Unit 14

Pacific Coast and Alaska Pelagic Fisheries

Introduction

Several stocks of small pelagic fish species support fisheries along the Pacific coast. The major ones are Pacific sardine, northern anchovy, jack and chub (Pacific) mackerel, and Pacific herring. Sardine, anchovy, and mackerel are primarily concentrated and harvested off California and Baja California. Pacific herring are taken along the west coast from California to Alaska.

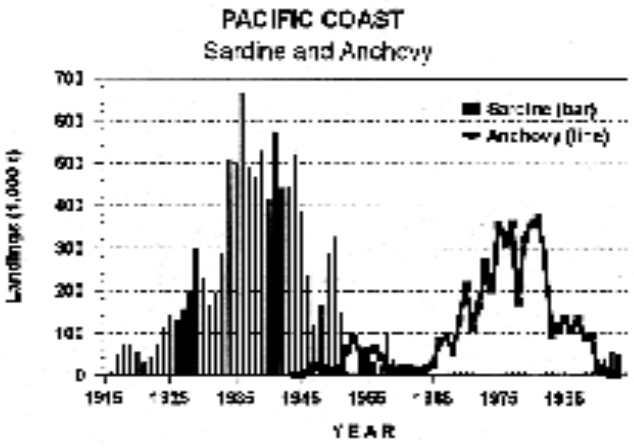

Fig. 14-1. Succession of species landings of Pacific sardine and northern anchovy.

Sardine and anchovy are the most prominent of the fisheries from a historical perspective. These small pelagic species, like Peruvian anchovy and Japanese sardine, tend to fluctuate widely in abundance. The California sardine fishery was the largest fishery in the western hemisphere during the 1930s and early-1940s when total catches averaged 500,000 t. Its abundance and catches declined after World War II (Fig. 14-1), and the stock finally collapsed in the late-1950s. In the mid-1940s, U.S. processors began canning anchovies as a substitute for sardine. Consumer demand for canned anchovies, however, was low and catches from the mid-1940s to mid-1950s averaged only 50,000 t. Catches declined and remained low before starting to increase in 1965. Together with catches from Mexico, the total catch increased to 350,000 t during 1975-80. Thereafter, U.S. catches declined due mainly to significant price reductions for fish meal. Low prices and market problems continue to prevent a significant U.S. reduction fishery for anchovies in recent years. The other small pelagic species also have a tendency to fluctuate widely in abundance.

All these pelagic fishery resources are under active management. The anchovy fishery is managed under the Northern Anchovy FMP by the Pacific FMC. Pacific sardine, Pacific herring, and chub mackerel are managed by the State of California. Jack mackerel north of lat. 39°N are managed under the Pacific Coast Groundfish FMP.

Table 14-1. Pacific Coast and Alaska Pelagics

Productivity in metric tons and status of fisheries resources

Species	Recent Average Yield (RAY)	Current Potential Yield (CPY)	Long-Term Potential Yield (LTPY)	Fishery Utilization Level	Stock Level Relative to LTPY
Pacific Coast					
Pacific sardine[1]	19,000	22,000	250,000	Full	Below
Northern Anchovy[1]	6,000	7,000	120,000	Full	Near
Jack mackerel	9,000	53,000	100,000	Under	Near
Chub mackerel[1]	24,000	23,000	28,000	Full	Below
Pacific herring	5,900	Unknown	Unknown	Full	Below
Alaska					
Pacific herring					
Gulf of Alaska	22,600	15,900	Unknown	Full	Near
Bering Sea	30,300	39,300	Unknown	Full	Near
Total	116,800	166,100	559,100		

[1] Mexican catches are typically as large or larger than U.S. catches, but are not included in RAY.

Species and Status

Pacific Sardine

California sardine abundance has gone through boom and bust cycles (Fig 14-2). The decline of the resource, from a biomass of more than 3 million t in the 1930s to unmeasurable low levels (a few hundred t) in the 1970s, stimulated much debate as to whether fishing or an adverse natural environmental period was to blame. In retrospect, the intensive fishing pressure on the resource at that time probably

accelerated a long-term pattern of natural decline. The biomass of sardines remained negligibly low for about 40 years. Since 1986, sardine biomass has increased by 30–40% per year and quotas have been allowed for commercial fishing. The biomass is currently 100,000–300,000 t.

