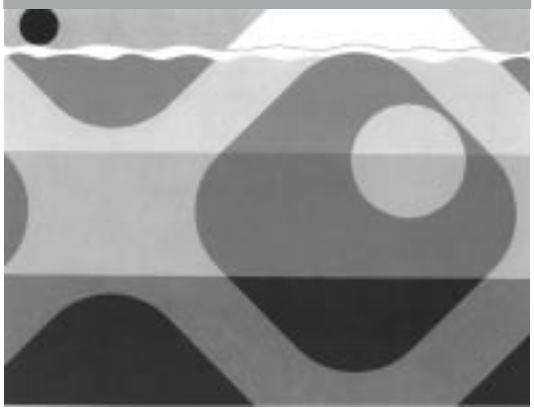
Part 1 National Overview



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National Overview

Introduction

The United States ranked fifth in the world for fisheries landings as reported by the Food and Agriculture Organization (FAO) of the United Nations in 1993, its latest survey year. The U.S. catch was 5.9% of the world's total catch of marine and freshwater fisheries products. The FAO survey also ranked the United States second in value for imports as well as exports of these products.

The stewardship of the U.S. living marine resources (LMRs) is entrusted to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (hereafter referred to as NOAA Fisheries or NMFS) which carries out its charge under many laws, treaties and mandates from the U.S. Congress. Most of NOAA Fisheries conservation responsibilities emanate from four statutes: the Magnuson Fishery Conservation and Management Act (MFCMA) regulates fisheries within the U.S. Exclusive Economic Zone (EEZ), the Endangered Species Act (ESA) protects species threatened or endangered, the Marine Mammal Protection Act (MMPA) regulates taking of marine mammals, the Fish and Wildlife Coordination Act authorizes collection of fisheries data and coordination with other agencies for environmental decisions affecting LMRs. A fifth statue, the Federal Power Act, provides for concurrent responsibilities with the U.S. Fish and Wildlife Service (USFWS) for protecting aquatic habitat.

The purview of NOAA Fisheries is the U.S. EEZ or the 200-nautical mile (nmi) zone off the United States (Fig. 1). Within the 0-3 nmi territorial sea, management jurisdiction belongs to the coastal states. Beyond the 200-nmi federal zone are international waters where living marine resources are intended to be regulated by applicable international laws and multilateral arrangements between governments. NOAA Fisheries plays an important role on behalf of the U.S. in the implementation of these international arrangements.

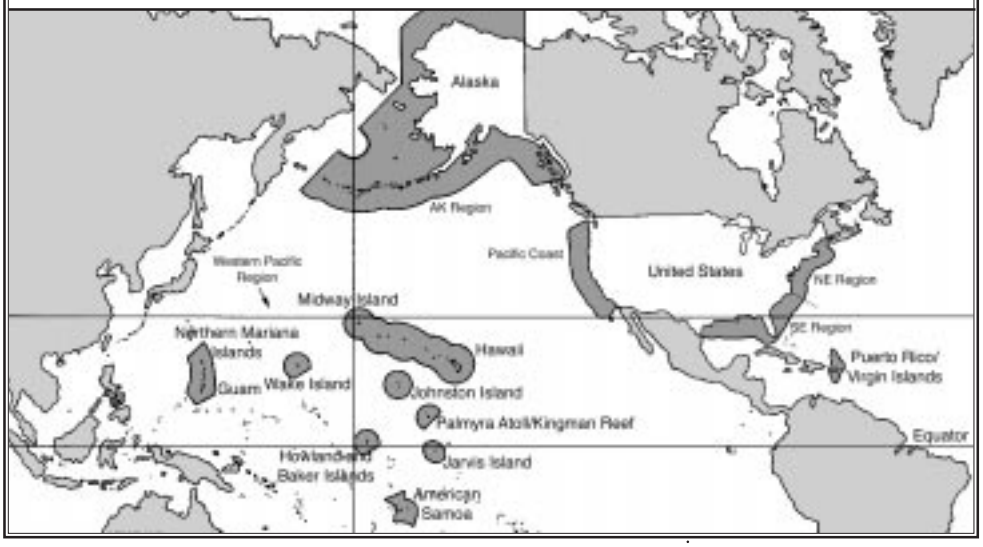
The intent of federal resource conservation laws requires that the best scientific information be used as the basis for management actions. NOAA Fisheries scientists collect and analyze much of this data. From these databases, the agency prepares scientific reports along with technical presentations to fishery managers, industry groups, and the public for use in formulating sound policies governing the use and protection of LMRs.

Ultimately, the Secretary of Commerce has management responsibility as the designated manager of the Nation's living marine resources within the U.S. EEZ. The fisheries resources are managed largely through well documented fishery management plans (FMPs). These management plans are developed through extensive consultations with state and other federal government agencies, public interest groups, and, in pertinent cases, international science and management organizations.

The FMPs originate through the MFCMA which established eight regional fishery management councils (FMCs) to develop management plans for the Nation's fishery resources (Appendix 2). The Councils represent diverse interests through their members who are nominated by state governors in each region and appointed by the Secretary of Commerce. For some fisheries and for protected resources such

Figure 1.

Exclusive Economic Zones of the United States and Representation of the Five Large Geographic Regions



Common Terms

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

- **Stock** ideally refers to a biologically isolated group of organisms (e.g., fish) that are genetically related. Since stocks intermix in the marine habitat, it may be necessary to consider all of the individuals of a species or several species in a geographical area as a stock when it is impractical to isolate them. Thus, a unit stock defined for management purposes may not necessarily correspond to a genetic unit.

- **Recent Average Yield (RAY)** is equivalent to the recent average catch. Unless otherwise designated, RAY is the reported fishery landings averaged for the most recent 3-year period of workable data, 1992-94.

- **Current Potential Yield (CPY)** is the current potential catch that can be taken depending on the current resource abundance and prevailing ecosystem considerations. This term is analogous to acceptable biological catch (ABC) that is specified in some FMPs.

- **Long-Term Potential Yield (LTPY)** is the maximum long-term average catch that can be achieved from the resource. This term is analogous to the concept of maximum sustainable yield (MSY).

- **Stock Level Relative to LTPY** is a measure of stock status. The present abundance level of the stock is compared with the level of abundance which on average would support the LTPY harvest. This level is expressed as below, near, above, or unknown relative to the abundance level that would produce LTPY.

- **Status of Resource Utilization** describes the level of fishery use of the resource (i.e., underutilized, fully utilized, overutilized, or unknown). It shows how the existing fishing effort compares with those levels necessary to achieve LTPY.

- **Threatened** or **Endangered** are terms defined under the Endangered Species Act. 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.

- **Potential Biological Removal (PBR)** is the sustainable removal level (in numbers) for marine mammals as calculated by the 1994 Amendments to the MMPA.

as marine mammals and sea turtles, FMPs and protected species recovery plans may be developed directly by NOAA Fisheries, with advice from the public and the regional FMCs.

This report covers most of the LMRs that are of interest for commercial, recreational, subsistence, or aesthetic reasons to the United States. The status of fishery resources is reported by regional units. Current and potential harvest levels are given, along with information on fishery utilization and management. The status of the marine mammal and sea turtle resources are included. Nearshore species, largely the management responsibility of coastal states, are also summarized.

The information contained in this report has been collected from many sources. Ideally, the most current 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 owing to lack of data, but they may still be adequate for fishery scientists to exercise professional judgments as to stock status and magnitude of potential yields. When information is inadequate, the status is classified as unknown. In such cases, potential yield would be estimated from recent catch levels. More detailed information on specific resources may be obtained from regional status of fisheries resources reports available from NOAA Fisheries science centers around the country (Appendix 3), and from coastal state fish and wildlife agencies.

Contents

Part 1 of OLO ’95 contains a national overview of significant LMRs. It includes this introduction, a brief introduction of terms, region by region resource summaries, a discussion of issues of national concern, and a discussion of near-term outlook. Part 1 also includes two feature articles—an essay on Pacific Northwest salmon, and an examination of the implications of the 1994 Amendments to the Marine Mammal Protection Act.

Part 2 presents in greater detail the status of regional LMRs in 25 separate units. These unit synopses describe species or species groups linked geographically, ecologically, or by characteristics of their fisheries.

Part 3 lists the principal authors and contributors, the FMCs and FMPs, the principal NOAA Fisheries facilities around the country, stock assessment principles and terms, and the scientific and common names of most species covered in this report.

Productivity of Stocks

The productivity and status of fishery resources utilized by the United States are summarized in Units 1 to 21. Productivity is represented by RAY, CPY, and LTPY. For some stocks, the U.S. shares fishery 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 as well as the prorated portion of the stock within the U.S. EEZ. OLO '95 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; any amount taken outside the U.S. EEZ has generally been small.

