

Fishery Data Series No. 92-38

Stock Assessment of the Return of Late Run Chinook Salmon to the Kenai River, 1991

by

S. L. Hammarstrom

September 1992

Alaska Department of Fish and Game

Division of Sport Fish



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Division of Sport Fish
Anchorage, Alaska

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ABSTRACT

The estimated total return of late-run chinook salmon *Oncorhynchus tshawytscha* to the Kenai River in 1991 was 40,163 plus the unavailable harvest estimate in the recreational marine fishery of Deep Creek (estimates will be available later in 1992 from the statewide harvest survey postal questionnaire). The total harvest in the marine gill net fisheries, commercial drift and set net, personal use set net and dip net, and Kenaitze Indian educational set gill net fisheries was 5,550. The total inriver return of late-run chinook salmon as estimated through hydroacoustic techniques was 34,614. The estimated angler-effort and harvest as measured from creel survey during the late chinook salmon run were 229,999 angler-hours and 6,849 chinook salmon, respectively.

Release mortality was estimated at 103 fish. Spawning escapement (27,662) was estimated through subtraction of total fishing mortality from total inriver return and met spawning requirements stipulated in the management plan. The predominant age class of the commercial harvest, inriver return, and recreational harvest was age-1.4 fish.

Migratory timing models were used to project spawning escapement during the 1991 fishery. Some restrictions to the fishery were required to achieve escapement goals.

Production from the 1984 brood did little better than replacement. However, production from the 1985 brood will approach two returns-per-spawner.

KEY WORDS: Kenai River, chinook salmon, *Oncorhynchus tshawytscha*, creel survey, effort, harvest, migratory timing, sibling ratios, brood tables.

INTRODUCTION

The largest freshwater recreational fishery in Alaska occurs in the Kenai River which received an average of nearly 270,000 angler-days of effort over the years 1983-1990 (Mills 1984-1991). This represents approximately 15% of the state's recreational fishing effort. The majority of the angler-effort occurs in the section of the river between the outlet of Skilak Lake and Cook Inlet (Figure 1) during a fishery directed primarily at returning chinook salmon *Oncorhynchus tshawytscha* during May, June, and July.

It has been long recognized that the Kenai River has two stocks of chinook salmon: (1) an early run which enters the river from mid-May through June, and (2) a late run which enters the river from late June through early August (Burger et al. 1985 and Bendock and Alexandersdottir 1991). Early-run fish are destined primarily for tributary spawning locations although some mainstem spawning also occurs. Late-run fish are destined almost exclusively for mainstem spawning locations. The focus of this report is the late run.

Prior to 1970, the recreational fishery in the Kenai River was comprised of shore-based anglers targeting on sockeye salmon *O. nerka* in July and coho salmon *O. kisutch* in August and early September. In 1973, large numbers of anglers began experimenting with a new fishing method that involved bouncing brightly colored terminal gear along the river bottom from a drifting boat. This technique had been used effectively by anglers fishing for chinook salmon on rivers in the Pacific Northwest. It proved to be a very effective method for catching chinook salmon on the Kenai River, and the fishery began to expand rapidly (Figure 2).

The Alaska Department of Fish and Game, Division of Sport Fish, initiated creel surveys for this fishery in 1974 (Hammarstrom 1975). A comprehensive stock assessment program was initiated in 1985 and included estimates of inriver return (Hammarstrom and Larson 1986). By 1988, continued growth of both early- and late-run fisheries had heightened both agency and public concerns that stocks were vulnerable to overexploitation. In response to this concern, the Board of Fisheries (BOF) in 1988 adopted management plans for the early and late returns of chinook salmon to the Kenai River (McBride et al. 1989). These plans stipulate both: (1) specific escapement goals for which the fisheries in question will be managed, and (2) the manner in which selected fisheries are to be managed in the event of conservation shortfall. These fisheries have been managed under the auspices of these management plans since 1989.

The objectives of the department's stock assessment program are two-fold. First, return statistics are compiled to assess production and include estimates of harvest and abundance by age. Second, run timing is modeled to implement the escapement goal policy and includes migratory timing estimates of effort, harvest, and abundance.

In this report, I present statistics for the 1991 late-run return, including estimates of inriver return, fishery parameters, and escapement. These estimates are compared to historic performance and their application to the 1991 return is discussed. Finally a forecast of the 1992 return is presented.

