# SOUTHEAST–YAKUTAT COMMERCIAL SALMON FISHERY

## Area Description and Gear Types

Commercial fisheries in the southeast panhandle portion of the state, the Southeast Alaska–Yakutat (SEAK) area, harvest a diverse assemblage of species and stocks and include a wider variety of gear types than in any other region of the state (Figure 14). Purse seine and drift gillnet gear are used in the Southeast Alaska area, which extends from Dixon Entrance to Cape Fairweather. Set gillnet gear is used in the Yakutat area, located between Cape Fairweather and Cape Suckling. Commercial trolling is allowed in both areas, but nowhere else in the state. While the salmon net fisheries are limited to state waters, the troll fishery operates in both state waters and federal waters of the Exclusive Economic Zone east of the longitude of Cape Suckling. Purse seine, drift gillnet, troll gear and floating fish traps are allowed in the Annette Island Fishery Preserve, a 3,000-foot wide zone offshore of Annette Island established by Presidential proclamation in 1916, where natives have exclusive fishing rights. The state does not actively manage Annette Island Fishery Preserve fisheries.

Since statehood, the numbers of salmon landed in the purse seine fishery have comprised 80% of the commercial salmon harvest in SEAK, followed by 7% in the drift gillnet fishery, 5% in the troll fishery, 1% in the set gillnet fishery, 2% at Annette Island, and the remainder coming from miscellaneous harvests including hatchery cost–recovery, test fisheries and confiscated fish (Figure 15).

While the purse seine fishery accounts for the vast majority of the salmon harvested in the SEAK salmon fishery, it primarily targets pink and chum salmon, the species with the lowest exvessel value per pound. The area's other commercial fisheries target higher value species. The drift gillnet fishery targets sockeye, coho, and chum salmon, and to a lesser extent Chinook salmon, while set gillnetters in the Yakutat area primarily harvest sockeye and coho salmon. Chinook and coho salmon are the predominant species harvested in the troll fishery. Although exvessel prices paid to fishermen are dependent on a wide variety of factors, sockeye salmon and troll-caught Chinook and coho salmon fetch a premium price relative to other gear types and species harvested in the SEAK commercial salmon fishery (Table 13).

## History of the Commercial Salmon Fishery

Commercial utilization of salmon in SEAK began in the late 1870s. Sockeye salmon was the first species exploited, but pink salmon have dominated the region's harvest since the early 1900s. Prestatehood average harvests peaked in the 1910s for sockeye and chum, in the 1930s for Chinook and pink salmon and in the 1940s for coho salmon (Figure 16, Panels A–E). As a result of lax federal management and chronic overfishing, harvest levels of all species were at very low levels by statehood. Following a period of stock rebuilding under state management and a period of reduced marine survivals in the late 1960s and early 1970s, harvests of all species have rebounded. During the 1990s, Chinook and sockeye salmon reached poststatehood peaks, and coho, pink and chum salmon reached all-time peaks.

Since statehood, annual commercial harvests of salmon in SEAK have averaged about 36.3 million fish, the highest of the 11 areas examined in this paper. With the exception of sockeye salmon, average annual catches for each species are also the highest of any of the 11 areas. Total annual commercial harvests have ranged from a low of about 5.7 million fish in 1975 to a high of almost 98 million fish in 1999 (Figure 16, Panel F). Average annual catches by species since statehood include 28 million pink (77%), 4.7 million chum (13%), 2 million coho (5.5%), 1.3 million sockeye (3.7%) and about 300,000 Chinook salmon (0.8%). The diverse commercial fisheries of the SEAK area are clearly among the most important in the entire state of Alaska. Annual reports on the area's fisheries are produced by ADF&G staff and offer detailed fishery data and insightful summaries of the fishery as well as management and assessment programs. See Bachman et al (2005).

## Other Salmon Harvests

Salmon are also harvested for subsistence and personal use in SEAK. Estimated harvests are determined from returns of harvest permits issued to users by ADF&G. The subsistence harvest averaged about 70,000 salmon from 1994 to 2003 (Table 14). Catches have been stable over this period (Figure 17). Sockeye salmon comprise slightly over 80% of the harvest. Studies indicate actual subsistence harvests are probably somewhat larger than those compiled from the return of harvest permits (Geiger et al 2005).

Salmon harvests in the SEAK sport fishery have rapidly increased over the last 25 years (Table 15). Chinook and coho salmon are the primary species tar-

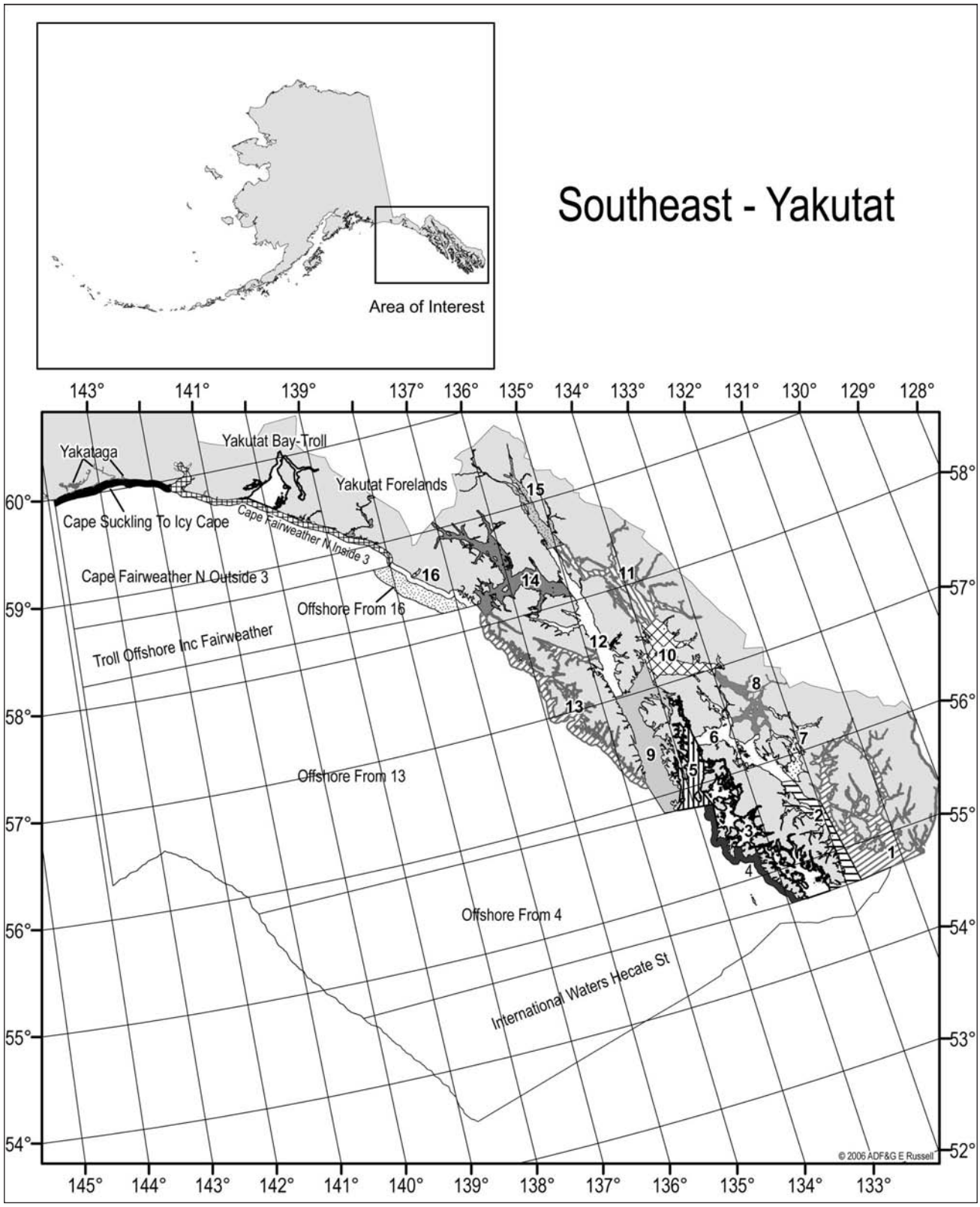


Figure 14. Southeast–Yakutat area commercial salmon fishery.

geted by sport anglers. Like subsistence and personal use fisheries, harvests in the sport fishery are generally minor in comparison to the commercial harvest, with the notable exception of Chinook salmon. Allocation of sport and commercial harvests of Chinook salmon in the SEAK fisheries is specified in state regulations established by the Alaska Board of Fisheries; since 1996, 20% of the combined sport and commercial troll fishery Chinook salmon allocation has been to sport fisheries. The ratio of the total commercial to sport fishery harvests during the last 25 years is about 200:1; ratios vary considerably by species from about 680:1 for pink salmon to 6:1 for Chinook salmon.

## Commercial Salmon Fishery Users

As of August 31, 2005, there were 3,133 active limited entry permits for SEAK commercial salmon fisheries, including 478 drift gillnet, 168 set gillnet, 415 purse seine, 1,112 hand troll and 960 power troll permits. From 1990 to 2004, there has been a downward trend in the number of permits of each gear type that are annually fished (Figure 18). The total number of permits fished in SEAK in 2004 (1,684) was one-third less than the number fished in 1990 (2,525). The biggest reductions have come in the hand troll and purse seine gear types.

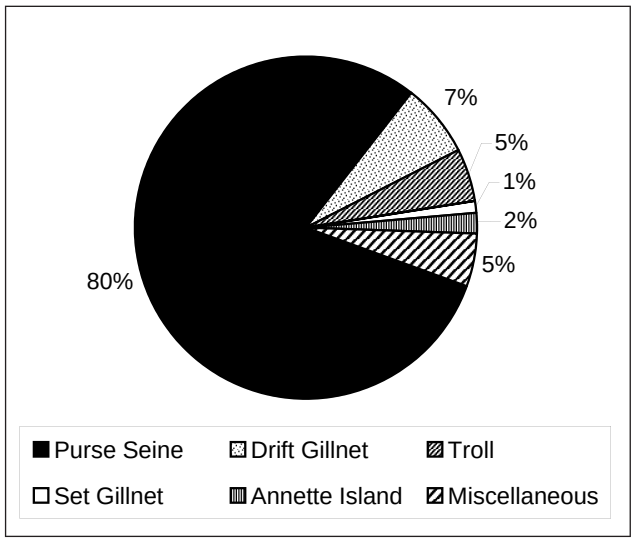


Figure 15. Average percent of the commercial salmon harvest by gear type in the SEAK area, 1960–2004.

Table 13. Average exvessel price per pound by species and harvest gear in SEAK area commercial fisheries, 2000–2004.

| | Species | | | | |
|---|---|---|---|---|---|
| Fishery | Chinook | Sockeye | Coho | Pink | Chum |
| Purse Seine | $0.50 | $0.87 | $0.32 | $0.12 | $0.25 |
| Drift Gillnet | $0.86 | $0.90 | $0.48 | $0.10 | $0.32 |
| Set Gillnet | $0.84 | $0.63 | $0.30 | $0.10 | $0.16 |
| Troll | $1.99 | $1.15 | $0.93 | $0.10 | $0.24 |

## Exvessel Value

From 1985 to 2004, the average annual exvessel value of the commercial salmon fishery in SEAK was about $96 million, ranging from a low of about $52 million in 2002 to a high of about $143 million in 1989. Adjusted for inflation and expressed in 2004 dollars, the average annual exvessel value was about $128 million. Inflation-adjusted exvessel value ranged from a low of $54 million in 2002 when about 57 million salmon were harvested to a high of $217 million in 1989 when about 66 million salmon were harvested (Figure 19). As elsewhere in Alaska, value has trended downward during this 20-year period, although a modest upward trend is apparent for 2003 and 2004. From 1985 to 2004, pink salmon accounted for 31.6% of the inflation adjusted total exvessel value, followed by coho salmon (21.5%), chum salmon (21.4%), sockeye salmon (16.2%) and Chinook salmon (9.4%).

## Management

There are over 5,500 salmon producing streams and tributaries in the SEAK area, and as a result most of the region's fisheries operate on mixed stocks and species. Due to the presence of salmon bound for transboundary rivers—rivers that flow into Southeast Alaska waters from headwaters in Canada, as well as streams in Canada and the Pacific Northwest—management of many SEAK commercial fisheries is influenced by PST agreements.

Management and regulatory frameworks for commercial SEAK salmon fisheries are highly complex. Fisheries are managed to obtain escapement objectives, promote the harvest of good quality salmon, attain Alaska Board of Fisheries allocations among gear groups and abide by PST agreements. Stock-specific management based on run strength of individual systems is practiced in the region's more terminal fisheries. The region's more mixed-stock fishing areas are managed through inseason monitoring of fishery performance and assessment of escapements and stock composition data; harvest rates are controlled through distribution of effort and regulation of time and area openings.

Hatcheries contribution to the commercial and sport fisheries in Southeast Alaska is significant. A total

of 18 hatcheries are currently operating in Southeast Alaska. Most are operated by private groups, but 2 research facilities are run by the federal government and one state-owned facility is operated by a PNP hatchery association through a professional services contract with ADF&G Division of Sport Fish (Figure 2). No hatcheries are located in the Yakutat area. Hatcheries located in the Pacific Northwest and British Columbia

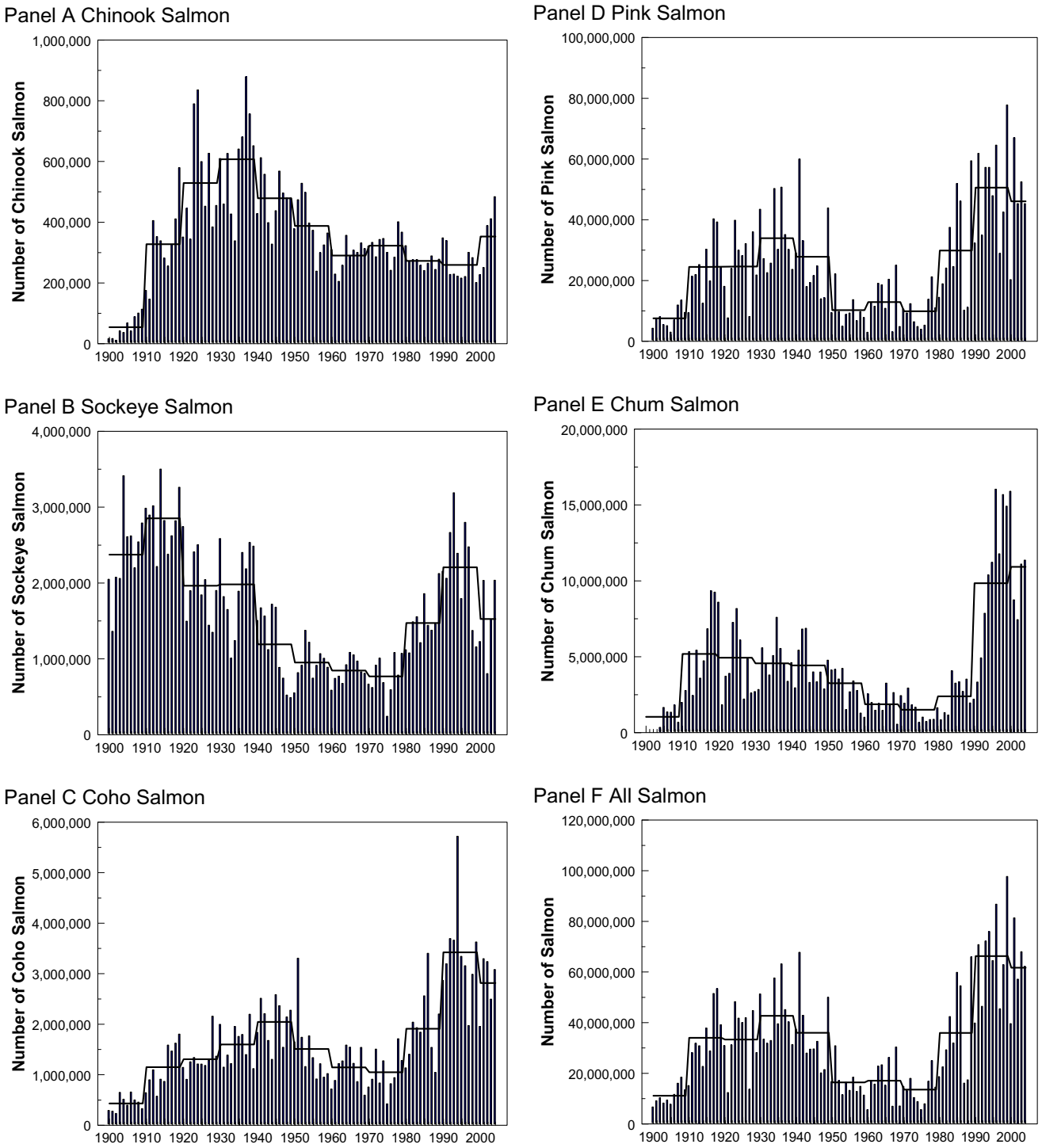


Figure 16. Commercial salmon harvests in SEAK from 1900–2004; bars provide annual catches and lines provide decade averages.

also contribute to some of the region's fisheries, particularly the Chinook salmon troll fishery.

From 1995 to 2004, Alaska hatcheries contributed an average of 14% of the total annual commercial common property salmon harvest in Southeast Alaska. By species, the average annual hatchery contributions were 71% for chum salmon, 22% for coho salmon, 21% for Chinook salmon, 13% for sockeye salmon, and 2% for pink salmon (White 2005 and Joint Northern/Southern Southeast Regional Planning Team 2004). Hatchery contributions to fisheries are estimated in several ways. Intensive coded-wire tag catch monitoring programs provide reliable inseason estimates of contributions of hatchery Chinook and coho salmon. Thermal otolith mark–recovery programs are used to estimate contributions of hatchery sockeye salmon and chum salmon in specific fisheries, particularly where fishery performance information is used for inseason management.

Table 14. Average annual harvests of salmon in SEAK area subsistence and personal use fisheries (rounded to the nearest 1,000 fish). Beginning in 1996, estimated harvests have been expanded to account for unreturned harvest permits (ADF&G 2005).

| Species | 1994–2003 Average | Annual Minimum | Annual Maximum |
|---|---|---|---|
| Chinook | 1,000 | 1,000 | 2,000 |
| Sockeye | 58,000 | 45,000 | 69,000 |
| Coho | 3,000 | 2,000 | 4,000 |
| Pink | 4,000 | 3,000 | 4,000 |
| Chum | 5,000 | 2,000 | 6,000 |
| Total | 70,000 | 57,000 | 82,000 |

Implementing the area's commercial salmon fishery management program is the responsibility of a region-wide troll fishery manager and 6 area management biologists and their assistants, located in Ketchikan/Craig, Petersburg/Wrangell, Sitka, Juneau, Haines and Yakutat. A management supervisor responsible for maintaining a coordinated regional management approach is needed because fish and fishermen move between the different management areas. Management is conducted by emergency order and publicized through issuance of news releases. Content of emergency orders is generally restricted to a single gear type, except those dealing with Terminal Harvest Area and Special Harvest Area fisheries that target hatchery fish, but most contain detailed time and area adjustments for multiple fishing areas. From 2000 to 2004 an average of 136 emergency orders were annually issued by Division of Commercial Fisheries staff to manage commercial, subsistence, and personal use fisheries in the SEAK area (Table 16). These same biologists are responsible for managing state subsistence and personal use salmon fisheries and numerous other non-salmon commercial fisheries, so the workload and responsibility of the positions is substantial.

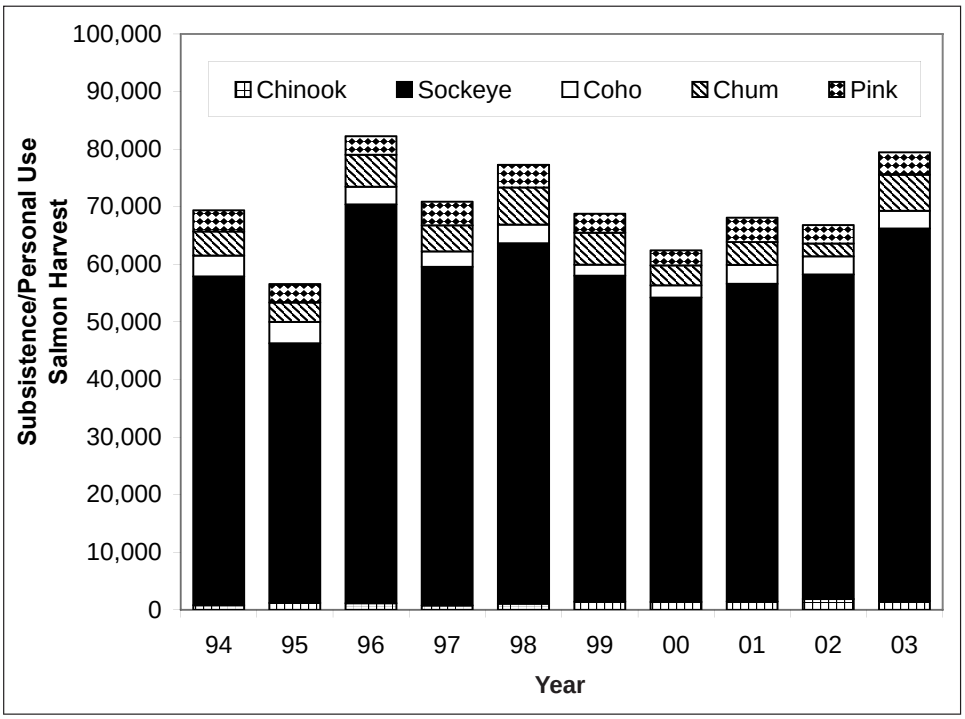


Figure 17. Subsistence and personal use harvests in the SEAK area from 1994–2003.

Annual preseason management plans are produced by ADF&G for the region's troll, purse seine, drift gillnet and set gillnet fisheries. The management plans include the department's expectations for salmon returns and summarize important management issues, regulatory requirements, and harvest strategies for the upcoming season. Staff from ADF&G also participates in annual department and industry task force forums prior to each fishing season to discuss management of the purse seine and drift gillnet fisheries. They also conduct an extensive series of preseason meetings on troll fisheries management in towns throughout the SEAK area.

The purse seine fishery operates by regulation in all or portions of 13 fishing districts in Southeast Alaska. Pink salmon is the primary species targeted by the fishery, and most management actions are based on inseason assessment of pink salmon abundance. Adult tagging studies have demonstrated differences in migratory routes for pink salmon returning to northern and southern Southeast Alaska, and stocks from the different subregions are grouped accordingly for management and assessment purposes. The northern subregion is further divided into inside and outside areas. Targeted fishing for summer chum salmon occurs primarily early in the season in hatchery terminal harvest areas such as Hidden Falls, and as the season progresses, near several rivers with wild fall chum salmon runs. The vast majority of the purse seine harvests of sockeye, coho and Chinook salmon are taken incidentally during the pink salmon fishery.

