Alaska Salmon

Unit 13

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INTRODUCTION

Pacific salmon occupy a special place in the lives of all Alaskans. Its role in the history and modern contemporary life of the 49th State have made the species a keystone resource that continues to shape Alaska today. Native peoples and their heritage have a long, rich tradition of relying on salmon for economic, cultural, and subsistence purposes. Cooley (1961) described the historical focus on salmon by Native Americans along the southeastern and southwestern Alaska coast as representing the most highly developed aboriginal fishing society in North America. Today, residents and nonresidents depend heavily on this resource for recreation, food, and industry. The commercial fisheries, along with a rapidly growing salmon and groundfish sport fishery, provides the state with its largest private-sector employment.

Alaska salmon harvests have increased over the last three decades but may have peaked in 1995 (Figure 13-1). After dropping to record low catches in the 1970's, most populations have rebounded, and the fisheries are now at or near all-time peak levels in many regions of the state (Burger and Wertheimer, 1995; Wertheimer, 1997). The record-high commercial catch of 217,000,000 salmon in 1995 was 17% higher than the previous record of 196,000,000 recorded in 1994. However, the commercial landings declined significantly in both 1996 and 1997. Recreational fishermen caught over 1,800,000 salmon in 1995 (Howe et al., 1996), and salmon subsistence fisheries in 1994, the most recent year available, harvested over 1,000,000 fish (North Pacific Anadromous Fish Commission, 1998).

A number of factors have contributed to the current high abundance of Pacific salmon in Alaska. These include: 1) pristine habitats with minimal impacts from extensive development, 2) favorable ocean conditions that allow high survival of juveniles, 3) improved management of the fisheries by state and Federal agencies, 4) elimination of high-seas drift-net fisheries by foreign nations, 5) hatchery production, and 6) reduction of bycatch in fisheries for other species.

Quality spawning and nursery habitat, favorable oceanic conditions, and sufficient numbers of spawning fish are likely the paramount issues affecting current abundance. Alaska salmon management continues to focus on maintaining pristine habitats and ensuring adequate escapements. However, ocean conditions that have favored high marine survivals in recent years, fluctuate due to interdecadal climate oscillations (Mantua et al., 1997). There is recent evidence that a change in ocean conditions in the North Pacific Ocean and Gulf of Alaska may be underway, possibly reflecting the downturn in abundance of Alaska salmon runs in 1996 and 1997.

FISHERY MANAGEMENT

Alaska's 34,000-mile coast is nearly two-thirds the length of the coastline of the conterminous 48 states. Along this coastline, over 14,000 interior water bodies support populations of five salmon species. Salmon management over such a vast area requires a complex mix of domestic and international bodies, treaties, regulations, and other agreements. Federal and state agencies cooperate in managing salmon fisheries. The Alaska Department of Fish and Game (ADFG) manages salmon fisheries within state jurisdictional waters where the majority of catches occurs. Management in the Federal Exclusive Economic Zone (3–200 miles offshore) is the responsibility of the North Pacific Fishery Management Council, which has

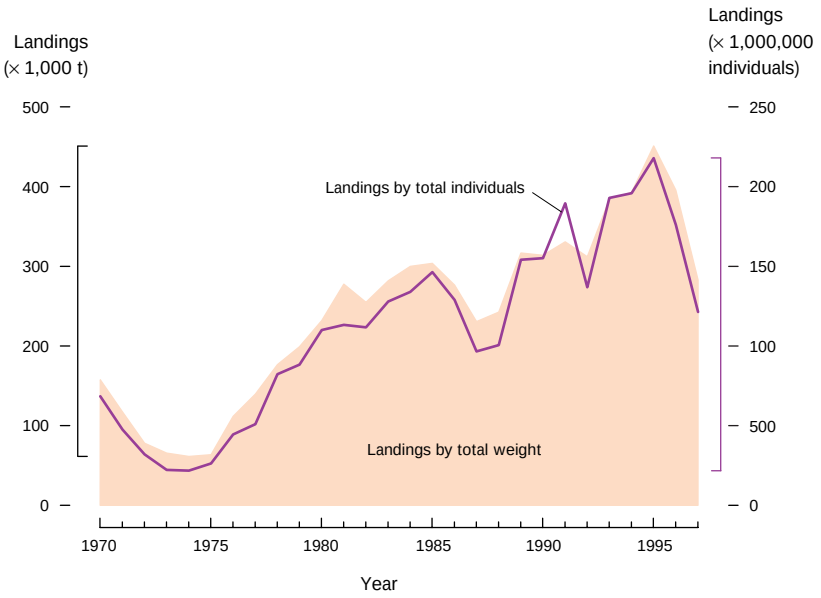

Figure 13-1
Commercial landings of Alaska salmon, all species, 1970–97, by metric tons (t) and individual fish.

deferred specific regulations to the state. Management of Alaska salmon fisheries is based primarily on regional stock groups of each species and on time and area harvesting by specific types of fishing gear.

