Nearshore Fisheries

Unit 21

EMORY D. ANDERSON
NMFS Northeast
Fisheries Science Center
Woods Hole
Massachusetts

TED CREASER
Maine Department of
Marine Resources
Boothbay Harbor Laboratory
West Boothbay Harbor
Maine

CLYDE L. MACKENZIE, JR.
NMFS Northeast
Fisheries Science Center
James J. Howard Marine
Sciences Laboratory
Highlands
New Jersey

JOSHUA BENNETT
NMFS Southeast
Fisheries Science Center
Miami
Florida

DOUGLAS A. WOODBY
Alaska Department of
Fish and Game
Juneau
Alaska

LOH-LEE LOW
NMFS Alaska Fisheries
Science Center
Seattle
Washington

SUSAN E. SMITH
NMFS Southwest Fisheries
Science Center
La Jolla
California

DAVID C. HAMM
NMFS Southwest Fisheries
Science Center
Honolulu Laboratory
Honolulu
Hawaii

INTRODUCTION

For the purposes of this report, "nearshore fishery resources" are those coastal and estuarine species found in the 0–3 nautical mile zone of coastal state waters, and for which the National Marine Fisheries Service (NMFS) has no direct management role.

Nearshore resources vary widely in species diversity and abundance. Many are highly-prized gamefish. Others are small fishes used for bait, food, and industrial products. The invertebrate species of greatest interest include crabs, shrimps, abalones, clams, scallops, and oysters. Recent average yields from coastal state waters were at least 310,402 metric tons (t) (Table 21-1). This amount excludes landings of large-scale nearshore fisheries like anchovy, sardine, herring and the invertebrate resources described in earlier chapters.

Because the composition of the nearshore fauna is very diverse and management authority is shared among the many coastal states and other local bodies, *Our Living Oceans 1999* does not attempt a detailed treatment of their status. However, this unit presents information on the more significant species of national interest. For more comprehensive assessments of individual species, readers should refer to reports published by state natural resource agencies

NORTHEAST REGION

The 1995–97 recent average yield for the northeastern U.S. nearshore species was at least 74,450 t (Tables 21-1 and 21-2). This estimate is conservative and reflects mostly commercial landings; however, recreational harvest estimates for many, especially the invertebrates, are lacking. The 1997 dockside revenue from the commercial landings was an estimated $206,000,000. Nearshore recreational value, though not available, is considered to be substantial.

There was an outbreak of *Pfiesteria piscidida*, a single-celled microorganism related to the dinoflagellates responsible for red tide, in the Chesapeake Bay region in the summer of 1997. This outbreak, possibly due to increased nutrients in the water caused by pollution, resulted in some fish kills as well as health problems for a small number of swimmers, divers, and fishermen in some isolated estuarine and coastal areas in Maryland and Virginia, and ranging as far south as North Carolina. As a consequence, some areas were temporarily closed to fishing, swimming, and boating activities.

Landings of blue crab are the most important of the nearshore harvests for the Northeast Region (Table 21-2). Commercial landings in 1997 were 45,500 t, 21% less than in 1996, with an ex-vessel value of about $83,000,000. Abundance in Chesapeake Bay, the region's main producer, was above average in the 1980's, but decreased somewhat in the 1990's and is currently at about the long-term average level (Rugolo et al., 1997). Harvest levels in Chesapeake Bay, which comprise about 85% of the region's total, declined nearly 40% from a high in 1993 to 1996, but improved about 25–30% in 1997. In contrast, blue crabs have been unusually abundant in Delaware and Raritan Bays, where landings have increased.

Sea urchins, second highest in northeast nearshore species landings (recent average yield of 11,400 t), have been subjected to increasing fishing pressure ever since a major fishery began in Maine waters in 1987 to supply the fresh roe market in Japan. Landings increased from about 700 t in 1987 to a high of 19,200 t in 1993, but have

Table 21-1
Recent average landings of nearshore resources by regions, in metric tons.

Region	Recent average yield (RAY)	Commercial RAY	Recreational RAY
Northeast	74,450	72,550	1,900[1]
Southeast	93,540	91,534	3,767[2]
Pacific	133,090	n/a	n/a
Western Pacific	1,420	n/a	n/a
Alaska	10,200	9,700	500
Total	312,700		

[1]Only for tautog and white perch; recreational harvest estimates unavailable for invertebrate species.
[2]Southeast Recreational RAY includes finfish only. Numbers are estimates based on surveys.

Table 21-2
Productivity in metric tons and status of northeast nearshore fishery resources.

Species/Group	Recent average yield (RAY)[1]	Fishery utilization level	Stock level relative to LTPY[2]
Blue crab	42,000	Full	Near
Sea urchin	11,400	Over	Below
Atlantic hardshell clam	3,400	Over	Below
Oyster	3,000	Over	Below
Blue mussel	2,600	Unknown	Near
Horseshoe crab	2,100	Unknown	Unknown
Tautog	1,700	Over	Below
Other shads and herring	1,700	Over	Below
White perch	1,200	Unknown	Unknown
Jonah crab	1,100	Unknown	Unknown
Softshell clam	1,000	Full	Below
Rock crab	900	Unknown	Unknown
Conch	850	Unknown	Unknown
Sea cucumber	740	Unknown	Unknown
American eel	480	Unknown	Unknown
Sea worm	240	Unknown	Unknown
Periwinkle	30	Unknown	Unknown
Bay scallop	10	Over	Below
Total	74,450		

[1]1995–97 average (including recreational landings).
[2]LTPY = Long-term potential yield.

declined to only 8,500 t in 1997. Abundance, as measured by catch-per-unit-effort, has steadily declined. At the peak of the fishery there were 2,800 harvesters delivering product to 85 buying stations along Maine's coast (Robert Morrill, Personal Communication[1]) As local areas are intensively harvested by divers, traps, rakes, and drags, the fishery has expanded to other areas. In the 1997–98 fishing season (September–April) in Maine, harvesting was restricted to 120 days because of concerns about the continued decline in abundance and the need for conservation.

