

**REGIONAL INFORMATION REPORT NO. 5J93-04**



**Preliminary Run Forecasts and Harvest Projections  
for 1993 Alaska Salmon Fisheries and Review of the 1992 Season**

**Edited by  
Harold J. Geiger  
and  
Herman Savikko**

**April 1993**

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PRELIMINARY RUN FORECASTS AND HARVEST PROJECTIONS  
FOR 1993 ALASKA SALMON FISHERIES AND REVIEW OF THE 1992 SEASON

Edited by

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and

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Division of Commercial Fisheries  
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## **AUTHORS**

Harold J. Geiger is the Statewide Salmon Biometrician for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 25526, Juneau, AK 99802.

Herman Savikko is a Fishery Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 25526, Juneau, AK 99802.

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## EXECUTIVE SUMMARY

The 1992 season resulted in a harvest of 136 million salmon. At this time last year, we predicted harvest of 139 million salmon. We predicted a harvest of only 43.8 million sockeye salmon, falling short of the actual 1992 harvest of 58 million. Our predicted harvest of 78.6 million pink salmon was above the actual 1992 catch of 59 million pink salmon. The exvessel value of the 1992 harvest was \$575 million, the second largest on record.

For the 1993 season, we are predicting a substantial increase in salmon harvest numbers, based on a large expected catch of 108 million pink salmon, statewide. Pink salmon catches in Alaska have exceeded 100 million only once, in 1991. We are expecting a catch of 48.0 million sockeye salmon in 1993, nearly unchanged from our 1992 projection but less than the actual 1992 catch. The expected harvest of all species combined is for a catch of 172 million salmon, which would be the second largest harvest on record.

We are continuing to refine and improve the forecasting methods for Bristol Bay sockeye salmon. Beginning with the 1991 forecast, the methods were changed to correct a chronic problem of underforecasting the Bristol Bay sockeye salmon run. Improved ocean conditions, reduced high-seas interceptions, improved fisheries management, and other factors have resulted in improved productivity of some Bristol Bay systems. The new forecasting methods considered this improved productivity, when forecasting future salmon production based on historical relationships. We believe the new methods will be more accurate and precise, but we wish to caution readers that the new forecast is less likely to be low. In spite of the correction for underforecasting, we have continued to underforecast the actual run. The 1992 forecast was for an inshore run of 37.2 million sockeye salmon to Bristol Bay, whereas the actual inshore run was 45.2 million.

The major fishing areas within the Southeast, Central, and Western Statistical Areas are shown in Figure 1. These regions and areas are the ones used in the Department's statistical leaflet series and prior statistical reports.

Forecasts of runs (catch + escapements) for major salmon fisheries and projections of the statewide commercial salmon harvest have been published yearly by the Alaska Department of Fish and Game since 1969 (ADF&G 1969-1984; Eggers 1985, 1986; Eggers and Dean 1987, 1988; Geiger and Savikko, 1989-1992). The Alaska Department of Fish and Game does not produce formal run-size forecasts for all salmon runs in the state but local salmon biologists do prepare harvest projections or harvest outlooks for all areas. These projections are based on formal forecasts, when available; when the formal forecasts are not available, local biologists use average historical catches and local knowledge of recent events to develop these outlooks. The projections for the 1993 Alaska commercial salmon harvest, by species and area are found in Tables 1 and 2. The harvest outlooks for AYK Region are developed as ranges; a table of these ranges is found in Appendix B.1. Trends in total statewide salmon harvests and catch projections in numbers of fish by species are found in Figures 2-6.

This report contains a detailed review of Alaska's 1992 commercial salmon season. We normally release it before final catch figures are available to provide preliminary information to the Board of Fisheries, the fishing industry, and the public well before the next season begins.

Predominate ages and brood years for 1993 salmon runs by species are as follows:

Species	Age of Returning Salmon in Years				
	2	3	4	5	6
Pink	1991				
Chum		1990	1989	1988	
Coho		1990	1989		
Sockeye			1989	1988	1987
Chinook			1989	1988	1987

The common and scientific names for Alaska's Pacific salmon species are as follows:

<u>Common (and Vernacular) Names</u>	<u>Scientific Name</u>
chinook, (king)	<i>Oncorhynchus tshawytscha</i>
sockeye, (red)	<i>Oncorhynchus nerka</i>
coho, (silver)	<i>Oncorhynchus kisutch</i>
pink, (humpy, humpback)	<i>Oncorhynchus gorbuscha</i>
chum, (dog)	<i>Oncorhynchus keta</i>

## DEFINITION OF TERMS

Commercial Harvest:	Harvests of fish that are sold for commercial purposes. This includes fish caught by the commercial common property fishery (see below) and by hatchery operators for cost recovery; it excludes sport, subsistence, and personal use harvests.
Commercial Common Property Harvest:	Harvests taken by the traditional competitive commercial fisheries (gillnet, purse seine, troll, etc.), as opposed to other commercial harvests resulting from hatchery cost recovery, fishing derbies, confiscated fish, etc.
Common Property Harvest:	Harvests taken by the commercial common property fisheries (see above), as well as the sport, subsistence, and personal use fisheries. (Note, this excludes hatchery harvests, etc.)
Cost Recovery Harvest:	Harvests of hatchery returns by hatchery operators in specially designated areas; these harvests fund the operation of hatcheries and other enhancement activities.
Enhancement of runs:	Hatcheries and other means of artificial propagation to create salmon runs or make existing salmon runs larger. Enhancement includes remote fish stocking, fertilization of lakes, and other techniques.
Escapement, spawning population or brood stock:	The portion of a salmon run which is not harvested and survives to reach the spawning grounds or hatchery.
Harvest projections or harvest outlooks	Harvest outlooks are the best available estimates of upcoming harvest levels. Prepared by local biologists, outlooks are based on formal run forecasts, when available. At other times outlooks are based on historical average catches, subjectively adjusted based on recent trends and local knowledge.
Run Forecast:	Forecasts of the run (harvests + escapement) are estimates of the fish returning in a given year based on information such as parent-year escapements, subsequent fry abundance, spring sea water temperatures, and escapement requirements. (Note: run forecasts are generally thought to be more reliable than harvest outlooks, but run forecasts are provided only for selected areas.)
Salmon Run:	The total number of mature salmon returning in a given year from ocean rearing areas to coastal waters.

## PRELIMINARY REVIEW OF THE 1992 ALASKA COMMERCIAL SALMON SEASON

The 1992 Alaska commercial salmon harvest of over 136 million salmon was in line with the state's most recent 10-year average catches. The exvessel value of the 1992 harvest was the second largest on record, with a catch worth over \$575 million to the fishing fleet. This compares to the record exvessel value of about \$750 million in 1988.

The 1992 season produced a record sockeye salmon catch of over 58 million fish worth over \$445 million exvessel. That value alone far exceeds the entire 1991 all-species, commercial salmon harvest exvessel value of \$310 million. Sockeye salmon accounted for about 43% of the statewide harvests, and this year's record catch was fueled by the second largest catch in Upper Cook Inlet's history, and the third largest catch in Bristol Bay's history. Commercial fishermen caught about 59 million pink salmon around the state, accounting for about 44% of the total salmon landing, down considerably from the 128 million pink record established in 1991. Chum salmon landings continued a recent downward trend, and represented about 7% of the Alaska harvest. Coho and chinook catches contributed 5% and less than 1% to the statewide total, respectively.

There are approximately 12,000 limited entry salmon permits in Alaska. The 1992 season again presented a mixed bag for those permit holders. Most drift fishermen willing to do battle in Bristol Bay's Egegik District did exceptionally well. Cook Inlet drifters and eastside setnetters took advantage of a sockeye return far stronger than anticipated. Southeast seiners targeted on a strong return of pink salmon. However, for others the season was a major disappointment. Pink salmon runs did not meet projected numbers in Prince William Sound, Lower Cook Inlet, and Kodiak. Weak fall chum salmon returns to the Yukon prevented any commercial fishery during the fall season. Some setnetters in Cook Inlet and Bristol Bay had little opportunity because of the nature of salmon returns to the river systems they fished. A summary of the state's major commercial fisheries follows, and specific catch figures can be found in Tables 3 through 7.

### *Southeast Alaska*

The 1992 Southeast Alaska commercial salmon harvest totaled 46.5 million fish (see Table 4). In 1992, 2.7 million sockeye salmon, 3.7 million coho salmon, and 5.0 million chum salmon were harvested in Southeast Alaska setting new record harvest levels for all three species. Harvests of these three species were about 2.5 times the respective 1960-1991 averages. The exvessel value of the region's salmon harvest exceeded \$92.3 million, compared to \$71.8 million in 1991 and \$95.4 million in 1990. Sales of sockeye and coho salmon accounted for over half of the exvessel earnings.

The pink salmon harvest in Southeast Alaska totaled 35.0 million fish in 1992, which is just under the 1982-1991 average of 36.0 million but well above the 1960-1991 average of 19.4 million. The preseason prediction called for a harvest in Southeast Alaska of 30.0 million. While the overall harvest was close to expectations, the distribution of the harvest was not accurately forecasted. The preseason harvest predictions were 27.0 million pink salmon in southern Southeast, 2.2 million in northern Southeast, and 0.8 million from hatchery production. Actual harvests totaled about 19.0 million in southern Southeast,

12.8 million in northern Southeast. No studies were conducted to assess the actual contribution of pink salmon to Southeast hatcheries, but fishery managers assumed about 2.5 million pink salmon came from Southeast hatcheries in 1992. Purse seine fishermen took 85% of the pink salmon harvested in 1992. The exvessel price paid for seine-caught pink salmon averaged \$0.15/pound—less than half the 1990 average of \$0.31/pound but better than the \$0.13/pound average in 1991. Overall escapement goals were achieved for pink salmon in both northern and southern Southeast. However, escapements to some individual districts were below target.

Escapements of sockeye, chum, coho, and chinook salmon in the region were generally good to excellent. All principal sockeye systems had escapements that were at or above goals, and record escapements were observed in Crescent and Hugh Smith Lakes. Escapements of summer and fall run chum salmon were below average in Lynn Canal systems but were characterized by managers as “good” in most other districts. Over 46,500 chum salmon were counted through a weir on Fish Creek at the head of Portland Canal, making this one of the largest escapements ever observed in this system. Escapements of coho were well above average in all systems routinely surveyed for this species. Chinook escapements were good in the Taku River and excellent in the Stikine and Situk Rivers but poor in the Alsek River and in Behm Canal/Boca de Quadra systems (Unuk, Chickamin, Blossom, and Keta Rivers). The preliminary estimate of about 66,000 chinook salmon escapement to Southeast Alaska and transboundary rivers increased for the first time since 1988. The 1992 estimate compares with an estimate of 57,000 from 1991.

Alaskan hatcheries continued to contribute coho and chinook salmon in relatively large numbers. Alaskan hatcheries contributed over 300,000 coho salmon and 24,000 chinook salmon to the 1992 Southeast Alaska troll fishery; or 21% and 13%, respectively, of the troll catch. Canadian and southern U.S. hatcheries contribute relatively few coho salmon to Southeast Alaska fisheries, but 75% of the 111,000 hatchery-origin chinook salmon harvested by troll and net fisheries in 1992 came from hatcheries in British Columbia, Washington, and Oregon.

Harvests of chinook salmon in the winter troll fishery (1 October 1991 to 14 April 1992) totaled 71,718 fish. The June Experimental Fishery, the Hatchery Access Fishery, and terminal troll fisheries harvested 39,265 chinook salmon. The summer troll fishery on 1–4 July and 23 August harvested 72,543 chinook salmon. The 4.5-day, summer troll season for chinook salmon was the shortest ever a consequence of a restrictive harvest ceiling and high chinook salmon abundances. The total all-gear chinook harvest for the 1992 accounting year is currently estimated to be 260,829 fish. Subtracting an Alaska hatchery add-on—the credit Alaskan fishermen get in the Pacific Salmon Commission negotiations for chinook salmon produced from Alaskan hatcheries—of 38,073 leaves a base catch of 222,756 chinook salmon. The troll harvest of 1.9 million coho was the second highest since statehood.

Purse seine harvests of sockeye, coho, and chum salmon in both southern (Districts 101–108) and northern (Districts 109–114) areas greatly exceeded 1982–1991 averages. Pink salmon harvests were well above average in northern districts but below average in the southern districts. The Department generally managed openings with a 2-days-on/2-days-off schedule. This schedule was consistent with that requested by the industry and appeared to provide orderly harvesting, processing, and catch reporting. A record harvest of over 1.3 million sockeye salmon was driven by a record harvest of almost 1.1 million in District 104. Pacific Salmon Commission staff estimate that 88,000 Fraser River sockeye salmon were intercepted in District 104 this season.

In the Southeast Region's drift gillnet fisheries, sockeye catches were 35% above average and coho catches set a record with the 1992 catch of 696,000, over twice the 1982-1991 average. Hours fished was above average in all districts except Lynn Canal (District 115). Coho catches were especially high in Districts 106 and 111. Chum catches were above average in all districts, except District 115 where they were 31% below average due to the very poor returns of late fall chum. Pink catches were below average in Districts 101 and 106 and were well above average in Districts 108, 111, and 115; the catch of 352,500 pink salmon in District 115 set a record.

The Yakutat Area set gillnet harvest of 313,000 sockeye salmon was 50% above the recent 10-year average and it was the third highest catch since statehood. The coho harvest was 293,000, the highest since 1941. The total area salmon harvest of 634,000 also makes 1992 the largest harvest since 1941. The East River fishery was the main producer with a sockeye harvest of 144,300 fish. This was the fourth highest sockeye catch for the East River fishery on record. The other main sockeye producer in the area, the Situk-Ahrnklin Inlet, also showed a remarkable production. The total sockeye harvest of 105,000 fish was the second highest for the Situk-Ahrnklin fishery since 1954. It was 2.5 times the recent 10-year average.

### *Prince William Sound*

The 1992 Prince William Sound Area commercial salmon harvest of 11.4 million fish was the smallest since 1978. The failure of pink salmon to return in projected numbers was the cause of the small harvest. The area harvest was composed of 8.6 million pink, 1.8 million sockeye, 618,000 coho, 334,000 chum, and 41,000 chinook salmon. The majority of the catch, 8.0 million, was taken in the commercial common property fisheries, and 3.4 million were sold for hatchery cost recovery and test fisheries.

The estimated value of the combined commercial salmon harvest was \$36.6 million, including hatchery sales. The drift gillnet catch was valued at \$27 million, setting the average earnings of the 528 permits at \$51,136. The set gillnet catch was valued at \$1.6 million, setting the average earnings of the 30 permits at \$53,333. The seine fishery was worth \$3.6 million for an average exvessel value of \$17,391 for the 207 permit holders. Revenue generated for hatchery operations through fish sales was \$4.35 million.

Prince William Sound is comprised of 11 management districts that correspond to the local geography and distribution of the five species of salmon harvested by the commercial fishery. The Copper River District commercial sockeye salmon fishery is the first salmon gillnet fishery in the state each season. The first period in the Copper River District was set for 12 hours on May 15. The 1992 sockeye harvest projection was 960,000 salmon, versus the 10-year average of 850,000 sockeye salmon. The harvest projection for chinook salmon was 41,000, slightly above the 10-year average of 36,000 chinook salmon. The traditional fishing schedule for the Copper River District is two 24-hour periods each week.

During the spring of 1992, clear skies and cold temperatures delayed spring breakup for the Copper River Valley. The late breakup reduced water flow out of the Copper River. This raised concern as to whether chinook and sockeye salmon would migrate into fresh water or remain offshore in the commercial fishing area waiting for conditions to change. Chinook catches started off quite strongly, however, and final landings of 39,810 fish were just slightly below preseason projections. Sockeye catches lagged severely at the beginning of the season, but final catches of nearly 971,000 fish were slightly over projection.

Coho management began in early August. The preseason outlook projected a harvest of 313,000 coho salmon from the Copper River District. The outlook is the average harvest from the past 10 years. The season ended September 23 with 297,000 coho salmon harvested.

The Bering River District opened June 15, with a 12-hour period. The Bering River District is opened simultaneously with each Copper River District open period. The preseason harvest outlook was 20,000 to 30,000 sockeye salmon; the actual harvest was 19,900.

Approximately 125,000 coho salmon were harvested in the Bering River District, which was very close to the preseason harvest projection. The fishing schedule was slightly less than the Copper River District due to the lower-than-anticipated escapement.

In the Esther Subdistrict, the Noerenberg Hatchery expected a return of 1.09 million early chum salmon. The actual harvest was 334,373 chum salmon (173,595 salmon to the commercial common property fishery and 160,778 fish for the corporate escapement). The harvest strategy was to minimize interception of Coghill Lake sockeye salmon, provide for corporate escapement, and permit the timely harvest of surplus chum salmon by the commercial fleet. The season opened on June 11 to an initial schedule of two 24-hour periods/week. The harvest during the first period was 4,000 chum salmon, which was much less than expected. With corporate escapement at only 3% of the anticipated number, the fishery was closed after the first period. On June 29, the second 24-hour period, the fishery reopened due to a significant increase in the collection of brood stock. However the inseason corporate escapement goal was not achieved.

The 1992 hatchery annual management plans for Noerenberg Hatchery chum salmon and Main Bay Hatchery sockeye salmon allowed the Prince William Sound Aquaculture Corporation (PWSAC) the option of having both species managed collectively. On July 1, PWSAC requested that ADF&G begin aggregate management. The management goal was to provide 30% of the value of the combined chum and sockeye salmon returns for corporate escapement. Rather than basing management decisions on number of fish by facility, the department simultaneously tracked the harvested weight and value of both the chum and sockeye returns.

The fishery was closed after the July 17 period to protect escapement of wild pink and chum salmon of the northwestern sound. Through August 2, about 29,642 sockeye salmon escaped at Coghill Lake, meeting the interim goal of 30,000.

The projected hatchery return of coho salmon was 235,000 during August and September. The coho run overlaps during August with the pink run to the Noerenberg Hatchery. The Esther Subdistrict is primarily managed for pink salmon during August and primarily for coho salmon during September. The coho salmon harvest in the Esther Subdistrict was 156,603 (112,415 commercial common property fishery and about 44,188 for the corporate escapement).

The Main Bay Hatchery expected 740,000 sockeye salmon to return. The sockeye harvest in the Esther Subdistrict was 684,250 (517,520 commercial common property fishery and 166,730 for the corporate escapement). The harvest strategy was two 36-hour periods per week in the entire Eshamy District. Beginning in mid-July emphasis on wild sockeye, pink, and chum salmon would take precedence over the hatchery return. This was the first season a cost recovery harvest occurred at Main Bay.

In preparation for the Prince William Sound purse seine fishery, aerial surveys to assess early chum and pink salmon in the Eastern and Northern Districts began in late June. By early July surveys started in the Coghill/Northwest/Eshamy area, and in late July the Southwestern, Montague, and Southeastern areas. Few chum or pink salmon were sighted during June and early July. This weak trend of low escapements continued from the eastern sound to all districts throughout the summer. In all areas except the Southwestern District, escapement never exceeded 60% of the season's desired goal. The Eastern, Southwestern, Montague, and Southeastern Districts achieved between 40% and 65% of their goal, whereas the Northern, Coghill, Northwestern, and Eshamy districts received 40% or less of their desired goal.