Over 25 different commercial salmon fisheries are managed with a special limited-entry permit system that specifies when and what type of fishing gear can be used in each area of the state. These fisheries, extending from Dixon Entrance in southeastern Alaska to Norton Sound in the Bering Sea, are allowed to catch salmon in different fisheries employing drift gillnets, set gillnets, beach seines, purse seines, hand troll, power troll or fishwheel harvest gear (Commercial Fisheries Entry Commission, 1997). Sport fishing is limited to hook and line, while the subsistence fishery may use gillnets, dipnets, or hook and line. Additional subsistence harvesting is also regulated by special permits.

Management of the fisheries is also negotiated with Canada under the Pacific Salmon Treaty. Recent negotiations for most fisheries, however, have stalled since agreements between the two countries were not reached on catch allocations for certain fisheries and species. Major disagreements exist over several issues including: 1) chinook salmon catches in southeastern Alaska where Canadian salmon are caught along with other U.S. stocks, 2) fisheries in the Dixon Entrance area where each country catches salmon originating in the other nation, and 3) Canadian fisheries off the west coast of Vancouver Island that catch salmon bound for Washington, Oregon, and the Columbia River. A current bright spot in negotiations with Canada involves salmon fisheries in the Yukon River where joint research and management programs in that large transboundary river system are nearing final agreement.

On a broader international scope, the management of salmon harvest in the high seas of the North Pacific Ocean from 1957 to 1992 was authorized by the International North Pacific Fisheries Commission (INPFC), and via bilateral and multilateral agreements and negotiations with Taiwan and the Republic of Korea. In 1993, the North Pacific Anadromous Fish Commission (NPAFC) was formed to replace the INPFC. The Commission (composed of Canada, Japan, the Russian Federation, and the United States) now provides a framework for international cooperation in salmon management and research in the North Pacific Ocean.

The NPAFC Convention prohibits high seas salmon fishing and trafficking of illegally caught salmon. Coupled with United Nations General Assembly Resolution 46/215, which bans large-

Table 13-1
Productivity in metric tons and status of Alaska salmon fishery resources.

Species	Recent average yield (RAY)	Current potential yield (CPY)	Long-term potential yield (LTPY)	Fishery utilization level	Stock level relative to LTPY
Pink	153,600	125,700	125,700	Full	Above
Sockeye	128,900	116,800	116,800	Full	Above
Chum	70,800	44,900	44,900	Full	Above
Coho	17,700	17,700	17,700	Full	Near
Chinook	5,100	5,500	5,500	Full	Below
Total	376,100	310,600	310,600		

scale pelagic driftnet fishing in the world's oceans, harvesting of Pacific salmon on the high seas, except for illegal fishing, no longer exists. This allows for effective management control to fully return to the salmon-producing nations.

Because salmon are anadromous fish that spend a portion of their life (1–7 years) at sea and then return to freshwater streams, rivers, and lakes to spawn and die, their well being and harvest management practices are also directly influenced by land management practices. The quality of freshwater habitats determine the success of reproduction and initial rearing of juveniles. Several agencies, entities, and groups have significant influence on the quality of freshwater spawning and rearing habitats for salmon throughout Alaska. Included among these are the U.S. Forest Service, Bureau of Land Management, National Park Service, National Wildlife Refuges, Alaska State Parks and Forests, Alaska Native Regional and Village Corporations, plus municipalities, boroughs, and other private landowners that control watersheds used by salmon.

SPECIES AND STATUS

All five species of Alaska salmon (pink, sockeye, chum, coho, and chinook) are fully utilized, and stocks in most regions of the state generally have rebuilt to or beyond previous high levels (Table 13-1). Research has been extensive into all aspects of salmon life histories (Groot and Margolis, 1991), and this information has been used in Alaska to help regulate fisheries on stocks by monitoring escapement size and catch numbers by species, season, and area. The unprecedented high abundance of Alaska salmon in recent years should not be interpreted as an absence of some of the same factors affecting declines of salmon in the Pacific Northwest. Issues and problems associated with overfishing, incidental take as bycatch in other fisheries, and losses of spawning and rearing habitats in freshwater and in nearshore ocean areas are also of concern in Alaska.