Oysters, one of the most valuable nearshore species (commercial landings valued at nearly $40,000,000 in 1997), have increased slightly in abundance in Delaware and Chesapeake Bays. Harvest levels had reached all-time lows in recent decades in both areas (Figure 21-1) because of sub-

[1]Robert C. Morrill, NMFS, Suite 212, Marine Trade Center, 2 Portland Fish Pier, Portland, ME 04101.

stantial mortalities caused by the diseases MSX and Dermo. Long Island Sound continues to be the region's largest oyster producer. In 1997, MSX caused mortalities of around 30% in some Connecticut beds, but production should be sustained because large supplies of live oysters easily exceed the quantity that markets will take. In most areas, oyster supplies in estuaries still exceed the current market demand. The James River is the most consistent oyster-producing habitat in Virginia, and abundance has increased there about 25% in the past 4 years. Improved abundance in traditional oyster-producing areas which had earlier suffered major declines due to disease will be dependent to a large extent on the successful development of improved broodstock of disease-resistant native eastern oysters, restocking programs, and habitat enhancement.

Landings and abundance of hardshell clams from the traditional harvesting grounds have risen in Narragansett Bay, Long Island Sound (Connecticut) and Raritan Bay, but have declined sharply in Great South Bay and Barnegat Bay. In recent years, hard clam hatchery production has been substantial along the U.S. east coast in response to the increased market demand for littlenecks (the smallest and most expensive market category). Current levels of landings are about half of the early 1950's level (Figure 21-2). Ex-vessel value of landings has been around $35,000,000 in recent years.

Softshell clam landings, which have declined since the late 1960's (Figure 21-2), continue to decline in the largest producing areas, Maine and Maryland. For yet unexplained reasons, the clams have failed to reproduce in quantity in eastern Maine, a large producer of clams in the past, and diseases (sarcomas and *Perkinsus*) may be the principal reason for the decline in stocks in Maryland. Clam abundance in Massachusetts, which now produces slightly more clams than Maine, has remained about level due to consistently good annual sets of seed and programs to depurate (cleanse) clams harvested from contaminated grounds. Current landings, around 1,000 t, are valued at about $8,000,0000–$10,000,000.

Abundance of blue mussels in nearshore areas of Maine and Massachusetts, which produce nearly all the landings for the region, has declined slightly

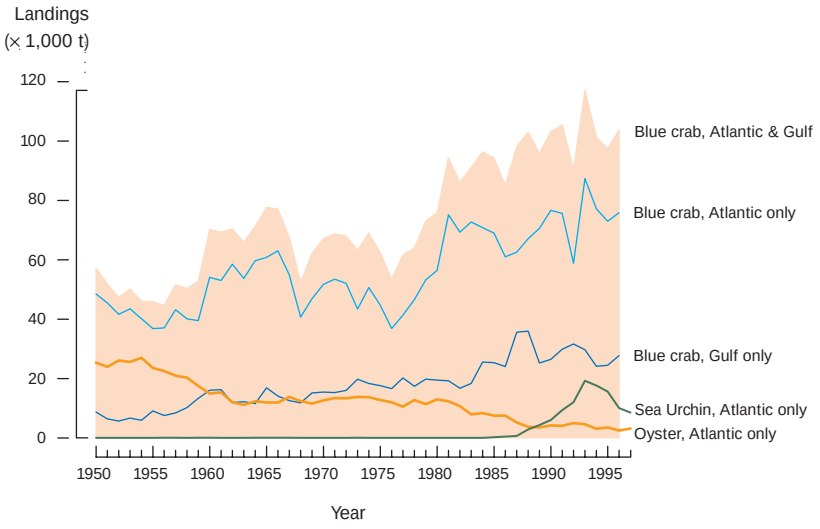

Figure 21-1
Landings of blue crab from the Gulf and Atlantic Coasts, and sea urchin and oyster from the Atlantic Coast, in metric tons (t).

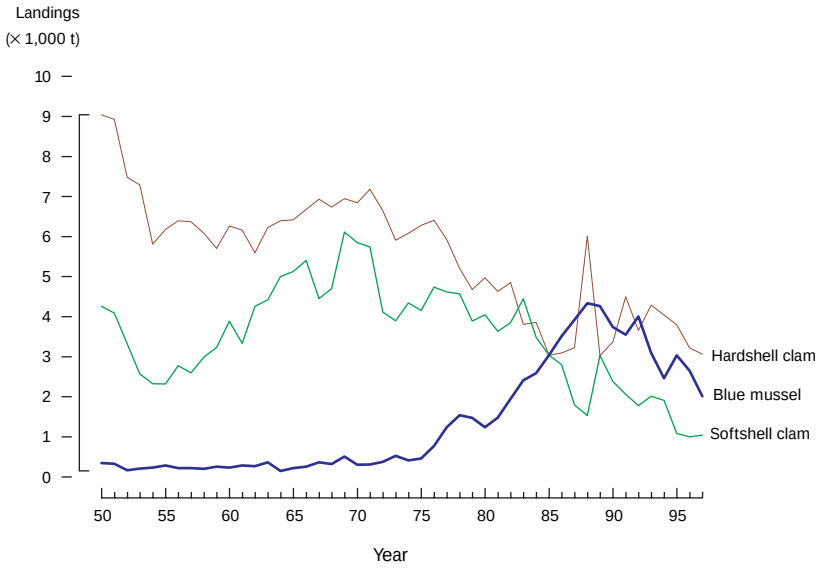

Figure 21-2
Landings of hardshell clam, shoftshell clam, and blue mussel from the Gulf and Atlantic Coasts, in metric tons (t).

in recent years. During the 1980's and early 1990's, landings increased markedly (Figure 21-2). Supplies and both market demand and prices have been good and steady in recent years.