Valdez Fisheries Development Association (VFDA) started pink salmon cost recovery harvesting on June 22 at Solomon Gulch Hatchery and June 24 at the Boulder Bay remote release site. By July 7 only 910,000 fish were collected for corporate escapement. Based on ADF&G's forecast of 4 million, over 2 million fish should have returned by July 7. The peak of the VFDA pink run typically occurs between July 4-6. VFDA's annual management plan called for the first commercial fishery after 40% of the revenue goal was attained. If 40% of the sales goal could not be met until late in the run, then the first commercial opening would occur at the peak of the run. If VFDA's assumptions for average weight, value, and marine survival were optimistic and the revenue goal was not obtainable, then VFDA guaranteed a minimum of 1 million fish to the commercial fleet.

The run peaked on and the 40% revenue goal was obtained by July 11. The seine fishery opened on July 11 for 12 hours in Valdez Arm and the western portion of Port Valdez. The harvest by 54 vessels was only 143,000 pinks. On July 13, VFDA requested Salmon Harvest Task Force members to discontinue the commercial fishery to allow for more corporate escapement. Since there was not unanimous agreement from Task Force members the fishery proceeded. Due to consideration of wild stocks, the fishery directed on the VFDA return was confined to the western portion of Port Valdez. This area opened on July 14 and was extended until July 20. From July 14-20 only 345,542 pinks were caught. Due to the weak run the 1 million fish guarantee to the commercial fleet was not met. The total harvest was 2.14 million or approximately one-half of the ADF&G forecast. VFDA collected 1.65 million pink salmon for corporate escapement, and the commercial fishery harvested 489,000. The return to Boulder Bay was extremely weak and there was no commercial fishery there.

Pink salmon returned to the Prince William Sound Aquaculture Association (PWSAC) hatcheries in late July and August. The forecast called for a total pink salmon hatchery return of 24 million. Based on unutilized salmon in 1991 and a review of processing capacity for 1992 by the Department of Commerce and Economic Development, an internal waters permit was issued to Oceantrawl Incorporated of Seattle, Washington. Oceantrawl brought in the Russian vessel BATM Pioneer Nicolaeva to help process the expected large pink salmon run.

By July 27 the hatchery return was less than 25% of the expected. The Salmon Harvest Task Force recommended a commercial opening on July 27 and 30. The openings were for 6 hours in the general waters of the Southwestern District and 12 hours in the three hatchery subdistricts. The harvest was 201,000 pink salmon on July 27 and 310,000 on July 30. Based on these low harvests, the period scheduled for August 1 was cancelled. Fish entry into the sound was assessed on August 1 with volunteer sets from several seine vessels. Test sets did not indicate a large volume of salmon entering the sound.

During the four succeeding commercial periods (August 3-11) fishing occurred in hatchery subdistricts and general waters of the Southwestern District. General waters alternated between the Montague Strait



corridor and the Knight Island corridor by period. During this time, harvests ranged from 444,000 to 618,000 pink salmon per period. The percentage of females in the hatchery sales harvests indicated the run peaked at each hatchery between August 10–15.

Beginning with the August 14 period and continuing for the remainder of the season, all seine openings were confined to the hatchery terminal harvest areas. The Cannery Creek Hatchery terminal harvest area closed for the season on August 25. Beginning August 25 and continuing until September 5, seine periods were scheduled in the waters of Lake and Quillion Bays of the Esther Subdistrict. The Port San Juan Subdistrict was open periodically until September 9.

The seine fleet harvested 4.37 million pinks from July 27 until season's end. The cumulative seine fleet harvest was 4.86 million for the entire summer. Preliminary information indicates that marine survival for both PWSAC and VFDA was about 1.5 to 1.7%. The average weight of pink salmon was approximately 3.4 pounds.

VFDA and PWSAC harvested 3.35 million fish for cost recovery. PWSAC fell short of their sales revenue goal by about \$4.7 million, and VFDA fell short of their revenue goal by about \$1.2 million.

### *Upper Cook Inlet*

The harvest of 10.4 million salmon for 1992 is virtually indistinguishable from the all-time record harvest of 10.45 million set in 1987. The high percentage of sockeye salmon in the harvest, coupled with a rise in sockeye prices, resulted in an exvessel value of approximately \$104 million, an eight-fold increase over 1991.

The harvest of 8.9 million sockeye salmon was the second highest catch on record, falling short of only the 9.5 million harvest of 1987. The 1992 sockeye harvest was valued at \$99.7 million and constituted 96% of the overall fishery value. The fishery was dominated by an extremely strong return of Kenai River sockeye salmon with most other returns ranging from above average to weak. The great disparity in stock strengths created substantial management problem, as managers tried to allow the harvest the large Kenai River return while still affording sufficient protection to a weak return to the Susitna River. A somewhat liberalized driftnet fishery and intense fishing in the east side set gillnet fishery succeeded in holding the Kenai River sonar count to roughly 1 million fish, still well above the maximum goal for this river of 700,000. Severe restrictions of the Northern District setnet fishery were required to assist the Susitna River sockeye escapement where the Yentna River sonar count of 66,000 fell well short of the minimum goal of 100,000. Escapements in other systems were generally well within desired ranges.

The 1992 harvest of 351,000 chum salmon was well below average for this species. This was due in part to an apparent weak return, and the fishing pattern implemented in the drift fishery to focus harvest on Kenai-bound sockeye salmon, while closing those waters where large numbers of chum salmon have been traditionally taken. While no precise estimate of Susitna River chum salmon escapement is available, subjective observations indicate freshwater abundance was fair. The exvessel value of the chum salmon harvest was estimated at just over \$1 million.

The 1992 harvest of 677,000 pink salmon maintains a pattern of weak even-year pink salmon harvests in Upper Cook Inlet following severe damage to spawning areas during fall floods in 1986. Recently we observed a steady recovery but this recovery was not sustained in 1992, repeating a general pattern of poor pink salmon returns throughout southcentral Alaska. Escapement levels in the Susitna River were poor, and the return to the Kenai River, as indicated by the daily harvest levels in the east side setnet fishery, was one of the poorest on record. The 1992 pink salmon harvest was valued at \$335,000.

The 1992 Upper Cook Inlet coho salmon harvest of 457,000 was significantly above average, following a general trend of strong coho salmon catches over the past decade. This was effected by a fishing pattern imposed on the drift fishery for sockeye management during the peak of the Susitna coho salmon return and closure of the Northern District setnet fishery during the same time. Reduced exploitation of Susitna-bound coho salmon provided good, though not exceptional, escapements. The early run of coho salmon to the Kenai River was subjected to intense commercial fishing pressure during the initial portion of the return due to the large Kenai River sockeye run. Daily harvests in this fishery indicated a fairly strong return of coho salmon through mid-August, but freshwater abundance appeared below average as indicated by catch rates in the recreational fishery. Minor stocks of coho salmon throughout the Northern District and the western Central District were generally average to above-average in strength. The exvessel value of the commercial coho salmon harvest was estimated at \$2.2 million.

The chinook salmon harvest of 16,700 was slightly below the long-term average but roughly equal to the average under the present regulatory structure. The weak return of chinook salmon to the Susitna River drainage was reflected in the Northern District directed chinook salmon fishery where the harvest of 3,900 was by far the worst in the 7-year history of this fishery. The final scheduled period of the fishery was closed by emergency order when conservation concerns arose and broad restrictions were implemented on many recreational fisheries.

The return of late-run Kenai River chinook salmon was somewhat below average and exhibited the latest run timing on record. When final spawning escapement projections fell below the 19,000 level in late July, the inriver recreational fishery was limited to catch-and-release for the remainder of the month. The eastside commercial fishery was also limited to regular periods until the sockeye escapement level was projected to exceed 700,000 as directed by the Late-Run Kenai River Chinook Salmon Management Plan. The commercial fishery limitation lasted only for several days but came during a time when large numbers of sockeye salmon were moving to the river along the beaches. The final spawning escapement of 23,326 chinook salmon was approximately 1,000 fish above the optimum goal.

The estimated exvessel value of the Upper Cook Inlet chinook salmon harvest was \$627,000.

### *Lower Cook Inlet*

Following the poor 1990 and 1991 seasons, the 1992 salmon fishery was an economic disaster for Lower Cook Inlet fishermen. The total salmon harvest of 685,000 fish accounted for only 38% of the preseason forecast. Pink salmon comprised 70% of the overall harvest, but the low prices offered again this year for pink salmon contributed to an overall exvessel value of \$1.4 million, the lowest since 1976. Hatchery cost recovery continued to play an increasingly significant role in Lower Cook Inlet. Of the total salmon harvested in Lower Cook Inlet, 43% were taken by Cook Inlet Aquaculture Association to support the

sockeye lake stocking program and Tutka Hatchery operations. Cost recovery efforts in Chenik and China Poot Subdistricts for sockeye salmon, and in Tutka Bay Subdistrict for pink salmon, composed 9.1% and 57.5% of the total Lower Cook Inlet sockeye and pink harvests, respectively. Table 5 shows catch, by district and species for Lower Cook Inlet.

Pink salmon returns, normally the dominant species in Lower Cook Inlet, were exceedingly weak. The harvest of 480,000 pink salmon was half of the long-term average, and only 42% of the preseason forecast. Hatchery fish as well as wild salmon experienced poor survival. For the third straight year the Tutka Hatchery return was considerably less than forecast. Despite a projected harvest of 685,000 pink salmon from Tutka Bay and Halibut Cove Lagoon—a secondary release site for Tutka Hatchery fry—these projects contributed only 98,000 fish to the commercial catch this season. After broodstock collection, which accounted for 70,000 salmon, and cost recovery, which accounted for 276,000 harvested, very few fish were left to harvest in the commercial common property fishery.

The total sockeye harvest of 177,000 was considerably less than the preseason projection of 483,000 fish. This year's catch was only 25% of the 1982–91 average, reversing the upward trend in sockeye production from FRED Division enhancement efforts over the last decade. Sockeye salmon only accounted for 26% of the landings in 1992 but still composed 78% of the total value of the Lower Cook Inlet fishery.

Sockeye returns to FRED Division's enhancement projects, which provided the bulk of the sockeye salmon harvested in recent years, were very disappointing. The Chenik Lake harvest of 14,000 was only 11% of the expected catch of 125,000 sockeye salmon. In the Southern District, the Leisure Lake stocking project produced a catch of 64,000, just slightly more than half the preseason expectation of 100,000 fish.

The chum salmon harvest of 22,200 fish was the fifth lowest on record. The catch was only 19% of the long-term average and continued a dramatic decline in the Lower Cook Inlet chum harvest for a fourth straight year. The poor returns were generally anticipated and conservative fishing schedules were implemented early in the season throughout the Kamishak and Outer Districts to protect chum salmon stocks. The conservative strategy paid off as most escapement goals were achieved, although some west side systems still fell below desired levels.

The preliminary coho harvest estimate of 4,400 was only 40% of the long-term average. The catch was almost equally split between the Southern District and the Kamishak Bay District. The coho runs appeared to be delayed approximately one week in the Southern District. Since the subsistence fishery lasted only one week, the delayed run timing apparently helped bolster escapement into the Fox River drainage where aerial surveys produced a relatively strong index (850 fish) in Clearwater Slough.

The chinook salmon are a non-target species for Lower Cook Inlet commercial fishermen. This year's harvest of 1,890 chinook salmon reached the historical record catch. Enhanced production in Halibut Cove Lagoon and Seldovia Bay were assumed to be the cause. Set gillnets accounted for 68% of the catch.

## *Bristol Bay*

The bay-wide salmon harvest for all species in 1992 totaled approximately 33.6 million fish. Sockeye salmon made up 32.0 million of that total. The commercial chinook salmon harvest totaled approximately 69,000 fish, well below the 1972–1991 average harvest of 108,000, but an improvement over the 36,000 fish harvest of 1991. The chum salmon harvest totaled 885,000 fish, the smallest harvest since 1975 and well below the 1972–1991 average harvest of 1.16 million. The pink salmon harvest totaled only 494,000 fish, far below the 1972–1991 mean even-year harvest of 1.7 million. Pink salmon catches were below normal in all districts except Togiak. The preliminary coho salmon harvest totaled approximately 191,000 fish, slightly above the 1972–1991 average harvest of 187,000 fish. The estimated exvessel value of the 1992 Bristol Bay salmon fisheries totaled \$191 million, the second largest exvessel value on record, exceeded only by the \$200 million record value attained in 1990. The 1981–1991 mean exvessel value was \$138 million. The 1992 figure should be viewed as a minimum estimate, as the final exvessel value will reflect future price adjustments, loyalty bonuses, and other compensation.

The inshore run of sockeye salmon totaled 45.2 million fish, approximately 21% greater than the preseason forecast of 37.2 million. As mentioned above, the harvest of sockeye salmon totaled 32.0 million. This was the third largest sockeye harvest on record for Bristol Bay, trailing only the catches of 37.4 million in 1983, and 33.2 million in 1990. The total sockeye salmon run to inshore Bristol Bay was the fifth largest recorded over the 41 years (1952–1992) that total run has been observed. It far exceeded the mean of 23.0 million. The largest total run on record occurred in 1980 when 62.5 million sockeye salmon returned. A total of 13.3 million sockeye salmon entered the escapement in 1992.

Sockeye runs were larger than anticipated in all districts except the Naknek-Kvichak, and all rivers except for the Kvichak met or exceeded escapement goals. The Kvichak River escapement of 4.7 million exceeded the lower escapement range of 4.0 million. The Egegik and Ugashik Rivers exceeded escapement goals by large margins. The Egegik District sockeye harvest of approximately 15.7 million fish is the largest on record breaking the previous high of 10.1 million set in 1990. The Ugashik District harvest of approximately 3.4 million sockeye salmon is the third largest on record trailing only catches of 6.5 million in 1985 and 5.0 million in 1986. The Togiak District harvest of 704,000 sockeye salmon is the second largest on record, trailing only the harvest of 822,000 in 1988. The Naknek-Kvichak District sockeye harvest of 9.3 million fish was above the 1972–1991 (20-year) average of 7.9 million, and the Nushagak District harvest of 2.9 million sockeye salmon was also slightly above the 20-year average harvest of 2.8 million.

Given the record setting sockeye harvest at Egegik, the weaker-than-expected run to the Kvichak, and the later-than-usual sockeye run at Ugashik, potential interception of sockeye salmon in the Egegik District was a topic of concern during the season. On one occasion the size of the Egegik District was temporarily reduced when the lateness of the Ugashik District escapement made attainment of the lower escapement range a major point of concern to management. However, the Ugashik run came pouring into Ugashik River on the morning of the line change. The problem seemed to be due mainly to fish simply staging outside the Ugashik District for longer than usual, rather than harvest elsewhere. The Egegik boundaries were later reinstated to their preseason configuration.

The chinook salmon run to most Bristol Bay districts was smaller than normal for the seventh consecutive year. Commercial harvests were far below average in every district. This marks the seventh consecutive year that commercial chinook harvests from Bristol Bay have been below average.

The 1992 coho salmon harvest totaled 191,000 fish, slightly above the 1972–1991 average harvest of 187,000. Harvests were average or above in all districts except Togiak. The Togiak coho harvest of 4,900 fish was about one-tenth the 20-year average harvest for this district. No coho escapement surveys were flown this year. The Portage Creek sonar counter operation in the Nushagak River was also curtailed too early to yield an assessment of coho escapement strength. With no daily assessment of coho run strength available, and with incidental indicators suggesting a weak coho escapement into the Nushagak River, the Nushagak commercial fishery was closed for the remainder of the season on August 15.

### *Kuskokwim Area*

The commercial salmon catch for the Kuskokwim River and Kuskokwim Bay fisheries was composed of 67,600 chinook (96% of recent year average), 192,300 sockeye (the third largest on record), 436,500 chum (below average), and 772,400 coho salmon (the second highest on record). The total pink salmon harvest was 85,900 fish, a record harvest.

The preliminary exvessel value was estimated at \$5.3 million, equal to the recent 10-year average. The 1992 chinook salmon price of \$0.66 per pound was below the \$0.80 average. Sockeye salmon prices of \$0.90 per pound were \$0.06 above average. Coho salmon prices were 29% below average at \$0.45 per pound. Chum salmon prices increased to \$0.32 per pound, \$0.01 higher than 1991 prices and higher than the average of \$0.28 for Kuskokwim fishers in recent years. Average price of pink salmon was \$0.06 per pound, \$0.02 below average.

Three of the five species had below average weights in 1992. Chinook salmon averaged 13.4 pounds, well below the recent 10-year average of 16.6 pounds. The average weight of sockeye salmon was 0.1 pounds, below the recent year average of 7.1 pounds. Chum salmon were 0.2 pounds below the 7.0 pound average for the fishery. Coho salmon averaged 7.3 pounds in 1992, 0.3 pounds above average. Pink salmon, at 3.9 pounds average weight, were 15% above their 3.4 pound historical average.

Commercial salmon fisheries occur in four districts in the Kuskokwim Area. Two within the Kuskokwim River, one in the costal waters near the village of Quinhagak, and one inside Goodnews Bay.

The total catch in the Kuskokwim River was approximately 46,900 chinook, 92,200 sockeye, over 666,100 coho, 7,400 pink, and 344,600 chum salmon. The chinook, sockeye, and pink salmon catches were above the most recent 10-year average. The coho salmon catch was 200,000 fish above average, the largest in the history of the fishery. The chum salmon catch was 32% below average due to an extremely weak return of 4-year-old fish. The total catch of nearly 1.16 million fish was slightly above average for the river fishery and continued the recent trend of catches over 1 million fish.

In the Kuskokwim Bay Quinhagak District fishery, the chinook salmon catch of 17,200 fish was 32% below average. In the Goodnews Bay District the chinook harvest of 3,500 fish was 37% below recent averages.

The Quinhagak District sockeye salmon catch of about 60,900 fish was the second highest on record, nearly three times larger than average. The Goodnews Bay District harvest of 39,100 fish was the third best ever, over 1.5 times larger than average.

The coho salmon harvest in the Quinhagak District of 86,400 was the second highest on record. The coho salmon catch of 19,800 was below average in the Goodnews Bay District. This is the third consecutive year of poor coho catches in the Goodnews Bay District.

Pink salmon catches in the Quinhagak (64,200 fish) and Goodnews Bay (14,300 fish) were the second highest on record and over three times the even-year average.

The Quinhagak District chum salmon catch of 73,300 fish was the highest on record, over twice the recent year average. The Goodnews Bay chum catch was 27% above average with 18,500 fish landed.

### *Yukon Area*

The total Yukon River harvest consisted of 121,000 chinook, 8,000 coho, and 556,000 chum salmon. The exvessel value of all Yukon area commercial salmon fisheries was estimated to be \$11.4 million.

Lower Yukon River fishermen harvested 114,000 chinook and 325,000 summer chum salmon. The fall chum and coho salmon commercial season was not reopened in 1992. The chinook salmon harvest was 15% above the recent 5-year average. The estimated average price per pound was a record \$4.12 for chinook salmon. A total of 679 permit holders participated in the fishery, with an exvessel value of approximately \$10.6 million. Chinook salmon escapement objectives were achieved through most of the drainage; however, there was a low proportion of females observed in Tanana River drainage escapements. The summer chum harvest was the third lowest since 1972, and fishing was curtailed early due to low escapement in the Andreafsky River drainage and the observed low proportion of age-4 summer chum salmon in the commercial and test fish catch.