The total LTPY of all U.S. fishery resources is estimated at 10.3 million t (Table 1). Total CPY is 9.1 million t, indicating that the present productivity of the stocks is 12% below the long-term potential. Total RAY is 7.2 million t or 30% below the long-term potential.

When only the U.S. prorated share of the resources is considered, the U.S. LTPY is 8.1 million t or 21% below total LTPY (Fig. 2). By region, the percentage distribution of U.S. LTPYs is 10% for the Northeast, 18% for the Southeast, 54% for Alaska, 14% for the Pacific coast, and 4% for the western Pacific oceanic regions (Table 2, Fig. 3).

The U.S. RAY is 5.06 million t or 37% below U.S. LTPY. The additional 37% potential yield was not realized because some of the stocks were underutilized while some have been overexploited and currently no longer producing at their full long-term potential. By region, the percentage distribution of U.S. RAYs is 9% Northeast, 23% Southeast, 54% Alaska, 9% Pacific coast, and 5% western Pacific oceanic (Table 2, Fig. 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 275 stock groups addressed in this report as being 30% below, 27% near, 9% above, and 34% unknown relative to the levels that would produce LTPY. This summary includes 74 stock groups of nearshore resources that are under the purview of coastal states.

Excluding nearshore resources, the remaining 201 stock groups that are under the purview of NOAA Fisheries have been classified as being 36% below, 30% near, 13% above, and 21% unknown relative to the abundance levels that would produce U.S. LTPY (Fig. 5). The 21% unknown category comprises 43 out of 201 stock groups. These 43 stock groups are generally of low abundance and contributed only to 2.7% of U.S. RAY.

There are 158 stock groups whose status are known that fall under the purview of NOAA Fisheries (Units 1-20 in Table 3). In this category, there is a high percentage of stock groups, 46% (involving 73 out of 158 known-stock status), that is below levels that would produce LTPY. The majority of these low

Table 1. Productivity of Fisheries Resources Utilized by the United States

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY) [1]

Unit / Fishery	Entire Range of Stock			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
1. Northeast demersals	185,535	183,735	479,335	145,900	402,365
2. Northeast pelagics	165,800	724,300	412,000	115,600	253,920
3. Atlantic anadromous	4,836	4,836	4,836	4,836	4,836
4. Northeast invertebrates	99,500	99,900	72,500	93,568	89,357
5. Atlantic highly migratory pelagics	246,955	242,455	245,519	14,600	19,100
6. Atlantic sharks	9,324	9,213	10,240	9,324	10,240
7. Atlantic/Gulf of Mexico coastal migratory pelagics	17,884	20,127	26,236	17,884	26,236
8. Atlantic/Gulf of Mexico reef fish	31,225	30,750	43,158	31,225	43,158
9. Southeast drum & croaker	16,785	16,785	68,715	16,785	68,715
10. Southest menhaden	890,000	890,000	1,140,000	890,000	1,140,000
11. Southeast/Caribbean invertebrates	112,483	111,641	95,165	112,483	95,165
12. Pacific coast salmon	22,957	33,312	33,312	22,957	33,312
13. Alaska salmon	364,800	296,500	296,500	364,800	296,500
14. Pacific coast & Alaska pelagics	116,800	166,100	559,100	116,800	559,100
15. Pacific coast groundfish	262,657	352,491	465,750	262,657	465,750
16. W. Pacific invertebrates	143	106	135	143	135
17. W. Pacific bottomfish & armorhead	388	626	2,738	388	2,738
18. Pacific highly migratory pelagics	2,077,232	2,003,188	2,033,706	240,438	278,945
19. Alaska groundfish	2,186,684	3,544,525	3,955,025	2,186,684	3,955,025
20. Alaska shellfish	125,744	125,745	113,779	125,744	113,779
21. Nearshore species	283,995	283,995	283,995	283,995	283,995
Total	7,221,727	9,140,330	10,341,744	5,056,811	8,142,371

[1] For row totals; where LTPY is unknown, CPY is substituted; where CPY is unknown, RAY is substituted. RAY is generally for the latest 3-year average, 1992-94.

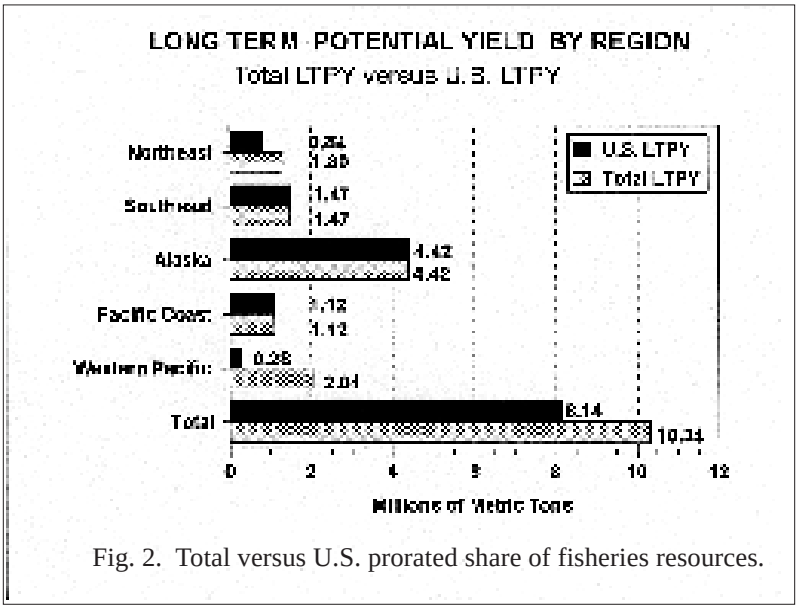


Fig. 2. Total versus U.S. prorated share of fisheries resources.

abundance cases occurred in Unit 1 (19 stocks of northeast demersal species), Unit 8 (9 stocks of Atlantic and Gulf of Mexico reef fish), and Unit 15 (6 stocks of Pacific coast groundfish). Less pronounced cases of low abundance can be found in all regions, including Alaska. For the remaining stocks (85 out of 158 known-stock status), these have been classified as 38% near and 16% above the levels that would produce LTPY. If it is assumed that stocks near or above levels that would produce LTPY are stocks in healthy condition, it may be stated that 54% of the known-stock status groups are at healthy abundance levels.

Status of Utilization

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

Table 4 summarizes the classifications for the 275 stock groups addressed in this report as being 12% underutilized, 34% fully utilized, 23% overutilized, and 31% unknown. This grouping includes 74 stock groups of nearshore resources that are under the purview of coastal states.

Excluding nearshore resources, the remaining 201 stock groups that are under the purview of NOAA Fisheries have been classified as 15% underutilized, 35% fully utilized, 28% overutilized, and 22% unknown (Fig. 6).

There is still a high percentage of stocks, 22% (involving 44 out of 201 stock groups), whose status of utilization is unknown. The majority of these 44 unknown stock groups are found in the Southeast region where assessments of coastal migratory species, reef fishes, and invertebrates have been difficult. This category also includes 7 stock groups from Unit 18 occurring in the western Pacific oceanic region where the highly migratory species of tunas move long distances across many national jurisdictions, making assessment of the stocks difficult.

There are 157 stock groups that are classified as being of known-utilization status that are under the purview of NOAA Fisheries (Units 1-20 in Table 4). Of these, 36% (involving 56 out of 157 known utilization-status groups) are overutilized. The majority of these overutilized cases occurred in Unit 1 (18 stocks from the Northeast demersal unit) and Unit 8 (10 stocks in the Atlantic and Gulf of Mexico reef fish unit). For the remaining stocks, they have been classified as 20% underutilized and 44% fully utilized, for a combined total of 64% utilization at under-to-full utilization levels.

Table 2. Regional Productivity of Fisheries Resources Utilized by the United States

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY). Unknown row totals are substituted as in Table 1.

Region	Entire Range of Stock			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
Northeast	777,856	1,330,456	1,289,420	449,734	844,808
Southeast	1,168,531	1,169,346	1,474,344	1,168,531	1,474,344
Alaska	2,732,298	4,025,140	4,423,674	2,733,298	4,423,674
Pacific Coast	462,759	609,948	1,116,207	462,759	1,116,207
Western Pacific Oceanic	2,079,283	2,005,440	2,038,099	242,489	283,338
Total	7,221,727	9,140,330	10,341,744	5,056,811	8,142,371

Regional and Species Group Synopses

Northeast Region

The Northeast region's finfish and invertebrates are grouped under demersal, coastal pelagic, anadromous, invertebrate, highly migratory pelagic, and nearshore resources. Their combined U.S. LTPY is 844,800 t (Table 5) out of a total LTPY of 1.29 million t for the region. The lower U.S. LTPY reflects the sharing of transboundary resources with Canada and some Atlantic countries. The

U.S. RAY totaled only 449,700 t or 53% of U.S. LTPY because some 33 species, principally groundfish, are overutilized and below the stock levels necessary to produce LTPY. The RAY of 449,700 t excluded 248,000 t of menhaden that were taken at the southern limit of the Northeast region. That amount has been added to the Southeast menhaden data (Unit 10) as it is an integral part of the South Atlantic menhaden stock.