Pink Salmon

Pink salmon are the most abundant species of Pacific salmon in Alaska (Figure 13-2), accounting for 50–60% of the total harvest each year. During the past 27-year period (1970–97), pink salmon comprised 56% of the average annual commercial salmon harvest (Figure 13-3). Pink salmon are mostly harvested by purse seines in the southeastern, southcentral, and Kodiak Island regions of the state. In Prince William Sound, hatcheries produce a large portion of the pink salmon catch.

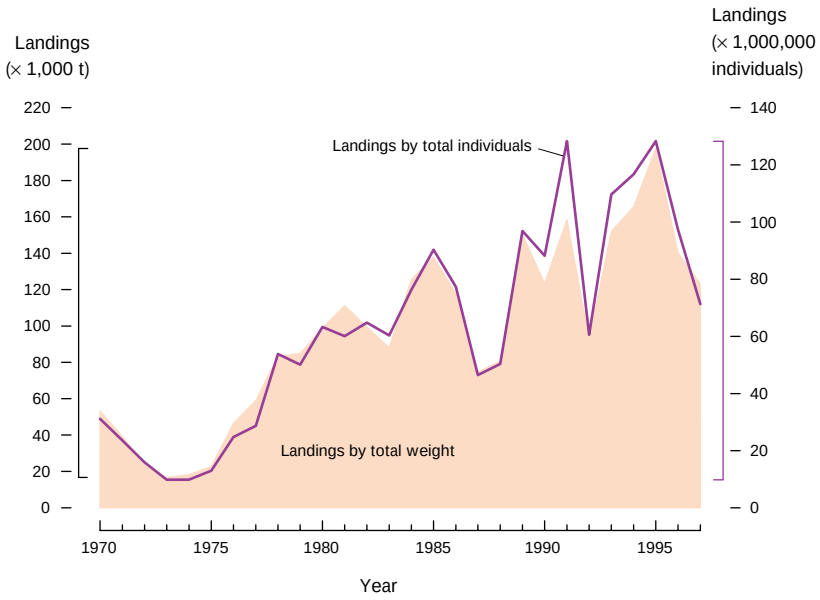

Figure 13-2
Alaska commercial landings of pink salmon, 1970–97, by metric tons (t) and individual fish.

Unique among the five species, pink salmon have a fixed life-history cycle whereby the species always matures and spawns at 2 years of age. This cycle is genetically fixed so that spawners in even-numbered years are always separate and distinct from spawners in odd-numbered years. Throughout much of its range the species has viable populations in both odd- and even-numbered years; however, in some areas pink salmon only occur in one or the other cycle year. In Bristol Bay and western Alaska, for example, pink salmon essentially occur only in even-numbered years, whereas in the Pacific Northwest they occur only in odd-numbered years.

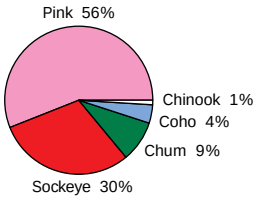

Figure 13-3
Alaska commercial salmon landings by numbers of fish, averaged over 1970–97.

Sockeye Salmon

Sockeye salmon (Figure 13-4), second in abundance, generally accounted for 30% of the harvest in recent years (Savikko, 1997). Sockeye salmon, however, provide greater dollar value to fishermen than all other commercially caught

