. RON Glembocki 705 Broadway Barnegat Light, NJ R. Glembocki
39. Joseph D Foy JR 33 W 4th ST Barnegat Light NJ 08006
40. Amy Massa 143 William Cook Blvd. Manahawkin NJ 08050 Amy Massa
41. CHARLES WILSON 159 R&D W Dr 6980689 BARNEGAT
42. Kim Dowd 30 Daniels Dr Manahawkin NJ 9781941
43. JANE BARRINGTON 18 W 4th BL NJ 08006 3611081 Jane Barrington
44. VALERIE FENELON 23 FAIR OAKS DR. BARNEGAT 698-8551 Valerie Fenelon
45. CRICKET LUKER 410 BROADWAY BARN. LT. NJ Cricket Luker
46. RAY ALLEN 142 ARNOLD BLVD., HIGHBAR HARBOR, N.J. Ray Allen
47. OWEN SMITH 1436 Rt 539 Warren Grove NJ. 08005
48. STACY BERNSTEIN 60 N. Lakeshore Drive Manahawkin NJ 08050
49. MICHAEL J. DAUB 8 RIVERSIDE DR. TUCKERTON NJ 08087
50. Eric Stilwell 136 Auburn Rd High Bar Harbor NJ 08008 Eric
51. Chris Van Bragan 814 Tampa Rd. Toms River NJ 08753
52. SARAH CROWLEY 136 Auburn RD Highbar Harbor NJ 08008
53. OWEN CAFFREY - 13 E. 15th B.L. 494-0244
54. John Alcher 8 W 7th Street BL NJ 08006
55. Charles Osterman - 16 E 19th St BL 494-3056 Charles Osterman
56. Diana Kelly 62 Cedar Run Dock Rd, West Creek, NJ 08092
57. Glenn Thomson 2004 Bayview Ave Barnegat Light NJ 08006
58. RICHARD ARENA 909 SEAVIEW AVE BARNEGAT LIGHT, N.J 08006 Richard Arena
59. Mike Johnson 1506a Bayview Ave Barnegat Light NJ 08006
60. CLAIRE ECKER 84 BRIARWOOD DR. LITTLE EGG HARBOR N.J. 08087 Claire L Ecker
61. ROBERT SOUTHERN 1409 Second Ave. Toms River NJ 08757
62. CHARLES KUHLMAN 21 W 21st ST. BARN LIGHT 08006 494-1921 C H Kuhlman

Name	Address	Phone Number 494-1591	Signature
63. Sandra Kuhlman	21 W 19 St		Sandra L Kuhlman
64. Frank Kelly	1406 Central Ave B Light NJ		Frank Kelly
65. Ed Castro	1321 Lakewood Manasquan	732-223-7571	E Castro
66. Tim Fawcett	PO Box 199 WIB, NJ, 07764	732-222-8217	[illegible]
67. Bill Denn	213 W 35 St Ship Bottom	732-814-6186	W [illegible]
68. Bridget Mikuletzky	163 Spinnaker Ave	597-2887	Bridget Mikuletzky
69. Karen Vavis	2 West 8th St BL NJ 08006	609-494-2026	Ka Vavis
70. Charles Thompson	809 Bunnell St Lanoka Harbor NJ 08734	609-242-9	[illegible]
71. David Connelly	19 W 5th St P.O. Box 42 Barnegat Light, NJ 08006		David Connelly
72. Ezra Holden	#8 4 St BL	609 494 1936	Ezra Holden
73. Rosemary Sommers	46 Arnold Blvd HBH	609 361 8323	Rosemary Sommers
74. Terri Lei Beideman	910 Bayview Ave. Barnegat Light, NJ	609-494-4075	Terri Beideman
75. Lee Trumbull	53 Harbor Lane Love Ladies NJ	609 361-9445	R Trumbull
76. Pat Doyle	77 Sunset Blvd. High Bar Harbor NJ 08008	494-3975	Pat Doyle
77. Deb Smith	10 W. 25th St B.L., N.J. 08006	494 5868	Deb Smith
78. Judy Johnson	14 W 6th St, BL	494-332-3244	Judith Johnson
79. Marcel Gilbert	41 Butler Rd LBI	609-494-8348	M Gilbert
80. Capt. Chas Einselen	75 Antioch Rd High Bar Harbor N.J. 08006		[illegible]
81. Mike Winter	12 W 4th St. Barnegat Light	2159134492	M Winter
82. John D'Addetta	16 W 7th St Barnegat Light	201-939-4289	John D'Addetta
83. Catherine D'Addetta	16 W. 7th St. Barnegat LT	2019394289	C D'Addetta
84. John D Baker	1875 Hickory Lane, Broadview Ht, Ohio 44147		John Baker
85. Richard Feehan	12 E 15th St Barnegat Light NJ	609-494-5011	Richard Feehan
86. Rod Odell	45 Arnold Blvd HBH NJ	609 361 9876	Rod Odell
87. Don Adams	119 N. Spinnaker Dr. L.EH. NJ	609-246-6586	D Adams
88. Nathan Castiello	214 May Street Hawthorne NJ	609 290 1627	[illegible]
89. Jason Opremcak	374 Voorhis Ave. Wyckoff, NJ	201-522-8083	Jason Opremcak
90. Emily Springer, Esq.	29 West 27th St. Barnegat Light, NJ	609 494 2761	Emily Springer, Esq.
91. John Braxap	10 E 8th St	609-468-5832	John Braxap
92. Kelly Bianchi	126 Overlook Ave. Boonton NJ	973 334 1721	Kelly
93. Kevin P. Meehan	#11 W 25th St Barnegat Light 08006	9088125[illegible]	K Meehan
94. Pleasance Feehan	12 E 15 St Barnegat Light 08006	609-494-5011	Pleasance Feehan
95. Pamela Feehan	320 South St Unit 8F Morristown NJ 07960		Pamela Feehan
96. Scott Caffrey	Po Box 12 Barnegat Light N.J. 08006		Scott Caffrey
97. Micah L. White	Loveladies Box 608 - Barnegat Light NJ 08006	609-494-282	
98. Carol Devine	424 Morris Blvd Maple Shade NJ 08052		
99. Amanda Gray	230 Brookville Rd Barnegat NJ 08005	609 618 77	
100. Mary Jane Preiser	1004 Bayview Ave Barnegat Light NJ 08006		Mary Jane Preiser