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

Principal groundfish and flounders in the Northeast, particularly cod, haddock, and yellowtail flounder, have been severely overfished and their overall abundance in 1994 was the lowest on record. Dogfish and skates, which increased in abundance beginning in the 1970s as groundfish and flounders decreased, currently comprise about 75% of the total fish biomass on Georges Bank and have supported increased catches in recent years. Since 1990, however, their abundances have also begun to decrease. Catches of other groundfish have become increasingly important in recent years as preferred species declined. In 1994, the U.S. catch of goosefish exceeded the catch of cod for the first time.

Five species, mainly pelagics, are presently underutilized, and the CPY of the two most abundant of these, Atlantic mackerel and herring, is nearly 522,500 t higher than their RAY. The anadromous striped bass, driven to very low levels of abundance in the early-1980s and subjected to severe catch restrictions beginning in the mid-1980s, was declared fully restored in early-1995. The region's valuable crustaceans and bivalve molluscs, both offshore (e.g., American lobster, sea scallop, surfclam, ocean quahog) and inshore (e.g., blue crab, oyster, blue mussel, hard and softshell clam) are nearly all fully or overexploited.

Most of the region's fisheries are included in FMPs either in place or under development. Very few FMPs have been successful in preventing overexploitation of their respective species. Amendment #5 to the Northeast Multispecies FMP, enacted early in 1994, was intended to limit commercial fishing effort on groundfish in

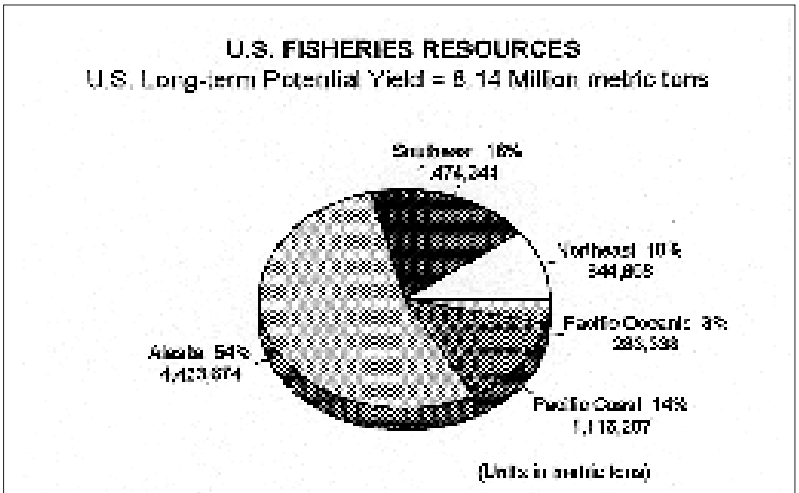


Fig. 3. Regional apportionment of long-term potential yield of the U.S. prorated share of fisheries resources.

New England and prevent the issuance of new vessel permits in this overcapitalized fishery. It is now judged to be insufficient in reducing fishing mortality as desired. In light of the serious nature of the collapse of cod, haddock, and yellowtail flounder, the Secretary of Commerce approved an emergency closure of portions of Georges Bank and a moratorium on

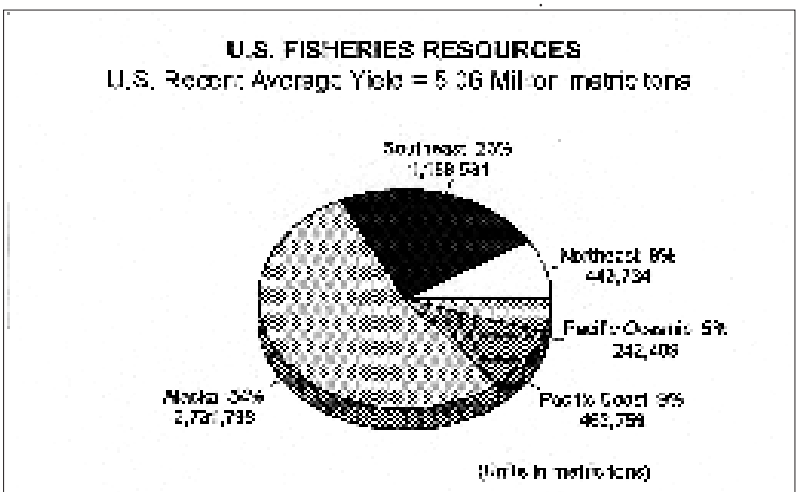


Fig. 4. Regional apportionment of recent average yield of the U.S. prorated share of fisheries resources.

commercial fishing for haddock, beginning 1 January 1994, which continues in place. The New England FMC is developing Amendment #7 to the Multispecies FMP, with the objective of reducing fishing mortality on these stocks to as near to zero as practicable. Concurrently,

Canada continues to maintain severe restrictions on its own groundfish fishery on Georges Bank to promote stock rebuilding.

Amendment #4 to the Sea Scallop FMP controls fishing effort by limiting the days at sea for each vessel, placing a moratorium on new entrants, and imposing a larger dredge mesh-ring size. Along with supplemental measures, it is intended to reduce fishing mortality and move this fishery from overutilization to full utilization. Plans are underway by the New England FMC to develop additional regulatory measures for American lobster that will include limits on numbers of traps, seasonal closures, and overall quotas.

Southeast Region

The Southeast region covers the Gulf of Mexico, Southeast Atlantic, and the Caribbean Sea. Its important resources are Atlantic sharks, Atlantic/Gulf of Mexico coastal migratory pelagics, Atlantic/Gulf of Mexico reef fish, drum and croaker, menhaden, Southeast Atlantic/Caribbean invertebrates, and nearshore resources. The total LTPY of fisheries resources is 1.47 million t and is virtually all available to the U.S. (Table 6). The U.S. RAY is 1.17 million t or 80% of U.S. LTPY.

Menhaden comprise about 75% of both the U.S. LTPY and U.S. RAY. Menhaden are considered fully utilized in both the Gulf of Mexico and Atlantic Ocean, with some growth overfishing in the Atlantic.

Shrimp led the region in value, although composing only 8% of the total Southeast LTPY and RAY. The three major species (brown, white, and pink) are considered 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.

The highly migratory pelagic species are important components of fisheries in the Northeast and Southeast regions. Bluefin tuna is well below the biomass level required for maximizing long-term yield. The marlins (white and blue) are below as well, although blue marlin appear to be increasing. Swordfish has recently declined to a level below that which would produce maximum long-term yield. Yellowfin tuna 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.

Large coastal sharks (as a group) may be overutilized, but the status of each species is presently unknown. Due to their life history strategies, sharks may be particularly vulnerable to overfishing.

Spanish mackerel appear to be fully utilized in both the Gulf of Mexico and Atlantic. King mackerel have been overfished in the Gulf, and a stringent rebuilding program has been in place for the last several years. King mackerel in the Atlantic may have some additional yield potential. 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 to fishery yield. The status is 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 stringent rebuilding plan has begun. Success of this rebuilding hinges 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

Table 3. Status of Stock Levels of U.S. Living Marine Resources, 1992-94

Unit / Fishery	Current Status Relative to the Level Producing LTPY				
	Below	Near	Above	Unknown	Total
1. Northeast demersals	19	3	2	1	25
2. Northeast pelagics	1	2	3	0	6
3. Atlantic anadromous	4	0	1	0	5
4. Northeast invertebrates	0	3	2	1	6
5. Atlantic highly migratory pelagics	4	4	0	2	10
6. Atlantic sharks	1	0	1	1	3
7. Atlantic/Gulf of Mexico coastal migratory pelagics	1	3	0	3	7
8. Atlantic/Gulf of Mexico reef fish	9	2	0	17	28
9. Southeast drum & croaker	4	0	0	3	7
10. Southest menhaden	0	2	0	0	2
11. Southeast/Caribbean invertebrates	3	6	0	5	14
12. Pacific coast salmon	2	3	0	0	5
13. Alaska salmon	1	1	3	0	5
14. Pacific coast & Alaska pelagics	3	4	0	0	7
15. Pacific coast groundfish	6	4	4	5	19
16. W. Pacific invertebrates	1	0	0	0	1
17. W. Pacific bottomfish & armorhead	3	3	0	0	6
18. Pacific highly migratory pelagics	2	12	0	1	15
19. Alaska groundfish	6	8	8	3	25
20. Alaska shellfish	3	0	1	1	5
21. Nearshore species	10	14	0	50	74
Subtotal of Units 1-20	73	60	25	43	201
% of Subtotal	36%	30%	13%	21%	
% of 158 "known" stock groups	46%	38%	16%		
Total of Units 1-21	83	74	25	93	275
% of Total	30%	27%	9%	34%	
% of 182 "known" stock groups	45%	41%	14%		

Atlantic region, many of the key species are considered overutilized (e.g., vermilion and other snappers, red porgy, several groupers, amberjacks, jewfish). In the Caribbean, Nassau grouper and jewfish are considered overutilized; the status of other species is unknown.

