National Assessment of Excess Harvesting Capacity in Federally Managed Commercial Fisheries

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The authors of the regional reports are identified on the title page of each report. Similarly, the authors of Appendix 13—the technical appendix describing the data envelopment analysis (DEA) used to estimate harvesting capacity—are listed on that title page.

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1. Introduction

This report presents the results of the initial assessment of excess harvesting capacity in federally managed commercial fisheries. The assessment includes most but not all federally managed commercial fisheries, and provides the broadest economic analysis of federally managed commercial fisheries to date. Fisheries included and not included are listed separately in Table 1, and the reasons specific fisheries were not included are discussed in Appendix 1. The assessment is for 2004, the most recent year for which useable data were available.

NOAA's National Marine Fisheries Service (NMFS) made a commitment to conduct this assessment in response to national and international concerns that overcapacity, overfishing, and other often co-occurring undesirable outcomes of a common management problem prevent the attainment of the goal of productive and sustainable marine ecosystems. The other undesirable outcomes include high levels of bycatch, adverse impacts on habitat, less safe working conditions on fishing vessels, lower product quality, poor economic performance, less viable fishing communities, non-compliance with regulations, and a management regime that is unnecessarily complex, contentious, and costly.

The importance of dealing with these problems, in part by managing the level and use of harvesting capacity, is discussed in a variety of documents, including:

- Several Food and Agriculture Organization of the United Nations (FAO) agreements and reports (e.g., the Code of Conduct for Responsible Fisheries, the International Plan of Action for the Management of Fishing Capacity, and related reports).
- United Nations General Assembly fisheries resolutions and agreements.
- U.S. National Plan of Action for the Management of Fishing Capacity and related NMFS reports.
- NMFS Strategic Plans.
- Magnuson-Stevens Fishery Conservation and Management Act (MSA).

It is important domestically and globally for NMFS to send a clear and consistent message concerning the importance of more effectively controlling the level and use of harvesting capacity. Including the commitment to assess overcapacity in the U.S. National Plan of Action for the Management of Fishing Capacity, and meeting that commitment, have contributed to this goal.

Table 1. Fisheries included and not included in the assessment.

Fisheries Included in the National Assessment
Atlantic States Marine Fisheries Commission
• Northern Shrimp Fishery[1]
Caribbean Fishery Management Council
• Spiny Lobster Fishery of Puerto Rico and the U.S. Virgin Islands
• Shallow Water Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands
• Queen Conch Fishery of Puerto Rico and the U.S. Virgin Islands
Gulf of Mexico Fishery Management Council
• Reef Fish Fishery of the Gulf of Mexico
Mid-Atlantic Fishery Management Council
• Atlantic Surfclam and Ocean Quahog Fisheries
• Atlantic Mackerel, Squid, and Butterfish Fisheries
• Summer Flounder, Scup, and Black Sea Bass Fisheries
• Atlantic Bluefish Fishery
• Tilefish Fishery
New England Fishery Management Council
• Atlantic Sea Scallop Fishery
• Northeast Multispecies Fishery
• Monkfish Fishery
• Atlantic Herring Fishery
• Atlantic Deep Sea Red Crab Fishery
NMFS
• Consolidated Atlantic Highly Migratory Species Fishery
North Pacific Fishery Management Council
• Groundfish Fishery of the Gulf of Alaska
• Groundfish Fishery of the Bering Sea and Aleutian Islands Area
• Bering Sea/Aleutian Islands King and Tanner Crab Fisheries
• Scallop Fishery off Alaska
• Pacific Halibut Fishery off Alaska (not an FMP fishery)
Pacific Fishery Management Council
• Coastal Pelagic Species Fishery
• Pacific Coast Groundfish Fishery
• U.S. West Coast Fisheries for Highly Migratory Species
South Atlantic Fishery Management Council
• Snapper-Grouper Fishery of the South Atlantic Region
South Atlantic and Gulf of Mexico Fishery Management Councils Joint Efforts
• Coastal Migratory Pelagic Fisheries of the Gulf of Mexico and South Atlantic
Western Pacific Regional Fishery Management Council
• Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region[2]
• Pelagic Fisheries of the Western Pacific Region[3]

Table 1 Continued.

Fisheries *Not* Included in the National Assessment
Gulf of Mexico Fishery Management Council
• Red Drum Fishery of the Gulf of Mexico
• Stone Crab Fishery of the Gulf of Mexico
• Shrimp Fishery of the Gulf of Mexico
Mid-Atlantic Fishery Management Council
• Spiny Dogfish Fishery
New England Fishery Management Council
• Small Mesh Multispecies Fishery
• Skate Fishery
• Atlantic Salmon Fishery
NMFS
• Federally permitted fisheries beyond the U.S. EEZ (e.g., U.S. tuna vessels in the Western Pacific)
North Pacific Fishery Management Council
• High Seas Salmon Fishery off the Coast of Alaska East of 175 Degrees East Longitude
Pacific Fishery Management Council
• West Coast Salmon Fishery
• Pacific Halibut Fishery off California, Oregon, and Washington (not an FMP fishery)
South Atlantic Fishery Management Council
• Atlantic Coast Red Drum Fishery
• Shrimp Fishery of the South Atlantic Region
• Golden Crab Fishery of the South Atlantic Region
• Dolphin and Wahoo Fishery
South Atlantic and Gulf of Mexico Fishery Management Councils Joint Efforts
• Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic
Western Pacific Regional Fishery Management Council
• Crustaceans Fisheries of the Western Pacific Region

1. At the request of the New England Fishery Management Council, this fishery, which is managed by the Atlantic States Marine Fisheries Commission, was included in the National Assessment; however, it is not a federally managed fishery.

2. This includes only the Hawaii longline fleet, which accounted for about 54 percent of the commercial landings in this fishery in 2004. The American Samoa longline fleet, which accounted for about 28 percent of the landings in this fishery, was not included.

3. This includes only the Northwest Hawaiian Islands bottomfish fleet, which accounts for about 37 percent of the commercial landings in this fishery.

NMFS, the Regional Fishery Management Councils (Councils), the Interstate Marine Fisheries Commissions (Commissions), all participants in the Council/Commission/NMFS fishery management process, and our fishery management partners around the world are involved in ongoing collaborative efforts to manage the level and use of harvesting capacity more effectively. This assessment supports those collaborative efforts in several additional ways.

1. The assessment has contributed to the development of the conceptual and analytical foundation and datasets that can be used in future collaborative efforts.

2. As with many modeling exercises, the insights that resulted from this exercise may be as valuable as the estimates it produced. Appendix 2 presents many of these insights, or basic lessons learned or relearned, while preparing for and conducting this assessment.

3. The assessment produced a clearer understanding of the current region-specific and fishery-specific strengths and weaknesses of the data that are available to support economic analyses for a broad range of fishery management issues.

4. Information in this report was used in preparing the excess harvesting capacity report to Congress required by the MSA as amended in 2007. That report identifies and describes the fisheries with the most severe examples of excess harvesting capacity, and discusses measures to reduce excess harvesting capacity and private sources of funding for those measures.

NMFS has organized this report to examine several dimensions of excess harvesting capacity. In this report and the report to Congress, NMFS defines "harvesting capacity" as the capability of one or more specific vessels to catch fish. Harvesting capacity is determined by factors such as the normal and realistic operating conditions of each vessel, the machinery and equipment in place, other physical characteristics of the vessels (e.g., vessel size and horsepower), the technology, the availability and skill of skippers and crew, the abundance of the stocks of fish, and, perhaps, the fishery regulations that constrain that capability. The harvesting capacity of a specific set of fishing vessels is measured in terms of the potential pounds or tons of catch of those fishing vessels, and not in terms of the number, size, or horsepower of those fishing vessels. NMFS interprets the term "excess harvesting capacity" to mean "too much" harvesting capacity and uses the following three measures or indicators of excess harvesting capacity for commercial fisheries:

- **Excess Capacity:** capacity in excess of actual harvests
- **Overcapacity:** capacity in excess of the quotas
- **Overharvest:** harvests in excess of the quotas

These three measures or indicators are in terms of the capacity, actual harvests, and harvest quotas for the commercial fisheries. Therefore, the total harvests and harvests quotas could be substantially greater than the commercial harvests and quotas for stocks that are also subject to recreational or subsistence fisheries. For a stock without a commercial harvest quota, the commercial target catch level or harvest guideline level is used as a proxy for the commercial harvest quota.

1.1 Findings

1.1.1 Major Quantitative Findings

The following summary of the major quantitative findings is for 25 fisheries, 60 fleets, and 127 species groups. Due to substantial problems with the landings data and other data for the U.S. Caribbean fisheries, the estimates for those fisheries are very tentative and probably not comparable to the estimates for the other fisheries. Therefore, the results for the Caribbean fisheries are not included in the following summary. Typically, fisheries are defined by fishery management plan (FMP), fleets are defined by vessel or gear type and fishery, and species groups are determined by the individual species or species groups for which separate harvest quotas are set. The assessment of excess harvesting capacity is based on higher and lower harvesting capacity estimates for most fisheries. The two estimates are not intended to bracket the range of feasible harvesting capacity estimates; they are intended to allow for a more complete assessment of excess capacity and overcapacity by providing a range that accounts for different underlying assumptions about the vessels' ability to increase their harvest. However, because the additional data required to generate the lower estimates were not available for all fisheries, the following findings are based only on the higher estimates.

1. The excess capacity rates (the percent of capacity that was redundant with respect to the commercial harvest in 2004) and the overcapacity rates (the percent of capacity that was redundant with respect to the commercial harvest quota in 2004) vary considerably among regions and fisheries, and even among fleets and stocks within individual fisheries.

2. For 12 of the 25 assessed fisheries and 18 of 60 of the assessed fleets, excess capacity rates were about 50 percent or more. In 6 of the 23 fisheries for which there were catch targets and overcapacity could therefore be calculated, the overcapacity rates exceeded 30 percent.

3. In some fisheries with high rates of excess capacity and overcapacity in 2004, there was overharvest of quotas. However, in other fisheries with high rates of excess capacity and overcapacity, this undesirable outcome was prevented by effective controls on the use of harvesting capacity.

    i. 11 of the 25 fisheries had at least one species group that was overharvested in 2004.
    ii. The higher overcapacity rate exceeded 30 percent for 6 of those 11 fisheries.
    iii. The higher overcapacity rate exceeded 30 percent for 3 of the 14 fisheries without an overharvested species group.
    iv. There was overcapacity for 61 species groups but overharvest for only 20 species groups.
    v. The higher overcapacity rate exceeded 50 percent for 14 species groups but only 8 of those species groups were overharvested.
    vi. The higher excess capacity rate exceeded 50 percent for 25 species groups, of which 19

4. The capacity estimates must be used with caution. The excess capacity and overcapacity rates do not indicate if capacity should be reduced, by how much to reduce it, how to reduce capacity, or the urgency for reducing it. These determinations will be more difficult for (1) multispecies fisheries, (2) rebuilding stocks, (3) stocks subject to environmental fluctuations, (4) fisheries with significant recreational components, and (5) fisheries with significant foreign harvests. With an effective limited access privilege program (LAPP) in place, the need for such determinations will be substantially reduced, if not eliminated.

1.1.2 Major Policy Findings

The following major policy findings are based on almost two decades of efforts by NMFS to better understand and effectively address the problems resulting from ineffective controls on the level and use of harvesting capacity. These findings can help in determining how to use this assessment and specifically what to do when there is substantial excess capacity or overcapacity.

1. Excess harvesting capacity and overfishing are only two of several often co-occurring undesirable outcomes of the same underlying management problem: i.e., in the absence of well-defined and secure harvest privileges, the race for fish typically is used to allocate the allowable catch among competing fishermen, and the race for fish provides incentives for individual fishermen to increase harvesting capacity and to take other actions that prevent the attainment of the objectives of sustainable fisheries. The undesirable results of this problem can be increased by inadequate information, monitoring, and enforcement, which, in part, can be due to the underlying problem. In essence, without well-defined and secure harvest privileges, such as those established using LAPPs and similar programs, which are authorized by the MSA, the interests of individual fishermen are not aligned with the objectives of sustainable fisheries, and fishermen do not have sufficient incentives to support investments in the conservation and management of fisheries.

2. Although overcapacity is not the root cause of overfishing, high levels of overcapacity can contribute to overfishing. In addition, overfishing for a specific stock cannot occur in the absence of overcapacity for that stock unless either recreational and subsistence fisheries contribute to overfishing for that stock or the commercial harvest quota exceeds the overfishing level. Often when there is overcapacity, it will be necessary to use management measures to restrict catch, and at any point in time, the greater the overcapacity, the harder it will be to design and enforce management measures that will prevent overfishing. There are three reasons for this: (1) more restrictive measures will be required; (2) fishermen will have a greater incentive to circumvent any measure that increases their costs or decreases their revenues; and (3) there will be a greater incentive to use political pressure to redefine (increase) the allowable catch levels. In some fisheries with high rates of overcapacity in 2004, there was overharvest. However, in other fisheries with high rates of overcapacity, overharvest was prevented by effective management controls on the use of harvesting capacity or other factors.

3. Efforts to address the often co-occurring undesirable outcomes individually without addressing the common underlying management problem often have increased the severity of those outcomes and are likely to fail.

4. By themselves, the excess capacity and overcapacity estimates do not indicate whether capacity should be reduced, how much capacity should be reduced, how to reduce capacity, or the urgency for reducing it. These determinations generally will be more difficult for (1) multispecies fisheries, (2) rebuilding stocks, (3) stocks subject to sharp environmental fluctuations, (4) stocks with significant recreational catch, and (5) international stocks with significant foreign harvests. With effective LAPPs in place, the need for such determinations will be substantially reduced, if not eliminated.

5. The optimum level of harvesting capacity typically is not the level at which excess capacity, overcapacity, or both are equal to zero. Therefore, there can be excess capacity, overcapacity, and even overharvest, and, potentially, high rates for each, when harvesting capacity is at or near the optimum level. One reason is that, because it is not practical to change the size and physical characteristics of a fleet each time either the other determinants of actual catch and capacity change or the commercial quota changes, the optimum level of capacity may result in high rates of excess capacity some years and low rates other years. Similarly, the optimum level of capacity may result in high positive or negative rates of overcapacity some years and low rates other years; and depending on the effectiveness of catch monitoring and control programs, the same can be true for the overharvest rate. For example, the Southwest Region coastal pelagic and albacore troll fisheries face El Niño-Southern Oscillation (ENSO) events in the California Current and other areas of the Eastern Pacific Ocean that can result in large fluctuations in the temporal and spatial availability of fish in these fisheries, the commercial quotas, and therefore the catch and harvesting capacity. So even without a change in the size or physical characteristics of the fleets, there can be high overcapacity in one year and low overcapacity or even undercapacity the following year.

6. Even without annual changes in the determinants of the excess capacity and overcapacity rates, the optimum rates probably are not equal to zero because there are multiple conservation and management objectives. Clearly multiple objectives were considered in designing most LAPPs, which can include individual fishing quota (IFQ) programs, regional fishery associations, community quotas, and harvest cooperatives. For example, the Alaska Region halibut and sablefish IFQ programs include many transferability constraints in order to meet distributional or social objectives. Similarly, an individual fisherman has multiple objectives and, in order to have a fishing vessel that is safer, more comfortable, and more versatile, may choose to have a larger fishing vessel than typically is necessary for most fishing trips. For example, in part because the capacity of a vessel cannot be tailored to the conditions of each fishery in which it is used, vessels that are used in multiple fisheries will tend to have some fishing trips for which their harvesting capacity is not used fully.

7. LAPPs address the underlying cause of the often co-occurring undesirable outcomes, including excess harvesting capacity. An effective LAPP will tend to result in a level of capacity that is closer (perhaps much closer) to the optimum level, where, as explained

above, the optimum level is not necessarily the level of capacity associated with a low rate of excess capacity or overcapacity. In addition, with an effective LAPP, the excess capacity or overcapacity that occurs probably will contribute less to the other undesirable outcomes, because the underlying management problem is being addressed and because fishermen generally will be more willing and able to accept and adapt to quota reductions or other management actions taken to rebuild stocks and prevent/end overfishing of target and non-target species. Therefore, an effective LAPP can decrease substantially the severity of those undesirable outcomes, which means there probably will be no need to do anything else to manage the level of harvesting capacity. However, the full reduction in harvesting capacity will not be instantaneous. It will take fishermen time to decide how to respond to the new incentives and opportunities provided by a LAPP and more time to carry out those decisions. The size and speed of the reduction will depend on a variety of factors, including the transferability rules. For example, if the ongoing harvest privileges can be sold but not leased (i.e., if the privileges for a given year cannot be sold without selling the ongoing harvest privileges), fishermen who want to hold the ongoing privileges as an investment, because they expect the price of the ongoing privileges to increase, would have an incentive to remain in the fishery and use their annual privileges. The effectiveness of a LAPP in reducing the harvesting capacity of the fleets in a specific fishery also can be limited by the absence of LAPPs for the other fisheries in which those fleets participate. In addition, the characteristics of some fisheries with LAPPs may tend to result in estimates that overstate the excess capacity and overcapacity rates in those fisheries relative to the rates in some other fisheries. Two such characteristics are discussed in Section 3: (1) the dominance of fishing trips with only one species, and (2) the greater flexibility each fisherman has in deciding how, when, and where to catch fish with some LAPPs. These two characteristics could partly explain why the estimated excess capacity and overcapacity rates were relatively high for Alaska Region halibut and pollock fisheries and for the Northeast Region surfclam and ocean quahog fishery, which each had a LAPP or LAPP-like program for all or much of the fishery.

1.2 Organization of the Report

The remainder of this section provides background information on (1) the previous efforts to define and measure harvesting capacity that were the foundation for this assessment; (2) the work done in preparation for this assessment; and (3) the process used to conduct the assessment. Section 2 presents the definitions of harvesting capacity, excess capacity, and overcapacity used for this assessment and the conceptual framework for those definitions. Therefore, this assessment will be easier to understand and interpret if that section is read carefully before reading the later sections. Section 3 explains the methods used to generate the estimates of harvesting capacity, excess capacity, and overcapacity presented in this report. Section 4 contains a discussion of the variables used to summarize the assessment results. The assessment results are summarized in Section 5, and the assessment reports are presented in Appendices 3 through 10, respectively, for the eight groups of fisheries listed below. With the exception of the Atlantic Highly Migratory Species (HMS) and the U.S. Caribbean fisheries, the fisheries are grouped by NMFS Region.

Groups of Fisheries	
1. Northeast	5. Northwest
2. Southeast	6. Southwest
3. Atlantic HMS	7. Alaska
4. U.S. Caribbean	8. Pacific Islands

For each group of fisheries, the assessment is presented by fleet and by "species group," which refers to one or more individual species. For example, the species groups for which total allowable catches (TACs) existed in 2004 were used for the Alaska groundfish fisheries. The term "fleet" refers to a specific part of a fishery, where fleets generally were identified by gear type and area or fishery. Specifically, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing boats, because many boats used more than one type of gear or participated in more than one fishery in 2004. For example, in the case of the Atlantic HMS pelagic longline fleet (1) the fleet refers to the fishing trips for which Atlantic HMS fish were caught with pelagic longline gear; (2) the assessment of harvesting capacity for that fleet is for those trips and not for the other fishing activities of the boats that made those trips; (3) some fishing boats used multiple types of gear to catch HMS fish and therefore were in multiple HMS fleets; and (4) some of these boats made landings without HMS fish and therefore were in other fisheries also. In addition, multiple species often were caught together. As a result, many fishing boats contributed to the catch and therefore to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species groups, fleets, or fisheries.

The fishery group-specific assessments, which are presented in Appendices 3 through 10 and summarized in Section 5, typically include:

1. An introduction, which includes a brief summary of the assessment results;
2. A brief description of the main management measures used in the fisheries in 2004, with an emphasis on those that limited catch per trip, the number of trips, or both;
3. A brief description of fleet-specific statistics on the physical characteristics of active fishing boats and on trip characteristics for specific types of trips in 2004, where the trip characteristic statistics summarize catch or landings data for those trips and, if they were available, variable input data (e.g., days at sea, number of sets, and crew size);
4. A brief discussion of the methods used to estimate harvesting capacity (e.g., the fixed and variable inputs, outputs, and stratifications used in the capacity estimation models);
5. The assessment results by fleet for all species combined; and
6. The assessment results by species group for all fleets combined.

1.3 Background Information

This section provides summary information on the following: (1) the previous efforts to define and measure harvesting capacity that were the foundation for the assessment; (2) the work done in preparation for the assessment; and (3) the process used to conduct the assessment.

The definitions of harvesting capacity, excess capacity, and overcapacity, and the estimation methods presented in Sections 2 and 3, respectively, have evolved over time as the result of extensive efforts to define these three terms and to develop methods for estimating harvesting capacity. FAO and NMFS are among the organizations that contributed to those efforts. Some of the NMFS contributions are described next.

NMFS has actively participated in domestic and international efforts to assess and, when appropriate, to manage the level of harvesting capacity. In late 1998, NMFS developed recommendations for the implementation of a standardized fishing boat registration and information management system. The recommendations are being implemented under the National Fisheries Information System through a cooperative effort by NMFS, the Councils, the Commissions, and state fishery management agencies. This information system will provide improved data on the physical characteristics of fishing boats, and it will provide data that will allow fishery managers to track the participation of fishing boats across fisheries. The fishing boat characteristics data are critical for estimating harvesting capacity for all types of fishing boats, and the cross-fishery participation data are critical for estimating the harvesting capacity of boats or fleets that participate in multiple fisheries.

NMFS established a National Task Force for Defining and Measuring Fishing Capacity in 1998, which completed an initial draft report in 1999. Based in part on the recommendations in that report, NMFS initiated a plan to prepare a series of three reports on harvesting capacity for federally managed commercial fisheries. The reports were intended to provide increasingly useful information concerning the levels of harvesting capacity, as the feasibility of estimating harvesting capacity for all federally managed fisheries increased and as the issues associated with defining and estimating overcapacity were addressed further. The first report, *Identifying Harvest Capacity and Over-Capacity in Federally-Managed Fisheries: A Preliminary Qualitative Report*, was completed in 2001. The second report, *Assessments of Excess Fishing Capacity in Select Federally-Managed Commercial Fisheries*, was completed in 2006. This assessment is the third report.

NMFS was a key participant in the FAO technical and policy-level consultations that produced the Code of Conduct for Responsible Fisheries in 1995. The results of NMFS efforts to identify and develop the concepts and analytical tools to more accurately measure and evaluate excess harvesting capacity were shared with and adopted by the U.N. Food and Agriculture Organization (FAO). Subsequent FAO sponsored international consultations lead to the preparation of the International Plan of Action for the Management of Fishing Capacity, which was adopted by the FAO Committee on Fisheries in February 1999 and endorsed by the FAO Council in November 2000. The many reports and publications prepared for or resulting from the FAO technical consultations on defining and measuring harvesting capacity were used extensively in the preparation of subsequent NMFS reports and assessments.

The United States National Plan of Action for the Management of Fishing Capacity was completed in August 2004. To meet its stewardship responsibilities and its commitment to the FAO, NMFS included the following five Commitments in the National Plan.

1. Establish and, when necessary and appropriate, revise the medium and long-term national capacity reduction targets.
2. Prepare regular assessments of overcapacity in federally managed fisheries.

3. Work with the Regional Fishery Management Councils to reduce overcapacity in fisheries under their jurisdiction.
4. Convene a national meeting in 2005 that addresses, among other things, the capacity issue, where NMFS and its constituents can review progress and focus on future priorities.
5. Help the Councils develop/prioritize goals for capacity reduction in specific fisheries.

This report presents the results of the first assessment to be completed in response to Commitment 2. In addition, it will assist in meeting Commitments 1, 3, and 5.

In preparing to conduct the first assessment, NMFS held two overcapacity workshops. The first workshop was held in Washington, D.C., on September 7–9, 2005, and the second workshop was held at the Southwest Fisheries Science Center (La Jolla, California) on March 28–30, 2006. The objective for the first workshop was to have productive discussions that would assist in determining the types of overcapacity assessments that would generate the most useful information for the Councils and NMFS as they continue their efforts to manage the level and use of harvesting capacity more effectively. The workshop participants—predominantly NMFS and Council staff—are listed in Appendix 11. In addition to the workshop documents prepared before the first workshop (Appendix 12), a draft summary of the first workshop was prepared. Among other things, the summary includes the comments and recommendations of Council staff regarding the September 7–9, 2005, meeting on fishing capacity.

The principal objective for the second workshop was to determine what would be included in the initial assessment of overcapacity, the process and analytical methods that would be used to conduct the assessment, and how specific data/modeling issues would be addressed. A workshop plan was prepared before the second workshop, and a draft summary was prepared afterwards. The workshop plan included a proposal for what would be included in the first assessment of overcapacity, a proposal for a cooperative assessment process with specific responsibilities for various participants, the proposed analytical methods, a list of specific modeling and data issues, and a list of potential activities beyond the first round of regular assessments of overcapacity.

The workshop participants (Appendix 11) reached substantial agreement on how those proposals should be changed and, therefore, on how the assessment would be conducted. However, additional adjustments to the plan were agreed to as the assessments were actually conducted. As a result of those agreements, we:

1. Used data envelopment analysis (DEA), a mathematical programming approach, to estimate harvesting capacity (capacity output) by trip and species group;
2. Used DEA models that allowed for variable returns to scale;
3. Summed the estimates by trip to generate the capacity estimates by fleet for all species combined and by species group for all fleets combined;
4. Used those aggregate estimates of harvesting capacity and estimated landings or catch to calculate excess capacity by fleet for all species combined and by species group for all fleets combined; and
5. Used those aggregate estimates of harvesting capacity by species group and the

species group–specific commercial quotas (CQs) or their proxies to calculate overcapacity by species group for all fleets combined.

DEA is briefly described in Section 3 (Estimation Methods) and more fully described in Appendix 13.

Generally, the Fisheries Science Center with knowledge of a specific group of fisheries provided the data and other information that were used to conduct the assessment and prepare the report for that group of fisheries. The HMS Division of the Office of Sustainable Fisheries performed that function for the Atlantic HMS fisheries. John Walden (NEFSC) conducted the assessments and provided summary tables for six of the eight groups of fisheries. Jim Kirkley (College of William and Mary) did the same for the other two groups of fisheries and consulted with John Walden on modeling issues for many of the eight groups of fisheries. Joe Terry used the summary tables and descriptions of the estimation methods provided by John Walden and Jim Kirkley, as well as background information provided by the Science Centers and the HMS Division, to prepare the draft and final reports for five groups of fisheries. John Walden prepared the report for the Northeast fisheries and the first draft for the Pacific Islands Region fisheries, and Jim Kirkley prepared the first draft for the Caribbean fisheries. Fisheries Science Center or HMS Division economists assisted in writing the reports. This included reviewing or contributing to the initial drafts. After those NMFS economists had reviewed the initial drafts, each draft was revised and sent to the appropriate Fisheries Science Center Director and Regional Administrator for final review and approval. For the Atlantic HMS fisheries, the final draft was sent to the Director of the Office of Sustainable Fisheries for final review and approval. Those reports, as revised to respond to the final review comments, are presented in Appendices 3 through 10.

2. Definitions and Their Conceptual Framework

The assessment results presented in this report are specific to the definitions of harvesting capacity, excess capacity, and overcapacity presented below. A clear understanding of these definitions will avoid confusion, given that different definitions for these three terms have been used elsewhere, such as in previous discussions of harvesting capacity.

2.1 Definitions

Ever since fishery experts at FAO began publishing studies in the early 1990s about the global dimensions of overfishing and overcapacity, national governments and regional fishery management organizations (RFMOs) have engaged in efforts to assess and address the problems resulting from insufficient control of the level and use of harvesting capacity. Frequently, harvesting capacity has been measured in terms of the numbers and sizes of fishing vessels. Even today, the European Union uses a combination of the size and engine power of a fishing vessel as its measure of a vessel's harvesting capacity. Similarly, the Inter-American Tropical Tuna Commission (IATTC) measures capacity in terms of the hold capacity of the tuna vessels operating in IATTC waters.

NMFS defines and measures harvesting capacity in terms of the potential harvest of a fishing vessel or fleet of vessels, for two reasons. First, for most fishery management purposes, the potential harvest of a fleet is more important than one or two physical vessel characteristics. Second, for most industries in the United States, capacity is a measure of potential output, and although potential output depends on, among other things, fixed inputs, capacity is not normally measured in terms of those inputs.

In the instructions that accompany the U.S. Census Bureau's Survey of Plant Capacity Utilization, which is used to estimate capacity for most U.S. industries, capacity (or full production capability) is defined as "the maximum level of production that this establishment could reasonably be expected to attain under normal and realistic operating conditions fully utilizing the machinery and equipment in place."

Accordingly, NMFS developed the following definition of harvesting capacity:

> **Harvesting capacity** is the maximum amount of fish that the fishing fleets could have reasonably expected to catch or land during the year under the normal and realistic operating conditions of each vessel, fully utilizing the machinery and equipment in place, and given the technology, the availability and skill of skippers and crew, the abundance of the stocks of fish, some or all fishery regulations, and other relevant constraints.

With this definition, harvesting capacity is a measure of the constrained ability of specific fleets (one or more specific vessels) to catch or land fish.

That definition and the following definitions of excess capacity and overcapacity used for this assessment have evolved over time as the result of extensive efforts to define these three terms. The FAO and NMFS are among the organizations that contributed to those efforts.

> **Excess capacity** is the difference between harvesting capacity and estimated catch or landings.

> **Overcapacity** is the difference between harvesting capacity and a short-term target catch level for the commercial fisheries, such as the commercial quota (CQ) or its proxy.

If an insignificant part of the total catch of a species was taken in recreational and subsistence fisheries, the total allowable catch (TAC) could be the target catch level that is used as the reference point to calculate overcapacity. However, to allow for the cases in which a significant part of the total catch was taken in recreational and subsistence fisheries, the harvest quotas for the commercial fisheries (CQs) or their proxies are used as the reference point for calculating overcapacity.

Although a long-term target catch level, such as maximum sustainable yield (MSY) or maximum economic yield (MEY), could be used, this report uses a short-term target catch level—CQ or CQ proxy—as the reference point to calculate overcapacity, for two reasons. First, it provides a measure of overcapacity that is more useful for some management purposes, particularly if there are substantial differences between the current stock conditions and those associated with the long-term target catch level, and if it will take many years to attain those conditions. Second, it would be very difficult to estimate harvesting capacity for the stock conditions associated with a long-term target catch level if it will take many years to attain those conditions or if they have not been observed for many years. If the stock conditions associated with a long-term target catch level are the current stock conditions, the short-term and long-term target catch levels will be equal.

For the Pacific Coast and Alaska groundfish fisheries, overcapacity is defined in terms of *total* catch (i.e., landed plus discarded catch); however, for all other fisheries, it is defined in terms of *landed* catch. Ignoring other potential sources of error, this means that for all other fisheries, if the commercial quotas were in terms of total harvest and if at-sea discards accounted for a significant part of the total catch, overcapacity would be underestimated substantially. For the rest of this section and Sections 2 through 5, the generic term "catch" either can refer to total catch or to just landed catch (i.e., landings).

Harvesting capacity and excess capacity for a fleet can and probably should be assessed for all species combined, just as the capacity of a group of automobile plants is assessed for all automobiles combined and not by type of automobile. However, the same is not true for overcapacity, which is defined for each species group with a target catch level (e.g., a CQ or its proxy); where as noted above, a species group can refer to one or more individual species. This species group–specific capacity concept appears in the report by the NMFS National Task Force for Defining and Measuring Fishing Capacity, various FAO technical consultation reports and related reports, and the U.S. National Plan of Action for the Management of Fishing Capacity. Both the objective of preventing overfishing by species group and the belief that it is practical to prevent overfishing by controlling only the level of harvesting capacity have contributed to the popularity of this species group–specific concept.

This objective is reasonable but the belief is not well founded. There are several common fishery characteristics that make it impractical to prevent overfishing by reducing the level of harvesting capacity without also controlling the use of the harvesting capacity that exists. It is not practical because the required reduction in harvesting capacity would result in catch levels substantially below the target catch levels for most species and, therefore, the cost of preventing overfishing would be unnecessarily high in terms of the other management objectives. The characteristics include: (1) multispecies boats that could readily and substantially change the species composition of their annual catch; (2) part-time boats that could become full-time boats; (3) latent boats (i.e., those that could have participated in a fishery but did not) that could become active boats; (4) boats that are able to catch more than they are willing to catch; (5) fluctuations in the overfishing levels and harvesting capacity; (6) uncertainty concerning actual harvesting capacity; and (7) multiple conservation and management objectives.

As noted above, many fishing boats contributed to the catch and therefore to the estimates of harvesting capacity, excess capacity and overcapacity for multiple species groups, fleets, or fisheries. This caveat is particularly relevant for fisheries with vessels that typically had multi-species or multi-gear activities. For example, the typical Southeast finfish boat fishes for a variety of species, both on each trip and throughout the seasons. They are constantly adapting to resource, market, and other conditions. Further, the gear-based sub-fleets are not well delineated in the Southeast because many fishing boats use more than one type of gear during a year. In light of these factors, the merit of a single species capacity, and particularly overcapacity, measure needs to be carefully evaluated. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species in the absence of any management measures that prevented such a shift. The present analysis, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is somewhat less of a problem for the assessment of harvesting capacity by fleet for all species combined; however, because it is common for fishing boats to switch between gear types, the problem is not eliminated.

2.2 Conceptual Framework

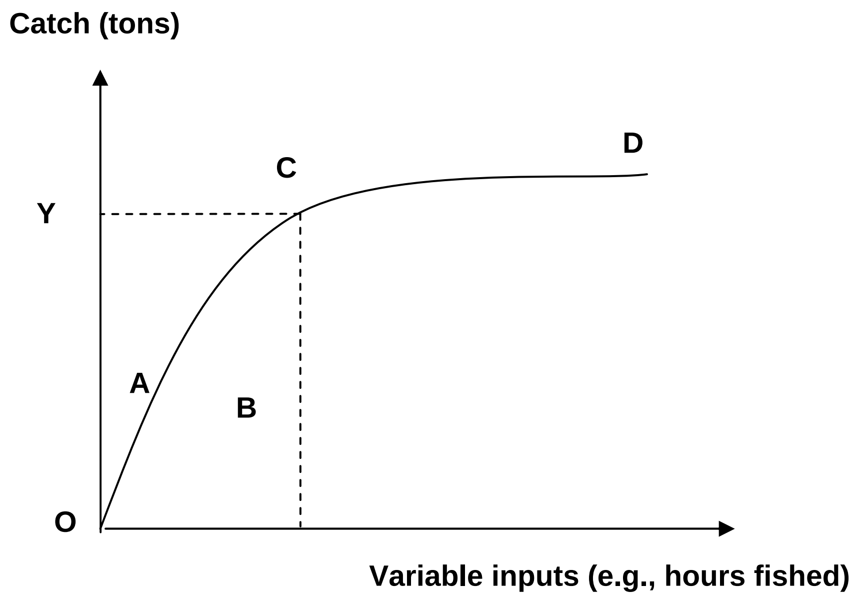
In this section, we examine the concepts of harvesting capacity (capacity output), excess capacity, overcapacity, and capacity utilization. A clear understanding of these concepts not only facilitates the interpretation of the results, but also provides insight into their use when developing capacity monitoring and capacity management programs.[1]

For the purposes of this report and as noted above, harvesting capacity is a measure of the ability of a specific fleet or boat to catch fish given the constraints included in the definition of harvesting capacity. This often is referred as the technological definition of capacity, whereas an economic definition would seek to define capacity as the output level at which an economic objective such as profit maximization or cost minimization is met. Regrettably, the data required to measure economic capacity are only available for a few commercial fisheries in the United States.

Figure 1 presents the total product (catch) curve of a specific fishing boat and trip. It shows the maximum output (catch) that a specific fishing boat is able to produce during a particular type of fishing trip at various variable input levels given the fixed inputs (e.g., physical characteristics) of that boat and the other constraints on catch included in the definition of harvesting capacity. The line that goes through OAC traces the relevant portion of the curve. The line beyond C and through D traces the part of the curve associated with levels of variable inputs that are beyond those for normal and realistic operating conditions for that boat. Those levels of output are technically possible but cannot be attained under normal and realistic operating conditions.

[1] For a more in-depth discussion of these concepts and metrics, see Kirkley et al. (2002), Kirkley et al. (2004), and Grafton et al. (2006).

Figure 1. Total product (catch) curve for a specific fishing boat and trip.

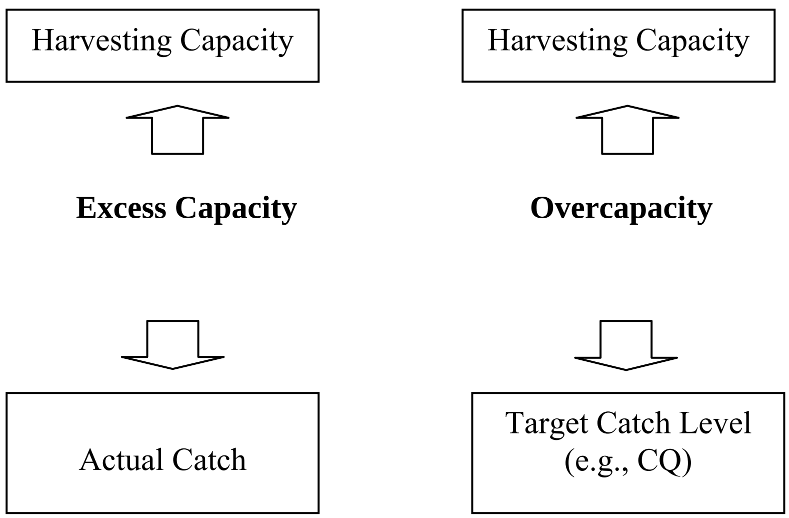


Although all points along the total product curve, such as point A, are technically efficient (i.e., no more fish could be caught given the associated levels of variable and fixed inputs and the other constraints), only the point on this curve corresponding to the highest level of variable inputs under normal and realistic operating conditions yields harvesting capacity for that fishing boat and that type of trip. Graphically, capacity is the level of catch associated with point C, which is Y tons of catch. Any catch level below the curve, such as that for point B, would be considered technically inefficient because more catch would have been possible without using more of the variable inputs. A boat's annual harvesting capacity is the sum of its harvesting capacity for all of its fishing trips that year. Similarly, a fleet's annual harvesting capacity is the sum of the annual harvesting capacity of all the boats in that fleet.

Excess capacity occurs for a fleet when the combined harvesting capacity of all the boats in a fleet is greater than that fleet's actual catch—i.e., the fleet could have caught more fish. For example, if in 2004 the fleet's estimated harvesting capacity was 100 tons of red snapper and its actual catch was 40 tons, excess capacity for red snapper in 2004 would have been 60 tons. Excess capacity occurs when there is technical inefficiency, inadequate use of variable inputs, or both (Grafton et al. 2006). Either or both may result from, among other things, changing market conditions (e.g., low fish prices or high fuel prices) and changing regulations (e.g., lower quotas). However, the estimates of technical inefficiency and therefore harvesting capacity can also reflect boat-specific differences in either crew skill levels or normal and realistic operating conditions, unobserved differences in fixed inputs, and other measurement errors.

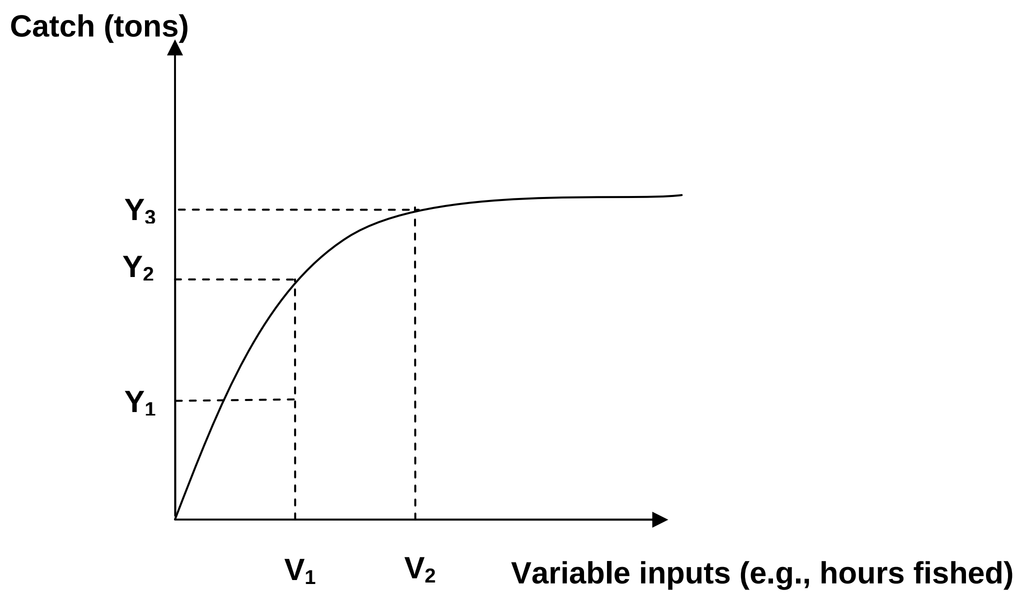
A closely related concept is overcapacity, which occurs when the fleet's harvesting capacity is greater than the target catch level (e.g., the CQ) for that fleet—i.e., the fleet had the capacity to catch more than the target catch level set for that fleet. Overcapacity will be negative (i.e., there is undercapacity) if the target catch level exceeds harvesting capacity. Continuing with the numerical example for red snapper, if the red snapper CQ was 30 tons and the harvesting capacity was 100 tons of red snapper in 2004, then overcapacity for red snapper was 70 tons in 2004. In this example, we know there was overcapacity because catch exceeded the CQ, but the level of overcapacity cannot be determined without an estimate of harvesting capacity. The concepts of excess capacity and overcapacity are depicted in Figure 2.

Figure 2. Excess capacity and overcapacity.



Another useful concept is capacity utilization (CU). Traditionally, CU has been defined as the ratio of actual output to capacity output (Grafton et al. 2006). Therefore, for commercial fisheries CU measures actual catch relative to harvesting capacity, where the difference between the two can be due to both technical inefficiency (i.e., actual catch is below the total product curve) and inadequate variable input use (i.e., the level of the variable inputs used is too low to allow the harvesting capacity level to be taken). Figure 3 depicts the levels of actual catch (Y_1), technically efficient output (Y_2) for the level of variable inputs actually used (V_1), and harvesting capacity (Y_3), which requires the technically efficient use of a level of variable inputs equal to V_2 for a specific fishing boat and type of trip. In this example, CU = Y_1/Y_3. A CU less than 1 indicates the presence of excess capacity. Using the above numerical example for red snapper for a fleet, we obtain a CU for the fleet of 0.4 (40/100 tons), which suggests that 60 percent of the harvesting capacity was not utilized and therefore that the actual catch of 40 tons could have been harvested by a fleet with 60 percent less harvesting capacity. The inverse of this ratio (1/CU) indicates how much larger the catch would have been if the harvesting capacity had been fully utilized. In our numerical example, the inverse of CU equals 2.5 (1/CU=1/0.4=2.5) and the fleet would have been able to harvest 150 percent more red snapper or an additional 60 tons of red snapper if it had fully utilized its harvesting capacity.

Figure 3. Technically efficient output, capacity output, and capacity utilization for a specific fishing boat and trip.



The "unbiased" or technically efficient capacity utilization (CU') is defined as the ratio of technical efficient output to capacity output. Technically efficient output is the maximum output possible conditional on the current fixed and variable inputs (Grafton et al., 2006). In Figure 3, Y_2 is the technically efficient output for the level of variable inputs actually used (V_1), Y_3 is harvesting capacity, V_2 is the level of variable inputs required to produce that level of catch and the highest level of variable input use possible under normal and realistic operating conditions, and CU' equals Y_2/Y_3 for that specific fishing boat and type of trip. To increase catch from the technically efficient level to the capacity level, the fishing boat would have needed to increase variable input utilization from V_1 to V_2. CU' and its inverse (1/ CU') capture the forgone harvesting potential caused by inadequate variable input use (Grafton et al., 2006). Continuing with the numerical example for red snapper for a fleet, if the technically efficient catch is 75 tons of red snapper, CU' equals 0.75 (75 /100 tons), red snapper catch would have been increased by 35 tons (75 – 40 tons) if the actual level of variable inputs had been used efficiently, and red snapper catch would have been increased by an additional 25 tons (100 – 75 tons) if variable input use had been increased sufficiently.

3. Estimation Methods

Data envelopment analysis (DEA) is a commonly used method for estimating technically efficient output, capacity output (i.e., harvesting capacity), and the level of variable input use required to produce capacity output. Using DEA for all federally managed fisheries included in the initial assessment allows for greater standardization of capacity estimation for these fisheries.

Briefly, as used in this assessment, this method "envelops" the observed input–output combinations from the trips of the fishing boats in a fleet to recreate a multidimensional total product (catch) curve that depicts the maximum amount of fish per trip for all species combined that could have been harvested by boats with varying levels of fixed inputs (e.g., physical characteristics). One of DEA's main advantages is that, with a sufficient number of observations, it can easily accommodate multiple inputs and outputs, while allowing constraints to be placed on the production process. It also can provide capacity estimates with limited input and output data. However, DEA is non-parametric and non-stochastic—i.e., the deviations from the total product curve (inefficiencies) are assumed to be non-random events (Grafton et al. 2006; Terry and Kirkley 2006).[2]

Trip-level catch and effort data and data on the physical characteristics of fishing boats were used to estimate harvesting capacity for species groups for each trip by quarter (or other multi-month period). In addition, technically efficient catch and the capacity levels of the variable inputs were estimated by trip if trip-level variable input data (e.g., crew size, days at sea, and number of sets) were consistently available for a fishery. Such data were not available for the Alaska, Northwest, or Southwest fisheries. Typically, the capacity estimates by trip were summed over all trips to generate annual estimates for each boat, and the annual estimates by boat were then summed to generate the aggregate estimates of harvesting capacity presented in this report.

There were two principal exceptions to using the actual number of trips for each vessel. For the Northeast multispecies fishery, the number of trips was expanded in order to estimate capacity in the absence of the very restrictive and vessel-specific day-at-sea limits in 2004. The expansion was based on the total days at sea for each vessel in 1991 (this year was chosen because it was a period of heavy fishing activity before days at sea were directly regulated). A similar implicit expansion on the number of trips was used for the Atlantic sea scallop fishery and for the same reason. However, the average number of days at sea for 1985–1990 was used for the scallop fishery. Theses adjustments to the number of trips are discussed in Sections 3.3.3 and 3.5.3 of Appendix 3.

The formation of the quarterly clusters and type of trip clusters (i.e., using a separate DEA model for each stratum defined by time period and type of trip) reduced the extent to which harvesting capacity and technically efficient output were overestimated, because it reduced the impact of unobserved factors that explain differences in catches among trips. This is particularly important when capacity is estimated by trip and a large part of the deviation in catch among trips is either due to random events, variables that are not used in the DEA models, or measurement errors. The physical characteristics of boats (e.g., length, horsepower, gross registered tons, engine type, refrigeration capability, and hull type) and trip characteristics (e.g., catch by species or species group, crew size, days at sea, number of sets, target species, fishing gear, area, and quarter) were used either as variables in the DEA models or to stratify trip-level data (e.g., group all observations pertaining to boats fishing in a particular resource area during a given season and

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[2] There has been an expanding body of literature in recent years on stochastic DEA (see, for example, Cherchye, L., T. Kuosmanen, and T. Post. 2006. New Tools for Dealing with Errors in Variables in DEA Unpublished manuscript; and Gstach, E. 1998. Another Approach to Data Envelopment Analysis in Noisy Environments: DEA+. Journal of Productivity Analysis 9:161–176).

having the same basic physical characteristics, such as a wood hull and diesel engine).

The observations used in the DEA models for most fleets were fishing trips, as commonly defined. However, there were three exceptions. For a catcher-processor vessel or catcher vessel delivering to motherships in the Pacific Coast groundfish fishery, each day with reported catch was counted as a trip; and for a catcher-processor vessel in the Alaska groundfish fishery, each week with reported groundfish catch was counted as a trip.

There are two important implications of basing the estimates of harvesting capacity on the actual number of trips for each boat. First, the estimates are constrained by the CQs, days-at-sea limits, and other regulations that limited the number of trips in 2004. This means, for example, that the harvesting capacity of a fleet of boats that on average in 2004 could only make 50 trips per boat due to restrictive catch or effort quotas would be based on an average of only 50 trips per boat, even if historically the average number of trips per boat had been substantially greater than 50. Second, because the estimates of harvesting capacity for a fishery were for the fishing boats that participated in that fishery in 2004, the harvesting capacity (latent capacity) of the boats that were permitted to fish in a specific fishery but did not do so in 2004 were not included in the estimates of harvesting capacity, excess capacity, and overcapacity. There was not enough time to use permit information for each fishery, and the estimates of capacity for the boats that participated in that fishery in 2004, to address the latent capacity associated with the permits that were not used in 2004.

For each fishery, estimates were provided for both the usual measure of capacity output and the input-corrected output level (if the required variable input data were available). For convenience in presenting these estimates and the associated estimates of excess capacity and overcapacity, these two estimates are simply referred to as the "higher" and "lower" capacity estimates.

(1) The first and higher estimate, which is the usual measure of capacity output, provides an estimate of what the harvest would have been if all estimated technical inefficiency had been eliminated and if variable inputs had been fully utilized (i.e., used at the level required to attain capacity output). There was technical inefficiency if more could have been produced without increasing the amount of inputs used.

(2) The second and lower estimate provides an approximation of what the harvest would have been if the variable inputs had been fully utilized but if the estimated technical inefficiency had not been eliminated. Therefore, the lower estimate is based on the actual level of technical efficiency, not the estimated potential level of technical efficiency.

The second and lower capacity estimate (LCE) can be generated by adding the difference between the higher capacity estimate (HCE) and the estimate of technically efficient output (TE) to actual catch (C)—that is, LCE = (HCE – TE) + C.[3] In Figure 3, this would be $(Y_3 - Y_2) + Y_1$ for the specific fishing boat and type of fishing trip, and in our numerical example for red snapper, in which actual catch of the fleet is 40 tons, technically efficient catch is 75 tons and the

[3] A different algorithm was used to produce the lower capacity estimates, but the two algorithms produce comparable estimates.

higher estimate of harvesting capacity is 100 tons, the second and lower estimate of red snapper harvesting capacity would be 65 tons of red snapper [(100 – 75) + 40].

The second and lower estimate is provided to address the concern that the first estimate may overstate the amount of fish a given fleet could have expected to harvest under the normal and realistic operating conditions of each vessel[4]. The reason for this concern is that, with the first estimate, all of the differences in harvest levels among trips of a specific type are attributed to technical inefficiency and differences in the levels of fixed inputs when, in fact, some of the differences in harvest levels could have been due to nonobserved factors, including differences in skill levels among skippers or crews, unobserved differences in fixed inputs, weather conditions, mechanical failures, luck (e.g., being at the right place at the right time to catch an unusually large amount of fish), and temporal or spatial differences in fish stocks.

The potential for the first estimate to overstate what the fleet could have harvested under the normal and realistic operating conditions of each vessel is greater when trip-level data are used to estimate harvesting capacity and much of the harvest is accounted for by trips in which only one species is harvested. That is because when capacity is estimated by trip, the peer trips that are used to estimate capacity are defined in terms of both vessel characteristics and the species composition of the catch. Therefore, for single species trips, all the trips for a given species and for vessels with similar vessel characteristics would be peer trips and the trip with the most catch would be the capacity estimate for all those peer trips. Conversely, if many species are taken on most trips and if the species composition differs by trip, there will be relatively few peer trips to estimate the capacity for each trip, which means that more of these trips will have no or few peers and will be estimated to be at or close to capacity. This may account for the relatively high estimates of excess capacity in some of the North Pacific fisheries, such as the Alaska halibut, sablefish, and pollock fisheries. The other characteristic of those fisheries and other fisheries with LAPPs that probably contributed to relatively high rates of excess capacity and overcapacity is the additional control the harvest privilege owners have over when and how fish are caught. Some may have decided to use all their harvest privileges (e.g., IFQs) on a small number of large trips while others may have decided to make more but smaller trips. The trip level capacity estimates will tend to reflect the catch per trip from the larger trips; therefore, there will be high estimates of excess capacity if a large part of the total catch was taken with small trips. The lack of variable input data for the Alaska Region fisheries limited what could be done to account for such differences in trip types for the fisheries with IFQs or fishing cooperatives.

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[4] A more complete discussions of this concern are included in the following two papers:

Kirkley, J. E., C. J. Morrison-Paul, and D. E. Squires. 2002. Capacity and Capacity Utilization in Common Pool Resource Industries. Journal of Environmental and Resource Economics 22:1/2 (June), 71-97.

Kirkley, J. E., C .J. Morrison-Paul, and D. E. Squires. 2004. Deterministic and Stochastic Estimation for Fishery Capacity Reduction. Marine Resource Economics 19, 271-294.

The two estimates are not intended to bracket the range of feasible harvesting capacity estimates; they are intended to allow for a more complete assessment of excess capacity and overcapacity by providing a range that accounts for different underlying assumptions about the vessels' ability to increase their harvest. However, given the definition of harvesting capacity stated above, and barring other factors that could result in either estimate overstating or understating harvesting capacity, actual harvesting capacity would tend to be between the two estimates because the underlying assumptions for the first and second estimates, respectively, are too lenient and too restrictive relative to that definition of harvesting capacity. Estimates of what capacity would have been in 2004 in the absence of the management measures that constrained landings per trip, the number of trips, or both in 2004 would tend to exceed the capacity estimates presented in this report. However, they would have been more speculative estimates of harvesting capacity. Similarly, estimates of what capacity would have been if no stocks had been overfished would have produced larger but again more speculative estimates of harvesting capacity.

For the fisheries without consistently available variable input data, it was not possible to provide estimates of the technically efficient harvest levels, estimates of the levels of variable input use required to harvest at the capacity level, and the lower capacity estimates that were reported for most fisheries. This makes it more difficult to evaluate whether the harvesting capacity estimates for those fisheries are reasonable approximations of harvesting capacity as defined above.

In addition, it should be noted that assessments of overcapacity require commercial harvest quotas or quota proxies, because overcapacity is the difference between estimated harvesting capacity and the commercial harvest quota, which is assumed to be a target harvest level that will achieve the sustainability objectives for a fishery. However, some federally managed fisheries do not have quotas or quota proxies for all commercially important species, and this report could not estimate overcapacity for those fisheries. This was the case for the Pacific Fishery Management Council's U.S. West Coast fisheries for highly migratory species and the Western Pacific Fishery Management Council's pelagic fisheries of the Western Pacific Region.

4. Variables Used to Summarize the Assessment Results

The assessment for each of the eight groups of fisheries is by fleet for all species combined and by species group for all fleets combined. This section lists and discusses the variables typically used in Appendices 3 through 10 to summarize these two types of assessments. When variable inputs were not available consistently for a group of fisheries, only the higher capacity estimate (HCE) could be generated; therefore, the variables that require the lower capacity estimate (LCE) could not be included. Similarly, when a commercial quota (CQ) or its proxy was not available for a species group, the variables that require a CQ or its proxy could not be included. In this section, the generic term "catch" can refer to either total catch or just landed catch (i.e., landings).

The following variables typically were included in the assessments by fleet for all species combined:

1. Reported or estimated catch from trip-level data
2. The percent of that catch used in the DEA models
3. Lower capacity estimate (LCE)
4. Higher capacity estimate (HCE)
5. Lower excess capacity estimate
6. Higher excess capacity estimate
7. LCE as a percent of reported or estimated catch
8. HCE as a percent of reported or estimated catch
9. Reported or estimated catch as a percent of the LCE
10. Reported or estimated catch as a percent of the HCE

The following variables typically were included in the assessments by species group for all fleets combined:

1. Reported or estimated catch from trip-level data
2. Official catch estimate from various sources
3. Reported or estimated catch as a percent of the official catch estimate
4. Commercial quota (CQ) or its proxy
5. Lower capacity estimate (LCE)
6. Higher capacity estimate (HCE)
7. Lower excess capacity estimate
8. Higher excess capacity estimate
9. LCE as a percent of official catch estimate
10. HCE as a percent of official catch estimate
11. Official catch estimate as a percent of the LCE
12. Official catch estimate as a percent of the HCE
13. Lower overcapacity estimate
14. Higher overcapacity estimate
15. LCE as a percent of the CQ
16. HCE as a percent of the CQ
17. CQ as a percent of the LCE
18. CQ as a percent of the HCE
19. Official catch estimate as a percent of the CQ

Although including a variable that is the inverse of another variable is redundant, it makes those assessment variables more readily available. In order to avoid misunderstandings or confusion concerning the assessment results, this section includes brief explanations of the meaning or use of these variables.

4.1 Variables Used in Assessing Capacity by Fleet for All Species Combined

4.1.1 Reported or estimated catch from trip level data

This is either the reported or the estimated catch that was generated using the trip-level data that were available for a fleet. As noted above, landings data, not total catch data, are presented for most fisheries.

4.1.2 Percent of catch used in the DEA models

All else being equal, one would have higher confidence in estimates based on a higher percent of the reported or estimated catch.

4.1.3 Lower capacity estimate (LCE) and higher capacity estimate (HCE)

The difference between the lower and higher capacity estimates (LCEs and HCEs), the reasons for including both when possible, and the problems resulting from not being able to include both were explained in Section 3.

4.1.4 Excess capacity with the LCE or HCE

This is LCE (or HCE) minus reported or estimated catch. It is an estimate of the harvesting capacity that was not used or, equivalently, it is an estimate of the increase in catch that would have occurred if the fleet had operated at capacity.

4.1.5 The LCE or HCE as a percent of reported or estimated catch

This variable indicates the percent increase in landings that would have occurred if the fleet had operated at capacity. For example, if the LCE is 115 percent of the reported landings, the fleet would have landed 15 percent more fish if it had landed an amount equal to the LCE.

4.1.6 Reported or estimated catch as a percent of the LCE or HCE

This is a measure of capacity utilization—it indicates the percent of estimated harvesting capacity that was used and, therefore, the percent of capacity that could have been eliminated without reducing landings if the fleet had fully utilized the remaining capacity. For example, if the HCE is 100 tons and actual landings were 75 tons, the capacity utilization was 75 percent (i.e., 75 percent of the estimated capacity was used) and the actual landings could have been taken by a fleet with 25 percent less capacity.

4.2 Additional variables used in assessing capacity by species group for all fleets combined

The variables discussed above have similar meanings and uses when used in the assessment by species group for all fleets combined. However, for species groups taken either in multispecies fisheries or by multispecies fishing boats, the species-specific assessment can be misleading because it is based on just one of the many combinations of catch by species group that could have occurred if the fleets had operated at capacity in 2004. The meanings and uses of the additional variables used to present the assessment results by species group for all fleets combined are discussed next.

4.2.1 Official catch estimate

By necessity, trip-level catch data were used in the DEA models. For some fisheries, this required the use of logbook data or other data sources that were not as complete or accurate as the sources used to produce the official catch estimates for the fisheries. To correct for the differences between these two estimates of catch and thereby allow for meaningful comparisons between the estimates of harvesting capacity and the CQs, the harvesting capacity estimates based on the trip-level data were adjusted using a multiplier equal to the ratio of the official catch to the corresponding trip-level catch estimates. These adjustments were made by species group.

4.2.2 Reported or estimated catch as a percent of the official catch estimate

All else being equal, one would have higher confidence in estimates based on trip-level catch data that were close to 100 percent of the official catch estimate. The inverse of this variable was used to make the adjustment mentioned above.

4.2.3 Commercial quota (CQ) or its proxy

The CQ or its proxy, which is assumed to be a target harvest level that will achieve the sustainability objectives for a fishery, was the reference point used to calculate overcapacity by species groups for all fleets combined. In some cases, when there were fleet-specific CQs for a species group, overcapacity was also assessed by fleet.

4.2.4 Lower and higher overcapacity estimates

This is LCE (or HCE) minus the CQ. It is an estimate of the extent catch would have exceeded the CQ if all fleets had operated at capacity or, equivalently, it is an estimate of the harvesting capacity that was not needed to take the CQ if the fleets had operated at capacity.

4.2.5 LCE or HCE as a percent of the CQ

This variable indicates the percent by which estimated harvesting capacity exceeded the CQ. For example, if the HCE is 150 percent of the CQ, the estimated harvesting capacity exceeded the CQ by 50 percent and, if the fleets had operated at capacity, they would have exceeded the CQ by 50 percent.

4.2.6 CQ as a percent of the LCE or HCE

If there was overcapacity, this variable indicates the percent decrease in harvesting capacity that would have been possible without preventing the CQ from being taken if the remaining capacity had been fully utilized. For example, if the CQ was 65 percent of the HCE and 80 percent of the LCE, fleets with 35 percent or 20 percent less harvesting capacity, respectively, would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Conversely, if there was under capacity, this variable indicates the percent increase in harvesting capacity that would have been necessary for the fleets to have taken the CQ. For example, if the CQ was 155 percent of the LCE and 130 percent of the HCE, fleets with 55 percent and 30 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004 given the LCE and HCE, respectively. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on that species group.

4.2.7 Official catch estimate as a percent of the CQ

This variable indicates the utilization rate for a CQ. If this variable is greater than 100 percent, it indicates the percent by which the catch of a species group exceeded its CQ or CQ proxy in 2004, and it indicates the presence but not the level of overcapacity in 2004. For example, a value of 160 percent indicates that catch exceeded the CQ by 60 percent. Conversely if it is less than 100 percent, it indicates the percent of the CQ that was taken and therefore the percent increase in catch that would have been required to take the CQ in 2004. For example, with a value of 75 percent, only 75 percent of the CQ was taken, which means that catch would have had to increase by 33 percent to equal the CQ in 2004.

5. Summary of Results

NMFS interprets the term "excess harvesting capacity" to mean "too much" harvesting capacity, compared to actual catch, the commercial quota, or both. In addition, the actual catch relative to the commercial quota is a measure of the control of both the level and use of harvesting capacity. Thus, NMFS distinguishes among "excess harvesting capacity," (the generic term that means too much harvesting capacity), "excess capacity" (capacity in excess of actual harvests), "overcapacity" (capacity in excess of the quota), and "overharvest" (catch in excess of the quota). The findings are presented in terms of the rates of excess capacity, overcapacity, and overharvest both by species group and by fishery and in terms of excess capacity rates by fleet, where fleets generally are defined by gear type and fishery, and where fisheries generally are defined by fishery management plan (FMP).

These three measures of excess harvesting capacity are summarized below:

> **Excess capacity rate:** the percentage reduction in harvesting capacity that would have eliminated excess capacity in 2004, which is the percent of harvesting capacity that was redundant with respect to the actual catch in 2004.
>
> **Overcapacity rate:** the percentage reduction in harvesting capacity that would have eliminated overcapacity in 2004, which is the percent of harvesting capacity that was redundant with respect to the commercial quota in 2004.
>
> **Overharvest rate:** the percentage reduction in catch that would have eliminated overharvest in 2004, which is the percent of catch that was redundant with respect to the commercial quota in 2004.

The aggregate excess capacity, overcapacity, and overharvest rates were calculated using the aggregate estimates of harvesting capacity and catch and the aggregate commercial quotas or their proxies.

The following numerical example demonstrates the concepts of excess capacity, overcapacity and overharvest rates. If the harvest was 110 tons, if the commercial quota was 120 tons, and if the capacity estimate was 200 tons, then excess capacity was 90 tons (200 – 110 tons), overcapacity was 80 tons (200 – 120 tons), and overharvest was -10 tons (110 – 120 tons). Therefore, the excess capacity rate was 45 percent because, if harvesting capacity had been 45 percent (90/200) less in 2004, and if the fleets had fully utilized their remaining harvesting capacity, both harvesting capacity and the harvest would have been 110 tons and there would have been no excess harvesting capacity in 2004. Similarly, the overcapacity rate was 40 percent because, if harvesting capacity had been 40 percent (80/200) less in 2004, the harvesting capacity would have been equal to the quota of 120 tons and there would have been no overcapacity in 2004. Finally, the overharvest rate was -9 percent because, if the harvest had been 9 percent (10/110) greater in 2004, the harvest would have been 120 tons, the same as the quota, and there would have been neither over nor under harvest.

The overcapacity and overharvest rates, respectively, would be negative if the harvesting capacity estimate and the harvest were less than the commercial quota. In these cases, the overcapacity and overharvest rates, respectively, indicate the percentage increases in harvesting capacity and harvest that would have been required to take the commercial quota or its proxy in 2004.

Each of these three measures of excess harvesting capacity provides different information. A high excess capacity rate indicates that the actual harvest in 2004 could have been taken by much smaller fleets and, therefore, at a lower cost. A smaller fleet could have consisted of fewer vessels, fishing vessels that each had less harvesting capacity, or both. The cost reductions could have included lower operating costs and annual fixed costs as well as reduced costs associated with, for example, bycatch, impacts on habitat, unsafe fishing practices, and fishery management. A high excess capacity rate does not indicate that there was either overcapacity or overharvest. It should be noted that typically there will be some excess capacity in each fishery; therefore, it is important to focus on situations with *high* excess capacity and not just any excess capacity.

A high positive overcapacity rate means that the fleets had the ability to harvest much more than the 2004 commercial quota. Therefore, much smaller fleets could have taken the commercial quota. Although high positive overcapacity rates are commonly accompanied by a high excess capacity rate, a high positive overcapacity rate can occur either without high (or even any) excess capacity or without overharvest. Smaller fleets could have taken the commercial quota and had some of the types of cost reductions mentioned in the previous paragraph. If the actual harvest was less than the commercial quota, the excess capacity rate was greater than the overcapacity rate.

A high positive overharvest rate indicates that the fleets had and used the ability to harvest much more than the commercial quota. This result can occur only if there is overcapacity and the use of that capacity is not adequately controlled. If there was a high positive overharvest rate, much smaller fleets would have had the same types of cost reductions mentioned above. Perhaps more importantly, smaller fleets, better control of the use of their harvesting capacity or both would have prevented overharvest and the costs associated with overharvest. If the quota was set well below the overfishing level, a high overharvest rate does not necessarily mean that there was overfishing.

In addition to providing the estimated excess capacity, overcapacity, and overharvest rates, the following regional summaries present information on the rankings of the various fleets and fisheries based on their excess harvesting, overcapacity, and overharvest rates. Due to substantial problems with the landings data and other data for the U.S. Caribbean fisheries, the estimates for those fisheries are very tentative and probably not comparable to the estimates for the other fisheries. Therefore, the rankings reported for the other 25 fisheries exclude the three U.S. Caribbean fisheries. But the rankings presented for those three fisheries are based on the capacity estimates for all 28 fisheries.

The following 11 basic terms of reference and constraints for the estimates summarized below, some of which were discussed above, are intended to put the estimates in the appropriate context and to clarify the nature of the estimates, thereby increasing the probability that the summary will be interpreted appropriately.

1. The capacity assessments address commercial fisheries exclusively, and do not cover the for-hire charter and private angler recreational sectors, even though those sectors account for much or most of the total catch of some species.

2. This report estimates harvesting capacity exclusively, and does not address processing capacity. However, to the extent that fish processor capacity in 2004 limited the catch or landings per trip, the number of trips, or both, it was implicitly accounted for in the estimates of harvesting capacity

3. The estimates are based exclusively on data for vessels that participated in the fishery in 2004. Therefore, these estimates do not address the latent capacity of vessels that could have fished in 2004 but, for whatever reason, failed to do so. For some fisheries, including latent capacity would have substantially increased the estimated excess capacity and overcapacity rates.

4. The estimates are for harvesting capacity as defined in this report; i.e., the lower and higher capacity estimates, respectively, are estimates of what the fleets could have caught in 2004 if (1) they had fully utilized the variable inputs per trip (days at sea, number of sets, and crew size per trip) and (2) if they had done that and also eliminate the estimated technical inefficiencies. They are not estimates of what the fishermen would have chosen to catch given the conditions and constraints they faced and their objectives in 2004.

5. Because the estimates all use 2004 data, they do not capture changes in resource, environmental, market, or regulatory conditions that took place after 2004. Examples of recent changes in regulatory conditions are the LAPP and buyback programs in some Alaska Region fisheries, the LAPP for the Gulf of Mexico red snapper fishery, reductions in days at

sea in certain Northeast Region fisheries, and a variety of more restrictive management measures in the Atlantic highly migratory species fisheries.

6. The estimates are for the fish stock conditions in 2004. There was no attempt to estimate what excess harvesting capacity would have been or would be for alternative stock conditions, such as the fully recovered stock condition for a stock that is overfished or recovering. As a stock recovers, both harvesting capacity and the quota will tend to increase; therefore, the direction and rate of change in overcapacity, for example, will depend on the rates at which both increase as the stock recovers.

7. As noted above, many fishing boats contributed to the catch and, therefore, to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species groups, fleets, or fisheries. The fleet-specific and species group-specific estimates presented in this report are of what catch would have been in 2004 if the catch for a specific type of trip had been greater than it actually was in 2004, but if neither the species composition of each trip nor the number of trips of each type had changed. Therefore, the fleet-specific and species group-specific harvesting capacity estimates do not reflect how much of each species group could have been caught in 2004 or how much each fleet could have caught in 2004 if the fishing vessels had changed either the catch composition or the number of trips for one or more types of trips. Under different circumstances, the harvesting capacity estimates could have been quite different. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species if the management measures did not prevent such a shift. The present assessment, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is somewhat less of a problem for the assessment of harvesting capacity by fleet for all species combined; however, because it is common for fishing boats to switch between gear types, the problem is not eliminated

8. With the exception of the Pacific Coast and Alaska groundfish fisheries, the assessments are in terms of landings, not total harvests; therefore, discards are not included in the estimates. If the commercial quotas were in terms of total harvest and if at-sea discards accounted for a significant part of the total harvest, overcapacity and overharvest could be underestimated substantially.

9. Estimates of overcapacity and overharvest require, by definition, a commercial quota or a functional equivalent. However, some federally managed fisheries include species that lack such quotas, and therefore overcapacity and overharvest could not be assessed for those species or in aggregate for such a fishery.

10. With the two principal exceptions of the Northeast multispecies fishery and the Atlantic sea scallop fishery, the estimates of harvesting capacity for each fishery are based on the actual number of trips each fishing vessel took in 2004 and not on either on the number of trips that were taken in other years or the potential maximum number of trips each vessel could have taken in 2004 under the normal and realistic operating conditions for each vessel if the number of trips had not been limited by fishery management measures such as harvest quotas.

11. NMFS planned and prepared this report to minimize regional disparities and ensure as much comparability as possible. The analysts used the same terms, definitions, and DEA approach, and based their assessments on 2004 data. In addition, the same three economists worked with regional economists to conduct all the assessments. However, there were differences among the fisheries and sometimes within a single fishery with respect to industry structure, fleet makeup, management approaches, and the availability and quality of data. Such differences inevitably decreased the comparability of the estimates, both among fisheries and within some fisheries.

5.1 Northeast

The Northeast Region report assesses excess harvesting capacity in 11 commercial fisheries under the jurisdiction of the New England and Mid-Atlantic Fishery Management Councils and the Atlantic States Marine Fisheries Commission. The estimates in this report show that 10 of the top 20 fleets in terms of the higher excess capacity rates are located in the Northeast Region—the hook, gillnet, and trawl fleets in the multispecies fishery; the northern shrimp trawl fleet; the herring trawl and purse seine fleets; the Atlantic scallop limited access dredge fleet; the Atlantic mackerel-squid-butterfish mid-water trawl fleet; and the surfclam-ocean quahog dredge fleet (Table 2).

Northeast Region fisheries account for 4 of the top 9 and for 11 of the top 20 fisheries in terms of the higher excess capacity rates (Table 4). A few of these fisheries with high excess capacity rates are high-value fisheries, such as the Northeast multispecies and Atlantic scallop fisheries. Other fisheries with high excess capacity rates are relatively small, such as the northern shrimp and tilefish fisheries. In addition, Northeast Region fisheries accounted for 5 of the 8 fisheries with the highest aggregate overcapacity rates—the Atlantic sea scallop, Atlantic tilefish, northern shrimp, monkfish, and summer flounder-scup-black sea bass fisheries. However, the aggregate overcapacity rates can be misinterpreted, because certain fisheries in this region include some species that exhibit overcapacity and others that do not. For instance, in the multispecies fishery, there was overcapacity for 9 quotas and undercapacity for the other 7 quotas (Table 3). For those 9 quotas, the higher overcapacity rates ranged from 8 percent for witch flounder to 65 percent for Georges Bank and Gulf of Maine Atlantic cod. Similarly, in the mackerel-squid-butterfish fishery, squid—in particular Illex (short-finned) squid—exhibits overcapacity, but mackerel and butterfish do not.

The Northeast Regional Office noted that the tilefish capacity estimates in this report are likely to be biased downward because, as the result of a lawsuit (Hadaja v. Evans) that disrupted the management process, some or all tilefish landings, although reported by dealers, may not have been reported by some vessels. In addition, the excess capacity and overcapacity rates were in part higher for the multispecies and scallop fisheries, because, in those two fisheries, the harvesting capacity estimates were not based on the actual number of trips taken in 2004, but rather on a larger number of trips that reflected the number of days-at-sea per vessel before the restrictive days-at-sea limits were imposed.

Table 2. Northeast assessment by fleet.

Fishery	Gear	Catch	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Atl. bluefish[1]	Gillnet	1.8	7%	22%	33	43
Atl. herring[1]	Bottom trawl	11	1%	1%	41	59
Atl. herring[1]	Mid-water pair trawl	128	17%	50%	12	15
Atl. herring[1]	Midwater trawl	33	17%	50%	11	14
Atl. herring[1]	Purse seine	43	9%	44%	28	21
Atl. mackerel, squid & butterfish[1]	Bottom trawl	143	12%	29%	24	33
Atl. mackerel, squid & butterfish[1]	Midwater trawl	52	15%	45%	18	20
Atl. sea scallops[2]	General category dredge	2.0	2%	10%	39	54
Atl. sea scallops[2]	General category trawl	11	3%	9%	35	56
Atl. sea scallops[2]	Limited access dredge	63	29%	49%	7	18
Atl. sea scallops[2]	Limited access trawl	2.9	16%	32%	17	28
Atl. surf clam & ocean quahog[3]	Dredge (Maine mahogany quahog)	0.1	50%	67%	2	2
Atl. surf clam & ocean quahog[3]	Dredge (ocean quahog)	3.8	7%	22%	32	42
Atl. surf clam & ocean quahog[3]	Dredge (surf clam)	3.1	17%	38%	14	25
Atl. tilefish[1]	Hook	2.7	17%	31%	13	29
Atlantic deep sea red crab[1]	Pot	4.4	5%	26%	34	39
NE multispecies[1]	Bottom trawl	86	49%	52%	3	12
NE multispecies[1]	Gillnet	39	47%	56%	4	8
NE multispecies[1]	Hook	2.6	65%	71%	1	1
Northern shrimp[1]	Trawl	3.9	24%	59%	8	6
Summer flounder, scup & black sea bass[1]	Bottom trawl (5.5-6.4 in.)	29	11%	21%	26	44
Summer flounder, scup & black sea bass[1]	Pots & traps	1.2	37%	55%	6	9

1. Million pounds live weight.
2. Million pounds meat weight.
3. Million bushels.

Table 3. Northeast assessment by species group and fishery.

Fishery	Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
Atl. mackerel, squid & butterfish	Butterfish	1.2	13.0	1.2	1.3	4%	11%	-962%	-883%	-1002%
Atl. mackerel, squid & butterfish	Illex Squid	58	53	68	93	16%	38%	23%	43%	8%
Atl. mackerel, squid & butterfish	Loligo Squid	34.1	37.5	37.9	43.4	10%	22%	1%	14%	-10%
Atl. mackerel, squid & butterfish	Mackerel	118	331	134	190	12%	38%	-146%	-74%	-179%
Atl. Bluefish	Atl. Bluefish	7.6	10.5	9.6	12.0	22%	37%	-9%	12%	-39%
Atl. herring	Atl. herring	207	551	245	403	15%	49%	-125%	-37%	-166%
Atl. scallops	Atl. scallops	64	40	90	122	28%	47%	56%	67%	38%
Atl. tilefish	Atl. tilefish	2.6	2.0	3.2	3.8	17%	31%	37%	48%	24%
Atlantic deep sea red crab	Deep sea red crab	4.4	5.9	4.7	6.0	5%	26%	-27%	1%	-34%
Monkfish	Monkfish	47	52	77	90	39%	48%	32%	42%	-12%
Northern shrimp	Northern shrimp	3.9	5.5	5.1	9.6	24%	59%	-7%	43%	-41%
NE Multispecies	American Plaice	3.8	8.1	6.4	6.7	41%	44%	-27%	-22%	-116%
NE Multispecies	Cod (GB)	7.7	6.5	17.1	18.6	55%	59%	62%	65%	15%
NE Multispecies	Cod (Gulf of Maine)	8.4	8.6	21.3	24.8	61%	66%	60%	65%	-2%
NE Multispecies	Haddock (GB)	15.8	52.6	34.8	38.8	55%	59%	-51%	-36%	-232%
NE Multispecies	Haddock (Gulf of Maine)	2.3	10.7	4.7	5.1	52%	56%	-129%	-110%	-373%
NE Multispecies	Pollock	11.2	23.3	18.7	19.3	40%	42%	-25%	-21%	-109%
NE Multispecies	Redfish	0.9	3.6	1.3	1.4	34%	35%	-171%	-164%	-309%
NE Multispecies	White Hake	7.7	8.5	12.2	12.5	37%	38%	31%	32%	-10%
NE Multispecies	Windowpane Flounder	0.2	1.8	0.6	0.6	73%	74%	-226%	-215%	-1104%
NE Multispecies	Winter Flounder (GB)	6.5	6.6	12.9	14.6	50%	56%	49%	55%	-2%

Table 3 Continued.

Fishery	Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
NE Multispecies	Winter Flounder (Gulf of Maine)	1.1	7.2	2.7	2.9	61%	63%	-166%	-152%	-590%
NE Multispecies	Winter Flounder (SNE)	3.2	6.3	11.7	13.1	73%	76%	46%	52%	-96%
NE Multispecies	Witch Flounder	6.4	11.4	11.9	12.4	46%	48%	4%	8%	-77%
NE Multispecies	Yellowtail Flounder (GB)	13.7	23.6	24.3	25.9	44%	47%	3%	9%	-73%
NE Multispecies	Yellowtail Flounder (Gulf of Maine)	1.8	1.9	4.5	4.7	59%	61%	56%	58%	-6%
NE Multispecies	Yellowtail Flounder (SNE)	0.4	1.6	1.7	1.8	79%	79%	10%	11%	-321%
Atl. surfclam & ocean quahog	Maine Mahogany Quahog	96	100	194	295	50%	67%	49%	66%	-4%
Atl. surfclam & ocean quahog	Ocean Quahog	3,832	5,000	4,120	4,927	7%	22%	-21%	-1%	-30%
Atl. surfclam & ocean quahog	Surfclam	3,128	3,400	3,772	5,083	17%	38%	10%	33%	-9%
Summer flounder, scup & black sea bass	Black Sea Bass	3.1	3.8	4.3	5.3	28%	41%	12%	28%	-22%
Summer flounder, scup & black sea bass	Scup	9.3	12.3	12.6	13.5	26%	31%	2%	9%	-32%
Summer flounder, scup & black sea bass	Summer Flounder	17.2	16.8	25.5	31.4	32%	45%	34%	47%	3%

The catch, commercial quotas (CQs), and capacity estimates are in millions of pounds live weight for most species groups; however, they are in millions of pounds meat weight for scallops and in thousands of bushels for surfclams and ocean quahogs.

Table 4. Northeast assessment by fishery.

Fishery	Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
Atl. bluefish[1]	8	22%	37%	-9%	12%	-39%	7	14	9	13	13
Atl. deep sea red crab[1]	4	5%	26%	-27%	1%	-34%	16	20	10	17	12
Atl. herring[1]	207	15%	49%	-125%	-37%	-166%	9	6	15	21	22
Atl. mackerel, squid & butterfish[1]	211	13%	35%	-80%	-33%	-106%	13	15	14	20	19
Atl. sea scallops[3]	64	28%	47%	56%	67%	38%	4	11	1	1	1
Atl. surfclam & ocean quahog[4, 5]	7	13%	32%	-5%	18%	-20%	12	17	7	11	10
Atl. tilefish[1]	3	17%	31%	37%	48%	24%	8	18	2	4	2
Monkfish[1]	47	39%	48%	32%	42%	-12%	2	9	3	6	9
NE multispecies[1]	91	51%	55%	2%	10%	-101%	1	2	6	15	18
Northern shrimp[1]	4	24%	59%	-7%	43%	-41%	6	1	8	5	14
Summer flounder, scup & black sea bass[1]	30	30%	41%	22%	35%	-11%	3	13	4	7	8

1. Million pounds live weight.
2. Million pounds dressed weight.
3. Million pounds meat weight.
4. Million bushels.
5. The Maine mahogany quahog quota is just a very small part of the total ocean quahog quota.

5.2 Southeast

The Southeast Region report provides estimates for three fisheries under the jurisdiction of the Gulf of Mexico and South Atlantic Fishery Management Councils: (1) the South Atlantic snapper-grouper fishery, (2) the Gulf of Mexico and South Atlantic fisheries for coastal migratory pelagic resources, and (3) the Gulf of Mexico fishery for reef fish resources. All three are complex multispecies and multigear fisheries, with significant regulatory constraints, including some that are due to bycatch problems.

Three Southeast Region fleets were in the top 20 in terms of the higher excess capacity rates (Table 5). Those three fleets and their ranks are as follows: the Gulf of Mexico coastal migratory pelagics troll fleet (3rd); Atlantic coastal migratory pelagics other gear fleet (7th); and the Atlantic coastal migratory pelagics troll fleet (11th). The South Atlantic and Gulf of Mexico coastal migratory pelagics fishery was ranked 8th in terms of the higher excess capacity rates, and the other two Southeastern Region fisheries were ranked 23rd and 24th out of 25 fisheries Table 7). In terms of aggregate overcapacity rates, the three Southeastern Region fisheries were ranked 12th, 14th, and 23rd based on the higher capacity estimates for the 23 fisheries for which overcapacity could be estimated.

In 2004, none of the stocks in the South Atlantic and Gulf of Mexico coastal migratory pelagics fishery was overharvested (Table 6). In the South Atlantic snapper-grouper fishery, no stock was overharvested in 2004; however, the overharvest assessment for this fishery is only for the three species that had explicit commercial quotas in 2004 (golden tilefish, greater amberjack, and snowy grouper). In the Gulf of Mexico reef fish fishery, two stocks were overharvested in 2004 (deep water grouper and tilefish).

Table 5. Southeast Region assessment by fleet (million pounds).

Fishery	Gear	Catch	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Atl. coastal migratory pelagics	Gillnet	1.0	3%	35%	37	27
Atl. coastal migratory pelagics	Other	0.9	8%	59%	31	7
Atl. coastal migratory pelagics	Troll	1.8	16%	53%	16	11
Atl. coastal migratory pelagics	Vertical line	2.3	14%	39%	21	23
GOM coastal migratory pelagics	Troll	0.9	22%	62%	10	3
GOM coastal migratory pelagics	Vertical Line	1.7	17%	28%	23	46
GOM reef fish	Longline	8	9%	12%	29	52
GOM reef fish	Trap	1.0	10%	15%	27	50
GOM reef fish	Vertical line	11	13%	20%	22	46
SA snapper-grouper	Diving	0.2	1%	2%	40	58
SA snapper-grouper	Longline	0.5	11%	16%	25	48
SA snapper-grouper	Vertical Line	2.4	3%	5%	38	57

Table 6. Southeast assessment by species group and fishery (million pounds).

Fishery	Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
Atl. coastal migratory pelagics	King Mackerel (SA)	2.7	3.7	3.3	5.9	18%	55%	-14%	37%	-39%
Atl. coastal migratory pelagics	Spanish Mackerel (SA)	3.5	3.9	3.9	7.6	10%	53%	1%	49%	-10%
GOM coastal migratory pelagics	King Mackerel (GOM)	1.9	3.3	2.5	3.1	23%	40%	-33%	-4%	-72%
GOM coastal migratory pelagics	Spanish Mackerel (GOM)	1.2	5.2	1.2	1.3	5%	10%	-326%	-304%	-349%
Atl. & GOM coastal migratory pelagics	Total	9.2	16.0	10.8	17.9	15%	48%	-48%	11%	-73%
GOM Reef Fish	Deep Water Groupers	1.45	1.20	1.47	1.48	1%	2%	18%	19%	17%
GOM Reef Fish	Red Grouper (part of SW grouper)	5.9	6.3	7.0	7.5	15%	21%	10%	17%	-6%
GOM Reef Fish	Red Snapper	4.6	4.7	5.3	5.8	13%	20%	13%	20%	-1%
GOM Reef Fish	Shallow Water Groupers	9.3	10.4	10.8	11.6	14%	20%	4%	11%	-11%
GOM Reef Fish	Tilefish	0.63	0.49	0.71	0.73	12%	14%	31%	32%	22%
GOM Reef Fish	Total	16.0	16.7	18.3	19.6	13%	18%	9%	15%	-4%
South Atl. snapper-grouper	Golden Tilefish	0.27	1.12	0.34	0.38	20%	28%	-231%	-199%	-314%
South Atl. snapper-grouper	Greater Amberjack	0.36	1.22	0.40	0.46	11%	22%	-201%	-164%	-237%
South Atl. snapper-grouper	Snowy Grouper	0.17	0.41	0.17	0.18	4%	5%	-133%	-130%	-143%
South Atl. snapper-grouper	Total	0.80	2.75	0.92	1.01	13%	21%	-199%	-171%	-244%

Table 7. Southeast assessment by fishery (million pounds).

Fishery	Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
Atl. & GOM coastal migratory pelagics	9	15%	48%	-48%	11%	-73%	10	8	11	14	17
GOM reef fish	16	13%	18%	9%	15%	-4%	14	24	5	12	6
SA snapper-grouper[1]	1	13%	21%	-199%	-171%	-244%	11	23	16	23	23

1. The assessment for this fishery is for the three species with explicit commercial quotas (TACs) and, therefore, it includes only about one-third of the total harvest in this fishery.

5.3 Atlantic HMS

The Atlantic highly migratory species fisheries report deals with the commercial fisheries for tuna, swordfish, and sharks, all of which are managed under a single consolidated fishery management plan. These are multispecies and multigear fisheries, and are conducted within and outside the U.S. 200-mile exclusive economic zone in the Atlantic Ocean and adjacent waters, the Caribbean Sea and Gulf of Mexico. However, fisheries in the Caribbean are covered in the Caribbean report. Unlike the vast majority of federally managed fisheries, many of the Atlantic HMS fisheries are international, in which U.S. fishermen are only one user group. Since these are international fisheries, NMFS and the Madrid-based International Commission for the Conservation of Atlantic Tunas share management responsibilities. Because these are highly migratory resources, some of them are significantly affected by fishing operations conducted in the eastern Atlantic by fishermen from other countries.