Upper Yukon River harvests were estimated to be 7,000 chinook salmon, 213,000 summer chum salmon, 19,000 fall chum salmon, and 8,000 coho salmon. Much of the actual sales consisted of salmon roe. Average price per pound for summer chum salmon roe was \$4.53. The summer chum harvest in Subdistrict 4-A slightly exceeded the targeted harvest of 91,500 pounds of summer chum roe. Aerial surveys indicated summer chum salmon escapements were generally below desired levels, except in the Anvik River. Fall chum salmon escapements appeared to be below objectives in all systems, except for the Sheenjack River. The Anvik River escapement was 57% greater than the escapement objective of 500,000 fish. A total of 143 permit holders participated in the Upper Yukon Area fishery, which was worth approximately \$0.8 million.

### *Norton Sound Area*

The 1992 Norton Sound commercial salmon fishery produced a total catch of 200,000 salmon. A total of 110 fishermen reported commercial harvests during 1992, the lowest number of participants since 1977, when records were first kept. Poor returns combined with the lack of buyers caused some fishermen not to fish. Norton Sound fishermen received about \$448,000 for their catch during 1992. This is the third lowest exvessel value since 1976 and is 11% below the recent 5-year average.

The chum salmon catch of 83,000 was well below the long-term average. The low chum harvest was due to poor returns to northern Norton Sound, and a poor market throughout the district. Buyers paid an average of \$0.22 per pound for chum salmon. The 1992 chum salmon catch was valued at \$131,000 to Norton Sound fishermen.

The coho harvest was the largest on record. The 1992 coho catch of 105,000 was 113% and 114% above the recent 5- and 10-year averages, respectively. The exvessel value of this harvest was estimated to be \$271,000.

The harvest of 4,500 chinook salmon was 29% and 45% below the recent 5- and 10-year averages, respectively. The exvessel value of chinook salmon was \$38,000.

### *Kotzebue Area*

The 1992 commercial chum salmon catch in the Kotzebue District totaled 289,000. This catch is 96% of the recent 13-year average. Fishery managers use the 13-year average to make the comparisons for the purpose of management decisions. A slow passage rate in early August caused some concern for the Noatak escapement resulting in a period closure and a reduction in fishing time for remaining periods. This is the 7th year in the last 14 years in which 15 openings were not fished. A total of 408 hours were fished in 1992. This is substantially less than the recent 13-year (1979–1991) average of 534 hours. The average number of hours for each period for 1992 was 29.1, compared to 35.6 for the 13-year average.

Fishery managers held meetings with fishermen throughout the season to distribute catch statistics and gain input for management decisions. Because there are no inseason run assessment indices on the Kobuk River, subsistence fishermen were called several times to obtain information on run strength. Fishery managers also made personal contact with Kobuk Delta and Kiana subsistence fishermen to gain further knowledge of the run strength and timing.

Total return of chum salmon was slightly below average. Few fishermen choose to participate in the 1992 fishery; 149 fishing permits were used in 1992. This is the second-lowest participation ever observed, surpassing only the 1991 level of just 143 permits. Low prices and higher-than-normal construction job opportunities in Kotzebue may have caused the reduced number of participating permit holders.

A total of about 2.4 million pounds of chum salmon were purchased. The local dock price for chum salmon was \$0.22 per pound and apparently it discouraged many people from fishing. Additionally, about 2,714 pounds of chinook salmon (\$1.89 per pound), and 11,951 pounds of Dolly Varden char (\$0.10 per pound) were purchased. With an estimated total earnings average of \$3,582 per participating permit holder, the Kotzebue commercial harvest was valued at \$534,000.

## *Kodiak*

A total of 8.4 million salmon were harvested in the Kodiak area, compared to preseason expectations of 13.6 million fish. The estimated exvessel value of this year's salmon harvest was estimated to be \$38.7 million, which is \$7.3 million higher than 1991, but well below the record of \$104 million in 1988.

The 1992 harvest included 24,200 chinook salmon, with an average weight 14.3 lbs. This is the largest chinook harvest on record, surpassing the 1991 record when 22,200 chinook salmon were harvested.

The sockeye harvest of 4.16 million fish is the fifth largest harvest on record. Only 1991, 1990, 1908, and 1901 were higher. Preseason harvest expectations were 3.25 million sockeye salmon. The average weight was 5.68 lbs per fish.

A total of 278,000 coho salmon were harvested, which ranks as the seventh largest harvest on record. Preseason harvest expectations were 250,000 coho salmon. The average weight was 8.18 lbs per fish.

The harvest of chum salmon was 679,000 fish. Preseason harvest expectations were 870,000 fish, which is below the recent 10-year average harvest of 962,000 fish. The average weight was 7.25 lbs per fish.

The pink salmon harvest of 3.3 million fish was 6.0 million fish below the preseason harvest expectations. This was the lowest even-year harvest since 1974 when 2.6 million pink salmon were harvested and well below the past 5-even-year average harvest of 10.1 million fish. The average weight was 3.75 lbs per fish.

By species, the exvessel value of the sockeye harvest was \$33.0 million, chum salmon \$1.97 million, pink salmon \$1.86 million, coho salmon 1.36 million, and chinook salmon \$433,000. By gear type, the beach seiners averaged \$5,000, purse seiners \$93,000, and set gillnetters \$41,000 per permit holder.

Pink salmon escapements ranged from poor to excellent with the weaker areas being Karluk River, Alitak District streams, and streams in Ugak and Chiniak Bays. Overall chum salmon escapements were good with the weaker areas being in Alitak Bay, Dry Bay, Ugak Bay, and Kizhuyak Bay. Coho salmon escapements overall were good, but Chiniak Bay streams and Karluk River were weak. Overall sockeye salmon escapements were very good, but the early Upper Station and Uganik Lake runs were weak. Chinook salmon escapement counts of 9,100 into Ayakulik River and 9,600 into Karluk River met the escapement goals.

## *Chignik*

The 1992 Chignik salmon fishery harvested 3.59 million salmon, which included 1.50 million sockeye salmon. The exvessel value of the salmon harvested within the Chignik Management Area was estimated to be \$14.7 million, a little more than the last 20-year average of \$12.0 million.

There is an overlap in the run timing of Black Lake (first run) and Chignik Lake (second run) sockeye salmon stocks returning to the Chignik system. For management purposes, the time between June 26 to



July 9 is called the transition period during which assessment of second-run strength is the primary management objective. A major indicator of the transition from first-run to second-run stocks is the age class composition of the commercial harvest. Typically, the first run is dominated by age-1.3 and -1.2 fish, whereas the second run is comprised of primarily age-2.3 and -2.2 fish. The harvest from June 26 through July 7 was 473,000 sockeye salmon.

The second run proved to be weaker than projected prior to the season. Harvests from July 8 through September 30, the last day of fishing, totaled 339,000 sockeye salmon. The preliminary inseason escapement estimate for the Chignik Lake stocks through August 5, the last day of counting at the weir, was 242,000 fish, essentially meeting the 250,000 fish second-run escapement goal.

The 1992 chinook salmon harvest of 11,000 fish set a post-1960 record. The catch was well above the 5,000-fish harvest prediction. Excluding inriver sport and subsistence harvests, the escapement totaled 3,800 chinook salmon greater than 650 mm in length .

The 1992 pink salmon harvest was 1.54 million fish, somewhat below the 2.00 million projected harvest. The projected harvest would have easily been exceeded, except that fishermen targeted sockeye salmon instead of pink salmon due to the lower pink salmon prices. The pink salmon returns were well above expectations for the remainder of the Alaska Peninsula, whereas Kodiak management areas were well below expectations. Pink salmon escapements were very good in the Eastern District and average in the Western and Perryville Districts.

The 1992 chum salmon catch was 243,000 fish, just over the expected 235,000. The majority were harvested in the Central and Western Districts. Problems encountered with immature chum salmon catches in the past years, prompted commercial fishing closures in the Mitrofanina Section of the Western District in early July.

The 1992 Chignik Area coho salmon harvest totaled 296,000 fish, about 100,000 fish more than the harvest projection of 200,000 salmon. Fishing effort for coho salmon continued through September. No estimates of escapement in the Chignik Lakes System were available because the weir was removed prior to the start of the coho run. Aerial surveys of Eastern District streams in early September revealed average coho escapements.

#### **Alaska Peninsula/Aleutian Islands**

##### **SOUTH UNIMAK - SHUMAGIN ISLAND "FALSE PASS" JUNE FISHERY**

Sockeye salmon allocations, based on 8.3% of the inshore Bristol Bay harvest forecast, were 432,000 and 1.96 million for the Shumagin Islands and South Unimak Fisheries respectively. A 700,000 chum salmon catch cap was placed on both fisheries combined.

Chum salmon were in low abundance throughout the South Unimak fishery, except during the morning of June 22 when a large number of chum salmon appeared at Cape Lutke. A closure was immediately announced for the Cape Lutke Section, which minimized the chum salmon harvest.

Exvessel prices during June averaged \$1.00–1.10 for chinook, \$1.50–1.80 for sockeye, \$0.07 for pink, and \$ 0.35 for chum salmon. Estimated catches were as follows:

	<u>Chinook</u>	<u>Sockeye</u>	<u>Pink</u>	<u>Chum</u>
Shumagin Islands	1,400	410,000	140,000	102,000
South Unimak	2,400	2,047,000	502,000	324,000
Total	3,800	2,457,000	642,000	426,000

#### SOUTHEASTERN DISTRICT MAINLAND FISHERY

Through July 25, an estimated 93,800 Chignik-destined sockeye salmon were harvested in the Southeastern District Mainland fishery. Prior to July 25, only Orzinski Bay and Stepovak Flats are managed for local stocks.

The Orzinski Lake sockeye salmon return was much stronger than expected. Throughout the season interim escapement goals were exceeded. Orzinski Bay was open for continuous salmon fishing from July 6 through August 2. The sockeye salmon harvest in Orzinski Bay exceeded 105,000 salmon, and the escapement into Orzinski Lake was an estimated 25,000 sockeye salmon.

#### SOUTH PENINSULA JULY–AUGUST

The estimated South Peninsula salmon harvest during July and August (including fish caught in the Southeastern District Mainland prior to July 25) was as follows:

Chinook	4,000
Sockeye	902,000
Coho	386,000
Pink	8,948,000
Chum	932,000
Total	11,172,000

A Superior Court judge overturned the Board of Fisheries post-June management plan. The plan restricted the area that could be fished to terminal locations prior to July 20, as a way to limit the harvest of non-local stocks. The area covered by the Southeastern District Management Plan was not affected by the ruling. During July 6–20 in locations outside of the Southeastern District Mainland and in the terminal locations where fishing prior to July 20 was allowed, the commercial harvest was approximately 275,000 sockeye, 44,000 coho, 145,000 pink, and 100,000 chum salmon.

Portions of the South Peninsula (primarily the Shumagin Islands) were closed to seining during July 15–29 due to the presence and potential bycatch of immature salmon—mostly sockeye salmon. This was the fourth consecutive year that immature salmon have been a problem in this area.

The post-June pink salmon harvest of 8.95 million salmon was the third largest on record, exceeded only by the 1984 and 1991 harvests. The indexed escapement of 2.83 million was more than the 1980 to 1990 even-year average of 2.50 million. Except for three isolated locations, excellent pink salmon escapements were attained throughout South Peninsula Area streams.

The post-June South Peninsula chum salmon harvest was less than the previous 10-year average of 1.01 million fish. The index chum salmon escapement of 335,000 was substantially below the previous 10-year average of 495,000. Escapements into area streams were uneven, ranging from poor to excellent. Intensive fishing to harvest pink salmon caused chum salmon stocks to suffer where the two species were mixed.

The South Peninsula indexed sockeye salmon escapement was estimated at 98,000. The previous 10-year average was 67,000. In addition to Orzinski Lake, Thin Point Lake was a major contributor. Thin Point Lake's escapement was estimated at 32,600 and 30,300 sockeye salmon were harvested in Thin Point Cove.

The post-June South Peninsula coho salmon catch totaled 402,000 fish, of which 128,000 were caught in July, 242,000 in August, and 32,000 in September. Coho salmon escapement information is incomplete at this time. However, 15,000 coho salmon were observed in Thin Point Lagoon, the largest known South Peninsula producer, which was unusually high for that system.

#### ALEUTIAN ISLANDS AND ATKA - AMLIA ISLANDS AREAS

Pink salmon runs in the Aleutian Islands were disappointing and did not demonstrate the strength found in South Peninsula runs.

The Unalaska Island catch totaled 289,000 pink and 2,000 sockeye salmon. The entire Unalaska harvest came from Makushin Bay. Escapements were generally poor to fair in those systems surveyed. The pink salmon run was especially weak in Unalaska Bay.

The Atka-Amlia Islands harvest totaled 200 sockeye, 9,900 pink and 300 chum salmon. Nearly all fishing took place in the vicinity of Atka village as a combination of bad weather and small boats prevented exploitation of larger stocks in the area. A survey of the stream which had the largest escapement in 1982 accounted for a disappointingly small number of fish in 1992. Thirteen set gillnets operated at Atka, with all fishermen participating in this fishery from Atka or the Pribilof Islands.

August 3 was the scheduled start of the first commercial salmon fishery for the Atka and Amlia Island Management Area. Fishing did not begin until August 5 because the local processor did not have an ADF&G Intent to Operate Form to process salmon. Seventeen fishermen registered to fish set gillnet gear. By season's end, August 28, a total of 13 fishermen made 41 landings of salmon.

A total of 10,489 salmon were landed. The harvest included 231 sockeye, 42 coho, 9,908 pink, and 308 chum salmon. Pink salmon were the targeted species in this fishery, and other species were taken incidentally. The incidental-catch originated from small local stocks of sockeye, coho, and chum salmon. The lower-than-expected harvest resulted from weak returns to local streams combined with poor weather conditions which restricted the small skiffs to Nazan and Korovin Bays.

Windy weather during most of August forced the fishery to focus on a few streams that were accessible from the village. At midseason the markers were moved from 500 to 1000 yards for Army Dock (Yaxagim Chugaa) Creek, which had received disproportional fishing effort. Further adjustments were made to allow fishing during periods of good weather. The majority of the management area was opened for continuous fishing while Nazan Bay and Old Harbor Lagoon remained on a 3-day-a-week schedule.

The value of the fishery is difficult to estimate. As of this date the Atka Fishermen's Association (local fisheries processing cooperative) has not sold its fish or posted final prices. Fishermen may receive \$.09/pound for processed pinks and possibly up to \$.50/pound for fish used for bait. The value of the pink catch could range from \$3,100 to \$17,000. No price estimates are available for the incidental species.

Pink salmon escapements in 1992 were poor. Peak escapement surveys in 12 index streams was 44,000 pink salmon. The escapement for the same streams was 354,000 fish in 1982, the only previous year that a survey was conducted (an atypically high escapement year for the Aleutians). Initial observations indicate a reasonable escapement for these streams would be about 125,000 fish. Local residents also felt the number of pink salmon this year were well below expectations.

The variable nature of pink salmon returns in the Aleutians combined with the lack of multiple-year escapement information make it impossible to project next season's catch and escapement.

## NORTH PENINSULA

The North Peninsula sockeye harvest of 3.53 million fish set a new harvest record. The previous record of 2.60 million occurred in 1985. The area between Port Moller and Strogonof Point accounted for 3.07 million sockeye salmon, of which 2.33 million were harvested prior to July 19. The Nelson Lagoon sockeye harvest was 377,000 fish. The North Peninsula sockeye escapement (Bear, Nelson, and Ilnik weir counts, plus indexed total for other systems) was estimated at 758,000. Sockeye salmon escapement goals were met in all North Peninsula systems.

The chum salmon harvest along the North Peninsula totaled 332,000 which is slightly below the previous 10-year average of 366,000 salmon. The indexed total escapement was 352,000. Escapements throughout the area were variable. The Joshua Green River accounted for nearly one-third of the total escapement.

The North Peninsula coho salmon harvest totaled 194,000 fish. The major harvest locations were Nelson Lagoon (73,000), Cinder River (60,000), and Port Moller to Strogonof Point (40,000). Escapements were good to excellent in the major systems. It was not possible to survey all the coho systems in the area due to funding and fall survey conditions.

The chinook salmon harvest along the North Peninsula totaled 13,000 fish, well below the previous 10-year average of 18,000. The indexed escapement of 7,000 was also well below the previous 10-year average of 13,000. Chinook salmon runs have been declining for the past 7 years.

The North Peninsula usually produces minor runs of pink salmon. The 1992 harvest of 179,000 was the fourth largest on record, but was much lower than the 1990 record of 518,000 fish. Most of the harvest was taken in Herendeen Bay (96,000 fish) and in the Port Moller to Strogonof Point area (81,000). The Herendeen Bay indexed total escapement was 155,000 with Lawrence Valley Creek, accounting for over 90% of the total. Also in Bechevin Bay the indexed total pink salmon escapement of 49,000 was good. Escapement data was incomplete from most other locations.

**PRELIMINARY FORECASTS OF 1993 SALMON RUNS  
TO SELECTED ALASKA FISHERIES**

The Alaska Department of Fish and Game prepares forecasts for salmon runs that affect the major fisheries around the state. Salmon runs to be forecasted are selected using several criteria, including economic importance, feasibility, compatibility with existing programs, and management needs. For the 1993 fishing year, forecast fisheries are as follows:

Southern Southeast	-	pink salmon
Northern Southeast	-	pink salmon
Prince William Sound	-	pink, chum, and Coghill District sockeye salmon
Prince William Sound/Copper River	-	sockeye and chinook salmon
Upper Cook Inlet	-	sockeye salmon
Lower Cook Inlet	-	pink salmon
Kodiak	-	pink salmon
	-	Ayakulik River sockeye salmon
	-	Upper Station Lakes sockeye salmon
	-	Frazer Lake sockeye salmon
	-	Chignik sockeye salmon
	-	Bristol Bay sockeye and chinook salmon

A variety of information was used to make salmon run forecasts. In most cases the principal indicator of future abundance is the escapement magnitudes of the parental stocks. Other information that might have been considered includes spawning stock distribution, egg deposition, survival to intermediate life stages, environmental conditions, and historical age composition. A range of run possibilities are predicted for each forecasted fishery. In general, based on past experience, the actual run can be expected to fall within the range (between the lower and upper limits) less than half the time.

Please see the appendices for further details. Table 8 provides run forecast, harvest projection, and forecast ranges for all runs with a formal forecast in 1993. The 1992 forecast, together with information on forecast accuracy for 1992, is provided in Table 9.