The status of drum and croaker stocks is largely unknown. Many of the smaller species could also be heavily impacted from bycatch of the shrimp fleet; thus weakfish bycatch in the Atlantic is becoming a major management issue. Red drum harvest in the Gulf and South Atlantic EEZs have been prohibited, and harvests in state waters have been reduced for several years due to low spawning levels. All indications are that fishing mortality has been reduced significantly and recovery is expected.

Status information for invertebrates other than shrimp is mixed. Spiny lobster is apparently overutilized in the Southeast region. Spiny lobster status in the Caribbean is uncertain, but possibly overutilized, with growth overfishing. Stone crab appears to be fully utilized, while queen conch may be overutilized.

Alaska Region

The Alaska region dominates in the tonnage of fisheries resources that could be obtained in the long term for the United States. The major resources are salmon, groundfish, Pacific halibut, shellfish, and herring. Their combined U.S. LTPY is 4.42 million t (Table 7). The resources are generally healthy with regional CPY only 9% below LTPY. The U.S. RAY has been steady at about 2.73 million t, or 38% below LTPY. Catches are substantially below long-term potential because many of the resources, particularly flatfish species, are underutilized.

Alaska salmon stocks have produced bumper harvests in recent years. The RAY of 364,800 t is actually 23% above LTPY because 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 MFCMA. Until its implementation in 1977, Alaska's groundfish fisheries, except for Pacific halibut, were dominated by foreign fishers. Then, within a few years under the new management regime, the U.S. fishery largely replaced the foreign fishing fleet.

For the Bering Sea/Aleutian Islands groundfish, RAY is 1.9 million t (Table 7). The major species groups harvested are walleye pollock, Pacific cod, flatfishes, Atka mackerel, rockfish, and sablefish. Except for Greenland turbot, 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 the Gulf of Alaska groundfish, RAY is 249,600 t. The major species groups harvested include walleye pollock, Pacific cod, sablefish, flatfishes, and slope rockfish. Overall abundance of groundfish in the Gulf has been relatively stable, except for walleye pollock, which is down.

Pacific herring stocks are producing slightly below their LTPYs. Shrimp resources are down throughout Alaska. King crab resources are depressed, but Tanner crab stocks are still relatively high.

In addition to the general groundfish

Table 4. Status of Utilization Levels of U.S. Living Marine Resources, 1992-94

Unit / Fishery	Degree of Fisheries Utilization of the Resource				
	Under	Full	Over	Unknown	Total
1. Northeast demersals	2	4	18	1	25
2. Northeast pelagics	4	1	1	0	6
3. Atlantic anadromous	0	2	3	0	5
4. Northeast invertebrates	0	3	2	1	6
5. Atlantic highly migratory pelagics	0	4	4	2	10
6. Atlantic sharks	0	1	1	1	3
7. Atlantic/Gulf of Mexico coastal migratory pelagics	1	2	1	3	7
8. Atlantic/Gulf of Mexico reef fish	0	2	10	16	28
9. Southeast drum & croaker	0	0	3	4	7
10. Southest menhaden	0	2	0	0	2
11. Southeast/Caribbean invertebrates	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 & Alaska pelagics	1	6	0	0	7
15. Pacific coast groundfish	5	9	3	2	19
16. W. Pacific invertebrates	0	0	1	0	1
17. W. Pacific bottomfish & armorhead	3	0	3	0	6
18. Pacific highly migratory pelagics	4	2	2	7	15
19. Alaska groundfish	10	13	0	2	25
20. Alaska shellfish	1	4	0	0	5
21. Nearshore species	3	24	7	40	74
Subtotal of Units 1-20	31	70	56	44	201
% of Subtotal	15%	35%	28%	22%	
% of 157 "known" stock groups	20%	44%	36%		
Total of Units 1-21	34	94	63	84	275
% of Total	12%	34%	23%	31%	
% of 191 "known" stock groups	18%	49%	33%		

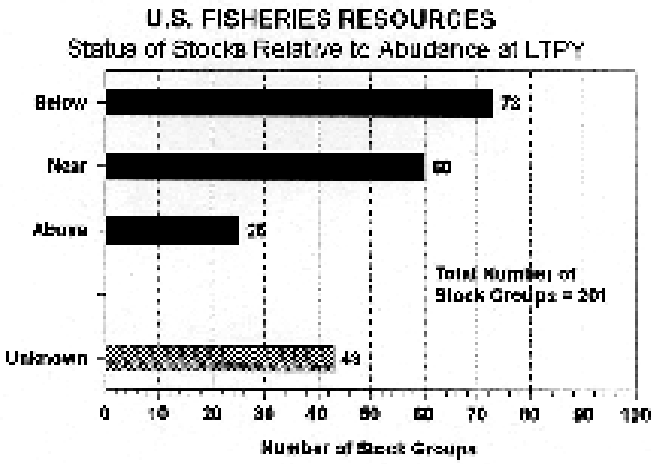


Fig. 5. Number of stock groups classified by their status of stock levels relative to abundance levels that would produce long-term potential yield for stocks under NOAA Fisheries purview.

complex, Pacific halibut is a groundfish species that has supported an important traditional fishery for both the U.S. and Canada. This resource is fully utilized and managed by the International Pacific Halibut Commission. Abundance peaked in 1989 and has been declining steadily at about 10% per year since.

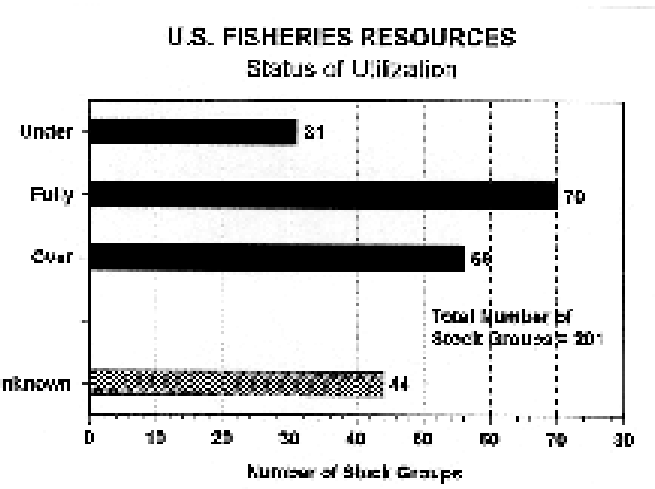


Fig. 6. Number of stock groups classified by their status of utilization for stocks under NOAA Fisheries purview.

Pacific Coast Region

The Pacific coast fisheries resources have a combined U.S. LTPY of 1.12 million t (Table 8). The major species are salmon, coastal pelagics, groundfish, Pacific halibut, and nearshore resources. The U.S. RAY is 462,800 t or only 41% of LTPY. The lower RAY is due mainly to lower abundances of coastal pelagic species (Unit 14) and groundfish (Unit 15) and underutilization of some species. Most stocks are fully utilized or overutilized.

All five species of Pacific salmon are fully or overutilized. The RAY of 23,000 t is 69% of its LTPY. Depressed production is partly due to ocean conditions that have been generally unfavorable for salmon off the Pacific coast since the late-1970s. Some stocks are depleted and have triggered ESA designations.

Coastal pelagic fishes are low in abundance, and all, except jack mackerel, are fully utilized. Jack mackerel is one of the few underutilized Pacific coast species. The RAY of 64,000 t is only 12% of LTPY. The Pacific sardine population has been increasing after decades at low abundance levels.

The groundfish fishery harvests a vast array of bottom-dwelling species from Washington to California. The RAY of 262,500 t is 56% of LTPY. The large difference between RAY and LTPY is due to a variety of factors and the diversity of this fishery complex. Some species are overexploited, some have experienced periods of low recruitment, and some are underutilized. Pacific whiting dominates the commercial catch, accounting for 72% of the groundfish catch. Rockfishes and lingcod also support popular recreational fisheries. Certain stocks, such as Pacific ocean perch, are in need of rebuilding following overutilization and a period of poor recruitment. Shortbelly rockfish is substantially underutilized.