Preseason pink salmon forecasts are developed by ADF&G each year, primarily to provide industry with an expectation for the upcoming year's fishery. The purse seine fishery is managed based on inseason assessment of run strength obtained from catch and catch per unit effort data, test fishing, and frequent aerial surveys of salmon abundance along migratory corridors and in terminal bays and spawning streams. Pink salmon sex ratios in the harvest are determined and compared with historical data to evaluate run timing. The magnitude of incidental purse seine harvests of sockeye salmon in several areas is controlled by regulation or PST agreement. The purse seine fishery

Table 15. Average annual harvest of salmon in the SEAK sport fishery, rounded to the nearest 1,000 fish).

| Species | 1980–1989 | 1990–1999 | 2000–2004 |
|---|---|---|---|
| Chinook | 24,000 | 55,000 | 71,000 |
| Sockeye | 6,000 | 16,000 | 22,000 |
| Coho | 53,000 | 158,000 | 289,000 |
| Pink | 49,000 | 63,000 | 78,000 |
| Chum | 5,000 | 12,000 | 20,000 |
| Total | 138,000 | 305,000 | 480,000 |

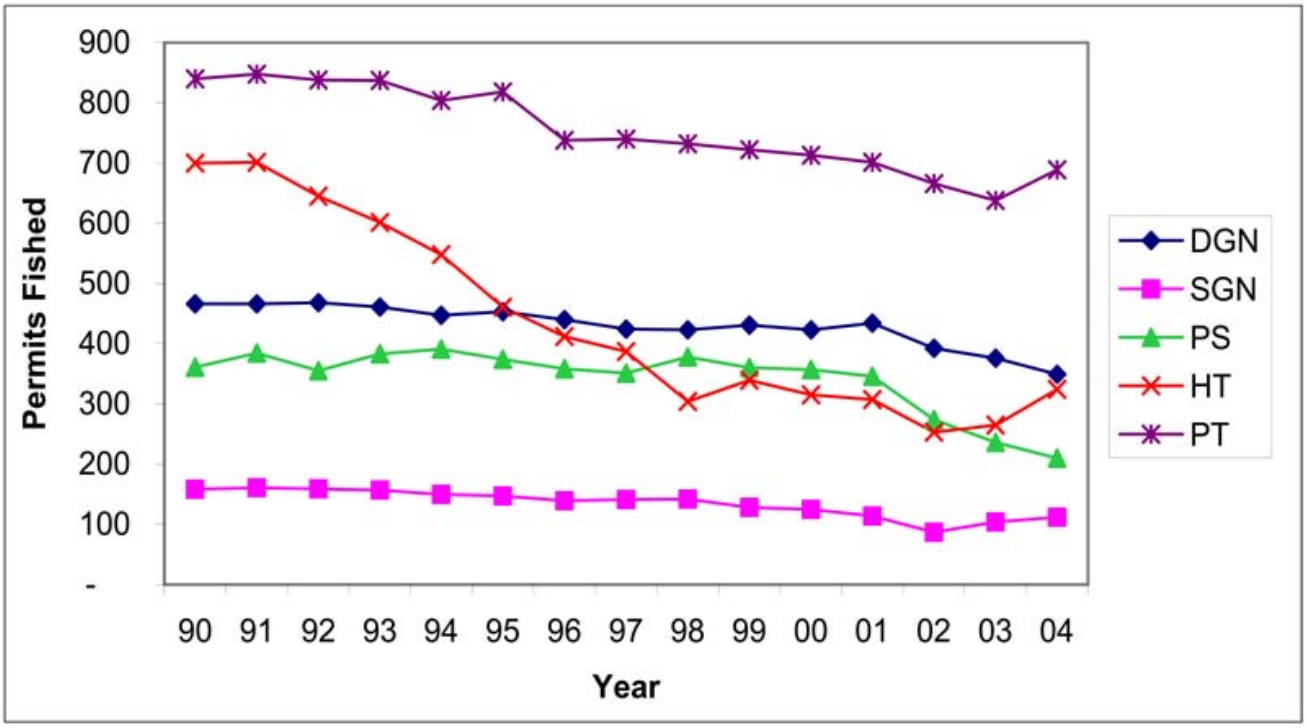


Figure 18. Commercial salmon limited entry permits fished in the SEAK area, by gear type and year, 1990–2004. (DGN = drift gillnet, SGN = set gillnet, PS = purse seine, HT = hand troll, and PT = power troll.)

in District 104, on the outside coast of southern Southeast Alaska, is managed through late July (statistical week 31) to abide by PST provisions that limit the fishery's harvest of sockeye salmon bound for the Nass and Skeena rivers in northern British Columbia. Since 1999 this has limited the District 104 fishery to 2.45% of the annual allowable harvest of Nass and Skeena River sockeye salmon. Annual allowable harvest and total allowable catch are terms defined in the PST that represent the harvestable surplus in excess of the escapement goal.The purse seine harvest of sockeye salmon along the Hawk Inlet shore of Admiralty Island in upper Chatham Strait is limited by state regulation for allocative reasons during the month of July.

In response to requests from industry, in 2002 ADF&G changed its management approach for the purse seine fishery from the traditional 2-day-on, 2-day-off fishing schedule that had been in place during the peak of the fishing season in the late 1980s, to a more flexible fishing schedule involving longer fishing periods. In years of large returns, open fishing periods are now commonly from 4 to 6 days during the peak of the season, with specific fishing areas opening and closing within that time frame. The change has allowed industry to spread out deliveries of fish to processing plants, reducing the time from fish capture to delivery and processing. This improves the quality of the product, but has resulted in increased fishery monitoring costs for ADF&G.

There are 5 traditional drift gillnet fishing areas in Southeast Alaska, stretching from District 1 (Tree Point and Portland Canal) in the south near the inter-

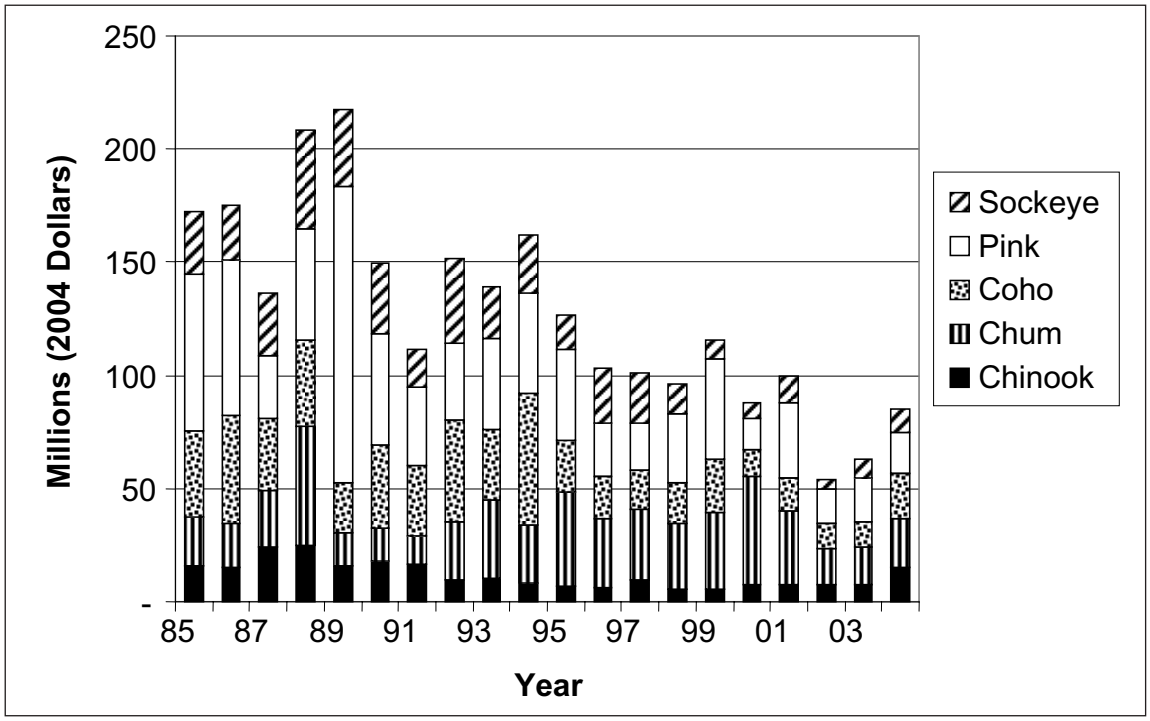


Figure 19. Exvessel value of the Southeast Alaska/Yakutat area commercial salmon fisheries, 1985–2004, adjusted for inflation into 2004 dollars.

Table 16. Number of emergency orders issued by Division of Commercial Fisheries staff in 2000–2004 for inseason management of commercial and subsistence/personal use fisheries in the SEAK area.

| Fishery | 2000 | 2001 | 2002 | 2003 | 2004 | Total |
|---|---|---|---|---|---|---|
| Commercial Purse Seine | 29 | 24 | 26 | 23 | 25 | 127 |
| Commercial Drift Gillnet | 16 | 21 | 20 | 18 | 20 | 95 |
| Commercial Troll | 51 | 35 | 33 | 29 | 20 | 168 |
| Commercial Set Gillnet (Yakutat) | 38 | 24 | 36 | 29 | 34 | 161 |
| Commercial THA and SHA[a] | 22 | 28 | 21 | 18 | 22 | 111 |
| Subsistence/Personal Use | 3 | 2 | 7 | 4 | 3 | 19 |
| Regional Total | 159 | 134 | 143 | 121 | 124 | 681 |

[a] Terminal Harvest Areas and Special Harvest Areas.

national border with Canada, to District 6 (Prince of Wales) and District 8 (Stikine River) in central portions of the region, and to District 11 (Taku–Snettisham) and District 15 (Lynn Canal) in the north (Figure 14). Drift gillnetting is also allowed in several terminal areas to target returns of enhanced fish near hatcheries or remote release sites. The drift gillnet fisheries target sockeye, pink and summer-run chum salmon during the summer season from mid-June through mid-August, and coho and fall- run chum salmon thereafter through late September or early October.

Drift gillnet fishing areas are opened concurrently on a weekly basis. Fishing time varies among districts depending on the strength of runs migrating through each district. Fishing time and area within each district is regulated as necessary to adjust overall harvest rates or harvests of specific stocks. In 2005, following a long-term cooperative international Chinook salmon rebuilding program under the auspices of the PST, agreement was reached with Canada over joint management and harvest sharing of transboundary Taku and Stikine River Chinook salmon runs. After being closed for almost 30 years, drift gillnet and troll fisheries targeting Chinook salmon were reinstituted in 2005 in Alaska near the mouths of the 2 rivers and Canadian commercial fisheries were allowed within Canadian portions of the rivers. In 2005, close to 50,000 Chinook salmon were taken in Alaska in these fisheries, worth an estimated exvessel value of approximately $2 million. The resumption of these Alaskan fisheries is due in large part to major improvements made in stock assessment programs, and the long-term sacrifices of Alaskan fishermen to rebuild the runs.

With the exception of the Lynn Canal fishery, all the region's drift gillnet fisheries are affected by provisions of the PST. The PST agreement signed in 1999 specifies that, through 2008, the District 1 fishery can harvest an average of 13.8% of the annual allowable harvest of the Nass River sockeye salmon run, the District 6 and 8 gillnet fisheries can harvest 50% of the total allowable catch of Stikine River sockeye salmon, and that the District 11 gillnet fishery can harvest 82% of the total allowable catch of wild Taku River sockeye salmon and 50% of the total allowable catch of sockeye salmon produced from joint U.S.-Canada Taku River sockeye salmon enhancement projects.

In order to implement such complex harvest sharing agreements, ADF&G has developed intensive sockeye salmon stock identification programs. A variety of biological attributes including scale pattern features, age composition, and parasite prevalence are examined to estimate contributions of specific sockeye salmon stocks to harvests in the region's drift gillnet and southern Southeast Alaska purse seine fisheries. By combining estimates of harvest with information from escapement enumeration programs, estimates of total run and PST harvest sharing performance are determined. The contribution of sockeye salmon from Alaska hatcheries is determined by sampling the harvests for thermal otolith marks; all sockeye salmon released from the region's hatcheries are otolith marked. The department is studying the potential application of genetic stock identification methods to improve the resolution and inseason processing capabilities of the region's sockeye salmon stock identification program.

The drift gillnet fisheries are managed through inseason assessment of run strength, although preseason forecasts of Taku and Stikine River Chinook and Stikine River sockeye salmon are used to guide the season's initial openings in specific districts. Fishery managers closely monitor fishery performance (catch and catch per unit effort), stock composition data, escapement information, test fisheries, statistical run forecasting models, and information from other fisheries to assess run strength inseason. Contribution of hatchery stocks to harvests is taken into account, particularly in areas where fishery performance is used as a primary management tool.

In contrast to the region's other commercial fisheries, which generally occur over large areas and target mixed stocks, the set gillnet fisheries in the Yakutat area are, with few exceptions, confined to intertidal areas and ocean waters immediately adjacent to the mouths of rivers. Although close to 25 different fisheries are typically opened each year, most of the set gillnet harvest is typically taken in a few major areas, including the Situk–Ahrnklin, Alsek and Tsiu rivers and Yakutat Bay. The terminal nature of the fisheries has enabled the department to assemble stock–recruit information and develop escapement goals for many of the major stocks taken in the set gillnet fisheries.

Management of the set gillnet fisheries is accomplished primarily through inseason escapement monitoring, including survey counts for many systems and a weir on the Situk River, which supports the area's largest commercial, sport and subsistence fisheries. Monitoring of catch and catch per unit effort data is also important, particularly for several glacial rivers in which escapement surveys are of limited value.

The region's commercial troll fishery primarily harvests Chinook and coho salmon and, with few exceptions, other species are harvested incidentally. The troll fleet is comprised of hand and power troll gear types. Power troll vessels are generally larger than hand troll vessels and gurdies used to deploy and

retrieve troll lines are power-operated, whereas hand troll gear includes hand-operated gurdies or sport fishing poles. Power trollers have taken an average of 89% of the Chinook salmon and 86% of the coho salmon harvested in the troll fishery from 1975 to 2004.

The Chinook salmon troll fishery is separated into winter and summer seasons. During the October 1 to April 30 winter season, trolling is limited to the inside waters of the region. The summer season lasts from May 1 to September 30, and is further separated into spring and summer fisheries. The spring fisheries, which occur primarily in inside waters near hatchery release sites or along migration routes of returning hatchery fish, are intended to increase the harvest of Alaska hatchery Chinook salmon. The majority of the annual troll harvest of Chinook salmon is taken during the summer fishery, which opens in early July.

The SEAK Chinook salmon troll fisheries have been managed since 1980 to not exceed an annual catch quota (Gaudet et al 2004). Annual all-gear Chinook salmon harvest quotas have been in effect since the PST was signed in 1985. The 1999 PST agreement implemented a bilateral abundance-based management approach for west coast Chinook salmon fisheries. Rather than being managed for a fixed annual catch ceiling, SEAK fisheries catch quotas are now determined annually by the Pacific Salmon Commission's Chinook Technical Committee, and are based on preseason and inseason forecasts of the aggregate abundance of all Chinook salmon stocks present in Southeast Alaska. Quotas do not include Alaska hatchery fish, except for a base level of 5,000 fish that represents pretreaty harvests of Alaska hatchery Chinook salmon. Regulations adopted by the Alaska Board of Fisheries further specify harvest sharing of the all-gear quota among commercial and sport users.

The commercial troll fishery for coho salmon is managed to comply with conservation and allocation objectives established by the Alaska Board of Fisheries. Currently, regulations specify a troll closure for conservation reasons in late July if the total projected commercial harvest is less than 1.1 million wild fish, and an August closure if the number of coho reaching inside areas is inadequate to either provide for spawning needs or achieve allocation objectives among competing commercial drift gillnet and recreational fisheries. There are no PST harvest quotas for SEAK coho salmon fisheries, although the 1999 PST agreement stipulates that the troll fishery in waters near the U.S.–Canada border will close if harvest rates by Alaska trollers in that area fall below specified levels.

Inseason management of the commercial Chinook salmon troll fishery is accomplished through monitoring harvest and fishing effort and assessing contribution of Alaska hatchery stocks generated from coded-wire tag data. Due to the fast pace of the summer fishery, ADF&G generates inseason harvest estimates using a fisheries performance data program to estimate catch per unit effort from confidential interviews of trollers and estimates of effort from aerial surveys of the fishing grounds. Inseason monitoring of the coho salmon troll harvest is accomplished through the troll fisheries performance data program, compilation of fish tickets, coded-wire tag data that provides information on run strength of long-term wild indicator stocks and hatchery stocks, and escapement monitoring programs.

A complex set of stock assessment programs has been developed to support management and long-term monitoring of salmon stock status in the SEAK area. Funding sources for the developing assessment programs have evolved over time, and many programs have become much more reliant on federal grant appropriations over the last 20 years. Information gathered from these programs forms the basis for SEAK salmon escapement goals. Currently, ADF&G has 11 escapement goals for Chinook salmon, 14 for coho salmon, 13 for sockeye salmon and 3 for pink salmon. Der Hovanisian and Geiger (2005) provide detailed information on the region's salmon escapement goals and stock status. In this paper we provide a brief review of the assessment programs, escapement goals and abundance trends for some of the region's major stocks.

The origins of the region's Chinook salmon stock assessment program date back to the 1970s. Long-term escapement monitoring projects were initiated for 11 of the region's 34 known Chinook salmon producing rivers, including all of the major producers (production greater than 10,000 fish), 7 medium producers (production of 1,500 to 10,000 fish), and one minor producer (production of less than 1,500 fish) (McPherson et al 2005). Over time, the program was modified from simply obtaining peak survey counts of spawners to estimating total escapement. Expansion factors were developed relating survey counts to total escapement. Presently, weirs, mark–recapture programs, and helicopter surveys are used to monitor escapements. Biological data is collected to estimate escapement by age and sex. Obtaining stock-specific estimates of harvest is an active area of current research. Wild-stock coded wire tagging programs have been conducted for varying periods on 7 of the rivers, and harvest rates for nearby wild or hatchery stocks have been used as proxies to estimate harvests for other systems. For the last several years, genetic

stock identification techniques have been applied to the region's Chinook salmon harvests in an attempt to improve estimates of stock composition.

*Chinook salmon*

Chinook salmon escapements in the SEAK area have increased substantially from levels seen prior to the start of the stock rebuilding program mid-1970s. Biological escapement goals have been developed for all 11 Chinook salmon index systems (McPherson et al 2005). Escapements for all systems, with the exception of the Blossom River, have been within or above goal ranges for at least 5 of the last 6 years. Peak survey counts of escapement for the Blossom River were within the goal range of 250 to 500 fish during 2004 and 2005, but averaged 14% (35 fish) below the lower end of the range from 2000 to 2003. Figure 20 shows escapements over the last 30 years to the region's 3 largest producers of Chinook salmon, the transboundary Stikine, Taku and Alsek rivers.

The Division of Sport Fish has, over time, assumed more responsibility for funding and operation of the region's Chinook salmon stock assessment program. Although many of the programs remain jointly operated by both divisions, the Canadian Department of Fisheries and Oceans is also involved in the stock assessment programs of transboundary rivers. The region's Chinook salmon stock assessment program is almost entirely supported through a wide variety of federal funding sources—a less than ideal situation given the uncertain nature of future federal budgets.

*Sockeye salmon*

In the SEAK area, ADF&G operates a wide variety of sockeye salmon stock assessment projects centering efforts on the region's largest producers. These are the rivers that drive commercial fisheries management decisions. The stock assessment projects include long-term escapement monitoring on (1) the transboundary Alsek, Taku and Stikine rivers, which are operated with assistance from the Canadian Department of Fisheries and Oceans, (2) large mainland lake systems including Situk, Chilkat, Chilkoot, and McDonald lakes, and (3) smaller mainland systems such as Hugh Smith Lake. Estimates of harvest and total run size are available for about a dozen of the SEAK sockeye salmon stocks, including many of the region's larger producers. The department's escapement monitoring efforts are augmented by other governmental agencies and several tribal and aquaculture associations. They operate or assist with operation of smaller enumeration projects at other sockeye salmon systems scattered throughout the region. The U.S. Fish and Wildlife Service's Office of Subsistence Management has provided ADF&G with about $2.6 million since 2000 through its Fisheries Resource Monitoring Program to partner with other agencies and tribal groups in conducting short-term assessment projects on 17 sockeye lake systems that support important subsistence fisheries in Southeast Alaska.

Sockeye salmon escapement goals are currently established for 3 Yakutat area stocks, 4 transboundary river stocks, and 6 stocks that spawn in Southeast Alaska (Geiger et al 2005). The majority of these stocks have met or exceeded escapement goals in most or all years over the last 20 years. Further discussion in this

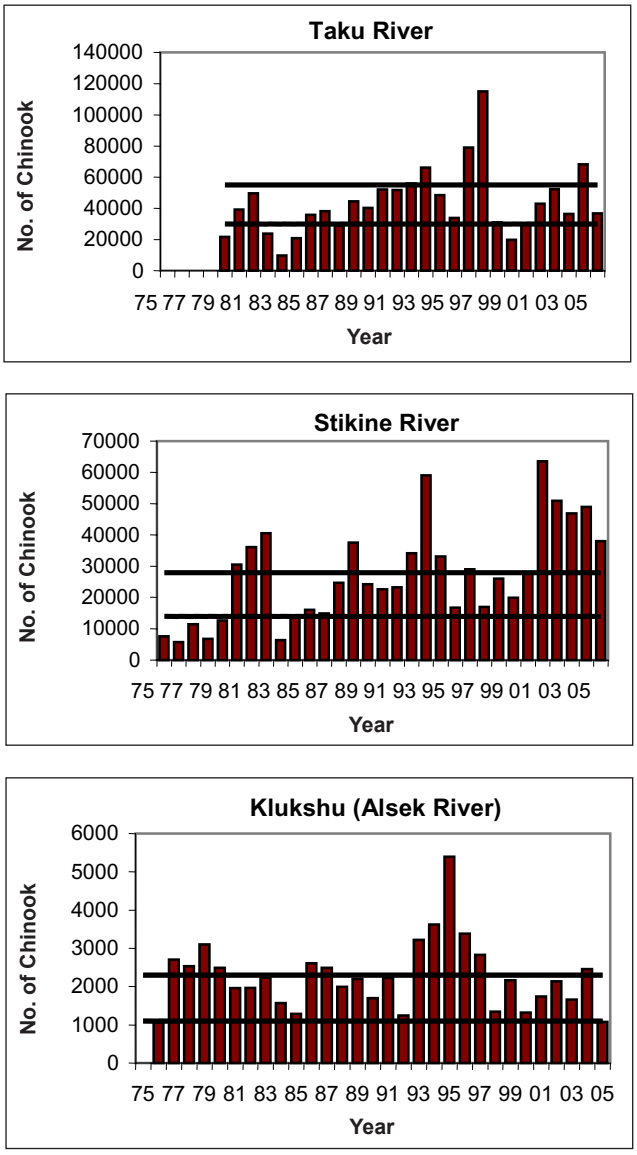


Figure 20. Estimated escapements of Chinook salmon in the Taku, Stikine and Klukshu (index tributary for Alsek River) rivers from 1975–2005 and the respective biological escapement goal ranges.

section will concentrate on a subset of the sockeye stocks distributed across the region, including several that have recently recovered from 5 to10 year periods of low production.

The Situk River system supports the largest commercial set gillnet, subsistence, and sport fisheries for sockeye salmon in the Yakutat area. The stock was managed by ADF&G to achieve an escapement goal of 45,000 to 55,000 fish during the early 1990s before adopting a biological escapement goal of 30,000 to 70,000 fish in 1995. Escapement is monitored with a weir, and escapements have exceeded the lower end of the escapement goal range each year since 1976 (Figure 21).

