National Overview

INTRODUCTION

The conservation and management of living marine resources (LMR's) in the United States is entrusted to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS), which carries out its charge under many laws, treaties, and legislative mandates from the U.S. Congress. Most of the agency's stewardship responsibilities come from five statutes:

- The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) regulates fisheries within the U.S. Exclusive Economic Zone (EEZ),
- The Endangered Species Act (ESA) protects species that are in danger of extinction or likely to become an endangered species,
- The Marine Mammal Protection Act (MMPA) regulates the taking of marine mammals,
- The Fish and Wildlife Coordination Act (FWCA) authorizes collection of fisheries data and coordination with other agencies for environmental decisions affecting LMR's, and
- The Federal Power Act provides for concurrent responsibilities with the U.S. Fish and Wildlife Service (USFWS) in protecting aquatic habitat.

The NMFS regulates fisheries in the 3–200 nautical mile (n.mi.) Federal EEZ seaward of the 48 contiguous states, Alaska, Hawaii, and U.S.-affiliated islands (Figure 1). Within the 0–3 n.mi. territorial sea,[1] management jurisdiction belongs to the coastal states and multistate fisheries commissions. International waters outside the U.S. EEZ are regu-

[1]Territorial waters extend 9 n.mi. off the shores of Texas, the Florida Gulf Coast, and Puerto Rico.

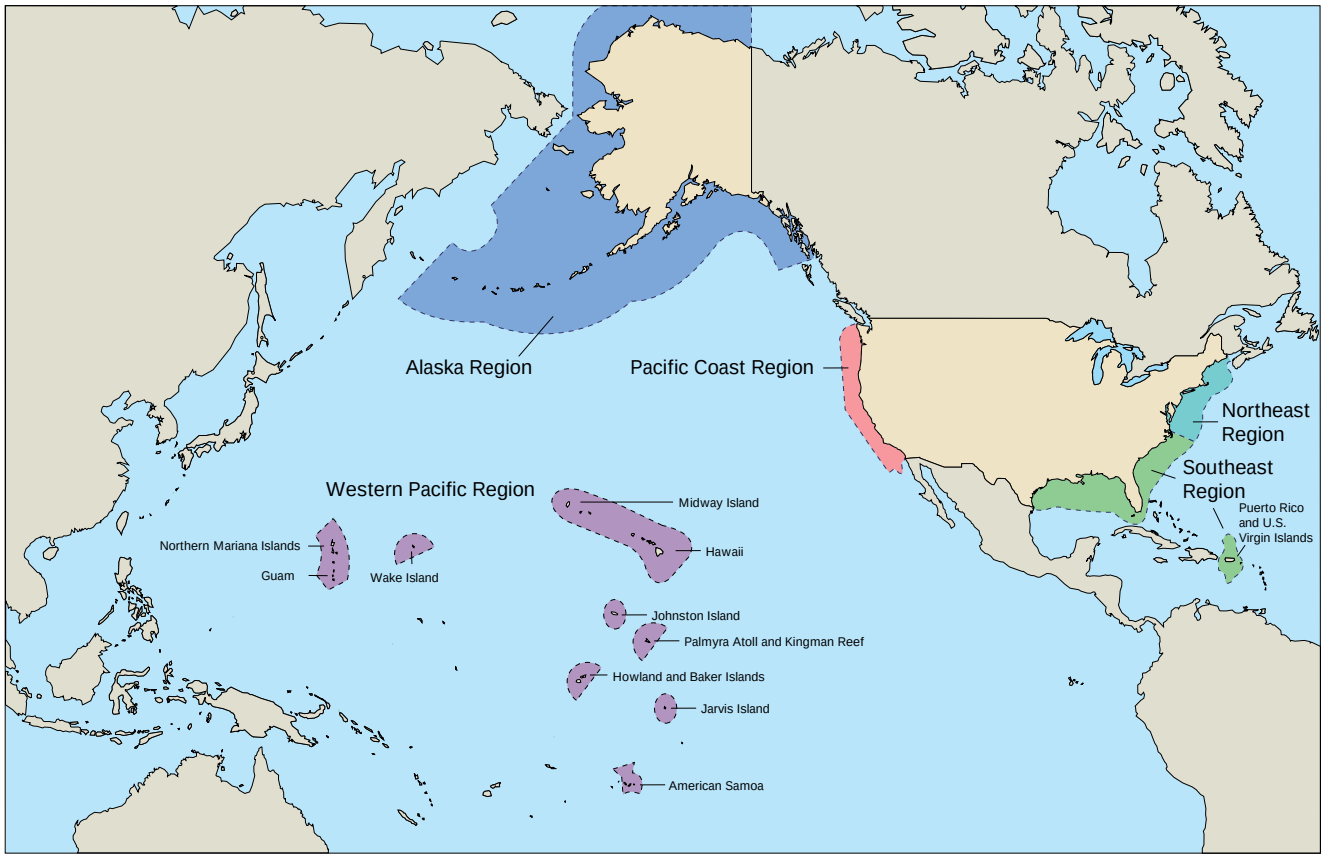

Figure 1
Our Living Oceans 1999 divides the 200-nautical-mile U.S. Exclusive Economic Zone (EEZ) into five regions for purposes of reporting the status of U.S. living marine resources.

lated by applicable international laws and multilateral agreements among sovereign governments, and the agency plays an important role on behalf of the United States in the implementation of those international arrangements. Federal resource conservation laws require that the best scientific information be used as the basis for management actions. NMFS scientists collect and analyze much of these data. From these data bases, the agency prepares scientific reports and makes technical presentations to fishery managers, industry groups, and the public for use in formulating sound policies governing the long-term protection and sustainable use of U.S. LMR's.

Ultimately, the Secretary of Commerce has management responsibility for most marine life in U.S. waters. Fishery resources are managed largely through fishery management plans (FMP's). These plans are generally developed by fishery management councils (FMC's) through extensive consultations with state and other Federal agencies, affected industry sectors, public interest groups, and, in pertinent cases, international science and management organizations.

FMP's for EEZ stocks originate through the MSFCMA, which established eight regional FMC's (Appendix 2). The FMC's represent diverse interests through their members, who are nominated by state governors in each region and appointed by the Secretary of Commerce. For most marine fisheries and for Federally protected marine mammals and sea turtles, FMP's and protected species recovery plans may be developed by NMFS with input from the public and by direction of the FMC's.

Our Living Oceans 1999 (*OLO '99*) covers the majority of LMR's that are of interest for commercial, recreational, subsistence, and aesthetic or intrinsic reasons to the United States. The biological status of U.S. fishery resources is reported. Current and potential harvest levels are presented, along with information on the degree of utilization of each resource by its fishery and a discussion of significant management issues. Selected nearshore species, largely the responsibility of the coastal states, are also discussed, and the status of U.S. stocks of marine mammals and sea turtles are summarized.

Information in this report has been collected from many sources. Ideally, the latest peer-reviewed stock-assessment reports and publications, which serve as the scientific basis for management, are used. For some species, stock assessments may not be complete, due to lack of data, but they may still be adequate for fishery scientists to exercise professional judgments as to stock status and the magnitude of potential fishery yield. When information is inadequate, the stock or fishery status is classified as unknown. In such cases, potential yield is estimated from the most recent catch statistics. More detailed information can be obtained from regional reports produced by NMFS fisheries science centers around the country (Appendix 3) and from state natural resource agencies.

CONTENTS

Part 1 contains the national overview of significant LMR's and their fisheries. It includes this introduction, a brief review of common terms, LMR summaries and trends, issues of national concern, and a discussion of near-term outlook. Part 1 also includes three feature articles—an examination of the precautionary approach in U.S. marine fisheries management, an essay on the management history of the Northeast groundfish fishery, and a review of the Gulf of Mexico's king mackerel fishery.

Part 2 presents in greater detail the biological status of LMR's in 25 separate units. These unit synopses describe important species or species groups that are linked geographically, ecologically, or by characteristics of their fisheries.

Part 3 includes appendices for acknowledgments, regional FMC's and FMP's, principal NMFS facilities around the country, stock assessment principles and terms, a detailed (but not exhaustive) listing of the scientific and common names of species covered in this report, and acronyms and abbreviations.

COMMON TERMS

Most of the technical terms or phrases used in this report are defined in Appendix 4; the most important are reviewed here.

Stock ideally refers to a biologically distinct group of organisms that are genetically related or reproductively isolated from other segments of a larger population. Since stocks intermix in the marine ecosystem, it may be necessary to consider all of the individuals of a species, or several co-occurring species within a geographical area, as one fishery stock when it is impractical to differentiate between them. Thus, a stock unit defined for fishery management purposes may not necessarily correspond to a discrete genetic unit.

Recent average yield (RAY) is equivalent to the recent catch history. RAY is the reported fishery landings averaged for the most recent 3-year period of workable data, usually 1995–97, unless otherwise indicated.

Current potential yield (CPY) is the potential catch that can be taken depending on the current stock abundance and prevailing ecosystem considerations.[2] This term is analogous to acceptable biological catch (ABC) that is specified in some FMP's.

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[2]For many stocks, LTPY or CPY may be unknown. For the purpose of reporting total LTPY and CPY across resources within the various fishery units and for the Nation as a whole, if CPY was unknown RAY was substituted when calculating a unit, regional, or national total CPY. If LTPY was unknown CPY was substituted, or, failing that, RAY was substituted in calculating totals.

Long-term potential yield (LTPY) is the maximum long-term average catch that can be achieved from the resource.[2] This term is analogous to the concept of maximum sustainable yield (MSY) in fisheries science.

Stock level relative to LTPY is a measure of a stock's biological status. The current abundance level of the stock is compared to the level of abundance that, on average, would support the LTPY. This level is expressed as below, near, above, or unknown relative to the abundance level that would produce LTPY.[3]

Status of resource utilization describes the degree to which a stock is utilized by its fishery (i.e. underutilized, fully utilized, overutilized, or unknown). It shows how the existing fishing effort compares with levels necessary to achieve LTPY from the resource.

Threatened or endangered are terms specifically defined under the ESA. A species is considered endangered if it is in danger of extinction throughout a significant portion of its range; it is threatened if it is likely to become an endangered species within the foreseeable future.

Potential biological removal (PBR) is a concept that establishes a quantitative process for setting levels of take such that marine mammal stocks will equilibrate within their optimal population size. PBR (calculated in numbers of animals) is the sustainable removal level defined by the MMPA 1994 Amendments. Stocks for which bycatch levels exceed PBR are classified as strategic (stocks listed as depleted under the MMPA, or threatened or endangered under the ESA, are also considered strategic regardless of the level of take).

PRODUCTIVITY OF STOCKS

The United States is ranked fifth in the world for fisheries landings as reported by the Food and Agriculture Organization (FAO) of the United Nations for 1996, its latest survey

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[3]Since 1997, NMFS has been required to produce an annual "Report to Congress on the Status of Fisheries of the United States," which classifies stocks as overfished, not overfished, or approaching an overfished condition. As explained in Appendix 4, there is not a one-to-one correspondence between the status classifications in *Our Living Oceans* and those in the Report to Congress.

Unit number and fishery	Total productivity (t) over the entire range of stock: Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield (LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
1. Northeast demersal	159,875	134,475	317,500	142,215	253,555
2. Northeast pelagic	158,500	711,550	701,700	121,300	462,000
3. Atlantic anadromous	9,408	9,208	9,208	9,408	9,208
4. Northeast invertebrate	130,500	109,300	138,000	127,200	133,900
5. Atlantic highly migratory pelagic	352,800	315,470	348,300	18,300	18,100
6. Atlantic shark	7,393	6,430	6,430	7,393	6,430
7. Atlantic coastal migratory pelagic	15,454	20,339	26,448	15,454	26,448
8. Atlantic, Gulf of Mexico, and Caribbean reef fish	25,737	24,641	37,136	25,737	37,136
9. Southeast drum and croaker	33,623	31,420	78,835	33,623	78,835
10. Southeast menhaden	860,000	860,000	1,140,000	860,000	1,140,000
11. Southeast and Caribbean invertebrate	119,376	116,575	120,953	119,376	120,953
12. Pacific Coast salmon	17,304	33,312	33,312	17,304	33,312
13. Alaska salmon	376,100	310,600	310,600	376,100	310,600
14. Pacific Coast and Alaska pelagic	153,500	334,200	455,200	112,500	348,400
15. Pacific Coast groundfish	353,264	395,958	462,800	268,085	391,796
16. Western Pacific invertebrate	109	160	222	109	222
17. Western Pacific bottomfish and armorhead	492	470	2,802	492	2,802
18. Pacific highly migratory pelagic	2,049,418	3,439,825	3,435,031	253,606	253,116
19. Alaska groundfish (total)	2,033,982	3,100,410	3,983,420	2,026,272	3,963,290
Eastern Bering Sea and Aleutian Islands	1,775,600	2,499,900	3,478,700	1,775,600	3,478,700
Gulf of Alaska	211,922	548,770	452,980	211,922	452,980
Pacific halibut	46,460	51,740	51,740	38,750	31,610
20. Alaska shellfish	52,131	52,131	113,218	52,131	113,218
21. Nearshore	312,700	312,700	312,700	312,700	312,700
Total	7,221,666	10,319,174	12,033,815	4,899,305	8,016,021

Table 1
Productivity in metric tons (t) of fisheries resources utilized by the United States.

year (FAO, 1997). The U.S. catch was 4.5% of the world's total catch (121 million metric tons (t)) of marine and freshwater fisheries products. The FAO also ranked the United States second in value for world imports (12.5% of the $56.9 billion world total), and third (5.6%) in the $52.9 billion international trade in world exports of fish and fishery products, including aquaculture, in 1996 (FAO, 1997).

The productivity (Table 1) and status of fishery resources utilized by the United States are summarized in Units 1–21. LMR productivity is represented by RAY, CPY, and LTPY.

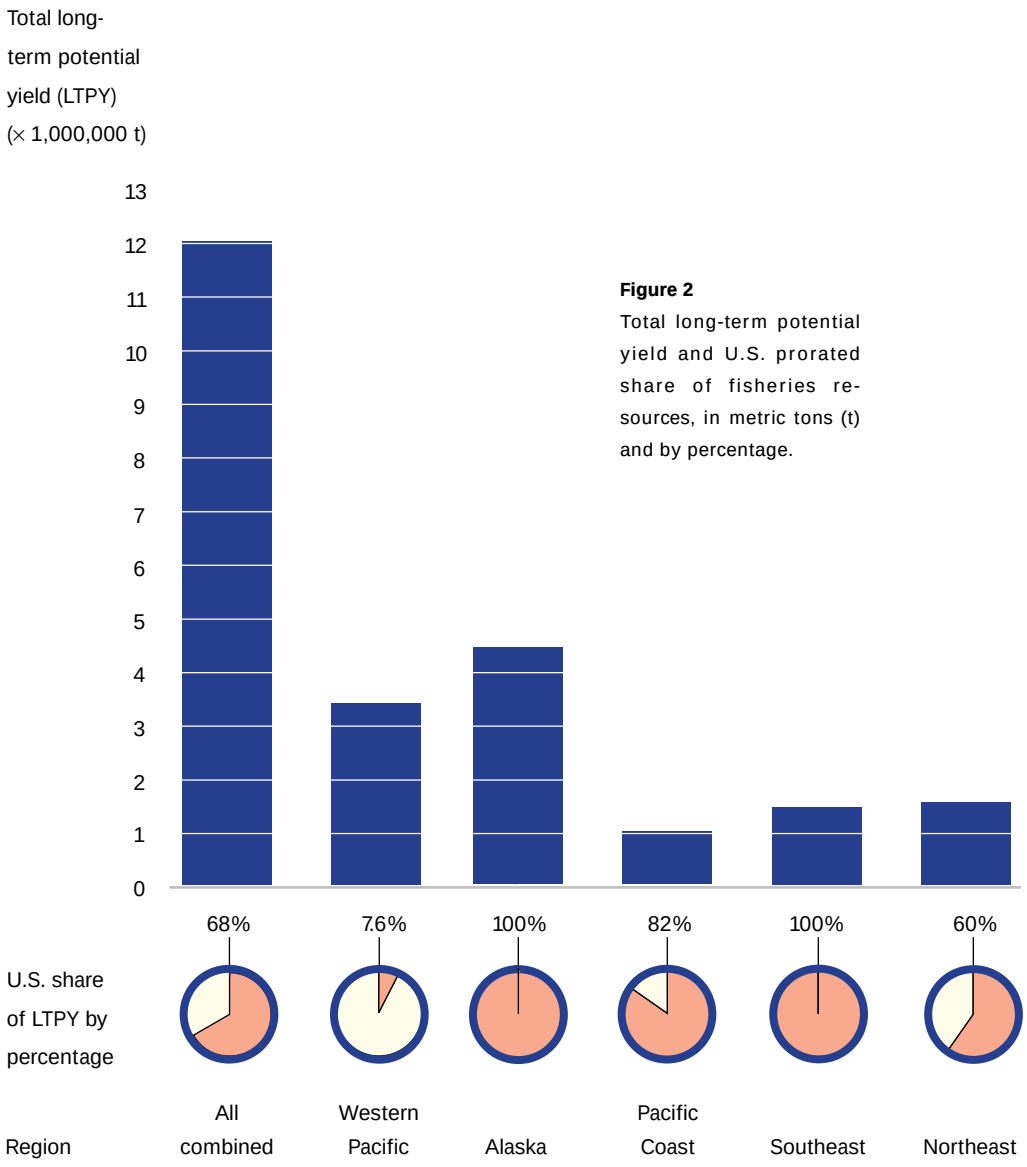

Figure 2
Total long-term potential yield and U.S. prorated share of fisheries resources, in metric tons (t) and by percentage.