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Table 1. Preliminary projections of 1993 Alaska commercial salmon harvests by fishing area and species, in units of thousands of fish.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
<b>Southeast Region</b>	279 1/	1,790	2,440	53,200	3,060	60,700
Cordova Area	30	1,703	729	25,200	638	28,300
Upper Cook Inlet	15	2,500	450	25	350	3,340
Lower Cook Inlet	0	285	17	935	121	1,358
Bristol Bay Area	64	32,000	179	0	1,300	33,543
<b>Central Region</b>	109	36,400	1,370	26,100	2,400	66,500
Kodiak Area	21	2,370	290	21,600	1,200	25,481
Chignik	5	1,940	169	1,300	213	3,627
South Peninsula	10	3,400	300	6,000	1,300	11,010
North Peninsula	10	1,900	200	5	200	2,315
Aleutian Islands	0	0	0	0	0	0
<b>Westward Region</b>	46	9,610	950	28,900	2,910	42,400
<b>A.Y.K. Region</b>	168	153	632	1	1,839	2,790
<b>TOTAL ALASKA</b>	<b>602</b>	<b>48,000</b>	<b>5,400</b>	<b>108,000</b>	<b>10,200</b>	<b>172,000</b>

1/ Based on the 1983-1992 average harvest. The harvest quota for 1993 has yet to be set by the Alaska Board of Fisheries and the Pacific Salmon Commission.

Columns do not total exactly due to rounding

Revised February 11, 1993

See Tables 4,5,6, and 7 for definition of management regions

Table 2. Preliminary projections of 1993 Alaska commercial salmon harvests by statistical region and species, in units of thousands of fish.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
<b>Southeast</b>						
Statistical Region	279 1/	1,790	2,440	53,200	3,060	60,700
Cordova Area	30	1,703	729	25,200	638	28,300
Upper Cook Inlet	15	2,500	450	25	350	3,340
Lower Cook Inlet	0	285	17	935	121	1,358
Kodiak Area	21	2,370	290	21,600	1,200	25,481
Chignik	5	1,940	169	1,300	213	3,627
South Peninsula	10	3,400	300	6,000	1,300	11,010
<b>Central</b>						
Statistical Region	81	12,100	1,950	55,000	3,820	73,100
North Peninsula	10	1,900	200	5	200	2,315
Aleutian Islands	0	0	0	0	0	0
Bristol Bay Area	64	32,000	179	0	1,300	33,543
A.Y.K. Region	168	153	632	1	1,839	2,793
<b>Western</b>						
Statistical Region	242	34,000	1,010	0	3,330	38,600
<b>TOTAL ALASKA</b>	<b>602</b>	<b>48,000</b>	<b>5,400</b>	<b>108,000</b>	<b>10,200</b>	<b>172,000</b>

1/ Based on the 1983-1992 average harvest. The harvest quota for 1993 has yet to be set by the Alaska Board of Fisheries and the Pacific Salmon Commission.

Columns do not total exactly due to rounding; Revised February 11, 1993

See Tables 4,5,6, and 7 for definition of management regions

Table 3. Preliminary 1992 Alaska commercial salmon harvests by fishing area and species, in thousands of fish.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
<b>Southeast Region</b>	233	2,660	3,680	35,000	4,960	46,500
Prince William Sound	41	1,800	618	8,600	334	11,402
Upper Cook Inlet	17	9,100	469	696	274	10,565
Lower Cook Inlet	2	177	4	480	22	685
Bristol Bay	69	32,000	191	494	885	33,606
<b>Central Region</b>	129	43,100	1,280	10,300	1,520	56,300
Kodiak Area	24	4,160	278	3,300	679	8,441
Chignik	11	1,500	296	1,500	243	3,550
South Peninsula	7	3,500	402	9,600	1,353	14,862
North Peninsula	13	3,500	194	179	332	4,218
Aleutian Islands	0	2	0	299	0	301
<b>Westward Region</b>	56	12,700	1,170	14,900	2,610	31,400
<b>AYK Region</b>	193	192	886	92	1,360	2,730
<b>TOTAL ALASKA</b>	<b>611</b>	<b>58,700</b>	<b>7,020</b>	<b>60,300</b>	<b>10,500</b>	<b>137,000</b>

Columns do not total exactly due to rounding

Revised March 9, 1993

Table 4. Preliminary 1992 Southeast Alaska commercial salmon harvests by fishing area and species, in thousands of fish.

Fishing Area	SPECIES					Total
	Chinook 1/ Sockeye	Coho	Pink	Chum		
Tree Point Drift Gillnet	1	245	40	581	282	1,149
Prince of Wales Gillnet	1	203	299	94	141	738
Stikine River Gillnet	1	53	22	66	15	158
Southern Districts Seine	16	1,228	325	17,189	1,237	19,996
Annette Island Trap	0	1	0	68	1	70
Annette Island Gillnet	0	56	54	548	90	750
Annette Island Seine	0	3	17	338	12	371
Annette Island Troll	0	0	0	0	0	1
<b>Southern Southeast Total</b>	<b>21</b>	<b>1,790</b>	<b>757</b>	<b>18,886</b>	<b>1,778</b>	<b>23,232</b>
Taku-Snettisham Gillnet	2	135	172	314	113	737
Lynn Canal Gillnet	1	286	109	352	245	992
Yakutat Set Net	2	313	293	19	7	634
Northern Districts Seine	0	100	158	12,098	1,049	13,407
<b>Northern Southeast Total</b>	<b>5</b>	<b>835</b>	<b>732</b>	<b>12,783</b>	<b>1,414</b>	<b>15,770</b>
Southeast Troll 2/	180	23	1,929	672	87	2,890
Hatchery Terminal Area Fisheries						
Gillnet	5	0	3	0	49	57
Seine	1	8	5	453	923	1,391
Troll	4	0	0	0	0	4
Private Hatchery Fishery	17	1	258	2,137	705	3,118
Test Fisheries	0	7	1	27	7	42
<b>SOUTHEAST REGION</b>	<b>233</b>	<b>2,660</b>	<b>3,680</b>	<b>35,000</b>	<b>4,960</b>	<b>46,500</b>

1/ Excludes catch of two thousand small (<21") chinook salmon harvested by seine gear.

2/ Includes chinook salmon caught by troll gear from October 1, 1991 to April 14, 1992.

Columns do not total exactly due to rounding

Compiled January 12, 1993

Table 5. Preliminary 1992 Central Region Alaska commercial salmon harvests by fishing area and species, in thousands of fish.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Bering River	0	20	126	0	0	145
Copper River	40	971	292	2	6	1,310
PWS General	0	32	12	4,654	28	4,726
PWS Hatcheries	1	163	72	3,054	57	3,347
Coghill District /1	0	59	114	364	184	721
Unakwik District /1	0	2	0	17	0	20
Eshamy District	0	518	2	543	56	1,119
PWS Miscellaneous /2	0	7	1	3	3	13
Prince William Sound	41	1,770	618	8,634	334	11,400
Southern District	2	107	1	417	2	529
Kamishak District	0	69	1	3	20	93
Outer District	0	1	0	0	0	1
Eastern District	0	0	2	60	0	62
Lower Cook Inlet	2	177	4	480	22	685
Central District	13	9,039	378	672	249	10,350
Northern District	5	69	91	24	25	214
Upper Cook Inlet	17	9,110	469	696	274	10,600
Naknek-Kvichak	5	9,330	18	216	227	9,797
Nushagak District	48	2,901	85	190	313	3,536
Egegik District	1	15,677	47	1	114	15,840
Ugashik District	7	5,550	35	0	100	5,693
Togiak District	130	5,187	85	198	616	6,217
Bristol Bay Total	69	32,000	191	494	885	33,600
<b>CENTRAL REGION</b>	<b>129</b>	<b>43,100</b>	<b>1,280</b>	<b>10,300</b>	<b>1,520</b>	<b>56,300</b>

/1 Includes both seine and gillnet catches.

/2 Educational permits, confiscated fish, test fish, etc.

Columns do not total exactly due to rounding

Revised March 8, 1993

Table 6. Preliminary 1992 Westward Region Alaska commercial salmon harvests by fishing area and species, in thousands of fish.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kodiak Area	24	4,160	278	3,300	679	8,440
Chignik Areas	11	1,496	296	1,544	243	3,590
South Peninsula	7	3,460	402	9,568	1,353	14,790
North Peninsula	13	3,529	194	179	332	4,247
Alaska Peninsula Total	20	6,990	600	9,750	1,690	19,000
Aleutian Islands	0	2	0	299	0	301
<b>WESTWARD REGION</b>	<b>56</b>	<b>12,600</b>	<b>1,170</b>	<b>14,900</b>	<b>2,610</b>	<b>31,300</b>

Columns do not total exactly due to rounding

Updated March 9, 1993

Table 7. Preliminary 1992 Arctic-Yukon-Kuskokwim Region Alaska commercial salmon harvests by fishing area and species, in thousands of fish.

Fishing Area	SPECIES					Total
	Chinook	Sockeye	Coho	Pink	Chum	
Kuskokwim River	47	92	666	7	345	1,157
Kuskokwim Bay	21	100	106	79	92	397
<b>Kuskokwim Area Total</b>	<b>67</b>	<b>192</b>	<b>772</b>	<b>86</b>	<b>436</b>	<b>1,550</b>
Lower Yukon River	114	0	0	0	325	439
Upper Yukon River 1/	7	0	8	0	232	247
<b>Yukon River Total</b>	<b>121</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>556</b>	<b>685</b>
Norton Sound	5	0	105	6	83	200
Kotzebue Area	0	0	0	0	289	289
<b>AYK REGION</b>	<b>193</b>	<b>192</b>	<b>886</b>	<b>92</b>	<b>1,370</b>	<b>2,730</b>

1/ On the Upper Yukon River an additional 100,000 pounds of chum salmon roe was sold in addition to the fish sold in the round.

Columns do not total exactly due to rounding

Updated March 9, 1993

Table 8. Preliminary forecasts of salmon runs and commercial harvests of some Alaskan fisheries in 1993, expressed in units of millions of fish.

Area	Species	Forecast Run	Escapement Goal	Forecast Harvest	Forecast Run Range	
Southeast S.E. Hatchery	Pink	83	30.7	52.3	67.0 -- 99.5	
	Pink	1.1	0.2	0.9		
		84.1	30.9	53.2		
Prince William Sound	Pink	27.60	2.47	25.17	15.92 -- 46.96	
	Chum	1	0.37	0.66	0.58 -- 1.57	
	Sockeye	0.854	0.071	0.783	0.466 -- 1.340	
	Coho	0.299	0.004	0.295	0.217 -- 0.387	
	Chinook	0.0030	0.0003	0.0030	0.0002 -- 0.0063	
Copper River	Sockeye	1.624	0.704	0.92	1.396 -- 1.852	
	Chinook	0.042	0.015	0.027	0.035 -- 0.049	
Upper Cook Inlet	Sockeye	4.0	1.5	2.5	0.6 -- 7.4	
Lower Cook Inlet	Pink	1.402	0.492	0.855	0.655 -- 3.598	
Kodiak	Pink	24.9	3.3	21.6		
	Upper Station, Early	Sockeye	0.098	0.063	0.036	0.050 -- 0.150
	Upper Station, Late	Sockeye	0.585	0.175	0.410	0.300 -- 0.900
	Frazer Lake	Sockeye	0.430	0.170	0.260	0.200 -- 0.700
Chignik 1/	Sockeye	2.59	0.65	1.94	1.74 -- 3.78	
Bristol Bay 2/ Nushagak	Sockeye	44.7	9.8	34.9	27.3 -- 62.1	
	Chinook	0.138	0.075	0.063	0.090 -- 0.187	
<b>Total</b>		<b>194.4</b>	<b>50.8</b>	<b>143.4</b>		

Compiled January 14, 1993.

1/ Includes intercepted Chignik bound salmon.

2/ Bristol Bay harvest includes 2.4 million South Peninsula quota.



Table 9. Comparison of actual and forecast 1992 salmon runs, with errors and relative errors for some major Alaskan salmon fisheries, in millions of fish. a/

Area	Species	1992		Estimated Run b/	Forecast Harvest	Forecast Run	Forecast Error c/	Relative Error d/
		Harvest	Escape-ment					
Southeast Total	Pinks	35.0	29.2	64.2	30.0	56.7	-7.50	-11.7%
Prince William Sound	Pinks	8.6	1.6	10.2	28.04	30.58	20.4	199.2%
	Chums	0.33	0.28	0.61	1.67	2.01	1.40	230.0%
Prince William Sound	Sockeye	0.774	0.069	0.843	0.703	0.758	-0.085	-10.0%
Copper River	Sockeye	0.96	0.75	1.71	0.96	1.754	0.04	2.6%
	Chinook	0.040	0.011	0.051	0.041	0.056	0.005	10.0%
Upper Cook Inlet	Sockeye	9.10	1.50	10.60	3.6	5.10	-5.50	-51.9%
Lower Cook Inlet	Pinks	0.48	0.23	0.71	1.134	1.518	0.81	112.9%
Kodiak	Pinks	3.30	3.50	6.80	9.2	13.4	6.60	97.1%
Upper Station, Early	Sockeye	0.023	0.018	0.041	0.05	0.1	0.06	143.9%
Upper Station, Late	Sockeye	0.218	0.2	0.418	0.125	0.3	-0.12	-28.2%
Frazer	Sockeye	0.224	0.206	0.43	0.88	1.08	0.65	151.2%
Ayakulik	Sockeye	0.404	0.344	0.748	0.42	0.67	-0.08	-10.4%
Chignik	Sockeye	1.50	0.24	1.74	2.05	2.70	0.96	55.4%
Bristol Bay	Sockeye	34.5	13.2	47.7	28.8	39.6	-8.1	-17.0%
Nushagak	Chinook	0.069	0.083	0.152	0.121	0.196	0.044	28.9%
Total		95.5	51.5	147.0	107.8	156.5	10	6.5%

a/ Table updated March 10, 1993.

b/ Run is Harvest plus Escapement

c/ Error is Forecast Run minus Run

d/ Relative Error is Error divided by Run times 100%

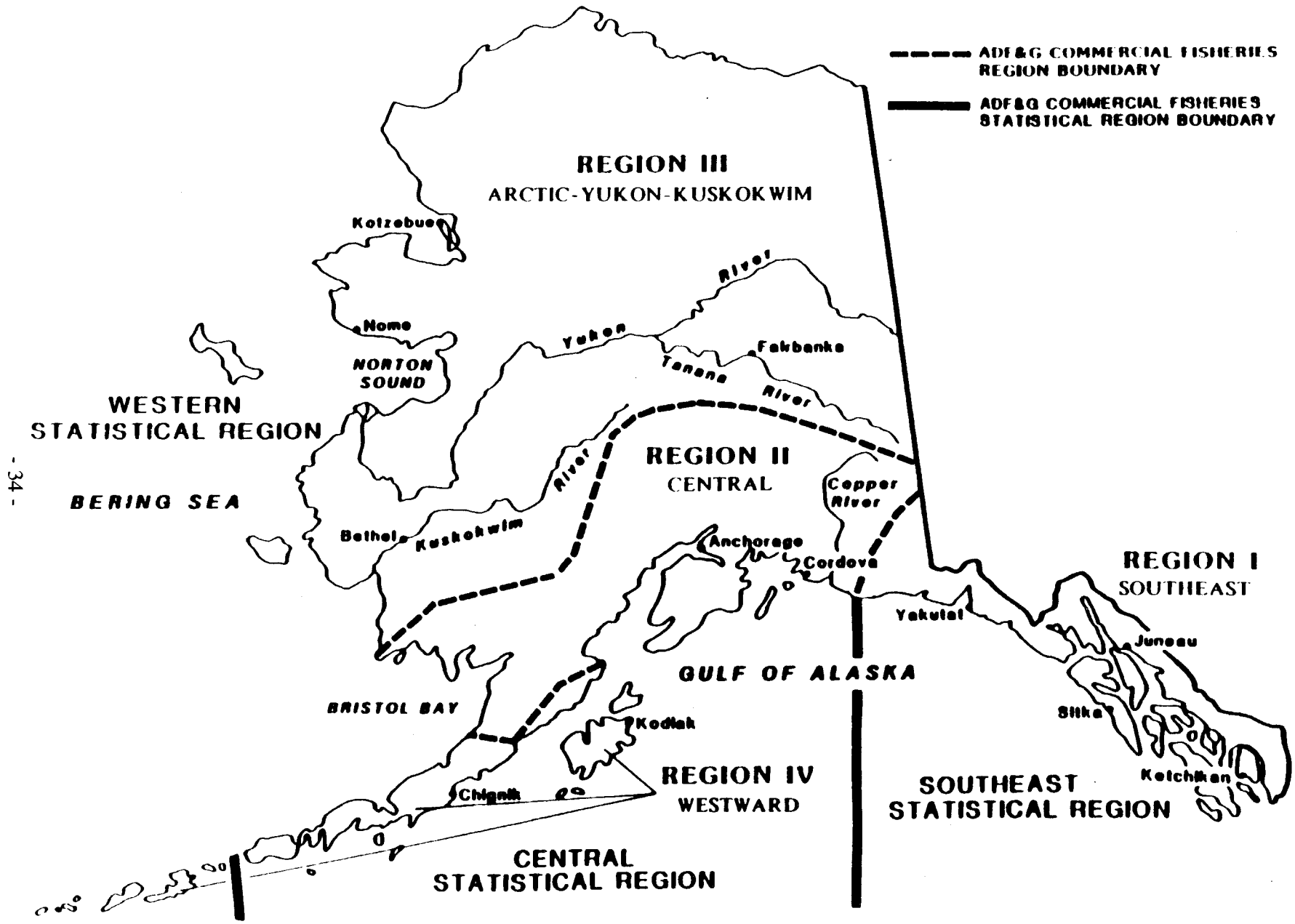


Figure 1. The three statistical regions (Western, Central, Southeastern) and the four fisheries regions (Westward, A-Y-K, Central, Southeastern) of the Alaska Department of Fish and Game, Division of Commercial Fisheries.