Chilkoot Lake is one of 2 large sockeye salmon producing lakes in the Lynn Canal area. The sockeye salmon stock of Chilkoot Lake experienced a severe downturn in production in the 1990s. In response, ADF&G took management action to limit commercial harvest of the stock and obtained federal funding to study the lake's freshwater productivity. Studies identified the lake's freshwater rearing environment probably contributed to the stock's decline, and indicated increased glacial turbidity and a drastic reduction in zooplankton abundance as possible mechanisms. Returns to the system have rebounded in recent years and the escapement goal has been met in each of the last 5 years (Figure 22). The Chilkoot Lake weir is the only sockeye salmon enumeration project in the entire SEAK area that remained in the state's FY 06 general fund budget. Studies of the lake's freshwater productivity were discontinued in 2005 due to a lack of funding.

The transboundary Taku River is one of the region's largest producers of sockeye salmon. The sockeye salmon returns are jointly managed by ADF&G and the Canadian Department of Fisheries and Oceans through the Transboundary Technical Committee to the Pacific Salmon Commission and according to PST agreements. Escapement has been monitored since 1984 with a joint U.S.–Canada mark–recapture program. Escapements have met or exceeded the escapement goal range every year (Figure 23).

Tahltan Lake, located in northwestern British Columbia, is the largest producer of sockeye salmon in the transboundary Stikine River drainage and a significant contributor to fisheries in Southeast Alaska. As is the case for the Taku River, management of Stikine River sockeye salmon is shared with Canada and subject to PST agreements. The Tahltan stock has shown cyclical trends in abundance since 1959, when a weir was first operated on the system. Recently, from 1997 to 2002, the stock experienced a series of low returns when the escapement goal was not achieved (Figure 24). Both agencies developed a coordinated management approach to reduce harvests in the countries'

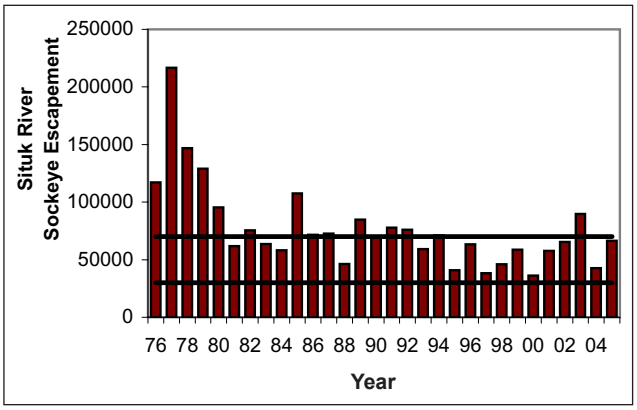


Figure 21. Situk River weir counts of sockeye salmon from 1976–2005 and the sustainable escapement goal of 30,000–70,000 fish.

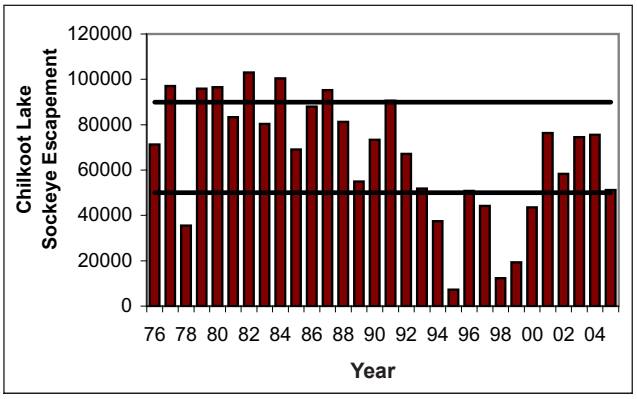


Figure 22. Chilkoot Lake weir counts of sockeye salmon from 1976–2005 and the sustainable escapement goal of 50,000–90,000 fish.

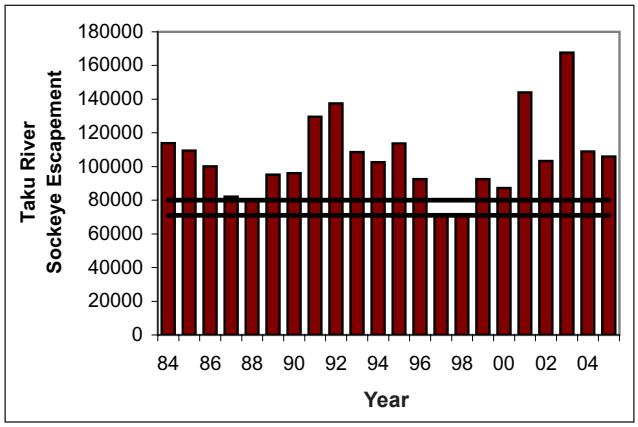


Figure 23. Mark–recapture estimates of Taku River sockeye salmon escapement from 1984–2005 and the sustainable escapement goal of 71,000–80,000 fish.

respective fisheries. Adult returns increased dramatically from 2003 to 2005 and estimates of the numbers of outmigrating smolts forecast healthy returns for the system over the next several years.

The Hugh Smith Lake sockeye salmon stock was recognized as a stock of concern in 2003 after a series of poor returns during which the escapement goal was not achieved. After analyzing stock productivity information, ADF&G developed a revised escapement goal of 8,000 to 18,000 fish, replacing the existing non-scientifically-based goal of 15,000 to 35,000 fish, and in concert with the Board of Fisheries developed an action plan for the stock. The action plan specified management actions to reduce harvests in nearby commercial drift gillnet and purse seine fisheries and ordered a review of the fry stocking rehabilitation and stock assessment programs. New funding to support increased assessment efforts on the stock was obtained through the Southeast Sustainable Salmon Fund (part of the Pacific Coast Salmon Recovery Fund). These studies have shown that management measures outlined in the action plan are appropriately timed and located to effect harvests of the stock. Studies have also shown that although fry stocking efforts increased adult returns they have, to date, been ineffective in boosting the system's long-term production (Geiger et al 2005), and ADF&G recently decided to suspend lake stocking efforts for one life cycle to allow further study of the program. Escapements to Hugh Smith Lake exceeded the escapement goal range each year from 2003 to 2005 (Figure 25), and the Board of Fisheries removed Hugh Smith Lake sockeye salmon as a stock of concern in 2006 because the stock no longer meets the criteria for the designation.

### *Coho salmon*

Coho salmon are found in roughly 2,500 primary anadromous streams throughout the SEAK area. From a practical standpoint, it is feasible to closely monitor production of only a small fraction of these streams to serve as health indicators of the region's coho salmon stocks. Indicator stocks are distributed geographically across the region, and assessments are categorized as full indicator or escapement indicator stock programs. Full indicator stock programs include juvenile coded wire tagging and adult harvest and escapement monitoring. From this, detailed population dynamic parameters can be estimated, including smolt production, adult escapement, harvest contributions and distribution, exploitation rates, marine survival and total adult production. There are currently 7 long-term indicator stock programs in the region, the majority of which were established in the early 1980s. Escapement indicator stocks include those that meet survey timing and consistency standards so that ADF&G can conduct foot or helicopter surveys of spawner abundance. Currently, the list of long-term escapement indicator stocks includes 14 streams near Ketchikan, 6 near Sitka, 5 near Juneau and 4 near Yakutat.

Coho salmon escapement goals have been established for 13 individual stock or aggregated stock groups distributed across a broad range of production magnitude—from a few thousand to several hundred thousand (Shaul et al 2005). Escapement goals have been met most years for all these stocks. Figure 26 shows information on catch, escapement, and total run size for the 4 longest-term full indicator stocks in the region.

By expanding the coho indicator stock program to cover a larger number of systems, ADF&G hopes and provide more thorough geographic coverage throughout the Southeast Alaska–Yakutat area. Fund-

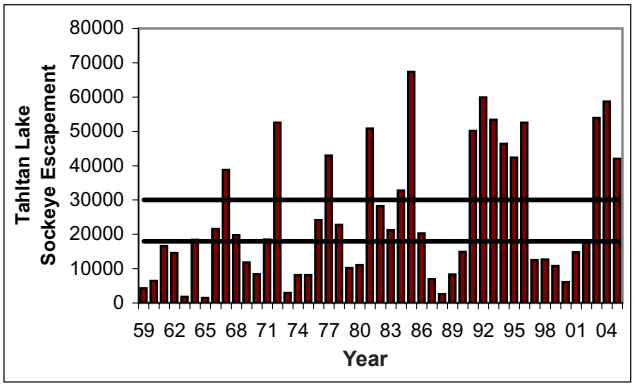


Figure 24. Tahltan Lake weir counts of sockeye salmon from 1959–2005 and the biological escapement goal of 18,000–30,000 fish.

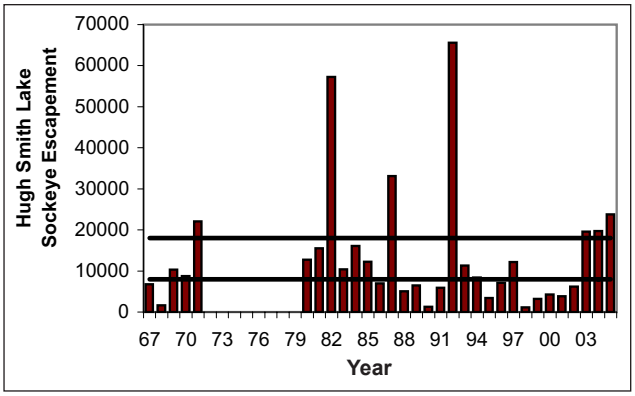


Figure 25. Hugh Smith Lake weir counts of sockeye salmon from 1967–2005 and the biological escapement goal of 8,000–18,000 fish (the weir was not operated from 1971–1979).

ing availability, however, is hindering these efforts. Indeed, the erosion of state general fund budgets has required ADF&G to move funding for several of the full indicator stock programs to short-term federal funding sources, threatening the long-term viability of the coho salmon assessment program.

*Pink salmon*

Monitoring pink salmon escapement in Southeast Alaska requires ADF&G to survey roughly 700 of the region's more than 2,500 pink salmon spawning streams. Peak aerial survey counts are calibrated to adjust for bias in counting rates among observers, but there is not currently a scientifically accepted way of converting index counts to total escapement. Escapement goals were established in the 1970s for aggregated streams in northern and southern portions of the region, and have been modified several times since. In 1998, the escapement goal for the northern area was split into goals for stocks in inside and outside waters. Finally, in 2003, biological escapement goals were established for the Southern Southeast, Northern Southeast Inside and Northern Southeast Outside subregions. The commercial fisheries are actively managed by ADF&G to distribute escapement among 45 pink salmon stock groups. Each group represents a geographic grouping of streams that support pink salmon runs with similar migratory routes and run timing. Escapement targets for each stock group are determined using historical escapement data to apportion subregion escapement goals. Pink salmon production in the Yakutat area is minor and is monitored primarily with a weir on the area's largest producer, the Situk River.

Southeast Alaska has enjoyed prodigious abundance of pink salmon over the last 20 years. Not only have average harvests been the highest in history during this period, escapement measures have been at their highest levels on record as well (Figure 27). Escapements in the Southern Southeast and Northern Southeast Inside subregions have met or exceeded escapement goals in all but one year since 1985, and the Northern Southeast Outside subregion has met or

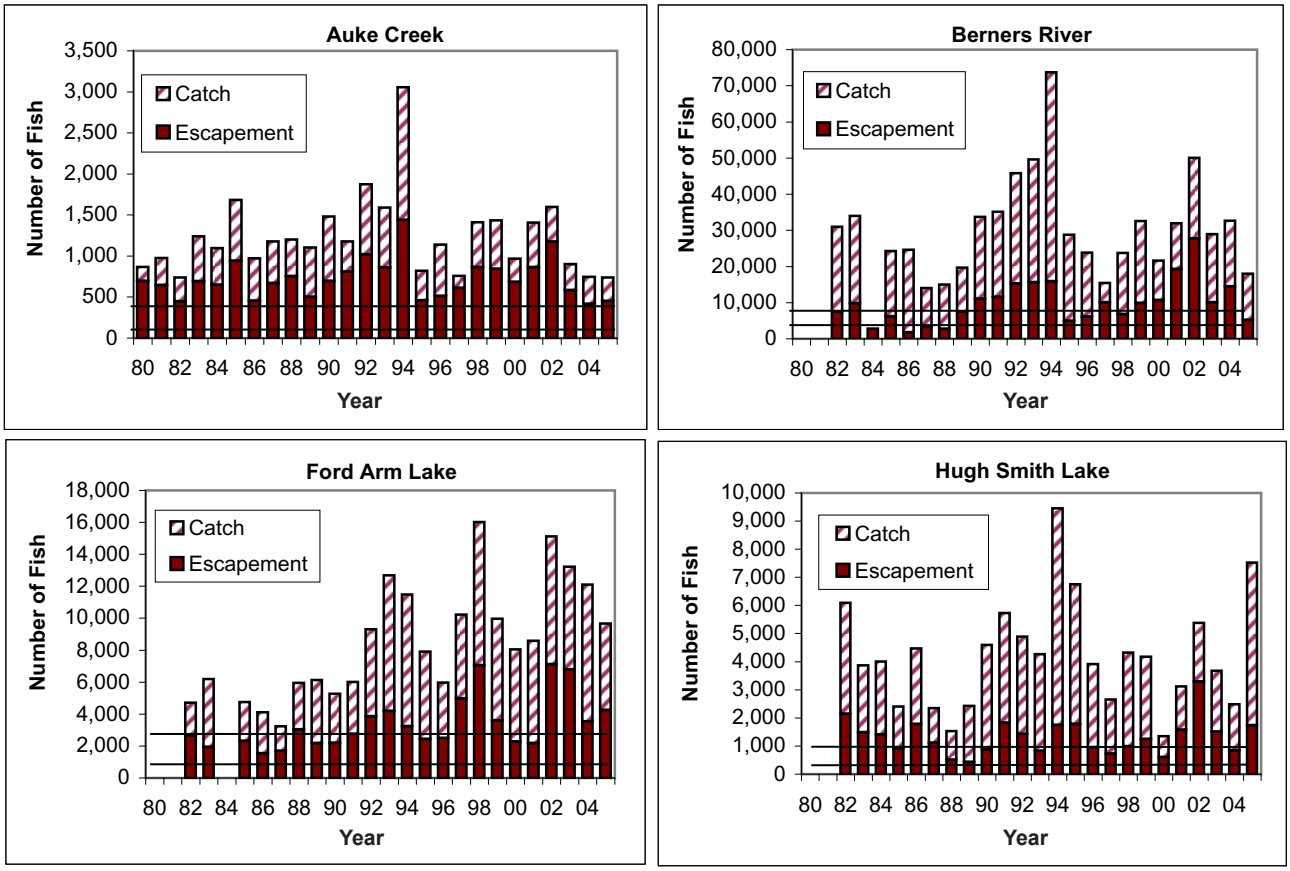


Figure 26. Catch, escapement, total run size and the current escapement goal range for Auke Creek, Berners River, Ford Arm Lake and Hugh Smith Lake wild coho salmon indicator stocks from 1980–2005. No data is available for Ford Arm Lake in 1984, and only escapement data is available for Berners River in 1984.

exceeded escapement goals every year since 1994. During this period, market limitations have constrained maximum harvests somewhat below what stock abundance would have allowed.

The ADF&G stock assessment program for chum salmon in the SEAK area is less developed than for other salmon species. Escapements are assessed through aerial and foot surveys but several factors limit the usefulness of the survey data. Most survey counts are obtained opportunistically during surveys to monitor pink salmon escapement in conjunction with management of the purse seine fishery. The vast numbers of pink salmon in many streams prevents observers from obtaining accurate counts of the less abundant chum salmon. Also, there is currently no way to adjust survey counts for bias among observers. The region's total harvest of wild chum salmon is estimated; detailed stock-specific harvest information is available for very few stocks.

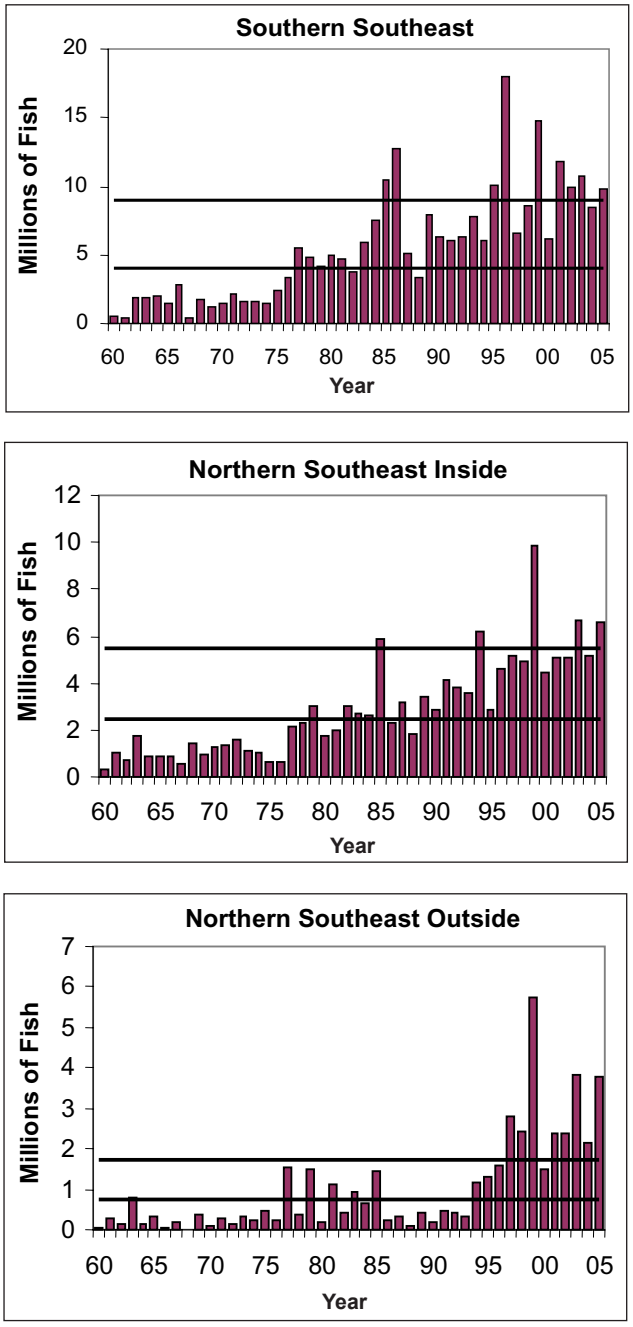


Figure 27. Annual pink salmon escapement index for the Southern Southeast, Northern Southeast Inside and Northern Southeast Outside subregions from 1960–2005 and the respective biological escapement goal ranges.

Available data indicates increasing trends in overall escapement and harvest of wild chum salmon stocks in the SEAK area. Heinl (2005) identified 82 streams in Southeast Alaska with sufficient long-term survey data to assess trends in chum salmon escapement. After converting stream count data to rank index values, Heinl showed an annual increasing trend of 2.3% (Figure 28) in the combined 82-stream index during the years from 1984 to 2004. Considered individually, escapement trends in 60 (73%) of the streams were stable or increasing and 22 (27%) were declining. Estimated harvests of wild chum salmon in the region's fisheries over this time period also show an increasing trend of 3.7% (Figure 28).

## Budget History and Fiscal Support

While broad gauges of the overall abundance of wild chum salmon in the SEAK area show positive trends and indicate stocks are generally being managed in a sustainable manner, the lack of quality escapement and stock-specific harvest information has prevented ADF&G from establishing biologically-based escapement goals for chum salmon in Southeast Alaska. The department obtained federal funds through the Southeast Sustainable Salmon Fund to estimate chum salmon escapement from 2002 to 2005 in the Chilkat River, believed to be the region's largest chum salmon producer. This information will be used to develop a reliable index of annual abundance for that stock. Further improvements to the existing assessment program for chum salmon will require significant funding increments.

It is clear that salmon stocks in the SEAK area are being managed in a sustainable manner and that overall stock status is currently very healthy. The long-term prognosis for funding many of the Division of Commercial Fisheries core assessment and management programs in the region is less certain, however. State general fund support for the region's salmon programs has essentially remained static since 1982, but effective

buying power over this period has declined by over 50% (Table 3).

The State of Alaska is fortunate to have received substantial federal budgetary support in recent years for the salmon program in the SEAK area, although much of this money has been directly associated with increased responsibilities of implementing PST fishing agreements. Two long-term federal grants have provided substantial funding for the SEAK area salmon program. An annual Pacific Salmon Commission grant has provided funding since the mid-1980s to implement Treaty fishery regimes. With the exception of a couple of 1-year supplemented appropriations, funding from this grant has declined slightly over time, particularly when inflation is taken into account; annual appropriations have averaged approximately $3 million since 1997. A federal–state matching grant through the Anadromous Fisheries Act has provided an average of about $300,000 annually in federal funds for salmon management and assessment over a similar time period.

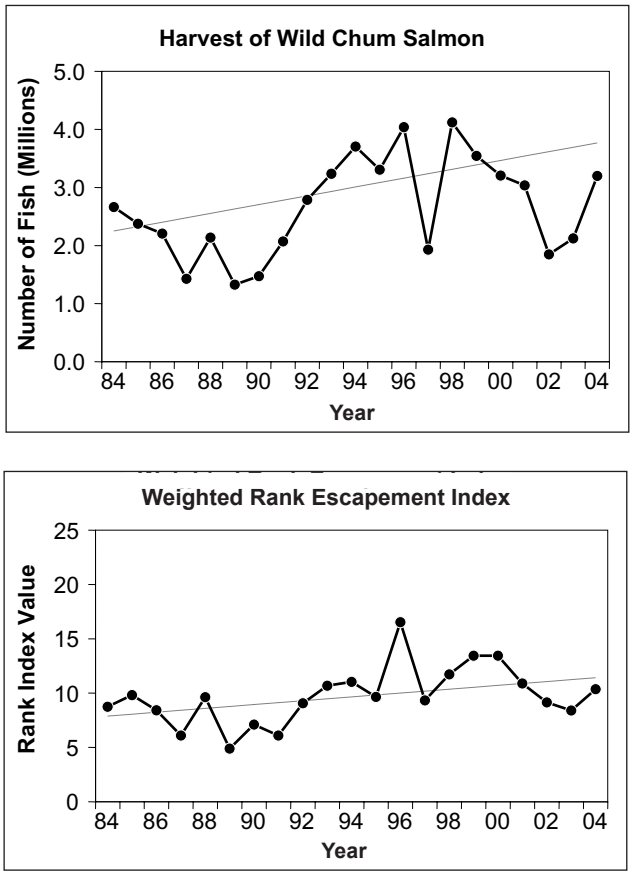


Figure 28 (from Heinl 2005). Annual estimated 82-stream escapement index and commercial harvest of wild chum salmon in Southeast Alaska from 1984–2004 (escapement index is represented in rank terms rather than numbers of fish; the dashed lines represent regression lines, as described in Heinl 2005).

Several new sources of funding have come into play in recent years. Since 1998, ADF&G has received about $350,000 annually in federal funds for Chinook salmon stock assessment in the region in conjunction with signing of a Letter of Agreement on Chinook salmon management with several Pacific Northwest states. A total of approximately $7.5 million in funding through the Southeast Sustainable Salmon Fund has been provided since 2000 to the Division of Commercial Fisheries to support their research and assessment projects in the SEAK area and to aid in implementing the new abundance-based PST agreements. The first substantial distributions from the Northern Fund were made in 2004 and 2005. The Northern Fund is an endowment fund established by the 1999 PST agreement and funded through appropriations from the U.S. Congress. It is used to improve the scientific basis of management, small-scale enhancement, and habitat restoration in central and northern British Columbia, Southeast Alaska and the transboundary Stikine, Taku and Alsek rivers. In 2004 and 2005, the primary distributions to ADF&G from this fund were to support development of sockeye and Chinook salmon genetic stock identification capabilities in Southeast Alaska and to improve the infrastructure for the ADF&G statewide genetics lab.