For some stocks, the United States shares productivity with other fishing nations because these stocks range beyond the U.S. EEZ. For the purposes of this report, the productivity of transboundary species is compiled for the entire stock and sometimes provided for the prorated portion of the stock within the U.S. EEZ. *OLO '99* reports both total productivity and the prorated U.S. share of the stocks based on the ratio of the U.S. RAY to total RAY. The U.S. RAY is taken primarily within the U.S. EEZ.

Table 2
Regional productivity in metric tons (t) of fisheries resources utilized by the United States.

Region	Total productivity (t) over the entire range of stock: Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield (LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
Northeast	885,533	1,354,453	1,589,158	492,873	951,213
Southeast	1,155,123	1,152,945	1,503,342	1,155,123	1,503,342
Alaska	2,509,633	3,519,656	4,472,638	2,509,633	4,472,638
Pacific Coast	619,938	850,245	1,038,087	486,049	852,263
Western Pacific	2,051,439	3,441,875	3,439,475	255,627	257,560
Total	7,221,666	10,319,174	12,042,700	4,899,305	8,037,016

The total LTPY of all U.S. fishery resources, across their entire range, is estimated to be 12,033,815 metric tons (t) (Table 1). Total CPY is 10,319,174 t, indicating that the present productivity of the stocks is 14% below the long-term potential. Total RAY is 7,221,666 t, or 40% below the long-term potential.

When only the U.S. prorated share of the resources is considered, the U.S. LTPY is 8,016,021 t or 33% below total LTPY (Figure 2). By region, the percentage distribution of U.S. LTPY's is 55% for Alaska, 19% for the Southeast, 12% for the Northeast, 11% for the Pacific Coast, and 3% for the Western Pacific Region (Table 2, Figure 3).

The U.S. RAY is 4,899,305 t or 39% below U.S. LTPY. The missing 39% potential yield was not realized because some of the stocks were underutilized while some have been overexploited and therefore were not producing at their full long-term potential. By region, the percentage distribution of U.S. RAY is 51% Alaska, 24% Southeast, 10% Northeast, 10% Pacific Coast, and 5% Western Pacific (Table 2, Figure 4).

STATUS OF STOCKS

The status of stocks is classified according to the current level of abundance relative to the level that would produce LTPY. Table 3 summarizes the classifications for the 283 stock groups addressed in this report as being 31% below, 31% near, 8% above, and 30% unknown relative to the levels that would produce LTPY. This summary includes 80 stock

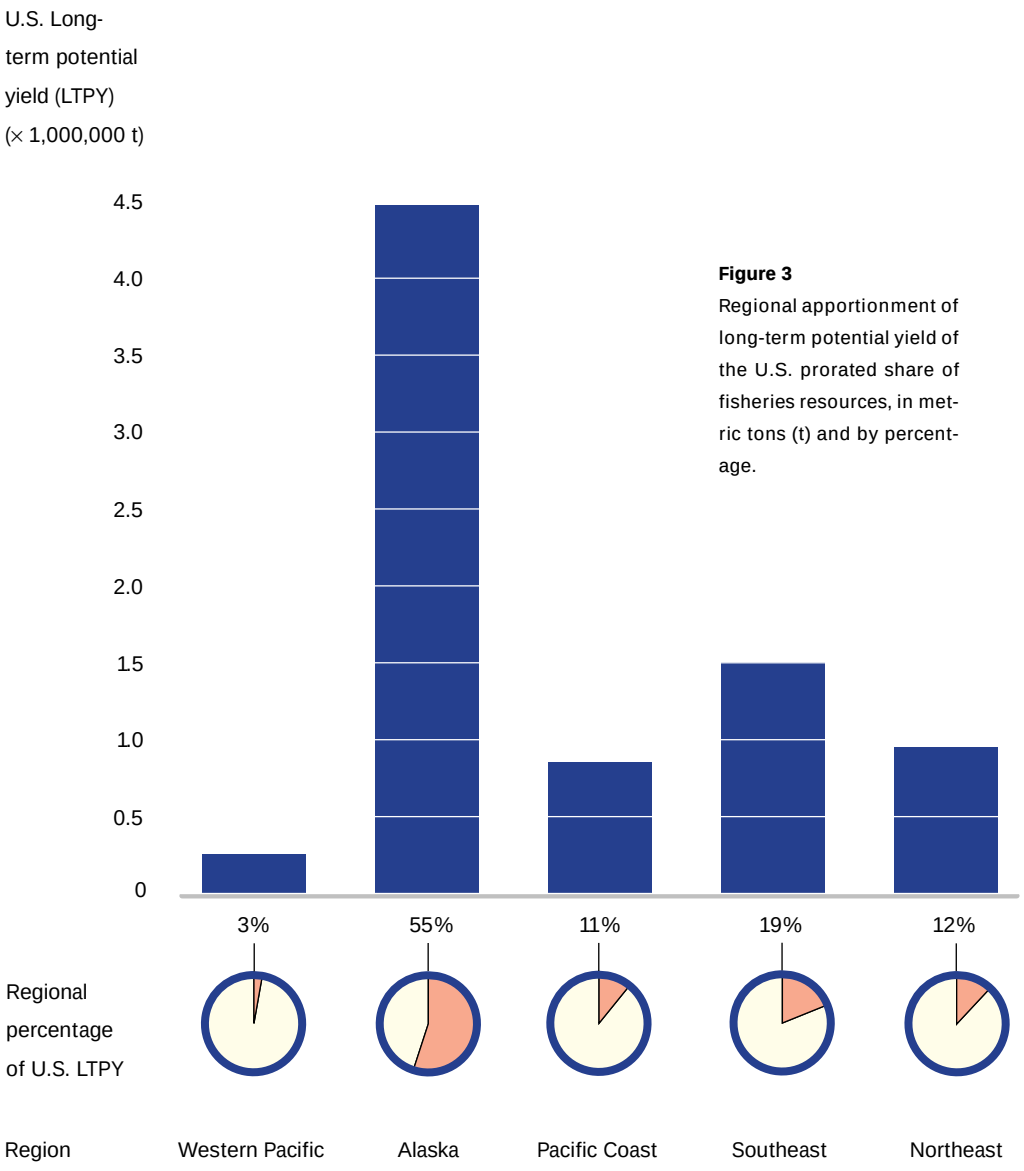

Figure 3
Regional apportionment of long-term potential yield of the U.S. prorated share of fisheries resources, in metric tons (t) and by percentage.

groups of nearshore resources that are under the purview of coastal states. The 85 stocks classified as unknown contributed 6.6% of U.S. RAY.

Excluding nearshore resources, the remaining 203 stock groups that are under Federal jurisdiction have been classified as being 36% below, 31% near, 11% above, and 22% unknown relative to the abundance levels that would produce U.S. LTPY (Figure 5). The 22% unknown category comprises 45 out of 203 stock groups. These 45 stock groups are generally of low abundance and contributed only 2.5% of U.S. RAY.

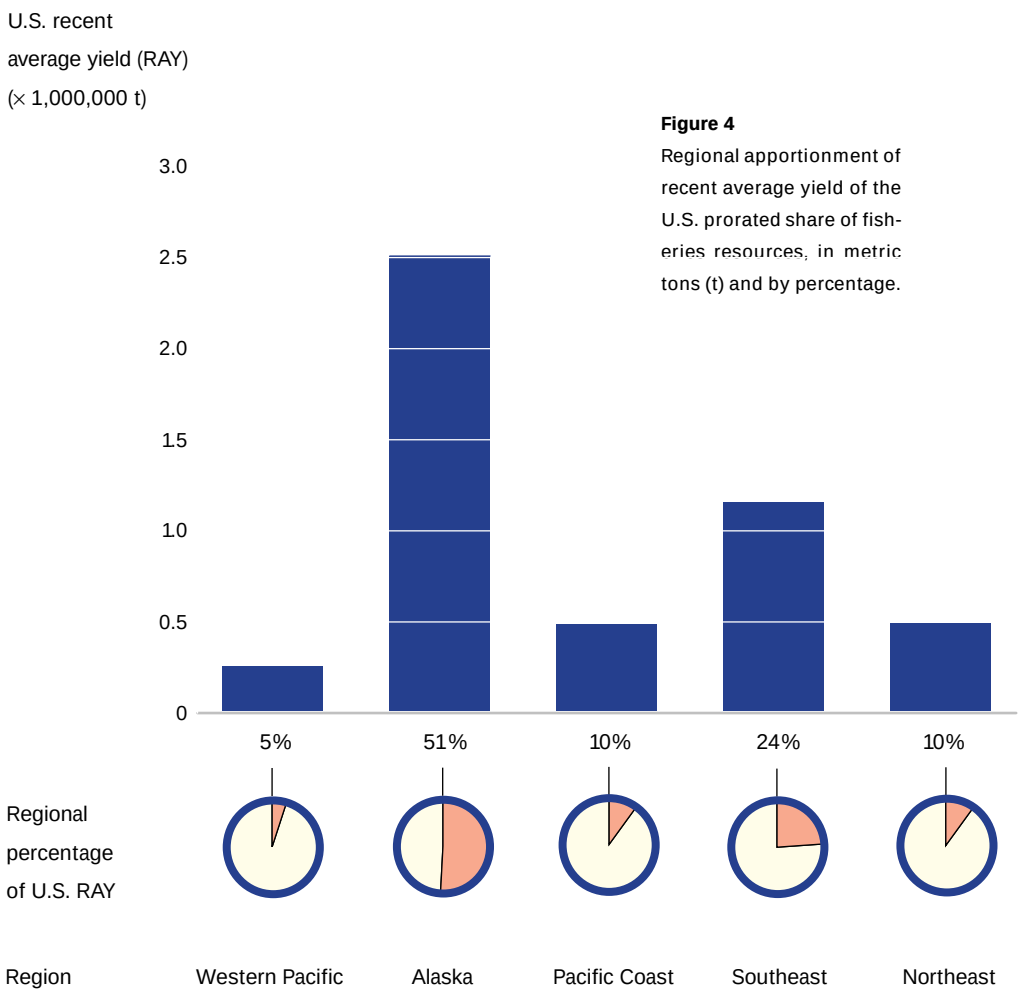

Figure 4
Regional apportionment of recent average yield of the U.S. prorated share of fisheries resources, in metric tons (t) and by percentage.

There are 158 stock groups whose status is “known” that fall under NMFS purview (Units 1–20 in Table 3). In this category, a high percentage of stock groups (46%, or 73 out of 158 groups with known status) are below levels that would produce LTPY. The majority of these low abundance cases occurred in Unit 1 (21 stocks of Northeast demersal species), Unit 8 (nine stocks of Atlantic and Gulf of Mexico reef fish), and Unit 15 (eight stocks of Pacific Coast groundfish). Less pronounced cases of low abundance can be found in all regions. The remaining stocks (85 out of 158 known-stock status) have been classified as 39% near and 15% above the levels that would produce LTPY. Assuming that stocks near or above levels that would produce LTPY are stocks in healthy condition, 54% of the known-status groups are at healthy abundance levels.

Table 3
Status of stock levels of U.S. fisheries resources, 1995–97.

Unit number and fishery	Current status relative to the level producing LTPY: Below	Near	Above	Unknown	Total
1. Northeast demersal	21	2	0	2	25
2. Northeast pelagic	1	0	3	0	4
3. Atlantic anadromous	4	0	1	0	5
4. Northeast invertebrate	1	4	1	2	8
5. Atlantic highly migratory pelagic	7	2	0	1	10
6. Atlantic shark	1	0	1	1	3
7. Atlantic coastal migratory pelagic	1	3	0	3	7
8. Atlantic, Gulf of Mexico, and Caribbean reef fish	9	3	0	16	28
9. Southeast drum and croaker	3	0	0	4	7
10. Southeast menhaden	0	2	0	0	2
11. Southeast and Caribbean invertebrate	2	7	0	5	14
12. Pacific Coast salmon	2	3	0	0	5
13. Alaska salmon	1	1	3	0	5
14. Pacific Coast and Alaska pelagic	0	6	1	0	7
15. Pacific Coast groundfish	8	4	2	5	19
16. Western Pacific invertebrate	1	0	0	0	1
17. Western Pacific bottomfish and armorhead	2	4	0	0	6
18. Pacific highly migratory pelagic	1	11	2	1	15
19. Alaska groundfish (total)	5	10	8	4	27
20. Alaska shellfish	3	0	1	1	5
21. Nearshore	14	26	0	40	80
Subtotal of Units 1–20	73	62	23	45	203
% of Subtotal	36%	31%	11%	22%	
% of 158 "known" stock groups	46%	39%	15%		
Total of Units 1–21	87	88	23	85	283
% of Total	31%	31%	8%	30%	
% of 198 "known" stock groups	44%	44%	12%		

DEGREE OF UTILIZATION

The degree of utilization describes the level of use of a fisheries resource as being underutilized, fully utilized, overutilized, or unknown. It compares existing fishing effort with the appropriate levels necessary to achieve LTPY.

