Northeast Fisheries Science Center Reference Document 95-09

# Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW)

*The Plenary*

NOAA/National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, MA 02543-1026

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**Reports of the 19th Northeast Regional Stock Assessment Workshop (19th SAW)**

CRD 95-02 Assessment of the Gulf of Maine cod stock for 1994

by Ralph Mayo

CRD 95-03 A preliminary assessment for white hake in the Gulf of Maine-Georges Bank Region

by K.A. Sosebee, L. O'Brien, and L.C. Hendrickson

CRD 95-04 Assessment of scup (*Stenotomus chrysops*), 1994, report of the Pelagic/Coastal Subcommittee

CRD 95-05 Analytical assessment of surfclam populations in the Middle Atlantic region of the United States in 1994

by R.J. Weinberg, S.A. Murawski, R. Conser, J. Brodziak, L. Hendrickson, H.-L. Lai, P. Rago, K. Sosebee, and A. Lesen

CRD 95-06 Bayesian framework for modified DeLury Model

by Ray Conser

CRD 95-07 Ocean quahog populations from the Middle Atlantic to the Gulf of Maine in 1994

by S. Murawski, J. Weinberg, P.Rago, J. Brodziak, L. Hendrickson, R. Conser, K. Sosebee, and H.-L. Lai

CRD 95-08 Report of the 19th Stock Assessment Workshop (19th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments

CRD 95-09 Report of the 19th Stock Assessment Workshop (19th SAW), the Plenary

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## MEETING SUMMARY

The **Plenary Meeting** of the **19th Northeast Regional Stock Assessment Workshop (19th SAW)** was held during 30 - 31 January 1995 at the Dunes Hotel in Ocean City, Maryland just prior to the January meeting of the Mid-Atlantic Fishery Management Council (MAFMC). About 40 persons attended the meeting, including members and staff of the MAFMC, industry representatives, and SAW Subcommittee chairs. A list of participants is presented in Table 1 and the meeting agenda in Table 2. Draft copies of the "SARC Consensus Summary of Assessments" and "Advisory Report on Stock Status" were available for meeting participants.

### Opening

Dave Keifer, Executive Director of the Mid-Atlantic Fishery Management Council, opened the meeting. He introduced the SAW Chairman, Dr. Terrence P. Smith (NEFSC), and welcomed the Plenary participants.

### Introduction

Dr. Terry Smith introduced the speakers on the agenda: Ralph Mayo (Chairman, Northern Demersal Subcommittee) who presented background assessment information concerning the Gulf of Maine cod and Gulf of Maine-Georges Bank white hake advice; Dr. Emory Anderson (Chairman, Pelagic/Coastal Subcommittee) who made the scup presentation; and Dr. Steven Murawski (Acting Chairman, Invertebrate Subcommittee) the surfclam and ocean quahog presentations. After each presentation of assessment related information, Dr. Smith summarized the stock status and management advice for the species/stock.

Table 1. List of participants.

**National Marine Fisheries Service**
Northeast Fisheries Science Center
Emory D. Anderson
Wendy Gabriel
Ralph K. Mayo
Steve Murawski
Helen Mustafa
Fred Serchuk
Terry Smith
Northeast Regional Office
Andy Rosenberg
**Mid-Atlantic Fishery Management Council**
Lee Anderson
Rick Cole
Tony DiLernia
Robert Hamilton, Jr.
John Mason
Tom McVey
Alan Weiss
Tom Hoff
Dave Keifer
Jose L. Montanez
Nancy Targett
**New England Fishery Management Council**
Tom Hill
**Atlantic States Marine Fisheries Commission**
George Lapointe
**Delaware Division of Fish & Wildlife**
Desmond K. Kahn
**National Fisheries Institute**
Niels Moore
Lee Weddig
**Manomet Observatory**
Peter Ruel
**Atlantic Shellfish**
Warren Alexander
**Chincoteague**
Bernard Rubin
**Doxell Sea Clams**
Bob Doxell
**Mid-Atlantic Food**
Vern Conoway
Wally Gordon
**Nanticoke Seafood Corp.**
William R. Meadows
**Rick-Sea Pak**
James Hardel
**Sea Watch**
Tom Alspach
Norman Pennypacker
**Wallace & Assoc.**
Rick Savage
David Wallace
**LNA Inc. F/V "ELLIE B"**
Louie LaLace
**F/V "FLICKA" & F/V "DYRSTEN"**
Lars Axelsson

In addition, Dr. Fred Serchuk (NEFSC) made a presentation on the results and implications of the NEFSC 1994 sea scallop survey, an intermediate step for presenting information, as scallop will be on the SAW-20 agenda.

Table 2. Agenda for the 19th Northeast Regional Stock Assessment Workshop (19th SAW), Plenary Meeting.

**Dunes Manor Hotel**
**Ocean City, Maryland**
**30-31 January 1995**

**AGENDA**

Monday, 30 January

| | | |
|---|---|---|
| 1:00 | Opening | Executive Director MAFMC, D. Keifer |
| 1:15 | Stock Assessment Review Committee* (SARC) Meeting Highlights and Report | SAW Chairman, T.P. Smith |
| 1:30 | **Advisory Report on Stock Status** Presentation and Discussion | |
| | Introduction | T.P. Smith |
| | Gulf of Maine Cod | R. Mayo |
| | White Hake | R. Mayo |
| | Scup | E. Anderson |
| | Summary of Advice | T.P. Smith |

Tuesday, 31 January

| | | |
|---|---|---|
| 9:00 | Sea Scallop 1994 Survey Results and Implications | F. Serchuk |
| 9:30 | Continue **Advisory Report on Stock Status** Presentation and Discussion | T.P. Smith |
| | Surfclam | S. Murawski |
| | Ocean Quahog | S. Murawski |
| | Summary of Advice | T.P. Smith |
| 11:30 | Other Business | |

Dr. Smith stressed that the information that will be presented at this Plenary meeting does not represent the work of the individual presenters but the consensus of the Stock Assessment Review Committee (SARC) which met during 28 November - 2 December 1994. He discussed the composition of the SARC (Table 3), including the expertise of its members, and the SARC meeting agenda. At their meeting, the SARC reviewed Subcommittee reports developed at a number of Subcommittee meetings (Table 4) as well as other detailed assessment and methods documents. The SARC determined that six documents would be published in the NEFSC Reference documents series along with this report and the "SARC Consensus Summary of Assessments" (Table 5).

Table 3. Composition of the SARC.

Chair:
**Terry Smith, NEFSC**
(SAW Chairman)

Four *ad hoc* assessment members chosen by the Chair:
**Han-Lin Lai, NEFSC**
**Wally Morse, NEFSC**
**Paul Rago, NEFSC**
**Mark Terceiro, NEFSC**

One person from NMFS, Northeast Regional Office:
**Andy Rosenberg, NERO**

One person from each Regional Management Council:
**Andy Applegate, NEFMC**
**Tom Hoff, MAFMC**

Atlantic States Marine Fisheries Commission/ State personnel:
**Najih Lazar, ASMFC**
**Steve Cadrin, MA DMF**

One Scientist from:
Canada - **Kees Zwanenburg, DFO, Dartmouth, NS**
Academia - **Judy Grassle, Rutgers University**
Other Region - **Glen Jamieson, DFO, Nanaimo, BC**

Table 4. SAW-19 Subcommittee meetings.

| Subcommittee - Species Analysis<br>Participants | | Meeting Date<br>and Place |
|---|---|---|
| **Northern Demersal Subcommittee - Gulf of Maine Cod and Gulf of Maine/Georges Bank White Hake** | | |
| A. Applegate, NEFMC | L. Hendrickson, NEFSC | 17 - 21 October 1994 |
| R. Brown, NEFSC | R. Mayo, NEFSC (Chair) | Woods Hole, MA |
| J. Burnett, NEFSC (White Hake only) | | |
| S. Cadrin, MA DMF | L. O'Brien, NEFSC | |
| R. Conser, NEFSC | K. Sosebee, NEFSC | |
| T. Helser, NEFSC | S. Wigley, NEFSC | |
| **Coastal/Pelagic Subcommittee - Scup** | | |
| E. Anderson, NEFSC (Chair) | S.-W Ling, NEFSC | 1 - 4 November 1994 |
| S. Correia, MA DMF | J. Mason, NY DEC | Woods Hole, MA |
| T.Currier, MA DMF | C. Moore, MAFMC | |
| W. Gabriel, NEFSC | J. Musick, VIMS | |
| J. Kocik, NEFSC | D. Simpson CT DEP | |
| M. Lambert, NEFSC | M. Terceiro, NEFSC | |
| N. Lazar, ASMFC | | |
| **Invertebrate Subcommittee - Surfclam and Ocean Quahog** | | |
| J. Brodziak, NEFSC | S. Murawski, NEFSC (Chair) | 31 October - |
| R. Conser, NEFSC | V. Nordahl, NEFSC | 3 November 1994 |
| L. Hendrickson, NEFSC | P. Rago, NEFSC | Woods Hole, MA |
| T. Hoff, MAFMC | C. Weidman, WHOI | |
| H.-L. Lai, NEFSC | J. Weinberg, NEFSC | |
| A. Lesen, NEFSC | | |

Table 5. 19th SAW NEFSC Reference Documents.

| | |
|---|---|
| CRD 95-02 | Assessment of the Gulf of Maine Cod Stock for 1994 by R.K. Mayo |
| CRD 95-03 | A Preliminary Analytical Assessment of White Hake in the Gulf of Maine-Georges Bank Region by K.A. Sosebee, L. O'Brien, and L.C. Hendrickson |
| CRD 95-04 | Assessment of Scup (*Stenotomus chrysops*), 1994, Report of the Pelagic/Coastal Subcommittee |
| CRD 95-05 | Analytical Assessment of Surfclam Populations in the Middle Atlantic Region of the United States in 1994 by R.J. Weinberg, S.A. Murawski, R. Conser, J. Brodziak, L. Hendrickson, H.-L. Lai, P. Rago, K. Sosebee, and A. Lesen |
| CRD 95-06 | Bayesian Framework for the Modified DeLury Model by R. Conser |
| CRD 95-07 | Ocean Quahog Populations from the Middle Atlantic to the Gulf of Maine in 1994 by S. Murawski, J. Weinberg, P. Rago, J. Brodziak, L. Hendrickson, R. Conser, K.Sosebee, and H.-L.Lai |
| CRD 95-08 | Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments |
| CRD 95-09 | Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW), The Plenary |

Table 6. Subcommittee Species Assignments.

o Northern Demersal Subcommittee

| | |
|---|---|
| Atlantic Cod | Witch Flounder |
| Haddock | Silver Hake |
| Pollock | Cusk |
| American Plaice | Wolffish |
| Redfish | White Hake |

o Southern Demersal Subcommitee

| | |
|---|---|
| Summer Flounder | Skate |
| Yellowtail Flounder | Winter Flounder |
| Goosefish (Monkfish) | Windowpane Flndr |
| Red Hake | Ocean Pout |
| Tilefish | |

o Pelagic/Coastal Subcommittee

| | |
|---|---|
| Mackerel | River Herring |
| Herring | Striped Bass |
| Atlantic Salmon | Black Sea Bass |
| Butterfish | Bluefish |
| American Shad | Scup |
| Dogfish | Tautog |

o Invertebrate Subcommittee

| | |
|---|---|
| Scallop | Northern Shrimp |
| Lobster | Surfclam |
| Short-finned Squid | Ocean Quahog |
| Long-finned Squid | |

*The SAW Process*

Dr. Smith reviewed the SAW process, indicating that it is a continuous "cycle" (Figure 1). In this cycle, the SAW Steering Committee Meeting represents the end of one SAW process and the beginning of another. The Steering Committee reviews the documentation and recommendations from the last SAW and identifies species/stocks to be assessed and reviewed during future SAWs, setting the terms of reference for the analyses. Four species Subcommittees are responsible for the assessment of about 40 Northeast species/stocks which are grouped by region and type (Table 6). Although ASMFC and state experts participate on Subcommittees, more state representation is desirable, particularly on the Northern Demersal Subcommittee.

The SARC reviews the Subcommittee reports and other submitted analyses, develops the "Consensus Summaryof Assessments" and the "Advisory Report on Stock Status," and determines which documents will be published in the NEFSC Reference Document series. The advice developed in the SARC meeting, with some background assessment information, is vetted at the SAW Plenary meeting.

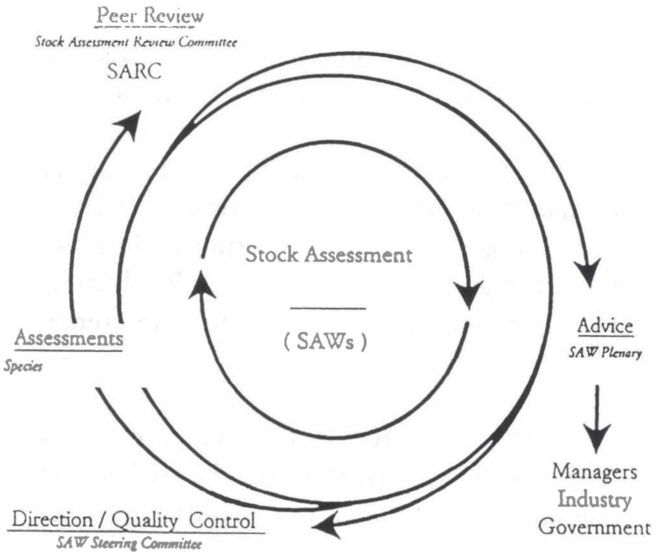



Figure 1. Northeast Regional Stock Assessment Workshop (SAW) process.

The next Steering Committee meeting is scheduled for 17 February 1995. At that time, the Committee will set the species/stock and the terms of reference for assessment analyses during the SAW-20 cycle and discuss the SAW process and documentation.

**Presentation of Advice**

Dr. Smith reviewed the outline of the Advisory Report and the utility of the stock status chart in the Introduction. The two dimensional chart indicates recommended action based on the biomass level and the exploitation status. Each stock in the Advisory Report is characterized according to this chart. The Introduction section also contains a Glossary of Terms and, for the first time, a table to convert the instantaneous fishing mortality rate (F) to an annual exploitation rate.

The presentations that followed were based on information contained in the Report of the 19th Northeast Regional Stock Assessment Workshop, SARC Consensus Summary of Assessments and the "Advisory Report on Stock Status" section of this report.

Gulf of Maine Cod

The previous assessment of Gulf of Maine cod was reviewed at SAW-15 (December 1992). Total landings in 1992 were 10,900 mt, a sharp decline from 17,800 mt in 1991.

The Gulf of Maine cod is distinguished from Georges Bank cod by slower growth rates and a later age of maturation. Examination of commercial landings of Gulf of Maine cod, 1893-1993, indicates a dramatic drop in landings. This dramatic drop is also seen in the index of abundance and commercial landings per unit of effort (LPUE) of directed trips, 1965-1993. The last major increase to the fishery was due to the large 1987 year class. Once this year class was fully recruited, however, the LPUE and indices of abundance declined sharply. In

1993, the landings were 8,300 mt. LPUE declined sharply in 1993 to a pre-1989 level and survey indices of number and weight per tow in autumn of 1993 and spring of 1994 were at record-low levels .

Sufficient sampling for an analytical assessment has been available only since 1982. VPA results indicate that 1993 fishing mortality (F) is 0.93 and the 1994 spawning stock biomass is 9,400 mt. The yield and SSB per recruit analysis indicates that $F_{0.1}$=0.16; $F_{MAX}$=0.27; and $F_{20\%}$=0.35.

*Summary of Research Recommendations*

Future assessments should include all available sea-sampling data to develop a second index of abundance and, where possible, should incorporate discards and recreational data. Non-age based assessment techniques, such as the DeLury method, should be used to give a better indication of fishing mortality.

*Summary of Status and Advice*

The exploitation of Gulf of Maine cod is too high, currently at 56% (F=0.93), about 3 times the overfishing rate and more than 2 times the overfishing exploitation rate. The spawning stock biomass is at record low and recent recruitment is poor.

Management advice:

- o Reduce exploitation to 27% ($F_{20\%}$=0.35)
- o Halt decline in spawning stock biomass (SSB)
- o Rebuild SSB to reduce the risk of recruitment failure

Dr. Terry Smith reviewed the short-term and medium-term forecasts for this stock. Medium- term projections indicate that under the status quo fishing mortality rate landings and spawning stock biomass will continue to decline. Conversely, if the fishing mortality rate is reduced to $F_{20\%}$ (0.35), the stock will begin to rebuild.

<u>Gulf of Maine - Georges Bank White Hake</u>

The previous assessment of white hake was an index level assessment reviewed during SAW-11 (October 1990). At the time, exploitation rates were estimated to have increased despite a decline in landings. The SAW-11 SARC was concerned about the decline in survey indices and recommended that basic data on the population dynamics of this species be obtained for the purpose of evaluating and monitoring this trend.

The current assessment of white hake is an analytical assessment. A modified DeLury Model was used to define recruits and fully-recruited animals and a Surplus Production Model was used to define biomass reference points.

Although there is a seasonal component to white hake distribution, the fishery is primarily concentrated in the Gulf of Maine. Landings during the 1992-1993 period exceeded 9,000 mt, compared to 5,000 mt - 6,000 mt in the late 1980s. Most of the landings were taken by trawl and gillnet from the Gulf of Maine. Sizes of landed animals generally exceeded 40 cm and sizes of discards generally ranged from 30-50 cm and in some years as low as 20 cm. Although the LPUE declined during the 1980s, it has increased since 1989. As the fishery is basically non-directed, it is difficult to measure and estimate the trend.

Landings in 1993 were 9,200 mt, close to the record high, with the LPUE at a relatively low level. Survey indices are relatively stable. The 1993 F was calculated to be 0.42 with the 1994 exploited biomass at 14,950 mt. MSY was calculated to be 7,685 mt; $B_{MSY}$= 21,017 mt; $B_{MAX}$=80,460 mt; and K=11,494 mt. The yield per recruit analysis indicated that $F_{0.1}$=0.13 and $F_{MAX}$=0.22.

*Summary of Research Recommendations*

The SARC recommended estimation of the proportions of white and red hake in commercial landings. The ability to distinguish between white and red hake, however, continues to be a problem. Stock structure of white hake in the region from Southern New England to the Scotian Shelf should be investigated to determine the extent to which mixing occurs. In this regard, the utility of otolith exchange between the USA and Canada should be explored. Also recommended was the incorporation of Canadian landings from the Scotian Shelf into the white hake assessment and the extension of the time series in the Surplus Production Model to a period before 1985 for the purpose of increasing the range in biomass for estimating the shape of the surplus production function.

*Summary of Status and Advice*

Recent white hake landings are high, above 9,000 mt, while MSY is 7,700 mt. White hake dominates current landings in the Gulf of Maine. The stock is fully exploited.

Management advice:

- Do not increase exploitation as recent landings are very high.
- Caution is warranted. Although under the current definition of overfishing, the stock is not overfished, new reference points have been offered for consideration.

Scup

The last assessment review of scup took place at SAW-11 (October 1990). The analysis was prepared by the Connecticut Department of Environmental Protection. In the interim, a yield per recruit analysis was conducted in the ASMFC Scup/Black Sea Bass Technical Committee.

Scup in the area from Cape Cod through Cape Hatteras is assumed to be one unit stock. Within this area, scup move onshore in the summer and offshore in the winter with the bulk of the resource residing around Cape Cod. Long-term trends in commercial catch have been estimated back to 1930. The catch peaked in the mid 1960s, averaging over 19,000 mt per year. Catches in 1993 were 4,400 mt, a 25% decline from 1992, and only about 20% of the peak in 1960. The time series of recreational catches is 1979-1987.

The trend in fishing mortality peaked in 1988 and the current F value is five times higher than $F_{MAX}$. Since well over two-thirds of the population (67%-68%) is removed every year, the fishery is becoming increasingly dependent on very small fish. Only 6%-7% of the total stock fished are mature fish, the rest are immature fish, ages 0-2. The trend in recruitment is declining.

*Summary of Research Recommendations*

As many sources of uncertainly in this assessment are due to decreasing in sea- and port-sampling, which seriously impacts the ability to assess scup, one of the SARC's recommendations was to improve sea- and port sampling of fisheries catching scup. Given current sampling difficulty, the SARC recommended non-age based assessment methods. The SARC also recommended investigation of the trophic relationships of the species.

*Summary of Status and Advice*

The stock is overexploited; $F_{MAX}$=0.24 (19% exploitation), and current exploitation is 67% (F=1.3). In 1993, spawning stock biomass was 4,600 mt and has been declining since 1990.

Management advice:

- o Immediately and substantially reduce the exploitation rate.
- o Reduce exploitation on younger fish, ages 0-2 and less than 7".

Surfclam

The following conversion values apply to the surfclam assessment:

- o 1,000 metric tons (meats) = 129,706 bushels
- o 2 inches =5 centimeters
  1 fathom = 1.83 meters
- o F=0.2=18% of stock is caught each year, 4% of stock dies each year due to natural causes
- o 50% of discarded clams are assumed to die
- o LPUE = Landings Per Unit of Effort (Bushels per Hour Fished)

The surfclam resource was last assessed during SAW-15 (December 1992). Results of that assessment indicated that the resource was at a medium level of abundance and fully exploited. At the time, it was predicted that the Northern New Jersey supply would be depleted in 6 - 7 years and the Mid-Atlantic supply in 11-14 years at current quota levels. Survey biomass declined 50% from 1982 to 1992 and LPUE also declined. Based on surveys, the total mortality rate for the Northern New Jersey area was 6% per year and in Delmarva 17% per year. The research recommendations from SAW-15 called for the development of more sophisticated stock depletion models; an examination of survey precision and survey scope reduction; and an evaluation of port sampling.

The SAW-19 terms of reference included estimates of current stock size, fishing mortality rates, and likely trends in abundance for a 10-year period under alternative quota levels; summaries of fishery independent abundance indices; trends in landings, size composition, areal distribution, and LPUE for appropriate population units. In addition, the S&S Committee asked the SARC to incorporate current low-levels of observed recruitment into 'Supply Years' calculations.

The current assessment addresses many of the research recommendations from SAW-15 in addition to the SAW-19 terms of reference established for surfclam. Supply years calculations incorporate recent recruitment, stochastic estimates of starting stock and natural mortality.

The assessment indicates that the large year class spawned in the late 1970s still dominates the total Mid-Atlantic resource. The majority of landings are currently from off Northern New Jersey, where exploitable biomass in 1994 was 78,000 mt of meats (10.1 million bushels). At the current rate of catch this equals about 4 years of supply. Landings off Delmarva account for 14% of the Mid-Atlantic total. With 23,000 mt of exploitable biomass (3.0 million bushels), the current harvest can be taken for about 11 years if recruitment declines modestly. Exploitation rates in Northern New Jersey and Delmarva are about 18%. Under current quotas and fishing patterns, exploitation rates will increase to about 70% in ten years. There is about seven years of supply for Northern New Jersey and Delmarva combined. Under a quota reduction of 16% there is a 50% chance of constant catch for 10 years.