While federal funds have allowed ADF&G to maintain and improve some of its salmon assessment and management programs in the SEAK area, long-term funding for the federal grants is uncertain. Furthermore, due to erosion of state general fund support, substantial amounts of some federal grants, including over half of the base Pacific Salmon Commission grant, are currently used to pay salaries for ADF&G permanent full-time and seasonal management and research staff. To counter this trend, approximately $400,000 is included in the Governor's FY 07 state budget request to move salary costs for 11 of the region's management biologists off federal funding and onto state general fund dollars. Adequate and stable fiscal support for ADF&G is essential to continue its outstanding resource monitoring program in the SEAK area, particularly during a time when increasing demands are being made by a commercial fishing industry under intense pressure to restructure and improve profitability.

## PRINCE WILLIAM SOUND COMMERCIAL SALMON FISHERY

### Area Description and Gear Types

The Prince William Sound salmon management area is located northwest of Yakutat along the north central Gulf of Alaska, and includes coastal waters and drainages between Cape Suckling and Cape Fairfield. The area is divided into 11 commercial fishing districts corresponding to geography and the distribution of salmon runs (Figure 29). Regulations specify where gear types can be fished. Fishermen using drift gillnets target salmon returns to the Copper and Bering rivers in the easternmost districts in the management area near the mouths of the 2 rivers. In the adjacent waters of Prince William Sound, the fishery is driven by production originating from many small streams and—over the last 30 years—hatcheries. Purse seine gear is allowed in 8 of the 9 fishing districts in Prince William Sound, while drift gillnet gear is allowed in 3 districts and set gillnet gear is allowed only in the Eshamy District.

Private nonprofit corporations operate 6 hatcheries that contribute to salmon production in the area, 5 of which are located along the shores of Prince William Sound and one in the upper Copper River drainage. Salmon production from Prince William Sound hatcheries is dominated by pink salmon, but there is also substantial production of chum, sockeye and coho salmon. Hatchery production in the Copper River drainage is limited to sockeye salmon. The beginning of the Prince William Sound hatchery program dates back to the early 1970s. Large-scale returns of hatchery fish began in the 1980s and have continued to the present.

### History of the Commercial Salmon Fishery

Commercial utilization of salmon in the Prince William Sound area began in the late 1880s. The commercial salmon fishery developed first along the Copper River delta. Prior to 1916, only a single cannery operated in the region, near the mouth of the Copper River at the town of Eyak (PWSRPT 1983). Annual salmon harvests from 1900 to 1915 ranged from about 0.4 million to 1.5 million fish, and were comprised primarily of sockeye salmon. Then, as additional canneries were constructed and became operational, fisheries expanded into new portions of the Prince William Sound area and began to target other species. Since 1916, the number of pink salmon harvested annually in Prince William Sound commercial fisheries has typically far exceeded that of sockeye salmon. Average decadal harvests of all salmon in the Prince William Sound area during the 1930s through the 1950s ranged from about 6.5 million to 9.7 million fish. Prestatehood average harvests peaked in the 1920s for Chinook salmon, in the 1930s for sockeye salmon, and in the 1940s for coho, pink and chum salmon (Figure 30, Panels A–E).

Responding to declining catches in the fishery, the federal government greatly restricted and even closed Prince William Sound fishery (except for the Copper River and Bering River Districts) for several years during the 1950s. Pink and chum salmon catches increased during the early years of state management. After a brief upsurge in pink and chum salmon catches during early years of management by the State of Alaska in the early 1960s. The Good Friday earthquake of 1964 struck and caused major changes to many Prince William Sound streams and a period of instability and lower catches ensued during the remainder of the decade (PWSRPT 1983). Harsh winters in the early 1970s provided a further setback for Prince William Sound salmon production, and ADF&G closed or severely limited the purse seine fishery from 1972 through 1974 due to poor returns. Improved survival conditions and the beginning of hatchery returns led to increased catches of pink and chum salmon in the late 1970s. Hatchery returns have greatly increased harvests of these species since that time. Poststatehood harvest peaks in the Prince William Sound area occurred in the 1990s for Chinook salmon and the 2000s for sockeye, coho, pink and chum salmon.

Commercial harvests of all salmon in the Prince William Sound management area since statehood have averaged about 18.7 million fish annually, ranging from a low of 1.2 million salmon in 1972 to a high of 59.1 million salmon in 2003 (Figure 30, Panel F). Average catch by species during this period has been about 15.8 million pink (84.4%), 1.3 million sockeye (6.8%), 1.2 million chum (6.6%), 400,000 coho (2.1%) and 30,000 Chinook salmon (0.2%).

Since 1985, the numbers of salmon landed in the purse seine fishery have comprised 85% of the total commercial common property harvest in the Prince William Sound area, followed by 14% in the drift gillnet and 1% in the set gillnet fishery (Figure 31). While the purse seine fishery accounts for the large majority of the salmon harvest, it primarily targets pink salmon, the species with the lowest exvessel value per pound. The drift and set gillnet fisheries target other, higher valued species.

### Other Salmon Harvests

Harvests of salmon by noncommercial users in the Prince William Sound area are minor in comparison

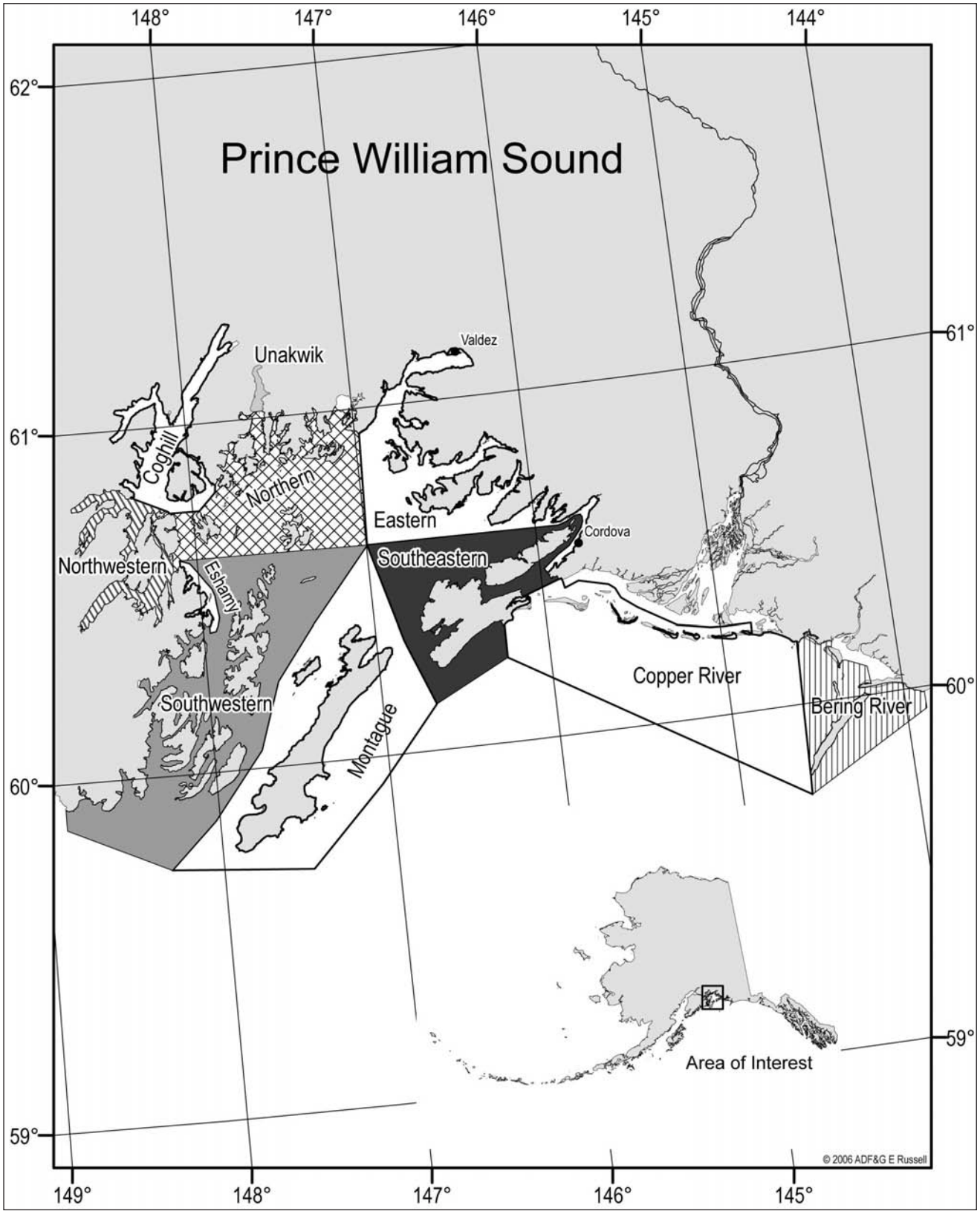


Figure 29. Prince William Sound area commercial salmon fishery.

to commercial harvests, but are increasing over time. Subsistence and personal use salmon fisheries in the Prince William Sound area are among the largest in Alaska (Figure 9). The average annual subsistence and personal use harvest from 1988 to 2003 was about 129,000 salmon (Table 17), of which 99% was taken within the Copper River drainage or at the mouth of the river. Harvests have increased during this time period (Figure 32). Sockeye salmon represent over 90% of the harvest.

Sport harvests of salmon in the Prince William Sound management area have increased rapidly over

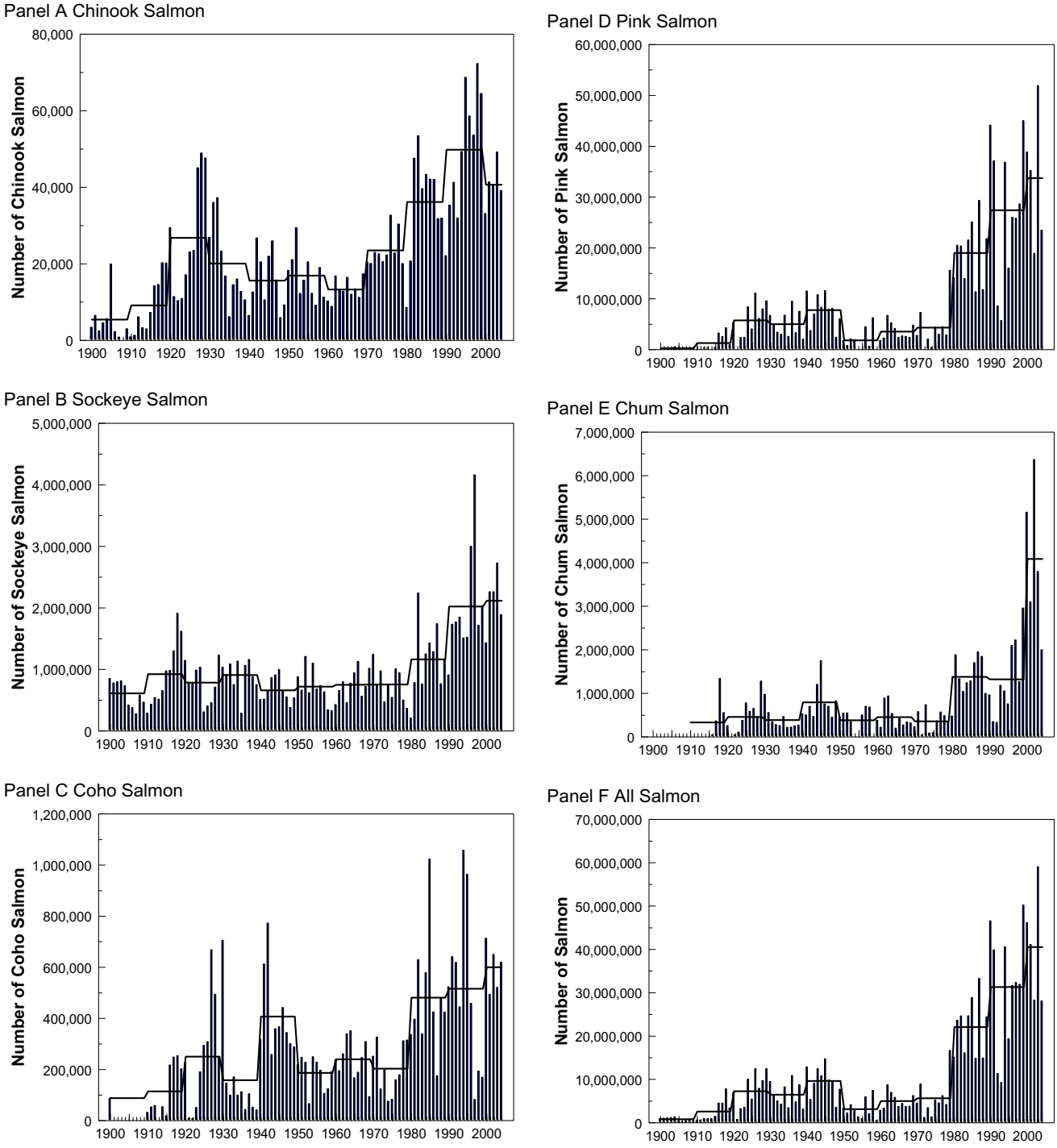


Figure 30. Commercial salmon harvests in Prince William Sound from 1900–2004; bars provide annual catches and lines provide decade averages.

the last 25 years (Table 18), particularly for coho, sockeye and Chinook salmon. Sport fishing harvests remain minor compared to commercial harvests. Coho salmon have represented the majority of the sport harvest of salmon over the last 15 years. The ratio of the average annual commercial harvest to sport harvest of salmon in the Prince William Sound area during the last 25 years is about 200:1, but ranges widely by species from about 5:1 for Chinook and 6:1 for coho, to about 680:1 for pink salmon.

## Commercial Salmon Fishery Users

As of August 31 2005, there were 834 active commercial salmon limited entry permits for Prince William Sound commercial salmon fisheries, including 538 drift gillnet, 266 purse seine, and 30 set gillnet permits. From 1990 to 2004, the number of drift and set gillnet permits actively fished has remained stable but the number of purse seine permits fished has dramatically declined (Figure 33). The reduction in the number of purse seine users fishing in Prince William Sound reflects the drop in prices for pink salmon; the average price per pound for seine-caught pink salmon was $0.32 in 1990 but only $0.10 in 2004. Pink salmon provides an average of about 80% of the exvessel value of the seine fishery. In contrast, the drift and set gillnet fleets derive the majority of the exvessel value of their catch from sockeye salmon. While sockeye salmon prices have also declined over this period, the relative decline is less than for pink salmon; the average price per pound for sockeye salmon taken in the drift gillnet fishery in 1990 was $2.24, compared to $1.53 in 2004. This is due in part to development of successful marketing strategies for Copper River salmon.

## Exvessel Value

The exvessel value of the Prince William Sound salmon fishery, including sales of hatchery cost recovery fish, has averaged about $47 million annually from 1985 to 2004. Adjusted for inflation and expressed in

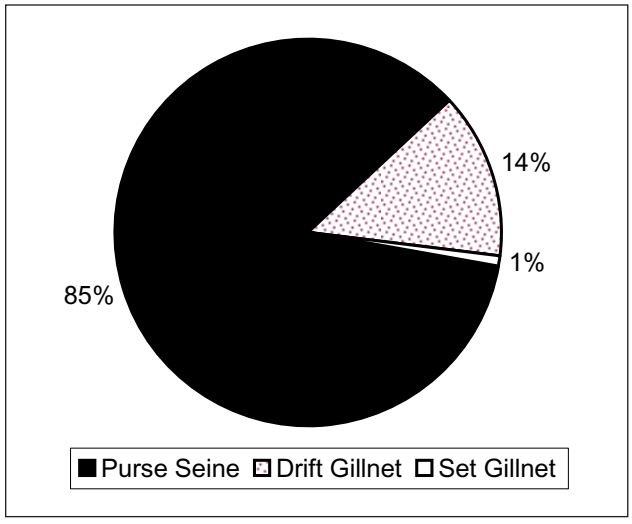


Figure 31. Average percent of the commercial common property salmon harvest by gear type in the Prince William Sound management area, 1985–2004.

Table 17. Average annual harvests of salmon in Prince William Sound area subsistence and personal use fisheries (rounded to the nearest 1,000 fish).

| Species | 1988–2003 Average | Annual Minimum | Annual Maximum |
|---|---|---|---|
| Chinook | 5,000 | 3,000 | 10,000 |
| Sockeye | 122,000 | 86,000 | 234,000 |
| Coho | 2,000 | 1,000 | 7,000 |
| Pink | <1,000 | <1,000 | 1,000 |
| Chum | <1,000 | <1,000 | 1,000 |
| Total | 129,000 | 92,000 | 245,000 |

Table 18. Average annual harvests of salmon in the Prince William Sound sport fishery (rounded to the nearest 1,000 fish).

| Species | 1980–1989 | 1990–1999 | 2000–2004 |
|---|---|---|---|
| Chinook | 3,000 | 11,000 | 10,000 |
| Sockeye | 8,000 | 15,000 | 19,000 |
| Coho | 31,000 | 91,000 | 195,000 |
| Pink | 31,000 | 44,000 | 37,000 |
| Chum | 4,000 | 2,000 | 3,000 |
| Total | 77,000 | 164,000 | 264,000 |

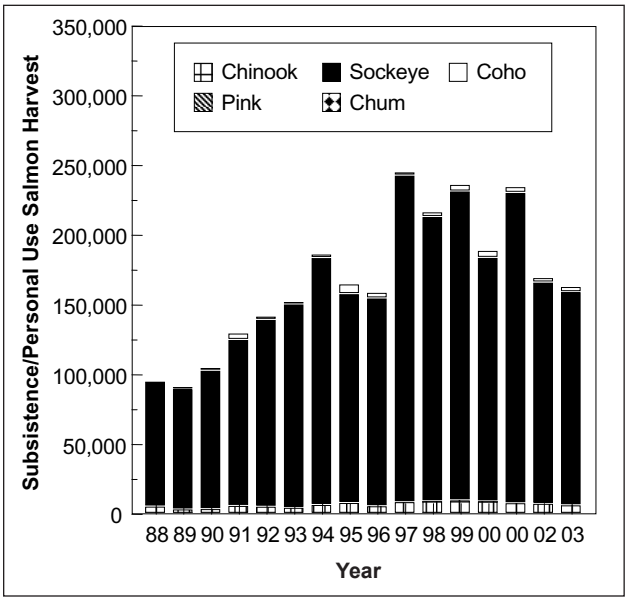


Figure 32. Harvests of salmon in subsistence and personal use fisheries of Prince William Sound, 1988–2003.

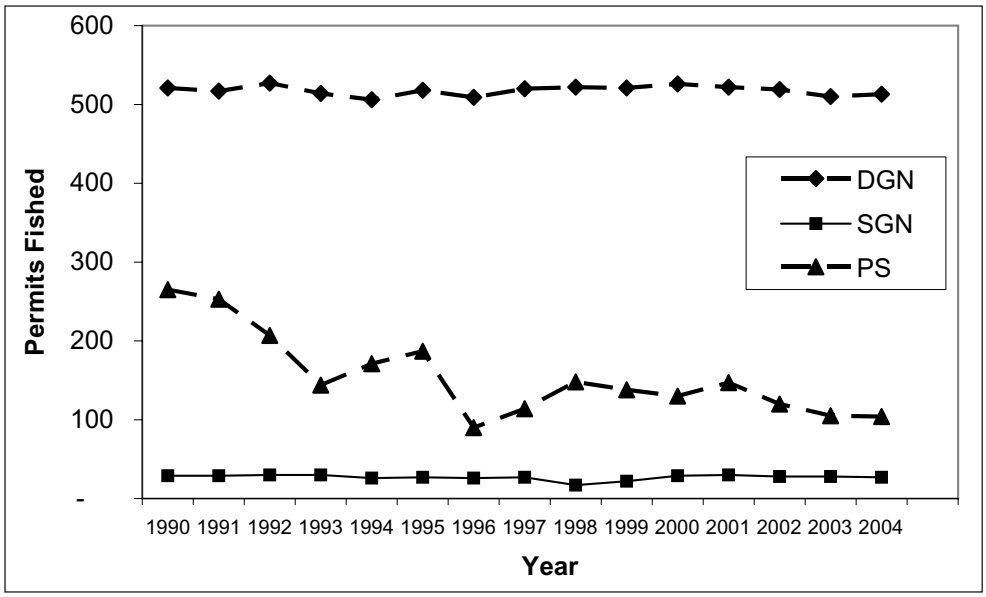


Figure 33. Number of commercial salmon limited entry permits fished in the Prince William Sound area, by gear type and year, 1990–2004. (DGN = drift gillnet, SGN = set gill net, PS = purse seine).

2004 dollars, the average annual exvessel value during this period was about $63 million, ranging from a low of about $33 million in 1993 to a high of about $127 million in 1988 (Figure 34). Exvessel value of the fishery declined sharply in 1991 from the high levels of the mid- to late 1980s and has remained fairly stable since then. Reduction in the price per pound paid for pink salmon has been the major reason for the decline. From 1985 to 2004, pink salmon accounted for 41% of the inflation adjusted total exvessel value, sockeye salmon for 34%, chum salmon for 12%, coho salmon for 8% and Chinook salmon for 5%. Since 1991, however, sockeye salmon have contributed a greater share of the value of the salmon harvest in the Prince William Sound area than have pink salmon.

## Management

The Prince William Sound commercial salmon fisheries are managed by ADF&G to achieve escapement goals while allowing for the orderly harvest of surplus wild and hatchery stocks. Management plans established in regulation provide guidance for the department to manage fisheries for sustained yield of wild stocks. Regulatory plans also establish criteria for the exvessel value allocation of the harvest among commercial

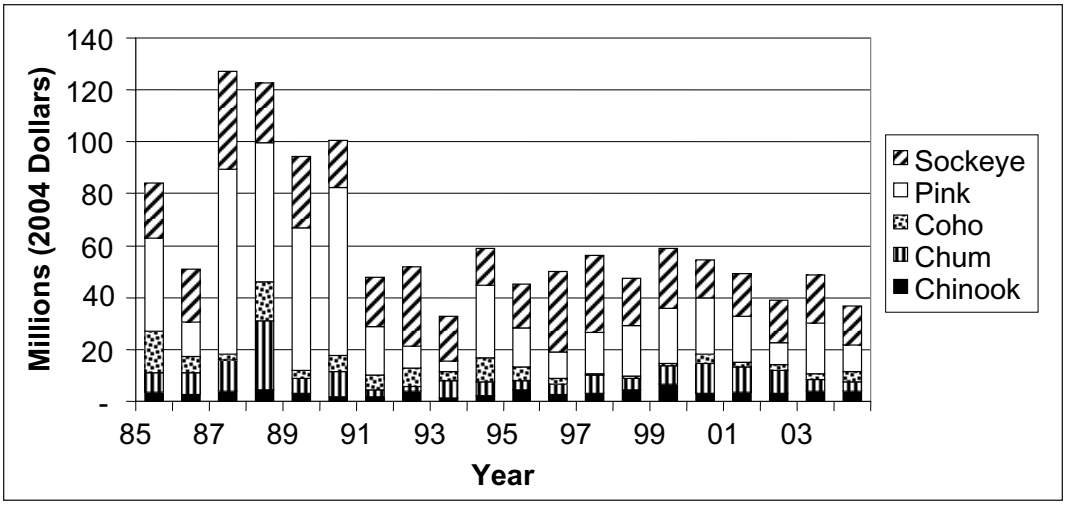


Figure 34. Exvessel value of the Prince William Sound commercial salmon fishery, 1985–2004, adjusted for inflation into 2004 dollars.

gear groups, and designate changes in gear group access to specific fishing areas to correct discrepancies in allocations. The Prince William Sound Task Force, an advisory body composed of commercial processors, gear groups, and aquaculture associations, serves as a forum for industry to exchange ideas and provide management recommendations to ADF&G.