Only one Atlantic HMS fleet is among the top 20 in terms of the higher excess capacity rates. The bottom longline fleet, which targets sharks, was ranked 5th (Table 8). The Atlantic HMS fishery was ranked 12th out of 25 fisheries in terms of the higher excess capacity rates (Table 10). In terms of the higher overcapacity rates, the Atlantic HMS fishery ranked 19th out of 23 fisheries for which overcapacity could be estimated. In 2004, three HMS stocks were overharvested; they were large coastal sharks in the Gulf of Mexico, the North Atlantic, and the South Atlantic (Table 9). Interestingly, the Atlantic HMS FMP as a whole had a higher excess capacity rate of 47 percent, but a negative overcapacity rate of –22 percent and a negative overharvest rate of –130 percent, reflecting underharvest of the aggregate commercial quota by U.S. fishermen.

Table 8. Atlantic HMS assessment by fleet (million pounds)

Gear	Catch[1]	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Bottom longline	2.8	39%	61%	5	5
Handgear	0.8	22%	39%	9	24
Other net	0.8	15%	31%	19	30
Pelagic longline	10	14%	28%	20	35
Trawl	0.1	13%	40%	23	22

1. Bluefin tuna is not included.

Table 9. Atlantic HMS assessment by species group (metric tons).

Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
Albacore Tuna	137	759	153	168	10%	18%	-396%	-351%	-454%
Blue Sharks	0.1	273.0	0.1	0	2%	2%	< -500%	< -500%	< -500%
Large Coastal Sharks GOM	1,075	478	2,101	3,463	49%	69%	77%	86%	56%
Large Coastal Sharks N. Atl.	121	58	151	204	20%	41%	62%	72%	52%
Large Coastal Sharks S. Atl.	695	614	862	1,326	19%	48%	29%	54%	12%
Other Pelagic Sharks	146	488	161	175	9%	17%	-203%	-178%	-234%
Porbeagle Sharks	2.6	92.3	2.6	2.6	0%	0%	< -500%	< -500%	< -500%
Small Coastal Sharks GOM	55	218	67	77	17%	29%	-226%	-181%	-294%
Small Coastal Sharks S. Atl.	163	222	203	276	20%	41%	-10%	20%	-36%
Swordfish	2,089	7,096	2,417	2,767	14%	24%	-194%	-156%	-240%

Table 10. Atlantic HMS[1] assessment by fishery (million pounds).

Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
9	27%	47%	-68%	-22%	-130%	5	12	13	19	20

2. Bluefin tuna is not included.

5.4 U.S. Caribbean

The U.S. Caribbean area report assessed capacity in three federally managed commercial fisheries conducted off Puerto Rico and the U.S. Virgin Islands: (1) spiny lobster, (2) shallow-water reef fish, and (3) queen conch. In addition, these assessments are provided for three distinct areas: St. Thomas and St. John; St. Croix; and Puerto Rico. These fisheries are highly complex and are generally characterized by small coastal boats, a wide variety of gear, a large number of target species, and serious problems with data, including data on landings. These are relatively small fisheries, and the total landings of all the assessed fisheries were only about 1,700 tons in 2004, most of which was taken in shallow, near-shore waters instead of the 200-mile exclusive economic zone.

Due to data problems, the Caribbean area capacity estimates are tentative, and probably not comparable to the estimates for the other regions. That said, these estimates indicate that, based on 2004 data, there were high rates of excess capacity for many fleets and substantial levels of overcapacity for most species groups. Excess capacity estimates for all three fisheries were quite high, in particular for shallow-water reef fish fishery, which employs passive trap gear. In terms of the higher overharvest rates, the three U.S. Caribbean fisheries were ranked 1st, 2nd, and 4th out of 28 fisheries. Based on the harvest estimates and the commercial quota proxies that were used, the aggregate overharvest rates were 28 percent, 51 percent, and 55 percent, respectively, for the shallow-water reef fish, spiny lobster, and queen conch fisheries (Table 13).

Table 11. U.S. Caribbean assessment by fleet

Area	Gear	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Puerto Rico	Beach seine	8%	57%	50	19
Puerto Rico	Bottom line	29%	88%	11	1
Puerto Rico	By hand	0%	0%	68	88
Puerto Rico	Cast Net	16%	82%	31	3
Puerto Rico	Fish pot	9%	56%	44	21
Puerto Rico	Gillnet	25%	71%	13	8
Puerto Rico	Land crab	17%	53%	27	26
Puerto Rico	Lobster pot	11%	58%	42	17
Puerto Rico	Longline	20%	58%	20	18
Puerto Rico	Rod and reel	20%	22%	21	66
Puerto Rico	Scuba	27%	85%	12	2
Puerto Rico	Silk haul	0%	0%	68	88
Puerto Rico	Skin diving	61%	80%	3	4
Puerto Rico	Snare	0%	0%	68	88
Puerto Rico	Trammel net	4%	48%	58	37
Puerto Rico	Troll line	19%	74%	22	6
St Croix	Cast Net	6%	8%	55	83
St Croix	Free diving	4%	33%	57	49
St Croix	Gillnet	3%	26%	60	62
St Croix	Line fishing	24%	73%	16	7
St Croix	Scuba	7%	54%	53	24
St Croix	Seine net	14%	45%	35	38
St Croix	Trammel net	0%	0%	68	88
St Croix	Traps	6%	34%	54	48
St Thomas & St John	Cast Net	8%	54%	49	25
St Thomas & St John	Free Diving	31%	51%	9	30
St Thomas & St John	Gillnet	0%	16%	68	73
St Thomas & St John	Line Fishing	21%	64%	19	11
St Thomas & St John	Scuba	2%	23%	64	65
St Thomas & St John	Seine net	66%	79%	1	5
St Thomas & St John	Traps	24%	51%	15	29

Table 12. U.S. Caribbean assessment by species group and fishery (thousand pounds).

Fishery	Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
Queen Conch	Total	616	276	822	2,527	25%	76%	66%	89%	55%
Spiny Lobster	Total	716	349	875	3,400	18%	79%	60%	90%	51%
Shallow water Reef fish	Angel-fish	12.4	6.3	13.1	20	5%	38%	52%	69%	49%
Shallow water Reef fish	Box-fish	133	101	163	309	18%	57%	38%	67%	24%
Shallow water Reef fish	Goatfish	16.0	21.2	19.0	28	16%	44%	-11%	25%	-32%
Shallow water Reef fish	Grouper	245	167	314	640	22%	62%	47%	74%	32%
Shallow water Reef fish	Grunts	237	159	278	438	14%	46%	43%	64%	33%
Shallow water Reef fish	Jack	166	102	352	720	53%	77%	71%	86%	39%
Shallow water Reef fish	Parrotfish	520	251	569	923	9%	44%	56%	73%	52%
Shallow water Reef fish	Porgy	59	38	76	121	23%	51%	50%	68%	35%
Shallow water Reef fish	Snapper	1,090	1,026	1,446	6,632	25%	84%	29%	85%	6%
Shallow water Reef fish	Squirrelfish	11.0	17.3	12.0	17.2	8%	36%	-44%	-1%	-56%
Shallow water Reef fish	Surgeonfish	104	33	129	190	20%	45%	74%	82%	68%
Shallow water Reef fish	Tilefish	0.1	0.7	0.1	0.1	0%	0%	-1214%	-1214%	-1214%
Shallow water Reef fish	Triggerfish	211	98	265	463	20%	54%	63%	79%	54%
Shallow water Reef fish	Wrasse	74	54	89	292	17%	75%	39%	81%	27%

Table 13. U.S. Caribbean assessment by fishery (thousand pounds).

Fishery	Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
Queen Conch	616	25%	76%	66%	89%	55%	6	2	1	2	1
Spiny Lobster	716	18%	79%	60%	90%	51%	10	1	2	1	2
Shallow water Reef fish	2,880	23%	73%	44%	81%	28%	8	3	4	3	4

5.5 Northwest

The Northwest Region report focuses on one fishery, the Pacific Coast groundfish fishery, and assesses capacity in the various sectors of this fishery. The estimates are broken out by (1) fleet and/or gear sector and (2) target species. This approach highlights the complexity of the capacity problem and the need to disaggregate the management units to develop meaningful findings. The groundfish covered by the Pacific Fishery Management Council's groundfish FMP include over 82 species that, with few exceptions, live on or near the bottom of the ocean.

Not surprisingly, many of the groundfish landings in this fishery included multiple species that were taken incidentally, including species that are overfished and not target species, and, as a result, management measures to reduce the bycatch of such species were highly constraining. Since there is such a wide variety of groundfish, many different gear types are used to target them. The trawl fishery is the most important sector, but groundfish can also be caught with troll, hook and line, pot, gillnet, and other gear. Finally, the groundfish fishery has four components: (1) limited entry trawl, (2) limited entry fixed gear, (3) open access groundfish, and (4) open access non-groundfish.

The major species categories in this fishery are:

- Rockfish: 64 different species of rockfish, including widow, yellowtail, canary, shortbelly, and vermilion rockfish; bocaccio, chilipepper, cowcod, yelloweye, thornyheads, and Pacific ocean perch.
- Flatfish: 12 species of flatfish, including various soles, starry flounder, turbot, and sanddab.
- Roundfish: Six species of roundfish, including lingcod, cabezon, kelp greenling, Pacific cod, Pacific whiting, and sablefish.
- Sharks and skates: Six species, including leopard shark, soupfin shark, spiny dogfish, big skate, California skate, and longnose skate.
- Other species: These include ratfish, finescale codling, and Pacific rattail grenadier.

Only one Northwest Region fleet was in the top 20 in terms of the higher excess capacity rates. It is the hook and line fleet, which was ranked 19th (Table 14). The Pacific Coast groundfish fishery was ranked 21st out of 25 fisheries in terms of the higher excess capacity rates and was ranked 9th out of 23 fisheries in terms of the higher aggregate overcapacity rates (Table 16). There was overharvest for just one target species (sablefish) in 2004 (Table 15).

Table 14. Northwest Region assessment for the Pacific Coast groundfish by fleet (million pounds).

Fleet	Catch	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Hook & line	6	-	45%	-	19
Other Gear	0.8	-	28%	-	36
Pot	1.8	-	38%	-	26
Trawl (shoreside delivery)	243	-	31%	-	31
Trawl (catcher-processor)	162	-	10%	-	55
Trawl (mothership delivery)	101	-	15%	-	51

Table 15. Northwest Region[1] assessment for the Pacific Coast groundfish by species group (1,000 metric tons).

Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
Arrow-tooth Flounder	3.9	5.8	-	7.4	-	47%	-	22%	-47%
Dover Sole	7.3	7.4	-	8.4	-	13%	-	12%	-1%
English Sole	1.2	3.1	-	1.7	-	32%	-	-80%	-162%
Other Flatfish	2.1	2.8	-	4.0	-	46%	-	29%	-32%
Pacific Cod	1.1	3.2	-	1.2	-	8%	-	-166%	-189%
Pacific Whiting	210	217	-	273	-	23%	-	21%	-4%
Petrale Sole	1.9	2.8	-	2.1	-	8%	-	-32%	-44%
Sablefish	7.2	7.0	-	17.5	-	59%	-	60%	3%
Thornyhead Rockfish	0.9	1.2	-	1.1	-	22%	-	-5%	-35%
Total	235	250	-	317	-	26%	-	21%	-6%

1. The assessment for this fishery is for the target species, which accounted for the vast majority of the harvest in 2004, and not for the species that are being rebuilt and can only be taken as incidental catch in this fishery.

Table 16. Northwest Region assessment for the Pacific Coast groundfish (million pounds).

Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
519	-	26%	-	21%	-6%	-	21	-	9	7

5.6 Southwest

The Southwest Region report covers two fisheries under the jurisdiction of the Pacific Fishery Management Council: (1) the coastal pelagic species (CPS) fishery for squid, sardine, jack and Spanish mackerel, and northern anchovy; and (2) the West Coast highly migratory species (HMS) fishery for 13 species of tunas, swordfish, and sharks. The fisheries for coastal pelagic species are taken mainly with seine gear, and include limited entry and non-limited entry fleets.

Two Southwest Region fleets are among the top 20 in terms of the higher excess capacity rates—the HMS troll fleet, which ranked 13th and the CPS seine fleet, which ranked 17th (Table 17). The CPS fishery was ranked 5th out of 25 fisheries and the HMS fishery was ranked 10th in terms of the higher excess capacity rates (Table 19). In terms of the higher aggregate overcapacity rates, the HMS fishery could not be ranked because there were no commercial quotas or their proxies for some species., and the CPS fishery was ranked 18th out of 23 fisheries. In 2004, neither of the two HMS stocks with a commercial quota proxy was overharvested (Table 18). None of the CPS stocks was overharvested in 2004.

It should be noted that both the CPS and HMS fisheries target stocks that are subject to a fluctuating marine environment, such as the periodic warming and cooling of surface waters in the California Current and Eastern Pacific. Environmental changes affect the abundance and availability of the stocks, and, as a result, there may be excess capacity or overcapacity in some years, but not in other years. In addition, both the CPS and HMS fleets are multipurpose, targeting different species according to abundance, environmental factors and market conditions. In this situation, fishermen may choose to have a larger fishing vessel than typically is necessary for most fishing trips. In part because the capacity of a vessel cannot be tailored to the conditions of each fishery in which it is used, this would be particularly true for CPS and HMS vessels that are used in multiple fisheries. Finally, because the HMS fishery operates in competition with fleets of other nations, excess harvesting capacity for the domestic vessels and foreign vessels combined determines the potential for overharvest and overfishing for the HMS stocks of fish.

Table 17. Southwest Region assessment by fleet (million pounds).

Fishery	Fleet	Catch	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Coastal pelagic species	Purse sine	309	-	50%	-	17
West Coast HMS	Drift Gillnet	0.7	-	12%	-	53
West Coast HMS	Gillnet	0.4	-	27%	-	37
West Coast HMS	Hook & line	3.9	-	27%	-	38
West Coast HMS	Seine	2.0	-	21%	-	45
West Coast HMS	Troll	30	-	51%	-	13

Table 18. Southwest Region assessment by fishery and species group (metric tons).

Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
Jack Mackerel	1,160	31,000	-	1,512	-	23%	-	-1950%	-2572%
Market Squid	40,088	107,049	-	111,341	-	64%	-	4%	-167%
Northern Anchovy	7,019	56,000	-	10,305	-	32%	-	-443%	-698%
Pacific Mackerel	3,708	11,960	-	5,666	-	35%	-	-111%	-223%
Pacific Sardine	89,339	122,747	-	151,734	-	41%	-	19%	-37%
Total	141,314	328,756	-	280,559	-	50%	-	-17%	-133%
Albacore	14,540	-	-	29,265	-	50%	-	-	-
Bigeye Thresher Shark	5.3	-	-	5.7	-	6%	-	-	-
Bigeye Tuna	22.2	-	-	22.2	-	0%	-	-	-
Blue Shark	0.8	-	-	0.8	-	0%	-	-	-
Bluefin Tuna	10.1	-	-	10.1	-	0%	-	-	-
Common Thresher	116	340	-	148	-	22%	-	-129%	-193%
Dorado	1.2	-	-	1.2	-	1%	-	-	-
Mako Shark	55	150	-	69	-	20%	-	-117%	-171%
Pelagic Thresher Shark	1.6	-	-	1.6	-	0%	-	-	-
Skipjack Tuna	307	-	-	385	-	20%	-	-	-
Swordfish	1,255	-	-	1,388	-	10%	-	-	-
Unspecified Tuna	9.3	-	-	9.3	-	0%	-	-	-
Yellowfin Tuna	488	-	-	648	-	25%	-	-	-
Total	16,811	490	-	31,955	-	47%	-	-	-

Table 19. Southwest Region assessment by fishery (million pounds).

Fishery	Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
SW coastal pelagic species	312	-	50%	-	-17%	-133%	-	5	-	18	21
SW West Coast HMS	37	-	47%	-	-	-	-	10	-	-	-

5.7 Alaska

The Alaska Region report presents estimates of capacity for five federally managed commercial fisheries: (1) Gulf of Alaska (GOA) groundfish, (2) Bering Sea/Aleutian Islands (BSAI) groundfish, (3) BSAI King and Tanner crab, (4) Alaska scallops, and (5) Pacific halibut. These Alaska fisheries are among the most important in the U.S. EEZ in terms of volume and value, and have been more thoroughly restructured since 1995 than the fisheries in any other region.

In Alaska, unlike most other regions, the assessments distinguished between catcher vessels and catcher-processor vessels. The excess capacity rates for virtually all categories of catcher vessels (hook and line, pot, and trawl) were considerably higher than for the catcher-processor fleets. This could in part be explained by the fact that, because the capacity estimates for the catcher and catcher-processor vessels, respectively, were based on retained catch and total catch, the species compositions tended to vary more for catcher-processors and, as explained earlier, that characteristic tends to result in estimated excess and overcapacity rates that are lower than they otherwise would have been.

Three Alaska Region fleets are among the top 20 in terms of the higher excess capacity rates—the catcher vessel pot, hook and line, and trawl fleets, which ranked 4th, 10th, and 16th, respectively (Table 20). The BSAI crab, Pacific halibut, and GOA groundfish fisheries, respectively, ranked 3rd, 4th, and 7th out of 25 fisheries in terms of the higher excess capacity rates (Table 22). Further down the list are the BSAI groundfish and GOA scallop fisheries, which ranked 16th and 19th. In terms of the higher aggregate overcapacity rates, the BSAI crab, Pacific halibut, BSAI groundfish, and GOA groundfish fisheries were ranked 2nd, 3rd, 8th, and 10th respectively out of 23 fisheries with overcapacity rates (Table 22). However, the LAPP and buyback program in the BSAI crab fishery significantly reduced the number of active fishing vessels after 2005. As noted earlier, the relatively high excess capacity and overcapacity rates for the Pacific halibut fishery and for some of the catcher vessel fleets are in part explained by the fact that a large share of their landings was accounted for by trips with only one reported species. In 2004, there was overharvest for 3 of the 4 BSAI crab species groups, for 5 of the 18 BSAI groundfish species groups, and for 2 of the 17 GOA groundfish species groups (Table 21).

Table 20. Alaska Region assessment by fleet (million pounds).

Fleet	Catch	LEC Rate	HEC Rate	LEC Rank	HEC Rank
Dredge catcher processor	0.4	-	29%	-	32
Hook & line catcher processor	329	-	25%	-	41
Hook & line catcher vessel	119	-	54%	-	10
Pot catcher processor	11	-	15%	-	49
Pot catcher vessel	134	-	62%	-	4
Trawl catcher processor	2,206	-	0%	-	60
Trawl catcher vessel	2,089	-	50%	-	16

Table 21. Alaska Region assessment by fishery and species group and fishery (1,000 metric tons).

Fishery	Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
BSAI Crab	Golden king crab	2.8	2.7	-	6.2	-	55%	-	58%	6%
BSAI Crab	Red king crab	7.2	7.2	-	13.5	-	47%	-	47%	0%
BSAI Crab	Snow crab	10.9	9.4	-	24.4	-	56%	-	61%	13%
BSAI Crab	Crab total	20.8	19.3	-	44.1	-	53%	-	56%	8%
BSAI groundfish	Alaska plaice	7.9	10.0	-	8.0	-	1%	-	-25%	-27%
BSAI groundfish	Arrowtooth flounder	18.2	16.1	-	20.1	-	9%	-	20%	12%
BSAI groundfish	Atka mackerel	61	63	-	61	-	0%	-	-4%	-4%
BSAI groundfish	Flathead sole	17.4	18.1	-	18.0	-	3%	-	0%	-4%
BSAI groundfish	Greenland turbot	2.2	3.2	-	2.6	-	15%	-	-24%	-46%
BSAI groundfish	Northern rockfish	4.7	5.0	-	4.7	-	0%	-	-7%	-7%
BSAI groundfish	Other flatfish	5.0	4.9	-	5.3	-	5%	-	7%	2%
BSAI groundfish	Other rockfish	0.32	0.80	-	0.35	-	8%	-	-130%	-151%
BSAI groundfish	Other species	29.3	25.2	-	37.4	-	22%	-	33%	14%
BSAI groundfish	Pacific cod	212	215	-	379	-	44%	-	43%	-2%
BSAI groundfish	Pacific Ocean perch	11.9	12.5	-	11.9	-	0%	-	-5%	-5%
BSAI groundfish	Pollock	1,482	1,493	-	2,243	-	34%	-	33%	-1%
BSAI groundfish	Rock sole	49	45	-	50	-	2%	-	9%	7%
BSAI groundfish	Rougheye rockfish	0.21	0.20	-	0.21	-	2%	-	7%	5%
BSAI groundfish	Sablefish	2.0	5.8	-	3.1	-	37%	-	-85%	-193%
BSAI groundfish	Shortraker rockfish	0.24	0.53	-	0.26	-	7%	-	-102%	-117%
BSAI groundfish	Squid	1.01	1.08	-	1.04	-	2%	-	-5%	-7%
BSAI groundfish	Total flatfish	175	-	-	181	-	3%	-	-	-
BSAI groundfish	Total rockfish	17.3	-	-	17.5	-	1%	-	-	-
BSAI groundfish	Yellowfin sole	76	80	-	77	-	2%	-	-3%	-5%
BSAI groundfish	Total	1,979	2,000	-	2,923	-	32%	-	32%	-1%

Table 21. Continued.

Fishery	Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
BSAI halibut	Pacific halibut	5.4	6.1	-	10.3	-	47%	-	41%	-12%
GOA groundfish	Arrowtooth flounder	15.3	38.0	-	20.6	-	26%	-	-84%	-148%
GOA groundfish	Atka mackerel	0.82	0.60	-	0.82	-	1%	-	27%	27%
GOA groundfish	Deep-water flatfish	0.68	6.07	-	0.99	-	31%	-	-512%	-790%
GOA groundfish	Demersal shelf rockfish	0.26	0.45	-	0.30	-	13%	-	-50%	-73%
GOA groundfish	Flatfish Sub-total	22.9	-	-	32.8	-	30%	-	-	-
GOA groundfish	Flathead sole	2.4	10.9	-	3.4	-	30%	-	-219%	-354%
GOA groundfish	Northern rockfish	4.8	4.9	-	5.2	-	8%	-	7%	-1%
GOA groundfish	Other rockfish	0.89	0.67	-	0.89	-	0%	-	25%	24%
GOA groundfish	Other species	4.5	19.9	-	7.0	-	36%	-	-185%	-346%
GOA groundfish	Pacific cod	43.1	48.0	-	92.5	-	53%	-	48%	-11%
GOA groundfish	Pacific ocean perch	11.6	13.3	-	13.3	-	13%	-	0%	-15%
GOA groundfish	Pelagic shelf rockfish	2.7	4.5	-	3.0	-	11%	-	-48%	-67%
GOA groundfish	Pollock	63	71	-	141	-	55%	-	49%	-13%
GOA groundfish	Rex sole	1.5	12.7	-	1.6	-	11%	-	-669%	-764%
GOA groundfish	Rockfish Sub-total	22.0	-	-	25.5	-	14%	-	-	-
GOA groundfish	Sablefish	15.6	16.6	-	31.3	-	50%	-	47%	-6%
GOA groundfish	Shallow-water flatfish	3.1	20.7	-	6.1	-	50%	-	-238%	-570%
GOA groundfish	Shortraker/Rougheye rockfish	1.00	1.32	-	1.35	-	26%	-	2%	-32%
GOA groundfish	Thornyhead rockfish	0.82	1.94	-	1.25	-	35%	-	-55%	-137%
GOA groundfish	Total	172	272	-	333	-	48%	-	18%	-58%
GOA halibut	Pacific halibut	30.2	30.9	-	61.4	-	51%	-	50%	-2%
GOA Scallop	Scallop	0.19	0.25	-	0.27	-	30%	-	8%	-31%
BSAI & GOA halibut	Pacific halibut	35.7	37.0	-	72	-	50%	-	48%	-4%

Table 22. Alaska Region assessment by fishery (million pounds).

Fishery	Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
BSAI crab	46	-	53%	-	56%	8%	-	3	-	2	3
BSAI groundfish	4,364	-	32%	-	32%	-1%	-	16	-	8	4
GOA groundfish	379	-	48%	-	18%	-58%	-	7	-	10	15
GOA scallop	0.4	-	30%	-	8%	-31%	-	19	-	16	11
Pacific halibut	79	-	50%	-	48%	-4%	-	4	-	3	5

5.8 Pacific Islands

The Pacific Islands Region report addresses two fisheries: the Hawaii-based longline fishery and the Northwest Hawaiian Islands (NWHI) bottomfish fishery. The Hawaii-based longline fishery (124 active vessels) accounts for about 54 percent of the commercial landings of pelagic species in the Pacific Islands region. The NWHI bottomfish fishery (9 permitted vessels) accounts for about 37 percent of the commercial landings of the U.S. bottomfish fisheries in this region. Together, these two fleets accounted for slightly more than 8,000 tons of landings in 2004. The fisheries assessed in this regional report (and the Caribbean area report) are far smaller than most of the fisheries in the other regional reports.

This report found modest levels of excess capacity for these two fisheries, although both have been subject to recent regulatory constraints on production. In the Hawaii longline pelagic fishery, the lower and higher excess capacity rates were 9 percent and 25 percent, respectively, and this fishery was ranked 22nd in terms of the higher excess capacity rates (Table 25). The higher overcapacity rate for bigeye tuna, the only species in this complex with a commercial quota proxy, was 23 percent (Table 24). However, 2004 was an unusual year in which the swordfish fishery started much later than usual because the fishery could not open until new regulations had been implemented, which did not happen until late in the year. The Hawaii longline fishery could not be ranked in terms of overcapacity because there was a commercial quota proxy for only one of the important species. Despite the estimated presence of excess harvesting capacity and overcapacity for bigeye tuna, reported landings of this species approached but did not exceed the bigeye tuna commercial quota proxy in 2004.

In the NWHI bottomfish fishery, the lower and higher excess capacity rates, respectively, were 1 percent and 17 percent in 2004, this fishery ranked 25th in terms of the higher excess capacity rates, and there was no overcapacity (Table 25). In addition, only 59 percent of the NWHI bottomfish commercial quota proxy was actually harvested in 2004.

Table 23. Pacific Islands Region assessment by fleet (million pounds).

Fishery	Fleet	Catch	LEC Rate	HEC Rate	LEC Rank	HEC Rank
NWHI bottomfish[1]	Handline	0.4	3%	19%	36	47
Hawaii based pelagics	Longline	18[2]	9%	25%	30	40

1. These estimates are for the vessels that participated in the NWHI bottomfish fishery but they also reflect their catch in the main Hawaiian Islands area bottomfish fishery.
2. This catch estimate includes about 6.1 million pounds of other pelagic species that are not included in Tables 24 and 25.

Table 24. Pacific Islands Region assessment by species group (bottomfish in 1,000 pounds pelagics in million pounds).

Species Group	Catch	CQ	LCE	HCE	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate
NWHI bottomfish	266	449	268	320	1%	17%	-67%	-40%	-69%
Bigeye Tuna	10.0	10.3	11.0	13.4	9%	25%	7%	23%	-2%
Swordfish	0.37	-	0.39	0.47	7%	22%	-	-	-
Yellowfin Tuna	1.28	-	1.38	1.67	8%	24%	-	-	-

Table 25. Pacific Islands Region assessment by fishery (million pounds).

Fishery	Catch	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
Hawaii based pelagic fisheries	12	9%	25%	-	-	-	15	22	-	-	-
NWHI bottomfish fishery	0.3	1%	17%	-67%	-40%	-69%	17	25	12	22	16

5.9 Summary by Fishery for Seven of the Eight Groups of Fisheries

Table 26. Assessment by fishery for seven of the eight groups of fisheries[1].

Fishery	Catch[2]	LEC Rate	HEC Rate	LOC Rate	HOC Rate	OH Rate	LEC Rank	HEC Rank	LOC Rank	HOC Rank	OH Rank
AK BSAI crab	46	-	53%	-	56%	8%	-	3	-	2	3
AK BSAI groundfish	4,364	-	32%	-	32%	-1%	-	16	-	8	4
AK GOA groundfish	379	-	48%	-	18%	-58%	-	7	-	10	15
AK GOA scallop	0.4	-	30%	-	8%	-31%	-	19	-	16	11
AK Pacific halibut	79	-	50%	-	48%	-4%	-	4	-	3	5
Atl. HMS	9	27%	47%	-68%	-22%	-130%	5	12	13	19	20
NE Atl. bluefish	8	22%	37%	-9%	12%	-39%	7	14	9	13	13
NE Atl. deep sea red crab	4	5%	26%	-27%	1%	-34%	16	20	10	17	12
NE Atl. herring	207	15%	49%	-125%	-37%	-166%	9	6	15	21	22
NE Atl. mackerel, squid & butterfish	211	13%	35%	-80%	-33%	-106%	13	15	14	20	19
NE Atl. sea scallops	64	28%	47%	56%	67%	38%	4	11	1	1	1
NE Atl. surf clam & ocean quahog[3]	7	13%	32%	-5%	18%	-20%	12	17	7	11	10
NE Atl. tilefish	3	17%	31%	37%	48%	24%	8	18	2	4	2
NE monkfish	47	39%	48%	32%	42%	-12%	2	9	3	6	9
NE multispecies	91	51%	55%	2%	10%	-101%	1	2	6	15	18
NE northern shrimp	4	24%	59%	-7%	43%	-41%	6	1	8	5	14
NE summer flounder, scup & black sea bass	30	30%	41%	22%	35%	-11%	3	13	4	7	8
NW Pacific Coast groundfish[4]	519	-	26%	-	21%	-6%	-	21	-	9	7
PI Hawaii based pelagic fisheries	12	9%	25%	-	-	-	15	22	-	-	-
PI NWHI bottomfish fishery	0.3	1%	17%	-67%	-40%	-69%	17	25	12	22	16
SE Atl. & GOM coastal migratory pelagics	9	15%	48%	-48%	11%	-73%	10	8	11	14	17
SE GOM reef fish	16	13%	18%	9%	15%	-4%	14	24	5	12	6
SE SA snapper-grouper	1	13%	21%	-199%	-171%	-244%	11	23	16	23	23
SW coastal pelagic species	312	-	50%	-	-17%	-133%	-	5	-	18	21
SW West Coast HMS	37	-	47%	-	-	-	-	10	-	-	-

Table 26. Continued.

1. Due to substantial problems with the landings data and other data for the U.S. Caribbean fisheries, the estimates for those fisheries are very tentative and probably not comparable to the estimates for the other fisheries. Therefore, the three U.S. Caribbean fisheries are not included in this table.
2. The catch estimates are in millions of pounds live weight for most species groups; however, they are in millions of pounds meat weight for scallops and in millions of bushels for surfclams and ocean quahogs.
3. The Maine mahogany quahog quota is just a very small part of the total ocean quahog quota.
4. The assessment for this fishery is for the target species, which accounted for the vast majority of the harvest in 2004, and not for the species that are being rebuilt and can only be taken as incidental catch in this fishery.
5. The assessment for this fishery is for the three species with explicit commercial quotas (TACs) and, therefore, it includes only about one-third of the total harvest in this fishery.
6. A "-" is used when that measure of excess harvesting capacity could not be generated because either variable input data or an aggregate commercial quota (or its proxy) was not available for a specific fishery.

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APPENDIX 1

Reasons for Excluding Specific Fisheries

The National Assessment includes 27 of the 44 federally managed commercial fisheries, most of which are defined in terms of an FMP. At the request of the New England Fishery Management Council, it also includes the Northern shrimp fishery, which is managed by the Atlantic States Marine Fisheries Commission and is not federally managed. It excludes 17 federally managed commercial fisheries. Generally, those 17 fisheries were excluded for one or more of the following five reasons: (1) adequate data were not available for 2004; (2) neither a commercial quota nor its proxy was available for 2004; (3) given the biological characteristics of the species in a fishery or the characteristics of the management regime, assessing overcapacity in terms of a commercial quota did not make sense; (4) although the fishery was managed under an FMP, most of the management authority had been delegated to one or more states; and (5) the fishery did not exist/occur in 2004. For each of the eight groups of fisheries, this section identifies the reasons for excluding each of 17 fisheries.

1. Northeast

The assessment for the Northeast Region (Appendix 3) includes 11 of the 16 commercial fisheries managed by the New England Fishery Management Council, the Mid-Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission. The skate fishery was not included in this report due to data issues, and a lack of a total allowable catch (TAC) for the various skate species. The small mesh multispecies fishery, which includes whiting, was not included due to lack of a TAC for whiting in 2004. The spiny dogfish fishery was not included because dogfish were typically an incidental catch species for other fisheries in 2004. The American lobster fishery, which is not federally managed, was not included due to a lack of boat-specific data. The Atlantic salmon fishery was not included because Atlantic salmon are managed under the Endangered Species Act and there was no commercial fishery in 2004.

2. Southeast

The assessment for the Southeast Region (Appendix 4) includes 3 of the 11 commercial fisheries managed by the South Atlantic Fishery Management Council and the Gulf of Mexico Fishery Management Council. The reasons for excluding the other eight FMP fisheries are presented below.

The shrimp fisheries in both the Atlantic and Gulf suffer from data availability issues. For example, effort data were available for only about 1 percent of the trips, and boat-specific trip-level landings data were not available consistently in 2004. Further, as a fluctuating, climate-linked, annual crop without an annual quota, these fisheries do not lend themselves to an assessment of overcapacity. The spiny lobster and stone crab fisheries occur primarily in Florida state waters, and the Federal Government effectively defers management to the State of Florida. The golden crab fishery (Atlantic) and the wreckfish fishery (Atlantic) are small, specialty fisheries. They each rely on separate data collection efforts, and these data are not available in the appropriate, standardized form the analysis required. There is no commercial harvest of red drum in either the Atlantic or the Gulf. The regulations of the dolphin/wahoo FMP came into effect after 2004.

3. Atlantic Highly Migratory Species

The assessment for the Atlantic highly migratory species fishery (Appendix 5) includes the one commercial fishery managed by NMFS that is not under the jurisdiction of a Regional Fishery Management Council. With the following exception, the assessment includes all of the commercial HMS fisheries in the North Atlantic, South Atlantic, and Gulf of Mexico. There are two reasons bluefin tuna was not assessed separately. First, bluefin tuna data limitations for the purse seine and handgear fleets prevented the preparation of estimates for bluefin tuna that would have been comparable to those for the other HMS fleets and species groups. Second, although the data were adequate for the longline fleets, bluefin tuna can only be taken as incidental catch by those fleets and trip limits were used to control the amount of bluefin tuna that could be landed; therefore, useful estimates of bluefin tuna harvesting capacity could not be prepared for the longline fleets. The assessment for the HMS fisheries in the U.S. Caribbean is included in the assessment for that area.

4. Caribbean

The assessment for the U.S. Caribbean (Appendix 6) includes all three of the commercial fisheries managed by the Caribbean Fishery Management Council.

5. Northwest

The assessment for the Northwest Region (Appendix 7) includes one of the five commercial fisheries managed by the Pacific Fishery Management Council. However, two of the other four fisheries are included in the assessment for the Southwest Region. The Northwest report presents an assessment of harvesting capacity, excess capacity, and overcapacity in 2004 for the Pacific Coast groundfish fishery. The federally managed West Coast Pacific halibut and salmon fisheries are included in this report.

The halibut fishery was not included because only a very small share of Pacific halibut harvest is from the West Coast. The vast majority is taken off Alaska, and the Pacific halibut fishery off Alaska is included in the assessment for the Alaska Region. The salmon fishery was not included in the assessment because data limitations prevented production of an assessment comparable to those conducted for other federally managed commercial fisheries. Within the salmon fishery, data on fixed inputs such as boat physical characteristics were suspect, and data on variable inputs such as effort were not available. Data on physical characteristics exhibited wide variation in horsepower for similar length fishing boats. At the boat level, landings per trip varied widely across trips, indicating that the lack of effort data would cause significant modeling problems. The regulation of salmon relies mostly on area and time restrictions, which are dynamically set through the season, rather than on a commercial quota (CQ) set prior to the seasons. As a result, defining overcapacity as capacity minus the CQ does not make sense for the salmon fishery.

6. Southwest

The assessment for the Southwest Region (Appendix 8) includes the other two commercial fisheries managed by the Pacific Fishery Management Council.

7. Alaska

The assessment for the Alaska Region (Appendix 9) includes five of the six commercial fisheries managed by the North Pacific Fishery Management Council. The High Seas Salmon Fishery Off the Coast of Alaska East of 175 Degrees East Longitude was not included in the assessment because all management authority for that fishery has been delegated to the State of Alaska and the fishery is a small but integrated part of the salmon troll fishery in Southeast Alaska.

8. Pacific Islands

The assessment for the Pacific Islands Region (Appendix 10) includes two of the three commercial fisheries managed by the Western Pacific Fishery Management Council. However, for those two fisheries, the assessment is for the dominant fleets but not all fleets. The assessment includes the Hawaii-based longline fishery and the Northwestern Hawaiian Islands (NWHI) bottomfish fishery. They are major components of the pelagic fisheries of the Western Pacific Region and the bottomfish and seamount groundfish fisheries of the Western Pacific Region. The American Samoa–based longline fishery and the bottomfish fisheries in the Main Hawaiian Islands and the other Pacific islands were not included. The data available for the American Samoa-based longline fishery were not strictly comparable with the data for the Hawaii-based longline fishery, and inadequate data were available for the other bottomfish fisheries.

APPENDIX 2

Basic Lessons on Monitoring and Controlling Harvesting Capacity

Excess harvesting capacity can significantly hamper our ability to attain the goal of productive and sustainable marine ecosystems. As a result, fishery managers have increasingly focused efforts on improving the management of harvesting capacity, which includes monitoring and controlling both the level and use of harvesting capacity. In preparing for and conducting the assessment of harvesting capacity in federally managed commercial fisheries, NMFS compiled a list of basic lessons on monitoring and controlling harvesting capacity.

Lessons of a general nature:

1. It is important to understand the underlying management problem that can produce excess harvesting capacity and various other often co-occurring undesirable outcomes.
2. Successful management of harvesting capacity requires the authority, technical capability, resources, and political will to design, implement, and enforce effective management measures.
3. Addressing the issue of excess harvesting capacity does *not* require good estimates of harvesting capacity.
4. It is very difficult to obtain more than temporary reductions in excess harvesting capacity without addressing the associated allocation issues.
5. In general, it is simpler and less costly to *prevent* excess harvesting capacity than to *decrease* it.

Lessons concerning technical matters:

1. The first step is to achieve a common understanding of the meaning of *harvesting capacity*, *excess capacity*, *overcapacity*, and *excess harvesting capacity.*
2. By themselves, the estimates of excess capacity and overcapacity do not indicate *if* capacity should be reduced, *how much* capacity should be reduced, *how* to reduce it, or the *urgency* for reducing it.
3. In defining and assessing harvesting capacity, it is important to: (a) identify the criteria and the fishery regulations that are included as constraints; and (b) account for discarded catch and the fleets that share a common quota.
4. An excess harvesting capacity assessment must be based on a specified set of boats, fleets, and fishing activities.
5. Assessments should be limited to commercial fisheries.
6. Comparisons across fisheries should be cautiously interpreted.

Lessons regarding implementation of capacity controls:

1. It is possible, but typically not sensible, to prevent overfishing by controlling the *level* of harvesting capacity without also controlling the *use* of harvesting capacity.
2. If limits on the number and physical characteristics of the boats are used to control harvesting capacity, periodic reductions in the limits will be necessary to prevent increases in harvesting capacity.
3. It is important to account for the multispecies and multi-fishery activities and capabilities of fishing boats.

Discussion

Lessons of a general nature:

1. It is important to understand the underlying management problem that can produce excess harvesting capacity and various other often co-occurring undesirable outcomes.

As noted in Section 1, excess harvesting capacity and overfishing are just two of several often co-occurring undesirable outcomes of a common underlying management problem. The underlying management problem and the other often co-occurring undesirable outcomes were discussed in Section 1 and are not repeated here. Unfortunately, most efforts to manage marine capture fisheries address the undesirable outcomes rather than the underlying management problem; therefore, those efforts often exacerbate the severity of the undesirable outcomes.

2. **Successful management of harvesting capacity requires the authority, technical capability, resources, and political will to design, implement, and enforce effective management measures.**

The requirements for the successful management of the level and use of harvesting capacity include the authority, technical capability, resources, and political will to design, implement, and enforce effective management measures. Meeting these requirements is challenging for fisheries that are within a single EEZ, but typically it has been more difficult to do so for straddling stocks and high seas fisheries. The additional difficulties for multilateral fisheries include the potential for more diverse interests and the need for bilateral or multilateral agreements among the relevant EEZ states. For high seas fisheries, the interests can be even more diverse, more states are involved in the international negotiations, and the authority of a RFMO to enforce its fishery regulation on all participants in a fishery on the high seas is less well established than the authority of a state to enforce its fishery regulations in its EEZ. Success in meeting these criteria will depend on the incentives fishermen, fishery managers, and others involved in the fishery management process have to invest in the conservation and management of fishery resources; and without well defined and secure harvest privileges, fishermen and states often will not have sufficient incentives for such investments.

3. **Addressing excess harvesting capacity does not require good estimates of harvesting capacity.**

When the problems associated with excess harvesting capacity have become sufficiently obvious and important, fishery managers have taken a variety of actions to control the level and use of harvesting capacity. Generally, this has been done in the absence of quantitative estimates of harvesting capacity. However, capacity analyses can assist in predicting and monitoring the success of such actions.

The methods that can be used to determine if there is excess harvesting capacity include rigorous quantitative analysis and simpler quantitative or qualitative analysis. The appropriate method(s) will depend on the data available, the intended use of the assessment, and, therefore, the desired qualities of the estimate of harvesting capacity. Examples of more rigorous quantitative analysis include data envelopment analysis (DEA), which is a mathematical programming approach, stochastic production frontier (SPF) analysis, peak to peak analysis, and surveys of vessel owners or operators. A less data-demanding method is to calculate catch per ton of carrying capacity for fishing boats for which there are good estimates of both carrying capacity and catch, and then to use that result and an estimate of carrying capacity for the entire fleet to estimate the potential catch (i.e., capacity output) of the fleet.

Much of the same information is required for a quantitative assessment of harvesting capacity and other management issues. Trip-specific data on catch, effort (including the variable inputs used), and fishing practices, and vessel-specific information on fixed variables or vessel characteristics are among the basic data required for a rigorous quantitative assessment of harvesting capacity and other management issues. However, with the addition of information concerning the revenue generated by the catch, the costs of the variable and fixed inputs, the demand for seafood products, and the behavior of fishermen, more useful assessments of harvesting capacity and other management issues can be provided.

4. **It is very difficult to obtain more than temporary reductions in excess harvesting capacity without addressing the associated allocation issues.**

Because allocation issues are at the heart of many management problems, including excess harvesting capacity, and because most management measures, including those to control the level and use of harvesting capacity, will have allocation effects, it will be very difficult to obtain more than temporary reductions in excess harvesting capacity without addressing the allocation issues. There are a variety of examples in which making the difficult allocation decisions led to substantial improvements in fishery management and the management of harvesting capacity. Some of these improvements resulted from the acceptance of more effective regulations; however, other improvements were the result of industry initiatives and cooperative actions that would not have been possible if the allocation issues had not already been addressed.

There are allocation issues both between fishermen and others who benefit from living marine resources and among and within different groups of fishermen, where the groups can be defined, for example, by gear, vessel size or type, target species, home port, and type of fishery (e.g., subsistence, sport, and small or large scale commercial).

5. In general, it is simpler and less costly to prevent excess harvesting capacity than to decrease it.

Unfortunately, many management actions are reactive—a response to an obviously critical undesirable outcome or problem. For example, the issue of excess harvesting capacity usually has not become a sufficiently high priority for action until there is significant excess harvesting capacity and the adverse effects cannot be ignored. Analysis of the trends in capacity to demonstrate a growing potential for an unacceptably high level of harvesting capacity is most useful when fishery policy and management actions are proactive.

Lessons concerning technical matters

1. The first step is to achieve a common understanding of the meaning of *harvesting capacity, excess capacity, overcapacity,* and *excess harvesting capacity*.

There has been general agreement at a number of international consultations and workshops on harvesting capacity that harvesting capacity should be defined and, therefore, measured in terms of the ability of a fleet to harvest or land fish, which can be stated either in terms of the weight or number of fish or in terms of the associated fishing mortality. Based on the Report of the FAO Technical Consultation on the Measurement of Harvesting capacity Mexico City, December 1999, Pascoe et al.[5] define harvesting capacity as "the amount of fish (or fishing effort) that can be produced over a period of time (e.g., a year or a fishing season) by a vessel or a fleet if fully utilized and for a given resource condition," where "full utilization in this context means normal but unrestricted use, rather than some physical or engineering maximum."

For the purposes of its ongoing assessment of excess harvesting capacity in federally managed commercial fisheries, NMFS uses the following definitions.

> **Harvesting capacity** is the maximum amount of fish that the fishing fleets could have reasonably expected to catch or land during the year under the normal and realistic operating conditions of each vessel, fully utilizing the machinery and equipment in place, and given the technology, the availability and skill of skippers and crew, the abundance of the stocks of fish, some or all fishery regulations, and other relevant constraints.
>
> With this definition, harvesting capacity is a measure of the constrained ability of specific fleets (one or more specific vessels) to catch or land fish.
>
> **Excess capacity** is the difference between harvesting capacity and estimated catch or landings.
>
> **Overcapacity** is the difference between harvesting capacity and a short-term target catch

[5] Pascoe, S., J.E. Kirkley, D. Gréboval, and C.J. Morrison-Paul. 2003. *Measuring and Assessing Capacity in Fisheries: Issues and Methods.* FAO Fisheries Technical Paper No. 433, Vol. II, Rome: FAO.

level for the commercial fisheries, such as the commercial quota (CQ) or its proxy.

Excess Harvesting Capacity is the generic term that means too much harvesting capacity.

With these definitions, the harvesting capacity of a fleet is determined by several variables, including the number of boats in the fleet and the physical characteristics of the individual boats (e.g., their length, engine power, gross registered tons, hold capacity in metric tons or cubic meters, engine type, refrigeration capability, and hull type). However, the physical characteristics of the fleet are not measures of harvesting capacity. Consider the following analogy: the capacity of a room (i.e., the number of people that can exit that room safely in an emergency) is *determined* in part by the physical characteristics or the room (e.g., its size and the number and width of the exits) but it is *measured* in terms of the number of people, not the physical characteristics of the room.

2. By themselves, the estimates of excess capacity and overcapacity do not indicate *if* capacity should be reduced, *how much* capacity should be reduced, *how* to reduce it, or the *urgency* for reducing it.

The estimate of excess capacity and overcapacity do not, in and of themselves, indicate if capacity should be reduced, how much capacity should be reduced, how to reduce capacity, or the urgency for reducing it. These determinations generally will be more difficult for (1) multispecies fisheries, (2) rebuilding stocks, (3) stocks subject to sharp environmental fluctuations, (4) stocks with significant recreational catch, and (5) international fisheries. When the underlying management problem has been addressed effectively, the need for such determinations will be substantially reduced, if not eliminated. Given all the diverse biological, economic, and social objectives of fisheries and ecosystem management, the optimum level of harvesting capacity typically is not the level at which the excess capacity or overcapacity rate or both are equal to zero. When there is excess capacity or overcapacity and a command and control management approach is used, a variety of factors should be considered to determine if, by how much, how quickly, and how harvesting capacity should be decreased. The factors include: (1) the objectives for fishery management; (2) the weights given to each objective; and (3) how a specific capacity reduction measure will affect the attainment of those objectives. Therefore, when a command and control approach is used, the requirements for capacity analysis and other types of analysis increase. Conversely, an effective LAPP can substantially diminish or eliminate the need for capacity assessments. For example, the explanation provided by Willing[6] of why New Zealand had not developed a National Plan of Action for the Management of Harvesting capacity was that, with ITQ programs already in place in virtually all of New Zealand's fisheries, such a plan, including the assessment of harvesting capacity, is not necessary; the market for ITQs determines the optimal level of capacity.

3. In defining and assessing harvesting capacity, it is important to: (a) identify the criteria and the fishery regulations that are included as constraints; and (b) account for discarded catch and the fleets that share a common quota.

[6] Willing, J. 2005. New Zealand's Approach to Managing Fishing Capacity. Unpublished report, International Fisheries Group, New Zealand Ministry of Fisheries.

NMFS developed the following criteria for useful assessments of harvesting capacity and overcapacity: (1) disaggregated, vessel-level data should be used in the assessment models; (2) to the extent practical, the assessment of capacity should reflect the fact that many fishing boats participate in multispecies fisheries or multiple fisheries and account for all of the fishing activities of the fishing boats; (3) to the extent practical, the assessments should recognize the ability and propensity of boats to change the species/stock composition of their annual catch; (4) latent capacity should be addressed; (5) the assessment approach/methods selected should be feasible given the data and resources that are expected to be available; and (6) steps should be taken to ensure adequate comparability of the assessments given the purposes of the assessments.

Fishery regulations can affect both the ability of a fleet to catch fish and the extent to which that ability is used. Therefore, providing a clear definition of harvesting capacity includes being explicit concerning what regulations are included as constraints in defining and assessing harvesting capacity. If the target catch level includes mortality for both retained and discarded catch, and if harvesting capacity is estimated in terms of retained catch, an adjustment to either the capacity estimate or the target catch level will be necessary to calculate overcapacity. Similarly, in the absence of separate quotas for the various fleets that share a common quota, the overcapacity of the individual fleets cannot be calculated without using a proxy for individual quotas.

4. A capacity assessment must be based on a specified set of boats, fleets, and fishing activities.

Although data availability often will limit the choices made concerning which boats, fleets, and fishing activities to include in the assessment, some thought should be given to what should be included and the effects of not being as inclusive as is desirable given the objectives for the assessments. The decisions on what vessels to include can be made based on gear type, vessel size, type of fishery (e.g., artisanal, sport, and industrial), and active versus all authorized vessels. The decisions on which of their fishing activities or non-fishing activities to include can be made, for example, based on the species landed and the areas of operation. Similarly, when harvesting capacity is to be controlled, it is important to determine whether the controls will apply to all fishing vessels and supply vessels.

5. Assessments should be limited to commercial fisheries.

Similar to overcapacity in the commercial fisheries, excess demand in recreational/sport fisheries can make it more difficult to meet the conservation and management objectives for living marine resources. However, due to the important differences in the motivations of commercial and recreational/sport fishermen, more research is required to determine what concepts and analytical methods should be used to assess the recreational/sport fisheries’ counterparts to harvesting capacity, excess capacity, and overcapacity in the commercial fisheries. The need for additional research should not prevent fishery management entities from improving the management of recreational/sport fisheries in a variety of ways when it is appropriate to do so. Based on this lesson, NMFS limited its initial round of assessments of excess harvesting capacity to federally managed commercial fisheries.

6. Comparisons across fisheries should be cautiously interpreted.

Several factors limit the comparability of harvesting capacity assessments across fisheries, regions, or fleets. The factors include: (1) differences among fisheries in terms of the fishery regulations, and other fishery-specific characteristics and data availability and quality; and (2) differences in the type and details of the assessment methods used. As in most empirical assessments, the analyst is required to make many decisions concerning how to address various modeling and data issues. These decisions, and therefore the results, will differ by analyst.

The degree of comparability can be evaluated only if there is sufficient information on the estimation processes that were used. This would include information on how the fundamental data and modeling issues were addressed in a specific assessment. In addition, the process for conducting the assessments can be designed to increase comparability.

Lessons regarding implementation of capacity controls

1. It is possible, but typically not sensible, to prevent overfishing by controlling the level of harvesting capacity without also controlling the use of harvesting capacity.

Due to a variety of characteristics that many fisheries exhibit, it is possible, but typically not sensible, to prevent overfishing by controlling the level of harvesting capacity without also controlling the use of harvesting capacity. It is not sensible because the required reduction in harvesting capacity would result in catch levels substantially below the target catch levels for most species and, therefore the cost of preventing overfishing would be unnecessarily high in terms of the other management objectives. The characteristics include: (1) multispecies boats that could readily and substantially change the species composition of their annual catch; (2) part-time boats that could become full-time boats; (3) latent boats (i.e., those that could have participated in a fishery but did not) that could become active boats; (4) boats that are able to catch more than they are willing to catch; (5) fluctuations in the overfishing levels and harvesting capacity; (6) uncertainty concerning actual harvesting capacity; and (7) multiple conservation and management objectives. Two implications are as follows: (1) estimates of the reduction in harvesting capacity that, by itself, would prevent overfishing for a specific stock or group of stocks are often of limited use; and (2) adequate monitoring, control, and surveillance (MCS) measures are necessary to ensure that the measures designed to control the use of harvesting capacity are effective.

2. If limits on the number and physical characteristics of the boats are used to control harvesting capacity, periodic reductions in the limits will be necessary to prevent increases in harvesting capacity.

The management of harvesting capacity can include setting explicit limits on the number and physical characteristics of the boats in a fishery, where the physical characteristics include such factors as the length, beam, carrying capacity, engine power, and fish-finding equipment of each vessel. However, without regular decreases in such limits, harvesting capacity is expected to increase unless the perverse incentives that result in excess harvesting capacity are eliminated. There are two reasons for this. First, technological improvements will occur and will increase harvesting capacity. Second, when boat owners and states have incentives to increase the harvesting capacity of their boats, they can be quite creative in doing so by taking advantage of the physical and operational characteristics that are not subject to those limits. This creativity can result in fishing boats that often are more costly, perhaps less safe to operate, and have physical or operating characteristics that have been distorted by the limits. For example, when there is a limit on the length of boats, beamier boats will become more popular; or when carrying capacity is limited, the use of tenders and other support vessels or less distant ports will tend to increase.

Although it is difficult to control a fleet's harvesting capacity by controlling the number and physical characteristics of the boats in a fleet, in some cases, better alternatives may not be feasible.

Note that limits with exceptions for certain types of boats will tend to increase the number of boats that just meet the exception rule. For example, if the limit on the number of boats in a fishery applies only to boats that are more than 24 meters long, boats that are only 24 meters but have other physical characteristics that more than compensate for the length restriction will become popular. Therefore, if the limits apply just to larger boats, limits that are more restrictive will be required on the larger boats to attain any specific harvesting capacity target for the fishery as a whole.

Limits on the aggregate physical characteristics of the boats in a fleet will be even less effective in controlling the level of harvesting capacity because the harvesting capacity of a fleet will depend on both the fleet's aggregate physical characteristics and the distribution of those characteristics among the boats in the fleet. For example, if there is a 50,000 horsepower (hp) limit for the fleet as a whole and if the fleet is limited to 100 boats, there are many ways the 50,000 hp limit could be distributed among 100 or fewer boats. Over time, the distribution of the 50,000 hp limit would tend to change in a way that would increase harvesting capacity. Basically, aggregate limits are less restrictive than limits on each vessel.

This problem is increased when the same boats participate in fisheries under different management entities. Consider the simple example of two fisheries with 100 boats that participate in both fisheries. If the number of boats is limited to 100 in each fishery and if vessel replacements are allowed, the total number of boats could increase to 200 with each vessel participating in only one of the fisheries. This would substantially increase, but not necessarily double, the harvesting capacity in each fishery. This example demonstrates the importance, for example, of communication and coordination among the RFMOs as they impose measures to control harvesting capacity.

3. It is important to account for the multispecies and multi-fishery activities and capabilities of fishing boats.

Another room-capacity analogy can be used to explain the potential problems of species-specific assessments of excess harvesting capacity. The capacity of a fishing fleet is similar to the capacity of a room in that often it is a useful measure of potential aggregate, but not disaggregate, output. For example, based on its physical characteristics, the capacity of a room (i.e., the number of people that can exit that room safely in an emergency) could be 100; but its capacity by gender makes no sense because there are 101 possible combinations of numbers of females and males given the aggregate capacity of 100. For a fleet that includes boats that catch two or more species of fish and that can substantially change the species composition of their annual catch, the concept of capacity by species or stock is as ambiguous as room capacity by gender. Therefore, while an analysis of capacity utilization that accounts for all of the activity of the boats in a fleet can be useful as a measure of the economic performance of that fleet, an analysis of capacity by species or stock often will be less useful and potentially misleading. However, this does not preclude focusing on a fishery or stock-specific problems that are exacerbated by the current level of harvesting capacity. Unfortunately, data availability often will both preclude an estimate of capacity that accounts for all of the activity of the boats in a fleet and increase the potential for a stock-specific estimate to be misleading.

APPENDIX 3

Northeast Region Assessment

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1. Introduction

The Northeast Region Report includes fisheries managed by the New England Fishery Management Council (NEFMC), the Mid-Atlantic Fishery Management Council (MAFMC), and the Atlantic States Marine Fisheries Commission (ASMFC). The specific fishery management plans (FMPs) managed by the NEFMC included in this report are the Atlantic Sea Scallop FMP, the Northeast Multispecies FMP, the Monkfish FMP, the Atlantic Herring FMP, and the Atlantic Deep Sea Red Crab FMP. The Skate FMP was not included in this report due to data issues, and a lack of a total allowable catch (TAC) for the various skate species. The small mesh multispecies FMP, which includes whiting, was not included due to lack of a TAC for whiting in 2004. The FMPs managed by the MAFMC included in this report are the Atlantic Surfclam and Ocean Quahog FMP; the Atlantic Mackerel, Squid and Butterfish FMP; the Summer Flounder, Scup and Black Sea Bass FMP; the Atlantic Bluefish FMP; and the Tilefish FMP. The Spiny Dogfish FMP was not included because dogfish were typically an incidental catch species for other fisheries in 2004. The ASMFC is responsible for the Northern Shrimp FMP and the Lobster FMP. For this report, the lobster FMP is not included due to a lack of vessel-specific data.

Vessels fishing in the Northeast do not “map” cleanly into individual FMPs. That is, a vessel using bottom trawl gear may catch species spanning several FMPs on a single trip (e.g., multispecies groundfish and squid). Additionally, there may be more than one gear type catching species belonging to a single FMP. For example, vessels using bottom trawl gear, gillnet gear, and hook gear all catch cod that is managed under the multispecies FMP. This makes summarizing the results challenging. The report for the Northeast Region is summarized by FMP, but each section may include vessels that are primarily included in other FMPs. For example, under the summer flounder, scup and black sea bass FMP, most summer flounder is landed by vessels using either 5.5- or 6.0-inch mesh. However, summer flounder is also caught by vessels in the multispecies fishery, so the capacity assessment for summer flounder will include vessel activity in the multispecies fishery. Although this leads to overlap of vessels among the various FMPs, this does not pose a problem because the report focuses on species-specific capacity estimates in relation to TACs.

Sections 1 through 4 of the National Assessment provide critical background information. These sections explain the purpose and nature of the national assessment; define harvesting capacity and related terms used in this report; describe data envelopment analysis (DEA), which is the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment; and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the Northeast Region fisheries will be easier to understand and interpret if sections 1 through 4 of the National Assessment are read first.

The rest of the Northeast Region Report is organized as follows: first, there is a brief description of the data. This is followed by individual reports for each FMP managed by the NEFMC, followed by results for FMPs managed by the MAFMC, and then the results for the fishery managed by the ASMFC. A summary of the excess capacity assessments by FMP is presented in section 3.12 at the end of this report.

2. Data

The landings data for all reported trips by vessels operating in the Northeast Region in 2004 were used to estimate capacity for the various fisheries. The landings data were taken both from dealer reports at the point of first sale and from vessel trip reports. Additionally, some FMPs had other reporting requirements and therefore we used other sources of data to supplement, or to replace, the dealer reports and vessel trip reports. The landings data were combined with other vessel and trip specific data to compile a trip record for each reported trip.

The first step in constructing a trip record was to match vessel trip reports with dealer reports based on a common permit, month, day, dealer number, and species. This yielded a record with the amount landed by species based on the reported amounts from the dealer. This record was supplemented with effort and crew information from the vessel trip reports. Additional information from the vessel trip reports—such as the area fished, the type of gear used, the mesh size for trawl and gillnet gear or ring size for scallop gear, and the amount of gear fished—was also added to the record. For those trip reports that did not match a dealer report, the vessel trip report landings data were used. This may result in a less precise estimate of landings, because the weights in the vessel trip reports are based on the captain's estimate, not on what clears the market. On the other hand, the precision of the capacity estimates may be increased because the number of observations available for use in estimating the models greatly increases. Finally, information from the vessel permit file on type of permit, horsepower, gross registered tonnage, vessel length, engine type, refrigeration capability, and hull type was added to each trip record.

Trip records were stratified based on additional information from the trip reports, and physical characteristics of the vessel. First, the trips were stratified by gear type (i.e., trawl, hook, dredge) and then by gear characteristic such as mesh size, and then by vessel hull type (i.e., wood, steel, fiberglass, or other). Using hull type and gear characteristics to stratify the data was important, because vessel groupings need to be based on similar technologies—i.e., wood vessels need to be grouped with wood vessels, and vessels using 5.5-inch mesh should not have their capacity estimated with vessels using 1.5-inch mesh. Additionally, if area fished was considered an important factor in the capacity estimate, trips were further stratified by area fished. Outputs were the species landed on each trip. Because some trips landed a large number of species, species not managed under an individual FMP were generally aggregated into an “other” output category. The trip data by stratum was then used to estimate harvesting capacity for each trip within the stratum.

3. Capacity Assessments by Fishery

The capacity assessments for each fishery (1) identify the gear groups involved in the fishery; (2) provide information on the management regime; (3) provide statistics both on the physical characteristics (i.e., length, gross tonnage, and horsepower) of the vessels in the fishery and on trip characteristics (days per trip and crew size); (4) describe the method used to estimate harvesting capacity; and (5) present the results of the assessment. The description of the method used identifies the stratification, fixed and variable inputs, and species or species groups used to estimate capacity. For each fishery, the detailed results are presented in one or more tables that include landings data for 2004, the TAC (or TAC proxy) for 2004, the lower and higher estimates of harvesting capacity, the resulting estimates of excess capacity and overcapacity, and comparisons between the estimates of the actual levels of effort (e.g., days at sea, number of trips, and crew size) in 2004 and the corresponding capacity levels of effort (i.e., estimates of the levels of effort required to make the capacity levels of landings). The tables include the percent of reported landings included in the DEA models for specific gear groups (all else being equal, the higher the percentage the better the estimate), reported landings as a percent of the capacity estimates (this is a measure of capacity utilization), the TAC and the estimates of capacity as a percent of reported landings, and the reported landings and capacity estimates as a percent of the TAC. The tables also include total reported landings for all gear groups combined (including all landings whether or not they can be attributed to a specific gear group) and the sum of reported landings that can be attributed to the modeled gear groups. The ratio of the two (i.e., the total to the sum) for each species was used to adjust the estimates of capacity generated as the sum of capacity estimates across modeled gear groups.

3.1 Atlantic Herring Fishery

3.1.1 Introduction

In the Northeast Region, the Atlantic herring fishery is prosecuted by vessels using bottom trawl gear (3 percent of 2004 total landings), mid-water trawl gear (15 percent of 2004 total landings), purse seine gear (21 percent of 2004 total landings), and pair trawl gear (61 percent of 2004 total landings). The fishery is primarily managed through area-specific quotas. Most U.S. commercial catches occur between May and October in the Gulf of Maine, consistent with the peak season for the lobster fishery. Additionally, there is a relatively substantial winter fishery in southern New England, and catches from Georges Bank have increased somewhat in recent years.

3.1.2 Vessels

In total, 64 vessels landed herring in 2004; 34 vessels used bottom trawl gear, 11 used mid-water trawl gear, 4 used purse seine gear, and 15 used paired mid-water trawl gear (Table 3.1.1).

Bottom trawl vessels averaged 56 feet, 56 gross tons, and 461 horsepower. Trips ranged between 0.15 and 14.0 days, with an average of 0.76. Crew size was between 1 and 15, with an average of 2.5 (Table 3.1.1). Bottom trawl vessels used mesh sizes from 1 to 5.4 inches. Trips using a mesh size greater than 5.4 inches were included with trips using similar mesh size, although herring was not included as an individual output for these other trawl sectors. Overall, trips using the larger mesh size landed less than 1 percent of the total herring for vessels using this gear type, and represented just a small number of trips.

Mid-water trawl vessels averaged 67 feet in length, and had a mean gross tonnage of 120 and a mean horsepower of 929. Trips were between 0.04 and 15 days, with an average of 1.05. Crew size ranged between 1 and 13, with an average of 3.01.

Purse seine vessels averaged 63 feet in length, with an average gross tonnage of 100 and average horsepower of 468. Trips were between 0.17 and 2.77 days, with an average of 0.74. Crew size was between 1 and 7, with an average of 5.6.

Mid-water pair trawl vessels averaged 103 feet in length, had an average gross tonnage of 185, and an average horsepower of 1,255. Trips were between 0.02 and 11.79 days, with an average of 1.58. Crew size was between 1 and 15, with an average of 2.5.

3.1.3 Methods

Capacity was estimated for vessels based on their gear type. Within each gear type, vessels were further stratified based on type of hull (wood, fiberglass, or steel), refrigeration capability (refrigerated seawater, freezer trawler, or unknown), management area, and mesh size. The estimates were based on all trips for which herring was an output (i.e., was landed). However, herring was not the only output included in the capacity assessment if other species were landed on the same trip. Generally, other species were placed in a separate category only if they were managed under a different FMP. Because many species could be caught on a single trip within a gear type, some species needed to be aggregated to keep the models tractable. Other species included as outputs for the bottom trawl fleet were loligo and illex squid, whiting, mackerel, summer flounder, butterfish, scup, bluefish, monkfish, croaker, scallops, red hake, dogfish, and black sea bass. All remaining species were aggregated into an “other” category. Fixed inputs for the bottom trawl fleet were gross tonnage, horsepower, and vessel length, and the variable inputs were days at sea and crew size.

The mid-water trawl fleet outputs included herring, mackerel, and scup; the purse seine fleet's only output was herring, and the outputs for the mid-water pair trawl fleet were herring and mackerel. Because the methods for estimating capacity for pair trawl vessels have not been developed, and because the data required to do so were not available consistently in 2004, DEA was not used to estimate capacity for this fleet. The lower (higher) capacity estimate for the pair trawl fleet was generated by multiplying its reported landings by the ratio of the lower (higher) capacity estimate to reported landings for the mid-water trawl fleet. We believe this method of estimating capacity for the pair trawl fleet is preferable to using reported landings as the estimate of capacity. Similarly, the estimates of the capacity levels of inputs for the pair trawl fleet were generated by multiplying its actual level of inputs by the ratio of the capacity to actual levels of inputs for the mid-water trawl fleet.

Capacity was estimated on a trip-level basis. For trips not included in a distinct stratum, the capacity was assumed to equal reported landings so that all trips could be included in the capacity assessment. Yearly capacity for each vessel was the sum of the individual trip-level estimates. Total capacity was calculated as the sum of each vessel's capacity.

3.1.4 Results

The results are first presented by fleet for all species combined for trips that included herring landings (see Table 3.1.2) and then for just herring for all fleets combined (see Table 3.1.3). The bottom trawl fleet had total reported landings, including herring and other species, of 10.6

million pounds, and the capacity estimate was between 10.7 and 10.8 million pounds (Table 3.1.2). Capacity for the mid-water trawl fleet was between 40.4 and 67.1 million pounds, compared to reported landings of 33.4 million pounds. The purse seine fleet had reported landings of 43.0 million pounds, with an estimated capacity between 47.3 and 77.4 million pounds. Capacity for the mid-water pair trawl fleet was between 155 and 257 million pounds, compared to reported landings of almost 128 million pounds. For the bottom trawl and purse seine fleets, the ability to harvest at capacity would have required a minimal increase in average days fished (i.e., from 0.76 to 0.77 days and from 0.74 to 0.76 days, respectively). For the mid-water trawl fleet, effort would have needed to increase from 1.05 to 1.90 days per trip. Because DEA could not be used to estimate capacity for the mid-water pair trawl fleet, there is no DEA estimate of the increase in days per trip that would have been needed to make the capacity level of landings. However, the rate of increase in days per trip for the mid-water trawl fleet may provide a good estimate of the increase that would have been required for the pair trawl fleet.

To compare the species-specific herring capacity to the TAC, the herring component of the total capacity from Table 3.1.2 for all species combined needed to be broken out. The total commercial herring landings from all sources in 2004 was 207.5 million pounds. The lower estimate of capacity across all gear sectors was about 245 million pounds, and the higher estimate was about 403 million pounds (Table 3.1.3). In 2004, the TAC for Atlantic herring was 551 million pounds. The TAC is almost 125 percent (37 percent) greater than the lower (higher) capacity estimate, which indicates that there was not overcapacity in the Atlantic herring fishery. However, in 2004 there were 102 vessels permitted to land herring, but there were only 64 vessels with recorded herring landings. If these vessels chose to fish for herring, the harvest capacity would increase.

Table 3.1.1 Vessel and trip characteristics of the Atlantic herring fleets in 2004.

	Bottom Trawl	Mid-water Trawl	Purse Seine	Mid-water Pair Trawl
Number of Vessels	34	11	4	15
Vessel Length				
Minimum	27	35	46	58
Maximum	138	128	79	150
Median	51.5	58	63	101
Mean	56	67	63	103
Gross Tonnage				
Minimum	3	16	5	66
Maximum	197	476	170	394
Median	39	66	113	181
Mean	56	120	100	185
Horsepower				
Minimum	200	300	333	333
Maximum	2,775	2,985	580	2,100
Median	350	540	480	1,200
Mean	461	929	468	1,255
Trip Characteristics				
Days				
Minimum	0.15	0.04	0.17	0.02
Maximum	14.00	14.98	2.77	11.79
Median	0.40	0.71	0.75	1.29
Mean	0.76	1.05	0.74	1.58
Crew				
Minimum	1	1	1	1
Maximum	15	13	7	15
Median	2	3	6	2
Mean	2.50	3.01	5.6	2.5

Table 3.1.2 Capacity assessment for vessels in the Atlantic herring fishery in 2004 (million pounds, live weight, all species combined).

	Bottom Trawl	Mid-water Trawl	Purse Seine	Mid-water Pair Trawl[7]
Reported Landings[8]	10.6	33.4	43.0	127.7
Landings Used in the DEA Models	0.4	33.4	39.8	0.0
Percent of Landings Used in the DEA Models[9]	3.8%	100.0%	92.5%	0.0%
Lower Capacity Estimate (LCE)	10.7	40.4	47.3	154.6
Higher Capacity Estimate (HCE)	10.8	67.1	77.4	256.7
Lower Excess Capacity Estimate	0.1	7.0	4.3	26.8
Higher Excess Capacity Estimate	0.1	33.8	34.4	129.0
Reported Landings as a % of the LCE	99.5%	82.6%	90.9%	82.6%
Reported Landings as a % of the HCE	98.8%	49.7%	55.5%	49.8%
Number of Vessels	34	11	4	15
Number of Trips				
Actual	284	287	255	619
Capacity	284	225	241	485
Total Days at Sea				
Actual	215.8	301.4	188.7	975.0
Capacity	219.0	428.0	182.0	1384.8
Days at Sea per Vessel				
Actual	6.3	27.4	47.2	65.0
Capacity	6.4	38.9	45.5	92.3
Days at Sea per Trip				
Actual	0.8	1.1	0.7	1.6
Capacity	0.8	1.9	0.8	2.9
Mean Crew Size				
Actual	2.5	3.01	5.5	2.5
Capacity	2.6	3.5	5.5	2.9
Total Crew Days (mean crew size x total days at sea)				
Actual	540	907	1,038	2,438
Capacity	569	1,498	1,001	4,025

[7] As explained in the text, in the absence of DEA estimates of capacity for the mid-water pair trawl fleet, the lower (higher) capacity estimate for the pair trawl fleet was generated by multiplying its reported landings by the ratio of the lower (higher) capacity estimate to reported landings for the mid-water trawl fleet. Similarly, the estimates of capacity levels of inputs for the pair trawl fleet were generated by multiplying its actual level of inputs by the ratio of the capacity to actual; levels of inputs for the mid-water trawl fleet.

[8] Source: Herring Plan Development Team. Landings only include trips with landed herring.

[9] With the exception of the mid-water pair trawl fleet, capacity was set equal to reported landings for trips not used in the DEA models.

Table 3.1.3 Species-specific capacity assessments for Atlantic herring in 2004 (million pounds of herring, live weight).

Landings	
Sum of Landings Reported by Gear Group[10]	207.3
Reported Total (All Gear Groups Combined)[11]	207.5
TAC	551.2
Lower Capacity Estimate (LCE)	245.27
Higher Capacity Estimate (HCE)	403.25
Lower Excess Capacity Estimate	37.8
Higher Excess Capacity Estimate	195.8
Lower Overcapacity Estimate	-305.9
Higher Overcapacity Estimate	-147.9
Reported Landings as a % of the LCE	84.6%
Reported Landings as a % of the HCE	51.4%
TAC a % of the Reported Landings	265.7%
LCE a % of the Reported Landings	118.2%
HCE a % of the Reported Landings	194.4%
TAC as a % of the LCE	224.7%
TAC as a % of the HCE	136.7%
Reported Landings as a % of the TAC	37.6%
LCE a % of the TAC	44.5%
HCE a % of the TAC	73.2%

3.2 The Deep Sea Red Crab Fishery

3.2.1 Introduction

The deep sea red crab fishery is fished by vessels using pot gear primarily in deep water in the mid-Atlantic region. The fishing year for red crab spans two calendar years, starting March 1 and ending on February 28. Quotas are the primary management tool, with an overall quota of 5,928,000 pounds (live weight), and a days-at-sea allocation for the entire fleet of 780 days to harvest the TAC. Additionally, there is a trip limit of 75,000 pounds for vessels in permit category B.

[10] Source: Herring Plan Development Team. Landings only include trips with landed herring.
[11] Herring Plan Development Team. Some landings belonging to miscellaneous gear groups were not included.

3.2.2 Vessels

A total of four vessels landed red crab in calendar year 2004, of which three had category B permits and one had a category C permit. Vessels had a mean length of 95 feet, gross tonnage of 193, and horsepower of 675. Vessels fished on average 598 pots per trip, with a range between 540 and 600. Trips ranged between 2.2 and 12.3 days, with an average of 8.8. Crew size was between 1 and 6, with an average of 4 (Table 3.2.1).

3.2.3 Methods

Vessels were first stratified by permit type. There are two limited access permit categories. Category B vessels must demonstrate average red crab landings greater than 250,000 pounds per year during the 3-year period March 1, 1997, through February 29, 2000, and they are subject to a trip limit of 75,000 pounds. Category C vessels are eligible for a larger trip limit, given that they demonstrate proof of one trip with landings greater than 75,000 pounds during the same 3-year time frame. Fixed inputs used in the model were length, gross tonnage, horsepower, and number of pots. Variable inputs included days at sea and crew size. The single output was red crab, and although there may be incidental catch of other species, none was reported as being landed. Average capacity per trip for each vessel was then multiplied by the observed number of trips to obtain vessel-specific capacity estimates. The total capacity for the fleet is found by summing across all vessels and outputs.

3.2.4 Results

The lower estimate of capacity was 4.67 million pounds (live weight), and the higher estimate was 6.00 million pounds (Table 3.2.2). Reported landings of 4.42 million pounds for these four vessels were 95 percent of the lower capacity estimate, and 74 percent of the higher capacity estimate. The capacity estimates were based on a total of 577 days at sea, compared to an actual level of 632 days in 2004. On a per-vessel basis, this translated into an average number of days per trip of 8.0 compared to an actual of 8.8.

The lower estimate of capacity was 1.26 million pounds less than the TAC, and the higher estimate was 70 thousand pounds greater than the TAC (Table 3.2.2). Because the assessment was made on a calendar-year basis, it is difficult to compare to a TAC, which is set for March 1 through February 28. Consequently, the fishing year TAC is being used as a proxy for a calendar-year 2004 TAC. Although the higher capacity estimate indicates slight overcapacity, neither the TAC nor the limit on fleet days at sea was reached in 2004.

Table 3.2.1 Vessel and trip characteristics for the deep sea red crab fishery in 2004.

Physical Characteristics	
Number of Vessels	4
Vessel Length	
Minimum	83
Maximum	116
Median	94
Mean	95
Gross Tonnage	
Minimum	184
Maximum	199
Median	198
Mean	193
Horsepower	
Minimum	525
Maximum	825
Median	760
Mean	675
Pots	
Minimum	540
Maximum	600
Median	600
Mean	598
Trip Characteristics	
Days	
Minimum	2.2
Maximum	12.3
Median	8.4
Mean	8.8
Crew	
Minimum	1
Maximum	6
Median	4
Mean	4

Table 3.2.2 Species-specific capacity assessment for pot vessels in the deep sea red crab fishery in 2004 (million pounds of red crab, live weight).

Reported Landings[12]	4.42
Landings Used in the DEA Models	4.42
Percent of Landings Used in the DEA Models	100.0%
TAC	5.93
Lower Capacity Estimate (LCE)	4.67
Higher Capacity Estimate (HCE)	6.00
Lower Excess Capacity Estimate	0.25
Higher Excess Capacity Estimate	1.58
Lower Overcapacity Estimate	-1.26
Higher Overcapacity Estimate	0.07
Reported Landings as a % of the LCE	95%
Reported Landings as a % of the HCE	74%
TAC a % of the Reported Landings	134%
LCE a % of the Reported Landings	106%
HCE a % of the Reported Landings	136%
TAC as a % of the LCE	127%
TAC as a % of the HCE	99%
Reported Landings as a % of the TAC	75%
LCE a % of the TAC	79%
HCE a % of the TAC	101%
Number of Vessels	4
Actual Number of Trips	72
Capacity Number of Trips	72
Actual Days at Sea	632
Capacity Days at Sea	577
Actual Days at Sea per Vessel	157.9
Capacity Days at Sea per Vessel	144.3
Actual Days at Sea per Trip	8.8
Capacity Days at Sea per Trip	8.0
Actual Mean Crew Size	6.7
Capacity Mean Crew Size	6.8
Total Crew Days (mean crew size x total days at sea)	
Actual	4,232
Capacity	3,911

[12] Source: Red Crab Plan Development Team.

3.3 Northeast Multispecies Fishery

3.3.1 Introduction

The multispecies fishery is prosecuted by vessels using bottom trawl gear, gillnet gear, and hook gear. The fishery is managed through a combination of effort controls, trip limits, quotas, and seasonal and year-round closures. Additionally, an allocation has been granted to a group of vessels using hook and line gear, which they manage among themselves. There are 15 species managed over several stock areas under this FMP. These include cod, haddock, yellowtail flounder, Atlantic pollock, white hake, windowpane flounder, witch flounder, winter flounder, redfish, American plaice, silver hake, red hake, offshore hake, Atlantic halibut, and ocean pout.[13] There are four separate stock areas for some of these species, which includes the Gulf of Maine, Georges Bank, Southern New England, and the Mid-Atlantic area.

3.3.2 Vessels

The vessels that participated in the fishery in 2004 were included in the capacity assessment. The bottom trawl fleet was comprised of vessels using bottom trawl gear with mesh size between 6.5 and 8.5 inches, and there were 476 of these vessels. The gillnet fleet was comprised of 336 vessels, which used sink gillnet gear, and the hook fleet was made up of 73 vessels, which used bottom longline gear. Few if any vessels were in more than one of these fleets.

Bottom trawl vessels had a mean length of 60 feet, gross tonnage of 79, and horsepower of 444. Trips ranged between 0.01 and 15.17 days, with an average of 1.48 days per trip. Crew size was between 1 and 8, with an average of 2.2 per trip (Table 3.3.1).

Gillnet vessels averaged 42 feet in length, with an average gross tonnage of 23 and average horsepower of 369. Trips were between 0.01 and 5 days, with an average of 0.6. Crew size was between 1 and 4, with an average of 2.4. It should be noted that for both the gillnet and hook fleets, trip length may not be as important as the time the gear was in the water fishing and the number of nets hauled. Many trips appear to be short, but they are merely retrieving fish from gear that could have been soaking for as long as 48 hours. However, the data on trip duration were much better than the data on soak time and amount of gear hauled, particularly for the gillnet fleet.

Hook vessels averaged 38 feet in length and had a mean gross tonnage of 18 and a mean horsepower of 321. The number of hooks set per trip ranged between 100 and 6,000, with an average of 1,645. Trips were between 0.04 and 5.21 days, with an average of 0.63. Crew size ranged between 1 and 4, with an average of 2.1.

3.3.3 Methods

Data were first stratified by gear type. Within each gear type, vessels were then separated further based on type of hull (wood, fiberglass, or steel) and mesh size for the trawl and gillnet fleets.

[13] Red hake, silver hake, and offshore hake are being moved into a separate small mesh fishery management plan (FMP) under Amendment 12 to the Multispecies Plan.

Fixed inputs included vessel length, gross tons, and horsepower. For hook vessels, the number of hooks used on a trip was also considered a fixed input because the data showed that most vessels did not vary the number of hooks between trips. Variable inputs included days at sea (number of days used, not the number of days allocated) and crew size.

There were 21 species, and one aggregate grouping, included as outputs in the capacity assessment. Ten of these are considered "large mesh" species, and include cod, haddock, yellowtail flounder, winter flounder, windowpane flounder, American plaice, pollock, Acadian redfish, white hake, and witch flounder. Three are considered "small mesh" species—silver hake, red hake, and ocean pout. Other species caught by these vessels and included as separate outputs were bluefish, black sea bass, dogfish, monkfish, summer flounder, loligo squid, scup, and skates. All other species, with the exception of scallops, were aggregated into an "other" category. Trips that landed any scallops were included as part of the Atlantic sea scallop capacity assessment. Generally, a species was included in a separate category only if it was managed under an FMP. It should be noted that the trawl category caught the greatest number of species, and the assessments for both the gillnet and hook sectors did not include as many species as the trawl sector.

Assessing capacity in the multispecies fishery presented challenges that did not face other fleets. Many of the principal species managed under this plan have area-specific target total allowable catches (TACs). For example, different TACs are used for Georges Bank cod and Gulf of Maine cod. And many of the regulations in the multispecies fishery are area-specific. In the Gulf of Maine, for example, certain areas may be closed during specific times of the year, while the Georges Bank area remains open. Trip limits for species may differ depending on area fished, which forced the capacity assessment to be conducted on an area basis, with trips assigned to specific statistical areas. These areas were then aggregated into four broad regions—Georges Bank, Gulf of Maine, Southern New England, and Mid-Atlantic. Once trips were assigned to an area, all trips within a stratum were included within the capacity assessment. For example, one stratum was wooden vessels using trawl gear with 6.5-inch mesh making trips in the Gulf of Maine

Once trip level capacity was estimated for all strata, each vessel's total capacity needed to be estimated. However, this was problematic because under the current regulations, each vessel has a specific days-at-sea limit that cannot be exceeded. This limit is far lower than what some, but not all, vessels would choose to fish, and what historical records showed they fished before days-at-sea limits were used as a regulatory tool. To estimate capacity in the absence of these regulations, several adjustments were needed. First, the total days at sea by each vessel during 1991 was obtained. The year 1991 was chosen because it was a period of heavy fishing activity before days at sea were directly regulated. Vessels were then stratified by gear type and tonnage group,[14] and percentiles for days at sea were calculated for each of the various groupings. The higher trip level capacity estimates from the DEA model for each vessel were then translated into capacity per day at sea. This was only done for trips where at least one of the species regulated under the multispecies plan was landed. "Total days at sea" was then used as an expansion factor to estimate yearly capacity, which was either the average days at sea fished per year for each gear type and tonnage class during 1991, or the 90th percentile days at sea if capacity days

[14] Tonnage groupings were 5–50, 51–150, and greater than 150.

from the DEA model were greater than the average (Table 3.3.2). This calculation yielded the higher capacity estimate. The lower capacity estimate was obtained in a similar manner, except it used the lower trip capacity estimate and days at sea returned from the DEA model to calculate capacity per day.

For trips in which no multispecies groundfish were landed, the lower and higher estimates of capacity were the sum over all non-groundfish trips of the trip level capacity estimates. These totals were added to the groundfish capacity estimates to obtain a total non-species-specific capacity estimate for each gear sector (Table 3.3.3). Additionally, for the six stocks not assessed on an area basis, capacity estimates from other sectors using a different mesh size were added to the totals. In particular, vessels using bottom trawl gear between 5.5 and 6.0 inches had incidental catch of most species in this assessment.

3.3.4 Results

The bottom trawl fleet had reported landings of 86.3 million pounds for all species, with capacity estimated between 169.1 and 181.7 million pounds (Table 3.3.3). On a percentage basis, landings were between 48 and 51 percent of capacity. The estimates of capacity were based on 45,327 days at sea, compared to an estimated 21,981 days at sea used in 2004. The method used to generate the capacity level of days at sea, which was based on the actual days at sea in 1991, was described above. The gillnet fleet had estimated total landings of 39.0 million pounds, with an estimated capacity between 73.9 and 88.6 million pounds. Landings were between 44 and 53 percent of capacity. The capacity estimates were based on 11,384 days at sea, compared to an estimated 9,521 days at sea in 2004. The hook fleet had estimated total landings of 2.6 million pounds, and an estimated capacity between 7.5 and 8.8 million pounds. Landings were estimated to be between 29 and 35 percent of capacity. The capacity estimates were based on 2,366 days at sea, compared to an estimated 809 days at sea in 2004.

The species-specific assessment of overcapacity depends on the relationship between individual TACs and the capacity estimate broken out by species. In the multispecies complex, there was overcapacity in 2004 for nine stocks based on the difference between estimated capacity and the target TACs,[15] using either the lower capacity or higher capacity estimates. The stocks experiencing overcapacity compared to the 2004 TACs are as follows: (1) Gulf of Maine cod and yellowtail flounder; (2) Georges Bank cod, yellowtail flounder, and winter flounder; (3) Southern New England yellowtail flounder and winter flounder; and (4) white hake and witch flounder in the unassigned stock area (Table 3.3.4). For those nine stocks, the lower estimate of capacity as a percentage of the TAC ranged from 103 to 263 percent. The corresponding range for the higher estimates of capacity was 109 to 289 percent. However, reported landings exceeded the TAC for only one stock, Georges Bank cod. And Georges Bank yellowtail flounder exhibited a strong "retrospective" pattern in subsequent assessments, indicating that the 2004 TAC was likely set too high. It should be noted that the multispecies fishery is one of the most heavily regulated in the northeast region, with both input and output controls designed to limit catch. In the absence of those controls, the landings, and hence the capacity estimates for

[15] The 2004 estimated landings are based on the 2005 stock assessment reported in "Assessment of 19 Northeast Groundfish Stocks through 2004", NEFSC Reference Document 05-13, September 2005, Woods Hole, MA.

2004 would have been higher.

Table 3.3.1 Vessel and trip characteristics of the multispecies fishery fleets in 2004.