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Tuesday, February 12, 2008 12:54 PM
To: Mike Ergler
Cc: Montanez, Jose L.
Subject: RE: Tilefish 1 Comments

Comments received after close of comment period. Your input will be treated as a late submission.

-----Original Message-----
From: Mike Ergler [mailto:mergler@gpinet.com]
Sent: Tuesday, February 12, 2008 12:00 PM
To: Info
Subject: Tilefish 1 Comments

Michael J. Ergler, P.E.
Greenman-Pedersen, Inc.
50 Glenmaura National Blvd., Suite 301 | Scranton, PA 18505
ph: 570-342-3700x185 | fax: 570-342-4080
civil & surveying - structural - HVAC - electrical - plumbing - fire protection engineering

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

Dear Mr. Furlong:

This letter is in support of the 2001-2005 time line or **Option 1D2** in the current Mid Atlantic Fishery Management Council Alternative up for Public Comment on Monday, February 4, 2008, at the Riverhead Holiday Inn Express East End, as well as on February 5th and 6th in Warwick, RI, and Toms River, NJ, respectively.

After reviewing all the Alternatives in *Amendment 1* of the *Tilefish Management Plan* that is currently going through the Federal Public Comment Hearing phase, it is clear to me that **Option 1D2** is the only option consistent with the course that National Marine Fisheries has addressed in every other fishery in fairness while reducing capacity.

Option 1D2 addresses important issues as reducing capacity to allow the Tilefish Fishery to rebound and eliminating latent permits which closes the door to the possibility of over fishing and to creating a situation where permit owners, not currently making a living from the species, from selling or leasing their permits for profit.

Option 1D2 supports the current participants in the fishery that have consistent landings during the period of 2001-2005 and who have proven that their sole source of income is based on the landings of Tilefish during this time period.

Thank you for your time and considering my vote in this matter.

Yours truly,

Michael J. Ergler, P.E.
NAME

Structural Engineer
TITLE

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Tuesday, February 12, 2008 4:15 PM
To: Art Elias
Cc: Montanez, Jose L.
Subject: RE: Tilefish Amendment

Comments received after close of comment period. Your input will be treated as a late submission.

-----Original Message-----
From: Art Elias [mailto:aelias@kellkirk.com]
Sent: Tuesday, February 12, 2008 4:06 PM
To: Info
Subject: Tilefish Amendment

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong

Executive Director

Mid-Atlantic Fishery Management Council

300 South New Street, Room 2115

Dover, DE 19904

Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

NAME Arthur Elias

TITLE Assistant Director of Engineering

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Wednesday, February 13, 2008 1:31 PM
To: Montanez, Jose L.
Subject: FW: Tilefish Amendment Letter[1]

Another late one.

-----Original Message-----
From: charles edson [mailto:charedson@comcast.net]
Sent: Tuesday, February 12, 2008 7:14 PM
To: Info
Cc: sgreenman@gpinet.com
Subject: Tilefish Amendment Letter[1]

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong

Executive Director

Mid-Atlantic Fishery Management Council

300 South New Street, Room 2115

Dover, DE 19904

Telephone: (302) 674-2331

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Thank you for your time and considering my vote in this matter.