The assessment was not without problems and includes several sources of uncertainty. The 1994 survey results themselves are suspect, due to an increase in survey catchability and do not make sense from the population dynamics point of view. The survey was compared to other surveys and the assessment was adjusted for this inconsistency. The adjustment was based on surveys since 1982.

*Summary of Research Recommendations*

The SARC recommended improved and revised biological studies of growth, maturity, and meat yield; expansion of the DeLury models back to the 1960s; incorporation of fine-scale spatial analysis in the GLM; development of a multi-index version of the DeLury model; examination of the need to adjust LPUE for effort reporting; and examination of factors affecting survey gear efficiency relative to clam size. Genetic and other studies are also warranted to better understand stock structure.

*Summary of Status and Advice*

Surfclam is fully-exploited at a medium biomass level. The Northern New Jersey fully-recruited biomass is declining while the Southern New England and Georges Bank resources, about 30% of total stock biomass, are currently not fished.

Management advice:

- o Given current exploitation patterns there is only about 7 years worth of supply in Northern New Jersey and Delmarva combined.
- o The Northern New Jersey supply is 4 years.
- o Recruitment in Delmarva is less than current removals.
- o For a 10 year horizon in the Northern New Jersey and Delmarva area, the quota should be reduced 16%, to 16,400 mt.

<u>Ocean Quahog</u>

The following are definitions of conversion values relevant to this assessment:

- o 1,000 metric tons (meats) = 220,500 bushels
- o 2 inches = 5 centimeters
  1 fathom = 1.83 meters
- o $F = 0.2$ = 18% of stock caught each year, 2% of the stock dies each year due to natural causes
- o LPUE = Landings Per Unit of Effort (bushels per hour fished)

Ocean quahogs are one of the longest-living, slowest growing marine bivalves in the world. Under normal circumstances, they live to be more than 100 years old. The exceedingly slow growth rate gives the appearance of the same size quahogs being harvested over a period of time.

Ocean quahog was last assessed during SAW-15 (December 1992). That assessment indicated that the resource (Georges Bank - North Carolina) was at a high biomass level and fully exploited. Recruitment in the southern region was found to be practically non-existent, only 2%, with no major recruitment events in 20 years; LPUE had fallen by one third; and 13-17 years of supply was projected for currently fished areas. Supply in the southern area was projected to be 30 years. The Maine population is different in that the animals are smaller and slower growing. SAW-15 research recommendations called for the examination of survey precision and more sophisticated methods for estimating stock size and exploitation rates.

All terms of reference set by the SAW Steering Committee for SAW-19 were addressed in the current assessment. Total landings for ocean quahog have leveled off since 1976. Since 1970 there has been a progressively northward shift in landings, with Delmarva peaking in 1988, New Jersey peaking in 1991, and most current landings coming from Long Island. Resource abundance in these areas has declined substantially (representing 40% - 60% of the total resource).

The huge resource observed on Georges Bank and in Southern New England have not been fished. These areas are considered too deep for current fishing gear and will require the development of innovative fishing technology before they can be harvested.

*Summary of Research Recommendations*

The SARC recommended evaluation of regional differences in catchability from the Leslie-DeLury Model to calibrate survey swept-area calculation for unfinished areas; biological studies of maturity and growth for the development of biological reference points; the development of spatial geographic methods for estimating population size; and, increased levels of biological sampling.

*Summary of Status and Advice*

The ocean quahog resource is fully-exploited and at a medium biomass level. The biomass is declining in exploited areas, with about half of the resource remaining currently unfished. Supply year forecasts were carried out for current exploitation patterns, separate area forecasts, combined area forecast, and no recruitment assumed.

Management Advice:

- o Given the current quota and current effort patterns the supply (all areas) will be exhausted in less than 30 years.
- o Current supply for Delmarva, New Jersey, and Long Island combined is about 11 years (Delmarva - 32 years, New Jersey - 14 years, and Long Island - 4 years).
- o The resource is sustainable in the long-term at a lower harvest rate.
- o Fishing may be expanded into currently unfished areas (Georges Bank and deeper waters).

## 1994 Sea Scallop Survey Results and Implications

The NEFSC sea scallop research vessel survey monitors trends in relative abundance, size composition, and recruitment patterns in USA sea scallop resources. The 1994 survey was conducted 22 June -1 July in the Mid-Atlantic region (227 tows) and 5-18 July in the Georges Bank region (190 tows in U.S. and 47 tows in Canadian waters). A stratified random sampling design was employed using a 2.44 m (8 ft) wide scallop dredge with 5.1 cm (2 inch) ringbag and 3.8 cm (1-1/2 inch) mesh liner; the tows were 15 minutes in duration at a speed of 3.5 knots. The distribution of principle regions of the survey is presented in Figure 2.

Survey results show that the total abundance of sea scallops in the Mid-Atlantic region is more than 4 times greater than the total abundance level in the USA Georges Bank region (Figures 3 and 4). Survey shell height frequency data reveal that both large and small scallops occur at the same stations.

On Georges Bank, the 1994 survey results indicate that sea scallop abundance and biomass remained near the record-low 1993 levels. Abundance of harvestable-sized ($\geq$70 mm shell height) scallops fell to near record-low levels in 1994 in the Southeast Part of Georges Bank and to record-low levels in the USA Northern Edge and Peak area. In the South Channel area, the abundance of harvestable-size scallops increased slightly (Figure 3). Overall, the USA Georges Bank harvestable biomass is dominated by scallops less than 40 meat count (Figure 5). Pre-recruit (<70 mm shell height) indices suggest that recruitment from the 1991 year class is poor in the South channel and on the USA Northern Edge and Peak, but above-average in the Southeast Part of the Bank (Figure 3).

In the Mid-Atlantic region, total sea scallop abundance has increased and is currently at a high level (Figure 4). In the New York Bight area, the abundance of harvestable-size scallops nearly doubled between 1993 and 1994. In both the Delmarva and Virginia-North Carolina areas, survey abundance and biomass indices of harvestable-size scallops increased to record-high levels. The 1994 survey indices of pre-recruit scallops indicate that recruitment of the 1991 year class is strong in the New York Bight, above-average in Delmarva, and weak in Virginia-North Carolina.

The combined USA Georges Bank and Mid-Atlantic resources are dominated by small, more than 80 count, scallops (Figure 5).

Until recruitment improves and abundance levels increase on Georges Bank, effort will likely be directed to the Mid Atlantic region where abundance levels are high and recruitment has improved in the last two years.

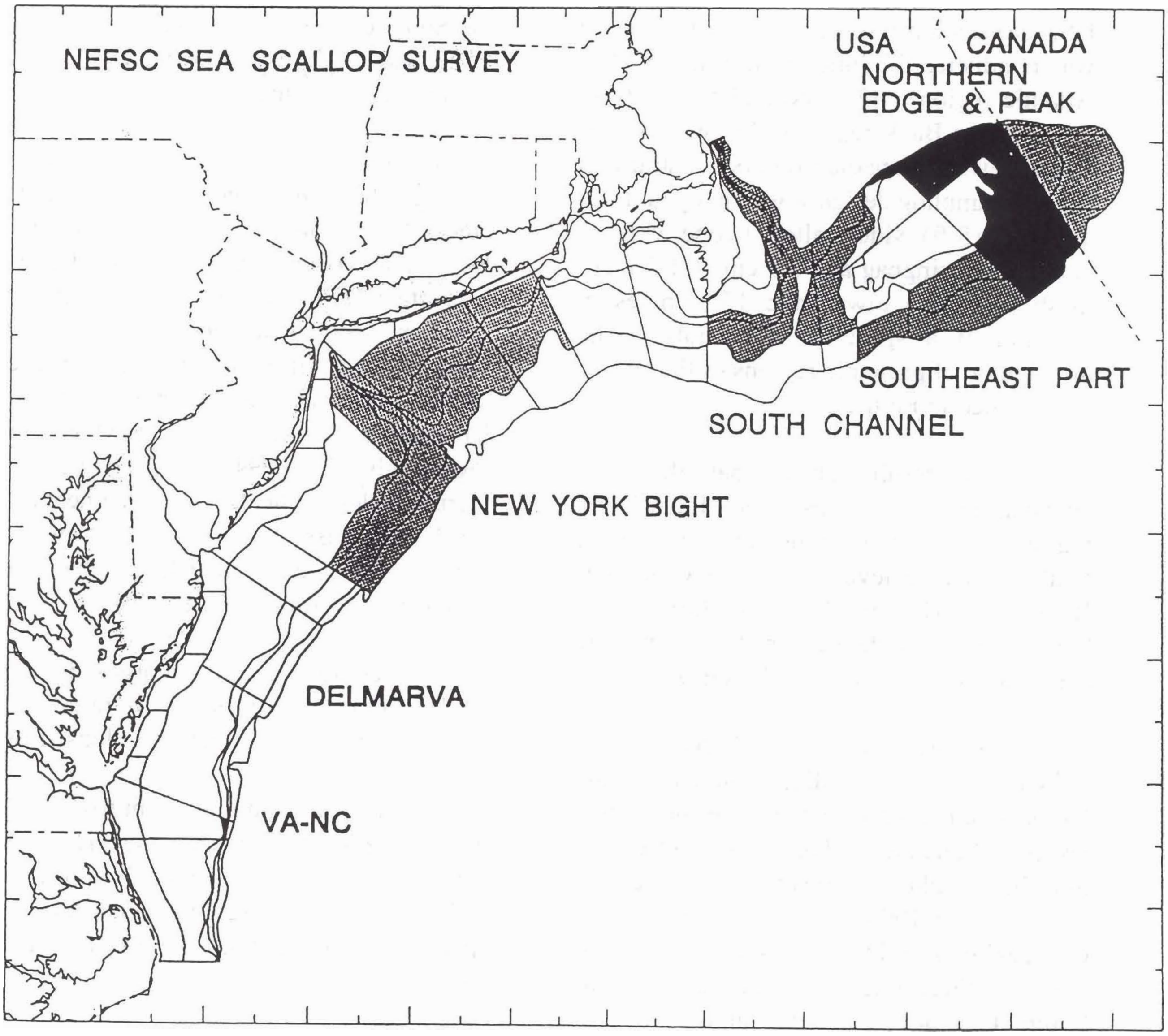



Figure 2. Principal regions of the Northeast Fisheries Science Center Sea Scallop Survey.

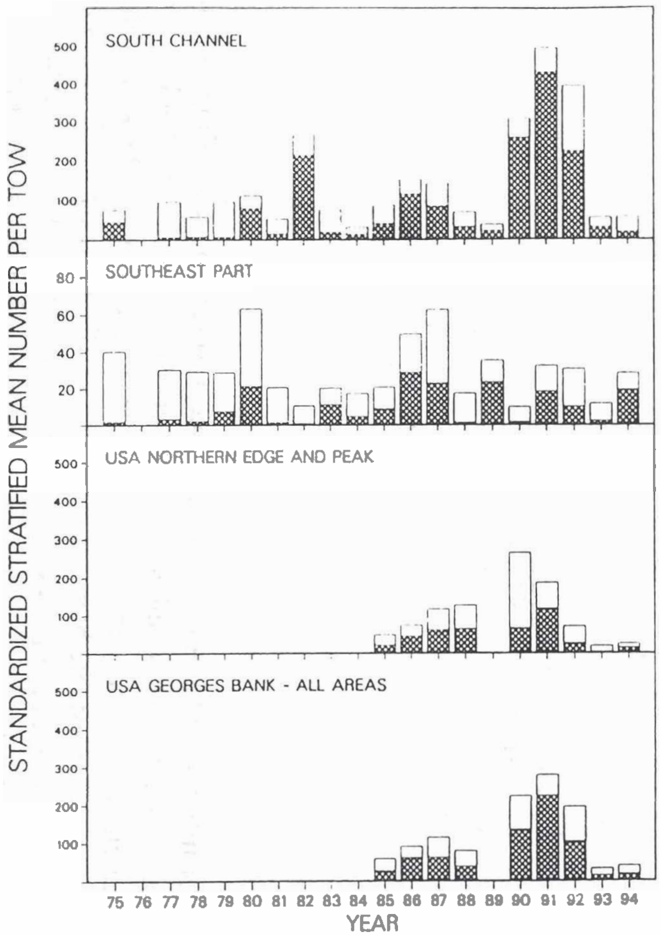



Figure 3. Relative abundance indices of sea scallops, by principal region on USA Georges Bank, from USA sea scallop research vessel surveys conducted during 1975 and 1977-1994. The shaded portion of each bar represents the relative abundance of pre-recruit scallops (<70 mm shell height); the upper, non-shaded portion of each bar represents the relative abundance of recruited or harvestable-size scallops (≥70 mm shell height).

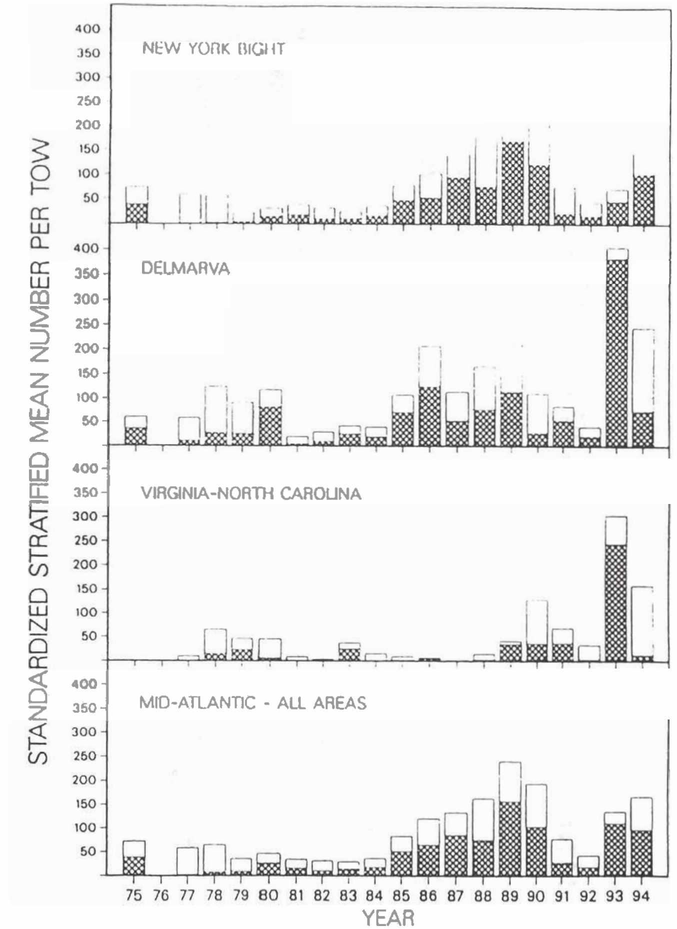



Figure 4. Relative abundance indices of sea scallops, by principal region in the Mid-Atlantic, from USA sea scallop research vessel surveys conducted during 1975 and 1977-1994. The shaded portion of each bar represents the relative abundance of pre-recruit scallops (<70 mm shell height); the upper, non-shaded portion of each bar represents the relative abundance of recruited or harvestable-size scallops (≥70 mm shell height).

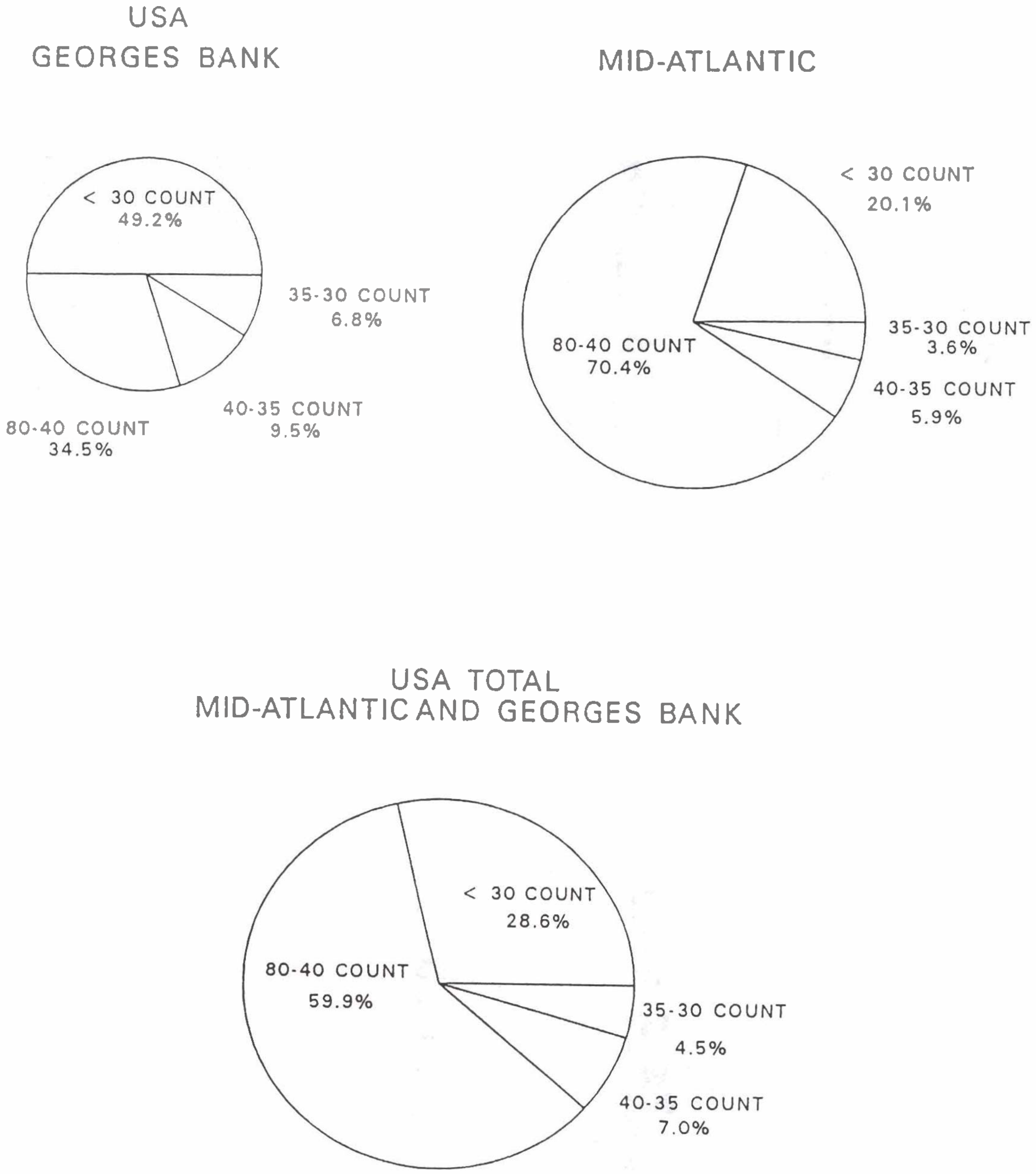



Figure 5. Percentage distribution of harvestable biomass (meat weight) of sea scallops, within various meat count intervals (number of meats per pound), from the 1994 USA sea scallop research vessel survey in the USA portion of the Georges Bank and Mid-Atlantic regions. Harvestable biomass is defined as all sea scallops $\geq$70 mm shell height. Data derived from the 1994 survey distributions of standard stratified mean meat weight per tow (areas of circles are proportional to harvestable biomass).

# ADVISORY REPORT ON STOCK STATUS

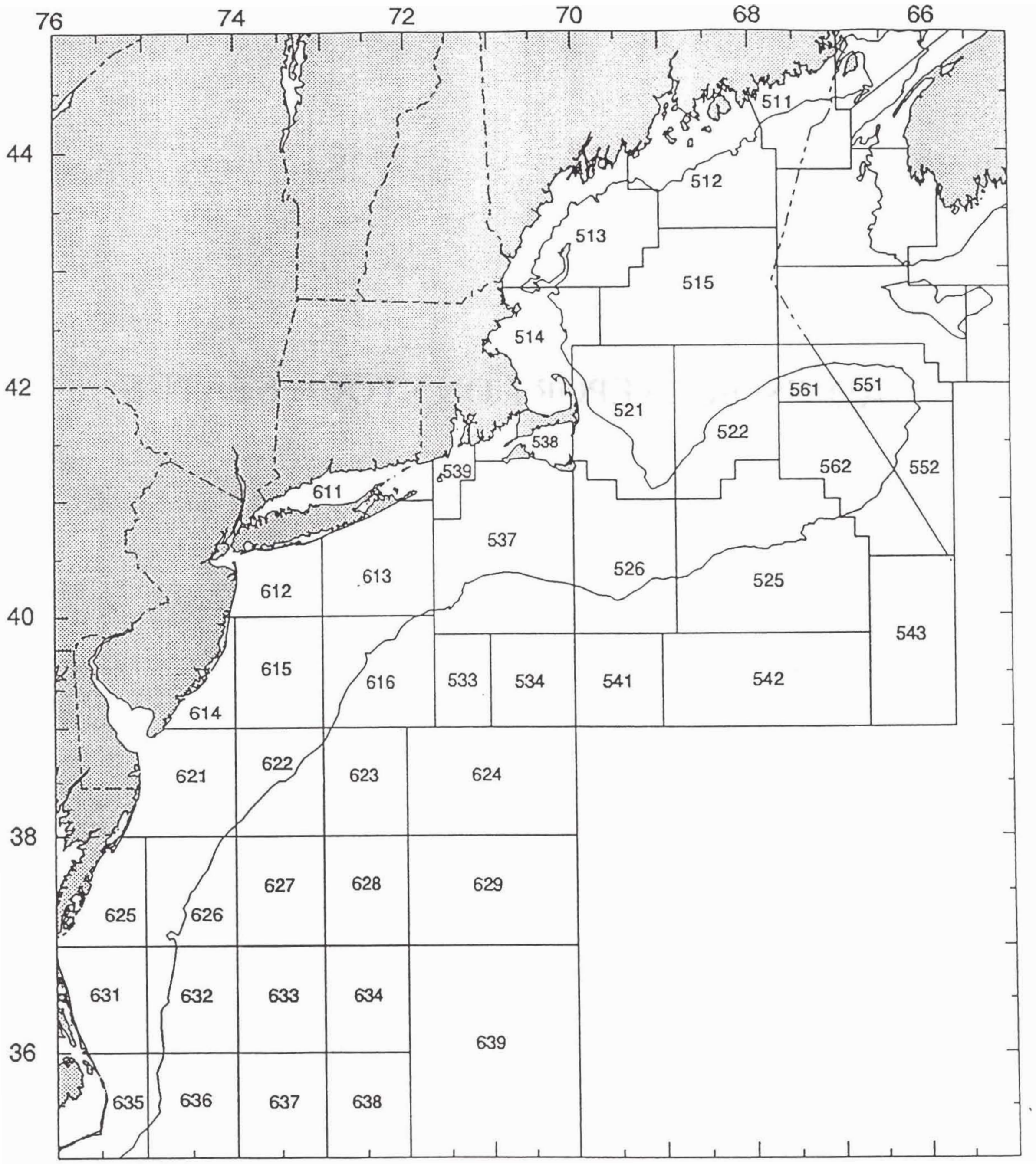



Figure 6. Statistical areas used for catch monitoring in offshore fisheries in the northeast United States

## INTRODUCTION

The **Advisory Report on Stock Status** is a major product of the Northeast Regional Stock Assessment Workshop. It summarizes the technical information contained in the Stock Assessment Review Committee (SARC), Consensus Summary of Assessments and is intended to serve as scientific advice for fishery managers on resource status.