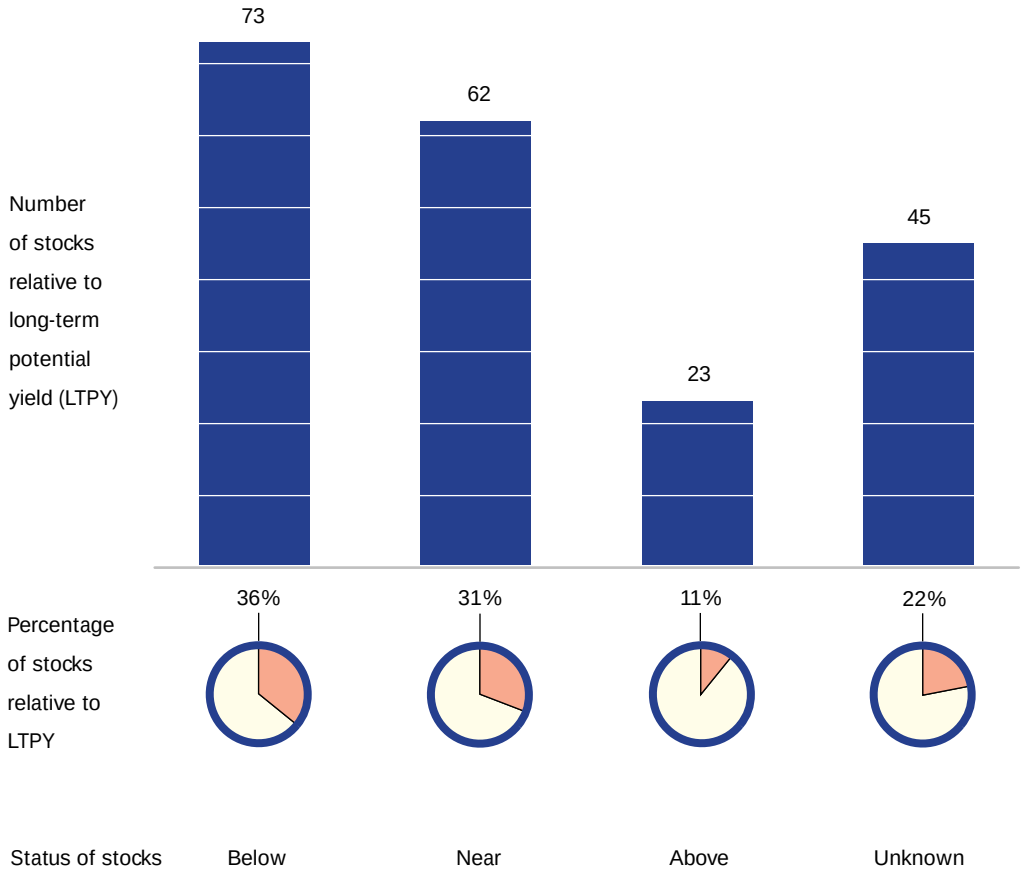

Figure 5
The number and percentage of stocks under NMFS purview that are above, near, or below the population level that would produce long-term potential yield.

Table 4 summarizes the classifications for the 283 stock groups addressed in this report as being 13% underutilized, 39% fully utilized, 22% overutilized, and 27% unknown. This grouping includes 80 stock groups of nearshore resources that are under the purview of coastal states. Excluding nearshore resources, the remaining 203 stock groups that are under NMFS purview have been classified as 15% underutilized, 37% fully utilized, 27% overutilized, and 21% unknown (Figure 6).

There is still a high percentage of stocks, 21% (involving 43 out of 203 stock groups), whose degree of utilization is unknown. The majority of these 43 unknown stock groups are found in the Southeast Region, where assessments of coastal migratory species, reef fishes, and invertebrates are complex and incomplete because of the huge diversity of species and fisheries. This category also includes 7 stock groups from Unit 18 in the Western Pacific Region, where the highly migratory species of tunas move long distances across many national jurisdictions, making assessment of stock utilization difficult.

Unit number and fishery	Degree of fisheries utilization of the resource				
	Under	Full	Over	Unknown	Total
1. Northeast demersal	0	7	16	2	25
2. Northeast pelagic	3	0	1	0	4
3. Atlantic anadromous	0	1	4	0	5
4. Northeast invertebrate	1	3	2	2	8
5. Atlantic highly migratory pelagic	0	2	7	1	10
6. Atlantic shark	0	1	1	1	3
7. Atlantic coastal migratory pelagic	1	2	1	3	7
8. Atlantic, Gulf of Mexico, and Caribbean reef fish	1	3	10	14	28
9. Southeast drum and croaker	0	0	3	4	7
10. Southeast menhaden	0	2	0	0	2
11. Southeast and Caribbean invertebrate	0	7	2	5	14
12. Pacific Coast salmon	0	3	2	0	5
13. Alaska salmon	0	5	0	0	5
14. Pacific Coast and Alaska pelagic	2	5	0	0	7
15. Pacific Coast groundfish	5	10	2	2	19
16. Western Pacific invertebrate	0	1	0	0	1
17. Western Pacific bottomfish and armorhead	3	1	2	0	6
18. Pacific highly migratory pelagic	5	2	1	7	15
19. Alaska groundfish (total)	9	16	0	2	27
20. Alaska shellfish	1	4	0	0	5
21. Nearshore	5	34	8	33	80
Subtotal of Units 1–20	31	75	54	43	203
% of Subtotal	15%	37%	27%	21%	
% of 160 "known" stock groups	19%	47%	34%		
Total of Units 1–21	36	109	62	76	283
% of Total	13%	39%	22%	27%	
% of 207 "known" stock groups	17%	53%	30%		

Table 4
Status of utilization levels of U.S. fisheries resources, 1995–97.

There are 160 stock groups classified as being of known status that are under NMFS purview (Units 1–20 in Table 4). Of these, 34% (54 out of 160 known-status groups) are overutilized. The majority of these overutilized cases occurred in Unit 1 (16 stocks from the Northeast demersal unit) and Unit 8 (10 stocks of Atlantic and Gulf of Mexico reef fish). The remaining stocks have been classified as 19% underutilized and 47% fully utilized, for a combined total of 66% not overutilized.

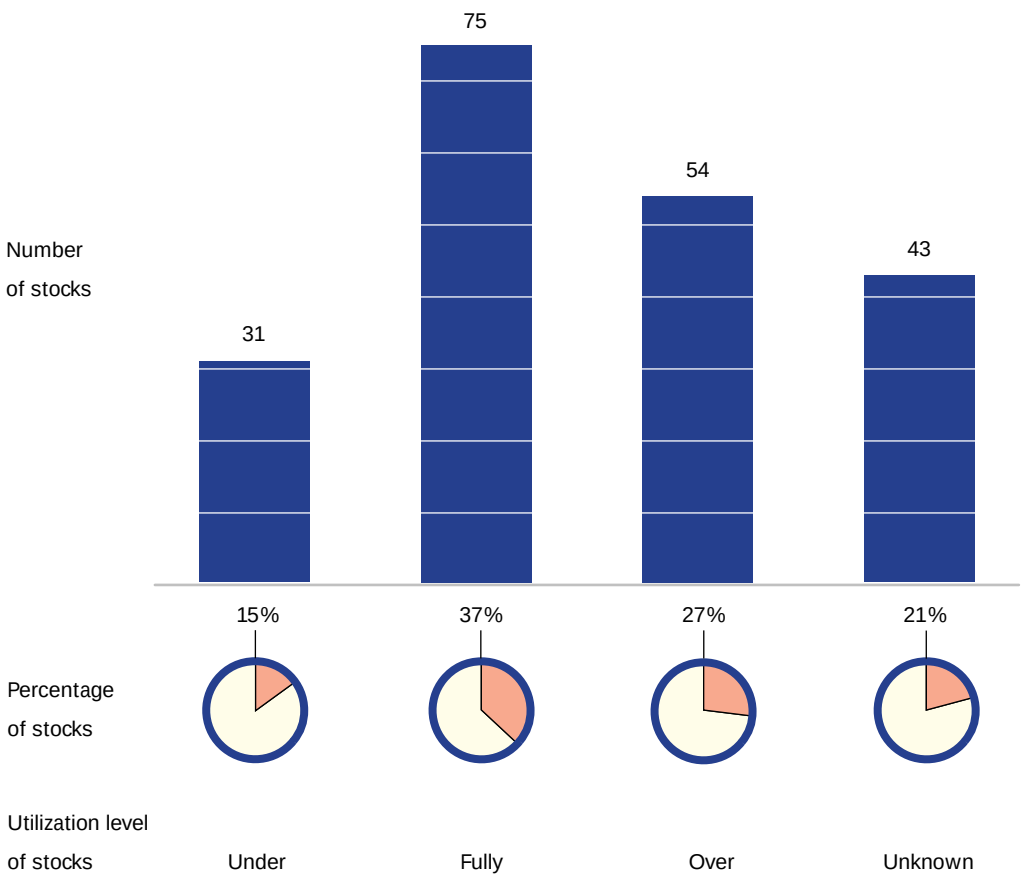

Figure 6
Number and percentage of stock groups classified by their status of utilization for stocks under NMFS purview.

REGIONAL AND SPECIES-GROUP SYNOPSES

Northeast Region

The Northeast Region's finfish and invertebrates are grouped under demersal, pelagic, anadromous, invertebrate, highly migratory pelagic, and nearshore resources. Their combined northeastern U.S. LTPY is 951,213 t (Table 5) out of a total (U.S. and Canada) LTPY of 1,589,158 t for the region. The lower U.S. LTPY reflects the sharing of transboundary resources with Canada. The U.S. RAY totaled only 492,873 t, or 52% of the U.S. LTPY, because 29 species, principally groundfish, are overutilized and below the stock levels necessary to produce LTPY. The RAY of 492,873 t excluded 300,000 t of menhaden that were taken in the Northeast. That amount has been added to the Southeast menhaden data (Unit 10) as it is an integral part of the South Atlantic menhaden stock.

Unit number and fishery	Total productivity (t) over the entire range of stock (U.S. and Canada): Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield (LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
1. Northeast demersal	159,875	134,475	317,500	142,215	253,555
2. Northeast pelagic	158,500	711,550	701,700	121,300	462,000
3. Atlantic anadromous	9,408	9,208	9,208	9,408	9,208
4. Northeast invertebrate	130,500	109,300	138,000	127,200	133,900
5. Atlantic highly migratory pelagic	352,800	315,470	348,300	18,300	18,100
21. Northeast nearshore resources	74,450	74,450	74,450	74,450	74,450
Total	885,533	1,354,453	1,589,158	492,873	951,213

Table 5
Productivity in metric tons (t) of fisheries resources of the Northeast Region, 1995–97.

The mixed-species groundfish fishery has traditionally been the most valuable, followed by American lobster and Atlantic sea scallop. Recreational fisheries for species such as Atlantic cod, winter flounder, Atlantic mackerel, striped bass, bluefish, and bluefin tuna are also important to the region's economy.

Principal groundfish and flounders in the Northeast, particularly cod, haddock, and yellowtail flounder, have been severely overfished, reaching record low levels in spawning-stock biomass in 1993–94, but they have since begun to rebuild.[4] Dogfish and skates, which increased in abundance beginning in the 1970's as groundfish and flounders declined, currently comprise a substantial fraction of the total fish biomass on Georges Bank and have supported larger catches in recent years. Since 1990, however, their abundances have also begun to decrease. Catches of other groundfish have become more important in recent years as the preferred species continued to decline in number. In 1994, the U.S. catch of goosefish exceeded the catch of Atlantic cod for the first time.

Five species, mainly pelagic fishes, are presently underutilized, and the CPY of the two most abundant of these, Atlantic mackerel and herring, is about 555,500 t higher than their combined RAY. The anadromous striped bass, driven to very low levels of abundance

[4]The haddock population started to rebuild around 1994–95, and has been improving steadily.

in the early 1980's and subjected to severe catch restrictions beginning in the mid 1980's, was declared fully restored in early 1995. The region's valuable crustaceans and bivalve mollusks, both offshore (e.g. American lobster, sea scallop, surfclam, and ocean quahog) and inshore (e.g. blue crab, oyster, blue mussel, and hard and softshell clam) are nearly all fully or overexploited.

Most Northeast Region fisheries are governed by FMP's that are either in place or under development. Despite the goals of FMP's, overexploitation of their respective species has occurred in many cases, and efforts to rebuild have generally not yet succeeded in fully restoring depleted stocks. Striped bass (managed since 1981 by an Atlantic States Marine Fisheries Commission (ASMFC) FMP), herring, mackerel, short-finned squid, and surfclams (managed by Federal FMP's) are the only species to have fully recovered from overutilization. Both summer flounder and weakfish have experienced marked increases in abundance and reductions in fishing mortality as a result of regulatory constraints imposed by FMP's, although target levels have not yet been fully achieved. Amendment 5 to the Northeast Multispecies FMP, approved in March 1994, was intended to limit commercial fishing effort on groundfish in New England and bring recovery within 5–10 years. However, scientific advice issued in August 1994, indicating that the Georges Bank stocks of cod, haddock, and yellowtail flounder had collapsed or were in danger of collapsing, led to the Secretary of Commerce approving, in December 1994, an emergency closure of portions of Georges Bank and severely restricting fishing for haddock. In addition, the New England Fishery Management Council (NEFMC) developed and implemented Amendment 7 to the Multispecies FMP to further reduce fishing mortality on these stocks by means of even stricter restrictions on fishing. As a result, some rebuilding has occurred for stocks on Georges Bank, but additional restrictions are in the process of being implemented to achieve management objectives for the cod stock in the Gulf of Maine. Concurrently, Canada has tightened controls on its groundfish fishery on the eastern part of Georges Bank to promote stock rebuilding, and these measures have resulted in improved abundance in those waters.

Amendment 4 to the Sea Scallop FMP, implemented in 1994, was intended to control fishing effort by limiting the days at sea for each vessel, placing a moratorium on new entrants, and imposing a larger mesh-ring size for dredges. Since fishing mortality on sea scallops has remained well above the overfishing level, further measures for reducing effort and protecting undersized scallops (closed areas in the Mid-Atlantic area) are being devel-

oped. Some protection of scallops has been achieved by the closure, since December 1994, of portions of Georges Bank to all fishing for the protection of groundfish. Amendment 3 to the ASMFC American Lobster FMP, approved in December 1997, introduced effort control and various other measures aimed at reducing the currently high fishing mortality on lobsters.

The highly migratory pelagic species (Unit 5) are important components of domestic fisheries in the Northeast and Southeast Regions, and for international fisheries elsewhere in the Atlantic Ocean. For the purpose of summarizing the information, they have been included in the Northeast Region. U.S. RAY is 5.2% of the total RAY for these stocks over the range of their distribution. The western Atlantic bluefin tuna is well below historic population levels. Marlins (blue and white) and sailfish are below as well. Swordfish in the North Atlantic is also below the level that would produce maximum long-term yield. Yellowfin tuna, which accounts for 39% of the total RAY for these stocks, is presently fully exploited and near its maximum long-term yield. Bigeye tuna exploitation has recently increased, but current yields are not expected to be maintained because they are about 20% above LTPY.

Southeast Region

The Southeast Region covers the Gulf of Mexico, the Southeast Atlantic, and the Caribbean Sea. Its important resources are Atlantic sharks, Atlantic and Gulf of Mexico coastal migratory pelagics, Atlantic and Gulf of Mexico reef fish, drum and croaker, menhaden, Southeast Atlantic and Caribbean invertebrates, highly migratory pelagic fishes (see the Northeast Region summary), and nearshore resources. A conservative estimate of the total LTPY of fisheries resources is 1,503,342 t, and virtually all are available to the United States (Table 6). The Southeast RAY is 1,155,123 t or 77% of the estimated Southeast LTPY.

Menhaden comprise about 74% of both the U.S. LTPY and U.S. RAY in this region. Menhaden are considered fully utilized in both the Gulf of Mexico and Atlantic Ocean, with some growth overfishing occurring in the Atlantic.

Shrimp led the region's fisheries in value, although they are only 10% of the total Southeast LTPY and RAY. The three major species (brown, white, and pink) are considered

Unit number and fishery	Total productivity (t) over the entire range of stock: Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield (LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
6. Atlantic shark	7,393	6,430	6,430	7,393	6,430
7. Atlantic coastal migratory pelagic	15,454	20,339	26,448	15,454	26,448
8. Atlantic, Gulf of Mexico, and Caribbean reef fish	25,737	24,641	37,136	25,737	37,136
9. Southeast drum and croaker	33,623	31,420	78,835	33,623	78,835
10. Southeast menhaden	860,000	860,000	1,140,000	860,000	1,140,000
11. Southeast and Caribbean invertebrate	119,376	116,575	120,953	119,376	120,953
21. Southeast nearshore species	93,540	93,540	93,540	93,540	93,540
Total	1,155,123	1,152,945	1,503,342	1,155,123	1,503,342

Table 6
Productivity in metric tons (t) of fisheries resources of the Southeast Region, 1995–97.

fully utilized in both the Gulf of Mexico and Atlantic. Yields are not now closely tied to shrimping effort—about half the current effort in the Gulf could produce about the same long-term average yield.