Yours truly,

Charles Edson

NAME

Professional Engineer

TITLE

TREAT AS LATE SUBMISSION

RECEIVED
FEB 13 2008
MID-ATLANTIC FISHERY COUNCIL

2/13/08

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

I AM WRITING THIS LETTER IN SUPPORT OF THE 2001-2005 TIME LINE OR OPTION 1D2 IN ALTERNATIVE 1 OF THE TILEFISH AMENDMENT 1.THIS TO ME SEEMS TO BE THE ONLY FAIR OPTION .IT IS CONSISTANT WITH THE COURSE THAT NMFS HAS ADDRESSED IN EVERY OTHER FISHERY. IT DEALS WITH ALL THE IMPORTANT ISSUES, SUCH AS REDUCING CAPACITY AND LATENT PERMITS WHILE SUPPORTING THE ACTUAL USERS WHO HAVE RELIED ON THE FISHERY TO SUPPORT THERE FAMILIES. THANK YOU FOR YOUR TIME

SINCERLY Paul L. Zeise

P.O. BOX 724
Hampton Bays, N.Y. 11946

NYS Food fish # 5480
Commercial vessel operator's permit
10011254

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Thursday, February 14, 2008 4:41 PM
To: Montanez, Jose L.
Subject: FW: Tilefish 1 Comments

Attachments: Tilefish Amendment Letter.doc

Tilefish Amendment Letter.doc ...

Another late one.

-----Original Message-----
From: Thanh Nguy [mailto:tnguy@gpinet.com]
Sent: Thursday, February 14, 2008 2:42 PM
To: Info
Subject: Tilefish 1 Comments

Thanh Q Nguy
Project Engineer
Greenman-Pedersen, Inc.
105 Central Street, Suite 4100
Stoneham, MA 02180
tel: (781)279-5500
fax: (781)279-5501

February 3, 2008

"Tilefish Amendment 1"

PUBLIC COMMENT: Due by February 11, 2008

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

Dear Mr. Furlong:

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Thank you for your time and considering my vote in this matter.

Yours truly,

Thanh Q. Nguy
NAME

Project Engineer
TITLE

José

RECEIVED
FEB 25 2008
MID-ATLANTIC FISHERY COUNCIL

"LATE"

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

I AM WRITING THIS LETTER IN SUPPORT OF THE 2001-2005 TIME LINE OR OPTION 1D2 IN ALTERNATIVE 1 OF THE TILEFISH AMENDMENT 1.THIS TO ME SEEMS TO BE THE ONLY FAIR OPTION .IT IS CONSISTANT WITH THE COURSE THAT NMFS HAS ADDRESSED IN EVERY OTHER FISHERY. IT DEALS WITH ALL THE IMPORTANT ISSUES, SUCH AS REDUCING CAPACITY AND LATENT PERMITS WHILE SUPPORTING THE ACTUAL USERS WHO HAVE RELIED ON THE FISHERY TO SUPPORT THERE FAMILIES. THANK YOU FOR YOUR TIME

SINCERLY

John Beyler

F/V MARY ELizabeth

ATTN: MAFMC

RECEIVED
FEB 28 2008
MID-ATLANTIC FISHERY COUNCIL

Mike Green
PO Box 37
Barnegat Light, NJ 08006

SOUTH JERSEY NJ 080
20 FEB 2008 PM

"LET US DARE ... THINK, SPEA... E."
John Adams, ...
poweroftheu...

US Dept of Commerce
NOAA/National Marine Fisheries
One Blackburn Drive
Gloucester MA
Att: NE Council

01930+2237 C014

José
2/28/08

Dear Sirs

My name is Mike Green
I Am owner operater of the
Gipper 556363 From Barnegat
Light New Jersey. Ive tilefished
for Almost 30 yrs. 20 yrs on my
own Boat I fished my boat steady
for tilefish for 8 months A year
since 1988 During the Summer
months. when the Golden Tile Are
spawning And mating we would
lay off the fishing Pressure Nobody
wants to be bothered when mating.
Im sure we can agree on that.
OK First thing we are trying to
do is Protect the fish correct
Please Correct If IAm wrong About
Anything I write. What is being
question is the legality of somebody
on the council to be Allocated 2.5
million lbs of tile to Lori Nolan
who just happens to own A few
of those Boats. Hmm Sounds A little
fishy Somewhow Something Dont
seem rite Ive Fished every winter
yes winter in A 55 Ft Boat
with A half A million lbs
of landings U CAN check that
Besides the 5yrs Before Log Books