The bay scallop is the most sensitive commercial mollusk to environmental perturbations, and its abundance remains low throughout the region because of the presence of adverse algal blooms, declines in abundance of eelgrass, and other prob-

lems. Rhode Island and eastern Long Island, which once produced large quantities of bay scallops, now have sparse stocks because dense algal blooms or "brown tide" kill the scallops. Scallop abundance and landings in Massachusetts have declined slightly in the past year or two, but are well below the levels experienced in the late 1970's and early 1980's as a result of lost habitat and increased numbers of predators.

Conchs or whelks are harvested from Massachusetts through New York with pots and in Virginia with dredges. Landings and the sizes of conchs landed have both declined slightly in response to steady harvesting from Massachusetts through New York, but landings have been stable in Chesapeake Bay (Virginia). Periwinkles, harvested only in Maine, have declined in abundance because of intense harvesting. Increased numbers of fishermen are now, for the first time, using dredges and rakes to harvest periwinkles to supplement their incomes. In addition, smaller periwinkles are being marketed.

Landings of Jonah and rock crabs have remained fairly stable, with abundance unknown but thought to be fairly high. Abundance of slow growing horseshoe crabs has declined in Delaware Bay, the site of greatest concentration.

A renewed interest in horseshoe crabs as bait for the American eel and conch pot fisheries, and use of horseshoe crab blood by the biomedical industry, elevated commercial catches from 412 t in 1990 to about 2,800 t by 1997. An interstate fishery management plan was adopted by the Atlantic States Marine Fisheries Commission (ASMFC) in October 1998 in recognition of the importance of horseshoe crabs and their eggs to the coastal ecosystem as food for migrating shorebirds, finfish, and sea turtles, and in concern over the growing exploitation rate (ASMFC, 1998). The ASMFC fishery management plan mandates conservation measures in the Mid-Atlantic area and monitoring programs throughout the species' Atlantic coastal range

Sea worms, dug principally in Maine, have continued to decline both in abundance and in average size because of heavy harvesting. These worms are highly sought as bait by marine recreational fishermen from Massachusetts to South Carolina.

A new fishery for sea cucumbers began in Maine several years ago to supply Asian markets. At present, only one processor and three fishing vessels are involved in that fishery. Landings peaked at about 1,300 t in 1996 and were only 61 t in 1997. Abundance appears to be relatively steady.

Of the finfish included in this unit, only tautog has been assessed. Recreational fishing accounts for about 85% of the total landings, which have continued to decline in recent years. Abundance remains at record low levels.

SOUTHEAST REGION

Relatively few fisheries from the southeast are highlighted in this unit, as many of the truly nearshore fisheries of the region have been covered under Units 7, 9, 10, and 11. In the southeast as in the northeast, the recent average yields reported here are underestimated, because they can generally be based only on commercial landings. Recreational landings, which may be considerable, are generally unavailable for the invertebrates that dominate the southeast nearshore fisheries. Bycatch mortality is not estimated, or is incompletely estimated, for many species.

Blue crabs dominate the nearshore catch by weight. Recent landings have fluctuated around 60,000 t (Figure 21-1, Table 21-3). Oyster harvests have trended downward over the last decade, but recent landings have been steady with a recent average yield of 10,440 t. Calico scallop has been important in the landings in the past (20,000 t in 1984), but recent landings have averaged 1,184 t.

Mullet landings in the region have been affected by a ban on nets over 500 square feet in Florida's waters. This ban took effect July 1, 1995. Recent average yield is down to 12,558 t, but more telling are the landings for 1996, which were reported at 9,484 t. Commercial landings outweigh the recreational catch by slightly more than 10:1. Herrings (not including American shad, alewife, or blueback herring) and Spanish sardine recent average yields total 6,040 t in the southeast, almost all from commercial landings. Bait fisheries for species such as ballyhoo and bigeye scad (goggle-eye) exist primarily in south Florida, with a net fishery for bigeye scad in the Florida pan-

Species	Recent average yield (RAY[1])	Commercial RAY[1]	Recreational RAY[1]	Fishery utilization level	Stock level relative to LTPY[2]
Blue crab	59,876	59,876	Unknown	Unknown	Unknown
Mullet	12,558	11,537	1,021	Unknown	Unknown
Oysters	10,440	10,440	Unknown	Unknown	Unknown
Other herring & Spanish sardine	6,040	5,980	60	Unknown	Unknown
Flounder (southern & Gulf)	1,514	609	905	Unknown	Unknown
Bait shrimp	1,264	1,264	Unknown	Unknown	Unknown
Calico scallops	1,184	1,184	Unknown	Unknown	Unknown
Ballyhoo, bigeye scad, flyingfish	664	644	20	Unknown	Unknown
Total	93,540	91,534	Unavailable		

Table 21-3
Productivity in metric tons and status of southeast nearshore fishery resources.