Information is incomplete on the status of invertebrates other than shrimp. Spiny lobster off the southeastern U.S. coast is apparently overutilized and below the LTPY level. The recreational catch of spiny lobster is unknown but thought to be significant. The Caribbean spiny lobster status is uncertain, but that species is possibly overutilized and experiencing growth overfishing. Stone crab appears to be fully utilized. Queen conch off the southeastern U.S. coast has been below the LTPY level for some time, despite a joint state-Federal protection program.

RAY for Atlantic sharks is less than 1% of the total for the Southeast Region. However, sharks are a very important component of the ecosystem. Because of their low reproductive capacity, sharks are considered to be particularly vulnerable to overfishing. Large coastal sharks (as a group consisting of 17 species) may be overutilized, but the status of each species is presently unknown. When managed in aggregate, it is likely that some stocks will be overfished while others will go underutilized. Improvements in data collection are necessary before these stocks can be assessed more adequately on an individual basis.

Coastal migratory pelagic fishes account for 1.3% of the Southeast RAY (Table 6). Spanish mackerel appear to be fully utilized in both the Gulf of Mexico and Atlantic. King mackerel are below the LTPY level in the Gulf, where a stringent rebuilding program has been in place for the last several years. In the Atlantic, king mackerel are underutilized and have the potential to produce additional yield. The status of other coastal migratory pelagic species in the region is unknown.

Reef fish in the Southeast Region include over 200 stocks of more than 100 species currently contributing 25,737 t in fishery yield. The degree of utilization and status relative to LTPY are unknown for many of these stocks, but several of the major species have been assessed. In the Gulf of Mexico, red snapper are overfished, and a rebuilding plan has begun. RAY is about 40% greater than CPY, which may slow or impede stock recovery. The success of this rebuilding program hinges primarily on the reduction of bycatch of juvenile red snapper in the Gulf shrimp fishery. Red grouper appears to be fully utilized in the Gulf of Mexico. In the Atlantic, many of the key species are considered overutilized (e.g. vermilion and other snappers, red porgy, several groupers, amberjacks, and jewfish). In the Caribbean, Nassau grouper and jewfish are considered overutilized; the status of other species is unknown.

The status of drum, spot, croaker, seatrouts, and kingfish stocks, which contribute about 3% of the Southeast RAY, is largely unknown. These species constitute the bulk of a bycatch that averaged 175,000 t during the 1980's, when billions of juveniles were discarded annually. Bycatch has become a major management issue, and efforts are underway to reduce bycatch through new gear designs. Red drum harvests in the U.S. EEZ of the Gulf of Mexico and South Atlantic have been prohibited, and harvests in state waters have been reduced for several years due to low spawning levels. All indications are that recruitment is increasing, and recovery is expected, although not necessarily in the immediate future.

As noted above, the highly migratory pelagic species (Unit 5) are important components of domestic fisheries in the Southeast and Northeast Regions, and for international fisheries elsewhere in the Atlantic. In particular, the Southeast Region includes major components of the fisheries for swordfish, marlins, sailfish and yellowfin. However, for purposes of summarizing the information, these have been included in the Northeast Region and were discussed in that section.

Unit number and fishery	Total productivity (t) over the entire range of stock: Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
13. Alaska salmon	376,100	310,600	310,600	376,100	310,600
14. Alaska herring	45,500	55,200	55,200	45,500	55,200
19. Alaska groundfish					
Eastern Bering Sea and Aleutian Islands	1,775,600	2,499,900	3,478,700	1,775,600	3,478,700
Gulf of Alaska	211,922	548,770	452,980	211,922	452,980
Halibut (Alaska)	38,180	42,855	51,740	38,180	51,740
20. Alaska shellfish	52,131	52,131	113,218	52,131	113,218
21. Alaska nearshore species	10,200	10,200	10,200	10,200	10,200
Total	2,509,633	3,519,656	4,472,638	2,509,633	4,472,638

Table 7
Productivity in metric tons (t) of fisheries resources of the Alaska Region, 1995–97.

Alaska Region

The Alaska Region dominates in the tonnage of fisheries resources that could be obtained in the long term for the United States. Its major resources are Pacific salmon, groundfish, Pacific halibut, shellfish, and herring. Their combined U.S. LTPY is 4,472,638 t (Table 7). The resources are generally healthy, with regional CPY 22% below LTPY. The U.S. RAY has been steady at about 2,510,000 t, or 44% below LTPY. Catches are substantially below the long-term potential because many of the resources, particularly flatfish species, are underutilized.

Alaska's salmon stocks have generally produced bumper harvests in recent years, although some stocks have been down. The RAY of 376,100 t is actually 21% above LTPY, because returning salmon runs have been particularly successful. Five species of Pacific salmon (chinook, coho, sockeye, pink, and chum) contribute to the catch.

The development of domestic groundfish fisheries off Alaska has been a great success under the MSFCMA. Until its implementation in 1977, Alaska's groundfish fisheries, except for Pacific halibut, were dominated by foreign fishing. Then, within a few years under the new management regime, the U.S. fishery largely replaced the foreign fishing fleets.

Unit number and fishery	Total productivity (t) over the entire range of stock: Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield (LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
12. Pacific Coast salmon	17,304	33,312	33,312	17,304	33,312
14. Pacific Coast pelagic	108,000	279,000	400,000	67,000	293,200
15. Pacific Coast groundfish	353,264	395,958	462,800	268,085	391,796
19. Halibut (Can., Wash., Oreg., and Calif.)	8,280	8,885	8,885	570	865
21. Pacific Coast nearshore species	133,090	133,090	133,090	133,090	133,090
Total	619,938	850,245	1,038,087	486,049	852,263

Table 8
Productivity in metric tons (t) of fisheries resources of the Pacific Coast Region, 1995–97.

For the Eastern Bering Sea and Aleutian Islands groundfish, RAY is 1,775,600 t (Table 7), 49% below LTPY. The major species groups harvested are walleye pollock, Pacific cod, flatfishes, Atka mackerel, rockfish, and sablefish. Greenland turbot and sablefish are below LTPY levels. All flatfish species are high in abundance and in excellent condition. Walleye pollock and Pacific cod abundances are much lower than their recent high levels, but are still close to the levels that would produce LTPY.

For Gulf of Alaska groundfish, RAY is 211,922 t, 53% below LTPY. The major species groups harvested include walleye pollock, Pacific cod, sablefish, flatfishes, and slope rockfish. Walleye pollock, sablefish and slope rockfish are below their respective LTPY levels. Pacific cod and thornyhead rockfish are high in abundance, and the status of the remaining groundfish stocks is unknown.

In addition to the general groundfish complex, Pacific halibut is a groundfish species that has supported an important traditional fishery for both the United States and Canada. This resource is fully utilized and managed by the International Pacific Halibut Commission. Abundance has been stable since 1993.

Pacific herring stocks are producing about 45,500 t, perhaps slightly below their LTPY's. Three shellfish resources, Tanner crab, king crab, and shrimp are below their LTPY

levels, with a combined RAY 84% below their long-term potential. Snow crab stocks are in good condition, but the RAY has decreased substantially since the early 1990's.

Pacific Coast Region

Pacific Coast fisheries resources have a prorated U.S. LTPY of 852,263 t (Table 8). The major species are Pacific salmon, coastal pelagic fishes, groundfish, Pacific halibut, and nearshore resources. The total U.S. RAY is 619,938 t or 73% of LTPY. The lower RAY is due mainly to underutilization of some species and to low abundance of some stocks. Most stocks are either fully utilized or overutilized.

All five salmon species are fully or overutilized. The RAY of 17,304 t is 52% of its LTPY. Depressed production is partly due to generally unfavorable ocean conditions for salmon off the Pacific Coast since the late 1970's and other factors such as habitat degradation. Some stocks are depleted and have triggered ESA designations and status reviews.

Coastal pelagic fishes typically fluctuate widely in abundance, and most stocks are low in abundance relative to historical levels and are fully utilized. The total RAY of 108,000 t is only 27% of LTPY. The Pacific sardine population has been increasing after decades of low abundance levels and now accounts for 52% of the U.S. RAY for coastal pelagic fishes. Jack mackerel and northern anchovy are underutilized.

The groundfish fishery harvests a vast array of bottom-dwelling species from Washington to California. The total RAY of 353,264 t is 76% of LTPY. The difference between RAY and LTPY is due to a variety of factors, including the diversity of this fishery complex. Some species are overexploited, some have experienced periods of low recruitment, and some are underutilized. Despite being below LTPY, Pacific whiting dominates the commercial U.S. RAY, accounting for 78% of the west coast groundfish catch. Rockfishes and lingcod also support popular recreational fisheries. Certain stocks, such as Pacific ocean perch, need to be rebuilt following overutilization and a period of poor recruitment. Shortbelly rockfish is underutilized because of a lack of market.

Pacific Coast shellfish resources are diverse and important both commercially and recreationally. Shrimp, crab, clam, and abalone fisheries are relatively small in terms of

Unit number and fishery	Total productivity (t) over the entire range of stock: Total recent average yield (RAY)	Total current potential yield (CPY)	Total long-term potential yield (LTPY)	Prorated productivity (t) within the U.S. EEZ: U.S. RAY	U.S. LTPY
16. Western Pacific invertebrate	109	160	222	109	222
17. Western Pacific bottomfish and armorhead	492	470	2,802	492	2,802
18. Pacific highly migratory pelagic	2,049,418	3,439,825	3,435,031	253,606	253,116
21. Western Pacific nearshore species	1,420	1,420	1,420	1,420	1,420
Total	2,051,439	3,441,875	3,439,475	255,627	257,560

Table 9
Productivity in metric tons (t) of fisheries resources of the Western Pacific Region, 1995–97.

tonnage landed, but they contribute substantially to the value of the fisheries, due to the high prices they command. Most shellfish species are fully utilized.

Recreational fisheries are important along the Pacific Coast and especially so in southern California. A wide variety of species is taken, and the recreational catch of some greatly exceeds the commercial catch. Many are nearshore resources. Gamefishes such as albacore, billfishes, rockfish, and salmon are highly prized. Recreational crabbing, clam digging, and abalone diving activities are also significant.

Western Pacific Region

The vast area that encompass this region stretches across the central and western Pacific and includes the Hawaiian Islands and the U.S.-affiliated islands of American Samoa, Guam, and the Northern Marianas (Figure 1). These are tropical and subtropical island waters with a large diversity of species but relatively low sustainable yields due to limited ocean nutrients. Though the magnitude of the fisheries may be relatively small (U.S. RAY and U.S. LTPY are only slightly above 250,000 t: Table 9) when compared to certain larger mainland fisheries, they are valued highly and are important culturally and socially in Hawaii and the Pacific islands. Additionally, certain transboundary fisheries hold considerable international interest, with high collective importance and value to Pacific Rim nations and U.S. fleets fishing within and beyond the U.S. EEZ. Fishery resources include highly migratory pelagic fishes, bottomfishes, nearshore reef fishes, and

invertebrates. The region also supports protected species such as the Hawaiian monk seal, sea turtles, whales, and dolphins.

The highly migratory stocks (tunas, billfishes, swordfish, sharks, and others) range the high seas, often beyond U.S. fisheries management jurisdiction. Tunas are the major catch component and migrate across multiple jurisdictions in the Pacific. The combined LTPY of these stocks throughout their migratory range is 3,435,031 t, while the prorated U.S. LTPY is only about 7.5% of that. Of the 15 stock groups of highly migratory pelagic fishes, 11 stocks are near the levels that would produce their LTPY's, 1 is below LTPY (blue marlin), 2 are above (yellowfin and skipjack in the central-western Pacific), and 1 (pelagic sharks) is of unknown status. Together, these stocks account for 99% of the region's RAY in tonnage and support some of the most valuable fisheries in the world.

Western Pacific bottomfishes (snappers, jacks, grouper, emperors) are harvested from a variety of rock and coral habitats around Hawaii and western Pacific islands. About 90% of the catch is taken in the Main Hawaiian Islands, where stock assessments indicate some important species are only at 10–30% of original stock levels in some areas. But when the resources are considered across the region, the U.S. RAY of 492 t is only 18% of LTPY, mainly because stocks in the Northwestern Hawaiian Islands, American Samoa, and the Mariana Islands are underutilized.

Pelagic armorhead was harvested from 1968 to the late 1980's or early 1990's by foreign fleets on the summits and slopes of submerged seamounts along the southern Emperor-northern Hawaiian Ridge. Of these undersea mountains, the only group under U.S. jurisdiction is the Hancock Seamounts (representing less than 5% of the total fishing grounds). Fishing there has been prohibited since 1984, to allow the stock to recover after foreign catch rates declined to low levels. The United States has never fished pelagic armorhead, but because of its fishery potential, the resource is regulated under a Seamount Groundfish FMP.

The most important invertebrate fisheries in the Western Pacific Region are for spiny and slipper lobsters. They are primarily fished in the Northwestern Hawaiian Islands. This fishery began in 1977 and reached its peak during the mid 1980's, but it has since declined. The primary cause of the decline is thought to be a general reduction in lobster productivity and recruitment since 1989, stemming from mesoscale oceanographic changes. Since

1991, a limited entry and harvest guideline regulatory regime has been implemented, which has allowed some recovery in the fishery. The lobster total RAY of 109 t is 49% of LTPY.

Nearshore Resources

In this report, nearshore fishery resources are those coastal and estuarine species under the control of coastal states and for which NMFS does not have direct responsibility. Many of these species provide the basis for locally important commercial and recreational fisheries. They vary widely in species diversity and abundance. Many are highly prized gamefish. Others are small fishes used for bait, food, and industrial products. Those of greatest interest include invertebrate species like crabs, shrimps, abalones, clams, scallops, and oysters.

Because it is difficult to assess the condition of many of the Nation's nearshore resources, a high percentage are of unknown status. No firm estimates exist for LTPY or CPY. Thus, the RAY of 312,700 t (Table 1) has been used to indicate minimum amounts for CPY and LTPY. The RAY itself may have been underestimated due to incomplete landings information, and it excludes landings of large-scale nearshore fisheries like anchovy, sardine, herring, and invertebrate resources, which are reported in other units.

Because the composition of nearshore resources is diverse and management is spread out among the many coastal states and other local authorities, a comprehensive treatment of them has not been attempted in this report. Unit 21 presents information on the more significant species and their general status.

Marine Mammals

The Marine Mammal Protection Act Amendments of 1994 (Public Law 103-238) require the Secretary of Commerce and the Secretary of Interior to develop stock assessment reports (SAR's) for all marine mammal stocks that are found within U.S. waters. NMFS is responsible for assessing and managing stocks of whales, dolphins, porpoises, seals, sea lions, and fur seals. USFWS has authority over stocks of Pacific walrus, Alaska polar bear, Alaska and Pacific Coast sea otter, and West Indian manatee.

Table 10
Status and trends of marine mammals and sea turtles, 1995–97.

Unit number, area, and species	Number of stocks	Strategic	Endangered	Threatened	Depleted
22. Alaska marine mammals	33	10	7	1	1
23. Pacific Coast and Hawaii marine mammals	55	11	9	1	0
24. Atlantic Coast and Gulf of Mexico marine mammals	57	26	7	0	1
Total	145	47	23	2	2
25. Atlantic and Pacific sea turtles	13		6	7	

The 1994 Amendments require NMFS to include, among other things, information on how a stock is defined, a minimum abundance estimate, the stock's current and maximum net productivity rate, current population trend, a calculation of potential biological removal (PBR), assessment of whether incidental fishery takes are "insignificant and approaching zero mortality and serious injury rate," and an assessment of whether the level of human-caused mortality and serious injury is likely to reduce the stock to below optimum sustainable population (OSP) or whether the stock should be classified as a strategic stock. Strategic stocks are those that are listed as endangered or threatened under the ESA or declining and likely to be listed in the foreseeable future, those designated as depleted under the MMPA (i.e. below OSP), and those for which human-caused mortality exceeds the PBR. SAR's are to be reviewed annually for strategic stocks and for stocks for which new information is available, and at least once every 3 years for all other stocks. The 1994 Amendments also require that take reduction teams involving user groups and environmental groups be formed for each strategic stock and charges them with developing plans to reduce takes to below the PBR's.