The unique aspect of present-day salmon management in Prince William Sound is that, unlike any other area in Alaska, enhanced fish far outnumber wild fish in the harvest. The prevalence of hatchery fish has complicated management and assessment programs for Prince William Sound salmon. Hatchery management plans established in regulation specify terminal areas near each of the 5 large Prince William Sound hatcheries where ADF&G, in consultation with PNP hatchery operators, manages fisheries to achieve cost recovery and brood stock objectives. Annual hatchery management plans developed by PNP operators and ADF&G specify cost recovery, brood stock goals and harvest management strategies for each hatchery.

Preseason forecasts are developed to aid industry in planning for upcoming fishing seasons and to guide early season management. Annual preseason forecasts of run size are prepared by ADF&G staff for wild Prince William Sound pink and chum salmon, sockeye runs to Eshamy and Coghill lakes, and the Copper River (Eggers 2006). Forecasts of hatchery returns are developed by the aquaculture associations. As information on run strength accrues from catch and escapement monitoring programs, management decisions become increasingly more reliant on inseason assessments of run strength.

Prince William Sound commercial salmon fisheries are managed out of the Cordova ADF&G office. Two management biologists are in charge of day-to-day management of the fisheries, and have issued an average of 113 emergency orders annually from 2000 to 2004 (Table 19) in the process of managing the area's commercial, subsistence, and personal use fisheries. Detailed summaries of salmon fisheries management and assessment programs are produced annually for the Prince William Sound, Copper River and Bering River. See Ashe et al (2005).

The drift gillnet fleet is the largest of the Prince William Sound gear groups. The fleet targets salmon returns to the Copper and Bering River Districts, and the Eshamy, Coghill and Unakwik Districts of Prince William Sound. Almost all Prince William Sound fishermen drift gillnet in the Copper River District during portions of the fishing season, although substantial numbers move to other districts as opportunities arise to target other returns. Drift gillnet fishery openings in the various districts are, to the extent possible, scheduled concurrently in order to spread effort among fishing areas. Drift gillnet fisheries in the Copper and Bering River Districts are located in marine waters adjacent to the mouths of these large rivers, and target stocks bound for the respective drainages. With the exception of hatchery sockeye salmon that augment the Copper River return, management in the 2 districts is unaffected by hatchery stocks. The Copper River drainage is the largest in the Prince William Sound area and is the fifth largest river system in Alaska (Hollowell and Taube 2005). It is the single largest producer of wild salmon in the Prince William Sound area, supporting substantial runs of Chinook, sockeye and coho salmon. The Bering River drainage is much smaller and primarily produces sockeye and coho salmon.

The Copper River fishery is managed according to guidelines contained in 2 regulatory management plans. The Copper River District Management Plan specifies an inriver sockeye salmon escapement goal that includes components for spawning, subsistence, personal use, and sport harvests, as well as brood stock and surplus for Gulkana hatchery returns. The Copper River King Salmon Management Plan specifies a Chinook salmon escapement goal and a suite of tools for managers to manage Chinook salmon returns. The Copper River fishery typically opens in mid-May due to the early migratory timing of Chinook and sockeye salmon bound for spawning locations in the upper drainage. The openings occur earlier in the year than any other salmon net fisheries in Alaska, with the exception of recently reopened Chinook salmon fisheries on Taku and Stikine River in Southeast Alaska. Salmon marketing programs have taken advantage of

Table 19. Number of emergency orders issued by Division of Commercial Fisheries staff from 2000–2004 for inseason management of commercial and subsistence/personal use salmon fisheries in the Prince William Sound area.

| | Year | | | | | |
|---|---|---|---|---|---|---|
| Fishery | 2000 | 2001 | 2002 | 2003 | 2004 | Average |
| Commercial Purse Seine | 38 | 47 | 31 | 51 | 35 | 40 |
| Commercial Gillnet | 50 | 67 | 70 | 88 | 88 | 73 |
| Other | 1 | – | – | 1 | – | <1 |
| Regional Total | 89 | 114 | 101 | 140 | 123 | 113 |

the early availability and outstanding quality of Copper River Chinook and sockeye salmon, and lucrative markets have developed for the fish. By mid-June, management emphasis is on upriver wild and hatchery sockeye salmon stocks as well as sockeye salmon that spawn in the lower Copper River delta seaward of the Chugach Mountains. Management focus switches to coho salmon beginning in early August. Inseason management of the Copper River District relies on enumeration of Copper River escapement past a sonar site located about 50 km upstream from the river mouth at Miles Lake, aerial escapement surveys of lower delta systems, and comparison of harvests with weekly forecasts developed from historical run timing information. Contributions of hatchery fish to the Copper River sockeye harvest and escapement are determined from an otolith mark–recovery program. The Bering River district typically opens in mid-June, and managers schedule fishery openings concurrently with the Copper River district. Inseason management of the Bering District relies on aerial surveys of escapement and monitoring of catches.

Drift and set gillnetting is allowed in the Eshamy District, where the fishery primarily targets sockeye salmon returning to Eshamy Lake and the Main Bay Hatchery. A weir operated at Eshamy Lake provides inseason escapement information. Drift gillnet and purse seine fishermen share returns to the Coghill District and much smaller Unakwik Districts. In the Coghill District, the gillnet fishery targets sockeye returns to Coghill Lake and enhanced chum salmon returns to the Wally Noerenberg Hatchery. A weir at Coghill Lake provides inseason escapement information for sockeye salmon returns to that system.

The purse seine fishery is managed to achieve wild pink and chum salmon escapements and to allow for the orderly harvest of surplus wild and hatchery stocks. Pink and chum salmon escapements are monitored through weekly aerial surveys of 208 index streams distributed throughout Prince William Sound. The Southwestern District, the chief entrance corridor for salmon migrating back to Prince William Sound, is closed to purse seining prior to July 18 by regulation to allow early run salmon to reach inner waters of the Sound. Test fishing is conducted in the Southwestern District in July and August to provide information on pink salmon stock composition and sex ratios. All salmon released from Prince William Sound hatcheries can be distinguished by presence of otolith marks. This information is used, together with monitoring of escapements and catch rates, to manage purse seine fishing in the general districts. Management to achieve cost recovery goals for the area's PNP hatcheries is accomplished by opening and closing subdistricts near the hatcheries. When wild stocks are weak, these terminal areas can be opened to selectively target hatchery returns.

Escapement goals currently in effect for Prince William Sound salmon stocks are: one for Chinook, 5 for sockeye, 2 for coho, 2 for pink and 5 for chum salmon stocks or stock aggregates (M. J. Evenson, ADF&G Fairbanks, personal communication). All goals are sustainable escapement goals, with the exception of the biological escapement goal in place for Eshamy Lake sockeye salmon. A brief description of the goals and associated data sets follows.

### *Chinook salmon*

The Copper River is the only appreciable producer of Chinook salmon in the Prince William Sound area. A sustainable escapement goal of 24,000 or more Chinook salmon was established for the system in 2002 (Bue et al 2002), based on an age-structured analysis used to generate historical estimates of escapement (Savereide 2001). Historically, ADF&G monitored Copper River Chinook salmon escapements through aerial surveys of 9 clearwater spawning tributaries. Radio telemetry studies conducted by ADF&G between 1999 and 2004 revealed that the aerial survey program provided neither a consistent nor reliable measure of total escapement of Copper River Chinook salmon (Savereide 2005). Mark–recapture methods are now used to estimate the total drainage-wide escapement of Copper River Chinook salmon. The Native Village of Eyak, in cooperation with LGL Alaska Research Associates Inc. has operated the program annually since 2000 (Smith et al 2005). Figure 35 shows the estimated Copper River Chinook salmon escapements

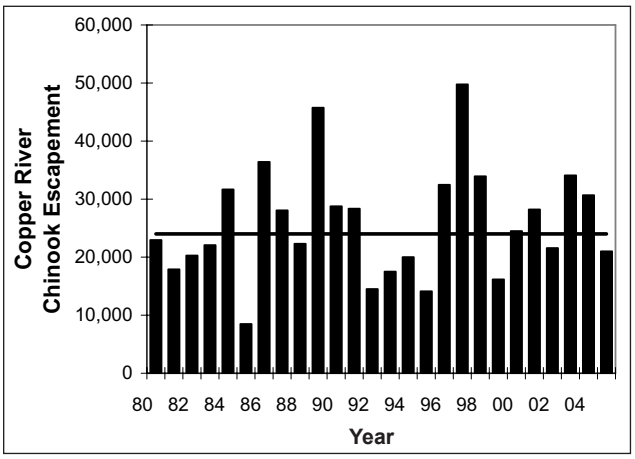


Figure 35. Estimated Copper River Chinook salmon escapements from 1980–2005 and the sustainable escapement goal of 24,000 fish.

since 1980 relative to the current escapement goal, which has been met or exceeded in about half of the years since 1980.

*Sockeye salmon*

The Copper River is the main producer of sockeye salmon in the Prince William Sound area. Sustainable escapement goals are established for stocks spawning in the upper Copper River basin and further downriver in the Copper River delta area. The inriver return of upper Copper River sockeye salmon has been monitored using sonar since 1978. Escapement is estimated by subtracting upstream sport, subsistence, and personal use harvests from sonar counts. The contributions of upriver and delta stocks to the Copper River commercial harvest have not been consistently estimated, so total return data is not available. The current escapement goal for the stock is 300,000 to 500,000 fish. Escapements have exceeded the lower end of the goal range in 23 of 28 years, including 15 of the last 16 years (Figure 36).

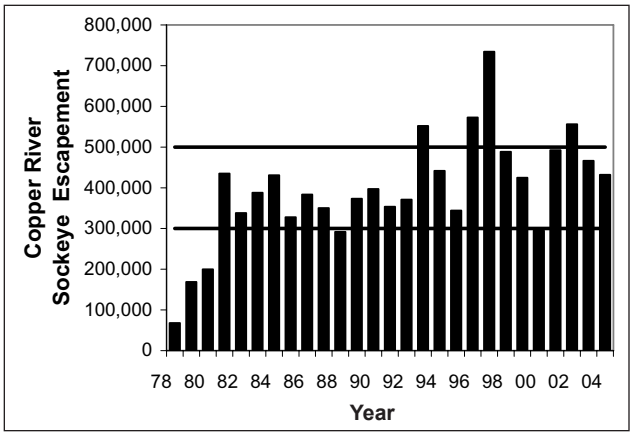


Figure 36. Estimated sockeye salmon escapement to the upper Copper River from 1978–2005 and the sustainable escapement goal range of 300,000–500,000 fish. Data from 2005 not shown because inriver harvest data is not yet available.

Escapements of Copper River delta stocks are monitored by aerial survey, and the sustainable escapement goal of 55,000 to 130,000 fish represents the sum of peak aerial counts from 17 index streams. Escapements have been above the lower end of the current goal range in 29 of 35 years since 1971, including every year since 1990 (Figure 37).

Bering River sockeye salmon are monitored by aerial survey, and the current sustainable escapement goal of 20,000 to 35,000 fish represents the sum of peak aerial survey counts from 7 index systems. Since 1983, Bering River escapements have exceeded the lower end of the current escapement goal range in 18 of 23 years (Figure 38).

Weirs are used to count sockeye salmon escapement into Coghill and Eshamy Lakes. Production from Coghill Lake has been affected by fry plants and lake enrichment programs, which complicates analysis of stock productivity. A period of low returns in the early 1990s may have been caused by high densities of sockeye salmon fry overgrazing zooplankton populations (Edmundsen et al 1992). Since 1962, weir counts of the Coghill Lake escapement have been highly variable, ranging from a high of 187,000 fish to a low of 7,000 fish, but have exceeded the lower end of the current sustainable escapement goal range of 20,000 to 40,000 fish in 37 of 44 years (Figure 39).

A biological escapement goal of 20,000 to 40,000 sockeye salmon is in place for Eshamy Lake. Following a period of very poor runs in the 1970s, when escapements were below 20,000 fish in all but one year, Eshamy Lake escapements have exceeded the lower

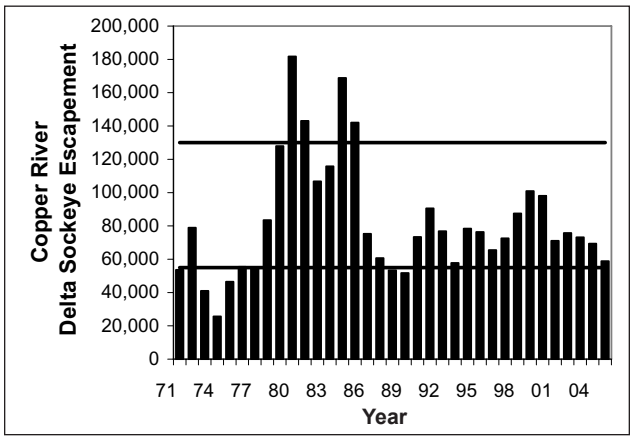


Figure 37. Peak aerial survey counts of Copper River Delta sockeye salmon from 1971–2005 and the sustainable escapement goal range of 55,000–130,000 fish.

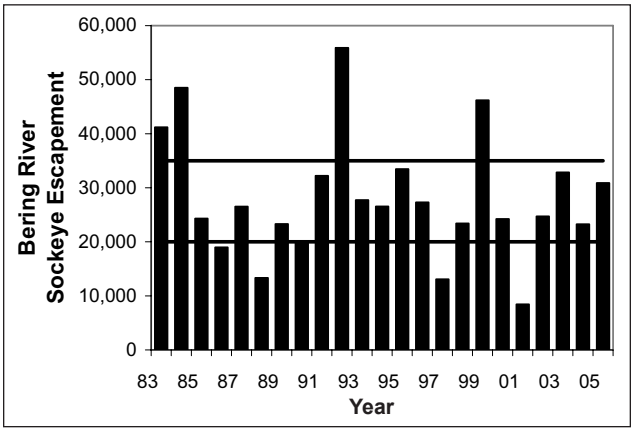


Figure 38. Peak aerial survey counts of Bering River sockeye salmon from 1983–2005 and the sustainable escapement goal range of 20,000–35,000 fish.

end of the current escapement goal range in 18 of the 24 years since 1980, when the weir became operational (Figure 40).

*Coho salmon*

There are 2 sustainable escapement goals for coho salmon in the Prince William Sound area, one for fish spawning in the Copper River delta and the other for Bering River delta streams. Escapements are measured as peak aerial survey counts, including 18 streams in the Copper River delta and 7 streams in the Bering River delta. Since 1981, escapements of both stocks have exceeded the lower end of their respective escapement goal ranges in all but 4 years (Figure 41 and 42).

*Pink salmon*

A sustainable escapement goal of 1.25 million to 2.75 million fish is established for Prince William Sound pink salmon. Escapement surveys are conducted on a weekly basis for 208 index streams, and indices of spawning escapement are estimated using area-under-the-curve methodology and a 17.5-day stream life (Bue et al 1998). As seen in Figure 43, escapements during the mid-1960s through the mid-1970s were below the current goal, followed by a period of high escapements from the late 1970s through the mid-1980s. Escapements since 1985 have been above the lower end of the escapement goal range in 15 of 21 years. In addition to the sustainable escapement goal for pink salmon that spawn in Prince William Sound streams, ADF&G has established management objectives to ensure distribution of spawning pink salmon among streams in the area.

*Chum salmon*

Threshold sustainable escapement goals have been established for chum salmon in 5 districts of Prince William Sound. Escapement indices dating back to

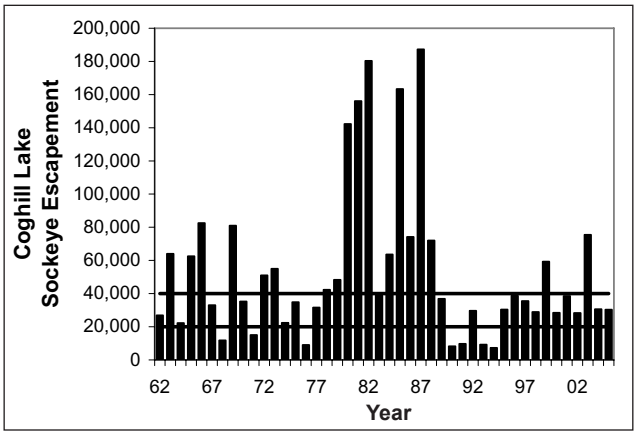


Figure 39. Coghill Lake weir counts of sockeye salmon from 1962–2005 and the sustainable escapement goal range of 20,000–40,000 fish.

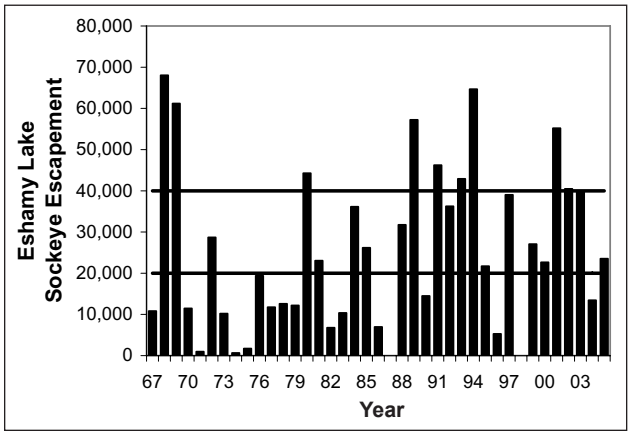


Figure 40. Eshamy Lake weir counts of sockeye salmon from 1967–2005 and the biological escapement goal range of 20,000–40,000 fish. The weir was not operated in 1987 and 1998.

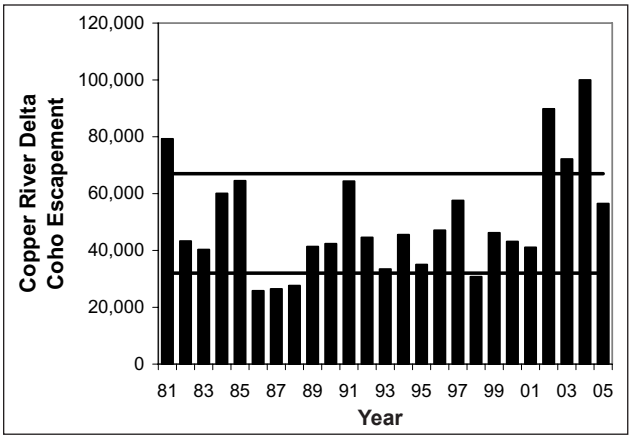


Figure 41. Peak aerial survey counts of Copper River Delta coho salmon from 1981–2005 and the sustainable escapement goal range of 32,000–67,000 fish.

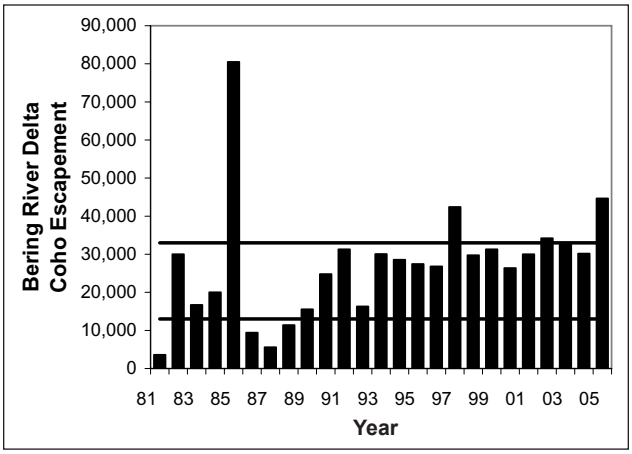


Figure 42. Peak aerial survey counts of Bering River Delta coho salmon from 1981–2005 and the sustainable escapement goal range of 13,000–33,000 fish.

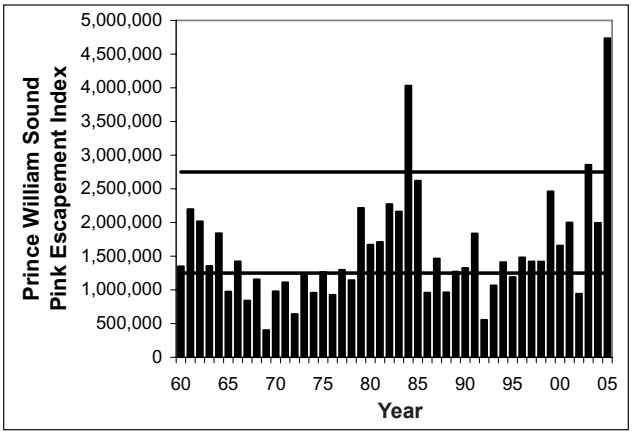


Figure 43. Index of escapement for Prince William Sound pink salmon and the sustainable escapement goal of 1.25 million to 2.75 million fish.

1965 have been developed using similar methods as detailed above for pink salmon. From 1996 to 2005, escapements to the Eastern and Southeastern Districts were above threshold levels in all years. During the same 10-year period, escapements of chum salmon in the Northern and Northwestern Districts met or exceeded their respective escapement thresholds in 9 of the 10 years while chum salmon escapements in the Coghill District met or exceeded the threshold in 7 of the 10 years (Figure 44).

## Budget History and Fiscal Support

State general fund support for the ADF&G Prince William Sound salmon management and stock assessment programs has increased by approximately 79% since 1982, but the effective buying power of these funds has actually decreased substantially as a result of inflation (Table 3). During the last 15 years, several other agencies and funding sources have supported salmon stock assessment projects in the Prince William Sound area, including the Exxon Valdez Oil Spill Trustee Council and the U.S. Fish and Wildlife Service, Office of Subsistence Management. These funded studies have helped improve escapement monitoring programs in Prince William Sound and the Copper River drainage and have helped develop programs to estimate hatchery and wild stock contributions to commercial fisheries.

Although commercial salmon harvests in the Prince William Sound area have been at record levels in recent years and ADF&G's stock assessment capabilities have improved, the job of fishery managers has grown more complex. High proportions of the harvest are now composed of hatchery fish, particularly pink and chum salmon, and managing for sustained production of wild stocks requires more inseason information and attention. From a longer-term perspective, it is important to continue to improve assessment programs to enable inspection of trends in hatchery and wild stock production. There is controversy about the possible impacts of Prince William Sound enhanced production on the region's wild salmon stocks. Hilborn and Eggers (2000) assert that the productivity (return per spawner) of wild pink salmon in Prince William Sound has declined in the face of large scale hatchery releases, though the magnitude of the hatchery effect has been challenged (Wertheimer et al 2001, Hilborn and Eggers 2001). Wertheimer et al (2004) provide evidence that wild stocks of pink salmon in Prince William Sound remain highly productive and that enhanced production of pink salmon in Prince William Sound resulted in a net gain of up to 25 million fish per year between the 1990 and 2000 return years, at the expense of the possible displacement of up to 4.6 million wild pink salmon. There is a need to continue analyses and additional research into interaction of hatchery and wild fish in Prince William Sound. As Wertheimer et al point out in their 2004 paper "We need to continue both retrospective analyses and empirical research examining the interaction of hatchery and wild fish in Prince William Sound, to better understand and quantify the impacts of hatcheries, and to refine hatchery strategies and regulation to minimize impacts when and where necessary." Adequate funding will be needed to conduct such studies and analyses in the future.