[1]RAYs are for 1994–1996. Recreational data are estimates based on surveys.
[2]LTPY = Long-term potential yield.

handle. A major portion of the bigeye scad were landed in Palm Beach County prior to the state-issued net ban. Present landings in that area are a result of a live-bait fishery and have a high value. Ballyhoo landings from the Palm Beach area also dropped, but those in the Florida Keys have been steady. Flying fish are often landed with the ballyhoo.

PACIFIC COAST

On the Pacific Coast, California contributes the most commercial landings of nearshore species at an estimated 93,954 t (Table 21-4), followed by Oregon (22,198 t) and Washington (14,637 t). The total value of the fisheries, much of which is related to marine recreational angling, is difficult to estimate but is thought to be sizable. Although not a direct measure of economic value, an estimated 2,000,000 California anglers spend $800,000,000 yearly on about 6,000,000 fishing trips to catch nearly 30,000,000 saltwater fish—most in nearshore waters—and add more than $1.8 billion to the U.S. economy. In addition to the many commercial nearshore species, marine anglers also land species that have been reserved exclusively for sport—such as striped bass, sturgeon, kelp bass, and California corbina.

Nearshore species also support an expanding California live-fish fishery valued at more than $3,600,000 in 1996, with estimated statewide landings of 562 t. The 65 target species include California halibut, California sheephead, white croaker, and other nearshore finfish, and are caught primarily by hook-and-line and trap gear. Live and premium quality fresh (dead) fish are sold as specialty items to local restaurants. The growing demand for live-fish species has increased fishing pressure on other commercial nearshore species and resulted in a limited-entry program for the live-fish trap fishery in southern California.

Shrimp—Shrimp supports nearshore commercial fisheries throughout the Pacific region. They also provide opportunity for recreational fishing, especially near urban centers as in Puget Sound, Washington. The most common species harvested are Pacific (pink), ocean, spot, sidestripe, and bay shrimps. In recent years, landings appear to be on a slight increase from a cyclic low (Figure 21-3). Ridgeback, pink, and spot prawns are taken in California by trawl and trap vessels. Spot prawns support a very lucrative commercial live-prawn fishery. Landings of ridgeback and spot prawns increased 39% in 1996, to 511 t.

Crab—Dungeness crab is the most abundant crab harvested along the Pacific coast. Commercial fisheries operate along all the west coast states, with Oregon and northern California providing the bulk of the landings. Some recreational crabbing also occurs and is an important recreational and subsistence fishery to many ethnic groups. Like other crustacean resources, Dungeness crab abundance is highly variable. In recent years, abundance seems to be on the increase from a low cycle. The

Table 21-4

Productivity in metric tons and status of Pacific nearshore fishery resources.

Area and species	Recent average yield (RAY)[1]	Fishery utilization level	Stock level relative to LTPY[2]
California			
California market squid	68,863	Unknown	Unknown
Sea urchins	10,062	Full	Near
Shrimp	4,853	Full	Near
Dungeness crab	5,315	Full	Near
Other crabs	526	Full	Unknown
Bonito, Pacific	312	Unknown	Unknown
Smelt	913	Near full	Unknown
Elasmobranchs	889	Unknown	Unknown
California halibut	341	Under[3]	Near
Sea cucumbers	314	Unknown	Unknown
Spiny lobster	264	Full	Unknown
Abalones	91	Over	Below
Croakers	238	Unknown	Unknown
Barracuda, Pacific	146	Unknown	Unknown
Bivalves	666	Unknown	Unknown
Other nearshore fishes and invertebrates	207	Unknown	Unknown
Total	94,000		
Oregon			
Clams	50	Under	Near
Oysters	69	Full	Near
Dungeness crab	5,899	Under	Near
Shrimp	7,193	Full	Below
Sea urchin	431	Over	Near
Elasmobranchs	546	Under	Near
Sturgeon	104	Full	Below
Other fish and invertebrates	345	Under	Unknown
Total	14,637		
Washington			
Geoduck clam	1,102	Full	Near
Other clams	2,956	Full	Near
Oysters	3,223	Full	Near
Other bivalves	445	Unknown	Below
Dungeness crab	9,747	Full	Near
Shrimp	3,275	Full	Near
Sea cucumber	355	Full	Near
Sea urchin	595	Full	Near
Elasmobranchs	2,140	Full	Near
Sturgeon	114	Full	Near
Other fish and invertebrates	501	Full	Below
Total	24,453		
Total	133,090		

[1]California RAY's are averaged from 1994–96, except abalone (1995–97). Washington and Oregon RAY's are 1995–97. All bivalve landings are in whole weights except Washington and Oregon oysters (meat weights). California data are from NMFS (Statistics and Economics Division, 1315 East-West Highway, Silver Spring, MD 20910) extracts of California Department of Fish and Game commercial catch statistical reports. California bivalve data are from the PacFIN data base (maintained by the Pacific States Marine Fisheries Commission 45 SE 82nd Drive, Suite 100, Gladstone, OR 97027). Abalone data are from Bill Jacobson (NMFS SW Regional Office, 501 West Ocean Blvd, Long Beach, CA 90802). Washington and Oregon data came from the Washington and Oregon Departments of Fish and Wildlife, respectively.

[2]LTPY = Long-term potential yield.