In the past, sardines were harvested for fish meal, bait, and human consumption. Currently, there is no fish meal (reduction) fishery. Sardines are now taken for human consumption and bait. Commercial demand for sardines is strong and, as resource abundance grows, the fishery is expected to revive.

The sardine resource is recovering but remains at low abundance. Current potential yield is only 22,000 t or less than 9% of LTPY (Table 14-1).

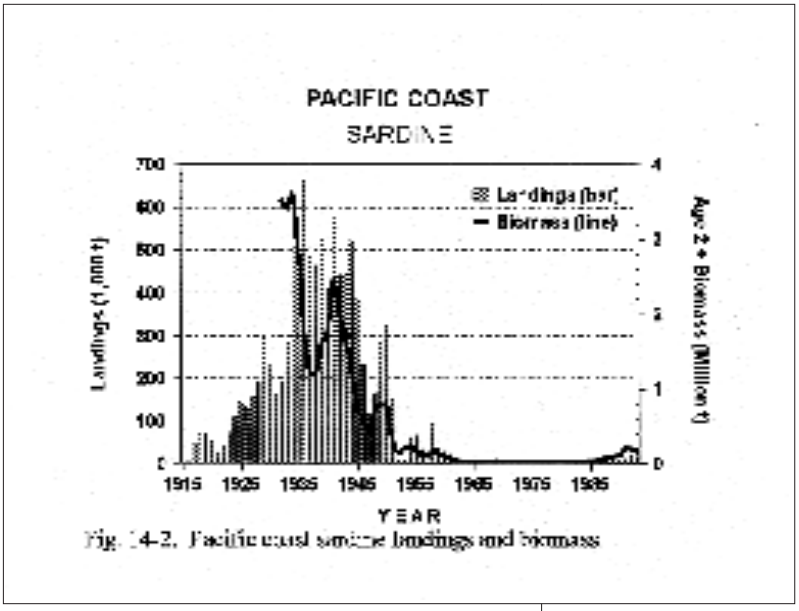

Fig. 14-2. Pacific coast sardine landings and biomass

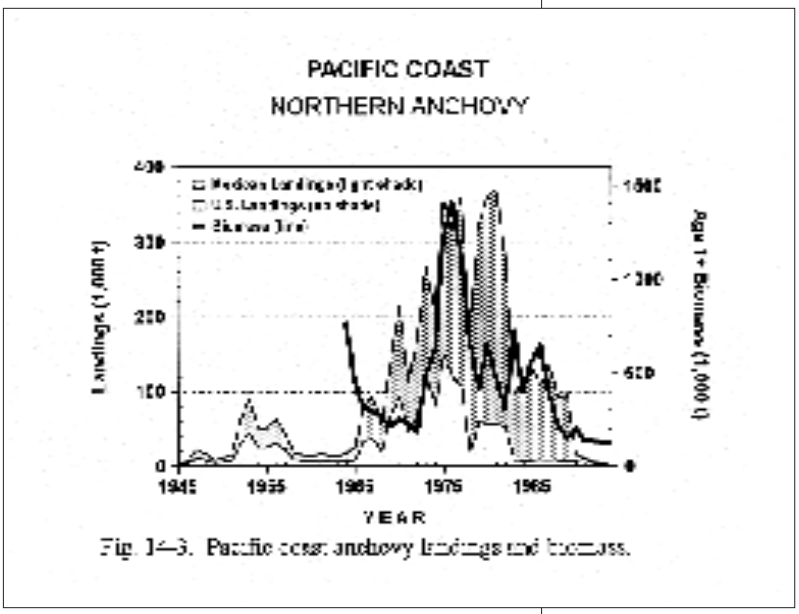

Fig. 14-3. Pacific coast anchovy landings and biomass.

Northern Anchovy

Northern anchovies are fished off California and Mexico. The "central subpopulation" of the resource is the one that supports most of the U.S. fisheries. Anchovies are harvested for reduction into fish meal, oil, and soluble protein products. Other catches are used for human consumption (fresh, frozen, canned, and paste), and as bait (live and frozen) for recreational fisheries.