An important aspect of scientific advice on fishery resources is the determination of whether a stock is currently over-, fully-, or under-exploited. As these categories specially refer to the act of fishing, they are best thought of in terms of exploitation rates relative to the Councils' overfishing and maximum sustainable yield (MSY) definitions. The exploitation rate is simply the proportion of the stock alive at the beginning of the year that is caught during the year. When that proportion exceeds the amount defined by the Councils' overfishing definition, it is considered to be over-exploited. When the stock is at such a level that the MSY can be taken but the fishery is only removing a small portion of the stock, then it is considered to be under-exploited.

Another important factor for classifying the status of a resource is the current stock level, for example, spawning stock biomass (SSB). It is possible that a stock that is not currently overfished in terms of present exploitation rates is still at a low biomass level due to heavy exploitation in the past. In this case, future recruitment to the stock is very important and the probability of improvement is increased greatly by increasing the SSB. Conversely, a stock currently at a high level may be exploited at a rate greater than the overfishing definition level until such time as it is fished down to a stock size judged appropriate for maximum productivity or desirable from an ecological standpoint. Therefore, where possible, stocks under review were classified as high, medium, or low biomass compared to historic levels. The figure below describes this classification.

STOCK LEVEL

EXPLOITATION STATUS

| | LOW | MEDIUM | HIGH |
|---|---|---|---|
| OVER EXPLOITED | REDUCE EXPLOITATION REBUILD STOCK BIOMASS | REDUCE EXPLOITATION REBUILD AGE STRUCTURE | REDUCE EXPLOITATION INCREASE YIELD PER RECRUIT |
| FULLY EXPLOITED | REDUCE EXPLOITATION REBUILD STOCK BIOMASS | MAINTAIN EXPLOITATION RATE AND YIELD | MAINTAIN EXPLOITATION RATE AND YIELD |
| UNDER EXPLOITED | MAINTAIN LOW EXPLOITATION WHILE STOCK REBUILDS | INCREASE EXPLOITATION SLOWLY TO REFERENCE LEVEL | INCREASE EXPLOITATION TO REFERENCE LEVEL |

# Glossary of Terms

**Biological reference points:** Fishing mortality rates that may provide acceptable protection against growth overfishing and/or recruitment overfishing for a particular stock. The rate and points are usually calculated from equilibrium yield-per-recruit curves, spawning stock biomass-per-recruit curves and stock recruitment data. Examples are $F_{0.1}$, $F_{MAX}$ and $F_{MSY}$.

**Exploitation pattern:** The pattern of fishing mortality on different age classes of the stock. This pattern often varies by type of fishing gear, area and seasonal distribution of fishing, and the growth and migration of the fish. The pattern can be changed by modifications to fishing gear, for example, increasing mesh or hook size, or by changing the proportion of harvest by gear type.

**Mortality rates:** Populations of animals decline exponentially. This means that the number of animals that die in an "instant" is at all times proportional to the number present. The decline is defined by survival curves such as

$$N_{t+1} = N_t e^{-z}$$

when the number of deaths is proportional to the number present, Z is the total instantaneous mortality rate which can be separated into deaths due to fishing (F) and deaths due to all other causes (M) and e is the base of the natural logarithm (2.71828). To better understand the concept of an instantaneous mortality rate consider the following example. Suppose the instantaneous total mortality rate is 2 (i.e., Z = 2) and that we are interested in how many animals of an initial population of 1 million fish are alive at the end of one year. If we break the year up into 365 days (that is, the 'instant' of time is one day) then 2/365 or 0.548% of the population dies each day. On the first day of the year 5,480 fish die (1,000,000 x 0.00548), leaving 994,520 fish. On day 2, 5,450 fish die (994,520 x 0.00548) leaving 989,070 fish. At the end of the year there remain 134,593 fish ($1{,}000{,}000 \times (1-0.00548)^{(365)}$). If, we had instead selected a smaller 'instant' of time, say an hour, at the end of the first time interval (an hour) 0.0228% of the population would have died (2/8,760 hours per year) and we would calculate that there would be 135,304 fish remaining at the end of the year ($1{,}000{,}000 \times (1-0.00228)^{(8760)}$). As our instant of time becomes shorter and shorter the exact answer to the number of animals surviving is given by the survival curve mentioned above, that is,

$$N_{t+1} = N_t e^{-Z}$$

or, for our example,

$$N_{t+1} = 1{,}000{,}000\ e^{-2} = 135{,}335 \text{ fish}$$

**Exploitation rate:** The proportion of a population at the beginning of the year that is caught during the year. That is, if 1 million fish were alive on January 1 and 200,000 were caught during the year, the exploitation rate is 200,000 divided by 1 million or 20%.

**$F_{MAX}$:** The rate of fishing mortality that produces the maximum level of yield-per-recruit. This is the point where growth overfishing begins.

**$F_{0.1}$:** The fishing mortality rate where the increase in yield-per-recruit for an increase in a unit-of-effort is only 10 percent of the yield-per-recruit produced by the first unit of effort on the unexploited stock (i.e., the slope of the yield-per-recruit curve for the $F_{0.1}$ rate is only one-tenth the slope of the curve at its origin).

**$F_{MSY}$:** The fishing mortality rate that maintains a stock at its maximum sustainable yield.

**Growth overfishing:** The rate of fishing above $F_{MAX}$ ; a rate of fishing at which weight loss due to mortality exceeds weight gain due to growth.

**MSY:** The largest average catch that can be taken from a stock under existing environmental conditions.

**Recruitment:** The number of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term can also refer to the number of fish from a year class reaching a certain age. For example, all fish reaching their second year would be age 2 recruits.

**Recruitment overfishing:** The rate of fishing above which the recruitment to the spawning stock becomes significantly reduced. This is caused by a greatly reduced spawning stock, and is characterized by a decreasing proportion of older fish in the catch, and generally very low recruitment year after year.

**Spawning stock biomass:** The total weight of all sexually mature fish in the population.

**Spawning stock biomass-per-recruit (SSB/R):** The expected lifetime contribution to the spawning stock biomass for each recruit. An equilibrium value of SSB/R is calculated for each level of F for a given exploitation pattern, rate of growth, and natural mortality. This means that under constant conditions of growth, natural mortality, and exploitation pattern over the life span of the species, an expected average SSB/R would result from each constant rate of fishing.

**Status of exploitation:** An appraisal of exploitation for each stock is given as under-exploited, fully-exploited, and over-exploited. These terms describe the effect of current fishing mortality on each stock, and are equivalent to the Councils' terms of under-fished, fully-fished, or over-fished. Status of exploitation is based on current data and the knowledge of the stocks over time.

**TAC:** Total allowable catch is the total regulated catch from a stock in a given time period, usually a year.

**Virtual population analysis (or cohort analysis):** A retrospective analysis of the catches from a given year class over its life in the fishery. This technique is used extensively in fishery assessments.

**Year class (or cohort):** Fish born in a given year. For example, the 1987 year class of cod includes all cod born in 1987. This year class would be age 1 in 1988, age 2 in 1989, and so on.

**Yield-per-recruit (Y/R or YPR):** The average expected yield in weight from a single recruit. For a given exploitation pattern, rate of growth, and natural mortality, an equilibrium value of Y/R is calculated for each level of F.

Table 7. Percentage of stock (in numbers) caught annually (i.e., exploitation rates) for different fishing mortality rates.

| | Cod | White Hake | Scup | Surf Clam | Ocean Quahog |
|---|---|---|---|---|---|
| M | 0.2 | 0.2 | 0.2 | 0.05 | 0.02 |
| F | | | | | |
| 0.1 | 9% | 9% | 9% | 9% | 9% |
| 0.2 | 16% | 16% | 16% | 18% | 18% |
| 0.3 | 24% | 24% | 24% | 25% | 26% |
| 0.4 | 30% | 30% | 30% | 32% | 33% |
| 0.5 | 36% | 36% | 36% | 38% | 39% |
| 0.6 | 41% | 41% | 41% | 44% | 45% |
| 0.7 | 46% | 46% | 46% | 49% | 50% |
| 0.8 | 51% | 51% | 51% | 54% | 55% |
| 0.9 | 55% | 55% | 55% | 58% | 59% |
| 1.0 | 58% | 58% | 58% | 62% | 63% |
| 1.1 | 62% | 62% | 62% | 65% | 66% |
| 1.2 | 65% | 65% | 65% | 68% | 69% |
| 1.3 | 67% | 67% | 67% | 71% | 72% |
| 1.4 | 70% | 70% | 70% | 74% | 75% |
| 1.5 | 72% | 72% | 72% | 76% | 77% |
| 1.6 | 74% | 74% | 74% | 78% | 79% |
| 1.7 | 76% | 76% | 76% | 80% | 81% |
| 1.8 | 78% | 78% | 78% | 82% | 83% |
| 1.9 | 79% | 79% | 79% | 84% | 84% |
| 2.0 | 81% | 81% | 81% | 85% | 86% |

## A. GULF OF MAINE COD (Division 5Y) ADVISORY REPORT

**State of Stock:** The stock is overexploited and at a low biomass level . Current spawning stock biomass is at a record-low level (Figure A2), increasing the probability that recruitment may be impaired. The 1988-1992 year classes are among the poorest on record. Fishing mortality rate (F) has fluctuated around 1.0 (58% exploitation rate) since 1983 (Figure A1) ($F_{1993}$ = 0.93 or 56% exploitation rate), and is approximately 3 times greater than the overfishing definition ($F_{20\%}$ = 0.35 or 27% exploitation rate ) . Current bottom trawl survey biomass indices are the lowest in the 30-year autumn series and are about 7% of the level observed in the 1960s (Figure A7).

**Management Advice:** The decline in spawning stock biomass should be halted and reversed immediately. To achieve this, fishing mortality should be reduced immediately to $F_{20\%}$ (0.35 or 27% exploitation rate) or lower to eliminate overfishing. At $F_{20\%}$, commercial landings are predicted to be 3,100 tons in 1995. Rebuilding of spawning stock biomass to previously observed higher levels is necessary to reduce the risk of recruitment failure.

**Forecasts:** Short-term (1995-1997) forecasts of landings and spawning stock biomass are provided in the table below. Also provided are medium-term projections (10 years) for landings, spawning stock biomass, and recruitment using the same starting conditions as in the short-term projections under two exploitation scenarios: (1) $F_{SQ}$ = 0.93, 1995-2005 (Figures A8-A10); and (2) $F_{20\%}$ = 0.35 (Figures 11-13).

**Forecast Table for 1995-1997:** F (1994) = 0.93; Recruitment (age 2) of the 1993, 1994 and 1995 year classes was based on R/SSB ratios of 1980-1991 year classes; SSB assumed as 9,400 mt in 1993 and 8,100 mt in 1994.

**Landings and SSB in thousands of metric tons.**

| | | Predicted Medians | | | | |
|---|---|---|---|---|---|---|
| | F 94 - 96 | SSB (95) | Landings (95) | SSB (96) | Landings (96) | SSB (97) |
| A) | $F_{0.1}$ = 0.16 | 8.2 | 1.5 | 12.2 | 2.2 | 16.6 |
| B) | $F_{20\%}$ = 0.35 | 8.0 | 3.1 | 10.4 | 3.9 | 12.4 |
| C) | $F_{(93)}$ = 0.93 | 7.4 | 6.9 | 6.5 | 6.0 | 5.5 |

Consequences/Implications

(A) SSB increases; SSB in 1996 above 1993 level; landings decline to record-low.
(B) SSB increases above 1993 level; landings in 1995 decline to lowest since 1963 then increase.
(C) SSB decreases to record low level; landings continue to decrease and decline to the lowest level since 1973.

**Medium-Term Projections:** Continued fishing at F = 0.93 in 1995 and thereafter will result in further declines in SSB to about 2,000 mt after 10 years. A reduction in F to $F_{20\%}$ (0.35) in 1995 and thereafter will result in increase in SSB to about 28,000 mt after 10 years (Figures A8 - A13).

**Catch and Status Table (weights in '000 mt, recruitment in millions): Gulf of Maine Cod**

| Year | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Max | Min | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | (1982-1993) | |
| USA Commercial Landings | 7.5 | 8.0 | 10.4 | 15.2 | 17.8 | 10.9 | 8.3 | - | 17.8 | 7.5 | 11.4 |
| Otter Trawl | 4.3 | 4.5 | 6.2 | 10.4 | 13.0 | 7.3 | 4.9 | - | 13.0 | 4.3 | 7.6 |
| Sink Gill Net | 3.0 | 3.3 | 4.0 | 4.4 | 4.2 | 3.1 | 3.1 | - | 4.4 | 2.6 | 3.5 |
| Handline/Line Trawl | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | 0.5 | 0.3 | - | 0.5 | <0.1 | 0.2 |
| Other Gear | 0.1 | 0.1 | 0.1 | 0.2 | 0.3 | <0.1 | <0.1 | - | 0.3 | <0.1 | 0.1 |
| CAN Commercial Landings | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Other Commercial Landings | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Total Commercial Landings | 7.5 | 8.0 | 10.4 | 15.2 | 17.8 | 10.9 | 8.3 | - | 17.8 | 7.5 | 11.4 |
| Discards | | Discards occur but reliable estimates not presently available | | | | | | | - | - | - |
| USA Recreational Landings[1] | 2.6 | 3.0 | 4.2 | 3.4 | 2.5 | 1.0 | 2.7 | - | 4.2 | 1.0 | 2.8 |
| Catch used in Assessment | 7.5 | 8.0 | 10.4 | 15.2 | 17.8 | 10.9 | 8.3 | - | 17.8 | 7.5 | 11.4 |
| Sp. stock biomass[2] | 14.1 | 17.1 | 26.1 | 21.9 | 19.9 | 12.8 | 9.4 | 8.1[3] | 26.1 | 9.4 | 17.4 |
| Recruitment (Age 2) | 6.1 | 8.2 | 17.8 | 2.8 | 2.6 | 4.2 | 4.3 | 4.2 | 17.8 | 2.6 | 5.4[4] |
| Mean F (4-5,u) | 1.17 | 0.98 | 0.91 | 0.87 | 0.99 | 1.03 | 0.93 | 0.93[3] | 1.17 | 0.59 | 0.96 |
| Exploitation Rate | 64% | 58% | 55% | 53% | 58% | 59% | 56% | 56% | 64% | 41% | 57% |

[1] Not used in assessment. [2] At beginning of the spawning season (March 1). [3] Predicted or assumed. [4] Geometric mean

**Stock Identification and Distribution:** Gulf of Maine cod are distributed from Massachusetts Bay north along the coast of Maine to the Bay of Fundy and eastward across the Gulf of Maine. Cod are found in the Gulf of Maine throughout the year, but appear to form coastal concentrations in summer months. Gulf of Maine cod are distinguished from those on Georges Bank by a slower rate of growth and later age at full sexual maturation.

**Catches:** Commercial landings increased in the mid 1970s and early 1980s, reaching 14,000 mt in 1983. Catches declined during 1984-1987, increased to record-highs in 1990 and 1991, but have since declined sharply (Figure A1). Total commercial landings in 1993 were 8,300 mt, and are expected to decline to about 7,000 mt in 1994. Recreational landings over this period have averaged 10 to 30% of the total landings.

**Data and Assessment:** An analytical assessment (VPA) was conducted of commercial landings-at-age data tuned with the ADAPT method using standardized NEFSC and Massachusetts DMF spring and autumn survey catch-per-tow at age data, and standardized USA commercial LPUE indices. The precision and uncertainty associated with the estimates of fishing mortality and spawning stock biomass in 1993 were quantitatively evaluated.

**Biological Reference Points:** Yield and SSB per recruit analyses performed with an assumed M of 0.20 indicate that $F_{0.1}$ = 0.16 (13% exploitation rate), $F_{MAX}$ = 0.27 (22% exploitation rate) and $F_{20\%}$ = 0.35 (27% exploitation rate) (Figure A3).

**Fishing Mortality:** Since 1983 fishing mortality rates have been very high, varying between F= 0.87 (53% exploitation rate) and F= 1.17 (64% exploitation rate), far in excess of $F_{0.1}$, $F_{MAX}$ and $F_{20\%}$. Accounting for the uncertainty associated with the 1993 F estimates, there is an 80% probability that the 1993 F was between 0.75 (48% exploitation rate) and 1.15 (63% exploitation rate) (Figure A).

**Recruitment:** The 1987 year class was the strongest on record, but all subsequent year classes (1988-92) are the poorest in the VPA time series (Figure A2).

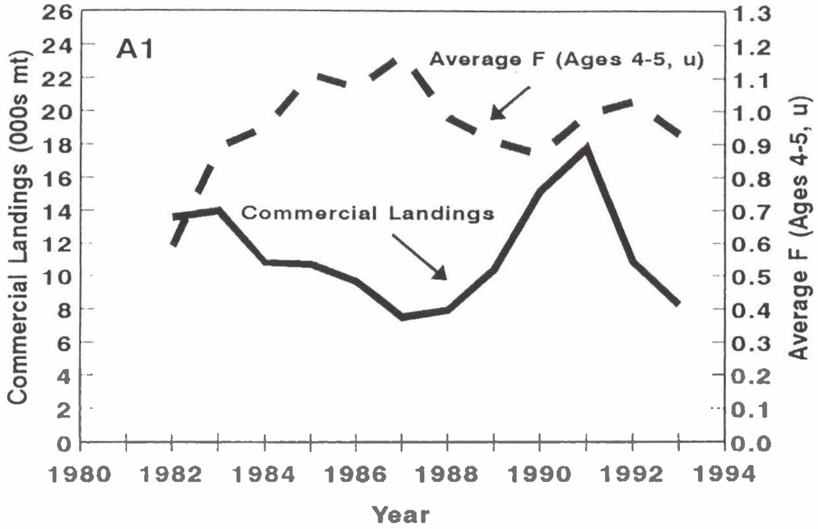
**Spawning Stock Biomass:** SSB declined by nearly 40% between 1982 and 1987 (22,400 mt to 14,100 mt), increased to a record-high level in 1989 of 26,100 mt due to recruitment of the strong 1987 year class to the spawning stock, but has since fallen to a record-low level of 9,400 mt in 1993 (Figure A2). Accounting for the uncertainty associated with the 1993 SSB estimates, there is an 80% probability that the 1993 SSB was between 8,800 mt and 11,200 mt (Figure A5).

**Special Comments:** Based on preliminary indications from the Massachusetts bottom trawl survey, the 1993 year class appears to be moderate in size. If young cod are abundant there will be an increased potential for discarding in 1995.

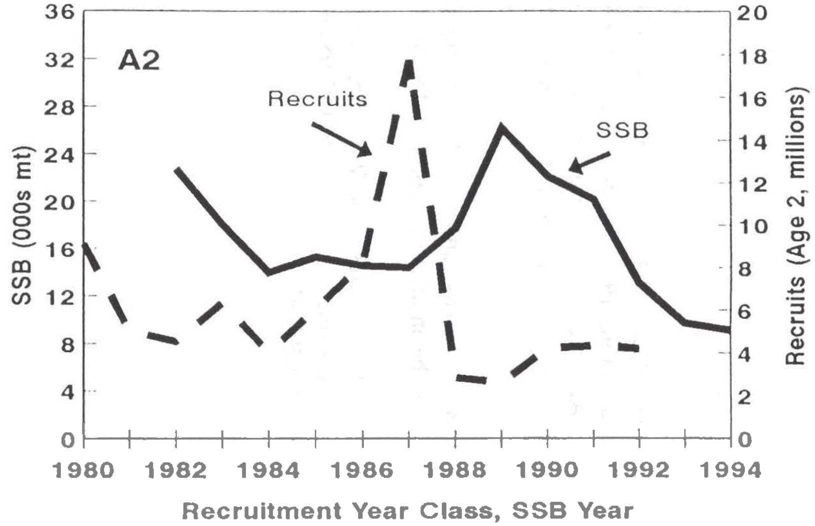
**Source of Information:** Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC CRD 95-08 and Mayo, R.K., 1995, Assessment of the Gulf of Maine cod stock for 1994, NEFSC CRD 95-02.