Fleet	Trawl	Gillnet	Hook
Total Number of Vessels	476	336	73
Vessel Length			
Minimum	26	17	23
Maximum	107	123	82
Median	60	42	36
Mean	60	42	38
Gross Tonnage			
Minimum	3	2	2
Maximum	199	199	102
Median	67	19	15
Mean	79	23	18
Horsepower			
Minimum	110	110	118
Maximum	1,500	2,000	740
Median	380	350	320
Mean	444	369	321
Hooks			
Minimum			100
Maximum			6,000
Median			1,100
Mean			1,645
Trip Characteristics			
Days			
Minimum	0.01	0.01	0.04
Maximum	15.17	5.00	5.21
Median	0.53	0.44	0.51
Mean	1.48	0.60	0.63
Crew			
Minimum	1	1	1
Maximum	8	4	4
Median	2	2	2
Mean	2.2	2.4	2.1

Table 3.3.2 Days at sea used in 1991 that are the basis of the expansion factors used to estimate capacity for the multispecies fishery.

Gear	Mean	90th Percentile
Trawl		
<=50 Gross Registered Tons	52	119
51-150 Gross Registered Tons	103	198
>150 Gross registered Tons	127	228
Gillnet		
<=50 Gross Registered Tons	50	136
> 50 Gross Registered Tons	52	122
Hook		
<= 50 Gross Registered Tons	27	85
> 50 Gross Registered Tons	50	59

Table 3.3.3 Capacity assessment for vessels in the multispecies fishery in 2004 (million pounds, live weight, all species combined).

	Bottom Trawl	Gillnet	Hook
Landings			
Reported Landings[16]	86.3	39.0	2.6
Landings Used in the DEA Models	77.6	30.6	2.5
Percent of Landings Used in the DEA Models[17]	89.9%	78.4%	95.5%
Lower Capacity Estimate (LCE)	169.1	73.9	7.5
Higher Capacity Estimate (HCE)	181.7	88.6	8.8
Lower Excess Capacity Estimate	82.8	34.9	4.9
Higher Excess Capacity Estimate	95.4	49.6	6.2
Reported Landings as a % of the LCE	51%	53%	35%
Reported Landings as a % of the HCE	48%	44%	29%
Number of Vessels	476	336	73
Number of Trips			
Actual	14,654	14,928	1,348
Capacity	14,654	14,928	1,348
Total Days at Sea Used			
Actual	21,981	9,521	809
Capacity	45,327	11,384	2,366
Days at Sea Used per Vessel			
Actual	46.2	28.3	11.1
Capacity	95.2	33.9	32.4
Days at Sea per Trip			
Actual	1.48	0.60	0.63
Capacity	3.09	0.76	1.76
Mean Crew Size			
Actual	2.20	2.40	2.10
Capacity	2.20	2.40	2.10
Total Crew Days (mean crew size x total days at sea)			
Actual	48,358	22,850	1,698
Capacity	99,719	27,322	4,969

[16] Source: Northeast Regional Office vessel trip and dealer reports.
[17] Capacity was set equal to reported landings for trips not used in the DEA models.

Table 3.3.4 Species-specific capacity assessments for the northeast multispecies fishery in 2004 (million pounds, live weight).

	Stock Area: Gulf of Maine				Stock Area: Georges Bank			
	Cod	Haddock	Yellowtail Flounder	Winter Flounder	Cod	Haddock	Yellowtail Flounder	Winter Flounder
Sum of Landings Reported by Gear Group[18]	6.28	1.57	1.10	0.88	5.72	12.60	11.19	5.82
Reported Total landings[19]	8.37	2.25	1.83	1.05	7.65	15.82	13.67	6.46
TAC	8.55	10.65	1.94	7.24	6.50	52.59	23.64	6.61
Lower Capacity Estimate (LCE)	21.30	4.66	4.46	2.73	17.07	34.83	24.28	12.90
Higher Capacity Estimate (HCE)	24.76	5.07	4.68	2.87	18.64	38.78	25.89	14.59
Lower Excess Capacity Estimate	12.93	2.41	2.63	1.68	9.42	19.01	10.61	6.44
Higher Excess Capacity Estimate	16.39	2.82	2.85	1.82	10.99	22.96	12.22	8.13
Lower Overcapacity Estimate	12.75	-5.99	2.52	-4.52	10.57	-17.76	0.64	6.28
Higher Overcapacity Estimate	16.21	-5.58	2.73	-4.37	12.14	-13.81	2.25	7.98
Reported Landings as a % of the LCE	39%	48%	41%	39%	45%	45%	56%	50%
Reported Landings as a % of the HCE	34%	44%	39%	37%	41%	41%	53%	44%
TAC a % of the Reported Landings	102%	473%	106%	690%	85%	332%	173%	102%
LCE a % of the Reported Landings	255%	207%	244%	260%	223%	220%	178%	200%
HCE a % of the Reported Landings	296%	225%	256%	274%	244%	245%	189%	226%
TAC as a % of the LCE	40%	229%	44%	266%	38%	151%	97%	51%
TAC as a % of the HCE	35%	210%	42%	252%	35%	136%	91%	45%
Reported Landings as a % of the TAC	98%	21%	94%	14%	118%	30%	58%	98%
LCE a % of the TAC	249%	44%	230%	38%	263%	66%	103%	195%
HCE a % of the TAC	289%	48%	241%	40%	287%	74%	110%	221%

[18] Source: Northeast Region vessel trip reports and dealer reports for individually identified vessels and trips.
[19] Source: Assessment of 19 Northeast groundfish stocks through 2004; 2005 Groundfish Assessment Review Meeting (2005 GARM), Northeast Fisheries Science Center, Wood Hole, Massachusetts, 15-19 August 2005. http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0513

Table 3.3.4 Continued.

	Stock Area: Southern New England		Stock Area: Unassigned					
	Yellowtail Flounder	Winter Flounder	Windowpane Flounder	American Plaice	Pollock	Redfish	White Hake	Witch Flounder
Sum of Landings Reported by Gear Group	0.24	1.27	0.16	3.11	9.74	0.75	4.22	5.47
Reported Total Landings	0.37	3.21	0.15	3.77	11.16	0.88	7.72	6.43
TAC	1.56	6.31	1.81	8.15	23.33	3.60	8.46	11.41
Lower Capacity Estimate (LCE)	1.73	11.68	0.55	6.41	18.67	1.33	12.19	11.91
Higher Capacity Estimate (HCE)	1.75	13.14	0.57	6.68	19.30	1.36	12.53	12.40
Lower Excess Capacity Estimate	1.36	8.47	0.40	2.64	7.51	0.45	4.47	5.48
Higher Excess Capacity Estimate	1.38	9.93	0.42	2.91	8.14	0.48	4.81	5.97
Lower Overcapacity Estimate	0.17	5.37	-1.25	-1.73	-4.66	-2.27	3.72	0.50
Higher Overcapacity Estimate	0.19	6.83	-1.23	-1.47	-4.03	-2.23	4.07	1.00
Reported Landings as a % of the LCE	21%	27%	27%	59%	60%	66%	63%	54%
Reported Landings as a % of the HCE	21%	24%	26%	56%	58%	65%	62%	52%
TAC a % of the Reported Landings	421%	196%	1204%	216%	209%	409%	110%	177%
LCE a % of the Reported Landings	467%	364%	370%	170%	167%	151%	158%	185%
HCE a % of the Reported Landings	473%	409%	382%	177%	173%	155%	162%	193%
TAC as a % of the LCE	90%	54%	326%	127%	125%	271%	69%	96%
TAC as a % of the HCE	89%	48%	315%	122%	121%	264%	68%	92%
Reported Landings as a % of the TAC	24%	51%	8%	46%	48%	24%	91%	56%
LCE a % of the TAC	111%	185%	31%	79%	80%	37%	144%	104%
HCE a % of the TAC	112%	208%	32%	82%	83%	38%	148%	109%

3.4 The Monkfish Fishery

3.4.1 Introduction

The monkfish fishery is managed jointly by the NEFMC and MAFMC. The fishery is managed through a combination of effort controls and trip limits, and is impacted by the regulations used in the multispecies fishery.

3.4.2 Vessels

The two primary gear types used to harvest monkfish were gillnets and bottom trawls. Descriptive statistics for vessels using these gear types can be found in section 3.3, which describes the multispecies fishery. Additionally, section 3.5 describes vessels fishing in the Atlantic sea scallop fishery, which catch monkfish as incidental catch.

3.4.3 Methods

The methods used for estimating overcapacity in the monkfish fishery are described in the sections on the multispecies fishery (3.3) for the multispecies trawl and gillnet fleets, and section 3.5 for the Atlantic sea scallop fishery. The methods for the "other" trawl fleet are described in the section for the squid, mackerel, and butterfish fishery (3.8). Vessels using large mesh gillnets (> 8.5-inch mesh), and landing monkfish, were accounted for in the gillnet sector of the multispecies fishery. However, for these large mesh gillnet vessels, there was no expansion of daily capacity by total estimated days at sea in 1991. Rather, the trip level capacity estimates for each vessel were summed to arrive at a total capacity estimate. This total was added to the capacity estimate obtained by expanding total days at sea on directed multispecies trips for gillnet vessels.[20] Similarly, for trawl vessels using a smaller mesh size than found in the multispecies fishery (the "other" trawl category), both the lower capacity and higher capacity estimates were the sum of trip level estimates for all vessels.

3.4.4 Results

Species-specific capacity estimates for monkfish from the multispecies trawl fleet, the gillnet fleet, the scallop dredge fleet, and the remaining bottom trawl vessels are combined in Table 3.4.1. Total landings used in the models for these four fleet sectors were 36.9 million pounds (live weight), which was 79 percent of the total dealer-reported landings from all sources of 46.7 million pounds.

The total estimated monkfish capacity for these fleet sectors was between 76.6 and 89.6 million pounds (Table 3.4.1). Reported landings were 61 percent of the lower capacity estimate, and 52 percent of the higher capacity estimate. The 2004 TAC was 52.3 million pounds, and comparison of the TAC and the capacity estimates indicates there was between 24.3 and 37.2 million pounds of overcapacity for monkfish.

[20] See section 3.3.

Because most of the capacity estimate is generated by the multispecies trawl and gillnet fleets, it should be noted that part of their capacity estimates is based on a level of effort that took place in 1991, for those trips considered directed groundfish trips. Had the vessels fished below those levels in the absence of days-at-sea regulations, the estimates would be reduced.

Table 3.4.1 Species-specific capacity assessment for monkfish in 2004 (million pounds of monkfish, live weight).

Landings	
Sum of Landings Reported by Gear Group[21]	36.9
Reported Total[22]	46.7
TAC	52.3
Lower Capacity Estimate (LCE)	76.6
Higher Capacity Estimate (HCE)	89.6
Lower Excess Capacity Estimate	29.9
Higher Excess Capacity Estimate	42.9
Lower Overcapacity Estimate	24.3
Higher Overcapacity Estimate	37.2
Reported Landings as a % of the LCE	61%
Reported Landings as a % of the HCE	52%
TAC a % of the Reported Landings	112%
LCE a % of the Reported Landings	164%
HCE a % of the Reported Landings	192%
TAC as a % of the LCE	68%
TAC as a % of the HCE	58%
Reported Landings as a % of the TAC	89%
LCE a % of the TAC	146%
HCE a % of the TAC	171%

[21] Source: Northeast Regional Office vessel trip and dealer reports for individually identified vessels and trips.
[22] Source: Northeast region dealer reports from all sources.

3.5 The Atlantic Sea Scallop Fishery

3.5.1 Introduction

The Atlantic sea scallop fishery is currently managed by the NEFMC through an Area Rotation program combining area-specific harvest controls in "Access Areas," closed areas, and open area effort controls. Limited access vessels are assigned to permit categories, which limits their available days at sea and trip limits in specified areas. Vessels are allowed to carry over a certain number of unused days at sea to the following year. Dredge width for all but the small dredge vessel category is restricted to no more than a combined 31 feet. For the limited access small dredge category, vessels are restricted to using one dredge only, with a maximum width of 10.5 feet. Vessels assigned to the "general" category are not limited by days at sea, but are instead only allowed to land 400 pounds (meat weight) of scallops per trip. If general category vessels are fishing in specific groundfish areas, they are also currently restricted to one dredge, with a maximum width of 10.5 feet. During 2004, the minimum ring size was raised from 3.5 to 4.0 inches. The twine top mesh size for scallop dredges is also restricted to a minimum of 10 inches to reduce bycatch. Crew size is limited to seven for all limited access vessels, except that small dredge category vessels are restricted to a crew of five and there is no restriction on crew size in Access Areas. The Area Rotation management strategy has been the cornerstone of scallop fishery management since 2004 under Amendment 10. Under the Area Rotation management strategy, areas are closed until the biomass of harvestable scallops is deemed large enough to support fishing in those areas for a period of consecutive years (e.g., 3 to 5 years under current strategies).

Note that, under typical area rotation schemes, an access area would be open with area-specific controls for 3 years, but a more conservative approach was adopted for the Elephant Trunk that spread effort across 5 years under current measures.

3.5.2 Vessels

Vessels that harvested scallops used either dredge gear or bottom trawl gear. In 2004, there were 296 limited access dredge vessels, 214 general category dredge vessels, 26 limited access trawl vessels, and 179 general category trawl vessels that landed scallops (Table 3.5.1). Limited access dredge vessels were on average 81 feet in length, 148 gross registered tons, and had an engine horsepower of 787 (Table 3.5.1). These vessels averaged 8.29 days at sea per trip, and their crew size was restricted to seven by regulation. Limited access vessels were larger than the general category dredge vessels that averaged 48 feet in length, 37 gross registered tons, and had an engine horsepower of 368. General category dredge vessels averaged 0.73 days at sea per trip. General category vessels are not subject to the crew size regulations, but most vessels could not physically carry large crews, as reflected by their average crew size of 2.8. Limited access trawl vessels were on average 75 feet long, had gross registered tonnage of 121, and had horsepower of 536. These vessels averaged 7.5 days at sea per trip, and were also subject to the crew size regulations. General category trawl vessels averaged 68 feet in length, 102 gross registered tons, and had an average horsepower of 490. The average number of days at sea for these vessels was 1.96, and they had an average crew size of 3.5.

3.5.3 Methods

Vessels landing scallops in 2004 were first stratified by permit type into either the limited access group or the general category group. Within the limited access category, vessels were then stratified by gear type (dredge or trawl), and by limited access category (full-time and all other). Dredge vessels were then further stratified by fishing area (mid-Atlantic and New England), hull type (i.e., wood, steel, fiberglass, or other), engine type (i.e., gas or diesel) and ring size (3.5- or 4-inch). The estimates were based on all trips for which scallops were an output (i.e., were landed). However, scallops were not the only output included in the capacity assessment if there were other species landed on the same trip. Generally, other species were placed in a separate category only if they were managed under a different FMP. Fixed inputs for the dredge vessels were vessel length, gross registered tonnage, horsepower, and crew size, because virtually all trips used a seven-person crew. The single variable input was days at sea. Trawl vessels were stratified by fishing area, type of net used, hull type, engine type, and mesh size. The fixed and variable factors used in the models were the same as those used to model the dredge fleet. For both gear types, when there were not enough observations in a stratum to estimate a model, capacity was set equal to reported landings.

Because the full-time limited access vessels have been restricted to no more than 120 days of fishing per year, expanding the trip level estimates to yearly capacity estimates required an additional calculation. Before days at sea were limited, vessels in the full-time permit category fished on average 216 days per year, vessels with a part-time permit fished 87 days per year, and vessels in the occasional permit category fished 18 days per year in the time period 1985–1990.[23] These values were used as upper limits on the total days vessels would fish per year in the absence of days-at-sea regulations, and given the current rotational area strategy. If the capacity models returned total days needed to reach capacity for individual vessels that was below these limits, total capacity for each vessel equaled the sum of capacity across all trips. For vessels where the total days needed to reach capacity exceeded these limits, total capacity was divided by the days at sea needed to reach capacity to arrive at a value for capacity per day at sea. This figure was then multiplied by the upper limit for the permit category to arrive at an estimate of yearly capacity. Capacity for each fleet component (i.e., dredge and trawl) was the sum of capacity over all permits. The general category scallop vessels were stratified in the same manner as the limited access vessels. Vessels were first stratified by gear type (dredge or trawl), and then within gear type by fishing area (Mid-Atlantic or New England), hull type, and type of engine. Dredge vessels were then further stratified by ring size, and trawl vessels were stratified by mesh size. Observations that were considered outliers had their capacity set equal to their reported landings. Yearly capacity for each vessel was the sum of its trip level capacity estimates, and total capacity for a fleet was the sum of the yearly capacity estimates across all vessels.

3.5.4 Results

The results are first presented by fleet for all species combined for trips that included scallop landings (see Table 3.5.2) and then for scallops only for all fleets combined (see Table 3.5.3).

[23] New England Fishery Management Council. 1993. Final Amendment #4 and Supplemental Environmental Impact Statement to the Sea Scallop Fishery Management Plan. Saugus, MA.

The limited access dredge fleet had the highest level of total landings and the highest capacity estimates. Landings for all species were estimated to be 63.3 million pounds, and the capacity estimate was between 89.7 and 123.2 million pounds, based on 36,123 days at sea (Table 3.5.2). Capacity days at sea were higher than the actual days at sea of 26,732 in 2004, which is reasonable given that vessels in the full-time permit category can fish up to 216 days per year.

The limited access trawl fleet had estimated landings for all species of 2.9 million pounds, and a capacity estimate between 3.4 and 4.2 million pounds. This was based on 1,584 days at sea versus an actual level of 1,440 days in 2004.

The general category dredge fleet had estimated landings of 2.0 million pounds, and estimated capacity of between 2.1 and 2.3 million pounds. This would have required 4,686 days at sea compared to 4,344 days at sea actually fished in 2004. On a trip level basis, the average days at sea would have needed to increase from 0.73 to 0.79.

The general category trawl fleet had an estimated capacity between 11.1 and 11.8 million pounds, compared to estimated landings of 10.8 million pounds, requiring 3,996 days at sea compared to 3,934 actually fished in 2004. This increase was caused by a slight increase in days at sea per trip, from 1.96 to 2.0. Unlike the other three fleets—for which scallops accounted for at least 94 percent of their reported scallop trip landings for all species combined in 2004—scallops accounted for less than 7 percent of the total reported landings of the general category trawl fleet's trips with scallop landings.

To determine overcapacity, the species-specific capacity estimates for scallops across all four fleets need to be compared to the TAC in 2004. Sea scallops are managed through target fishing mortality rates (Fs), and therefore there is no explicit TAC. However, if the target F was converted to a TAC for 2004, the TAC would have been 40.0 million pounds.

The lower estimate of capacity for all fleets was 89.9 million pounds and the higher estimate was 122.4 million pounds (Table 3.5.3). The difference between estimated capacity and the TAC is 49.9 million pounds for the lower capacity estimate and 82.4 million pounds for the higher capacity estimate, indicating substantial overcapacity in the Atlantic scallop fishery.

Table 3.5.1 Vessel and trip characteristics in the Atlantic sea scallop fleets in 2004.

	Limited Access	Limited Access	General Category	General Category
	Dredge	Trawl	Dredge	Trawl
Number of Vessels	296	26	214	179
Vessel Length				
Minimum	43	49	21	36
Maximum	120	92	159	106
Median	82	75	43	70
Mean	81	75	48	68
Gross Tonnage				
Minimum	13	14	2	10
Maximum	258	181	196	201
Median	153	121	24	107
Mean	148	121	37	102
Horsepower				
Minimum	260	350	110	165
Maximum	3,000	850	2,200	1,380
Median	750	520	330	430
Mean	787	536	368	490
Trip Characteristics				
Days				
Minimum	0.25	0.01	0.01	0.03
Maximum	20.60	17.52	5.83	14.4
Median	7.96	7.70	0.63	0.96
Mean	8.29	7.50	0.73	1.96
Crew				
Minimum	N.A.	N.A.	1	1
Maximum	N.A.	N.A.	7	7
Median	N.A.	N.A.	3	4
Mean	N.A.	N.A.	2.8	3.5

Table 3.5.2 Capacity assessment for vessels fishing in the Atlantic sea scallop fishery in 2004 for all species combined (million pounds meat weight for scallops and live weight for other species).

	Limited Access Dredge	Limited Access Trawl	General Category Dredge	General Category Trawl
Landings				
Reported Landings[24]	63.3	2.9	2.0	10.8
Landings Used in the DEA Models	58.4	2.1	1.8	9.5
Percent of Landings Used in the DEA Models[25]	92.3%	71.5%	87.0%	88.4%
Lower Capacity Estimate (LCE)	89.7	3.4	2.1	11.1
Higher Capacity Estimate (HCE)	123.2	4.2	2.3	11.8
Lower Excess Capacity Estimate	26.4	0.5	0.0	0.4
Higher Excess Capacity Estimate	59.9	1.4	0.2	1.0
Reported Landings as a % of the LCE	70.6%	83.9%	98.5%	96.6%
Reported Landings as a % of the HCE	51.4%	67.6%	89.7%	91.4%
Number of Vessels	296	26	214	179
Number of Trips				
Actual	3,224	192	5,951	2,007
Capacity	3,212	190	5,947	2,000
Total Days at Sea				
Actual	26,732	1,440	4,344	3,934
Capacity	36,123	1,584	4,686	3,996
Days at Sea per Vessel				
Actual	90.3	55.4	20.3	22.0
Capacity	122.0	60.9	21.9	22.3
Days at Sea per Trip				
Actual	8.29	7.50	0.73	1.96
Capacity	11.25	8.34	0.879	2.00
Mean Crew Size				
Actual	7.0	7.0	2.8	3.5
Capacity	7.0	7.0	2.7	3.8
Total Crew Days (mean crew size x total days at sea)				
Actual	187,124	10,080	12,164	13,768
Capacity	252,861	11,088	12,652	15,185

[24] Source: Northeast Regional Office vessel trip and dealer reports for individually identified vessels and trips. Scallop weights are in meat weights and finfish species are in live weight.
[25] Capacity was set equal to reported landings for trips not used in the DEA models.

Table 3.5.3 Species-specific capacity assessments for Atlantic sea scallops in 2004 (million pounds of scallops, meat weight).

Landings	
Sum of Landings Reported by Gear Group[26]	66.1
Reported Total[27]	64.4
TAC	40.0
Lower Capacity Estimate (LCE)	89.9
Higher Capacity Estimate (HCE)	122.4
Lower Excess Capacity Estimate	25.5
Higher Excess Capacity Estimate	58.0
Lower Overcapacity Estimate	49.9
Higher Overcapacity Estimate	82.4
Reported Landings as a % of the LCE	72%
Reported Landings as a % of the HCE	53%
TAC a % of the Reported Landings	62%
LCE a % of the Reported Landings	140%
HCE a % of the Reported Landings	190%
TAC as a % of the LCE	44%
TAC as a % of the HCE	33%
Reported Landings as a % of the TAC	161%
LCE a % of the TAC	225%
HCE a % of the TAC	306%

[26] Source: Northeast Regional Office vessel trip and dealer reports for individually identified vessels and trips.
[27] Source: Northeast Regional Office dealer reports from all sources.

3.6 The Tilefish Fishery

3.6.1 Introduction

The tilefish fishery is fished by vessels primarily using hook gear in the mid-Atlantic region. The fishing year for tilefish spans 2 calendar years, starting November 1 and ending on October 31. Quotas are the primary management tool, with an overall quota of 1,995,000 pounds. Five percent is subtracted from this amount for incidental catch vessels (category D), which are subject to a trip limit that may be adjusted annually. The remainder is divided among vessels in three other permit categories, as follows: Full-time Tier 1 (Category A), 66 percent; Full-time Tier 2 (category B), 15 percent; and Part-time (category C), 19 percent. In fishing year 2004, category A vessels received a quota of 1.25 million pounds, 284 thousand pounds were allocated to category B vessels, and 360 thousand pounds were allocated to category C vessels.

3.6.2 Vessels

A total of 15 hook vessels landed tilefish in calendar year 2004, and 3 of these had category A permits. The 15 vessels had a mean length of 63 feet, gross tonnage of 67, and horsepower of 438. Vessels set, on average, 3,462 hooks per trip, with a range of 600 and 6,000 hooks per trip. Trips ranged from 1.5 to 10.7 days, with an average of 5.7 days. Crew size was between one and six, with an average of four (Table 3.6.1). During 2004, a lawsuit *(Hadaja v. Evans)* disrupted the management process. Specifically, permitting and reporting requirements were postponed for more than a year (May 15, 2003, to May 31, 2004), and it is suspected that several vessels that were not part of the tilefish limited entry program landed tilefish during that period. However, 2004 was still used as the year for analysis, to be consistent with other fisheries, both regionally and nationally. Therefore, the capacity estimates reported in this section are likely to be biased downward, because some or all tilefish landings, although reported by dealers, may not have been reported by some vessels.

For the 2004 fishing year, there was a substantial number of latent permits, with a total of 2,109 vessels possessing tilefish permits. The majority of these (2,076) were held by category D vessels that mainly used trawl and gillnet gear, and that were limited to an incidental overall TAC of 5 percent of the quota. There were 33 vessels in 2004 having a category A, B, or C permit, and 11 were included in the assessment.

3.6.3 Methods

Vessels were first stratified by permit type. Those in categories B, C, and D were separated into one group, and those in category A formed their own group. Fixed inputs used in the model were length, gross tonnage, horsepower, and number of hooks. Variable inputs included days at sea and crew size. The two outputs were tilefish and all other species aggregated into an “other” category. The other species were chiefly albacore and bigeye tuna. Average capacity per trip for each vessel was multiplied by the observed number of trips to obtain vessel-specific capacity estimates. For two vessels, the trips used for expansion were less than the observed trips because the resulting days at sea would have been higher than observed days at sea for any of the vessels. The total capacity for the fleet is found by summing across all vessels and outputs.

3.6.4 Results

The lower estimate of capacity for all species combined was 3.21 million pounds (live weight), and the higher estimate was 3.86 million pounds (Table 3.6.2), compared to reported landings of 2.66 million pounds. The capacity estimates were based on a total of 1,091 days fished, compared to an actual level of 922 days in 2004. On a per-vessel basis, this translated into an average number of days per trip of 7.2, compared to an actual of 5.7 in 2004.

Tilefish was broken out separately, and landed weights were converted to live weight for comparison with the TAC (Table 3.6.3). The lower estimate of capacity was 3.17 million pounds, and the higher estimate of capacity was 3.83 million pounds. The TAC was 63 percent of the lower estimate of capacity and 52 percent of the higher estimate of capacity.

Because the assessment was made on a calendar year basis, it is difficult to compare to a TAC set for November 1, 2003, to October 31, 2004. However, the 10-year rebuilding schedule uses a constant harvest strategy; i.e., the TAC does not change between years. Therefore, the analysis indicates there was overcapacity for this fishery in 2004. Other indications of overcapacity in this fishery are that the category C fishery has been shut down early, after landing its share of the TAC, each year since the FMP was implemented (except in 2003, when the reporting requirements were suspended due to the lawsuit). Total reported landings exceeded the TAC by 32 percent in 2004.

Table 3.6.1 Vessel and trip characteristics for hook vessels in the tilefish fishery in 2004.

Physical Characteristics		Trip Characteristics	
Number of Vessels	15		
Vessel Length		Days	
Minimum	39	Minimum	1.5
Maximum	82	Maximum	10.7
Median	63	Median	5.6
Mean	63	Mean	5.7
Gross Tonnage		Crew	
Minimum	5	Minimum	1
Maximum	165	Maximum	6
Median	61	Median	4
Mean	67	Mean	4
Horsepower			
Minimum	210		
Maximum	700		
Median	443		
Mean	438		
Hooks			
Minimum	600		
Maximum	6,000		
Median	4,000		
Mean	3,462		

Table 3.6.2 Capacity assessment for hook vessels in the tilefish fishery in 2004 (million pounds live weight for all species combined).

Landings	
Reported Landings[28]	2.66
Landings Used in the DEA Models	2.25
Percent of Landings Used in the DEA Models[29]	84.8%
Lower Capacity Estimate (LCE)	3.21
Higher Capacity Estimate (HCE)	3.86
Lower Excess Capacity Estimate	0.55
Higher Excess Capacity Estimate	1.21
Reported Landings as a % of the LCE	82.9%
Reported Landings as a % of the HCE	68.8%
Number of Vessels	15
Number of Trips	
Actual	161
Capacity	152
Total Days at Sea	
Actual	922
Capacity	1,091
Days at Sea per Vessel	
Actual	61.4
Capacity	72.7
Days at Sea per Trip	
Actual	5.7
Capacity	7.2
Mean Crew Size	
Actual	3.7
Capacity	3.5
Total Crew Days (mean crew size x total days at sea)	
Actual	3,410
Capacity	3,787

[28] Source: Tilefish Plan Development Team
[29] Capacity was set equal to reported landings for trips not used in the DEA models

Table 3.6.3 Species-specific capacity assessment for tilefish landed by hook gear vessels in 2004 (million pounds of tilefish, live weight).

Reported Landings	2.64
TAC	2.00
Lower Capacity Estimate (LCE)	3.17
Higher Capacity Estimate (HCE)	3.83
Lower Excess Capacity Estimate	0.54
Higher Excess Capacity Estimate	1.19
Lower Overcapacity Estimate	1.18
Higher Overcapacity Estimate	1.83
Reported Landings as a % of the LCE	83%
Reported Landings as a % of the HCE	69%
TAC a % of the Reported Landings	76%
LCE a % of the Reported Landings	120%
HCE a % of the Reported Landings	145%
TAC as a % of the LCE	63%
TAC as a % of the HCE	52%
Reported Landings as a % of the TAC	132%
LCE a % of the TAC	159%
HCE a % of the TAC	192%

3.7 Surfclam and Ocean Quahog Dredge Fishery

3.7.1 Introduction

The surfclam and ocean quahog dredge fisheries are regulated by the MAFMC through the Atlantic Surfclam and Ocean Quahog FMP. The two species in this FMP, surfclams and ocean quahogs, are principally managed through an Individual Transferable Quota (ITQ) system. A small portion of the ocean quahog resource off the coast of Maine is managed through an overall TAC of 100,000 Maine bushels, and is known as the Maine mahogany quahog fishery. Vessels in the Maine mahogany quahog fishery can also lease quota from the ITQ fishery. The quahogs harvested by the Maine vessels generally go to a different market, with higher prices than quahogs from the ITQ fishery. During 2004, the surfclam quota was 3.4 million bushels, the ocean quahog quota was 5.0 million bushels, and the Maine mahogany quahog quota was 100,000 Maine bushels.

3.7.2 Vessels

There were 35 vessels with surfclam trips, 29 vessels with ocean quahog trips, and 34 vessels with Maine mahogany quahog trips in 2004 (Table 3.7.1). Fourteen vessels landed both surfclams and ocean quahogs. Vessels participating in the ITQ fishery were larger, landed more per trip, and had larger crews than the Maine mahogany quahog fishery (Table 3.7.1). Four vessels in the ITQ fishery also had a small amount of scallop landings using scallop dredge gear. Four vessels from the Maine quahog fishery used scallop dredge gear, lobster pot gear, and purse seine gear to land scallops, lobster, sea urchins, Atlantic herring, and white hake. These four vessels were not included in the capacity assessment.

3.7.3 Methods

Because vessels either landed surfclams, ocean quahogs, or Maine mahogany quahog on a given trip, there is no multi-output production process at the trip level. Landings for each vessel were divided into calendar year quarters. For vessels participating in the ITQ fisheries, the physical characteristics (i.e., fixed inputs) used in the DEA models were gross registered tons, horsepower, vessel length, and dredge width (Table 3.7.1). Dredge width was not included for the Maine mahogany quahog vessels because of missing data for several vessels. However, because the size of the cutting bar on a dredge in Maine is restricted by regulation to 32 inches, there is little variability in dredge width for these vessels. The variable inputs used for all vessels were crew size and days at sea, and the output was bushels of surfclams, ocean quahogs, or Maine mahogany quahogs landed.

For each fleet sector (i.e. surfclam, ocean quahog, Maine mahogany quahog), a separate DEA model was used to calculate capacity by trip and vessel on a quarterly basis. Additionally, for the Maine mahogany quahog fleet, the data were further stratified by hull type (vessels in the surfclam and ocean quahog fleets were all made of steel). Yearly capacity by vessel and fleet sector was estimated by summing trip level capacity over all trips and vessels. If the total capacity days at sea for any vessel resulting from the DEA models were greater than the maximum observed for the fleet sector, the estimated capacity for that particular vessel was reduced. This was done by calculating the maximum trips the vessel could take based on the average capacity days at sea per trip and the upper limit on days fished. This number was then multiplied by average capacity per trip to arrive at an estimate of total capacity for that particular vessel.

3.7.4 Results

Based on both sets of harvesting capacity estimates, there was overcapacity (Table 3.7.2) for surfclams and Maine mahogany quahogs, and no overcapacity for ocean quahogs. The range for overcapacity in the surfclam fleet was between 372,000 and 1.7 million bushels. For the Maine mahogany quahog fleet, the range was between 94,000 and 195,000 bushels. The estimates of the capacity days at sea were 2,836 for the surfclam fleet, 2,682 for the ocean quahog fleet, and 1,286 for the Maine mahogany quahog fleet. For the surfclam fleet, attaining capacity would have required increasing the average days at sea per trip from 0.85 to 1.15, or 35 percent. For the Maine mahogany quahog fleet, effort would have needed to increase from 0.42 to 0.5 days per trip, or 19 percent.

Table 3.7.1 Vessel and trip characteristics by trip type for the surfclam and ocean quahog fisheries in 2004.[30]

Fleet	Surfclam	Ocean Quahog	Maine Mahogany Quahog
Total Number of Vessels	35	29	34
Vessel Length			
Minimum	67	69	35
Maximum	162	163	58
Median	85	97	40
Mean	90	100	42
Gross Tonnage			
Minimum	72	98	2
Maximum	537	258	50
Median	152	174	12
Mean	160	161	15
Horsepower			
Minimum	350	400	165
Maximum	1,250	2,200	600
Median	675	850	356
Mean	712	885	351
Dredge Width (inches)			
Minimum	74	60	
Maximum	410	360	
Median	120	120	
Mean	139	156	
Trip Characteristics			
Days			
Minimum	0.01	0.03	0.06
Maximum	2.58	4.00	0.75
Median	0.88	1.42	0.42
Mean	0.85	1.43	0.42
Crew			
Minimum	3	3	2
Maximum	7	10	4
Median	4	5	3
Mean	4.26	5.0	2.8

[30] Source: NMFS logbook data and permit data.

Table 3.7.2 Species-specific capacity assessments for the surfclam and ocean quahog fisheries in 2004 (thousand bushels).

	Surfclam	Ocean Quahog	Maine Mahogany Quahog
Reported Landings[31]	3,128	3,832	96
Landings Used in the DEA Models	3,134	3,823	100
Percent of Landings Used in the DEA Models[32]	100.2%	99.8%	103.8%
TAC	3,400	5,000	100
Lower Capacity Estimate (LCE)	3,772	4,120	194
Higher Capacity Estimate (HCE)	5,083	4,927	295
Lower Excess Capacity Estimate	644	289	98
Higher Excess Capacity Estimate	1,955	1,095	198
Lower Overcapacity Estimate	372	-880	94
Higher Overcapacity Estimate	1,683	-73	195
Reported Landings as a % of the LCE	83%	93%	50%
Reported Landings as a % of the HCE	62%	78%	33%
TAC a % of the Reported Landings	109%	130%	104%
LCE a % of the Reported Landings	121%	108%	202%
HCE a % of the Reported Landings	163%	129%	306%
TAC as a % of the LCE	90%	121%	51%
TAC as a % of the HCE	67%	101%	34%
Reported Landings as a % of the TAC	92%	77%	96%
LCE a % of the TAC	111%	82%	194%
HCE a % of the TAC	150%	99%	295%
Number of Vessels	35	29	73
Actual Number of Trips	2,765	1,782	2,571
Capacity Number of Trips	2,467	1,757	2,571
Actual Total Days at Sea	2,350	2,513	1,076
Capacity Total Days at Sea	2,836	2,682	1,286
Actual Days at Sea per Vessel	67.2	86.6	14.7
Capacity Days at Sea per Vessel	81.0	92.5	17.6
Actual Days at Sea per Trip	0.85	1.41	0.42
Capacity Days at Sea per Trip	1.15	1.53	0.50
Actual Mean Crew Size	4.3	5.0	2.8
Capacity Mean Crew Size	4.1	4.9	3.0
Actual Total Crew Days (mean crew size x total days at sea)	10,012	12,512	3,013
Capacity Total Crew Days	11,628	13,008	3,857

[31] Source: Northeast region vessel trip reports.
[32] Capacity was set equal to reported landings for trips not used in the DEA models.

3.8 Squid, Mackerel, and Butterfish Fisheries

3.8.1 Introduction

The squid, mackerel, and butterfish fisheries are fished by vessels using bottom trawl, mid-water trawl, and pair trawl gear in the northeast region. The primary management tool in this fishery in 2004 was quotas, with some being implemented on a quarterly basis.

3.8.2 Vessels

In 2004, 323 vessels used bottom trawl gear, 18 vessels used mid-water trawl gear, and 15 used mid-water pair trawl gear (Table 3.8.1). Bottom trawl vessels had a mean length of 63 feet, gross tonnage of 86, and horsepower of 497. Trips ranged between 0.01 and 15.3 days, with an average of 1.72 days. Crew size was between 1 and 26, with an average of 2.9 (Table 3.8.1). Bottom trawl vessels used mesh sizes from 1 inch to 5.4 inches.

Mid-water trawl vessels were between 35 and 128 feet in length, with a mean length of 69. Gross tonnage ranged between 14 and 476, with an average value of 117. Horsepower was between 300 and 2,985, with a mean of 849. Trips were between 0.04 and 15 days, with an average of 1.46. Crew size ranged between 1 and 14, with an average of 3.4.

3.8.3 Methods

Capacity was estimated for vessels based on their gear type. Within each gear type, vessels were stratified further based on type of hull (wood, fiberglass, or steel), refrigeration capability (refrigerated seawater, freezer trawler, or unknown), and mesh size. The estimates were based on all trips for which squid, mackerel, or butterfish was an output (i.e., was landed). However, squid, mackerel, and butterfish were not the only outputs included in the capacity assessment if there were other species landed on the same trip. Generally, a species was included in a separate category only if it the species was managed under an FMP. Other individual species included as outputs were whiting, summer flounder, scup, bluefish, monkfish, croaker, scallops, red hake, dogfish, and black sea bass. The remaining species were aggregated into an "other" category. Fixed inputs for both fleets were gross tonnage, horsepower, and vessel length, and the variable inputs were days at sea and crew size. Because the methods for estimating capacity for pair trawl vessels have not been developed, and because the data required to do so were not available consistently in 2004, DEA was not used to estimate capacity for this fleet. The lower (higher) capacity estimate for the pair trawl fleet was generated by multiplying its reported landings by the ratio of the lower (higher) capacity estimate to reported landings for the mid-water trawl fleet. We believe this method of estimating capacity is preferable to using reported landings for the pair trawl fleet.

Capacity was estimated on a trip level basis. For trips that were not included in a distinct stratum, the capacity was assumed to equal reported landings. This was done so all trips could be included in the capacity assessment. Trip level estimates were then expanded to a yearly basis by summing trip level capacity for each vessel. Total capacity was calculated as the sum of capacity across all vessels.

3.8.4 Results

The results are first presented by fleet for all species combined for trips that included squid, mackerel, or butterfish landings (see Table 3.8.2) and then for just squid, mackerel, and butterfish for all fleets combined (see Table 3.8.3). With one exception, the estimates by fleet were based on all trips for which squid, mackerel, or butterfish was an output (i.e., was landed). The exception is that trips that included herring landings were excluded from the fleet-specific assessments for squid, mackerel, and butterfish because they were included in the fleet-specific assessment for the herring fleet. However, all trips with squid, mackerel, or butterfish landings were used to generate the species-specific assessments in Table 3.8.3.

The bottom trawl fleet had total landings for all species combined of 143.1 million pounds, and the capacity estimate was between 162.9 and 200.3 million pounds (Table 3.8.2). Capacity for the mid-water trawl fleet was between 61.7 and 95.6 million pounds, compared to reported landings of 52.4 million pounds. For both fleets, the ability to harvest at capacity would have required an increase in average days fished. For the bottom trawl fleet, effort would have needed to be increased from 1.72 to 1.83 days per trip, and for the mid-water trawl fleet the effort needed would have been 1.73 days compared to an actual level of 1.46 days in 2004.

On an individual species basis, capacity was estimated to be between 68.4 and 93.1 million pounds for Illex squid in 2004 (Table 3.8.3), compared to a TAC of 52.9 million pounds. This indicates there was overcapacity for Illex squid in 2004. Loligo squid had an estimated capacity between 37.9 and 43.4 million pounds. The 2004 TAC for loligo squid was 37.48 million pounds, which indicates there was little to moderate overcapacity for loligo squid in 2004. The estimated capacity for mackerel was between 134.2 and 189.5 million pounds. This was based on landings of 79.5 million pounds for these three fleets, compared to total landings of 118.4 million pounds. Given that the total estimated capacity is well below the TAC of 330.7 million pounds, there was no overcapacity for mackerel in 2004. The estimated capacity for butterfish was between 1.22 and 1.32 million pounds, while the TAC was 13.01 million pounds. The capacity estimates were well below the TAC, indicating there was no overcapacity for butterfish in 2004.

Table 3.8.1 Vessel and trip characteristics of the squid, mackerel, and butterfish fleets in 2004.

	Bottom Trawl	Mid-water Trawl
Number of Vessels	323	18
Vessel Length		
Minimum	25	35
Maximum	138	128
Median	65	71
Mean	63	69
Gross Tonnage		
Minimum	2	14
Maximum	288	476
Median	83	113
Mean	86	117
Horsepower		
Minimum	110	300
Maximum	2,775	2,985
Median	400	580
Mean	497	849
Trip Characteristics		
Days		
Minimum	0.01	0.04
Maximum	15.30	15.00
Median	0.79	0.90
Mean	1.72	1.46
Crew		
Minimum	1	1
Maximum	26	14
Median	3	3
Mean	2.90	3.40

Table 3.8.2 Capacity assessment for vessels in the squid, mackerel, and butterfish fishery in 2004 (million pounds, live weight for all species combined).

	Bottom Trawl	Mid-water Trawl		
Landings				
Reported Landings[33]	143.1	52.4		
Landings Used in the DEA Models	107.4	40.2		
Percent of Landings Used in the DEA Models[34]	75.1%	76.7%		
Lower Capacity Estimate (LCE)	162.9	61.7		
Higher Capacity Estimate (HCE)	200.3	95.6		
Lower Excess Capacity Estimate	19.8	9.4		
Higher Excess Capacity Estimate	57.2	43.3		
Reported Landings as a % of the LCE	88%	85%		
Reported Landings as a % of the HCE	71%	55%		
Number of Vessels	323	18		
Number of Trips				
Actual	7,354	358		
Capacity	7,354	358		
Total Days at Sea				
Actual	12,649	523		
Capacity	13,462	618		
Days at Sea per Vessel				
Actual	39.2	29.0		
Capacity	41.7	34.4		
Days at Sea per Trip				
Actual	1.72	1.46		
Capacity	1.83	1.73		
Mean Crew Size				
Actual	2.90	3.40		
Capacity	2.86	3.37		
Total Crew Days (mean crew size x total days at sea)				
Actual	36,682	1,777		
Capacity	38,502	2,084		

[33] Source: Northeast Regional Office dealer reports and vessel trip reports.
[34] Capacity was set equal to reported landings for trips not used in the DEA models.

Table 3.8.3 Species-specific capacity assessment in the squid, mackerel and butterfish fishery in 2004 (million pounds, live weight).

	Mackerel	Illex Squid	Loligo Squid	Butterfish
Landings				
Sum of Landings Reported by Gear Group[35]	79.5	61.1	29.6	0.68
Reported Total	118.4[36]	57.5[37]	34.1[38]	1.18[39]
TAC	330.7	52.9	37.5	13.01
Lower Capacity Estimate (LCE)	134.2	68.4	37.9	1.22
Higher Capacity Estimate (HCE)	189.5	93.1	43.4	1.32
Lower Excess Capacity Estimate	15.8	10.94	3.9	0.04
Higher Excess Capacity Estimate	71.1	35.59	9.4	0.14
Lower Overcapacity Estimate	-196.5	15.53	0.5	-11.78
Higher Overcapacity Estimate	-141.2	40.18	5.9	-11.68
Reported Landings as a % of the LCE	88%	84%	90%	96%
Reported Landings as a % of the HCE	62%	62%	78%	89%
TAC a % of the Reported Landings	279%	92%	110%	1102%
LCE a % of the Reported Landings	113%	119%	111%	104%
HCE a % of the Reported Landings	160%	162%	127%	112%
TAC as a % of the LCE	246%	77%	99%	1062%
TAC as a % of the HCE	174%	57%	86%	983%
Reported Landings as a % of the TAC	36%	109%	91%	9%
LCE a % of the TAC	41%	129%	101%	9%
HCE a % of the TAC	57%	176%	116%	10%

35 Source: Northeast regional Office dealer and vessel trip reports.
36 Source: Northeast Fisheries Science Center SAW 42 Document. http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0609/btbls.pdf
37 Source: Northeast Fisheries Science Center SAW 42 Document. http://www.nefsc.noaa.gov/nefsc/publications/crd0609/ctbls.pdf
38 Source: L. Hendrickson, personal communication.
39 Source: Northeast Regional Office dealer database.

3.9 Summer Flounder, Scup, and Black Sea Bass Fishery

3.9.1 Introduction

The summer flounder, scup, and black sea bass fishery is fished by vessels using bottom trawl gear, hook and line gear, floating traps, and pot gear mainly in the mid-Atlantic region. A small amount of summer flounder and black sea bass is also landed by the scallop dredge fleet. The fishery is managed primarily through quotas, with the overall quota being divided between the commercial and recreational sectors.

3.9.2 Vessels

Because the majority of the catch is taken by vessels using bottom trawl gear and pot and trap gear, the capacity assessment focused on these two gear types. The description of the bottom trawl vessels focuses on those using 5.5- or 6.0-inch mesh trawl gear. Vessels in the northeast multispecies fishery and the squid, mackerel, and butterfish fishery also landed these species, and these vessels are described in sections 3.3 and 3.8.

There were 390 bottom trawl vessels using either 5.5- or 6.0-inch mesh in 2004. These vessels had a mean length of 61 feet, gross tonnage of 79, and horsepower of 446. Trips ranged between 0.02 and 6 days, with an average of 1.33. Crew size was between 1 and 5, with an average of 2.17 (Table 3.9.1). There were 81 vessels using pots and traps. These vessels had a mean length of 38 feet, gross tonnage of 17, and horsepower of 337. Trips ranged between 0.01 and 3.6 days, with an average of 0.39. Crew size ranged between 1 and 4, with a mean of 1.7 (Table 3.9.1).

3.9.3 Methods

Capacity was estimated separately for each gear type. Within each gear type, vessels were stratified further based on type of hull (wood, fiberglass, or steel) and mesh size for the trawl fleets. Fixed inputs included vessel length, gross tons, and horsepower. Variable inputs included days at sea and crew size. Although the number of traps hauled and soak time are important for determining capacity for the fixed gear pot and trap fishery, data on these variables generally were inadequate and were therefore not included in the capacity assessment.

For the trawl fleet using 5.5- or 6.0-inch mesh, 17 species and one aggregate grouping were included as outputs in the capacity assessment. Individual species included summer flounder, scup, black sea bass, winter flounder, bluefish, cod, haddock, loligo squid, monkfish, American plaice, pollock, redfish, skates, white hake, silver hake, witch flounder, and yellowtail flounder. Vessels using pot and trap gear had four outputs and one aggregate output. The individual species were scup, black sea bass, tautog, and lobster.

In addition to the two main gear types described above, trawl vessels using both smaller and larger mesh sizes were included in the species-specific capacity assessment. For those trawl vessels in the multispecies fishery, species-specific capacity estimates are based on expansion of effort to 1991 levels as described in section 3.3.

3.9.4 Results

The bottom trawl fleet had reported landings of 29.3 million pounds, with capacity estimated between 32.9 and 37.2 million pounds (Table 3.9.2). On a percentage basis, landings were between 79 and 89 percent of capacity. The estimates of capacity were based on 12,882 days at sea, compared to an estimated 10,855 days at sea in 2004. The pot and trap fleet had estimated landings of 1.2 million pounds, with an estimated capacity between 1.9 and 2.6 million pounds. Landings were between 45 and 63 percent of capacity. The estimates of capacity were based on 1,147 days at sea, compared to an estimated 926 days at sea in 2004.

The assessment of overcapacity depends on the relationship between the TAC and the capacity estimate. For these three species, the capacity assessment included estimates from all trawl vessels regardless of mesh size, from the pot and trap fleet, and from the scallop dredge fleet (see section 3.5).

The TAC for summer flounder was 16.8 million pounds (live weight) in 2004. The lower estimate of capacity was 25.5 million pounds and the higher estimate was 31.4 million pounds (Table 3.9.3). This translated into an overcapacity estimate between 8.7 and 14.6 million pounds. With respect to summer flounder, there is clear evidence of overcapacity. Additionally, in 2004 reported landings were 103 percent of the TAC.

The TAC for scup in 2004 was 12.3 million pounds (live weight). The lower estimate of capacity is 12.6 million pounds and the higher estimate is 13.5 million pounds (Table 3.9.3). Based on both sets of capacity estimates, there was slight overcapacity for scup in 2004. However, in 2004 only 76 percent of the TAC was taken.

The TAC for black sea bass was 3.8 million pounds (live weight) in 2004. The lower estimate of capacity was 4.3 million pounds and the higher estimate of capacity was 5.3 million pounds (Table 3.9.3). Based on both sets of numbers, there was overcapacity for black sea bass in 2004. However, in 2004 only 82 percent of the TAC was taken.

Table 3.9.1 Vessel and trip characteristics of vessels participating in the summer flounder, scup, and black sea bass fishery in 2004.

	Bottom Trawl (5.5 or 6.0 inch mesh)	Pots & Traps
Number of Vessels	390	81
Vessel Length		
Minimum	26	23
Maximum	111	58
Median	63	36
Mean	61	38
Gross Tonnage		
Minimum	4	2
Maximum	246	60
Median	75	14
Mean	79	17
Horsepower		
Minimum	110	80
Maximum	1,500	700
Median	381	300
Mean	446	337
Trip Characteristics		
Days		
Minimum	0.02	0.01
Maximum	6.00	3.60
Median	0.50	0.33
Mean	1.33	0.39
Crew		
Minimum	1	1
Maximum	5	4
Median	2	2
Mean	2.17	1.70

Table 3.9.2 Capacity assessment for vessels in the summer flounder, scup, and black sea bass fishery in 2004 (million pounds, live weight for all species combined).

	Bottom Trawl (5.5 or 6.0 inch mesh)	Pots & Traps
Landings		
Reported Landings[40]	29.3	1.2
Landings Used in the DEA Models	26.0	1.0
Percent of Landings Used in the DEA Models[41]	88.9%	82.7%
Lower Capacity Estimate (LCE)	32.9	1.9
Higher Capacity Estimate (HCE)	37.2	2.6
Lower Excess Capacity Estimate	3.6	0.7
Higher Excess Capacity Estimate	7.9	1.6
Reported Landings as a % of the LCE	89%	63%
Reported Landings as a % of the HCE	79%	45%
Number of Vessels	390	81
Number of Trips		
Actual	8,162	2,375
Capacity	8,051	2,206
Total Days at Sea		
Actual	10,855	926
Capacity	12,882	1,147
Days at Sea per Vessel		
Actual	27.8	11.4
Capacity	33.0	14.2
Days at Sea per Trip		
Actual	1.3	0.4
Capacity	1.6	0.5
Mean Crew Size		
Actual	2.2	1.7
Capacity	2.3	1.8
Total Crew Days (mean crew size x total days at sea)		
Actual	23,556	1,575
Capacity	29,241	2,065

[40] Source: Northeast Regional Office vessel trip and dealer reports.
[41] Capacity was set equal to reported landings for trips not used in the DEA models.

Table 3.9.3 Species-specific capacity assessment for summer flounder, scup, and black sea bass in 2004 (million pounds, live weight).

Landings	Summer Flounder	Scup	Black Sea Bass
Sum of Landings Reported by Gear Group[42]	15.6	5.2	2.3
Reported Total[43]	17.2	9.3	3.1
TAC	16.8	12.3	3.8
Lower Capacity Estimate (LCE)	25.5	12.6	4.3
Higher Capacity Estimate (HCE)	31.4	13.5	5.3
Lower Excess Capacity Estimate	8.3	3.3	1.2
Higher Excess Capacity Estimate	14.2	4.2	2.2
Lower Overcapacity Estimate	8.7	0.3	0.5
Higher Overcapacity Estimate	14.6	1.2	1.5
Reported Landings as a % of the LCE	68%	74%	72%
Reported Landings as a % of the HCE	55%	69%	59%
TAC a % of the Reported Landings	97%	132%	122%
LCE a % of the Reported Landings	148%	135%	139%
HCE a % of the Reported Landings	183%	145%	170%
TAC as a % of the LCE	66%	98%	88%
TAC as a % of the HCE	53%	91%	72%
Reported Landings as a % of the TAC	103%	76%	82%
LCE a % of the TAC	152%	102%	114%
HCE a % of the TAC	187%	110%	140%

[42] Source: Northeast Regional Office vessel trip and dealer reports for individually identified vessels.
[43] Source: Northeast regional Office dealer database.

3.10 Bluefish Fishery

3.10.1 Introduction

The bluefish fishery is managed by the MAFMC through an overall commercial quota that is divided among the states, and through recreational harvest limits. There is a small directed bluefish fishery by vessels using drift and runaround gillnets off North Carolina, and bluefish are also caught by sink gillnet, trawl, and hook gear as incidental catch in other fisheries.

3.10.2 Methods

The methods for estimating capacity for vessels that used trawl and sink gillnet gear and that landed bluefish as a retained incidental catch species was documented in previous sections (sections 3.1, 3.3., 3.8, and 3.9). This section explains the methods used to estimate capacity for vessels using drift and runaround gillnet gear. Hook gear was not included in the capacity assessment because bluefish are such a small component of the hook gear landings.

Vessels were first stratified by gillnet type (drift and runaround) and then by vessel hull type (wood, fiberglass, or steel) and mesh size. Fixed inputs included vessel length, gross tons, and horsepower. Variable inputs included days at sea and crew size. Although the size of the nets, the number of nets hauled, and soak time are important factors in determining capacity for the gillnet vessels, the data on these variables were generally inadequate and therefore were not used in the capacity assessment. All capacity estimates were made on a trip level basis. If there were not enough data in a given stratum to estimate capacity, capacity was set equal to reported landings. Total capacity by species was the sum of the estimated capacity by species for all trips.

3.10.3 Results

There were 41 vessels using drift and runaround gillnet gear in 2004 (Table 3.10.1). Vessels were between 14 and 56 feet in length, with an average of 39 feet. Gross tonnage was between 1 and 36, with a mean of 16. Horsepower was between 130 and 1,342, with an average of 378. Trip length was between 0.03 and 4.5 days with an average of 0.46. Crew size averaged 2, with a range between 1 and 8.

Total landings for all species combined for these vessels were 1.77 million pounds (Table 3.10.2). The lower estimate of capacity was 1.91 million pounds, and the higher estimate was 2.27 million pounds. Landings were 93 percent and 78 percent of the lower and higher capacity estimates, respectively. The capacity estimates were based on 1,075 trips with an average of 0.44 days at sea per trip, and an average crew size of 2.

To make an assessment of overcapacity, bluefish capacity estimates must be aggregated from all fleets. A total of 7.6 million pounds of bluefish was landed in 2004 from individually identified and unknown vessels (Table 3.10.3). This resulted in a lower capacity estimate of 9.6 million pounds and a higher estimate of 12.0 million pounds. The TAC in 2004 was 10.5 million pounds. Using the lower capacity estimate there was no overcapacity in the bluefish fishery, and using the higher capacity estimate there was 14 percent overcapacity. However, in 2004 only 72 percent of the TAC was taken.

Table 3.10.1 Vessel and trip characteristics of drift and runaround gillnet vessels participating in the bluefish fishery in 2004.

Number of Vessels	41
Vessel Length	
Minimum	14
Maximum	56
Median	39
Mean	39
Gross Tonnage	
Minimum	1
Maximum	36
Median	15
Mean	16
Horsepower	
Minimum	130
Maximum	1342
Median	360
Mean	378
Trip Characteristics	
Days	
Minimum	0.03
Maximum	4.50
Median	0.42
Mean	0.46
Crew	
Minimum	1
Maximum	8
Median	2
Mean	2

Table 3.10.2 Capacity assessment for vessels using drift and runaround gillnet gear in the 2004 bluefish fishery for all species combined (million pounds, live weight).

Landings	
Reported Landing [44]	1.8
Landings Used in the DEA Models	0.9
Percent of Landings Used in the DEA Models[45]	50%
Lower Capacity Estimate (LCE)	1.9
Higher Capacity Estimate (HCE)	2.3
Lower Excess Capacity Estimate	0.1
Higher Excess Capacity Estimate	0.5
Reported Landings as a % of the LCE	93%
Reported Landings as a % of the HCE	78%
Number of Vessels	41
Number of Trips	
Actual	1,075
Capacity	1,075
Total Days at Sea	
Actual	469
Capacity	471
Days at Sea per Vessel	
Actual	11.4
Capacity	11.5
Days at Sea per Trip	
Actual	0.46
Capacity	0.44
Mean Crew Size	
Actual	2.0
Capacity	2.0
Total Crew Days (mean crew size x total days at sea)	
Actual	938
Capacity	942

[44] Source: Northeast Region vessel trip and dealer reports.
[45] Capacity was set equal to reported landings for trips not used in the DEA models.

Table 3.10.3 Species-specific capacity assessment for bluefish from all fleets in 2004 (million pounds of bluefish live weight).

Landings	
Sum of Landings Reported by Permit and Gear Type[46]	4.8
Reported Total[47]	7.6
TAC	10.5
Lower Capacity Estimate (LCE)	9.6
Higher Capacity Estimate (HCE)	12.0
Lower Excess Capacity Estimate	2.1
Higher Excess Capacity Estimate	4.4
Lower Overcapacity Estimate	-0.9
Higher Overcapacity Estimate	1.5
Reported Landings as a % of the LCE	78%
Reported Landings as a % of the HCE	63%
TAC a % of the Reported Landings	139%
LCE a % of the Reported Landings	127%
HCE a % of the Reported Landings	159%
TAC as a % of the LCE	109%
TAC as a % of the HCE	88%
Reported Landings as a % of the TAC	72%
LCE a % of the TAC	92%
HCE a % of the TAC	114%

[46] Source: Northeast Region vessel trip and dealer reports for individually identified vessels and trips.
[47] Source: Northeast Region dealer data from all sources.

3.11 Northern Shrimp Fishery

3.11.1 Introduction

The Gulf of Maine northern shrimp fishery is managed through an interstate agreement between the states of Maine, New Hampshire, and Massachusetts administered by the ASMFC. The principal measures used to control mortality in the fishery have been restrictions on season length and mesh size. In 2003, the ASMFC settled on a 40-day fishing season in the months of January, February, and March 2004, with a prohibition on fishing Saturdays and Sundays. In addition, vessels were required to use the Nordmore grate to reduce finfish bycatch, and there was a prohibition on the use of mechanical “shaking devices” that had been used to cull, grade, or separate catches of shrimp.

3.11.2 Vessels

Two gear types—trawls and traps—are used to harvest northern shrimp. However, in 2004 only 2 percent of the harvest was by vessels using traps, and these vessels were excluded from the analysis. A total of 114 trawl vessels landed northern shrimp in Maine, New Hampshire, and Massachusetts. Vessels averaged 44 feet in length, had gross registered tonnage of 28, and horsepower of 332. Average crew size was 2, and vessels spent an average of 0.47 days at sea per trip (Table 3.11.1). For the season, vessels fished on average 7.6 days and made 16.2 trips (Table 3.11.2).

3.11.3 Methods

Landings per trip for each vessel were initially stratified by fishing zone. There were two fishing zones based on depth—one in water less than 55 fathoms (inshore) and the other in water deeper than 55 fathoms (offshore). Within each fishing zone, observations were then stratified by month and hull type (i.e. wood, steel, fiberglass, other). Fixed inputs used in the DEA model were gross registered tons, horsepower, and vessel length. The variable inputs used for all vessels were crew size and days at sea, and the output was pounds of shrimp landed. The DEA model calculated capacity by trip for each vessel in each month. For strata without enough observations to estimate a DEA model, capacity was set equal to reported landings.

3.11.4 Results

To assess the level of overcapacity, the capacity estimates need to be compared to a TAC for 2004. For the northern shrimp fishery, this is problematic because the technical committee of the ASMFC recommended that there be no directed fishery for northern shrimp in 2004, essentially setting the TAC to zero. However, the ASMFC instead decided to allow a 40-day season in 2004, with mandatory Saturday and Sundays off. Therefore, to have a TAC to compare with the capacity estimates, the 2005 TAC was used.

Reported landings for the shrimp trawl fleet in 2004 were 3.9 million pounds. The lower capacity estimate was 5.1 million pounds and the higher capacity estimate was 9.6 million pounds (Table 3.11.2). The average days at sea per trip were 0.47 in 2004, and 0.54 days per trip were needed to reach capacity. Both the mean crew size and the capacity crew size per trip were approximately 2. Results show overcapacity of 75 percent in relation to the 2005 TAC of 5.5 million pounds based on the higher capacity estimate. The lower capacity estimate is slightly below the 2005 TAC. However, because the vessels were restricted in terms of season length to less than 40 days, clearly there was overcapacity in this fishery in 2004.

Table 3.11.1 Vessel and trip characteristics of the northern shrimp trawl fleet in 2004.

Total Number of Vessels	114
Vessel Length	
Minimum	32
Maximum	72
Median	42
Mean	44
Gross Tonnage	
Minimum	3
Maximum	116
Median	23
Mean	28
Horsepower	
Minimum	165
Maximum	650
Median	320
Mean	332
Trip Characteristics	
Days	
Minimum	0.02
Maximum	0.96
Median	0.48
Mean	0.47
Crew	
Minimum	1
Maximum	5
Median	2
Mean	2.0

Table 3.11.2 Species-specific capacity assessment for vessels in the 2004 northern shrimp fishery (million pounds of shrimp, live weight).

Reported Landings[48]	3.9
Landings Used in the DEA Models	3.6
Percent of Landings Used in the DEA Models[49]	92.3%
TAC	5.5
Lower Capacity Estimate (LCE)	5.1
Higher Capacity Estimate (HCE)	9.6
Lower Excess Capacity Estimate	1.2
Higher Excess Capacity Estimate	5.7
Lower Overcapacity Estimate	-0.4
Higher Overcapacity Estimate	4.1
Reported Landings as a % of the LCE	76%
Reported Landings as a % of the HCE	41%
TAC a % of the Reported Landings	141%
LCE a % of the Reported Landings	132%
HCE a % of the Reported Landings	246%
TAC as a % of the LCE	107%
TAC as a % of the HCE	57%
Reported Landings as a % of the TAC	71%
LCE a % of the TAC	94%
HCE a % of the TAC	175%
Number of Vessels	114
Actual Number of Trips	1,850
Capacity Number of Trips	1,850
Actual Total Days at Sea	870
Capacity Total Days at Sea	999
Actual Days at Sea per Vessel	7.6
Capacity Days at Sea per Vessel	8.8
Actual Days at Sea per Trip	0.47
Capacity Days at Sea per Trip	0.54
Actual Mean Crew Size	2.0
Capacity Mean Crew Size	2.0
Actual Total Crew Days (mean crew size x total days at sea)	1,739
Capacity Total Crew Days	1,998

48 Source: Northeast Region vessel trip reports.

49 Capacity was set equal to reported landings for trips not used in the DEA models.

3.12 Summary of Excess Capacity Assessments in 2004 by FMP

In 2004, there was excess capacity (i.e., estimated harvesting capacity exceeded reported landings) in each of the 11 FMPs for both the lower and higher capacity estimates. For the lower capacity estimates, landings as a percent of harvesting capacity ranged from 49 percent in the northeast multispecies fishery to 95 percent in the Atlantic deep sea red crab fishery (Table 3.12). For the higher capacity estimates, landings as a percent of harvesting capacity ranged from 41 percent in the northern shrimp fishery to 74 percent in both the Atlantic deep sea red crab fishery and the Atlantic mackerel, squid, and butterfish fisheries. Therefore, for the lower capacity estimates, estimated harvesting capacity exceeded reported landings from a low of 6 percent in the Atlantic deep sea red crab fishery to a high to 106 percent in the northeast multispecies fishery; and for 6 of the 11 FMPs, the lower capacity estimate exceeded reported landings by at least 25 percent. Similarly, for the higher capacity estimates, estimated harvesting capacity exceeded reported landings from a low of 34 percent in the Atlantic mackerel, squid, and butterfish fisheries to a high to 146 percent in the northern shrimp fishery; and for 9 of the 11 FMPs, the higher capacity estimate exceeded reported landings by at least 45 percent.

The high level of excess capacity in the multispecies fishery was due in part to the capacity estimates being based on the number of days at sea per vessel in 1991 rather than the actual number of days at sea in 2004, where the latter were severely constrained by vessel-specific days-at-sea limits. Because most of the capacity estimate for monkfish is generated by the multispecies trawl and gillnet fleets, it should be noted that for those trips that were considered directed groundfish trips, the monkfish capacity estimates are based on a level of effort that took place in 1991. For the same reason, the summer flounder, scup, and black sea bass capacity estimates are higher than they would otherwise be. Specifically, for those trips that were considered directed groundfish trips for trawl vessels in the multispecies fishery, species-specific capacity estimates (including those for summer flounder, scup, and black sea bass) are based on expansion of effort to 1991 levels as described in section 3.3.

Table 3.12 Summary of Northeast Region assessments of excess capacity in 2004 by FMP.

FMP	Total Reported Landings	Lower Capacity Estimate (LCE)	Higher Capacity Estimate (HCE)	Lower Excess Capacity Estimate	Higher Excess Capacity Estimate	Total Reported Landings as a % of the LCE	Total Reported Landings as a % of the HCE	The LCE as a % of Total Reported Landings	The HCE as a % of Total Reported Landings
Atlantic Herring	207.5	245.3	403.2	37.8	195.8	85%	51%	118%	194%
Atlantic Deep Sea Red Crab	4.4	4.7	6.0	0.3	1.6	95%	74%	106%	136%
Northeast Multispecies	90.8	186.7	203.0	95.9	112.2	49%	45%	206%	224%
Monkfish	46.7	76.6	89.6	29.9	42.9	61%	52%	164%	192%
Atlantic Sea Scallop	64.4	89.9	122.4	25.5	58.0	72%	53%	140%	190%
Tilefish	2.6	3.2	3.8	0.5	1.2	83%	69%	120%	145%
Atlantic Surfclam and Ocean Quahog	7.1	8.1	10.3	1.0	3.3	87%	68%	115%	146%
Atlantic Mackerel, Squid and Butterfish	211.2	247.3	283.9	36.1	72.8	85%	74%	117%	134%
Summer Flounder, Scup and Black Sea Bass	29.6	42.4	50.2	12.7	20.6	70%	59%	143%	169%
Atlantic Bluefish	7.6	9.6	12.0	2.1	4	78%	63%	127%	159%
Northern Shrimp	3.9	5.1	9.6	1.2	5.7	76%	41%	132%	246%
With two exceptions landings and capacity are in million of pounds live weight. They are reported in million of pounds meat weight for scallops and in millions of bushels for Atlantic surfclams and ocean quahogs.									

APPENDIX 4

Southeast Region Assessment

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1. Introduction

This report presents an assessment of harvesting capacity in 2004 for the commercial fisheries managed under the fishery management plans (FMPs) for: (1) the snapper-grouper fishery of the South Atlantic Region, (2) the coastal migratory pelagic resources of the Gulf of Mexico and South Atlantic, and (3) the reef fish resources of the Gulf of Mexico. An assessment of harvesting capacity for the commercial fisheries managed under the FMPs for the spiny lobster fishery, shallow water reef fish fishery, and queen conch resources of Puerto Rico and the U.S. Virgin Islands is presented in the U.S. Caribbean Region Report.

An assessment was not prepared for the commercial fisheries managed under the FMPs for Atlantic Coast red drum, the shrimp and golden crab fisheries of the South Atlantic Region; the spiny lobster fishery of the Gulf of Mexico and South Atlantic; and the dolphin and wahoo, red drum, stone crab, and shrimp fisheries of the Gulf of Mexico. The reasons for excluding these fisheries from the assessment are presented below.

The shrimp fisheries in both the Atlantic and Gulf suffer from data availability issues. For example, effort data were available for only about 1 percent of the trips, and vessel-specific trip level landings data were not available consistently in 2004. Further, as a fluctuating, climate-linked, annual crop without an annual quota, these fisheries do not lend themselves to an assessment of overcapacity. The spiny lobster and stone crab fisheries occur primarily in Florida State waters, and the federal government effectively defers management to the State of Florida. The golden crab fishery (Atlantic) and the wreckfish fishery (Atlantic) are small, specialty fisheries. They each rely on separate data collection efforts, and these data are not available in the appropriate, standardized form required for the analysis. There is no commercial harvest of red drum in either the Atlantic or the Gulf of Mexico. The regulations of the dolphin/wahoo FMP came into effect after 2004.

Sections 1 through 4 of the National Assessment provide critical background information. Specifically, they explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the four Southeast fisheries will be difficult to understand and could easily be misinterpreted if those sections are not read first.

In line with the national report, the assessment of the Southeast commercial fisheries is by fishery, fleet, and total allowable catch (TAC) species group. The fleets and TAC species groups are identified by fishery in Table 1. “Fleet” refers to a specific part of a fishery and “species group” can refer to one or more individual species. Specifically, “fleets” refers to mutually exclusive sets of trips and not to mutually exclusive sets of vessels. This use of the term is explained by the following points using the example of the snapper-grouper fishery longline fleet: (1) the snapper-grouper fishery longline fleet refers to the trips for which longline gear was used to land snapper-grouper; (2) the assessment of harvesting capacity for that fleet is for such trips and not for the other fishing activities of the vessels that made such trips; (3) if a vessel landed snapper-grouper with longline gear on some trips and with another type of gear on other trips, the vessel was in multiple snapper-grouper fleets; and (4) many vessels in the snapper-grouper fishery longline fleet were also in fleets for other fisheries. In addition, multiple species groups typically were landed together. As a result, many vessels contributed to the landings and, therefore, to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species groups, fleets, or fisheries.

Table 1 Fleets and TAC species groups by fishery.

Snapper-Grouper Fishery of the South Atlantic Region	**Reef Fish Fishery of the Gulf of Mexico**
Fleets Vertical line gear Longline gear Diving gear TAC Species Groups Snowy grouper Golden tilefish Greater amberjack	Fleets Longline gear Vertical line gear Trap gear TAC Species Groups Red snapper Tilefish Deep water grouper Shallow water grouper Red grouper
Coastal Migratory Pelagic Fishery of the South Atlantic	**Coastal Migratory Pelagic Fishery of the Gulf of Mexico**
Fleets Vertical line gear Troll gear Gillnet gear Other gear TAC Species Groups King mackerel Spanish mackerel	Fleets Vertical line gear Troll gear TAC Species Groups King mackerel Spanish mackerel

In the Southeast, this caveat is particularly important because of the multispecies, multi-gear nature of the fisheries. The typical Southeast finfish vessel fishes for a variety of species on each trip and throughout the seasons, constantly adapting to resource, market, and other conditions. Further, the gear-based sub-fleets are not well delineated in the Southeast because many vessels use more than one type of gear during a year. In light of these factors, the merit of a single species capacity, and particularly overcapacity, measure needs to be carefully evaluated. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species if existing management measures did not prevent such a shift. The present analysis, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is somewhat less of a problem for the assessment of harvesting capacity by fleet for all species combined; however, because it is common for vessels to switch between gear types, the problem is not eliminated.

A target catch level, such as the quota for the commercial fisheries, is the reference point used to calculate overcapacity by species group in the national harvesting capacity assessment. In the reports for the other regions, the terms "TAC" or "TAC proxy" refer to the commercial quota. However, throughout this report, the term "commercial quota" or "CQ" is used in lieu of either of those two terms. This difference in terms used does not imply a difference in what was assessed.

The assessment indicates there were low to relatively high rates of excess capacity among the fleets in the four fisheries, there was overcapacity for six area-specific TAC species groups with the lower capacity estimates and for one more species group with the higher capacity estimates, but that reported landings exceed the CQs for only two species groups. The main findings are summarized below by fishery.

South Atlantic Snapper-Grouper Fishery:

1. There were relatively low rates of excess capacity for each of the three fleets.
2. For all fleets combined, harvesting capacity exceeded reported landings by 4 percent and 8 percent, respectively, for the lower and higher capacity estimates.
3. There was no overcapacity for any of the three TAC species groups in 2004.

South Atlantic Coastal Migratory Pelagic Fishery:

1. There were relatively low rates of excess capacity with the lower capacity estimates, but relatively high rates of excess capacity with the higher capacity estimates.
2. For all fleets combined, harvesting capacity exceeded reported landings by 14 percent and 89 percent, respectively, for the lower and higher capacity estimates.
3. There was no overcapacity for king mackerel with the lower capacity estimate and 60 percent overcapacity with the higher capacity estimate, but reported landings were only 72 percent of the king mackerel CQ in 2004.
4. There was overcapacity of 1 percent and 95 percent for Spanish mackerel with the lower and higher capacity estimates, respectively, but only 91 percent of the CQ was taken in 2004.

Gulf Reef Fish Fishery:

1. There were relatively low to moderate rates of excess capacity for each of the three fleets.
2. There were low to higher rates of overcapacity for the five TAC species groups.
3. For all fleets combined, harvesting capacity exceeded reported landings by 13 percent and 20 percent, respectively, for the lower and higher capacity estimates.
4. With the lower capacity estimates, overcapacity was between 4 percent for shallow water grouper and 44 percent for tilefish.

5. With the higher capacity estimates, overcapacity was between 12 and 48 percent, respectively, for shallow water grouper and tilefish.
6. The fact that reported landings exceeded the tilefish and deep water grouper CQs by 28 percent and 21 percent, respectively, is further evidence of overcapacity for those two TAC species groups in 2004.
7. The other three CQs were approached but not exceeded.

Gulf Coastal Migratory Pelagic Fishery:

1. There were low to higher rates of excess capacity for the two fleets.
2. For both fleets combined, harvesting capacity exceeded reported landings by 23 percent and 83 percent, respectively, for the lower and higher capacity estimates.
3. There was no overcapacity for either of the two TAC species groups (king and Spanish mackerel).

It is important to remember that the reported landings—and therefore, the estimates of harvesting capacity and excess capacity for 2004—would have been higher for most if not all fleets in the absence of the management measures that limited the number of trips or landings per trip in 2004. The same is true for the estimates of landings, excess capacity, and overcapacity for most if not all species groups.

The remainder of this report consists of a brief discussion of the methods used to estimate harvesting capacity followed by a separate section for each of the four fisheries. Each fishery-specific section includes the following: (1) a brief description of the main management measures used in the fishery in 2004, with an emphasis on those that limited catch per trip, the number of trips, or both in 2004; (2) a brief description of fleet-specific statistics on the vessel physical characteristics and trip characteristics for the fishing vessels that participated in the fishery in 2004; (3) the assessment results by fleet for all species combined; and (4) the assessment results by TAC species group for all fleets combined.

The summary tables and text present reported landings and the estimates of harvesting capacity, excess capacity, and overcapacity in million pounds live weight, rounded to the nearest 0.1 or 0.01 million pounds (100,000 or 10,000 pounds), and they present percentages that typically are rounded to the nearest 1 percent. In some cases, the rounding might give the impression of internal inconsistencies. For example, the excess capacity estimates may not be exactly equal to the difference between the harvesting capacity and landings estimates in the report. Similarly, the percentage of excess capacity cannot always be reproduced exactly by using the landings data and harvesting capacity estimate in the report.

2. Methods

DEA was used to estimate harvesting capacity by trip and species group. Trips were stratified by area according to their port of landing. Port of landing was used as the first level categorization for all trips. State codes were used to assign trips either to the south Atlantic (NC, SC, GA, and the east coast of FL) or the Gulf of Mexico (west coast of FL including the Keys, AL, MS, LA, and TX). For the DEA models, the South Atlantic and Gulf of Mexico were then divided into two and four sub-regions, respectively, based on county codes. The dividing line in the South Atlantic occurs in northeast Florida. The sub-regions in the Gulf were as follows: The Keys (entire Monroe County), the west coast of the Florida peninsula, the northern Gulf, and the western Gulf.[50] Trips were then further stratified by gear type, target species, season (e.g., month or quarter), and/or area fished. Finally, if there was a clear difference between day trips and longer trips, days at sea were used to delineate these groups.

The record generated for each trip included fixed and variable input data and landings data. Vessel length and horsepower were used as fixed inputs for virtually all strata; in addition, gross tonnage was used for some strata. The number of days at sea and crew size generally were used as the variable inputs; however, when consistently available, the amount of gear used per trip (e.g., the number of sets per trip) often was used as an additional variable input. The Southeast Fisheries Science Center (SEFSC) supplied the trip level data and CQs used in the assessment. The sources for the trip level data and vessel characteristics data were the Southeast Region Coastal Logbook Program and Southeast Region federal commercial fisheries permits databases, respectively. The species groups for the landings data varied by fishery. Landings were divided into 48 species groups, although no stratum contained them all. For this report, all non-TAC species were combined.

A separate DEA model was used to estimate capacity by trip and species group for each stratum. Variables such as area, gear type, target species, and season were used to stratify the data to ensure, to the extent practical, that the trips within a stratum were based on similar technologies. For example, the estimates of trips with longline gear in one area and season were not estimated with data for trips with different gear, areas, or seasons. The importance of including trips with similar technologies within each stratum is discussed more thoroughly in Section 3 of the National Assessment.

Trips with missing or obviously incorrect fixed or variable input data could not be used in the DEA models. Such trips usually were placed in a "miscellaneous" file and the capacity for such trips was set equal to reported landings. Information on the total number of trips, the number of trips used in the DEA models, total reported landings, and the landings used in the models is

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[50] This one-size-fits-all geographic breakdown cannot perfectly match the species-specific management areas for all species considered in this report. For instance, some catch landed in the Florida Keys is assigned to the Atlantic snapper-grouper rather than the Gulf reef fish stocks for management purposes. Hence the comparisons of estimated landings and harvesting capacity, and the Council's commercial quotas used to estimate overcapacity, will not be based on exactly the same geographical area definition and might introduce some bias. The mackerel stocks pose a further problem, in that the jurisdictional boundary varies seasonally within each calendar year across the Atlantic-Gulf break used in this report.

included in Tables 3.2, 4.2, 5.2, and 6.2. The trip level capacity estimates were summed to produce estimates of capacity by vessel as well as the aggregate estimates by fleet or TAC species group presented in this report.

3. Snapper-Grouper Fishery of the South Atlantic Region

The assessment for the snapper-grouper fishery of the South Atlantic Region focused on three fleets that accounted for most of the reported landings in 2004 (vertical line, longline, and diving gear fleets) and the three TAC species groups (snowy grouper, golden tilefish, and greater amberjack). Harvesting capacity was set equal to reported landings for the other fleets, which accounted for a minor part of the total reported landings for the TAC species groups, typically had too few trips to be included in the DEA models, and were not included in the fleet-specific estimates of harvesting capacity presented in Section 3.2.

The South Atlantic snapper-grouper fishery is regulated by the Snapper-Grouper Fishery of the South Atlantic Region FMP. It is a limited access fishery under the jurisdiction of the South Atlantic Fishery Management Council. The snapper-grouper management complex encompasses 73 stocks. A variety of gear types are used to harvest these stocks, including vertical line gear (handline and bandit gear), bottom longlines, gillnet, cast nets, fish pots (traps), and (power) spears while diving. The species harvested vary, to some degree, within the jurisdictional area of the Council (temperate North Carolina to subtropical Florida); however, some stocks are taken throughout this range. Commercial snapper-grouper fishermen also participated in other fisheries.

Given the number of species and complexity of this fishery, the whole spectrum of commercial fishery regulations is used for management, including limited entry, two-for-one transferability of permits, gear restrictions, size limits, special management zones, trip limits, closed seasons, and hard quotas. The latter three methods had the greatest effect on constraining effort, and therefore on the estimates of harvesting capacity and overcapacity for 2004. Until 2006, hard quotas were in place for snowy grouper, golden tilefish, and greater amberjack. In October 2006, species subject to quota management were expanded through Amendment 13C to include red porgy, black sea bass, and vermilion snapper. This Amendment also reduced quotas for snowy grouper and golden tilefish in an effort to end overfishing. In 2008, the Council anticipates submitting Amendment 15 to the Snapper-Grouper FMP, which addresses rebuilding plans for snowy grouper, black sea bass, and red porgy; reductions in bycatch of deepwater snapper-grouper species; prohibition of recreational sale; restrictions on the number of black sea bass tags issued to fishermen and associated number of pots; adjustment of the time period for permit renewal; and other actions. Due to major changes since 2004 in the management and quota levels in this fishery, the results presented in this report for 2004 do not reflect current levels of harvesting capacity, excess capacity, or overcapacity.

The assessment indicates there were relatively low rates of excess capacity for each of the three fleets and no overcapacity for the three TAC species groups in 2004. For individual fleets, estimated harvesting capacity exceeded reported landings by between 1 and 13 percent for the lower capacity estimates and by between 2 and 18 percent for the higher capacity estimates. For all fleets combined, harvesting capacity exceeded reported landings by 4 percent and 8 percent, respectively, for the lower and higher capacity estimates. For the three TAC species groups, the CQs exceeded the lower capacity estimates by between 133 and 231 percent, and they exceeded the higher capacity estimates by between 130 and almost 200 percent. But it should be noted that in 2004 actual landings only amounted to 24 to 41 percent of the CQs.

3.1 Vessel and Trip Characteristics by Fleet

Information on vessel physical characteristics and trip characteristics for the fishing vessels that participated in the South Atlantic snapper-grouper fishery in 2004 is discussed below by fleet (i.e., gear type) and summarized in Table 3.1. As noted above, "fleets" refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing vessels in that fleet. If a fishing vessel was in multiple fleets, it is included in the vessel characteristics statistics for multiple fleets. Vessels or trips without data for a specific characteristic were not included in the statistics reported below for that characteristic. For example, because gross tonnage was available for USCG-registered vessels only, the gross tonnage statistics exclude state-registered boats, which were generally smaller than USCG-registered vessels.

3.1.1 Vertical Line Gear Fleet

The vertical line gear fleet was by far the largest (in terms of the number of boats) and most productive (in terms of total reported landings) of the three South Atlantic snapper-grouper fishery fleets. Landings with vertical line gear were reported for 309 fishing boats in 2004 (Table 3.1). They took a total of 2,792 trips and their total reported landings were about 2.4 million pounds in 2004 (Table 3.2). The boats ranged in length from 20 to 55 feet with a mean of 32 feet. Their gross tonnage was between 1 and 68 tons with a mean of 16. They had between 60 and 900 horsepower with a mean of 332. The days at sea per trip ranged from 1 to 6 with a mean of 1.8. The crew size was between 1 and 6 with a mean of 2.1. The number of lines used per trip ranged from 1 to 30 with a mean of 2.4.

3.1.2 Longline Gear Fleet

Landings with longline gear were reported for 25 fishing boats in 2004 (Table 3.1). They took a total of 169 trips and their total reported landings were about 0.5 million pounds in 2004 (Table 3.2). The boats ranged in length from 24 to 58 feet with a mean of 44 feet. Their gross tonnage was between 10 and 68 tons with a mean of 32. They had between 165 and 900 horsepower with a mean of 394. The days at sea per trip ranged from 1 to 9 with a mean of 4.3. The crew size was between 1 and 4 with a mean of 2.5. The number of sets per trip ranged from 1 to 45 with a mean of 9.4.

3.1.3 Diving Gear Fleet

Landings with diving gear were reported for 38 fishing boats in 2004 (Table 3.1). They took a total of 322 trips and their total reported landings were about 0.2 million pounds in 2004 (Table 3.2). The boats ranged in length from 22 to 46 feet with a mean of 31 feet. Their gross tonnage was between 3 and 34 tons with a mean of 15. They had between 115 and 850 horsepower with a mean of 302. The days at sea per trip ranged from 1 to 7 with a mean of 1.8. The crew size was between 1 and 4 with a mean of 2. The number of divers per trip ranged from 1 to 5 with a mean of 1.9.

Table 3.1 Vessel and trip characteristics by fleet for vessels in the 2004 snapper-grouper fishery of the South Atlantic Region.

	Vessel Characteristics				Trip Characteristics		
Fleet	Vertical Line	Longline	Diving		Vertical Line	Longline	Diving
Total Number of Vessels	309	25	38				
Vessel Length				Days at Sea			
Minimum	20	24	22	Minimum	1	1	1
Maximum	55	58	46	Maximum	6	9	7
Median	31	44	29	Median	1.0	4.0	1.0
Mean	32	44	31	Mean	1.8	4.3	1.8
Gross Tonnage[1]				Crew Size			
Minimum	1	10	3	Minimum	1	1	1
Maximum	68	68	34	Maximum	6	4	4
Median	15	30	14	Median	2.0	2.0	2.0
Mean	16	32	15	Mean	2.1	2.5	2.0
Horsepower[2]				Number of Sets[3]			
Minimum	60	165	115	Minimum	1	1	1
Maximum	900	900	850	Maximum	30	45	5
Median	300	325	270	Median	2.0	7.0	2.0
Mean	332	394	302	Mean	2.4	9.4	1.9

1. The gross tonnage data are based on USCG-registered vessels only; this results in an upward bias for the reported minimums, means, and medians, because state-registered boats were generally smaller than USCG-registered vessels.
2. Due to reporting irregularities, the horsepower data provide only a rough index of actual horsepower.
3. For vertical line, this is the number of lines used; for longline, it is the number of sets; and for diving, it is the number of divers.

Sources: Southeast Region Coastal Logbook Program and Southeast Region federal commercial fisheries permit databases.

3.2 Harvesting Capacity Assessment by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 3.2. The results of the assessment by species group for all fleets combined are presented in Section 3.3. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and thus the harvesting capacity estimates for multiple fleets).

3.2.1 Vertical Line Gear Fleet

The vertical gear fleet had total reported landings of almost 2.4 million pounds in 2004, and the lower and higher capacity estimates were over 2.4 million and 2.5 million pounds (Table 3.2). Therefore, estimated capacity exceeded reported landings in 2004 by less than 0.1 million pounds or 3 percent for the lower capacity estimate, and by more than 0.1 million pounds or 6 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 95 percent of its higher capacity level and 97 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 5 percent or 3 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+1%), mean crew size (0%), total crew days (+1%), and mean number of lines used per trip (–4%).