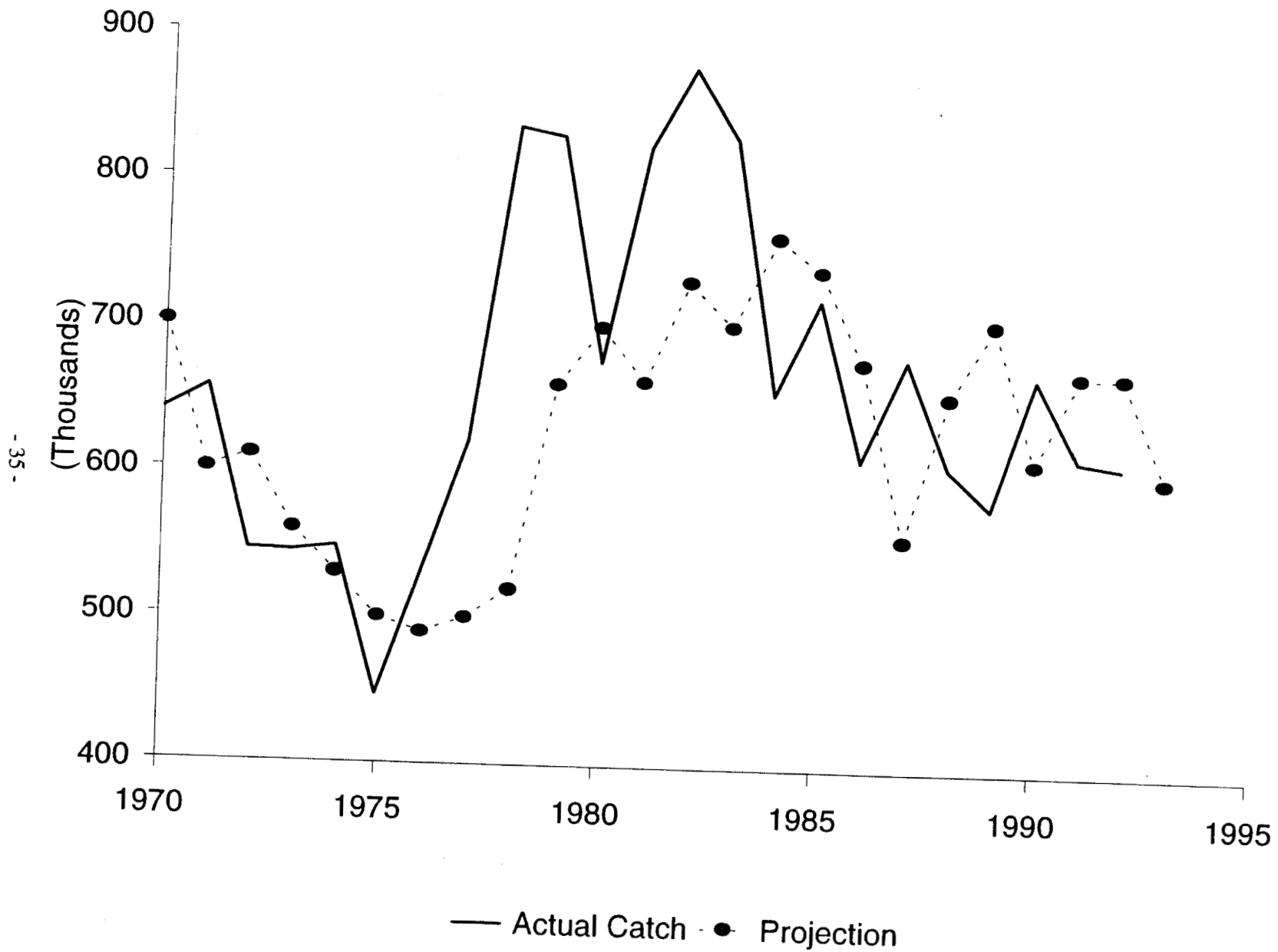


Figure 2. Relationship between actual catch (thousands) and projected catch (thousands) for Alaskan chinook salmon from 1970–1992, with the 1993 projection.

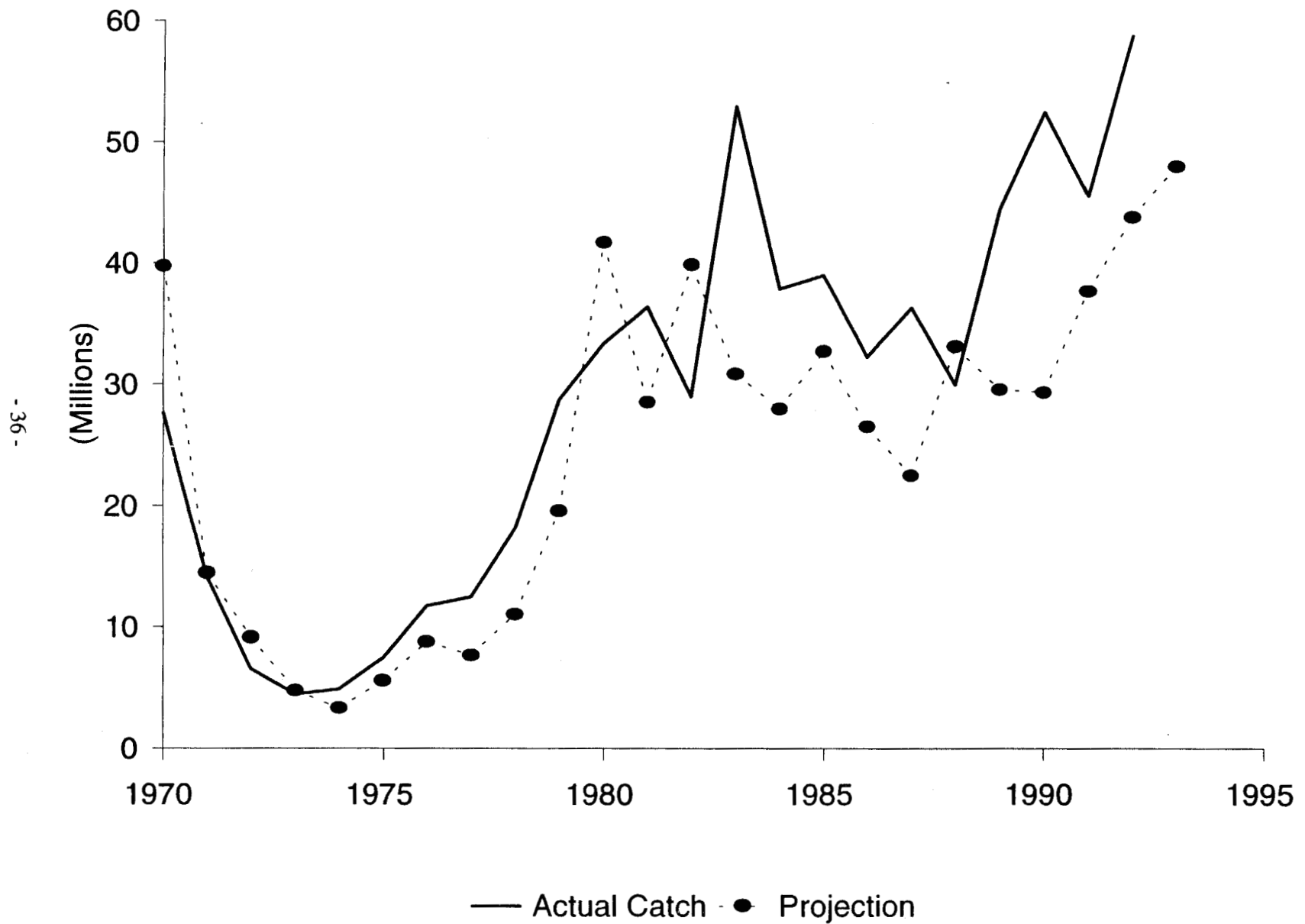


Figure 3. Relationship between actual catch (thousands) and projected catch (thousands) for Alaskan sockeye salmon from 1970–1992, with the 1993 projection.

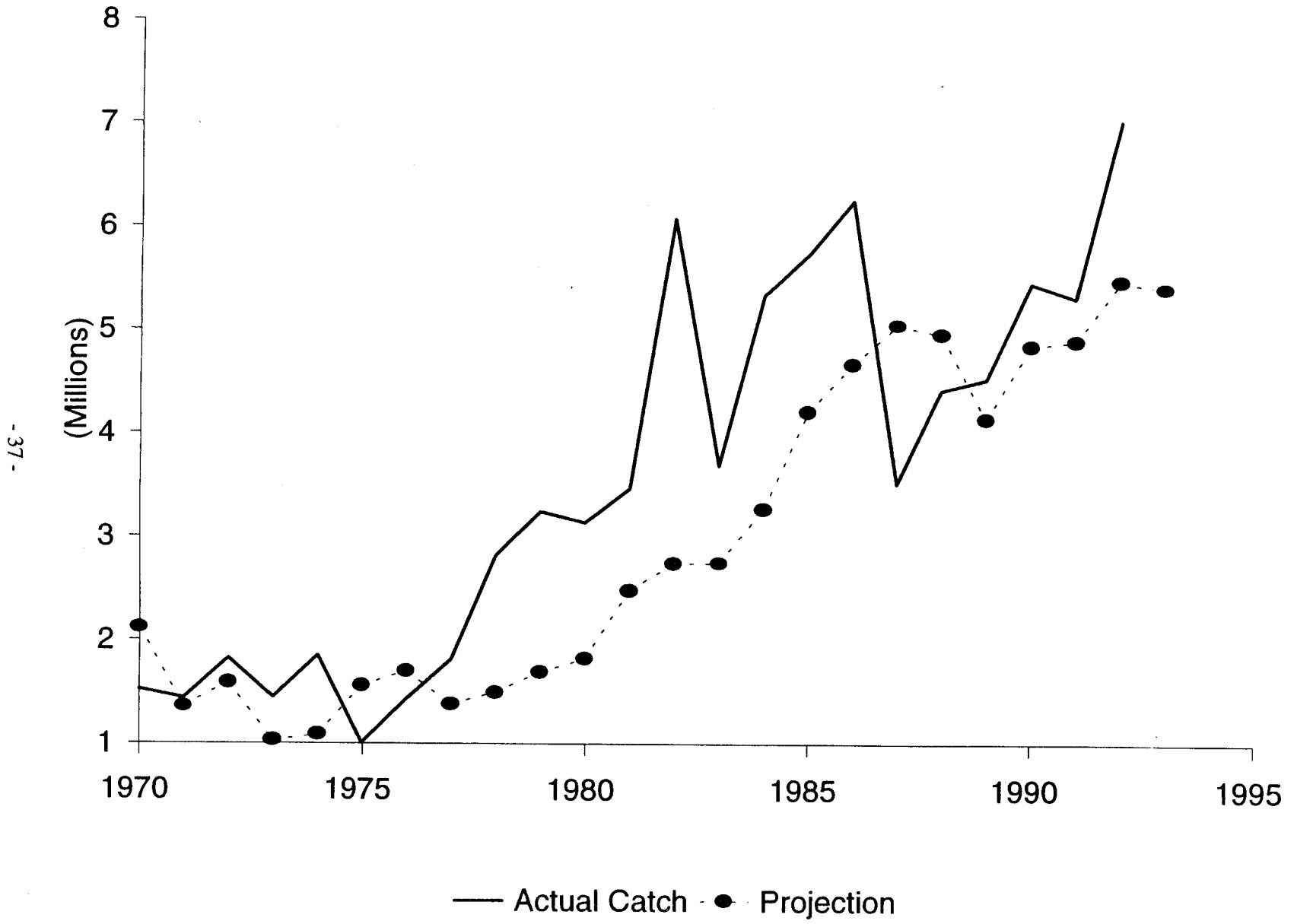


Figure 4. Relationship between actual catch (thousands) and projected catch (thousands) for Alaskan coho salmon from 1970–1992, with the 1993 projection.

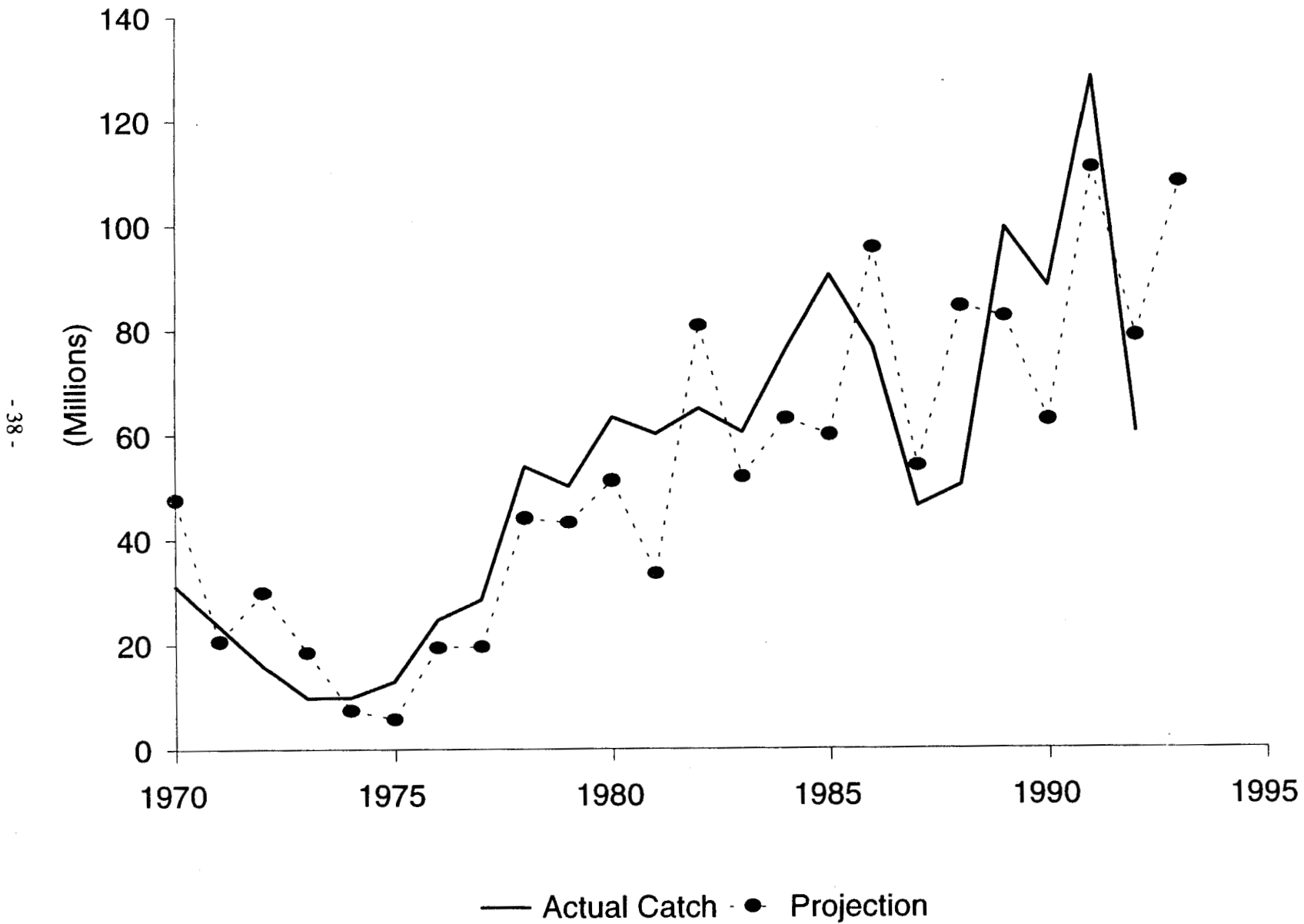


Figure 5. Relationship between actual catch (thousands) and projected catch (thousands) for Alaskan pink salmon from 1970–1992, with the 1993 projection.

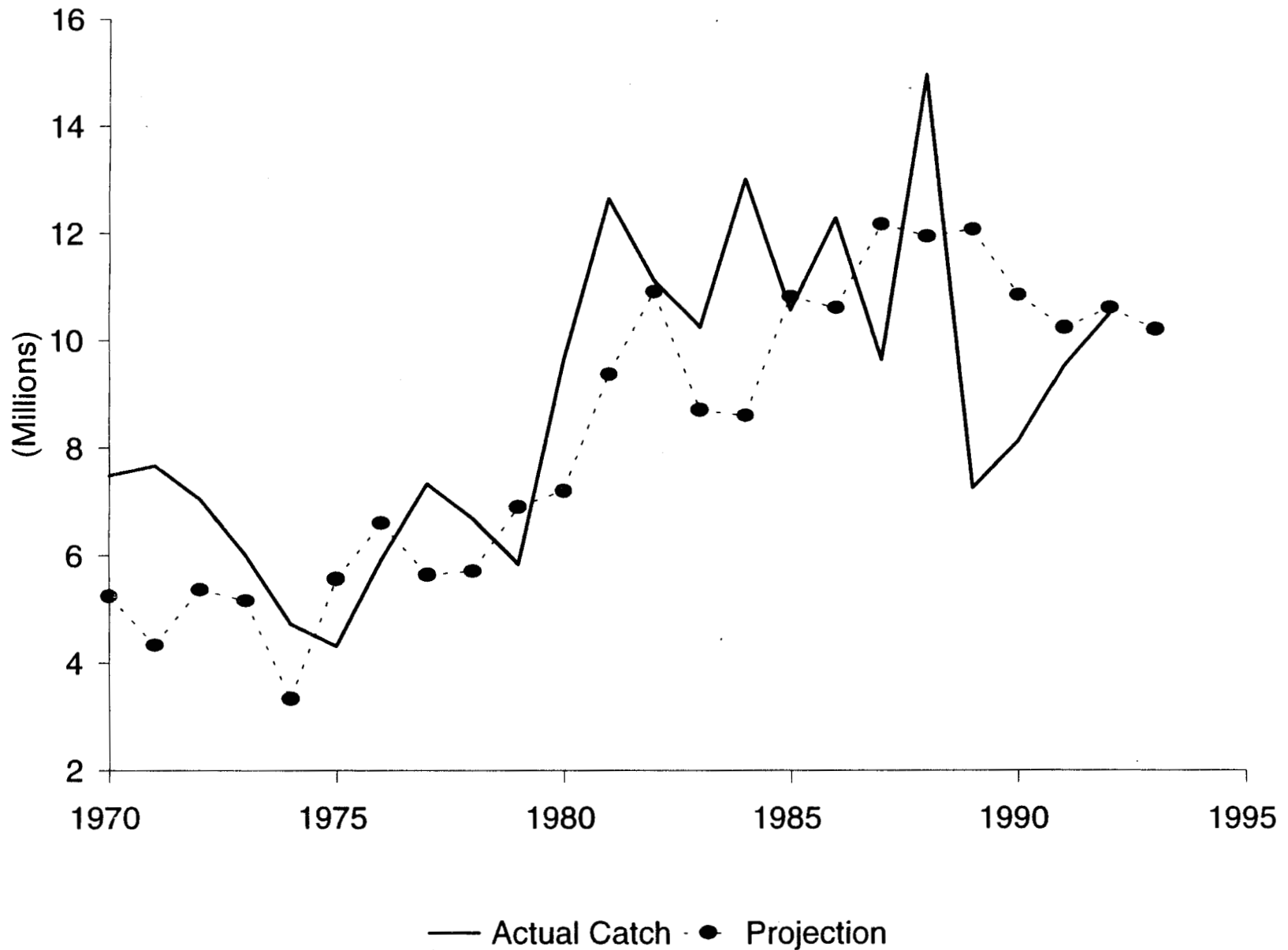


Figure 6. Relationship between actual catch (thousands) and projected catch (thousands) for Alaskan chum salmon from 1970–1992, with the 1993 projection.





APPENDIX—FORECAST METHODS AND DISCUSSIONS



**FORECAST AREA: Southeast Alaska****SPECIES: Pink Salmon****PRELIMINARY FORECAST OF 1993 RUN:**

	Forecast Estimate ( <u>millions</u> )	Forecast Range ( <u>millions</u> )
<b>NATURAL PRODUCTION:</b>		
Natural Run	83.0	67.0-99.5
Escapement Goal	30.7 <sup>1</sup>	
Commercial Common Property Harvest	52.3	

**HATCHERY AND SUPPLEMENTAL PRODUCTION:**

Hatchery Run	1.1
Broodstock Needs	0.2
Commercial Common Property Harvest <sup>2</sup>	0.9

**TOTAL PRODUCTION:**

Total Run	84.1
Escapement Goal	30.9
Commercial Common Property Harvest <sup>2</sup>	53.2

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<sup>1</sup> An expansion factor of 2.5 was applied to the escapement index to convert the index to an estimate of total escapement. In addition the escapement index goal for southern Southeast was changed from a point goal of 6.0 million to a range of 6.0 to 9.0 million.