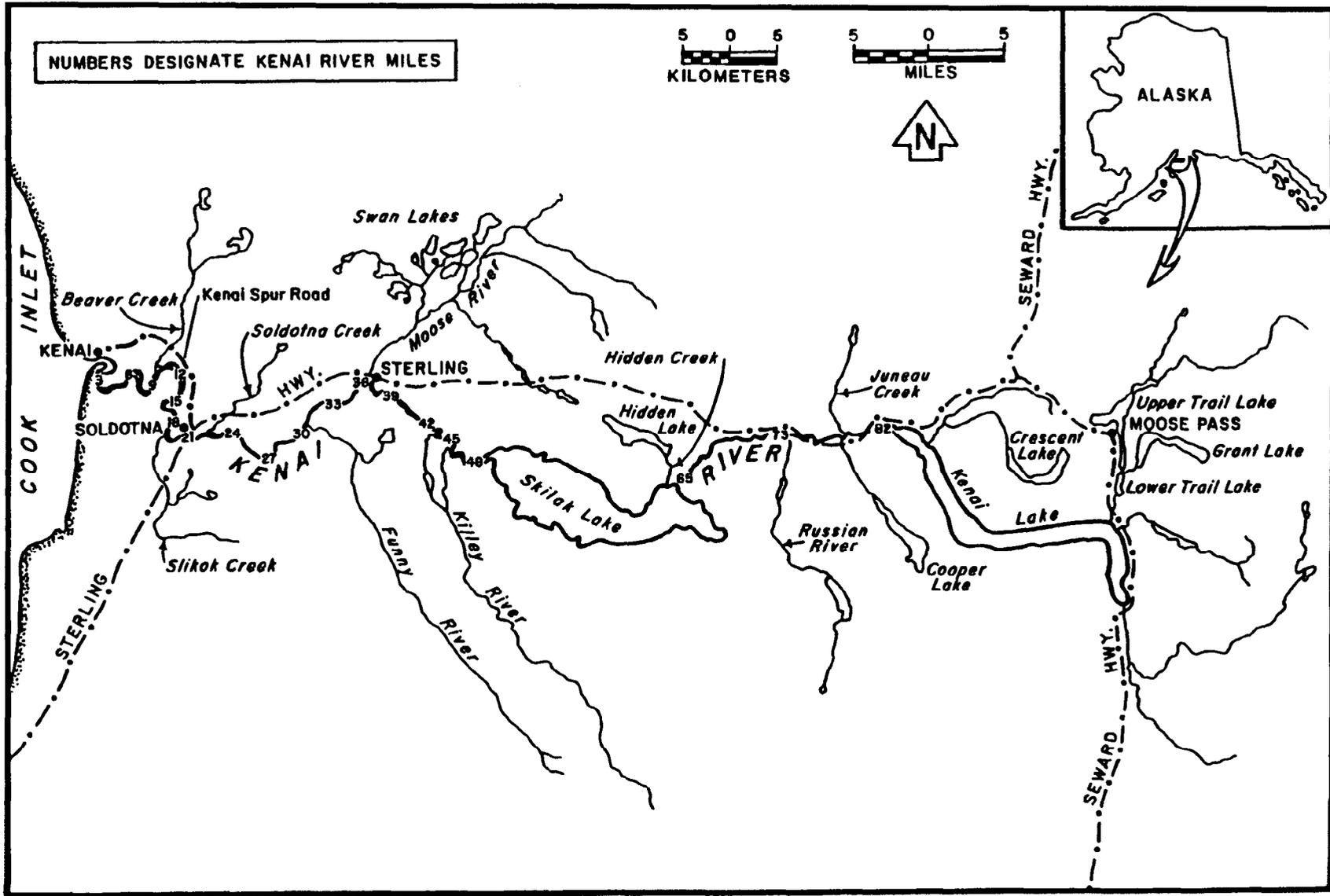


Figure 1. Map of Kenai River drainage.