FEB 22 2008

So the Plans that the Council has to eliminate me from a fishery that Ive Done Directly For 20 yrs. Stinks yall Decided in your offices who can do what and catch how much thats fine. But to Allocate 2.5 million lbs of Tile to Lori Nolan and her boats is truly unfair and I question the legallity. Give Something to the fish. Area closures, time closur trip quatas, Don't make it a free for all, get all you can, Divide up the lb's evenly. This is America the land of equal oppurtunity. Please come up with a plan thats fair to all fisherman. Not Favor Somebody on council. For those four Boats From Montauk NY to be Puttin out 50 miles of Hooks during the summer months when the fish Are Spawning is just ludierous And Bad Fishery management There we go another Point we Agree on I Knew we could get along. I dont mean to sound aggravated by this letter But I am And so are alot of other fisherman from Barnegat Light

I want A Plan that includes
Landings from 1988 to 1998
Since 2001 I had to switch
out of Tilefishin cause the
fishin was terrible because of
overfishin All those yrs of the
montauk Boats targetting (Kittens)
to make there Boat Payments
Kittens are less than a Pound
Nice Huh! Thats the same People
who are getting 2.5 millons And
I who did the rite thing And
Laid off the fish in the summer
is getting screwed when the
Derby Fishing opens in Nov 1 I'll go
Again Quik Quatas Kill People Ask the
People on NE Council, Something has
to change you Know And I do to
If I get Pinched out of this Fishery
I will get a lawyer I will spend the mony
Lets Keep it Safe and a Substainable
Fishery thats managed Properly
And Fairly

Thank you

Mike Green

The Gipper 556363

Check my Landings

RECEIVED
FEB 29 2008
MID-ATLANTIC FISHERY COUNCIL

Jose
3/3/08

Daniel T. Furlong
Executive Director
Mid-Atlantic Fishery Management Council
300 South New Street, Room 2115
Dover, DE 19904
Telephone: (302) 674-2331

LASE

I AM WRITING THIS LETTER IN SUPPORT OF THE 2001-2005 TIME LINE OR OPTION 1D2 IN ALTERNATIVE 1 OF THE TILEFISH AMENDMENT 1.THIS TO ME SEEMS TO BE THE ONLY FAIR OPTION .IT IS CONSISTANT WITH THE COURSE THAT NMFS HAS ADDRESSED IN EVERY OTHER FISHERY. IT DEALS WITH ALL THE IMPORTANT ISSUES, SUCH AS REDUCING CAPACITY AND LATENT PERMITS WHILE SUPPORTING THE ACTUAL USERS WHO HAVE RELIED ON THE FISHERY TO SUPPORT THERE FAMILIES. THANK YOU FOR YOUR TIME

SINCERLY

R Schneider
58 Washington Heights Ave
H. Bays NY 11946

José
4/17/08

To W. Peter Jensen,

THIS LETTER IS IN REGARDS TO THE TILEFISH AMENDMENT 1 PLAN UP FOR APPROVAL 4/10/08.

I am Frank Green I own the fishing vessel Bookie in tier 2. I would like to express my concerns about the adoption of the Amendment 1. I am in support of 1D2 in alternative because it meets all the objectives that should be addressed as they have been in all the other fisheries { latent permits, over capacity and keeps the boats who truly rely on fishery to survive in it at the level at which they have shown. } I have lost 3 permits because of latent effort. NE Multispecies,lobster and now general scallop. I lost them because I have been full time Tilefishing!!!!! Everybody who has no landings are in favor of 1D4 which is giving fish to people who haven't caught a fish in over 20 years. If 1D4 were to be adopted like the Historical tilefish coalition would love. It would be giving excessive allocation to 16 latent permitted boats as the chart below shows while reducing my income by 80%. I cannot survive with that type of cut.

TABLE 1

boat #	best timeline in lbs	equal share allocation	% of lbs over
tier 2			
3	14,500	56,857	392% MORE
4	44,077	56,857	33% MORE
part time			
3	3,510	14,440	311% MORE
4	9,619	14,440	50% MORE
6	2,270	14,440	636%MORE
11	9,022	14,440	60%MORE
13	0000	14,440 NO %	*A COMPLETE GIFT*
14	4,800	14,440	300%MORE
15	7,609	14,400	89%MORE
16	0,005????	14,440	2,888%MORE
17	1,887	14,440	665%MORE
18	5,951	14,440	142%MORE
19	2,587	14,440	458%MORE