Pacific coast shellfish resources are diverse and important both commercially and recreationally. Shrimp, crab, clams, and abalone fisheries are relatively small in terms of tonnage landed, but they contribute substantially to the value of Pacific coast 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 are taken, and the recreational catch of some greatly exceeds the commercial catch. Many are nearshore resources. Gamefishes such as albacore, tuna, billfishes, rockfish, and salmon are highly prized. Recreational crabbing, clam digging, and abalone diving activities are also

significant.

Western Pacific Oceanic Region

The vast area that encompass this region stretches across the central and western Pacific Ocean and includes the Hawaiian Islands and the U.S. territories of American Samoa, Guam, and the Northern Marianas. These are tropical and subtropical island waters with a large diversity of species but relatively low sustainable yields due to limiting ocean nutrient availability. Though the magnitude of the fisheries may be relatively small (U.S. LTPY is only 283,300 t and U.S. RAY is 242,500 t, Table 9) when compared to certain larger mainland fisheries, seafood and fisheries are valued highly and important culturally and socially in Hawaii and the Pacific island territories. 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, green sea turtle, and blue, fin, and sperm whales.

The highly migratory stocks (tunas, billfishes, swordfish, sharks, and others) range the high seas and often occur beyond U.S. fisheries management jurisdiction. Tunas provide the major catch component and are species that migrate across multiple jurisdictions in the Pacific. The combined LTPY of these stocks throughout their migratory range is over 2.0 million t, while the prorated U.S. LTPY is only 278,900 t. Of the 15 stock groups of highly migratory pelagics, 12 stocks are near the levels that would produce their LTPYs, two are below LTPY, and one is of unknown status.

Western Pacific bottomfishes (snappers, jacks, grouper, emperors) are harvested from a variety of rock and coral habitats around Hawaii and western Pacific island territories. 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, and overutilization is of concern. But when the resources are considered across the region, the U.S. LTPY of 2,700 t is seven times higher than U.S. RAY because stocks in the northwestern Hawaiian Islands, American Samoa and Marianas are underutilized.

Pelagic armorhead has been harvested by foreign fleets on the summits and slopes of submerged seamounts along the southern Emperor-northern Hawaiian Ridge since 1968. Of these undersea mountains, the only group under U.S. jurisdiction is the Hancock Seamounts, where armorhead fishing has been prohibited since 1984 to allow the stock to recover after catch rates declined to low levels. The U.S. has never fished armorhead, but because of it's fishery potential, the resource is regulated under a Seamount Groundfish FMP. This stock is currently in a recovery stage.

The most important invertebrate fisheries in the western Pacific 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-1980s, but 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, emergency closures, a limited entry regime, and a closed season was adopted to rebuild the stocks. The lobster LTPY is now much lower than during the 1983-89 period, but the stock is recovering.

Nearshore Resources

For the purposes of this report, "nearshore fishery resources" are those coastal and estuarine species under the purview of coastal states and for which NOAA Fisheries does not have direct responsibility. Many of these coastal and estuarine species provide the basis for important commercial and recreational fisheries. They vary widely in

Table 5. Productivity of Fisheries Resources of the Northeast Region, 1992-94

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY) [1]

Unit / Fishery	Entire Range of Resource			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
1. Northeast demersals	185,535	183,735	479,335	145,900	402,365
2. Northeast pelagics	165,800	724,300	412,000	115,600	253,920
3. Atlantic anadromous	4,836	4,836	4,836	4,836	4,836
4. Northeast invertebrates	99,500	99,900	72,500	93,568	89,357
5. Atlantic highly migratory pelagics	246,955	242,455	245,519	14,600	19,100
21. Northeast nearshore species	75,230	75,230	75,230	75,230	75,230
Northeast Total	777,856	1,330,456	1,289,420	449,734	844,808

[1] For row totals; where LTPY is unknown, CPY is substituted; where CPY is unknown, RAY is substituted. RAY is generally for the latest 3-year average, 1992-94.

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 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. Rather than providing an in-depth review of their status, Unit 21 presents information on the more significant species and their general status.

Table 6. Productivity of Fisheries Resources of the Southeast/Gulf of Mexico/Caribbean Region, 1992-94

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY) [1]

Unit / Fishery	Entire Range of Resource			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
6. Atlantic sharks	9,324	9,213	10,240	9,324	10,240
7. Atlantic/Gulf of Mexico coastal migratory pelagics	17,884	20,127	26,236	17,884	26,236
8. Atlantic/Gulf of Mexico reef fish	31,225	30,750	43,158	31,225	43,158
9. Southeast drum & croaker	16,785	16,785	68,715	16,785	68,715
10. Southest menhaden	890,000	890,000	1,140,000	890,000	1,140,000
11. Southeast/Caribbean invertebrates	112,483	111,641	95,165	112,483	95,165
21. Southeast nearshore species	90,830	90,830	90,830	90,830	90,830
Southeast Total	1,168,531	1,169,346	1,474,344	1,168,531	1,474,344

[1] For row totals; where LTPY is unknown, CPY is substituted; where CPY is unknown, RAY is substituted. RAY is generally for the latest 3-year average, 1992-94.

It is difficult to assess the condition of many of the country's nearshore resources. A high percentage are of unknown status. No firm estimate exists for LTPY nor CPY. Thus, the RAY of 284,000 t (Table 1) has been used to indicate minimum amounts for CPY and LTPY. The RAY itself has been underestimated and excludes landings of large-scale nearshore fisheries like anchovy, sardine, herring, and invertebrate resources which are reported in other unit chapters.

Marine Mammals

The amended MMPA of 1994 requires the Secretary of Commerce and the Secretary of Interior to develop stock assessment reports (SARs) for all marine mammal stocks that are found within U.S. waters. NOAA Fisheries is responsible for assessing and managing 155 stocks of cetaceans and pinnipeds. The U.S. Fish and Wildlife Service has authority for stocks of North Pacific walrus, Alaska polar bear, West Indian manatee, and Alaska and California sea otters. SARs for all stocks are divided into three separate regions—Alaska, Pacific including Hawaii, and Atlantic including the Gulf of Mexico.

The MMPA requires an SAR to include, among other things, information on how the stock was defined, a minimum abundance estimate, the stock's current and maximum net productivity rate, current population trend, a calculation of PBRs, an assessment of whether incidental fishery takes are "insignificant and approaching zero mortality and serious injury rate," and an assessment whether the level of human-caused mortality and serious injury is likely to reduce the stock to below OSP or whether the stock should be classified as a "strategic stock." SARs are to be reviewed annually for strategic stocks and for stocks for which new information is available, and at least once every three years for all other stocks. The 1994 amendments also require that take reduction teams be formed for each strategic stock and charges them with developing plans to reduce takes to below the PBRs. 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 anthropogenic mortality exceeds the estimated replacement yield.

Of the 163 marine mammal stocks managed under the MMPA, 54 are classified as strategic (Table 10). These include 4 stocks that are depleted under the MMPA, 4 that are listed as threatened and 24 as endangered under the ESA, 17 for which the total annual mortality exceeds PBR, and other stocks where information on stock status or fisheries related mortality is uncertain. In addition, 2 of 10 stocks of eastern tropical Pacific dolphin are listed as depleted under the MMPA.

With regard to population trends, of the 163 marine mammal stocks in U.S. waters, there is sufficient long-term population information to describe trends for only 55 stocks (33%), and the status of the remaining 108 stocks (66%) is unknown. Of those for which information is available, 8 (5%) are declining, 24 (15%) are known to be stable, and 23 (14%) are believed to be increasing (Table 10). The new regime

established by the 1994 MMPA amendments, once implemented by NOAA Fisheries and the USFWS, will contribute to the long-term database needed to detect and evaluate trends for all marine mammal stocks.

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. Limited stock assessment data exist for about one-half of these species.

All sea turtles are listed either as endangered or threatened under the ESA (Table 10). The Kemp's ridley, hawksbill, and leatherback turtles are listed as endangered throughout their ranges. The loggerhead and olive ridley turtles are listed as threatened throughout their U.S. ranges, as is the green turtle, except the Florida nesting population which is listed as endangered.

The large Pacific population of green sea turtles at French Frigate Shoals in the Hawaiian Islands is thought to be increasing, but there is continuing concern about the tumor-associated fibropapilloma disease. Efforts continue to investigate the cause of the disease and halt its advance among green sea turtles in both Hawaiian and Florida waters.