NMFS SAR's are produced for three regions and more than 145 stocks—Alaska (33); the Pacific Ocean, including Hawaii (55); and the Atlantic Ocean, including the Gulf of Mexico (57). Currently, 47 marine mammal stocks are classified as strategic (Table 10). These include stocks that are considered depleted (2) under the MMPA, listed as threatened (2) and endangered (23) under the ESA, 15 stocks for which the total annual mortality equals or exceeds PBR, and 46 stocks for which population status or fisheries related mortality is uncertain. Although explicitly excluded from U.S. management under the PBR section of the MMPA, 2 of 10 stocks of eastern tropical Pacific dolphins are listed as depleted.

There are sufficient long-term population data to assign trends for only 18 stocks (12%), with the remaining stocks undetermined. Where reliable information is available, 3 are declining, 6 are stable, and 9 are increasing. Alaska has 13 of 33 stocks that are of known status. The Atlantic Ocean and Gulf of Mexico have only 6 stocks of known status—the harbor, gray, harp, and hooded seals, harbor porpoise, and the western North Atlantic coastal stock of bottlenose dolphin. Upwards of 33 putative stocks of bottlenose dolphins in Gulf of Mexico estuaries, bays, and sounds are of indeterminate status. There are insufficient data to assign an abundance trend to any Pacific Ocean or Hawaiian marine mammal stock.

Sea Turtles

Six species of sea turtles regularly spend all or part of their lives off the U.S. Atlantic and Pacific Coasts and in U.S. territorial waters of the Caribbean Sea and western Pacific Ocean. All sea turtles are listed either as endangered or threatened under the ESA (Table 10). The Kemp's ridley, hawksbill, and leatherback are listed as endangered throughout their range. The loggerhead and olive ridley are listed as threatened throughout their U.S. range, as is the green turtle, except the Florida nesting population, which is listed as endangered.

The large Pacific green turtle population at French Frigate Shoals in the Hawaiian Islands is thought to be increasing, but there is continuing concern about fibropapilloma, a tumor-associated disease. Leatherbacks are seriously declining on their major nesting beaches throughout the Pacific. The collapse of these nesting populations is due to the incidental mortality from fishing and direct harvest of adults and eggs.

Several distinct loggerhead populations have been identified for the Atlantic and Gulf of Mexico. The southern Florida nesting population appears to be increasing; in contrast, the population that nests north of Cape Canaveral through North Carolina is declining. In the western North Atlantic and Gulf of Mexico, the Kemp's ridley population appears to be in the earliest stages of recovery. This can be attributed to the full protection of nesting turtles and their nests in Mexico and the requirement to use turtle excluder devices in shrimp trawls.

Although much progress has been made towards eliminating the killing of sea turtles in shrimp and summer flounder trawl gear, there continues to be a problem from longlines, driftnets, and gillnets from other fisheries.

RECENT TRENDS

Successive editions of *Our Living Oceans* have sought to maintain consistency in the way stocks are classified and in the way data are reported, and therefore to provide a basis for examining overall trends in the degree of utilization of fishery resources. An examination of recent trends is presented here by comparing the data reported in *OLO '92* and *OLO '99*. Since these editions generally pertain to stock status averaged over 1988–90 and 1995–97, respectively, the comparisons provide an idea of trends over a 7- to 9-year time frame. Readers wishing to obtain more detailed accounting of interannual changes for stocks of interest should refer to the reference sources listed at the end of each unit.

Stock Level Status and Degree of Utilization

The degree of fishery utilization (underutilized, fully utilized, or overutilized) shows how the level of fishing effort exerted on the resource compares to the level necessary to achieve LTPY. In general, management actions[5] should seek to prevent changes that would cause the utilization level to worsen (go from underutilized or fully utilized to overutilized), and should encourage changes that would reverse overutilization (go from overutilized to fully utilized or underutilized). By 1999 (not counting nearshore resources for which NMFS does not have primary monitoring responsibilities), the status of 17 stocks improved, changing from overutilized to fully utilized (+16) or underutilized (+1) (Table 11). Those improving were pollock, yellowtail flounder, haddock, and redfish in the Northeast Region; Spanish mackerel in the Gulf of Mexico and Atlantic (2 stocks); Atlantic menhaden; pink, brown and white shrimp in the Gulf of Mexico and Atlantic (6 stocks); pink, sockeye, and chum salmon off the Pacific Coast; and albacore in the North Pacific. Nine stocks experienced changes in the opposite direction, from under- or fully utilized to overutilized: red hake, spiny dogfish, silver hake, windowpane flounder, black sea bass, and

[5]The actual management actions taken by the regional fishery management councils are linked to their own technical definitions of overfishing and overfished status, which do not always correspond to the fishery utilization and stock level status used in *Our Living Oceans.*

Degree of fishery utilization (1992)	Total	Number of stocks by degree of fishery utilization in *OLO '99*: Over (and change)	Full (and change)	Under (and change)	Unknown (and change)
	Total number of stocks by degree of fishery utilization in *OLO '92*				
Over	59	42 (-17)	16 (+16)	1 (+1)	0 (0)
Full	56	6 (+6)	41 (-15)	7 (+7)	2 (+2)
Under	26	3 (+3)	4 (+4)	18 (-8)	1 (+1)
Unknown	47	3 (+3)	8 (+8)	3 (+3)	33 (-14)
Total	188	54 (-5)	69 (+13)	29 (+3)	36 (-11)

Stock-level status (1992)	Total	Number of stocks by stock-level status relative to LTPY in *OLO '99*: Below (and change)	Near (and change)	Above (and change)	Unknown (and change)
	Total number of stocks by stock-level status relative to LTPY in *OLO '92*				
Below	56	49 (-7)	5 (+5)	2 (+2)	0 (0)
Near	64	14 (+14)	42 (-22)	7 (+7)	1 (+1)
Above	25	4 (+4)	5 (+5)	14 (-11)	2 (+2)
Unknown	43	4 (+4)	5 (+5)	1 (+1)	33 (-10)
Total	188	71 (+15)	57 (-7)	24 (-1)	36 (-7)

Table 11
Change in degree of fishery utilization (above) and in stock level status relative to LTPY (below) between *OLO '92* and *OLO '99* (Units 1–20).

Table shows the number of stocks in each *OLO '92* category (over, full, under, below, near, above, and unknown) that have stayed in the same category or shifted to a different category in *OLO '99*. These comparisons can be interpreted as changes between the late 1980's and the mid 1990's. Stocks not appearing in both *OLO '92* and *OLO '99* are not included in this summary. Entries of "variable by river" from *OLO '92* for alewife, American shad, and sturgeons (Unit 3) have been interpreted as overutilized and below LTPY in *OLO '99*.

bluefish in the Northeast Region; and albacore, blue marlin, and bigeye tuna in the Northeast and Southeast Regions. In aggregate, then, the changes in utilization levels were positive during this time period, resulting in a net reduction in the number of overutilized stocks. In terms of scientific understanding, the utilization level became known for 14

stocks that were previously classified as unknown. This is in contrast to only 3 stocks whose utilization level was reclassified as unknown.

The stock level relative to LTPY shows how the stock size compares to the level of abundance which on average would support the LTPY harvest. In general, management actions should prevent stocks from falling below LTPY, or rebuild them (i.e. to change from below LTPY to near or above LTPY). In terms of stock level relative to LTPY, 7 stocks changed status from below LTPY to near or above LTPY: pollock in the Northeast Region, Atlantic menhaden, Gulf of Mexico pink shrimp, Pacific sardine, North Pacific albacore, thornyhead rockfish in the Gulf of Alaska, and western Pacific spiny and slipper lobsters. In contrast, 18 stocks changed status from near or above LTPY to below LTPY: Atlantic cod, windowpane flounder, spiny dogfish, red hake, white hake, bluefish, sea scallop, albacore, and bigeye tuna in the Northeast Region; coho salmon, Pacific whiting, sablefish, widow rockfish, canary rockfish, and yellowtail rockfish off the Pacific Coast (Oregon-Vancouver Island); Tanner crabs off Alaska; and sablefish in the Eastern Bering Sea and Aleutian Islands and Gulf of Alaska (2 stocks). The status of 10 stocks was reclassified as known, compared to 3 stocks that were reclassified as unknown.

Changes in the degree of utilization by the fishery can occur more rapidly than changes in stock status relative to LTPY. For example, a fishery can be regulated such that the stock's classification changes from overutilized to underutilized in a single year by restricting the number of days-at-sea of fishing vessels, by closing large areas to fishing, or by other regulatory measures. In contrast, allowing a stock to rebuild from below to above LTPY can take many years, depending on the stock's intrinsic natural capacity to grow, on its initial level of depletion, and on the regulatory measures put in place during the rebuilding program. Similarly, deterioration in stock status from, for example, near to below LTPY is a process that cannot always be halted instantaneously.

In addition, changes in how stocks are classified in terms of population status and utilization by the fishery can be due to improved scientific understanding of their long-term potential and of how fishing affects stock abundance over time. Even though NMFS has intended to use terms like LTPY in a consistent manner in every edition of *Our Living Oceans*, our ability to quantify LTPY improves as we accumulate more biological and fishery information, which can result in substantive changes. For example, the two stocks that experienced the largest positive and negative changes in estimates of LTPY between *OLO*

Unit number and fishery[1]	U.S. RAY *OLO '92*	U.S. RAY *OLO '99*	Change (t)	Change (%)
1. Northeast demersal	170,221	142,215	-28,006	-16%
2. Northeast pelagic	101,100	121,300	20,200	20%
3. Atlantic anadromous	3,773	9,408	5,635	149%
4. Northeast invertebrate[2]	129,400	126,200	-3,200	-2%
5. Atlantic highly migratory pelagic	16,512	18,300	1,788	11%
6. Atlantic sharks	9,530	7,393	-2,137	-22%
7. Atlantic coastal migratory pelagic	15,838	15,454	-384	-2%
8. Atlantic, Gulf of Mexico, and Caribbean reef fish	35,186	25,737	-9,449	-27%
9. Southeast drum and croaker	25,808	33,623	7,815	30%
10. Southeast menhaden[2]	920,000	860,000	-60,000	-7%
11. Southeast and Caribbean invertebrate	126,960	119,376	-7,584	-6%
12. Pacific Coast salmon	43,360	17,304	-26,056	-60%
13. Alaska salmon	318,104	376,100	57,996	18%
14. Pacific Coast and Alaska pelagic[2]	120,400	106,500	-13,900	-12%
15. Pacific Coast groundfish	288,538	268,085	-20,453	-7%
16. Western Pacific invertebrate	395	109	-286	-72%
17. Western Pacific bottomfish and armorhead	558	492	-66	-12%
18. Pacific highly migratory pelagic	430,061	253,606	-176,455	-41%
19. Alaska groundfish (total)	1,903,324	2,026,272	122,948	6%
Eastern Bering Sea and Aleutian Islands	1,661,766	1,775,600	113,834	7%
Gulf of Alaska[2]	202,308	211,049	8,741	4%
Pacific halibut (less Canada)	39,250	38,750	-500	-1%
20. Alaska shellfish	123,821	52,131	-71,690	-58%
21. Nearshore	225,185	312,700	87,515	39%
Total	5,008,074	4,891,432	-116,642	-2%

Table 12
Comparison of U.S. recent average yield (RAY) in metric tons (t) reported by *OLO '92* and *OLO '99*.

[1]Some stocks were listed under different units in 1992. Unit groupings correspond to *OLO '99.*

[2]Some stocks were not listed in both reports. For comparability, these RAY totals exclude the following: red crab, Unit 4, 1999; butterfish, Unit 10, 1992; Pacific herring, Unit 14, 1999; Atka mackerel, Unit 19 (Gulf of Alaska), 1999.

'92 and *OLO '99* were rock sole in the Eastern Bering Sea (a 285,000 t increase) and Pacific cod in the Gulf of Alaska (a 321,000 t decrease). In some cases, changes in estimates of LTPY coincide with changes in status classification. An example is windowpane flounder in the Northeast Region, for which an initial LTPY value of 5,000 t for *OLO '92* and *OLO '93* was provisional, based on historical landings. In *OLO '95*, LTPY was estimated to be much lower (2,100 t), and at the same time the stock status classification changed from near LTPY to below LTPY.

Stock	Region	Unit number	U.S. recent average yield (RAY) *OLO '92*	U.S. recent average yield (RAY) *OLO '99*	Change (t)	Change (%)	Status relative to long-term potential yield (LTPY)
Tanner (including snow) crabs	Alaska	20	109,910	41,910	-68,000	-62%	Below
Atlantic cod	Northeast	1	58,600	15,200	-43,400	-74%	Below
Bluefish	Northeast	2	25,100	11,200	-13,900	-55%	Below
Sea scallop	Northeast	4	16,100	7,100	-9,000	-56%	Below
Yellowtail flounder	Northeast	1	9,200	2,400	-6,800	-74%	Below
Jack mackerel	Pacific Coast	14	8,766	2,000	-6,766	-77%	Above
Coho salmon	Pacific Coast	12	7,944	1,421	-6,523	-82%	Below
Pollock	Northeast	1	9,300	3,800	-5,500	-59%	Near
Scup	Northeast	1	7,400	3,300	-4,100	-55%	Below
Northern anchovy	Pacific Coast	14	7,997	4,000	-3,997	-50%	Near
Porgies (Gulf of Mexico)	Southeast	8	3,798	125	-3,673	-97%	Unknown
Sockeye salmon	Pacific Coast	12	5,097	1,740	-3,357	-66%	Near
Sablefish (Bering Sea and Aleutian Islands)	Alaska	19	4,100	1,600	-2,500	-61%	Below
Small coastal sharks	Southeast	6	3,000	685	-2,315	-77%	Above
Windowpane flounder	Northeast	1	2,700	800	-1,900	-70%	Below
Ocean pout	Northeast	1	1,300	60	-1,240	-95%	Near
Pacific cod	Pacific Coast	15	1,687	515	-1,172	-69%	Unknown
Haddock	Northeast	1	2,000	900	-1,100	-55%	Below
Other porgies (Atlantic)	Southeast	8	844	67	-777	-92%	Unknown
Wreckfish (Atlantic)	Southeast	8	1,100	349	-751	-68%	Near
Alewife/blueback	Northeast	3	1,200	500	-700	-58%	Below
Cusk	Western Pacific	1	1,200	600	-600	-50%	Below
Spiny and slipper lobsters	Western Pacific	16	395	109	-286	-72%	Above
Nassau grouper and jewfish (Gulf of Mexico)	Southeast	8	73	2	-71	-97%	Below
Sturgeons	Northeast	3	73	7	-66	-90%	Below
Nassau grouper and jewfish (Atlantic)	Southeast	8	7	1	-6	-86%	Below
Total			288,892	100,391	-188,501	-65%	

Table 13
Comparison of recent average yield (RAY, U.S. share only) in metric tons (t), except for highly migratory stocks (Units 5 and 18, which have a very high percentage of non-U.S. landings) between *OLO '92* and *OLO '99*. Only stocks with RAY changes greater than –50% are listed. Nearshore resources are not included.

Therefore, the summary picture of recent trends presented in Table 11 should be interpreted with care. It is evident that most stock status classifications in *OLO '99* remained the same as in *OLO '92*. Nevertheless, it appears that more stocks have improved in utilization level (17 stocks) than have worsened (9 stocks). At the same time, more stocks have worsened in stock-level status (18) than have improved (7). Overall, this implies some net progress in bringing excessive fishing mortality rates under control, but it does not

appear that there has been an overall net improvement in stock status. In fact, this summary serves to confirm that a transition to eliminate overfishing and rebuild overfished stocks has begun, but it does not reflect the very real and substantive management measures that have been enacted in recent years nor the improved scientific understanding of resource dynamics and potential. A case in point is that of Northeast demersal fisheries, which have recently (since 1996–97) been subjected to very substantial reductions in fishing mortality in order to begin rebuilding programs that are designed to meet specific long-term targets (see Feature Article 2). Strengthened management measures designed to reduce overfishing and initiate rebuilding are also currently being implemented in many other fisheries, and this should result in an acceleration in the rate of improvement of stock status and degree of fishery utilization in the near future.