3.2.2 Longline Gear Fleet

The longline gear fleet had total reported landings of 0.54 million pounds in 2004, and the lower and higher capacity estimates were 0.61 million and 0.64 million pounds (Table 3.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.07 million pounds or 13 percent for the lower capacity estimate, and by 0.1 million pounds or 18 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 84 percent of its higher capacity level and 89 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 16 percent or 11 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+1%), mean crew size (+4%), total crew days (+5%), and mean number of sets per trip (+2%).

3.2.3 Diving Gear Fleet

The diving gear fleet had total reported landings of just under 0.20 million pounds in 2004, and the lower and higher capacity estimates were just under 0.20 million and just over 0.20 million pounds (Table 3.2). Therefore, estimated capacity exceeded reported landings in 2004 by 1,000 pounds or less than 1 percent for the lower capacity estimate, and by 4,000 pounds or 2 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 98 percent of its higher capacity level and 99 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 2 percent or 1 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+1%), mean crew size (+5%), total crew days (+6%), and mean number of divers per trip (+0%).

3.2.4 All Fleets Combined

All fleets combined had total reported landings of 3.1 million pounds in 2004, and the lower and higher capacity estimates were 3.2 million and just over 3.3 million pounds (Table 3.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.1 million pounds or 4 percent for the lower capacity estimate, and by over 0.2 million pounds or 8 percent for the higher capacity estimate. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at 93 percent of their higher capacity level and 96 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 7 percent or 4 percent less capacity would have been able to make the reported landings if they had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea (+1%) and total crew days (+2%).

Table 3.2 Harvesting capacity assessment by fleet for vessels in the 2004 snapper-grouper fishery of the South Atlantic Region for all species combined (million pounds, live weight).

	Vertical Line	Longline	Diving	Total
Landings				
Reported Landings	2.4	0.54	0.20	3.1
Landings Used in the DEA Models	2.1	0.43	0.18	2.7
Percent of Landings Used in the DEA Models	88%	80%	89%	87%
Lower Capacity Estimate (LCE)	2.4	0.61	0.20	3.2
Higher Capacity Estimate (HCE)	2.5	0.64	0.20	3.4
Lower Excess Capacity Estimate	0.1	0.07	0.00	0.1
Higher Excess Capacity Estimate	0.1	0.10	0.00	0.2
LCE as a % of Landings	103%	113%	101%	104%
HCE as a % of Landings	106%	118%	102%	108%
Reported Landings as a % of the LCE	97%	89%	99%	96%
Reported Landings as a % of the HCE	95%	84%	98%	93%
Number of Vessels	309	25	38	-
Numbers of trips				
Actual	2,792	169	322	3,283
Used in the DEA Models	2,193	133	283	2,609
Total Days at Sea				
Actual	5,151	725	575	6,451
Capacity	5,202	730	579	6,511
Mean Days at Sea per Vessel				
Actual	16.7	29.0	15.1	-
Capacity	16.8	29.2	15.2	-
Days at Sea per Trip				
Actual	1.8	4.3	1.8	-
Capacity	1.9	4.3	1.8	-
Mean Crew Size				
Actual	2.1	2.5	2.0	-
Capacity	2.1	2.6	2.1	-
Total Crew Days (mean crew size x total days at sea)				
Actual	10,817	1,813	1,150	13,780
Capacity	10,924	1,898	1,216	14,038
Mean Number of Sets[1]				
Actual	2.4	9.4	1.9	-
Capacity	2.3	9.6	1.9	-

1. For vertical line, this is the number of lines used; for longline, it is the number of sets; and for diving, it is the number of divers.

3.3. Harvesting Capacity Assessment by TAC Species Group for All Fleets Combined

3.3.1 Snowy Grouper

The reported landings of snowy grouper for all fleets combined were 0.17 million pounds in 2004, and the lower and higher capacity estimates were over 0.17 million and under 0.18 million pounds (Table 3.3). Estimated capacity exceeded reported landings in 2004 by 7,000 pounds or 4 percent for the lower capacity estimate, and by 9,000 pounds or 5 percent for the higher capacity estimate. This means the fleets would have landed that much more snowy grouper if they had operated at capacity in 2004. It also means the fleets were operating at 95 percent of their higher capacity level and 96 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 5 percent or 4 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was some excess capacity, the species-specific capacity estimates for snowy grouper were below the CQ of 0.41 million pounds, and only 41 percent of the CQ was taken in 2004. The lower capacity estimate (0.17 million pounds) was 0.23 million pounds less than the CQ, or only 43 percent of the CQ. The higher capacity estimate (0.18 million pounds) was 43 percent of the CQ, or 0.23 million pounds less than the CQ. This means that for the lower or higher capacity estimates, respectively, larger fleets with 133 percent or 130 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on snowy grouper. However, in 2006 the CQ was lowered to only 0.14 million pounds. If this lower CQ had been used in 2004, there would have been overcapacity for snowy grouper in 2004 with both capacity estimates.

3.3.2 Golden Tilefish

The reported landings of golden tilefish for all fleets combined were 0.27 million pounds in 2004, and the lower and higher capacity estimates were 0.34 million and 0.38 million pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.07 million pounds or 25 percent for the lower capacity estimate, and by 0.1 million pounds or 38 percent for the higher capacity estimate. This means the fleets would have landed that much more golden tilefish if they had operated at capacity in 2004. It also means the fleets were operating at only 72 percent of their higher capacity level and 80 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 28 percent or 20 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, the species-specific capacity estimates for golden tilefish were below the CQ of 1.12 million pounds, and only 21 percent of the CQ was taken in 2004. The lower capacity estimate (0.34 million pounds) was 0.78 million pounds less than the CQ, or only 30 percent of the CQ. The higher estimate (0.38 million pounds) was 0.75 million pounds less than the CQ (33 percent of the CQ). This means that for the lower or higher capacity estimates, respectively, larger fleets with 231 percent or 199 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on tilefish. However, in 2006 the CQ was lowered to only 0.33 million pounds. If this lower CQ had been used in 2004, there would have been overcapacity for golden tilefish in 2004 with both capacity estimates.

3.3.3 Greater Amberjack

The reported landings of greater amberjack for all fleets combined were 0.36 million pounds in 2004, and the lower and higher capacity estimates were 0.40 million and 0.46 million pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.04 million pounds or 12 percent for the lower capacity estimate, and by 0.10 million pounds or 28 percent for the higher capacity estimate. This means the fleets would have landed that much more greater amberjack if they had operated at capacity in 2004. It also means the fleets were operating at 78 percent of their higher capacity level and 89 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 22 percent or 11 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was some excess capacity, the species-specific capacity estimates for greater amberjack were less than the CQ of 1.21 million pounds, and only 30 percent of the CQ was taken in 2004. The lower capacity estimate (0.40 million pounds) was 33 percent of the CQ, or 0.81 million pounds below the CQ. The higher capacity estimate (0.46 million pounds) was 0.76 million pounds below the CQ, or only 38 percent of the CQ. This means that for the lower or higher capacity estimates, respectively, larger fleets with 201 percent or 164 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on greater amberjack.

Table 3.3 Harvesting capacity assessment by TAC species group for all fleets combined in the 2004 snapper-grouper fishery of the South Atlantic Region (million pounds, live weight).

	Snowy Grouper	Golden Tilefish	Greater Amberjack
Landings	0.17	0.27	0.36
CQ	0.41	1.12	1.22
Lower Capacity Estimate (LCE)	0.17	0.34	0.40
Higher Capacity Estimate (HCE)	0.18	0.38	0.46
Lower Excess Capacity Estimate	0.01	0.07	0.04
Higher Excess Capacity Estimate	0.01	0.10	0.10
LCE as a % of Landings	104%	125%	112%
HCE as a % of Landings	105%	138%	128%
Landings as a % of the LCE	96%	80%	89%
Landings as a % of the HCE	95%	72%	78%
Lower Overcapacity Estimate	-0.23	-0.78	-0.81
Higher Overcapacity Estimate	-0.23	-0.75	-0.76
LCE as a % of CQ	43%	30%	33%
HCE as a % of CQ	43%	33%	38%
Landings as a % of the CQ	41%	24%	30%
CQ as a % of LCE	233%	331%	301%
CQ as a % of HCE	230%	299%	264%

Note: Harvesting capacity was set equal to reported landings for the fleets that accounted for a minor part of the total reported landings for the TAC species groups, that typically had too few trips to be included in the DEA models, and that were not included in the fleet-specific estimates of harvesting capacity in Table 3.2. Therefore, the estimates in this table are for all fleets with reported landings of the TAC species groups.

4. Coastal Migratory Pelagic Fishery of the South Atlantic

The assessment for the coastal migratory pelagic fishery of the South Atlantic Region focused on the four fleets that accounted for most of the reported landings in 2004 (vertical line, troll, gillnet, and other gear fleets) and the two TAC species groups (king mackerel and Spanish mackerel).

This is principally a mackerel fishery. The South Atlantic mackerel fisheries are regulated by the Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic FMP. Because king and Spanish mackerel are migratory, they are only available seasonally, and are managed jointly throughout the Southeast Region. Based on the historical importance of the commercial fishery off Florida, management has allocated the majority of the commercial quota to the Florida area, and most fish are taken in south Florida from November through March. Spanish mackerel is of somewhat less importance. Both species are caught predominantly by hook and line, gillnet, and cast net gear. Mackerel fishermen participate in other fisheries when the mackerel fisheries are closed.

There has been a moratorium on the issuance of commercial king mackerel vessel permits since 1998, but existing permits are transferable. There is no moratorium on issuance of commercial Spanish mackerel vessel permits, but fishermen must meet income requirements to obtain a permit. The most prominent management features are gear restrictions, size limits, trip limits, and hard quotas assigned to various regional zones in the Gulf of Mexico and South Atlantic areas. The regulations most constraining of effort (and therefore of the estimates of harvesting capacity and overcapacity for 2004) were trip limits and the quotas. In 2004, the commercial quotas were not taken in the South Atlantic. The management regime for mackerel has not substantially changed since 2004. The time-limited moratorium on the issuance of new commercial vessel permits was replaced with a specific limited access program in 2005.

The assessment indicates that, for each of the four fleets, there were relatively low rates of excess capacity with the lower capacity estimates, but relatively high rates of excess capacity with the higher capacity estimates. For individual fleets, estimated harvesting capacity exceeded reported landings by between 3 and 19 percent for the lower capacity estimates, but by between 55 and 145 percent for the higher capacity estimates. For all fleets combined, harvesting capacity exceeded reported landings by 14 percent and 89 percent, respectively, for the lower and higher capacity estimates. For king mackerel, there was no overcapacity with the lower capacity estimate, but there was 60 percent overcapacity with the higher capacity estimate. However, reported landings were only 72 percent of the CQ. There was overcapacity of 1 percent and 95 percent for Spanish mackerel with the lower and higher capacity estimates, respectively, but only 91 percent of the CQ was taken in 2004.

4.1 Vessel and Trip Characteristics by Fleet

Information on vessel physical characteristics and trip characteristics for the fishing vessels that participated in the South Atlantic coastal migratory pelagic fishery in 2004 is discussed below by fleet (i.e., gear type) and summarized in Table 4.1. As noted above, “fleets” refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing vessels in that fleet. If a fishing vessel was in multiple fleets, it is included in the vessel characteristics statistics for multiple fleets. Vessels or trips without data for a specific characteristic were not included in the statistics reported below for that characteristic. For example, because gross tonnage was available for USCG-registered vessels only, the gross tonnage statistics exclude state-registered boats, which were generally smaller than USCG-registered vessels.

4.1.1 Vertical Line Gear Fleet

The vertical line gear fleet was the largest (in terms of the number of boats) and most productive (in terms of reported landings) of the four South Atlantic coastal migratory pelagic fishery fleets. Landings with vertical line gear were reported for 432 boats in 2004 (Table 4.1). They took a total of 4,967 trips and their total reported landings were about 2.3 million pounds in 2004 (Table 4.2). The boats ranged in length from 17 to 56 feet with a mean of 30 feet. Their gross tonnage was between 1 and 68 tons with a mean of 15. They had between 60 and 900 horsepower with a mean of 306. The days at sea per trip ranged from 1 to 6 with a mean of 1.1. The crew size was between 1 and 5 with a mean of 1.5. The number of lines used per trip ranged from 1 to 10 with a mean of 2.4.

4.1.2 Troll Gear Fleet

Landings with troll gear were reported for 325 boats in 2004 (Table 4.1). They took a total of 6,545 trips and their total reported landings were about 1.8 million pounds in 2004 (Table 4.2). The boats ranged in length from 17 to 57 feet with a mean of 30 feet. Their gross tonnage was between 1 and 54 tons with a mean of 13. They had between 85 and 870 horsepower with a mean of 308. The days at sea per trip ranged from 1 to 6 with a mean of 1. The crew size was between 1 and 8 with a mean of 1.2. The number of lines used per trip ranged from 1 to 8 with a mean of 3.

4.1.3 Gillnet Gear Fleet

Landings with gillnet gear were reported for 52 boats in 2004 (Table 4.1). They took a total of 1,213 trips and their total reported landings were over 1 million pounds in 2004 (Table 4.2). The boats ranged in length from 22 to 54 feet with a mean of 34 feet. Their gross tonnage was between 3 and 36 tons with a mean of 16. They had between 135 and 720 horsepower with a mean of 323. The days at sea per trip ranged from 1 to 3 with a mean of 1.1. The crew size was between 1 and 6 with a mean of 1.7. Data on the number of sets per trip were not available consistently for this fleet.

4.1.4 Other Gear Fleet

The other gear category includes cast net, trap, spear (diving), and longline gear, although cast net gear accounts for the large majority of the trips. Landings with other gear were reported for 98 boats in 2004 (Table 4.1). They took a total of 729 trips and their total reported landings were about 0.9 million pounds in 2004 (Table 4.2). The boats ranged in length from 17 to 58 feet with a mean of 30 feet. Their gross tonnage was between 1 and 68 tons with a mean of 17. They had between 88 and 750 horsepower with a mean of 287. The days at sea per trip ranged from 1 to 8 with a mean of 1.2. The crew size was between 1 and 5 with a mean of 1.7. Due to the mix of different types of gear, the effort variable "number of sets per trip" could not be used for this fleet.

Table 4.1 Vessel and trip characteristics by fleet for vessels in the 2004 coastal migratory pelagic fishery of the South Atlantic Region.

	Vessel Characteristics					Trip Characteristics			
Fleet	Vertical Line	Troll	Gillnet	Other		Vertical Line	Troll	Gillnet	Other
Total Number of Vessels	432	325	52	98					
Vessel Length					Days at Sea				
Minimum	17	17	22	17	Minimum	1	1	1	1
Maximum	56	57	54	58	Maximum	6	6	3	8
Median	28	29	34	27	Median	1.0	1.0	1.0	1
Mean	30	30	34	30	Mean	1.1	1.0	1.1	1.2
Gross Tonnage[1]					Crew Size				
Minimum	1	1	3	1	Minimum	1	1	1	1
Maximum	68	54	36	68	Maximum	5	8	6	5
Median	12	11	16	14	Median	1.0	1.0	1.0	2
Mean	15	13	16	17	Mean	1.5	1.2	1.7	1.7
Horsepower[2]					Number of Sets per Trip[3]				
Minimum	60	85	135	88	Minimum	1	1	-	-
Maximum	900	870	720	750	Maximum	10	8	-	-
Median	270	275	300	250	Median	2.0	3.0	-	-
Mean	306	308	323	287	Mean	2.4	3.0	-	-

1. The gross tonnage data are based on USCG-registered vessels only; this results in an upward bias for the reported minimums, means, and medians because state-registered boats were generally smaller than USCG-registered vessels.
2. Due to reporting irregularities, the horsepower data provide only a rough index of actual horsepower.
3. For vertical line and troll, this is the number of lines used. Data on the number of sets were not available consistently for the gillnet and other gear fleets.

Sources: Southeast Region Coastal Logbook Program and Southeast Region federal commercial fisheries permit databases.

4.2 Harvesting Capacity Assessment by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 4.2. The results of the assessment by species group for all fleets combined are in Section 4.3. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and thus the harvesting capacity estimates for multiple fleets).

4.2.1 Vertical Line Gear Fleet

The vertical line gear fleet had total reported landings of 2.3 million pounds in 2004, and the lower and higher capacity estimates were 2.7 million and 3.8 million pounds (Table 4.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.4 million pounds or 16 percent for the lower capacity estimate, and by 1.5 million pounds or 65 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 61 percent of its higher capacity level and 86 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 39 percent or 14 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (0%), mean crew size (+7%), total crew days (+7%), and mean number of lines used per trip (–4%).

4.2.2 Troll Gear Fleet

The troll gear fleet had total reported landings of 1.8 million pounds in 2004, and the lower and higher capacity estimates were 2.2 million and 3.9 million pounds (Table 4.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.4 million pounds or 19 percent for the lower capacity estimate, and by 2.1 million pounds or 113 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 47 percent of its higher capacity level and 84 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 53 percent or 16 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+2%), mean crew size (+1%), total crew days (+3%), and mean number of lines used per trip (0%).

4.2.3 Gillnet Gear Fleet

The gillnet gear fleet had total reported landings of 1.03 million pounds in 2004, and the lower and higher capacity estimates were 1.06 million and 1.59 million pounds (Table 4.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.03 million pounds or 3 percent for the lower capacity estimate, and by almost 0.56 million pounds or 55 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 65 percent of its higher capacity level and 97 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 35 percent or 3 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (–2%), mean crew size (–6%), and total crew days (–7%).

4.2.4 Other Gear Fleet

The other gear fleet had total reported landings of just under 0.9 million pounds in 2004, and the lower and higher capacity estimates were just over 0.9 million and 2.1 million pounds (Table 4.2). Therefore, estimated capacity exceeded reported landings in 2004 by almost 0.1 million pounds or 9 percent for the lower capacity estimate, and by over 1.2 million pounds or 145 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 41 percent of its higher capacity level and 92 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 59 percent or 8 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (0%), mean crew size (–2%), and total crew days (–2%).

4.2.5 All Fleets Combined

All fleets combined had total reported landings of 6 million pounds in 2004, and the lower and higher capacity estimates were 6.9 million and 11.4 million pounds (Table 4.2). Therefore, estimated capacity exceeded reported landings in 2004 by more than 0.8 million pounds or 14 percent for the lower capacity estimate, and by 5.4 million pounds or 89 percent for the higher capacity estimate. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 53 percent of their higher capacity level and 88 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 47 percent or 12 percent less capacity would have been able to make the reported landings if they had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea (+1%) and total crew days (+3%).

Table 4.2 Harvesting capacity assessment by fleet for vessels in the 2004 coastal migratory pelagic fishery of the South Atlantic Region for all species combined (million pounds, live weight).

	Vertical Line	Troll	Gillnet	Other	Total
Reported Landings	2.3	1.8	1.03	0.86	6.0
Landings Used in the DEA Models	1.9	1.6	0.89	0.75	5.2
Percent of Landings Used in the DEA Models	82%	89%	86%	87%	85%
Lower Capacity Estimate (LCE)	2.7	2.2	1.06	0.94	6.9
Higher Capacity Estimate (HCE)	3.8	3.9	1.59	2.10	11.4
Lower Excess Capacity Estimate	0.4	0.4	0.03	0.08	0.8
Higher Excess Capacity Estimate	1.5	2.1	0.56	1.24	5.4
LCE as a % of Landings	116%	119%	103%	109%	114%
HCE as a % of Landings	165%	213%	155%	245%	189%
Reported Landings as a % of the LCE	86%	84%	97%	92%	88%
Reported Landings as a % of the HCE	61%	47%	65%	41%	53%
Number of Vessels	432	325	52	98	-
Numbers of trips					
Actual	4,967	6,545	1,213	729	13,454
Used in the DEA Models	3,410	4,540	990	646	9,586
Total Days at Sea					
Actual	5,701	6,741	1,284	852	14,578
Capacity	5,716	6,872	1,262	852	14,702
Mean Days at Sea per Vessel					
Actual	13.2	20.7	24.7	8.7	-
Capacity	13.2	21.1	24.3	8.7	-
Days at Sea per Trip					
Actual			1.1	1.2	-
Capacity	1.2	1.1	1.0	1.2	-
Mean Crew Size					
Actual	1.5	1.2	1.7	1.7	-
Capacity	1.6	1.2	1.6	1.7	-
Total Crew Days (mean crew size x total days at sea)					
Actual	8,552	8,157	2,183	1,484	20,375
Capacity	9,146	8,384	2,019	1,448	20,997
Number of Sets per Trip[1]					
Actual	2.4	3.0	-	-	-
Capacity	2.3	3.0	-	-	-

1. For vertical line and troll gear, this is the number of lines used per trip. Data on the number of sets were not available consistently for the gillnet and other gear fleets.

4.3. Harvesting Capacity Assessment by TAC Species Group for All Fleets Combined

4.3.1 King Mackerel

The reported landings of king mackerel for all fleets combined were 2.7 million pounds in 2004, and the lower and higher capacity estimates were 3.3 million and 5.9 million pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.6 million pounds or 22 percent for the lower capacity estimate, and by almost 3.3 million pounds or 123 percent for the higher capacity estimate. This means the fleets would have landed that much more king mackerel if they had operated at capacity in 2004. It also means the fleets were operating at only 45 percent of their higher capacity level and 82 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 55 percent or 18 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity with both estimates of harvesting capacity, the lower species-specific capacity estimate for king mackerel in 2004 was less than the CQ (3.7 million pounds). The lower capacity estimate (3.3 million pounds) was 0.4 million pounds below the CQ, or only 88 percent of the CQ. This means that, for the lower capacity estimate, larger fleets with 14 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on king mackerel.

However, the higher capacity estimate exceeded the CQ by 2.2 million pounds, or 60 percent. This means that, for the higher estimate of capacity, smaller fleets with 38 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. Although there was excess capacity with both capacity estimates and overcapacity with the higher capacity estimate, only 72 percent of the king mackerel CQ was taken in 2004.

4.3.2 Spanish Mackerel

The reported landings of Spanish mackerel for all fleets combined were 3.5 million pounds in 2004, and the lower and higher species-specific capacity estimates were 3.9 million and 7.6 million pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.4 million pounds or 11 percent for the lower capacity estimate, and by 4 million pounds or 114 percent for the higher capacity estimate. This means the fleets would have landed that much more Spanish mackerel if they had operated at capacity in 2004. It also means the fleets were operating at 47 percent of their higher capacity level and 90 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 53 percent or 10 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The Spanish mackerel CQ was 3.9 million pounds in 2004. Species-specific capacity estimates exceeded the CQ by less than 0.05 million pounds or 1 percent for the lower capacity estimate, and by 3.7 million pounds or 95 percent for the higher capacity estimate. This means that for the lower or higher estimates of capacity, respectively, smaller fleets with 1 percent or 49 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for Spanish mackerel, the CQ was not exceeded—91 percent of the CQ was taken in 2004.

The assessment of harvesting capacity in this report generally is based on vessel and trip-specific federal logbook data and not on Accumulated Landings System (ALS) data because the ALS data do not consistently provide trip level data by vessel. The ALS is a database composed of dealer catch reports collected by the states. Due to the characteristics of both the Spanish mackerel fishery and the logbook program, the logbook data exclude a significant part of the total Spanish mackerel landings. The logbooks are a federal program implemented for federally managed species, usually species caught to a large degree in the EEZ. For the Spanish mackerel fishery conducted to a large degree in nearshore (i.e. state) waters by vessels that might not have any federal permit, a substantial part of the total landings reported in the ALS is not included in the landings reported in the federal logbooks. In 2004, the Spanish mackerel landings reported in the logbooks were 48 percent and 25 percent, respectively, of the ALS estimates of landings in the South Atlantic and Gulf of Mexico. For Spanish mackerel, the ALS landings data are likely to be more accurate than the logbook data. To correct for the landings that were not included in the logbook data, the estimates of Spanish mackerel landings and harvesting capacity based on the logbook data were adjusted using a multiplier equal to the ratio of total reported ALS landings to total reported logbook landings for Spanish mackerel. These adjustments were made to generate only the landings and harvesting capacity estimates presented in this section and in Section 6.3.2, which is the corresponding section for Gulf of Mexico Spanish mackerel.

Table 4.3 Harvesting capacity assessment by TAC species group for all fleets combined in the 2004 coastal migratory pelagic fishery of the South Atlantic Region (million pounds, live weight).

	King Mackerel	Spanish Mackerel
Landings	2.7	3.5
CQ	3.7	3.9
Lower Capacity Estimate (LCE)	3.3	3.9
Higher Capacity Estimate (HCE)	5.9	7.6
Lower Excess Capacity Estimate	0.6	0.4
Higher Excess Capacity Estimate	3.3	4.0
LCE as a % of Landings	122%	111%
HCE as a % of Landings	223%	214%
Landings as a % of the LCE	82%	90%
Landings as a % of the HCE	45%	47%
Lower Overcapacity Estimate	-0.4	0.0
Higher Overcapacity Estimate	2.2	3.7
LCE as a % of CQ	88%	101%
HCE as a % of CQ	160%	195%
Landings as a % of the CQ	72%	91%
CQ as a % of LCE	114%	99.2%
CQ as a % of HCE	63%	51.3%

5. Reef Fish Fishery of the Gulf of Mexico

The assessment for the reef fish fishery of the Gulf of Mexico focused on the three fleets that accounted for most of the reported landings in 2004 (longline, vertical line and trap gear fleets) and the five TAC species groups (red snapper, tilefish, deep water grouper, shallow water grouper, and red grouper, where red grouper is part of the shallow water grouper complex). Harvesting capacity was set equal to reported landings for the other fleets, which accounted for a minor part of the total reported landings for the TAC species groups, typically had too few trips to be included in the DEA models, and were not included in the fleet-specific estimates of harvesting capacity presented in Section 5.2.

The Gulf reef fishery is regulated by the FMP for Reef Fish Resources in the Gulf of Mexico. It is a limited access fishery under the jurisdiction of the Gulf of Mexico Fishery Management Council. The fishery management unit encompasses a large variety of species (currently 42). Commercial fishermen primarily target snapper and grouper, with red and gag grouper, red and vermilion snapper, and greater amberjack being the most common targets. The grouper fishery occurs mainly along the west coast of Florida (northeastern Gulf coast), while the snapper fishery occurs primarily along the northern and western Gulf coasts. A variety of gears are used to harvest reef fish, including vertical line gear (handline and bandit gear), bottom longline, fish traps, and (power) spears while diving. Commercial reef fish fishermen also participate in other fisheries.

Given the number of species and complexity of this fishery, the whole spectrum of commercial fishery regulations is used to manage this fishery, including gear restrictions, size limits, trip limits, a complex system of variable closed seasons, and hard quotas. The latter three were the regulations most constraining of effort (and therefore of the estimates of harvesting capacity and overcapacity for 2004). Quotas exist for red snapper, tilefish, deep-water grouper, and shallow-water grouper, the last of which contains a sub-quota for red grouper. Prior to 2004, these annual quotas were not met. However, with a 2004 reduction in the deep-water and shallow-water grouper quotas, the deep-water grouper quota was met in mid-July 2004 and the red grouper sub-quota was met in mid-November, closing the entire shallow-water grouper fishery. Major new regulations implemented since 2004 to constrain harvesting capacity in the reef fishery include the prohibition of fish traps (February 2007) and implementation of a commercial red snapper IFQ program (January 2007).

The assessment indicates there were relatively low to moderate rates of excess capacity for each of the three fleets, and low to higher rates of overcapacity for the five TAC species groups. For individual fleets, estimated harvesting capacity exceeded reported landings by between 10 percent and 15 percent for the lower capacity estimates, and by between 14 and 25 percent for the higher capacity estimates. For all fleets combined, harvesting capacity exceeded reported landings by 13 percent and 20 percent, respectively, for the lower and higher capacity estimates. With the lower capacity estimates, overcapacity was between 4 percent for shallow water grouper and 44 percent for tilefish; and with the higher capacity estimates, overcapacity was between 12 and 48, respectively, for shallow water grouper and tilefish. The fact that reported landings exceeded the tilefish and deep water grouper CQs by 28 percent and 21 percent, respectively, is further evidence of overcapacity for those two TAC species groups. The other three CQs were approached but not exceeded.

5.1 Vessel and Trip Characteristics by Fleet

Information on vessel physical characteristics and trip characteristics for the fishing vessels that participated in the Gulf of Mexico reef fish fishery in 2004 is discussed below by fleet (i.e., gear type) and summarized in Table 5.1. As noted above, "fleets" refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing vessels in that fleet. If a fishing vessel was in multiple fleets, it is included in the vessel characteristics statistics for multiple fleets. Vessels or trips without data for a specific characteristic were not included in the statistics reported below for that characteristic. For example, because gross tonnage was available for only USCG-registered vessels, the gross tonnage statistics exclude state-registered boats, which were generally smaller than USCG-registered vessels.

5.1.1 Longline Gear Fleet

Landings with longline gear were reported for 165 boats in 2004 (Table 5.1). They took a total of 1,976 trips and their total reported landings were about 8.4 million pounds in 2004 (Table 5.2). The boats ranged in length from 31 to 77 feet with a mean of 46 feet. Their gross tonnage was between 9 and 170 tons with a mean of 35. They had between 76 and 860 horsepower with a mean of 292. The days at sea per trip ranged from 1 to 15 with a mean of 7.2. The crew size was between 1 and 5 with a mean of 3.2. The number of sets per trip ranged from 1 to 79 with a mean of 19.4.

5.1.2 Vertical Line Gear Fleet

The vertical line gear fleet was the largest (in terms of the number of boats) and most productive (in terms of total reported landings) of the three Gulf of Mexico reef fish fishery fleets. Landings with vertical line gear were reported for 994 boats in 2004 (Table 5.1). They took a total of 11,533 trips and their total reported landings were about 11.1 million pounds in 2004 (Table 5.2). The boats ranged in length from 12 to 75 feet with a mean of 35 feet. Their gross tonnage was between 1 and 94 tons with a mean of 22. They had between 50 and 1,300 horsepower with a mean of 344. The days at sea per trip ranged from 1 to 4 with a mean of 1.4. The crew size was between 1 and 5 with a mean of 2.5. The number of lines used per trip ranged from 1 to 10 with a mean of 3.1.

5.1.3 Trap Gear Fleet

The trap gear fishery was small (in terms of the number of boats and reported landings) compared to the other two Gulf of Mexico reef fish fisheries. Landings with trap gear were reported for 41 boats in 2004 (Table 5.1). They took a total of 322 trips and their total reported landings were about 1 million pounds in 2004 (Table 5.2). The boats ranged in length from 31 to 61 feet with a mean of 41 feet. Their gross tonnage was between 11 and 72 tons with a mean of 26. They had between 165 and 1,400 horsepower with a mean of 502. The days at sea per trip ranged from 1 to 11 with a mean of 5.1. The crew size was between 1 and 6 with a mean of 2.5. The number of traps used per trip ranged from 3 to 100 with a mean of 73.8. As noted above, the use of traps was prohibited in federal waters of the Gulf of Mexico as of February 2007.

Table 5.1 Vessel and trip characteristics by fleet for vessels in the 2004 reef fish fishery of the Gulf of Mexico.

	Vessel Characteristics				Trip Characteristics		
Fleet	Longline	Vertical Line	Trap		Longline	Vertical Line	Trap
Total Number of Vessels	165	994	41				
Vessel Length				Days at Sea			
Minimum	31	12	31	Minimum	1	1	1
Maximum	77	75	61	Maximum	15	4	11
Median	43	34	40	Median	7.0	2.0	6.0
Mean	46	35	41	Mean	7.2	1.4	5.1
Gross Tonnage[1]				Crew Size			
Minimum	9	1	11	Minimum	1	1	1
Maximum	170	94	72	Maximum	5	5	6
Median	29	18	22	Median	3.0	2.0	2.0
Mean	35	22	26	Mean	3.2	2.5	2.5
Horsepower[2]				Number of Sets[3]			
Minimum	76	50	165	Minimum	1	1	3
Maximum	860	1300	1400	Maximum	79	10	100
Median	250	300	471	Median	17.0	2.0	78.0
Mean	292	344	502	Mean	19.4	3.1	73.6

1. The gross tonnage data are based on USCG-registered vessels only; this results in an upward bias for the reported minimums, means, and medians because state-registered boats were generally smaller than USCG-registered vessels.
2. Due to reporting irregularities, the horsepower data provide only a rough index of actual horsepower.
3. For longline, this is number of sets; for vertical line, it is the number of lines used; and for traps, it is the number of traps used.

Sources: Southeast Region Coastal Logbook Program and Southeast Region federal commercial fisheries permit databases.

5.2 Harvesting Capacity Assessment by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 5.2. The results of the assessment by species group for all fleets combined are presented in Section 5.3. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and thus the harvesting capacity estimates for multiple fleets).

5.2.1 Longline Gear Fleet

The longline gear fleet had total reported landings of 8.4 million pounds in 2004, and the lower and higher capacity estimates were 9.2 million and 9.6 million pounds (Table 5.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.8 million pounds or 10 percent for the lower capacity estimate, and by 1.2 million pounds or 14 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 88 percent of its higher capacity level and 91 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 12 percent or 9 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+6%), mean crew size (+3%), total crew days (+10%), and mean number of sets per trip (+10%).

5.2.2 Vertical Line Gear Fleet

The vertical line gear fleet had total reported landings of 11.1 million pounds in 2004, and the lower and higher capacity estimates were 12.8 million and 13.9 million pounds (Table 5.2). Therefore, estimated capacity exceeded reported landings in 2004 by 1.7 million pounds or 15 percent for the lower capacity estimate, and by 2.8 million pounds or 25 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 80 percent of its higher capacity level and 87 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 20 percent or 13 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+1%), mean crew size (0%), total crew days (+1%), and mean number of lines used per trip (0%).

5.2.3 Trap Gear Fleet

The trap gear fleet had total reported landings of only 1 million pounds in 2004, and the lower and higher capacity estimates were 1.1 million and 1.2 million pounds (Table 5.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.1 million pounds or 11 percent for the lower capacity estimate, and by 0.2 million pounds or 17 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 85 percent of its higher capacity level and 90 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 15 percent or 10 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+9%), mean crew size (+4%), total crew days (+14%), and mean number of traps used per trip (–1%). As noted above, the use of traps was prohibited in federal waters of the Gulf of Mexico as of February 2007.

5.2.4 All Fleets Combined

All fleets combined had total reported landings of 20.6 million pounds in 2004, and the lower and higher capacity estimates were 23.2 million and 24.7 million pounds (Table 5.2). Therefore, estimated capacity exceeded reported landings in 2004 by 2.6 million pounds or 13 percent for the lower capacity estimate, and by 4.1 million pounds or 20 percent for the higher capacity estimate. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at 83 percent of their higher capacity level and 89 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 17 percent or 11 percent less capacity would have been able to make the reported landings if they had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea (+4%) and total crew days (+6%).

Table 5.2 Harvesting capacity assessment by fleet for vessels in the 2004 reef fish fishery of the Gulf of Mexico for all species combined (million pounds, live weight).

	Longline	Vertical Line	Trap	Total[2]
Reported Landings	8.4	11.1	1.0	20.6
Landings Used in the DEA Models	7.2	9.9	0.8	17.9
Percent of Landings Used in the DEA Models	86%	89%	83%	87%
Lower Capacity Estimate (LCE)	9.2	12.8	1.1	23.2
Higher Capacity Estimate (HCE)	9.6	13.9	1.2	24.7
Lower Excess Capacity Estimate	0.8	1.7	0.1	2.6
Higher Excess Capacity Estimate	1.2	2.8	0.2	4.1
LCE as a % of Landings	110%	115%	111%	113%
HCE as a % of Landings	114%	125%	117%	120%
Reported Landings as a % of the LCE	91%	87%	90%	89%
Reported Landings as a % of the HCE	88%	80%	85%	83%
Number of Vessels	165	994	41	-
Numbers of trips				
Actual	1,976	11,533	322	13,831
Used in the DEA Models	1,819	9,194	294	11,307
Total Days at Sea				
Actual	13,080	13,435	1,657	28,172
Capacity	13,924	13,529	1,811	29,264
Mean Days at Sea per Vessel				
Actual	79.3	13.5	40.4	-
Capacity	84.4	13.6	44.2	-
Days at Sea per Trip				
Actual	7.2	1.5	5.1	-
Capacity	7.7	1.5	5.6	-
Mean Crew Size				
Actual	3.2	2.5	2.5	-
Capacity	3.3	2.5	2.6	-
Total Crew Days (mean crew size x total days at sea)				
Actual	41,856	33,588	4,143	79,586
Capacity	45,949	33,823	4,709	84,480
Mean Number of Sets per Trip[1]				
Actual	19.4	3.1	73.6	-
Capacity	21.4	3.1	72.5	-

1. For longline, this is the number of sets; for vertical line, it is the number of lines used; and for traps, it is the number of traps used.
2. Approximately 1.3 million pounds of reef fish was landed by gear groups with too few trips to be modeled. Harvesting capacity, which was set equal to reported landings for those gear groups, is not included in the totals in this table.

5.3. Harvesting Capacity Assessment by TAC Species Group for All Fleets Combined

5.3.1 Red Snapper

The reported landings of red snapper for all fleets combined totaled 4.6 million pounds in 2004, and the lower and higher capacity estimates were 5.3 million and 5.8 million pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.7 million pounds or 15 percent for the lower capacity estimate, and by 1.2 million pounds or 26 percent for the higher capacity estimate. This means the fleets would have landed that much more red snapper if they had operated at capacity in 2004. It also means that the fleets were operating at 80 percent of their higher capacity level and 87 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 20 percent or 13 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The red snapper CQ was 4.7 million pounds in 2004; therefore, estimated capacity exceeded the CQ by 0.7 million pounds or 14 percent for the lower capacity estimate, and by 1.2 million pounds or 25 percent for the higher capacity estimate. This means that for the lower or higher estimates of capacity, respectively, smaller fleets with 13 percent or 20 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for red snapper, the CQ was not exceeded—about 99 percent of the CQ was taken in 2004—due to inseason management actions that prevented the CQ from being exceeded even though harvesting capacity exceeded the CQ.

5.3.2 Tilefish

The reported landings of tilefish for all fleets combined totaled 0.63 million pounds in 2004, and the lower and higher capacity estimates were 0.71 million and 0.73 million pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.08 million pounds or 13 percent for the lower capacity estimate, and by 0.10 million pounds or 16 percent for the higher capacity estimate. This means the fleets would have landed that much more tilefish if they had operated at capacity in 2004. It also means the fleets were operating at 86 percent of their higher capacity level and 88 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 14 percent or 12 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The tilefish CQ was 0.49 million pounds in 2004, and the lower species-specific capacity estimate (0.71 million pounds) exceeded the CQ by 0.22 million pounds (44 percent), while the higher capacity estimate (0.73 million pounds) exceeded the CQ by 0.24 million pounds (48 percent). This means that for the lower or higher estimates of capacity, respectively, smaller fleets with 31 percent or 34 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. The fact that reported tilefish landings exceeded the CQ by 28 percent is further evidence that there was overcapacity in 2004.

5.3.3 Deep water grouper

The reported landings of deep water grouper for all fleets combined totaled 1.45 million pounds in 2004, and the lower and higher capacity estimates were 1.47 million and 1.48 million pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.01 million pounds or 1 percent for the lower capacity estimate, and by 0.03 million pounds or 2 percent for the higher capacity estimate. This means the fleets would have landed that much more deep water grouper if they had operated at capacity in 2004. It also means the fleets were operating at 98 percent of their higher capacity level and 99 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 2 percent or 1 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The deep water grouper CQ was 1.2 million pounds in 2004, and the lower species-specific capacity estimate (1.47 million pounds) exceeded the CQ by 0.26 million pounds (22 percent), while the higher capacity estimate (1.48 million pounds) exceeded the CQ by 0.27 million pounds (23 percent). This means that for the lower or higher estimates of capacity, respectively, smaller fleets with 8 percent or 9 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. The fact that the fishery was closed on July 15, 2004, and that reported deep water grouper landings exceeded the CQ by 21 percent is further evidence that there was overcapacity in 2004.

5.3.4 Shallow water grouper

The reported landings of shallow water grouper for all fleets combined totaled 9.3 million pounds in 2004, and the lower and higher capacity estimates were 10.8 million and 11.6 million pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 1.5 million pounds or 16 percent for the lower capacity estimate, and by 2.3 million pounds or 25 percent for the higher capacity estimate. This means the fleets would have landed that much more shallow water grouper if they had operated at capacity in 2004. It also means the fleets were operating at 80 percent of their higher capacity level and 86 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 20 percent or 14 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The shallow water grouper CQ was 10.4 million pounds in 2004. The lower species-specific capacity estimate (10.8 million pounds) exceeded the CQ by 0.4 million pounds (4 percent), while the higher capacity estimate (11.6 million pounds) exceeded the CQ by 1.2 million pounds (12 percent) This means that for the lower or higher estimates of capacity, respectively, smaller fleets with 4 percent or 11 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. Red grouper accounts for 64 percent of the shallow water grouper harvest. Due to the importance of red grouper, it has its own sub-quota within the shallow water grouper quota. Reaching either of these two quotas closes the entire shallow water grouper fishery. Although there was excess capacity and overcapacity for shallow water grouper, the CQ was not exceeded. About 90 percent of the CQ was taken in 2004 because the shallow water grouper fishery was closed on November 15, 2004, to prevent the red grouper sub-quota from being exceeded.

5.3.5 Red Grouper

The reported landings of red grouper for all fleets combined totaled 5.9 million pounds in 2004, and the lower and higher capacity estimates were 7 million and 7.5 million pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by almost 1.1 million pounds or 18 percent for the lower capacity estimate, and by 1.6 million pounds or 27 percent for the higher capacity estimate. This means the fleets would have landed that much more red grouper if they had operated at capacity in 2004. It also means the fleets were operating at 79 percent of their higher capacity level and 85 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 21 percent or 15 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The red grouper CQ was 6.3 million pounds in 2004, and the lower species-specific capacity estimate (7.0 million pounds) exceeded the CQ by 0.7 million pounds (11 percent), while the higher capacity estimate (7.5 million pounds) exceeded the CQ by almost 1.3 million pounds (20 percent). This means that for the lower or higher estimates of capacity, respectively, smaller fleets with 10 percent or 17 percent less harvesting capacity would have been able to take the CQ in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for red grouper, the CQ was not exceeded. About 95% of the CQ was taken in 2004 because the shallow water grouper fishery, which includes red grouper, was closed on November 15, 2004, to prevent the red grouper sub-quota from being exceeded.

Table 5.3 Harvesting capacity assessment by TAC species group for all fleets combined in the 2004 reef fish fishery of the Gulf of Mexico (million pounds, live weight).

	Red Snapper	Tilefish	Deep Water Grouper	Shallow Water Grouper	Red Grouper
Landings	4.6	0.63	1.45	9.3	5.9
CQ	4.7	0.49	1.20	10.4	6.3
Lower Capacity Estimate (LCE)	5.3	0.71	1.47	10.8	7.0
Higher Capacity Estimate (HCE)	5.8	0.73	1.48	11.6	7.5
Lower Excess Capacity Estimate	0.7	0.08	0.01	1.5	1.0
Higher Excess Capacity Estimate	1.2	0.10	0.03	2.3	1.6
LCE as a % of Landings	115%	113%	101%	116%	118%
HCE as a % of Landings	126%	116%	102%	125%	127%
Landings as a % of the LCE	87%	88%	99%	86%	85%
Landings as a % of the HCE	80%	86%	98%	80%	79%
Lower Overcapacity Estimate	0.7	0.22	0.26	0.4	0.7
Higher Overcapacity Estimate	1.2	0.24	0.27	1.2	1.3
LCE as a % of CQ	114%	144%	122%	104%	111%
HCE as a % of CQ	125%	148%	123%	112%	120%
Landings as a % of the CQ	99%	128%	121%	90%	95%
CQ as a % of LCE	87%	69%	82%	96%	90%
CQ as a % of HCE	80%	68%	81%	89%	83%

Note: Harvesting capacity was set equal to reported landings for the fleets that accounted for a minor part of the total reported landings for the TAC species groups, that typically had too few trips to be included in the DEA models, and that were not included in the fleet-specific estimates of harvesting capacity in Table 5.2. Therefore, the estimates in this table are for all fleets with reported landings of the TAC species groups. For all five TAC species groups combined, such fleets landed approximately 1.3 million pounds of reef fish in 2004.

6. Coastal Migratory Pelagic Fishery of the Gulf of Mexico

The assessment for the coastal migratory pelagic fishery of the Gulf of Mexico focused on the two fleets that accounted for most of the reported landings in 2004 (vertical line and troll gear fleets) and the two TAC species groups (king mackerel and Spanish mackerel). Harvesting capacity was set equal to reported landings for the other fleets, which accounted for a minor part of the total reported landings for the TAC species groups, typically had too few trips to be included in the DEA models, and were not included in the fleet-specific estimates of harvesting capacity presented in Section 6.2.

This is principally a mackerel fishery. The Gulf of Mexico and South Atlantic mackerel fisheries are regulated by the Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic FMP. Because king and Spanish mackerel are migratory, they are only available seasonally, and are managed jointly throughout the Southeast Region. Based on the historical importance of the commercial fishery off Florida, management has allocated the majority of the commercial quota to the Florida area, and most fish are taken in south Florida from November through March. Spanish mackerel is of somewhat less importance. Both species are caught predominantly by hook and line, gillnet, and cast net gear. Mackerel fishermen participate in other fisheries when the mackerel fisheries are closed.

There has been a moratorium on the issuance of commercial king mackerel vessel permits since 1998, but existing permits are transferable. There is no moratorium on issuance of commercial Spanish mackerel vessel permits, but fishermen must meet income requirements to obtain a permit. The most prominent management features are gear restrictions, size limits, trip limits, and hard quotas assigned to various regional zones in the Gulf of Mexico and South Atlantic areas. The regulations most constraining of effort (and therefore of the estimates of harvesting capacity and overcapacity for 2004) were trip limits and the quota. In 2004, the commercial quotas were not taken in the Gulf of Mexico. The management regime for mackerel has not substantially changed since 2004. The time-limited moratorium on the issuance of new commercial vessel permits was replaced with a specific limited access program in 2005.

The assessment indicates that there were low to higher rates of excess capacity for both fleets but no overcapacity for either of the two TAC species groups. For individual fleets, estimated harvesting capacity exceeded reported landings by 20 percent and 28 percent for the lower capacity estimates, and by 39 percent and 166 percent for the higher capacity estimates. For both fleets combined, harvesting capacity exceeded reported landings by 23 percent and 83 percent, respectively, for the lower and higher capacity estimates. The king mackerel CQ exceeded the lower and higher capacity estimates by 33 percent and 4 percent, respectively; and the Spanish mackerel CQ exceeded the lower and higher capacity estimates by more than 300 percent. In 2004, only 58 percent and 22 percent, respectively, of the king and Spanish mackerel CQs were taken.

6.1 Vessel and Trip Characteristics by Fleet

Information on vessel physical characteristics and trip characteristics for the fishing vessels that participated in the Gulf of Mexico coastal migratory pelagic fishery in 2004 is discussed below by fleet (i.e., gear type) and summarized in Table 6.1. As noted above, “fleets” refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing vessels in that fleet. If a fishing vessel was in both fleets, it is included in the vessel characteristics statistics for both fleets. Vessels or trips without data for a specific characteristic were not included in the statistics reported below for that characteristic. For example, because gross tonnage was available for USCG-registered vessels only, the gross tonnage statistics exclude state-registered boats, which were generally smaller than USCG-registered vessels.

6.1.1 Troll Gear Fleet

Landings with troll gear were reported for 140 boats in 2004 (Table 6.1). They took a total of 984 trips and their total reported landings were about 0.9 million pounds in 2004 (Table 6.2). The boats ranged in length from 21 to 60 feet with a mean of 37 feet. Their gross tonnage was between 1 and 63 tons with a mean of 25. They had between 90 and 1,100 horsepower with a mean of 346. The days at sea per trip ranged from 1 to 4 with a mean of 1.7. The crew size was between 1 and 4 with a mean of 1.7. The number of lines used per trip ranged from 1 to 6 with a mean of 3.2.

6.1.2 Vertical Line Gear Fleet

The vertical line gear fleet was the larger (in terms of the number of boats) and more productive (in terms of reported landings) of the two Gulf of Mexico coastal migratory pelagic fishery fleets. Landings with vertical gear were reported for 404 boats in 2004 (Table 6.1). They took a total of 1,784 trips and their total reported landings were about 1.7 million pounds in 2004 (Table 6.2). The boats ranged in length from 15 to 67 feet with a mean of 35 feet. Their gross tonnage was between 1 and 91 tons with a mean of 26. They had between 60 and 1,270 horsepower with a mean of 344. The days at sea per trip ranged from 1 to 4 with a mean of 1.5. The crew size was between 1 and 5 with a mean of 2.3. The number of lines used per trip ranged from 1 to 10 with a mean of 3.

Table 6.1 Vessel and trip characteristics by fleet for vessels in the 2004 coastal migratory pelagic fishery of the Gulf of Mexico.

	Vessel Characteristics			Trip Characteristics	
Fleet	Troll	Vertical Line		Troll	Vertical Line
Total Number of Vessels	140	404			
Vessel Length			Days at Sea		
Minimum	21	15	Minimum	1	1
Maximum	60	67	Maximum	4	4
Median	37	34	Median	1.0	1.0
Mean	37	35	Mean	1.7	1.5
Gross Tonnage[1]			Crew Size		
Minimum	1	1	Minimum	1	1
Maximum	63	91	Maximum	4	5
Median	22	22	Median	2.0	2.0
Mean	25	26	Mean	1.7	2.3
Horsepower[2]			Mean Number of Lines Used		
Minimum	90	60	Minimum	1	1
Maximum	1100	1270	Maximum	6	10
Median	300	300	Median	3.0	2.0
Mean	346	344	Mean	3.2	3.0

1. The gross tonnage data are based on USCG-registered vessels only; this results in an upward bias for the reported minimums, means, and medians because state-registered boats were generally smaller than USCG-registered vessels.
2. Due to reporting irregularities, the horsepower data provide only a rough index of actual horsepower.

Sources: Southeast Region Coastal Logbook Program and Southeast Region federal commercial fisheries permit databases.

6.2 Harvesting Capacity Assessment by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 6.2. The results of the assessment by species group for all fleets combined are presented in Section 6.3. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in both fleets, it contributed to the reported landings and thus the harvesting capacity estimates for both fleets).

6.2.1 Troll Gear Fleet

The troll gear fleet had total reported landings of only 0.9 million pounds in 2004, and the lower and higher capacity estimates were 1.2 million and 2.5 million pounds (Table 6.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.3 million pounds or 28 percent for the lower capacity estimate and by almost 1.6 million pounds or 166 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 38 percent of its higher capacity level and 78 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 62 percent or 22 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+15%), mean crew size (0%), total crew days (+17%), and mean number of lines used per trip (–3%).

6.2.2 Vertical Line Gear Fleet

The vertical line gear fleet had total reported landings of 1.7 million pounds in 2004, and the lower and higher capacity estimates were 2.1 million and 2.4 million pounds (Table 6.2). Therefore, estimated capacity exceeded reported landings in 2004 by almost 0.4 million pounds or 20 percent for the lower capacity estimate, and by 0.7 million pounds or 39 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 72 percent of its higher capacity level and 83 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 28 percent or 17 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+29%), mean crew size (–4%), total crew days (+24%), and mean number of lines used per trip (–7%).

6.2.3 All Fleets Combined

The two fleets combined had total reported landings of 2.7 million pounds in 2004, and the lower and higher capacity estimates were 3.3 million and 4.9 million pounds (Table 6.2). Therefore, estimated capacity exceeded reported landings in 2004 by 0.6 million pounds or 23 percent for the lower capacity estimate, and by 2.2 million pounds or 83 percent for the higher capacity estimate. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 55 percent of their higher capacity level and 81 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 45 percent or 19 percent less capacity would have been able to make the reported landings if they had operated at capacity. Harvesting at capacity would have occurred with the following percentage changes in the use of variable inputs: total days at sea (+24%) and total crew days (+21%).

Table 6.2 Harvesting capacity assessment by fleet for vessels in the 2004 coastal migratory pelagic fishery of the Gulf of Mexico for all species combined (million pounds, live weight).

	Troll	Vertical Line	Total
Landings			
Reported Landings	0.9	1.7	2.7
Landings Used in the DEA Models	0.8	1.2	2.0
Percent of Landings Used in the DEA Models	89.3%	68.5%	76%
Lower Capacity Estimate (LCE)	1.2	2.1	3.3
Higher Capacity Estimate (HCE)	2.5	2.4	4.9
Lower Excess Capacity Estimate	0.3	0.3	0.6
Higher Excess Capacity Estimate	1.5	0.7	2.2
LCE as a % of Landings	128%	120%	123%
HCE as a % of Landings	266%	139%	183%
Reported Landings as a % of the LCE	78%	83%	81%
Reported Landings as a % of the HCE	38%	72%	55%
Number of Vessels	140	404	-
Numbers of trips			
Actual	984	1,784	2,768
Used in the DEA Models	702	1,192	1,894
Total Days at Sea			
Actual	1,166	1,552	2,718
Capacity	1,369	1,997	3,366
Mean Days at Sea per Vessel			
Actual	8.3	3.8	-
Capacity	9.8	4.9	-
Days at Sea per Trip			
Actual	1.7	1.5	-
Capacity	2.0	1.9	-
Mean Crew Size			
Actual	1.7	2.3	-
Capacity	1.7	2.2	-
Total Crew Days (mean crew size x total days at sea)			
Actual	1,982	3,554	5,536
Capacity	2,327	4,393	6,721
Mean Number of Lines Used per Trip			
Actual	3.2	3.0	-
Capacity	3.1	2.8	-

6.3. Harvesting Capacity Assessment by TAC Species Group for All Fleets Combined

6.3.1 King Mackerel

The reported landings of king mackerel for all fleets combined were 1.9 million pounds in 2004, and the lower and higher capacity estimates were 2.5 million and 3.1 million pounds (Table 6.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.6 million pounds or 29 percent for the lower capacity estimate, and by 1.2 million pounds or 65 percent for the higher capacity estimate. This means the fleets would have landed that much more king mackerel if they had operated at capacity in 2004. It also means the fleets were operating at only 60 percent of their higher capacity level and 77 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 40 percent or 23 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, the species-specific capacity estimates were less than the CQ of 3.3 million pounds and only 58 percent of the CQ was taken in 2004. The lower species-specific capacity estimate (2.5 million pounds) was 0.8 million pounds less than the CQ (75 percent of the CQ), and the higher capacity estimate (3.1 million pounds) was more than 0.1 million pounds less than the CQ (96 percent of the CQ). This means that for the lower or higher capacity estimates, respectively, larger fleets with 33 percent or 4 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on king mackerel.

6.3.2 Spanish Mackerel

The reported landings of Spanish mackerel for all fleets combined were almost 1.2 million pounds in 2004, and the lower and higher capacity estimates were just over 1.2 million and almost 1.3 million pounds (Table 6.3). Therefore, estimated capacity exceeded reported landings in 2004 by less than 0.1 million pounds or 6 percent for the lower capacity estimate, and by over 0.1 million pounds or 11 percent for the higher capacity estimate. This means the fleets would have landed that much more Spanish mackerel if they had operated at capacity in 2004. It also means the fleets were operating at 90 percent of their higher capacity level and 95 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 10 percent or 5 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for Spanish mackerel in 2004 and only 22 percent of the CQ of 5.2 million pounds was taken. The lower species-specific capacity estimate (over 1.2 million pounds) was 4 million pounds less than the CQ, or only 23 percent of the CQ. The higher capacity estimate (almost 1.3 million pounds) was 3.9 million pounds less than the CQ or only 25 percent of the CQ. This means that, for both the lower or higher capacity estimates, larger fleets with more than a 300 percent increase in harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on Spanish mackerel. As noted in Section 4.3.2, the landings and capacity estimates presented for Spanish mackerel were adjusted upward to reflect the ALS landings data for Spanish mackerel.

Table 6.3 Harvesting capacity assessment by TAC species group for all fleets combined in the 2004 coastal migratory pelagic fishery of the Gulf of Mexico (million pounds, live weight).

	King Mackerel	Spanish Mackerel
Landings	1.9	1.2
CQ	3.3	5.2
Lower Capacity Estimate (LCE)	2.5	1.2
Higher Capacity Estimate (HCE)	3.1	1.3
Lower Excess Capacity Estimate	0.6	0.1
Higher Excess Capacity Estimate	1.2	0.1
LCE as a % of Landings	129%	106%
HCE as a % of Landings	165%	111%
Landings as a % of the LCE	77%	95%
Landings as a % of the HCE	60%	90%
Lower Overcapacity Estimate	-0.8	-4.0
Higher Overcapacity Estimate	-0.1	-3.9
LCE as a % of CQ	75%	23%
HCE as a % of CQ	96%	25%
Landings as a % of the CQ	58%	22%
CQ as a % of LCE	133%	426%
CQ as a % of HCE	104%	404%

Note: Harvesting capacity was set equal to reported landings for the fleets that accounted for a minor part of the total reported landings for the TAC species groups, that typically had too few trips to be included in the DEA models, and that were not included in the fleet-specific estimates of harvesting capacity in Table 6.2. Therefore, the estimates in this table are for all fleets with reported landings of the two TAC species groups.

APPENDIX 5

Atlantic Highly Migratory Species Assessment

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1. Introduction

This report presents an assessment of harvesting capacity in 2004 for the commercial fisheries managed under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (HMS FMP). The FMP integrates the management of highly migratory species (i.e., Atlantic tunas, swordfish, sharks, and billfishes) and the fishing activities of domestic commercial and recreational fishing operations within the Atlantic Ocean and adjacent waters, Caribbean Sea, and Gulf of Mexico. In this report, "Atlantic" refers to all of those areas. However, the assessment does not include either the fisheries in the U.S. Caribbean, which are addressed in a separate report, or charter/headboat operations, which are not strictly commercial fishing operations.

Sections 1 through 4 of the National Assessment provide critical background information. These sections explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the Atlantic HMS fisheries will be easier to understand and interpret if sections 1 through 4 of the National Assessment are read first.

The assessment is by fleet and by species group, where "fleet" refers to a specific part of a fishery and "species group" can refer to one or more individual species. Specifically, "fleets" refers to mutually exclusive sets of HMS trips and not to mutually exclusive sets of vessels. An HMS trip is a trip with any HMS landings. This use of "fleet" is explained by the following points using the example of the pelagic longline fleet: (1) the pelagic longline fleet refers to the fishing trips for which pelagic longline gear was used and Atlantic highly migratory species were landed; (2) the assessment of harvesting capacity for that fleet is for such trips and not for the other fishing activities of the vessels that made such trips; and (3) some vessels were in multiple fleets, as well as in fleets for other fisheries. In addition, multiple species groups often were landed together. Therefore, many vessels contributed to the landings and, therefore, to the estimates of harvesting capacity, excess capacity and overcapacity for multiple species groups, fleets, or fisheries.

For the Atlantic HMS fisheries, this caveat is particularly important because of the multi-species, multi-gear nature of the fisheries. Many vessels in these fisheries fish for a variety of species on each trip and throughout the seasons, constantly adapting to resource, market, and other conditions. In light of these factors, the merit of a single species capacity, and particularly overcapacity, measure needs to be carefully evaluated. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species if the existing fishery management measures did not prevent such a shift. The present analysis, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is less of a problem for the assessment of harvesting capacity by fleet for all species combined.

A target catch level, such as the quota for the commercial fisheries, is the reference point used to calculate overcapacity by species group in the National Assessment. In the reports for most other regions, "total allowable catch" (TAC) or "TAC proxy" refers to the commercial quota. However, throughout this report, "commercial quota" (CQ) is used in lieu of either of those two terms. This difference in the terms used does not imply a difference in what was assessed.

The summary tables present estimates of landings, harvesting capacity, excess capacity, and overcapacity in metric tons (t). However, the summary text typically presents them in terms of thousand t, and the report presents percentages that typically are rounded to the nearest 1 percent. The rounding can give the impression of internal inconsistencies. For example, the excess capacity estimate may not be exactly equal to the difference between the harvesting capacity and landings estimates presented in the text. Similarly, the percentage of excess capacity cannot always be reproduced exactly by using the landings and harvesting capacity estimates in the report.

The assessment indicates that there was significant heterogeneity in the rates of excess capacity among the five fleets, that with the lower and higher capacity estimates, respectively, there was at least some overcapacity for 3 and 4 of the 10 area-specific species groups, but that landings exceed only 3 of the 10 associated CQs. The main findings are summarized below by fleet for all species combined and by species group for all fleets combined.

Excess Capacity by Fleet for All Species Combined:

1. The lower harvesting capacity estimates exceeded landings from a low of 16 percent for the pelagic longline fleet to a high of 64 percent for the bottom longline fleet, and by 26 percent for the five fleets combined.
2. The higher harvesting capacity estimates exceeded landings from a low of 39 percent for the pelagic longline fleet to a high of 156 percent for the bottom longline fleet, and by 63 percent for the five fleets combined.

Excess Capacity and Overcapacity by Species Group for All Fleets Combined:

1. The lower capacity estimates exceeded landings from a low of 0 percent for porbeagle sharks and 2 percent for blue sharks to a high of 95 percent for large coastal sharks in the Gulf of Mexico.
2. The higher capacity estimates exceeded landings from a low of 0 percent for porbeagle sharks and 2 percent for blue shark to a high of 222 percent for large coastal sharks in the Gulf of Mexico.
3. With the lower capacity estimates, there was overcapacity for only 3 of the 10 area-specific species groups, and estimated harvesting capacity exceeded the CQs from a low of 40 percent for large coastal sharks in the South Atlantic to a high of 340 percent for large coastal sharks in the Gulf of Mexico.
4. With the higher capacity estimates, there was overcapacity for 4 of the 10 area-specific species groups, and estimated harvesting capacity exceeded the CQs from a low of 24 percent for small coastal sharks in the South Atlantic to a high of 625 percent for large coastal sharks in the Gulf of Mexico.

5. Landings exceeded only 3 of the 10 CQs, as follows: large coastal sharks in the Gulf of Mexico (125 percent), large coastal sharks in the South Atlantic (13 percent), and large coastal sharks in the North Atlantic (109 percent).

It is important to remember that the reported landings (and therefore, the estimates of harvesting capacity and excess capacity for 2004) would have been higher for most if not all fleets in the absence of the management measures that limited the number of trips, landings per trip, or both in 2004. The same is true for the estimates of landings, excess capacity, and overcapacity for most if not all species groups.

In addition, several significant changes in fish stock, environmental, market, and regulatory conditions since 2004 have affected harvesting capacity, excess capacity, and overcapacity in these fisheries. As a result, the levels of these three variables for some fleets or species groups probably have changed substantially since 2004. Examples of the changes in those conditions are discussed below.

The management of HMS fisheries, including annual fishery specifications, has been shifted to a calendar year. Mandatory workshops regarding species safe handling, release, and identification for longline and shark gillnet vessel owners are now required. In the Gulf of Mexico, Madison-Swanson and Steamboat Lumps Marine Reserves are closed to all HMS fishing, except surface trolling for HMS from May through October. In the Caribbean, six year-round bottom longline closures have been implemented for HMS vessels with bottom longline gear onboard, to protect essential fish habitat. Buoy gear is defined and authorized for use in the commercial swordfish handgear fishery. Handlines must now be attached to vessels.

General category bluefin tuna time period sub-quotas have been established for January, June–August, September, October–November, and December. NMFS implemented quotas and provisions recommended by the International Commission for the Conservation of Atlantic Tunas (ICCAT) at its 2006 meeting, including limiting the carryover of U.S. total underharvest to no more than 50 percent of the U.S. TAC and allowing for a one-time transfer of up to 15 percent of the U.S. TAC to other contracting parties with TAC allocations.

The fishing year for sharks is divided between three trimester seasons: the first is from January 1 to April 30; the second is from May 1 to August 31, the third is from September 1 to December 31 (with the exception of the season for large coastal sharks, which is generally shorter and dictated by available quota and catch rates). To prohibit shark finning, the second dorsal fin and anal fin must now remain on all sharks through landing. This decreases harvesting capacity for the shark species that had been subject to finning. Shark gillnet fishing is prohibited by the large whale regulations each year from November 15 to April 15 in the area from 27°51'N latitude to 33°27'N latitude extending from the shore outward to 80°W longitude, and 100 percent observer coverage is required in the Southeastern U.S. restricted area south of 29°00'N latitude from December 1 through March 31. NMFS is currently developing Amendment 2 to the Consolidated HMS FMP, it focuses on shark management measures to address the 2005/2006 large coastal shark assessments.

Amendment 2 will implement new shark management measures to rebuild overfished sandbar, dusky, and porbeagle sharks and to end overfishing of sandbar and dusky sharks based on the results of several stock assessments conducted in 2005 and 2006.

Swordfish incidental catch limits have been increased and vessel upgrading restrictions have been relaxed to adjust to the persistent underharvest of the swordfish quota. Incidental permit holders may now keep up to 15 North Atlantic swordfish with trawl on a squid trip, and 30 swordfish per trip may be kept for all other authorized gears.

The prices of fuel and commodities in general have been on the rise since 2004. Although ex-vessel prices received have increased somewhat for several HMS species, it is not clear whether these gains have offset increases in costs. These input price increases and the increases in regulatory burden described above continue to place economic pressure on HMS permit holders. The number of commercially permitted HMS vessels has declined since 2004.

The remainder of this report includes the following: (1) a brief description of the main management measures used in the fishery in 2004, with an emphasis on those that limited landings per trip, the number of trips, or both in 2004 and an explanation for the focus of the assessment in terms of fleets and species groups (Section 2): (2) a brief description of fleet-specific statistics on the reported landings and the physical and trip characteristics for the fishing vessels with HMS landings in 2004 (Section 3); (3) a brief description of the methods used to estimate harvesting capacity (Section 4); (4) the assessment results by fleet for all species groups combined (Section 5); and (5) the assessment results by HMS species group for all fleets combined (Section 6).

2. Management

Much of the following brief description of the 2004 management of highly migratory species is taken from the Consolidated HMS FMP and from a profile of the Atlantic pelagic longline fishery prepared by Dr. Christopher Rogers.[51]

The United States is a member of the International Commission for the Conservation of Atlantic Tunas (ICCAT)—the regional fisheries management organization responsible for the conservation and management of fisheries for tunas and other highly migratory species, including swordfish and billfish, in the Atlantic Ocean and adjacent waters. ICCAT is just beginning to examine shark management. The management of the Atlantic HMS fisheries is complicated by the wide-ranging nature of the fish and the many nations, states, and regions involved. Effective management requires a great deal of cooperation among these entities. NMFS and ICCAT have joint management responsibilities for the U.S. Atlantic HMS fisheries, which occur in areas both inside and beyond the U.S. EEZ in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico.

These fisheries are managed under the Consolidated HMS FMP. The HMS fisheries are the only

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[51] The report "The Atlantic Pelagic Longline Fishery" was prepared by Chris Rogers, NMFS, Office of International Affairs. It was prepared for the NMFS Overcapacity Workshop, September 7 – 9, 2005, Washington DC.

ones with direct Secretarial authority for management under the Magnuson-Stevens Fishery Conservation and Management Act. The other FMPs are under the jurisdiction of a Regional Fishery Management Council.

Tunas

The tunas managed with the Consolidated HMS FMP are Atlantic bluefin tuna and other tunas (i.e., Atlantic albacore, bigeye, skipjack, and yellowfin). There are minimum size limits for bigeye tuna, yellowfin tuna, and bluefin tuna. The seven types of gear that can be used for tuna are listed below; not all of these gear types can be used to target all tuna species.

Commercial Tuna Gear	
1. Pelagic Longline	5. Rod and Reel
2. Handline	6. Bandit Gear
3. Harpoon	7. Trap
4. Purse Seine	

A vessel permit is required to fish for or take Atlantic tunas. There are regional differences in the number of tunas that may be kept for some permit types. There are limited entry programs for the purse seine and longline fleets. In addition, a vessel that uses tuna longline gear is required to have directed or incidental swordfish and shark permits.

Swordfish

There is a limited entry program for the swordfish fishery. In addition, with either a directed or incidental swordfish permit, an Atlantic tuna longline category permit and an Atlantic shark permit are required. The directed and handgear swordfish permits include vessel upgrading restrictions. A directed swordfish permit allows a fisherman to target swordfish using any authorized gear. During a directed swordfish fishery closure, permit holders are allowed to land 15 swordfish per trip. A handgear permit allows a fisherman to target swordfish using only handgear. During a directed fishery closure, harpoons cannot be used but other handgear users may land 15 fish per trip. An incidental permit allows a fisherman to land swordfish incidental to the catch from other fishing activities. In 2004, the incidental limit was 2 swordfish per trip for most gear types. However, this limit was recently increased to 30 in the 2007 Rule to Modify Commercial Swordfish Management Measures, except in the squid trawl fishery where it was increased to 15. With the exception of a limited number of swordfish that may be taken incidentally on a vessel with squid trawl, North Atlantic swordfish can only be taken with handgear or longline gear. There is a minimum size limit for swordfish. The six types of gear that can be used for to target swordfish are listed below.

Commercial Swordfish Gear	
1. Pelagic Longline	4. Harpoon
2. Buoy Gear	5. Rod and Reel
3. Handline	6. Bandit Gear

Buoy gear was added as a separate gear type after 2004.

Sharks

The three shark species groups are large coastal sharks, small coastal sharks, and pelagic sharks, of which blue sharks and porbeagle sharks have separate quotas. The individual species are as follows:

1. **Large Coastal Sharks:** sandbar, silky, tiger, blacktip, spinner, lemon, bull, nurse, smooth hammerhead, scalloped hammerhead, great hammerhead, and other coastal sharks.

2. **Small Coastal Sharks:** blacknose, sharpnose, finetooth, and bonnethead sharks.

3. **Pelagic Sharks:** blue, porbeagle, shortfin mako, thresher, oceanic whitetip, and other pelagic sharks.

There is a limited entry program for Atlantic sharks. A directed shark permit, which has vessel upgrading restrictions, allows a fisherman to target shark using any authorized gear. An incidental shark permit allows a fisherman to land sharks incidental to the catch from other fishing activities. There is a 4,000-pound trip limit for directed permit holders. The incidental limits are 5 large coastal sharks per trip and 16 pelagic or small coastal sharks, combined, per trip. The allowable gear types are listed below.

Commercial Shark Gear	
1. Longline	4. Bandit Gear
2. Handline	5. Gillnet
3. Rod and Reel	

The gillnets cannot be longer than 2.5 km, must be attached to the vessel at one end while fishing, and may be subject to additional restrictions to protect large whales. There were no commercial minimum size limits for Atlantic sharks.

The following 19 species of sharks are prohibited species (i.e., retention is prohibited).

Prohibited Shark Species in the Commercial Fishery		
1. Atlantic angel	8. Caribbean sharpnose	14. Sand tiger
2. Basking	9. Dusky	15. Sevengill
3. Bigeye sand tiger	10. Galapagos	16. Sixgill
4. Bigeye sixgill	11. Longfin	17. Smalltail
5. Bigeye thresher	12. Narrowtooth	18. Whale
6. Bignose	13. Night	19. White
7. Caribbean reef		

Billfishes

Commercial fishermen are not allowed to fish for, take, or retain Atlantic billfish.

All Highly Migratory Species

Issues related to bycatch and gear conflicts have dominated the management of the U.S. Atlantic HMS fishery for the past decade. In fact, no definitive action has been undertaken to implement limited access privilege programs (LAPPs) in this fishery, partly because NMFS' focus has been on bycatch issues. However, the commercial HMS fleets are under limited access (except for Charter/Headboat and General Category) and there are vessel upgrading restrictions, which have limited the increases in capacity. Spatial and temporal closures and gear restrictions have been used to reduce the bycatch of turtles and specific species of finfish (e.g., the Grand Banks swordfish fishery was closed for 3 years due to turtle bycatch). The severe constraints placed on the harvesting sector (e.g., spatial and temporal closures, gear restrictions, and regulatory discards induced by retention limits) and reduced ex-vessel prices (possibly due to increased levels of imports) have reduced profitability; therefore, the number of active vessels has declined in recent years and the U.S. swordfish quota (allocation from ICCAT) has not been taken since 1998. In the absence of these fishery management restrictions, landings per trip and the number of trips (and therefore reported landings and the estimates of both harvesting capacity and overcapacity in 2004) would no doubt have been substantially higher.

The assessment focused on the seven HMS species groups and five fleets (defined by gear type) listed below. The trawl fleet—which can only land these species groups as incidental catch and which accounted for only 0.6 percent of the total landings for the 11 HMS species groups in 2004—is included in the assessment totals but is not discussed separately.

Bluefin tuna was not assessed separately for two reasons. First, bluefin tuna data limitations for the purse seine and handgear fleets prevented the preparation of estimates for bluefin tuna that would have been comparable to those for the other HMS fleets and species groups. Second, although the data were adequate for the longline fleets, bluefin tuna can only be taken as incidental catch by those fleets, and trip limits were used to control the amount of bluefin tuna that could be landed; therefore, useful estimates of bluefin tuna harvesting capacity could not be prepared for the longline fleets.

"Fleets" refers to mutually exclusive sets of HMS trips and not to mutually exclusive groups of vessels. Some vessels used more than one type of gear in 2004 and, therefore, were in multiple fleets.

Individual Species Groups in the HMS Assessment	
1. Albacore Tuna	5. Blue Sharks
2. Swordfish	6. Porbeagle Sharks
3. Large Coastal Sharks	7. Other Pelagic Sharks
4. Small Coastal Sharks	
Fleets in the HMS Assessment	
1. Bottom Longline	4. Net Gear (excluding purse seines and trawls)
2. Pelagic Longline	5. Trawl (Incidental catch)
3. Handgear	

The other tuna species (i.e., bigeye, skipjack, and yellowfin) were not assessed separately because there were no CQs for those species in 2004. Other fleets (i.e., gear types) , which accounted for a small part of total estimated commercial landings or for which vessel-specific trip level data were not available consistently, were not assessed separately; however, they were included in the assessment of overcapacity for the HMS species groups other than bluefin tuna. The method used to include them is discussed in Section 4. For most of the other fleets, HMS landings were retained incidental catch taken in fisheries for other species and accounted for a small percent of their total landings in trips with HMS landings. The five fleets included in the assessment accounted for 99 percent of the estimated HMS landings in the commercial fisheries in 2004 (Table 1) and, with the exception of bluefin tuna, they accounted for at least 93 percent of the landings for each of the HMS species groups. As noted above, a separate assessment was not prepared for bluefin tuna; however, bluefin tuna was included in the estimates by fleet for all species combined.

The assessment of harvesting capacity is based on trip level data by vessel. Therefore, the reported landings data used to estimate harvesting capacity and to generate the landings estimates discussed in Section 5 and summarized in Table 3 are from logbooks, not from dealer reports (which do not provide trip-specific landings by vessel). Two separate logbook programs provide HMS trip level landings and effort data: the Atlantic Highly Migratory Species Logbook and the Coastal Fisheries Vessel Logbook programs. Because the Atlantic HMS logbook reports the number of fish landed and not their weight, estimates of average weight by species or species group were used to estimate landed weight by trip and species. There are limitations to the data from these logbook programs due to missing reports, reporting errors, underreporting, species identification issues, and the use of average or estimated weights. The HMS Management Division of the NMFS Office of Sustainable Fisheries provided the landings estimates used to estimate harvesting capacity by fleet and the CQs, which were used as the reference points for calculating overcapacity.

The estimates of landings discussed in this section—summarized in Table 1 and used in calculating harvesting capacity for all fleets combined (Section 6 and Table 4)—are based on dealer reports. The method used to convert the estimates of harvesting capacity based on logbook data to estimates that are comparable to the more inclusive dealer report estimates of total landings by HMS species group is discussed in Section 4.

The reported landings in Table 1, which are based on dealer reports, are presented by fleet, species group, and CQ area. The CQ areas are the Gulf of Mexico, the South Atlantic, the North Atlantic, or these three areas combined. If the CQ for an HMS species group was not area-specific, reported landings for that species group are provided for all areas combined.

The area-specific landings data in Table 1 are based on the dealer location areas defined below.

Gulf of Mexico: Texas, Louisiana, Mississippi, Alabama, the west coast of Florida, and the Florida Keys.
South Atlantic: the east coast of Florida, Georgia, South Carolina, and North Carolina.
North Atlantic: all states north of North Carolina.

Table 1. Estimated commercial landings by gear, HMS species group, and commercial quota area in 2004[1] (metric tons[2]).

Species Group and Area	Bottom Longline	Pelagic Longline	Hand-gear	Trawl	Purse Seine	Other Net Gear	All Other	Total
Large Coastal Sharks (Gulf)	706	3	246	45	0	74	1	1,075
Large Coastal Sharks (South Atlantic)	557	4	16	2	0	117	0	695
Large Coastal Sharks (North Atlantic)	17	1	0	1	0	102	0	121
Large Coastal Sharks Sub-total	1,280	8	262	47	0	293	1	1,891
Small Coastal Sharks (Gulf)	27	0	0	0	0	28	0	55
Small Coastal Sharks (South Atlantic)	38	1	1	0	0	123	0	163
Small Coastal Sharks Sub-total	64	1	1	0	0	152	0	218
Blue Sharks (All areas)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Porbeagle Sharks (All areas)	0.0	0.0	0.0	1.2	0.0	1.4	0.0	2.6
Other Pelagic Sharks (All areas)	90	17	4	4	0	24	8	146
Albacore Tuna (All areas)	0	117	6	0	0	5	9	137
Bigeye Tuna (All areas)	0	292	4	0	0	0	1	297
Bluefin Tuna (All areas)	0	108	396	0	32	0	0	536
Skipjack Tuna (All areas)	0	0	1	0	0	17	0	18
Yellowfin Tuna (All areas)	0	2,471	242	0	0	3	2	2,717
Swordfish (All areas)	0	2,057	23	0	0	0	8	2,089
Total	1,435	5,072	938	52	32	495	30	8,053

1. Because the data are for the calendar year, the bluefin data do not agree with the official landings data that are reported by fishing year.
2. The landings are in dressed weight for sharks and in round weight for tunas and swordfish.

Source: The landings estimates are based on dealer reports and they include landings from state waters, the EEZ, and beyond the EEZ. The tuna and swordfish estimates were provided by Guillermo Diaz and Brad Brown (SEFSC) and the shark estimates were provided by Heather Balchowsky and Neil Baertlein (SEFSC).

3. Vessel and Trip Characteristics and Landings by Fleet

Fleet-specific statistics on the physical characteristics of the fishing vessels with HMS landings in 2004, on various characteristics of trips with HMS landings, and on HMS landings are discussed below and summarized in Tables 1 and 2. Statistics for the trawl fleet, which had limited HMS landings (0.6 percent of the total for all fleets) taken as incidental catch, are included in Tables 1 and 3 but are not discussed below. Logbook and dealer report data, respectively, were used to generate the trip characteristics and landings statistics. Vessels that participated in multiple fleets in 2004 are included in the statistics for multiple fleets. Vessels or trips without data for a specific characteristic were not included in the statistics reported below for that characteristic. For example, if the gross registered tonnage was unknown for 12 vessels (i.e., not in the vessel characteristics database used for this assessment), those 12 vessels were not included in estimating mean gross registered tonnage.

3.1 Bottom Longline Fleet

HMS landings with bottom longline gear were reported for 110 boats in 2004 (Table 2). Bottom longline gear includes trot line and other bottom longline gear. The fleet's total reported landings for the 11 HMS species groups in Table 1 were about 1.4 thousand t, or about 18 percent of the total for all fleets in 2004. Large coastal sharks accounted for 89 percent of the fleet's total reported HMS landings and other sharks accounted for the rest of its HMS landings. The fleet accounted for large shares of the reported total landings of the following highly migratory species: large coastal sharks 68 percent, blue sharks 100 percent, and other pelagic sharks 62 percent.

The boats in this fleet ranged in length from 23 to 70 feet with a mean of 44 feet. Their gross registered tonnage was between 8 and 129 tons with a mean of 33. Their minimum, maximum, and mean breadths were 10, 24, and 16 feet, respectively. The days at sea per trip ranged from 1 to 21 with a mean of 3.2 (the upper end of that range was probably for trips targeting grouper with sharks caught incidentally). The crew size was between 1 and 7 with a mean of 2.7. They set between 1 and 30 miles of longline gear at a time, with a mean of 9.8 miles.

3.2 Pelagic Longline Fleet

HMS landings with pelagic longline gear were reported for 115 boats in 2004 (Table 2). Pelagic longline gear includes surface longline and other pelagic longline gear. The fleet's total reported landings for the 11 HMS species groups in Table 1 were 5.1 thousand t, or 63 percent of the total for all fleets in 2004. Yellowfin tuna and swordfish, respectively, accounted for 49 percent and 41 percent of its total reported HMS landings. The fleet accounted for large shares of the reported total landings of the following highly migratory species: albacore tuna 85 percent, bigeye tuna 98 percent, yellowfin tuna 91 percent, and swordfish 98 percent.

The boats in this fleet ranged in length from 32 to 88 feet with a mean of 61 feet. Their gross registered tonnage was between 13 and 172 tons with a mean of 70. Their minimum, maximum, and mean breadths were 8, 25, and 19 feet, respectively. The days at sea per trip ranged from 1 to 41 with a mean of 10.5. The crew size was between 1 and 6 with a mean of 3.5. They set between 6 and 52 miles of longline gear at a time, with a mean of 26.9 miles.

3.3 Handgear Fleet

Handgear includes handline, troll, harpoon, rod and reel, and bandit gear. HMS landings with handgear were reported in logbooks for 169 boats in 2004 (Table 2). However, the logbook data are particularly incomplete for the handgear fleet; e.g., more than 500 boats were not accounted for in the logbook data. The fleet's total reported landings for the 11 HMS species groups in Table 1 were 938 t, or almost 12 percent of the total for all fleets in 2004. The landings included in the logbook data were only 349 t (Table 3). Large coastal sharks, bluefin tuna, and yellowfin tuna, respectively, accounted for 28 percent, 42 percent, and 26 percent of its total reported HMS landings. The fleet accounted for 14 percent of the landings of large coastal sharks, 74 percent of the bluefin tuna landings, and no more than 9 percent of the landings for the any of the other HMS species groups.

The boats in this fleet ranged in length from 18 to 106 feet with a mean of 42 feet. Their gross registered tonnage was between 6 and 158 tons with a mean of 34. Their minimum, maximum, and mean breadths were 10, 24, and 16 feet, respectively. The days at sea per trip ranged from 1 to 15 with a mean of 3.3. The crew size was between 1 and 8 with a mean of 2.5.

3.4 Other Net Gear Fleet

For this report, other net gear includes all gillnet, cast net, and pound net gear. It does not include trawl or purse seine gear. HMS landings with other net gear were reported for 31 boats in 2004 (Table 2). Their total reported landings for the 11 HMS species groups in Table 1 were 495 t, or 6 percent of the total for all fleets in 2004. Large and small coastal sharks, respectively, accounted for 59 percent and 31 percent of its total reported HMS landings. The fleet accounted for large shares of the reported total landings of the following highly migratory species: small coastal sharks 70 percent, porbeagle sharks 54 percent, and skipjack tuna 92 percent.

The boats in this fleet ranged in length from 23 to 61 feet with a mean of 38 feet. Their gross registered tonnage was between 8 and 69 tons with a mean of 25. Their minimum, maximum, and mean breadths were 10, 20, and 14 feet, respectively. The days at sea per trip ranged from 1 to 8 with a mean of 1.3. The crew size was between 1 and 6 with a mean of 2.4.

Table 2. Vessel and trip characteristics for five fleets of vessels with reported HMS landings in 2004.

Fleet	Bottom Longline	Pelagic Longline	Hand-gear	Trawl	Other Net Gear
Total Number of Vessels	110	115	169	32	31
Vessel Length					
Minimum	23	32	18	25	23
Maximum	70	88	106	122	61
Median	43	62	41	37	39
Mean	44	61	42	52	38
Gross Registered Tonnage					
Minimum	8	13	6	8	8
Maximum	129	172	158	199	69
Median	29	63	26	18	19
Mean	33	70	34	63	25
Breadth					
Minimum	10	8	10	10	10
Maximum	24	25	24	34	20
Median	16	20	15	12	14
Mean	16	19	16	16	14
Trip Characteristics					
Days at Sea per Trip					
Minimum	1	1	1	1	1
Maximum	21	41	15	7	8
Median	2.0	10.0	2.0	1.0	1.0
Mean	3.2	10.5	3.3	1.6	1.3
Crew Size					
Minimum	1	1	1	1	1
Maximum	7	6	8	7	6
Median	3.0	3.1	2.0	2	2.0
Mean	2.7	3.5	2.5	1.9	2.4
Miles of Longline Gear per Set					
Minimum	1	6	-	-	-
Maximum	30	52	-	-	-
Median	8.8	30.0	-	-	-
Mean	9.8	26.9	-	-	-

Source: The vessel characteristics come from HMS limited access swordfish, shark, and tuna permit form data. They are only for the vessels with landings included in the logbook data used to estimate harvesting capacity. Those data were also merged with U.S. Coast Guard vessel registry data to fill in some of the blanks and to get gross registered tonnage.

4. Methods

DEA was used to estimate harvesting capacity by trip and species group. A trip record was generated for each HMS trip by a vessel using bottom or pelagic longline gear, handgear, other net gear, or trawl gear. An HMS trip is a commercial fishing trip with any reported HMS landings. The five fleets included in the assessment accounted for about 99 percent of the estimated HMS landings in the commercial fisheries in 2004 (Table 1). For individual species groups other than bluefin tuna, they accounted for at least 93 percent of the landings for each of the HMS species groups (Table 1). As noted above, a separate assessment was not prepared for bluefin tuna; however, bluefin tuna was included in the estimates by fleet for all species combined.

The record generated for each HMS trip included fixed and variable input data and landings data, as well as other variables that were used to stratify trips. Vessel length, breadth, and gross registered tonnage were used as fixed inputs. The variable inputs were days at sea and crew size, and, for the longline fleets, the miles of longline gear per set. The nine species groups for the landings data are listed below.

Species Groups in the HMS Assessment	
1. Albacore Tuna	6. Blue Sharks
2. Bluefin Tuna	7. Porbeagle Sharks
3. Swordfish	8. Other Pelagic Sharks
4. Large Coastal Sharks	9. All Other Species Combined
5. Small Coastal Sharks	

The reported landings of individual species were summed to generate landings by species group for the multispecies groups.

Trips were stratified by area (Gulf of Mexico, North Atlantic, and South Atlantic), gear type, and quarter (if possible, given the number observations). Trips that were not used in the DEA models were primarily those missing information on the fixed or variable inputs. There were also some trips where a gear type was not recorded, although the area and quarter were recorded. For the trips not used in the DEA models, the estimates of harvesting capacity were set equal to reported landings.