Anchovy landings in California have fluctuated more in response to market conditions than to stock abundance. Figure 14-3 shows the historical trend of catches by the U.S. and Mexico. Landings by the U.S. have varied from less than 10,000 t to nearly 140,000 t. Since 1983, U.S. landings have been low (less than 10,000 t), and have been used mostly for live bait and other nonreduction uses. The biomass trend for the anchovy resource is also shown in the figure. The biomass in recent history peaked at 1.4 million t in 1985 and has declined steadily to 126,000 t by 1994.

The well-being of ecologically-related species in the ecosystem is an important factor in management of the anchovy resource. The endangered Brown Pelican, for example, depends on anchovies as an important food source. Thus, the anchovy FMP has specified a threshold for its optimum-yield determination to prevent anchovy depletion and provide adequate forage for marine fishes, mammals, and birds.

The anchovy resource is presently low in abundance. Current potential yield is only 7,000 t or less than 6% of LTPY (Table 14-1). No numerical limit has been placed on the live-bait catch in the United States on account of its small catch, but there is a 7,000 t quota for other nonreduction uses.

Pacific Sardine U.S. Landings (t)

1992	19,000
1993	31,000

Northern Anchovy U.S. Landings (t)

1992	3,700
1993	4,500

Jack Mackerel

Jack mackerel catches fluctuated widely with changing market demand and the ability of the fleet to fish for other species which were more profitable or available, like sardines and Pacific mackerel. In addition, the availability of jack mackerel can also be

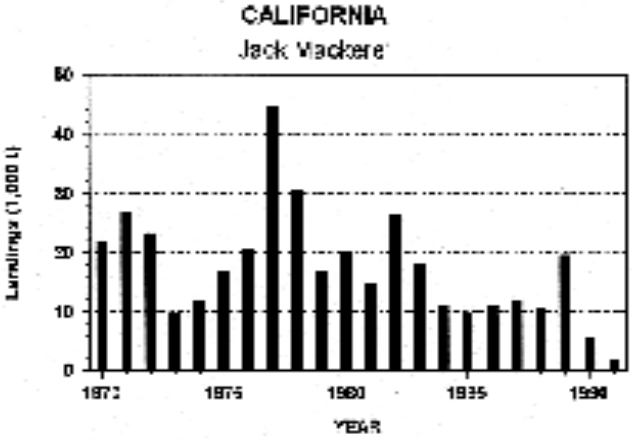

Fig. 14-4. California commercial landings of jack mackerel.

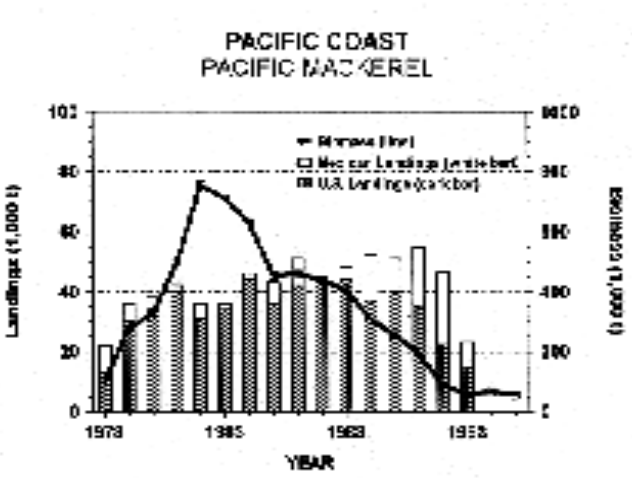

Fig. 14-5. Landings and biomass of Pacific (chub) mackerel.

Pacific Mackerel Landings (t)

1992	22,400
1993	14,300

California Pacific Herring Landings (t)

1993	3,900

very erratic. Jack mackerel has two distinct behavior patterns during its life cycle: juveniles are found inshore off southern California and Baja California while adult fish are distributed offshore and farther north, in some years, to as far as the Gulf of Alaska. Adult jack mackerel found offshore are sometimes caught incidentally by trawlers, particularly those targeting Pacific whiting.

The foreign trawl fisheries of the 1970s resulted in jack mackerel management being placed in the groundfish FMP and a bycatch quota of 12,000 t/year (north of lat. 39°N) was set. Restrictions on fishing for other groundfish species, including whiting, were thus avoided. The recent history of its commercial landings, mostly as incidental catch, is shown in Fig. 14-4. In 1991, interest in jack mackerel increased and the catch limit was raised to 52,000 t to allow a target fishery to operate. While this fishery has not yet materialized, signs of commercial interest continue. A purse seine fishery for jack mackerel has continued at a low level. Currently, it has no catch limit. Jack mackerel have been occasionally important to the partyboat sports fishery off southern California. It is also fished recreationally off piers.