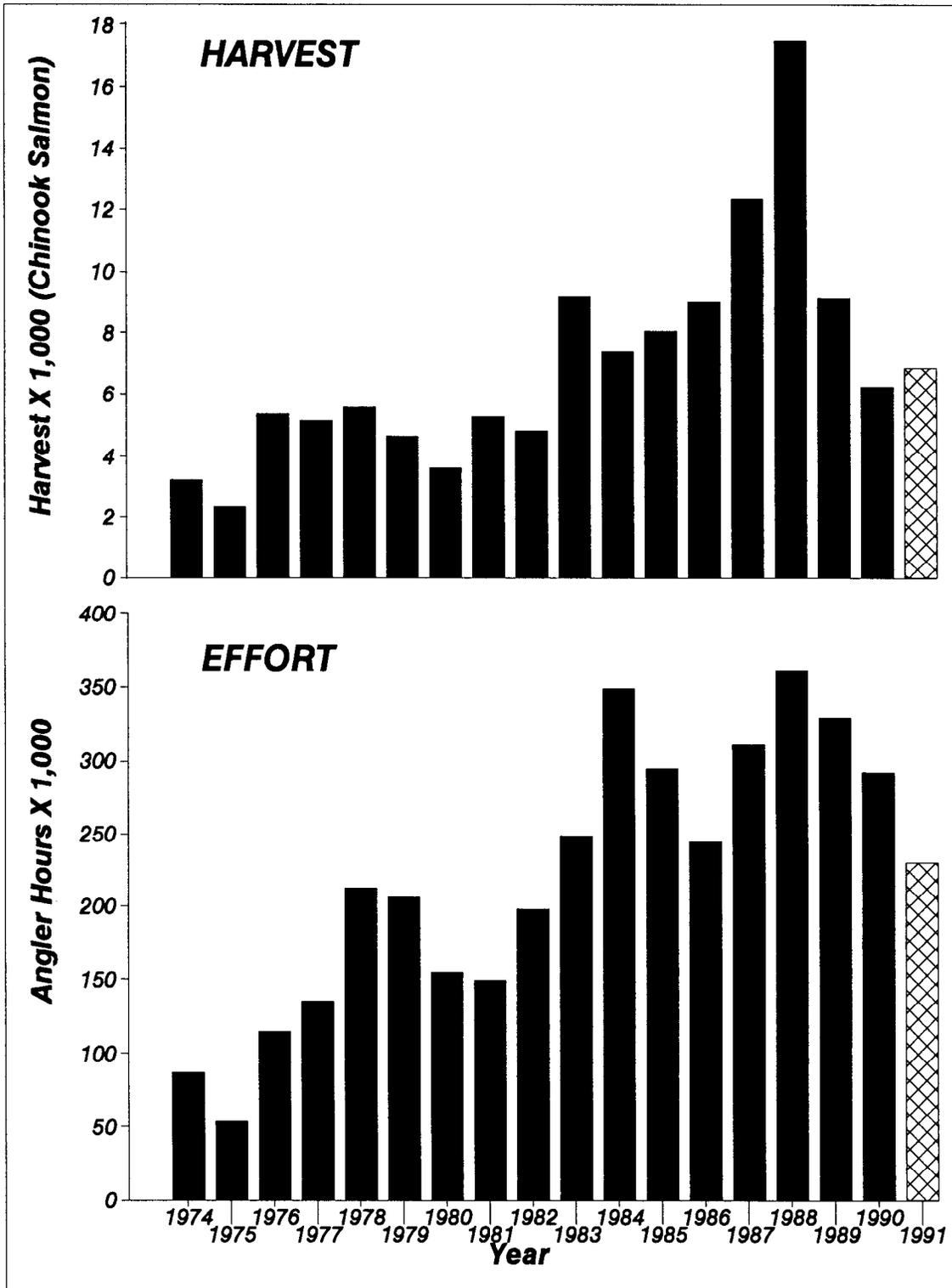


Figure 2. Historical harvest and effort in the recreational fishery for late-run chinook salmon, Kenai River, 1974-1991.

Previous information pertaining to the chinook salmon fisheries in the Kenai River has been presented by Hammarstrom (1975-1981, 1988-1991), Hammarstrom and Larson (1982-1984, 1986), Hammarstrom et al. (1985), and Conrad and Hammarstrom (1987). Details of the 1992 creel survey of the recreational fishery are reported by Hammarstrom (*In prep*). In addition, angler-effort and harvest by species for the recreational fishery has been estimated by Mills (1979-1991) via postal questionnaire. Rationale for the escapement goals and migratory timing data to implement the management plans are contained in McBride et al. (1989). Bendock and Alexandersdottir (1991) estimated hooking mortality for the Kenai River chinook salmon recreational fisheries. Estimates of total return by age have been summarized through 1990 by Sonnichsen and Alexandersdottir (1991).

METHODS

Fishing Regulations

As mentioned above, the recreational chinook salmon fisheries on the Kenai River are conducted under the guidance of the Kenai River Early and Late King Salmon Management Plans. Late-run fish are those chinook salmon entering the Kenai River after 1 July (Figure 3). If the projected escapement is less than 15,500, the department shall: (A) close the recreational chinook salmon fisheries in the Kenai River and in the marine waters of Cook Inlet north of Bluff Point, (B) close the commercial drift gill net fishery within 3 miles of the Kenai Peninsula shoreline, and (C) close the commercial set gill net fishery in the Upper Subdistrict of the Central District (Eastside Set Net Fishery). If the projected spawning escapement of late-run chinook salmon is between 15,500 and 22,300, the department shall, by emergency order, restrict the fishery through the use of bait, bag limit reduction, and/or time/area closure as necessary to achieve 22,300 fish in the escapement. If the projected escapement is between 15,500 and 19,000, the set net fishery on the east side shall be restricted to regular periods, however, if the final escapement of sockeye salmon into the Kenai River is projected to be greater than 700,000, the commercial drift and set net fisheries will not be restricted until the projected chinook salmon escapement is less than 15,500.