<sup>2</sup> Includes commercial common property and hatchery harvests.

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**FORECAST METHODS**

Multiple linear regression analysis was used to forecast the pink salmon return to Southeast Alaska. Harvest rather than return, was used as the dependent variable in the regression. The independent variables included, (1) brood year escapement index, (2) average daily minimum winter (November 1 through February 29) air temperatures from NOAA weather stations at Annette, Beaver Falls, Ketchikan, Petersburg, and Wrangell, and (3) sum of the previous two brood year escapement indices. This model

has an 80% prediction interval of 43.4 to 61.2 million. The prediction interval was computed as the estimated catch, plus or minus the product of the standard error of an individual prediction and the 90th percentile of a Student's t-distribution with 20 degrees of freedom. This normal-theory-based approach was deemed acceptable because the residuals of the model appear to be normally distributed with no significant positive autocorrelation. The total number of hatchery fry released in Southeast Alaska was not available as of the preparation of this forecast. Hatchery production was estimated by assigning a survival rate of 86% to the green egg-to-release life stage, and 1% to the release to return life stage.

## FORECAST DISCUSSION

This is the first year since the forecast program was initiated in 1966 that separate forecasts for southern and northern Southeast will not be made. The change was necessitated because the department no longer collects area-specific data for forecasting purposes. In southern Southeast both the preemergent and early marine programs have been eliminated. In northern Southeast the preemergent program has been eliminated, and the early marine program is not providing the abundance data needed to forecast returns to northern Southeast.

If the actual run approximates the forecast it will be the third largest harvest since statehood and the fourth largest harvest in the history of the fishery, which goes back to 1892. The large run forecast is the result of the winter of 1991/1992 being the mildest on record (1949 through 1992) and the brood year escapement index being near optimum and well distributed among streams.

The narrow forecast range from the regression model ( $\pm 8.8$  million) is the result of excluding return years 1987 and 1988 from the model. A possible cause for the over-prediction errors in 1987 and 1988 has recently been found. The sea surface temperatures at latitude  $45^{\circ}$  north, longitudes  $140^{\circ}$  through  $155^{\circ}$  west, were anomalously low in both 1987 and 1988. The temperatures in 1987 and 1988 were the lowest on record (1949 through 1990), 2.3 and 3.1 standard deviations below average. However, including the sea surface temperatures in the prediction model does not improve the model's performance. This could be the result of sea surface temperatures at  $45^{\circ}$  north acting in a threshold fashion (e.g., not having an influence on survival except in years of extreme cold). The sea surface temperatures at  $45^{\circ}$  north will be closely monitored throughout this winter. A new prediction will be developed and released, if the sea surface temperatures approach a level similar to 1987 or 1988.

The model used for forecasting Southern Southeast return for the past 2 years was also applied to all of Southeast Alaska. This modified Ricker model (Geiger and Savikko 1992), which includes 1987 and 1988, predicted a harvest in Southeast Alaska of 52.0 million. This is only 0.3 million lower than the point estimate obtained from the linear regression model. The 80% prediction interval was 26.1 to 103.3 million. The large width of this interval is due to the extra variability contributed by 1987 and 1988. The Ricker model assumes density dependent mortality factors caused the disasters in 1987 and 1988. Because it is just as likely that cold sea surface temperatures caused the disasters, and the brood year escapement index for the 1993 return was well below the level which influenced the returns in 1987 and 1988, we decided against using the Ricker model's prediction interval.

Although it was very clear that the Ricker model provided an unrealistically wide 80% prediction interval (there is no chance of a harvest of 103 million pink salmon in Southeast Alaska in 1993), we intuitively feel that the linear regression model provides an unrealistically narrow range ( $\pm 8.8$  million). Consequently, a subjective range was chosen, which is 40 to 65 million. The range reflects our confidence that the harvest in 1993 will be at least 5 million greater than occurred in 1992 and that it will probably not greatly exceed the all time record harvest of 62 million, which occurred in 1991.

Although separate forecasts for northern and southern Southeast are not being made, we do feel that northern Southeast will make up a significant portion of the overall harvest in Southeast Alaska. During the past 10 years, the harvest in northern Southeast has represented 28% of the total Southeast Alaska harvest. We expect it to be more important in 1993. The harvest in northern Southeast has been odd-year dominant since 1984 and based on the mild winter conditions and a brood year escapement index which was the second highest since statehood, we expect the odd year strength to continue in 1993. The all time record harvest in northern Southeast of 23.0 million occurred in 1941. We would not be surprised to see the 1993 harvest in northern Southeast reach this level.

Karl Hofmeister  
Fisheries Biologist  
Juneau

Jim Blick  
Biometrician  
Juneau

## FORECAST AREA: Prince William Sound

SPECIES: Pink Salmon

## PRELIMINARY FORECAST OF 1993 RUN:

	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
<i>Prince William Sound General Districts</i>		
Natural Run	5.41	1.76–16.66
Escapement Goal <sup>1</sup>	1.35	
Commercial Common Property Harvest	4.06	
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Valdez Fisheries Development Assoc. - Solomon Gulch Hatchery</i>		
Hatchery Run	2.22	1.54–2.90
Broodstock Needs	0.27	
Cost Recovery Needs	0.84	
Commercial Common Property Harvest	1.11	
<i>Prince William Sound Aquaculture Corp. - Cannery Creek Hatchery</i>		
Hatchery Run	5.97	2.47–9.47
Broodstock Needs	0.30	
Cost Recovery Needs	1.49	
Commercial Common Property Harvest	4.18	
<i>Prince William Sound Aquaculture Corp. - W.H. Noerenberg Hatchery</i>		
Hatchery Run	8.41	5.35–11.47
Broodstock Needs	0.33	
Cost Recovery Needs	2.20	
Commercial Common Property Harvest	5.88	
<i>Prince William Sound Aquaculture Corp. - A.F. Koernig Hatchery</i>		
Hatchery Run	5.63	4.80–6.46
Broodstock Needs	0.22	
Cost Recovery Needs	1.48	
Commercial Common Property Harvest	3.93	

<sup>1</sup> This is based on aerial surveys and is intended only as an index.

**FORECAST AREA: Prince William Sound****SPECIES: Pink Salmon****PRELIMINARY FORECAST OF 1993 RUN (continued):**

	Forecast Estimate <u>(millions)</u>	Forecast Range <u>(millions)</u>
<b>TOTAL PRODUCTION:</b>		
Total Run	27.64	15.92–46.96
Natural Escapement Goal	1.35	
Broodstock Needs	1.12	
Cost Recovery Needs	6.01	
Commercial Common Property Harvest	19.16	

**FORECAST METHODS**

The natural returns are predicted from a multiple linear regression of returning adults per outmigrating fry, April through June sea surface temperatures in the northern Gulf of Alaska, and an index of the size and duration of the spring zooplankton bloom in PWS. The measure of returns per alevin is the adult run divided by the alevin index from the preceding spring. The zooplankton index is settled volume above a defined critical value times the number of days the volume remains above that critical value. The 80% confidence interval for the forecast of natural returns was estimated from crossvalidation of the regression using jackknifing procedures.

The forecast for hatchery returns is the sum of hatchery-specific forecasts. For each hatchery the forecast is the product of the number of fry released and the mean hatchery-specific marine survival. The 80% confidence interval around the forecast is derived from the confidence interval around the mean of the marine survival data.

The projected broodstock needs for each hatchery are fairly accurate, but hatchery sales harvest (cost recovery) numbers are preliminary. Prince William Sound Aquaculture (PWSAC) brood and sales are currently limited to 30% of their total return by corporate policy but will vary depending upon inseason estimates of their return. Valdez Fisheries Development Association sales needs are not based upon a fixed percentage and have not been established for 1993. The escapement, brood stock and, cost recovery harvest requirements are treated as constants, and the confidence interval for the commercial common property harvest is the same as for the total return.

## FORECAST DISCUSSION

From data collected in recent years, Cooney (1991)<sup>1</sup> has strong evidence to support a correlation between poor marine survival in PWS pink salmon and the coincidence of cool April through July temperatures and low zooplankton (forage for fry) abundance. This correlation seems to explain some of the variability in our traditional forecast based solely upon the preemergent fry index. The latter model has performed poorly for odd cycle brood years having a large preemergent index, such as the one observed in 1992. On this basis, we opted to depart from tradition and try a new model which incorporates sea surface temperatures and zooplankton abundance to forecast the 1993 return. Although sea surface temperatures in the spring of 1992 were slightly above average, zooplankton abundance was low and the bloom was short-lived. The forecast based on these variables is considerably smaller than what would have been predicted from the alevin index alone and is also considerably smaller than many made in the early 1980s when water temperatures and food abundance were above average.

The point estimate of 22.2 million fish returning to hatcheries in 1993 is the fourth largest forecasted return of hatchery fish in PWS since the inception of the hatchery program. The decrease in projected returns for 1993 relative to those in 1990, 1991, and 1992 is primarily a function of smaller fry releases at some hatcheries. Most notably, VFDA had a major die off in their incubators in the winter of 1991/1992 and lost a significant portion of their 1991 brood year. The lower hatchery forecast is also partly the result of slightly lower estimates of average marine survival as a result of the sound-wide run failure in 1992.

Samuel Sharr  
Fisheries Biologist III  
PWS Salmon Research Project Leader  
Cordova

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<sup>1</sup> Cooney R. and Mark Willette 1991. Regional-level investigations of pink salmon production responses to interannual variations in ocean temperatures: Cooperative Fisheries and Oceanographic Studies. 1991 Pink and Chum Workshop, Parkersville, British Columbia.



## FORECAST AREA: Prince William Sound

## SPECIES: Chum Salmon

## PRELIMINARY FORECAST OF 1993 RUN:

	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
<i>Prince William Sound General Districts</i>		
Natural Run	201	95-451
Escapement Goal <sup>1</sup>	225	
Commercial Common Property Harvest	0	
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Valdez Fisheries Development Assoc. - Solomon Gulch Hatchery</i>		
Hatchery Run	54	42-66
Broodstock Needs	24	
Cost Recovery Needs	0	
Commercial Common Property Harvest	30	
<i>Prince William Sound Aquaculture Corp. - W.H. Noerenberg Hatchery</i>		
Hatchery Run	748	443-1053
Broodstock Needs	119	
Cost Recovery Needs	105	
Commercial Common Property Harvest	524	
TOTAL PRODUCTION:		
Total Run	1003	579-1570
Natural Escapement Goal	225	
Broodstock Needs	143	
Cost Recovery Needs	105	
Commercial Common Property Harvest	553 <sup>2</sup>	

<sup>1</sup> This is based on aerial surveys and is intended only as an index.

<sup>2</sup> Note that this number is greater than if escapement, brood stock, and sales harvests are subtracted from total return. This is because the total projected wild return is less than the escapement objective. Since this shortfall of wild fish cannot be made up from hatchery returns, it is not reasonable to subtract them from the combined hatchery and wild total return to estimate the common property harvest.

## FORECAST METHODS

The natural stock forecast is the pooled results of three separate regressions in which the returns of 3- and 4-year-old fish are predicted from pink returns from the same brood year and 5-year-old fish are predicted from sibling 4-year-old returns in 1989. Jackknife procedures were used on returns for years 1974 through 1990 to cross-validate the forecast model and estimate confidence intervals for each age-specific forecast. The predicted total return for all age groups and the associated 80% confidence interval are the sums of the predictions for individual ages.

The hatchery returns for 1992 are projected from fry releases in 1988, 1989, and 1990; an estimated marine survival of 1.82%; and average age composition data for natural chum returns from brood years 1978 through 1986. The marine survival rate is based on 6 years of fry release and adult return data from the ADF&G Main Bay hatchery. This is the only hatchery for which formal quantitative methods (coded wire tagging results) were used to estimate the portion of the adult returns intercepted in the commercial harvest, hence the only one with reliable total return estimates.

## FORECAST DISCUSSION

The forecast for natural chum returns in 1993 is the second lowest since 1965. This predicted return is largely driven by relatively poor returns of pink salmon from the 1989 brood year, the disastrous returns of pink salmon from the 1990 brood year and the very low abundance of 4-year-old chums in 1992. Forecast based on "siblings" of another species may seem suspect but in most years are corroborated by similar, albeit less reliable, predictions based on regressions between chum salmon sibling age groups.

Projected wild returns in 1993 are too small to meet the escapement objectives and will not support directed fisheries. Despite the complete failure of the wild stocks, the overall harvest of chums in 1993 should still be about two-thirds of the 1965–1991 average. The majority of the harvestable surplus will be from returns to the WHN facility, which is now near peak production capacity for early run chum salmon. A stock of chums having a late-season run timing have been maintained at Solomon Gulch Hatchery, and returns of that stock will contribute approximately 30 thousand fish to the total commercial chum harvest in 1993.

The confidence in the prediction of hatchery chum returns is low. The database for marine survival is limited to a few years of tagged returns to the Main Bay Hatchery. Average age-at-return data is similarly lacking for hatchery returns, and there are at least some indications that it may not follow trends observed in wild stocks.

Samuel Sharr  
Fisheries Biologist III  
PWS Salmon Research Project Leader  
Cordova

## FORECAST AREA: Prince William Sound

SPECIES: Sockeye Salmon

## PRELIMINARY FORECAST OF 1993 RUN:

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
NATURAL PRODUCTION:		
<i><u>Prince William Sound - Coghill Lake</u></i>		
Natural Run	58	25-168
Escapement Goal <sup>1</sup>	25	
Commercial Common Property Harvest	33	
<i><u>Prince William Sound - Eshamy Lake</u></i>		
Natural Run	78	9-148
Escapement Goal <sup>1</sup>	40	
Commercial Common Property Harvest	38	
<i><u>Prince William Sound - Unakwik District</u></i>		
Commercial Common Property Harvest	13	0-28
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i><u>PWSAC - Main Bay Hatchery (Coghill Stock On-site Returns)</u></i>		
Hatchery Run	393	259-747
Broodstock Needs	5	
Cost Recovery Needs	131	
Commercial Common Property Harvest	257	
<i><u>PWSAC - Main Bay Hatchery (Coghill River Returns)</u></i>		
Hatchery Run	59	39-112
Broodstock Needs	0	
Cost Recovery Needs	0	
Commercial Common Property Harvest	59	

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<sup>1</sup> This is based on aerial surveys and is intended only as an index.

## FORECAST AREA: Prince William Sound

## SPECIES: Sockeye Salmon

## PRELIMINARY FORECAST OF 1993 RUN (continued):

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i><u>PWSAC - Main Bay Hatchery (Eshamy Stock On-site Returns)</u></i>		
Hatchery Run	125	82-237
Broodstock Needs	2	
Cost Recovery Needs	74	
Commercial Common Property Harvest	49	
<i><u>PWSAC - Main Bay Hatchery (Eshamy Bay Remote Returns)</u></i>		
Hatchery Run	129	85-244
Broodstock Needs	0	
Cost Recovery Needs	0	
Commercial Common Property Harvest	129	
TOTAL PRODUCTION:		
Total Run	854	466-1340
Natural Escapement Goal	65	
Broodstock Needs	6	
Cost Recovery Needs	205	
Commercial Common Property Harvest	578	

## FORECAST METHODS

The forecast for the natural runs to Coghill Lake returns is the pooled results of four separate regressions. The returns of four 4-old-fish aged 1.2 were predicted from a sibling model using returns of fish aged 1.1 from the prior year. The same sibling model is used to predict returns of fish aged 1.3 from returns of fish aged 1.2, returns of fish aged 2.2 from returns of fish aged 1.2, and returns aged 2.3 from fish aged 1.3. Although catch- and escapement-at-age data exist for the Coghill sockeye returns from as far back as 1962, escapement data prior to the installation of the full weir in 1974 are unreliable. Escapement- and catch-at-age data in the regressions are from 1974 to the present. To calculate an 80% confidence interval, the runs for years 1979 through 1988 were predicted by crossvalidation using a jackknife procedure with

these same models. The predicted total run for all age groups and the associated 80% confidence interval is the sum of the predictions for individual ages.

The forecast for the wild run to Eshamy Lake is the mean of runs since 1965 and the 80% confidence interval is the confidence interval about the mean. The harvest projection for wild stocks in the Unakwik District is the mean of purse seine and gillnet catches in that district since 1968. The 80% confidence interval is the 80% confidence interval around the mean.

The forecast for Main Bay Hatchery on site and at remote release sites which originate from the Coghill stock are based on age specific marine survival rates and age at return data from brood year 1987 hatchery returns. The 1993 returns of 4- and 5-year-old fish will be the third significant run of hatchery fish originating from this brood stock. The majority of the returns will be approximately equal portions of 4- and five-year-old fish and only 60 thousand of the run will be to the remote smolt release site at Coghill River. In the absence of any time series of data for the hatchery sockeye salmon returns, the 80% confidence interval for the natural run to Coghill Lake is expressed as a percent error and used to estimate confidence interval that might be reasonable to expect at the hatchery.

The 1993 run will be the first significant one for hatchery fish originating from the Eshamy. In the absence of historical data for this hatchery stock, the forecast for both on-site and remote returns originating from the Eshamy stock are based on a 20% marine survival and age at return observed in the wild returns of the parent stock. The 20% marine survival is a best guess based on hatchery survival rates for sockeye salmon observed at other facilities. It is higher than the survival rate observed to date for the Coghill stock in the Main Bay facility but fish from the Eshamy stock seem to grow and survive better than fish from the Coghill stock and the 20% rate may be reasonable.

#### FORECAST DISCUSSION

The forecasted total run of approximately 58 thousand sockeye salmon to Coghill Lake in 1993 is the fifth lowest forecast in the last 20 years. The poor forecast for the natural stock in Coghill Lake is largely due to the extremely poor returns of 3- and 4-year-old fish age in 1992. The majority (70%) of returns to Coghill have historically been 5-year-old fish aged 1.3. The returns of 4-year-old fish in 1992 were well below average and based on the sibling model, this bodes poorly for 5-year-old returns aged 1.3 in 1992. The returns of fish aged 1.1 were also very small in 1992 and a very weak return of 4-year-old fish aged 1.2 is likely in 1993.

The poor returns to this lake in recent years appear to be due in part to limnological conditions in the lake. Based on some recent limnological data, the escapement goal for Coghill Lake has been temporarily lowered to allow plankton populations to recover, but given the likelihood that several thousand Coghill Lake sockeye will be intercepted in the fisheries directed at early returns of chum salmon to the WHN and Main Bay hatcheries, it is still extremely unlikely there will be any directed fishery for sockeye salmon in the Coghill District in 1993.

The Eshamy Lake stock is by far the single largest wild stock contributor to the harvests of sockeye salmon outside of the Coghill District. Many of these fish have historically been intercepted incidentally in the purse seine fishery in the Southwest District. The extent of these interceptions is not precisely known but can be estimated based upon run timing and age composition data. Weir counts of the escapement to Eshamy River are available for the last 50 years, and in recent years, age, sex, and size data has been systematically collected for the escapement to Eshamy Lake, the catch in the Eshamy District, and the incidental mixed stock catches in the Southwest District. Catch composition data, escapement data, and catch and escapement age composition data, can now be used to construct brood tables, and in a few years it may be possible to forecast these returns using something better than the mean.