Assessment and management of jack mackerel are difficult because of limited data and its broad distribution. The most recent estimate of biomass was made in 1983. Spawning biomass was estimated at 1.5 million t, and total biomass at 1.63-1.99 million t. Its potential yield is little more than an educated guess (Table 14-1).

Pacific (Chub) Mackerel

Pacific mackerel has a worldwide distribution in temperate and subtropical seas. On the Pacific coast, it is most abundant south of Point Conception, California. It supported one of California's major fisheries during the 1930-40s and again in the 1980s. It was second only to sardine during the heyday of the southern California sardine fisheries in the 1930-40s. The peak catch reached 73,000 t in 1935 and declined steadily thereafter. In 1970, a moratorium was placed on the fishery after the stock collapsed.

A series of successful year classes in the late 1970s initiated a recovery of the stock, and the fishery was reopened under a quota system in 1977. The resource is now harvested by three separate fisheries: the California commercial fishery, a sport fishery, and a Mexican commercial fishery. The recent history of U.S. harvest is shown in Fig. 14-5. From 1980 to 1989, the California recreational catch averaged 1,462 t per year.

The trend in chub mackerel biomass is also shown in Fig. 14-5. Recent peak abundance was 754,000 t in 1982. Abundance has declined to 87,000 t by 1992 and is thought to be continuing. Analyses of fish-scale deposits in ocean

bottom sediments off southern California indicate that the prolonged period of high mackerel biomass levels during the late-1970s and 1980s may have been unusual and would only be expected to occur, on average, about once every 60 years. In 1985, it was estimated that chub mackerel might sustain average yields between 26,000 and 29,000 t per year under management systems similar to that currently used to manage the stock by the State of California. The commercial catch is currently restricted by a quota of 10,800 t. If the biomass dips below 18,000 t, commercial fishing will be stopped.

Pacific Herring

Off the Pacific Coast, Pacific herring fisheries occur primarily off California. The fishery in Puget Sound, Washington, is small by comparison. The fishery off California has peaked three times during this century: during 1916-19 near 3,600 t, during 1947-53 near 4,500 t, and recently in 1982 near 10,000 t. In the earlier years, herring were harvested for reduction into fish meal and for pet food and bait. Some were canned to supplement the declining supply of sardines. Canned herring proved to be a poor substitute for sardines, and the fishery for human consumption ended in 1954.

Since 1973, herring in California have been harvested primarily for their roe for export to the Japanese market. Landings peaked in 1982 above 10,000 t (Fig. 14-6). Landings declined in 1984 when El Niño caused a corresponding decline in the herring population. However, most stocks have recovered somewhat and so have catches. The herring roe fishery is limited to California's four largest herring spawning areas: San Francisco Bay, Tomales-Bodega Bay area, Humboldt Bay, and Crescent City Harbor. San Francisco Bay has the largest spawning population of herring and supplies over 90 percent of the state's herring catch. The four spawning areas are managed separately by the California Department of Fish and Game, with catch quotas based on population estimates.

Another lucrative phase of the herring industry is the roe-on-kelp fishery. Beginning in 1965, scuba divers harvested species of marine vegetation with herring eggs attached from Tomales and San Francisco Bays. This product is exported as a Japanese delicacy. The fishery has evolved into the present roe-on-kelp fishery. Giant kelp is harvested from the Channel Islands off southern California, brought to San Francisco Bay, and suspended by 60 by 40 foot floating rafts. The rafts are towed to areas where herring spawning is expected to occur and are anchored. After spawning has ended, the kelp with herring eggs attached is removed from the rafts and packed in salt. Catches have been generally low (Fig. 14-7), but valuable.