[3]Considered underutilized since the gillnet fishery directed for this species ended January 1994 south of Pt. Arguello, where 86% of the gillnet catch had been taken.

productivity and status of the other crab resources, which tend to be localized, are largely unknown. In 1996, amendments to the Magnuson-Stevens Fishery Conservation and Management Act gave authority to the States of California, Washington, and Oregon for their crab fisheries in Federal waters and also recommended that the Pacific Fishery Management Council develop a fishery management plan for Dungeness crab. After exploring various management alternatives, in 1997 the council recommended that Congress extend interim authority beyond 1999 and expand the authority to include all management measures except limited entry provisions.

Abalone—Abalones are found mostly in California where utilization of the resource actually predates modern history. The meat is very valuable; a 14-ounce (397 grams) canned abalone may retail for $50 in Seattle's Chinatown. Of the five species harvested, the red, green, and black abalone are the most common. Red abalone is the only species to be harvested commercially in California since 1995. The central and southern California sport and commercial fishery was closed in May 1997, and the closure was extended indefinitely in early 1998. The black abalone fishery has been closed since 1993 to allow the population to recover from withering syndrome. The white abalone population is so low that it has been proposed as an endangered species. Commercial abalone harvesting is accomplished by "hooka" gear, where compressed air from the surface is supplied to the divers. Scuba gear is used in the California sport fishery where allowed by law, but otherwise sport fishing is restricted to free diving and shore picking.

At present, most of the species of abalone in central and southern California are overutilized. This is due to commercial harvesting efficiency, increased market demand, popularity of the sport fishery, habitat degradation, increasing predation by sea otters, and disease. Despite stricter management, abalone stocks remain vulnerable to continued depletion, and a new state management plan is being developed. The history of catches shows a continually declining trend (Figure 21-4).

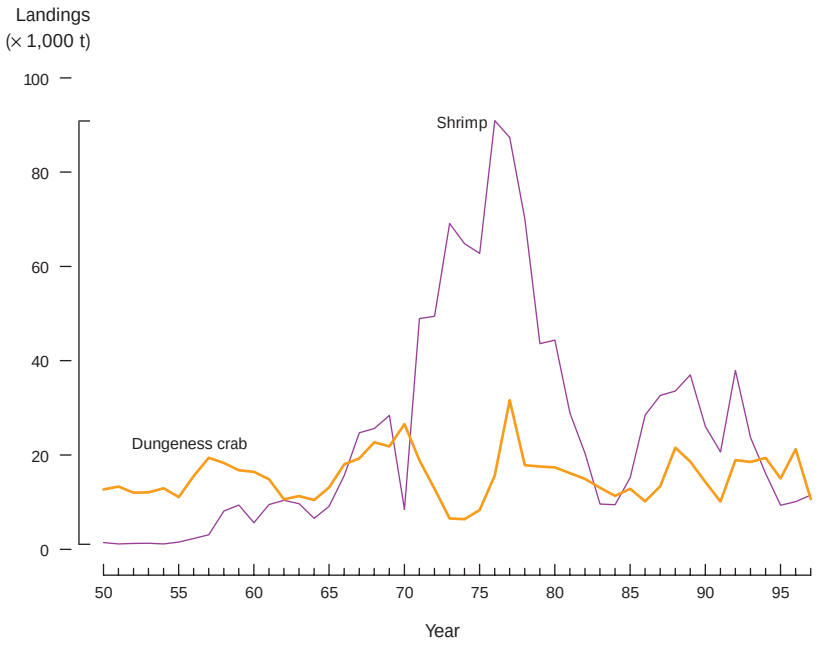

Figure 21-3
Commercial landings of Dungeness crab and several species of shrimp from the combined region of Washington, Oregon, and California, in metric tons (t).

Clam—Clam digging is a popular recreation for many families throughout the Pacific Coast, and most are harvested this way. Many species are harvested: razor clam, littleneck clams, pismo clam, gaper clam, Washington clam, butter clam, geoduck, and others. The clam fisheries are regulated by season length and bag limits. The status of the stocks can be inferred from catch performance and would be expected to be known for localized areas only. Since the number of beaches and, thus, stocks are too numerous, it would be difficult to generalize on the status of the stocks. Thus status of the stocks and degree of utilization are largely unknown.

The Pacific geoduck is the largest burrowing bivalve on the Pacific coast. Individuals can live for more than 100 years and reach 9 kg. They are harvested both commercially and recreationally, and the majority of the harvest comes from Puget Sound and British Columbia. Commercial harvest is by divers using high pressure water jets to excavate the clams. In Puget Sound, the population between 10 and 30 m depth is estimated at 127,000 t, and the average annual commercial harvest is 1,300 t.