Sockeye salmon fry from the Main Bay/Coghill stock were planted in Pass, and Esther Pass Lakes in the Coghill District in 1989 and again in Pass and Esther Pass Lakes in 1990. There is no evaluation program in place to assess the success of these plants and no forecast has been attempted. Nevertheless, based on the successful returns from the one stocking of sockeye salmon fry into nearby Davis Lake in 1988, there may be some harvestable returns to these remote release sites as well in 1993.

Samuel Sharr  
Fisheries Biologist III  
PWS Salmon Research Project Leader  
Cordova

## FORECAST AREA: Prince William Sound

SPECIES: Coho Salmon

## PRELIMINARY FORECAST OF 1993 RUN:

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
NATURAL PRODUCTION:		
<i>Prince William Sound General Districts</i>		
Commercial Common Property Harvest	12	0-30
HATCHERY AND SUPPLEMENTAL PRODUCTION:		
<i>Valdez Fisheries Development Assoc. - Solomon Gulch Hatchery</i>		
Hatchery Run	88	70-106
Broodstock Needs	3	
Cost Recovery Needs	27	
Commercial Common Property Harvest	58	
<i>Prince William Sound Aquaculture Corp. - W.H. Noerenberg Hatchery</i>		
Hatchery Run	199	147-251
Broodstock Needs	1	
Cost Recovery Needs	38	
Commercial Common Property Harvest	160	
TOTAL PRODUCTION:		
Total Run	299	217-387
Natural Escapement Goal	—	
Broodstock Needs	4	
Cost Recovery Needs	65	
Commercial Common Property Harvest	230	

## FORECAST METHODS

The harvest projection for wild fish is the mean of the historical harvest of wild stocks of coho salmon in PWS from 1968 to 1992. The harvest projection range is the 80% confidence interval about the 1968-1991 harvest mean.

The forecasts for hatchery runs are the product of the number of smolt released from each facility in 1990 and the average marine survival for each facility. The forecast range is based on the 80% confidence interval about the mean of marine survival.

#### FORECAST DISCUSSION

The mean marine survival rates for Solomon Gulch and WHN Hatcheries are 7.2% and 9.6%, respectively. The time series of survival rates is short, 7 years of data for one hatchery and 6 for the other, but the variance is small. Estimated survival rates for the hatchery coho returns were not originally based on tagging data but because natural stock production in PWS is small and harvests of coho salmon are mostly in hatchery terminal areas, total return estimates, and hence marine survival estimates, for hatchery stocks are probably fairly reliable.

Samuel Sharr  
Fisheries Biologist III  
PWS Salmon Research Project Leader  
Cordova



## FORECAST AREA: Prince William Sound

SPECIES: Chinook Salmon

## PRELIMINARY FORECAST OF 1993 RUN:

Forecast Estimate (thousands)	Forecast Range (thousands)
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## HATCHERY AND SUPPLEMENTAL PRODUCTION:

Prince William Sound Aquaculture Corp. - W.H. Noerenberg Hatchery

Hatchery Run	3.27	0.20-6.34
Broodstock Needs	0.38	
Cost Recovery Needs	1.62	
Commercial Common Property Harvest	1.27	

## TOTAL PRODUCTION:

Total Run	3.27	0.20-6.34
Natural Escapement Goal	_____	
Broodstock Needs	0.38	
Cost Recovery Needs	1.62	
Commercial Common Property Harvest	1.27	

## FORECAST METHODS

The prediction for hatchery runs are the product of the number of smolt released from each facility in 1990 and the average marine survival for each facility. The forecast range is based on the 80% confidence interval about the mean of marine survival.

## FORECAST DISCUSSION

There are a few tiny populations of wild chinook salmon in PWS, but they do not contribute significantly to area fisheries. WHN Hatchery is still in the brood stock building phase for this species.

Samuel Sharr  
 Fisheries Biologist III  
 PWS Salmon Research Project Leader  
 Cordova

**FORECAST AREA: Copper and Bering River Areas****SPECIES: Coho Salmon****PRELIMINARY FORECAST OF 1993 RUN:**

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
<b>HARVEST PROJECTION FOR NATURAL RUN:</b>		
Copper River District	310	139-437
Bering River District	124	0-230
Copper & Bering R. Total	434	131-659

**FORECAST METHODS**

The harvest projection for the 1993 run of coho salmon to the Copper and Bering River areas is based on the average catch of the commercial fishery for 1980 through 1992, and the range is the 80% confidence interval about the mean. Although harvest information exists for all years since statehood, only the last 12 years were used to represent 1993 because of substantial increases in efficiency, as well as changing fishing patterns and participation in recent years.

**FORECAST DISCUSSION**

Although there were occasional departures from long-term average temperatures, weather conditions during the freshwater residency of the two major brood years (1989 and 1990) were generally within normal ranges and survival is expected to be average. Returns from the 1989 brood year in the 1992 catch were slightly above the average return for the 1.1 age class; however, the correlation between age-1.1 returns and subsequent sibling returns is poor.

Construction of brood tables and the use of return-per-spawner and sibling-return relationships have not yielded satisfactory results. Possibilities for forecast improvements include reanalysis of historical catch scale samples to remove reader inconsistencies, collection of escapement age data, inclusion of environmental data for freshwater residency years, and inclusion of USFS overwinter survival data from spawning channels.

## FORECAST AREA: Copper River

## SPECIES: Sockeye Salmon

## PRELIMINARY FORECAST OF 1993 RUN:

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
NATURAL PRODUCTION:		
Natural Run	1,400	1,219-1,586
Escapement Goal	616	
Commercial Common Property Harvest	787	
SUPPLEMENTAL PRODUCTION:		
<i>Gulkana Hatchery</i>		
Hatchery Run	221	177-265
Brood Stock and Stream Escapement	88	
Commercial Common Property Harvest	132	
TOTAL PRODUCTION:		
Total Run	1,624	1,396-1,852
Escapement and Brood Stock	704	
Commercial Common Property Harvest	920	

## FORECAST METHODS

Natural Production: The 1993 sockeye salmon forecast utilized historical return-per-spawner data and parent-year escapement weighted by age class (4-, 5-, and 6-year-olds) for the Copper River Delta and Upper Copper River, independently. The 1993 predicted return will be influenced heavily by the 1988 and 1989 brood years for the Upper Copper River and for the Copper River Delta with 5-year-olds expected to be the strongest in each area.

Supplemental Production: The 1993 run will be the result of production from Gulkana hatchery. Brood years 1988 and 1989 using FRED Division standard survival assumptions should produce an adult return of 221,300. A harvest level of 60% would contribute 132,800 salmon to the commercial catch.

## FORECAST DISCUSSION

Natural Production: Continued relatively mild winter conditions, particularly on the Copper River Delta during the freshwater life history stage of the age groups represented in the 1993 return, should produce an above average return per spawner contribution from the below average parent year escapements of 1987, 1988, and 1989. Upper Copper River escapements were near average in all 3 years; thus, generally mild conditions and good distribution should yield above average returns. The forecast will error on the low side if environmental conditions continue to produce above average survival rates; additionally, moderate fry densities should increase the return per spawner.

Supplemental Production: Facility production data and conditions suggest that a wide variation in survival from the expected could significantly alter the 1993 total sockeye return; however, as future years data is collected, predictions will become more reliable.

Kenneth Roberson  
Research Biologist  
Glennallen

**FORECAST AREA: Copper River****SPECIES: Chinook Salmon****PRELIMINARY FORECAST OF THE 1993 RUN:**

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
<b>NATURAL PRODUCTION:</b>		
Total Run	42	35-49
Escapement Goal	15	
Commercial Common Property Harvest	27	

**FORECAST METHODS**

The 1993 chinook salmon forecast utilized historical aerial index and age composition data from the 4-, 5-, 6-, and 7-year-old age classes. Weighted index figures are combined to create a single index of abundance figure which, for lack of better data base, is compared to the historical average escapement index. The expected return is then a return per spawner calculation which does not consider relative density, climate conditions or distribution of spawners.

**DISCUSSION OF THE 1993 FORECAST**

During the past 11 years, chinook salmon returns to the Copper River have tended to be above average and have established several of the top catches on record. Escapements have generally been maintained at high levels. Only a failure of the 1987 and/or 1988 brood years or significant extra production from the 1989 brood year could seriously affect the forecasted return. No climate condition or other event is believed to have significantly impacted any of the brood years involved. A chinook salmon harvest of the 27,100 fish magnitude appears to be a solid although conservative estimate.

**FORECAST AREA: Upper Cook Inlet****SPECIES: Sockeye Salmon****PRELIMINARY FORECAST OF 1993 RUN:**

	Forecast Estimate ( <u>millions</u> )	Forecast Range ( <u>millions</u> )
<b>NATURAL PRODUCTION:</b>		
Total Run	4.0	0.6-7.4
Escapement Goal	1.5	
Commercial Common Property Harvest	2.5	

**FORECAST METHODS**

The major sockeye salmon systems in Upper Cook Inlet are the Kenai, Kasilof, Susitna, Crescent, Chakachatna/McArthur, Big Rivers, Packers Creek, and Fish Creek. Spawner, sibling, and smolt data, if available, were examined for each system. Forecasts for Crescent and Susitna river systems were the mean of results from two linear regression models: one using spawner and the other using sibling data. Forecasts for Kasilof and Kenai river systems were based on estimated smolt survival. Forecasts for Fish and Packer creek systems, also based on smolt survival, were made by Larry Peltz, ADF&G, FRED Division Area Biologist, and Tom Mears, Cook Inlet Aquaculture Association Executive Director, respectively. The range for the 1993 forecast incorporates the average coefficient of variation (CV) estimated for 1990 to 1992 for UCI. This average CV was used to estimate the variance of the 1993 UCI return and to estimate 80% confidence intervals.

**FORECAST DISCUSSION**

In 1992 the forecasted harvest using the Box Jenkins ARIMA model was 3.5 million fish. The actual harvest was 8.9 million fish. The 1992 forecast discussion noted that a larger return was possible if smolt data for the Kenai River system was used. To adjust the forecast technique to incorporate smolt data, a new technique was developed for 1993. Individual system forecast are as follows:

<u>System</u>	<u>Run</u>
Crescent River	218,000
Fish Creek	250,000
Kasilof River	991,000
Kenai River	1,942,000
Packer Creek	109,000
Susitna River	452,000

Kenneth E. Tarbox  
Research Project Leader  
Upper Cook Inlet

## FORECAST AREA: Lower Cook Inlet

## SPECIES: Pink Salmon

## PRELIMINARY FORECAST OF THE 1993 RUN:

	Forecast Estimate (thousands)	Forecast Range (thousands)
NATURAL PRODUCTION:		
Natural Run	798	338-2,707
Escapement Goal <sup>1</sup>	372	
Commercial Common Property Harvest <sup>2</sup>	401	
SUPPLEMENTAL PRODUCTION:		
Hatchery Run	604	317-891
Brood Stock	120	
Commercial Common Property Harvest <sup>3</sup>	484	
TOTAL PRODUCTION:		
Total Run	1,402	655-3,598
Brood Stock and Escapement	492	
Commercial Common Property Harvest <sup>4</sup>	885	

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<sup>1</sup> Escapement goal for systems included in the formal forecast. The total Lower Cook Inlet pink salmon escapement goal, including systems without a forecast, is 489,000.

<sup>2</sup> Rocky Bay is expected to be 25,096 below its escapement goal. Therefore, harvest (401,208) plus escapement goal of (372,500) plus the escapement shortfall (25,096) equal the total run forecast (798,804).

<sup>3</sup> Includes hatchery and commercial common property harvests.

<sup>4</sup> Additional harvests may be expected in systems not included within the forecast.

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## FORECAST METHODS

The forecast of wild pink salmon runs to 11 harvest areas in the Lower Cook Inlet Management area was based on either Ricker type curves or log-log regression analysis using 18 to 31 years of escapement

observations. The projected harvest was obtained by subtracting both escapement goals and escapement shortfalls from the forecast. The forecast range was developed from cross-validation errors. The forecast of supplemental pink salmon production was based on recent-year trends of average ocean survival rates (1–3%) for two enhancement sites. The projected harvest was obtained by subtracting brood stock goals from the supplemental production forecast.

## FORECAST DISCUSSION

The natural production model was tested with cross-validation methods. During the simulation tests, the model was able to correctly forecast 22 out of 31 directions of change in annual run size. Accordingly, we have some confidence that the 1993 run will continue the odd-year cycle; that is, larger sized runs during odd-numbered years. However, the model has performed poorly in forecasting the magnitude of the change in run size. The two recent runs, 1991 and 1992, were both less than the forecast. Of the 11 systems with a forecast in 1992, only five had runs within the forecast range; the other six were below the forecast range. By way of comparison, the 1991 and 1992 runs were also less than the supplemental production forecasts. We, therefore, have less confidence in the magnitude of the forecast. If realized, a natural run of the size being forecasted would be above the 1962–1992 median run size (647,500).

Pink salmon escapement levels in 1991 were uneven throughout the Lower Cook Inlet area. Escapements in Port Dick, Port Graham, Seldovia, and Windy Bay were within the desired range. Escapements in Humpy Creek, Resurrection, and Rocky Bays were below their escapement range, and those in Bruin Bay, Port Chatham, Nuka Bay, and Ursus-Rocky Coves exceeded escapement goals.

In the Southern District, harvests are projected to be 11 thousand in Humpy Creek, 20 thousand in Seldovia, and 4 thousand in Port Graham. Additional harvests are expected in China Poot Bay and the Barabara Creek area. Southern District supplemental production of pink salmon have made significant contributions to the total lower Cook Inlet commercial common property harvest. Contribution has ranged from 24–90% in recent years. However, recent hatchery cost recovery requirements have reduced the harvest available for the commercial common property fishery. Short-term rearing enhancement projects are expected to produce additional harvests of 90 thousand in Halibut Cove Lagoon and 394 thousand in Tutka Bay and Lagoon.

In the Outer District, harvests are projected to be 13 thousand in Port Chatham, 31 thousand in Windy Bay, 152 thousand in Port Dick, and 29 thousand in Nuka Bay. No harvest is expected in Rocky Bay. In the Eastern District, harvest is projected to be 22 thousand in Resurrection Bay. In the Kamishak Bay District, harvests are projected to be 154 thousand in Bruin Bay and 16 thousand in Ursus and Rocky Coves.

Henry Yuen  
C.F. Research Biologist

Nick Dudiak  
FRED Area Biologist

Lower Cook Inlet Management Area



## FORECAST AREA: Kodiak

## SPECIES: Pink Salmon

## PRELIMINARY FORECAST OF THE 1992 RUN:

	Forecast Estimate (millions)	Forecast Range (millions)
NATURAL PRODUCTION:		
Natural Run	18.1	16.5–19.7
Escapement Goal <sup>1</sup>	3.0	
Commercial Common Property Harvest	15.1	
HATCHERY PRODUCTION: <sup>2</sup>		
Hatchery Run	6.8	2.1–8.0
Broodstock Needs	0.3	
Commercial Common Property Harvest	6.5	
TOTAL PRODUCTION:		
Total Run	24.9	
Escapement Goal <sup>1</sup>	3.3	
Commercial Common Property Harvest	21.6	

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<sup>1</sup> With the exception of hatchery production all escapement values represent indexed escapement.

<sup>2</sup> Hatchery production forecast is for Kitoi Bay Hatchery and was prepared by Tim Joyce. See Afognak District for additional description. All numerical values represent numbers of pink salmon.

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## FORECAST METHODS

The forecast for the 1993 natural or wild pink salmon run to the Kodiak Management Area was determined as follows: A point estimate for the total management area run was calculated from a stepwise multiple regression analysis of the past 27 years' preemergent pink salmon sac fry sampling data. Variable used in the analysis were the indexed live fry densities and the combined March-April "departure from the norm" ambient air temperatures taken in Kodiak. The upper and lower ranges are the 80% confidence intervals.

Average survival rates from 1978–1991 were used to compute the Kitoi Bay Hatchery pink run point estimate. The low range estimate was calculated by using the average survival rate of the two lowest odd-year returns, and the high range was calculated by using the average survival rate of the two highest odd-year returns.

#### DISCUSSION OF THE 1993 FORECAST

Preemergent pink salmon fry sampling of the Kodiak Management Area index streams conducted during March and April of 1992 indicated generally good over-winter survival of the eggs and sac fry. These fry are from a good brood year escapement in 1991; the indexed escapement estimate was 4.32 million pink salmon. Sampling resulted in an unweighted live fry index of 289.21 live fry per square meter of spawning area. This live fry index is the highest odd-year index on record. Early spring conditions in 1992 were very favorable for outmigration and nearshore pink fry survival. The record high live fry density and mild spring conditions are the factors which result in the 1993 pink salmon run being forecasted at near-record-high levels. The live fry index for the 1993 run is very similar to the index generated in the spring of 1990 (275.01 live fry/m<sup>2</sup>) which resulted in an odd-year record high wild pink salmon harvest in 1991 of 15.3 million. However, in 1991, and in 1990, pink salmon returned at lower-than-expected levels and at low average weights. If marine conditions which may have affected the 1991 and 1990 runs haven't improved, the actual harvest for 1993 may only approach the lower end of the range at 15 million and likely will not reach the midpoint estimate of 21.6 million pink salmon.

The 1993 forecast by district is as follows:

Afognak District: The preemergent fry index for this district is well above average for an odd year, more closely approximating an even-year density. Fry production from Portage Creek (Perenos), East Arm Paramanof, and Big Danger Creek are all higher than average. Due to the excellent early marine conditions, a total run of 1.1 million pink salmon is expected. The escapement goal is 250,000 pink salmon, leaving 850,000 available for harvest.

Afognak District Supplemental Production: The Kitoi Bay Hatchery total pink run point estimate is 6.8 million fish from a release of 139.5 million reared fry and 7.6 million emergent fry. Only 270,000 pinks are needed for escapement and brood stock requirements, leaving 6.5 million pink salmon available for harvest. Hatchery manager Tim Joyce reports that early marine conditions will probably produce better than average survivals. Further, he stated that the condition of the fish was excellent at release so the odd-year midpoint of 6.8 million can be expected, but returns above 8.0 million are not expected.

Westside Districts: Overall, live fry densities for this district are the highest on record, mainly due to the exceptionally high level of live fry found in the Uyak River and higher-than-average fry survival in the Terror and Uganik Rivers. The Uyak, Terror, and Uganik Rivers all showed signs of flooding but the fry seemed to have held and survived well. Live fry indices were lower than expected in the East Uyak Creek (#203) and the Zachar River. Good escapement of pink salmon in 1991 combined with mild spring

conditions and excellent early-marine rearing conditions lead to a forecast of 5.5 million pink salmon expected to return to this district. The escapement goal for this district is 750,000 pink salmon. This leaves 4.75 million available for harvest.