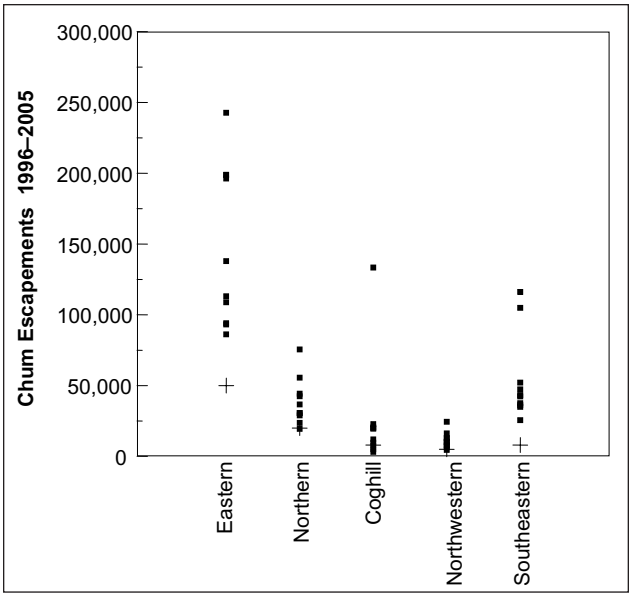


Figure 44. Escapements of chum salmon in 5 districts of Prince William Sound from 1996–2005 with sustainable escapement goals (annual escapements shown as solid squares, threshold sustainable escapement goals shown as + signs).

# COOK INLET COMMERCIAL SALMON FISHERY

## Area Description and Gear Types

Salmon were first caught commercially in Cook Inlet in 1882. From the inception of the fishery until statehood, various gear types including fish traps, gillnets, and seines were used to commercially harvest salmon in Cook Inlet. Since statehood, Lower Cook Inlet commercial salmon fisheries have been managed by the ADF&G Homer office; these fisheries occur in the Southern, Outer, Eastern and Kamishak Bay fishing districts. Salmon fisheries in Upper Cook Inlet are managed out of the ADF&G Soldotna office; these fisheries occur in the Central and Northern fishing districts. Figure 45 illustrates the commercial salmon fishing areas in Cook Inlet. Currently, only set gillnet gear is allowed in the Northern District. Set gillnet, drift gillnet, and purse seine gear is allowed in the Central District, however seine gear is restricted to the Chinitna Bay Subdistrict where it is only used sporadically. Set gillnets in Lower Cook Inlet are restricted to the Kachemak Bay area of the Southern District. Purse seine gear is used in all 4 of the Lower Cook Inlet commercial fishing districts (Southern, Outer, Eastern, and Kamishak Bay).

## History of the Commercial Salmon Fishery

Commercial harvests of Chinook salmon in Cook Inlet generally increased until reaching a decadal average of about 92,000 fish in the 1940s. Average harvests of Chinook salmon were about 13,000 fish in the 1960s, 12,000 fish in the 1970s, 25,000 fish in the 1980s, 17,000 fish in the 1990s, and 19,000 fish since 2000 (Figure 46, Panel A). The significant reduction in commercial fishery Chinook salmon harvests since statehood was due to (1) perceived overharvest of the species in Cook Inlet during the 1960s and (2) direct allocation of harvestable surplus to the sport fishery by actions taken at various Alaska Board of Fisheries meetings since then. Sockeye salmon harvests in Cook Inlet did not exceed 3 million fish in any year until 1982 (Figure 46, Panel B). The peak decadal average annual harvest prior to the 1980s occurred in the 1940s when about 1.6 million sockeye salmon were harvested commercially. Commercial harvests of sockeye salmon were about 4.5 million fish in the 1980s, 4.1 million fish in the 1990s, and 3.6 million fish since 2000. Prior to statehood, the peak average annual commercial harvest of coho salmon in Cook Inlet was about 400,000 fish with the catch decreasing to a lower level in the 1950s, 1960s and 1970s (Figure 46, Panel C). During the 1980s the commercial harvest averaged about 540,000 fish, in the 1990s the harvest averaged about 360,000 fish and since 2000 the harvest has averaged about 215,000 fish. As is the case for Chinook salmon over the past 25 years, the Alaska Board of Fisheries has made allocative decisions limiting commercial harvests of coho salmon in Cook Inlet and has allocated substantial surplus production of the species to the sport fishery. In the early years of the Cook Inlet commercial fishery, even-year pink salmon were very dominant with odd-year pink salmon seldom being caught. The 2 runs have been growing closer in abundance over the last 30 years in comparison to patterns in the early part of the 1900s (Figure 46, Panel D). The largest commercial harvest of pink salmon in Cook Inlet occurred in 1952 when almost 5 million were caught and sold. Decadal average harvests of pink salmon since the 1940s have fluctuated between about 1.3 million and 1.8 million fish per year. Harvests of chum salmon in the Cook Inlet commercial fishery increased until they peaked in the 1980s at about 906,000 fish (Figure 46, Panel E). Annual commercial harvests of chum salmon in the 1990s averaged about 258,000 fish and since 2000 have averaged about 219,000 fish. Total commercial salmon harvests in Cook Inlet peaked in the 1980s at about 7.7 million fish. Annual harvests since then averaged about 6.3 million fish in the 1990s, and about 5.8 million fish since 2000 (Figure 46, Panel F).

Over the 10-year period from 1994 to 2003, about 35% of all salmon commercially harvested in Cook Inlet were taken in Lower Cook Inlet and 65% were taken in Upper Cook Inlet. For the 3 higher-value commercial fishery species—Chinook, sockeye, and coho salmon (Table 20)—only 10% or less of the harvest occurred in Lower Cook Inlet. Proportions of the total Cook Inlet salmon harvest that have been caught in Lower Cook Inlet fishing districts by species were Chinook salmon (8%), sockeye salmon (10%), coho salmon (4%), pink salmon (87)%, and 13% for chum salmon (Figure 47).

Most salmon harvested in the Lower Cook Inlet commercial fishery are caught in the Southern District (80%). The Outer District has been next most important, accounting for about 10% of the harvest, while about 7% is caught in the Kamishak District and about 3% in the Eastern District (Figure 48). In Upper Cook Inlet, about 95% of the salmon harvest takes place in the Central District (Figure 49).

## Other Salmon Harvests

Subsistence harvests of salmon in Cook Inlet averaged about 8,200 fish from 1994 to 2003 while ranging from about 3,000 to 16,800 fish (Table 21). Recent harvests have increased somewhat from those observed in the

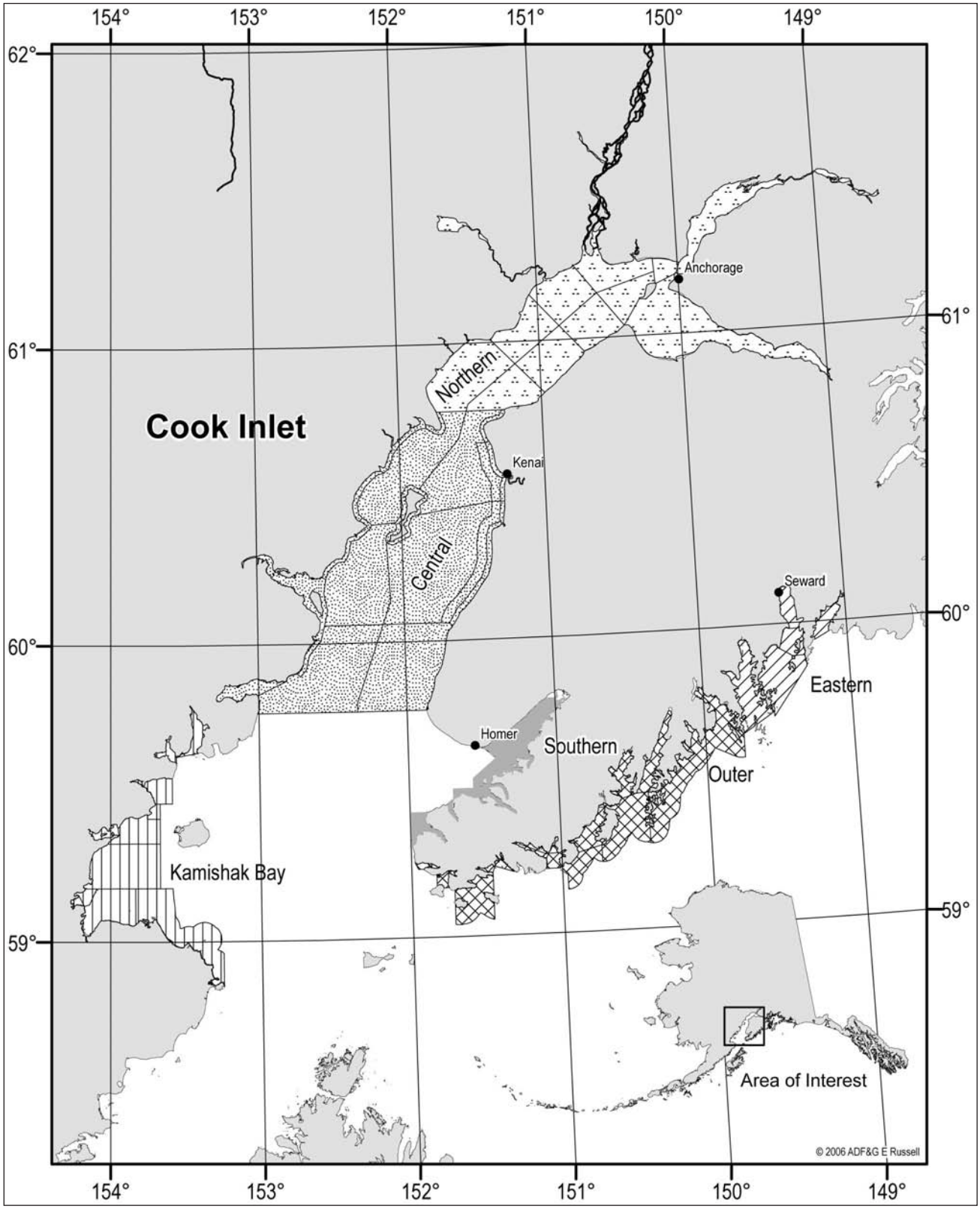


Figure 45. Cook Inlet area commercial salmon fishery.

1980s, particularly for sockeye salmon (Figure 50). Sockeye salmon have comprised about 35% of the harvest over the time period of 1980 to 2003, followed by Chinook salmon (23%), pink salmon (22%), coho salmon (16%), and chum salmon (4%). Subsistence harvests of salmon in Cook Inlet are minor compared to commercial harvest levels. The ratios of commercial harvests to subsistence harvests from 1994 to 2003 were 10:1 for Chinook salmon, 870:1 for sockeye salmon, 220:1 for coho salmon, 1,260:1 for pink salmon, 435:1 for chum salmon, and 660:1 for all salmon.

Salmon harvests in the Cook Inlet sport fishery have increased over the last 25 years (Table 22). Chinook, sockeye, and coho salmon are the primary

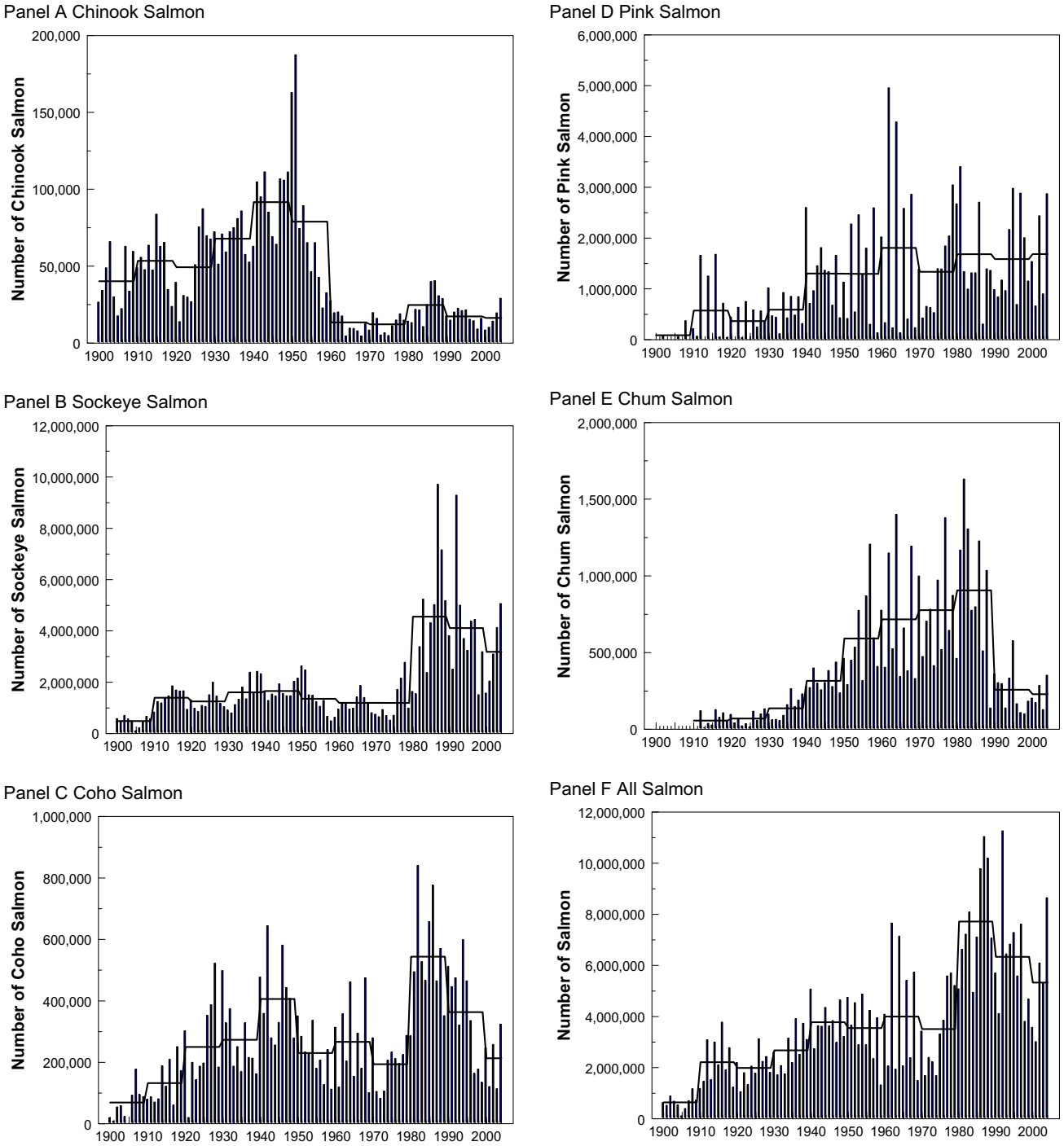


Figure 46. Commercial salmon harvests in Cook Inlet from 1900–2004; bars provide annual catches and lines provide decade averages.

species targeted by sport anglers. Like subsistence fisheries, harvests in the sport fishery are generally small in comparison to the commercial harvest, with the notable exceptions of Chinook and coho salmon.

Table 20. Average price paid per pound for salmon caught in Cook Inlet commercial fisheries during 2004.

| | Chinook | Sockeye | Coho | Pink | Chum |
|---|---|---|---|---|---|
| Lower Cook Inlet | $1.56 | $0.77 | $0.47 | $0.04 | $0.20 |
| Upper Cook Inlet | $1.00 | $0.65 | $0.20 | $0.05 | $0.12 |

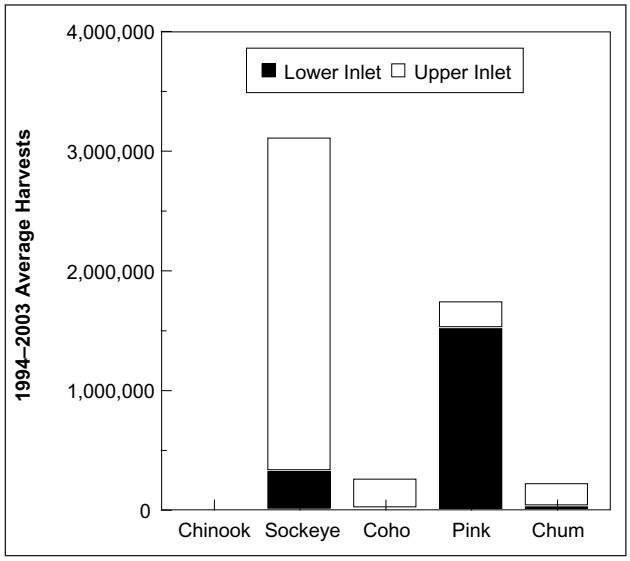


Figure 47. Recent 10-year (1994–2003) average commercial salmon harvests by species in Lower and Upper Cook Inlet.

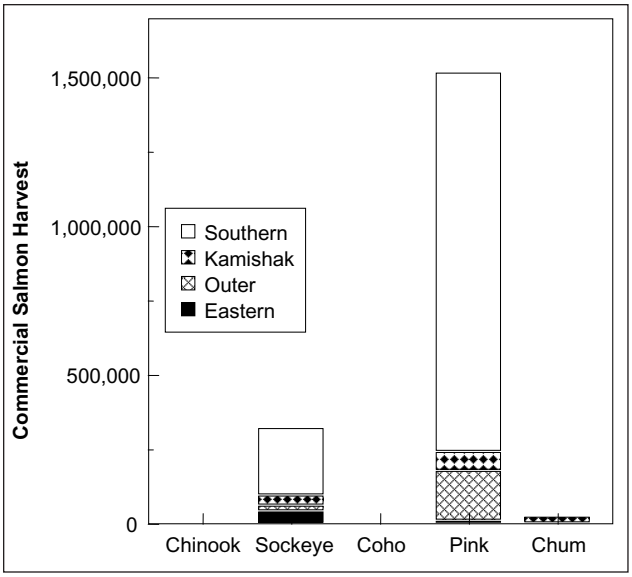


Figure 48. Recent 10-year (1994–2003) average commercial salmon harvests by species in the 4 fishing districts of Lower Cook Inlet.

The Alaska Board of Fisheries has made allocative decisions and adopted management plans that have limited access by commercial fishermen to Chinook and coho salmon in Cook Inlet. The ratio of the total commercial to total sport fishery salmon harvests since 2000 is about 8:1; ratios vary considerably by species. Since 2000, the ratio of commercial harvests to sport harvests are 0.25:1 for Chinook salmon, 10:1 for sockeye salmon, 1:1 for coho salmon, 60:1 for pink salmon, and 35:1 for chum salmon.

## Commercial Salmon Fishery Users

As of August 31, 2005, there were 1,390 limited entry permits valid for salmon fishing in Cook Inlet; 82 (6%) were purse seine permits, 571 (41%) were drift gillnet permits, and the remaining 737 (53%) were set gillnet permits (Table 4). Purse seine gear has accounted for about 34% of the commercial harvest of salmon in Cook Inlet while set gillnet accounts for 31% and

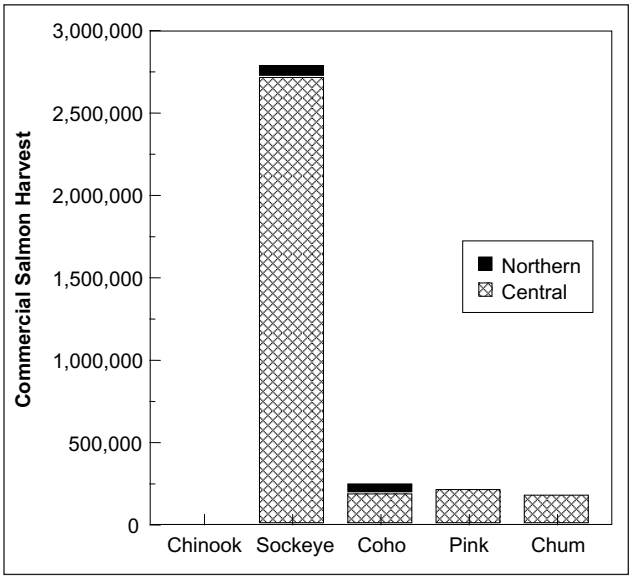


Figure 49. Recent 10-year (1994–2003) average commercial salmon harvests by species in the 2 fishing districts of Upper Cook Inlet.

Table 21. Average annual harvests of salmon in Cook Inlet subsistence fisheries from 1994–2003 (rounded to the nearest 100 fish).

| Species | 1994–2003 Average | Annual Minimum | Annual Maximum |
|---|---|---|---|
| Chinook | 1,500 | 900 | 1,900 |
| Sockeye | 3,600 | 900 | 11,500 |
| Coho | 1,200 | 400 | 2,000 |
| Pink | 1,400 | 500 | 2,100 |
| Chum | 500 | 200 | 1,200 |
| Total | 8,200 | 3,000 | 16,800 |

drift gillnet gear accounts for 35% (Figure 51). For Chinook salmon in Cook Inlet commercial fisheries, about 95% are harvested by set gillnet gear, 3% by drift gillnet gear and 1% by purse seine gear. About 47% of sockeye salmon in Cook Inlet are harvested by drift gillnet gear, about 44% by set gillnet gear and about 9% by purse seine gear. About 50% of coho salmon in Cook Inlet are harvested by drift gillnet gear, about 47% by set gillnet gear and about 3% by purse seine gear. About 86% of pink salmon in Cook Inlet are harvested by purse seine gear, about 8% by set gillnet gear and about 6% by drift gillnet gear. For chum salmon, about 78% are harvested by drift gillnet gear while set gillnets and purse seines are used to each capture about 11% of the total chum salmon catch.

## Exvessel Value

The average annual exvessel value of the commercial salmon fishery in Cook Inlet from 1985 to 2004 was about $41 million, ranging from a low of about $9 million in 2001 to a high of about $136 million in 1988. Adjusted for inflation and expressed in 2004 dollars, the average annual exvessel value was about $59 million. Inflation-adjusted exvessel value ranged from a low of $10 million in 2001 when about 3 million salmon were harvested to a high of $218 million in 1988 when about 10 million salmon were harvested (Figure 52). As elsewhere in Alaska, value has trended downward during the last 15 years, although a minor upward trend is apparent since 2001. From 1985 to 2004, sockeye salmon accounted for 90% of the inflation adjusted total exvessel value, followed by coho salmon (4%), chum salmon (3%), pink salmon (2%) and Chinook salmon (1%).

A substantial portion of the reduction in the exvessel value of the commercial salmon fishery over the past 15 years is due to a large reduction in the price paid per pound to fishermen when they sell their catch. For instance, in 1988 when exvessel value for sockeye salmon peaked in the Cook Inlet commercial fishery, fishermen were paid about $2.50 per pound, whereas in 2001 when the lowest exvessel value occurred, fishermen were only paid $0.62 in Lower Cook Inlet and $0.65 in Upper Cook Inlet (Figure 53).