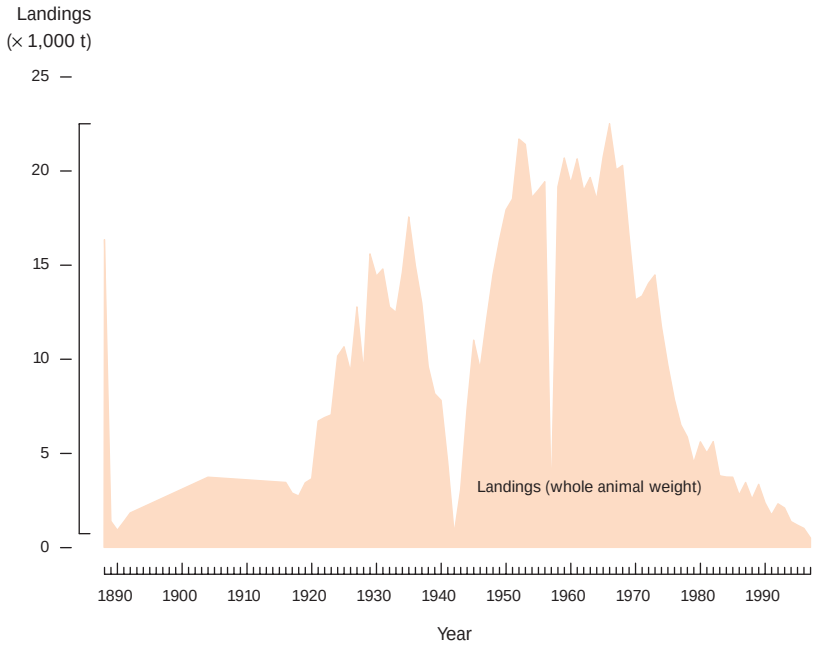

Figure 21-4
Landings of abalone in California, 1888–1997, in metric tons.

Squid—One species, the market squid, is harvested throughout the region, with California providing most of the catches. Squid landings in California reached a record high of 78,825 t in 1996, valued at about $30,000,000. It is harvested for bait as well as for food. In southern California, squid is popular in local ethnic food markets and the restaurant trade, but most of the catch is exported to Asia. Squid jigging is also a popular winter activity in the Pacific Northwest. In this sport fishery, anglers of all ages crowd under pier lights and jig for squid in the middle of cold winter nights.

Large-scale fluctuations are characteristic of the squid stock, due mainly to its short life span and from the influence of wide variations in the ocean environment, such as the 1997–98 El Niño event that caused landings to decrease by about 13% from 1996 landings. This short life history, however, makes it possible for squid to recover after natural population disasters as soon as ocean conditions improve again. Little is known about the biomass, structure, and status of the stock.

In recent years, the expansion of the southern California squid fishery and large harvests have prompted some fishermen and biologists to call for management measures to protect the squid resource, such as harvest restrictions and some form of limited entry. In 1977 the California state legislature enacted a bill that implemented a squid fishery permit program and directed the state Department of Fish and Game to provide recommendations for a squid management plan.

Sea Urchin—Commercial utilization of sea urchins in the United States essentially started in the early 1970's with the harvest of red sea urchin roe or "uni" for export to the Japanese sushi market. In addition to red sea urchin, several other species are found in U.S. waters, but most are of little commercial importance due to the small size of their roe. Though limited fisheries for red sea urchin take place off Washington and Oregon, the major fishery occurs in California.

The commercial fishery for red sea urchin began in southern California in 1971 as part of an NMFS program to develop new fisheries for underutilized species. The fishery expanded to northern California in the late 1970's and 1980's, and in 1990 the value of the catch (20,534 t) amounted to $24,700,000, making it the most valuable fishery in the state, which it remained through 1995. Commercial divers harvest red sea urchins using hooka gear mainly within depths of 7–20 m. The catch is landed alive. The resource has been generally underutilized throughout the Pacific coast, except for selected commercial fishing areas. In southern California, landings have generally declined since 1990 but the sea urchin resource remains productive, suggesting that the status of the stock is still good. In other areas, however, like northern California and Baja California, the fisheries have been characterized by rapid growth and decline. These experiences suggest that local stocks can be rapidly overharvested.

Sea Cucumber—Like sea urchins, the sea cucumber emerged more recently as a commercial species in the late 1970's. The slimy, warty sea cucumber is harvested by trawl and by hand and processed into a dried product primarily sold to the Asian market where it is a delicacy. A variety of sea cucumber species are found from Washington to California; the giant red sea cucumber and the warty sea cucumber are the species harvested in California. Total California sea cucumber landings were a record high 381 t (worth $18,700,000)

in 1996, with trawlers harvesting about 53% of the catch and divers harvesting the remainder. Little is known about the abundance and status of the stocks. Sea cucumbers have a relatively short life span, low maximum weight, low age of first maturity, high natural mortality, and highly fluctuating recruitment patterns. At the present level of harvest, the resource appears not threatened.

Elasmobranchs—Sharks, skates, and rays are an important commercial and recreational resource in the coastal waters of the eastern North Pacific. They are taken in large numbers as both target species and as bycatch in commercial groundfish and coastal pelagic fisheries. Sharks targeted for their flesh include the common thresher, shortfin mako, spiny dogfish, soupfin, and leopard sharks. Commercial shark fishing peaked off California during the mid 1980's with localized impact on the resource. Nearly 90% of pelagic sharks taken in this area are immature. Regulations imposed by fishery managers have since reduced total fishing effort and brought catches within manageable limits. Trends in localized catch rates and length at capture indicate that at least one species, the common thresher, may be recovering.

Skates, and some rays, are harvested as an inexpensive substitute for sea scallops. The longnose skate and big skate make up the most important catch in the skate trawl fishery off northern California, Oregon, and Washington. Increased demand from foreign markets has increased skate landings since 1995. Blue sharks are an important bycatch in most of these fisheries. Although the fins are valuable in the shark-fin trade, the carcasses are discarded. Shark finning is illegal in California.

Coastal pelagic sharks remain popular with recreational anglers as well. Angler effort directed at sharks has grown in recent years, and several shark fishing derbies are conducted annually.

Generally, the low reproductive potential of elasmobranchs makes them particularly susceptible to overfishing. Abundance and stock size remain unknown for most eastern Pacific elasmobranchs. However, much information has been learned in recent years, and fishery managers have taken steps to monitor and control harvest in most of these fisheries.