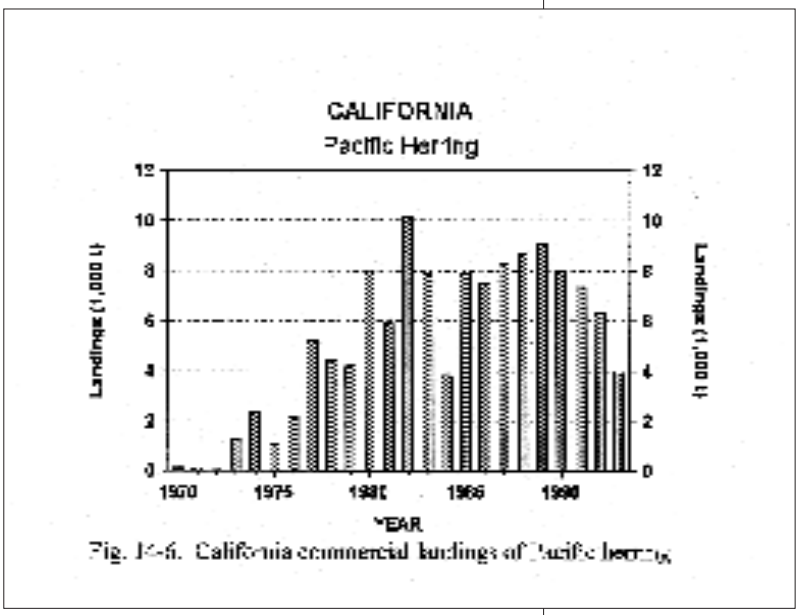

Fig. 14-6. California commercial landings of Pacific herring.

The herring spawning populations in Tomales and San Francisco Bays are estimated annually from hydroacoustic and spawning ground surveys. The spawning biomass has fluctuated widely in both areas since the 1983 El Niño through the more recent 1992-93 El Niño. The 1992-93 season estimates were a relatively high 3,700 tons in Tomales Bay and a relatively low 19,500 tons in San Francisco Bay. Humboldt Bay supports a smaller spawning stock, estimated in 1991 at 400 tons. Population estimates have not been made for the Crescent City herring stock, but observed spawning suggests that the population is large enough to support a minor fishery that occurs there.

Gulf of Alaska Pacific Herring Landings (t)

1993	21,300
1994	13,700

Bering Sea Pacific Herring Landings (t)

1993	25,900
1994	33,800

Alaska Pelagic Fisheries

Pacific Herring

Pacific herring is the major pelagic species that is harvested off Alaska. The fisheries occur

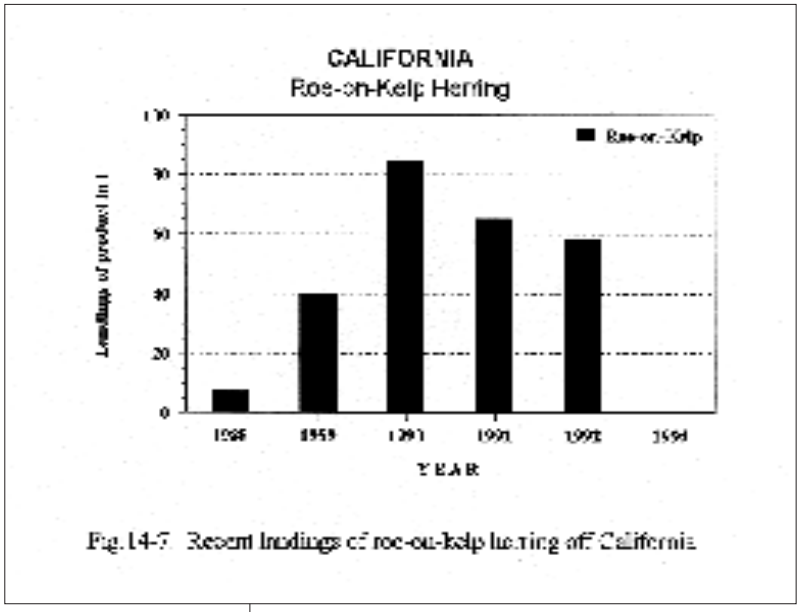

Fig. 14-7. Recent landings of roe-on-kelp herring off California.