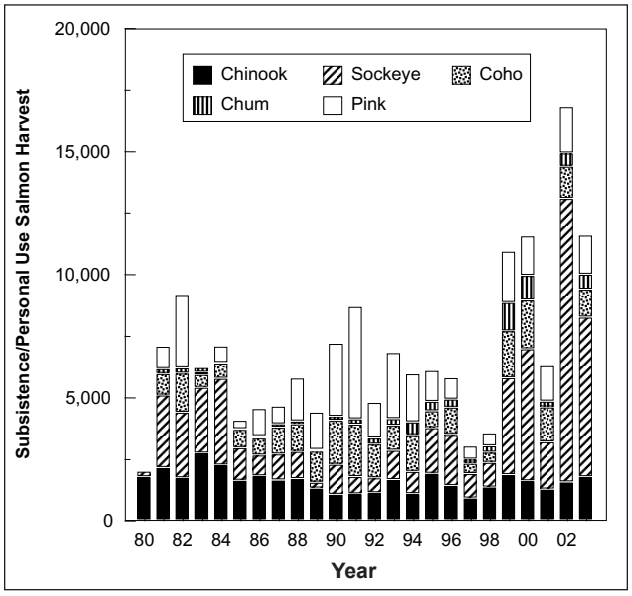


Figure 50. Harvests of salmon in subsistence fisheries of Cook Inlet, 1980–2003.

Table 22. Average annual harvests of salmon in the Cook Inlet sport fishery.

| Species | 1980–1989 | 1990–1999 | 2000–2004 |
|---|---|---|---|
| Chinook | 51,600 | 78,669 | 72,244 |
| Sockeye | 186,119 | 246,404 | 345,680 |
| Coho | 104,252 | 160,487 | 224,106 |
| Pink | 36,599 | 23,505 | 29,948 |
| Chum | 8,406 | 4,914 | 6,273 |
| Total | 386,976 | 513,979 | 678,251 |

## Management

The salmon fisheries of Cook Inlet are managed by ADF&G with the goal of achieving and maintaining sustained production. Much of the management effort in Upper Cook Inlet is directed at gillnet fisheries that target sockeye salmon in the Central District, whereas in Lower Cook Inlet, much of the management effort

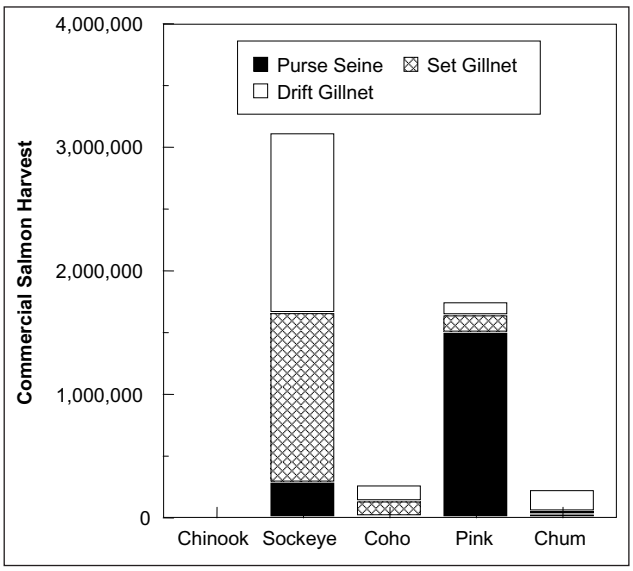


Figure 51. Recent 10-year (1994–2003) average commercial salmon harvests by gear type in Cook Inlet.

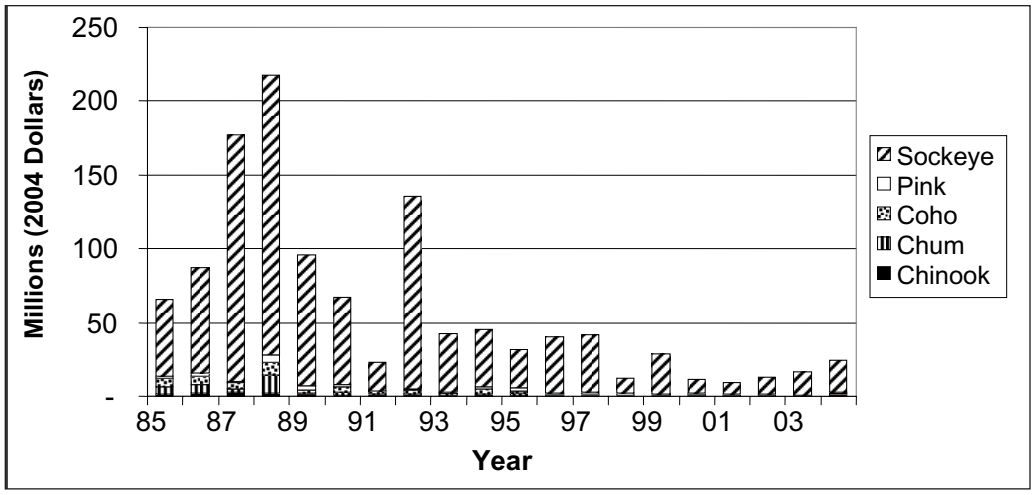


Figure 52. Exvessel value of the Cook Inlet commercial salmon fishery, 1985–2004, adjusted for inflation into 2004 dollars.

involves purse seine fishing in the Southern District. The Board of Fisheries has developed a number of management plans for Cook Inlet salmon fisheries. Salmon managers at ADF&G in Homer and Soldotna use their emergency order authority to carry out these regulatory management plans that serve to both allocate salmon to competing users and to conserve the salmon resource.

An active salmon fishery enhancement program has existed in Cook Inlet for the past several decades. The emphasis of that program has shifted somewhat from production of pink salmon to various enhancement techniques for sockeye salmon. Enhanced production can contribute as much as half of the catch of sockeye salmon in Lower Cook Inlet. While the enhancement program is very important in Upper Cook Inlet, the proportion of the catch from enhancement is less than 10%. Fishery managers in both Homer and Soldotna work with aquaculture associations and others to ensure commercial fishermen access to enhanced salmon runs. Annual management reports written by ADF&G staff since the early 1960s provide extensive and detailed fishery data and insight into the Cook Inlet management program and fishery. See Hammarstrom and Dickson (2005) for Lower Cook Inlet and Shields and Fox (2005) for Upper Cook Inlet.

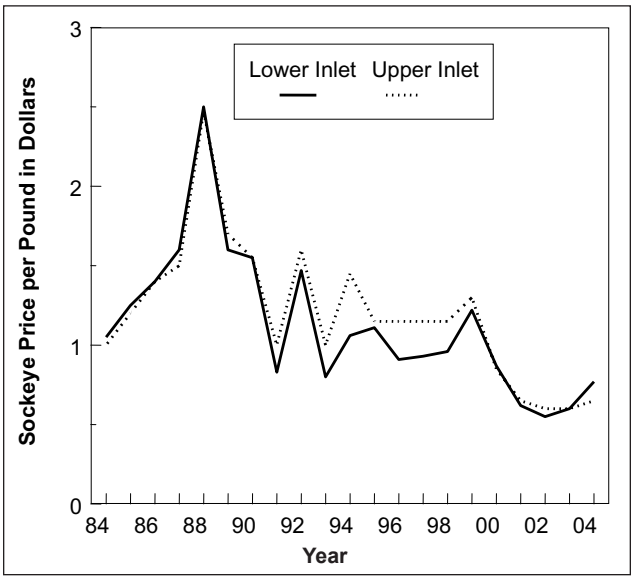


Figure 53. Average price paid per pound for sockeye salmon in Lower and Upper Cook Inlet commercial fisheries, 1984–2004.

Management of Cook Inlet commercial salmon fisheries is difficult and complex because annual run sizes and timing is often uncertain when decisions must be made, mixed stocks are harvested while some of the harvested stocks are still a considerable distance from their home streams, and the Board of Fisheries adopted management plans that address allocative issues and concerns between commercial and other users of the salmon resource. Inseason management of Cook Inlet commercial salmon fisheries is based upon salmon run abundance and timing indicators. Catch data, catch per effort data, test fish data, catch composition data, and escapement information from a variety of sources is used to assess stock strength on an inseason basis. Escapements of major stocks of sockeye salmon returning to Upper Cook Inlet are monitored continuously with the aid of sonar or weirs; for other stocks, surveys are made to index escapement abundance. Inseason run timing models are used to predict subsequent escapement levels using historic run passage information. These various data and predictions are used in concert with management plans adopted by the Board of Fisheries to adjust fishing areas and times with the goal of achieving escapement targets and allocative criteria

set by the Board of Fisheries. From 2000 to 2004, ADF&G Division of Commercial Fisheries managers issued an average of 54 emergency orders per year to regulate Cook Inlet salmon harvests, with a range of 44 in 2001 to 80 in 2004. Descriptions of each emergency order and the reasons for their issuance are provided in annual management reports. For an example, see Shields and Fox (2005) for the 2004 Upper Cook Inlet season.

Escapement goals currently in effect for management of salmon fisheries in the Cook Inlet area are fully described in Otis and Hasbrouck (2004) for Lower Cook Inlet and in Hasbrouck and Edmundson (2006) for Upper Cook Inlet. There are 40 sustainable escapement goals in effect in Lower Cook Inlet and 5 biological escapement goals and 26 sustainable escapement goals in effect in Upper Cook Inlet. Several of the escapement data sets available for Cook Inlet salmon are described in the following paragraphs.

*Chinook salmon*

There are 3 biological escapement goals and 18 sustainable escapement goals in effect for Chinook salmon spawning in Upper Cook Inlet and 3 sustainable escapement goals in effect for Chinook salmon in Lower Cook Inlet. Chinook salmon returning to the Kenai River are assessed by sonar in the lower river and 2 runs are recognized—an early run and a late run. The biological escapement goal for early-run Chinook salmon in the Kenai River is from 7,200 to 14,400 fish and in 17 of the past 19 years (89%) the observed escapement has met or exceeded the lower end of the goal range (Figure 54). The late run has a biological escapement goal range of 17,800 to 35,700 fish and all 19 recent escapements have exceeded the lower end of the range (Figure 55). The escapements for both runs in 2002 were lower than in most other years, the early run was short of the goal and the late run just barely surpassed the lower end of the goal range. The third biological escapement goal for Chinook salmon in Cook Inlet is 13,000 to 28,000 fish for the Deshka River stock of Chinook salmon (Figure 56). Since 1974, the escapement of Chinook salmon in the Deshka River exceeded the lower end of the goal range in 28 of the 31 years (90%); exceptions were in 1975, 1994, and 1995. There are an additional 18 spawning populations of Chinook salmon in Upper Cook Inlet with sustainable escapement goals. Of those 18, the 12 largest populations with the most complete recent 10-year escapement observations are included in Figure 57. With 10 years of observed escapement for the 12 spawning populations, 120 cells are possible; of these possible 120 cells, escapement counts were not obtained in 4 cells, resulting in a set of 116 cells with observations. During the time period from 1995 to 2004, 109 of the observed escapements (93%) exceeded the lower end of the sustainable escapement

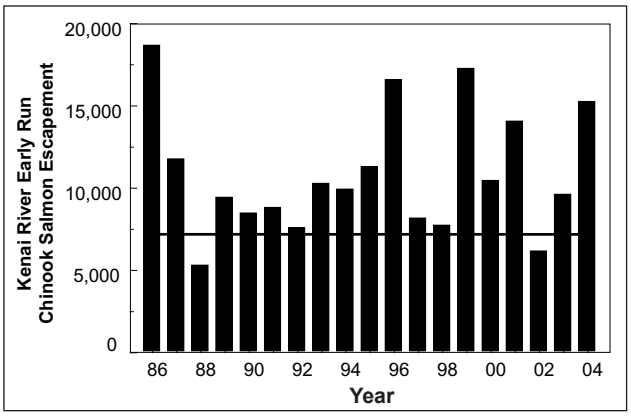


Figure 54. Early-run Chinook salmon escapements from 1986–2004 in the Kenai River, Upper Cook Inlet and the lower end of the biological escapement goal range of 7,200–14,400.

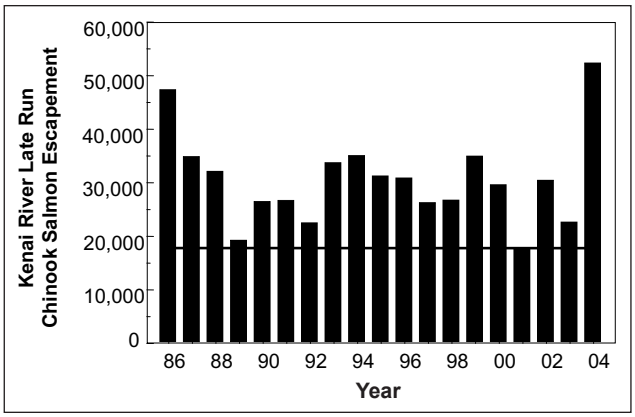


Figure 55. Late-run Chinook salmon escapements from 1986–2004 in the Kenai River, Upper Cook Inlet and the lower end of the biological escapement goal range of 17,800–35,700.

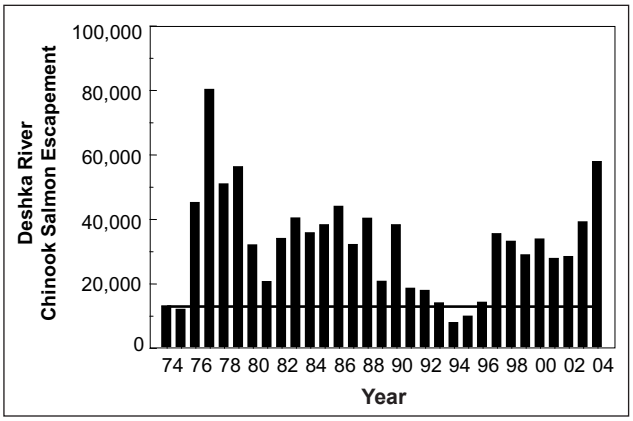


Figure 56. Chinook salmon escapements from 1974–2004 in the Deshka River, Upper Cook Inlet and the lower end of the biological escapement goal range of 13,000–28,000.

goal ranges (Figure 57). During the most recent 5-year period from 2000 to 2004, in 56 of the possible 58 cases (97%), the observed escapement exceeded the lower end of the sustainable escapement goal range.

*Sockeye salmon*

There are 2 biological escapement goals and 4 sustainable escapement goals in effect for sockeye salmon spawning in Upper Cook Inlet and 8 sustainable escapement goals in effect in Lower Cook Inlet. The largest stock of sockeye salmon in Cook Inlet spawns in the Kenai River system, and since 1968, escapements have been monitored by counting upstream fish with the aid of sonar equipment and subsequently subtracting fish caught upstream or entering a couple of tributaries where weirs are in place. The current sustainable escapement goal is 500,000 to 800,000 fish; since 1987 the annual escapements have exceeded the lower end of the goal range in 15 of the 19 years (79%); escapements less than the goal range occurred in 1990, 1991, 2000, and 2001 (Figure 58). The Russian River is located in the Kenai River drainage and it supports 2 runs, an early run and a late run. The early-run escapements have been counted with the aid of a weir since 1965 and have consistently exceeded the lower end of the sustainable escapement goal range of 14,000 to 37,000 fish since 1976 (Figure 59). The late-run escapements have been counted with the aid of a weir since 1963 and have consistently exceeded the lower end of the sustainable escapement goal range of 30,000 to 110,000 fish since 1994 (Figure 60).

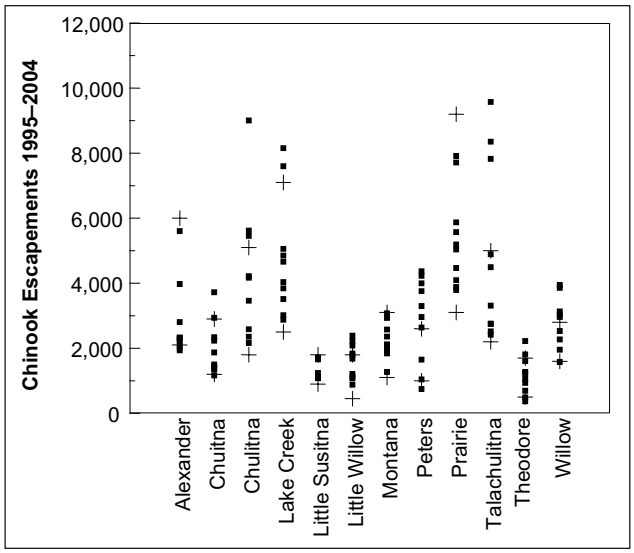


Figure 57. Chinook salmon escapements from 1995–2004 for 12 of the 18 Upper Cook Inlet stocks with sustainable escapement goals (annual escapements shown as solid squares, lower and upper ends of sustainable escapement goal range shown as + signs).

The Kasilof River has a biological escapement goal of 150,000 to 250,000 sockeye salmon; escapements in this river are counted with the aid of sonar

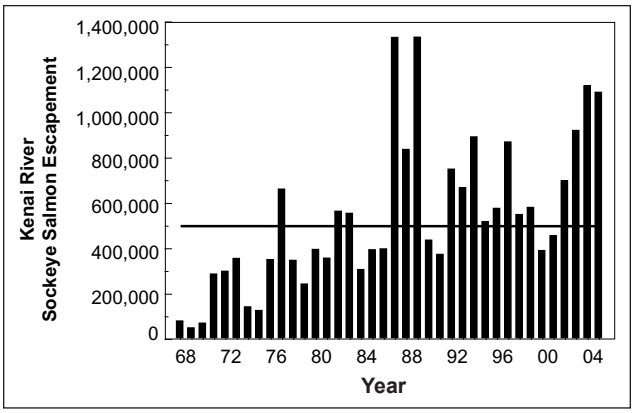


Figure 58. Sockeye salmon escapements from 1968–2005 in the Kenai River, Upper Cook Inlet and the lower end of the sustainable escapement goal range of 500,000–800,000.

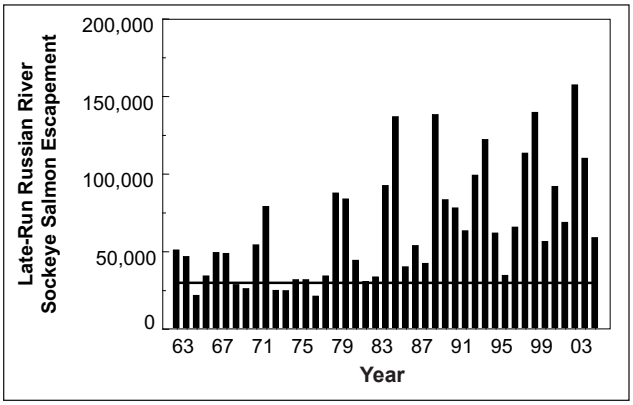


Figure 59. Early-run sockeye salmon escapements from 1965–2005 in the Russian River, Upper Cook Inlet and the lower end of the sustainable escapement goal range of 14,000–37,000.

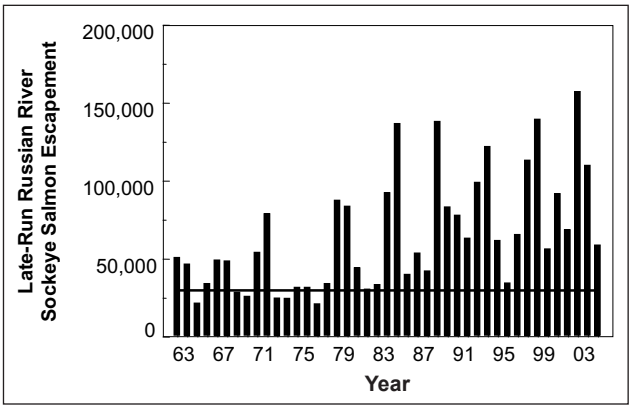


Figure 60. Late-run sockeye salmon escapements from 1963–2005 in the Russian River, Upper Cook Inlet and the lower end of the sustainable escapement goal range of 30,000–110,000.

gear. Since 1994, sockeye salmon escapements in the Kasilof River have consistently exceeded the lower end of the goal range (Figure 61). The biological escapement goal range for sockeye salmon in the Crescent River is 30,000 to 70,000 fish, escapements are counted with the aid of sonar gear and have consistently exceeded the lower goal range since 1997 (Figure 62). Sockeye salmon spawn in the Susitna River and ADF&G has counted salmon with the aid of sonar gear in the Yentna River, a tributary to the Susitna, since 1981. The sustainable escapement goal for the Yentna River is 90,000 to 160,000 fish (Figure 63) and this goal has been met or exceeded in 18 of the last 24 years (75%). However, in the last 5 years, the sustainable escapement goal for the Yentna River has only been met once (20%).

Figure 64 shows escapements from 1995 to 2004 and sustainable escapement goal ranges for 8 spawning populations of sockeye salmon in Lower Cook Inlet. With 8 stocks and 10 years of annual escapements, there are 80 cells included and of those, the observed escapement exceeded the sustainable escapement goal range in 71 of the cases (89%). Desire Lake failed to achieve its sustainable escapement goal range in 4 of the 10 years (1998, 2000, 2001, and 2003); Aialik Lake failed to achieve its goal in 1995 and 1996, Chenik Lake failed to achieve its goal in 1995 and 2001, and Mikfik Lake failed to achieve its goal in 2001 (Figure 64).

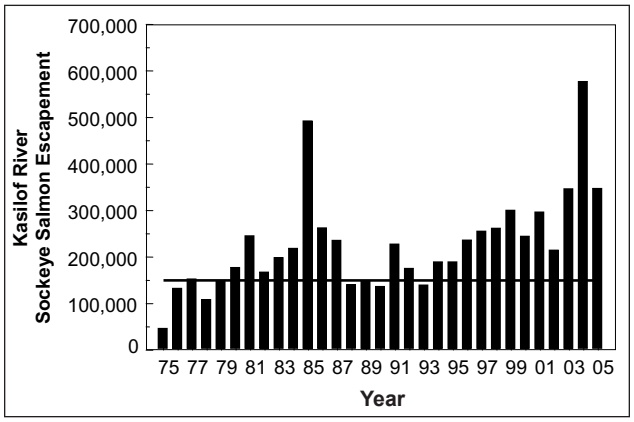


Figure 61. Sockeye salmon escapements from 1975–2005 in the Kasilof River, Upper Cook Inlet and the lower end of the biological escapement goal range of 150,000–250,000.

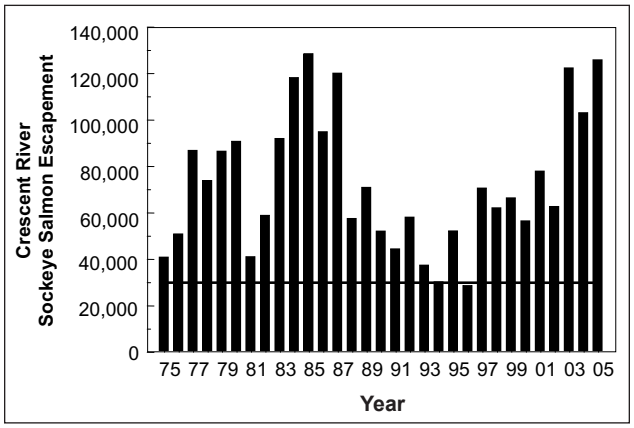


Figure 62. Sockeye salmon escapements from 1975–2005 in the Crescent River, Upper Cook Inlet and the lower end of the biological escapement goal range of 30,000–70,000.