Smelt—Smelt resources in the region belong to two different families, Osmeridae (the true smelt) and Atherinidae (the silversides). There are a number of species of the two families. The resources provide for seasonal commercial and recreational fisheries for Washington, Oregon, and California. The resources are known for their migratory runs to coastal areas and rivers to spawn. They come en masse, which makes them attractive targets for recreational and commercial fisheries. Some smelt fishing is almost a ritual. Night smelt, for example, with its nocturnal habits is harvested during a brief spawning period by A-frame dip nets in the surf zone. Most are caught in the Eureka, California, area. The grunion (a species in the smelt group) fishery is quite unique since by state law sport anglers may use only their hands to grab the fish during their spawning runs on southern California beaches.

Despite their economic and social importance to humans and to ecologically related species as an important forage-base species, the abundance and status of many smelt stocks are still poorly known. Much is known of the species' biology and location and timing of the runs, but more is yet to be learned about the causes of population fluctuations and long-term trends.

WESTERN PACIFIC REGION

Fisheries in the nearshore waters of the tropical and subtropical islands of Hawaii and the U.S.-associated Pacific islands are highly diverse though lower in aggregate volume than commercial or recreational fisheries of the U.S. mainland. Landings are reported to be about 1,400 t annually (Table 21-5). Many fisheries are unique to certain localities such as that for the palolo worm in American Samoa, seasonal fisheries for rabbitfish in Guam, and limpet (opihi) fisheries in Hawaii. Other fisheries are common to all islands, such as the fisheries for bigeye scad, called akule in Hawaii, atule in American Samoa, and atulai in Guam and the Northern Mariana Islands.

The more highly populated Main Hawaiian Islands receive the heaviest inshore fishing pressure, with lighter pressure from the less densely populated islands to the mostly uninhabited islands of the Northwestern Hawaiian Islands and

Table 21-5
Productivity in metric tons and status of western Pacific island nearshore fishery resources.

Area/species	Recent average yield (RAY)	Fishery utilization level	Stock level relative to LTPY[1]
Akule[2]	310	Full	Unknown
Opelu[2]	160	Full	Unknown
Other inshore fisheries[2]	700	Full	Unknown
Inshore reef fishes[3]	90	Full	Unknown
Inshore reef fishes[4]	160	Full	Unknown
Total	1,420		

[1]LTPY = long-term potential yield.
[2]Hawaiian Islands (1993–95 averge)
[3]Guam (1993–95)
[4]American Samoa (1993–95 average)

the northern islands of the Commonwealth of the Northern Mariana Islands. In the Main Hawaiian Islands, between 1980 and 1990 an average of 1,179 t of fishes and invertebrates were reported taken annually within 100 fathoms by commercial fishermen. According to the Hawaii Division of Aquatic Resources, the two pelagic carrangids, akule and opelu, support the largest inshore fisheries in the state. During the 1993–95 period, annual commercial landings for akule and opelu averaged 310 and 160 t, respectively. Other important commercial fisheries include those for surgeonfishes, squirrelfishes, parrotfishes, goatfishes, snappers, octopus, and various jacks or trevallies. There are significant recreational fisheries, but participation, landings, expenditures, and economic values are not well documented. The recreational and subsistence component of Hawaii's marine fisheries was last assessed in 1986, when it was estimated that 200,000 trips were taken by 6,700 vessels involved in nonmarket fishing (which includes recreational, subsistence, and submarket sales). Estimated landings by these "recreational" fishermen were 9,525 t (21,000,000 pounds), of which 4,536 t (10,000,000 pounds) were sold ($22,000,000). Total direct expenditures by these fisheries was $24,000,000, and the nonmarket value of the fishing experience was valued at $239,000,000.

The islands of American Samoa are partially surrounded by a narrow fringing coral reef which is inhabited by a diverse array of fishes and invertebrates. These are harvested by local residents on an almost daily basis. Total inshore subsistence catch for 1993–95 averaged 160 t worth $560,000. The catch is dominated in some years by the coastal migrant atule, but other more resident species such as other jacks, surgeonfish, mullet, octopus, groupers, and snappers are most consistently taken. Samoans also fish on the predicted nights of emergence of the palolo worm, which is considered a delicacy (actually its reproductive segments or epitokes). For Samoan inshore fisheries, downward trends in catch and catch per unit of effort have been observed in recent years, especially when the catches of the highly variable atule have been removed from the analysis.

Guam is the southernmost and largest island in the Mariana Island Archipelago, and like American Samoa, the principal inshore fisheries are based on a wide assortment of coral reef fishes. Fishes taken are jacks and scads (especially atulai, the bigeye scad), surgeonfishes, squirrelfishes, fusilier, rudderfish (guili), snappers, mullet (aguas), goatfishes (ti'ao), and rabbitfishes (mañahak). Invertebrate species include various marine crabs (including land crabs), spiny and slipper lobsters, sea urchins, octopus, squid, cuttlefish, tridacnid clams, topshell, chitons, conchs, strombids, and nerites. Guam inshore reefs appear to be fully exploited and have shown signs of overfishing. During 1993–95, the catch of nearshore reef fisheries averaged 90 t.

ALASKA REGION

Nearshore resources provide important subsistence and recreational fishing opportunities for

Table 21-6
Alaska nearshore resources productivity in metric tons and status.