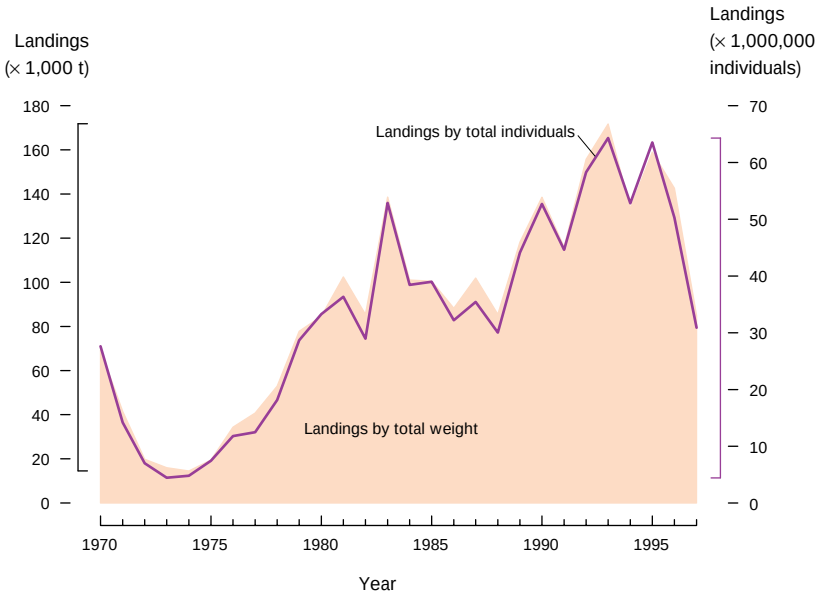

Figure 13-4
Alaska commercial landings of sockeye salmon, 1970–97, by metric tons (t) and individual fish.

salmon in Alaska combined, usually yielding from 60–70% of the ex-vessel value of the annual harvest. The Bristol Bay sockeye salmon fishery in southwestern Alaska is the most valuable capture fishery for salmon in the world, often yielding $300–400 million (ex-vessel) per year.

Sockeye salmon are harvested by purse seine in the southeastern, Kodiak, and Chignik fisheries and by drift gillnet or set gillnet throughout the state. The largest fisheries for sockeye salmon occur in the Bristol Bay, Cook Inlet, Alaska Peninsula-Aleutian Islands, and Kodiak regions, while other significant fisheries for this species also occur in the southeast, Prince William Sound, and Chignik regions.

The most common sockeye salmon life history pattern dictates that juveniles rear in lakes for 1–2 years before migrating seaward as smolts. The large lake complexes on Bristol Bay rivers provide this necessary life history component and form a critical part of the important fishery in this region. The Bristol Bay fishery, based on drift and set gillnet catches, is concentrated in a narrow window of time from late June until mid July when millions of returning adult sockeye salmon pour into Bristol Bay rivers from the ocean.

The 1997 preseason forecast for sockeye salmon returning to Bristol Bay was estimated to be about 34 million fish. Previous forecasts generally have been in reasonably close agreement with actual runs. During the previous 5-year period (1992–96), returns to Bristol Bay ranged from 29,600,000 to 44,400,000 fish and averaged 36,500,000 sockeye salmon per year (Savikko, 1997). The return to Bristol Bay in 1997, however, was only 18,900,000, with a fishery harvest of 12,300,000. This unexpectedly low return of sockeye salmon created a serious shortfall in the catch and incomes of fishermen and communities throughout a large region of southwestern Alaska dependent on this fishery.

Several hypotheses have been suggested to explain the 1997 shortfall of sockeye salmon returning to Bristol Bay. During May, June, and part of July of 1997 the region experienced unusually warm, calm weather that resulted in high water temperatures. One hypothesis suggested this caused high mortality and changes in migration behavior after returning salmon entered Bristol Bay. Other suggested causes of the shortfall include changes in freshwater or ocean rearing conditions that affected growth and survival of juveniles or immature adults, increased predation at sea, interception by other fisheries, disease, and overescapements on spawning grounds in recent years. The true cause of the shortfall, which may involve a combination of many factors, remains unknown. A paramount unanswered question, however, that arises from 1997 Alaska salmon returns, including those in Bristol Bay, is whether or not cyclic changes in oceanic environmental conditions have occurred that portends lower survivals and smaller returns for future runs.

Chum Salmon

Chum salmon (Figure 13-5) are harvested commercially by purse seines, drift and set gillnets, and in large western Alaska rivers by fish wheels. Statewide, over a 27-year period (1970–97), chum salmon have accounted for 9% of Alaska's salmon harvest (Figure 13-3). Over the past 5-year period (1993–97), the annual average chum salmon harvest across Alaska was 16,800,000 fish, with the 1997 harvest slightly below this average at 15,600,000 fish (Savikko, 1997). Currently, 60–70% of the commercially harvested chum salmon occur in Alaska's southeast region where hatcheries produce a significant portion of the catch.