# Gulf of Maine Cod

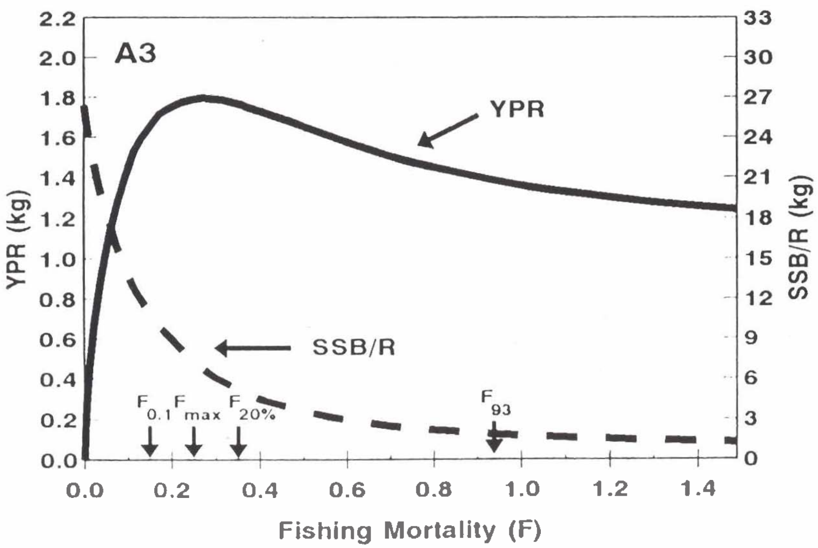
### *Trends in Commercial Landings and Fishing Mortality*



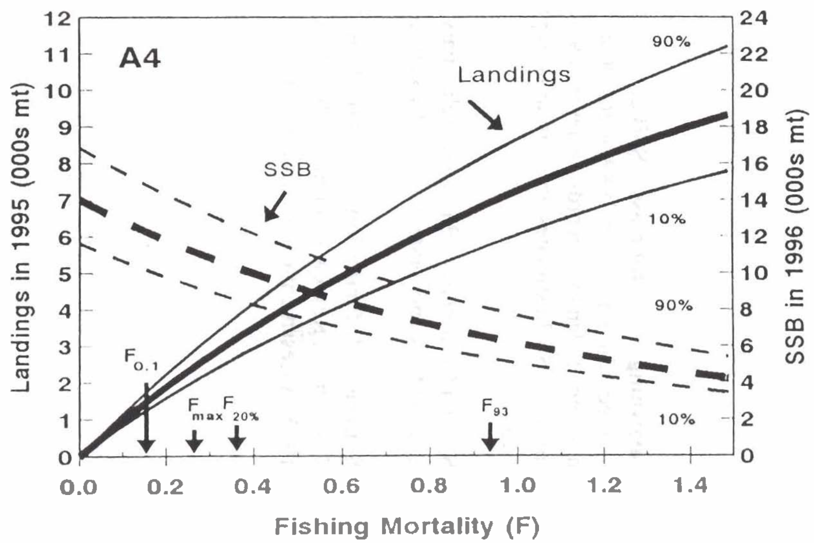

### *Trends in Spawning Stock Biomass and Recruitment*




### *Yield and Spawning Stock Biomass per Recruit*

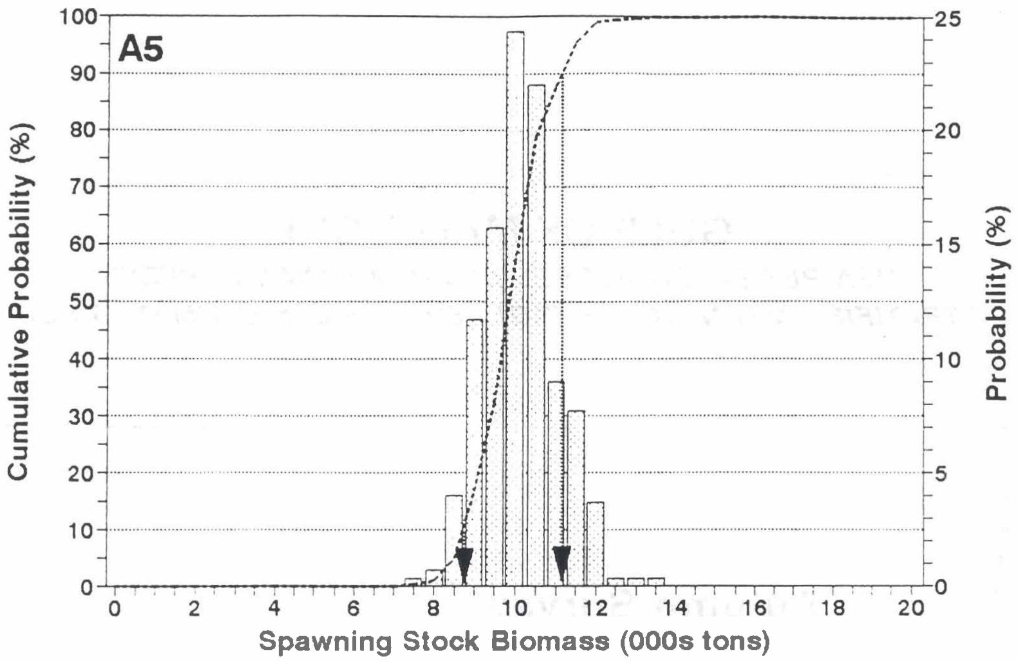


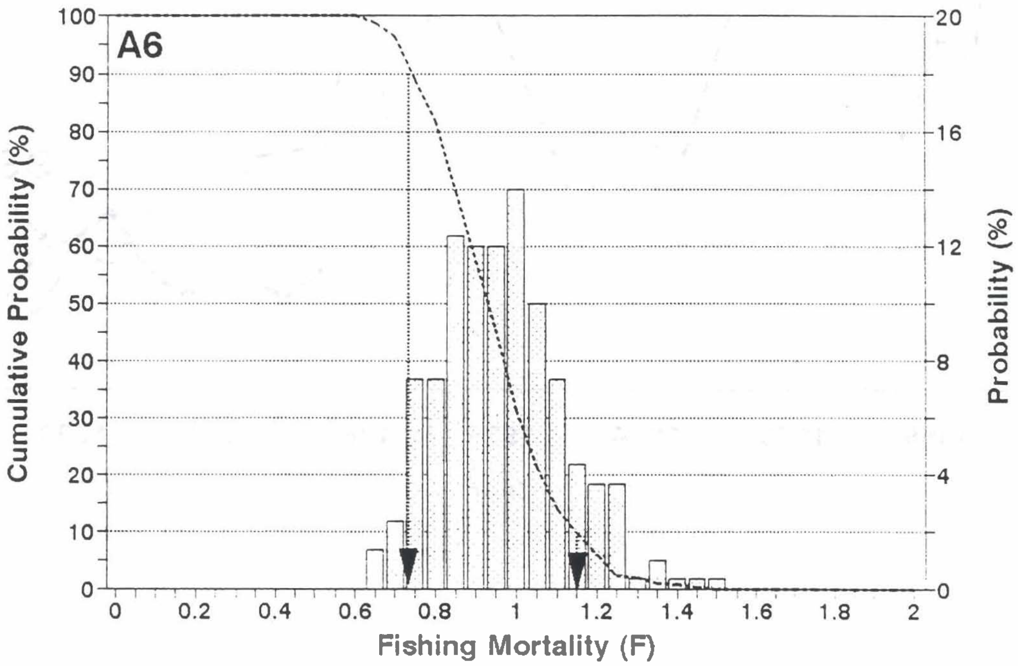

### *Short-Term Landings and Spawning Stock Biomass*



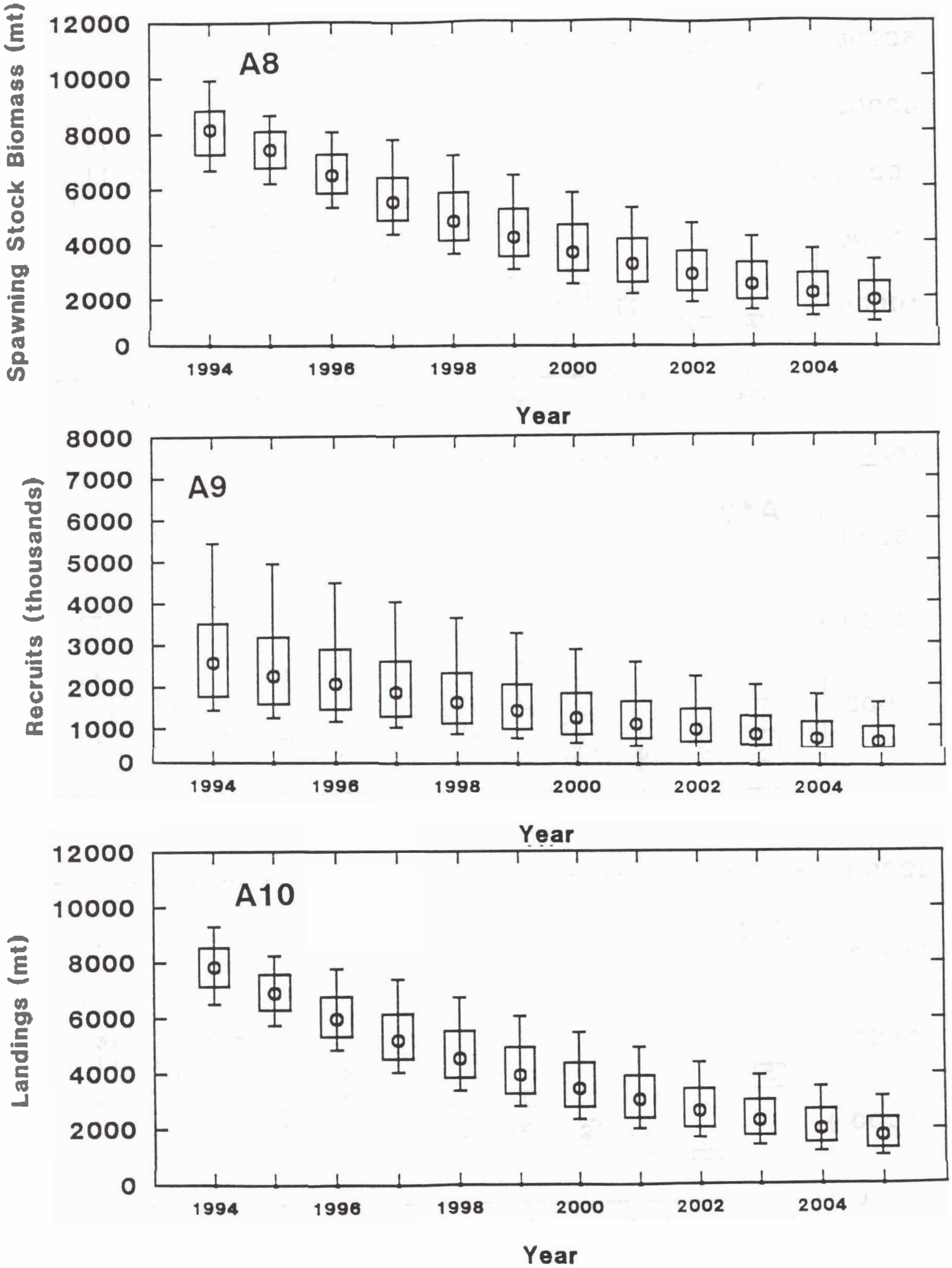
## Gulf of Maine Cod
### Precision of Estimates for SSB and F



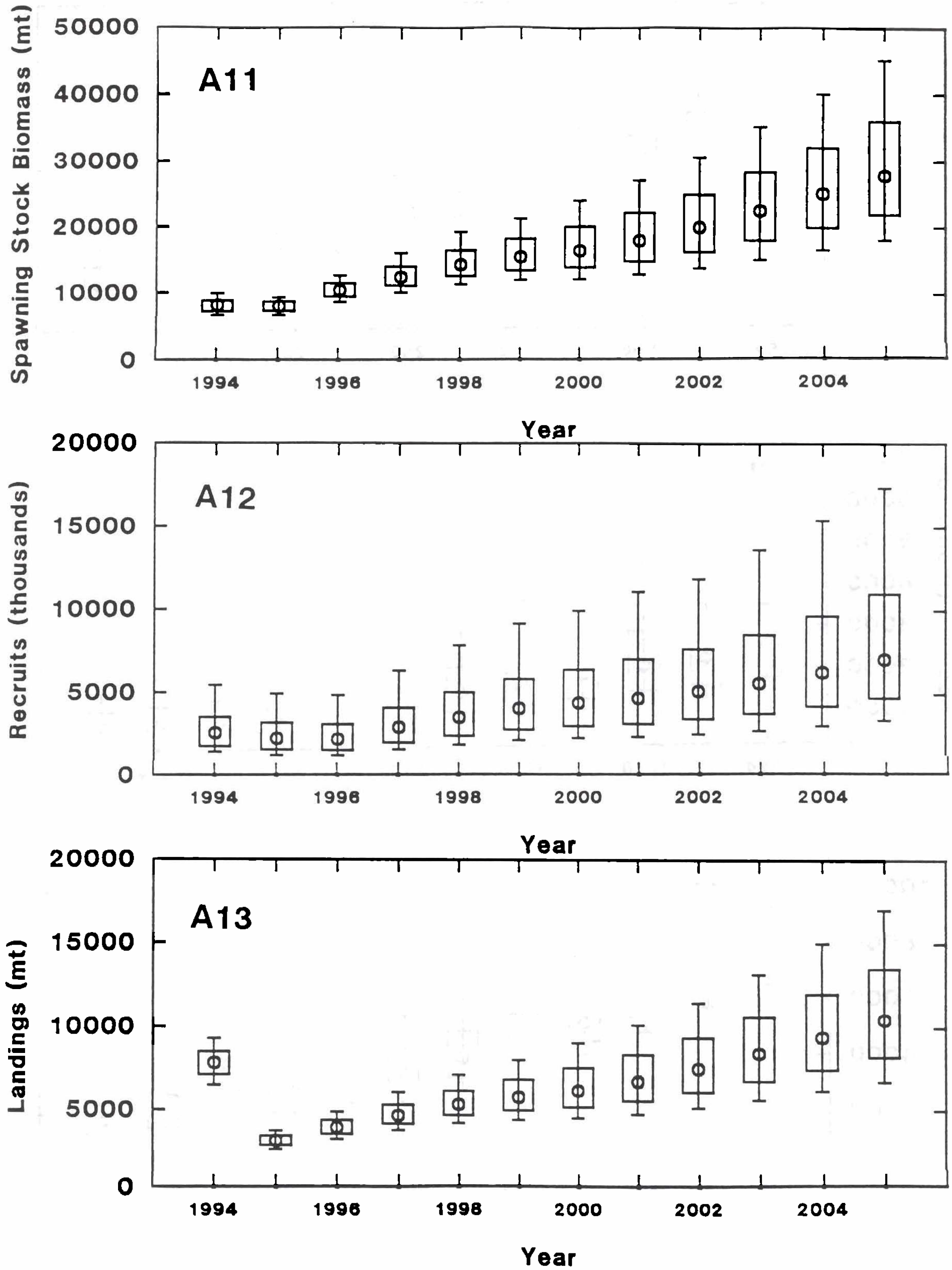



**Precision of the estimates of spawning stock biomass, SSB, (top panel) and fishing mortality, F, (lower panel) for Gulf of Maine cod. The bar height indicates the probability of values within that range. The dashed line gives the probability that SSB is less than or F is greater than the corresponding value on the x-axis. The arrows indicate the approximate 90% and 10% confidence levels for SSB and F.**




Medium-term stochastic projections of spawning stock biomass, recruitment and landings for Gulf of Maine cod at status quo fishing mortality (0.93). The open circles indicate the median outcome, the rectangles represent the 25th to 75th percentile range and the vertical lines represent the 10th to 90th percentile range.




Medium-term stochastic projections of spawning stock biomass, recruitment and landings for Gulf of Maine cod at F20% (0.35). The open circles indicate the median outcome, the rectangles represent the 25th to 75th percentile range and the vertical lines represent the 10th to 90th percentile range.

## B. GULF OF MAINE-GEORGES BANK WHITE HAKE ADVISORY REPORT

**State of Stock:** This stock is fully exploited and at a medium biomass level. The most recent 3-year average of the NEFSC autumn biomass indices (11.7) is above the current over-fishing definition (25th percentile of a 3-year moving average of NEFSC autumn biomass indices; currently 8.4) and therefore the stock is presently not over-fished. Exploitable biomass averaged 17,000 mt during 1992-1993 (Figure B2) and is below levels required to produce maximum sustainable yield ($B_{MSY}$ =21,000 mt). Landings in 1992 and 1993 increased to over 9,000 mt per year (Figure B1), well above 1985-1993 average landings (7,000 mt) and MSY (7,700 mt) (Figure B4). The fishing mortality rate on fully recruited fish has declined from the peak 1988 level (0.56; 39% exploitation rate) and has fluctuated about the long-term mean (0.40; 30% exploitation rate) since 1990 (Figure B1).

**Management Advice:** An increase in fishing mortality will result in a decline in long term yield. Therefore, F on this stock should not be allowed to increase.

**Forecast for 1995:** No forecasts were performed.

**Catch and Status Table (landings, biomass and recruitment in weight, '000s mt): Gulf of Maine-Georges Bank White Hake**

| Year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Max (1985-1993) | Min | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| USA Commercial Landings | 7.3 | 6.1 | 5.8 | 4.8 | 4.5 | 4.9 | 5.6 | 8.4 | 7.5 | - | 8.4 | 4.5 | 6.1 |
| Otter Trawl | 5.4 | 4.7 | 4.8 | 3.7 | 2.6 | 3.3 | 3.5 | 5.2 | 4.7 | - | 5.4 | 2.6 | 4.2 |
| Sink Gill Net | 1.4 | 1.2 | 0.9 | 1.0 | 1.9 | 1.5 | 1.6 | 2.3 | 1.6 | - | 2.3 | 0.9 | 1.5 |
| Handline/Line Trawl | <0.1 | <0.1 | <0.1 | <.1 | <0.1 | <0.1 | 0.3 | 0.9 | 1.2 | - | 1.2 | <0.1 | 0.3 |
| Other Gear | 0.4 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | <0.1 | <0.1 | - | 0.4 | <0.1 | 0.2 |
| CAN Commercial Landings[2] | 1.0 | 1.0 | 0.6 | 0.5 | 0.6 | 0.5 | 0.6 | 1.1 | 1.7 | - | 1.7 | 0.5 | 0.8 |
| Other Commercial Landings | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 |
| Total Commercial Landings | 8.3 | 7.1 | 6.4 | 5.3 | 5.1 | 5.5 | 6.2 | 9.6 | 9.1 | - | 9.6 | 5.1 | 7.0 |
| Discards | Discards occur but reliable estimates not presently available | | | | | | | | | | | | |
| USA Recreational Landings[3] | Recreational landings are insignificant (<0.1 mt) | | | | | | | | | | | | |
| Catch used in Assessment | 8.3 | 7.1 | 6.4 | 5.3 | 5.1 | 5.5 | 6.2 | 9.6 | 9.1 | - | 9.6 | 5.1 | 7.0 |
| Exploitable biomass[4] | 15.3 | 11.8 | 11.6 | 15.8 | 12.7 | 13.3 | 14.1 | 17.0 | 17.3 | 15.0 | 17.3 | 11.6 | 14.4 |
| Fully Recruited | 14.9 | 11.0 | 9.6 | 15.2 | 11.3 | 11.9 | 12.5 | 14.9 | 16.2 | 13.9 | 16.2 | 9.6 | 13.1 |
| Partially Recruited | 0.4 | 0.8 | 2.0 | 0.6 | 1.4 | 1.4 | 1.6 | 2.1 | 1.1 | 1.1 | 2.1 | 0.4 | 1.3 |
| Mean F (Fully Recruited) | 0.40 | 0.30 | 0.50 | 0.56 | 0.34 | 0.38 | 0.42 | 0.45 | 0.42 | - | 0.56 | 0.30 | 0.40 |
| Exploitation rate | 30% | 24% | 36% | 39% | 26% | 29% | 31% | 33% | 31% | | 39% | 24% | 30% |

[1] Predicted or assumed. [2] CAN Subarea 5. [3] Not used in assessment. [4] At the start of the spawning season (January 1).

**Stock Identification and Distribution:** All white hake landed in US waters were treated as a unit stock for the purposes of this assessment. Two spawning groups of white hake are found in the Scotian Shelf-Gulf of Maine to Georges Bank region. One group arises from a winter-spring spawn in deep waters from the Scotian Shelf through Southern New England. Growth patterns suggest that winter-spring spawning fish account for 98% of the white hake taken in recent NEFSC bottom trawl surveys. A summer spawn in shallow areas on the Scotian Shelf accounts for the second, minor group of white hake. These two groups mix extensively in certain areas of the Gulf of Maine and are not readily distinguished in commercial landings.

**Catches:** Landings have steadily increased since the mid-1960's from a low of 1,100 mt in 1967 to a series high of 9,600 mt in 1992. Landings in 1993 declined slightly from 1992 (Figure B1). In 1993, white hake represented the dominant groundfish species landed from the Gulf of Maine.

**Data and Assessment:** This assessment is based on a non-age structured (DeLury) analytical assessment of commercial landings calibrated using NEFSC autumn survey catch-per-tow data separated into partially (29-43 cm) and fully-recruited (>44 cm) components. A surplus production model was used to estimate MSY and $B_{MSY}$.

**Biological Reference Points:** The current biological reference point for white hake is index-based; defined as the 25th percentile of a 3-three moving average of NEFSC autumn biomass indices. Based on the first analytical assessment for this stock, preliminary estimates of alternative biological reference points based on fishing mortality rates and absolute stock biomass are available. A preliminary yield per recruit analysis (M assumed to be 0.20) with an assumed partial recruitment pattern indicated that $F_{0.1} = 0.13$ (11% exploitation rate) and $F_{MAX} = 0.22$ (18% exploitation rate) (Figure B3). A surplus production model, with assumed levels of resiliency ($\propto = 7$) and a corresponding K = 11,500 mt (biomass level below which recruitment over-fishing would occur), indicated that MSY = 7,700 mt and $B_{MSY}$ = 21,000 mt (Figure B4).

**Fishing Mortality:** The fully recruited fishing mortality rate peaked at 0.56 (39% exploitation rate) in 1988, declined to 0.34 (26% exploitation rate) in 1989 and has since fluctuated around the 1985-1993 mean of 0.40 (30% exploitation rate) (Figure B1). Fishing mortality rates over this period (F=0.40, with mean 80% confidence intervals of F=0.33 to 0.51 on average) have exceeded $F_{MAX}$ (F=0.22).

**Recruitment:** Biomass of partially-recruited white hake (29-43 cm) has fluctuated considerably over the 1985-1994 period, ranging from 400 mt (1985) to 2,100 mt (1992) (Figure B2). Partially recruited biomass in 1994 was 1,100 mt about equal to the 1985-1993 average of 1,300 mt.

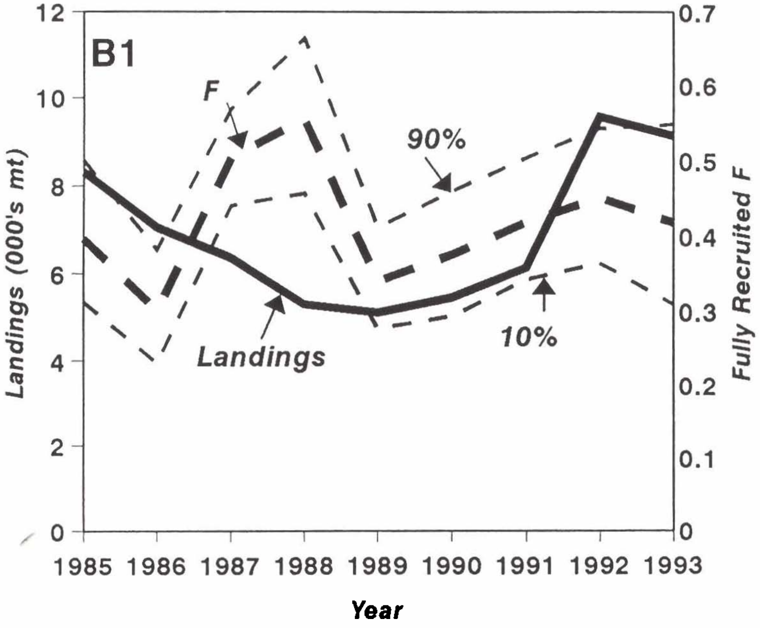
**Stock Biomass:** Exploitable biomass remained relatively stable over the 1985-1993 period ranging from 11,600 mt in 1987 to a maximum of 17,300 mt in 1993. Biomass levels in 1992-1994 were estimated to be above the 1985-1993 average of 14,400 mt (Figure B2).

**Special Comments:** The white hake assessment has been upgraded from an index-based to an analytical-based assessment. Results from analytical models have provided preliminary estimates of biological reference points based on fishing mortality rates and absolute stock biomass. Consideration of these reference points as alternative overfishing definitions is warranted. White hake and red hake are difficult to distinguish at smaller sizes (<40 cm). Canadian landings on the southwest Scotian Shelf (4X), averaging 50% of the total over the 1985-1993 period, were not used in the assessment. Although white hake distribution is contiguous throughout the Gulf of Maine and the Scotian Shelf, the degree of mixing between these regions is not known.