Issues of National Concern

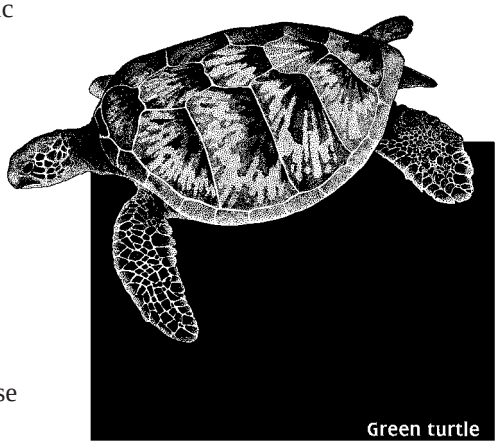
The management of living marine resources is complex and involves many biological, economic, social, and political factors. Each region and fishery discussed in this report, and even those fisheries that are currently well managed and yielding near their long-term potential for the national benefit, must continually adjust and adapt to ever-changing conditions. To increase long-term benefits from currently overutilized and depleted resources, the difficult issues and practices which have resulted in overutilization and resource depletion must be confronted.

In each of the 21 fishery and 4 protected species units, major issues affecting the resources and their management are raised. Although each resource unit has unique features, there are common themes that are significant to many, if not all, units. These are discussed below.

Resource Conservation and Utilization

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 NOAA Fisheries purview whose abundance status is known (73 out of 158 stock groups) are below the abundance levels that would produce LTPY. Similar compilations indicate that 36% of the stocks (56 out of 157 stock groups) are overutilized (Table 4).

The list of stocks that are overutilized or below the levels required to produce LTPY includes some of the our most valuable fishery resources, such as New England groundfish, Atlantic sea scallops, Gulf of Mexico shrimp, several pelagic highly migratory 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, Pacific striped bass) are also overutilized.


Green turtle
Chelonia mydas

The Northeast region has the worst case for overutilized stocks. Three historically important groundfish species (cod, haddock, and yellowtail flounder) on Georges Bank off New England are presently among the most depleted stocks in U.S. waters. Haddock and yellowtail flounder are classified as "collapsed" by virtue of their current low abundance (biomass of spawners is about 10% of the mid-1970s levels) due to prolonged excessive fishing pressure. The cod stock is in imminent danger of collapse, and portions of Georges Bank were closed to fishing beginning 1 January 1994 to reduce fishing mortality on these species and promote stock recovery.

All five species of Pacific salmon (chinook, coho, sockeye, pink, and chum), from Washington, Oregon, and California, may be considered overutilized and depleted. However, the main causes for their decline appear to be

changing ocean conditions and habitat alterations; although intense fishing pressure from competing user groups exacerbate the problem.

Most shellfish resources off Alaska are depressed and Alaska king crab is depleted in the eastern Bering Sea. Rockfish resources, particularly Pacific ocean perch, were overutilized by foreign fleets in the 1960s, but have since stabilized at historical long-term abundance levels.

In the Gulf of Mexico, the king mackerel was severely depleted because of excessively high catches in the late-1970s and early-1980s. It now supports catches about 36% of LTPY. Red snapper, traditionally the most important reef fish in the Gulf of Mexico, is taken mainly as incidental catch in the shrimp fishery, and currently supports catches only about 21% of LTPY. Red drum was subjected to intense fishing in the 1980s in response to consumer demands for "blackened redfish" and currently provides catches at about 46% of the long-term potential.

Table 7. Productivity of Fisheries Resources of the Alaska region, 1992-94

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY) [1]

Unit / Fishery	Entire Range of Resource			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
13. Alaska salmon	364,800	296,500	296,500	364,800	296,500
14. Alaska herring	52,900	55,200	55,200	52,900	55,200
19. Alaska groundfish					
Bering Sea/Aleutian Islands	1,902,402	3,025,385	3,483,785	1,902,402	3,483,785
Gulf of Alaska	249,582	492,240	451,440	249,582	451,440
Halibut (Alaska)	34,700	26,900	19,800	34,700	19,800
20. Alaska shellfish	125,744	125,745	113,779	125,744	113,779
21. Alaska nearshore species	3,170	3,170	3,170	3,170	3,170
Alaska Total	2,733,298	4,025,140	4,423,674	2,733,298	4,423,674

[1] For row totals; where LTPY is unknown, CPY is substituted; where CPY is unknown, RAY is substituted. RAY is generally for the latest 3-year average, 1992-94.

Other examples of overutilization can also be found throughout the country. Many are disproportionately impacted by fishing owing to their low numbers in relation to more abundant target species. In recent years, there has been growing awareness of federal actions to mitigate overutilized situations. All federal FMPs now require numerical overfishing levels to be specified according to sound population dynamics principles. Catches are normally restricted to help rebuild overfished stocks. Despite a vigilant watch for overutilization, resources do decline—some naturally, some through habitat change, and some through excessive fishing efforts—not all are controllable.

Many U.S. marine fisheries, including both the overutilized and fully utilized stocks, are overcapitalized. As generally understood, this means that there are more fishing vessels and gear trying to catch fish than are necessary to harvest the resource efficiently. Such overcapitalization is a major factor contributing to overutilization of a resource. Where fisheries are overcapitalized and performing poorly in economic terms, short-term economic concerns tend to receive undue weight relative to the steps needed to cut back harvests and achieve long-term biological and economic goals. The excess capital may maintain pressure to increase catch limits beyond potential yield levels, deplete the resource, and once depleted, prevent its recovery. Many of the other issues discussed in this report are complicated by overcapitalization. For example, excess numbers of boats exacerbate fish allocation and bycatch problems.

Economic theory and experience in most U.S. and worldwide fisheries indicate that overcapitalization is an inevitable consequence of management schemes that allow free access to fisheries. U.S. fisheries managers have recently established access controls for more fisheries. Individual transferable quota (ITQ) management plans have been approved and/or implemented for three fisheries: the Atlantic surf clam fishery, the Alaska sablefish fishery, and the Alaska Pacific halibut fishery. Additional controls on access, including ITQs, are under consideration by all FMCs.

A few abundant resources, such as some pelagic stocks in the Northeast region (Unit 2), jack mackerel off California (Unit 14), and flatfishes off Alaska (Unit 19), are currently underutilized. A much larger fishery yield can potentially be obtained from these stocks, but market conditions or bycatch limitations has kept the harvest low.

Shifting fishing pressure from overutilized to underutilized stocks may relieve pressure on stressed stocks and aid in the rebuilding of depleted stocks. However, the habitat of the stocks often overlap and effective harvesting strategies must be developed to fish one stock while not jeopardizing the other.

Bycatch

The incidental take of nontarget species in fishing operations reflects the fact

that species do not live in pure, discrete, exploitable patches, but as members of intermixing communities. 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 Bering Sea were discarded because they are not the valuable roe-bearing female fish. According to a recent United Nation's report examining bycatch amounts worldwide, 20-40% of the world's catch may have been discarded routinely.

Mitigation of bycatch problems is complex. The problem is partly biological and partly technological. While some technological innovations can work to reduce bycatch, such as the use of turtle excluder devices to minimize impacts on sea turtles in shrimp fisheries, most problems of bycatch are not as simple to resolve. In many cases, catches of high abundance species threatens low abundance species; thus the catch of more dominant species may have to be severely restricted.

Bycatch levels and control measures have occupied the attention of most fisheries management actions of all regional FMCs. Even when apparent solutions are found, the dynamics and abundance of marine species change in time and area, which can shift the character of the problems and require continuous adjustments to their solutions.

Habitat

Habitat loss and degradation affects mostly inshore and estuarine ecosystems. The primary threats come from alteration of freshwater flows, wetland loss, and destructive fishing methods. Diminution in freshwater volume and flow rates stem from damming and diversions of major rivers impacting nearshore ecosystems adapted to seasonal discharges of freshwater. Logging contributes to siltation and can destroy salmon spawning habitat upriver and impede their migratory paths.

Loss of aquatic plant-based habitat (e.g., coastal wetlands or eelgrass and kelp beds) resulting from development (e.g., marinas, docking facilities) adversely affects a variety of food webs that are important to adults and juveniles of many marine and anadromous species. Dredging and disposal of dredged material in estuaries and bays also cause significant habitat impacts.

Destructive fishing methods can also damage habitat and coral reefs. In the past, extremely damaging fishing practices that employed explosives or poisons were prevalent in some Pacific islands. These are now almost universally outlawed, but poaching by these methods remains a problem in remote regions of the western Pacific islands.

Nonindigenous Species

Many introductions of foreign (i.e., non-native) aquatic species are intentional, and made to enhance fisheries productivity or to establish organisms of cultural importance as people immigrated to new regions. However, new species may bring along undesired effects. They may compete with native species, dilute genetic integrity, or carry new diseases to the system.