The regulations for the chinook salmon fishery in the Kenai River are the most restrictive of any in Alaska. Only the mainstem Kenai River between the outlet of Skilak Lake and Cook Inlet (Figure 1) is open to fishing for chinook salmon. By regulation, the season for chinook salmon is from 1 January through 31 July, but it effectively begins in mid-May when the fish first begin entering the river. The daily bag and possession limits are one chinook salmon per day greater than 41 cm (16 in) total length and a seasonal limit of two chinook salmon greater than 41 cm. In 1991, fishing from boats downstream from the outlet of Skilak Lake was prohibited on Mondays in July. Anyone retaining a chinook salmon that was 41 cm in length or greater was prohibited from fishing from a boat in the Kenai River for the remainder of that day.

There were further restrictions for anglers employing guides. In 1991, fishing from a guided boat was allowed only between 0600 and 1800 hours during July and only Tuesday through Saturday. There was no time restriction on anglers using guides during August (extended season by emergency order through 4 August).

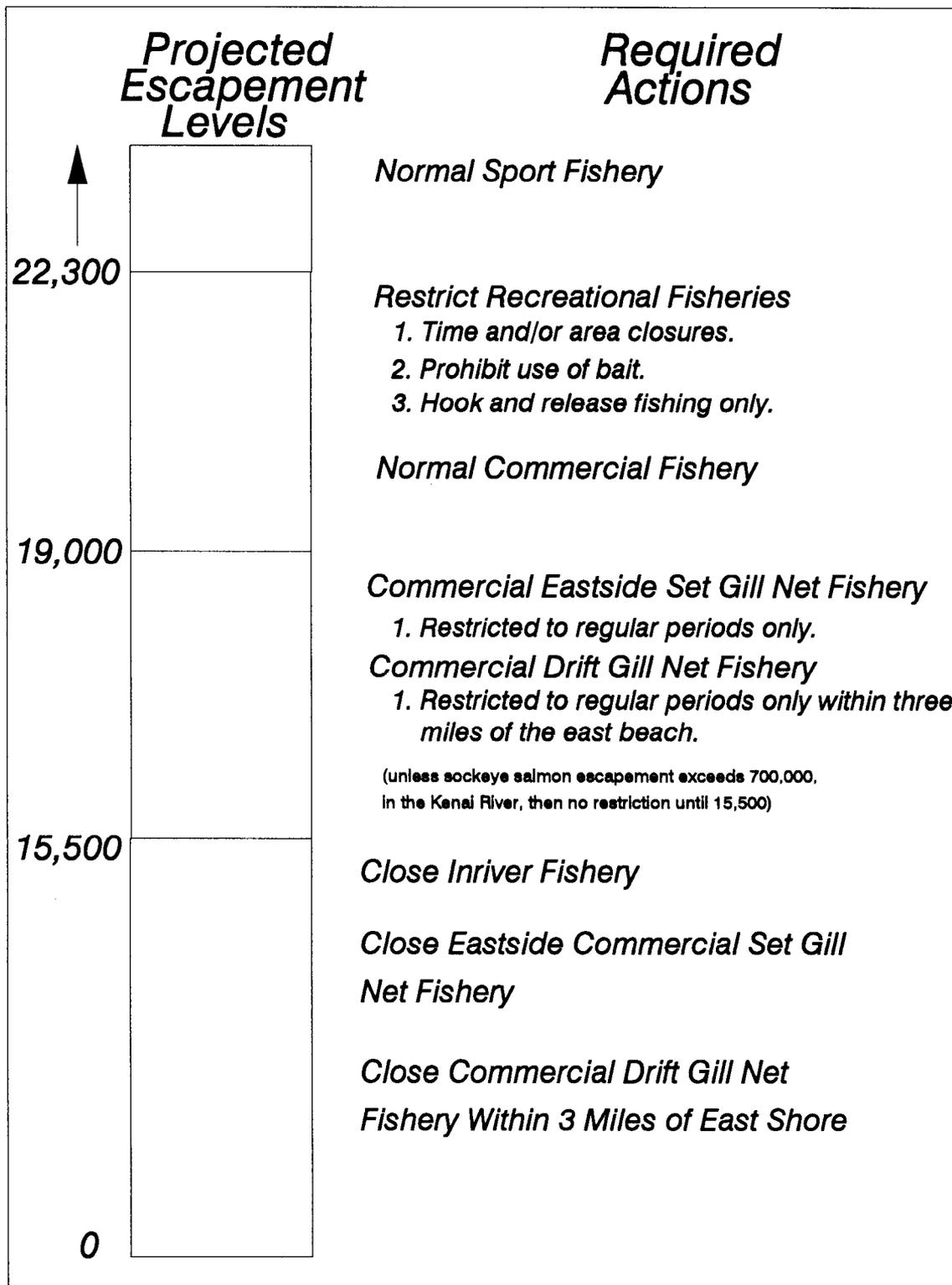


Figure 3. Escapement levels and required actions according to the Kenai River Late King Salmon Management Plan.

The late run management plan (Appendix B) was amended by the BOF for implementation during the 1991 season to provide for retention of large fish, 132 cm (52 in) or larger, if hook and release fishing was imposed. This regulation, along with numerous other changes adopted by the BOF at its 1990 meeting, were not enforceable until 21 July because of legal complications in the process of turning board action into regulation.