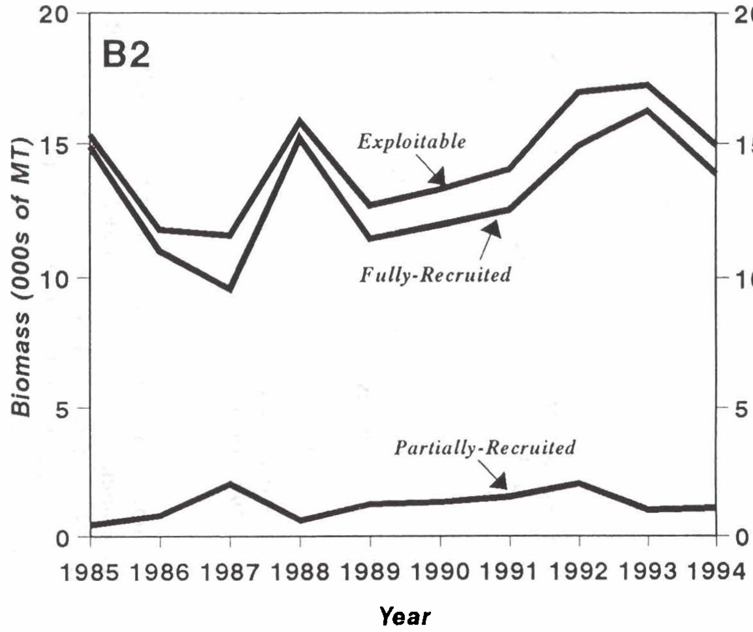
**Source of Information:** Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC CRD 95-08 and Sosebee, K., et al. 1995, A preliminary analytical assessment of white hake in the Gulf of Maine-Georges Bank region - 1994, NEFSC CRD 95-03.

# White Hake

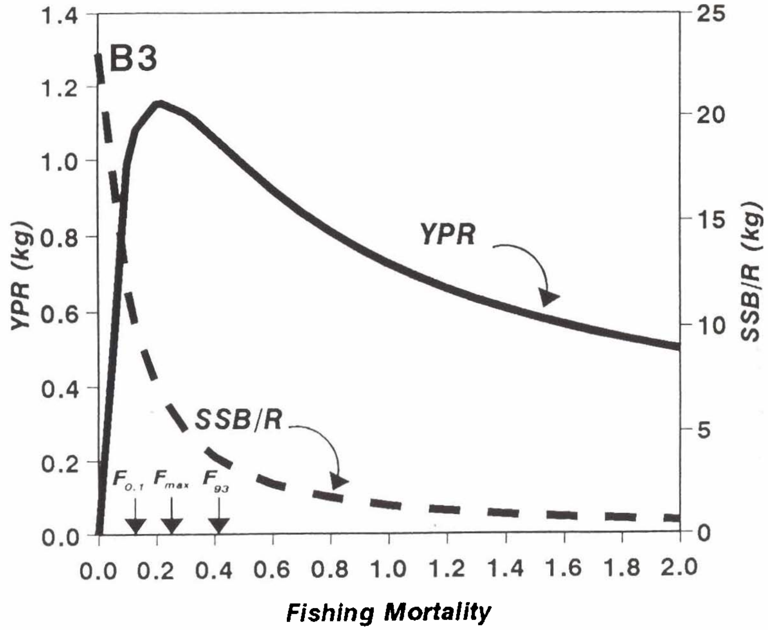
## Trends in Commercial Landings and Fishing Mortality



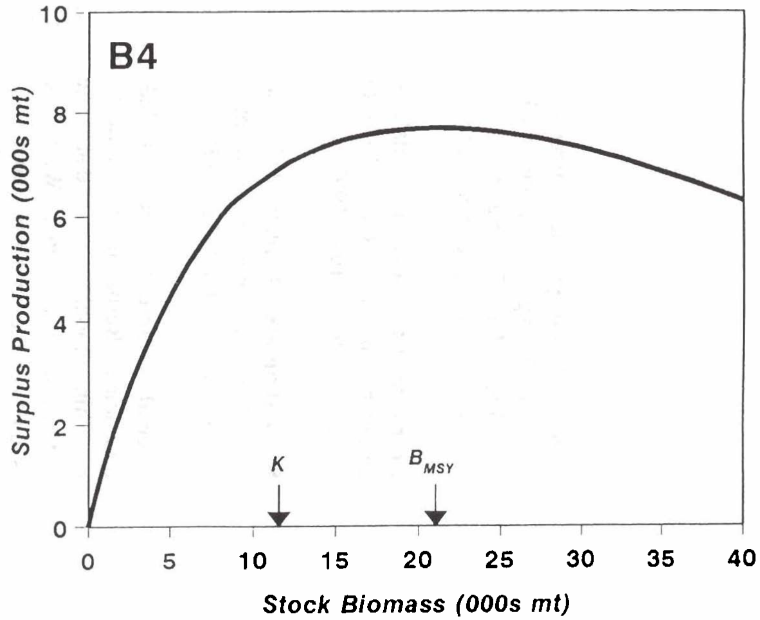

## Trends in Biomass




## Yield and Spawning Stock Biomass per Recruit




## Estimates of $B_{MSY}$, K, and Surplus Production



## C. SCUP ADVISORY REPORT

**State of Stock:** The stock is overexploited and at a low biomass level. Fishing mortality rates (1984-1993) have been well above $F_{MAX}$ =0.24 (19% exploitation rate) since 1984, and during 1991-1993 fishing mortality averaged about 1.3 (67% exploitation rate). Current spawning stock biomass is at a record-low level. Recruitment has decreased in recent years, and the stock has a highly truncated age structure (only 6.5% of the stock in 1992-1993 was age 3 and older). The 1993 total catch of 7,200 mt (61% commercial landings, 19% recreational landings, and 20% discards) is the lowest in the time series (1984-1993) and about half of the 1992 catch. From an historical perspective, commercial landings in 1993 (4,400 mt) were 20% of the peak landings in 1960. About 87% of the total catch in numbers during 1992-1993 consisted of largely immature age 0-2 (< 7") fish.

**Management Advice:** Fishing mortality on fully-recruited fish has been far in excess of all biological reference points and should be substantially reduced immediately. In addition to the reduction in overall exploitation, the high exploitation rates on age 0-2 (< 7") fish must be decreased to allow these fish to mature and contribute to future SSB. Delaying harvest until individuals are older and larger will result in significant increases in SSB and yield. Recruitment failure in a single year could result in a collapse of the fishery.

**Forecast for 1995:** A quantitative forecast of catch and SSB for 1995 is not provided due to the imprecision of the discard estimates and uncertain future recruitment. In the absence of strong year classes, however, continued exploitation at current fishing mortality rates will lead to further declines in SSB.

**Catch and Status Table (weights in '000 mt, recruitment in millions): Scup**

| Year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994[1] | Max | Min | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | (1984-1993) | |
| Commercial Landings | 6.7 | 6.9 | 6.1 | 5.7 | 3.7 | 4.3 | 6.9 | 6.0 | 4.4 | - | 7.8 | 3.7 | 5.9 |
| Commercial Discard Mortality[2] | 4.2[3] | 2.0[3] | 2.5[3] | 1.7[3] | 2.2 | 3.9 | 3.5 | 5.7[3] | 1.4 | - | 5.7 | 1.4 | 2.9 |
| Recreational Landings | 3.3 | 5.9 | 3.0 | 2.4 | 3.2 | 2.0 | 3.6 | 2.1 | 1.3 | - | 5.9 | 1.3 | 2.8 |
| Recreational Discard Mortality[4] | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | 0.1 | <0.1 | - | 0.1 | <0.1 | <0.1 |
| Catch used in Assessment | 14.3 | 14.9 | 11.6 | 9.8 | 9.2 | 10.3 | 14.1 | 13.9 | 7.2 | 5.7 | 14.9 | 7.2 | 11.7 |
| Spawning Stock Biomass[5] | 9.0 | 11.8 | 8.3 | 6.1 | 6.4 | 9.5 | 8.5 | 6.6 | 4.6 | 3.6 | 11.8 | 4.6 | 8.0 |
| Recruitment (Age 0) | 141.3 | 70.1 | 80.7 | 112.1 | 60.2 | 113.0 | 66.6 | 71.7 | 92.2 | 78.6 | 141.3 | 60.2 | 94.6 |
| Mean F (Ages 2-5, u) | 1.18 | 1.20 | 1.43 | 2.13 | 1.60 | 0.96 | 1.29 | 1.31 | 1.32 | 1.32 | 2.13 | 0.96 | 1.36 |
| Exploitation Rate | 64% | 65% | 71% | 83% | 74% | 57% | 67% | 68% | 68% | 68% | 83% | 57% | 69% |

[1]Predicted or assumed. [2]Assuming 100% mortality. [3]Extrapolated . [4]Assuming 15% mortality. [5]At start of spawning season (June 1).

**Stock Distribution and Identification:** Scup are distributed primarily between Cape Cod and Cape Hatteras. Although tagging studies have indicated the possibility of two stocks, one in Southern New England waters and the other extending south from New Jersey, the absence of definitive studies and the presence of distributional data from NEFSC bottom trawl surveys support the concept of a single unit stock extending from Cape Hatteras to New England.

**Catches:** From an annual average of less than 10,000 mt during 1930-1947, commercial landings increased to an average of over 19,000 mt in 1953-1964, peaked at over 22,000 mt in 1960, but then fell to only about 4,000 mt per year in the early 1970s. Commercial landings increased moderately during 1974-1986, varying between 7,000 and 10,000 mt per year, but have declined in recent years to a range of 3,700-6,900 mt, and were 4,400 mt in 1993 (25% decline from 1992). Since 1979, recreational landings have ranged between 1,200 and 5,900 mt per year, with 1,300 mt taken in 1993 (36% decline from 1992). Commercial discards, estimated from sea sampling data, averaged 3,400 mt per year during 1989-1993. Mortality from recreational discards averaged only 40 mt annually during 1979-1993. Total catch during 1984-1993 ranged from a high of nearly 15,000 mt in 1986 to a low of 7,200 mt in 1993 (Figure C1).

**Data and Assessment:** Scup was last assessed at the 11th SAW in 1990 based on yield-per-recruit and catch-curve analyses. The current assessment is analytical (VPA) and based on commercial and recreational catch-at-age data (landings and discards) for 1984-1993. Commercial discards during 1984-1988 and in the second half of 1992 were extrapolated from 1989-1991 and 1993 data. The VPA was tuned with the ADAPT method using catch-per-tow-at age data from the following research vessel trawl surveys: NEFSC spring and autumn, Massachusetts spring and autumn, Rhode Island spring-autumn pooled, Connecticut spring-autumn pooled, and Virginia Institute of Marine Science.

**Biological Reference Points:** Yield and SSB per recruit analyses performed with an assumed M of 0.20 indicated that $F_{0.1}$ = 0.14 (12% exploitation rate), $F_{MAX}$ = 0.24 (19% exploitation rate), and $F_{20\%}$ = 0.28 (22% exploitation rate) (Figure C3).

**Fishing Mortality:** Fishing mortality rate have been very high during the past ten years, ranging between 0.96 in 1990 (57% exploitation rate) and 2.13 in 1988 (83% exploitation rate) and averaging 1.36 (69% exploitation rate) (Figure C1), far in excess of any biological reference points. Accounting for the uncertainty in the 1993 estimates of F, there is an 80% probability that the 1993 F was between 0.80 (51% exploitation rate) and 2.40 (85% exploitation rate) (Figure C5). Total mortality (Z) estimates from catch-curve analysis of trawl survey catch-per-tow-at-age data, although highly variable, also suggest that F has been above 1.0 during 1984-1992.

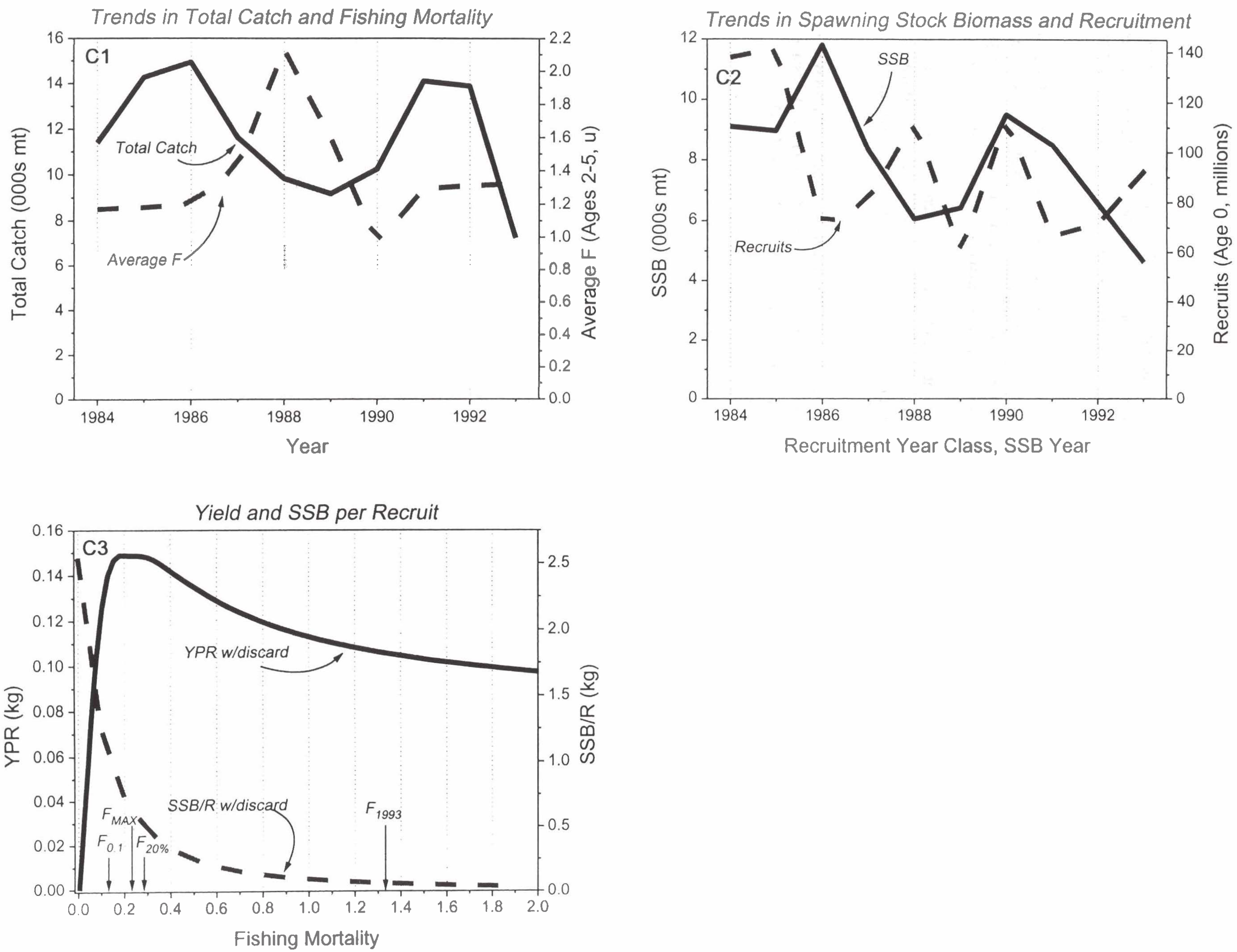
**Recruitment:** Recruitment declined from an average of 140 million fish at age 0 in 1984 and 1985 to an average of 83 million (range of 60 to 113 million) during 1986-1993 (Figure C2). The 1991 and 1992 year classes were among the weakest observed (67 and 72 million, respectively) in the VPA time series, while the 1993 year class is estimated to be about average.

**Spawning Stock Biomass:** SSB has declined steadily since 1990 to a record-low of 4,600 mt in 1993 (Figure C2). Accounting for the uncertainty associated with the 1993 SSB estimates, there is an 80% probability that the 1993 SSB was between 3,400 and 6,100 mt (Figure C4). Although the current assessment covered a relatively short time period (1984-1993), NEFSC survey data indicate that much higher levels of stock biomass occurred during the 1970s.

**Special Comments:** Due to the limitations in the sea sampling data used to estimate and characterize the commercial discards, age compositions of the total catch, and the estimates of fishing mortality and stock size derived from them, are uncertain . The fishery appears to be increasingly targeted on immature fish; ages 0-2 comprised an average of 74% of the total catch in numbers during 1984-1991 and 87% in 1992-1993.

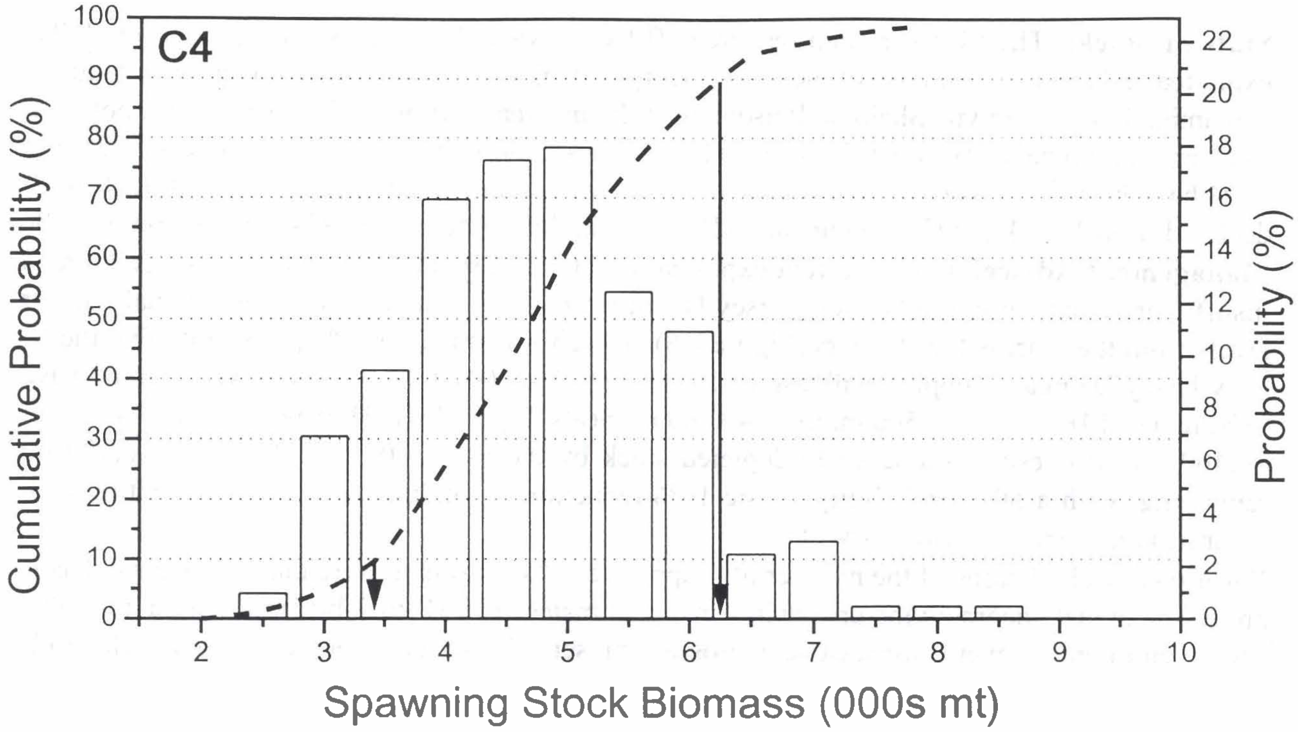
**Source of Information:** Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC CRD 95-08; Assessment of scup (*Stenotomus chrysops*), 1994 Report of the SARC Pelagic/Coastal Subcommittee, NEFSC CRD 95-04.

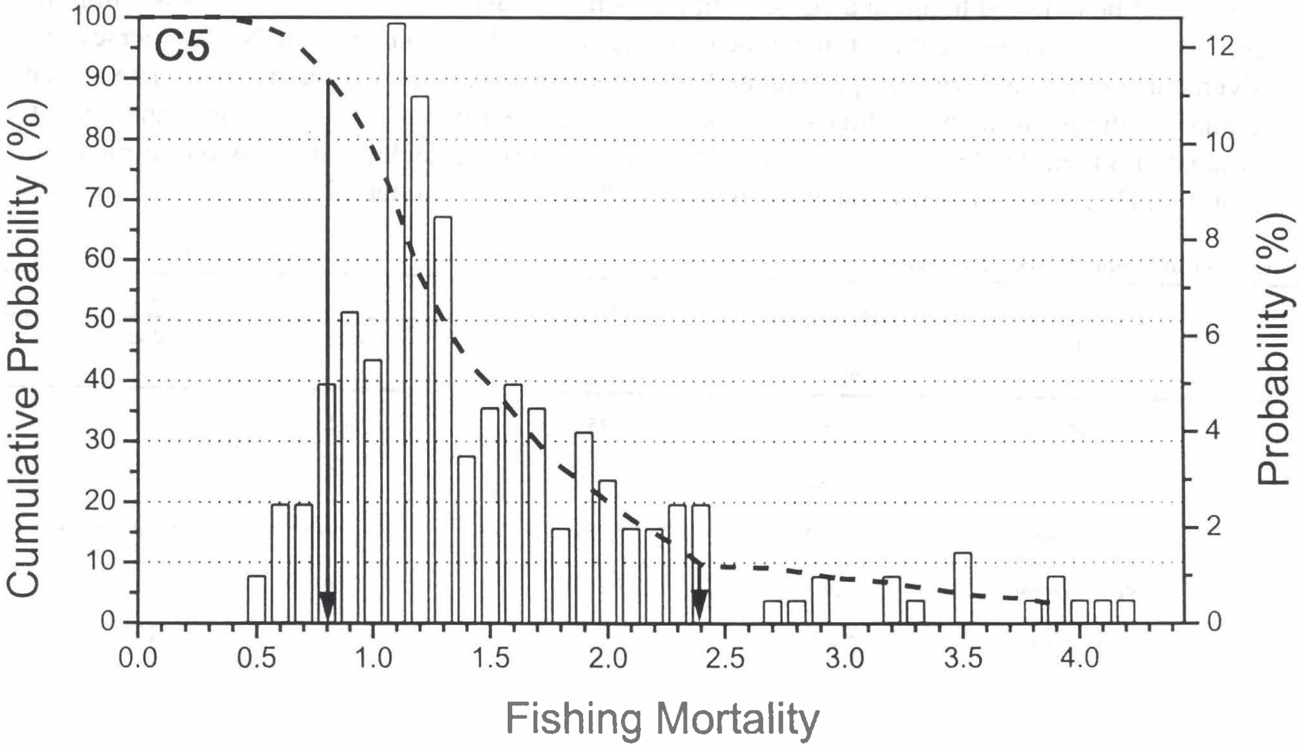
# Scup


Trends in Total Catch and Fishing Mortality
C1
Total Catch
Average F
Total Catch (000s mt)
Average F (Ages 2-5, u)
Year
0
2
4
6
8
10
12
14
16
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
1984
1986
1988
1990
1992
Trends in Spawning Stock Biomass and Recruitment
C2
SSB
Recruits
SSB (000s mt)
Recruits (Age 0, millions)
Recruitment Year Class, SSB Year
0
2
4
6
8
10
12
20
40
60
80
100
120
140
Yield and SSB per Recruit
C3
YPR w/discard
SSB/R w/discard
$F_{MAX}$
$F_{0.1}$
$F_{20\%}$
$F_{1993}$
YPR (kg)
SSB/R (kg)
Fishing Mortality
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.5
1.0
1.5
2.0
2.5
0.0
0.2
0.4
0.6
0.8
1.2
1.4
1.6
1.8

# Scup

## Precision Estimates for SSB and Fishing Mortality




Precision of the estimates of spawning stock biomass, SSB, (top panel) and fishing mortality, F, (lower panel) for scup. The bar height indicates the probability of values within that range. The dashed line gives the probability that SSB is less than or F is greater than the corresponding value on the x-axis. The arrows indicate the approximate 90% and 10% confidence levels for SSB and F.