Chum salmon runs in southwestern and western Alaska, similar to sockeye salmon, were below expectations in 1997 which added to the shortfall hardships in those regions. Management of chum salmon fisheries in western Alaska is complicated by another commercial fishery at False Pass in the Aleutian Islands. Western Alaska chum salmon may spend part of their ocean life in the Gulf of Alaska. These salmon, as maturing adults on their return migration, funnel through passes between the Aleutian Islands into the Bering Sea. The False Pass fishery, targeted primarily on sockeye salmon returning to Bristol Bay, must be managed to not overharvest chum salmon destined for the Kuskokwim and Yukon Rivers in western Alaska. Chum salmon in western Alaska are an important part of commercial fisheries in that region and a significant subsistence resource for local residents.

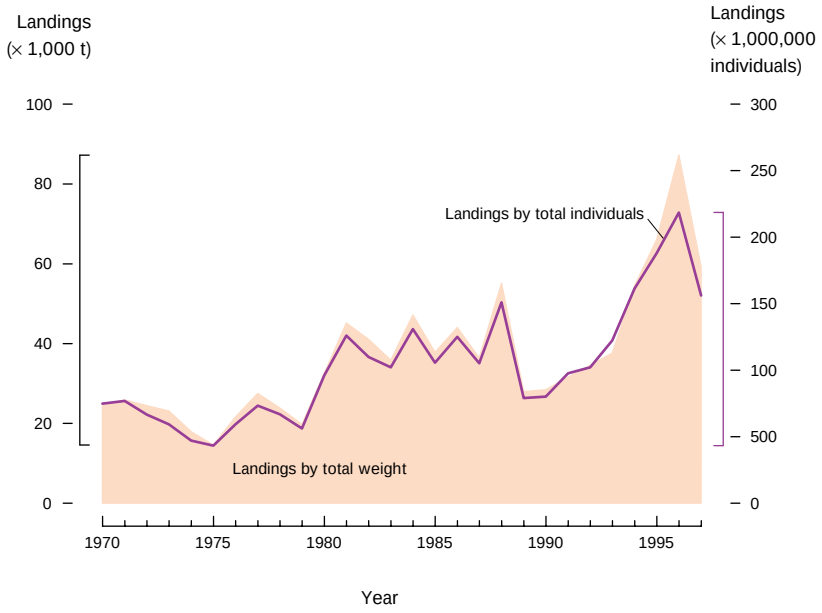

Figure 13-5
Alaska commercial landings of chum salmon, 1970–97 by metric tons (t) and individual fish.

Coho Salmon

Commercial catches of coho salmon across Alaska in 1997, totaling 2,900,000 fish, were less than half the recent 5-year average harvest levels (Savikko, 1997) and similar to record low catches in the 1970's (Figure 13-6). This decline was most noticeable in the southeast region where marine survivals from both wild and hatchery smolts dropped significantly from recent trends. As recently as 1995 over 3.3 million coho salmon were caught in the southeastern fisheries alone.

Coho salmon in Alaska are caught commercially by purse seines in the southeast and southcentral regions, by drift or set gillnets in all regions, and by hand and power troll gear in the southeast. Coho, along with sockeye and chinook salmon are popular target species in recreational fisheries throughout the state.

Chinook Salmon

The annual commercial harvest of chinook salmon in Alaska has averaged 500,000–700,000 fish in recent years (Figure 13-7). The statewide 10-year (1988–97) average annual harvest was 627,000 fish (Savikko, 1997). Chinook salmon, like coho salmon, are commercially harvested by purse seines in the southeast and southcentral regions, by drift or set gillnets in all regions, and by hand and power troll gear in the southeast. In addition, fishwheels harvest chinook salmon in western Alaska rivers for commercial sales and for subsistence uses.

In general, chinook salmon are the first species each year to begin spawning migrations into Alaska rivers. Only in a few Bristol Bay and western Alaska rivers are fisheries permitted to directly target these early returning runs of chinook salmon. However, in fisheries targeted on other salmon, chinook salmon are often taken incidentally. Sockeye salmon migrations into many larger river systems begin during the later portion of chinook salmon runs into the same rivers. In these cases, for example in certain Cook Inlet, and southeastern rivers, and in the Copper River near Cordova, fisheries that target sockeye salmon may catch significant numbers of chinook salmon. These fisheries may have a quota limiting the catch of chinook salmon.