The percent of trip specific landings used in the DEA models was 90 percent for the five fleets combined; it ranged from a low of 44 percent for the other net gear fleet to a high of 94 percent for the pelagic longline fleet, and it was between 58 percent and 92 percent for the other three fleets (Table 3). The percent of reported trips used in the DEA models was 76 percent for the five fleets combined; it ranged from a low of 34 percent for the other net gear fleet to a high of 92 percent for the pelagic longline fleet and it was between 41 percent and 88 percent for the other three fleets. The trip level capacity estimates were summed to produce the aggregate estimates by fleet or species group presented in this report.

The assessment of harvesting capacity in this report generally is based on vessel and trip-specific federal logbook data and not on dealer report data (which do not consistently provide trip level data by vessel). However, there are limitations to the data from the logbook programs due to missing reports, reporting errors, underreporting, species identification issues, and the use of average or estimated weights. For example, the commercial landings of Atlantic HMS charter/headboat permit holders, who can operate in a commercial manner when they are not for hire, are reported by federally permitted dealers; however, these permit holders are not required to provide logbook data. To correct for the landings not included in the logbook data (and therefore to allow for meaningful comparisons between the estimates of harvesting capacity and the CQs), the harvesting capacity estimates based on the logbook data were adjusted using a multiplier equal to the ratio of total reported landings in the dealer reports to total reported landings in the logbooks. These adjustments were made by HMS species group and CQ area to generate the harvesting capacity estimates presented in Section 6 and Table 4.

The estimates based on dealer reports tend to be more inclusive for two reasons: (1) they provide more complete landings data for the five gear groups undergoing separate assessments; and (2) they provide landings data for additional gear groups. Therefore, it is assumed that the species group–specific capacity utilization rates generated using the logbook data provide good estimates for all trips combined, including trips without logbook data and trips for other than the five gear groups that were assessed separately. This assumption is more likely to be valid if (1) the trips included in the logbook data are representative of all trips or (2) those trips account for a very large share of total landings by species group.

The logbook estimates of landings as a percent of the dealer report estimates are presented below. The dealer report estimates for tuna and swordfish, which were in round weight, were converted to dressed weight by dividing by 1.25 and 1.33, respectively, for tunas and swordfish. Blue shark was the only species group for which the dealer report estimate was substantially below the logbook estimate. The logbook and dealer estimates were 1.5 t and 0.1 t, respectively. This discrepancy probably is due to species group identification errors or because blue sharks were caught and reported but not landed.

Large Coastal Sharks GOM	56%
Small Coastal Sharks GOM	62%
Large Coastal Sharks S Atl.	62%
Small Coastal Sharks S Atl.	78%
Large Coastal Sharks N Atl.	28%
Blue Sharks	1549%
Porbeagle Sharks	35%
Other Pelagic Sharks	63%
Albacore Tuna	89%
Swordfish	104%

5. Harvesting Capacity Assessment by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess harvesting capacity for all species combined (i.e., the HMS species groups and all other species groups) are presented by fleet and summarized in Table 3. The landings and harvesting capacity estimates in this section and Table 3 are based on logbook information and are provided in metric tons dressed weight. The results of the assessment by species group for all fleets combined are in Section 6. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and thus to the harvesting capacity estimates for multiple fleets). The assessment for the trawl fleet, which can land only limited amounts of HMS species groups as incidental catch, is included in the assessment totals and in Table 3 but is not discussed separately.

5.1 Bottom Longline Fleet

The bottom longline fleet had total reported landings of 1.2 thousand t in 2004, and the lower and higher capacity estimates were 2 and 3.2 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.8 thousand t or 64 percent for the lower capacity estimate, and by almost 2 thousand t or 156 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 39 percent of its higher capacity level and 61 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a fleet with 61 percent or 39 percent less harvesting capacity would have been able to land as much as was landed in 2004 if it had fully utilized its remaining capacity. Harvesting at capacity would have occurred with the following percentage changes in variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+11 percent), mean crew size (–11 percent), total crew days (–1.2 percent), and mean miles of longline gear per set (–11 percent).

5.2 Pelagic Longline Fleet

The pelagic longline fleet had total reported landings of 4.6 thousand t in 2004, and the lower and higher capacity estimates were 5.3 and 6.4 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.7 thousand t or 16 percent for the lower capacity estimate, and by 1.8 thousand t or 39 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 72 percent of its higher capacity level and 86 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a fleet with 28 percent or 14 percent less harvesting capacity would have been able to land as much as was landed in 2004 if it had fully utilized its remaining capacity. Harvesting at capacity would have occurred with the following percentage changes in variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (7.9 percent), mean crew size (0 percent), total crew days (7.9 percent), and mean miles of longline gear per set (–1.1 percent).

5.3 Handgear Fleet

The handgear fleet had total reported landings of 349 t in 2004, and the lower and higher capacity estimates were 449 and 573 t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 99 t or 28 percent for the lower capacity estimate, and by 224 t or 64 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 61 percent of its higher capacity level and 78 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a fleet with 39 percent or 22 percent less harvesting capacity would have been able to land as much as was landed in 2004 if it had fully utilized its remaining capacity. Harvesting at capacity would have occurred with the following percentage changes in variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (+6.2 percent), mean crew size (–4 percent), and total crew days (+1.9 percent).

5.4 Other Net Gear Fleet

The other net gear fleet had total reported landings of 355 t in 2004, and the lower and higher capacity estimates were 418 and 511 t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 63 t or 18 percent for the lower capacity estimate, and by 156 t or 44 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means that the fleet was operating at only 69 percent of its higher capacity level and 85 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a fleet with 31 percent or 15 percent less harvesting capacity would have been able to land as much as was landed in 2004 if it had fully utilized its remaining capacity. Harvesting at capacity would have occurred with the following percentage changes in variable inputs: total days at sea and, therefore, mean days at sea per vessel and days at sea per trip (–1 percent), mean crew size (+4.2 percent), and total crew days (+3.1 percent).

5.5 The Five Fleets Combined

The five fleets combined had total reported landings of 6.6 thousand t in 2004, and the lower and higher capacity estimates were 8.3 and 10.7 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 1.7 thousand t or 26 percent for the lower capacity estimate, and by 4.1 thousand t or 63 percent for the higher capacity estimate. This means the five fleets would have landed that much more fish if they had operated at capacity in 2004. It also means that, in aggregate, the five fleets were operating at only 61 percent of their higher capacity level and 79 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 39 percent or 21 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity. Harvesting at capacity would have occurred with the following percentage changes in the total variable inputs: total days at sea (+8 percent) and total crew days (+6.4 percent).

Table 3. Harvesting capacity assessment for all species combined by fleet for vessels with reported HMS landings in 2004 (metric tons, dressed weight).

	Bottom Longline	Pelagic Longline	Hand-gear	Trawl	Other Net Gear	Total
Reported Landings	1,250	4,571	349	26	355	6,550
Landings Used in DEA Models	1,154	4,300	242	15	156	5,867
Percent Used in DEA Models	92%	94%	69%	58%	44%	90%
Lower Capacity Estimate (LCE)	2,049	5,306	449	29	418	8,251
Higher Capacity Estimate (HCE)	3,194	6,358	573	43	511	10,678
Lower Excess Capacity Estimate	799	735	99	4	63	1,701
Higher Excess Capacity Estimate	1,944	1,787	224	17	156	4,128
LCE as a % of Reported Landings	164%	116%	128%	114%	118%	126%
HCE as a % of Reported Landings	256%	139%	164%	167%	144%	163%
Reported Landings as a % of the LCE	61%	86%	78%	87%	85%	79%
Reported Landings as a % of the HCE	39%	72%	61%	60%	69%	61%
Number of Vessels	110	115	169	32	31	-
Actual Numbers of Trips	966	1,659	523	101	464	3,713
Trips Used in DEA Models	846	1,534	236	41	157	2,814
Percent Used in DEA Models	88%	92%	45%	41%	34%	76%
Actual Total Days at Sea	3,120	17,487	1,703	165	579	23,054
Capacity Total Days at Sea	3,469	18,871	1,808	167	573	24,888
Actual Mean Days at Sea per Vessel	28.4	152.1	10.1	5.2	18.7	214
Capacity Total Days at Sea	31.5	164.1	10.7	5.2	18.5	230
Actual Days at Sea per Trip	3.23	10.54	3.26	1.63	1.25	20
Capacity Total Days at Sea	3.59	11.37	3.46	1.65	1.23	21
Actual Mean Crew Size	2.7	3.5	2.5	1.9	2.4	13
Capacity Total Days at Sea	2.4	3.5	2.4	1.7	2.5	13
Total Crew Days (mean crew size x total days at sea)						
Actual	8,424	61,205	4,258	314	1,390	75,589
Capacity	8,326	66,049	4,339	284	1,433	80,430
Actual Mean Gear Length (miles)	9.8	26.9	-	-	-	-
Capacity Mean Gear Length (miles)	8.7	26.6	-	-	-	-

Note: The landings and capacity estimates are based on logbook data and are only for trips with HMS landings; therefore, they do not include landings or capacity estimates for the other trips by the vessels with HMS landings. However, the landings and capacity estimates do include other species landed with HMS species groups.

6. Harvesting Capacity Assessment by HMS Species Group and CQ Area for All Fleets Combined

The harvesting capacity assessment by species group for all fleets combined is presented below by HMS species group and CQ area. The harvesting capacity estimates generated using logbook landings data were adjusted to reflect the differences between estimates of landings from the logbook and from dealer reports. Therefore, the landings and harvesting capacity estimates discussed below and summarized in Table 4 are based on dealer report landings data. The estimates are in metric tons dressed weight and round weight, respectively, for sharks and for tunas and swordfish. The adjustment method is described in Section 4.

6.1 Gulf of Mexico Large Coastal Sharks

The reported landings of Gulf of Mexico large coastal sharks for all fleets combined were almost 1.1 thousand t in 2004, and the lower and higher species group specific capacity estimates were 2.1 and almost 3.5 thousand t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by about 1 thousand t, or 95 percent for the lower capacity estimate and by 2.4 thousand t or 222 percent for the higher capacity estimate. This means the fleets would have landed that much more shark if they had operated at capacity in 2004. It also means the fleets were operating at only 31 percent of their higher capacity level and 51 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 69 percent or 49 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

The CQ for Gulf of Mexico large coastal sharks was about 0.5 thousand t in 2004. The species group specific capacity estimates exceeded the CQ by 1.6 thousand t or 340 percent for the lower capacity estimate, and by 3 thousand t or 625 percent for the higher capacity estimate. This means that for the lower or higher estimates of capacity, respectively, fleets with 77 percent or 86 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that reported Gulf of Mexico large coastal sharks landings exceeded the CQ by 125 percent is further evidence that there was overcapacity in 2004.

6.2 Gulf of Mexico Small Coastal Sharks

The reported landings of Gulf of Mexico small coastal sharks for all fleets combined were 55 t in 2004, and the lower and higher species group specific capacity estimates were 67 and 77 t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by 12 t or 21 percent for the lower capacity estimate, and by 22 t or 40 percent for the higher capacity estimate. This means the fleets would have landed that much more shark if they had operated at capacity in 2004. It also means the fleets were operating at only 71 percent of their higher capacity level and 83 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 29 percent or 17 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity, there was not overcapacity for Gulf of Mexico small coastal sharks in 2004, and only 25 percent of the CQ of 218 t was taken. The lower species group specific capacity estimate (67 t) was 151 t less than the CQ, or only 31 percent of the CQ. The higher capacity estimate (77 t) was 140 t less than the CQ, or only 36 percent of the CQ. This means that for the lower or higher capacity estimates, respectively, fleets with 226 percent or 181 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004.

6.3 South Atlantic Large Coastal Sharks

The reported landings of South Atlantic large coastal sharks for all fleets combined were almost 0.7 thousand t in 2004, and the lower and higher species group specific capacity estimates were 0.9 and 1.3 thousand t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by almost 0.2 thousand t or 24 percent for the lower capacity estimate, and by 0.6 thousand t or 91 percent for the higher capacity estimate. This means the fleets would have landed that much more shark if they had operated at capacity in 2004. It also means the fleets were operating at only 52 percent of their higher capacity level and 81 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 48 percent or 19 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

The CQ for South Atlantic large coastal sharks was about 0.6 thousand t in 2004. The species group specific capacity estimates exceeded the CQ by 0.2 thousand t or 40 percent for the lower capacity estimate, and by 0.7 thousand t or 116 percent for the higher capacity estimate. This means that for the lower or higher estimates of capacity, respectively, fleets with 29 percent or 54 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that reported South Atlantic large coastal sharks landings exceeded the CQ by 13 percent is further evidence that there was overcapacity in 2004.

6.4 South Atlantic Small Coastal Sharks

The reported landings of South Atlantic small coastal sharks for all fleets combined were 163 t in 2004, and the lower and higher species group specific capacity estimates were 203 and 276 t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by 40 t, or 25 percent for the lower capacity estimate and by 113 t or 70 percent for the higher capacity estimate. This means the fleets would have landed that much more shark if they had operated at capacity in 2004. It also means the fleets were operating at only 59 percent of their higher capacity level and 80 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 41 percent or 20 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity with both estimates of harvesting capacity, the lower species group specific capacity estimate for South Atlantic small coastal sharks in 2004 was less than the CQ (222 t). The lower capacity estimate (203 t) was 19 t below the CQ, or 91 percent of the CQ. This means that, for the lower capacity estimate, fleets with 10 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on South Atlantic small coastal sharks.

However, the higher capacity estimate (276 t) exceeded the CQ by 54 t, or 24 percent. This means that, for the higher estimate of capacity, fleets with 20 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity with both capacity estimates and overcapacity with the higher capacity estimate, only 73 percent of the South Atlantic small coastal shark CQ was taken in 2004.

6.5 North Atlantic Large Coastal Sharks

The reported landings of North Atlantic large coastal sharks for all fleets combined were 121 t in 2004, and the lower and higher species group specific capacity estimates were 151 and 204 t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by 30 t or 25 percent for the lower capacity estimate, and by 83 t or 69 percent for the higher capacity estimate. This means that the fleets would have landed that much more shark if they had operated at capacity in 2004. It also means the fleets were operating at only 59 percent of their higher capacity level and 80 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 41 percent or 20 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

The CQ for North Atlantic large coastal sharks was 58 t in 2004. The species group specific capacity estimates exceeded the CQ by 93 t or 162 percent for the lower capacity estimate, and by 146 t or 254 percent for the higher capacity estimate. This means that for the lower or higher estimates of capacity, respectively, fleets with 62 percent or 72 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that reported North Atlantic large coastal shark landings exceeded the CQ by 109 percent is further evidence that there was overcapacity in 2004.

6.6 Blue and Porbeagle Sharks and Albacore Tuna

The lower harvesting capacity estimates for blue and porbeagle sharks and albacore tuna exceeded reported landings from 0 percent to 12 percent, the higher estimates exceeded reported landings from only 0 percent to 23 percent, the reported landings were from less than 0.5 percent to 18 percent of the CQs, and the higher harvesting capacity estimates were from less than 0.5 percent to 22 percent of the CQs. This means that there was not overcapacity for these three species and that fleets with substantially more harvesting capacity and operating at capacity would have been required to take the CQs in 2004. Alternatively, the fleets potentially could have taken the CQs in 2004 by increasing substantially either their total fishing effort or the part of their total fishing effort focused on blue and porbeagle sharks and albacore tuna.

6.7 Other Pelagic Sharks

The reported landings of other pelagic sharks for all fleets combined were 146 t in 2004, and the lower and higher species group specific capacity estimates were 161 and 175 t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by 15 t or 10 percent for the lower capacity estimate, and by 29 t or 20 percent for the higher capacity estimate. This means the fleets would have landed that much more shark if they had operated at capacity in 2004. It also means the fleets were operating at 83 percent of their higher capacity level and 91 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 17 percent or 9 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity, there was not overcapacity for other pelagic sharks in 2004, and only 30 percent of the CQ of 488 t was taken. The lower species group specific capacity estimate (161 t) was 327 t less than the CQ, or only 33 percent of the CQ. The higher capacity estimate (175 t) was 313 t less than the CQ, or only 36 percent of the CQ. This means that for the lower or higher capacity estimates, respectively, fleets with 203 percent or 178 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on other pelagic sharks.

6.8 Swordfish Revised

The reported landings of swordfish for all fleets combined were almost 2.1 thousand t in 2004, and the lower and higher species group specific capacity estimates were 2.4 and 2.8 thousand t (Table 4). Therefore, estimated capacity exceeded reported landings in 2004 by 0.3 thousand t or 16 percent for the lower capacity estimate, and by more than 0.7 thousand t or 32 percent for the higher capacity estimate. This means the fleets would have landed that much more swordfish if they had operated at capacity in 2004. It also means the fleets were operating at only 76 percent of their higher capacity level and 86 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, fleets with 24 percent or 14 percent less harvesting capacity would have been able to land as much as was landed in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity, there was not overcapacity for swordfish in 2004, and only 29 percent of the CQ of 7.1 thousand t was taken. The lower species group specific capacity estimate (2.4 thousand t) was 4.7 thousand t less than the CQ, or only 34 percent of the CQ. The higher capacity estimate (2.8 thousand t) was 4.3 thousand t less than the CQ, or only 39 percent of the CQ. This means that for the lower or higher capacity estimates, respectively, fleets with 194 percent or 156 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets potentially could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on swordfish.

Table 4. Harvesting capacity assessment[1] by Atlantic HMS species group and CQ area for all fleets combined in 2004 (metric tons[2]).

	Gulf of Mexico CQs		South Atlantic CQs		North Atlantic CQs
	Large Coastal Sharks	Small Coastal Sharks	Large Coastal Sharks	Small Coastal Sharks	Large Coastal Sharks
Landings	1,075	55	695	163	121
Commercial Quota (CQ)	478	218	614	222	58
Lower Capacity Estimate (LCE)	2,101	67	862	203	151
Higher Capacity Estimate (HCE)	3,463	77	1,326	276	204
Lower Excess Capacity Estimate	1,026	12	166	40	30
Higher Excess Capacity Estimate	2,388	22	631	113	83
LCE as a % of the Landings	195%	121%	124%	125%	125%
HCE as a % of the Landings	322%	140%	191%	170%	169%
Landings as a % of the LCE	51%	83%	81%	80%	80%
Landings as a % of the HCE	31%	71%	52%	59%	59%
Lower Overcapacity Estimate	1,624	-151	247	-19	93
Higher Overcapacity Estimate	2,986	-140	712	54	146
LCE as a % of the CQ	440%	31%	140%	91%	262%
HCE as a % of the CQ	725%	36%	216%	124%	354%
CQ as a % of the LCE	23%	326%	71%	110%	38%
CQ as a % of the HCE	14%	281%	46%	80%	28%
Landings as a % of the CQ	225%	25%	113%	73%	209%

Table 4 Continued.

	Non Region Specific Commercial Quotas				
	Blue Sharks	Porbeagle Sharks	Other Pelagic Sharks	Albacore Tuna	Swordfish
Landings	0.1	2.6	146	137	2,089
Commercial Quota (CQ)	273	92	488	759	7,096
Lower Capacity Estimate (LCE)	0.1	2.6	161	153	2,417
Higher Capacity Estimate (HCE)	0.1	2.6	175	168	2,767
Lower Excess Capacity Estimate	0.0	0	15	16	328
Higher Excess Capacity Estimate	0.0	0	29	31	678
LCE as a % of the Landings	102%	100%	110%	112%	116%
HCE as a % of the Landings	102%	100%	120%	123%	132%
Landings as a % of the LCE	98%	100%	91%	90%	86%
Landings as a % of the HCE	98%	100%	83%	82%	76%
Lower Overcapacity Estimate	-273	-90	-327	-606	-4,679
Higher Overcapacity Estimate	-273	-90	-313	-591	-4,329
LCE as a % of the CQ	0%	3%	33%	20%	34%
HCE as a % of the CQ	0%	3%	36%	22%	39%
CQ as a % of the LCE	268519%	3550%	303%	496%	294%
CQ as a % of the HCE	268519%	3550%	278%	451%	256%
Landings as a % of the CQ	0%	3%	30%	18%	29%

1. The capacity estimates for the longline, handgear, trawl, and net fleets were generated with DEA models. The capacity estimates for the other fleets, which accounted for a small part of the total commercial HMS landings in 2004, are based on the estimated capacity utilization rates for those five fleets combined and the reported landings of the other fleets. All the capacity estimates in this table were generated by adjusting the estimates based on logbook data to provide estimates that are comparable to the dealer report estimates of landings included in this table. The adjustment method is discussed in Section 4.

2. The landings and capacity estimates are in dressed weight for sharks and in round weight for tunas and swordfish.

APPENDIX 6

U.S. Caribbean Region Assessment

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1. Introduction

This report presents an assessment of harvesting capacity for the commercial fisheries managed under the fishery management plans (FMPs) for the spiny lobster fishery, shallow water reef fish fishery, and queen conch resources of Puerto Rico and the U.S. Virgin Islands. The assessment, which is for 2004, includes fisheries in commonwealth, territorial, and exclusive economic zone (EEZ) waters in the U.S. Caribbean.

Sections 1 through 4 of the National Assessment provide critical background information. Specifically, they explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the U.S. Caribbean fisheries will be difficult to understand and could easily be misinterpreted if those sections are not read first.

The assessment for the U.S. Caribbean fisheries is by fleet and by species group for each of three areas. The three areas are St. Thomas and St. John, St. Croix, and Puerto Rico. The first two areas are in the U.S. Virgin Islands (USVI). "Fleet" refers to a specific part of a fishery and "species group" refers to one or more individual species. Specifically, fleets refer to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing boats. This use of "fleet" is explained by the following points using the example of the St. Thomas and St. John line fishing fleet: (1) this fleets refers to the St. Thomas and St. John fishing trips for which line fishing gear was used; (2) the assessment of harvesting capacity for that fleet is for such trips and not for the other fishing activities of the fishing boats that made such trips; and (3) some boats in the St. Thomas and St. John line fishing fleet used additional types of gear and, therefore, were in multiple St. Thomas and St. John fleets. In addition, fishermen typically landed multiple species groups together. As a result, many boats contributed to the landings and, therefore, to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species groups and fleets.

The assessment indicates that there were high rates of excess capacity for many fleets and substantial levels of overcapacity for most optimum yield (OY) species groups in 2004. For individual St. Thomas and St. John fleets, estimated harvesting capacity exceeded reported landings by 2 percent to 191 percent for the lower capacity estimates, and by 29 percent to almost 400 percent for the higher capacity estimates. For all St. Thomas and St. John fleets combined, harvesting capacity exceeded reported landings by 44 percent and 142 percent, respectively, for the lower and higher capacity estimates.

For the St. Croix fleets, estimated harvesting capacity exceeded reported landings by 0 percent to 31 percent for the lower capacity estimates, and by 0 percent to over 250 percent for the higher capacity estimates. For all St. Croix fleets combined, harvesting capacity exceeded reported landings by 12 percent and 132 percent, respectively, for the lower and higher capacity estimates.

Finally, for the Puerto Rico fleets, estimated harvesting capacity exceeded reported landings by 4 percent to 155 percent for the lower capacity estimates, and by 29 percent to about 700 percent for the higher capacity estimates. For all Puerto Rico fleets combined, harvesting capacity exceeded reported landings by 30 percent and 420 percent, respectively, for the lower and higher capacity estimates. The assessment of overcapacity for each of the 16 OY species groups listed in Table 1 for all areas and fleets combined indicates that there was substantial overcapacity for most OY species groups. By simply comparing estimated landings to the OY proxies, it is clear that there was overcapacity for all but three OY species groups (goatfish, squirrelfish, and tilefish) in 2004. For the other 13 OY species groups, estimated landings exceeded the OY proxies from 6 percent to over 200 percent. The lower capacity estimates were less than the OY proxies for only three OY species groups (goatfish, squirrelfish, and tilefish). For the other 13 OY species groups, the lower capacity estimates exceeded the OY proxies from a low of 41 percent for snapper to a high of almost 300 percent for surgeonfish. The higher capacity estimates were less than the OY proxies for only two OY species groups (squirrelfish and tilefish). For the other 14 OY species groups, the higher capacity estimates exceeded the OY proxies from a low of 34 percent for goatfish to more than 800 percent for both lobster and conch.

Problems with under-reported landings, particularly for Puerto Rico, raised concerns about the accuracy of the assessments (see Section 2). For Puerto Rico, reported landings were 62 percent of estimated landings[52]; and for the USVI, reported landings were 80 percent of estimated landings.[53] An additional concern with the assessment of Puerto Rico's fleets is that, due to data problems, only 44 percent of the reported landings data could be used in the DEA models. This means that only about 27 percent of the estimated total landings were used to estimate harvesting capacity for the Puerto Rico fleets because overall only 44 percent of the reported landings were used in the DEA models and only 62 percent of the estimated total landings were reported.

The remainder of this report consists of brief discussions of the management of the U.S. Caribbean commercial fisheries and the data used in the assessment of harvesting capacity, followed by a separate section for each of the three areas and a summary of the overcapacity assessment for the three areas combined. Each area-specific section contains the following: (1) a brief description of statistics on the physical characteristics and reported landings by fleet of the fishing boats with reported landings in 2004; (2) a brief description of the methods used to estimate harvesting capacity; (3) the assessment results by fleet for all species combined; and (4) the assessment results by species group for all fleets combined.

The summary tables and text present reported landings and estimated landings, as well as estimates of harvesting capacity, excess capacity, and overcapacity in thousand pounds whole weight, rounded to the nearest 0.1 or 1 thousand pounds (100 or 1,000 pounds), and they present percentages that typically are rounded to the nearest 1 percent. This rounding can give the impression of internal inconsistencies. For example, the excess capacity estimates may not be exactly equal to the difference between the harvesting capacity and landings estimates in the

[52] Daniel Matos, Puerto Rico Departamento de Recursos Naturales y Ambientales (DRNA), personal communication.

[53] Josh Bennett, USVI Department of Planning and Natural Resources (DPNR), personal communication.

report. Similarly, the percentage of excess capacity cannot always be reproduced exactly by using the landings data and harvesting capacity estimate in the report.

2. Fishery Management and the Data Used in the Assessment

2.1 Fishery management

Broadly speaking, the U.S. Caribbean fisheries in the EEZ are managed under a regulated open-access regime. No permits are required to harvest in federal waters (other than for the highly migratory species [HMS] fishery). A number of marine protected areas and seasonal closures are established to protect the spawning aggregations of various reef fish species. In addition, the harvest of certain species such as Goliath and Nassau grouper is prohibited. The harvest of queen conch in the EEZ (with the exception of the Lang Bank) also is banned. Gillnets and trammel nets are prohibited in the Caribbean EEZ reef fish and spiny lobster fisheries. Traps (i.e., pots), gillnets, trammel nets, and bottom longlines on coral or hard bottom is prohibited year-round in the existing seasonally closed areas and Grammanik Bank in the EEZ. Size limits and mesh size regulations are also in place.

In U.S. Virgin Islands waters (0–3 miles), there has been a moratorium on new entry since 2001. The fishery is primarily managed via minimum size limits, seasonal closures, and mesh size restrictions. Gillnets and trammel nets are being phased out of the fishery. For queen conch, there is a daily quota of 150 conch per licensed fisherman. In Puerto Rico waters (0–9 miles), there are licensing requirements but the fishery is not closed to new entry. This regulated open access fishery is managed primarily via seasonal closures, size limits, and mesh size regulations.

In summary, fishing effort was constrained by season closures on certain species (which limited the number of trips in 2004) and a daily quota for queen conch (which limited landings per trip). In 2007, the same constraints remain in place and no new ones have been added. The optimal yields have not changed. Therefore, changes to fishery regulations probably have not been diminished the current relevancy of the capacity assessment for 2004.

For the Caribbean fisheries, OYs are specified for 16 species groups, where most OY species groups include more than one individual species. These OYs are for all fisheries (i.e., the commercial and recreational) and all areas combined. Therefore, to assess overcapacity in the commercial fisheries for each of three areas, it was necessary to have an OY proxy by species group for the commercial fisheries in each area. The OY proxies were generated by first apportioning a share of each OY to the commercial fisheries based on the percent of the catch of the OY species group accounted for by the commercial fisheries. Average annual landings by species for 1997–2001 and 1994–2002, respectively, were used for the commercial fisheries of Puerto Rico and the USVI. Recreational landings were averaged from the Marine Recreational Fisheries Statistics Survey (MRFSS) over 2000–2001 for Puerto Rico, and extrapolated for the USVI. That share of the OY was then apportioned among the three areas based on the percent of the commercial catch of that OY species group accounted for by the commercial fisheries of each area. The fishery-wide OYs that were used are from Table 8 of the Comprehensive Amendment to the Fishery Management Plans of the U.S. Caribbean. The data in Tables 5 and 7 of that report were used to apportion each OY to the commercial fisheries as a whole and among the three areas for assessing overcapacity in the commercial fisheries of each of the three areas. The resulting OY proxies are in Table 1.

A target catch level, such as the quota for the commercial fisheries, is the reference point used to calculate overcapacity by species group in the National Assessment. In the reports for the other regions, “TAC” or “TAC proxy” refers to the commercial quota. Because there were neither TACs nor commercial quotas for most OY species groups in the Caribbean fisheries, OY proxies were the reference points used in this report. In most fisheries, TACs are set below the corresponding OYs. Therefore, the use of OY proxies as the reference points results in higher reference points than were used for most fisheries. This means that, all else being equal, the estimates of overcapacity presented in this report have a downward bias compared to those in the other reports. “OY proxy” is used throughout this report to highlight that important difference between the overcapacity estimates in this report and those in the reports for the other regions.

Table 1: U.S. Caribbean commercial fishery OY proxies by OY species group and area (1,000 pounds, whole weight)

OY Species Group	OY Proxies		
	St. Thomas and St. John	St. Croix	Puerto Rico
Spiny Lobster	38.52	37.01	273.31
Queen Conch	0.75	36.59	238.27
Snapper	60.78	56.10	909.10
Grouper	19.72	13.70	133.28
Grunt	18.22	16.82	124.17
Goatfish	0.12	1.89	19.15
Porgy	7.56	1.77	28.89
Squirrelfish	1.05	0.01	16.19
Tilefish	0.08	0.08	0.51
Jack	22.62	6.76	72.47
Parrotfish	25.14	142.48	83.18
Surgeonfish	15.66	17.66	0.01
Triggerfish/Filefish	35.00	11.05	51.46
Boxfish	17.27	5.76	77.67
Wrasse	0.11	0	54.07
Angelfish	6.19	0.06	0.07

2.2 Data Used in the Assessment

The Southeast Fisheries Science Center (SEFSC) supplied trip level commercial landings and effort data for 2004. Commercial landings reports contained information on the date and duration of the trip, gear type used, gear amount (e.g., number of traps) and usage (e.g., soak time), landings by species group, and crew size. There were important differences between the data available for Puerto Rico and the USVI. Species-specific landings data were used for Puerto Rico but they do not exist for the USVI with the exceptions of conch, lobster, and whelk. In addition, fishing area data were used for the USVI, but they do not exist for Puerto Rico. Landing site data were used for Puerto Rico but they do not exist for the USVI. Perhaps the most critical difference between the 2004 data for the USVI and Puerto Rico was that only 27 percent of total estimated catch could be used in the DEA models for Puerto Rico, compared to 67 percent for St. Thomas and St. John and 72 percent for St. Croix. There are two reasons for this difference. First, there was significant under-reporting of landings for Puerto Rico in 2004 due to the industry's opposition to the new fishery regulations; for all species combined, it was estimated that only 62 percent of the actual landings were reported.[54] For the USVI fisheries, it was estimated that the reported landings were 80 percent of total landings.[55] Second, due to data problems, only 44 percent of the reported landings could be used in the DEA models for Puerto Rico, compared to 84 percent for St. Thomas and St. John and 90 percent for St. Croix. Due both to the small percentage of estimated total landings used in the DEA models and to the uncertainty concerning actual landings by OY species group, the credibility problems for the assessments would appear to be most severe for Puerto Rico.

Boat-specific information such as length, beam, engine power, and hull type from the 2001 Puerto Rico Fishermen Census and the 2003 USVI Fishermen Census was made available (Matos et al. 2003; Kojis 2004). The USVI Department of Planning and Natural Resources (DPNR) and Puerto Rico Departamento de Recursos Naturales y Ambientales (DRNA), respectively, had collected the data used in this report for the fisheries of the USVI and Puerto Rico.

3. Fisheries of St. Thomas and St. John

This section presents fleet-specific information on both the physical characteristics of the fishing boats that participated in the St. Thomas and St. John commercial fisheries in 2004 and their reported landings. The physical characteristics and landings data are summarized in Tables 3.1 and 3.2, respectively. The information on fishing boat characteristics includes statistics on the reported fishing boat length and engine power. Boats without data for a specific characteristic were not included in the statistics reported below for that characteristic. For example, if the engine power was unknown for 12 fishing boats (i.e., not in the fishing boat characteristics database used for this assessment), those 12 fishing boats were not included in estimating mean engine power.

[54] Daniel Matos, Puerto Rico Departamento de Recursos Naturales y Ambientales (DRNA), personal communication.

[55] Josh Bennett, USVI Department of Planning and Natural Resources (DPNR), personal communication.

In the St. Thomas and St. John fisheries, reported landings for 2004 were 80 percent of total estimated landings. Because fleet-specific adjustment factors were not available, the under-reporting was not adjusted for in the statistics and estimates presented in Sections 3.1 and 3.3, which present information by fleet. However, under-reporting was adjusted for in the statistics presented in Section 3.4, which includes comparisons of the OY proxies to harvesting capacity estimates by OY species group for all fleets combined.

The fishing boat characteristics and reported landings data are provided for the six fleets (i.e., types of fishing trips) defined by gear type and 22 species groups listed below. Other fleets (e.g., gillnet gear fleet) accounted for a very small part of the reported landings in 2004. Their reported landings are included in the totals, but neither their reported landings nor boat characteristics are provided by fleet.

St. Thomas and St. John Fleets	
1. Cast net	4. Seine net
2. Free diving	5. Scuba
3. Line fishing	6. Trap

St. Thomas and St. John Species Groups		
1. Grouper	9. Boxfish	17. Squirrelfish
2. Snapper	10. Angelfish	18. Baitfish
3. Grunt	11. Barracuda	19. Lobster
4. Porgy	12. Goatfish	20. Conch
5. Jack	13. Mackerel	21. Whelk
6. Surgeonfish	14. Tuna	22. Miscellaneous
7. Parrotfish	15. Dolphin	
8. Triggerfish	16. Wahoo	

3.1 Boat Characteristics and Reported Landings by Fleet

This section presents fleet-specific information on fishing boat characteristics and reported landings. Tables 3.1 and 3.2 summarize that information. As noted above, “fleets” refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing boats. Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing boats in that fleet. If a fishing boat was in multiple fleets, it is included in the boat characteristics and reported landings statistics for multiple fleets.

3.1.1 Cast Net Gear Fleet

Landings with cast net gear were reported for 7 boats in 2004. The boats ranged in length from 12 to 21 feet with a mean of 16 feet. They had between 15 and 55 horsepower with a mean of 37 (Table 3.1). Baitfish accounted for almost all of their reported landings of 11.7 thousand pounds, and their landings accounted for almost half of the total reported landings of baitfish for the St. Thomas and St. John fleets (Table 3.2). In total, this fleet accounted for only 1 percent of the total reported landings by those fleets.

3.1.2 Free Diving Gear Fleet

Landings with free diving gear were reported for 12 boats in 2004. The boats ranged in length from 12 to 25 feet with a mean of 18 feet. They had between 15 and 100 horsepower with a mean of 46 (Table 3.1). Whelk accounted for 78 percent of their reported landings of 3.4 thousand pounds, and their landings accounted for 88 percent of the total reported landings of whelk for the St. Thomas and St. John fleets (Table 3.2). In total, this fleet accounted for less than 0.5 percent of the total reported landings by those fleets.

3.1.3 Line Fishing Gear Fleet

The line fishing gear fleet was the largest and second most productive of the St. Thomas and St. John fleets. The 63 boats that reported landings with line fishing gear in 2004 were typically larger than the boats in most St. Thomas and St. John fleets. They ranged in length from 12 to 48 feet with a mean of 22 feet. They had between 15 and 800 horsepower with a mean of 130 (Table 3.1). Snapper landings of 69 thousand pounds accounted for 45 percent of their total reported landings of 151 thousand pounds, and their landings accounted for 49 percent of the total reported landings of snapper for the St. Thomas and St. John fleets (Table 3.2). Their tuna landings of 11.8 thousand pounds accounted for 73 percent of the total reported tuna landings for the St. Thomas and St. John fleets. The other species groups for which this fleet produced most of the landings were barracuda (97 percent), mackerel (83 percent), dolphin (93 percent), and wahoo (100 percent). In total, this fleet accounted for 19 percent of the total reported landings by those fleets.

3.1.4 Seine Net Gear Fleet

Landings with seine net gear were reported for 16 boats in 2004. The boats ranged in length from 16 to 34 feet with a mean of 20 feet. They had between 40 and 225 horsepower with a mean of 65 (Table 3.1). Jack accounted for 52 percent of their reported landings of 67 thousand pounds and snapper accounted for 31 percent, and their jack landings accounted for 61 percent of the total reported landings of jack for the St. Thomas and St. John fleets (Table 3.2). In total, this fleet accounted for 9 percent of the total reported landings by those fleets.

3.1.5 Scuba Gear Fleet

The 8 boats that reported landings with scuba gear in 2004 ranged in length from 12 to 19 feet with a mean of 17 feet. They had between 15 and 100 horsepower with a mean of 54 (Table

3.1). Lobster accounted for 48 percent of their total reported landings of 14.3 thousand pounds and their landings accounted for 5 percent of the total reported lobster landings for the St. Thomas and St. John fleets (Table 3.2). In total, they accounted for only 2 percent of the total reported landings by those fleets.

3.1.6 Trap Gear Fleet

The trap gear fleet was the second largest and by far the most productive St. Thomas and St. John fleet. The 54 boats that reported landings with trap gear in 2004 were typically larger than the boats in most St. Thomas and St. John fleets. They ranged in length from 12 to 40 feet with a mean of 26 feet. They had between 15 and 350 horsepower with a mean of 154 (Table 3.1). Lobster landings of 133 thousand pounds accounted for 25 percent of their total reported landings of 534 thousand pounds, and their landings accounted for 95 percent of the total reported lobster landings for the St. Thomas and St. John fleets (Table 3.2). This fleet accounted for the vast majority of the reported landings of 10 of the 22 species groups. In total, it accounted for 68 percent of the total reported landings by those fleets.

Table 3.1 Boat characteristics for the fishing boats that participated in the St. Thomas and St. John fisheries in 2004.

	Cast Net	Free Diving	Line Fishing	Seine Net	Scuba	Trap	Total
Number of Boats	7	12	63	16	8	54	133
Boat Length (ft)							
Mean	16	18	22	20	17	26	23
Minimum	12	12	12	16	12	12	12
Maximum	21	25	48	34	19	40	48
Engine Power (hp)							
Mean	37	46	130	65	54	154	128
Minimum	15	15	15	40	15	15	15
Maximum	55	100	800	225	100	350	800
Number of Trips	118	50	1,681	373	193	2,776	5,196

Table 3.2 Reported landings in the St. Thomas and St. John fisheries by fleet and species group, 2004 (1,000 pounds, whole weight).

	Cast Net	Free Diving	Line Fishing	Seine Net	Scuba	Trap	Total	% in DEA models
Grouper	0.0	0.1	12.9	0.8	0.4	56.9	71.1	86%
Snapper	0.0	0.1	68.6	20.8	2.3	49.4	141.3	78%
Grunt	0.0	0.0	1.3	2.1	0.0	42.2	45.6	91%
Porgy	0.0	0.0	0.4	0.1	0.0	25.3	25.8	90%
Jack	0.0	0.0	20.7	34.7	0.2	0.9	56.5	85%
Surgeonfish	0.0	0.0	0.1	0.0	0.0	41.2	41.3	90%
Parrotfish	0.0	0.1	1.9	0.0	2.4	52.3	56.7	93%
Triggerfish	0.0	0.0	1.5	0.0	0.2	86.3	88.0	88%
Boxfish	0.0	0.0	0.0	0.0	0.0	32.2	32.3	88%
Angelfish	0.0	0.0	0.0	0.0	0.2	10.3	10.6	79%
Barracuda	0.0	0.0	3.2	0.1	0.0	0.0	3.3	83%
Goatfish	0.0	0.0	0.1	0.0	0.0	0.1	0.2	77%
Mackerel	0.0	0.0	5.8	1.1	0.0	0.1	7.0	62%
Tuna	0.0	0.0	11.8	4.3	0.0	0.0	16.1	59%
Dolphin	0.0	0.0	6.3	0.0	0.0	0.4	6.7	42%
Wahoo	0.0	0.0	4.1	0.0	0.0	0.0	4.1	12%
Squirrelfish	0.0	0.0	0.0	0.0	0.0	2.1	2.1	25%
Baitfish	11.7	0.0	10.6	2.9	0.0	0.4	25.6	43%
Lobster	0.0	0.2	0.1	0.0	6.8	133.1	140.2	92%
Conch	0.0	0.4	0.0	0.0	1.4	0.0	1.8	87%
Whelk	0.0	2.9	0.0	0.2	0.1	0.0	3.2	92%
Misc. Species	0.0	0.0	1.5	0.0	0.1	0.5	2.1	80%
Total	11.7	3.7	150.8	67.0	14.3	533.8	781.4	84%

3.2 Methods

Data envelopment analysis (DEA), a mathematical programming approach, was used to estimate harvesting capacity by trip. Boat length and engine power were used as the fixed inputs, and hours fished per trip was used as the variable input. The outputs were the landings for each of the 22 species groups, which included OY species groups and other species groups. Trips were stratified by gear type (i.e., fleet) and quarter. A separate DEA model was used to estimate capacity by trip and species group for each stratum. The resulting estimates by trip were summed to calculate harvesting capacity by boat for a given type of trip, and the boat-specific estimates were summed to generate the species group and fleet-specific harvesting capacity estimates presented in this report.

Due to missing observations and coding errors in both the catch trip reports and the fishermen census, the DEA models could not use all the trip data for each fleet. For the St. Thomas and St. John fleets as a whole, 84 percent of the reported landings were used in the DEA models (Table 3.2). For individual species groups, the percent of reported landings used in the DEA models ranged from 12 percent for wahoo to 93 percent for parrotfish. Most of the commercially important reef fish and shellfish were well represented in the analysis. For example, the DEA models included 78 percent of the snapper landings, 86 percent of the grouper landings, 88 percent of the triggerfish landings, and 92 percent of the lobster landings. In contrast, the DEA models included a smaller part of the reported landings for pelagic species such as wahoo (12 percent), dolphin (42 percent), and tuna (59 percent); however, their contribution to total landings was modest. The data used in the DEA models accounted for the fishing activities of 73 percent of the fishing boats with reported landings in 2004.

To provide estimates of excess capacity (i.e., the difference between the estimate of harvesting capacity and reported landings) by fleet, the estimates of harvesting capacity by fleet based on the data (i.e., trips) used in the DEA models were expanded to estimate harvesting capacity by fleet based on all trips. The fleet-specific expansion factor used was equal to total reported landings divided by the reported landings used in the DEA models for each fleet. Therefore, the implicit assumption was that the estimate of capacity utilization for each fleet based on the data used in the DEA models provided a good estimate of capacity utilization for each fleet as a whole.

3.3 Capacity Assessment by Fleet for All Species Combined

This section presents the results of the fleet-specific assessments of harvesting capacity and excess capacity for all species combined. Table 3.3 summarizes the results. Section 3.4 presents the species group-specific results for all fleets combined. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing boats. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and therefore to the harvesting capacity estimates for multiple fleets).

3.3.1 Cast Net Gear Fleet

The cast net gear fleet had total reported landings of 11.7 thousand pounds in 2004, and the lower and higher capacity estimates were 12.8 and 25.2 thousand pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 1.1 thousand pounds or 9 percent for the lower capacity estimate, and by 13.5 thousand pounds or 115 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 46 percent of its higher capacity level and 92 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 54 percent or 8 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with no change in the average number of hours fished per trip.

3.3.2 Free Diving Gear Fleet

The free diving gear fleet had total reported landings of 3.7 thousand pounds in 2004, and the lower and higher capacity estimates were 5.3 and 7.5 thousand pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 1.6 thousand pounds or 44 percent for the lower capacity estimate, and by 3.9 thousand pounds or 105 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 49 percent of its higher capacity level and 69 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 51 percent or 31 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 25 percent reduction in the average number of hours fished per trip.

3.3.3 Line Fishing Gear Fleet

The line fishing gear fleet had total reported landings of 151 thousand pounds in 2004, and the lower and higher capacity estimates were 192 and 420 thousand pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 41 thousand pounds or 27 percent for the lower capacity estimate, and by 269 thousand pounds or 178 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 36 percent of its higher capacity level and 79 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 64 percent or 21 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with no change in the average number of hours fished per trip.

3.3.4 Seine Net Gear Fleet

The seine net gear fleet had total reported landings of 67 thousand pounds in 2004, and the lower and higher capacity estimates were 195 and 326 thousand pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 128 thousand pounds or 191 percent for the lower capacity estimate, and by 259 thousand pounds or 387 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 21 percent of its higher capacity level and 34 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 79 percent or 66 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have required a 17 percent increase in the average number of hours fished per trip in 2004.

3.3.5 Scuba Gear Fleet

The scuba gear fleet had total reported landings of 14.3 thousand pounds in 2004, and the lower and higher capacity estimates were 14.6 and 18.5 thousand pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.3 thousand pounds or 2 percent for the lower capacity estimate, and by 4.1 thousand pounds or 29 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 77 percent of its higher capacity level and 98 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 23 percent or 2 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 25 percent reduction in the average number of hours fished per trip.

3.3.6 Trap Gear Fleet

The trap gear fleet had total reported landings of 534 thousand pounds in 2004, and the lower and higher capacity estimates were 702 and 1,097 thousand pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 168 thousand pounds or 31 percent for the lower capacity estimate, and by 563 thousand pounds or 106 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 49 percent of its higher capacity level and 76 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 51 percent or 24 percent less capacity would have been able to make the reported landings if it had operated at capacity.

3.3.7 All Fleets Combined

The St. Thomas and St. John fleets had total reported landings of almost 0.8 million pounds in 2004, and the lower and higher capacity estimates were 1.1 and 1.9 million pounds (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.3 million pounds or 44 percent for the lower capacity estimate, and by 1.1 million pounds or 142 percent for the higher capacity estimate. This means these fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 41 percent of their higher capacity level and 70 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 59 percent or 30 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Table 3.3 St. Thomas and St. John fisheries harvesting capacity assessment by fleet for all species combined, 2004 (1,000 pounds, whole weight).

	Cast Net	Free Diving	Line Fishing	Seine net	Scuba	Trap	Total
Reported Landings	11.7	3.7	151	67	14.3	534	781
Landings Used in the DEA Models	2.7	3.4	94	63	13.9	479	656
Percent of Landings Used in the DEA Models	23%	92%	62%	95%	97%	90%	84%
Lower Capacity Estimate (LCE)	12.8	5.3	192	195	14.6	702	1,121
Higher Capacity Estimate (HCE)	25.2	7.5	420	326	18.5	1,097	1,894
Lower Excess Capacity Estimate	1.1	1.6	41	128	0.3	168	340
Higher Excess Capacity Estimate	13.5	3.9	269	259	4.2	563	1,113
LCE as a % of Reported Landings	109%	144%	127%	291%	102%	131%	144%
HCE as a % of Reported Landings	215%	205%	278%	487%	129%	206%	242%
Reported Landings as a % of the LCE	92%	69%	79%	34%	98%	76%	70%
Reported Landings as a % of the HCE	46%	49%	36%	21%	77%	49%	41%
Reported Hour/Trip	3.0	4.0	6.0	6.0	4.0	-	-
Capacity Hour/Trip	3.0	3.0	6.0	7.0	3.0	-	-

3.4 Capacity Assessment by Species Group for All Fleets Combined

The assessment of harvesting capacity, excess capacity, and overcapacity for each of the 14 OY species groups landed by the St. Thomas and St. John fleets for all fleets combined is summarized in Table 3.4 and discussed in this section. Although Table 3.4 includes estimates of harvesting capacity and excess capacity for species groups without OYs, the following discussion focuses on the 14 OY species groups landed by the St. Thomas and St. John fleets. Those OY species groups are listed below.

OY Species Groups Landed by the St. Thomas and St. John Fleets					
1	Grouper	6	Surgeonfish	11	Goatfish
2	Snapper	7	Parrotfish	12	Squirrelfish
3	Grunt	8	Triggerfish	13	Lobster
4	Porgy	9	Boxfish	14	Conch
5	Jack	10	Angelfish		

Tilefish and wrasse are the two OY species groups not included. There were either no or only insignificant reported landings for those two OY species groups.

To allow for a meaningful comparison to the OY proxy for each OY species group, the capacity estimates generated for the reported landings used in the DEA models were adjusted upward using a factor equal to the ratio of estimated landings to landings used in the DEA models for each OY species group.

By simply comparing estimated landings to the OY proxies, it is clear that there was substantial overcapacity for most OY species groups in 2004. Estimated landings exceeded the OY proxies for 13 of the 14 OY species groups. The one exception was squirrelfish, with estimated landings equal to 73 percent of the OY proxy. The percent by which estimated landings exceeded the OY proxies in 2004 ranged from 91 percent for goatfish to almost 400 percent for lobster. The estimated landings exceeded the OY proxies by 100 percent or more for 12 OY species groups.

The lower capacity estimates exceeded the estimated landings from a low of 2 percent for goatfish to a high of 199 percent for jack. The higher capacity estimates exceeded the estimated landings from a low of 7 percent for goatfish to a high of 431 percent for jack. With the exception of squirrelfish, for which both the lower and higher estimates of capacity were less than the OY proxy, the lower capacity estimates exceeded the OY proxies from a low of 94 percent for goatfish to a high of 849 percent for jack. The higher capacity estimates exceeded the OY proxies from a low of 103 percent for goatfish to a high of 1,586 percent for jack.

Table 3.4 St. Thomas and St. John fisheries harvesting capacity assessment by species group for all fleets combined, 2004 (1,000 pounds, whole weight).

	Grouper	Snapper	Grunt	Porgy	Jack	Surgeonfish	Parrotfish
Landings Used in the DEA Models	61	111	41	23	48	37	53
Estimated Total Landings	91	165	62	35	72	55	79
% Used in DEA Models	67%	67%	67%	67%	67%	67%	67%
OY Proxy	20	61	18	8	23	16	25
Lower Capacity Estimate (LCE)	125	238	82	49	215	78	104
Higher Capacity Estimate (HCE)	215	401	127	78	381	123	159
Lower Excess Capacity Estimate	34	73	20	14	143	23	25
Higher Excess Capacity Estimate	124	236	65	44	309	68	80
LCE as a % of Estimated Landings	137%	144%	132%	141%	299%	141%	132%
HCE as a % of Estimated Landings	236%	243%	206%	226%	531%	222%	202%
Estimated Landings as a % of the LCE	73%	69%	76%	71%	33%	71%	76%
Estimated Landings as a % of the HCE	42%	41%	49%	44%	19%	45%	50%
Lower Overcapacity Estimate	105	177	63	41	192	63	78
Higher Overcapacity Estimate	196	340	109	70	359	107	134
LCE as a % of the OY Proxy	633%	392%	448%	643%	949%	500%	412%
HCE as a % of the OY Proxy	1093%	660%	697%	1032%	1686%	786%	631%
Estimated Landings as a % of the OY Proxy	462%	272%	339%	457%	318%	354%	313%

Table 3.4 Continued.

	Triggerfish	Boxfish	Angelfish	Barracuda	Goatfish	Mackerel	Tuna
Landings Used in the DEA Models	78	29	8.4	2.7	0.2	4.3	9.9
Estimated Total Landings	116	42	12.4	4.0	0.2	6.4	14.7
% Used in DEA Models	67%	67%	67%	67%	67%	67%	67%
OY Proxy	35	17	6.2	N.A.	0.1	N.A.	N.A.
Lower Capacity Estimate (LCE)	152	59	13.1	4.5	0.2	7.2	17.0
Higher Capacity Estimate (HCE)	232	94	20.1	7.7	0.2	20.6	28.7
Lower Excess Capacity Estimate	36	16	0.6	0.4	0.0	0.8	2.3
Higher Excess Capacity Estimate	117	51	7.7	3.7	0.0	14.1	14.0
LCE as a % of Estimated Landings	131%	138%	105%	111%	102%	113%	115%
HCE as a % of Estimated Landings	201%	221%	162%	191%	107%	320%	195%
Estimated Landings as a % of the LCE	76%	72%	95%	90%	98%	89%	87%
Estimated Landings as a % of the HCE	50%	45%	62%	52%	94%	31%	51%
Lower Overcapacity Estimate	117	41	6.9	N.A.	0.1	N.A.	N.A.
Higher Overcapacity Estimate	197	77	13.9	N.A.	0.1	N.A.	N.A.
LCE as a % of the OY Proxy	434%	340%	211%	N.A.	194%	N.A.	N.A.
HCE as a % of the OY Proxy	664%	543%	324%	N.A.	203%	N.A.	N.A.
Estimated Landings as a % of the OY Proxy	331%	246%	201%	N.A.	191%	N.A.	N.A.

Table 3.4 Continued.

	Dolphin	Wahoo	Squirrelfish	Baitfish	Lobster	Conch	Whelk	Misc. Species
Landings Used in the DEA Models	2.4	0.5	0.5	10.9	129	1.6	3.0	1.7
Estimated Total Landings	3.6	0.7	0.8	16.3	191	2.3	4.4	2.5
% Used in DEA Models	67%	67%	67%	67%	67%	67%	67%	67%
OY Proxy	N.A.	N.A.	1.1	N.A.	38.5	0.8	N.A.	N.A.
Lower Capacity Estimate (LCE)	8.1	0.7	0.8	19.4	238	2.4	6.7	2.7
Higher Capacity Estimate (HCE)	17.7	0.9	1.0	35.6	399	2.7	9.7	3.2
Lower Excess Capacity Estimate	4.6	0.0	0.0	3.1	47	0.1	2.2	0.2
Higher Excess Capacity Estimate	14.2	0.2	0.2	19.4	207	0.4	5.2	0.7
LCE as a % of Estimated Landings	227%	103%	105%	119%	124%	104%	150%	109%
HCE as a % of Estimated Landings	494%	132%	130%	219%	208%	115%	218%	130%
Estimated Landings as a % of the LCE	44%	97%	95%	84%	80%	97%	67%	92%
Estimated Landings as a % of the HCE	20%	76%	77%	46%	48%	87%	46%	77%
Lower Overcapacity Estimate	N.A.	N.A.	-0.2	N.A.	200	1.6	N.A.	N.A.
Higher Overcapacity Estimate	N.A.	N.A.	0.0	N.A.	360	1.9	N.A.	N.A.
LCE as a % of the OY Proxy	N.A.	N.A.	77%	N.A.	619%	319%	N.A.	N.A.
HCE as a % of the OY Proxy	N.A.	N.A.	95%	N.A.	1035%	354%	N.A.	N.A.
Estimated Landings as a % of the OY Proxy	N.A.	N.A.	73%	N.A.	497%	308%	N.A.	N.A.

4. Fisheries of St. Croix

Information on both the physical characteristics of the fishing boats that participated in the St. Croix commercial fisheries in 2004 and their reported landings is discussed below by fleet (i.e., gear type). The physical characteristics and landings are summarized in Tables 4.1 and 4.2, respectively. The information on fishing boat characteristics includes statistics on the reported fishing boat length and engine power. Boats without data for a specific characteristic were not included in the statistics reported below for that characteristic.

In the St. Croix fisheries, it was estimated that the reported landings for 2004 were 80 percent of total landings. Because fleet-specific adjustment factors were not available, the under-reporting was not adjusted for in the statistics and estimates presented in Sections 4.1 and 4.3, which present information by fleet. However, under-reporting was adjusted for in the statistics presented in Section 4.4, which includes comparisons of the OY proxies to harvesting capacity estimates by OY species group for all fleets combined.

The fishing boat characteristics and reported landings data are provided for the 7 fleets defined by gear type and 20 species groups listed below. Some boats participated in more than one fleet in 2004.

St. Croix Fleets	
1. Free diving	5. Scuba
2. Gillnet	6. Trap
3. Line fishing	7. Trammel net
4. Seine net	

St. Croix Species Groups		
1. Grouper	8. Triggerfish	15. Wahoo
2. Snapper	9. Boxfish	16. Baitfish
3. Grunt	10. Barracuda	17. Lobster
4. Porgy	11. Goatfish	18. Conch
5. Jack	12. Mackerel	19. Whelk
6. Surgeonfish	13. Tuna	20. Miscellaneous
7. Parrotfish	14. Dolphin	

The reported landings of other fleets (e.g., cast net gear fleet) that landed very small amounts in 2004 are included in the totals but are not provided by fleet.

4.1 Boat Characteristics and Reported Landings by Fleet

Information on fishing boat characteristics and reported landings is discussed below and summarized in Tables 4.1 and 4.2 for each St. Croix fleet. As noted above, “fleets” refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing boats.

Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing boats in that fleet. If a fishing boat was in multiple fleets, it is included in the boat characteristics and reported landings statistics for multiple fleets.

4.1.1 Free Diving Gear Fleet

Landings with free diving gear were reported for 13 boats in 2004. The boats ranged in length from 13 to 28 feet with a mean of 18 feet. They had between 8 and 275 horsepower with a mean of 68 (Table 4.1). Conch accounted for 39 percent of their reported landings of 44 thousand pounds, and their landings accounted for 14 percent of the total reported landings of conch for the St. Croix fleets (Table 4.2). Although whelk accounted for only 8 percent of their reported landings, their whelk landings were 88 percent of the reported whelk landings for all fleets combined. In total, this fleet accounted for 4 percent of the total reported landings by all fleets.

4.1.2 Gillnet Gear Fleet

Landings with gillnet gear were reported for 18 boats in 2004. The boats ranged in length from 15 to 27 feet with a mean of 21 feet. They had between 7 and 200 horsepower with a mean of 81 (Table 4.1). Parrotfish accounted for 75 percent of their reported landings of 117 thousand pounds, and their landings accounted for 30 percent of the total reported landings of parrotfish for the St. Croix fleets (Table 4.2). In total, this fleet accounted for 12 percent of the total reported landings by those fleets.

4.1.3 Line Fishing Gear Fleet

The line fishing gear fleet was the largest and second most productive of the St. Croix fleets. The 94 boats that reported landings with line fishing gear in 2004 ranged in length from 10 to 38 feet with a mean of 21 feet. They had between 4 and 275 horsepower with a mean of 87 (Table 4.1). Snapper landings of 78 thousand pounds accounted for 31 percent of their total reported landings of 249 thousand pounds, and their landings accounted for 62 percent of the total reported landings of snapper for the St. Croix fleets (Table 4.2). Their tuna landings of 20.8 thousand pounds accounted for 99 percent of the total reported tuna landings for the St. Croix fleets. The other species groups for which this fleet produced most of the landings were jack (63 percent), barracuda (69 percent), mackerel (96 percent), dolphin (99 percent), wahoo (100 percent), baitfish (58 percent), and miscellaneous species (98 percent). In total, this fleet accounted for 25 percent of the total reported landings by those fleets.

4.1.4 Seine Net Gear Fleet

Landings with seine net gear were reported for 7 boats in 2004. The boats ranged in length from 20 to 25 feet with a mean of 23 feet. They had between 40 and 150 horsepower with a mean of 92 (Table 4.1). Parrotfish accounted for 51 percent of their reported landings of 12.7 thousand pounds, but their parrotfish landings accounted for only 2 percent of the total reported landings of parrotfish for the St. Croix fleets (Table 4.2). In total, this fleet accounted for about 1 percent of the total reported landings by those fleets.

4.1.5 Scuba Gear Fleet

The scuba gear fleet was the second largest and the most productive St. Croix fleet. The 56 boats that reported landings with scuba gear in 2004 were typically a bit larger than the boats in most St. Croix fleets. They ranged in length from 22 to 25 feet with a mean of 24 feet. They had between 85 and 115 horsepower with a mean of 95 (Table 4.1). Parrotfish (133 thousand pounds), lobster (109 thousand pounds) and conch (107 thousand pounds), respectively, accounted for 31 percent, 25 percent, and 25 percent of their total reported landings of 429 thousand pounds, and their landings accounted for 46 percent, 89 percent, and 85 percent of the total reported landings of parrotfish, lobster, and conch, respectively, for the St. Croix fleets (Table 4.2). In total, this fleet accounted for 43 percent of the total reported landings by those fleets.

4.1.6 Trap Gear Fleet

The 39 boats that reported landings with trap gear in 2004 ranged in length from 17 to 28 feet with a mean of 21 feet. They had between 30 and 260 horsepower with a mean of 85 (Table 4.1). Parrotfish landings of 38.3 thousand pounds accounted for 30 percent of their total reported landings of 127 thousand pounds and their landings accounted for 13 percent of the total reported parrotfish landings for the St. Croix fleets (Table 4.2). This fleet accounted for almost half of the reported landings of grunt and surgeonfish. In total, it accounted for 13 percent of the total reported landings by those fleets.

4.1.7 Trammel Net Gear Fleet

Landings with trammel net gear were reported for 3 boats in 2004. The boats ranged in length from 14 to 25 feet with a mean of 20 feet. They had between 15 and 250 horsepower with a mean of 73 (Table 4.1). Parrotfish accounted for 86 percent of their reported landings of 16.8 thousand pounds, and their landings accounted for 5 percent of the total reported landings of parrotfish for the St. Croix fleets (Table 4.2). In total, this fleet accounted for about 2 percent of the total reported landings by those fleets.

Table 4.1 Boat characteristics for the fishing boats that participated in the St. Croix fisheries in 2004.

	Free Diving	Gill Net	Line Fishing	Seine Net	Scuba	Trap	Tram-mel Net	Total
Number of Vessels	13	18	94	7	56	39	3	160
Vessel Length (ft)								
Mean	18	21	21	23	24	21	20	20
Minimum	13	15	10	20	22	17	14	10
Maximum	28	27	38	25	25	28	25	38
Engine Power (hp)								
Mean	68	81	87	92	95	85	73	83
Minimum	8	7	4	40	85	30	15	4
Maximum	275	200	275	150	115	260	250	275
Number of Trips	595	295	4,170	111	4,469	1,833	48	11,527

Table 4.2 Reported landings in the St. Croix fisheries by fleet and species group, 2004 (1,000 pounds, whole weight).

	Free Diving	Gill Net	Line Fishing	Seine Net	Scuba	Trap	Tram-mel Net	Total	% in DEA Models
Grouper	1.1	1.3	23.3	0.1	17.4	5.7	0.0	48.9	79%
Snapper	7.2	3.4	77.8	0.2	19.3	18.0	0.0	125.8	89%
Grunt	0.2	4.9	7.6	0.0	10.0	21.5	0.0	44.1	87%
Porgy	0.0	1.1	0.4	0.0	1.0	0.9	0.0	3.4	82%
Jack	0.0	1.4	8.9	1.4	2.0	0.5	0.0	14.3	97%
Surgeonfish	0.0	11.0	0.5	0.0	8.4	18.9	2.4	41.2	85%
Parrotfish	6.1	87.1	0.8	6.5	132.6	38.3	14.4	285.8	90%
Triggerfish	0.2	1.7	5.5	0.0	12.0	8.6	0.0	28.0	81%
Boxfish	0.3	1.3	0.1	0.0	4.0	5.2	0.0	10.9	75%
Angelfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
Barracuda	0.5	1.1	11.1	0.1	2.5	0.9	0.0	16.2	87%
Goatfish	0.0	0.0	0.8	0.0	3.2	2.4	0.0	6.4	40%
Mackerel	0.0	0.0	14.7	0.0	0.4	0.2	0.0	15.4	97%
Tuna	0.0	0.0	20.8	0.0	0.0	0.2	0.0	21.0	91%
Dolphin	0.0	0.0	47.0	0.0	0.0	0.6	0.0	47.6	94%
Wahoo	0.0	0.0	17.0	0.0	0.1	0.0	0.0	17.1	87%
Squirrelfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0%
Baitfish	0.0	0.0	7.0	4.4	0.0	0.5	0.0	12.0	92%
Lobster	7.6	1.6	0.2	0.0	108.7	3.9	0.0	122.1	92%
Conch	17.1	0.7	0.3	0.0	106.9	1.1	0.0	126.1	93%
Whelk	3.5	0.0	0.0	0.0	0.5	0.0	0.0	3.9	95%
Misc. Species	0.0	0.0	4.3	0.0	0.1	0.0	0.0	4.4	94%
Total	43.9	116.7	248.0	12.7	429.1	127.4	16.8	995.5	90%

4.2 Methods

DEA was used to estimate harvesting capacity by trip. Boat length and engine power were used as the fixed inputs, and hours fished per trip was used as the variable input. The outputs were the landings for each of the 22 species groups, which included OY species groups and other species groups. Trips were stratified by gear type (i.e., fleet) and quarter. A separate DEA model was used to estimate capacity by trip and species group for each stratum. The resulting estimates by trip were summed to calculate harvesting capacity by species group and fleet.

Due to missing observations and coding errors in both the catch trip reports and the fishermen census, the DEA models could not use all the trip data for each fleet. For the St. Croix fleets as a whole, 90 percent of the reported landings were used in the DEA models (Table 4.2). For individual species groups, the percent of reported landings used in the DEA models ranged from 40 percent for goatfish to 97 percent for jack and mackerel, and it exceeded 75 percent for all the other species groups. Most of the commercially important reef fish and boxfish were well represented in the analysis. The data used in the DEA models accounted for the fishing activities of 83 percent of the fishing boats with reported landings in 2004.

To provide estimates of excess capacity (i.e., the difference between the estimate of harvesting capacity and reported landings) by fleet, the estimates of harvesting capacity by fleet based on the data (i.e., trips) used in the DEA models were expanded to estimate harvesting capacity by fleet based on all trips. The fleet-specific expansion factor used was equal to total reported landings divided by the reported landings used in the DEA models for each fleet. Therefore, the implicit assumption was that the estimate of capacity utilization for each fleet based on the data used in the DEA models provided a good estimate of capacity utilization for each fleet as a whole.

4.3 Capacity Assessment by Fleet for All Species Combined

This section presents the results of the fleet-specific assessments of harvesting capacity and excess capacity for all species combined. Table 4.3 summarizes the results. Section 4.4 presents the species group–specific results for all fleets combined. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing boats. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and therefore to the harvesting capacity estimates for multiple fleets).

4.3.1 Free Diving Gear Fleet

The free diving gear fleet had total reported landings of 43.9 thousand pounds in 2004, and the lower and higher capacity estimates were 45.8 and 65.8 thousand pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 1.9 thousand pounds or 4 percent for the lower capacity estimate, and by 21.9 thousand pounds or 50 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 67 percent of its higher capacity level and 96 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 33 percent or 4 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 1 percent increase in the average number of hours fished per trip.

4.3.2 Gillnet Gear Fleet

The gillnet gear fleet had total reported landings of 117 thousand pounds in 2004, and the lower and higher capacity estimates were 120 and 158 thousand pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by about 3 thousand pounds or 3 percent for the lower capacity estimate, and by 41 thousand pounds or 35 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 74 percent of its higher capacity level and 97 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 26 percent or 3 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 7 percent decrease in the average number of hours fished per trip.

4.3.3 Line Fishing Gear Fleet

The line fishing gear fleet had total reported landings of 248 thousand pounds in 2004, and the lower and higher capacity estimates were 325 and 915 thousand pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 77 thousand pounds or 31 percent for the lower capacity estimate, and by 667 thousand pounds or 269 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 27 percent of its higher capacity level and 76 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 73 percent or 24 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 6 percent increase in the average number of hours fished per trip.

4.3.4 Seine Net Gear Fleet

The seine net gear fleet had total reported landings of 12.7 thousand pounds in 2004, and the lower and higher capacity estimates were 14.7 and 23.3 thousand pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 2.0 thousand pounds or 16 percent for the lower capacity estimate, and by 10.6 thousand pounds or 83 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 55 percent of its higher capacity level and 86 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 45 percent or 14 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 2 percent decrease in the average number of hours fished per trip.

4.3.5 Scuba Gear Fleet

The scuba gear fleet had total reported landings of 429 thousand pounds in 2004, and the lower and higher capacity estimates were 459 and 935 thousand pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 30 thousand pounds or 7 percent for the lower capacity estimate, and by 506 thousand pounds or 118 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 46 percent of its higher capacity level and 93 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 54 percent or 7 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with almost a 5 percent decrease in the average number of hours fished per trip.

4.3.6 Trap Gear Fleet

The trap gear fleet had total reported landings of 127 thousand pounds in 2004, and the lower and higher capacity estimates were 135 and 193 thousand pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 8 thousand pounds or 6 percent for the lower capacity estimate, and by 66 thousand pounds or 51 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 66 percent of its higher capacity level and 94 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 34 percent or 6 percent less capacity would have been able to make the reported landings if it had operated at capacity.

4.3.7 Trammel Net Gear Fleet

There were not enough observations (i.e., trips) to estimate harvesting capacity for the trammel net fleet; therefore, harvesting capacity was set equal to reported landings.

4.3.8 All Fleets Combined

The St. Croix fleets had total reported landings of almost 1 million pounds in 2004, and the lower and higher capacity estimates were 1.1 and 2.3 million pounds (Table 4.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.1 million pounds or 12 percent for the lower capacity estimate, and by 1.3 million pounds or 132 percent for the higher capacity estimate. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 43 percent of their higher capacity level and 89 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 57 percent or 11 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Table 4.3 St. Croix fisheries harvesting capacity assessment by fleet for all species combined, 2004 (1,000 pounds, whole weight).

	Free diving	Gillnet	Line fishing	Seine net	Scuba	Trap	Trammel net	Total
Reported Landings	43.9	117	248	12.7	429	127	16.8	995
Landings Used in the DEA Models	41.7	117	236	8.4	368	105	16.8	893
Percent of Landings Used in the DEA Models	95%	100%	95%	66%	86%	83%	100%	90%
Lower Capacity Estimate (LCE)	45.8	120	325	14.7	459	135	16.8	1,118
Higher Capacity Estimate (HCE)	65.8	158	915	23.3	935	193	16.8	2,307
Lower Excess Capacity Estimate	1.9	4	77	2.0	30	8	0.0	122
Higher Excess Capacity Estimate	21.9	41	667	10.6	506	66	0.0	1,312
LCE as a % of Reported Landings	104%	103%	131%	116%	107%	106%	100%	112%
HCE as a % of Reported Landings	150%	135%	369%	183%	218%	151%	100%	232%
Reported Landings as a % of the LCE	96%	97%	76%	86%	93%	94%	100%	89%
Reported Landings as a % of the HCE	67%	74%	27%	55%	46%	66%	100%	43%
Reported Hour/Trip	4.68	6.29	6.88	4.9	4.92	-	8	
Capacity Hour/Trip	4.73	5.85	7.31	4.78	4.7	-	8	

4.4 Capacity Assessment by Species Group for All Fleets Combined

The assessment of harvesting capacity, excess capacity, and overcapacity for each of the 12 OY species groups landed by the St. Croix fleets for all fleets combined is summarized in Table 4.4 and discussed in this section. Although Table 4.4 includes estimates of harvesting capacity and excess capacity for species groups without OYs, the following discussion focuses on the 12 OY species groups landed by the St. Croix fleets. Those OY species groups are listed below.

OY Species Groups Landed by the St. Croix Fleets		
1. Grouper	5. Jack	9. Boxfish
2. Snapper	6. Surgeonfish	10. Goatfish
3. Grunt	7. Parrotfish	11. Lobster
4. Porgy	8. Triggerfish	12. Conch

Squirrelfish, angelfish, tilefish, and wrasse are the four OY species groups that are not included. There were either no or only insignificant reported landings for those four OY species groups.

To allow for a meaningful comparison to the OY proxy for each OY species group, the capacity estimates generated for the reported landings used in the DEA models were adjusted upward using a factor equal to the ratio of estimated landings to landings used in the DEA models for each OY species group.

By simply comparing estimated landings to the OY proxies, it is clear that there was substantial overcapacity for each of the 12 OY species groups in 2004. The percent by which estimated landings exceeded the OY proxies in 2004 ranged from 89 percent for goatfish to 347 percent for conch. The estimated landings exceeded the OY proxies by 100 percent or more for 10 OY species groups.

The lower capacity estimates exceeded the estimated landings from a low of 3 percent for porgy to a high of 67 percent for jack. The higher capacity estimates exceeded the estimated landings from a low of 17 percent for porgy to a high of 356 percent for snapper. The lower capacity estimates exceeded the OY proxies from a low of 98 percent for goatfish to a high of 379 percent for conch. The higher capacity estimates exceeded the OY proxies from a low of 151 percent for goatfish to a high of 1,159 percent for snapper.

Table 4.4 St. Croix fisheries harvesting capacity assessment by species group for all fleets combined, 2004 (1,000 pounds, whole weight).

	Grouper	Snapper	Grunt	Porgy	Jack	Surgeonfish	Parrotfish
Landings Used in the DEA Models	39	112	38	2.8	14	35	258
Estimated Total Landings	54	155	53	3.8	19	49	359
% Used in DEA Models	72%	72%	72%	72%	72%	72%	72%
OY Proxy	14	56	17	1.8	7	18	142
Lower Capacity Estimate (LCE)	59	203	58	4.0	32	51	377
Higher Capacity Estimate (HCE)	101	706	83	4.5	70	67	599
Lower Excess Capacity Estimate	5	48	5	0.1	13	3	18
Higher Excess Capacity Estimate	48	551	29	0.6	51	18	240
LCE as a % of Estimated Landings	110%	131%	109%	103%	167%	105%	105%
HCE as a % of Estimated Landings	188%	456%	155%	117%	365%	138%	167%
Estimated Landings as a % of the LCE	91%	76%	92%	97%	60%	95%	95%
Estimated Landings as a % of the HCE	53%	22%	65%	86%	27%	73%	60%
Lower Overcapacity Estimate	45	147	41	2.2	25	34	235
Higher Overcapacity Estimate	88	650	66	2.7	64	49	457
LCE as a % of the OY Proxy	431%	363%	344%	224%	476%	290%	265%
HCE as a % of the OY Proxy	739%	1259%	491%	254%	1040%	379%	420%
Estimated Landings as a % of the OY Proxy	392%	276%	317%	217%	285%	275%	252%

Table 4.4 Continued.

	Triggerfish	Boxfish	Barracuda	Goatfish	Mackerel	Tuna	Dolphin
Landings Used in the DEA Models	23	8.2	14.1	2.6	15.0	19.2	45
Estimated Total Landings	31	11.4	19.6	3.6	20.9	26.7	62
% Used in DEA Models	72%	72%	72%	72%	72%	72%	72%
OY Proxy	11	5.8	N.A.	1.9	N.A.	N.A.	N.A.
Lower Capacity Estimate (LCE)	34	11.9	21.9	3.7	23.3	30.2	82
Higher Capacity Estimate (HCE)	47	16.7	38.4	4.7	38.7	73.9	188
Lower Excess Capacity Estimate	3	0.6	2.3	0.2	2.4	3.5	20
Higher Excess Capacity Estimate	16	5.3	18.8	1.2	17.9	47.2	126
LCE as a % of Estimated Landings	108%	105%	112%	105%	111%	113%	132%
HCE as a % of Estimated Landings	149%	147%	196%	133%	186%	277%	302%
Estimated Landings as a % of the LCE	92%	95%	89%	96%	90%	88%	76%
Estimated Landings as a % of the HCE	67%	68%	51%	75%	54%	36%	33%
Lower Overcapacity Estimate	23	6.2	N.A.	1.8	N.A.	N.A.	N.A.
Higher Overcapacity Estimate	36	10.9	N.A.	2.9	N.A.	N.A.	N.A.
LCE as a % of the OY Proxy	308%	207%	N.A.	198%	N.A.	N.A.	N.A.
HCE as a % of the OY Proxy	425%	290%	N.A.	251%	N.A.	N.A.	N.A.
Estimated Landings as a % of the OY Proxy	284%	197%	N.A.	189%	N.A.	N.A.	N.A.

Table 4.4 Continued.

	Wahoo	Baitfish	Lobster	Conch	Whelk	Misc. Species
Landings Used in the DEA Models	14.9	11.0	112	118	3.9	7.7
Estimated Total Landings	21	15.2	156	163	5.4	10.7
% Used in DEA Models	72%	72%	72%	72%	72%	72%
OY Proxy	N.A.	N.A.	37.0	36.6	N.A.	N.A.
Lower Capacity Estimate (LCE)	22.7	18.0	170	175	5.5	12.4
Higher Capacity Estimate (HCE)	41.5	36.9	397	349	7.2	23.8
Lower Excess Capacity Estimate	2.0	2.8	14	12	0.1	1.7
Higher Excess Capacity Estimate	20.8	21.6	241	185	1.8	13.1
LCE as a % of Estimated Landings	110%	118%	109%	107%	101%	116%
HCE as a % of Estimated Landings	201%	242%	254%	213%	133%	223%
Estimated Landings as a % of the LCE	91%	85%	92%	93%	99%	86%
Estimated Landings as a % of the HCE	50%	41%	39%	47%	75%	45%
Lower Overcapacity Estimate	N.A.	N.A.	133	139	N.A.	N.A.
Higher Overcapacity Estimate	N.A.	N.A.	360	312	N.A.	N.A.
LCE as a % of the OY Proxy	N.A.	N.A.	459%	479%	N.A.	N.A.
HCE as a % of the OY Proxy	N.A.	N.A.	1074%	953%	N.A.	N.A.
Estimated Landings as a % of the OY Proxy	N.A.	N.A.	422%	447%	N.A.	N.A.

5. Fisheries of Puerto Rico

Information on both the physical characteristics of the fishing boats that participated in the Puerto Rico commercial fisheries in 2004 and their reported landings is discussed below by fleet (i.e., gear type). The physical characteristics and landings are summarized in Tables 4.1 and 4.2, respectively. The information on fishing boat characteristics includes statistics on the reported fishing boat length, beam (i.e., width), and engine power. Boats without data for a specific characteristic were not included in the statistics reported below for that characteristic.

There was significant under-reporting of landings for Puerto Rico in 2004 due to the industry's opposition to the new fishery regulations. Because fleet-specific adjustment factors were not available, the under-reporting was not adjusted for in the statistics and estimates presented in Sections 5.1 and 5.3, which present information by fleet. However, under-reporting was adjusted for in the statistics presented in Section 5.4, which includes comparisons of the OY proxies to harvesting capacity estimates by OY species group for all fleets combined.

The fishing boat characteristics and reported landings data are provided for the 13 fleets defined by gear type and 26 species groups listed below. Some boats participated in more than one fleet in 2004.

Puerto Rico Fleets					
1	Beach seine	6	Longline	11	Cast net
2	Bottom line	7	Scuba	12	Land crab trap
3	Fish pot	8	Free diving	13	Rod and reel
4	Gillnet	9	Trammel net		
5	Lobster pot	10	Troll		

Although the fishing boat characteristics and reported landings are in Tables 5.1 and 5.2 for all 13 fleets, the following discussions focus on the first 10 fleets, which each accounted for more than 1 percent of the total reported landings of all Puerto Rico fleets in 2004. The reported landings of other fleets (e.g., snare gear fleet) that landed very small amounts in 2004 are included in the totals but are not provided by fleet.

Puerto Rico Species Groups					
1	Grouper 1 (Nassau)	5	Other Grouper	19	Dolphin
2	Grouper 2 (Goliath)	6	Snapper 1 (Deep Water Snappers)	20	Wahoo
3	Grouper 3	7	Snapper 2 (Shallow Water Snappers)	21	Squirrelfish
	Red Hind	8	Other Snapper	22	Tilefish
	Coney	9	Grunt	23	Lobster
	Rock Hind	10	Porgy	24	Conch
	Graysby	11	Jack	25	Wrasse
	Creole Fish	12	Parrotfish	26	Misc.
4	Grouper 4	13	Triggerfish		
	Red	14	Boxfish		
	Misty	15	Barracuda		
	Tiger	16	Goatfish		
	Yellowfin	17	Mackerels		
	Yellowedge	18	Tunas		
	Unclassified				

5.1 Boat Characteristics and Reported Landings by Fleet

Information on fishing boat characteristics and on reported landings is discussed below and summarized in Tables 5.1 and 5.2 for each Puerto Rico fleet. As noted above, “fleets” refers to mutually exclusive sets of fishing trips and not to mutually exclusive sets of fishing boats. Therefore, the landings data presented for each fleet are only for fishing trips with a specific gear type and exclude the landings data for all other trips made by the fishing boats in that fleet. If a fishing boat was in multiple fleets, it is included in the boat characteristics and reported landings statistics for multiple fleets.

5.1.1 Beach Seine Gear Fleet

Landings with beach seine gear were reported for 16 boats in 2004. The boats ranged in length from 16 to 25 feet with a mean of 19 feet. They ranged in beam from 3 to 10 feet with a mean of 6 feet. They had between 14 and 300 horsepower with a mean of 65 (Table 5.1). Their total reported landings were 66 thousand pounds (Table 5.2) and were principally accounted for by snapper (17 percent), grunt (16 percent), jack (19 percent), tuna (13 percent), and miscellaneous species (17 percent). In total, this fleet accounted for almost 4 percent of the total reported landings by the Puerto Rico fleets.

5.1.2 Bottom Line Gear Fleet

The bottom line fleet was the most productive fleet in terms of total reported landings. Landings with bottom line gear were reported for 316 boats in 2004. The boats ranged in length from 11 to 42 feet with a mean of 20 feet. They ranged in beam from 3 to 20 feet with a mean of 6 feet.

They had between 5 and 630 horsepower with a mean of 69 (Table 5.1). Their total reported landings were 536 thousand pounds (Table 5.2) and were principally accounted for by snapper (66 percent). This fleet accounted for about 29 percent of the total reported landings by the Puerto Rico fleets and it accounted for large shares of the total reported landings of several species groups: grouper (43 percent), snapper (67 percent), mackerel (56 percent), and tilefish (100 percent).

5.1.3 Fish Pot Gear Fleet

The fish pot gear fleet was the third most productive fleet in terms of total reported landings. Landings with fish pot gear were reported for 142 boats in 2004. The boats ranged in length from 10 to 45 feet with a mean of 20 feet. They ranged in beam from 3 to 20 feet with a mean of 7 feet. They had between 9 and 453 horsepower with a mean of 79 (Table 5.1). Their total reported landings were 353 thousand pounds (Table 5.2) and the largest shares of their total landings were contributed by snapper (26 percent) and lobster (18 percent). In total, this fleet accounted for about 19 percent of the total reported landings by the Puerto Rico fleets and it accounted for at least 50 percent of the reported landings of porgy, triggerfish, boxfish, goatfish, and squirrelfish.

5.1.4 Gillnet Gear Fleet

The gillnet gear fleet was the fourth most productive fleet in terms of total reported landings. Landings with gillnet gear were reported for 93 boats in 2004. The boats ranged in length from 14 to 34 feet with a mean of 19 feet. They ranged in beam from 3 to 12 feet with a mean of 6 feet. They had between 6 and 300 horsepower with a mean of 52 (Table 5.1). Their total reported landings were 163 thousand pounds (Table 5.2) and were principally accounted for by snapper (19 percent) and miscellaneous species (42 percent). In total, this fleet accounted for about 9 percent of the total reported landings by the Puerto Rico fleets.

5.1.5 Lobster Pot Gear Fleet

Landings with lobster pot gear were reported for 20 boats in 2004. The boats ranged in length from 15 to 30 feet with a mean of 20 feet. They ranged in beam from 3 to 11 feet with a mean of 6 feet. They had between 10 and 453 horsepower with a mean of 87 (Table 5.1). Their total reported landings were 31 thousand pounds (Table 5.2) and were principally accounted for by lobster (93 percent). In total, this fleet accounted for less than 2 percent of the total reported landings by the Puerto Rico fleets and 14 percent of the reported lobster landings.

5.1.6 Longline Gear Fleet

Landings with longline gear were reported for 35 boats in 2004. The boats ranged in length from 14 to 24 feet with a mean of 19 feet. They ranged in beam from 4 to 10 feet with a mean of 6 feet. They had between 6 and 300 horsepower with a mean of 49 (Table 5.1). Their total reported landings were 24.6 thousand pounds (Table 5.2) and were principally accounted for by snapper (75 percent). In total, this fleet accounted for less than 2 percent of the total reported landings by the Puerto Rico fleets.

5.1.7 Scuba Gear Fleet

The scuba gear fleet was the second most productive fleet in terms of total reported landings. Landings with scuba gear were reported for 144 boats in 2004. The boats ranged in length from 14 to 41 feet with a mean of 21 feet. They ranged in beam from 3 to 14 feet with a mean of 7 feet. They had between 10 and 653 horsepower with a mean of 83 (Table 5.1). Their total reported landings were 439 thousand pounds (Table 5.2) and were principally accounted for by lobster (23 percent) and conch (47 percent). In total, this fleet accounted for almost 24 percent of the total reported landings by the Puerto Rico fleets. This included 47 percent, 95 percent, and 61 percent of the reported lobster, conch, and wrasse landings, respectively.

5.1.8 Free Diving Gear Fleet

Landings with free diving gear were reported for 22 boats in 2004. The boats ranged in length from 14 to 34 feet with a mean of 19 feet. They ranged in beam from 4 to 12 feet with a mean of 7 feet. They had between 15 and 351 horsepower with a mean of 85 (Table 5.1). Their total reported landings were 19.4 thousand pounds (Table 5.2) and were principally accounted for by lobster (14 percent), conch (39 percent), and miscellaneous species (44 percent). In total, this fleet accounted for 1 percent of the total reported landings by the Puerto Rico fleets and did not account for a large share of the total for any species group.

5.1.9 Trammel Net Gear Fleet

Landings with trammel net gear were reported for 23 boats in 2004. The boats ranged in length from 16 to 30 feet with a mean of 19 feet. They ranged in beam from 4 to 8 feet with a mean of 6 feet. They had between 10 and 235 horsepower with a mean of 68 (Table 5.1). Their total reported landings were 63 thousand pounds (Table 5.2) and were principally accounted for by grunt (34 percent), parrotfish (25 percent), and lobster (17 percent). In total, this fleet accounted for just over 3 percent of the total reported landings by the Puerto Rico fleets. This included 24 percent and 30 percent of the reported grunt and parrotfish landings, respectively.

5.1.10 Troll Line Gear Fleet

The troll line gear fleet was the fifth most productive fleet in terms of total reported landings. Landings with troll line gear were reported for 116 boats in 2004. The boats ranged in length from 11 to 42 feet with a mean of 19 feet. They ranged in beam from 3 to 16 feet with a mean of 6 feet. They had between 5 and 630 horsepower with a mean of 66 (Table 5.1). Their total reported landings were 153 thousand pounds (Table 5.2) and were principally accounted for by mackerel (14 percent), tuna (39 percent), and dolphin (37 percent). In total, this fleet accounted for just over 8 percent of the total reported landings by the Puerto Rico fleets. This included 28 percent, 70 percent, 75 percent, and 86 percent of the reported mackerel, tuna, dolphin, and wahoo landings, respectively.