Recent Yields

Overall, average yields (U.S. share) of the fishery resources reported in Units 1–21 declined by 2% between the time periods considered by *OLO '92* and *OLO '99*. This corresponds to a decrease of more than 116,600 t (Table 12). The largest declines occurred for Pacific highly migratory fish stocks (-176,455 t), Alaska shellfish (-71,690 t), and Southeast menhaden (-60,000 t). The largest gains were for Eastern Bering Sea groundfish (113,834 t), Alaska salmon (57,996 t), and Northeast pelagic fisheries (20,200 t).

Table 13 lists the individual stocks or stock groups for which RAY decreased by 50% or more between *OLO '92* and *OLO '99*. In terms of tonnage, the largest reduction in RAY was for Tanner crabs in Alaska, after an all-time high in the early 1990's (Tanner crab landings, including snow crab, declined from 109,910 t in 1991 to 41,910 t in 1996). RAY for Atlantic cod in the Northeast Region also declined substantially during this time period, due to the low stock abundance caused by overfishing and to current fishing restrictions aimed at rebuilding the stock. For the same reasons, many of the stocks that experienced large percentage declines in RAY are from the Northeast (Table 13). Some stocks experienced large percentage declines in RAY, although the absolute magnitude of the landings is small. Examples are Nassau grouper and jewfish in the Gulf of Mexico and Atlantic, severely depleted stocks for which management aims to eliminate catches until rebuilding is achieved. Overall, 26 stock groups experienced a decrease in RAY of 50% or more, accounting for a 188,501 t decrease between *OLO '92* and this report.

Stock	Region	Unit number	U.S. recent average yield (RAY) *OLO '92*	U.S. recent average yield (RAY) *OLO '99*	Change (t)	Change (%)	Status relative to long-term potential yield (LTPY)
Atka mackerel (Bering Sea, Aleutians)	Alaska	19	21,100	83,800	62,700	297%	Near
Atlantic herring	Northeast	2	46,800	92,700	45,900	98%	Above
Chum salmon	Alaska	13	28,694	70,800	42,106	147%	Above
Bigeye tuna (Atlantic)	Northeast	5	63,233	100,700	37,467	59%	Below
Pacific sardine	Pacific Coast	14	3,511	35,000	31,489	897%	Near
Rock sole (Bering Sea, Aleutians)	Alaska	19	31,600	56,500	24,900	79%	Above
Flatfish (Gulf of Alaska)	Alaska	19	13,548	36,294	22,746	168%	Unknown
Other fish (Bering Sea, Aleutians)	Alaska	19	4,200	24,000	19,800	471%	Above
Other flatfish (Bering Sea, Aleutians)	Alaska	19	18,400	38,100	19,700	107%	Above
Pacific herring (Bering Sea)	Alaska	14	15,715	34,000	18,285	116%	Near
Goosefish	Northeast	1	11,700	27,600	15,900	136%	Below
Spiny dogfish	Northeast	1	10,600	23,900	13,300	125%	Below
Striped bass	Northeast	3	1,400	8,300	6,900	493%	Above
Pacific halibut (Bering Sea)	Alaska	19	3,200	8,930	5,730	179%	Near
Arrowtooth flounder (Bering Sea, Aleutians)	Alaska	19	5,600	11,300	5,700	102%	Above
Pink shrimp (Gulf of Mexico)	Southeast	11	5,454	11,009	5,555	102%	Near
Other rockfish (Bering Sea, Aleutians)	Alaska	19	800	5,800	5,000	625%	Above
Seatrouts	Southeast	9	6,250	10,820	4,570	73%	Variable
Northern shrimp	Northeast	4	3,800	7,600	3,800	100%	Unknown
Blue marlin (Atlantic)	Northeast	5	1,086	4,100	3,014	278%	Below
Rock shrimp	Southeast	11	3,419	6,240	2,821	83%	Unknown
Atlantic croaker	Southeast	9	4,946	7,657	2,711	55%	Below
Red drum (Gulf of Mexico)	Southeast	9	2,828	5,031	2,203	78%	Below
Stone crab	Southeast	11	1,264	2,961	1,697	134%	Near
Seabob shrimp	Southeast	11	2,269	3,947	1,678	74%	Unknown
Red snapper (Gulf of Mexico)	Southeast	8	2,228	3,815	1,587	71%	Below
Pelagic shelf rockfish (Gulf of Alaska)	Alaska	19	1,179	2,605	1,426	121%	Unknown
Shrimp	Alaska	20	340	1,637	1,297	381%	Below
White marlin (Atlantic)	Northeast	5	262	1,600	1,338	511%	Below
Spot	Northeast	1	1,500	2,500	1,000	67%	Unknown
Tilefish	Northeast	1	800	1,200	400	50%	Below
Pacific halibut (Wash., Ore., Calif.)	Pacific Coast	19	250	570	320	128%	Near
Snappers (Caribbean)	Southeast	8	224	422	198	88%	Unknown
Royal red shrimp	Southeast	11	143	250	107	75%	Unknown
Bottomfish (NW Hawaiian Islands)	Western Pacific	17	98	184	86	88%	Near
Queen conch (Puerto Rico)	Southeast	11	55	91	36	65%	Below
Wahoo	Western Pacific	18	101	160	59	58%	Near
Subtotal (without Units 5 and 18)			253,915	625,563	371,648	146%	
Total (all units)			318,597	732,123	413,526	130%	

Table 14 lists the individual stock groups for which RAY increased by 50% or more during the same time period. Many of these stocks are from the Alaska Region, where overfishing has not been widespread in the past. Examples of Alaska stocks with large gains in RAY include Atka mackerel, chum salmon, rock sole, and various other flatfishes (Table 14). In the Northeast Region, RAY increased for striped bass after an aggressive rebuilding program and a series of good recruitments. Other Northeast stocks that experienced large gains in RAY are often less traditional species like spiny dogfish, which replaced the more traditional stocks when they became depleted. In the Southeast Region, large relative gains in RAY were observed for shrimps and, despite low population sizes, for stocks such as red snapper and red drum in the Gulf of Mexico. Environmental conditions often modulate long-term trends in stock abundance. The increased levels of RAY for coastal pelagic fishes like herrings and sardine are partly due to more favorable environmental conditions. The overall gain in RAY for the 37 stocks in Table 14 amounts to 413,500 t. However, part of that total includes catches of tuna and tuna-like species made by other countries. The total gain excluding these stocks amounts to nearly 372,000 t.

It is evident from Table 13 that many of the stocks that experienced declines in landings are below the level that supports LTPY (65% of the stocks of known status in Table 13 are below LTPY). That is, the landings for many of these stocks decreased because their population sizes can no longer support historical levels of catch, or because of restrictive management regulations aimed at rebuilding the stocks, or both. In contrast, many of the stocks that had very large increases in landings had population sizes that could support LTPY (62% of the stocks of known status in Table 14 are near or above LTPY).

Table 14 (facing page)
Comparison of recent average yield (RAY, U.S. share only, in metric tons (t) except for highly migratory stocks from Units 5 and 18, which have a very high percentage of non-U.S. landings) between *OLO '92* and *OLO '99*. Only stocks with RAY changes greater than +50% are listed. Nearshore resources are not included.

Protected Resources

Perhaps the most positive development over the period since enactment of the 1994 MMPA Amendments has been the increase in quality of NMFS stock assessment information covering a greater number of separate stocks. *OLO '92* reported on 82 stocks of marine mammals and sea turtles from the Atlantic and Pacific Regions, but with fully 74% having unknown status. In this report, about twice that number of marine mammal and sea turtle stocks (158) are enumerated. Still problematic is that trends can only be assigned

to 12% of marine mammal stocks, and that no trend characterizations, other than for sea turtles, can be made in the Pacific Ocean. The designation of strategic stock confers special status which requires NMFS to prepare recovery plans for impacted stocks and closer scrutiny through annual status assessments.

Marine Mammals Off the Atlantic Coast, only the northeastern U.S. bottlenose dolphin stock changed from unknown to stable trend status. Because the total annual mortality estimate was higher than PBR, this stock was listed as depleted in 1998. Minimum population estimates, as compared to 1992, are equivocal for fin, humpback, pilot, and northern right whales, and trends cannot be assigned. Northwest Atlantic harbor porpoise and harbor seals are the only species with increasing abundance over 1992 levels. In the Gulf of Mexico, abundance estimates are available for six stocks of bottlenose dolphins, but there are more than 33 individual groups found in bays, estuaries, and sounds that are of unknown status.

The Hawaiian monk seal remains critically endangered throughout its range, with no discernible improvement in stock size since last reported in *OLO '95*. Three Pacific Coast stocks of harbor seal are increasing, but little else can be said about the remaining species. In the eastern tropical Pacific, several dolphin stocks are thought to have stabilized, largely from significant reductions in bycatch mortality associated with the tuna purse-seine fishery.

Recent stock assessments in Alaska show continued incremental improvement for bowhead whales, gray whales, and Southeast Alaska harbor seals. Although the threatened eastern Pacific stock of Steller sea lions (east of long. 144°W) has shown some improvement, the western U.S. Pacific stock (west of long. 144°W) continues to decline precipitously and has been placed in endangered status. In late 1998, NMFS issued a biological opinion finding the western U.S. Pacific stock to be in jeopardy and implemented emergency rules prior to the January opening of the 1999 walleye pollock fishery. Continuing their declining trend are harbor seals in the Gulf of Alaska and Bering Sea. The northern fur seal population remains stable, but retains its depleted status under the MMPA. The eastern stock of North Pacific gray whale has the distinction of being the first marine mammal to be removed from ESA listing. This species has fully recovered and is at or above its initial unexploited stock size.

Sea Turtles ESA status for all species of sea turtles remains unchanged from their initial listings in the 1970's, but progress has been made in developing new trend data and separation of populations. Improvements over 1992 include estimates of nesting females now available for the Atlantic populations of leatherback, and for several nesting populations in the Pacific of the leatherback, loggerhead, and olive ridley. Recent work in genetic stock identification has identified three loggerhead populations in the southeastern United States and a fourth off Mexico's Yucatán Coast.

Recent assessments suggest improving conditions in several stocks. Green turtles continue to increase from 1992 levels throughout their U.S. range. Increases were also observed for central-southwest Florida loggerhead (from stable in 1992), and for olive ridley in the Pacific (from unknown in 1992). Conservation efforts for the Atlantic Kemp's ridley has reversed an estimated 3% annual rate of decline (since 1978) to a sustained increase in the number of nests beginning in the early 1990's. The leatherback has gone from unknown status throughout its U.S. range to stable in the Atlantic but declining in the Pacific. The Pacific stocks of loggerhead and hawksbill are now considered stable relative to unknown status in 1992. Less promising circumstances are noted for two loggerhead stocks (northern Florida-North Carolina and Florida Panhandle) and the Atlantic hawksbill as they are in declining or unknown status.

ISSUES OF NATIONAL CONCERN

The management of living marine resources is complex and involves many biological, economic, social, and political factors. Each region and fishery discussed in this report, even those fisheries that are currently well managed and yielding near their long-term potential for the national benefit, must continually adjust and adapt to ever-changing conditions. To increase long-term benefits from currently overutilized and depleted fishery resources, the difficult issues and practices, which have resulted in overutilization and resource depletion must be confronted. In all 25 units, major issues affecting the resources and their management are raised. Although each resource unit has unique features, common themes are significant to many, if not all of them; they are discussed below.

Resource Conservation and Utilization by the Fishery

The primary concern of fishery management is conservation—the protection and wise use of the Nation's living marine resources. Management strategies must consider which stocks are overutilized and too low to produce LTPY. Table 3 indicates that 46% of the stocks under NMFS purview, whose status is known (73 out of 158 stock groups), are below the abundance levels that would produce LTPY. Similar compilations indicate that 34% of the stocks (54 out of 160 stock groups) are overutilized (Table 4).

The list of stocks that are overutilized or below the levels required to produce LTPY includes some of our most valuable fishery resources, such as New England groundfish, Atlantic sea scallops, several pelagic highly migratory fish stocks (including Atlantic bluefin tuna and swordfish), some Pacific salmon stocks, some rockfish off Alaska, and Alaska king crab. Many nearshore stocks (including several oyster populations, bay scallops, abalones, and Pacific striped bass) are also overutilized.

The Northeast Region presents the worst case of overutilized stocks (Tables 3 and 4). Cod, haddock, and yellowtail flounder, historically the most important groundfish species on Georges Bank off New England, are presently among the most depleted stocks in U.S. waters. By 1994, the Georges Bank haddock and yellowtail flounder stocks had collapsed, and Georges Bank cod was in danger of collapse. Restrictive controls on fishing effort, and closure of large areas on Georges Bank, have been implemented to reduce fishing mortality, and haddock and yellowtail flounder stocks are now improving.[5]

Examples of resource overutilization can also be found in all other regions. In some cases, like Pacific salmon, the main causes for their decline appear to be changing ocean conditions and habitat alterations, although intense fishing pressure from competing user groups has exacerbated the problem. Other stocks are disproportionately impacted by fishing owing to their low numbers in relation to more abundant target species.

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[5]On Georges Bank, the spawning-stock biomass of haddock is currently about one-fourth to one-third of the historical average. The spawning-stock biomass of yellowtail flounder has rebounded to its highest level since 1973.

In recent years, there has been growing awareness of Federal actions to mitigate overutilized situations. Throughout the early and mid 1990's, Federal FMP's were amended to specify numerical definitions of overfishing levels according to sound population dynamics principles (see Appendix 4). The fisheries managed by those FMP's need to maintain fishing mortality at levels lower than the definition of overfishing, which can be accomplished by a number of controls such as limiting catches. As the previous section on recent trends indicates, it is still too early to realize the full benefits of related conservation actions that have been taken in all regions. More recently, concurrent with the writing of this report, all FMP's are being amended again to revise the overfishing definitions, if necessary, to comply with changes made to the MSFCMA when it was reauthorized in October 1996. The amended Act has been interpreted by NMFS as being consistent with the precautionary approach, a framework for ensuring that conservation objectives take precedence over short-term economic considerations (see Feature Article 1). The Act, for example, dictates that management needs to maintain the abundance of stocks at levels capable of producing LTPY (or MSY). As a result, it is expected that management measures designed to eliminate overfishing will be strengthened in the near future.

In the case of stocks that are below LTPY, the amended MSFCMA requires plans to rebuild the stocks as quickly as possible. The benefits of rebuilding are not trivial. A very conservative estimate of the potential gain in yield from restoring overutilized stocks (those below LTPY) is 138,700 t, or a 39% increase of their combined RAY (Table 15). Many of these stocks are extremely valuable, not only commercially and to recreational anglers, but also as important components of the ecosystems that they are a part of, such that the true benefits to the Nation are difficult to quantify.