In 1991, a subsistence gill net fishery was to take place in selected marine waters of Cook Inlet that had the potential of impacting the Kenai River chinook salmon return. Various court challenges and legal complications resulted in minimal effort during 1991 causing insignificant impact.

Stock Assessment

Late-run Kenai River chinook salmon are assessed at several locations on their spawning migration. Since other populations of late-run chinook salmon in Cook Inlet are less abundant than the Kenai River population, chinook salmon harvested in the marine waters of Cook Inlet after 1 July are assumed to be of Kenai River origin. The first significant harvest occurs in the recreational marine fishery in the vicinity of the Village of Ninilchik. This harvest is estimated by postal questionnaire, the results of which are unavailable until the subsequent year (Mills 1979-1991). Further, the estimates derived do not differentiate between early and late runs and thus the harvest is apportioned according to the results of creel survey work conducted on site from 1973-1985 (Hammarstrom 1975-1981, Hammarstrom and Larson 1982-1984, Hammarstrom et al. 1985, Sonnichsen and Alexandersdottir 1991).

Additional harvest occurs in the commercial set gill net fishery along the eastern shore of Cook Inlet and to a lesser degree in the commercial drift gill net fishery. Both of these commercial fisheries target sockeye salmon *O. nerka* and the chinook salmon harvest is bycatch. The conduct of the commercial fisheries falls under the auspices of the Upper Cook Inlet Salmon Management Plan. A single net educational fishery for members of the Kenaitze Indian tribe has been authorized since 1989. In 1991, a subsistence gill net fishery was established by the BOF, however, various legal complications and challenges precluded any significant impact to the returning fish this past year.

The inriver return has been estimated annually since 1984. Two methods have been employed: (1) a tag/recapture program from 1984-1990 (Hammarstrom and Larson 1986, Conrad and Larson 1987, Conrad 1988, Carlon and Alexandersdottir 1989, Alexandersdottir and Marsh 1990), and (2) a hydroacoustic (sonar) program from 1984-1991 (Burwen and Skvorc *In prep* 1989 data, Burwen and Skvorc *In prep* 1990 data, Burwen and Skvorc *In prep* 1991 data). Since 1987, sonar has provided the best estimate of the inriver return. The tag/recapture project was not conducted in 1991.

Of critical importance is an estimate of the age, sex, and size composition of the inriver return. Prior to 1991, scale samples collected from chinook salmon captured with large mesh gill nets for the tag/recapture study provided the samples for this analysis. In 1991, the techniques employed for that study were continued, however, the personnel requirements were halved since tags were no longer released and the sample size required could still be

achieved. The result of this component is an estimate of the numbers of chinook salmon by age entering the river.

As these fish continue on their migration, they encounter Alaska's largest freshwater recreational fishery that occurs from approximately river mile 8 (river kilometer 13) to river mile 50 (river kilometer 81). Harvest of chinook salmon in this fishery has been estimated through a creel survey since 1974 and the catch has been estimated only since 1986 (Hammarstrom 1975-1981, 1988-1991, *In prep*; Hammarstrom and Larson 1982-1984, 1986; Hammarstrom et al. 1985; Conrad and Hammarstrom 1987). Release mortality is accounted for and estimated at 8.3% for late-run fish (Bendock and Alexandersdottir 1991, 1992). The age, sex, and size composition of the harvest is estimated from samples collected from the recreational fishery as part of the angler interviews conducted in the creel survey (Hammarstrom 1991). The age composition mortalities attributed to hook and release fishing were assumed to be equal to that determined for the harvest. There is an undefined bias introduced in that smaller fish tend to be released more often than larger fish and small males tend to suffer higher mortality than large males or females (Bendock and Alexandersdottir 1991); however, the numbers of fish that succumb to hook and release fishing were relatively small and would not alter conclusions made regarding production. The result of the creel survey is an estimate of the number of fish, by age and sex, removed from the spawning population as a direct result of recreational fishing.

To clarify terms, inriver return refers to all fish that are counted past the sonar in the Kenai River. Total return refers to all late-run Kenai River chinook salmon harvested in upper Cook Inlet marine fisheries plus the inriver return. Escapement (fish that survive all fisheries and are potential spawners) is estimated by subtracting total mortalities from the recreational fishery (harvest plus hook and release mortalities) from the inriver return.

Brood and Sibling Relationships

Chinook salmon in the Kenai River are managed to achieve optimum sustained production. In 1988, spawning requirements were computed to sustain levels of production realized during the years 1984 to 1988 and were based on limited information from the Kenai River and the experience of other researchers working with chinook salmon on the North American west coast (McBride et al. 1989). Total return data are being compiled to assess production and refine these escapement goals. Analysis of production from any escapement requires assimilation of returns by age class from that brood. Classic analysis of production from various levels of escapement will require data that span decades. For Kenai River chinook salmon, assessment of any year's spawning escapement requires annual return data out to 8 years of age.