The introduction of the Pacific oyster, *Crassostrea gigas*, from Japan to the U.S. Pacific coast, which now comprises much of the aquaculture production in that area, is an example of introduction that went well. Other cases are less fortunate. The discovery of nonindigenous shrimp species in South Carolina waters during the 1980s is an example of the more common consequence of accidental introductions from aquaculture sources. Pacific black tiger prawn, *Penaeus monodon*, and Pacific white shrimp, *Penaeus vannamei*, that escaped aquaculture ponds brought new diseases to the native stocks. The Pacific white shrimp, in particular, is known to sometimes harbor infectious hypodermal and hematopoietic necrosis virus and other diseases that can devastate native shrimp stocks.

While there are benefits to be gained from species introductions, the dangers of such activities are now better appreciated, and numerous regulations have been enacted to control them. In most application reviews, the risks from intentional introductions are compared to the benefits before introductions are allowed. Even so, unforeseen adverse impacts from introductions can occur.

Unintentional introductions are increasing even as intentional introductions have declined. Unintentional aquatic introductions include the release of ornamental organisms from the aquarium trade and the accidental release of cultured species. Potential problems have been

found in Florida and Hawaii where there are abundant native aquarium-trade species. Thus far, the problems has not become widespread.

Another mechanism of unintentional introduction is salmon net-pen escapes. Atlantic salmon cultured in net pens in the Atlantic Northeast and Pacific Northwest do escape and may spawn with natural salmon runs, leading to erosion of local genetic integrity. Double-mesh nets and the use of sterile animals (triploidy) are possible ways to reduce impacts of net-pen escapes.

Table 8. Productivity of Fisheries Resources of the Pacific Coast Region, 1992-94

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY) [1]

Unit / Fishery	Entire Range of Resource			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
12. Pacific coast salmon	22,957	33,312	33,312	22,957	33,312
14. Pacific coast pelagics	63,900	110,900	503,900	63,900	503,900
15. Pacific coast groundfish	262,657	352,491	465,750	262,657	465,750
19. Halibut (Pacific Coast)	200	300	200	200	200
21. Pacific Coast nearshore species	113,245	113,245	113,245	113,245	113,245
Pacific Coast Total	462,759	609,948	1,116,207	462,759	1,116,207

[1] For row totals; where LTPY is unknown, CPY is substituted; where CPY is unknown, RAY is substituted. RAY is generally for the latest 3-year average, 1992-94.

Nonindigenous organisms may be difficult to eradicate once they become established. The effects of introductions are impossible to predict. Slowing the spread of non-indigenous marine species and reversing the impacts of introduced species are conservation problems of growing significance.

Transboundary Jurisdiction

The fact that many living marine resources often cross the boundaries between states and with other nations complicates even the most comprehensive fisheries exploitation and management regime. Effective oversight of these species requires coordination, cooperation, and agreement among all interested parties. Stocks located largely within the waters of more than one state are, to an increasing extent, managed by interstate compacts. One example of successful interstate management is the recovery of Atlantic striped bass, highlighted in OLO '93. After striped bass was reduced to very low abundance in the 1970s, a plan was developed by the Atlantic States Marine Fisheries Commission (ASMFC) which called for a series of tight fishing restrictions during 1981-90, followed by a gradual relaxation of controls as remedial measures began to take effect. This effort culminated in a declaration in January 1995 of full stock restoration.

Stocks located primarily within federal waters are managed by plans prepared by regional FMCs and implemented and enforced by NOAA Fisheries. Stocks whose distribution overlaps the jurisdiction of more than one regional FMC require the participation of multiple FMCs.

Most stocks that extend beyond the U.S. EEZ are managed wholly or in part under international conventions. In the Atlantic, highly migratory bluefin tuna and swordfish fall under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas. Regulation of these particular species is difficult since international consensus on catch levels for these high-valued fish is not always reached nor agreed on. Further, enacted measures must always be equally enforced by all nations to be effective.

Another example of a transboundary stock issue occurs on Georges Bank off New England. In 1984, a World Court decision resolving the U.S.-Canada maritime boundary dispute awarded each country part of the bank. The resulting "Hague Line" gave each country custody over the fisheries in their respective waters and the stocks distributed over the entire bank. In spite of the obvious need for joint management of important cod, haddock, pollock, yellowtail flounder, and sea scallops stocks, each country has so far exercised separate control on fisheries in their respective zones. The lack of bilateral management agreements has added to the complexity of rebuilding these overfished stocks. Recently, both countries have again taken independent actions to restrict fishing on Georges Bank.

Off the Pacific coast, anchovy and sardine straddle the border with Mexico, and several important groundfish stocks extend across the border into Canadian waters. Highly migratory tuna and billfish also cross international borders, and some range Pacific-wide. 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. One example is the interception of U.S. pollock stocks that occurs in the international zone of the central Bering Sea, known as the "Donut hole" area. Several international meetings were convened to address the problem, and temporary agreement was reached among all affected parties to cease fishing in the zone during 1992-95. In another positive development, an international treaty was signed and ratified in late 1995 to manage the Aleutian Basin pollock resources.

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 Greenland has recently been reduced through measures implemented by the North Atlantic Salmon Conservation Organization (NASCO). 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 always-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. In the Pacific Ocean, high-seas salmon driftnet fishing is now banned under a United Nations General Assembly Resolution and by the North Pacific Anadromous Fish Commission.

Marine Mammals and Protected Species

The cumulative effects of commercial fishing activities with regard to marine mammal status are still largely unknown. One important interaction is competition for fish. Sea lions in Alaska, for example, eat juvenile pollock, while the fishing fleet target adult pollock. Thus, while direct competition is minimized, there is concern that commercial fisheries may disrupt prey availability either through bycatch of small pollock or from general disruption of the underlying food web.

The release of fish-processing waste can alter the feeding behavior of some marine animals. Sea lions and killer whales learn to feed on fish waste discharged by processing vessels and shore-based plants. This creates an artificial dependency that may not be beneficial to the long-term well being of the animals.

Direct interactions with fishing gear can be fatal to some marine mammals, but direct kills have generally been few. Other direct interactions that can interfere with normal marine mammal behavior are less well understood, but may be important in the vicinity of critical habitats and rookeries.

Of course the other side of this issue is that marine mammal competition for fishery resources may reduce fishery yields. The relationship between such predation and fishery yield is complex and difficult to quantify, but marine mammal consumption probably has a significant effect on some fisheries.

Many protected marine mammal and sea turtle stocks are listed as endangered or threatened under the ESA or depleted under the MMPA (Table 10). 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.

Table 9. Productivity of Fisheries Resources of the Western Pacific Oceanic Region, 1992-94

Productivity indicators are expressed in metric tons by long-term potential yield (LTPY), current potential yield (CPY), and recent average yield (RAY) [1]

Unit / Fishery	Entire Range of Resource			Prorated within U.S. EEZ	
	Total RAY	Total CPY	Total LTPY	U.S. RAY	U.S. LTPY
16. W. Pacific invertebrates	143	106	135	143	135
17. W. Pacific bottomfish & armorhead	388	626	2,738	388	2,738
18. Pacific highly migratory pelagics	2,077,232	2,003,188	2,033,706	240,438	278,945
21. W. Pacific nearshore species	1,520	1,520	1,520	1,520	1,520
Western Pacific Total	2,079,283	2,005,440	2,038,099	242,489	283,338

[1] For row totals; where LTPY is unknown, CPY is substituted; where CPY is unknown, RAY is substituted. RAY is generally for the latest 3-year average, 1992-94.

Contaminants

Toxic contaminants in estuarine and marine habitats originate from a variety of sources, including industrial and sewage treatment plants, urban and agricultural runoff, and air pollution. These contaminants include toxic metals and such organic chemicals as chlorinated hydrocarbons and petroleum compounds.

Elevated concentrations of these contami-

nants can be found in bottomfish and shellfish from a number of urban and industrialized sites in many coastal areas. For example, bottomfish species from a number of chemically contaminated areas in the vicinity of such major cities as Boston, New York, Los Angeles, and Seattle exhibit liver cancers and other lesions that are associated with the process that leads to liver cancer. While cancers are the most dramatic of the lesions observed, early degenerative or proliferative conditions are much more prevalent and are found in animals from moderately as well as heavily contaminated sites. Others may suffer various types of reproductive impairment such as inhibited spawning ability and reduced viability of eggs and larvae.

Little is known about contaminant effects on marine mammals, although studies continue on the effects of DichloroDiphenylTrichloroethane (DDT) and Polychlorinated Biphenyls (PCBs) on California sea lions. Toxic effects range from sublethal changes, such as slower growth, to death.

There is also widespread public concern about large oil spills in the marine environment. A large spill can cause extensive loss of plants and wildlife, commercial and recreational uses, and property values. The 1989 *Exxon Valdez* oil spill in Prince William Sound, Alaska, is a recent example.