Table 5.1 Boat characteristics for the fishing boats that participated in the Puerto Rico fisheries in 2004.

	Beach Seine	Bottom Line	Cast Net	Fish Pot	Gill Net	Land Crab Trap	Lobster Pot
Number of Boats	16	316	26	142	93	6	20
Boat Length (ft)							
Mean	19	20	19	20	19	16	20
Minimum	16	11	14	10	14	15	15
Maximum	25	42	34	45	34	18	30
Boat Beam (ft)							
Mean	6	6	6	7	6	4	6
Minimum	3	3	4	3	3	3	3
Maximum	10	20	12	20	12	5	11
Engine Power (hp)							
Mean	65	69	93	79	52	23	87
Minimum	14	5	8	9	6	10	10
Maximum	300	630	550	453	300	40	453
Number of Trips	210	4,425	242	2,078	1,021	13	381

	Long Line	Rod and Reel	Scuba	Free Diving	Trammel Net	Troll Line
Number of Boats	35	4	144	22	23	116
Boat Length (ft)						
Mean	19	19	21	19	19	19
Minimum	14	15	14	14	16	11
Maximum	24	23	41	34	30	42
Boat Beam (ft)						
Mean	6	8	7	7	6	6
Minimum	4	6	3	4	4	3
Maximum	10	10	14	12	8	16
Engine Power (hp)						
Mean	49	148	83	85	68	66
Minimum	6	70	10	15	10	5
Maximum	300	300	653	351	235	630
Number of Trips	228	10	4,625	212	495	1,042

Table 5.2 Reported landings in the Puerto Rico fisheries by fleet and species group, 2004 (1,000 pounds, whole weight).

	Beach seine	Bottom line	Cast net	Fish pot	Gillnet	Land crab	Lobster pot	Longline
All Grouper	0.1	27.5	0.0	15.4	1.2	0.0	0.1	0.5
Grouper 1	0.0	2.0	0.0	0.2	0.1	0.0	0.0	0.0
Grouper 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grouper 3	0.1	21.1	0.0	14.4	1.0	0.0	0.1	0.4
Grouper 4	0.0	4.4	0.0	0.8	0.2	0.0	0.0	0.1
Other Grouper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All Snapper	11.2	356.3	0.0	90.2	31.4	0.0	0.2	18.5
Snapper 1	1.1	173.6	0.0	21.4	0.2	0.0	0.0	0.4
Snapper 2	9.7	169.9	0.0	62.1	24.7	0.0	0.2	17.9
Other Snapper	0.5	12.8	0.0	6.7	6.5	0.0	0.0	0.2
Grunt	10.8	6.8	0.0	36.4	13.3	0.0	0.0	0.4
Porgy	0.3	1.6	0.0	9.1	4.8	0.0	0.0	0.1
Jack	12.4	18.5	0.0	2.8	16.0	0.0	0.0	0.3
Parrotfish	4.3	1.2	0.0	14.9	10.0	0.0	0.0	0.0
Triggerfish	0.4	6.7	0.0	22.3	0.3	0.0	0.1	0.1
Boxfish	1.2	0.9	0.0	32.4	2.4	0.0	1.4	0.0
Barracuda	1.9	2.5	0.0	0.2	1.5	0.0	0.0	0.0
Goatfish	0.3	0.5	0.0	6.4	0.8	0.0	0.0	0.0
Mackerel	2.0	43.0	0.1	1.1	7.4	0.0	0.0	0.1
Tuna	8.7	14.4	0.0	1.0	1.3	0.0	0.0	0.0
Dolphin	0.2	16.3	0.0	0.8	0.2	0.0	0.0	0.0
Wahoo	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Squirrelfish	0.0	1.7	0.0	4.3	0.6	0.0	0.0	0.0
Tilefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lobster	0.4	1.3	0.0	64.7	2.2	0.1	28.9	0.0
Conch	0.0	2.1	0.0	1.5	0.2	0.0	0.0	0.0
Wrasse	0.2	1.2	0.0	12.2	0.7	0.0	0.1	0.0
Misc.	11.5	33.2	15.7	37.3	68.5	0.6	0.1	4.4
Total	65.9	536.3	15.9	353.0	162.7	0.6	31.0	24.6

Table 5.2 Continued.

	Rod and reel	Scuba	Free diving	Trammel net	Troll line	Total	% in DEA Models
All Grouper	0.0	14.8	0.1	0.4	3.2	63.4	43%
Grouper 1	0.0	1.3	0.0	0.0	0.6	4.3	33%
Grouper 2	0.0	1.1	0.0	0.0	0.0	1.1	0%
Grouper 3	0.0	11.4	0.1	0.4	2.0	51.0	46%
Grouper 4	0.0	0.9	0.0	0.0	0.6	7.0	39%
Other Grouper	0.0	0.0	0.0	0.0	0.0	0.0	100%
All Snapper	0.1	18.5	0.1	4.3	4.1	535.0	39%
Snapper 1	0.0	2.5	0.0	0.0	2.7	202.0	48%
Snapper 2	0.1	8.5	0.1	2.9	1.1	297.1	34%
Other Snapper	0.0	7.4	0.1	1.3	0.3	35.9	34%
Grunt	0.0	0.4	0.0	21.2	0.0	89.4	37%
Porgy	0.0	1.0	0.0	1.0	0.0	17.9	31%
Jack	0.0	0.5	0.0	1.8	0.8	53.0	39%
Parrotfish	0.0	5.7	0.1	15.4	0.0	51.7	44%
Triggerfish	0.0	12.8	0.1	0.4	0.2	43.3	40%
Boxfish	0.0	11.4	0.0	2.7	0.0	52.4	41%
Barracuda	0.0	0.1	0.0	0.0	0.4	6.6	41%
Goatfish	0.0	0.1	0.0	0.1	0.1	8.3	40%
Mackerel	0.3	0.8	0.0	0.1	21.8	76.7	46%
Tuna	0.0	0.2	0.0	0.0	59.6	85.2	40%
Dolphin	0.5	0.7	0.0	0.0	57.5	76.3	49%
Wahoo	0.1	0.0	0.0	0.0	3.9	4.5	69%
Squirrelfish	0.0	0.3	0.0	0.1	0.0	7.1	39%
Tilefish	0.0	0.0	0.0	0.0	0.0	0.0	100%
Lobster	0.0	100.9	2.7	10.9	0.0	212.9	47%
Conch	0.0	204.8	7.5	0.1	0.0	216.2	57%
Wrasse	0.0	24.7	0.3	0.7	0.1	40.1	50%
Misc.	0.1	41.6	8.5	3.8	1.7	227.2	47%
Total	1.2	439.2	19.4	62.9	153.4	1,867.3	44%

5.2 Methods

DEA was used to estimate harvesting capacity by trip. Boat length, beam, and engine power were used as the fixed inputs, and hours fished per trip was used as the variable input. The outputs were the landings for each of the 26 species groups, which included OY species groups and other species groups. Trips were stratified by gear type (i.e., fleet) and quarter. A separate

DEA model was used to estimate capacity by trip and species group for each stratum. The resulting estimates by trip were summed to calculate harvesting capacity by species group and fleet.

Due to missing observations and coding errors in both the catch trip reports and the fishermen census, the DEA models could not use all the trip data for each fleet. For the Puerto Rico fleets as a whole, only 44 percent of the reported landings were used in the DEA models (Table 5.2). This is less than the 84 percent for the St. Thomas and St. John area and the 90 percent for the St. Croix area. For individual species groups (excluding grouper group 2 for which none of the reported landings were included in the DEA models), the percent of reported landings used in the DEA models ranged from 31 percent for porgy to 100 percent for tilefish, and it was at least 50 percent for only four species groups. Combined with the fact that the reported landings were only 62 percent of total estimated landings, for the fleets as a whole, only about 27 percent of the estimated total landings were used to estimate harvesting capacity. This could substantially decrease the accuracy and usefulness of the harvesting capacity estimates.

To provide estimates of excess capacity (i.e., the difference between the estimate of harvesting capacity and reported landings) by fleet, the estimates of harvesting capacity by fleet based on the data (i.e., trips) used in the DEA models were expanded to estimate harvesting capacity by fleet based on all reported trips. The fleet-specific expansion factor used was equal to total reported landings divided by the reported landings used in the DEA models for each fleet. Therefore, the implicit assumption was that the estimate of capacity utilization for each fleet based on the data used in the DEA models provided a good estimate of capacity utilization for each fleet as a whole.

5.3 Capacity Assessment by Fleet for All Species Combined

This section presents the results of the fleet-specific assessments of harvesting capacity and excess capacity for all species combined for 10 fleets. The results for other gear types (e.g., cast net) that each accounted for less than 1 percent of the total reported landings of all Puerto Rico fleets in 2004 are presented in Table 5.3 but are not discussed below. Section 5.4 presents the species group–specific results for all fleets combined. As noted above, “fleets” refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing boats. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with a specific gear type (i.e., if a vessel was in multiple fleets, it contributed to the reported landings and therefore to the harvesting capacity estimates for multiple fleets).

5.3.1 Beach Seine Gear Fleet

The beach seine gear fleet had total reported landings of 66 thousand pounds in 2004, and the lower and higher capacity estimates were 72 and 154 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 6 thousand pounds or 9 percent for the lower capacity estimate, and by 88 thousand pounds or 133 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 43 percent of its higher capacity level and 92 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 57 percent or 8 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 6 percent decrease in the average number of hours fished per trip.

5.3.2 Bottom Line Gear Fleet

The bottom line gear fleet had total reported landings of 536 thousand pounds in 2004, and the lower and higher capacity estimates were 759 and 4,317 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 223 thousand pounds or 42 percent for the lower capacity estimate, and by 3,780 thousand pounds or 705 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 12 percent of its higher capacity level and 71 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 88 percent or 29 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with an 8 percent decrease in the average number of hours fished per trip.

5.3.3 Fish Pot Gear Fleet

The fish pot gear fleet had total reported landings of 353 thousand pounds in 2004, and the lower and higher capacity estimates were 389 and 798 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 36 thousand pounds or 10 percent for the lower capacity estimate, and by 446 thousand pounds or 126 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 44 percent of its higher capacity level and 91 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 56 percent or 9 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 0.1 percent decrease in the average number of hours fished per trip.

5.3.4 Gillnet Gear Fleet

The gillnet gear fleet had total reported landings of 163 thousand pounds in 2004, and the lower and higher capacity estimates were 217 and 561 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 55 thousand pounds or 34 percent for the lower capacity estimate, and by 398 thousand pounds or 245 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 29 percent of its higher capacity level and 75 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 71 percent or 25 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 3 percent increase in the average number of hours fished per trip.

5.3.5 Lobster Pot Gear Fleet

The lobster pot gear fleet had total reported landings of 31 thousand pounds in 2004, and the lower and higher capacity estimates were 35 and 74 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 4 thousand pounds or 12 percent for the lower capacity estimate, and by 43 thousand pounds or 139 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 42 percent of its higher capacity level and 89 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 58 percent or 11 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with almost a 6 percent increase in the average number of hours fished per trip.

5.3.6 Longline Gear Fleet

The longline gear fleet had total reported landings of 25 thousand pounds in 2004, and the lower and higher capacity estimates were 31 and 58 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 6 thousand pounds or 26 percent for the lower capacity estimate, and by 34 thousand pounds or 137 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 42 percent of its higher capacity level and 80 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 58 percent or 20 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with an 11 percent increase in the average number of hours fished per trip.

5.3.7 Scuba Gear Fleet

The scuba gear fleet had total reported landings of 439 thousand pounds in 2004, and the lower and higher capacity estimates were 604 and 2,854 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 164 thousand pounds or 37 percent for the lower capacity estimate, and by 2,415 thousand pounds or 550 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 15 percent of its higher capacity level and 73 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 85 percent or 27 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with about a 4 percent increase in the average number of hours fished per trip.

5.3.8 Free Diving Gear Fleet

The free diving gear fleet had total reported landings of 19.4 thousand pounds in 2004, and the lower and higher capacity estimates were 49.5 and 95.1 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by about 30 thousand pounds or 155 percent for the lower capacity estimate, and by 76 thousand pounds or 390 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means that the fleet was operating at only 20 percent of its higher capacity level and 39 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 80 percent or 61 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 2 percent increase in the average number of hours fished per trip.

5.3.9 Trammel Net Gear Fleet

The trammel net gear fleet had total reported landings of 63 thousand pounds in 2004, and the lower and higher capacity estimates were 65 and 120 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 2 thousand pounds or 4 percent for the lower capacity estimate, and by 57 thousand pounds or 91 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 52 percent of its higher capacity level and 96 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 48 percent or 4 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with a 14 percent decrease in the average number of hours fished per trip.

5.3.10 Troll Line Gear Fleet

The troll line gear fleet had total reported landings of 153 thousand pounds in 2004, and the lower and higher capacity estimates were 190 and 591 thousand pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by 37 thousand pounds or 24 percent for the lower capacity estimate, and by 438 thousand pounds or 285 percent for the higher capacity estimate. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 26 percent of its higher capacity level and 81 percent of its lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, a smaller fleet with 74 percent or 19 percent less capacity would have been able to make the reported landings if it had operated at capacity. Harvesting at capacity would have occurred with almost an 8 percent increase in the average number of hours fished per trip.

5.3.11 All Fleets Combined

The Puerto Rico fleets had total reported landings of 1.9 million pounds in 2004, and the lower and higher capacity estimates were 2.4 and 9.7 million pounds (Table 5.3). Therefore, estimated capacity exceeded reported landings in 2004 by over 0.5 million pounds or 30 percent for the lower capacity estimate, and by over 7.8 million pounds or 420 percent for the higher capacity estimate. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 19 percent of their higher capacity level and 77 percent of their lower capacity level; therefore, for the higher or lower estimates of capacity, respectively, smaller fleets with 81 percent or 23 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Table 5.3 Puerto Rico fisheries harvesting capacity assessment by fleet for all species combined, 2004 (1,000 pounds, whole weight).

	Beach seine	Bottom line	Cast net	Fish pot	Gillnet	Land crab	Lobster pot
Reported Landings	65.9	536	15.9	353	163	0.6	31.0
Landings Used in the DEA Models	21.0	215	7.0	137	65	0.1	11.0
Percent of Landings Used in the DEA Models	32%	40%	44%	39%	40%	20%	35%
Lower Capacity Estimate (LCE)	71.7	759	18.8	389	217	0.8	34.8
Higher Capacity Estimate (HCE)	153.6	4,317	90.0	799	561	1.4	74.2
Lower Excess Capacity Estimate	5.8	223	2.9	36	55	0.1	3.8
Higher Excess Capacity Estimate	87.8	3,780	74.2	446	398	0.7	43.2
LCE as a % of Reported Landings	109%	142%	118%	110%	134%	120%	112%
HCE as a % of Reported Landings	233%	805%	568%	226%	345%	213%	239%
Reported Landings as a % of the LCE	92%	71%	84%	91%	75%	83%	89%
Reported Landings as a % of the HCE	43%	12%	18%	44%	29%	47%	42%
Reported Hour/Trip	7.48	8.13	6.92	8.5	7.45	8.77	7.2
Capacity Hour/Trip	7.01	7.46	3.58	8.49	7.67	9.7	7.6

Table 5.3 Continued.

	Longline	Rod & reel	Scuba	Free diving	Trammel net	Troll line	Total
Reported Landings	24.6	1.2	439	19.4	62.9	153	1,867
Landings Used in the DEA Models	9.4	0.6	242	7.4	34.7	76	828
Percent of Landings Used in the DEA Models	38%	49%	55%	38%	55%	50%	44%
Lower Capacity Estimate (LCE)	30.9	1.5	604	49.5	65.4	190	2,433
Higher Capacity Estimate (HCE)	58.3	1.6	2,854	95.1	119.8	591	9,717
Lower Excess Capacity Estimate	6.3	0.3	164	30.1	2.5	36	566
Higher Excess Capacity Estimate	33.8	0.3	2,415	75.7	56.9	438	7,850
LCE as a % of Reported Landings	126%	124%	137%	255%	104%	124%	130%
HCE as a % of Reported Landings	237%	129%	650%	490%	191%	385%	520%
Reported Landings as a % of the LCE	80%	80%	73%	39%	96%	81%	77%
Reported Landings as a % of the HCE	42%	78%	15%	20%	52%	26%	19%
Reported Hour/Trip	7.26	7.5	7.48	7.08	6.26	7.81	-
Capacity Hour/Trip	8.09	7.8	7.75	7.23	5.38	8.41	-

5.4 Capacity Assessment by Species Group for All Fleets Combined

The assessment of harvesting capacity, excess capacity, and overcapacity for each of the 14 OY species groups landed by the Puerto Rico fleets for all fleets combined is summarized in Table 5.4 and discussed in this section. Although Table 5.4 includes estimates of harvesting capacity and excess capacity for species groups without OY proxies, the following discussion focuses on the 14 OY species groups landed by the Puerto Rico fleets. Those OY species groups are listed below.

OY Species Groups Landed by the Puerto Rico Fleets		
1. Grouper	6. Parrotfish	11. Tilefish
2. Snapper	7. Triggerfish	12. Lobster
3. Grunt	8. Boxfish	13. Conch
4. Porgy	9. Goatfish	14. Wrasse
5. Jack	10. Squirrelfish	

Surgeonfish and angelfish are the two OY species groups that are not included. There were no reported landings for these two OY species groups.

To allow for a meaningful comparison to the OY proxy for each OY species group, the capacity estimates generated for the reported landings used in the DEA models were adjusted upward using a factor equal to the ratio of estimated landings to landings used in the DEA models for each OY species group.

By simply comparing estimated landings to the OY proxies, it is clear that there was overcapacity for six OY species groups in 2004. The percent by which estimated landings exceeded the OY proxies are as follows: jack (3 percent), triggerfish (25 percent), boxfish (2 percent), lobster (35 percent), conch (89 percent), and wrasse (37 percent). For the other eight OY species groups, estimated landings as a percent of the OY proxies ranged from 10 percent for tilefish to 100 percent for parrotfish.

The lower capacity estimates exceeded the estimated landings from a low of 0 percent for tilefish to a high of 43 percent for conch. The higher capacity estimates exceeded the estimated landings from a low of 0 percent for tilefish to more than 600 percent for snapper and lobster.

The lower capacity estimates were less than the OY proxies for five OY species groups (grouper, porgy, goatfish, squirrelfish, and tilefish). For the other nine OY species groups, the lower capacity estimates exceeded the OY proxies from a low of 10 percent for snapper to a high of 170 percent for conch. The higher capacity estimates were less than the OY proxies for only two OY species groups (squirrelfish and tilefish). For the other 12 OY species groups, the higher capacity estimates exceeded the OY proxies from a low of 22 percent for goatfish to more than 800 percent for both lobster and conch.

Table 5.4 Puerto Rico fisheries harvesting capacity assessment by species group for all fleets combined, 2004 (1,000 pounds, whole weight).

	Sum Grouper	Grouper 1	Grouper 3	Grouper 4	Sum Snapper	Snapper 1	Snapper 2
Landings Used in the DEA Models	27	1.4	23	2.7	211	96	102
Estimated Total Landings	101	5.1	85	10.0	770	351	374
% Used in DEA Models	27%	27%	27%	27%	27%	27%	27%
OY Proxy	133	N.A.	N.A.	N.A.	909	N.A.	N.A.
Lower Capacity Estimate (LCE)	130	5.8	113	10.7	1,004	395	550
Higher Capacity Estimate (HCE)	323	8.8	296	18.6	5,524	2,409	2,927
Lower Excess Capacity Estimate	29	0.7	28	0.7	234	44	176
Higher Excess Capacity Estimate	222	3.6	210	8.6	4,754	2,058	2,552
LCE as a % of Estimated Landings	129%	113%	133%	107%	130%	112%	147.0%
HCE as a % of Estimated Landings	321%	171%	346%	186%	717%	686%	782.2%
Estimated Landings as a % of the LCE	77%	89%	75%	93%	77%	89%	68.0%
Estimated Landings as a % of the HCE	31%	59%	29%	54%	14%	15%	12.8%
Lower Overcapacity Estimate	-3	N.A.	N.A.	N.A.	95	N.A.	N.A.
Higher Overcapacity Estimate	190	N.A.	N.A.	N.A.	4,615	N.A.	N.A.
LCE as a % of the OY Proxy	98%	N.A.	N.A.	N.A.	110%	N.A.	N.A.
HCE as a % of the OY Proxy	242%	N.A.	N.A.	N.A.	608%	N.A.	N.A.
Estimated Landings as a % of the OY Proxy	75%	N.A.	N.A.	N.A.	85%	N.A.	N.A.

Table 5.4 Continued.

	Other Snapper	Grunt	Porgy	Jack	Parrotfish	Triggerfish	Boxfish
Landings Used in the DEA Models	12	33	5.6	20	23	18	22
Estimated Total Landings	45	122	20.6	75	83	64	80
% Used in DEA Models	27%	27%	27%	27%	27%	27%	27%
OY Proxy	N.A.	124	28.9	72	83	51	78
Lower Capacity Estimate (LCE)	59	138	23.9	105	89	79	92
Higher Capacity Estimate (HCE)	189	228	38.6	268	166	184	199
Lower Excess Capacity Estimate	14	16	3.3	31	6	15	13
Higher Excess Capacity Estimate	144	106	18.1	193	83	119	119
LCE as a % of Estimated Landings	132.2%	113%	116%	141%	107%	123%	116%
HCE as a % of Estimated Landings	422.7%	187%	188%	359%	200%	286%	250%
Estimated Landings as a % of the LCE	75.7%	89%	86%	71%	93%	82%	86%
Estimated Landings as a % of the HCE	23.7%	54%	53%	28%	50%	35%	40%
Lower Overcapacity Estimate	N.A.	14	-5.0	33	5	27	15
Higher Overcapacity Estimate	N.A.	104	9.8	196	82	132	121
LCE as a % of the OY Proxy	N.A.	111%	83%	145%	107%	153%	119%
HCE as a % of the OY Proxy	N.A.	184%	134%	370%	199%	357%	256%
Estimated Landings as a % of the OY Proxy	N.A.	99%	71%	103%	100%	125%	102%

Table 5.4 Continued.

	Barracuda	Goatfish	Mackerel	Tuna	Dolphin	Wahoo	Squirrelfish
Landings Used in the DEA Models	2.7	3.3	35	34	37	3.1	2.8
Estimated Total Landings	10.0	12.2	128	125	137	11.4	10.3
% Used in DEA Models	27%	27%	27%	27%	27%	27%	27%
OY Proxy	N.A.	19.2	N.A.	N.A.	N.A.	N.A.	16.2
Lower Capacity Estimate (LCE)	11.0	15.0	193	152	155	11.9	11.1
Higher Capacity Estimate (HCE)	20.7	23.4	512	415	619	29.0	16.2
Lower Excess Capacity Estimate	1.0	2.8	65	27	18	0.4	0.9
Higher Excess Capacity Estimate	10.7	11.2	384	291	482	17.6	5.9
LCE as a % of Estimated Landings	110%	123%	150.5%	122%	113%	104%	109%
HCE as a % of Estimated Landings	206%	192%	398.9%	333%	452%	254%	157%
Estimated Landings as a % of the LCE	91%	81%	66.4%	82%	89%	96%	92%
Estimated Landings as a % of the HCE	48%	52%	25.1%	30%	22%	39%	64%
Lower Overcapacity Estimate	N.A.	-4.1	N.A.	N.A.	N.A.	N.A.	-5.0
Higher Overcapacity Estimate	N.A.	4.2	N.A.	N.A.	N.A.	N.A.	0.0
LCE as a % of the OY Proxy	N.A.	78%	N.A.	N.A.	N.A.	N.A.	69%
HCE as a % of the OY Proxy	N.A.	122%	N.A.	N.A.	N.A.	N.A.	100%
Estimated Landings as a % of the OY Proxy	N.A.	64%	N.A.	N.A.	N.A.	N.A.	63%

Table 5.4 Continued.

	Tilefish	Lobster	Conch	Wrasse	Misc. Species
Landings Used in the DEA Models	0.0	101	123	20	106
Estimated Total Landings	0.1	369	450	74	389
% Used in DEA Models	27%	27%	27%	27%	27%
OY Proxy	0.5	273	238	54	N.A.
Lower Capacity Estimate (LCE)	0.1	467	644	89	551
Higher Capacity Estimate (HCE)	0.1	2,604	2,176	292	2,389
Lower Excess Capacity Estimate	0.0	98	194	15	162
Higher Excess Capacity Estimate	0.0	2,235	1,726	218	2,000
LCE as a % of Estimated Landings	100%	127%	143%	120%	141.7%
HCE as a % of Estimated Landings	100%	707%	484%	394%	614.6%
Estimated Landings as a % of the LCE	100%	79%	70%	83%	70.6%
Estimated Landings as a % of the HCE	100%	14%	21%	25%	16.3%
Lower Overcapacity Estimate	-0.5	193	406	35	N.A.
Higher Overcapacity Estimate	-0.5	2,331	1,938	238	N.A.
LCE as a % of the OY Proxy	10%	171%	270%	165%	N.A.
HCE as a % of the OY Proxy	10%	953%	913%	539%	N.A.
Estimated Landings as a % of the OY Proxy	10%	135%	189%	137%	N.A.

6. Overcapacity Assessment by OY Species Group for All Areas Combined

The assessment of overcapacity for each of the 16 OY species groups (see Table 1) is summarized in Table 6 and discussed in this section for all areas combined. By simply comparing estimated landings to the OY proxies, it is clear that there was overcapacity for all but three OY species groups in 2004. The percent by which estimated landings exceeded the OY proxies are as follows: grouper (47 percent), snapper (6 percent), grunt (49 percent), porgy (54 percent), jack (63 percent), parrotfish (108 percent), triggerfish (217 percent), boxfish (32 percent), lobster (105 percent), conch (223 percent), wrasse (37 percent), surgeonfish (212 percent), and angelfish (97 percent). For the other three OY species groups, estimated landings as a percent of the OY proxies were as follows: goatfish (76 percent), squirrelfish (64 percent), and tilefish (8%).

The lower capacity estimates were less than the OY proxies for only three OY species groups (goatfish, squirrelfish, and tilefish). For the other 13 OY species groups, the lower capacity estimates exceeded the OY proxies from a low of 41 percent for snapper to a high of almost 300 percent for surgeonfish. The higher capacity estimates were less than the OY proxies for only two OY species groups (squirrelfish and tilefish). For the other 14 OY species groups, the higher capacity estimates exceeded the OY proxies from a low of 34 percent for goatfish to more than 800 percent for both lobster and conch.

Table 6. Overcapacity assessment by OY species group for all areas combined (1,000 pounds, whole weight).

	Grouper	Snapper	Grunt	Porgy	Jack	Parrot-fish	Trigger-fish	Box-fish
Landings Used in the DEA Models	127	433	113	32	83	334	118	58
Estimated Total Landings	245	1,090	237	59	166	520	211	133
% Used in DEA Models	52%	40%	48%	54%	50%	64%	56%	44%
OY Proxy	167	1,026	159	38	102	251	98	101
Lower Capacity Estimate (LCE)	314	1,446	278	76	352	569	265	163
Higher Capacity Estimate (HCE)	640	6,632	438	121	720	923	463	309
Lower Excess Capacity Estimate	69	356	40	18	186	49	54	29
Higher Excess Capacity Estimate	394	5,542	200	62	554	403	252	176
LCE as a % of Estimated Landings	128%	133%	117%	130%	212%	109%	125%	122%
HCE as a % of Estimated Landings	261%	608%	184%	206%	434%	177%	219%	232%
Estimated Landings as a % of the LCE	78%	75%	86%	77%	47%	91%	80%	82%
Estimated Landings as a % of the HCE	38%	16%	54%	49%	23%	56%	46%	43%
Lower Overcapacity Estimate	147	420	118	38	250	319	167	62
Higher Overcapacity Estimate	473	5,606	279	83	618	672	365	209
LCE as a % of the OY Proxy	188%	141%	174%	200%	346%	227%	271%	162%
HCE as a % of the OY Proxy	384%	646%	275%	317%	707%	368%	475%	307%
Estimated Landings as a % of the OY Proxy	147%	106%	149%	154%	163%	208%	217%	132%

Table 6 Continued.

	Goatfish	Squirrel-fish	Tilefish	Lobster	Conch	Wrasse	Surgeon-fish	Angel-fish
Landings Used in the DEA Models	6.1	3.3	0.0	342	242	20	72	8.4
Estimated Total Landings	16.0	11.0	0.1	716	616	74	104	12.4
% Used in DEA Models	38%	30%	27%	48%	39%	27%	69%	67%
OY Proxy	21.2	17.3	0.7	349	276	54	33	6.3
Lower Capacity Estimate (LCE)	19.0	12.0	0.1	875	822	89	129	13.1
Higher Capacity Estimate (HCE)	28.4	17.2	0.1	3,400	2,527	292	190	20.1
Lower Excess Capacity Estimate	3.0	0.9	0.0	158	206	15	25	0.6
Higher Excess Capacity Estimate	12.4	6.1	0.0	2,684	1,912	218	86	7.7
LCE as a % of Estimated Landings	119%	108%	100%	122%	133%	120%	125%	105%
HCE as a % of Estimated Landings	177%	155%	100%	475%	411%	394%	183%	162%
Estimated Landings as a % of the LCE	84%	92%	100%	82%	75%	83%	80%	95%
Estimated Landings as a % of the HCE	56%	64%	100%	21%	24%	25%	55%	62%
Lower Overcapacity Estimate	-2.2	-5.3	-0.6	526	546	35	96	6.7
Higher Overcapacity Estimate	7.2	-0.1	-0.6	3,051	2,252	237	157	13.8
LCE as a % of the OY Proxy	90%	69%	8%	251%	298%	164%	388%	207%
HCE as a % of the OY Proxy	134%	99%	8%	975%	917%	538%	570%	318%
Estimated Landings as a % of the OY Proxy	76%	64%	8%	205%	223%	137%	312%	197%

APPENDIX 7

Northwest Region Assessment

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1. Introduction

This report presents an assessment of harvesting capacity for the Pacific Coast groundfish fishery. The assessment is for 2004 and is based on available data for landings, discards, and total allowable catches (TACs) for 2004. Neither the West Coast Pacific halibut fishery nor the fisheries managed under the fishery management plan (FMP) for West Coast Salmon are included in this report.

While the halibut fishery is a federally-managed fishery, only a very small share of Pacific halibut harvest is from the West Coast. Therefore, the halibut fishery was not included in the assessment of overcapacity provided by this report.

The salmon fishery was not included in the assessment of overcapacity provided by this report because data limitations prevented production of an assessment that would have been comparable to those conducted for other federally managed commercial fisheries. Within the salmon fishery, data on fixed inputs such as vessel physical characteristics were suspect, and data on variable inputs such as effort were not available. Data on physical characteristics exhibited wide variation in horsepower for vessels of similar length. At the vessel level, landings per trip varied widely across trips, indicating that the lack of effort data would cause significant modeling problems. The regulation of salmon relies mostly on area and time restrictions, which are dynamically set through the season, rather than on a TAC set prior to the seasons. As a result, defining overcapacity as capacity minus the TAC does not make sense for the salmon fishery.

Sections 1 through 4 of the National Assessment provide critical background information. These sections explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the Pacific Coast groundfish fishery will be easier to understand and interpret if sections 1 through 4 of the National Assessment are read first.

The assessment of the Pacific Coast groundfish fishery is by fleet and by species group, where “fleet” refers to a specific part of a fishery and “species group” can refer to one or more individual species. Specifically, “fleets” refers to mutually exclusive sets of groundfish trips and not to mutually exclusive sets of vessels. A groundfish trip is a trip with landings of one or more of the nine groundfish target species groups. This use “fleet” is explained by the following points using the example of the hook and line fleet: (1) the hook and line fleet refers to the groundfish trips for which hook and line gear was used; (2) the assessment of harvesting capacity for that fleet is for such trips and not for the other fishing activities of the vessels that made such trips; and (3) some vessels were in multiple groundfish fleets, as well as in fleets for other fisheries. In addition, multiple species groups typically were landed together. Therefore, many vessels contributed to the landings and, therefore, to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species groups, fleets, or fisheries.

For the Pacific Coast groundfish fishery, this caveat is particularly important because of the multi-species, multi-gear nature of the fisheries. Many vessels in these fisheries fish for a variety of species on each trip and throughout the seasons, constantly adapting to resource, market, and other conditions. In light of these factors, the merit of a single species capacity, and particularly overcapacity, measure needs to be carefully evaluated. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species if the existing fishery management measures did not prevent such a shift. The present analysis, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is less of a problem for the assessment of harvesting capacity by fleet for all species combined.

The assessment indicates that for individual groundfish fleets, there was between 11 and 83 percent excess capacity and that for all groundfish fleets combined there was 29 percent excess capacity. That is, it was estimated that the boats in the groundfish fleets could have landed 29 percent more fish (principally groundfish) in 2004 if they had operated at capacity. For the nine individual groundfish target species groups, the assessment indicates there was no overcapacity for Pacific cod, English sole, petrale sole, or thornyhead rockfish, and that the overcapacity for the other five groundfish target species groups were as follows: Pacific whiting (26 percent), sablefish (152 percent), Dover sole (14 percent), arrowtooth flounder (28 percent), and other flatfish (41 percent). Although there appeared to be overcapacity for those five groundfish target species groups, the TAC was exceeded only for sablefish and only by 3 percent.

It is important to remember the following points: (1) a variety of management measures reduced catch per trip and the number of trips in 2004, and therefore reduced the harvesting capacity estimates for 2004; (2) landings of rebuilding species were severely constrained during 2004; (3) landings of other species were constrained by efforts to decrease the bycatch of the rebuilding species; (4) because any estimate of overcapacity for rebuilding species based on 2004 landings data would be misleading and meaningless, estimates of overcapacity for rebuilding species are not presented; (5) although landings data for all groundfish species (including rebuilding species) that were landed with the target species were used to estimate harvesting capacity, excess capacity, and overcapacity, overcapacity estimates are only presented for species that were target species during 2004; and (6) due to the species composition of the landings of the hook and line fleet, there was a disproportionately large effect on the harvesting capacity estimates for that fleet.

This report includes the following information: (1) a brief description of the management of the Pacific Coast groundfish fishery, with an emphasis on the management measures that limited catch per trip or the number of trips in 2004, and an explanation for the focus of the assessment in terms of groundfish fleets and species group (Section 2): (2) a brief description of groundfish fleet-specific statistics on the reported landings and the physical and trip characteristics for the fishing vessels with groundfish trips in 2004 (Section 3); (3) a brief description of the methods used to estimate harvesting capacity (Section 4); (4) the assessment results by fleet for all species groups combined (Section 5); and (5) the assessment results by groundfish target species group for all Pacific Coast groundfish fleets combined (Section 6). The trip characteristics statistics are limited to the number of trips per vessel because more complete data on trip characteristics (e.g., days at sea, number of sets, or crew size) were not available consistently.

The summary tables and text present reported landings, estimated total catch, the harvesting capacity estimates, and the harvesting capacity assessments in thousand metric tons (t) round weight, rounded to the nearest 0.1 or 1 thousand t (100 t or 1,000 t), and they present percentages that typically are rounded to the nearest 1 percent. The resulting rounding can give the impression of internal inconsistencies. For example, the excess capacity estimates presented may not be exactly equal to the difference between the harvesting capacity and landings estimates in the report. Similarly, the percentages in the report cannot always be reproduced exactly by using the landings data and harvesting capacity estimates presented in the report.

2. Groundfish Management and the Focus of the Assessment

The Pacific Coast Groundfish FMP covers over 80 species of rockfish, flatfish, roundfish, and other species. Because groundfish are typically harvested in multi-species complexes, several different groundfish species are caught simultaneously. Groundfish catch and landings include both target and non-target species. The latter are caught merely as incidental catch in the pursuit of target species, which can be groundfish species or other species.

Groundfish are managed through measures including trip and landing limits, quotas, area and seasonal closures, and gear restrictions. The groundfish harvest has been greatly constrained in recent years (including 2004) by the low biomass of some species and the resulting low TACs for those species. There are currently seven overfished species managed under the Groundfish FMP. Each of these overfished species co-occurs or mixes with other, more abundant groundfish species. To protect and rebuild overfished stocks, the harvest of the more abundant groundfish stocks that co-occur with the overfished species has been restricted using the types of management measures mentioned above. Total revenues from the groundfish fishery have fallen by 40 to 50 percent over the past few years.

The Pacific Fishery Management Council's Groundfish Fishery Strategic Plan, *Transition to Sustainability*, calls for reductions in fleet capacity across all sectors of the commercial groundfish fishery. In December 2003, an industry-funded groundfish trawl buyback program was completed whereby 91 vessels and 91 federal limited entry groundfish trawl permits, 27 other federal fishing permits, and 121 state crab and shrimp permits were removed from commercial fishing. The Pacific Fishery Management Council is currently preparing an Environmental Impact Statement evaluating the implementation of a limited access privilege program for the limited entry trawl fleet, which accounts for about two-thirds of Pacific Coast groundfish landings revenue.

Due to data availability and the characteristics of the groundfish fishery, the assessment focused on the nine groundfish target species groups and five groundfish fleets listed below.

Groundfish Target Species Groups

1 Pacific cod	6 Petrale sole
2 Pacific whiting	7 Arrowtooth flounder
3 Sablefish	8 Other flatfish
4 Dover sole	9 Thornyhead rockfish
5 English sole	

Fleets

1 Hook and line	4 Trawl (delivering to motherships)
2 Pot	5 Catcher processors
3 Trawl (delivering shoreside)	

Estimates of harvesting capacity and overcapacity for all fleets combined are presented for each of these nine target species groups, and estimates of harvesting capacity and excess capacity for all species combined are presented for each of these five fleets.

In 2004, the total reported landings of groundfish were just over 232 thousand t (Table 1), the nine target species groups listed above accounted for all but 4 thousand t of the total, and the five fleets accounted for over 99 percent of the reported landings of all groundfish species and of the nine groundfish target species groups.

The vast majority of groundfish was landed by approximately 300 vessels with limited entry permits; although other vessels could land groundfish, they were subject to very restrictive trip limits that were intended to limit their ability to target groundfish species. Hook and line vessels and pot vessels with both limited entry permits and sablefish endorsements and trawl vessels with limited entry permits accounted for over 99 percent of the total reported landings of the nine groundfish target species groups and of all groundfish (Table 1).

Most of the vessels in the groundfish fleets also participate in other West Coast fisheries (e.g., salmon, crab, and shrimp), and some participate in the commercial fisheries off Alaska. However, this assessment was limited to their participation in the Pacific Coast groundfish fishery.

When interpreting the results of this study, it is important to remember that the reported landings (and therefore the harvesting capacity estimate for each of the nine groundfish target species groups in this multi-species groundfish fishery) depend not only on characteristics of the fleet and availability of the species group, but also on the availability of the other eight target species groups and other potential bycatch species, market induced limitations on landings (e.g., processor-imposed landing limitations), and fishery regulations.

Because the analysis of overcapacity requires a TAC, efforts to define species groups for the overcapacity analysis began with consideration of the species groups for which a TAC or TAC proxy could be obtained. For calendar year 2004, commercial fishery optimum yields (OYs) are available or can be calculated for the 23 groundfish species groups listed below by category.

Roundfish:		11	Shortbelly rockfish
1	Lingcod	12	Widow rockfish
2	Pacific cod	13	Canary rockfish
3	Pacific whiting	14	Chilipepper
4	Sablefish	15	Boccacio
Flatfish:		16	Splitnose rockfish
5	Dover sole	17	Yellowtail rockfish
6	English sole	18	Thornyhead rockfish
7	Petrale sole	19	Cowcod
8	Arrowtooth flounder	20	Darkblotched rockfish
9	Other flatfish	21	Yelloweye rockfish
Rockfish:		22	Black rockfish
10	Pacific ocean perch	23	Minor rockfish

Published commercial fishery OY estimates for 2004 were available for all four roundfish species. However, an estimate of capacity and overcapacity is not presented for lingcod, as it has been identified as being overfished (with a spawning stock abundance less than 25 percent of the spawning population that would exist if the stock had never been fished). Because of the harvest limitations placed on overfished rebuilding species, a meaningful estimate of harvesting capacity and overcapacity cannot be developed from 2004 landings data for lingcod.

Whereas acceptable biological catches (ABCs) were available for all five flatfish species, an OY and a commercial fishery OY were available only for Dover sole. OYs and commercial fishery OYs were not available for English sole, petrale sole, arrowtooth flounder, or other flatfish during 2004. Because OYs and commercial fishery OYs were available for these species during 2005, the ratio of the 2005 commercial OY to the 2005 ABC was applied to the 2004 ABC for each of those species groups in order to estimate the 2004 commercial fishery OY. Landings of flatfish species during 2004 were limited not only by OY targets but also by processor-imposed per-trip landing limits that further restricted landings.

Although commercial fishery OYs were available for 14 rockfish species groups, restrictions on harvest of overfished species in the multi-species groundfish fishery make it difficult to apply these commercial fishery OYs to get a meaningful estimate of overcapacity. Seven of the 14 rockfish species with available commercial OYs have been declared overfished. Because measures must be taken to rebuild stock abundance of overfished species to a level that supports maximum sustained yield, a targeted fishery for these overfished species did not exist in 2004. Rather, any landings of these species were taken as incidental catch by vessels targeting other species. Because estimation of capacity for a species taken only as incidental catch does not make sense, an overcapacity estimate is not presented for these seven overfished rebuilding species. The seven overfished rockfish species that are being rebuilt are listed below.

1 Pacific ocean perch
2 Widow rockfish
3 Canary rockfish
4 Boccacio rockfish
5 Cowcod
6 Darkblotched rockfish
7 Yelloweye rockfish

Among the seven remaining rockfish species for which commercial fishery OYs were available, concern about incidental catch of rebuilding species placed severe limits on the harvesting of the five species listed below.

1. Shortbelly rockfish
2. Chilipepper rockfish
3. Yellowtail rockfish
4. Black rockfish
5. Splitnose rockfish

These harvest limitations, induced by concerns about bycatch of rebuilding species, caused landings of these species to be much lower than commercial OYs, and prevented the development of meaningful harvest capacity estimates for those species using 2004 landings data. As a result of these harvest limitations induced by rebuilding plans for overfished species—on both the rebuilding species and other species for which rebuilding species are taken as incidental catch—thornyhead rockfish is the only rockfish species group for which an estimate of overcapacity is presented.

The commercial fishery OYs or proxies for them were used as the TACs for the purpose of assessing overcapacity for each of the nine groundfish target species groups.

Table 1 Reported commercial landings[1] by fleet and species group for Pacific Coast groundfish trips[2] and other trips[3] with groundfish landings in 2004 (1,000 metric tons, round weight).

	Shoreside Delivery Fleets								At-Sea Delivery Fleets				
	Hook and Line		Pot		Trawl		Other	Sub-	Trawl	Trawl	Sub-	Grand	Other
Species Group	LE & SE[4]	All	LE & SE	All	LE[5]	All	Gear	Total	(MS)	(CP)	Total	Total	Trips
Pacific Cod	0.0	0.0	0.0	0.0	1.1	1.1	0.0	1.1	0.0	0.0	0.0	1.1	0.0
Pacific Whiting	0.0	0.0	0.0	0.0	89.7	89.7	0.0	89.7	45.7	73.2	118.9	208.6	0.0
Sablefish	1.5	1.8	0.6	0.8	2.4	2.4	0.0	5.0	0.0	0.0	0.0	5.0	0.0
Dover Sole	0.0	0.0	0.0	0.0	6.6	6.7	0.0	6.7	0.0	0.0	0.0	6.7	0.0
English Sole	0.0	0.0	0.0	0.0	0.9	0.9	0.0	0.9	0.0	0.0	0.0	0.9	0.0
Petrale Sole	0.0	0.0	0.0	0.0	1.9	1.9	0.0	1.9	0.0	0.0	0.0	1.9	0.0
Arrowtooth Flounder	0.0	0.0	0.0	0.0	2.3	2.3	0.0	2.3	0.0	0.0	0.0	2.3	0.0
Other Flatfish	0.0	0.0	0.0	0.0	1.2	1.3	0.0	1.3	0.0	0.0	0.0	1.3	0.0
Thornyhead Rockfish	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0.7	0.0	0.0	0.0	0.7	0.0
Sub-Total	1.5	1.9	0.6	0.8	106.6	106.8	0.0	109.5	45.7	73.2	118.9	228.4	0.0
All Other Groundfish	0.3	0.4	0.0	0.0	2.0	2.0	0.1	2.5	0.3	0.4	0.7	3.2	0.8
All Groundfish	1.8	2.3	0.6	0.8	108.6	108.8	0.1	112.0	46.0	73.6	119.6	231.6	0.8
All Other Species	0.1	0.2	0.0	0.0	1.0	1.3	0.3	1.8	0.0	0.0	0.0	1.8	0.1
Total	1.9	2.5	0.6	0.8	109.6	110.2	0.3	113.8	46.0	73.6	119.6	233.4	0.9

1. These data are only for trips with groundfish landings; therefore, they do not include landings for other trips by the vessels with groundfish landings.
2. A groundfish trip is a trip in which at least one of the nine groundfish target species groups was landed.
3. Other trips are trips with groundfish landings that do not include any of the nine groundfish target species groups.
4. Vessels with limited entry permits and sablefish fixed gear endorsements.
5. Vessels with limited entry permits.

Sources: The reported landings are based on data extracted from PacFIN and AFSC Observer Program databases.

3. Vessel Characteristics and Landings by Fleet

Information on landings and on vessel and trip characteristics are discussed below and summarized in Tables 1 and 2 for each of five groundfish fleets. As noted above, "fleet" refers to a specific part of the groundfish fishery. Specifically, the five fleets refer to mutually exclusive sets of groundfish trips and not to mutually exclusive sets of vessels, where a groundfish trip is a trip with landings of one or more of the nine groundfish target species groups. Therefore, the landings data presented for each fleet are only for groundfish trips with a specific gear type and exclude the landings data for all other trips made by the vessels in that fleet. Some vessels used multiple gear types or made both shoreside and at-sea deliveries in 2004. Therefore, some vessels are included in the statistics for multiple fleets, and therefore the total number of vessels with groundfish trips is less than the sum of vessel counts across the five fleets.

The vessel characteristics statistics are for the reported length, gross registered tonnage, horsepower, and breadth of the fishing vessels. The trip characteristics statistics are for the number of trips only, because data on other trip characteristics (e.g., days at sea per trip and crew size) were not available consistently. Vessels without data for a specific vessel characteristic were not included in the statistics reported below for that characteristic. For example, if the gross registered tonnage was unknown for 12 vessels (i.e., not in the vessel characteristics database used for this assessment), those 12 vessels were not included in estimating mean gross registered tonnage. In addition, a horsepower value of less than 100 was considered erroneous and was not used in calculating the horsepower statistics.

For each fishing vessel in a shoreside delivery fleet, a unique reported landings date on a fishticket (i.e., landings report) for the vessel was used to define a trip. Therefore, in those relatively few instances when a vessel made more than one trip per day and all the landings were reported the same day, the landings for those trips would be aggregated into one trip for the purposes of this report. Conversely, if the catch from one trip was split into two or more deliveries with separate fishtickets and landings dates, the landings for such a trip would be split into multiple trips for the purposes of this report. The required data to define a trip more precisely or uniquely were not available consistently. For each fishing vessel in an at-sea delivery fleet, each day with reported catch was counted as a trip.

With the exception of landings data for the at-sea delivery fleets, the data used to both describe the fleets and estimate harvesting capacity were extracted from databases maintained by the Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office. Landings data for the two at-sea delivery fleets were taken from the Alaska Fisheries Science Center (AFSC) Observer Program database.

3.1 Hook and Line Fleet

In 2004, 377 boats had one or more reported groundfish trips with hook and line gear (Table 2). Sablefish accounted for most of the landings for those trips. Hook and line gear includes longline, setline, jig, hand line, and drop line gear, but not troll gear. Longline gear accounted for most of the catch taken with hook and line gear. The fleet's total reported landings from groundfish trips were about 2.5 thousand t, or about 1 percent of the total for all groundfish fleets in 2004 (Table 1). Substantially more vessels used hook and line gear than any other gear; in fact, more vessels used hook and line gear than the other four main groundfish gear types combined. The vessels varied widely in terms of their physical characteristics and number of groundfish trips. The boats ranged in length from 14 to 86 feet with a mean of 37 feet. Their gross registered tonnage was between 6 and 190 tons with a mean of 31. They had between 100 and 871 horsepower with a mean of 242. Their breadth ranged from 8 to 31 with a mean of 14. The number of groundfish trips per vessel was between 1 and 174 with a mean of 10. The fleet's total reported groundfish landings were about 2.3 thousand t in 2004, or 90 percent of its total landings for groundfish trips. The fleet's total landings for the groundfish target species groups were 1.9 thousand t, or 74 percent of its total landings for groundfish trips and 1 percent of the total reported landings of the nine groundfish target species groups for the groundfish fleets. The fleet's sablefish landings of 1.8 thousand t represented 72 percent of its total reported groundfish trip landings and 36 percent of the total reported sablefish landings for the groundfish fleets. The hook and line fleet did not account for a large share of the reported landings of any other groundfish target species groups.

3.2 Pot Fleet

In 2004, 81 boats had one or more reported groundfish trips with pot gear (Table 2). Sablefish accounted for most of the landings for those trips. The fleet's total reported landings from groundfish trips were about 0.8 thousand t, or less than 0.5 percent of the total for all groundfish fleets in 2004 (Table 1). The vessels varied widely in terms of their physical characteristics and number of groundfish trips. The boats ranged in length from 18 to 90 feet with a mean of 42 feet. Their gross registered tonnage was between 8 and 171 tons with a mean of 37. They had between 100 and 871 horsepower with a mean of 288. Their breadth ranged from 10 to 26 feet with a mean of 15 feet. The number of groundfish trips per vessel was between 1 and 223 with a mean of 16. The fleet's total reported groundfish landings was about 0.8 thousand t in 2004, or 99 percent of its total landings for groundfish trips. The fleet's total landings for the nine groundfish target species groups was 0.8 thousand t, or 98 percent of its total landings for groundfish trips and less than 0.5 percent of the total reported landings of the nine groundfish target species groups for the groundfish fleets. The fleet's sablefish landings of 0.8 thousand t represented 98 percent of its total reported groundfish trip landings and 16 percent of the total reported sablefish landings for the groundfish fleets. The pot fleet did not account for a large share of the reported landings of any other groundfish target species groups.

3.3 Trawl Fleet Delivering Shoreside

The nine groundfish target species groups were delivered shoreside by 164 fishing vessels that used bottom trawl or pelagic trawl gear in 2004 (Table 2). Pacific whiting accounted for most of the landings for those trips. The fleet's total reported landings from groundfish trips were about 110 thousand t, or about 47 percent of the total for all groundfish fleets in 2004 (Table 1). Although these vessels varied in terms of their physical characteristics and number of groundfish trips, typically they were larger, had more horsepower, and on average made more groundfish trips than the vessels in the other shoreside delivery fleets. For example, their mean gross registered tonnage was more than twice that of any other fleet delivering shoreside. The boats ranged in length from 25 to 103 feet with a mean of 63 feet. Their gross registered tonnage was between 12 and 199 tons with a mean of 80. They had between 100 and 1,600 horsepower with a mean of 404. Their breadth ranged from 11 to 36 feet with a mean of 19 feet. The number of groundfish trips per vessel was between 1 and 180 with a mean of 35. The fleet's total reported groundfish landings were about 109 thousand t in 2004, or 99 percent of its total landings for groundfish trips. The fleet's total landings for the nine groundfish target species groups was 107 thousand t, which represented 97 percent of its total landings for groundfish trips and 47 percent of the total reported landings of the nine groundfish target species groups for the groundfish fleets. The fleet's Pacific whiting landings of almost 90 thousand t represented 81 percent of its total reported groundfish trip landings and 43 percent of the total reported Pacific whiting landings for the groundfish fleets. In addition, this trawl fleet accounted for a very large share of the reported landings of each of the other eight groundfish target species groups: Pacific cod (100 percent), sablefish (47 percent), the flatfish species groups (99 to 100 percent), and thornyhead rockfish (95 percent).

3.4 Trawl Fleet Delivering to Motherships

In 2004, 14 fishing vessels used bottom trawl or pelagic trawl gear to target Pacific whiting and deliver it to motherships (Table 2). Compared to their Pacific whiting catch, these trawlers took relatively small amounts of other groundfish species as incidental catch that was delivered to motherships with their Pacific whiting catch. Their total reported groundfish deliveries to motherships totaled about 46 thousand t, or about 20 percent of the total reported landings for all groundfish fleets in 2004 (Table 1). These vessels, which tended to be larger and have more horsepower than the trawlers in the shoreside delivery fleet, ranged in length from 72 to 133 feet with a mean of 94 feet. Their gross registered tonnage was between 131 and 199 tons with a mean of 183. They had between 600 and 1,800 horsepower with a mean of 1,165. Their breadth ranged from 24 to 40 feet with a mean of 30 feet. The number of days with reported groundfish landings per vessel was between 16 and 51 with a mean of 25. The fleet's total reported groundfish landings was about 46 thousand t in 2004, or 100 percent of its total landings for groundfish trips. The fleet's total landings for the nine groundfish target species groups were 45.7 thousand t, which represented 99 percent of its total landings for groundfish trips and 20 percent of the total reported landings of the nine groundfish target species groups for the groundfish fleets. The fleet's Pacific whiting landings of 45.7 thousand t was 99 percent of its total reported groundfish trip landings and 22 percent of the total reported Pacific whiting landings for the groundfish fleets. The trawl fleet that delivered to motherships did not account for a large share of the reported landings of any other groundfish target species group.

3.5 Catcher Processor Fleet

Pacific whiting was targeted and harvested by 6 trawl catcher processors in 2004 (Table 2). Their total reported landings from Pacific Coast groundfish trips were almost 74 thousand t, or about 32 percent of the total for all groundfish fleets in 2004 (Table 1). Compared to their Pacific whiting catch, these trawlers took relatively small amounts of other groundfish species as incidental catch. These fishing vessels were much larger and had more horsepower than the vessels in any of the other groundfish fleets. They ranged in length from 241 to 344 feet with a mean of 269 feet. Their gross registered tonnage was between 1,562 and 4,555 tons with a mean of 2,728. They had between 5,000 and 6,480 horsepower with a mean of 5,910. Their breadth ranged from 44 to 60 feet with a mean of 49 feet. The number of days with reported groundfish landings per vessel was between 22 and 120 with a mean of 44. The fleet's total reported groundfish landings was also almost 74 thousand t, in 2004 or 100 percent of its total landings for groundfish trips. The fleet's total landings for the nine groundfish target species groups was 73.2 thousand t, which represented virtually all Pacific whiting, and was 99 percent of its total landings for groundfish trips, 32 percent of the total reported landings of the nine groundfish target species groups for the groundfish fleets, and 35 percent of the total reported Pacific whiting landings for the groundfish fleets. The catcher processor fleet did not account for a large share of the reported landings of any other groundfish target species group.

Table 2. Vessel and trip characteristics by groundfish fleet for vessels with Pacific Coast groundfish trips[1] in 2004.

Fleet	Hook & Line	Pot	Trawl (SD)[2]	Trawl (MS)[3]	Catcher Processors
Total Number of Vessels	377	81	164	14	6
Vessel Length					
Minimum	14	18	25	72	241
Maximum	86	90	103	133	344
Median	37	40	62	88	253
Mean	37	42	63	94	269
Gross Registered Tonnage					
Minimum	6	8	12	131	1,562
Maximum	190	171	199	199	4,555
Median	23	24	72	191	2,504
Mean	31	37	80	183	2,728
Horsepower					
Minimum	100	100	100	600	5,000
Maximum	871	871	1,600	1,800	6,480
Median	218	243	350	1,200	6,250
Mean	242	288	404	1,165	5,910
Breadth					
Minimum	8	10	11	24	44
Maximum	31	26	36	40	60
Median	13	13	19	29	45
Mean	14	15	19	30	49
Trips[4]					
Minimum	1	1	1	16	22
Maximum	174	223	180	51	120
Median	4	9	24	17	31
Mean	10	16	35	25	44

1. A groundfish trip is a trip in which at least one of the nine groundfish target species groups was landed.
2. Trawlers with shoreside deliveries.
3. Trawlers with mothership deliveries.
4. For trawlers with mothership deliveries and catcher processors, trips are the number of days with reported groundfish landings.

Sources: This table is based on data extracted from PacFIN and AFSC Observer Program databases.

4. Methods

Landings data for all groundfish trips in 2004 were used to estimate capacity for the various fleets and each of the nine groundfish target species groups. A groundfish trip is a trip with landings of one or more of the nine groundfish target species groups. The landings data for the shoreside delivery fleets were taken from the PacFIN fishticket (i.e., landings report) database. Landings data for the two at-sea delivery fleets were taken from the AFSC Observer Program database. The landings data were combined with other vessel-specific and trip-specific data to compile a trip record for each reported groundfish trip. As noted in Section 3, the methods used to define a trip were different for the shoreside and at-sea delivery fleets, and were determined by the data that were consistently available for those two sets of fleets. The vessel-specific data were vessel horsepower, gross registered tonnage, length, breadth, and hull type, which were taken from the PacFIN vessel registration and permit database. The trips were then stratified to ensure that similar types of trips were included in each model. The stratification methods used are discussed below separately for the shoreside and at-sea delivery fleets.

4.1 Methods for the Shoreside Delivery Fleets

DEA was used to estimate harvesting capacity by trip and species group for each reported groundfish trip for which the landings were at least 100 pounds and the reported horsepower of the vessel was greater than 99. The data provided by the NMFS Northwest Fisheries Science Center identified the groundfish trips, as well as non-groundfish trips that included some groundfish taken as incidental catch and landed. Examples of such trips included salmon trips with troll gear and shrimp trips with trawl gear. For this group of fleets, a trip for a vessel is defined by a unique landings (fishticket) date for that vessel. For the groundfish trips that did not meet both criteria and for the groundfish trips in strata with too few observations (trips) to be used in a DEA model, capacity was set equal to reported landings. The landings used in the DEA models for the shoreside delivery fleets ranged from 54 percent of reported landings for the “other” gear fleet, which accounted for less than 0.5 percent of the total reported landings of the nine groundfish target species groups, to 100 percent of reported landings for the trawl fleet, and were 99 percent of reported landings for all shoreside delivery fleets combined (Table 2). In addition, fishing vessels using dredge gear were not included because they landed only a small amount of groundfish in 2004.

Because no trip level variable input data (e.g., days at sea, number of sets, or crew size) were consistently available for these vessels, variable inputs were not included in the DEA models. The effects of this data deficiency are discussed in Section 4.3. The fixed inputs used in the DEA models were vessel length, gross registered tons, horsepower, and breadth. The outputs were landings by the nine groundfish target species groups and several aggregate species groups for other groundfish species and non-groundfish species.

Groundfish trips were stratified by fleet (e.g., trawl vessels delivering shoreside, hook and line vessels, and pot vessels), as well as by season and vessel hull type (i.e. wood, steel, fiberglass, or other). In addition, the hook and line, pot, and trawl fleets were stratified by whether the vessel had a limited entry permit; and, given sufficient observations, the hook and line fleet was stratified by whether the vessel had a sablefish endorsement, which allowed it to land much more sablefish. A separate DEA model was used to estimate capacity by trip and species group for each stratum. Using hull type and gear type to stratify the data was important, because vessel groupings need to be based on similar technologies (i.e., wood vessels need to be grouped with wood vessels, and vessels using trawl gear should not have their capacity estimated with vessels using pot gear). The trip level capacity estimates were summed to produce the aggregate estimates presented in this report.

4.2 Methods for the At-Sea Delivery Fleets

DEA was used to estimate harvesting capacity by day, instead of per trip. Data were stratified into two fleets (i.e., catcher-processors and trawlers that delivered to motherships). For the latter fleet, vessels without horsepower data were placed in a separate strata. A separate DEA model was used to estimate harvesting capacity by day and species group for each stratum. The fixed inputs were vessel length, gross registered tons, horsepower, and breadth. The outputs were landings by the nine groundfish target species groups and several aggregate species groups for other groundfish species and non-groundfish species. Because trip level variable input data (e.g., number of sets or crew size) were not available consistently for these vessels in 2004, variable inputs were not included in the DEA models. The effects of this data deficiency are discussed in Section 4.3.

All the observations for these two fleets were used in DEA models. The trip level capacity estimates were summed to produce the aggregate estimates presented in this report.

4.3 Effects of Not Having Variable Inputs in the DEA Models

Variable inputs (e.g., days at sea, number of sets, or crew size) were not included in the DEA models because such data were not available consistently for the fishery. The effects of this data deficiency are discussed below.

If variable inputs are not included in a DEA model, it is not possible to generate an estimate of the capacity level of input use, an estimate of the technically efficient level of output (landings), or the lower capacity estimates that are being reported for many other fisheries. This makes it more difficult to evaluate whether the capacity estimates presented in this report are reasonable approximations of the maximum amount of fish the fleets could have reasonably expected to harvest (land) under normal and realistic operating conditions, fully utilizing the machinery and equipment in place, and given the other constraints in the definition of harvesting capacity. The following text from Section 3 of the National Assessment describes the difference between the lower and higher capacity estimates and the potential importance of presenting both estimates of harvesting capacity.

> For each fishery, estimates were provided for both the usual measure of capacity output and the input-corrected output level (if the required variable input data were available). For convenience in presenting these estimates and the associated estimates of excess capacity and overcapacity, these two estimates are simply referred to as the “higher” and “lower” capacity estimates.
>
> (1) The first and higher estimate, which is the usual measure of capacity output, provides an estimate of what the harvest would have been if all estimated technical inefficiency had been eliminated

and if variable inputs had been fully utilized (i.e., used at the level required to attain capacity output). There was technical inefficiency if more could have been produced without increasing the amount of inputs used.

(2) The second and lower estimate provides an approximation of what the harvest would have been if the variable inputs had been fully utilized but if the estimated technical inefficiency had not been eliminated. Therefore, the lower estimate is based on the actual level of technical efficiency, not the estimated potential level of technical efficiency.

The second and lower estimate is provided to address the concern that the first estimate may overstate the amount of fish a given fleet could have expected to harvest under the normal and realistic operating conditions of each vessel.[56] The reason for this concern is that, with the first estimate, all of the differences in harvest levels among trips of a specific type are attributed to technical inefficiency and differences in fixed inputs when, in fact, some of the differences in harvest levels could have been due to nonobserved factors, including differences in skill levels among skippers or crews, unobserved differences in fixed inputs, weather conditions, mechanical failures, luck (e.g., being at the right place at the right time to catch an unusually large amount of fish), and temporal or spatial differences in fish stocks.

The potential for the first estimate to overstate what the fleet could have harvested under the normal and realistic operating conditions of each vessel is greater when trip-level data are used to estimate harvesting capacity and much of the harvest is accounted for by trips in which only one species is harvested. That is because when capacity is estimated by trip, the peer trips that are used to estimate capacity are defined in terms of both vessel characteristics and the species composition of the catch. Therefore, for single species trips, all the trips for a given species and for vessels with similar vessel characteristics would be peer trips and the trip with the most catch would be the capacity estimate for all those peer trips. Conversely, if many species are taken on most trips and if the species composition differs by trip, there will be relatively few peer trips to estimate the capacity for each trip, which means that more of these trips will have no or few peers and will be estimated to be at or close to capacity. This may account for the relatively high estimates of excess capacity in some of the North Pacific fisheries, such as the Alaska halibut, sablefish, and pollock fisheries. The other characteristic of those fisheries and other fisheries with LAPPs that probably contributed to relatively high rates of excess capacity and overcapacity is the additional control the harvest privilege owners have over when and how fish are caught. Some may have decided to use all their harvest privileges (e.g., IFQs) on a small number of large trips while others may have decided to make more but smaller trips. The trip level capacity estimates will tend to reflect the catch per trip from the larger trips; therefore, there will be high estimates of excess capacity if a large part of the total catch was taken with small trips. The lack of variable input data for the Alaska Region fisheries limited what could be done to account for such differences in trip types for the fisheries with IFQs or fishing cooperatives.

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[56] More complete discussions of this concern are included in the following two papers:

Kirkley, J. E., C. J. Morrison-Paul, and D. E. Squires. 2002. Capacity and Capacity Utilization in Common Pool Resource Industries. Journal of Environmental and Resource Economics 22:1/2 (June), 71-97.

Kirkley, J. E., C .J. Morrison-Paul, and D. E. Squires. 2004. Deterministic and Stochastic Estimation for Fishery Capacity Reduction. Marine Resource Economics 19, 271-294.

> The two estimates are not intended to bracket the range of feasible harvesting capacity estimates; they are intended to allow for a more complete assessment of excess capacity and overcapacity by providing a range that accounts for different underlying assumptions about the vessels' ability to increase their harvest. However, given the definition of harvesting capacity stated above, and barring other factors that could result in the first estimate overstating or understating harvesting capacity, actual harvesting capacity would tend to be between the two estimates because the underlying assumptions for the first and second estimates, respectively, are too lenient and too restrictive relative to that definition of harvesting capacity. An estimate of what capacity would have been in 2004 in the absence of the management measures that constrained landings per trip, the number of trips, or both in 2004 would tend to exceed the higher capacity estimate. However, it would have been a more speculative estimate of harvesting capacity. Similarly, estimates of what capacity would have been if no stocks had been overfished, would have produced larger but again more speculative estimates of harvesting capacity.
>
> For the fisheries without consistently available variable input data, it was not possible to provide estimates of the technically efficient harvest levels, estimates of the levels of variable input use required to harvest at the capacity level, and the lower estimates that were reported for most fisheries. This makes it more difficult to evaluate whether the harvesting capacity estimates for those fisheries are reasonable approximations of harvesting capacity as defined for this assessment.

Both the lower and higher harvesting capacity estimates were included in the assessments for the fisheries in the Northeast, Southeast, and Pacific Islands Regions and for the Atlantic highly migratory species fisheries. For that group of fisheries, excluding the U.S. Caribbean, DEA models were used to generate harvesting capacity estimates for 63 species groups. The lower capacity estimates ranged from 52 percent of the higher capacity estimates for Southeast Atlantic Spanish mackerel to 99 percent for Gulf of Mexico deep water groupers. The mean and median values for the 63 species groups were 84 percent and 87 percent, respectively. It is not known whether the lower capacity estimates as percentages of the higher capacity estimates for the Pacific Coast groundfish fishery would have been within or below that range if the lower estimates could have been made.

4.4 Estimated Total Catch and the Overcapacity Estimates

The TACs for the nine groundfish target species groups are in terms of total catch (i.e., landed catch plus at-sea discards that occur prior to the landings). Because these at-sea discards are significant for some species groups, the assessment of overcapacity required an adjustment to the capacity estimates that were based on landed catch. The Northwest Fisheries Science Center provided the estimates of total catch to landed catch by species group and gear type that were used to make the required adjustments. This adjustment was made only for the harvesting capacity estimates presented in Table 4.

The ratio used for this adjustment for each species group and gear type is listed below, where each ratio is (landed + discarded catch) to landed catch.

	Trawl Gear	Other Gear
Pacific cod	1.006	1.667
Whiting	1.011	None
Sablefish	1.114	1.667
Dover sole	1.098	2.333
English sole	1.357	1.000
Petrale sole	1.021	1.000
Arrowtooth	1.681	17.600
Other flatfish	1.676	1.000
Thornyhead rockfish	1.200	1.007

5. Results by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 3. The results of the assessment by target species group for all fleets combined are presented in Section 6. As noted above, “fleets” refers to mutually exclusive sets of groundfish trips and not to mutually exclusive sets of vessels, where a groundfish trip is a trip with landings of one or more of the nine groundfish target species groups. Therefore, the landings data and capacity assessment presented for each fleet are only for groundfish trips with a specific gear type (i.e., if a vessel was in multiple groundfish fleets, it contributed to the reported landings and therefore the harvesting capacity estimates for multiple fleets).

5.1 Hook and Line Fleet

The hook and line fleet had total reported groundfish trip landings of 2.5 thousand t in 2004, and the capacity estimate was 4.6 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 2.1 thousand t or 83 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 55 percent of its capacity level and, therefore, a smaller fleet with 45 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.2 Pot Fleet

The pot fleet had total reported groundfish trip landings of 0.8 thousand t in 2004, and the capacity estimate was 1.3 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.5 thousand t or 62 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 62 percent of its capacity level and, therefore, a smaller fleet with 38 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.3 Trawl Fleet Delivering Shoreside

The trawl fleet delivering shoreside had total reported groundfish trip landings of 110 thousand t in 2004, and the capacity estimate was 158 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 48 thousand t or 44 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 69 percent of its capacity level and, therefore, a smaller fleet with 31 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.4 Summary for All Shoreside Delivery Fleets Combined

All shoreside delivery fleets combined had total reported groundfish trip landings of 114 thousand t in 2004, and the capacity estimate was 165 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 51 thousand t or 45 percent. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 69 percent of their capacity level and, therefore, smaller fleets with 31 percent less capacity would have been able to make the reported landings if they had operated at capacity. To be complete, the assessment for all shoreside delivery fleets combined includes the "other" gear fleet (groundfish trips with net or troll gear). That fleet accounted for less than 50 t of the total landings of the nine groundfish target species groups and an insignificant part of the harvesting capacity estimate for the shoreside delivery fleets.

5.5 Trawl Fleet Delivering to Motherships

The trawl fleet delivering to motherships had total reported groundfish trip landings of 46 thousand t in 2004, and the capacity estimate was 54 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 8 thousand t or 17 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 85 percent of its capacity level and, therefore, a smaller fleet with 15 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.6 Catcher Processor Fleet

The catcher processor fleet had total reported groundfish trip landings of almost 74 thousand t in 2004, and the capacity estimate was almost 82 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by about 8 thousand t or 11 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 90 percent of its capacity level and, therefore, a smaller fleet with 10 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.7 Summary for All At-Sea Delivery Fleets Combined

The two at-sea delivery fleets combined had total reported groundfish trip landings of over 119 thousand t in 2004, and the capacity estimate was over 135 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by about 16 thousand t or 13 percent. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at 88 percent of their capacity level and, therefore, smaller fleets with 12 percent less capacity would have been able to make the reported landings if they had operated at capacity.

5.8 Summary for All Fleets Combined

All fleets combined had total reported groundfish trip landings of 233 thousand t in 2004, and the capacity estimate was 300 thousand t (Table 3). Therefore, estimated capacity exceeded reported landings in 2004 by 67 thousand t or 29 percent. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 78 percent of their capacity level and, therefore, smaller fleets with 22 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Table 3. Harvesting capacity assessment by Pacific Coast groundfish fleet for vessels with groundfish trips[1] in 2004 (1,000 metric tons, round weight).

	Shoreside Delivery Fleets					At-Sea Delivery Fleets			
	Hook & Line	Pot	Trawl	Other Gear	Total	Trawl (MS)	Trawl (CP)	Total	Grand Total
Landings									
Reported Landings	2.5	0.8	110	0.3	114	46	73.6	120	233
Landings Used in the DEA Models	2.2	0.7	110	0.2	113	46	73.6	120	233
Percent of Landings Used in the DEA Models	89%	88%	100%	54%	99%	100%	100%	100%	100%
Capacity Estimate	4.6	1.3	159	0.5	164.9	54	81.5	135.4	300.4
Excess Capacity Estimate	2.1	0.5	48	0.1	51	8	7.9	16	67
Capacity Estimate as a % of Landings	183%	162%	144%	139%	145%	117%	111%	113%	129%
Actual Landings as a % of the Capacity Estimate	55%	62%	69%	72%	69%	85%	90%	88%	78%

1. A groundfish trip is a trip in which at least one of the nine groundfish target species groups was landed.

Sources: The data on reported landings and both vessel and trip counts are based on data extracted from PacFIN and AFSC Observer Program database.

6. Results by Groundfish Target Species Group for All Fleets Combined

The species group–specific assessments of harvesting capacity, excess capacity, and overcapacity for each of nine groundfish target species groups for all fleets combined are summarized in Table 4 and discussed in this section. As noted in Section 4.3, the assessment of overcapacity required a comparison of a TAC—which applies to total catch rather than to landings—to a harvesting capacity estimate, which also applies to total catch.

6.1 Pacific Cod

The estimated catch of Pacific cod for all fleets combined was 1.1 thousand t in 2004, and the species group–specific capacity estimate was 1.2 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 0.1 thousand t or 9 percent. This means the fleets would have caught that much more Pacific cod if they had operated at capacity in 2004. It also means the fleets were operating at 92 percent of their capacity level and, therefore, smaller fleets with 8 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for Pacific cod in 2004 and only 35 percent of the TAC of 3.2 thousand t was taken. The species-specific capacity estimate (1.2 thousand t) was 2 thousand t less than the TAC, or only 38 percent of the TAC. This means that larger fleets with 166 percent more harvesting capacity and operating at capacity would have been required to take the TAC in 2004. Alternatively, the fleets could have taken the TAC in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on Pacific cod.

6.2 Pacific Whiting

Although the assessment summary in Table 4 for Pacific whiting is presented for each of the three fleets for which there was separate quota, the following discussion is for the three fleets combined. The estimated catch of Pacific whiting for all fleets combined was about 209 thousand t in 2004, and the species group–specific capacity estimate was about 273 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 64 thousand t or 30 percent. This means the fleets would have caught that much more Pacific whiting if they had operated at capacity in 2004. It also means the fleets were operating at only 77 percent of their capacity level and, therefore, smaller fleets with 33 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

The Pacific whiting TAC was 217 thousand t in 2004. The species-specific capacity estimate exceeded the TAC by 56 thousand t or 26 percent; therefore, there was overcapacity. This means that smaller fleets with 21 percent less harvesting capacity would have been able to take the TAC in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for Pacific whiting, the TAC was not exceeded, as 96 percent of the TAC was taken in 2004. For Pacific whiting, in-season management actions prevented the TAC from being exceeded even though harvesting capacity exceeded the TAC. The same is true for other groundfish target species groups for which the TACs were approached but not exceeded.

6.3 Sablefish

The estimated catch of sablefish for all fleets combined was 7.2 thousand t in 2004, and the species group–specific capacity estimate was 17.5 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 10.4 thousand t or 144 percent. This means the fleets would have caught that much more sablefish if they had operated at capacity in 2004. It also means the fleets were operating at only 41 percent of their capacity level and, therefore, smaller fleets with 59 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

The sablefish TAC was 7 thousand t in 2004. The species specific capacity estimate exceeded the TAC by 10.6 thousand t or 152 percent; therefore, there was overcapacity. This means that smaller fleets with 60 percent less harvesting capacity would have been able to take the TAC in 2004 if they had operated at capacity. The fact that estimated sablefish catch exceeded the TAC by 3 percent is further evidence that there was overcapacity in 2004.

6.4 Dover Sole

The estimated catch of Dover sole for all fleets combined was 7.3 thousand t in 2004, and the species group–specific capacity estimate was 8.4 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 1.1 thousand t or 15 percent. This means the fleets would have caught that much more Dover sole if they had operated at capacity in 2004. It also means the fleets were operating at 87 percent of their capacity level and, therefore, smaller fleets with 13 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

The Dover sole TAC was 7.4 thousand t in 2004. The species-specific capacity estimate exceeded the TAC by 1 thousand t or 14 percent; therefore, there was overcapacity. This means that smaller fleets with 12 percent less harvesting capacity would have been able to take the TAC in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for Dover sole, the TAC was not exceeded, as 99 percent of the TAC was taken in 2004.

6.5 English Sole

The estimated catch of English sole for all fleets combined was 1.2 thousand t in 2004, and the species group–specific capacity estimate was 1.7 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 0.5 thousand t or 46 percent. This means the fleets would have caught that much more English sole if they had operated at capacity in 2004. It also means that the fleets were operating at only 68 percent of their capacity level and, therefore, smaller fleets with 32 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for English sole in 2004, and only 38 percent of the TAC of 3.1 thousand t was taken. The species-specific capacity estimate (1.7 thousand t) was 1.4 thousand t less than the TAC, or only 56 percent of the TAC. This means that larger fleets with 80 percent more harvesting capacity and operating at capacity would have been required to take the TAC in 2004. Alternatively, the fleets could have taken the TAC in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on English sole.

6.6 Petrale Sole

The estimated catch of petrale sole for all fleets combined was 1.9 thousand t in 2004, and the species group–specific capacity estimate was 2.1 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 0.2 thousand t or 9 percent. This means the fleets would have caught that much more petrale sole if they had operated at capacity in 2004. It also means the fleets were operating at 92 percent of their capacity level and, therefore, smaller fleets with 8 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for petrale sole in 2004 and only 69 percent of the TAC of 2.8 thousand t was taken. The species-specific capacity estimate (2.1 thousand t) was 0.7 thousand t less than the TAC, or only 76 percent of the TAC. This means that larger fleets with 32 percent more harvesting capacity and operating at capacity would have been required to take the TAC in 2004. Alternatively, the fleets could have taken the TAC in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on petrale sole.

6.7 Arrowtooth Flounder

The estimated catch of arrowtooth flounder for all fleets combined was 3.9 thousand t in 2004, and the species group–specific capacity estimate was 7.4 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 3.5 thousand t or 89 percent. This means the fleets would have caught that much more arrowtooth flounder if they had operated at capacity in 2004. It also means the fleets were operating at only 53 percent of their capacity level and, therefore, smaller fleets with 47 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

The arrowtooth flounder TAC was 5.8 thousand t in 2004. The species-specific capacity estimate exceeded the TAC by 1.6 thousand t or 28 percent; therefore, there was overcapacity. This means that smaller fleets with 22 percent less harvesting capacity would have been able to take the TAC in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for arrowtooth flounder, the TAC was not exceeded, as only 68 percent of the TAC was taken in 2004.

6.8 Other Flatfish

The estimated catch of other flatfish for all fleets combined was over 2.1 thousand t in 2004, and the species group–specific capacity estimate was almost 4 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by over 1.8 thousand t or 86 percent. This means the fleets would have caught that much more other flatfish if they had operated at capacity in 2004. It also means the fleets were operating at only 54 percent of their capacity level and, therefore, smaller fleets with 46 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

The other flatfish TAC was 2.8 thousand t in 2004. The species-specific capacity estimate exceeded the TAC by 1.2 thousand t or 41 percent; therefore, there was overcapacity. This means that smaller fleets with 29 percent less harvesting capacity would have been able to take the TAC in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for other flatfish, the TAC was not exceeded, as only 76 percent of the TAC was taken in 2004.

6.9 Thornyhead Rockfish

The estimated catch of thornyhead rockfish for all fleets combined was 0.9 thousand t in 2004, and the species group–specific capacity estimate was 1.1 thousand t (Table 4). Therefore, estimated capacity exceeded estimated catch in 2004 by 0.2 thousand t or 28 percent. This means the fleets would have caught that much more thornyhead rockfish if they had operated at capacity in 2004. It also means the fleets were operating at only 78 percent of their capacity level and, therefore, smaller fleets with 22 percent less capacity would have been able to take the estimated catch if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for thornyhead rockfish in 2004 and only 74 percent of the TAC of 1.2 thousand t was taken. The species-specific capacity estimate (1.1 thousand t) was 0.1 thousand t less than the TAC, or 95 percent of the TAC. This means that larger fleets with 5 percent more harvesting capacity and operating at capacity would have been required to take the TAC in 2004. Alternatively, the fleets could have taken the TAC in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on thornyhead rockfish.

Table 4. Harvesting capacity assessment by Pacific Coast groundfish target species group and TAC allocation for all fleets combined in 2004 (1,000 metric tons, round weight).

	Roundfish Target Species Groups					
		Pacific Whiting				
	Pacific Cod	TSD[1]	TMS[2]	CP[3]	All Fleets	Sablefish
Estimated Catch	1.1	90.7	45.7	73.2	209.5	7.2
TAC	3.2	90.5	53.4	73.3	217.2	7.0
Capacity Estimate	1.2	138.7	53.6	81.0	273.4	17.5
Excess Capacity Estimate	0.1	48.1	7.9	7.8	63.9	10.4
Capacity Estimate as a % of the Estimated Catch	109%	153%	117%	111%	130%	244%
Estimated Catch as a % of the Capacity Estimate	92%	65%	85%	90%	77%	41%
Overcapacity Estimate	-2.0	48.2	0.3	7.8	56.2	10.6
Capacity Estimate as a % of the TAC	38%	153%	100%	111%	126%	252%
TAC as a % of the Capacity Estimate	266%	65%	100%	90%	79%	40%
Estimated Catch as a % of the TAC	35%	100%	86%	100%	96%	103%
	Flatfish and Rockfish Target Species Groups					
	Dover Sole	English Sole	Petrale Sole	Arrowtooth Flounder	Other Flatfish	Thornyhead Rockfish
Estimated Catch	7.3	1.2	1.9	3.9	2.1	0.9
TAC	7.4	3.1	2.8	5.8	2.8	1.2
Capacity Estimate	8.4	1.7	2.1	7.4	4.0	1.1
Excess Capacity Estimate	1.1	0.5	0.2	3.5	1.8	0.2
Capacity Estimate as a % of the Estimated Catch	115%	146%	109%	189%	186%	128%
Estimated Catch as a % of the Capacity Estimate	87%	68%	92%	53%	54%	78%
Overcapacity Estimate	1.0	-1.4	-0.7	1.6	1.2	-0.1
Capacity Estimate as a % of the TAC	114%	56%	76%	128%	141%	95%
TAC as a % of the Capacity Estimate	88%	180%	132%	78%	71%	105%
Estimated Catch as a % of the TAC	99%	38%	69%	68%	76%	74%

1. Trawlers with shoreside deliveries.
2. Trawlers with mothership deliveries.
3. Catcher processors.

APPENDIX 8

Southwest Region Assessment

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1. Introduction

This report presents assessments of harvesting capacity in 2004 for the commercial fisheries managed under the fishery management plans (FMPs) for the coastal pelagic species (Section 2) and the U.S. West Coast fisheries for highly migratory species (Section 3).

For each fishery, the assessment is by fleet and by species, where “fleet” refers to a specific part of a fishery. Specifically, “fleets” refers to mutually exclusive sets of trips and not to mutually exclusive sets of vessels. This use of “fleet” is explained by the following points using the example of the CPS fishery: (1) the Washington seine fleet refers to the fishing trips for which seine gear was used and coastal pelagic species were landed in Washington; (2) the assessment of harvesting capacity for that fleet is for such trips and not for the other fishing activities of the vessels that made such trips; and (3) some vessels were in multiple coastal pelagic species seine gear fleets, as well as in fleets for other gear groups or for other fisheries. In addition, multiple species often were landed together. As a result, many vessels contributed to the landings and, therefore, to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species, fleets or fisheries.

For the CPS and HMS fisheries, this caveat is particularly important because of the multi-species, multi-gear nature of the fisheries. Many vessels in these two fisheries fish for a variety of species on each trip and throughout the seasons, constantly adapting to resource, market, and other conditions. In light of these factors, the merit of a single species capacity, and particularly overcapacity, measure needs to be carefully evaluated. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species if the existing fishery management measures did not prevent such a shift. The present analysis, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is less of a problem for the assessment of harvesting capacity by fleet for all species combined.

Sections 1 through 4 of the National Assessment provide critical background information. These sections explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the CPS and HMS fisheries will be easier to understand and interpret if sections 1 through 4 of the National Assessment are read first.

The assessment for the CPS and HMS fisheries indicates that in 2004 there were low to relatively high rates of excess capacity among the fleets in the two fisheries, that there was overcapacity for two of the five coastal pelagic species and probably for neither of the two highly migratory species with a harvest guideline, and that none of the harvest guidelines were exceeded. The main findings are summarized below by fishery.

CPS Fishery:

1. There were relatively high estimated rates of excess capacity for each of the six fleets.
2. Estimated excess capacity ranged from 62 percent for the Oregon fleet to 131 percent for the non–limited entry Southern California fleet, approached or exceeded 100 percent for the other four fleets, and was 100 percent for all six seine fleets combined.
3. The estimated overcapacity was only 4 percent for market squid and 24 percent for Pacific sardine.
4. For the other three species, there was no overcapacity and estimated harvesting capacity ranged from only 5 percent of the harvest guideline for jack mackerel to 47 percent of the harvest guideline for Pacific mackerel.

HMS Fishery:

1. There were relatively low to high estimated rates of excess capacity.
2. Estimated excess capacity ranged from 14 percent for the drift gillnet fleet to 103 percent for the troll fleet and was 89 percent for all five fleets combined.
3. Unless less than 44 percent and 46 percent, respectively, of the harvest guidelines for common thresher shark and shortfin mako shark were available to the commercial fishery in 2004, the assessment suggests that the commercial fishery did not have overcapacity for either of the two species with a harvest guideline in 2004.

It is important to remember that the reported landings (and therefore the estimates of harvesting capacity and excess capacity for 2004) would have been higher for most if not all fleets, in the absence of the management measures that limited the number of trips, landings per trip, or both. The same is true for the estimates of landings, excess capacity, and overcapacity for most if not all species. In addition, because the vessels in the CPS and HMS fleets fish in multiple areas and for multiple species (including CPS, HMS, and other species), the CPS or HMS fishery is but one component of an overall fishing strategy for these vessels. Consequently, the design of the vessel may be better suited for non-CPS or non-HMS fisheries, in which case a more comprehensive measure of harvesting capacity would be useful. Also, because CPS fisheries are characterized by extreme variability both in the availability of CPS resources and in market conditions, the harvesting capacity levels of the CPS vessels are designed to allow vessel owners to take advantage of the peak periods when they occur. Therefore, there will be extended periods when landings are below harvesting capacity and harvesting capacity is substantially greater than a single TAC or the combined TACs for the coastal pelagic species.

In general, conditions in the West Coast CPS fisheries in 2006 were relatively unchanged from 2004. The size and composition of the CPS finfish limited entry fleets remained virtually unchanged from 2004. The same is true for the Oregon and Washington limited entry fleets and the California limited entry market squid fleet. The biomass estimate and corresponding harvest guideline (HG) for sardine were down slightly from 2004, as were reported landings. For Pacific mackerel, the biomass and corresponding HG increased nearly twofold from 2004 to 2006; landings likewise nearly doubled. For the monitored only species, there were no changes from 2004 in the acceptable biological catches (ABCs) for anchovy, jack mackerel, and squid. Jack mackerel landings were unchanged, anchovy landings increased by 6,000 t, and squid landings increased by 9,000 t. Ex-vessel prices across the board remained relatively unchanged with only slight decreases for anchovy and Pacific mackerel. In 2006, Amendment 11 to the CPS FMP was implemented, which changed the HG allocation procedure for sardine from area-based to seasonally-based. This will make more sardines available to the Pacific Northwest fisheries, and there has been interest on their part to increase the number of permits in the Oregon and Washington limited entry programs. The Washington tribes are expected to expand their participation in the sardine fishery, which will likely increase harvesting capacity.