A predictable relationship between consecutive-year returns of the same brood (i.e. sibling relationships) has been established for the late run (Sonnichsen and Alexandersdottir 1991). Estimation of sibling ratios (the ratio of one age to one or more younger ages in a brood year) were used to forecast expected returns for future years. By using mean sibling ratios of those years for which complete return data are available, models were developed to predict the returns for 1990 and 1991 (Sonnichsen and Alexandersdottir 1991). These models were updated with the analysis of the 1991 return and a forecast for the 1992 return was developed.

Migratory Timing

The following databases were used to estimate migratory timing of the chinook salmon return to the Kenai River: (1) inriver return, measured by daily gill net CPUE for 1984 to 1986 and by daily sonar counts for 1987 to 1991, (2) inriver recreational fishery statistics to include effort, harvest per hour (HPUE), catch per hour (CPUE), harvest, and catch.

Historic cumulative daily proportions of each of these statistics were used to generate migratory timing models of each parameter that were applied to data from the gear in question to predict season-end values (McBride et al. 1989). Cumulative daily proportions of the inriver return for the years 1985-1990 (1989 excluded due to abnormally early timing) were averaged to formulate the model that projected total inriver return for 1991 (Appendix A1). Cumulative daily proportions of recreational effort, HPUE, and CPUE for the years 1984-1990 were used to generate the model that projected the harvest and catch for 1991 (Appendices A2-A11).

On a daily basis, inriver return was projected by dividing the 1991 cumulative sonar count by the historic mean cumulative proportion through that same date. Similarly, harvest and catch were also projected. Escapement was projected by subtracting the projected fishing mortality (inriver harvest + hook and release mortality) from the projected inriver return. Although projections are made from the commencement of the fishery, precision of the estimates is insufficient to detect significant deviations from historic performance until mid July.

ASSESSMENT OF THE 1991 LATE RETURN OF CHINOOK SALMON TO THE KENAI RIVER

Recreational Marine Harvest

As mentioned above, harvest from the recreational fishery in the vicinity of the Village of Ninilchik is monitored by use of the statewide harvest postal questionnaire (Mills 1984-1991). The results from the 1991 fishery will not be available until late 1992. However, the harvest in this fishery has averaged approximately 1,000 chinook salmon annually and casual reports received in 1991 did not suggest significantly increased harvest.

Commercial Harvest

The commercial harvest in the set gill net fishery along the eastern shore of Cook Inlet was 4,891 fish. This is slightly less than the 1990 harvest and well below the 1984 to 1990 mean of 13,173. In order to achieve the desired escapement goal of sockeye salmon into the Kenai River, little additional fishing time was granted this fishery beyond that scheduled by regulation, especially when compared to the additional time granted during recent years in response to extremely strong returns of sockeye salmon. The reported harvest of chinook salmon in the drift gill net fishery was 241 fish, well below the historical mean. Conservation concern for sockeye salmon was responsible for time restrictions in this fishery. A total of 130 chinook salmon were reported retained for personal use from the combined commercial set and drift gill net harvest.

A total of 446 fish with readable scales were sampled from the commercial set gill net harvest (Table 1). These samples were used to allocate the commercial set gill net, drift gill net, and subsistence gill net harvests. Most of the harvest was composed of age-1.4 fish (33.6%), closely followed by age-1.3 (32.5%), and -1.2 (24.9%) fish.

Subsistence Harvest

Because of various legal complications with the process of turning BOF action into regulation, court challenges, and temporary restraining orders issued in 1991, there were only four periods scheduled for subsistence fishing; one period was for dip net gear only. Additionally, the Kenaitze Indian Tribe conducted a single net educational fishery during the month of July and August under a permit issued by the Commissioner of Fish and Game. The combined chinook salmon harvest from these fisheries was 288 fish.

Inriver Return

Sonar equipment was activated 16 May and operated continually through the early and late runs (Burwen and Skvorc *In prep* 1991 data). Inriver return from 1 July through 8 August was 34,614 fish (Table 2). The 1991 return was slightly larger than the 1990 return but significantly smaller than the 1984 to 1990 mean of 41,305.

A total of 322 chinook salmon were captured in gill net test fishing during the late run (Table 3). The inriver return was comprised predominantly of age 1.4 (69.6%) followed by age class 1.3, 1.2, and 1.5 (15.8%, 7.5%, 6.5%, respectively). The 1991 allocation of the total return by age along with the historical age composition (1986 to 1990) appear in Table 4.

Recreational Fishery

The 1991 recreational fishery started 1 July. Concern for insufficient fish to achieve the optimum escapement goal of 22,300 fish prompted an emergency order prohibition of bait on 18 July. This restriction was removed on 26 July as a response to a building return and the ability to achieve the escapement goal. Due to a significant increase in the numbers of fish entering the river, and the assurance that the desired escapement goal had been achieved, the fishery was extended to 4 August in the intertidal area of the river; the upper terminus of this area is near the confluence of Beaver Creek (Figure 1).