## D. SURFCLAM ADVISORY REPORT

**State of Stock:** The EEZ surfclam resource off Delmarva and New Jersey (Figure D1) is fully-exploited and at a medium level of biomass. Georges Bank is currently closed to harvesting due to contamination by Paralytic Shellfish Poisoning (PSP), and that portion of the resource has not been assessed analytically. Between 74% and 91% of Mid-Atlantic landings taken between 1986 and 1994 have been from Northern New Jersey. In this area, nominal landings per unit effort (LPUE) declined from 1848 kg/hr (240 bu/hr) in 1986 to 761 kg/hr (99 bu/hr) in 1994, a reduction of 59%.
**Management Advice:** Given current exploitation rates and spatial patterns of landings, there is insufficient resource in the N. New Jersey/Delmarva regions to maintain current annual harvest levels from these areas for 10 years (Figure D6). To achieve at least a 50% probability that the N. New Jersey/Delmarva supplies will last for 10 years (1995-2004), total annual harvests would have to be reduced 16% from 19,500 mt to 16,400 mt of meats (Figure D7). However, annual harvest of 16,400 mt will result in a severely depleted stock by the year 2004 (i.e., less than 16,400 mt remaining, with a 50% probability). The 16% reduction in landings applies to the entire Mid-Atlantic area currently being harvested.
**Forecasts:** Calculations of the number of "supply years" of resource were made with a stochastic projection model, incorporating uncertainty in the estimates of 1994 stock biomass, natural mortality and recruitment. Several forecast scenarios are presented. Assumptions examined include (1) harvesting at a constant exploitation rate (e.g., 20%), as well as at constant annual quota; (2) no recruitment and recent levels of recruitment; and (3) current harvest levels as well as lower levels that would be required to attain a 10 year supply (with at least a 50% probability). Assuming that current levels of recruitment continue, time to exhaustion of the resource in the N. New Jersey area given current fishing levels is approximately 4 years (80% confidence interval: 3-6). The present annual landings from the Delmarva region alone are relatively low (2,470 mt), and time to exhaustion given this level is in excess of 100 years. However, lacking any new recruitment, the supply in Delmarva will only last about 6 years (80% confidence interval 3-9).

**Forecast Table of Supply Years: Surfclams**

| Area | Quota Assumption | Landings Option (mt/yr) | Mean Recruitment (mt/yr) | Supply Years Mean | Supply Years Median | Supply Years 80% C.I. |
|---|---|---|---|---|---|---|
| NNJ | 1992-1994 | 16,986 | 7,259 | 4.5 | 4 | 3 - 6 |
| | | 16,986 | 0 | 2.9 | 3 | 2 - 4 |
| | Constant F | u=0.2 | 7,259 | (Avg. Landings Yr. 10 = 6364 mt) | | |
| | 10 Year Horizon | 11,263 | 7,259 | 9.6 | 10 | 7 - 12 |
| DMV | 1992-1994 | 2,470 | 4,212 | - | >100 | |
| | | 2,470 | 0 | 6.3 | 6 | 3 - 9 |
| NNJ+DMV | 1992-1994 | 19,456 | 11,471 | 6.7 | 7 | 5 - 9 |
| | 10 Year Horizon | 16,385 | 11,471 | 9.8 | 10 | 7 - 13 |

**Catch and Status Table (weights in '000 mt, meats): Surfclams**

| Year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | Max (1982-1993) | Min (1982-1993) | Mean (1982-1993) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quota - EEZ TAC | 21.2 | 24.3 | 24.3 | 24.3 | 25.2 | 24.3 | 22.0 | 22.0 | 22.0 | 22.0 | - | - | - |
| Landings - EEZ | 23.7 | 22.6 | 21.7 | 23.3 | 21.8 | 23.9 | 20.5 | 21.6 | 21.7 | 19.8[1] | 33.8[2] | 6.4[2] | 19.5[2] |
| - NNJ | 8.4 | 14.7 | 17.2 | 19.2 | 16.4 | 17.0 | 17.6 | 18.3 | 16.3 | 16.3[1] | 19.2[3] | 1.3 | 11.4[3] |
| - DMV | 6.6 | 2.6 | 1.3 | 1.1 | 3.1 | 3.5 | 1.6 | 1.2 | 3.4 | 2.8[1] | 6.8[3] | 0.0 | 3.1[3] |
| - Other | 8.7 | 5.3 | 3.2 | 3.0 | 2.3 | 3.4 | 1.3 | 2.1 | 2.0 | 0.7[1] | 8.7[3] | 0.0 | 02.5[3] |
| Landings - State | 9.2 | 10.8 | 5.4 | 4.9 | 8.1 | 8.5 | 9.4 | 11.7 | 11.6 | - | 24.1[2] | 1.1[2] | 7.6[2] |
| Discards: | | | | | | | | | | | | | |
| - NNJ | 1.9 | 2.3 | 1.4 | 1.3 | 1.0 | 1.1 | 0.5 | 0.9 | 0.0[4] | 0.0[4] | 3.6 | 0.0 | 1.4 |
| - DMV | 1.7 | 0.2 | 0.4 | 0.1 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0[4] | 0.0[4] | 2.3 | 0.0 | 0.7 |
| Catch used in Assessment: | | | | | | | | | | | | | |
| - NNJ | 10.3 | 17.0 | 18.6 | 20.5 | 17.4 | 18.1 | 18.1 | 19.2 | 16.3 | 16.3 | 20.5 | 7.6 | 15.5 |
| - DMV | 8.3 | 2.8 | 1.7 | 1.2 | 3.4 | 3.6 | 1.6 | 1.2 | 3.4 | 2.8 | 9.1 | 1.2 | 4.2 |
| Exploitable Biomass: | | | | | | | | | | | | | |
| - NNJ | 85.3 | 101.4 | 97.5 | 94.6 | 90.3 | 86.0 | 82.3 | 83.7 | 80.9 | 78.8 | 101.4 | 39.6 | 80.8 |
| - DMV | 19.2 | 16.4 | 20.4 | 22.4 | 23.9 | 21.7 | 21.9 | 22.4 | 22.6 | 22.9 | 23.9 | 6.7 | 18.8 |
| F (on Exploited Sizes): | | | | | | | | | | | | | |
| - NNJ | 0.02 | 0.12 | 0.17 | 0.16 | 0.14 | 0.20 | 0.20 | 0.21 | 0.20 | - | 0.27 | 0.00 | 0.15 |
| - DMV | 0.44 | 0.17 | 0.12 | 0.18 | 0.21 | 0.21 | 0.17 | 0.09 | 0.20 | - | 0.66 | 0.09 | 0.26 |
| Exploitation Rate : | | | | | | | | | | | | | |
| - NNJ | 2% | 11% | 15% | 15% | 13% | 18% | 18% | 19% | 18% | - | 24% | 0% | 14% |
| - DMV | 35% | 15% | 11% | 16% | 19% | 19% | 15% | 8% | 18% | - | 47% | 8% | 22% |

[1] Projected, based on data available on September 13, 1994. [2] Over period 1965-1993. [3] Over period 1978-1993. [4] Assumed, no discards reported.

**Stock Distribution and Identification:** The Atlantic surfclam occurs both in state waters and the US EEZ along the Atlantic seaboard from Maine through N. Carolina (Figure D1). Surfclams have planktonic larvae which may disperse sufficiently to cause gene flow throughout this geographical range. Published genetic studies do not exist. Variation in shell morphology among populations has been reported.

**Catches:** Annual EEZ quotas have been set since 1978 and total landings reflect the quotas (Figure D3). Since 1983, 90-100% of EEZ landings have been taken from the Mid-Atlantic region. Between 1986-1994, 74-91% of the Mid-Atlantic landings came from the N. New Jersey region, 5-16% from Delmarva, and 0-10% from S. New Jersey. Discarding reached substantial levels (e.g. 33% by weight of the total catch in the NJ region) in the early 1980s, declined through the mid- to late-1980s, and has been below 5% since 1991.

**Data and Assessment:** Surfclams were last assessed in December, 1992 (SAW 15). The current assessment of the Mid-Atlantic resource is an analytical assessment (modified DeLury model) based on commercial landings, LPUE, discard information, and research survey data. The natural mortality rate was assumed to be 0.05.

**Biological Reference Points:** Yield per recruit analysis based on current exploitation patterns indicated that $F_{0.1} = 0.07$ and $F_{MAX} = 0.21$ for the New Jersey region (Figure D5), and $F_{0.1} = 0.08$ and $F_{MAX} = 0.24$ for the Delmarva region (Figure D5).

**Fishing Mortality:** Fishing mortality rates (F) in the Northern New Jersey varied between 0.14 and 0.21 during 1986-1993 (Figure D3). During this same period, fishing mortality rates in the Delmarva region varied between 0.09 and 0.21 (Figure D3).

**Recruitment:** "Fully recruited" surfclams are defined as those 120 mm shell length and larger, and 5 years and older. "Recruits" are surfclams that will grow to be fully recruited within one year, a group with shell lengths of 105-119 mm. "Prerecruits" are less than 105 mm long. Between 1984 and 1994, the stock of clams in the N. New Jersey region has typically been composed of 80,000-100,000 mt of fully-recruited clams and 6,000-11,000 mt of recruits (Figure D4). In the Delmarva region , the stock has typically been composed of 10,000-23,000 mt of fully-recruited clams and 1,000-6,300 mt of recruits. Prerecruits are generally most abundant in the same regions as recruits and fully recruited surfclams.

**Stock Biomass:** Exploitable biomass in the N. New Jersey region declined from 101,000 mt in 1986 (80% confidence interval: 95,000 - 107,000) to 79,000 mt in 1994 (80% confidence interval: 67,000 - 91,000) (Figure D8). Exploitable biomass in the Delmarva region has remained fairly stable, ranging between 16,000 mt in 1986 (80% confidence interval: 9,000 - 23,000) to 23,000 mt in 1994 (80% confidence interval: 13,000 - 32,000) (Figure D9).

**Special Comments:** Recruitment to this stock occurs in two ways. First, there is a steady, low level of recruitment. Second, there can be infrequent and unpredictable large recruitment events. The last large recruitment events off New Jersey occurred in 1976 and off Delmarva in 1977. The 1994 surfclam survey catchability was unusually high and substantially different from previous surveys. Because of this, the 1994 survey data were not used for tuning the DeLury models or in estimating fully-recruited biomass by region.

**Source of Information:** Report of the 19th Northeast Regional Stock Assessment Workshop (19th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC CRD 94-08; Weinberg et al. 1994., Analytical assessment of surfclam populations in the middle Atlantic Region of the United States in 1994, NEFSC CRD 95-05; Murawski, S. and F. Serchuk, 1980, Assessment and status of Surf clam *Spisula solidissima* (Dillwyn) populations in offshore middle Atlantic waters of the United States. NMFS Laboratory Reference Document No. 80-33.

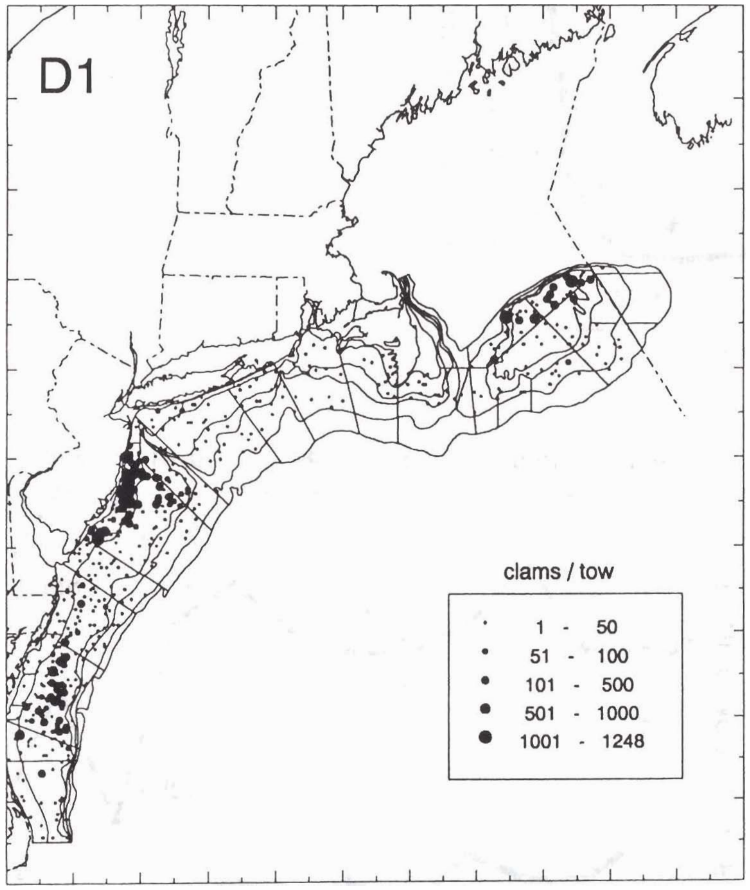



Figure D1. **Surfclam abundance per tow based on the 1992 and 1994 NEFSC surveys.**

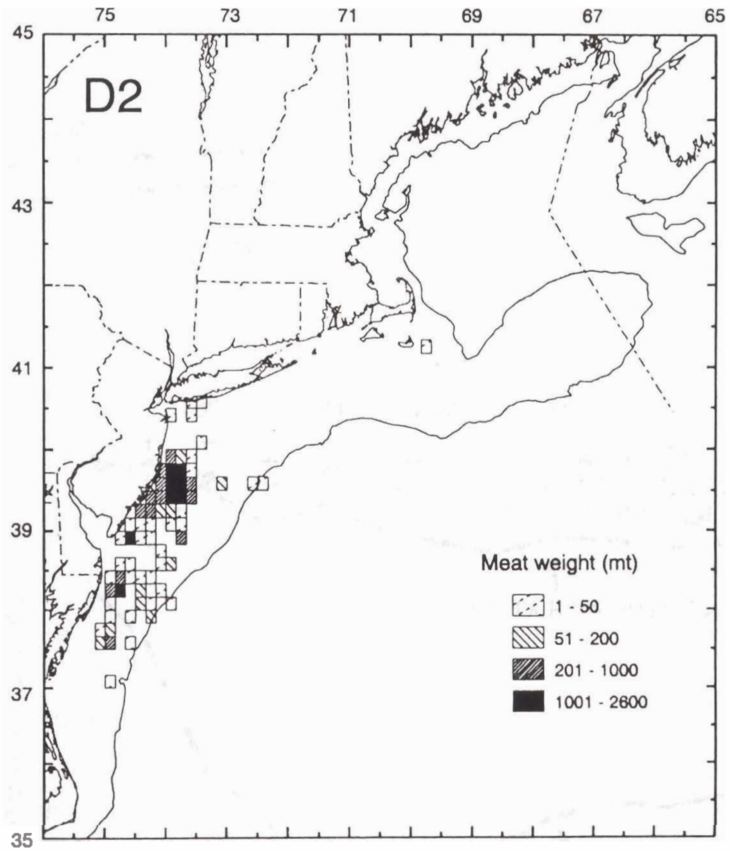
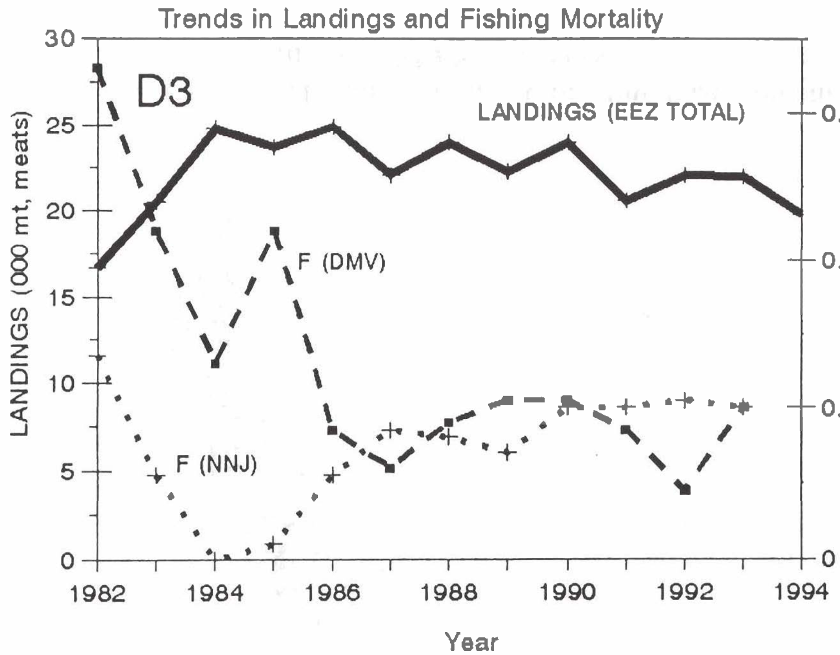
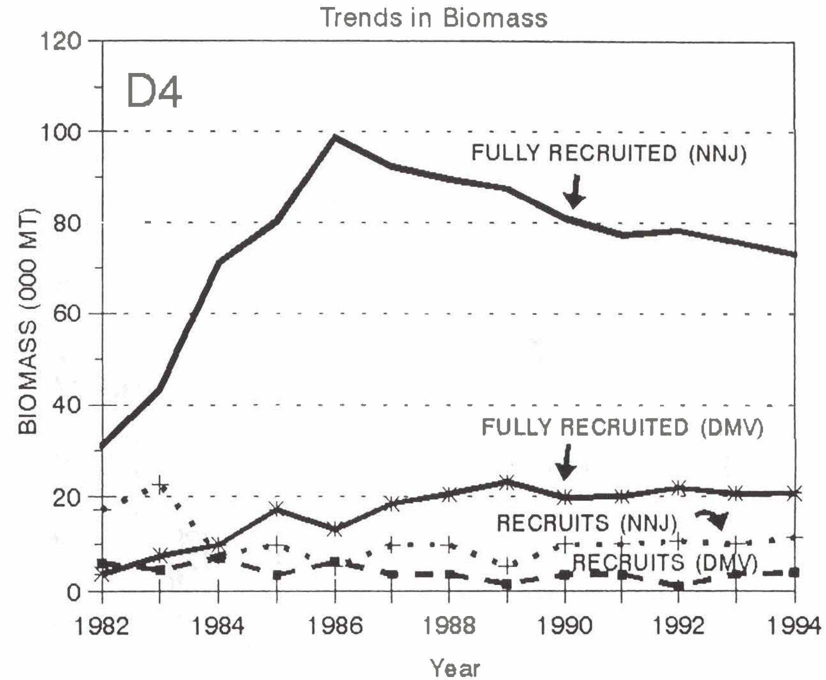
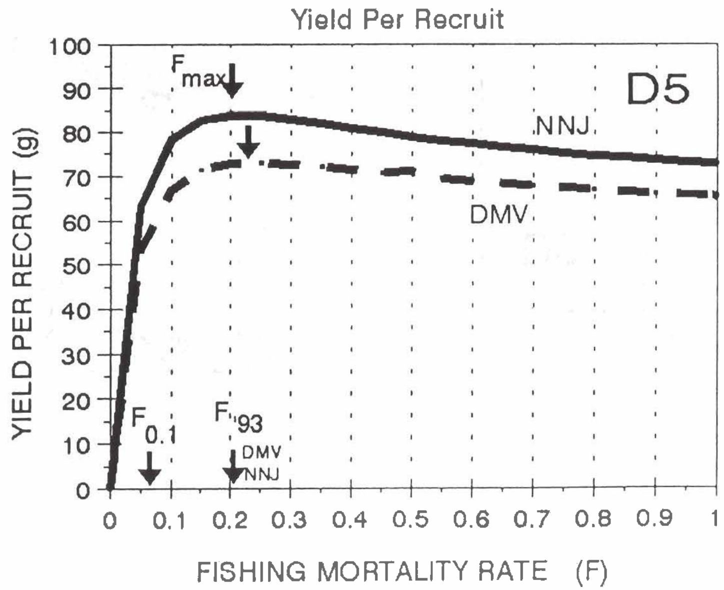



Figure D2. **Surfclam landings in 1993.**

# SURFCLAM

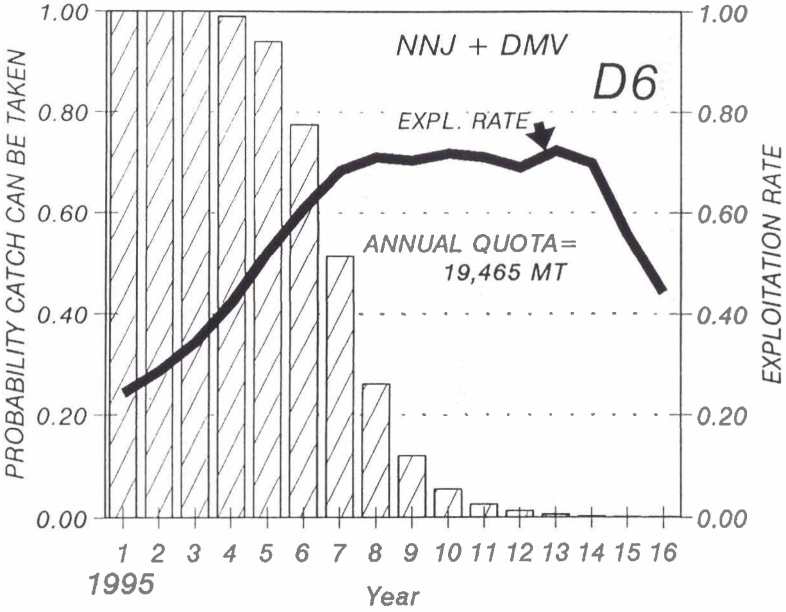

Trends in Landings and Fishing Mortality
D3
LANDINGS (EEZ TOTAL)
F (DMV)
F (NNJ)
LANDINGS (000 mt, meats)
FISHING MORTALITY ,F
30
25
20
15
10
5
0
0.6
0.4
0.2
0
1982
1984
1986
1988
1990
1992
1994
Year


Trends in Biomass
D4
FULLY RECRUITED (NNJ)
FULLY RECRUITED (DMV)
RECRUITS (NNJ)
RECRUITS (DMV)
BIOMASS (000 MT)
120
100
80
60
40
20
0
1982
1984
1986
1988
1990
1992
1994
Year