It is important to recognize that the benefits of rebuilding depleted stocks cannot be realized immediately after the rebuilding plans become operational. The amount of time required to rebuild a stock depends on the species' longevity and growth potential, on environmental influences, and on the management controls put in place. For example, a stock of long-lived rockfish that has been overfished for decades cannot be rebuilt in 10 years under average environmental conditions, even under a complete moratorium on fishing. Where fisheries are overcapitalized and performing poorly in economic terms, as many U.S. fisheries are, short-term economic concerns have tended to receive undue weight relative to the steps needed to cut back harvests–sometimes for many years–and achieve long-term biological and economic goals. The reauthorized MSFCMA effectively limits the weight

Stocks	Region	Recent average yield (RAY)	Long-term potential yield (LTPY)	Change (t)	Change (%)
American plaice	Northeast	4,300	7,200	2,900	67%
Atlantic cod	Northeast	15,200	40,000	24,800	163%
Atlantic halibut	Northeast	15	300	285	1,900%
Black sea bass	Northeast	3,500	Unknown	Unknown	Unknown
Cusk	Northeast	600	Unknown	Unknown	Unknown
Goosefish	Northeast	27,600	Unknown	Unknown	Unknown
Red hake	Northeast	1,400	Unknown	Unknown	Unknown
Scup	Northeast	3,300	Unknown	Unknown	Unknown
Silver hake	Northeast	15,500	Unknown	Unknown	Unknown
Spiny dogfish	Northeast	23,900	Unknown	Unknown	Unknown
Summer flounder	Northeast	9,700	24,500	14,800	153%
Tilefish	Northeast	1,200	1,200	0	0%
Windowpane flounder	Northeast	800	1,900	1,100	138%
Winter flounder	Northeast	5,500	12,900	7,400	135%
Witch flounder	Northeast	2,000	2,900	900	45%
Wolffish	Northeast	400	Unknown	Unknown	Unknown
Bluefish	Northeast	11,200	42,700	31,500	281%
Alewife/blueback	Northeast	500	Unknown	Unknown	Unknown
American shad	Northeast	600	Unknown	Unknown	Unknown
Atlantic salmon	Northeast	1	Unknown	Unknown	Unknown
Sturgeons	Northeast	7	Unknown	Unknown	Unknown
Sea scallop	Northeast	7,100	9,310	2,210	31%
Bigeye tuna	Northeast	100,700	80,000	-20,700	-21%
Albacore (North Atlantic)	Northeast	31,900	32,000	100	0%
Blue marlin (Atlantic)	Northeast	4,100	4,500	400	10%
Bluefin tuna (West Atlantic)	Northeast	2,300	5,250	2,950	128%
Sailfish (West Atlantic)	Northeast	900	700	-200	-22%
Swordfish (North Atlantic)	Northeast	14,800	13,000	-1,800	-12%
White Marlin (North Atlantic)	Northeast	1,600	2,200	600	38%

Table 15
Potential gains in yield in metric tons (t) from rebuilding overutilized stocks that are currently below LTPY. RAY and LTPY are U.S. share only, except for tunas and billfishes. The total is a conservative estimate, assuming that LTPY equals RAY when RAY is unknown.

Table continued on the next page

that can be given to short-term economic concerns when a stock's LTPY is in jeopardy. As a result, management measures designed to achieve rebuilding should also be strengthened over the near future.

A few abundant resources, such as some pelagic stocks of Atlantic mackerel and herring in the Northeast Region (Unit 2), jack mackerel off California (Unit 14), flatfishes off

Stocks	Region	Recent average yield (RAY)	Long-term potential yield (LTPY)	Change (t)	Change (%)
Large coastal sharks	Southeast	5,216	Unknown	Unknown	Unknown
King mackerel (Gulf of Mexico)	Southeast	3,307	9,750	6,443	195%
Nassau grouper and jewfish (Gulf of Mexico)	Southeast	2	Unknown	Unknown	Unknown
Red snapper (Gulf of Mexico)	Southeast	3,815	15,000	11,185	293%
Nassau grouper and jewfish (Atlantic)	Southeast	1	Unknown	Unknown	Unknown
Other groupers (Atlantic)	Southeast	1,150	Unknown	Unknown	Unknown
Other snappers (Atlantic)	Southeast	652	Unknown	Unknown	Unknown
Red porgy (Atlantic)	Southeast	236	450	214	91%
Red snapper (Atlantic)	Southeast	155	Unknown	Unknown	Unknown
Vermilion snapper (Atlantic)	Southeast	564	Unknown	Unknown	Unknown
Nassau grouper and jewfish (Caribbean)	Southeast	4	Unknown	Unknown	Unknown
Atlantic croaker	Southeast	7,657	50,000	42,343	553%
Red drum (Atlantic)	Southeast	800	Unknown	Unknown	Unknown
Red drum (Gulf of Mexico)	Southeast	5,031	7,900	2,869	57%
Queen conch	Southeast	91	Unknown	Unknown	Unknown
Spiny lobster (southeast United States)	Southeast	3,325	3,565	240	7%
Chinook salmon	Pacific Coast	7,444	11,460	4,016	54%
Coho salmon	Pacific Coast	1,421	5,300	3,879	273%
Lingcod	Pacific Coast	1,966	1,943	-23	-1%
Pacific ocean perch	Pacific Coast	800	1,100	300	38%
Bottomfish (Main Hawaiian Islands)	Western Pacific	249	254	5	2%
Pelagic armorhead	Western Pacific	0	2,123	2,123	N/A
Blue marlin	Western Pacific	23,278	23,278	Unknown	Unknown
Subtotal for "known" LTPY		271,844	410,560	138,716	51%
Subtotal for "known" LTPY excluding tuna and billfish		115,544	272,910	157,366	136%
Total		357,787	496,503	138,716	39%

Table 15
Continued from previous page.

Alaska (Unit 19), and tunas in the central-western Pacific, are currently underutilized. A much larger fishery yield can potentially be obtained from these stocks, perhaps as high as an extra 1,270,000 t (excluding tunas, Table 16). However, market conditions or bycatch limitations have kept the harvest for many of these stocks at low levels. Shifting fishing pressure from overutilized to underutilized stocks may relieve pressure on stressed stocks and aid in the rebuilding of depleted stocks. However, the habitats of the stocks often overlap and effective harvesting strategies must be developed to fish one stock while not jeopardizing others.

Stocks	Region	Recent average yield (RAY)	Long-term potential yield (LTPY)	Change (t)	Change (%)
Atlantic herring	Northeast	92,700	266,000	173,300	187%
Atlantic mackerel	Northeast	14,600	140,000	125,400	859%
Butterfish	Northeast	2,800	16,000	13,200	471%
Jack mackerel	Pacific Coast	2,000	100,000	98,000	4,900%
English sole	Pacific Coast	1,263	3,100	1,837	145%
Shortbelly rockfish	Pacific Coast	38	23,500	23,462	61,742%
Skipjack tuna (central-western Pacific)	Western Pacific	950,527	2,000,000	1,049,473	110%
Yellowfin tuna (central-western Pacific)	Western Pacific	335,451	600,000	264,549	79%
Arrowtooth flounder	Alaska	11,300	230,000	218,700	1,935%
Other fish	Alaska	24,000	27,800	3,800	16%
Other flatfish	Alaska	38,100	253,000	214,900	564%
Other rockfish	Alaska	5,800	8,300	2,500	43%
Rock sole	Alaska	56,500	449,000	392,500	695%
Subtotal without tunas		249,101	1,516,700	1,267,599	509%
Total		1,535,079	4,116,700	2,581,621	168%

Table 16
Potential gains in yield in metric tons (t) from fully utilizing underutilized stocks that are currently above LTPY. RAY and LTPY are U.S. share only, except for tunas.

In addition to requirements for preventing overfishing, ending overfishing of currently depressed stocks, and rebuilding depleted stocks, the reauthorized MSFCMA also contains provisions for reducing bycatch and minimizing the mortality of unavoidable bycatch, designating and conserving essential habitat, reforming the approval process for fishery management plans and regulations, reducing conflicts of interest on regional fishery management councils, and establishing user fees. The original 1976 Magnuson Fishery Conservation and Management Act contained seven national standards dealing with overfishing and optimum yield, best available science, management units, allocation of fishing privileges, economic efficiency, accounting for variation in stocks and fisheries, and minimizing management costs. There are now an additional three new national standards on fishing communities, bycatch, and safety at sea. Since the MSFCMA was reauthorized, NMFS and the fishery management councils have succeeded in implementing many of its requirements, including the development of new guidelines on most of the national standards and definitions of essential habitat, FMP amendments, formation of several special committees and advisory panels, and preparation of numerous studies and reports.

Almost all major U.S. fisheries now have some form of limited access in recognition of pervasive problems of overcapacity and overcapitalization and their effects on overfishing. Four U.S. fisheries (Alaska halibut and sablefish, wreckfish, and surfclams-ocean quahogs) have individual fishing quotas (IFQ's), a mechanism considered to be effective at matching fishing effort to resource productivity, but often perceived to result in other problems. In 1996, the U.S. Congress established a moratorium on new IFQ programs pending review by a National Academy of Sciences committee. That review was recently (December 1998) completed and is generally favorable towards IFQ's, although recognizing that this system of management is not a panacea and may not be applicable for all fisheries (NRC, In press). The United States has also been involved in several FAO-sponsored initiatives concerned with the issue of excess fishing capacity.

Transboundary Jurisdiction

Many living marine resources often cross political or geographic boundaries, complicating their assessment and management. The boundaries can be between states, between adjacent countries, or even between distant countries in international waters. Sometimes boundaries are crossed by juvenile or adult fish during migrations, and sometimes the boundaries are crossed by larvae drifting with ocean currents. In all cases, these movements complicate even the most comprehensive fisheries assessment and management regimes. Effective oversight of these species requires coordination, cooperation, and agreement among all interested parties.

Stocks located primarily within Federal waters are managed under FMP's prepared by regional FMC's and implemented and enforced by NMFS. Stocks whose distribution overlaps the jurisdiction of more than one regional FMC require the participation of multiple FMC's. Most stocks that extend beyond the U.S. EEZ are managed wholly or in part under international conventions.

Stocks located largely within the waters of more than one state are, to an increasing extent, managed by interstate mechanisms. One example of successful interstate management is the recovery of Atlantic striped bass under a rebuilding plan developed by the Atlantic States Marine Fisheries Commission; striped bass were considered to be fully restored in 1995. Examples of other resources that require interstate coordination of management are menhaden and mackerels in the Atlantic and Gulf of Mexico.

The United States shares important resources with its continental neighbors. Several groundfish stocks in the Northeast Region are shared with Canada. Although there is no formal mechanism to manage these stocks jointly, there is considerable interaction between the two countries in terms of sharing knowledge and information and in conducting joint assessments and reviews. In addition, the two countries share a similar objective of maintaining fishing mortality levels below the same threshold. Pacific halibut represent an example of a formal arrangement to assess and manage stocks shared by the U.S. and Canada jointly through the International Pacific Halibut Commission.

To the south, other valuable resources are shared with Mexico: Gulf of Mexico migratory pelagics (mackerels) and Pacific Coast pelagics (mackerels, sardine, and anchovy), as well as highly migratory stocks of tunas, swordfish, and sharks. No bilateral agreements are yet in place for the assessment and management of these stocks, although the foundations for these joint and multilateral agreements are being developed through MEXUS-Gulf and MEXUS-Pacific bilateral discussions, as well as through Mexico's developing interest in joining the International Commission for the Conservation of Atlantic Tunas (ICCAT).

In the Atlantic, highly migratory bluefin tuna and swordfish fall under the jurisdiction of ICCAT. Regulation of these particular species is difficult, since international consensus on catch levels for these high-valued fish is not always reached or agreed on. Further, enacted measures must always be successfully enforced by all nations to be effective. Highly migratory tuna and billfish also cross international borders in the Pacific, and some range across the Pacific. While international exchange of scientific information has been historically good, progress on joint management has been slow. In the absence of cooperative international management regimes, most stocks are regulated by individual coastal nations.

In some cases, foreign fisheries targeting migrating U.S.-origin stocks outside the U.S. EEZ can undermine Federal management of those stocks. Salmon on both the Atlantic and Pacific Coast begin life in freshwater and migrate to the open ocean to feed and mature before returning to their natal streams to spawn. During this period, salmon are subject to fishing pressure outside U.S. waters. Heavy exploitation of U.S.-origin Atlantic salmon in the commercial fisheries off Newfoundland and Greenland has recently been reduced through a Canadian closure of the Newfoundland fishery and through measures implemented by the North Atlantic Salmon Conservation Organization. Off the Pacific Coast, some U.S.-origin salmon are intercepted by Canadian fishermen while migrating

through Canadian waters, and some sockeye and pink salmon originating in Canada's Fraser River are caught by U.S. fishermen while transiting U.S. waters. The ever contentious allocation of expected catches from stocks originating from each country to fishermen of both nations is handled by the U.S.-Canada Pacific Salmon Commission. Some U.S. pollock from the Eastern Bering Sea migrate into the Russian zone in the northwestern Bering Sea where they are subject to exploitation by Russian fisheries. While there is scientific exchange on this issue between Russia and the United States, a joint management scheme has not yet been formulated.

Other stocks migrate over international borders through larval drift. Caribbean spiny lobsters, distributed from Brazil to Bermuda, produce larvae that can live from 4 to 9 months in the plankton, thus having the potential to move long distances. As yet, there is no international mechanism for the routine analysis and compilation of data that would facilitate Caribbean-wide management schemes for lobsters. A similar situation results in the need for international plans to manage pelagic armorhead fisheries off seamounts in the Western Pacific Region.

Bycatch

Bycatch, the incidental take of nontarget species or sizes in fishing operations, is a worldwide problem that results in 17,900,000–39,500,000 t of the world's commercial fish catch being discarded (Alverson et al., 1994). Bycatch not only creates waste but also makes it nearly impossible to meet management objectives simultaneously for the mix of species caught and, in many cases, bycatch results in the overutilization of stocks.

Bycatch is a ubiquitous problem, as can be appreciated from many units in Part 2 of this report. In all regions, bycatch results in overutilization or underutilization of resources, conflicts of allocation between competing user groups, or unwanted interactions with protected resources like marine mammals, birds, and sea turtles. Groundfish fisheries have notoriously visible bycatch problems. The fisheries, whether conducted with trawl gear, longlines, or pot gear, catch and discard large volumes of animals that are of the wrong size, wrong species, wrong maturity stage, or are otherwise unwanted. For instance, as much as 60–80% of the rock sole caught in recent years in the Eastern Bering Sea were discarded because they are not the valuable roe-bearing female fish. Several Alaska groundfish stocks are underutilized because their fisheries also catch other depleted stocks or stocks that are

under strict quota management, such as halibut or king and Tanner crabs. The bycatch of juvenile red snapper in the Gulf of Mexico shrimp fisheries restricts the speed at which the snapper stock can be rebuilt. Tuna and swordfish fisheries often catch marlins and sailfish, prized targets for recreational anglers. There are many other examples.

Mitigation of bycatch problems is complex. The problem is partly biological and partly technological. Some technological innovations can work to reduce bycatch, such as the use of turtle excluder devices to minimize impacts on sea turtles in the shrimp fisheries of the Gulf of Mexico or fish excluder devices to reduce bycatch of groundfish in the northern shrimp fishery of the Northeast Region. Research by NMFS, industry, and academia continues to develop fishing gears that are more species-selective. In some cases, however, new technologies cannot resolve the problem adequately and it may be necessary to use closed-area and closed-season controls on fishing. In the Northeast Region, for instance, scalloping is prohibited in some areas to aid in the rebuilding of Atlantic cod and yellowtail flounder. Time-area closures are also being used to reduce salmon bycatch in Alaska groundfish fisheries. Time-area closures may require continuous adjustments when the dynamics and abundance of the species of concern change in time and space and therefore require routine scientific monitoring.

Habitat

The requirement to identify essential fish habitat (EFH) was one of the most substantive changes in the 1996 reauthorization of the MSFCMA. With the EFH and related provisions, the amended Act gives heightened consideration to fish habitat in resource management decisions, and provides significant new tools to assist resource managers to conserve the habitats of marine, estuarine, and anadromous fish and shellfish resources.

EFH is identified as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity.” The MSFCMA requires that fishery management plans identify and describe EFH for all life stages of each species Federally managed within the U.S. EEZ, using the best scientific information available. Within areas identified as EFH, fishery management councils must minimize to the extent practicable adverse effects on the habitat caused by fishing practices. They must also identify adverse impacts from nonfishing activities and consider conservation and enhancement measures to mitigate those impacts. Federal agencies that authorize, fund, or undertake actions that may ad-

versely affect EFH must consult with the Secretary of Commerce, through NMFS, regarding the effects of their actions on the habitat and on the associated fisheries. NMFS can provide conservation and enhancement recommendations where appropriate, designed to minimize adverse impacts to EFH. These new policies incorporate the precautionary approach into the management of fish habitats.