Chemicals, microbial pathogens, and marine toxins are potential contaminants to seafood. In most U.S. coastal areas, the human health risks projected from current levels of marine environmental contamination in marine seafood products are either negligible or undetectable. However, fish and shellfish from some areas, such as near Boston Harbor and San Pedro Bay near Los Angeles, have been known to contain elevated levels of toxic chemicals that could be potentially harmful to human health.

Another major type of pollution, discharges of infectious microorganisms from agricultural and domestic sources, can contaminate clams, oysters, and other shellfish species. This potential risk to humans has resulted in the closing of vast coastal waters to shellfish aquaculture and harvesting; however, with present management practices, the risk remains relatively low.

Marine biotoxins, such as paralytic shellfish poisoning (PSP) and domoic acid or amnesiac shellfish poisoning (ASP) adversely affect fisheries by jeopardizing the safety of some of their products. PSP results from the consumption of molluscs infected with specific strains of dinoflagellates. Domoic acid outbreaks have occurred in a variety of seafood products and caused huge losses to the seafood industry. For example, in the fall of 1991, an outbreak of domoic acid poisoning in Monterey Bay, California, moved up the coast and to Oregon and Washington. Like PSP, the primary route of human exposure to domoic acid is from eating affected molluscs (e.g., razor clams), although the viscera of Dungeness crab is also known to accumulate high levels of the acid. The mechanism by which the acid is accumulated is not clear. Biotoxins occur naturally, but the apparent increase in their occurrence may be related to coastal development, including nutrient enrichment.

Table 10. Status and Trends of Marine Mammals and Sea Turtles

Unit	Decreasing	Stable	Increasing	Unknown	Total	Strategic Status	MMPA / ESA Status[1] E, T, D
22. Alaska Region	2	10	5	18	35	9	6,2,1
23. Pacific Region	4	13	13	36	66	16	9,2,2
24. Atlantic Region	2	1	5	54	62	29	9,0,1
% of Total	5%	15%	14%	66%	163		
25. Sea Turtles[2]	2	2	2	4	10		7,3,0

[1] E = Endangered, T = Threatened, D = Depleted
[2] Five stocks of sea turtles from the Pacific side and five from the Atlantic side.

Marine Debris

Marine debris pollutes all of the world's oceans, but the problem hardly begins there. Close to 80% of the debris is washed, blown, or dumped from shore. This debris casts a broad shadow over marine and littoral animals, plants, and perhaps even entire ecosystems. Biological studies tell us that waterborne litter entangles wildlife and masquerades as a food source, smothers beaches and bottom-growing plants, and provides a surface for colonizing small organisms that travel on marine debris to distant shores, perhaps with adverse ecological consequences. Entanglement is the most obvious of all biological impacts. Northern fur seals entangled in net webbing were spotted as early as the 1930s. Only fleeting glimpses of entangled animals are possible from planes and ships. Many die and sink or are eaten by predators without detection; others remain submerged and hidden beneath the ocean surface. At least 135 species of marine vertebrates and eight invertebrates have been reported entangled in marine debris. The list now includes most of the world's sea turtle species and more than 25% of marine mammal

species.

Ingestion of some marine debris can be a serious threat. Sea turtles mistake clear plastic bags for jellyfish, a favorite natural food. Ingested debris damages the digestive tract, causes starvation by blocking food, may be toxic, and in general is a serious source of mortality.

For centuries, we have used the oceans as dumping grounds for waste. Trash was simply heaved overboard from ships; much of it still is. At present, two global conventions combat marine debris pollution from sea-based sources: the London Dumping Convention (LDC) and the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78). Land-based sources of marine pollution are beginning to be addressed globally in follow-up meetings to the 1992 U.N. Conference on Environment and Development. The U.S. is party to these fora and takes an active role in mitigating marine debris problems. Education and promotion of awareness of the issue and its many solutions seem the best ways to combat this widespread phenomenon.

Adequacy of Scientific Information and Assessments

The status of fishery resources has been classified as unknown for 34% of the stocks covered in OLO '95. Most are nearshore resources (50 out of 74 nearshore stock groups). The figure may give an overly negative impression of our knowledge of national LMRs. However, they accounted for only 4.7% of U.S. RAY (238,000 t out of 5.06 million t) during 1992-94. In turn, this means that the status is known for the stocks that produce more than 95% of the U.S. catch.

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 effective research and data sets will be needed.

Many potential benefits from LMRs may not be achieved because of insufficient data. When the status of LMRs is unknown or imprecisely known, it is necessary to harvest more conservatively to guard against accidental depletion. Some groundfish fisheries in the eastern Bering Sea and Gulf of Alaska (Unit 19) are examples of such a cautious strategy. On the other hand, the lack of precision in assessments of fishery resources has rather unfortunately been used in some cases to argue that the evidence of overutilization was not strong enough to justify restricting a fishery. This argument has led to the depletion of many historically abundant stocks (e.g., most of the historical New England groundfish and flounder stocks represented in Unit 1).

Uncertainty about the relationship between marine mammals and fisheries now threatens both. In the example of Steller sea lions off Alaska, the sea lion population has declined substantially and the scientific basis to determine if the fishery is negatively impacting them remains incomplete.

It is also important to note that the status of stocks is unknown for 65% (112 out of 173 stock groups) of the marine mammal and sea turtle groups reported here. Trend data are similarly lacking.

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 LMRs. These gaps include the effects of environmental variability and change; including climate, functional habitat alteration, and long-term environmental degradation. Also included are gaps in knowledge about multispecies interactions.

Outlook

The ocean environment is particularly complex. Such factors as wide temperature fluctuations, frequent storm events, and global ocean warming, to name a few, combine to create a highly variable environment that affects resource populations. What is lacking is good information and scientific knowledge on the quantitative interrelationships of the major species and the components of marine ecosystems.

A wide range of human activities affect LMRs. Ever-intensifying fishing efforts and deployment of more powerful and sophisticated fishing gear and electronic fish-finding equipment have resulted in gross overfishing of some resources. Associated with fishing is "bycatch," the situation in which nontarget species are taken in fishing operations. These problems have caused management to move toward "controlled access" to fishing whereby catch quotas would be allocated to individual fishing vessels instead of granting free and open access to all vessels. This move towards the allocation

of quota share to individual vessels is gradually achieving wider acceptance by both managers and fishermen.

Today, another major issue is mitigation to protect endangered or threatened species. The use of riverine waters for irrigation, power generation, and consumptive uses by large urban areas has compromised freshwater flows and the survival of Pacific salmon runs. The people and the courts have become more involved with mitigation of the issues, and some rather extreme options, as in the case of the removal of the two Elwha River Dams on the Olympic Peninsula of Washington State, are being contemplated.

Urbanization has led to habitat alterations in rivers, estuaries, as well as coastal zones. Along with urbanization has come alteration of freshwater flows, erosion, introduction of toxic chemicals and other contaminants into the waters, introduction of nonindigenous species, and degradation of the marine habitats essential to the survival of LMRs.

Many demographic trends suggest that these conditions and threats are not likely to change in the immediate future. Some 50% of the U.S. population reportedly lives within a 2- or 3-hour drive of major freshwater systems (the Great Lakes) or the coastal ocean. As the national economy grows, there will be further development at the land-sea interface. The human desire to live within sight of the ocean has never abated and, increasingly, urban dwelling areas are being developed on or near the shorelines.

There are also many natural changes in the dynamics of the ecosystem that may exacerbate the aforementioned issues. For instance, global warming research over the past two decades now shows widespread impacts on living marine resources. Articles in recent issues of major scientific publications such as *Science*, indicate subtle yet progressive warming of Pacific coastal waters and consequently an eradication of certain species that would have been found in these waters a half-century ago. The foregoing suggests that it is necessary to have a far better understanding of how human activities, in concert with short- and long-term climatic changes, can compromise LMR viability.

Thus far, the utilization and management of the Nation's LMRs have been approached mainly from a resource-by-resource point of view. As information on multispecies relationships, ecosystem interactions, and environmental influences becomes more available, management approaches can move toward more explicit considerations of human activities on all components of the ecosystem. The goal is to move toward utilization of living marine resources for their combined ecological, recreational, commercial, and other aesthetic values. These optimal values and uses are no simple matter to define, let alone achieve. Thus the task will remain a formidable challenge for the fisheries, scientists and managers.

Generally, the outlook for the welfare of the Nation's LMRs is "guarded" with a need to remain vigilant. The unprecedented decline in the Northeast groundfish fisheries, the precarious state of some Pacific Northwest salmon stocks, and declines in some marine mammal populations are situations that need special attention. While many of our marine resources remain in good condition, they must be attentively managed and conserved under a suite of federal laws and international treaties. The science of the marine environment and the resources found there must be improved, because without reliable scientific knowledge, resource utilization and management must continue in a very conservative and narrow scope. ❑