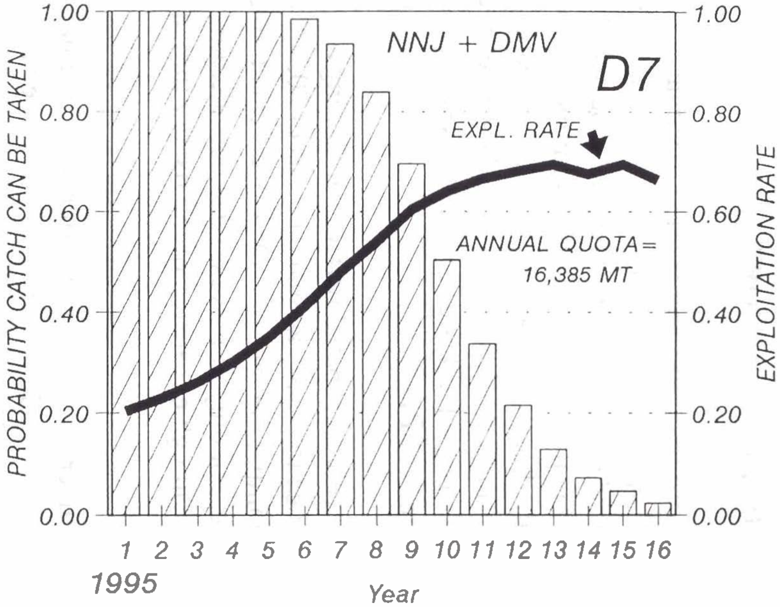

Yield Per Recruit
D5
Fmax
NNJ
DMV
F0.1
F'93
DMV
NNJ
YIELD PER RECRUIT (g)
100
90
80
70
60
50
40
30
20
10
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
FISHING MORTALITY RATE (F)

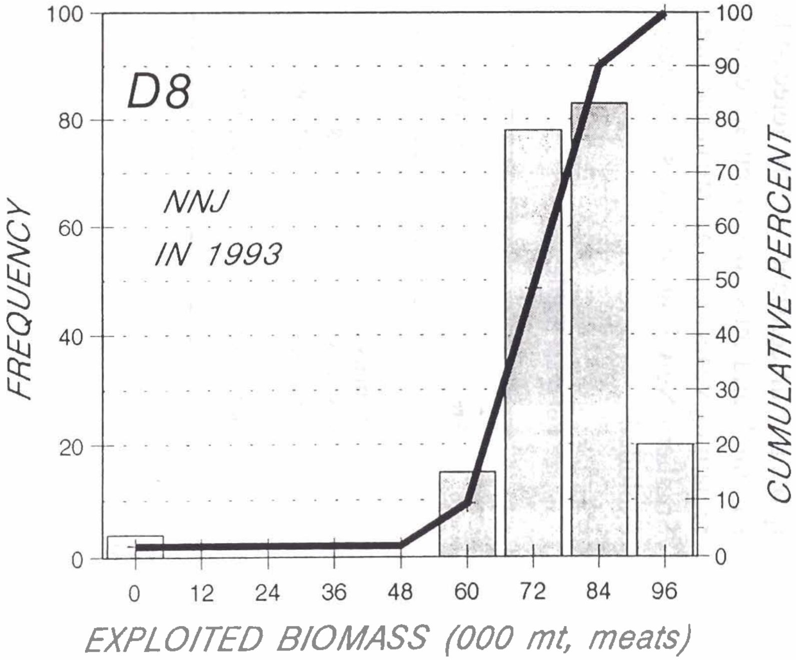
# SURFCLAM

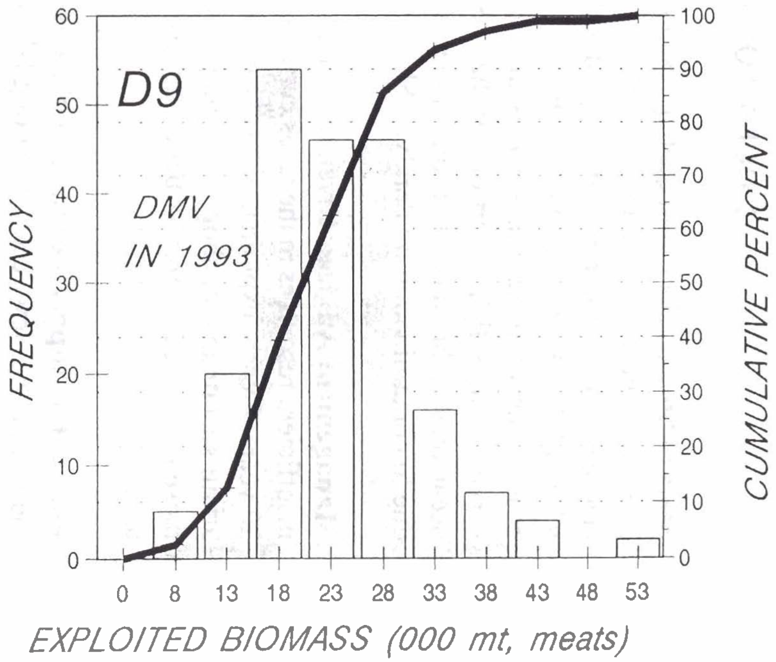
SUPPLY YEARS FROM FISHED AREAS AT CURRENT QUOTA




SUPPLY YEARS FROM FISHED AREAS AT 10 YEAR SUPPLY HORIZON



## E. OCEAN QUAHOG ADVISORY REPORT

**State of Stock:** The ocean quahog resource in EEZ waters from Long Island to Delmarva is fully-exploited and at a medium level of abundance. Portions of the resource in the Gulf of Maine, Georges Bank, Southern New England and Long Island (in deep waters) were not assessed (Figures E1 and E2). As would be expected of a long-lived bivalve species, annual recruitment appears to be low relative to standing stock, without exceptionally large year classes. Based on research vessel survey data, unfished portions of the U.S. EEZ resource account for at least 40-60% of the total ocean quahog biomass. Portions of the resource on Georges Bank are currently closed to harvesting due to contamination by Paralytic Shellfish Poisoning (PSP).

**Management Advice:** Given the current harvest levels and spatial patterns of landings, there are insufficient resources in the areas currently being fished to sustain annual landings of 20,000 mt for 30 years. Present exploitation levels are effectively mining the resource. Management strategies to attain sustainable quahog yields may be achievable, but only at harvest rates considerably below those in the areas currently being heavily fished, or through expansion of the fishery into unfished areas.

**Forecast of Supply Years:** Calculations of the number of 'supply years' of resource remaining in the Delmarva, New Jersey and Long Island regions were made with a stochastic projection model, incorporating uncertainty in the estimation of 1994 stock biomass and natural mortality rates, and assuming no recruitment. The projection assumes that the current regional proportions of the total quota remain constant. For the forecast for all regions combined (Figure E6), stock biomasses were summed, and thus no explicit allocation of the catch among regions was assumed. Estimates of remaining years of supply are conservative since resources in the Gulf of Maine, Georges Bank, and Southern New England areas, and deep water portions of the Long Island area (Figure E1) were excluded.

**Forecast Table:**

| | Quota | Supply Years | | |
|---|---|---|---|---|
| Area | (mt/yr) | Mean | Median | 80% CI |
| Delmarva | 1,790 | 32.5 | 32 | 24-42 |
| New Jersey | 8,020 | 14.3 | 14 | 11-18.5 |
| Long Island | 10,360 | 4.0 | 4 | 2-6 |
| DMV+NJ+LI | 20,170 | 11.4 | 11 | 8-15 |

**Catch and Status Table (weights in '000 mt, meats): Ocean Quahog**

| Year | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994[1] | Max | Min (1976-1993) | Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Quota (EEZ) | 20.0 | 27.2 | 27.2 | 27.2 | 23.6 | 24.0 | 24.0 | 24.0 | 24.5 | 24.5 | - | | |
| Landings (Total) | 23.8 | 20.6 | 22.8 | 21.0 | 23.1 | 21.2 | 22.3 | 22.9 | 23.4 | - | 23.8 | 2.5 | 17.7 |
| Landings (EEZ) | 23.6 | 19.8 | 22.2 | 20.6 | 23.0 | 21.1 | 22.2 | 22.8 | 22.1 | 19.6 | 23.6 | 1.9 | 17.1 |
| Delmarva | 7.2 | 8.2 | 10.5 | 11.7 | 6.4 | 3.7 | 4.8 | 2.4 | 2.0 | 1.0 | 11.7 | 0.6 | 5.2 |
| New Jersey | 10.7 | 9.1 | 9.1 | 7.0 | 14.0 | 15.6 | 14.6 | 6.9 | 10.2 | 6.9 | 15.6 | 6.0 | 9.6 |
| Long Island | 0.0 | 0.4 | 1.2 | 0.6 | 0.6 | 0.7 | 1.7 | 11.9 | 8.7 | 10.5 | 11.9 | 0.0 | 1.6 |
| Discards | 0.0 | | | | Discards are thought to be insignificant. | | | | | | | | |
| Catch used in Assessment | 19.9 | 17.7 | 20.7 | 19.3 | 21.1 | 20.0 | 21.1 | 21.2 | 20.9 | 18.4 | 21.2 | 1.9 | 17.1 |
| | | | | | | | | | | | Max | Min (1988-1994) | Mean |
| Biomass | | | | | | | | | | | | | |
| Delmarva | - | | - | 114.5 | 97.9 | 100.5 | 89.8 | 88.1 | 81.8 | 80.4 | 114.5 | 80.4 | 93.3 |
| New Jersey | - | | - | 206.3 | 206.9 | 194.4 | 175.4 | 136.5 | 142.9 | 141.0 | 206.9 | 136.5 | 171.9 |
| Long Island[2] | - | | - | 85.4 | 83.1 | 80.8 | 78.5 | 75.3 | 64.6 | 56.9 | 85.4 | 56.9 | 74.9 |
| Fishing Mortality Rate | | | | | | | | | | | | | |
| Delmarva | - | | - | 0.10 | 0.07 | 0.04 | 0.05 | 0.03 | 0.02 | 0.01 | 0.10 | 0.01 | 0.05 |
| New Jersey | - | | - | 0.03 | 0.07 | 0.08 | 0.08 | 0.05 | 0.07 | 0.05 | 0.08 | 0.03 | 0.06 |
| Long Island[2] | - | | - | 0.01 | 0.01 | 0.01 | 0.02 | 0.16 | 0.13 | 0.18 | 0.18 | 0.01 | 0.07 |
| Exploitation Rate | | | | | | | | | | | | | |
| Delmarva | - | - | - | 10% | 6% | 4% | 5% | 3% | 2% | 1% | 10% | 1% | 5% |
| New Jersey | - | - | - | 3% | 7% | 8% | 8% | 5% | 7% | 5% | 8% | 3% | 6% |
| Long Island[2] | - | - | - | 1% | 1% | 1% | 2% | 15% | 13% | 17% | 17% | 1% | 8% |

[1]Projected, based on data available in September, 1994
[2]For portions of the areas currently being fished

**Stock Distribution and Identification:** Ocean quahogs are distributed on both sides of the Atlantic, from the Bay of Cadiz of Southwest Spain, intermittently across the North Atlantic and down the North American coast to Cape Hatteras. Commercial concentrations occur throughout the continental shelf area between Georges Bank and Cape Hatteras, generally in waters 40 to 60 m deep (Figure E1). Some concentrations also exist in the Gulf of Maine. No explicit studies of stock definition have been undertaken. However, given the 60 day larval life span of quahogs, animals on the southern shelf are likely components of a single population. Growth rate differences between Gulf of Maine and Mid-Atlantic quahogs are sufficient to consider them separate units for the purposes of stock assessment.

**Catches:** EEZ landings generally account for about 95-100% of annual totals. Total EEZ landings of ocean quahogs increased from 0 in 1975 to 14,300 mt (shucked meats) in 1979, and peaked at 23,800 mt in 1985. Landings have never reached the annual EEZ quota, except in 1985. The Mid-Atlantic fishery was concentrated off Delmarva and Southern New Jersey during the 1970s and mid-1980s. During the late 1980s and early 1990s, the fishery expanded northward, first off Northern New Jersey, and then to the Long Island area. Current estimates of ocean quahog landings by area are: Long Island (54%), followed by New Jersey (36%), Delmarva (5%), and Southern New England (5%) (Figure E2). Total annual landings in the Gulf of Maine are about 100 mt.

**Data and Assessment:** Total mortality rates and stock sizes for quahogs in Delmarva, New Jersey and Long Island fishery areas were estimated using a modified Leslie-DeLury method. LPUE was estimated from GLM standardizations of catch and effort data derived from fishing vessel logbooks (Figure E4). The proportion of the total stock existing in unfished areas was estimated from research vessel survey data (Figure E1).

**Biological Reference Points:** Yield and stock biomass per recruit calculations were made for the Mid-Atlantic portion of the resource, assuming growth parameters of Murawski et al. (1982). Knife-edge selection at age 17 (60 mm) was assumed, since few quahogs smaller than 60 mm occur in this region. M was assumed to be 0.02. $F_{MAX}$ was calculated to be 0.065 (6% exploitation rate); $F_{0.1}$ = 0.030 (3% exploitation rate) (Figure E5). Based on differences in growth rate, these calculations may not be applicable to Gulf of Maine quahogs.

**Recruitment:** Annual recruitment per unit area is probably low, as would be expected for a long-lived bivalve. Limited age-frequency data show a low annual recruitment rate. Animals taken from the Gulf of Maine fishery area grow at a substantially slower rate than in the Mid-Atlantic and on Georges Bank. On average, a 50 mm quahog from the northern Gulf of Maine is about 30 years old (Kraus et al. 1992), whereas the same sized animal off Long Island is about 12 years old (Murawski et al. 1982).

**Fishing Mortality:** Total mortality rates estimated for the period 1988-1994 were: Delmarva Z=0.064; New Jersey Z=0.094; Long Island Z=0.080 (Figure E4). Annual mortality rates show declining Fs in Delmarva and New Jersey and increasing Fs off Long Island in recent years. M, the natural mortality rate, is not precisely known, but likely to be in the range of 0.015-0.025. A constant M of 0.02 was used in Y/R calculations, and a stochastic M, ranging uniformly between 0.015 and 0.025 was used in supply year forecasts.

**Stock Biomass:** Exploitable biomass in the Delmarva region declined from 115,000 mt to 80,000 mt in 1994. Exploitable biomass in the New Jersey area declined from 206,000 mt in 1988 to 141,000 mt in 1994, while exploitable biomass off of Long Island dropped from 85,000 mt in 1988 to 57,000 mt in 1994.

**Special Comments:** Based on research vessel survey data, between 40-60% of the total biomass of ocean quahogs in the Mid-Atlantic-Georges Bank region occurs in areas that are either lightly fished (Southern New England) or not fished at all (Georges Bank). Additionally, substantial quantities of the Long Island resource exist in waters 30-40 fm (54-73 meters) deep, which is generally beyond depths normally fished (Figure E1).

**Source of Information:** Report of the 19th Stock Assessment Workshop (19th SAW), Stock Assessment Review Committee (SARC) Consensus Summary of Assessments, NEFSC CRD 95-08; Weinberg et al.,1994, Ocean quahog populations from the middle Atlantic to the Gulf of Maine in 1994, NEFSC CRD 95-07; Kraus, M.G., B.F. Beal, S.R. Chapman and L.McMartin, 1992, A comparison of growth rates in *Arctica islandica* (Linnaeus, 1767) between field and laboratory populations, J. Shellfish. Res. Vol 11(2):289-294; Murawski, S.A., J.W. Ropes and F.M. Serchuk, 1982, Growth of the ocean quahog, *Arctica islandica*, in the Middle Atlantic Bight, Fishery Bulletin 80(1):21-34; Weinberg, J.R., 1993, Ocean quahog populations from the Middle Atlantic to the Gulf of Maine in 1992, NEFSC CRD 93-02. 18 pp.

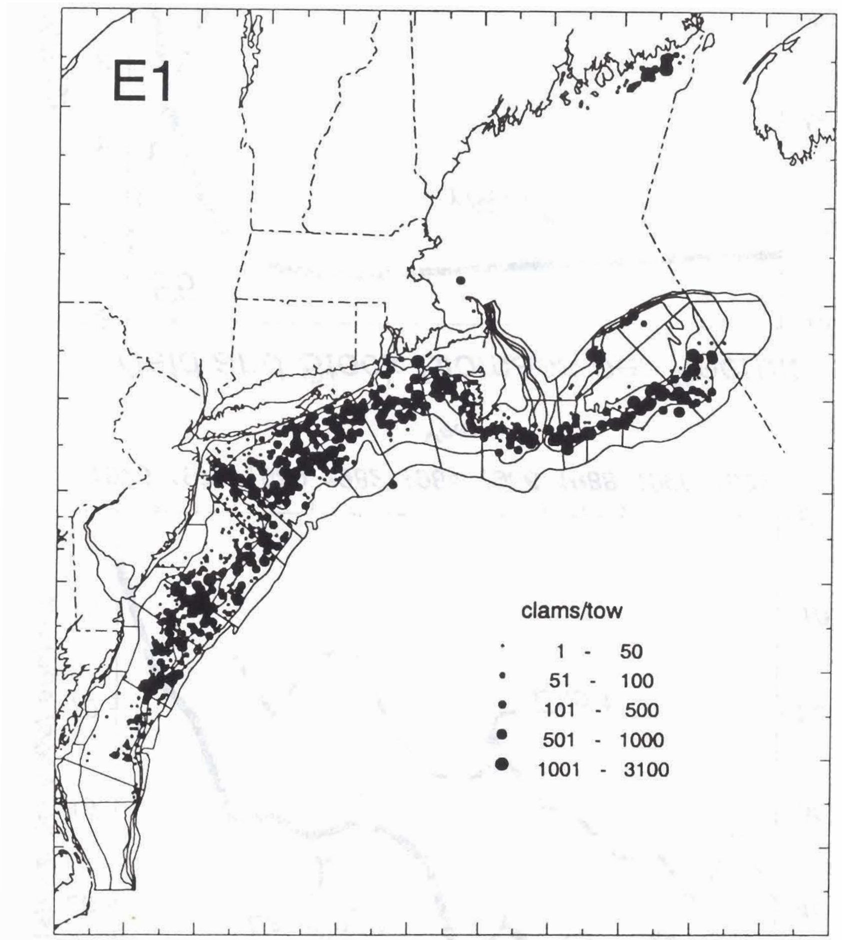



Figure E1. Distribution of ocean quahog abundance per tow from hydraulic dredge surveys, 1982-1992.

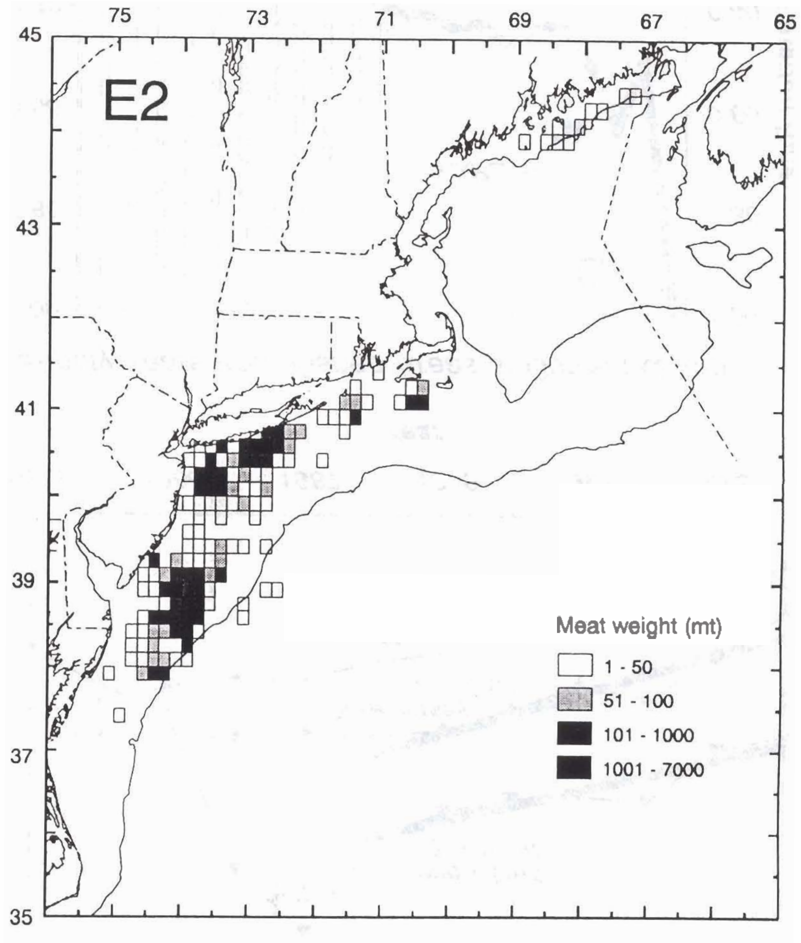
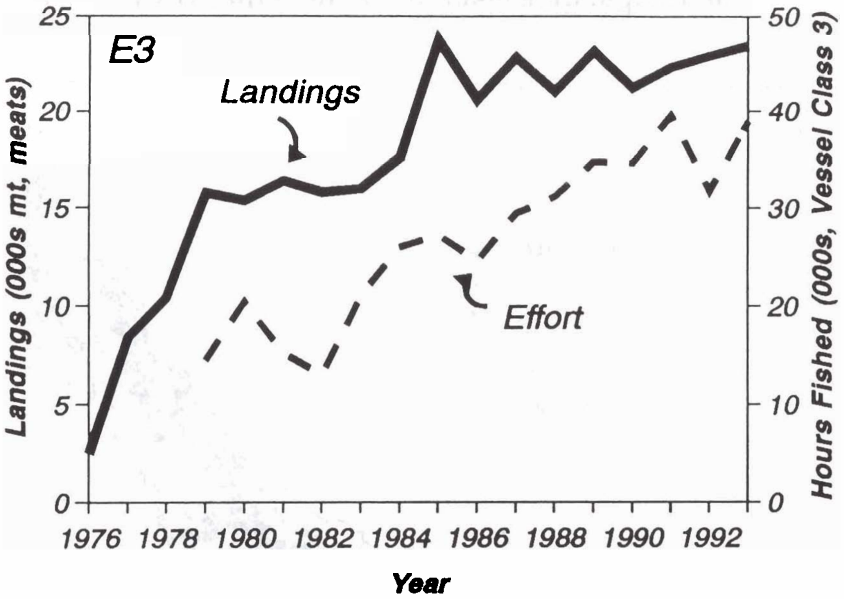


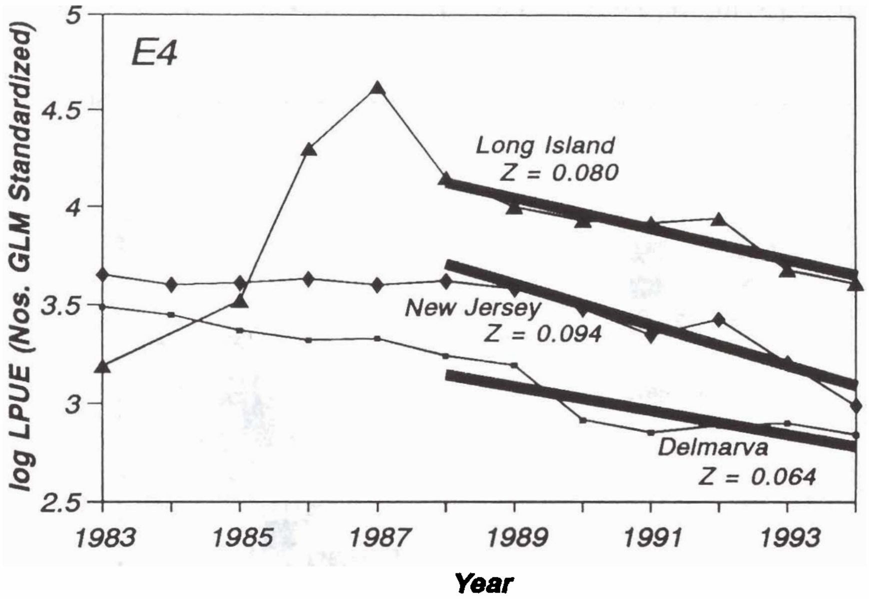

Figure E2. Distribution of ocean quahog landings by 10' square, 1993.