21	**3,025**	**14.440**	**377%MORE**
22	**5,498**	**14,440**	**162%MORE**

These percentages are ridiculous. In conclusion , it would be very hard for NMFS or MAFMC to explain legally the reasoning behind allocating fish to boats that **DO NOT SHOW THE LANDINGS TO SUPPORT that type of excessive allocation.** I can't even compute the percentage above and beyond for boat #13 because he has never caught a fish in ANY time period. THAT'S WHY I LABELED IT A COMPLETE GIFT. I am hoping that MAFMC council members can stay the course on fisheries management plans as in other fisheries . Dealing with latent permits, reducing capacity and over capitalization. This fishery desperatly needs these issues dealt with. Too many boats for First I would like to give you a little background as to where this fishery is a present day. Back in 2001when the plan was implemented there were 10 boats total who actually fished this fishery. From 2001 to 2005 this fishery was rebounding at a pace that was way ahead of schedule. In 2005 the council announced the plan for Amendment 1. Since the announcement All these other boats in part time and tier 2 entered the fishery in hopes of claiming a part of the quota share for financial gain even though they have no intentions of using the fishery. Since 2005"s announcement and the influx of boats in this fishery it has declined drasticly. What we used to catch in 3 to 4 days we can't even catch in 10 days. This fishery is in trouble again. This fishery cannot handle anymore than 11 boats its too small and statistics prove it. All the users of this fishery are in support of using the 2001-2005 timeline. Tier 2 and part time have a big problem of there are more boats with latent permits than actual users of the fishery in these catagories. In tier 2 which is the tier that I am in is the fishing boat BOOKIE, there are 5 boats in that tier. Two of the boats were sold over 10 yrs ago and fishing in other fisheries with no intentions of Tilefishing. One other boat has a full time scallop permit and has been scalloping all the way up to the day when MAFMC announced the plan for Amendment 1. in 2005. I personally was told by that owner that he was just getting back into it to get landings so he could get some shares and again by his captian this last trip that they wouldn't even be doing this if Amendment 1 wasn't announced. The last boat had been full time swordfishing and had left the Tilefish fishery over 10 years ago . He too entered in 2005 when the plan was announced. If you leave a fishery for over 5 years you do not rely on it in any shape or form as I do. My landings from 1997 to present day have always stayed consistant with being a full time Tilefisherman. 1997-304,000lbs 1998-340,000 from 1997- 2005 best 5 yr average is over 288,000lbs per year. From 2001-2005 my 3 yr average is over 244,000lbs. Please take into consideration these points and support 1D2 as it is the only fair way to allocate fish to people who rely on it to survive as I do. Thank you for your time

Sincerely

Frank Green FV/Bookie

Jose
5/2/08

Christin Bjornberg
F/V Bjorn II
PO Box 784
Barnegat Light, NJ 08006-0784
609-361-9687
May 2, 2008

Daniel T. Furlong
Executive Director
Mid- Atlantic Fishery Council

Dear Mr. Furlong,

My name is Chris Bjornberg. I am the wife of Carl Bjornberg Jr., mother of triplets (now 12 years old), and together we are the proud owners of the long liner **Bjorn II**. I have to write to you in regard to the recent decision by the Mid-Atlantic Council to virtually squeeze us out of the Tilefish industry.

Except for a few years, we have fished our boat for Tilefish since 1989 when we had the nearly $700,000 boat built. My husband has been the sole provider for our family and now we are going to lose much more than half our yearly income due to this incredibly unfair decision. When our triplets were born in 1995 they were severely premature requiring a 3 month intensive neonatal care stay in the hospital. My husband stayed home to morally support me and be with his children in their life or death survival ordeal. He is a good man and works hard to keep his family clothed and fed. We live modestly, trying to make ends meet and raise a family.

I have watched the boats from Montauk reap the benefits of a quota they can barely meet except for fishing with double crews. Then, other boats belonging to the Mears and Svelling, who were in the part-time category now, will now receive a larger share than us who are in the full time Tier 2 category. The other boat in Tier 2 the BOOKIE owned by Frank Green only has those few years 2001-2004 as his main years. My husband and him had a <u>'Gentlemans'</u> agreement to share the quota and therefore would not need to have a 'DERBY" and fish during the winter months. But for two years Mr. Green broke his agreement and fished heavily cutting into our 'share'. (So of course the yearly tallies for him were higher than ours). Mr. Green also stated to the council that this is his only permit that keeps him sustained but he too has a Tuna and Swordfish permit and has fished side by side with our boat after the Tilefish season ended. My point is that he is getting the lions share under false pretenses. It would be fair and equitable to share the Tier 2 quota with him.

You have no idea how much this is going to devastate our family. Fishing is what we are and what we do and this seems to be the final straw to end our fishing livelihood. My husband will never be able to hand down our business to our children as it has always been his hope. If this reduction down to 6.6% actually happens we could never survive.

We do have a Tuna and Swordfish permit but as you are probably aware the United States is far behind meeting our ICAAT quota. Now with the fuel prices going into orbit a fishery that barely paid for its expenses before will be a far cry from providing a survivable income for our boat and the five families our boat provides for. Tuna and Sword has never been and will never be a fishery that sustains us, there is too much foreign import and fluctuation of prices. We need the Tilefish to keep us alive.