Alitak District: Live fry densities for this district were excellent. The overall live fry index for this district is one of the highest on record. Heavy flooding was evident on the Deadman River but the fry held and survived exceptionally well, and fry densities were well above average. Upper Dog Salmon (east fork) was sampled this year and densities were very high. Scouring was evident on lower Dog Salmon and lower Humpy Rivers. The densities for Humpy River were better than average though more freezing damage was noted. Once again, the mild spring should enhance early-marine fry survival. As a result of the high fry densities and the very favorable early-marine conditions, a run of 3.5 million pink salmon is expected for this district. The escapement goal is 635,000 for the Alitak District leaving 2.87 million pink salmon available for harvest.

Eastside Districts: The overall live fry index for this district is very good. There were very high fry densities on some eastside streams (particularly Seven Rivers and Kiliuda) though the streams around the road system did show flooding damage (the Buskin, American, Sid Olds, and Saltery Creeks all had average to below average live fry densities). If the good spring conditions aid survival of outmigrating fry the pink run in 1993 for this district should be strong. With 6.5 million pink salmon forecasted to returned to these districts, and an escapement goal of 750,000, this leaves 5.75 million pink salmon available for harvest.

Mainland District: Fry sampling in this district was incomplete due to adverse weather conditions. Most streams sampled showed signs of flooding. Dakavak and Geographic streams were completely blank, with no live fry or eggs found. A few dead eggs were found. Kukak, Missak, Kinak, and Kashvik streams all had very good live fry indices. Alinchak and Big Creek were low average with flooding and freezing damage evident. Overall, live pink fry densities were fair, and combined with good early marine conditions about 1.5 million pink salmon are forecasted to return to this district. Escapement requirements for this district are 645,000 pink salmon, leaving 855,000 pink salmon available for harvest.

Prepared by: Kevin Brennan  
Assistant Area Management Biologist  
Kodiak Management Area

**FORECAST AREA: Kodiak, Frazer Lake****SPECIES: Sockeye Salmon****PRELIMINARY FORECAST OF THE 1993 RUN:**

	Forecast Estimate (thousands)	Forecast Range (thousands)
<b>TOTAL PRODUCTION:</b>		
Total Run	430	200–700
Escapement Goal	140–200	
Commercial Common Property Harvest	230–290	

**FORECAST METHODS**

The 1993 Frazer Lake forecast is the pooled results of four age-specific estimates derived by regression equations of sibling-return relationships for post-1974 broods. Age 1.2 predication was determined from age-1.1 siblings; age 1.3 from age-1.2 siblings; age 2.2 from age-1.2 and age-2.2 siblings; and age 2.3 from age-2.2 siblings. The forecast range is the approximate 80% confidence level around the mean as derived from the proportional error of previous Frazer Lake run forecasts.

**FORECAST DISCUSSION**

The 1993 Frazer Lake run (430 thousand) should provide about half as many fish as the previous 5-year average (840 thousand) but about the same number as the 1992 run (418 thousand). Four- and five-year-old, two-ocean fish are expected to compose about 86% of the 1993 run. The projected 1993 commercial harvest is 230 to 290 thousand fish. In the Alitak Bay District, the Frazer Lake sockeye run is mainly from early June to mid-July, and the run generally peaks in late June. Confidence in this forecast is moderate.

Bruce M. Barrett  
 Fisheries Biologist  
 Division of Commercial Fisheries

**FORECAST AREA: Kodiak, Upper Station Lakes****SPECIES: Sockeye Salmon, Early Run****PRELIMINARY FORECAST OF THE 1993 RUN:**

	Forecast Estimate (thousands)	Forecast Range (thousands)
<b>TOTAL PRODUCTION:</b>		
Total Run	98	50-150
Escapement Goal	50-75	
Commercial Common Property Harvest	23-48	

**FORECAST METHODS**

The 1993 Upper Station run forecast is the pooled results of four age-specific estimates derived by regression equations of sibling-return relationships for post-1974 broods. Age 1.2 predication was determined from age-0.2 and age-1.1 siblings; age 1.3 from age-1.2 siblings; age 2.2 from parent escapement and age-1.2 and estimated age-1.3 siblings; and age 2.3 from age-2.2 siblings. The forecast range is the approximate 80% confidence level around the mean as derived from the proportional error of previous early run forecasts for Upper Station Lakes.

**FORECAST DISCUSSION**

If the forecast is correct, the 1993 run should provide about 20% fewer fish than the previous 5-year average (124 thousand) but more than twice the run that occurred in 1992 (41 thousand). Most (62%) of the 1993 run is expected to be age-2.2 fish which are two-ocean 5-year-olds. The expected 1993 commercial harvest from the early run is about 25 to 50 thousand fish. In the Alitak Bay District, the early Upper Station sockeye run extends from early June to mid-July; the peak occurs about mid June. Overall, confidence in the 1993 forecast is not high.

Bruce M. Barrett  
 Fisheries Biologist  
 Division of Commercial Fisheries

**FORECAST AREA: Kodiak, Upper Station Lakes****SPECIES: Sockeye Salmon, Late Run****PRELIMINARY FORECAST OF THE 1993 RUN:**

	Forecast Estimate ( <u>thousands</u> )	Forecast Range ( <u>thousands</u> )
<b>TOTAL PRODUCTION:</b>		
Total Run	585	300-900
Escapement Goal	150-200	
Commercial Common Property Harvest	385-435	

**FORECAST METHODS**

The 1993 Upper Station late run forecast represents the sum of four age-specific estimates from regressions equations developed from sibling and escapement-return relationships for the post 1974 brood years and a single age-specific estimate derived from a smolt abundance index. Age 0.2 return was determined from a parent escapement relationship; age 0.3 from age-0.2 siblings; age 1.3 from age-1.2 siblings; and age 2.2 from the estimated age-1.3 siblings. Age 1.2 return from the 1989 brood year was estimated from the relationship of age-1. smolt and age 1.2 adult abundance for the 1988 brood year. The forecast range is the approximate 80% confidence level around the mean as derived from the proportional error of previous late run forecasts for Upper Station Lakes.

**FORECAST DISCUSSION**

The 1993 run is expected to provide about 20% fewer fish than the previous 5-year average (719 thousand) but 40% more than the 1992 run (418 thousand). Age-0.2 and age-0.3 fish should compose about 40% of the run, and age 2.2 is expected to be about 35% of the run, which are two-ocean 5-year-olds. The expected 1993 commercial harvest from the late run is 385 to 435 thousand fish. In the Alitak Bay District, the late Upper Station sockeye run extends from mid-July through early September. Typically, the peak is in mid-August. Confidence in this forecast is moderate.

Bruce M. Barrett  
 Fisheries Biologist  
 Division of Commercial Fisheries

**FORECAST AREA: Kodiak, Ayakulik River (Red River)**

SPECIES: Sockeye Salmon

**PRELIMINARY FORECAST OF THE 1993 RUN:**

	Forecast Estimate <u>(thousands)</u>	Forecast Range <u>(thousands)</u>
<b>TOTAL PRODUCTION:</b>		
Total Run	480	300-700
Escapement Goal	200-300	
Commercial Common Property Harvest	180-280	

**FORECAST METHODS:**

The 1993 Ayakulik sockeye forecast is a sum of individual predications for six age classes: 1.1, 2.1, 1.2, 1.3, 2.2, and 2.3. The predications were calculated from multiple regression equations developed from correlations between siblings, escapements, and returns for brood years post 1974. The forecast range is derived from the proportional error of previous Ayakulik River sockeye forecasts.

**FORECAST DISCUSSION:**

The forecasted 1993 Ayakulik sockeye run (480 thousand) is about half the previous 5-year average (1 million) and about 40% less than the 1992 run (748 thousand). Most (85%) of 1993 run should be 5- and 6-year-old fish produced from the 1987 and 1988 escapements. The expected 1993 commercial harvest off the Ayakulik run is 180 to 280 thousand fish. The majority of the catch should occur in June. The confidence in this forecast is good.

Bruce M. Barrett  
 Fisheries Biologist  
 Division of Commercial Fisheries

## FORECAST AREA: Chignik Management Area

SPECIES: Sockeye salmon

## PRELIMINARY FORECAST OF THE 1993 RUN:

	Forecast Estimate (thousands)	Forecast Range (thousands)
TOTAL PRODUCTION:		
<i>Early Run (Black Lake)</i>		
Run	1,600	1,120–2,160
Escapement	400	
Commercial Common Property Harvest	1,200	
<i>Late Run (Chignik Lake)</i>		
Run	950	620–1,620
Escapement	250	
Commercial Common Property Harvest	700	
<i>Total Chignik Run</i>		
Total Run	2,590	1,740–3,780
Escapement	650	
Commercial Common Property Harvest	1,940	

## FORECAST METHODS

The estimated run to Black Lake is the sum of a regression estimate for two major age classes (ages 1.3 and 2.3) and a 10-year average for minor age classes; the Chignik Lake run is based on a recruit per spawner relationship. The Black Lake forecast is based on the historical relationship between the number and length of prior-year age-1.2 fish, and the parent year escapement number. All other age classes are predicted from a 10-year average. The Chignik Lake forecast accuracy has historically been quite variable and developing a model, such as the one used for the Black Lake run, has been unsuccessful. The Chignik Lake run forecast for 1993 was derived using an average return per spawner ( $R/S = 4.41$ ) for years after 1969.

## DISCUSSION OF THE 1993 FORECAST

Early Run: The 1993 Black Lake sockeye salmon run is expected to be 1.64 million fish. This is approximately 0.10 million fish less than the 1982–91 average run of 1.74 million fish and 200,000 fish



less than the 1992 forecast. This below-average run is expected because in 1992 age-1.2 fish numbered 33,005 less than the 10-year average of 175,456.

Late Run: The estimated 1993 Chignik Lake sockeye run is 0.95 million fish, 20,000 less than the 1982-91 average of 1.15 million fish. The Chignik Lake run forecast accuracy has historically been quite poor when compared to actual returns. The 1987 parent year, which is expected to produce 60% of the 1993 run, was 35,548 below the 250,000 desired escapement goal.

Alan Quimby  
Area Management Biologist  
Chignik Area ADF&G

David Owen  
Assistant Area Biologist  
Chignik Area ADF&G

FORECAST AREA: **Bristol Bay**SPECIES: **Sockeye Salmon**

## PRELIMINARY FORECAST OF 1993 RUN:

	Forecast Estimate ( <u>millions</u> )	Forecast Range ( <u>millions</u> )
<b>TOTAL PRODUCTION:</b>		
Total Run	44.7	27.3–62.1
Escapement Goal	9.8	
South Peninsula Quota	2.9	
Commercial Common Property Harvest (Inshore)	32.0	

Forecasted sockeye harvests for inshore Bristol Bay fishing districts are as follows: Naknek-Kvichak = 9.3 million; Egegik = 14.8 million; Ugashik = 4.2 million; Nushagak = 3.3 million; and Togiak = 0.4 million.

## FORECAST METHODS

The 1993 Bristol Bay sockeye salmon forecast is the sum of individual predictions for nine river systems (Kvichak, Branch, Naknek, Egegik, Ugashik, Wood, Igushik, Nushagak/Mulchatna, and Togiak) and four age classes (age 1.2, 1.3, 2.2, and 2.3). Predictions for each age class returning to a river system (except Nushagak/Mulchatna) were calculated by averaging results from simple linear regression models based on the relationship between returns and either spawners or siblings. Also the relationships between returns and smolt outmigrants were examined with regression models for Kvichak, Egegik, Ugashik, and Wood Rivers. Results from each regression model were excluded from final forecast calculations if the slope of the line was not significantly different from zero ( $P < 0.25$ ). The mean return of an age class to a specific river system was used to predict returns when none of the models could be used. Nushagak/Mulchatna River predictions were calculated from 1982–92 mean returns by age class. In addition to the four major age classes, a prediction was also made for the return of age-0 freshwater fish to Nushagak/Mulchatna River because of their relative importance to the total run of that system.

The database used for the 1993 forecast of sockeye returns was similar to that used for the 1989–92 predictions. We used production data from recent years (since 1978) to predict returns for systems on the eastside of Bristol Bay (Kvichak, Branch, Naknek, Egegik, and Ugashik Rivers) and all years data (since 1956) for systems on the westside of Bristol Bay (Wood, Igushik, and Togiak Rivers). Because the number of returning adults produced from each spawner has shown a dramatic increase since 1978 for eastside rivers, we thought use of recent data would provide more accurate and less biased predictions of

run size. To estimate and compare forecasting errors of using recent versus all data, we made predictions for 9 years (1984–92). For eastside Bristol Bay predictions collectively, results from predicting 9 years in the past indicated that the use of recent data would increase accuracy (mean absolute percent error; 1984–92 was 28.1% using recent data and 45.2% using all data) and decrease bias (mean percent error; 1984–92 was -22.8% using recent data and -45.2% using all data). However, using recent data for westside predictions resulted in large over-forecasting errors which reduced accuracy (mean absolute percent error; 1984–92 was 55.4% using recent data and 22.9% using all data) and increased bias (mean percent error; 1984–92 was 46.4% using recent data and -21.2% using all data).

Although using recent production data rather than all data reduced prediction errors for eastside rivers during years tested (1984–92), we still would have under forecasted eastside returns 7 out of 9 years. To further correct this tendency of under-forecasting, we increased the 1993 forecast for each river by its respective prediction error for the years 1984 to 1992. The 1993 adjustments by river resulted in an overall increase of 36.5% for the total Bristol Bay forecast. The 1984-92 predictions errors by river were: 33% for Kvichak, 10% for Branch, 21% for Naknek, 53% for Egegik, 31% for Ugashik, 20% for Wood, 83% for Igushik, and 37% for Togiak. The average prediction errors for years 1984 to 1992 were used because those were the years we were able to hindcast using recent years production data. We also investigated trends in predictions errors based on all years data with regression and time series analysis but chose not to use these methods because results were similar to the simpler method of applying 1984–92 prediction errors.

The mean squared error (MSE) of the total run forecast was calculated from total run predictions made for 1987 to 1992 and was based on the same methods used for the 1993 forecast (the use of recent years production data for eastside systems and all years production data for westside systems corrected by each individual river's average error rate). The MSE was then used to estimate the standard error and 80% confidence bounds.

## FORECAST DISCUSSION

Based on the method described above, 44.7 million sockeye salmon are expected to return to Bristol Bay in 1993. A run of this size would be 38% greater than the previous 20-year mean (32.3 million; range, 3.5 million to 66.3 million), and 14% greater than the previous 10-year mean (39.2 million; range, 24.0 million to 48.9 million). Runs are expected to exceed spawning escapement goals for all systems.

The inshore harvest is expected to be 32.0 million sockeye salmon. A harvest of this size would be 76% greater than the previous 20-year mean (18.2 million; range, 0.7 million to 37.3 million) and 27% greater than the previous 10-year mean (25.1 million; range, 13.9 million to 37.3 million). An additional 2.9 million Bristol Bay sockeye salmon will be harvested during June in the Shumagin Islands and South Unimak fisheries under the current Alaska Board of Fisheries management plan (8.3% of the total projected 34.9 million harvest).

Differences in projections from the three linear regression models (spawner-return, sibling, and smolt) and out of range data suggest possible deviations in the 1993 forecast. The returns of sockeye salmon to the Kvichak River could be less than predicted because the smolt data base predicted fewer returns of all ages than either the spawner-return or the sibling databases. There is a high degree of uncertainty in forecasting the 1993 run to Egegik District because some data used in regression models were beyond the range of data used to fit these models; the number of spawners in 1988, age-II smolt in 1990 and 1991, and age-2.2 adults in 1992 were all greater than had ever before been recorded. Such data was omitted from forecasting models in past years, but based on hindcasting results, we felt that inclusion of these data will improve forecasting accuracy.

Beverly Cross  
Barry Stratton  
Drew Crawford

Research Biologists  
Anchorage

**FORECAST AREA: Bristol Bay, Nushagak District****SPECIES: Chinook Salmon****PRELIMINARY FORECAST OF 1993 RUN:**

	Forecast Estimate ( <u>thousands</u> )	Forecast Range ( <u>thousands</u> )
<b>TOTAL PRODUCTION:</b>		
Total Run	138	90–187
In-River Run Goal <sup>1</sup>	75	
Commercial Common Property Harvest	64	

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<sup>1</sup> The Nushagak inriver run goal is 75,000 chinook salmon which provides for a biological escapement goal of 65,000 spawners and an additional harvest of 10,000 chinook salmon by upriver subsistence and sport fisheries.

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**FORECAST METHODS**

The 1993 chinook salmon forecast for Nushagak District is the sum of individual predictions for five age classes (ages 1.1, 1.2, 1.3, 1.4, and 1.5). The prediction for each age class was first calculated from a simple linear regression model based on the relationship between sibling returns in succeeding years (e.g., age-1.4 returns for 1993 based on age-1.3 returns in 1992). However, predictions from regression models were only used if the slope of the line was significantly different from zero ( $P < 0.25$ ). If this criteria was not met, the mean return of an age class was used to predict 1993 returns.

Regression models were used to predict age-1.3, age-1.4, and age-1.5 returns. Mean returns were used to predict age 1.1 and 1.2. In addition, the 1993 forecast was adjusted to account for over-forecasting errors that have occurred for 8 out of the past 9 years. The 1993 prediction was reduced by the 1984–1992 average forecast error (19.35%). The average forecast error from 1984–1992 was used because the number of chinook salmon returning to Nushagak River has declined since 1984. A cross-validation procedure was used to estimate the mean squared error (MSE) of 1984–1992 total run predictions calculated with the same methods used in 1993. The MSE was then used to estimate the standard error and the 80% confidence bounds.

**FORECAST DISCUSSION**

The age composition of the 1993 forecasted run is 0.4% (0.5 thousand) age 1.1, 14.1% (19.6 thousand) age 1.2, 38.9% (53.8 thousand) age 1.3, 42.9% (59.4 thousand) age 1.4, and 3.7% (5.2 thousand) age 1.5. The 1993 forecasted run of 138.5 thousand chinook salmon is 15% less than the long-term (1966–1992) mean run of 163.3 thousand, and 26% greater than the most recent 5-year (1988–1992) mean run of 109.5 thousand. The projected harvest of 63.5 thousand is 22% less than the long-term mean harvest of 81.4 thousand and 96.6% greater than the most recent 5-year mean harvest of 32.3 thousand. The chinook salmon run to Nushagak District declined from 1984–1990 but increased somewhat in 1991 and 1992.

Beverly Cross  
Research Project Leader

**HARVEST OUTLOOK FOR THE AYK REGION:**

Management Area	Species					
	Chinook	Sockeye	Coho	Pink	Chum	Fall Chum
Kuskokwim River	19-56	33-137	196-660	0	199-1382	
Kuskokwim Bay	15-55	13-124	35-118	0	13-87	
Kuskokwim Total	34-111	46-26	231-778	0-1	212-1469	
Yukon	80-98	0	50-75	0	400-800	72-197
Norton Sound	6-8	0	50-80	0 <sup>1</sup>	50-80	
Kotzebue Sound	0	0	0	0	150-250	
<b>Total</b>	<b>120-217</b>	<b>46-261</b>	<b>331-933</b>	<b>0-1</b>	<b>812-2599</b>	<b>72-197</b>
Mean	168	153	632	.5	1705	134

<sup>1</sup> Norton Sound pink salmon returns for 1993 should be large for an odd-year return which are usually smaller than even-year returns; limited markets have resulted in the very low harvest projections.