Angler effort during the fishery for late-run chinook salmon was estimated at 229,999 angler-hours (SE = 6,459) (Hammarstrom *In prep*). Estimated harvest was nearly average at 6,849 (SE = 410) with an estimated catch of 8,091 (SE = 479). Anglers employing professional guides accounted for 56% of the harvest and 36% of the effort (Table 5).

A total of 223 fish with readable scales were sampled from the recreational harvest. The majority of the harvest was age class 1.4 (76%) (Table 6). Historical comparison of the age composition of the late-run recreational harvest is presented in Table 7 (1976-1991).

Since 1986, the first year estimates of total catch in the recreational fishery were available, an average of 29% of the catch has been released.

Table 1. Estimates by age class of the number of chinook salmon harvested in the Upper Subdistrict commercial set and drift gill net fisheries, subsistence/personal use fisheries and educational fisheries, Upper Cook Inlet, Alaska, 1991.

	Age Class										
	0.2	0.4	1.1	1.2	1.3	1.4	1.5	2.1	2.3	2.4	Total
Males											
Sample Size		1	2	70	95	100	7		2	1	278
Percent		0.2	0.4	15.7	21.3	22.4	1.6		0.4	0.2	62.3
SE Percent		0.2	0.3	1.7	1.9	2.0	0.6		0.3	0.2	2.3
Harvest		11	24	873	1,185	1,247	87		24	11	3,462
SE Harvest		11	17	92	104	105	31		17	11	122
Females											
Sample Size	1	1	1	41	48	72	2	1	1		168
Percent	0.2	0.2	0.2	9.2	10.8	16.1	0.4	0.2	0.2		37.7
SE Percent	0.2	0.2	0.2	1.4	1.5	1.7	0.3	0.2	0.2		2.3
Harvest	11	11	11	511	599	898	25	11	11		2,088
SE Harvest	11	11	11	73	78	93	17	11	11		122
Combined											
Sample Size	1	2	3	111	143	172	9	1	3	1	446
Percent	0.2	0.4	0.7	24.9	32.1	38.6	2.0	0.2	0.7	0.2	100.0
SE Percent	0.2	0.3	0.4	2.0	2.2	2.3	0.7	0.2	0.4	0.2	
Harvest	11	22	35	1,384	1,784	2,145	112	11	35	11	5,550
SE Harvest	11	17	21	109	118	123	36	11	21	11	

Table 2. Historical sonar counts of chinook salmon in the Kenai River during the late run, 1987-1991.

Date	1987		1988		1989		1990		1991	
	Daily Counts	Cum Counts								
7/01	507	507	526	526	769	769	578	578	267	267
7/02	429	936	404	930	489	1,258	305	883	300	567
7/03	405	1,341	398	1,328	353	1,611	486	1,369	333	900
7/04	628	1,969	292	1,620	566	2,177	436	1,805	519	1,419
7/05	596	2,565	482	2,102	1,106	3,283	853	2,658	316	1,735
7/06	523	3,088	654	2,756	879	4,162	795	3,453	242	1,977
7/07	769	3,857	379	3,135	680	4,842	929	4,382	186	2,163
7/08	483	4,340	725	3,860	776	5,618	432	4,814	139	2,302
7/09	384	4,724	471	4,331	1,404	7,022	309	5,123	393	2,695
7/10	314	5,038	1,732	6,063	560	7,582	359	5,482	481	3,176
7/11	340	5,378	1,507	7,570	2,010	9,592	778	6,260	403	3,579
7/12	751	6,129	1,087	8,657	2,763	12,355	557	6,817	330	3,909
7/13	747	6,876	2,251	10,908	910	13,265	1,175	7,992	308	4,217
7/14	761	7,637	2,370	13,278	2,284	15,549	1,481	9,473	572	4,789
7/15	913	8,550	2,405	15,683	1,111	16,660	1,149	10,622	542	5,331
7/16	1,466	10,016	1,259	16,942	1,344	18,004	1,011	11,633	1,029	6,360
7/17	1,353	11,369	1,520	18,462	963	18,967	2,395	14,028	2,052	8,412
7/18	841	12,210	2,180	20,642	1,382	20,349	2,113	16,141	3,114	11,526
7/19	2,071	14,281	1,724	22,366	425	20,774	1,363	17,504	1,999	13,525
7/20	3,709	17,990	2,670	25,036	820	21,594	1,499	19,003	1,422	14,947
7/21	3,737	21,727	3,170	28,206	916	22,510	787	19,790	1,030	15,977
7/22	1,835	23,562	1,302	29,508	583	23,093	573	20,363	1,050	17,027
7/23	1,700	25,262	1,502	31,010	756	23,849	642	21,005	2,632	19,659
7/24	2,998	28,260	1,386	32,396	783	24,632	1,106	22,111	2,204	21,863
7/25	1,915	30,175	999	33,395	495	25,127	810	22,921	1,306	23,169
7/26	1,968	32,143	924	34,319	432	25,559	671	23,592	1,216	24,385
7/27	1,523	33,666	960	35,279	618	26,177	755	24,347	1,195	25,580
7/28	2,101	35,767	1,398	36,677	538	26,715	603	24,950	1,901	27,481
7/29	1,923	37,690	1,400	38,077	441	27,156	546	25,496	1,146	28,627
7/30	2,595	40,285	1,158	39,235	391	27,547	382	25,878	791	29,418
7/31	2,372	42,657	910	40,145	383	27,930	316	26,194	974	30,392
8/01	470	43,127	925	41,070	351	28,281	393	26,587	897	31,289
8/02	314	43,441	781	41,851	201	28,482	388	26,975	867	32,156
8/03	263	43,704	989	42,840	132	28,614	533	27,508	392	32,548
8/04	835	44,539	1,524	44,364	142	28,756	717	28,225	331	32,879
8/05	904	45,443	1,091	45,455	107	28,863	723	28,948	174	33,053
8/06	648	46,091	1,333	46,788	107	28,970	552	29,500	343	33,396
8/07	694	46,785	1,186	47,974	65	29,035	516	30,016	618	34,014
8/08	658	47,443	1,449	49,423			682	30,698	600	34,614
8/09	368	47,811	1,132	50,555			679	31,377		
8/10	312	48,123	755	51,310			678	32,055		
8/11			698	52,008			547	32,602		
8/12							362	32,964		
8/13							221	33,185		
8/14							139	33,324		
8/15							150	33,474		
Total		48,123		52,008		29,035		33,474		34,614