My plea to you is as a mother, a wife, and fishing boat owner "**Please do not put us out of existence**" This current plan will do just that. Imagine you and your family if you lost your job and the huge investment (for us it's a half million dollar boat). This is absolutely heartbreaking, my husband and I can't sleep at night wondering what our future will be.

There must be some other way of creating a more fair redistribution of the Tilefish quota than is now in the works. How can the council, with a clear conscience, destroy other peoples' livelihood without knowing how much it affects us!? I am asking you, and the other council members to consider what I have written as the truth, and in all earnestness our last ditch hope that there can be reconsideration on the quota given to our boat.

Cordially,

Christin Bjornberg

Christin Bjornberg

Mother, wife, co-owner of the F/V Bjorn II

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Friday, May 02, 2008 12:15 PM
To: fishma56@comcast.net
Cc: Montanez, Jose L.
Subject: RE: Tilefish 1 comments

I received and read a FAXed copy of your May 2nd letter to me and will include it in the comment section of our Tilefish Amendment 1 submission package to the National Marine Fisheries Service (NMFS). At this point in time, I cannot undo what has been done by the Council. However, what has been done by the Council has not yet been finalized by NMFS. In fact, I do not expect that our submission package to NMFS to be transmitted until the end of this month at the earliest.

By providing NMFS a copy of your letter, NMFS will have the opportunity to reflect on how our Council's action will impact you and your family. You may wish to contact Pat Kurkul the NMFS Regional Administrator (978-281-9250) who will be directly involved in making the final decision to implement what the Council has done. Prior to making a final decision, NMFS is required to provide the public with an opportunity to comment on the proposed and final rules that will implement Amendment 1 to The Tilefish FMP, so you will have an opportunity then to state your case in terms of how NMFS proposed measures will impact your livelihood.

-----Original Message-----
From: fishma56@comcast.net [mailto:fishma56@comcast.net]
Sent: Friday, May 02, 2008 10:08 AM
To: Info
Subject: Tilefish 1 comments

Dear Mr. Furlong,

I have written you the attached letter in response to the proposed Tilefish Quota Amendments.

I am a mother of triplet twelve year olds, a wife, and the co-owner of the long liner Bjorn II. I have written this letter to you and the council in an attempt to show you how your decision on the final quota will affect real people not just a boat name on paper. The final outcome as the council is planning will effectively end our 25 year fishing lively-hood.

Please give us a moment of your time to read my letter and for you to reflect on how your decision will affect my family.

Sincerely,
Christin Bjornberg

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Tuesday, May 13, 2008 4:55 PM
To: Montanez, Jose L.
Subject: FW: Tilefish Amendment 1 F/V Bjorn 2

FYI.

-----Original Message-----
From: Furlong, Daniel T.
Sent: Tuesday, May 13, 2008 4:54 PM
To: 'Anita Potter'
Subject: RE: Tilefish Amendment 1 F/V Bjorn 2

Thank you for your email and comments regarding our actions on Amendment 1 to the Tilefish FMP. On May 2nd I sent the below email to your sister, Christin Bjornberg in response to her letter of May 2.

##

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##

The points made in the above email are still applicable to your family's situation.

-----Original Message-----
From: Anita Potter [mailto:apotter64@yahoo.com]
Sent: Tuesday, May 13, 2008 3:15 PM
To: Furlong, Daniel T.
Subject: Tilefish Amendment 1 F/V Bjorn 2

Daniel T. Furlong
Executive Director
Mid-Atlantic director

Help save the Bjorn II
Imagine having your livelihood stripped from you. Something you have been doing for 25 plus years. It's your heart and soul, which feeds your family, as well as many others. That's what could happen if somebody doesn't prevent this from happening.
My brother-in-law Carl Bjornberg and my sister Christin Bjornberg have been running their fishing business for what seems to be forever. That's all they do. This industry pays for them to live in their home, drive their car, most importantly to feed their three young children, health insurance for their family, the payments and upkeep of their boat. It is a hard earned sweat. When my sister Chris shared with me that limits had been set and limited to certain fishers, I was in shock; thinking of her and her family, and their crew

José
5/14/08

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

F/V Bjorn II

The fishing vessel Bjorn II is going to be effectively eliminated from the Tilefish industry due to an unfair proposal, the Tilefish Amendment 1, by the Mid-Atlantic Fishery Management Council. This decision shows bias and an indiscriminant decision based on the selection of arbitrary fishing years that disregards the entire fishing history of Carl Bjornberg and his family owned boat.