## *Coho salmon*

There are 3 sustainable escapement goals in place for coho salmon spawning in Upper Cook Inlet. The

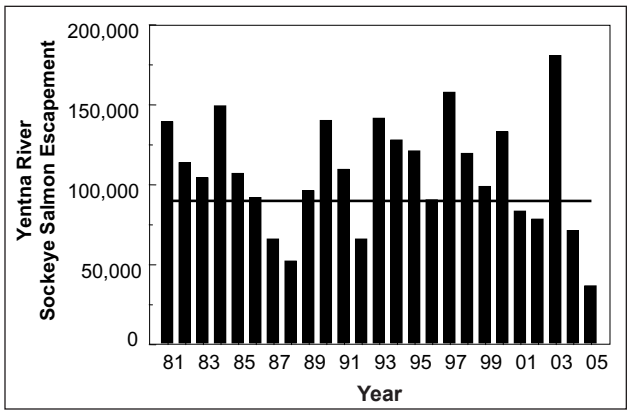


Figure 63. Sockeye salmon escapements from 1981–2005 in the Yentna River, Upper Cook Inlet and the lower end of the sustainable escapement goal range of 90,000–160,000.

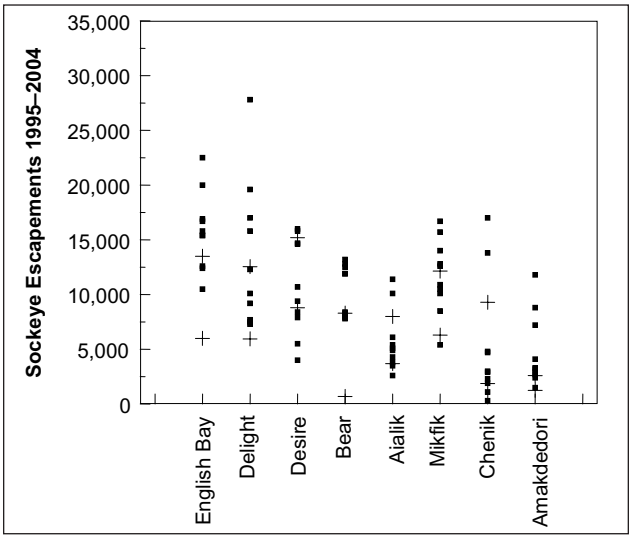


Figure 64. Sockeye salmon escapements from 1995–2004 for the 8 Lower Cook Inlet stocks with sustainable escapement goals (annual escapements shown as solid squares, lower and upper ends of sustainable escapement goal range shown as + signs).

sustainable escapement goal for coho salmon in Jim Creek is 450 to 700 fish (Figure 65) and this goal has been met or exceeded in 17 of the last 20 years (85%). Efforts have been made to count coho salmon in the Little Susitna River since 1988 and the sustainable escapement goal for the stock is 10,100 to 17,700 fish (Figure 66). The Little Susitna River escapement goal for coho salmon has been met or exceeded in 15 of the last 17 years (88%), however, the escapement in 1999 was substantially less than desired.

*Pink salmon*

There are 20 sustainable escapement goals in effect for pink salmon that spawn in streams of Lower Cook Inlet. Like pink salmon stocks elsewhere, spawning strength in individual streams shows tremendous variability from year to year. Observed annual counts of pink salmon escapement in 3 of the largest spawning populations in Lower Cook Inlet are shown in Figure 67, 68, and 69. In general, since statehood, abundance of pink salmon in Lower Cook Inlet has increased. Pink salmon escapement strength in the last 3 life cycles (since 1999) for even-year fish spawning in the Bruin River exceeded the sustainable escapement goal of 18,650 to 155,750 fish, while the odd-year line failed to achieve the goal in 1999 and 2001 but then exceeded the goal in 2003 (Figure 67). In the Rocky River, the sustainable escapement goal is 9,350 to 54,250 fish and both the even-year line and the odd-year line exceeded the goal in each of the last 3 life cycles of pink salmon (Figure 68). In Sunday Creek, the sustainable escapement goal is 4,850 to 28,850 pink salmon and both lines exceeded the goal in each of the last 3 life cycles (Figure 69). Ten of the other 17 sustainable escapement goals for spawning populations of pink salmon in Lower Cook Inlet are shown in Figure 70 along with observed escapement counts from 1995 to 2004. The 10 spawning popula-

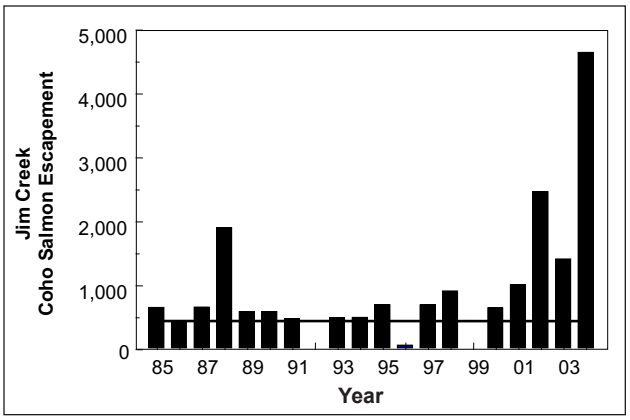


Figure 65. Coho salmon escapements from 1985–2004 in Jim Creek, Upper Cook Inlet and the lower end of the sustainable escapement goal range of 450–700.

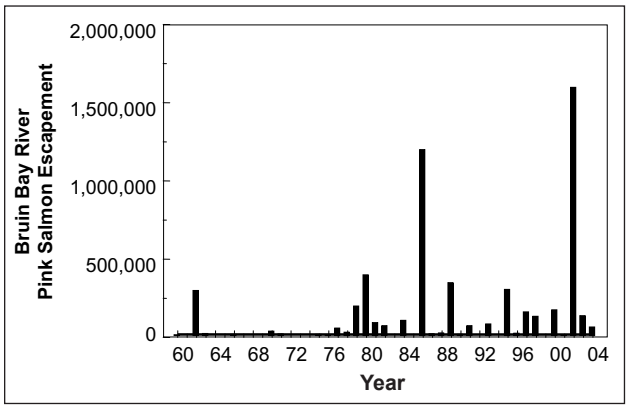


Figure 67. Pink salmon escapement counts from 1960–2004 in the Bruin River, Lower Cook Inlet and the lower end of the sustainable escapement goal of 18,650–155,750; counts not obtained in 1961, 1964, 1965, and 1968.

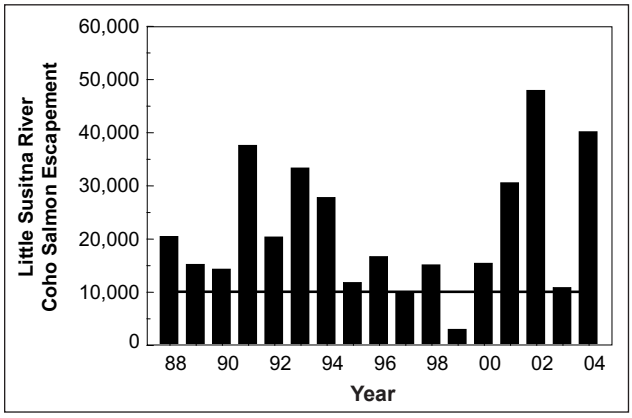


Figure 66. Coho salmon escapements from 1988–2004 in the Little Susitna River, Upper Cook Inlet and the lower end of the sustainable escapement goal range of 10,100–17,700.

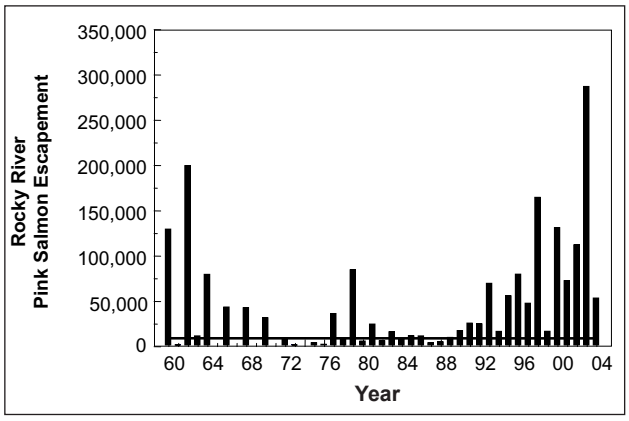


Figure 68. Pink salmon escapement counts from 1960–2004 in the Rocky River, Lower Cook Inlet and the lower end of the sustainable escapement goal of 9,350–54,250.

tions shown are the most numerous of the 17 stocks and have the most complete escapement observations. Of the 100 possible stock-year cells, the observed escapement exceeded the sustainable escapement goal in 87 cases (87%). Since 2000, for these 10 spawning populations of pink salmon, the rate of observed escapements exceeding the sustainable escapement goal was 96%. Like the Bruin River, Rocky River, and Sunday Creek pink salmon escapement counts, the observed escapements for these other 10 pink salmon populations often grossly exceeded the escapement goal (Figure 70).

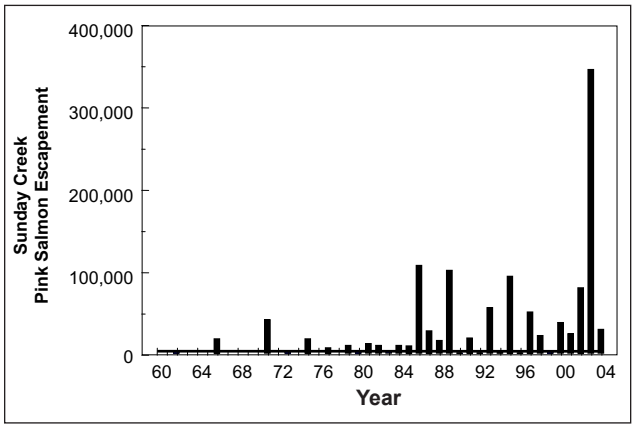


Figure 69. Pink salmon escapement counts from 1960–2004 in Sunday Creek, Lower Cook Inlet and the lower end of the sustainable escapement goal of 4,850–28,850; counts not obtained in 1961, 1964, 1965, 1967, and 1968.

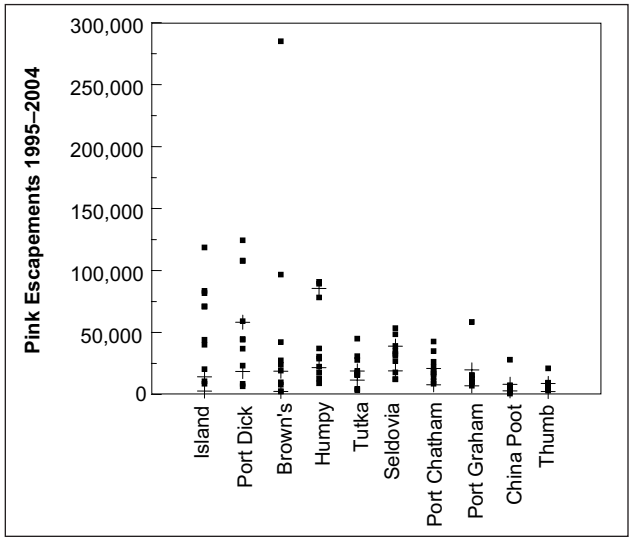


Figure 70. Pink salmon escapements from 1995–2004 for ten of the Lower Cook Inlet stocks with sustainable escapement goals (annual escapements shown as solid squares, lower and upper ends of sustainable escapement goal range shown as + signs).

*Chum salmon*

There are 12 sustainable escapement goals in effect for chum salmon spawning in Lower Cook Inlet and one sustainable escapement goal in effect for chum salmon spawning in Upper Cook Inlet. The largest stock of chum salmon in Lower Cook Inlet spawns in the McNeil River; the sustainable escapement goal is 13,750 to 25,750 fish. The McNeil River goal for chum salmon has been met in 15 of the past 21 years (Figure 71). Nine of the 11 other Lower Cook Inlet chum salmon stocks that have consistent escapement observations over the past 10 years are shown in Figure 72. Over the 10-year period of time, observed escapements have exceeded sustainable escapement goals for these 9 spawning populations of chum salmon in 87% of the cases (Figure 72). Since 2000, escapement goals for these 9 stocks of chum salmon have been met in 93% of the cases. In Upper Cook Inlet, the chum salmon that spawn in Clearwater Creek have a sustainable escapement goal of 3,800 to 8,400 fish. From 1989 to 2003, the goal was met in 11 of the 15 years (73%). Escapement was not counted in 2004 (Figure 73).

## Budget History and Fiscal Support

Many of the salmon stock assessment activities carried out in Cook Inlet are implemented and funded by the ADF&G Division of Sport Fish, including most for Chinook and coho salmon as well as several for sockeye salmon. Other organizations also implement stock assessment activities, such as the Cook Inlet Aquaculture Association, which funds and operates weir-based salmon enumeration programs and other activities in Cook Inlet.

The salmon stock assessment program implemented by the Division of Commercial Fisheries in

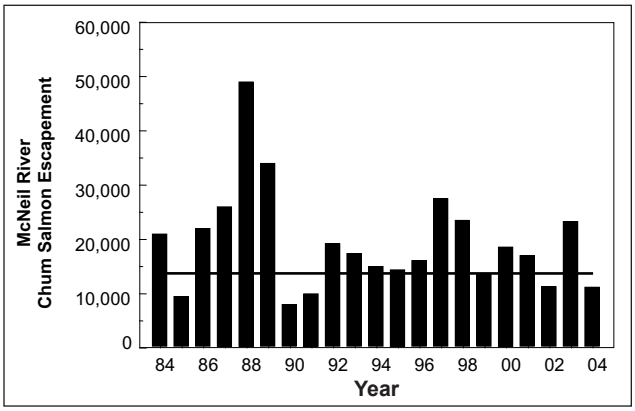


Figure 71. Chum salmon escapement counts from 1984–2004 in the McNeil River, Lower Cook Inlet and the lower end of the sustainable escapement goal of 13,750–25,750.

Lower Cook Inlet consists of about $60,000 for aerial and ground-based escapement surveys, about $15,000 to support a weir based salmon enumeration effort at Delight Lake, and about $40,000 for catch composition sampling. These modest funding amounts and the data they provide are used by the Homer-based staff to manage salmon fisheries in a sustainable manner in Lower Cook Inlet. Any significant improvement in the Lower Cook Inlet salmon stock assessment program will require additional fiscal resources over the modest amounts used for management in this area over the past 40 years.

Substantial program development has taken place in Upper Cook Inlet to assess sockeye salmon and much of the effort is funded and operated by the ADF&G Division of Commercial Fisheries. Sonar gear has been developed, purchased, and used over the past 30 years to count salmon passing upstream in the mainstems of the Kenai, Kasilof, and Crescent rivers as well as the Yentna River, a tributary to the Susitna River. These systems are all glacial and salmon cannot be observed visually. Development and application of sonar-based enumeration represented breakthrough technology in the 1970s. The annual implementation of these stock assessments has greatly assisted the fishery management program in Upper Cook Inlet. Operating costs for these 4 sonar-based escapement assessment efforts total about $200,000 per year. Salmon are counted and sampled for age–sex–size composition as they pass upstream at these 4 locations. While the sonar-based estimates of sockeye salmon passage have benefited fishery management in Cook Inlet, the estimates of passage have not been verified with other methodology since their inception in the 1970s.

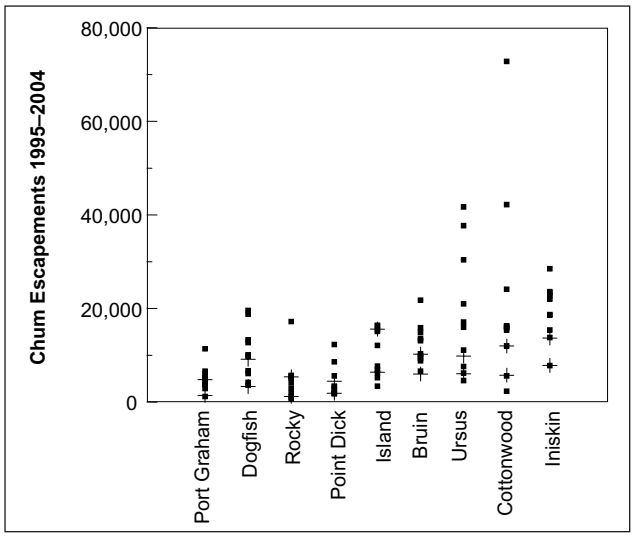


Figure 72. Chum salmon escapements from 1995–2004 for 9 of the Lower Cook Inlet stocks with sustainable escapement goals (annual escapements shown as solid squares, lower and upper ends of sustainable escapement goal range shown as + signs).

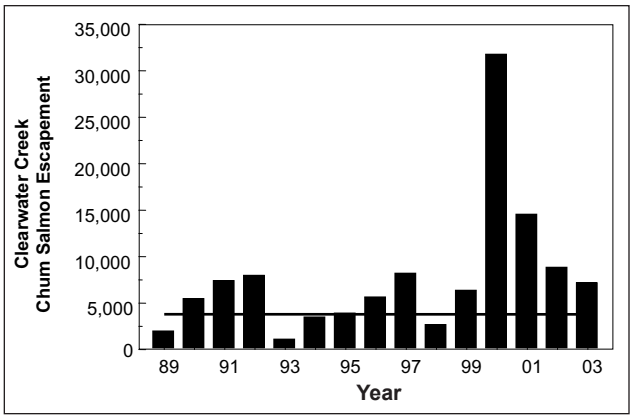


Figure 73. Chum salmon escapement counts from 1989–2003 in Clearwater Creek, Upper Cook Inlet and the lower end of the sustainable escapement goal of 3,800–8,400.

Commercial harvests of sockeye salmon in Upper Cook Inlet are monitored with the fish ticket system. These catches are sampled to estimate age composition of the harvest; costs for catch sampling are about $90,000 per year. In some areas of Cook Inlet, age composition has typically been used to estimate stock composition of the harvest under the assumption of equal exploitation by age class for major sockeye salmon stocks. This information is coupled with assumptions of single stock harvests in other areas. The estimates of stock- and age-specific catch and escapement data have been the basis for development of brood tables, which are used for both preseason forecasting capability and for estimation of stock productivity and identification of biological escapement goals. These efforts have provided the basis for about a 25-year set of paired estimates of escapements and subsequent recruitments for major stocks of sockeye salmon returning to Upper Cook Inlet. These same data can be used to estimate annual harvest rates exerted on these stocks of sockeye salmon. Examination of such estimated harvest rates on Kenai, Kasilof, Crescent, and Susitna-origin sockeye salmon from 1980 to 2005 indicates that very high sustained harvest rates have been exerted on the Kenai stock of sockeye salmon while conversely, moderate harvest rates have been exerted on the Crescent River stock (Figure 74).

While accuracy and precision of estimated annual catches, as well as annual age compositions of both escapements and catches, is considered to be excellent on a postseason basis, the allocation methodology used to apportion sockeye salmon catches to component stocks in Cook Inlet is little more than a crude approxi-

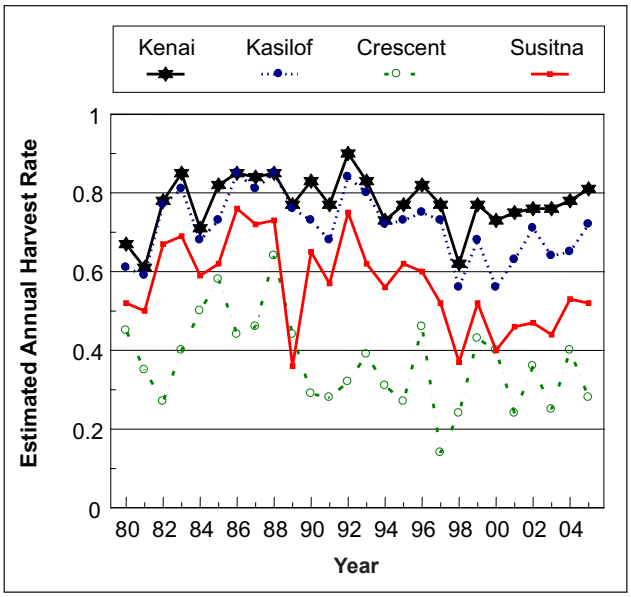


Figure 74. Estimated annual harvest rates for 4 stocks of Upper Cook Inlet sockeye salmon from 1980–2005.

mation of the actual catch by stock. Annual estimates of escapement are of unknown accuracy and precision and, as stated above, these sonar-based estimates have not been verified during the 30 years that they have been used for stock assessment in Upper Cook Inlet. Further, the escapement of the Susitna River stock of sockeye salmon is deemed double the sonar-based estimate derived from the Yentna River; concurrent sonar estimates made in the 2 rivers from 1981 to 1985 indicated the Yentna contributed, on average, 49% of the Susitna drainage escapement of sockeye salmon. The series of largely untested assumptions used to allocate stock composition is problematic. In some parts of Upper Cook Inlet, the assumption is made that sockeye harvests are comprised of a single stock. In other areas, it is assumed that all stocks are exploited at the same level on an age class basis. These assumptions need to be verified with scientifically based stock composition estimation techniques. In the 1980s and 1990s, sporadic efforts were made to implement better fishery science for catch allocations, but budget cuts, logistics, and technical concerns with the methodology resulted in a situation where methods used over the last several years are based on the approach described herein. This is a technical area of the stock assessment program that begged for improvement. Recent advances in DNA-based genetic stock identification methods provide the potential to develop accurate and precise scientifically-based stock composition estimates. In FY 06, with a new increment of general funds, the Division of Commercial Fisheries has embarked on a $250,000-per-year effort to implement genetic stock identification of sockeye salmon in Cook Inlet and hence improve the scientific basis of catch allocations. A test fish program implemented annually in Cook Inlet to gauge abundance of sockeye salmon entering Upper Cook Inlet (ongoing operational cost of about $70,000)—if coupled with inseason genetic-based stock composition—has the potential to provide abundance by stock, and thereby provide better inseason information for fishery management than currently exists.

Another major concern right now is stock assessment and status of Susitna River-origin sockeye salmon. Only the fish migrating in the Yentna are annually assessed and the Yentna River sockeye salmon sustainable escapement goal has only been met in one of the last 5 years (Figure 63). As a result, in 2006, ADF&G is planning to initiate a large-scale stock assessment effort in the Susitna River in an effort to better understand productivity and to document when and where Susitna River-origin sockeye salmon are caught in fisheries. This information will be used to develop an improved regulatory management regime. In FY 06, the Division of Commercial Fisheries obtained a new increment of $200,000 in operational funds for Susitna sockeye escapement assessment and has requested additional new funding in FY 07.

The Division of Commercial Fisheries faces several challenges in Cook Inlet. The Cook Inlet commercial salmon fishery is an important fishery in Alaska, yet the Division has had difficulty maintaining adequate fiscal resources needed to implement the intense inseason management and stock assessment effort required to manage sockeye salmon stocks in Upper Cook Inlet. Operational budget increments obtained in FY 06 for genetic-based stock identification and improved stock assessment in the Susitna River have helped the situation; however, additional resources are needed. The commercial fishing industry in Cook Inlet faces other challenges. Low prices paid for sockeye salmon since the early 1990s, even when coupled with strong annual harvests, have resulted in business failures for both fishermen (low exvessel prices) and processors (low first wholesale prices). Can the industry and fishery be restructured, can the fishery management regime be modified, and can the product be harvested and processed such that value increases with the end result being improved economic viability of the Cook Inlet commercial salmon fishery?