The remainder of this report consists of a brief discussion of the data used to estimate harvesting capacity and the effects of not having variable input data, which is followed by a separate section for each of the two fisheries. Each fishery-specific section includes the following: (1) a brief description of the main management measures used in the fishery in 2004, with an emphasis on those that limited catch per trip, the number of trips, or both in 2004; (2) a brief discussion of the focus of the assessment in terms of fleets (as defined above) and species; (3) a brief description of fleet-specific statistics on the vessel physical and trip characteristics and reported landings for the fishing vessels that participated in the fishery in 2004; (4) a brief description of the methods used to estimate harvesting capacity; (5) the assessment results by fleet for all species combined; and (6) the assessment results by species for all fleets combined. The landings and harvesting capacity estimates presented in this report are in metric tons (t) live weight.

The summary tables present reported landings and the harvesting capacity assessments in metric tons (t); however, the summary text typically presents them in thousand t. The resulting rounding can give the impression of internal inconsistencies. For example, the excess harvesting capacity estimate presented in the text may not be exactly equal to the difference between the estimate of harvesting capacity and the reported landings presented in the text. Similarly, the percentages are typically presented rounded to the nearest 1 percent; therefore, the percentages in the text cannot always be reproduced exactly by using the landings data and harvesting capacity estimates presented in the text.

The trip characteristics statistics are limited to the number of trips per vessel. More complete information on trip characteristics (e.g., days at sea, number of sets, or crew size) was not available consistently. For each vessel, a unique reported landings date on a fishticket (i.e., landings report) for the vessel was used to define a trip. Therefore, in those relatively few instances when a vessel made more than one trip per day and all the landings were reported the same day, the landings for those trips would be aggregated into one trip for the purposes of this report. Conversely, it the catch from one trip was split into two or more deliveries with separate fishtickets and landing dates, the landings for such a trip would be split into multiple trips for the purposes of this report. The data required to define a trip more precisely or uniquely were not available consistently.

Because there are no total allowable catches (TACs) for these fisheries, TAC proxies were used as the reference points for calculating overcapacity by species. The harvest guidelines were used as the TAC proxy for 2004.

Variable inputs (e.g., days at sea, number of sets, or crew size) were not included in the DEA models because such data were not available consistently for these two fisheries. The effects of this data deficiency are discussed below.

If variable inputs are not included in a DEA model, it is not possible to generate an estimate of the capacity level of input use, an estimate of the technically efficient level of output (landings) or the lower capacity estimates that are being reported for many other fisheries. This makes it more difficult to evaluate whether the capacity estimates presented in this report are reasonable approximations of the maximum amount of fish that the fishing fleets could have reasonably expected to harvest (land) in 2004 under normal and realistic operating conditions, fully utilizing the machinery and equipment in place, and given the other constraints in the definition of harvesting capacity. The following text from Section 3 of the National Assessment describes the difference between the lower and higher capacity estimates and the potential importance of presenting both estimates of harvesting capacity.

> For each fishery, estimates were provided for both the usual measure of capacity output and the input-corrected output level (if the required variable input data were available). For convenience in presenting these estimates and the associated estimates of excess capacity and overcapacity, these two estimates are simply referred to as the "higher" and "lower" capacity estimates.
>
> (1) The first and higher estimate, which is the usual measure of capacity output, provides an estimate of what the harvest would have been if all estimated technical inefficiency had been eliminated and if variable inputs had been fully utilized (i.e., used at the level required to attain capacity output). There was technical inefficiency if more could have been produced without increasing the amount of inputs used.
>
> (2) The second and lower estimate provides an approximation of what the harvest would have been if the variable inputs had been fully utilized but if the estimated technical inefficiency had not been eliminated. Therefore, the lower estimate is based on the actual level of technical efficiency, not the estimated potential level of technical efficiency.
>
> The second and lower estimate is provided to address the concern that the first estimate may overstate the amount of fish a given fleet could have expected to harvest under the normal and realistic operating conditions of each vessel[57]. The reason for this concern is that, with the first estimate, all

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[57] A more complete discussions of this concern are included in the following two papers:

Kirkley, J. E., C. J. Morrison-Paul, and D. E. Squires. 2002. Capacity and Capacity Utilization in Common Pool Resource Industries. Journal of Environmental and Resource Economics 22:1/2 (June), 71-97.

Kirkley, J. E., C .J. Morrison-Paul, and D. E. Squires. 2004. Deterministic and Stochastic Estimation for Fishery Capacity Reduction. Marine Resource Economics 19, 271-294.

of the differences in harvest levels among trips of a specific type are attributed to technical inefficiency and differences in fixed inputs when, in fact, some of the differences in harvest levels could have been due to nonobserved factors, including differences in skill levels among skippers or crews, unobserved differences in fixed inputs, weather conditions, mechanical failures, luck (e.g., being at the right place at the right time to catch an unusually large amount of fish), and temporal or spatial differences in fish stocks.

The potential for the first estimate to overstate what the fleet could have harvested under the normal and realistic operating conditions of each vessel is greater when trip-level data are used to estimate harvesting capacity and much of the harvest is accounted for by trips in which only one species is harvested. That is because when capacity is estimated by trip, the peer trips that are used to estimate capacity are defined in terms of both vessel characteristics and the species composition of the catch. Therefore, for single species trips, all the trips for a given species and for vessels with similar vessel characteristics would be peer trips and the trip with the most catch would be the capacity estimate for all those peer trips. Conversely, if many species are taken on most trips and if the species composition differs by trip, there will be relatively few peer trips to estimate the capacity for each trip, which means that more of these trips will have no or few peers and will be estimated to be at or close to capacity. This may account for the relatively high estimates of excess capacity in some of the North Pacific fisheries, such as the Alaska halibut, sablefish, and pollock fisheries. The other characteristic of those fisheries and other fisheries with LAPPs that probably contributed to relatively high rates of excess capacity and overcapacity is the additional control the harvest privilege owners have over when and how fish are caught. Some may have decided to use all their harvest privileges (e.g., IFQs) on a small number of large trips while others may have decided to make more but smaller trips. The trip level capacity estimates will tend to reflect the catch per trip from the larger trips; therefore, there will be high estimates of excess capacity if a large part of the total catch was taken with small trips. The lack of variable input data for the Alaska Region fisheries limited what could be done to account for such differences in trip types for the fisheries with IFQs or fishing cooperatives.

The two estimates are not intended to bracket the range of feasible harvesting capacity estimates; they are intended to allow for a more complete assessment of excess capacity and overcapacity by providing a range that accounts for different underlying assumptions about the vessels' ability to increase their harvest. However, given the definition of harvesting capacity stated above, and barring other factors that could result in the first estimate overstating or understating harvesting capacity, actual harvesting capacity would tend to be between the two estimates because the underlying assumptions for the first and second estimates, respectively, are too lenient and too restrictive relative to that definition of harvesting capacity. An estimate of what capacity would have been in 2004 in the absence of the management measures that constrained landings per trip, the number of trips, or both in 2004 would tend to exceed the higher capacity estimate. However, it would have been a more speculative estimate of harvesting capacity. Similarly, estimates of what capacity would have been if no stocks had been overfished, would have produced larger but again more speculative estimates of harvesting capacity.

For the fisheries without consistently available variable input data, it was not possible to provide estimates of the technically efficient harvest levels, estimates of the levels of variable input use required to harvest at the capacity level, and the lower estimates that were reported for most fisheries. This makes it more difficult to evaluate whether the harvesting capacity estimates for those fisheries are reasonable approximations of harvesting capacity as defined for this assessment.

Both the lower and higher harvesting capacity estimates were included in the assessments for the fisheries in the Northeast, Southeast, and Pacific Islands Regions and for the Atlantic highly migratory species fisheries. For that group of fisheries, excluding the U.S. Caribbean, DEA models were used to generate harvesting capacity estimates for 63 species groups. The lower capacity estimates ranged from 52 percent of the higher capacity estimates for Southeast Atlantic Spanish mackerel to 99 percent for Gulf of Mexico deep water groupers. The mean and median values for the 63 species groups were 84 percent and 87 percent, respectively. It is not known whether the lower capacity estimates as percentages of the higher capacity estimates for the Southwest Region CPS and HMS fisheries would have been within or below that range if the lower estimates could have been made.

2. Coastal Pelagic Species Fishery

2.1 Introduction

The five species listed below are managed under the Pacific Fishery Management Council's CPS FMP.

1. Pacific (chub or blue) mackerel
2. Jack (Spanish) mackerel
3. Market squid
4. Northern anchovy
5. Pacific sardine

Coastal pelagic species are taken as target species principally with seine gear and taken as incidental catch with other gear in other fisheries. In 2004, 99.3 percent of the total landings of the five coastal pelagic species were made with seine gear (Table 2.1), and the seine gear share of the total landings by species ranged from 90.6 percent for jack mackerel to 100 percent for northern anchovy. Therefore, the assessment focused on harvesting capacity for the seine fleets. The estimate of harvesting capacity for each of the five coastal pelagic species for the other fleets was set equal to reported landings for those fleets.

Reported Pacific sardine landings of about 89 thousand t in 2004 were about 63 percent of the total reported CPS landings of 141 thousand t, and market squid landings of 40 thousand t accounted for over 28 percent of that total. Northern anchovy, Pacific mackerel, and jack mackerel, respectively, contributed 5 percent, 2.6 percent, and 0.8 percent to that total.

The CPS finfish fishery south of 39^{o} N latitude operates under a federal limited entry program, which is subject to a capacity limit expressed in terms of an aggregate vessel gross tonnage harvesting capacity proxy. The capacity limit was established at 5,650.9 gross tons under Amendment 10 to the CPS FMP. The limited entry permits are transferable to another vessel if the second vessel is of comparable size. A vessel without a federal limited entry permit could land CPS finfish in the area covered by that limited entry program but would be subject to a much stricter CPS finfish trip limit. The vessels that made CPS landings in Oregon and Washington were subject to state permit limits in 2004.

Table 2.1 Reported CPS landings for all gear and seine gear by species, 2004 (metric tons, live weight)

Species	All Gear	Seine Gear	% Seine Gear
Pacific mackerel	3,708	3,671	99.0%
Jack mackerel	1,160	1,051	90.6%
Market squid	40,088	39,290	98.0%
Northern anchovy	7,019	7,019	100.0%
Pacific sardine	89,339	89,260	99.9%
Total	141,314	140,291	99.3%

The FMP does not limit the number of trips a vessel participating in CPS finfish fishery can make annually. Limited entry vessels can have on board no more than 125 t of CPS finfish at any time (the average landing is about 50 t), and vessels landing no more than 5 t per trip are exempted from FMP limited entry requirements. Oregon and Washington have had performance provisions as part of their limited entry programs for sardine, but these are currently being revised.

The assessment was done for the following six seine gear fleets:

1. Washington: Trips with CPS landings with seine gear in Washington.
2. Oregon: Trips with CPS landings with seine gear in Oregon.
3. Northern California LE: Trips with CPS landings with seine gear in Northern California by limited entry (LE) permitted vessels.
4. Northern California non LE: Trips with CPS landings with seine gear in Northern California by other vessels.
5. Southern California LE: Trips with CPS landings with seine gear in Southern California by LE permitted vessels.
6. Southern California non LE: Trips with CPS landings with seine gear in Southern California by other vessels.

These are mutually exclusive sets of CPS trips but they are not mutually exclusive groups of vessels. For example, some LE permitted vessels made landings in all four areas. Ports south of Monterey were considered to be in Southern California.

A brief description of statistics on the physical characteristics of the fishing vessels with CPS seine landings in 2004, the number of CPS seine trips, and landings for CPS seine trips is presented by fleet in Section 2.2. The methods used to estimate harvesting capacity are discussed in Section 2.3. The estimates of harvesting capacity and excess capacity by seine gear fleet for all species combined are presented in Section 2.4. The estimates of harvesting capacity, excess capacity, and overcapacity for all fleets combined (i.e., seine fleets and other fleets) for each of the five coastal pelagic species are presented in Section 2.5. The landings, total allowable catch (TAC) proxies, and harvesting capacity estimates presented in this report are in metric tons live weight.

2.2 The Coastal Pelagic Species Vessels and Landings by CPS Seine Fleet

Information on vessel physical characteristics and the number of CPS trips per vessel for the fishing vessels that used seine gear to land coastal pelagic species in 2004, as well as information on their landings, are discussed below by fleet and summarized in Tables 2.2 and 2.3. This information is for trips with CPS landings, and not for the other types of trips taken by those vessels. The information on vessel characteristics includes statistics on the reported length, net tonnage, horsepower, and breadth of the fishing vessels. Vessels without data for a specific vessel characteristic were not included in the statistics reported below for that characteristic. For example, if the horsepower was unknown for 12 vessels (i.e., not in the vessel characteristics database used for this assessment), those 12 vessels were not included when estimating mean horsepower.

The data used both to describe the fleets and to estimate harvesting capacity were provided by Ben Wood at the Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office.

2.2.1 Washington Fleet

In 2004, 14 vessels had reported CPS landings in Washington with seine gear (Table 2.2). The vessels ranged in length from 49 to 82 feet with a mean of 61 feet. Their net tonnage was between 37 and 130 tons with a mean of 65. They had between 345 and 700 horsepower with a mean of 497. Their breadth ranged from 17 to 26 feet with a mean of 21. The number of trips was between 1 and 78 with a mean of 22. Their total reported landings were about 9.2 thousand t in 2004, of which 100 percent were coastal pelagic species (Table 2.3). The fleet's Pacific sardine landings of 8.9 thousand t were 97 percent of its total reported landings and 10 percent of the total reported Pacific sardine landings for the CPS seine fleets. In total, this fleet accounted for 6.5 percent of all reported landings for those fleets.

2.2.2 Oregon Fleet

In 2004, 23 vessels had reported CPS landings in Oregon with seine gear (Table 2.2). The vessels ranged in length from 21 to 76 feet with a mean of 54 feet. Their net tonnage was between 3 and 103 tons with a mean of 51. They had between 170 and 700 horsepower with a mean of 409. Their breadth ranged from 11 to 26 feet with a mean of 20. The number of trips was between 1 and 79 with a mean of 41. Their total reported landings were about 36.3 thousand t in 2004, of which almost 100 percent were coastal pelagic species (Table 2.3). The fleet's Pacific sardine landings of 36.1 thousand t were over 99 percent of its total reported landings and 41 percent of the total reported Pacific sardine landings for the CPS seine fleets. In total, this fleet accounted for 26 percent of all reported landings for those fleets.

2.2.3 Northern California LE Fleet

In 2004, 14 vessels with federal CPS finfish limited entry permits had reported CPS landings in Northern California with seine gear (Table 2.2). The vessels ranged in length from 50 to 79 feet with a mean of 61 feet. Their net tonnage was between 27 and 94 tons with a mean of 53. They had between 240 and 1,000 horsepower with a mean of 489. Their breadth ranged from 16 to 28 feet with a mean of 21. The number of trips was between 1 and 133 with a mean of 55. Their total reported landings were about 23.8 thousand t in 2004, of which almost 100 percent were coastal pelagic species (Table 2.3). The fleet's Pacific sardine landings of 14.8 thousand t were 62 percent of its total reported landings and 16.5 percent of the total reported Pacific sardine landings for the CPS seine fleets. In total, this fleet accounted for 17 percent of all reported landings for those fleets.

2.2.4 Northern California non LE Fleet

In 2004, 14 vessels without federal CPS finfish limited entry permits had reported CPS landings in Northern California with seine gear (Table 2.2). The vessels ranged in length from 27 to 76 feet with a mean of 49 feet. Their net tonnage was between 5 and 112 tons with a mean of 37. They had between 55 and 650 horsepower with a mean of 293. Their breadth ranged from 9 to 22 feet with a mean of 17. The number of trips was between 1 and 105 with a mean of 20. On average for the vessels that landed coastal pelagic species in Northern California, the vessels without federal CPS finfish limited entry permits were smaller, had less horsepower, and made fewer trips than did the vessels with such permits. Their total reported landings were about 2.2 thousand t in 2004, of which 99 percent were coastal pelagic species (Table 2.3). The fleet's Pacific sardine landings of 1.1 thousand t were 50 percent of its total reported landings and 1.2 percent of the total reported Pacific sardine landings for the CPS seine fleets. In total, this fleet accounted for 1.5 percent of all reported landings for those fleets.

2.2.5 Southern California LE Fleet

In 2004, 41 vessels with federal CPS finfish limited entry permits had reported CPS landings in Southern California with seine gear (Table 2.1). The vessels ranged in length from 45 to 86 feet with a mean of 63 feet. Their net tonnage was between 11 and 123 tons with a mean of 61. They had between 165 and 1,000 horsepower with a mean of 429. Their breadth ranged from 13 to 28 feet with a mean of 21. The number of trips was between 3 and 161 with a mean of 54. Their total reported landings were about 51.5 thousand t in 2004, of which almost 100 percent were coastal pelagic species (Table 2.3). The fleet's Pacific sardine landings of 24.1 thousand t were 47 percent of its total reported landings and 27 percent of the total reported Pacific sardine landings for the CPS fleets. The fleet's market squid landings of 21.7 thousand t were 42 percent of its total reported landings and 55 percent of the total reported market squid landings for the CPS seine fleets. This fleet also made 68 percent of the Pacific mackerel landings and 94 percent of the jack mackerel landings reported for these seine fleets. In total, this fleet accounted for 37 percent of all reported landings for those fleets.

2.2.6 Southern California non LE Fleet

In 2004, 43 vessels without federal CPS finfish limited entry permits had reported CPS landings in Southern California with seine gear (Table 2.1). The vessels ranged in length from 16 to 79 feet with a mean of 52 feet. Their net tonnage was between 4 and 112 tons with a mean of 40. They had between 85 and 1,060 horsepower with a mean of 359. Their breadth ranged from 11 to 26 feet with a mean of 18. The number of trips was between 1 and 91 with a mean of 23. On average for the vessels that landed coastal pelagic species in Southern California, the vessels without federal CPS finfish limited entry permits were smaller, had less horsepower, and made fewer trips than did the vessels with such permits. Their total reported landings were about 17.5 thousand t in 2004, of which virtually 100 percent were coastal pelagic species (Table 2.3). The fleet's Pacific sardine landings of 4.3 thousand t and market squid landings of 11.9 thousand t, respectively, were 25 percent and 68 percent of its total reported landings and 4.8 percent and 30 percent of the total reported Pacific sardine and market squid landings for the CPS seine fleets. In total, this fleet accounted for 12 percent of all reported landings for those fleets.

Table 2.2 Vessel and trip characteristics by fleet for vessels in the 2004 coastal pelagic species seine fishery.

	Washington	Oregon	Northern California		Southern California	
Fleet			LE	Non LE	LE	Non LE
Total Number of Vessels	14	23	14	14	41	43
Vessel Length (feet)						
Minimum	49	21	50	27	45	16
Maximum	82	76	79	76	86	79
Median	59	58	58	50	60	51
Mean	61	54	61	49	63	52
Net Tonnage						
Minimum	37	3	27	5	11	4
Maximum	130	103	94	112	123	112
Median	61	52	50	40	58	41
Mean	65	51	53	37	61	40
Horsepower						
Minimum	345	170	240	55	165	85
Maximum	700	700	1,000	650	1,000	1,060
Median	488	385	470	270	400	340
Mean	497	409	489	293	429	359
Breadth (feet)						
Minimum	17	11	16	9	13	11
Maximum	26	26	28	22	28	26
Median	20	21	20	18	21	18
Mean	21	20	21	17	21	18
Trips						
Minimum	1	1	1	1	3	1
Maximum	78	79	133	105	161	91
Median	12	48	44	13	39	14
Mean	22	41	55	20	54	23

Note: The vessel characteristics data generally are from state vessel registration information.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the data summarized in this table.

Table 2.3 Reported landings[1] by coastal pelagic species seine fleet and species for seine trips with CPS landings in 2004 (metric tons, live weight).

	Washington	Oregon	Northern California			Southern California			All Fleets
			LE	Non LE	Both	LE	Non LE	Both	
Pacific Mackerel	22	106	490	0	490	2,483	570	3,053	3,671
Jack Mackerel	1	24	0	0	0	993	34	1,027	1,051
Market Squid	0	14	4,681	1,023	5,704	21,681	11,890	33,572	39,290
Northern Anchovy	213	13	3,850	41	3,891	2,267	635	2,902	7,019
Pacific Sardine	8,934	36,111	14,759	1,078	15,837	24,058	4,319	28,377	89,260
CPS Sub-Total	9,170	36,268	23,780	2,142	25,922	51,482	17,449	68,930	140,291
All Other Species	0	18	32	15	47	25	6	31	95
Total	9,170	36,286	23,812	2,157	25,969	51,507	17,454	68,961	140,386

1. These landings data are only for trips with CPS landings; therefore, they do not include landings for other trips by the vessels with CPS landings.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the data summarized in this table.

2.3 Methods

DEA was used to estimate harvesting capacity by trip and species. A trip record was generated for each trip with reported landings of any coastal pelagic species. For those trips by vessels using seine gear, coastal pelagic species typically accounted for most to all of the reported landings, and in aggregate coastal pelagic species accounted for 99.9 percent of the total reported landings for such trips. However, for the trips that included CPS landings by other gear groups, coastal pelagic species typically were a small part of the total landings, and in total accounted for only 2.3 percent of the total landings for such trips. Because landings with seine gear accounted for the vast majority of CPS landings (Table 2.1), only seine gear trips with CPS landings were used in the DEA models. The CPS capacity estimates were set equal to reported landings for the other gear groups.

The record that was generated for each trip included fixed input and landings data, as well as other variables that were used to stratify trips. Vessel breadth, net tonnage, length, and horsepower were used as fixed inputs. Because no trip level variable input data (e.g., days at sea, number of sets, or crew size) were consistently available for this fishery, variable input data were not used to estimate harvesting capacity. The species for the landings data were the five species managed under the CPS FMP (northern anchovy, market squid, Pacific sardine, Pacific (chub or blue) mackerel, and jack (Spanish) mackerel) and all other species combined. As noted above, the trip data were provided by the Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office. Sam Herrick at the Southwest Fisheries Science Center (SWFSC) supplied the harvest guidelines for 2004 that were used as the TAC proxies.

Trips were stratified by four landing port areas: Washington, Oregon, Northern California, and Southern California. As noted above, ports south of Monterey were considered to be in Southern California. Trips were then further stratified by hull type, quarter, and whether they had a federal CPS finfish limited entry permit (for California port areas only). Vessels with and without federal CPS finfish limited entry permits and landings in California were placed in separate strata because, as noted above, a vessel without a federal CPS finfish limited entry permit could land CPS finfish in the area covered by that limited entry program but was subject to a much stricter CPS finfish trip limit. A state permit, but not a federal CPS finfish limited entry permit, was required to target squid. Not all fishermen with federal CPS finfish limited entry permits had a state squid permit, and not all fishermen with a state squid permit had federal CPS finfish limited entry permits in 2004.

Trips with missing or obviously incorrect fixed input data could not be used in the DEA models. Such trips usually were placed in a "miscellaneous" file and the capacity for such trips was set equal to reported landings. For the six individual CPS seine fleets, 98 to 100 percent of the reported landings were used in the DEA models and 97 to 100 percent of the trips were used (Table 2.4). The trip level capacity estimates were summed to produce the aggregate estimates by fleet or species presented in this report.

2.4 Harvesting Capacity Assessment by CPS Seine Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by CPS seine fleet and summarized in Table 2.4. The results of the assessment by species group for all fleets combined are presented in Section 2.5. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with seine gear and CPS landings in a specific port group (i.e., if a vessel was in multiple CPS fleets, it contributed to the reported landings and therefore the harvesting capacity estimates for multiple CPS seine fleets).

2.4.1 Washington Fleet

The Washington fleet had total reported landings of 9.2 thousand t in 2004 and the capacity estimate was 17.8 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 8.6 thousand t or 94 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 52 percent of its capacity level; therefore, a smaller fleet with 48 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity. Fishermen in the Washington fleet often own both a Washington and an Oregon state permit so that they can land fish in either state.

2.4.2 Oregon Fleet:

The Oregon fleet had total reported landings of 35.8 thousand t in 2004 and the capacity estimate was 57.9 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 22.1 thousand t or 62 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 62 percent of its capacity level; therefore, a smaller fleet with 38 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity. Fishermen in the Oregon fleet often own both a Washington and an Oregon state permit so that they can land fish in either state.

2.4.3 Northern California LE Fleet

The Northern California LE fleet had total reported landings of 23.8 thousand t in 2004 and the capacity estimate was 49.5 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 25.6 thousand t or 108 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 48 of its capacity level; therefore, a smaller fleet with 52 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

2.4.4 Northern California non LE Fleet

The Northern California non LE fleet had total reported landings of 2.2 thousand t in 2004 and the capacity estimate was 4.7 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 2.5 thousand t or 117 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 46 percent of its capacity level; therefore, a smaller fleet with 54 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

2.4.5 Southern California LE Fleet

The Southern California LE fleet had total reported landings of 51.5 thousand t in 2004 and the capacity estimate was 109 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 57.5 thousand t or 112 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 47 percent of its capacity level; therefore, a smaller fleet with 53 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

2.4.6 Southern California non LE Fleet

The Southern California non LE fleet had total reported landings of 17.5 thousand t in 2004 and the capacity estimate was 40.3 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 22.9 thousand t or 131 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 43 percent of its capacity level; therefore, a smaller fleet with 57 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

2.4.7 All Six Seine Fleets Combined

All six CPS seine fleets combined had total reported landings of 140 thousand t in 2004 and the capacity estimate was 279 thousand t (Table 2.4). Therefore, estimated capacity exceeded reported landings in 2004 by 139 thousand t or 100 percent. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 50 percent of their capacity level; therefore, smaller fleets with 50 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Table 2.4 Harvesting capacity assessment by fleet for vessels in the 2004 coastal pelagic species seine fishery (metric tons, live weight).

			Northern California		Southern California		Total
Landings	Washington	Oregon	LE	Non LE	LE	Non LE	
Actual	9,158	35,833	23,812	2,157	51,507	17,454	139,921
Modeled	9,158	35,542	23,812	2,155	51,507	17,052	139,226
Percent Modeled	100%	99%	100%	100%	100%	98%	100%
Capacity Estimate	17,755.9	57,926	49,459	4,685	109,003	40,345	279,173
Excess Capacity Estimate	8,598.3	22,093	25,647	2,527	57,496	22,891	139,253
Capacity Estimate as a % of Landings	194%	162%	208%	217%	212%	231%	200%
Actual Landings as a % of the Capacity Estimate	52%	62%	48%	46%	47%	43%	50%
Number of Vessels	14	23	14	14	41	43	-
Numbers of trips							
Actual	306	940	772	273	2,226	1,011	5,528
Modeled	306	916	771	271	2,226	981	5,471
Percent Modeled	100%	97%	100%	99%	100%	97%	99%

Note: The reported landings and capacity estimates are only for seine trips with CPS landings; therefore, they do not include landings or capacity estimates for the other trips by the vessels with CPS seine landings.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the landings data summarized in this table.

2.5 Harvesting Capacity Assessment by Species for All Fleets Combined

The species specific assessments of harvesting capacity, excess capacity, and overcapacity for each of the five coastal pelagic species for all fleets combined (i.e., seine and other fleets) are summarized in Table 2.5 and discussed in this section.

2.5.1 Pacific Mackerel

The reported landings of Pacific mackerel for all fleets combined were 3.7 thousand t in 2004 and the species specific capacity estimate was 5.7 thousand t (Table 2.5). Therefore, estimated capacity exceeded reported landings in 2004 by 2.0 thousand t or 53 percent. This means the fleets would have landed that much more Pacific mackerel if they had operated at capacity in 2004. It also means the fleets were operating at only 65 percent of their capacity level and, therefore, smaller fleets with 35 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess harvesting capacity, there was no overcapacity for Pacific mackerel in 2004, and only 31 percent of the TAC proxy of 12.0 thousand t was taken. The species-specific capacity estimate (5.7 thousand t) was 6.3 thousand t less than the TAC proxy, or only 47 percent of the TAC proxy. This means that larger fleets with 111 percent more harvesting capacity and operating at capacity would have been required to take the TAC proxy in 2004. Alternatively, the fleets could have taken the TAC proxy in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on Pacific mackerel.

2.5.2 Jack Mackerel

The reported landings of jack mackerel for all fleets combined were 1.16 thousand t in 2004, and the species-specific capacity estimate was 1.51 thousand t (Table 2.5). Therefore, estimated capacity exceeded reported landings in 2004 by 0.35 thousand t or 30 percent. This means the fleets would have landed that much more jack mackerel if they had operated at capacity in 2004. It also means the fleets were operating at only 77 percent of their capacity level and, therefore, smaller fleets with 23 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for jack mackerel in 2004, and only 4 percent of the TAC proxy of 31 thousand t was taken. The species-specific capacity estimate (1.5 thousand t) was 29.5 thousand t less than the TAC proxy, or only 5 percent of the TAC proxy. This means that larger fleets with substantially more harvesting capacity and operating at capacity would have been required to take the TAC proxy in 2004. Alternatively, the fleets could have taken the TAC proxy in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on jack mackerel.

2.5.3 Market Squid

The reported landings of market squid for all fleets combined were 40 thousand t in 2004, and the species-specific capacity estimate was 111 thousand t (Table 2.5). Therefore, estimated capacity exceeded reported landings in 2004 by 71 thousand t or 178 percent. This means the fleets would have landed that much more market squid if they had operated at capacity in 2004. It also means the fleets were operating at only 36 percent of their capacity level and, therefore, smaller fleets with 64 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The market squid TAC proxy was 107 thousand t in 2004. The species-specific capacity estimate exceeded the TAC proxy by 4.3 thousand t or 4 percent; therefore, there was some overcapacity. This means that smaller fleets with 4 percent less harvesting capacity would have been able to take the TAC proxy in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for market squid, the TAC proxy was not exceeded, as only 37 percent of the TAC proxy was taken in 2004.

2.5.4 Northern Anchovy

The reported landings of northern anchovy for all fleets combined were 7 thousand t in 2004, and the species-specific capacity estimate was 10.3 thousand t (Table 2.5). Therefore, estimated capacity exceeded reported landings in 2004 by 3.3 thousand t or 47 percent. This means the fleets would have landed that much more northern anchovy if they had operated at capacity in 2004. It also means the fleets were operating at only 68 percent of their capacity level and, therefore, smaller fleets with 32 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for northern anchovy in 2004, and only 13 percent of the TAC proxy of 56 thousand t was taken. The species-specific capacity estimate (10.3 thousand t) was 45.7 thousand t less than the TAC proxy, or only 18 percent of the TAC proxy. This means that larger fleets with substantially more harvesting capacity and operating at capacity would have been required to take the TAC proxy in 2004. Alternatively, the fleets could have taken the TAC proxy in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on northern anchovy.

2.5.5 Pacific Sardine

The reported landings of Pacific sardine for all fleets combined were 89 thousand t in 2004, and the species-specific capacity estimate was 152 thousand t (Table 2.5). Therefore, estimated capacity exceeded reported landings in 2004 by 62 thousand t or 70 percent. This means the fleets would have landed that much more Pacific sardine if they had operated at capacity in 2004. It also means the fleets were operating at only 59 percent of their capacity level and, therefore, smaller fleets with 41 percent less capacity would have been able to make the reported landings if they had operated at capacity.

The Pacific sardine TAC proxy was 123 thousand t in 2004. The species-specific capacity estimate exceeded the TAC proxy by 29 thousand t or 24 percent. This means that smaller fleets with 19 percent less harvesting capacity would have been able to take the TAC proxy in 2004 if they had operated at capacity. Although there was excess capacity and overcapacity for Pacific sardine, the TAC proxy was not exceeded, as only 73 percent of the TAC proxy was taken in 2004.

Table 2.5 Harvesting capacity assessment by species for all fleets combined in the 2004 coastal pelagic species fishery (metric tons, live weight).

	Pacific Mackerel	Jack Mackerel	Market Squid	Northern Anchovy	Pacific Sardine
Reported Landings	3,708	1,160	40,088	7,019	89,339
TAC Proxy	11,960	31,000	107,049	56,000	122,747
Capacity Estimate	5,666	1,512	111,341	10,305	151,734
Excess Capacity Estimate	1,958	352	71,253	3,286	62,396
Capacity Estimate as a % of the Reported Landings	153%	130%	278%	147%	170%
Landings as a % of the Capacity Estimate	65%	77%	36%	68%	59%
Overcapacity Estimate	-6,294	-29,488	4,292	-45,695	28,987
Capacity Estimate as a % of the TAC Proxy	47%	5%	104%	18%	124%
TAC Proxy as a % of the Capacity Estimate	211%	2050%	96%	543%	81%
Reported Landings as a % of the TAC Proxy	31%	4%	37%	13%	73%

Note: The CPS capacity estimates for the seine fleets were generated with DEA models. The capacity estimates for the other fleets, which accounted for a small part of the total landings of coastal pelagic species (Table 2.1), are equal to their reported landings.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the landings data summarized in this table.

3. U.S. West Coast Fisheries for Highly Migratory Species

3.1 Introduction

The 13 species listed below are managed under the FMP for U.S. West Coast fisheries for highly migratory species (HMS).

1. Albacore
2. Bigeye tuna
3. Bluefin tuna
4. Skipjack tuna
5. Yellowfin tuna
6. Swordfish
7. Striped marlin
8. Bigeye thresher shark
9. Blue shark
10. Common thresher
11. Pelagic thresher shark
12. Shortfin mako shark
13. Dorado (also known as dolphinfish and mahi-mahi))

The HMS FMP prohibits the sale of striped marlin by all vessels as a means to provide for and maximize recreational fishing opportunities. Therefore, no striped marlin landings were reported for the commercial fisheries and striped marlin was not included in the assessment. Highly migratory species are taken as target species principally with the five gear types listed below. In addition, they are taken as incidental catch with other gear in other fisheries.

1. Troll
2. Seine
3. Hook & Line
4. Gillnet
5. Drift Gillnet

In 2004, 99.6 percent of the total landings of the 12 highly migratory species were made with those five gear groups (Table 3.1) and their share of the total landings by species ranged from 38 percent for blue shark to 100 percent for each tuna species, bigeye and pelagic thresher sharks, and dorado. Therefore, the assessment focused on harvesting capacity for those five gear group fleets. The estimate of harvesting capacity for each of the 12 highly migratory species for the other fleets was set equal to reported landings for those fleets.

Reported albacore landings of about 14.5 thousand t in 2004 were almost 87 percent of the total reported HMS landings of 16.7 thousand t, and swordfish landings of 1.2 thousand t accounted for 7.1 percent of that total. Yellowfin and skipjack tuna, respectively, contributed 2.9 percent and 1.8 percent to that total, and the other species each accounted for less than 1 percent of the total.

Much of the following brief description of the management of highly migratory species is taken from the Pacific Fishery Management Council (PFMC) website (www.pcouncil.org/hms/hmsback.html). The United States is a member of the Inter-American Tropical Tuna Commission (IATTC)—the Regional Fisheries Management Organization responsible for the conservation and management of fisheries for tunas and other species taken by tuna-fishing vessels in the eastern Pacific Ocean. The management of HMS fisheries is complicated by the wide-ranging nature of the fish and the many nations, states, and regions involved. Effective management requires a great deal of cooperation among these entities.

Therefore, NMFS, the PFMC, and the IATTC have joint management responsibilities for the U.S. West Coast HMS fisheries, which occur in areas both inside and beyond the U.S. EEZ in the Pacific Ocean. With the exception of the swordfish drift gillnet fishery off California, the HMS fisheries are open access fisheries. The FMP prohibits longline fishing inside the West Coast EEZ. In addition to the 13 species managed under the HMS FMP, other species are monitored for informational purposes, and some species—including great white sharks, megamouth sharks, basking sharks, Pacific halibut, and Pacific salmon—are designated as prohibited species (i.e., retention is prohibited).

There were no total allowable catch quotas (TACs) for highly migratory species in 2004 and there are still none (with the exception of bigeye tuna). However, there were (and are) harvest guidelines for two species. A TAC is a specified numerical harvest objective, the attainment of which typically triggers the closure of the fishery or fisheries for that species. A harvest guideline is a numerical harvest level that is a general objective and is not a quota. If the harvest guidelines have been reached, NMFS will initiate a review of the species according to provisions in the HMS FMP and in consideration of Council guidance. The HMS FMP established annual harvest guidelines of 340 t for common thresher sharks and 150 t for shortfin mako sharks. These two harvest guidelines are shared between the commercial and sports fisheries. While commercial passenger fishing vessels' (CPFVs) catch of thresher and shortfin mako sharks is not significant, private sport vessels are known to target these shark species at significant levels.[58] Because total catches and basic population dynamic parameters for these shark species are not well known, they are being managed using precautionary harvest guidelines. The harvest guidelines were used as the TAC proxies (i.e., benchmarks) for calculating overcapacity for those two species. Overcapacity could not be assessed for the 10 highly migratory species without comparable benchmarks.

The main FMP commercial fishery that targets thresher shark is the drift gillnet (DGN) fishery, although there is a limited amount of commercial fishing for sharks in other commercial fisheries (e.g., the hook and line fishery). Thresher shark is directly targeted in the DGN fishery, while shortfin mako shark constitutes an important incidental catch. DGN thresher and shortfin mako shark catch is directly limited by a prohibition on fishing within 75 miles of the coast between May 1 and August 14, and is indirectly limited by other conservation measures that limit effort (e.g., the closure of the turtle conservation area south of Pt. Conception during El Niño events to DGN fishing in order to protect endangered loggerhead turtles). Recreational shark catch is limited by a California Department of Fish and Game bag limit of 2 sharks per day per angler.

A brief description of statistics on the physical characteristics of the fishing vessels with HMS landings in 2004, the number of HMS trips, and landings for HMS trips is presented by fleet in Section 3.2. The methods used to estimate harvesting capacity are discussed in Section 3.3. The estimates of harvesting capacity and excess capacity by fleet for all species combined are presented in Section 3.4. The estimates of harvesting capacity and excess for each of the 12 highly migratory species and estimates of and overcapacity for the two species with harvest guidelines are presented for all fleets combined in Section 3.5. The landings, TAC proxies, and

[58] Categories for recreational catch of shortfin mako and thresher sharks are included in the MRFSS and CRFS surveys, but catch estimates may underestimate actual private vessel catch levels due to the lack of private marina sampling.

harvesting capacity estimates presented in this report are in metric tons live weight. The assessment was done by gear group fleets and species. The five gear-specific fleets refer to mutually exclusive sets of HMS trips but not to mutually exclusive groups of vessels. Some vessels used more than one type of gear and, therefore, were in multiple fleets.

Table 3.1 Reported landings[1] by gear group fleet and species for trips with HMS landings in 2004 (metric tons, live weight).

Species	Troll	Seine	Hook & Line	Gillnet	Drift Gillnet	Sub-Total	Grand Total All Gear	% Accounted for by the First Five Gear Groups
Albacore	13,764	1	763	1	11	14,539.9	14,540	100%
Bigeye Tuna	0	0	22	0	0	22.2	22	100%
Bluefin Tuna	0	0	0	1	9	10.1	10	100%
Skipjack Tuna	0	306	0	0	0	306.8	307	100%
Unspecified Tuna	0	0	9	0	0	9.2	9	100%
Yellowfin Tuna	0	484	3	0	1	487.9	488	100%
Swordfish	0	0	935	7	175	1,117.0	1,186	94%
Bigeye Thresher Shark	0	0	0	0	5	5.3	5	100%
Blue Shark	0	0	0	0	0	0.2	1	38%
Common Thresher Shark	0	0	4	44	66	114.4	115	99%
Pelagic Thresher Shark	0	0	0	1	0	1.6	2	100%
Shortfin Mako Shark	0	1	9	21	23	53.6	54	98%
Dorado	0	0	1	0	0	1.2	1	100%
HMS Sub-Total	13,765	792	1,747	75	290	16,669.4	16,740	100%
Grand Total (HMS and non-HMS)	13,787	917	1,777	172	337	16,990.0	18,333	93%
HMS % of Total	100%	86%	98%	44%	86%	98%	91%	-
Number of HMS trips	2,582	30	458	435	331	3,836.0	4,098	94%

1. These landings data are only for trips with HMS landings; therefore, they do not include landings for other trips by the vessels with HMS landings.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the data summarized in this table.

3.2 The Highly Migratory Species Vessels and Landings by Fleet

Information on HMS landings, vessel physical characteristics, and the number of HMS trips per vessel for the fishing vessels with HMS landings in 2004 are discussed below and summarized in Tables 3.1 and 3.2. This information is for trips with HMS landings, not for the other types of trips taken by those vessels. The information on vessel characteristics includes statistics on the reported length, net tonnage, horsepower, and breadth of the fishing vessels. Vessels without data for a specific vessel characteristic were not included in the statistics reported below for that characteristic.

The data used both to describe the fleets and to estimate harvesting capacity were provided by Ben Wood at the Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office.

3.2.1 Troll Gear Fleet

The troll gear fleet was by far the largest (in terms of the number of boats) and most productive (in terms of total reported landings) of the five West Coast HMS fishery fleets. Landings with troll gear were reported for 716 fishing boats in 2004 (Table 3.2). The boats ranged in length from 16 to 128 feet with a mean of 47 feet. Their net tonnage was between 1 and 154 tons with a mean of 27. They had between 20 and 1,200 horsepower with a mean of 251. Their breadth ranged from 8 to 29 feet with a mean of 15. The number of trips was between 1 and 28 with a mean of 3.6. The fleet's HMS landings of 13.8 thousand t were almost 100 percent of its total reported landings and 82 percent of the total reported HMS landings for all fleets. The fleet's albacore landings of 13.8 thousand t were almost 100 percent of its total reported landings and 95 percent of the total reported albacore landings for all fleets.

3.2.2 Seine Gear Fleet

In 2004, only 14 boats had reported HMS landings with seine gear (Table 3.2). The boats ranged in length from 33 to 80 feet with a mean of 62 feet. Their net tonnage was between 5 and 123 tons with a mean of 62. They had between 125 and 940 horsepower with a mean of 427. Their breadth ranged from 14 to 26 feet with a mean of 21. The number of trips was between 1 and 10 with a mean of 2.1. Their total reported landings were about 917 t in 2004, of which 792 t or 86 percent were highly migratory species (Table 3.1). The fleet's HMS landings were almost 5 percent of the total reported HMS landings for all fleets. The fleet's skipjack and yellowfin tuna landings of 306 and 484 t, respectively, were 33 percent and 53 percent of its total reported landings and about 100 percent and 99 percent of the total reported landings of those two species for all fleets.

3.2.3 Hook & Line Gear Fleet

In 2004, 113 boats had reported HMS landings with hook and line gear (Table 3.2). The boats ranged in length from 12 to 99 feet with a mean of 41 feet. Their net tonnage was between 1 and 150 tons with a mean of 28. They had between 15 and 1,080 horsepower with a mean of 292. Their breadth ranged from 10 to 28 feet with a mean of 17. The number of trips was between 1 and 23 with a mean of 4.1. Their total reported landings were about 1.8 thousand t in 2004, of which 1.7 thousand t or 98 percent were highly migratory species (Table 3.1). The fleet's HMS landings were 10.4 percent of the total reported HMS landings for all fleets. The hook and line fleet accounted for very large shares of the reported landings of the following four highly migratory species: bigeye tuna and unspecified tuna (100 percent), swordfish (79 percent), and dorado (99 percent).

3.2.4 Gillnet Gear Fleet

Gillnet gear, other than drift gillnets, is a non-approved gear to target HMS species under the HMS FMP. Incidental landings are limited to 10 HMS individuals per trip. The HMS FMP was implemented in 2004, and in that year 50 boats had reported incidental HMS landings with gillnet gear, excluding drift gillnets (Table 3.2). The boats ranged in length from 26 to 55 feet with a mean of 38 feet. Their net tonnage was between 1 and 52 tons with a mean of 15. They had between 80 and 550 horsepower with a mean of 231. Their breadth ranged from 9 to 17 feet with a mean of 13. The number of trips was between 1 and 44 with a mean of 8.7. Their total reported landings were about 172 t in 2004, of which 75 t or 44 percent were highly migratory species (Table 3.1). The fleet's HMS landings were 0.5 percent of the total reported HMS landings for all fleets. The fleet's common thresher shark and shortfin mako shark landings of 44 t and 21 t, respectively, were 25 percent and 12 percent of its total reported landings and 38 percent of the total reported landings for each of those two species. In addition, about 90 percent of the total reported landings of pelagic thresher shark were made with gillnet gear.

3.2.5 Drift Gillnet Gear Fleet

In 2004, 45 boats had reported HMS landings with drift gillnet gear (Table 3.2). The boats ranged in length from 33 to 76 feet with a mean of 44 feet. Their net tonnage was between 5 and 112 tons with a mean of 23. They had between 106 and 650 horsepower with a mean of 270. Their breadth ranged from 10 to 22 feet with a mean of 15. The number of trips was between 1 and 22 with a mean of 7.3. Their total reported landings were about 337 t in 2004, of which 290 t or 86 percent were highly migratory species (Table 3.1). The fleet's HMS landings were about 2 percent of the total reported HMS landings for all fleets. The fleet's swordfish and common thresher shark landings of 175 t and 66 t, respectively, were 52 percent and 20 percent of its total reported landings and 15 percent and 58 percent of the total reported landings for those two species. In addition, the drift gillnet fleet accounted for large shares of the reported landings of the following four highly migratory species: bluefin tuna (87 percent), bigeye thresher shark (96 percent), common thresher shark (58 percent), and shortfin mako shark (42 percent).

Table 3.2 Vessel and trip characteristics by fleet for vessels in the 2004 highly migratory species fishery.

Fleet	Troll	Seine	Hook & Line	Gillnet	Drift Gillnet
Total Number of Vessels	716	14	113	50	45
Vessel Length (feet)					
Minimum	16	33	12	26	33
Maximum	128	80	99	55	76
Median	46	64	34	37	42
Mean	47	62	41	38	44
Net Tonnage					
Minimum	1	5	1	1	5
Maximum	154	123	150	52	112
Median	20	52	17	12	14
Mean	27	62	28	15	23
Horsepower					
Minimum	20	125	15	80	106
Maximum	1,200	940	1,080	550	650
Median	225	370	245	214	250
Mean	251	427	292	231	270
Breadth (feet)					
Minimum	8	14	10	9	10
Maximum	29	26	28	17	22
Median	14	20	16	13	14
Mean	15	21	17	13	15
Trips					
Minimum	1	1	1	1	1
Maximum	28	10	23	44	22
Median	3	1	3	5	6
Mean	3.6	2.1	4.1	8.7	7.3

Note: The vessel characteristics data generally are from state vessel registration information.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the data summarized in this table.

3.3 Methods

DEA was used to estimate harvesting capacity by trip and species. A trip record was generated for each trip with any reported HMS landings. For trips by vessels using troll, seine, hook and line, gillnet, or drift gillnet gear, highly migratory species typically accounted for most to all of the reported landings, and in aggregate highly migratory species accounted for 98 percent of the total reported landings for such trips. However, for the trips that included HMS landings by other gear groups, highly migratory species typically were a small part of the total landings, and in aggregate accounted for only 5.3 percent of the total landings for such trips. Because landings with the five gear types accounted for the vast majority of HMS landings (Table 3.1), only trips with those gear types and HMS landings were used in the DEA models. The HMS capacity estimates were set equal to reported landings for the other gear groups.

The record that was generated for each HMS trip included fixed input and landings data, as well as other variables that were used to stratify trips. Vessel breadth, net tonnage, length, and horsepower were used as fixed inputs. Because no trip level variable input data (e.g., days at sea, number of sets, or crew size) were consistently available for this fishery, variable input data were not used to estimate harvesting capacity. The species for the landings data were the 12 species managed under the HMS FMP, unspecified tuna, and all other species combined. The trip data were provided by the Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office. Sam Herrick at the SWFSC supplied the two harvest guidelines for 2004 that were used as the TAC proxies.

Trips were stratified by four landing port groups (Washington, Oregon, Northern California, and Southern California), hull type, and quarter (given enough trips). Ports south of Point Conception were considered to be in Southern California. Trips with missing or obviously incorrect fixed input data could not be used in the DEA models. Such trips usually were placed in a "miscellaneous" file and the capacity for such trips was set equal to reported landings. Additionally, in order to reduce the influence of potential outliers on the models' results, neither the upper nor the lower 5 percent of trips per stratum based on total catch of all species combined were used in the DEA models. For the five individual HMS fleets, the percent of reported landings used in the DEA models ranged from a low of 53 percent for the gillnet gear fleet to a high of 79 percent for the hook and line gear fleet, and was between 70 and 75 percent for the other three fleets (Table 3.3). The percent of reported trips used in the DEA models ranged from a low of 54 percent for the hook and line gear fleet to a high of 79 percent for the drift gillnet gear fleet, and was between 60 and 78 percent for the other three fleets. The trip level capacity estimates were summed to produce the aggregate estimates by fleet or species presented in this report.

3.4 Harvesting Capacity Assessment by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 3.3. The results of the assessment by species group for all fleets combined are presented in Section 3.5. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of fishing vessels. Therefore, the landings data and capacity assessment presented for each fleet are only for trips with HMS landings with a specific gear group (i.e., if a vessel was in multiple HMS fleets, it contributed to the reported landings and therefore the harvesting capacity estimates for multiple HMS fleets).

3.4.1 Troll Gear Fleet

The HMS troll fleet had total reported landings of 13.8 thousand t in 2004 and the capacity estimate was 28 thousand t (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 14.2 thousand t or 103 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 49 percent of its capacity level and, therefore, a smaller fleet with 51 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

3.4.2 Seine Gear Fleet

The HMS seine fleet had total reported landings of 917 t in 2004 and the capacity estimate was about 1,155 t (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 238 t or 26 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 79 percent of its capacity level and, therefore, a smaller fleet with 21 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

3.4.3 Hook and Line Gear Fleet

The HMS hook and line fleet had total reported landings of 1.8 thousand t in 2004 and the capacity estimate was 2.4 thousand t (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 0.6 thousand t or 36 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 73 percent of its capacity level and, therefore, a smaller fleet with 27 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

3.4.4 Gillnet Gear Fleet

The gillnet fleet had total reported landings of 172 t in 2004 and the capacity estimate was 236 t (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 64 t or 37 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 73 percent of its capacity level and, therefore, a smaller fleet with 27 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity. As noted above, gillnet gear is a non-approved gear to target HMS species under the HMS FMP. Therefore, the

HMS gillnet landings were taken as incidental catch.

3.4.5 Drift Gillnet Gear Fleet

The HMS drift gillnet fleet had total reported landings of 337 t in 2004 and the capacity estimate was 383 t (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 46 t or 14 percent. This means the fleet would have landed that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 88 percent of its capacity level and, therefore, a smaller fleet with 12 percent less capacity would have been able to make the reported landings if it had operated at capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

3.4.6 All Five HMS Fleets Combined

All five HMS fleets combined had total reported landings of 17 thousand t in 2004 and the capacity estimate was 32 thousand t (Table 3.3). Therefore, estimated capacity exceeded reported landings in 2004 by 15 thousand t or 89 percent. This means the fleets would have landed that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 53 percent of their capacity level and, therefore, smaller fleets with 47 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Table 3.3 Harvesting capacity assessment by fleet for vessels in the 2004 highly migratory species fishery (metric tons, live weight).

Gear Type	Troll	Seine	Hook & Line	Gillnet	Drift Gillnet	Total
Landings						
Actual	13,787	917	1,777	172	337	16,990
Modeled	9,956	686	1,401	91	237	12,370
Percent Modeled	72%	75%	79%	53%	70%	73%
Capacity Estimate	27,954	1,155	2,420	236	383	32,147
Excess Capacity Estimate	14,167	238	643	64	46	15,157
Capacity Estimate as a % of Landings	203%	126%	136%	137%	114%	189%
Actual Landings as a % of the Capacity Estimate	49%	79%	73%	73%	88%	53%
Number of Vessels	692	14	113	50	45	-
Numbers of trips						
Actual	2,579	30	458	435	331	3,833
Modeled	2,004	18	247	322	262	2,853
Percent Modeled	78%	60%	54%	74%	79%	74%

Note: The reported landings and capacity estimates are only for trips with HMS landings; therefore, they do not include landings or capacity estimates for the other trips by the vessels with HMS landings.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the landings data summarized in this table.

3.5 Harvesting Capacity Assessment by Species for All Fleets Combined

The species-specific assessments of harvesting capacity and excess capacity for each of the 12 highly migratory species landed in the commercial fishery for all fleets combined are summarized in Table 3.4 and discussed in this section. As noted above, TAC proxies (i.e., harvest guidelines) were available for only common thresher sharks and shortfin make sharks and the harvest guidelines were shared by the commercial and recreational fisheries. Therefore, the assessment of overcapacity could be conducted for only those two species, and the estimates of overcapacity for those two species understate overcapacity in the commercial fishery because not all of the TAC proxies used to calculate overcapacity actually were available to the commercial fishery.

3.5.1 Albacore

The reported landings of albacore for all fleets combined were over 14.5 thousand t in 2004 and the species-specific capacity estimate was over 29.2 thousand t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 14.7 thousand t or 101 percent. This means the fleets would have landed that much more albacore if they had operated at capacity in 2004. It also means the fleets were operating at only 50 percent of their capacity level and, therefore, smaller fleets with 50 percent less capacity would have been able to make the reported landings if they had operated at capacity. An albacore tuna TAC proxy was not available; therefore, overcapacity could not be assessed.

3.5.2 Bigeye Tuna, Bluefin Tuna, Unspecified Tuna, Blue Sharks, Pelagic Thresher Sharks, and Dorado

The capacity estimates for each of six species (bigeye tuna, bluefin tuna, unspecified tuna, blur sharks, pelagic thresher sharks, and dorado) were equal to reported landings (Table 3.4). This means the fleets were operating at capacity for each of those species. TAC proxies were not available for any of these species; therefore, overcapacity could not be assessed.

3.5.3 Skipjack Tuna

The reported landings of skipjack tuna for all fleets combined were 307 t in 2004 and the species specific capacity estimate was 385 t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 79 t or 26 percent. This means the fleets would have landed that much more skipjack tuna if they had operated at capacity in 2004. It also means the fleets were operating at only 80 percent of their capacity level and, therefore, smaller fleets with 20 percent less capacity would have been able to make the reported landings if they had operated at capacity. A skipjack tuna TAC proxy was not available; therefore, overcapacity could not be assessed.

3.5.4 Yellowfin Tuna

The reported landings of yellowfin tuna for all fleets combined were 488 t in 2004 and the species-specific capacity estimate was 648 t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 160 t or 33 percent. This means the fleets would have landed that much more yellowfin tuna if they had operated at capacity in 2004. It also means the fleets were operating at only 75 percent of their capacity level and, therefore, smaller fleets with 25 percent less capacity would have been able to make the reported landings if they had operated at capacity. A yellowfin tuna TAC proxy was not available; therefore, overcapacity could not be assessed.

3.5.5 Swordfish

The reported landings of swordfish for all fleets combined were 1.3 thousand t in 2004 and the species-specific capacity estimate was 1.4 thousand t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 0.1 thousand t or 11 percent. This means the fleets would have landed that much more swordfish if they had operated at capacity in 2004. It also means the fleets were operating at 90 percent of their capacity level and, therefore, smaller fleets with 10 percent less capacity would have been able to make the reported landings if they had operated at capacity. A swordfish TAC proxy was not available; therefore, overcapacity could not be assessed.

3.5.6 Bigeye Thresher Shark

The reported landings of bigeye thresher shark for all fleets combined were 5.3 t in 2004 and the species-specific capacity estimate was 5.7 t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 0.3 t or 6 percent. This means the fleets would have landed that much more bigeye thresher shark if they had operated at capacity in 2004. It also means the fleets were operating at 94 percent of their capacity level and, therefore, smaller fleets with 6 percent less capacity would have been able to make the reported landings if they had operated at capacity. A bigeye thresher shark TAC proxy was not available; therefore, overcapacity could not be assessed.

3.5.7 Common Thresher Shark

The reported landings of common thresher shark for all fleets combined were 116 t in 2004 and the species-specific capacity estimate was 148 t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 32 t or 28 percent. This means the fleets would have landed that much more common thresher shark if they had operated at capacity in 2004. It also means the fleets were operating at only 78 percent of their capacity level and, therefore, smaller fleets with 22 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for common thresher shark in 2004 (when the harvesting capacity estimate for the commercial fishery was compared to the TAC proxy that is shared by the commercial and recreational fisheries), and only 34 percent of the TAC proxy of 340 t was taken in the commercial fishery. The species-specific capacity estimate (148 t) was 192 t less than the TAC proxy, or only 44 percent of the TAC proxy. This means that if the full TAC proxy had been available to the commercial fishery, larger fleets with 129 percent more harvesting capacity and operating at capacity would have been required to take the TAC proxy in 2004. Alternatively, the fleets could have taken the TAC proxy in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on common thresher shark. However, because the TAC proxy (i.e., harvest guideline) is shared by the commercial and recreational fisheries, the overcapacity of the commercial fishery is understated. The amount of the downward bias depends on the share of the harvest guideline that actually was available to the commercial fishery in 2004. But if more than 44 percent of the harvest guideline was available to the commercial fishery in 2004, the assessment suggests the commercial fishery did not have overcapacity for common thresher shark in 2004.

3.5.8 Shortfin Mako Shark

The reported landings of shortfin mako shark for all fleets combined were 55 t in 2004 and the species-specific capacity estimate was 69 t (Table 3.4). Therefore, estimated capacity exceeded reported landings in 2004 by 14 t or 25 percent. This means the fleets would have landed that much more shortfin mako shark if they had operated at capacity in 2004. It also means the fleets were operating at only 80 percent of their capacity level and, therefore, smaller fleets with 20 percent less capacity would have been able to make the reported landings if they had operated at capacity.

Although there was excess capacity, there was no overcapacity for shortfin mako shark in 2004 (when the harvesting capacity estimate for the commercial fishery was compared to the TAC proxy that is shared by the commercial and recreational fisheries), and only 37 percent of the TAC proxy of 150 t was taken in the commercial fishery. The species-specific capacity estimate (69 t) was 81 t less than the TAC proxy, or only 46 percent of the TAC proxy. This means that if the full TAC proxy had been available to the commercial fishery, larger fleets with 117 percent more harvesting capacity and operating at capacity would have been required to take the TAC proxy in 2004. Alternatively, the fleets could have taken the TAC proxy in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on shortfin mako shark. However, because the TAC proxy (i.e., harvest guideline) is shared by the commercial and recreational fisheries, the overcapacity of the commercial fishery is understated. The amount of the downward bias depends on the share of the harvest guideline that actually was available to the commercial fishery in 2004. But if more than 46 percent of the harvest guideline was available to the commercial fishery in 2004, the assessment suggests that the commercial fishery did not have overcapacity for shortfin mako shark in 2004.

Table 3.4 Harvesting capacity assessment by species for all fleets combined in the 2004 highly migratory species fishery (metric tons, live weight).

Species	Landings	TAC Proxy	Capacity Estimate (CE)	Excess Capacity Estimate	CE as a % of Landings	Landings as a % of CE	Overcapacity Estimate	CE as a % of TAC Proxy	TAC Proxy as a % of CE	Landings as a % of TAC Proxy
Albacore	14,540	-	29,265	14,725	201%	50%	-	-	-	-
Bigeye Tuna	22.2	-	22.2	0.0	100%	100%	-	-	-	-
Bluefin Tuna	10.1	-	10.1	0.0	100%	100%	-	-	-	-
Skipjack Tuna	307	-	385	79	126%	80%	-	-	-	-
Yellowfin Tuna	488	-	648	160	133%	75%	-	-	-	-
Unspecified Tuna	9.3	-	9.3	0.0	100%	100%	-	-	-	-
Swordfish	1,255	-	1,388	134	111%	90%	-	-	-	-
Bigeye Thresher Shark	5.3	-	5.7	0.3	106%	94%	-	-	-	-
Blue Shark	0.8	-	0.8	0.0	100%	100%	-	-	-	-
Common Thresher	116	340	148	32	128%	78%	-192	44%	229%	34%
Pelagic Thresher Shark	1.6	-	1.6	0.0	100%	100%	-	-	-	-
Shortfin Mako Shark	55	150	69	14	125%	80%	-81	46%	217%	37%
Dorado	1.2	-	1.2	0.0	101%	99%	-	-	-	-

Note: The HMS capacity estimates for the troll, seine, hook and line, gillnet, and drift gillnet fleets were generated with DEA models. The capacity estimates for the other fleets, which accounted for a small part of the total HMS landings (Table 3.1), are equal to their reported landings.

Source: The Pacific States Marine Fisheries Commission's Pacific Fisheries Information Network (PacFIN) Office in Seattle provided the landings data summarized in this table.

APPENDIX 9

Alaska Region Assessment

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1. Introduction

This report presents an assessment of harvesting capacity in 2004 for the following five federally managed commercial fisheries:

1. Groundfish fishery of the Gulf of Alaska (GOA).
2. Groundfish fishery of the Bering Sea and Aleutian Islands area (BSAI).
3. Bering Sea/Aleutian Islands king and Tanner crab fishery.
4. Scallop fishery off Alaska.
5. Pacific halibut fishery off Alaska.

The first four fisheries are managed under fishery management plans (FMPs). The Pacific halibut fishery off Alaska is federally managed but not under an FMP. The only FMP fishery off Alaska that is not included in the assessment is the High Seas Salmon Fishery Off the Coast of Alaska East of 175 Degrees East Longitude. That fishery was excluded because all management authority for the fishery has been delegated to the State of Alaska, and the fishery is a small but integrated part of the salmon troll fishery in southeast Alaska.

Sections 1 through 4 of the National Assessment provide critical background information. These sections explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the five Alaska Region fisheries will be easier to understand and interpret if sections 1 through 4 of the National Assessment are read first.

The assessment results are presented by fleet and by species group for those identified in Table 1. Although they were included in the assessment, the results are not reported for a small number of fleets and area-specific species groups because their aggregate catch data are confidential due to the small number of vessels in a fleet or with catch of a species group. They are as follows: the Eastern Aleutian Tanner crab (bairdi) fishery, the BSAI scallop fishery, and the catcher vessel dredge fleet.

"Species group" can refer to one or more individual species. For example, the groundfish total allowable catch (TAC) species groups are used. "Fleet" refers to a specific part of a fishery. Specifically, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of vessels. This use of "fleet" is explained by the following points using the example of the catcher vessel trawl fleet: (1) the catcher vessel trawl fleet refers to the fishing trips for which catcher vessels used trawl gear; (2) the assessment of harvesting capacity for that fleet is for such trips and not for the other fishing activities of the vessels that made such trips; and (3) some vessels were in multiple fleets in the federally managed fisheries off Alaska, as well as in other Alaska fisheries such as salmon and herring, and some participated in commercial fisheries in other parts of the United States. In addition, multiple species often were caught together. As a result, many vessels contributed to the catch and, therefore, to the estimates of harvesting capacity, excess capacity, and overcapacity for multiple species groups, fleets, or fisheries.

For the federally managed fisheries off Alaska, this caveat is particularly important because of the multi-species, multi-gear nature of the fisheries. Many vessels in these fisheries fish for a variety of species on each trip and throughout the seasons, constantly adapting to resource, market, and other conditions. In light of these factors, the merit of a single species capacity, and particularly overcapacity, measure needs to be carefully evaluated. For instance, should the ex-vessel price for any one species rise substantially relative to the prices of the other species, large amounts of fishing effort could and probably would be shifted toward harvesting that species if the existing fishery management measures did not prevent such a shift. The present analysis, which was for 2004 and based on data for 2004, was not intended to account for such shifts. This is less of a problem for the assessment of harvesting capacity by fleet for all species combined.

Table 1 Fleets and species groups.

Fleets Defined by Gear and Mode of Operation	
Catcher Vessels	Catcher-Processor Vessels
Hook and line	Hook and line
Pot	Pot
Trawl	Trawl
	Dredge
Species Groups by Area	
Gulf of Alaska	Bering Sea/Aleutian Islands
Atka mackerel	Atka mackerel
Pacific cod	Pacific cod
Pollock	Pollock
Sablefish	Sablefish
Arrowtooth flounder	Alaska plaice
Deep-water flatfish	Arrowtooth flounder
Flathead sole	Flathead sole
Rex sole	Greenland turbot
Shallow-water flatfish	Rock sole
Demersal shelf rockfish	Yellowfin sole
Northern rockfish	Other flatfish
Pacific ocean perch	Northern rockfish
Pelagic shelf rockfish	Pacific ocean perch
Shortraker/rougheye rockfish	Rougheye rockfish
Thornyhead rockfish	Shortraker rockfish
Other rockfish	Other rockfish
Other species (groundfish)	Squid
Halibut	Other species (groundfish)
Scallops	Halibut
	Golden king crab
	Red king crab
	Snow crab

A target catch level, such as the quota for the commercial fisheries, is the reference point used to calculate overcapacity by species group in the national harvesting capacity assessment. For the Alaska groundfish fisheries, the TACs were used as the commercial quotas; for the crab and scallop fisheries, the high end of each guideline harvest level (GHL) range was used; and for the Pacific halibut fisheries, the commercial quotas established by the International Pacific Halibut Commission (IPHC) were used. Therefore, "commercial quota" (CQ) is used to refer to the groundfish TACs, the shellfish GHLs, and the commercial halibut fishery quota. The sub-area and gear- or fleet-specific CQs were summed to produce aggregate CQs for the GOA and BSAI.

The assessment of overcapacity by species group is in terms of the aggregate CQs for each of those two areas. Although this is a useful level of aggregation for this report, which is part of the National Assessment, assessments at lower levels of aggregation would be more useful to the North Pacific Fishery Management Council and NMFS as they continue to develop and assess specific management actions to deal with the problems of overcapacity.

The assessment indicates that there was significant heterogeneity in the rates of excess capacity among the seven fleets, that there was at least some overcapacity for 20 of the 41 area-specific species groups, but that reported catch exceeded only 10 of the associated CQs. The main findings are summarized below by fleet for all species combined and by species group for all fleets combined, including the fleets for which the species group is a target species and the fleets for which the species group is incidental catch that is retained or discarded.

Estimated excess capacity by fleet for all species combined:

1. For individual fleets, estimated harvesting capacity exceeded catch by a low of less than 0.5 percent for the trawl catcher-processor fleet to a high of 166 percent for the pot catcher vessel fleet.
2. Estimated harvesting capacity exceeded catch by 105 percent for the catcher vessel fleets and by 5 percent for the catcher-processor vessel fleets.
3. For all fleets combined, estimated harvesting capacity exceeded catch by 53 percent.

Estimated excess capacity and overcapacity by GOA groundfish TAC species group for all fleets combined:

1. For individual species groups, estimated harvesting capacity exceeded catch from a low of less than 0.5 percent for other rockfish to a high of 124 percent for pollock.
2. There was at least some overcapacity for 7 of the 17 species groups.
3. For individual species groups with overcapacity, estimated harvesting capacity exceeded the CQ from a low of 2 percent for shortraker/rougheye rockfish to a high of 97 percent for pollock.
4. Catch exceeded 2 of the 17 CQs: Atka mackerel (36 percent) and other rockfish (32 percent).

Estimated excess capacity and overcapacity by BSAI groundfish TAC species groups for all fleets combined:

1. For individual species groups, estimated harvesting capacity exceeded catch from a low of less than 0.5 percent for Atka mackerel to a high of 79 percent for Pacific cod.
2. There was at least some overcapacity for 7 of the 18 species groups.
3. For individual species groups with overcapacity, estimated harvesting capacity exceeded the CQ from a low of 7 percent for rougheye rockfish to a high of 76 percent for Pacific cod.
4. Catch exceeded 5 of the 18 CQs: arrowtooth flounder (13 percent), rock sole (8 percent), other flatfish (2 percent), rougheye rockfish (6 percent), and other species of groundfish (17 percent).

Estimated excess capacity and overcapacity by crab, scallop, and halibut species group for all fleets combined:

1. For individual species groups, estimated harvesting capacity exceeded catch from a low of 43 percent for scallops to a high of 125 percent for BSAI snow crab.
2. There was overcapacity for each area-specific species group.
3. For individual species groups, estimated harvesting capacity exceeded the CQ from a low of 8 percent for GOA scallops to a high of 158 percent for BSAI snow crab.
4. Catch exceeded 2 of the 6 CQs: BSAI golden king crab (7 percent) and BSAI snow crab (15 percent).

It is important to remember that the catch (and therefore the estimates of harvesting capacity and excess capacity for 2004) would have been higher for most, if not all, fleets, in the absence of the management measures that limited the number of trips, catch per trip, or both in 2004. The same is true for the estimates of catch, excess capacity, and overcapacity for most, if not all, species groups.

The harvesting capacity estimates were surprisingly high for the BSAI pollock fishery, the GOA and BSAI Pacific halibut fisheries, and the GOA and BSAI hook and line sablefish fisheries, which had already been operating under IFQ or IFQ-like fishery management programs for several years. The Pacific halibut and sablefish IFQ program were implemented in 1995 and resulted in a large reduction in fleet size. The BSAI pollock cooperatives, which are similar to IFQ programs in several important ways, were implemented in 1999 and 2000, respectively, for the at-sea processing and shoreside delivery sectors. The cooperatives also resulted in fleet consolidation. The unexpectedly high harvesting capacity estimates could be due to a variety of factors, including a large number of trips with only one species and an inability to stratify trips by the amount of quota available to a fishing boat. These two factors add to the importance of being able to generate both the lower and higher harvesting capacity estimates, as was done for fisheries with variable input data. Unfortunately, such data were not available consistently for the Alaska fisheries. These estimates also demonstrate the importance of having additional information to improve the stratification by vessel or trip and, thereby, to increase the degree to which we can account for the variables that explain differences in catch among trips.

In addition, several significant changes in fish stock, environmental, market, and regulatory conditions since 2004 have affected harvesting capacity, excess capacity, and overcapacity in these fisheries. As a result, the levels of these three variables for some fleets or species groups probably have changed substantially since 2004. For example,

1. The BSAI pollock quota was almost 1.5 million metric tons (t) in 2004, but it could be around 1.2 million t in 2008.
2. In 2006, the northward migration and decline of the pollock stock made pollock more difficult to catch (e.g., catcher vessels delivering shoreside were required to run farther, and therefore not all of the BSAI pollock TAC was taken).
3. Due to the BSAI groundfish optimum yield (OY) cap of 2 million t, the decreases in the BSAI pollock TAC have allowed increases in the TACs and catch of other species, primarily flatfish. The relatively high pollock TAC in 2004 meant the TACs and catch of

flatfish were lower than usual, which resulted in lower harvesting capacity estimates for flatfish.

4. The buyback program for longline catcher-processor vessels in the BSAI groundfish fishery will at least temporarily decrease the harvesting capacity of the hook and line catcher-processor fleet.
5. Efforts by the hook and line catcher-processor fleet to increase efficiency have increased catch per unit effort dramatically.
6. The formation of harvesting cooperatives for the rest of the BSAI trawl catcher-processor fleet is expected to decrease harvesting capacity.
7. Other fleet rationalization programs for the BSAI and GOA groundfish fisheries are also expected to decrease harvesting capacity.
8. Due to the rationalization of the BSAI crab fishery in 2005 and the buyback program for that fishery, the number of vessels in the fishery is about a third of what it was in 2004. Therefore, the capacity estimates presented for BSAI crab are not relevant to the current fishery.

Although the focus of this assessment was on harvesting capacity and not processing capacity, the catch per trip and the number of trips in 2004 were no doubt affected by processing capacity. As a result, the estimates of harvesting capacity were influenced by processing capacity.

The remainder of this report consists of the following: (1) brief descriptions of the main management measures used in the five fisheries in 2004, with an emphasis on those that limited catch per trip, the number of trips, or both in 2004 (Section 2); (2) a brief description of fleet-specific statistics both on the physical characteristics of the fishing vessels that participated in the federally managed commercial fisheries off Alaska in 2004 and on their catch and number of trips in those fisheries (Section 3); (3) a brief discussion of the methods used to estimate harvesting capacity (Section 4); (4) the assessment results by fleet for all species combined (Section 5); and (5) the assessment results by species group for all fleets combined, including the fleets for which the species group is a target species and the fleets for which it is incidental catch that is retained or discarded (Section 6).

The summary tables and text generally present the estimates of catch, harvesting capacity, excess capacity, and overcapacity in thousand metric tons (t) round weight rounded to the nearest thousand or 0.1 thousand t (1,000 or 100 t), and they present percentages that typically are rounded to the nearest 1 percent. This rounding can give the impression of internal inconsistencies. For example, the excess capacity estimates may not be exactly equal to the difference between the harvesting capacity and catch estimates in the report. Similarly, the percentage by which estimated harvesting capacity exceeded estimated catch cannot always be reproduced exactly by using the catch data and harvesting capacity estimates in the report.

2. Fishery Management Regimes

This section presents brief fishery specific descriptions of the main management measures used in the five fisheries in 2004, with an emphasis on those that limited catch per trip, the number of trips, or both in 2004.

2.1 Groundfish Fisheries

The Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands area (BSAI) groundfish fisheries are limited entry fisheries. The target species include pollock, Pacific cod, sablefish, Atka mackerel, and various flatfish and rockfish species groups. The management measures used in 2004 include the following: (1) hard TACs (quotas), which in some cases are allocated by fleet, sub-area, or season; (2) a variety of measures designed to reduce the bycatch of groundfish, other fish, seabirds, and marine mammals; (3) a variety of measures designed to protect critical habitat for marine mammals and essential fish habitat; (4) individual fishing quotas (IFQs) for the fixed gear sablefish fishery; (5) community development quotas (CDQs) for Native coastal communities in western Alaska; (6) harvesting cooperatives in the BSAI pollock fishery; and (7) an extensive at-sea and onshore observer program that among other things was used to support the in-season management of both TACs in terms of total catch (i.e., landed and discarded catch) and prohibited species catch (PSC) limits. These management measures reduced catch per trip and the number of trips in 2004.

2.2 BSAI Crab Fisheries

The BSAI crab fisheries were limited entry pot fisheries. The crab fisheries were managed by size, sex, and season. In addition, pot limits and at-sea and onshore observer programs were used. A fishery was closed when its guideline harvest level was reached. The three crab stocks that have historically accounted for most of the crab catch and revenue (Bristol Bay red king crab, Tanner crab, and snow crab) and some other stocks were at relatively low levels in 2004. Therefore, very limited or no fishing was permitted for some stocks. These management measures reduced catch per trip and the number of trips in 2004.

The following crab fisheries did not open in 2004: the Pribilof blue and red king crab fisheries, the St. Matthew blue king crab fishery, the Aleutian Islands red king crab fishery, the Bering Sea Tanner crab (bairdi) fishery, and the South Peninsula Tanner crab (bairdi) fishery. In addition, total catch data are confidential for the 2004 Eastern Aleutian Tanner crab (bairdi) fishery because fewer than four boats participated in that fishery. Therefore, those seven crab fisheries are not included in the assessment for the BSAI crab fisheries.

The crab rationalization program was implemented in 2005. It includes IFQs, individual processor quotas (IPQs), and measures to maintain crab processing in and deliveries to certain communities. As a result of the crab rationalization program, there was a substantial decrease in the number of vessels participating in the crab fisheries. Because of that decrease and associated changes in operating conditions, the assessment for 2004 does not reflect current conditions in the BSAI crab fisheries.

2.3 Alaska Scallop Fishery

The scallop fishery is a limited entry fishery. Most of the catch was by vessels that belonged to an industry-implemented and industry-managed harvesting cooperative. Various management measures were used to control the bycatch of other species. The measures include PSC limits and at-sea observer coverage requirements. A fishing area was closed when its guideline harvest level was reached.

2.4 Pacific Halibut Fishery

The commercial Pacific halibut fishery off Alaska is a hook and line fishery and it has been managed with IFQs since 1995.

3. The Vessels by Fleet

Brief fleet-specific descriptions of statistics on the physical characteristics of the fishing vessels that participated in the federally managed commercial fisheries off Alaska in 2004 and on their catch and number of trips in those fisheries are presented in this section. The information on vessel characteristics, which is summarized in Table 2, includes statistics on the reported length, horsepower, and gross tonnage of the fishing vessels, where gross tonnage is a measure of the volume and not weight. Vessels without data for a specific vessel characteristic were not included in the statistics reported below for that characteristic. For example, if the horsepower was unknown for 12 vessels (i.e., not in the vessel characteristics database used for this assessment), those 12 vessels were not included when estimating mean horsepower. If a vessel characteristic that was used in a DEA model was not available for a vessel, an alternative method was used to estimate harvesting capacity for that vessel (see Section 4). Vessels that used multiple gear types or operated as both catcher and catcher-processor vessels in 2004 are included in more than one fleet.

The trip characteristics statistics are limited to the number of trips per vessel. Data on days at sea, number of sets, and crew size were not available consistently. For each vessel other than a groundfish catcher-processor vessel, a unique reported landings date on a fish ticket (i.e., landings report) for the vessel was used to define a trip. Therefore, in those relatively few instances when a vessel made more than one trip per day and all the landings were reported the same day, the catch for those trips would be aggregated into one trip for the purposes of this report. Conversely, it the catch from one trip was split into two or more deliveries with separate fish tickets and landings dates, the catch for such a trip would be split into multiple trips for the purposes of this report. The data required to define a trip more precisely or uniquely were not available consistently. For groundfish catcher-processor vessels, a trip was a week with reported groundfish catch. In the future, product transfer reports may be used to better identify trips and trip lengths for catcher-processor vessels, and better utilization of other existing data collection programs may provide trip level variable input data for catcher vessels and catcher-processor vessels.

The catch data reported in this section is included in Table 3. For groundfish species, the catch is total catch (i.e., landed catch and discarded catch); however, for the other species groups the catch is landed catch excluding at-sea discards.

The data used to describe the fleets and to estimate harvesting capacity were extracted from fish ticket databases maintained by the Pacific States Marine Fisheries Commission's (PSMFC) Alaska Fisheries Information Network (AKFIN) Office, from observer data collected and maintained by the Fisheries Monitoring and Analysis Division (FMA) of the Alaska Fisheries Science Center, from commercial-vessel license listings maintained by the Commercial Fisheries Entry Commission (CFEC) of the State of Alaska, and from Federal Fisheries Permit listings and Catch Accounting System data maintained by the Alaska Regional Office.

3.1 Hook and Line Catcher Vessels

In 2004, 1,696 catcher vessels used hook and line gear to catch 54 thousand t of fish, which was principally groundfish and halibut and accounted for 2.4 percent of the combined catch of the seven fleets (Tables 2 and 3). Hook and line gear includes longline and jig gear. Longline gear accounts for most of the catch taken with hook and line gear. Substantially more vessels used hook and line gear than any other gear; in fact, more vessels used hook and line gear than all other gears combined. The vessels varied widely in terms of their physical characteristics. They ranged in length from 16 to 154 feet with a mean of 45 feet. Their gross tonnage was between 1 and 3,000 tons with a mean of 38. They had between 8 and 2,250 horsepower with a mean of 318. The number of trips by vessel also varied widely, from 1 to 50 with a mean of 5.5.

3.2 Pot Catcher Vessels

In 2004, 392 catcher vessels used pot gear to catch 61 thousand t of fish, which was principally Pacific cod and crab and accounted for 2.7 percent of the combined catch of the seven fleets (Tables 2 and 3). The vessels varied widely in terms of their physical characteristics. They ranged in length from 28 to 184 feet with a mean of 91 feet. Their gross tonnage was between 3 and 745 tons with a mean of 147. They had between 130 and 4,000 horsepower with a mean of 760. The number of trips by vessel also varied widely, from 1 to 43 with a mean of 7.

3.3 Trawl Catcher Vessels

In 2004, 154 catcher vessels used trawl gear to catch 947 thousand t of fish, which was principally groundfish and accounted for about 43 percent of the combined catch of the seven fleets (Tables 2 and 3). The vessels varied widely in terms of their physical characteristics and tended to be larger and have more horsepower than the other catcher vessels. They ranged in length from 58 to 219 feet with a mean of 106 feet. Their gross tonnage was between 58 and 1,412 tons with a mean of 249. They had between 300 and 6,600 horsepower with a mean of 1,283. The number of trips by vessel also varied widely, from 1 to 56 with a mean of 27.

3.4 All Catcher Vessels Combined

In 2004, 2,078 catcher vessels caught almost 1.1 million t of fish, which was principally groundfish and accounted for 48 percent of the combined catch of the seven fleets (Tables 2 and 3).

3.5 Hook and Line Catcher-Processor Vessels

In 2004, 42 catcher-processor vessels used hook and line (almost exclusively longline) gear to catch 149 thousand t of fish, which was principally groundfish and accounted for 6.7 percent of the combined catch of the seven fleets (Tables 2 and 3). The vessels varied widely in terms of their physical characteristics. They ranged in length from 56 to 196 feet with a mean of 142 feet. Their gross tonnage was between 50 and 1,129 tons with a mean of 454. They had between 265 and 4,800 horsepower with a mean of 1,344. The number of trips (i.e., number of weeks with reported catch) by vessel also varied widely, from 3 to 45 with a mean of 27.4.

3.6 Pot Catcher-Processor Vessels

In 2004, 12 catcher-processor vessels used pot gear to catch 4.8 thousand t of fish, which was principally Pacific cod and crab and accounted for 0.2 percent of the combined catch of the seven fleets (Tables 2 and 3). The vessels varied in terms of their physical characteristics. They ranged in length from 76 to 180 feet with a mean of 158 feet. Their gross tonnage was between 168 and 920 tons with a mean of 504. They had between 720 and 2,250 horsepower with a mean of 1,525. The number of trips by vessel also varied widely, from 1 to 23 with a mean of 5.6.

3.7 Trawl Catcher-Processor Vessels

In 2004, 40 catcher-processor vessels used trawl gear to catch 1 million t of fish, which was principally groundfish and accounted for 45 percent of the combined catch of the seven fleets (Tables 2 and 3). The vessels varied in terms of their physical characteristics but were larger and had more horsepower than most other fishing vessels in the Alaska fisheries. They ranged in length from 104 to 376 feet with a mean of 223 feet. Their gross tonnage was between 180 and 5,308 tons with a mean of 1,799. They had between 800 and 8,800 horsepower with a mean of 3,824. The number of trips (i.e., number of weeks with reported catch) by vessel ranged from 9 to 42 with a mean of 26.1.

3.8 Dredge Catcher-Processor Vessels

In 2004, 4 catcher-processor vessels used dredge gear to catch 190 t of fish, which was almost exclusively scallops and accounted for less than 0.05 percent of the combined catch of the seven fleets (Tables 2 and 3). The vessels varied in terms of their physical characteristics. They ranged in length from 58 to 123 feet with a mean of 89 feet. Their gross tonnage was between 53 and 199 tons with a mean of 123. They had between 330 and 850 horsepower with a mean of 599. The number of trips by vessel also varied widely, from 1 to 9 with a mean of 4.4.

3.9 All Catcher-Processor Vessels Combined

In 2004, 94 catcher-processor vessels caught almost 1.2 million t of fish, which was principally groundfish and accounted for 52 percent of the combined catch of the seven fleets (Tables 2 and 3).

Table 2. Vessel characteristics and the number of trips by fleet for vessels that participated in one or more of the five federally-managed commercial fisheries off Alaska[1] in 2004.

	Catcher Vessels			Catcher-Processor Vessels			
	Hook & Line	Pot	Trawl	Hook & Line	Pot	Trawl	Dredge
Number of Vessels	1,696	392	154	42	12	40	4
Vessel Length (feet)							
Minimum	16	28	58	56	76	104	58
Maximum	154	184	219	196	180	376	123
Median	42	98	99	140	166	227	88
Mean	45	91	106	142	158	223	89
Gross Tonnage							
Minimum	1	3	58	50	168	180	53
Maximum	3,000	745	1,412	1,129	920	5,308	199
Median	24	173	184	448	469	1,453	119
Mean	38	147	249	454	504	1,799	123
Horsepower							
Minimum	8	130	300	265	720	800	330
Maximum	2,250	4,000	6,600	4,800	2,250	8,800	850
Median	275	700	1,125	1,200	1,575	3,200	608
Mean	318	760	1,283	1,344	1,525	3,824	599
Number of Trips[2]							
Minimum	1	1	1	3	1	9	1
Maximum	50	43	56	45	23	42	9
Median	4	3	25	27	2	26	4
Mean	5.5	7.0	27.0	27.4	5.6	26.1	4.4

1. These are the GOA and BSAI groundfish fisheries, the BSAI crab fishery, the scallop fishery, and the Pacific halibut fishery.
2. The number of weeks with reported catch for a groundfish catcher-processor vessel and the number of unique fish ticket dates for any other type of vessel.

Data Sources: Fish tickets from the AKFIN database; Catch Accounting System data and Federal Fisheries Permit listings from the Alaska Regional Office; and CFEC commercial-vessel license listings from the State of Alaska.

4. Methods

This section includes brief discussions of the following: (1) the data and methods used to estimate harvesting capacity (a more complete description of DEA is presented in the Section 3 and Appendix 13 of the National Assessment); (2) the effects of not having variable inputs in the DEA models; (3) the estimates of total catch for groundfish and the associated harvesting capacity estimates; and (3) the correction made to account for the difference between the catch estimates generated using the trip level data and the official catch estimates by species group.

4.1 Data and Methods

Trip level catch data for all trips that included reported catch from one or more of the five federally managed commercial fisheries in 2004 were used to estimate capacity for the various fleets. The catch data for all vessels excluding groundfish catcher-processor vessels were taken from the fish ticket (i.e., landings report) database maintained by Pacific States Marine Fisheries Commission's Alaska Fisheries Information Network (AKFIN) Office. Catch data for the groundfish catcher-processor vessels were taken from the catch reporting system maintained by the Alaska Regional Office. The catch data for each vessel were combined with other vessel-specific and trip-specific data to compile a trip record for each reported trip. As noted in Section 3, the methods used to define a trip were different for the groundfish catcher-processor vessels and all other vessels. The vessel-specific data were vessel horsepower, gross registered tonnage, length, engine type, and hull type, which were taken from the Alaska Regional Office vessel registration and permit databases. In addition, the type of trawl catch/processor vessel was included.

The trips were first stratified by fleet, fishery, and area (GOA and BSAI) and then typically further stratified by season (when possible), hull type, engine type, and targeted species (when possible). In addition, trawl catcher vessels trips were stratified by delivery type (i.e., shoreside or at-sea delivery), and trawl catcher-processor trips were stratified by type of catcher-processor (i.e., surimi, fillet, or headed and gutted trawl catcher-processor). The GOA longline halibut trips were stratified by area, hull type, whether the vessel had refrigeration, and whether the catch was less than 1 metric ton (t) net weight. The stratification for BSAI longline halibut trips was similar but excluded refrigeration. The trips with at least 1 t of catch were used in the DEA models. Those trips accounted of 89 percent and 79 percent, respectively, of the GOA and BSAI halibut catch. For the other longline halibut trips, harvesting capacity was set equal to actual catch. These stratifications were used to ensure that similar types of trips were included in each model.