I, the undersigned, know the owners personally: Carl Bjornberg Jr., Christin Bjornberg and their three children, 12 year old triplets, Britt, Kelsey, and Carl III.
Fishing is what Carl and his family do. The rulings by the council ignores the 25 years of their hard work in the Tile Fishery. This proposal will bring such hardship to the Bjornberg family that they will be forced to give up their boat and business. In addition, not only will it negatively affect the Bjornbergs' and the four families that the F/V Bjorn supports, but all the other businesses that the Bjorn II is associated with. My signature represents an endorsement for the F/V Bjorn II and her owners to be given a fair and more equal share in the proposed amendment.

Name Donna K. Talley

Address 316 Jefferson Avenue

Phone Number 609.653-1662

Signature [signature]

Fax from : 05-14-08 11:29 Pg: 1

José
5/14/08

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Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name [illegible] and [illegible] [illegible]

Address 1115 Ocean Hts Ave Egg Harbor Twp, NJ 08234

Phone Number 609-872-5540 + 609-992 0321

Signature [illegible]

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Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Jessica Peirson

Address 417 Monmouth St. Apt 2 Jersey City, NJ 07302

Phone Number 609-412-3203

Signature Jessica Peirson

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Jeremiah True

Address 26 Bartlett St. Haverill, MA 01832

Phone Number (978) 374 - 9135

Signature

5/14/08

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Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name TOM O' ROURKE

Address 18 PAIGE FARM ROAD, AMESBURY, MA 01913

Phone Number (978) 388-8859

Signature Tom O'Rourke

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Susan o'Rourke

Address 18 Paige Farm Rd. Amesbury, MA 0191

Phone Number 978-388-8859

Signature Susan o'Rourke

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name David Evans

Address 324 West 47th St. #4C, New York, NY 10036

Phone Number 914-450-2877

Signature 5/14/08.

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Thomas Stone

Address PO Box 498 18W 6th St. Barnegat Light NJ 08006

Phone Number 609-494-3391

Signature Thomas Stone

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Marie C. Stone

Address 18 W. 6th St. Box 498 Barnegat Lt. NJ

Phone Number 609-494-3391

Signature Marie C. Stone

5/19/08

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Vanessa Imbert

Address 120 E. 34th St 16B, New York, NY 10016

Phone Number 609-432-5288

Signature Vanessa Imbert

5/19/08

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Andrew Haas

Address 26 Cooper Av, Marlboro, NJ 07726

Phone Number 732-742-6546

Signature [signature]

C. Bjornberg, Inc.
F/V Bjorn II
P.O. Box 784
#3 E 15th St.
Barnegat Light, NJ
08006-0784
Ph# (609) 361-9687
Fax (609) 361-1636
May 20, 2008

Daniel T. Furlong
Executive Director
MAFMC

Dear Mr. Furlong,

Accompanying this cover letter are letters from family and friends who wish to express their support for our family and our boat F/V Bjorn II.

We would appreciate you adding these comments to those you have already and hopefully continue to receive in the final comments that you are going to submit to NMFS.

The people who have signed these letters are very upset and dismayed that this can happen to a small hard working family.

In addition, we must comment again that we are not the only family that has either lost their permit or have been cut down to a fraction of their previous effort. Before the last meeting when the MAFMC announced their final intentions, the word was out on the sea that the council had already made their minds up. This 'leak' made it crystal clear who knew of the decision prior to its declaration.

One may say that this is the viewpoint of a 'loser' but this boils down to more than "winners and losers" it reflects how a decision is just or unjust, and in the final analysis is the benefit to the few worth the hardship to the remaining.

Sincerely,

Carl and Chris Bjornberg

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Fred Buttari

Address 15 W 83rd St. Harvey Cedars NJ

Phone Number 609-494-2926

Signature [signature]

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name JoSePH H Bromley

Address 15 W 83rd St Harvey cedars N.J

Phone Number (609) 494-2926

Signature Joseph H Bromley

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Name Cynthia M. Buttari

Address 15 W 83rd st Harvey Cedars NJ

Phone Number 609-494-2926

Signature Cynthia M. Buttari

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Name Brent Donahue

Address 213 Cedar Lake Drive Collings Lakes NJ 08094

Phone Number (267) 984-8423

Signature Brent Donahue

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Executive Director
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Email: dfurlong@mafmc.org
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Name Henry A. Frank

Address 732 bluebird cir Mays Landing N.J. 08330

Phone Number

Signature

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Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Daniel Geiger

Address 29 Eldredge Ave. Del Haven NJ

Phone Number (609) 889-1543

Signature [signature]

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Matthew Schmidt

Address 486A N. Richmond Atlantic City NJ 08401

Phone Number 609-344-0514

Signature M. Schmidt

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Shahid Abdul-Karim

Address 1106 Ravens Crest Dr

Phone Number (609) 290-5565

Signature [signature]