The chinook salmon harvest in southeastern Alaska, where significant numbers of non-Alaska origin fish are caught, is normally regulated by a quota under provisions of the Pacific Salmon Treaty. This annual harvest quota is then reallocated among various fisheries by the Alaska Board of Fisheries, a regulatory body empowered to arbitrate which user group gets to catch how many salmon. For example, the troll fishery (both hand and power troll), which historically has been highly

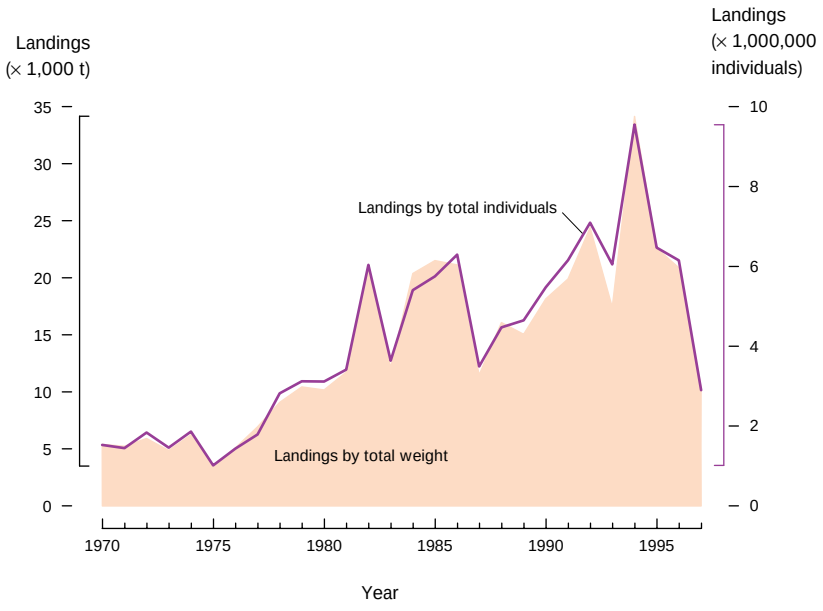

Figure 13-6
Alaska commercial landings of coho salmon, 1970–97, by metric tons (t) and individual fish.

dependent on chinook salmon, is allocated the largest portion of the southeastern chinook salmon quota. Net fisheries in the region (purse seine and drift gillnet) primarily target pink, chum, or sockeye salmon but are provided a quota to take a limited catch of chinook salmon in pursuit of other target species. The remaining allowable quota is allocated to guided and unguided sport fisheries.

ISSUES

Value of Alaska Salmon

Although commercial harvests of Alaska salmon have been at high levels in recent years, the value of the catch has declined significantly due to a number of complex worldwide factors. Value of the record 1995 statewide catch (451,000 metric tons (t)) was $466,000,000 (ex-vessel), but this value was well below that of the 1992 harvest (312,000 t) valued at $546,000,000. A fluctuating but downward trend in value of Alaska's salmon harvest has persisted over much of the last decade (Figure 13-8). Along with the downward trend in value of Alaska salmon is a rising trend in total worldwide salmon production (Alaska Seafood Marketing Institute, 1993). Increases in world salmon production are due not only to record levels of wild salmon caught in Alaska, Japan, and Russia, but especially to the continued rapid growth in worldwide production of farmed salmon (Folsom et al., 1992). Wild salmon, in this context, also includes fish produced from hatcheries and ocean ranching programs.

Total world salmon production from capture and farmed fisheries in 1995 was about 1,500,000 t as each fishery reached record production levels. This 1995 production represents a continuation of recent trends for increased production in both fisheries and in lower prices paid to fishermen (Heard, 1996 and 1997). Decreases in prices paid for wild-caught salmon in Alaska also characterizes capture fisheries for salmon in Japan (Kaeriyama and Urawa, 1993). The largest quantities of farmed salmon are raised in Norway and Chile. In 1997, Norway's farmed Atlantic salmon production of 315,000 t (Bill Atkinson News Report, 1998) exceeded the total Alaska commercial salmon harvest of 282,800 t.

Recreational Fisheries

Recreational (sport) fishing for salmon in Alaska continues to grow. Part of this growth is due to the fact that many Alaska households use sport fishing as convenient method to collect wholesome seafood for the table. Some part of the total sport fish harvest of salmon in Alaska, therefore, might more appropriately be included in subsistence fishery statistics. But a larger part of the growth is due to increased guided recreational fishing by tourists visiting Alaska. Sport fishing for salmon in Alaska as a recreational outlet is an important pursuit for both residents and nonresidents alike. A total of 414,449 Alaska sport fishing licenses were issued in 1995, with 58% issued to nonresident anglers. More nonresident sport fishing licenses have been sold in Alaska than resident licenses since 1990 (Howe et al., 1996). Sport fishing for salmon is a vital part of the recent rapid growth in Alaska tourism.