DEA models, with the assumption of variable returns to scale, were used to estimate harvesting capacity by trip and species group. Vessel length, gross tonnage, and horsepower were used as fixed inputs. Because no trip level variable input data (e.g., days at sea, number of sets, or crew size) were consistently available, variable input data were not used to estimate harvesting capacity. The species groups for the catch data were those listed in Table 1 plus scallops, scarlet king crab, and Tanner (bairdi) crab in the BSAI, and all other species in both the GOA and BSAI. Trips with missing or obviously incorrect fixed input data could not be used in the DEA models. Such trips usually were placed in a "miscellaneous" file and the capacity for such trips was set equal to catch. If there were too few trips in a specific stratum to be used in a DEA model, the capacity for such trips was also set equal to catch. With the exception of the halibut longline fleets discussed above, the percent of catch used in the DEA models ranged from 92 percent for the trawl catcher-processor fleet to 100 percent for the hook and line and the pot catcher-processor fleets, and was 95 percent for all fleets combined (Table 3). The trip level capacity estimates were summed to produce the aggregate estimates by fleet or species group presented in this report.

4.2 Effects of Not Having Variable Inputs in the DEA Models

Variable inputs (e.g., days at sea, number of sets, or crew size) were not included in the DEA models because such data were not available consistently for these five fisheries. The effects of that data deficiency are discussed below.

If variable inputs are not included in a DEA model, it is not possible to generate an estimate of the capacity level of input use, an estimate of the technically efficient level of output (catch), or the lower capacity estimates that are being reported for many other fisheries. This makes it more difficult to determine whether the capacity estimates presented in this report are reasonable approximations of the maximum amount of fish the fleets could have reasonably expected to catch under normal and realistic operating conditions, fully utilizing the machinery and equipment in place, and given the other constraints in the definition of harvesting capacity. The following text from Section 3 of the National Assessment describes the difference between the lower and higher capacity estimates and the potential importance of presenting both estimates of harvesting capacity.

> For each fishery, estimates were provided for both the usual measure of capacity output and the input-corrected output level (if the required variable input data were available). For convenience in presenting these estimates and the associated estimates of excess capacity and overcapacity, these two estimates are simply referred to as the "higher" and "lower" capacity estimates.
>
> (1) The first and higher estimate, which is the usual measure of capacity output, provides an estimate of what the harvest would have been if all estimated technical inefficiency had been eliminated and if variable inputs had been fully utilized (i.e., used at the level required to attain capacity output). There was technical inefficiency if more could have been produced without increasing the amount of inputs used.
>
> (2) The second and lower estimate provides an approximation of what the harvest would have been if the variable inputs had been fully utilized but if the estimated technical inefficiency had not been eliminated. Therefore, the lower estimate is based on the actual level of technical efficiency, not the estimated potential level of technical efficiency.
>
> The second and lower estimate is provided to address the concern that the first estimate may overstate the amount of fish a given fleet could have expected to harvest under the normal and realistic operating conditions of each vessel[59]. The reason for this concern is that, with the first estimate, all

[59] A more complete discussions of this concern are included in the following two papers:

Kirkley, J. E., C. J. Morrison-Paul, and D. E. Squires. 2002. Capacity and Capacity Utilization in of the differences in harvest levels among trips of a specific type are attributed to technical inefficiency and differences in fixed inputs when, in fact, some of the differences in harvest levels could have been due to nonobserved factors, including differences in skill levels among skippers or crews, unobserved differences in fixed inputs, weather conditions, mechanical failures, luck (e.g., being at the right place at the right time to catch an unusually large amount of fish), and temporal or spatial differences in fish stocks.

The potential for the first estimate to overstate what the fleet could have harvested under the normal and realistic operating conditions of each vessel is greater when trip-level data are used to estimate harvesting capacity and much of the harvest is accounted for by trips in which only one species is harvested. That is because when capacity is estimated by trip, the peer trips that are used to estimate capacity are defined in terms of both vessel characteristics and the species composition of the catch. Therefore, for single species trips, all the trips for a given species and for vessels with similar vessel characteristics would be peer trips and the trip with the most catch would be the capacity estimate for all those peer trips. Conversely, if many species are taken on most trips and if the species composition differs by trip, there will be relatively few peer trips to estimate the capacity for each trip, which means that more of these trips will have no or few peers and will be estimated to be at or close to capacity. This may account for the relatively high estimates of excess capacity in some of the North Pacific fisheries, such as the Alaska halibut, sablefish, and pollock fisheries. The other characteristic of those fisheries and other fisheries with LAPPs that probably contributed to relatively high rates of excess capacity and overcapacity is the additional control the harvest privilege owners have over when and how fish are caught. Some may have decided to use all their harvest privileges (e.g., IFQs) on a small number of large trips while others may have decided to make more but smaller trips. The trip level capacity estimates will tend to reflect the catch per trip from the larger trips; therefore, there will be high estimates of excess capacity if a large part of the total catch was taken with small trips. The lack of variable input data for the Alaska Region fisheries limited what could be done to account for such differences in trip types for the fisheries with IFQs or fishing cooperatives.

The two estimates are not intended to bracket the range of feasible harvesting capacity estimates; they are intended to allow for a more complete assessment of excess capacity and overcapacity by providing a range that accounts for different underlying assumptions about the vessels' ability to increase their harvest. However, given the definition of harvesting capacity stated above, and barring other factors that could result in the first estimate overstating or understating harvesting capacity, actual harvesting capacity would tend to be between the two estimates because the underlying assumptions for the first and second estimates, respectively, are too lenient and too restrictive relative to that definition of harvesting capacity. An estimate of what capacity would have been in 2004 in the absence of the management measures that constrained landings per trip, the number of trips, or both in 2004 would tend to exceed the higher capacity estimate. However, it would have been a more speculative estimate of harvesting capacity. Similarly, estimates of what capacity would have been if no stocks had been overfished, would have produced larger but again more speculative estimates of harvesting capacity.

For the fisheries without consistently available variable input data, it was not possible to provide estimates of the technically efficient harvest levels, estimates of the levels of variable input use required to harvest at the capacity level, and the lower estimates that were reported for most fisheries.

Common Pool Resource Industries. Journal of Environmental and Resource Economics 22:1/2 (June), 71-97.

Kirkley, J. E., C .J. Morrison-Paul, and D. E. Squires. 2004. Deterministic and Stochastic Estimation for Fishery Capacity Reduction. Marine Resource Economics 19, 271-294.

This makes it more difficult to evaluate whether the harvesting capacity estimates for those fisheries are reasonable approximations of harvesting capacity as defined for this assessment.

Both the lower and higher harvesting capacity estimates were included in the assessments for the fisheries in the Northeast, Southeast, and Pacific Islands Regions and for the Atlantic highly migratory species fisheries. For that group of fisheries, excluding the U.S. Caribbean, DEA models were used to generate harvesting capacity estimates for 63 species groups. The lower capacity estimates ranged from 52 percent of the higher capacity estimates for Southeast Atlantic Spanish mackerel to 99 percent for Gulf of Mexico deep water groupers. The mean and median values for the 63 species groups were 84 percent and 87 percent, respectively. It is not known whether the lower capacity estimates as percentages of the higher capacity estimates for the federally managed commercial fisheries off Alaska would have been within or below that range if the lower estimates could have been made.

4.3 Estimates of Total Catch for Groundfish and the Associated harvesting Capacity Estimates

The groundfish TACs or CQs are in terms of total catch (i.e., landed catch plus at-sea discards that occur prior to the landings), and for some species groups those at-sea discards are significant. Trip level estimates of total catch by TAC species group were available and used in the DEA models for groundfish catcher-processor vessels. However, because the trip level catch data for catcher vessels are of landed catch, landed catch was used in the DEA models for catcher vessels. In order to provide estimates of catch and harvesting capacity in terms of total catch for the groundfish catcher vessels, the catch and harvesting capacity estimates based on landed catch were adjusted using a multiplier equal to the ratio of total catch to landings. The Alaska Fisheries Science Center provided the estimates of total catch and landed catch by species group and gear type that were used to make the required adjustments. These adjustments were used to generate the groundfish catcher vessel catch and harvesting capacity estimates presented in this report. It is not known how the groundfish capacity estimates would have differed if trip level estimates of total catch had been available and used in the DEA models.

4.4 Using the Official Catch Estimates to Assess Overcapacity

There are various reasons why the trip level catch data that were used to estimate harvesting capacity do not sum to the official catch estimates for some species groups. To correct for the differences (and to therefore have an assessment of overcapacity in terms of the official estimates of total catch), the harvesting capacity estimates based on the trip level data were adjusted using a multiplier equal to the ratio of the official catch estimate to the catch estimate for the trip level data. These adjustments were made by species group and CQ area to generate the harvesting capacity estimates presented in Section 6 and Tables 4 through 6. The catch estimates presented with those capacity estimates are the official catch estimates provided by the Alaska Regional Office for groundfish and Pacific halibut and obtained from the Alaska Department of Fish and Game website (http://www.cf.adfg.state.ak.us/geninfo/shellfsh/04value.php).

5. Results by Fleet for All Species Combined

In this section, the results of the assessment of harvesting capacity and excess capacity for all species combined are presented by fleet and summarized in Table 3. The results of the assessment by species group for all fleets combined are presented in Section 6. As noted above, "fleets" refers to mutually exclusive sets of trips and not to mutually exclusive sets of vessels (i.e., if a vessel was in multiple fleets, it contributed to the catch and therefore to the harvesting capacity estimates for multiple fleets). The catch data and capacity assessments presented for the seven fleets are only for trips for the five fisheries included in this report. Therefore, they do not include catch from other types of trips (e.g., salmon, herring, or Pacific whiting trips). For groundfish species, the catch and capacity estimates are in terms of total catch (i.e., landed catch and discarded catch); however, for the other species groups, the estimates are in terms of landed catch excluding at-sea discards.

5.1 Hook and Line Catcher Vessels

The catch and harvesting capacity estimates, respectively, for the hook and line catcher vessel fleet were 54 thousand t and 118 thousand t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by 64 thousand t or 119 percent. This means the fleet would have caught that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 46 percent of its capacity level and, therefore, a fleet with 54 percent less capacity would have been able to catch as much as was caught in 2004 if it had fully utilized its remaining capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.2 Pot Catcher Vessels

The catch and harvesting capacity estimates, respectively, for the pot catcher vessel fleet were 61 thousand t and 161 thousand t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by 100 thousand t or 166 percent. This means the fleet would have caught that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 38 percent of its capacity level and, therefore, a fleet with 62 percent less capacity would have been able to catch as much as was caught in 2004 if it had fully utilized its remaining capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.3 Trawl Catcher Vessels

The catch and harvesting capacity estimates, respectively, for the trawl catcher vessel fleet were about 0.9 million t and 1.9 million t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by almost 1 million t or 100 percent. This means the fleet would have caught that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 50 percent of its capacity level and, therefore, a fleet with 50 percent less capacity would have been able to catch as much as was caught in 2004 if it had fully utilized its remaining capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.4 All Catcher Vessel Fleets Combined

The catch and harvesting capacity estimates, respectively, for all the catcher vessel fleets combined were almost 1.1 million t and 2.2 million t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by 1.1 million t or 105 percent. This means the fleets would have caught that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 49 percent of their capacity level and, therefore, fleets with 51 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

5.5 Hook and Line Catcher-Processor Vessels

The catch and harvesting capacity estimates, respectively, for the hook and line catcher-processor vessel fleet were 149 thousand t and 199 thousand t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by 50 thousand t or 33 percent. This means the fleet would have caught that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 75 percent of its capacity level and, therefore, a fleet with 25 percent less capacity would have been able to catch as much as was caught in 2004 if it had fully utilized its remaining capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.6 Pot Catcher-Processor Vessels

The catch and harvesting capacity estimates, respectively, for the pot catcher-processor vessel fleet were 4.8 thousand t and 5.6 thousand t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by 0.9 thousand t or 18 percent. This means the fleet would have caught that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at 85 percent of its capacity level and, therefore, a fleet with 15 percent less capacity would have been able to catch as much as was caught in 2004 if it had fully utilized its remaining capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.7 Trawl Catcher-Processor Vessels

The catch and harvesting capacity estimates, respectively, for the trawl catcher-processor vessel fleet were 1 million t and 1.004 million t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by only 4 thousand t or less than 0.5 percent. This means the fleet was operating at almost 100 percent of its capacity level and would not have caught much more fish if it had fully utilized its capacity in 2004.

5.8 Dredge Cater/Processor Vessels

The catch and harvesting capacity estimates, respectively, for the dredge cater/processor vessel fleet were 0.19 thousand t and 0.27 thousand t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by 0.08 thousand t or 41 percent. This means the fleet would have caught that much more fish if it had operated at capacity in 2004. It also means the fleet was operating at only 71 percent of its capacity level and, therefore, a fleet with 29 percent less capacity would have been able to catch as much as was caught in 2004 if it had fully utilized its remaining capacity. It is not known what percentage changes in the use of variable inputs would have been associated with operating at capacity.

5.9 All Catcher-Processor Vessel Fleets Combined

The catch and harvesting capacity estimates, respectively, for all the catcher-processor vessel fleets combined were 1.155 million t and 1.209 million t (Table 3), and estimated capacity exceeded catch in 2004 by 54 thousand t or 5 percent. This means the fleets would have caught that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at 96 percent of their capacity level and, therefore, fleets with 4 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

5.10 Summary for All Fleets Combined

The catch and harvesting capacity estimates, respectively, for all fleets combined were 2.2 million t and almost 3.4 million t (Table 3). Therefore, estimated capacity exceeded catch in 2004 by almost 1.2 million t or 53 percent. This means the fleets would have caught that much more fish if they had operated at capacity in 2004. It also means the fleets were operating at only 65 percent of their capacity level and, therefore, fleets with 35 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Table 3 Assessment of harvesting capacity by fleet for all species combined for 2004 (1,000 metric tons).

	Catcher Vessels				Catcher-Processor Vessels					
	Hook & Line	Pot	Trawl	Sub-Total	Hook & Line	Pot	Trawl	Dredge	Sub-Total	Grand Total
Catch[1]	54	61	947	1,062	149	4.78	1,000	0.19	1,155	2,217
Catch Used in the DEA Models	50	58	911	1,019	149	4.78	922	0.19	1,076	2,095
Percent of Catch Used in the DEA Models	93%	96%	96%	96%	100%	100%	92%	98%	93%	95%
Higher Capacity Estimate (HCE)[2]	118	161	1,899	2,178	199	5.64	1,004	0.27	1,209	3,387
Higher Excess Capacity Estimate	64	100	952	1,116	50	0.86	4	0.08	54	1,171
HCE as % of Catch	219%	266%	200%	205%	133%	118%	100%	141%	105%	153%
Catch as a % of the HCE	46%	38%	50%	49%	75%	85%	100%	71%	96%	65%
Number of Vessels	1,696	392	154	2,078	42	12	40	4	94	2,163

1. The catch and harvesting capacity estimates are in terms of total catch (i.e., landed and discarded catch) for groundfish and in terms of landed catch for all other species groups. With the exception of scallops, which are in meat weight, and Pacific halibut, which are in net weight, those estimates are in terms of round weight. The catch estimates are based on fish tickets from the AKFIN database and Catch Accounting System data from Alaska Regional Office.

2. Only the higher capacity estimates are provided because the variable input data required to generate the lower capacity estimates were not available consistently.

6. Results by Species Group and Area for All Fleets Combined

The species group–specific assessment of harvesting capacity, excess capacity, and overcapacity for each of the five federally managed fisheries for all fleets combined is summarized in Tables 4 through 6 and discussed in this section. For groundfish species, the catch and capacity estimates are in terms of total catch (i.e., landed catch and discarded catch); however, for the other species groups, the estimates are in terms of landed catch excluding at-sea discards.

6.1 Groundfish Fishery of the Gulf of Alaska

The assessment was conducted by species group for both the primary groundfish target species groups and the groundfish species groups that were taken primarily as incidental catch. We did not make a distinction between these two types of groundfish species groups because the capacity of the fleets to exceed the CQs for both types of species groups is of interest. However, the fishery management implications are not the same.

6.1.1 Atka Mackerel

For 2004, the GOA catch of Atka mackerel for all fleets combined and the species-specific capacity estimate were both about 0.8 thousand t (Table 4). Estimated capacity exceeded catch in 2004 by 1 percent. This means the fleets were operating at 99 percent of their capacity level and, therefore, fleets with 1 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The Atka mackerel CQ was 0.6 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 0.2 thousand t or 37 percent; therefore, there was overcapacity. This means that fleets with 27 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that Atka mackerel catch exceeded the CQ by 36 percent is further evidence that there was overcapacity in 2004. However, the management implications are different for this species taken principally as incidental catch.

6.1.2 Pacific Cod

The catch of Pacific cod for all fleets combined was 43 thousand t in 2004 and the species-specific capacity estimate was 92 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by 49 thousand t or 114 percent. This means the fleets would have caught that much more Pacific cod if they had operated at capacity in 2004. It also means the fleets were operating at only 47 percent of their capacity level and, therefore, fleets with 53 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The Pacific cod CQ was 48 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 44 thousand t, or 93 percent; therefore, there was overcapacity. This means that fleets with 48 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for Pacific cod, the CQ was not exceeded, as 90 percent of the CQ was taken in 2004.

6.1.3 Pollock

The catch of pollock for all fleets combined was almost 63 thousand t in 2004 and the species-specific capacity estimate was 141 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by 78 thousand t or 124 percent. This means the fleets would have caught that much more pollock if they had operated at capacity in 2004. It also means the fleets were operating at only 45 percent of their capacity level and, therefore, fleets with 55 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The pollock CQ was about 71 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 69 thousand t, or 97 percent; therefore, there was overcapacity. This means that fleets with 49 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for pollock, the CQ was not exceeded, as 88 percent of the CQ was taken in 2004.

6.1.4 Sablefish

The catch of sablefish for all fleets combined was 15.6 thousand t in 2004 and the species-specific capacity estimate was 31.3 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by 15.7 thousand t or 100 percent. This means the fleets would have caught that much more sablefish if they had operated at capacity in 2004. It also means the fleets were operating at only 50 percent of their capacity level and, therefore, fleets with 50 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The sablefish CQ was 16.6 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 14.8 thousand t, or 89 percent; therefore, there was overcapacity. This means that fleets with 47 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for sablefish, the CQ was not exceeded, as 94 percent of the CQ was taken in 2004.

6.1.5 Flatfish

The GOA catch of flatfish for all fleets combined was almost 23 thousand t in 2004 and the capacity estimate was almost 33 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by about 10 thousand t or 43 percent. This means that, ignoring the PSC limits that constrained flatfish catch, the fleets would have caught that much more flatfish if they had operated at capacity in 2004. It also means the fleets were operating at only 70 percent of their capacity level and, therefore, fleets with 30 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity. For individual flatfish species groups, estimated harvesting capacity exceeded catch from a low of 12 percent for rex sole to a high of 99 percent for shallow-water flatfish.

Although there was excess capacity for each flatfish species group in 2004, there was not overcapacity. Estimated harvesting capacity as a percent of the CQ ranged from a low of 13 percent for rex sole to a high of only 54 percent for arrowtooth flounder. And the percent of the CQ taken ranged from a low of 11 percent for deep-water flatfish to only 40 percent for arrowtooth flounder. This means that fleets with substantially more harvesting capacity and operating at capacity would have been required to take the CQs in 2004. Alternatively, the fleets potentially could have taken the CQs in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on the flatfish species groups. However, without a substantial reduction in halibut bycatch rates, such an expansion of effort would have been prevented by the halibut PSC limits.

6.1.6 Rockfish

The GOA catch of rockfish for all fleets combined was 22 thousand t in 2004 and the capacity estimate was 25.5 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by 3.5 thousand t or 16 percent. This means the fleets would have caught that much more rockfish if they had operated at capacity in 2004. It also means the fleets were operating at 86 percent of their capacity level and, therefore, fleets with 14 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity. For individual rockfish species groups, estimated harvesting capacity exceeded catch from a low of 0 percent for other rockfish to a high of 53 percent for thornyhead rockfish.

Although there was excess capacity for all but one rockfish species group in 2004, there was not overcapacity for demersal shelf rockfish, Pacific ocean perch, pelagic shelf rockfish, or thornyhead rockfish. Estimated harvesting capacity exceeded the CQ by the following amounts for the other rockfish species groups: northern rockfish 8 percent, shortraker/rougheye rockfish 2 percent, and other rockfish 33 percent. The fact that other rockfish catch exceeded its CQ by 32 percent is further evidence that there was overcapacity in 2004 for other rockfish even though there was not excess capacity for other rockfish.

6.1.7 Other Species

Most of the catch of the other species of groundfish is incidental catch in groundfish fisheries targeting other species groups. The catch of other species of groundfish for all fleets combined was 4.5 thousand t in 2004 and the species-specific capacity estimate was 7 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by 2.5 thousand t or 56 percent. This means the fleets would have caught that much more other species of groundfish if they had operated at capacity in 2004. It also means the fleets were operating at only 64 percent of their capacity level and, therefore, fleets with 36 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity, there was not overcapacity for the other species of groundfish in 2004 and only 22 percent of the CQ of almost 20 t was taken. The species-specific capacity estimate (7 thousand t) was about 13 thousand t less than the CQ, or only 35 percent of the CQ. This means that fleets with 185 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on other species of groundfish. However, much of the other groundfish catch was taken as incidental catch by fleets targeting other species groups.

6.1.8 All GOA Groundfish

The catch of all GOA groundfish for all fleets combined was 172 thousand t in 2004 and the capacity estimate was 333 thousand t (Table 4). Therefore, estimated capacity exceeded catch in 2004 by 161 thousand t or 94 percent. This means the fleets would have caught that much more groundfish if they had operated at capacity in 2004. It also means the fleets were operating at only 52 percent of their capacity level and, therefore, fleets with 48 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Table 4 Gulf of Alaska groundfish harvesting capacity assessment by species group for all fleets combined in 2004 (1,000 metric tons round weight).

	Catch[1]	CQ[2]	Higher Capacity Estimate (HCE)[3]	Higher Excess Capacity Estimate	HCE as a % of the Catch	Catch as a % of the HCE	Higher Over-Capacity Estimate	HCE as a % of the CQ	CQ as a % of the HCE	Catch as a % of the CQ
Atka mackerel	0.82	0.60	0.82	0.00	101%	99%	0.22	137%	73%	136%
Pacific cod	43.1	48.0	92.5	49.4	214%	47%	44.5	193%	52%	90%
Pollock	62.8	71.3	140.7	77.9	224%	45%	69.4	197%	51%	88%
Sablefish	15.6	16.6	31.3	15.7	200%	50%	14.8	189%	53%	94%
Flatfish										
Arrowtooth flounder	15.3	38.0	20.6	5.3	135%	74%	-17.4	54%	184%	40%
Deep-water flatfish	0.68	6.07	0.99	0.31	146%	69%	-5.08	16%	612%	11%
Flathead sole	2.4	10.9	3.4	1.0	142%	70%	-7.5	31%	319%	22%
Rex sole	1.5	12.7	1.6	0.2	112%	89%	-11.0	13%	769%	12%
Shallow-water flatfish	3.1	20.7	6.1	3.0	199%	50%	-14.6	30%	338%	15%
Flatfish Sub-total	22.9	-	32.8	9.8	143%	70%	-	-	-	-
Rockfish										
Demersal shelf rockfish	0.26	0.45	0.30	0.04	115%	87%	-0.15	66%	150%	58%
Northern rockfish	4.8	4.9	5.2	0.4	109%	92%	0.4	108%	93%	99%
Pacific ocean perch	11.6	13.3	13.3	1.7	115%	87%	-0.1	100%	100%	87%
Pelagic shelf rockfish	2.7	4.5	3.0	0.3	113%	89%	-1.4	68%	148%	60%
Shortraker/rougheye rockfish	1.00	1.32	1.35	0.35	135%	74%	0.03	102%	98%	75%
Thornyhead rockfish	0.82	1.94	1.25	0.44	153%	65%	-0.69	65%	155%	42%
Other rockfish	0.89	0.67	0.89	0.00	100%	100%	0.22	133%	75%	132%
Rockfish Sub-total	22.0	-	25.5	3.5	116%	86%	-	-	-	-
Other species	4.5	19.9	7.0	2.5	156%	64%	-12.9	35%	285%	22%
All Groundfish	172	-	333	161	194%	52%	-	-	-	-

1. The estimates of catch and harvesting capacity are in terms of total catch (i.e., landed and discarded catch).
2. The groundfish TACs summed over all GOA areas were used as the CQs.
3. Only the higher capacity estimates are provided because the variable input data required to generate the lower capacity estimates were not available consistently.

6.2 Groundfish Fishery of the Bering Sea and Aleutian Islands Area

The assessment was conducted by species group for both the primary groundfish target species groups and the groundfish species groups that were taken primarily as incidental catch. We did not make a distinction between these two types of groundfish species groups because the capacity of the fleets to exceed the CQs for both types of species groups is of interest. However, the fishery management implications are not the same.

6.2.1 Atka Mackerel

The catch of Atka mackerel for all fleets combined was 61 thousand t in 2004, the species-specific capacity estimate was 61 thousand t, and the CQ was 63 thousand t (Table 5). Therefore, the fleets were operating at capacity for Atka mackerel, there was neither excess capacity nor overcapacity for Atka mackerel in 2004, and only 96 percent of the CQ was taken. Because the capacity estimate was 2 thousand t less than the CQ, or only 97 percent of the CQ, fleets with 4 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on Atka mackerel.

6.2.2 Pacific Cod

The catch of Pacific cod for all fleets combined was 212 thousand t in 2004 and the species-specific capacity estimate was 379 thousand t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by 167 thousand t or 79 percent. This means the fleets would have caught that much more Pacific cod if they had operated at capacity in 2004. It also means the fleets were operating at only 56 percent of their capacity level and, therefore, fleets with 44 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The Pacific cod CQ was 215 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 163 thousand t, or 76 percent; therefore, there was overcapacity. This means that fleets with 43 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for Pacific cod, the CQ was not exceeded, as 98 percent of the CQ was taken in 2004.

6.2.3 Pollock

The BSAI catch of pollock for all fleets combined was almost 1.5 million t in 2004 and the species-specific capacity estimate was 2.2 million t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by more than 0.7 million t or 51 percent. This means the fleets would have caught that much more pollock if they had operated at capacity in 2004. It also means that the fleets were operating at only 66 percent of their capacity level and, therefore, fleets with 34 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The pollock CQ was almost 1.5 million t in 2004. The species-specific capacity estimate exceeded the CQ by more than 0.7 million t or 50 percent; therefore, there was overcapacity. This means that fleets with 33 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for pollock, the CQ was not exceeded, as 99 percent of the CQ was taken in 2004.

6.2.4 Sablefish

The BSAI catch of sablefish for all fleets combined was 2.0 thousand t in 2004 and the species-specific capacity estimate was more than 3.1 thousand t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by almost 1.2 thousand t or 58 percent. This means the fleets would have caught that much more sablefish if they had operated at capacity in 2004. It also means the fleets were operating at only 63 percent of their capacity level and, therefore, fleets with 37 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity, there was not overcapacity for sablefish in 2004 and only 34 percent of the CQ of 5.8 t was taken. The species-specific capacity estimate (about 3.1 thousand t) was 2.7 thousand t less than the CQ, or only 54 percent of the CQ. This means that fleets with 85 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on sablefish.

6.2.5 Flatfish

The BSAI catch of flatfish for all fleets combined was almost 175 thousand t in 2004 and the capacity estimate was 181 thousand t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by about 6 thousand t or 3 percent. This means that, ignoring the PSC limits that constrained flatfish catch, the fleets would have caught that much more flatfish if they had operated at capacity in 2004. It also means that the fleets were operating at 97 percent of their capacity level and, therefore, fleets with 3 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity. For individual flatfish species groups, estimated harvesting capacity exceeded catch from a low of 1 percent for Alaska place to a high of 18 percent for Greenland turbot.

There was not overcapacity for Alaska place, flathead sole, Greenland turbot, or yellowfin sole. For the other three flatfish species groups, estimated harvesting capacity exceeded the CQ by the following amounts: arrowtooth flounder 25 percent, rock sole 10 percent, and other flatfish 8 percent. The fact that arrowtooth flounder, rock sole, and other flatfish catches exceeded their CQs by 13 percent, 8 percent, and 2 percent, respectively, is further evidence that there was overcapacity in 2004 for those three flatfish species groups.

6.2.6 Rockfish

The BSAI catch of rockfish for all fleets combined was 17.3 thousand t in 2004 and the capacity estimate was almost 17.5 thousand t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by more than 0.1 thousand t or 1 percent. This means the fleets would have caught that much more rockfish if they had operated at capacity in 2004. It also means the fleets were operating at 99 percent of their capacity level and, therefore, fleets with 1 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity. For individual rockfish species groups, estimated harvesting capacity exceeded catch from a low of 0 percent for northern rockfish and Pacific ocean perch to a high of 9 percent for other rockfish.

Although there was excess capacity for three of the five rockfish species groups in 2004, there was overcapacity only for rougheye rockfish, for which estimated harvesting capacity exceeded the CQ by 7 percent. The fact that rougheye rockfish catch exceeded its CQ by about 6 percent is further evidence that there was overcapacity in 2004 for rougheye rockfish.

6.2.7 Squid

The BSAI catch of squid for all fleets combined was 1.01 thousand t in 2004 and the species-specific capacity estimate was 1.04 thousand t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by about 0.02 thousand t or only 2 percent. This means the fleets would have caught that much more squid if they had operated at capacity in 2004. It also means that the fleets were operating at 98 percent of their capacity level and, therefore, fleets with 2 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Although there was excess capacity, there was not overcapacity for squid in 2004 and only 94 percent of the CQ of 1.08 thousand t was taken. The species-specific capacity estimate (1.04 thousand t) was about 0.05 thousand t less than the CQ, or only 96 percent of the CQ. This means that fleets with 5 percent more harvesting capacity and operating at capacity would have been required to take the CQ in 2004. Alternatively, the fleets could have taken the CQ in 2004 by increasing either their total fishing effort or the part of their total fishing effort focused on squid. However, much of the squid catch was taken as incidental catch by fleets targeting other species.

6.2.8 Other Species

Most of the catch of the other species of groundfish is incidental catch in groundfish fisheries targeting other species groups. The catch of other species of groundfish for all fleets combined was 29.3 thousand t in 2004, and the species-specific capacity estimate was 37.4 thousand t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by about 8 thousand t or 27 percent. This means the fleets would have caught that much more other species of groundfish if they had operated at capacity in 2004. It also means the fleets were operating at only 78 percent of their capacity level and, therefore, fleets with 22 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The other species of groundfish CQ was 25.2 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 12.2 thousand t, or 49 percent; therefore, there was overcapacity. This means that fleets with 33 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that the catch of other species of groundfish exceeded the CQ by 17 percent is further evidence that there was overcapacity in 2004. However, the management implications are different for a species group taken principally as incidental catch.

6.2.9 All BSAI Groundfish

The catch of all BSAI groundfish for all fleets combined was 2 million t in 2004 and the capacity estimate was 2.9 million t (Table 5). Therefore, estimated capacity exceeded catch in 2004 by 0.9 million t or 48 percent. This means the fleets would have caught that much more groundfish if they had operated at capacity in 2004. It also means the fleets were operating at only 68 percent of their capacity level and, therefore, fleets with 32 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Table 5 Bering Sea/Aleutian Islands area groundfish harvesting capacity assessment by species group for all fleets combined in 2004 (1,000 metric tons round weight).

	Catch[1]	CQ[2]	Higher Capacity Estimate (HCE)[3]	Higher Excess Capacity Estimate	HCE as a % of the Catch	Catch as a % of the HCE	Higher Over-Capacity Estimate	HCE as a % of the CQ	CQ as a % of the HCE	Catch as a % of the CQ
Atka mackerel	61	63	61	0	100%	100%	-2.2	97%	104%	96%
Pacific cod	212	215	379	167	179%	56%	163.3	176%	57%	98%
Pollock	1,482	1,493	2,243	761	151%	66%	749.8	150%	67%	99%
Sablefish	2.0	5.8	3.1	1.2	158%	63%	-2.69	54%	185%	34%
Flatfish										
Alaska plaice	7.9	10.0	8.0	0.1	101%	99%	-2.0	80%	125%	79%
Arrowtooth flounder	18.2	16.1	20.1	1.8	110%	91%	4.0	125%	80%	113%
Flathead sole	17.4	18.1	18.0	0.6	104%	97%	-0.1	100%	100%	96%
Greenland turbot	2.2	3.2	2.6	0.4	118%	85%	-0.6	81%	124%	69%
Rock sole	48.7	45.2	49.8	1.2	102%	98%	4.6	110%	91%	108%
Yellowfin sole	76	80	77	2	102%	98%	-2	97%	103%	95%
Other flatfish	5.0	4.9	5.3	0.3	106%	95%	0.4	108%	93%	102%
Flatfish Sub-total	175	-	181	6	103%	97%	-	-	-	-
Northern rockfish	4.7	5.0	4.7	0.0	100%	100%	-0.3	94%	107%	94%
Pacific Ocean perch	11.9	12.5	11.9	0.0	100%	100%	-0.6	96%	105%	95%
Rougheye rockfish	0.21	0.20	0.21	0.00	102%	98%	0.01	107%	93%	106%
Shortraker rockfish	0.24	0.53	0.26	0.02	108%	93%	-0.26	50%	202%	46%
Other rockfish	0.32	0.80	0.35	0.03	109%	92%	-0.45	43%	230%	40%
Rockfish Sub-total	17.3	-	17.5	0.1	101%	99%	-	-	-	-
Squid	1.01	1.08	1.04	0.02	102%	98%	-0.05	96%	105%	94%
Other species	29.3	25.2	37.4	8.0	127%	78%	12.2	149%	67%	117%
All Groundfish	1,979	-	2,923	944	148%	68%	-	-	-	-

1. The estimates of catch and harvesting capacity are in terms of total catch (i.e., landed and discarded catch).
2. The groundfish TACs summed over all BSAI areas were used as the CQs.
3. Only the higher capacity estimates are provided because the variable input data required to generate the lower capacity estimates were not available consistently.

6.3 Bering Sea/Aleutian Islands King and Tanner Crab

As noted in Sections 1 and 2.2, the crab rationalization and vessel buyback programs implemented in 2005 substantially reduced the number of vessels participating in the BSAI crab fisheries. Therefore, the assessment for 2004 is of limited use for determining the current levels of harvesting capacity, excess capacity, or overcapacity. The high end of the guideline harvest level range was used as the CQ for each crab species.

6.3.1 Golden King Crab

The catch of golden king crab for all fleets combined was 2.8 thousand t in 2004 and the species-specific capacity estimate was 6.2 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 3.4 thousand t or 121 percent. This means the fleets would have caught that much more golden king crab if they had operated at capacity in 2004. It also means the fleets were operating at only 45 percent of their capacity level and, therefore, fleets with 55 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The golden king crab CQ was 2.7 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 3.6 thousand t or 135 percent; therefore, there was overcapacity. This means that fleets with 58 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that golden king crab catch exceeded the CQ by 7 percent is further evidence that there was overcapacity in 2004.

6.3.2 Red King Crab

The catch of red king crab for all fleets combined was 7.2 thousand t in 2004 and the species-specific capacity estimate was 13.5 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 6.3 thousand t or 88 percent. This means the fleets would have caught that much more red king crab if they had operated at capacity in 2004. It also means the fleets were operating at only 53 percent of their capacity level and, therefore, fleets with 47 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The red king crab CQ was 7.2 thousand t in 2004. The species specific capacity estimate exceeded the CQ by 6.3 thousand t or 88 percent; therefore, there was overcapacity. This means that fleets with 47 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for red king crab, the CQ was taken but not exceeded in 2004.

6.3.3 Snow Crab

The catch of snow crab for all fleets combined was 10.9 thousand t in 2004 and the species-specific capacity estimate was 24.4 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 13.5 thousand t or 125 percent. This means the fleets would have caught that much more snow crab if they had operated at capacity in 2004. It also means the fleets were operating at only 44 percent of their capacity level and, therefore, fleets with 56 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The snow crab CQ was 9.4 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 15 thousand t or 158 percent; therefore, there was overcapacity. This means that fleets with 61 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. The fact that snow crab catch exceeded the CQ by 15 percent is further evidence that there was overcapacity in 2004.

6.3.4 All BSAI Crab

The catch of BSAI crab for all fleets combined was 20.8 thousand t in 2004 and the species-specific capacity estimate was 44.1 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 23.2 thousand t or 111 percent. This means the fleets would have caught that much more crab if they had operated at capacity in 2004. It also means the fleets were operating at only 47 percent of their capacity level and, therefore, fleets with 53 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

6.4 Gulf of Alaska Scallop Fishery

The catch of scallop for all fleets combined was 0.19 thousand t in 2004 and the species-specific capacity estimate was 0.27 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 0.08 thousand t or 43 percent. This means the fleets would have caught that much more scallops if they had operated at capacity in 2004. It also means the fleets were operating at only 70 percent of their capacity level and, therefore, fleets with 30 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The scallop CQ was 0.25 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 0.02 thousand t or 8 percent; therefore, there was overcapacity. This means that fleets with 8 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for scallop, the CQ was not exceeded, as 76 percent of the CQ was taken in 2004. The high end of the guideline harvest level range was used as the CQ for Gulf of Alaska scallop fishery.

6.5 Pacific Halibut Fishery

6.5.1 GOA Pacific Halibut

The catch of halibut for all fleets combined was 30.2 thousand t in 2004 and the species-specific capacity estimate was 61.4 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 31.1 thousand t or 103 percent. This means the fleets would have caught that much more halibut if they had operated at capacity in 2004. It also means the fleets were operating at only 49 percent of their capacity level and, therefore, fleets with 51 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The halibut CQ was 30.9 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 30.4 thousand t, or 98 percent; therefore, there was overcapacity. This means that fleets with 50 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for halibut, the CQ was not exceeded, as 98 percent of the CQ was taken in 2004.

6.5.2 BSAI Pacific Halibut

The catch of halibut for all fleets combined was 5.4 thousand t in 2004 and the species-specific capacity estimate was 10.3 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by 4.9 thousand t or 90 percent. This means the fleets would have caught that much more halibut if they had operated at capacity in 2004. It also means the fleets were operating at only 53 percent of their capacity level and, therefore, fleets with 47 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

The halibut CQ was 6.1 thousand t in 2004. The species-specific capacity estimate exceeded the CQ by 4.2 thousand t, or 69 percent; therefore, there was overcapacity. This means that fleets with 41 percent less harvesting capacity would have been able to take the CQ in 2004 if they had fully utilized their remaining capacity. Although there was excess capacity and overcapacity for halibut, the CQ was not exceeded, as 89 percent of the CQ was taken in 2004.

6.5.3 GOA and BSAI Pacific Halibut

The catch of halibut for all fleets and all areas combined was almost 36 thousand t in 2004 and the species-specific capacity estimate was 72 thousand t (Table 6). Therefore, estimated capacity exceeded catch in 2004 by about 36 thousand t or 101 percent. This means the fleets would have caught that much more halibut if they had operated at capacity in 2004. It also means the fleets were operating at only 50 percent of their capacity level and, therefore, fleets with 50 percent less capacity would have been able to catch as much as was caught in 2004 if they had fully utilized their remaining capacity.

Table 6 Crab, scallop, and Pacific halibut harvesting capacity assessment by species group for all fleets combined in 2004 (1,000 metric tons).

	Catch[1]	CQ[2]	Higher Capacity Estimate (HCE)[3]	Higher Excess Capacity Estimate	HCE as a % of the Catch	Catch as a % of the HCE	Higher Over-Capacity Estimate	HCE as a % of the CQ	CQ as a % of the HCE	Catch as a % of the CQ
BSAI crab										
Golden king crab	2.8	2.7	6.2	3.4	221%	45%	3.6	235%	42%	107%
Red king crab	7.2	7.2	13.5	6.3	188%	53%	6.3	188%	53%	100%
Snow crab	10.9	9.4	24.4	13.5	225%	44%	15.0	258%	39%	115%
Total BSAI crab	20.8	-	44.1	23.2	211%	47%	-	-	-	-
Scallops										
GOA	0.19	0.25	0.27	0.08	143%	70%	0.02	108%	92%	76%
Pacific halibut										
GOA	30.2	30.9	61.4	31.1	203%	49%	30.4	198%	50%	98%
BSAI	5.4	6.1	10.3	4.9	190%	53%	4.2	169%	59%	89%
Total Pacific halibut	35.7	-	72	36	201%	50%	-	-	-	-

1. The estimates of catch and harvesting capacity are in terms of landings, which are in round weight with the exception of scallops, which are in meat weight.
2. The higher end of each crab and scallop guideline harvest level range and the commercial halibut quota were used as the CQs.
3. Only the higher capacity estimates are provided because the variable input data required to generate the lower capacity estimates were not available consistently.

APPENDIX 10

Pacific Islands Region Assessment

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1. Introduction

The Pacific Islands Region Report presents harvesting capacity assessments for the Hawaii-based longline fishery and the Northwestern Hawaiian Islands (NWHI) bottomfish fishery. They are major components of the fisheries managed under the fishery management plan (FMP) for Pelagic Fisheries of the Western Pacific Region and the FMP for the Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region. The other fisheries managed under these two FMPs (principally the American Samoa–based longline fishery and the bottomfish fisheries in the Main Hawaiian Islands and the other Pacific islands) were not included. The data available for the American Samoa–based longline fishery were not strictly comparable with the data for the Hawaii-based longline fishery, and inadequate data were available for the other bottomfish fisheries. The assessments, which are for 2004, are presented below by fishery. All the landings and capacity estimates are reported in whole weight.

The lower and higher harvesting capacity estimates for the Hawaii-based longline fishery for all species combined exceeded the reported landings in 2004 by 10 percent and 34 percent, respectively. This indicates that there was excess capacity for the fishery as a whole in 2004. The corresponding species-specific capacity estimates for bigeye tuna—the only species with a total allowable catch (TAC) proxy—exceeded reported landings by 10 percent and 34 percent, and they exceeded the TAC proxy by 7 percent and 30 percent. This indicates the presence of both excess capacity and overcapacity for bigeye tuna in 2004, but neither was exceptionally high. Despite the estimated presence of excess capacity and overcapacity, reported landings approached but did not exceed the bigeye tuna TAC proxy in 2004. However, the estimates were based on the fishing trips that occurred in 2004 and, due to a significant regulatory change, there was an unusually small number of swordfish trips that year.

For the Northwestern Hawaiian Islands (NWHI) bottomfish fishery, the lower and higher harvesting capacity estimates for all species combined exceeded the reported landings in 2004 by 3 percent and 23 percent, respectively. This indicates there was excess capacity for the fishery as a whole in 2004. The corresponding species group–specific capacity estimates for the NWHI area bottomfish only exceeded reported landings by 1 percent and 20 percent, which indicates there was excess capacity for NWHI area bottomfish. However, both harvesting capacity estimates were less than the TAC, which indicates there was not overcapacity for NWHI area bottomfish in 2004. In addition, only 59 percent of the NWHI area bottomfish TAC was taken in 2004.

Sections 1 through 4 of the National Assessment provide critical background information. Specifically, they explain the purpose and nature of the national assessment, define harvesting capacity and related terms used in this report, describe data envelopment analysis (DEA—the mathematical programming approach used to estimate harvesting capacity for this report and for the other reports included in the National Assessment), and describe other aspects of the methods used to estimate harvesting capacity. Therefore, the following harvesting capacity assessments for the Pacific Islands Region fisheries will be difficult to understand and could easily be misinterpreted if those sections are not read first.

2. The Hawaii-Based Longline Fishery

2.1 Introduction

The vessels in the Hawaii-based longline fishery primarily harvest highly migratory species such as bigeye tuna, yellowfin tuna, swordfish, and other pelagic species. It is a limited entry fishery with a maximum of 164 permits, which are renewable and freely transferable. There are two types of fishing operations in this fishery: deep sets to target tuna and shallow sets to target swordfish. Most fishery regulations apply to both types of sets; however, there are additional regulations for the shallow sets.[60] Since 2004, the total number of shallow sets has been limited to a maximum of 2,120 sets through the use of shallow-set certificates that are issued fishery-wide each year. A longline vessel operator making shallow sets must have a current shallow-set certificate for each set. Shallow-set certificates are freely transferable to another Hawaii-based longline permit holder without any involvement by the Pacific Islands Regional Office (PIRO). There was not a limit on the number of deep sets, which are for tuna.

The Hawaii-based longline fishery for swordfish was closed for much of 2000 and all of 2001–2003. The limit on shallow sets, which was implemented April 1, 2004, allowed the fishery to reopen. However, there were only a few swordfish fishing trips in 2004 because the peak swordfish season had passed by late 2004 when the fishermen actually received the shallow-set certificates required to target swordfish. Even though 2004 was not a typical year for the longline swordfish fishery (and therefore for the Hawaii-based longline fishery as a whole), the capacity assessment was made for 2004 to be consistent with the assessments for other federally managed commercial fisheries.

The Hawaii-based longline fishery occurs in areas both inside and beyond the U.S. EEZ in the Pacific Ocean, which include separate areas managed by two Regional Fisheries Management Organizations—the Inter-American Tropical Tuna Commission (IATTC) in the Eastern Pacific Ocean (EPO) and the Western and Central Pacific Fisheries Commission (WCPFC) in the Western and Central Pacific Ocean (WCPO). Prior to 2005, there were no catch limits for any of the species caught by the Hawaii-based longline fishery. However, bigeye tuna catch limits were set for the U.S. longline fleets in the EPO and WCPO in 2005 and 2006, respectively, due to the overfishing status of bigeye tuna in the Pacific Ocean. Currently, the catch limit for the two areas combined is 4,664 metric tons (10.3 million pounds), with a limit of 4,164 metric tons (t) in the WCPO (i.e., west of 150° W.) and a limit of 500 t in the EPO (i.e., east of 150° W.). Only the latter has been set in a final rule (Federal Register: March 29, 2007, Volume 72, Number 60). The former is the estimated status quo. The aggregate bigeye tuna catch limit of 10.3 million pounds was used as the bigeye tuna TAC proxy in the assessment of overcapacity for 2004.

There were 124 active vessels in the Hawaii-based longline fishery in 2004. The physical and trip characteristics of these vessels are summarized in Table 2.1. The vessels ranged in length from 48 to 98 feet with a mean of 71 feet. Their gross tonnage was between 14 and 199 tons with a mean of 104. They had between 150 and 730 horsepower with a mean of 427. The number of trips per vessel ranged from 2 to 19 with a mean of 10.8. The vessels set between 240

[60] The fishery regulation can be found at: http://www.fpir.noaa.gov/SFD/SFD_permits_2.html

and 3,185 hooks per set with a mean of 2,000. The number of sets per trip ranged from 1 to 32 with a mean of 12. Crew size was between 3 and 8 with a mean of 5. In 2004, these vessels landed an estimated 17.81 million pounds, which consisted of 10.05 million pounds of bigeye tuna, 1.28 million pounds of yellowfin tuna, 0.37 million pounds of swordfish, and an additional 6.11 million pounds of other pelagic species (Tables 2.2 and 2.3).

2.2 Methods

DEA was used to estimate harvesting capacity by trip, species, and quarter. The outputs were bigeye tuna, yellowfin tuna, swordfish, and other pelagic species, which was an aggregate output. The fixed inputs were vessel length, gross tonnage, and the number of hooks.[61] The variable inputs were the number of sets and crew size. To reduce the influence of potential outliers on the capacity estimates, neither the upper nor the lower 5 percent of trips per quarter based on total catch of all species combined were used in estimating harvesting capacity. The trip level estimates for each vessel were averaged, and then multiplied by the observed number of trips for each vessel. In rare instances, the total number of trips for a vessel was adjusted downward if the capacity number of sets returned by the model was greater than the observed maximum number of sets for any vessel in the entire fleet. In these few cases, the calculated number of trips used as the expansion factor was always lower than the observed number of trips. Estimates by vessel and quarter were then aggregated across all four quarters and all 124 vessels to arrive at an estimate of total capacity.

2.3 Results

The Hawaii-based longline fleet had total estimated landings for all species combined of 17.8 million pounds in 2004, and the capacity estimates were 19.5 and 23.8 million pounds (Table 2.2). The lower estimate of capacity was approximately 10 percent above the estimated landings, while the higher estimate was roughly 34 percent above the estimated landings; therefore, only 75 percent and 91 percent, respectively, of the higher and lower estimated levels of capacity were used in 2004. Harvesting at capacity would have occurred with a small decrease in the number of trips per vessel, an increase to 13 sets per trip for both capacity estimates compared to 12 sets per trip in 2004, and a small decrease in the mean crew size for both capacity estimates.

The species-specific capacity estimates for bigeye tuna were 11 and 13.4 million pounds compared to estimated landings of 10 million pounds and a TAC proxy of 10.3 million pounds (Table 2.3). The resulting estimates of excess capacity were 1 and 3.4 million pounds. Therefore, only 75 percent and 91 percent of the estimated bigeye tuna capacity were used, respectively, with the higher and lower capacity estimates in 2004. The estimates of overcapacity were 0.7 and 3.1 million pounds. Therefore, the capacity estimates exceeded the TAC proxy by 7 percent and 30 percent, respectively, for the lower and higher capacity estimates. This indicates the presence of both excess capacity and overcapacity for bigeye tuna in 2004, but neither was exceptionally high. Despite the estimated presence of excess capacity and overcapacity, reported landings approached but did not exceed the bigeye tuna TAC proxy in

[61]Although we report the average horsepower of the longline fleet, many vessels had missing observations for horsepower. Therefore, horsepower was not included in the models.

2004. However, the estimates were based on the fishing trips that occurred in 2004 and, due to a significant regulatory change, there was an unusually small number of swordfish trips that year, which means that 2004 was not a typical year for the Hawaii-based longline fishery as a whole.

The species-specific capacity estimates for yellowfin tuna were 1.38 and 1.67 million pounds compared to estimated landings of 1.28 million pounds in 2004 (Table 2.3). The estimate of excess capacity for the lower and higher capacity estimates, respectively, were 0.11 and 0.40 million pounds. Therefore, for the lower capacity estimate, there was 8 percent excess capacity for yellowfin tuna and 92 percent of the estimated capacity was used in 2004. For the higher capacity estimate, there was 31 percent excess capacity and only 76 percent of the estimated capacity was used. A yellowfin tuna TAC proxy was not available; therefore, overcapacity could not be assessed.

Swordfish had a lower capacity estimate of 0.39 million pounds and a higher estimate of 0.47 million pounds compared to estimated landings of 0.37 million pounds. The estimate of excess capacity for the lower and higher capacity estimates, respectively, were 0.03 and 0.10 million pounds. Therefore, for the lower estimate, there was 7 percent excess capacity for swordfish and 93 percent of the estimated capacity was used in 2004. For the higher estimate, there was 27 percent excess capacity and only 78 percent of it was used. However, as noted above, 2004 was not a typical year for the longline swordfish fishery As with yellowfin tuna, a TAC proxy was not available; therefore, swordfish overcapacity could not be assessed.

Table 2.1 Vessel and trip characteristics for the vessels that were active in the Hawaii-based longline fishery in 2004.

Vessel Characteristics		**Trip Characteristics**	
Number of Vessels	124	Trips per Vessel	
Vessel Length		Minimum	2
Minimum	48	Maximum	19
Maximum	98	Median	10
Median	71	Mean	10.8
Mean	71	Sets per Trip	
Gross Tonnage		Minimum	1
Minimum	14	Maximum	32
Maximum	199	Median	12
Median	103	Mean	12
Mean	104	Crew Size	
Horsepower		Minimum	3
Minimum	150	Maximum	8
Maximum	730	Median	5
Median	400	Mean	5
Mean	427		
		Hooks per Set	
		Minimum	240
		Maximum	3,185
		Median	1,950
		Mean	2,000

Data sources: Vessel characteristics are based on U.S. Coast Guard vessel registration data, except the horsepower data are collected through the cost-earnings survey conducted by PIFSC economists in 2006; and trip characteristics are based on the Hawaii longline federal logbook data, NMFS PIFSC.

Note: Although we report the average horsepower of the longline fleet, many vessels had missing observations for horsepower.

Table 2.2 Harvesting capacity assessment for the vessels that were active in the Hawaii-based longline fishery in 2004 (million pounds, whole weight, all species combined).

Estimated Landings	17.81
Lower Capacity Estimate (LCE)	19.52
Higher Capacity Estimate (HCE)	23.85
Lower Excess Capacity Estimate	1.71
Higher Excess Capacity Estimate	6.04
Reported Landings as a % of the LCE	91%
Reported Landings as a % of the HCE	75%
The LCE as a % of Reported Landings	110%
The HCE as a % of Reported Landings	134%
Trips per Vessel	
Actual	10.8
Capacity	10.6
Sets per Trip	
Actual	12
Capacity	13
Mean Crew Size	
Actual	5
Capacity	4.9

Data source: The estimated landings and trip statistics are based on the Hawaii longline federal logbook data, NMFS PIFSC. Since the logbooks contain the recorded number of fish kept and not fish weight, fish weight was calculated as the product of the number of fish kept and an estimate of the average weight per fish.

Table 2.3 Species-specific harvesting capacity assessment for the vessels that were active in the Hawaii-based longline fishery in 2004 (million pounds, whole weight).

Species Specific Estimates	Bigeye Tuna	Yellowfin Tuna	Swordfish
Estimated Landings	10.0	1.28	0.37
TAC Proxy	10.3	N.A.	N.A.
Lower Capacity Estimate (LCE)	11.0	1.38	0.39
Higher Capacity Estimate (HCE)	13.4	1.67	0.47
Lower Excess Capacity Estimate	1.0	0.11	0.03
Higher Excess Capacity Estimate	3.4	0.40	0.10
Lower Overcapacity Estimate	0.7	N.A.	N.A.
Higher Overcapacity Estimate	3.1	N.A.	N.A.
Estimated Landings as a % of the LCE	91%	92%	93%
Estimated Landings as a % of the HCE	75%	76%	78%
TAC Proxy as a % of the Estimated Landings	102%	N.A.	N.A.
LCE as a % of the Estimated Landings	110%	108%	107%
HCE as a % of the Estimated Landings	134%	131%	127%
TAC Proxy as a % of the LCE	93%	N.A.	N.A.
TAC Proxy as a % of the HCE	77%	N.A.	N.A.
Estimated Landings as a % of the TAC Proxy	98%	N.A.	N.A.
LCE as a % of the TAC Proxy	107%	N.A.	N.A.
HCE as a % of the TAC Proxy	130%	N.A.	N.A.

Data source: The estimated landings are based on the Hawaii longline federal logbook data, NMFS PIFSC. Since the logbooks contain the recorded number of fish kept and not fish weight, fish weight was calculated as the product of the number of fish kept and an estimate of the average weight per fish based on market weight adjusted to whole weight.

Note: There was not a TAC proxy for either yellowfin tuna or swordfish in 2004; therefore, overcapacity could not be assessed and no comparisons between the TAC proxy and either estimated landings or estimated capacity could be made for those two species and N.A. appears instead of those comparisons.

3. The Northwestern Hawaiian Islands Bottomfish Fishery

3.1 Introduction

The NWHI bottomfish fishery is also a limited entry fishery. A limited entry permit is required to fish for bottomfish management unit species (BMUS) in the EEZ around the NWHI, the islands, atolls, and reefs northwest of the main populated islands of the Hawaiian Archipelago. This area is subdivided into two subareas—the Mau zone from 161º 20’ W. longitude to 165º W. long., and the Hoomalu zone west of 165º W. long. Separate permits are issued for each subarea. Currently, access to the Hoomalu zone and the Mau zone is limited to 7 and 10 permits, respectively. In total, there were 9 active vessels with NWHI bottomfish permits in 2004. Due to the creation of the NWHI Marine National Monument in 2006,[62] all fishing (including bottomfish fishing) within the NWHI area will end in 2011. In addition, the NWHI bottomfish fishery will be limited to a total of 8 vessels until it ends in 2011 (this was the number of active vessels when the monument was established).

The commercial vessels in the NWHI bottomfish fishery harvest various species of bottomfish (mostly snapper and grouper) using handline gear. The 14 BMUS caught in the Hawaii fisheries are listed below.

1. Onaga (etelis coruscans)
2. Opakapaka (pristipomoides filamentosus)
3. Ehu (e. Carbunculus)
4. Kalekale (p. Seiboldii)
5. Gindai (p. Zonatus)
6. Uku (aprion virescens)
7. Lehi (aphareus rutilans)
8. Yellowtail kalekale (p. Auricilla)
9. Hapu'upu'u (epinephelus quernus)
10. Butaguchi (pseudocaranx dentex)
11. White ulua (caranx ignobilis)
12. Black ulua (c. Lugubris)
13. Kahale (seriola dumerili)
14. Taape (lutjanus kasmira)

In addition, these vessels harvest some pelagic species and a few other non-BMUS.

The NWHI area is the primary fishing ground of the NWHI bottomfish fleet, but in 2004 some of the vessels with NWHI bottomfish permits also fished in the main Hawaiian Islands (MHI) area, which was an open access area. In order to have the harvesting capacity assessment for the NWHI bottomfish fleet for all species combined (Table 3.2) cover all the bottomfish fishing activities of that fleet, that assessment was done for both areas (NWHI and MHI) combined. However, the species group–specific assessment (Table 3.3) was done just for the NWHI area, which means that the harvesting capacity of the NWHI bottomfish fleet for NWHI area

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[62]Information concerning the NWHI Marine National Monument can be found at: http://www.hawaiireef.noaa.gov/welcome.htm

bottomfish was compared to the NWHI area bottomfish TAC. A comparison of that fleet's harvesting capacity for bottomfish to the bottomfish TAC either for the two areas combined or for the MHI area alone was not feasible, because other vessels (mostly part-time commercial and recreational fishing vessels) accounted for part of the catch and, therefore, used part of the MHI area bottomfish TAC. In addition, the data required to assess harvesting capacity for the other vessels were not available.

The physical and trip characteristics of the 9 active vessels in the NWHI bottomfish fleet in 2004 are summarized in Table 3.1. The vessels ranged in length from 31 to 46 feet with a mean of 40 feet. Data on other physical characteristics were not available for all nine vessels. The number of trips per vessel ranged from 7 to 38 with a mean of 14.8. The vessels fished for 1 to 17 days per trip with a mean of 6, and fished for 1 to 176 hours per trip with a mean of 53.1. The vessels that took short, one-day trips fished for an average of 7 hours per trip. Some vessels made both one-day and multi-day trips. One-day trips tended to be in the MHI area and the multi-day trips tended to be in the NWHI area. The estimated landings from both areas for all species combined were 363 thousand pounds in 2004 (Table 3.2).

3.2 Methods

One DEA model was used to estimate capacity by trip for all trips in 2004 due to the small fleet size and the low total number of trips. Because there was a distinction between fishing activities based on trip length, both vessel length and days at sea were considered fixed inputs. Hours fished per trip was the variable input. Outputs were grouped into bottomfish, pelagic species, and other non-bottomfish species, by fishing area. In total there were six outputs (i.e., three for each of the two areas). For both the one-day trips and the multi-day trips, the upper and lower 5 percent of trips based on total catch of all species combined were not used in estimating harvesting capacity. This was done in order to reduce the influence of potential outliers on the capacity estimates. Average capacity per trip was then expanded by the observed number of trips for each vessel. In rare instances, the total number of trips for a vessel was adjusted downward if the estimated capacity hours fished was greater than observed for any vessel in the fleet. Total capacity was the sum of individual capacity estimates for all vessels in the fleet. The MSY, based on the stock assessment report *Status of the Hawaiian Bottomfish Stocks, 2004* (Moffitt et. al. 2006) is used as the TAC proxy in this report.

3.2 Results

The capacity estimates for all species combined for the 9 active vessels in this fishery were based on activity in both the MHI and NWHI fishing areas. The NWHI bottomfish fleet had total estimated landings for all species combined of 363 thousand pounds in 2004, and the capacity estimates were 374 and 447 thousand pounds (Table 3.2). The lower estimate of capacity was approximately 3 percent above the estimated landings, while the higher estimate was roughly 23 percent above the estimated landings. This means that in 2004 the fleet used 81 percent and 97 percent, respectively, of its higher and lower estimated harvesting capacity. Harvesting at capacity would have occurred with a small reduction in the number of trips per vessel and an increase in the hours per trip to 54.7 compared to 51.9 hours per trip in 2004.

The species-specific capacity estimates for NWHI area bottomfish alone were 268 and 320 thousand pounds compared to estimated landings of 266 thousand pounds and a TAC proxy of 449 thousand pounds in 2004 (Table 3.3). Therefore, bottomfish harvesting capacity exceeded estimated bottomfish landings in 2004 by 3 thousand pounds or 1 percent for the lower capacity estimate, and by 54 thousand pounds or 20 percent for the higher estimate. This means that the fleet used 83 percent and 99 percent, respectively, of its higher and lower estimated bottomfish capacity in 2004. However, both harvesting capacity estimates were less than the TAC proxy, which indicates there was not overcapacity for NWHI area bottomfish in 2004. The lower and higher harvesting capacity estimates, respectively, were only 60 percent and 71 percent of the TAC proxy, which indicates that a large increase in harvesting capacity, the fleet's total fishing effort, or the part of its total fishing effort focused on NWHI area bottomfish would have been required to take the NWHI area bottomfish TAC proxy in 2004. Only 59 percent of the NWHI area bottomfish TAC proxy was taken in 2004. Therefore, based on the estimates of harvesting capacity, the rate of excess capacity was minimal to moderate and there was no overcapacity. In fact, there was substantial undercapacity for NWHI area bottomfish by the NWHI bottomfish fleet.

Table 3.1 Vessel and trip characteristics for the vessels that were active in the Northwestern Hawaiian Islands (NWHI) bottomfish fishery in 2004.

Vessel Characteristic	
Number of Vessels	9
Vessel Length	
Minimum	31
Maximum	46
Median	42
Mean	40
Trip Characteristics	
Trips per Vessel	
Minimum	7
Maximum	38
Median	10
Mean	14.8
Days per Trip	
Minimum	1
Maximum	17
Median	4
Mean	6
Hours per Trip	
Minimum	1
Maximum	176
Median	33.5
Mean	53.1

Data sources: The vessel characteristics are based on the cost-earnings survey conducted by PIFSC economists in 2004 (Pan and Griesemer 2006); and the trip characteristics are based on fishermen's logbook data collected by the Division of Aquatic Resources, State of Hawaii.

Note: The trip characteristics are for trips by the NWHI bottomfish fleet in the NWHI and MHI areas.

Table 3.2 Harvesting capacity assessment for the vessels that were active in the Northwestern Hawaiian Islands (NWHI) bottomfish fishery in 2004 (thousand pounds, whole weight, all species combined for the NWHI and MHI areas).

Estimated Landings	363.3
Lower Capacity Estimate (LCE)	373.5
Higher Capacity Estimate (HCE)	446.6
Lower Excess Capacity Estimate	10.2
Higher Excess Capacity Estimate	83.2
Estimated Landings as a % of the LCE	97%
Estimated Landings as a % of the HCE	81%
The LCE as a % of Estimated Landings	103%
The HCE as a % of Estimated Landings	123%
Trips per Vessel	
Actual	14.8
Capacity	14.3
Hours per Trip	
Actual	51.9
Capacity	54.7

Data sources: The vessel characteristics are based on the cost-earnings survey conducted by PIFSC economists in 2004 (Pan and Griesemer 2006); the trip characteristics are based on fishermen's logbook data collected by the Division of Aquatic Resources, State of Hawaii; and the estimated landings are based on the dealer data collected by the Division of Aquatic Resources, State of Hawaii.

Table 3.3 Species group–specific harvesting capacity assessment for the vessels that were active in the Northwestern Hawaiian Islands (NWHI) bottomfish fishery in 2004 (thousand pounds of NWHI area bottomfish, whole weight).

Species Group Specific Estimates	NWHI Bottomfish
Estimated Landings	266
TAC Proxy (NWHI only)	449
Lower Capacity Estimate (LCE)	268
Higher Capacity Estimate (HCE)	320
Lower Excess Capacity Estimate	3
Higher Excess Capacity Estimate	54
Lower Overcapacity Estimate	-180
Higher Overcapacity Estimate	-129
Estimated Landings as a % of the LCE	99%
Estimated Landings as a % of the HCE	83%
TAC Proxy as a % of the Estimated Landings	169%
LCE as a % of the Estimated Landings	101%
HCE as a % of the Estimated Landings	120%
TAC Proxy as a % of the LCE	167%
TAC Proxy as a % of the HCE	140%
Estimated Landings as a % of the TAC Proxy	59%
LCE as a % of the TAC Proxy	60%
HCE as a % of the TAC Proxy	71%

Data source: The estimated landings are based on the dealer data collected by the Division of Aquatic Resources, State of Hawaii. The TAC proxy was based on the MSY estimated by Moffitt et. al. and reported in Status of the Hawaiian Bottomfish Stocks, 2004 (Pacific Islands Fisheries Science Center, Administrative Report H-06-01).

APPENDIX 11

Workshop Participants

First Overcapacity Workshop
Washington, D.C.
September 7–9, 2005

Name	Affiliation
Lee Anderson	NMFS Office of Policy
Jim Balsiger*	NMFS Director's Office
Erika Carlsen*	NMFS Office of International Affairs
Ray Clarke	NMFS/Pacific Islands Regional Office
Rita Curtis	NMFS Office of Science & Technology
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José Montañez	Mid-Atlantic Fishery Management Council
Steve Murawski*	NMFS Director's Office
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Dale Squires	NMFS Southwest Fisheries Science Center
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Galen Tromble	NMFS Office of Sustainable Fisheries
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* Participated in part of the workshop

Second Overcapacity Workshop
Southwest Fisheries Science Center
La Jolla, California
March 28–30, 2006

Rita Curtis	NMFS Office of Science & Technology
Ron Felthoven	NMFS Alaska Fisheries Science Center
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Carl Lian	NMFS/Northwest Fisheries Science Center
Christopher Liese	NMFS/Southeast Fisheries Science Center
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John Walden	NMFS Northeast Fisheries Science Center
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* Participated in part of the workshop via conference call or video conference.
** Participated in part of the workshop.

APPENDIX 12

List of Documents Prepared for the First Overcapacity Workshop

1. Defining and Assessing Overcapacity: A Background/Discussion Paper (August 30 Draft)

2. Overcapacity Workshop Description & Agenda (September 1 Draft)

3. Case Study 1: Thoughts Generated While Considering Overcapacity In The Surfclam And Ocean Quahog Fleet (Lee G. Anderson)

4. Case Study 2: The Atlantic Pelagic Longline Fishery (Chris Rogers)

5. Case Study 3: The International Bigeye Tuna Fishery (Chris Rogers)

6. Case Study 4: Federally Managed Fisheries Off Alaska: An Overview (Ron Felthoven)

7. Case Study 5: The Northeast Multispecies Fishery (John Walden)

APPENDIX 13

Data Envelopment Analysis and Estimating Capacity Output

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Note: This Appendix is based on Appendix A in the March 31, 2006, NMFS report *Assessments of Excess Fishing Capacity in Select Federally Managed Commercial Fisheries.*

1. Introduction

The assessments of harvesting capacity in this report are based on a mathematical programming approach called data envelopment analysis (DEA). Although this non-parametric, non-statistical approach was employed by others earlier as a way to estimate and assess technical efficiency in production, the term data envelopment analysis was first introduced to the Operations Research literature in 1978 by Charnes, Cooper, and Rhodes (CCR).[63] Technical efficiency is a measure of how close observed levels of outputs (inputs) are to potential maximum (minimum) levels of outputs (inputs). Alternatively, it is a measure of how close observed levels are to those output levels corresponding to a production frontier, which represents the technically efficient combination of outputs and inputs. The intellectual roots of DEA, however, actually extend back to the early 1950s with the Cowles Commission monograph (1951), Activity Analysis of Production and Resource Allocation, which was edited by Koopmans (Ray 2004). The CCR approach was an extension of the single output-single input ratio first introduced by Farrell (1957), who also developed a mathematical programming approach for estimating technical efficiency. Farrell's work was generated by the fact that mathematical functions relating outputs to inputs, and estimated by ordinary least squares, could not yield adequate information about efficiency because observed data points would lie on both sides of the fitted function. Farrell's concept of technical efficiency is also the same as the distance function approach proposed by Shephard (1953). There is, thus, a rather long history of using DEA to assess technical efficiency.

In contrast to Farrell, the CCR approach allowed for the estimation of technical efficiency for a production technology producing multiple outputs using multiple inputs, but subject to constant returns to scale. Banker, Charnes, and Cooper (BCC) introduced the multiple output, multiple input DEA framework under variable returns to scale. With the Farrell, CCR, and BCC frameworks, technical efficiency occurs when it is no longer possible to increase production of an output, given no change in input levels. In contrast, Koopmans defined a level of production as efficient whenever an increase in that output could only be achieved by a reduction in production of another output. Debreu introduced an alternative concept of technical efficiency in 1951. Debreu defined a "coefficient of resource utilization" as a measure of technical efficiency for the economy as a whole. Under Debreu's notion, any deviation of his measure from a value of 1 indicated some level of deadweight loss suffered by society because of inefficient utilization of resources.

However, DEA is but one of several methods for estimating and assessing technical efficiency.[64] Aigner and Chu (1968) proposed using mathematical programming to estimate a parametric specification of a production frontier, but constraining all observed output levels to be below the function. Another approach is a statistical frontier, which assumes that technical efficiency follows some statistical distribution such as the one-parameter gamma distribution or the exponential distribution; this approach requires a mathematical specification relating outputs to inputs, an assumption about the distribution of the efficiency term, and corrected ordinary least squares. A third approach, and now frequently used to estimate efficiency, is the stochastic

[63]Detailed discussions about DEA are available in Charnes et al. (1994), Ray (2004), Färe et al. (1985, 1994), and Cooper et al. (2000, 2006).
[64]For a discussion on additional methods, see Corbo and de Melo (1986) in Dogramaci (ed.).

production frontier (SPF) approach. This is similar to the statistical frontier, but also includes an error for statistical noise. Estimation of technical efficiency using the SPF approach requires specification of a functional form; an assumption about the distribution of the error term; and maximum likelihood estimation.

DEA is nonparametric, which means that no production, cost or profit function is directly estimated from the data (Ray 2004). That is, DEA imposes no specific underlying functional form on the correspondence between inputs and outputs. This is also, however, a criticism of DEA because DEA precludes estimation of marginal products, partial elasticities, marginal costs, or elasticities of substitution from a fitted model. A countervailing argument, however, is that since DEA is nonparametric, it does not impose rigid interactions between inputs and outputs, as is done with the approaches requiring the specification of a functional form. Another major criticism of DEA is that it is non-statistical, and thus, leaves no room for hypothesis testing. However, there are numerous nonparametric tests that can be used to examine hypothesis about production, and bootstrapping techniques have been developed to facilitate estimation of statistical confidence intervals. The latter development is particularly useful because it counters the criticism that DEA estimates attribute all noise or randomness to technical inefficiency.[65]

DEA estimates efficiency by comparing observed outputs (inputs) to a linear, piece-wise technology reflecting the best-practice (efficient) frontier technology. The best-practice frontier technology is a reference technology that depicts the most technically efficient combinations of inputs and outputs. There are three possible orientations of DEA[66]: (1) determine minimum level of inputs required to produce a given output; (2) determine maximum level of outputs that can be produced given existing levels of inputs; or (3) determine maximum expansion of outputs and contraction of inputs such that production is technically efficient.

2. Estimating Technical Efficiency and Capacity Using DEA

Technical efficiency is most often estimated from either the output or input orientation. Estimation can be based on solving a fractional programming problem in ratio form, or a dual linear programming problem in terms of the inverses of mathematical distance functions. For the purposes of estimating efficiency and capacity in this report, attention is restricted to the output orientation; the use of inverse output distance functions; radial expansions of outputs; and the framework of Färe (1984) and Färe et al. (1989).

[65] Coelli et al. (2005), however, demonstrate that the bootstrap does not actually incorporate noise. Alternatively, it provides information for dealing with sampling variability. They also suggest that if one has census data, rather than sample data, there is no need to conduct the bootstrap.

[66]For additional information about orientations and primal vs. dual linear programming specifications, see Cooper et al. (2000, 2006), Färe and Grosskopf (2004), Ray (2004), and Hsu (2003).

From an output orientation, technical efficiency represents the ratio of the observed levels of outputs to the maximum potential levels of outputs, given no change in input usage.[67] For the purpose of estimating technical efficiency in this study, we seek to determine the maximum potential expansion of outputs, along a ray (i.e., radial expansions of all outputs) without increasing the levels of fixed and variable inputs.[68] For the purpose of estimating capacity, we also seek to determine the maximum potential radial expansion in output levels, but allowing the levels of the variable inputs to adjust to their full utilization levels (i.e., the fixed inputs are not allowed to change while the variable inputs are allowed to change accordingly to the levels required to produce the capacity output).

Estimation of technical efficiency, from an output orientation, is accomplished by solving a linear programming (LP) problem corresponding to all observations. The more common LP problem is to determine the inverse of an output distance function corresponding to a wide array of output and input constraints. The value of this inverse distance function, θ, represents the proportion by which all outputs can be expanded, and is restricted by being ≥ 1.0 in value. Thus, if the value of $\theta = 1.5$, we say that, with technically efficient use of all inputs, outputs could be expanded by 50 percent. With DEA, we seek to determine a best practice frontier, which depicts the technically efficient combination of inputs and outputs. We do this by solving the following LP problem:

$$TE_{ocj} = \underset{\theta, z, \lambda}{Max\,\theta}$$

$$\text{subject to } \theta u_{jm} \leq \sum_{j=1}^{J} z_j u_{jm}, m = 1, \ldots, M,$$

$$\sum_{j=1}^{J} z_j x_{jn} \leq x_{jn}, n = 1, \ldots, N \qquad (1)$$

$$\sum_{j=1}^{J} z_j = 1.0$$

$$z_j \geq 0, j = 1, 2, \ldots, J$$

where θ is a measure of technical efficiency, TE, ($\theta \geq 1.0$); x is a vector of fixed and variable inputs; z is a vector of intensity variables used to construct the piece-wise technology; u is a vector of outputs; m indicates the m^{th} output; n indicates the n^{th} input; and j is the j^{th} observation. The constraint $\Sigma_j z_j = 1.0$ imposes variable returns to scale; deleting this constraint imposes constant returns to scale on the underlying production technology.

[67] Färe et al. (1994), Coelli et al. (1998), and Ray (2004) provide a detailed discussion on input vs. output oriented concepts of technical efficiency.

[68] DEA-derived estimates of technical efficiency need not be restricted to radial expansions; for further information, see Russell (1985), Ray (2004), and Färe and Grosskopf (2004).

To estimate capacity, we follow the DEA framework of Färe (1984) and Färe et al. (1989). Färe and Färe et al. demonstrated that capacity output, similar to the Johansen (1968) notion of capacity, could be estimated by solving the same problem used to estimate technical efficiency, but omitting the variable inputs. In this case, only the fixed inputs constrain output levels. The basic DEA problem is as follows:

$$
(2)\quad
\begin{aligned}
& TE_{ocj} = \underset{\theta,z,\lambda}{Max\,\theta} \\
& \text{subject to } \theta u_{jm} \le \sum_{j=1}^{J} z_j u_{jm},\ m = 1,\ldots,M, \\
& \sum_{j=1}^{J} z_j x_{jn} \le x_{jn},\ n \in F_x \\
& \sum_{j=1}^{J} z_j = 1.0 \\
& z_j \ge 0,\ j = 1,2,\ldots,J
\end{aligned}
$$

where θ is a measure of technical efficiency, TE, ($\theta \ge 1.0$), but interpreted as the proportion by which observed output can be expanded to yield capacity output; F is a vector of fixed inputs; z is a vector of intensity variables used to construct the piece-wise technology; u is a vector of outputs; m indicates the m^{th} output; n indicates the n^{th} fixed input; and j is the j^{th} observation. If we multiply the observed output by θ, we obtain an estimate of capacity output. If $\theta = 1.0$, output or production equals the capacity output, and if, for example, $\theta =1.7$, outputs could be expanded by 70 percent.

Capacity can also be estimated by solving the same problem but including nonbinding variable input constraints in order to make it explicit that the variable inputs are, in fact, decision variables. To ensure that the variable inputs, however, are not constraining, another parameter, λ, is added to the constraint, and the constraint is written as $\sum_j z_j x_{jn'} = \lambda_{jn'} x_{jn'}$, where n' corresponds only to the variable inputs. With this addition to the constraint, the solution to that problem provides an estimate of λ_{jn}. This facilitates the determination of the full utilization level for each variable input because λ_{jn} equals the ratio of the of the full utilization level for each variable input to the observed input level (i.e., the full variable input utilization rate).

Problems (1) and (2) impose strong disposability in outputs and variable returns to scale. Under strong disposability, it is assumed that a producer has the ability to dispose of any unwanted commodities without incurring any additional production cost or experiencing a loss in revenue. Under variable returns to scale, increasing all input levels by the same proportion will result in a different proportional change in output levels. For example, if all inputs are doubled, output levels might double (constant returns to scale), less than double (decreasing returns to scale), or more than double (increasing returns to scale).

The important aspect of variable returns to scale is that it permits different rates of change in output levels as input levels change. In fact, constant returns, decreasing returns, and increasing returns are all possible with variable returns to scale imposed on the technology. As noted above, the constraint $\Sigma z_j = 1.0$ imposes variable returns to scale. Constant returns to scale is a very common assumption imposed on the technology in the analysis of non-natural resource based industries (e.g., automobile manufacturing). In most production analysis, variable returns to scale is initially imposed and statistically examined. Since DEA is non-parametric, it is not possible to test for the validity of constant vs. non-constant returns to scale.[69] The assumption of variable returns to scale, however, results in estimates of capacity that are lower than they would be under constant returns to scale, but more likely to reflect the technology of fishing vessels.

Capacity output can only be realized through the full utilization of the variable inputs. The full-utilization level of the variable inputs can be determined by estimating the variable input utilization rate (VIUR). The solution to problem (2), with the modified constraint, may be used to estimate the VIUR. The variable input utilization rate for the n^{th} variable input is estimated as follows (Färe et al. 1994):

$$\lambda^*_{jn} = \frac{\sum_{j=1}^{J} z_j x^*_{jn}}{x_{jn}}, n \in V_x \tag{3}$$

where λ^* equals the ratio of the level of the n^{th} variable input required to produce the capacity level to the observed usage of the n^{th} variable input. A value of $\lambda > 1.0$ indicates a variable input whose usage needs to be expanded to achieve the capacity level of output; $\lambda < 1.0$ implies that usage of the variable input should be reduced (i.e., it could be reduced without preventing the attainment of the capacity level of output).

3. Two Simple Numerical Examples

To illustrate how the DEA models work, we use two simple examples that were included in an early draft report prepared by the NMFS National Fishing Capacity Task Force for Defining and Measuring Fishing Capacity. The first example has two hypothetical firms that produce one output with two inputs.[70] The firms use one fixed input, capital, and one variable input, labor. The observed outputs and inputs for each of the firms are presented in the table below.

	Capital = $x_{.,1}$	Labor = $x_{.,2}$	Output = y_j
Firm 1	$x_{1,1} = 100$	$x_{1,2} = 100$	$y_1 = 100$
Firm 2	$x_{2,1} = 100$	$x_{2,2} = 70$	$y_2 = 60$

[69] Banker and Maindiratta (1986) present a DEA model which permits the estimation and assessment of returns to scale. This is also discussed and illustrated in Cooper et al. (2006).

[70] It is assumed that both firms use the same production technology and homogeneous fixed and variable inputs to produce homogeneous products.

First consider Fare's DEA model of capacity for Firm 2:

$$Max_{(\theta,z)}\theta$$

subject to:

the constraint on output

$$z_1 * 100 + z_2 * 60 \geq \theta * 60$$

the constraint on the fixed input (capital)

$$z_1 * 100 + z_2 * 100 \leq 100$$

and the nonnegativity constraint on the z_j

$$z_j \geq 0, j = 1,2$$

In this capacity model, the constraint on the variable input, labor, was dropped. The objective function is maximized for Firm 2 by setting $z_1 = 1$, $z_2 = 0$. This allows θ to take a maximum value of 1.67. Thus, the model tells us that Firm 2 could have produced 100 units of output (1.67 times what it did produce and therefore produce as much output per unit of fixed inputs as Firm 1) if it had been as technically efficient as Firm 1 and used variable inputs as fully as Firm 1 (i.e., used 100 unit of labor instead of 70). It is important to remember that this estimate of technical capacity is relative not absolute (i.e., the DEA capacity model always gives results only in relation to the best observed practices which in this case includes only an observation of Firm 1).

The standard DEA model, where both fixed and variable inputs are considered, shows that Firm 1 is technically more efficient than Firm 2:

$$Max_{(\theta,z)}\theta$$

subject to:

the constraint on output

$$z_1 * 100 + z_2 * 60 \geq \theta * 60$$

the constraint on the fixed input (capital)

$$z_1 * 100 + z_2 * 100 \leq 100$$

the added constraint on the variable input (labor)

$$z_1 * 100 + z_2 * 70 \leq 70$$

and the nonnegativity constraint on the z_j

$$z_j \geq 0, j = 1,2$$

We maximize θ for Firm 2 by setting $z_2 = 0$; however, z_1 is constrained to a maximum value of 0.7 by the constraint on labor which in turn constrains θ to a maximum value of 1.17. Thus, this DEA model suggests that if Firm 2 had used its present level of fixed and variable inputs as efficiently as Firm 1, it would have been able to produce 70 units of output (1.17 times its actual production). Note that the efficient level of output of 70 units is lower than the capacity output of 100 units because it is constrained by the observed level of variable inputs used by Firm 2.

The models for Firm 1 can be set up and solved by simply substituting Firm 1's output and inputs on the right hand side of the constraints. Both the capacity and technical efficiency models are maximized by setting $z_2 = 0$, $z_1 = 1$. This allows θ to take a maximum value of 1.0. Thus, Firm 1 is simply compared against itself and found to be both efficient and producing at capacity. It is important to note that we do not know whether the efficiency or variable input utilization of Firm 1 could have been increased.[71] This might have increased the estimates of capacity for both Firm 1 and Firm 2. Thus, estimates of capacity are relative to observed practices, not absolute.

Normally, we would expect to have observations on more than two firms. In such cases, the model may pick one "technically efficient" firm to compare against (i.e., the z for that firm will be positive and all others will be zero) or it may pick a linear combination of firms (i.e., more than one z is positive and all others are zero). The latter case is illustrated using an example with three firms. Again the firms produce one output using one fixed input, capital, and one variable input, labor. The observed outputs and inputs for each of the firms are presented in the table below.

	Capital = $x_{j,1}$	Labor = $x_{j,2}$	Output = y_j
Firm 1	$x_{1,1} = 100$	$x_{1,2} = 50$	$y_1 = 100$
Firm 2	$x_{2,1} = 100$	$x_{2,2} = 100$	$y_2 = 50$
Firm 3	$x_{3,1} = 50$	$x_{3,2} = 100$	$y_3 = 100$

[71]An alternative DEA model, the additive model, can, however, be used to determine the need to expand or contract inputs or outputs. The additive model is further discussed in Cooper et al. (2006).

Consider, for Firm 2, the standard DEA model that measures technical efficiency

$$Max_{(\theta,z)}\theta$$

subject to:

the constraint on output

$$z_1 * 100 + z_2 * 50 + z_3 * 100 \geq \theta * 50$$

the constraint on the fixed input, capital

$$z_1 * 100 + z_2 * 100 + z_3 * 50 \leq 100$$

the constraint on the variable input, labor

$$z_1 * 50 + z_2 * 100 + z_3 * 100 \leq 100$$

and the nonnegativity constraint on the z_j

$$z_j \geq 0, j = 1,2,3$$

The objective function is now maximized for Firm 2 by setting $z_1 = z_3 = 0.67$, and $z_2 = 0$. This allows θ to take a maximum value of *2.67*. Thus the model suggests that Firm 2, had it been technically efficient, could have produced 133.5 units of output (2.67 times what was actually produced).

The standard DEA model, rather than the capacity model, was used for this example to illustrate how a linear combination of frontier firms can be used to determine efficiency. With the capacity model, where the constraint on labor is dropped, Firm 3 would be the only frontier firm since it has the highest output to capital ratio. The solution to the capacity model from the perspective of Firm 2 is simple. The objective function is now maximized by setting $z_3 = 1$, and $z_1 = z_2 = 0$. This allows θ to take a maximum value of 4.0. Thus the model suggests that Firm 2, were it technically efficient and using the variable input as fully as Firm 3, could have produced 200 units of output (four times what was actually produced).

The models presented above implicitly assume constant returns to scale (e.g., if all inputs are doubled or tripled, output will be doubled or tripled). As noted above, variable returns to scale (VRS) can be imposed by adding the following constraint to the model:

$$\sum_{j=1}^{J} z_j = 1$$

Essentially this constraint ensures that inefficient firms are only benchmarked against other firms of similar size.[72] The resulting technical efficiency scores are always less than or equal to those produced by the constant returns to scale (CRS) model (i.e., the efficient level of production calculated by the VRS model will never be greater than that calculated by the CRS model). The effect of adding this constraint to the example of the standard DEA model with three firms presented above is to restrict z_1 and z_3 to 0.5 (the model still constrains z_2 to 0) which contracts θ to a maximum value of 2.0. Thus the VRS model suggests that Firm 2, had it been technically efficient, could have produced 100 units of output (2.0 times what was actually produced).

In the simple case of one fixed input, one output and CRS, the capacity of each firm is equal to the product of the level of its fixed input and the maximum output to fixed input ratio of any of the firms. In the first example, the output to fixed input ratios are equal to 1 for Firm 1 and 0.6 for Firm 2; therefore, the capacity for each firm is 100 units of output (i.e., 100 units of capital * 1 unit of output/unit of capital) because they both have 100 units of capital, the fixed input. In the example with the three firms, Firm 3 has the maximum ratio of output to capital (100 to 50); therefore, Firms 1 and 2 each has capacity equal to 200 units of output (100 units of capital * 2 units of output/unit of capital) because each had 100 units of capital, and the capacity of Firm 3 is its actual level of output, 100 units of output (50 units of capital * 2 units of output/unit of capital). In that example, but with VRS, Firms 1 and 2 would be compared to each other because they had a similar level of capital, but they would not be compared to Firm 3, which had only half as much capital. In that case, the capacity of Firms 1 and 2 would be 100 units of output (100 units of capital * 1 unit of output/unit of capital) and the capacity of Firm 3 would be its actual level of output because there is no firm with a similar level of capital. This simple method of estimating capacity using the maximum output to input ratio obviously breaks down and the linear programming model needs to be used when there are multiple fixed inputs and/or multiple outputs. However, this very simple case is useful in making it easier to understand the DEA models used to estimate harvesting capacity.

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[72] A firm may be compared to a linear combination of firms with higher and lower levels of inputs and outputs.

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