Species/group	Recent average yield (RAY)[1]	Fishery utilization level	Stock level relative to LTPY
Dungeness crab	2,370	Full	Near
Tanner crab	900	Full	Unknown
Red King crab	160	Full	Below
Scallops	360	Full	Near
Shrimps	2,000	Unknown	Below
Geoduck clam	70	Unknown	Unknown
Other clams	200	Unknown	Unknown
Sea urchins	660	Unknown	Unknown
Sea cucumbers	655	Unknown	Unknown
Abalones	5	Full	Near
Sablefish	2,500	Full	Near
Lingcod	100	Full	Near
Rockfish	120	Full	Near
Other species	100	Unknown	Unknown
Total	10,200		

[1]1994–96

Alaskans. Most nearshore fisheries take place in Southeast Alaska near population centers, although subsistence fishing is distributed all along the Alaska coastline into the Bering Sea and Arctic Ocean. The fisheries are a mix of historic fisheries that have intensified and grown to provide significant local economic benefits. The nearshore resources and fisheries are managed by the Alaska Department of Fish and Game (ADFG).

Dungeness crabs are harvested near shore by small-boat commercial fleets and recreational fisheries primarily in the southeast Alaska, Yakutat, and Kodiak areas. About 30% of the U.S. production of Dungeness crabs traditionally comes from Alaska. Almost all Dungeness crabs (97%) are consumed domestically. The value and demand for the crabs are normally high. Commercial fishing effort in the traditional Dungeness crab fishery has intensified to the point that virtually all habitat is now "potted down" with crab pots. This trend is likely to grow now that a limited entry system is in place and fishing permits can be sold: new buyers will need to intensively fish their full limit of pots to pay for their permits and equipment. The traditional Tanner crab fishery has also intensified to the point that the 900 t (2,000,000-pound) harvest cap is reached in 1 week, where in the early 1970's the fishery was year round. Management of these crab fisheries suffers in the absence of stock assessment research. The traditional fishery for red king crab in Southeast Alaska is a bright spot: the fishery reopened in 1993 following 8 years of closure and is now managed under a conservative harvest regime supported by an annual stock assessment survey.

Pot shrimp fisheries have grown dramatically in the past decade in nearshore Alaska waters, and along with the trawl shrimp fisheries are now limited to entry. These are the only two significant commercial shrimp fisheries remaining in Alaska, and concern is high to develop stock assessment and conservative management programs to provide for sustained harvests. The species taken is mainly Alaskan pink shrimp. Other species taken are spot, sidestripe, coonstripe, and humpy.

The primary scallop species harvested in Alaska is the weathervane scallop. The fishery was pioneered in 1967 and peaked in 1969 when 840 t of shucked scallop meat was landed. The principal harvest areas are Kodiak and Yakutat in the Gulf of Alaska, with Dutch Harbor (Bering Sea) as a new fishing ground. Harvesting is by similar dredging gear and fishing technique used in the New England scallop fisheries. While the status of the stocks is not well known, they are not believed to be abundant and are vulnerable to overfishing. The fishery is regulated by the State of Alaska which limits the number of vessels and sets catch quotas.

Sea cucumbers and sea urchins are recent fisheries. They are harvested by divers and exported to Asia. Sea urchins are shipped live to Japan for the fresh roe market. While the status of the stocks is largely unknown, the fisheries are managed conservatively according to their recent historical performance. The ADFG surveys the resource periodically at selected sites to monitor major changes in relative abundance of the stocks.

Alaska natives have a long history of harvesting abalone for food, trade, and shell ornaments. The only species of abalone harvested in Alaska is the pinto abalone, taken almost exclusively from Southeast Alaska. The commercial fishery, involving handpicking by divers, started in the early 1970's. Abalones are considered gourmet seafood and are normally exported to Japan. The status of the stocks is unknown, and the fishery is regulated by the ADFG through monitoring of recent catch trends. The abalone fishery was closed in 1996 following 15 years of decline, due in part to overharvests and now to sea otter predation. The fishery will remain closed until a rebuilding program is developed. Commercial catch peaked at 82 t in 1977 and the 1994–96 recent average yield was only 5 t.

The dive fisheries in Southeast Alaska are developing actively. The red sea urchin fishery has grown from a 1994–96 recent average yield of 660 t to a 2,265 t (5,000,000-pound) harvest in just 2 years following the implementation of a fishery management plan and extensive stock assessment surveys funded largely by the industry and local governments. The sea cucumber fishery, now in its 8th year of sustained harvests under a conservative management regime, has become an established source of winter income for over 400 divers dividing an annual yield of 450 t (1,000,000 pounds). The geoduck clam fishery has the potential to double in size over the coming years due to industry sponsored exploration for new clam beds.

A key factor in the successful development of dive fisheries is a regional policy to require external funds for new fisheries. Also significant is a moratorium on entry to dive fisheries, creating a limited and known number of permit holders with a clear stake in the future of the resource. An expanding sea otter population, reintroduced in the mid 1960's following extirpation by the turn of the 20th century, may play the ultimate card in the future of nearshore dive fisheries for sea urchin, sea cucumber, and abalone, as well as for some Dungeness crab grounds. Significant losses to all of these fisheries have occurred in the past 5 years.

The amount of nearshore resources harvested by the subsistence and recreational fisheries off Alaska has been difficult to compile because of the state's wide geographical expanse and remoteness of such fishing activities. Excluding the recreational and subsistence catches of Pacific salmon and Pacific halibut, the total 1994–96 recent average yield was at least 10,200 t for the nearshore resource complex (Table 21-6). The recreational catch was probably 5% of the total. The component of the resources that are the most important are the invertebrates; although a wide variety of groundfish and other species are harvested incidentally to salmon and Pacific halibut fisheries.

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