# Ocean Quahog

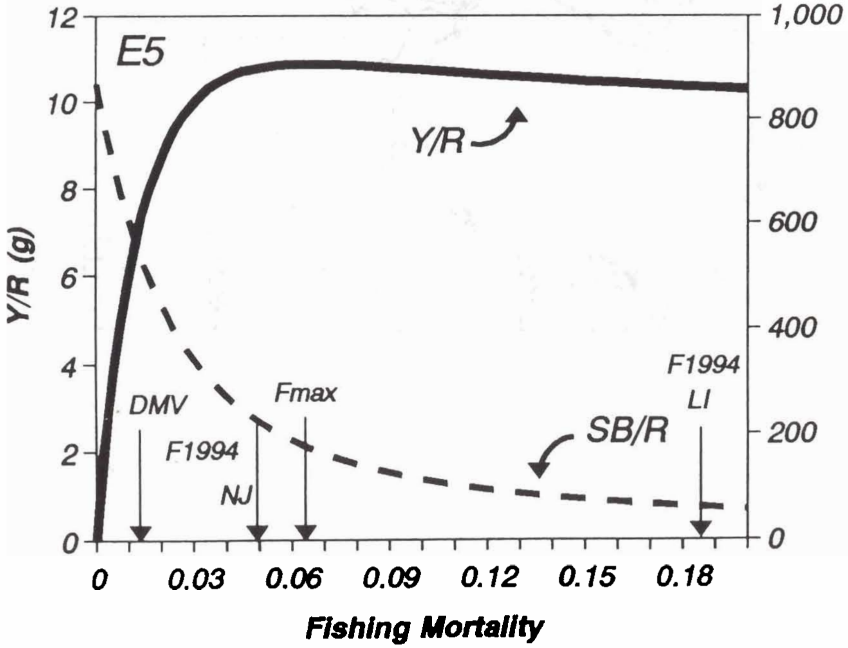
## Trends in Commercial Landings & Fishing Effort



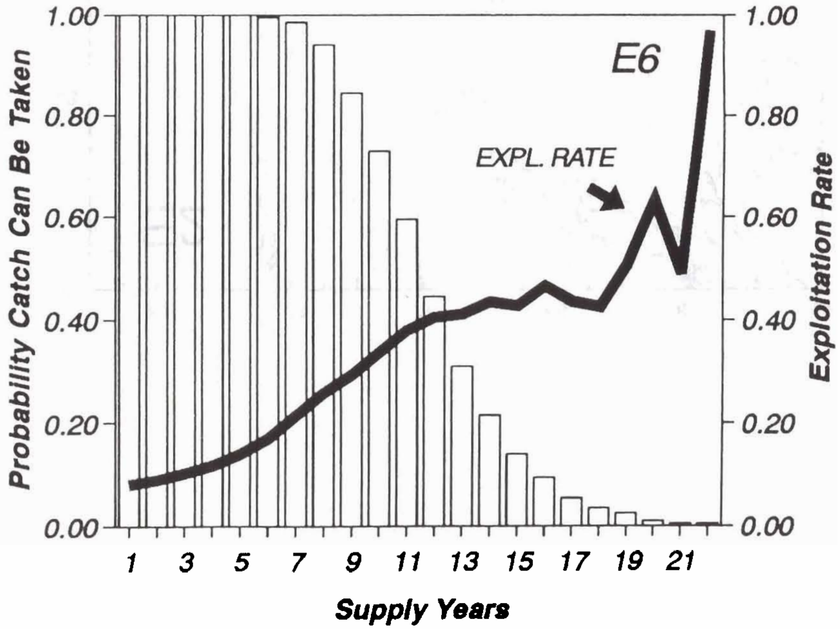

## Trends in LPUE (numbers) by Area




## Yield and Stock Biomass per Recruit




## Supply Years from Fished Areas at Current Quota



# CONCLUSIONS OF THE SAW STEERING COMMITTEE

Table 10.

## SAW/SARC Assessment Reviews by Species

| YEAR | 85 | 1986 | | 1987 | | 1988 | | 1989 | | 1990 | | 1991 | | 1992 | | 1993 | | 1994 | | 1995 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAW # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| BLACK SEA BASS | X | | | | + | + | | | X | | X | | X | | | | | | | X | |
| BLUEFISH | X | | X | X | X | X | | | | | X | | | | | | X | X | | | |
| BUTTERFISH | X | X | | X | | X | | X | | X | | X | | | | | X | | | | |
| COD-GB | X | | X | | | | X | | | | X | | X | | X | | | X | | | |
| COD-GM | X | | X | | | | X | | | | | X | | | X | | | | X | | |
| CUSK | X | | | | | | | | | | | | | | | | | | | | |
| FLDR, AM. PLAICE | X | X | | X | | | | | | | X | | | X | | | | | | | |
| FLDR, SUMMER | X | | X | | | X | + | + | X | | X | | X | | | X | | X | | X | |
| FLDR, WINTER | X | | X | | | | | | | | | | | | | | | | | | X |
| FLDR, WINTER-INSH. | X | | X | | + | + | + | | | | | | X | | | | | | | | |
| FLDR, WITCH | X | X | | | | | | | | | | | | | | | | X | | | |
| FLDR, YT | X | X | | | | | X | | | | | X | | | | | X | | | | |
| FLDR, YT-GB | | | | | | | | | | | | | | | | | | X | | | |
| GOOSEFISH | | | | | | | | | | | | | | X | | | | | | | |
| HADDOCK-GB | X | X | | X | | | | | | | | | X | | | | | | | X | |
| HADDOCK-GM | X | X | | | | | | | | | | | | | | | | | | | |
| HERRING | | | | | X | | | | X | | X | | X | | | X | | | | | X |
| LOBSTER | X | | X | | | | | | | X | | X | | X | | X | | | | | X |
| MACKEREL | X | X | | X | | X | | X | | X | | X | | | | | | | | X | |
| OCEAN POUT | X | | | | | | | | | | X | | | | | | | | | | |
| OCEAN QUAHOG | X | | X | | | | | | | X | | | | | X | | | | X | | |
| POLLOCK | X | | X | | | | | | X | X | | | | | | X | | | | | |
| RED HAKE | X | X | | | | | | | | | X | | | | | | | | | | |
| REDFISH | X | X | | | | | | | | | | | | | X | | | | | | |
| RIV. HERRING/SHAD | X | | | | | X | | | | | | | | | | | | | | | X |
| SALMON | X | | | | | | | | | | | | | | | | | | | | |
| SCALLOPS | X | X | | | | X | | | X | X | X | X | X | X | | | | | | X | |
| SCUP | X | | | X | | | X | | X | | X | | | | | | | | X | | |
| SHRIMP | X | | X | | X | | | | | | | | | | | | | | | | |
| SILVER HAKE | X | X | | X | | | | | | X | X | | | | | | X | | | | |
| SKATES | X | | | | | | | | | | | | | | | | | | | | |
| SPINY DOGFISH | X | | | | | | | | | | X | | | | | | | X | | | |
| SQUID, ILLEX | X | X | | X | | X | | X | | X | | X | | X | | | X | | | | X |
| SQUID, LOLIGO | X | X | | X | | X | | X | | X | | X | | X | | | X | | | | X |
| STRIPED BASS | X | | | | | | | | | | | | | | | | | | | | |
| SURF CLAM | X | | X | | | | X | | X | | | | | | X | | | | X | | |
| TAUTOG | | | | | | | | | | | | | | | | | | | | X | |
| TILEFISH | X | | | | | | | | | | | | | X | | X | | | | | |
| WEAKFISH | | | + | | | | | | | | | | | | | | | | | | |
| WHITE HAKE | X | X | | | | | | | | | X | | | | | | | | X | | |
| WOLFFISH | X | | | | | | | | | | | | | | | | | | | | |

+ = No formal assessment review; research needs, working group or special topic report.

## CONCLUSIONS OF THE SAW STEERING COMMITTEE

(Committee Members: J. Dunnigan, ASMFC; D. Keifer, MAFMC; D. Marshall, NEFMC;

A. Peterson, NMFS/NEFSC; J. Rittgers, NMFS/NER)

The SAW-19/20 Steering Committee Meeting was held on 17 February 1995 in Boston, Massachusetts. George Lapointe represented Jack Dunnigan (ASMFC) and Chris Moore represented Dave Keifer (MAFMC). In addition to Committee members or their representatives, other participants were Chris Kellogg (MAFMC), Terry Smith, SAW Chair, and Helen Mustafa, SAWs Coordinator (NEFSC).

Dr. Terry Smith led the discussions outlined in the agenda (Table 8). Reviewed were highlights of the SAW-19 SARC and Plenary meetings and the documents developed at these meetings. Discussed were 1994 data collection issues, research recommendations from SAW-19, and recurring recommendations which prompted the SARC to recommend the establishment of a working group to deal with assessment related sea-and port-sampling issues. The Committee considered the SARC's recommendation to change the forum for the public review of the advice; set the dates, species, and species terms of reference for SAW-20; and discussed future SAWs.

### 1. SAW-19

#### *1a. The SARC Meeting*

The SARC agenda (Table 9), composition of the SARC, and subcommittee meetings (Meeting Summary, Tables 3 and 4) were reviewed. Five species/stocks was found to be

Table 8. SAW-19/20 Steering Committee Meeting agenda.

Logan Airport Hilton
Boston, Massachusetts
**17 February 1995**
(Beginning at 10:00 AM)

**AGENDA**

1. Report on SAW-19 SARC and Plenary Meetings
   a. SARC Meeting
   b. Plenary Meeting
   c. Advisory Document
2. Research Recommendations

3. 1994 Data Collection Issues
4. SAW-20
   a. Meeting Dates and Places
      - SARC Meeting, 19-23 June 1995, Woods Hole
      - Plenary Meeting, 9-10 August 1995, Providence right after an ASMFC meeting and before a NEFMC meeting, if this can be arranged
   b. Species
      - proposed : Haddock, Scallop, Summer Flounder, Mackerel, Black Sea Bass, Shad, Tautog
   c. Terms of Reference
5. Future SARC and Plenary Meetings
   a. SAW-21
      - SARC Meeting, 27 November - 1 December 1995
      - SAW-21 Plenary Meeting, in conjunction with MAFMC or ASMFC
      - Suggested species - GB and GOM Cod, Lobster, Winter Flounder, SNE Yellowtail Flounder, Herring
   b. SAW-22
      - meeting dates, places, and species
6. Recurring Recommendations: Proposal for a Working Group to Examine the Role of the Sea-Sampling and Port-Sampling Programs in Assessment
7. SAW Process
   a. SARC
      - proposed group on "rethinking" the SARC model
   b. Plenary
      - options for conducting Plenary meetings
6. Other Business

Table 9. SAW-19 SARC agenda.

**NEFSC, Woods Hole, Massachusetts**
**28 November - 2 December 1994**
**AGENDA**

| SPECIES/STOCK | SUBCOMMITTEE & PRESENTER | SARC LEADER | RAPPORTEUR |
|---|---|---|---|
| **MONDAY, November 28** (1:00 PM - 7:30 PM) | | | |
| Opening | | T.P. Smith | H. Mustafa |
| Welcome | | | |
| Agenda | | | |
| Conduct of Meeting | | | |
| Scup (C) | Pelagic/Coastal<br>E. Anderson | N. Lazar | J. Kocik |
| Overview of DeLury and Surplus Production Model Used in Current Assessments | R. Conser | | H. Mustafa |
| **TUESDAY, November 29** (9:00 AM - 6:00 PM) | | | |
| White Hake (B) | Northern Demersal<br>R. Mayo | S. Cadrin | T. Helser |
| Gulf of Maine Cod (A) | Northern Demersal<br>R. Mayo | K. Zwanenburg | R. Brown |
| Review available draft sections for the SARC report | | | |
| **WEDNESDAY, November 30** (9:00 AM - 6:00 PM) | | | |
| Surf Clam (D) | Invertebrate<br>S. Murawski | J. Grassle | J. Weinberg |
| Ocean Quahog (E) | Invertebrate<br>S. Murawski | G. Jamieson | J. Brodziak |
| Review available draft sections for the SARC report | | | |
| **THURSDAY, December 1** (9:00 AM - 6:00 PM) | | | |
| Discuss and approve all "points" for the Advisory Report | | | |
| Review available figures and drafts for the Advisory Report | | | |
| Review all Research Recommendations | | | |
| **FRIDAY, December 2** (9:00 AM - 6:00 PM) | | | |
| Complete unfinished business | | | |
| Complete SARC Report sections | | | H. Mustafa (Coordinator) |
| Complete Advisory Report final review | | | |
| Other Business | | | H. Mustafa |

a comfortable number for the SARC to review in a five day session. The modified format for conducting the meeting allowed sufficient time to complete the final review of most of the documentation. Only the second drafts of documents or assessments reviewed late in the week were mailed to SARC members for approval. All other drafts were reviewed and approved by the SARC at the meeting.

Contributions of participants outside of the NEFSC were greatly appreciated. Especially valuable were the contributions of the state members and the expertise of the academic and outside members who provided a better understanding of the biology of the invertebrate species.

Basic material in the SARC reports was prepared in a number of Subcommittee meetings. A relatively high number of state scientists participated on the Pelagic/Coastal Subcommittee. Such participation is desirable on all Subcommittees.

*1b. The Plenary Meeting*

The format of the Plenary meeting was somewhat different from past meetings and included 1/2 hour presentations by Subcommittee Chairs with a summary of the status of the stock and management advice for each species by the SAW Chair. In addition, there was a presentation on the 1994 Sea Scallop Survey data.

The discussions at the Plenary Meeting relative to the surfclam and ocean quahog assessments were highlighted. Industry was not happy with the treatment of the anomalous results from the 1994 survey. Members of the Steering Committee indicated that the Plenary was indeed the right place for the industry to question the assessments and that industry should be welcome to send their scientists to SARC and Subcommittee meetings as well.

*1c. Advisory Document*

The addition of a conversion table to the Advisory Report and the notion of focusing on annual exploitation rates, for the purpose of presentation, rather than instantaneous fishing mortality rates were endorsed. Committee members also suggested avoiding jargon, with a specific suggestion that the concept of recruitment could be more simply motivated.

**2. Research Recommendations**

SAW-19 research recommendations were summarized and discussed. Some of these recommendations had been provided by previous SAWs and some are overarching between species/stocks. Discussed also were specific actions that were taken concerning past recommendations, particularly those relating to the MRFSS program. After SAW-18, a letter was sent to NMFS Statistics requesting increased precision of the length samples taken in the MRFSS. To date, there has been no response.

**3. Data Collection Issues**

The status of the 1994 fishery-dependent data and how to deal with data acquisition problems were discussed. Given the changeover in data collection systems in 1994 and delays in acquiring 1994 data, our ability to characterize the 1994 fishery may be compromised. The quality and compatibility of the 1994 data with the rest of the series was of concern and should be evaluated before these data are used for assessment purposes.

It is especially important to protect fishery-independent sources of data until 1994/1995 data issues are sorted out.

## 4. SAW-20

### *4a. Meeting Dates and Places*

**SAW-20 Stock Assessment Review Committee (SARC) Meeting**
NEFSC, Woods Hole, Massachusetts
19 - 23 June 1995

**SAW Public Review Workshop**[1]
Session-North, New England Fishery Management Council Meeting, 10 August 1995
Session-South, Mid-Atlantic Fishery Management Council, 1 August 1995

**SAW-20/21 Steering Committee Meeting**
Philadelphia, 15 August 1995

### *4b. Species/Stocks*

Haddock
Northern Demersal Subcommittee
R. Mayo, Chair
Sea Scallop
Invertebrate Subcommittee
P. Rago, Chair
Atlantic Mackerel
Pelagic/Coastal Subcommittee
E. Anderson, Chair
Summer Flounder
Southern Demersal Subcommittee
W. Gabriel, Chair
Black Sea Bass
Pelagic/Coastal Subcommittee
E. Anderson, Chair
Tautog
Pelagic/Coastal Subcommittee
E. Anderson, Chair

The Atlantic Sates Marine Fisheries Commission (Najih Lazar) will lead the assessment of tautog.

### *4c. Terms of Reference*

Considering the status of the 1994 data base, the SAW-20 VPA assessments will be based on data through 1993.

HADDOCK

a. Assess the status of Georges Bank haddock through 1993 and characterize variability of estimates of abundance and fishing mortality rates.

b. Provide updated estimates of maximum sustainable yield for the Georges Bank haddock stock.

c. Provide projected estimates of catch and SSB through 1996 at various levels of fishing mortality.

SEA SCALLOP

a. Provide updated research vessel survey data summarizing trends in abundance, size composition and recruitment for appropriate fishery units.

b. Summarize trends in the areal distribution, landings, effort, and size composition for commercial catches through 1993.

[1]The SAW Plenary format will be changed effective at the 20th SAW. See section 7 for a discussion.

c. Provide results of sea sampled scallop trips to evaluate the size composition, relative abundance and other relevant features of the sea scallop fishery.

d. Evaluate relative trends in size composition from NMFS dock-side and sea sampling programs, and make recommendations concerning future commercial sampling programs for sea scallop.

e. Evaluate the results of recent ageing studies of sea scallop and their utility in stock assessment. Make further recommendations regarding directions for future ageing studies.

SUMMER FLOUNDER

a. Provide updated assessment for the coastwide stock of summer flounder and provide catch and SSB options at various levels of fishing mortality.

b. Provide catch and SSB forecasts incorporating uncertainty in recruitment and stock size estimates (stochastic projections).

MACKEREL

a. Provide updated analytical assessment of the Northwest Atlantic mackerel stock (NAFO Subareas 2-6) through 1993 and characterize the variability of the terminal estimates of fishing mortality (F) and spawning stock biomass (SSB).

b. Provide short-term estimates of the catch and SSB at various levels of F.

c. Recalculate the long-term potential yield of this stock.

d. Review and update, as necessary, the biological reference points for this stock.

e. Describe the distribution of the stock in the spring of 1995 based on catches from the 1995 NEFSC spring trawl survey.

f. Evaluate the existing stock structure, i.e., the northern and southern components of the stock. If these components are not two distinct stocks, are there any behavioral or migratory differences between them?

BLACK SEA BASS

a. Summarize catches (landings and discards) and available length and age compositions for the northern (Cape Cod - Cape Hatteras) stock of black sea bass.

b. Summarize all available indices of stock abundance/biomass from commercial and recreational LPUE and research survey catch per tow.

c. Review all basic life history parameters for this stock.

d. Evaluate the possibility of upgrading the assessment from the yield-per-recruit to the analytical level (e.g., virtual population analysis if sufficient catch-at-age data exist, and non-age-based methods if not).

e. If possible, provide short-term estimates of the catch and SSB at various levels of F.

f. Update yield-per-recruit and spawning-stock-biomass-per-recruit analyses.

TAUTOG

a. Summarize recreational and commercial landings, length composition and available age/length data by state, Massachusetts - Virginia.

b. Summarize available indices of stock abundance by state based on states' bottom trawl and juvenile surveys.

c. Estimate age composition of recreational and commercial landings using Connecticut age/length key.

d. Provide estimates of fishing mortality for the "entire stock" and if possible by region (state).

e. Conduct, if possible, a full age based VPA, yield-per-recruit and spawning-stock-biomass-per-recruit analyses.

f. Review all data for developing overfishing definitions.

## 5. Future SAW Meetings

A chronology of assessment reviews by species (Table 10) was available as background information to facilitate discussion.

*a. SAW-21*

Suggested dates:
Stock Assessment Review Committee Meeting
27 November - 1 December 1995, NEFSC Woods Hole

SAW Public Review Workshop
Session - South, MAFMC Meeting
Session - North, NEFMC Meeting

Suggested species/stocks:
American Lobster
Short-finned Squid
Long-finned Squid
Winter Flounder
Atlantic Herring
American Shad
Northeast Groundfish Complex

- There should be a full assessment of winter flounder.

- Squids should be addressed from the spawning success point of view.

- A status report on the groundfish complex, based on survey results, should be provided.

*5b. SAW-22*

Suggested species/stocks:

Summer Flounder
Monkfish
Sea Scallop
Bluefish
White Hake
American Plaice
Haddock (depending on SAW-20 results)

## 6. Recurring Research Recommendations

The Steering Committee accepted the suggestion for the formation of an ad hoc Sea

Sampling Working Group to examine the role of the sea- and port-sampling programs in assessments, including the following three general terms of reference:

a) Summarize sea sampling activity, by fishery, season and year, for the period 1989-1993 (1994 if possible), including estimates of the fraction of fishery trips and catch sampled;

b) Provide a framework for the statistical design of sea sampling programs, evaluating the effects of sample size on precision of discard estimates, and appropriate protocol for biological sampling;

c) Evaluate the effects of precision and bias of discard estimates on stock assessment calculations and estimates of biological reference points;

The Steering Committee also suggested a fourth term of reference:

d) Prioritize and strategize the allocation of sampling (days-at-sea) with recognition of ad hoc needs, mandated requirements (e.g., marine mammal bycatch), management needs, and assessment needs and the dynamics of those needs.

## 7. SAW Process

The Steering Committee confirmed that the SAW process continues to be more accepted and credible. The process should remain open and transparent, where industry representatives can feel free to attend all meetings, from assessment development to the presentation of advice. Although there is no need for formal evaluation of the process, the Steering Committee will entertain any "bright" ideas that may be offered to improve it.

### *7a. The SARC*

Based on discussions at the SARC meeting an ad hoc advisory group was formed. The group, which is already meeting routinely, consists of the Subcommittee Chairs, the Chief of the NEFSC Population Dynamics Branch, the Chief of the NEFSC Conservation and Utilization Division, the SAWs Coordinator, and the SAW Chair.

### *7b. The SAW Plenary Meeting/ SAW Public Review Workshop*

The SAW-19 dual presentations, the SAW Plenary Meeting and the report to the NEFMC, were viewed as successful. The SAW Plenary model was discussed with the conclusion that two presentation sessions in place of a single Plenary Meeting would occur in the future. These sessions will be called SAW Public Review Workshop (Session - North and Session - South) and will be part of the NEFMC and MAFMC meeting agendas. Material on the species/stocks relevant to the particular Council will be highlighted and a summary of information on the other stocks will be presented at each meeting. Draft documents distributed at these sessions will not be final, however, until the whole "cycle" has been completed via a meeting of the SAW Steering Committee.