Coho salmon were the most popular sport caught salmon in Alaska, representing 30.3% of the 1,800,000 salmon caught by recreational fishermen in 1995 (Howe et al., 1996). Sockeye (22.5%) were the second most popular sport-caught salmon that year, followed by pink salmon (21.3%), chinook salmon (17.7%), and chum salmon (8.2%).

Bycatch and Multispecies Interactions

Bycatch of salmon by U.S. groundfish fisheries in the Bering Sea and the Gulf of Alaska remains a problem in fisheries management. Although the groundfish fisheries are prohibited from retaining any salmon they catch, about 60,000 chinook salmon were taken incidentally each year between 1992 and 1994 in these trawl fisheries. In that same period, about 173,000 other salmon (mostly chum salmon) per year were estimated as trawl bycatch. The problem is currently being addressed by the North Pacific Fishery Management Council through time-area closures and bycatch limits set for the groundfish fisheries.

Protecting Salmon Habitats

Responsible conservation of Alaska's salmon resource is a Federal responsibility shared with the state. Maintaining this renewable resource requires considered and planned use for the thousands of miles of riparian habitat in Alaska that support salmon production. Competing uses for this habitat include logging, mining, oil and gas development, and industrial and urban development. Although progress has been made in setting Federal and state land use guidelines, conflicts still occur. While working to change land use laws, natural resource managers continually face increasing demands from extractive industries to log, drill, or fill riparian habitats. An example is the continuing debate over the required size of clearcuts and buffer zones along anadromous fish streams. In its recent review of timber harvest in the Tongass National Forest, the U.S. Forest Service concluded that long-term application of current timber harvest procedures could lead to, or continue, declines in habitat productivity and eventual loss of salmonid stocks. The recent buy-back of Federal gas and oil leases in Bristol Bay is another example of long-term protection granted to the salmon resource.

In 1996, the Sustainable Fisheries Act amended the Magnuson-Stevens Fishery Conservation and Management Act to require the description, identification, conservation, and enhancement of essential fish habitat (EFH) in all fishery management plans throughout the United States. As a result of this legislation the EFH requirements for the Alaska salmon fishery management plan are now under development by North Pacific Fishery Management Council and the National Marine Fisheries Service (NMFS).

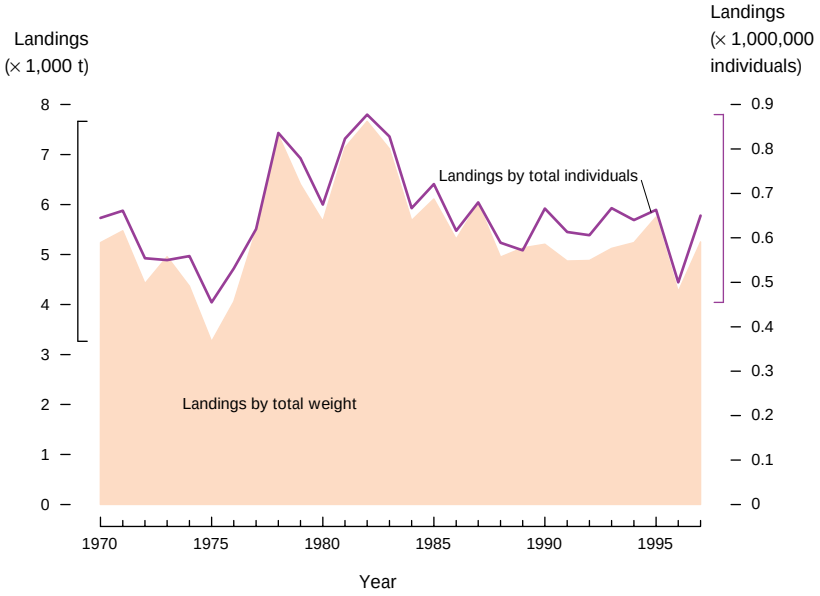

Figure 13-7
Alaska commercial landings of chinook salmon, 1970–97, by metric tons (t) and individual fish.