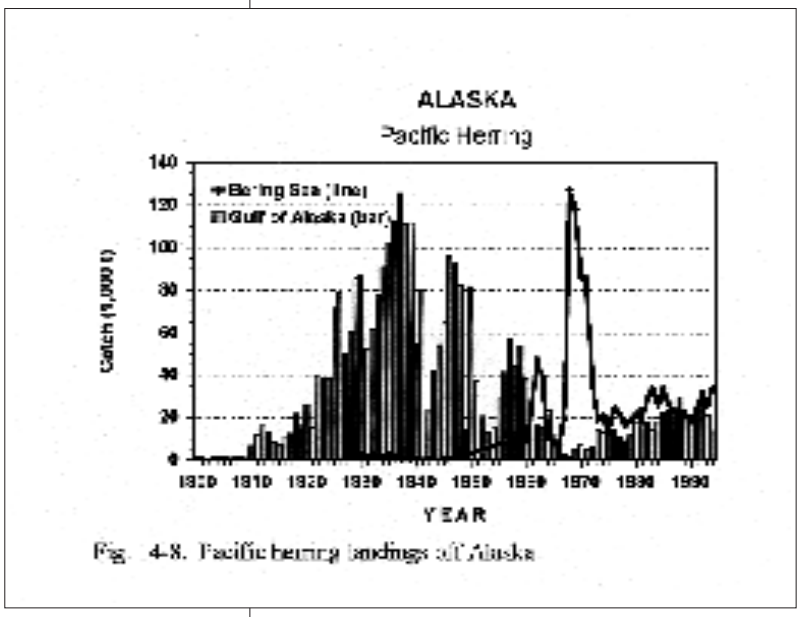

Fig. 14-8. Pacific herring landings off Alaska.

in specific areas in the Gulf of Alaska and the Bering Sea when the stocks come inshore to spawn. In the Gulf of Alaska, spawning concentrations occur mainly off southeastern Alaska, in Prince William Sound, and around the Kodiak Island-Cook Inlet area. In the Bering Sea, the centers of abundance are in northern Bristol Bay and Norton Sound. The fisheries occur within state waters and are, therefore, managed by the State of Alaska. The ADF&G regulates and monitors the resource by 20 separate fisheries.

In 1994, the total herring harvest in Alaska was 47,480 t that fetched an ex-vessel value of $24 million. The majority of the harvest was roe-bearing herring (43,410 t) and the remainder was food-and-bait herring (4,070 t) and herring roe-on-kelp (180 t).

In the Bering Sea, catches peaked dramatically in 1970 at more than 120,000 t and fell off to 21,000 t in 1977 (Fig. 14-8). Since then catches have risen slowly but steadily, reflecting better stock conditions. A portion of the Bering Sea herring harvest is taken as bycatch in the groundfish fishery. Regulations now limit bycatch to about 1,000 t. The Gulf of Alaska herring fisheries have a long history of harvest going back to the 1900s. Catches peaked at over 120,000 t in 1936. In recent years, catches have risen steadily from its low level of abundance in 1967.

From catch records, it is evident that herring biomass fluctuates widely due to influences of strong and weak year-classes. The period since the mid-1970s seems to be one of low-to-moderate herring abundance. The Bering Sea stocks are at moderate levels, with fish mostly of moderately strong 1987 and 1988 year classes. In most of the Gulf of Alaska, herring stocks are at moderate abundance levels. A strong 1988 year class that is present in the stocks is now declining rapidly in abundance. This year class is being replaced by another strong year-class (the 1992 year-class) that should sustain abundance levels in the near future. In Prince William Sound, however, herring abundance is at a historical low following a disease outbreak in 1993.

Issues

Transboundary Stocks and Jurisdiction

Mackerels, sardines, and anchovies are transboundary stocks exploited by both U.S. and Mexican fleets, but no bilateral management agreement has yet been reached for coordinated management of the stocks. Harvest levels are increasing in Mexican waters, and the absence of a governing bilateral agreement is compromising management of the same stocks that both countries fish on.

Underutilized Species

Jack mackerel is an underutilized species, while the Pacific sardine is increasing in abundance after decades at low levels. These species may support an increased harvest by U.S. fishermen in the near future.

PROGRESS

NOAA biologists continue to work closely with Pacific coast state biologists and the Pacific FMC in assessing and managing the stocks. Stock assessment models have been developed for northern anchovy, Pacific sardine, and chub mackerel. The new models are more reliable and precise than earlier ones used to estimate biomass for these stocks. The models now utilize more data, including fish spotter data from pilots employed by commercial fishermen and CALCOFI ichthyoplankton data. ❑