Coastal zones contain the most productive marine ecosystems, providing habitats and essential spawning and nursery areas for most of the major commercial and recreational fishery species. The habitats of the coastal zone also provide a number of critical services that maintain the health and stability of the coastal ecosystems benefiting the organisms that depend on the system and man. Coastal and riparian wetlands serve as efficient filters for contaminants derived from land-based runoff, moderate the effects of flooding, and, along with coral reefs, buffer storm surges and help retard coastal erosion. Coastal habitats (mangrove swamps, estuarine oyster beds, salt marsh wetlands, seagrass beds, coral reefs, etc.), although highly productive, are fragile, and susceptible to degradation through human activities. It is here, where the shore meets the sea, and where people are most inclined to build, manufacture, and recreate, that the most susceptible and diverse aspects of marine life exist.

As the world's most biologically diverse marine ecosystems, coral reefs are home to one-third of all marine fish species and tens of thousands of other species. Coral reef areas under U.S. jurisdiction cover approximately 16,879 square kilometers. In the United States, coral reefs appear threatened wherever they are close to large concentrations of people; however, data are available to monitor the status and trends of U.S. coral reefs in only a few sites. The International Year of the Reef, 1997, and the 1998 Executive Order on Coral Reef Protection are providing impetus to new reef monitoring programs that should greatly increase our understanding of the status and outlook for coral reefs worldwide.

If coral reefs represent the most diverse marine communities, coastal wetlands and estuaries rank among the most productive ecosystems. These systems, including salt marshes, seagrass beds, and mangroves, are associated with some of the world's greatest fisheries, and provide habitat for migrating shorebirds and waterfowl. They also provide critical ecological functions supplying nutrients for nearshore production, filtering land runoff, and stabilizing coastal lands. Approximately 75 percent, by weight, of the Nation's commercial fish

catch is composed of fish and shellfish that depend on estuaries at some critical stage in their life cycle.

Until quite recently, the United States was losing wetlands at a rapid rate. The Clean Water Act and other Federal environmental laws have been instrumental in decreasing wetland losses since that time. During 1982–92, the losses totaled 31,000 acres of wetland per year, down from 157,000 acres per year in 1974–83, and down further from the 398,000 acres per year in 1954–74. However, despite regulatory programs and natural resource management plans, human population growth and development continue to result in a net loss of habitat acreage and function.

In addition to the coastal and estuarine habitats, fishery managers must also extend their concern to the riverine and riparian ecosystems of anadromous species and to the deeper offshore ecosystems that support migratory and pelagic species. Although many fish stocks are stable in Alaska, many other west coast salmon stocks are so diminished that they are now listed, proposed for listing, or under consideration for listing under the ESA. Declines in abundance have been attributed to habitat loss and degradation from the cumulative impacts of human activities, including hydropower dams, irrigation diversions, logging, mining, grazing, urbanization, etc. Loss of these species from their traditional river reaches has devastating effects on the biological integrity of those ecosystems.

Although pelagic fishes usually are not correlated with the types of areas commonly thought of as fish habitat (e.g. wetlands and bottom substrate), physiographic and hydrographic structures with which migratory pelagic fishes are often associated (e.g. seamounts, current boundaries, temperature discontinuities) can be characterized as habitat. In spite of the distance from shore, these habitats are susceptible to adverse effects from both inshore and offshore activities due to the transport of materials to these locations, and to damage (e.g. to seamounts) caused by certain types of fishing gears.

Many changes in the environment are not directly caused by human activities. For example, the decline in ocean survival for coho and chinook salmon in the Pacific during the last 2 decades coincides with a change in the oceanographic regime off the west coast. As another example, the abundance of some species, notably sardine and anchovies, typically oscillates in cycles that last for decades. In all cases, however, human actions can accelerate the declines in population either from other changes to the habitat (e.g. for

salmon in the rivers of the Pacific Coast), or from overfishing (e.g. for Pacific sardine in the 1970's), and may prolong the period of low abundance.

Marine Mammals and Protected Species

Many protected marine mammal stocks and all U.S. sea turtles are listed as either endangered or threatened under the ESA. Developing and implementing management strategies to minimize the adverse impact of human activities on these animals and aiding their recovery, while not unnecessarily restricting commercial and recreational fisheries, is a major challenge.

Significant progress has been made towards the recovery of turtle stocks during the last decade. Management strategies are being strengthened in order to ensure that these stocks continue on the path to recovery. In 1998, NMFS and the USFWS published recovery plans for five species of Pacific turtles and for one distinct turtle nesting population. Efforts are also underway to revise some of the existing recovery plans for Atlantic populations.

Much progress has also been made towards the protection and recovery of marine mammal stocks. The 1994 reauthorization of the MMPA strengthened requirements for classification of stocks in terms of the magnitude of levels of bycatch compared to population size and productivity. Efforts at reducing human-induced mortality, especially bycatch, are being focused on those stocks where the problem is more severe. Bycatch mitigation efforts have been focused through take reduction teams, and take reduction plans are in preparation or have been adopted for several stocks and fisheries.

The main issues for several selected high profile marine mammal species are summarized here.

Southeastern U.S. bottlenose dolphins Our understanding of the status of bottlenose dolphins in the southeastern United States has improved greatly through use of photographic identification, radiotracking, and biomolecular analyses. In the Atlantic, two distinct ecotypes have been identified, a coastal form occurring in shallow warm waters and an offshore form occurring in deep colder water. The coastal form is considered to be a strategic stock because it is classified as depleted under the MMPA due to an earlier epizootic,

and because current levels of bycatch slightly exceed the proper PBR level. In the Gulf of Mexico, 33 stocks of bottlenose dolphins have been identified in bay, sound, and estuarine areas, which are mostly quite small. Five additional stocks have been identified from the coastal and offshore areas. Estimates of direct human-induced annual mortalities are only a small fraction of the abundances for these five stocks, so none are classified as strategic. Three anomalous mortality events have been documented for bottlenose dolphins, suggesting that these stocks may be physiologically stressed.

Atlantic harbor porpoise A harbor porpoise take reduction plan for the Northeast Region's sink gillnet and Mid-Atlantic coastal gillnet fisheries was implemented in December 1998. The bycatch of the Gulf of Maine-Bay of Fundy harbor porpoise in gillnets has exceeded the PBR since first estimated in 1990. The fishery has been subject to seasonal and spatial regulation in the Gulf of Maine, and this may be part of the reason that it has intensified in the Mid-Atlantic Region in recent years. The take reduction plan defines specific areas and seasons that are closed to fishing or where either acoustic deterrents or net modifications are required to be used. The success of the plan at reducing bycatch below PBR's will be closely monitored using observer programs and other at-sea research.

Steller sea lions Improved estimates of Steller sea lion abundance were obtained for 1998. The western U.S. Pacific stock has continued to decline, while the eastern Pacific stock appears to be either stable or increasing slightly. The human-caused mortality exceeded PBR for the western U.S. Pacific stock, but not for the eastern Pacific stock. Newly instituted management actions (in early 1999) include a no-entry zone around rookeries, a prohibition of groundfish trawling within 10–20 n.mi. of most Alaskan rookeries and important haulout sites, and spatial and temporal allocation of Eastern Bering Sea and Gulf of Alaska Atka mackerel and walleye pollock catches.

Eastern tropical Pacific dolphins The 1997 International Dolphin Conservation Program Act mandated new research to determine whether or not encirclement of dolphins during tuna purse-seine fishing in the eastern tropical Pacific has an adverse affect on the animals. The status of several eastern tropical Pacific dolphin stocks continues to be of concern, especially for two stocks classified as depleted because of incidental mortality that has occurred in the fishery since the early 1960's, even though incidental mortality of dolphins has been substantially reduced since the early 1990's. Research is underway to clarify the status of these stocks and to determine the effects of chase and recapture.

Adequacy of Scientific Information and Assessments

One of the most important national issues is the quality and quantity of data on which stock assessments and management decisions are based. Stock assessments and other scientific information are the foundation for the rational and sustainable utilization of renewable resources. Stock assessments require data on the biology of the species, catches, abundance trends, and stock characteristics such as age composition, which are put together to estimate the current status of the stock and its past history. This understanding aids managers in the selection of fishing targets to be achieved and thresholds or limits to be avoided.

Basic information is still lacking to construct adequate assessments for many U.S. LMR's. This is the main reason why 21% of the stocks reported in Units 1–20 have unknown utilization levels (Tables 3 and 4). These stocks of unknown status account for less than 3% of the U.S. RAY, but include important species, such as sharks and many reef fish, for which not even the catch is recorded on a species-by-species basis. Progress has been made during the last few years, as 14 stock groups whose utilization level was unknown in *OLO '92* are now of known status (Table 11). But sound, scientifically based fisheries management requires more than the ability to classify the status of stocks. Relatively precise estimates of actual abundance, fishing mortality, and potential yield (e.g. CPY and LTPY) are more desirable. To improve on these estimates, more comprehensive data and research are needed.

The recent study of stock assessment methods conducted by the National Academy of Science (NRC, 1998) suggests that one of the key pieces of information required to assess a stock is an adequate index of relative abundance. Abundance indices can be obtained from analyses of catch rates in the fishery, or from scientifically designed research surveys. The former type is often problematic because fishing operations tend to occur in areas of high fish density, thus introducing potential biases of serious consequence. For instance, an increasing trend in the efficiency of fishing operations over time could mask a decline in abundance. Research surveys do not suffer from the same problem, but they tend to be more imprecise and survey data are more expensive to collect.

The Northeast Region has the longest history of surveys, which have been conducted since the 1960's for groundfish, and more recently also for pelagic and invertebrate resources. All regions have fishery-independent surveys for some of their more important resources, and efforts are underway to improve NMFS' ability to obtain abundance indices through a data acquisition plan involving the deployment of new replacement fisheries research vessels and increases in the use of charter vessels. The new vessels are urgently needed because existing NOAA fisheries research vessels average 34 years old, are technologically obsolete, and are approaching the end of their useful service life. To ensure the continuity and scientific integrity of NMFS' survey time-series, each replacement vessel must be calibrated with its older counterpart, while it is still operational.

Many of the issues discussed in the previous sections end up, in one way or another, affecting the allocation of fishery resources. Allocation can be between countries, between states, between several commercial sectors, commercial-recreational, inshore-offshore, tribal-nontribal, and combinations of these. Allocation decisions require precise and accurate knowledge of user-specific harvest levels in addition to an understanding of the spatial segregation of the resource. Recreational fisheries have increased considerably in importance and are now the main source of fishing mortality for many stocks, particularly in coastal waters (Unit 21). But, because of their dispersed nature, recreational fishing impacts are difficult to quantify. The main source of data for recreational fisheries is the NMFS marine recreational fisheries statistics surveys (MRFSS[6]) which now constitutes a 20-year continuous time series. In recent years, there have been several efforts to increase levels of sampling (e.g. for king mackerel in the Southeast Region) and to conduct region-wide surveys to collect data on the demographics and economics of recreational fisheries (in the Northeast Region in 1994 and 1998, the Southeast Region in 1997, and the Pacific Coast Region in 1998). Cooperative programs to improve the collection of data on charter boat operations have also recently been initiated in Maine, New Hampshire, North Carolina, and the Gulf of Mexico. Data on recreational fisheries are now available to the public on the World Wide Web.[7]

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[6]MRFSS (Marine Recreational Fisheries Statistics Survey). NMFS Office of Science and Technology, Fisheries Statistics and Economics Division, Silver Spring, MD 20910.

[7]http://www.st.nmfs.gov/st1/recreational/database/index.html

New insight into the biology of some species is reshaping their stock assessments. For example, an improved understanding of the population structure of several Atlantic tunas is being obtained from genetic studies and from research using biological markers and new tagging technologies. New technologies may also play an important role in enhancing NMFS' capacity to provide more efficient and accurate fish surveys through, for example, the development of advanced, integrated acoustic and laser-based systems and sensor platforms. In most cases, the acoustic and laser-based optical technologies are complementary, addressing specific components of an overall assessment problem. For example, an integrated light detection and ranging (LIDAR) system could potentially be developed to survey midwater species, for which the LIDAR system could be used to estimate fish size or identify species, and the integrated acoustic sensor could be used to provide abundance estimates from greater water volumes than could be obtained using LIDAR alone.

In addition to uncertainties in the status of stocks and abundance estimates or trends, there are critical gaps in our knowledge about ecosystem effects on LMR's. These gaps include the effects of environmental variability and changes caused by climate, functional habitat alteration, and long-term environmental degradation. Also included are gaps in knowledge about multispecies interactions. Several recent studies have stressed the need to incorporate ecosystem considerations and multispecies interactions into fish stock assessments and management advice. The National Academy of Sciences indicates that in order to restore fish populations and protect ecosystems, it will probably be necessary to substantially reduce fishing mortalities on most species (NRC, 1999).

Outlook

Issues of National concern have not changed substantially since *Our Living Oceans* was first published in 1991. Indeed, it could be said that they have not changed much during the past 2 decades and that they are found in all corners of the world: concerns about overcapacity, overfishing, and the ability to rebuild overfished stocks; bycatch; allocation between user groups; management of stocks that straddle different jurisdictions; habitat degradation; fishing interactions with protected species; and the adequacy of scientific information in a complex environment.

Substantial advances have been made, and continue to be made, on all issues. But because each stock has its own characteristics, each fishery has its own peculiarities, and

each set of available data is unique in some way, the progress made towards resolving these problems on the whole seems slow.

Not only is each situation unique, but the forces giving rise to the problems also seem to grow over time. Ever intensifying fishing effort and deployment of more powerful and sophisticated fishing gear and electronic fish-finding equipment have resulted in gross overcapacity and overfishing of resources that were previously considered to be at near-optimal exploitation. The increasing demand for fishery products or for the fishing experience increases the pressure on LMR's constantly. Urbanization of coastal zones and population growth also put continuously increasing pressure on the nearshore habitats that many species depend on as nursery areas. Long-term impacts from causes such as global warming and biophysical changes to ecosystems will likely also affect many LMR's in ways that are difficult to forecast.

The available scientific information and the ability to implement and enforce effective management regulations have been, in many cases, insufficient to manage LMR's at their maximum potential without incurring significant conservation risks. In the face of such uncertainty, fishing should be allowed to proceed conservatively, setting aside part of the resource potential as insurance against unknown risks. But the many increasing pressures acting upon LMR's have given rise to unduly favoring short-term economic gain at the expense of long-term sustainable utilization. In fact, in the face of uncertainty, fishing has generally proceeded less conservatively.

This situation began to be reversed in the early 1990's, when FMP's were required to contain measurable definitions of overfishing, a conservation threshold or limit to be avoided irrespective of any short-term considerations. Today, FMP's are required to make the definitions of overfishing consistent with avoiding fishing levels higher than those that support MSY. If adequately implemented, the new requirements should result in immediate actions to eliminate overfishing, rebuild depleted stocks, and prevent other stocks from becoming overfished. However, it is important to realize that stock rebuilding will be slow in many cases, perhaps of the order of a generation or more for some species.

Parallel to strengthened management measures, there is a need for strengthened science: If more is known about a stock and the effects of fishing upon it, then it becomes possible to fine-tune its management and protect the stock with less need for conservatism.

There are many scientific elements that can be strengthened, and some may be unique to each situation. A common one to most situations is to set up permanent monitoring programs to measure relative abundance from fishery-independent data. Such efforts should improve the quality of many stock assessments and would also serve as an improved basis for the understanding of population dynamics.

The outlook for the Nation's living marine resources depends in good part on the management actions that are being taken at present. The decline in the abundance of many stocks in all U.S. regions during the past few decades was primarily the result of overfishing (sometimes compounded by environmental changes). The strengthened management measures, designed to reduce overfishing and begin rebuilding, that are being implemented should result in an acceleration in the rate of improvement of stock status and fishery utilization levels. Their success depends on how effectively they can be implemented over the foreseeable future. Short-term losses in yield are expected as an immediate cost of rebuilding overfished stocks. However, judging from the remarkable ability of many stocks to recover from overfishing, the outlook is very positive over the long term, and should result in the potential for higher sustainable yields with reduced risk to the resources.

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