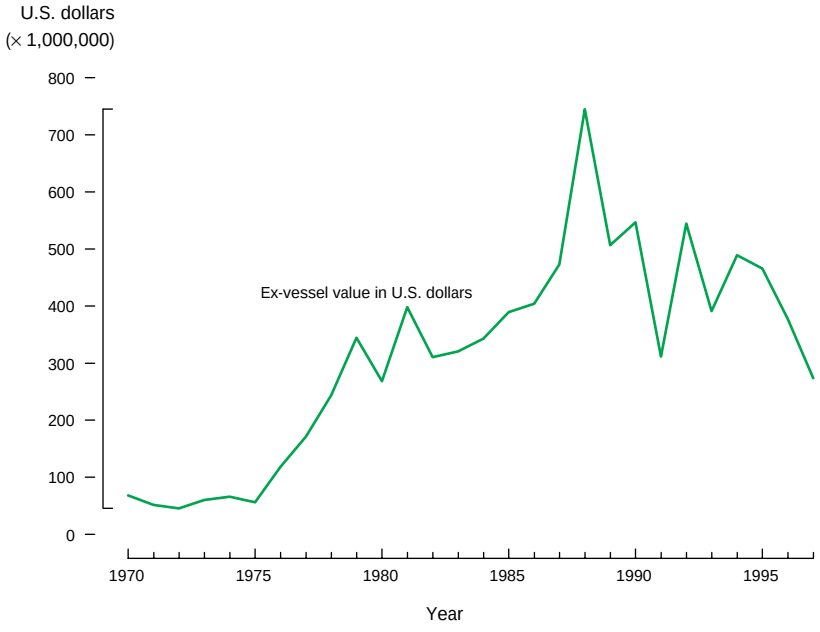

Figure 13-8
Ex-vessel value of Alaska commercial salmon landings, 1970–97, by metric tons and individual fish.

State resource managers deal with increasing demands of industrial developments while working to maintain productive natural habitats that support Alaska's wild salmon. To assist in meeting the need for a better understanding of the status of wild stocks, a cooperative study is underway between ADF&G, the Alaska Chapter of the American Fisheries Society, and various other agencies (including the NMFS) to provide a population status inventory of Alaska's salmon resources. The first phase of this program was recently completed for southeastern Alaska (Baker et al., 1996), and is now expanding to other regions of the state. In conjunction with this stock status survey, a correlative project, funded in part by the National Oceanic and Atmospheric Administration's Earth Science Data and Information Management program, is integrating available information on Alaska's salmon stocks into a geographic information format.

Hatcheries and Ocean Ranching

Alaska's salmon enhancement programs produce significant numbers of fish for commercial and sport harvest. While most hatcheries are now operated by private-sector regional aquaculture associations, the state manages to minimize catches of wild salmon in fisheries where large numbers of returning hatchery salmon are caught. Overfishing is of concern where wild stocks are in low abundance and spawning escapement goals may not be achieved. Prince William Sound is an area of particular concern where large returns of hatchery pink salmon mix with lower numbers of wild fish.

The present hatchery program in Alaska which began in 1974, contributed 29,400,000 salmon to commercial fisheries and 280,798 salmon to sport fisheries in 1996 (McNair, 1997). Major contributions to salmon fisheries from Alaska hatcheries vary considerably by species and region. Hatcheries in southeast made important contributions in 1996 to catches of sockeye, coho, chinook, and chum salmon; in Prince William Sound to catches of sockeye, pink, and coho salmon; in Cook Inlet to catches of chinook, coho, and sockeye salmon; and in Kodiak to catches of sockeye, coho, and pink salmon (McNair, 1997).

Interception Fisheries

Significant progress has been made to control the interception and incidental take of Alaska's salmon resources. First, a formerly legal high-seas salmon fishery by Japan, authorized by an international convention from 1952 to 1992, was terminated under the new Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean. Second, high-seas driftnet fisheries for squid by various countries that also intercepted U.S.-origin salmon stocks in the central North Pacific Ocean have been terminated by United Nations General Assembly Resolution 46/215. A remaining problem of salmon bycatch in U.S. groundfish fisheries in the Bering Sea and the Gulf of Alaska is actively being managed by the North Pacific Fishery Management Council through time-area closures and bycatch limits set for the groundfish fisheries. Interceptions of nontarget salmon species within state-managed salmon fisheries continue to be addressed by the Alaska Board of Fisheries. Negotiations continue between the United States and Canada, under the Pacific Salmon Treaty, to resolve long-standing interception issues, particularly in the northern British Columbia and Alaska boundary area, and in the Yukon River.

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