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

F/V Bjorn II

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Name Jonathan ONeil

Address 120 N Grand St Hammonton

Phone Number 609 517-3007

Signature Jonathan ONeil

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name William J. Kurz

Address 241 NORTH WASHINGTON STREET

Phone Number 609-561-9162

Signature William J. Kurz

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name John Saltzman

Address 103 Old Mill Dr. N. Cape May NJ

Phone Number 609-972-3078

Signature

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name MARTIN LINDHOLM

Address P.O. BOX 236 GREEN CREEK NJ 08219

Phone Number 609-780-5707

Signature Martin Lindholm

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Armando Jones

Address 101 Surrey Rd

Phone Number 609-889-8427

Signature Armando Jones

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name JIM HURLEY

Address 116 S. RALEIGH AVE AC NJ

Phone Number

Signature

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Vince Haugh

Address 3400 Landis Ave Sea Isle City

Phone Number 609-408-1599

Signature V P. Haugh

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Francis J. Nook

Address 2805 Central Ave 13 L 11.5-

Phone Number 609-494-6193

Signature Francis J. Nook

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name JAMES MATERNO

Address 18 W. 7th ST BL

Phone Number 494-3346

Signature [signature]

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Jake D'Arcangelo

Address 74 Bonito Dr Waretown NJ 08758

Phone Number 609 661-4940

Signature Jake D'Arcangelo

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Doris A. Smith
PO Box 397
Barnegat Light, NJ 08006

Address 5 E 13th St BL

Phone Number 609-494-7158

Signature Doris A. Smith

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email:
Fax: 302-674-5399

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Name ____Ronald Hart

Address ____1035 W Upland Ct. Mooresville,Indiana

Phone Number ____317-996-3766

Signature Ronald A. Hart

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Robyn Kopyta

Address 200 W. 60th St, 21E, NY, NY 10024

Phone Number 908-337-0717

Signature R. Kopyta

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Carol Kopyta

Address PO Box 21 Kenilworth NJ 07033

Phone Number 908-620-0399

Signature Carol Kopyta

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Nancy Kopyta

Address 1743 Union Ave, Union NJ 07083

Phone Number 908-964-3685

Signature Nancy Kopyta

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
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Name Karina Hathcock

Address 223 Warren st apt 1A, NJ

Phone Number

Signature

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Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Carrie Fellens

Address 573 Palisade Ave

Phone Number 917-602-2390

Signature Carrie Fellens

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Nancy Guajardo

Address 48th St Union City, NJ 0708

Phone Number N/A

Signature Nancy Guajardo

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Mr and Mrs Roger Halbing

Address 42 Arnold Blvd, P.O. Box 961, Barnegat Lt, N.J. 0800

Phone Number 609-494-1905

Signature Barbara Halbing
Roger J Halbing

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Anthony Paris

Address 488 ST. MARKS AVE

Phone Number Brooklyn, N.Y. 11238

Signature

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Executive Director
Mid-Atlantic Fishery Management Council
Email: dfurlong@mafmc.org
Fax: 302-674-5399

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Name Ellyn J. Halvorsen

Address 608 Broadway

Phone Number 609-494-7651 / 609-494-2489

Signature [signature]

Mr. Furlong;
Most All of Barnegat Light Residents along with Business are very Concerned about the Elimation of the majority of the Barnegat Light Fleet for Tilefish After 25 years - How does this Happen. This Needs [illegible] — Please Help All our Boats —

Attention: Daniel Furlong
Executive Director
Mid-Atlantic Fishery Management Council
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Fax: 302-674-5399

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Name ARTHUR NATSIS

Address 3802 BUCKINGHAM CIRCLE MIDDLETOWN, NJ 07748

Phone Number 917 - 796 - 4865

Signature

Montanez, Jose L.

From: Stacy McCann [smccann@mail.gpinet.com]
Sent: Thursday, February 07, 2008 8:22 PM
To: Info
Subject: tilefish 1 comments

Stacy A. McCann
Chief Coatings Inspector
GPI Southeast, Inc.
Cell: 352/274-8980
email: smccann@gpinet.com
Greenman-Pedersen, Inc.
http://www.gpinet.com

NO COMMENTS ATTACHED

Montanez, Jose L.

From: Furlong, Daniel T.
Sent: Thursday, February 07, 2008 11:12 AM
To: Montanez, Jose L.
Subject: FW: Tilefish 1 Comments

FYI

-----Original Message-----
From: Ralph Csogi [mailto:rcsogi@gpinet.com]
Sent: Thursday, February 07, 2008 10:55 AM
To: Info
Subject: Tilefish 1 Comments

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NO COMMENTS ATTACHED