Table 3. Estimates by age class of the number of late-run chinook salmon in the inriver return to the Kenai River, 1991.

	Age Class					Total
	1.2	1.3	1.4	1.5	2.3	
Males						
Sample Size	24	39	87	9	2	161
Percent	7.5	12.1	27.0	2.8	0.6	50.0
SE Percent	1.5	1.8	2.5	0.9	0.4	2.8
Return	2,580	4,192	9,353	967	215	17,307
SE Return	507	630	858	318	152	966
Females						
Sample Size	0	12	137	12	0	161
Percent	0.0	3.7	42.5	3.7	0.0	50.0
SE Percent	0.0	1.1	2.8	1.1	0.0	2.8
Return	0	1,290	14,727	1,290	0	17,307
SE Return	0	366	955	366	0	966
Combined						
Sample Size	24	51	224	21	2	322
Percent	7.5	15.8	69.6	6.5	0.6	100.0
SE Percent	1.5	2.0	2.6	1.4	0.4	
Return	2,580	5,482	24,080	2,257	215	34,614
SE Return	507	705	889	477	152	

Table 4. Estimates by age class of the total return of late-run Kenai River chinook salmon, 1986-1991.

	Age Class														Total
	0.2	0.3	0.4	0.5	1.1	1.2	1.3	1.4	1.5	1.6	2.1	2.2	2.3	2.4	
1986															
Percent	0.1	0.1	0.0	0.0	0.3	15.1	44.2	36.4	3.5	0.0	0.1	0.1	0.2	0.1	100.0
Return	43	43	22	22	260	12,017	35,314	29,039	2,774	22	43	43	152	43	79,837
SE Return	24	24	17	17	60	3,436	9,106	6,482	776	17	24	24	46	24	19,458
1987															
Percent	0.0	0.0	0.0	0.0	0.5	4.9	30.2	63.0	1.0	0.1	0.1	0.1	0.1	0.1	100.0
Return	0	0	0	0	361	3,635	22,427	46,812	775	99	51	44	97	58	74,359
SE Return					75	315	796	823	173	70	51	23	57	50	0
1988															
Percent	0.0	0.0	0.1	0.0	0.7	3.3	6.0	75.0	14.8	0.0	0.0	0.1	0.0	0.1	100.0
Return	0	0	35	0	454	2,235	4,116	51,232	10,120	0	0	46	15	101	68,354
SE Return			17		72	241	375	820	735			23	13	36	0
1989															
Percent	0.0	0.0	0.0	0.0	0.3	12.2	15.0	60.3	11.8	0.2	0.0	0.1	0.0	0.0	100.0
Return	0	0	0	0	108	5,052	6,193	24,905	4,887	76	0	34	0	13	41,268
SE Return					38	438	468	662	456	69		24		13	0
1990															
Percent	0.0	0.0	0.0	0.0	0.2	14.5	16.6	63.6	4.6	0.0	0.1	0.1	0.1	0.2	100.0
Return	0	11	11	0	65	5,749	6,572	25,237	1,841	0	45	23	23	79	39,656
SE Return		10	10		22	480	519	655	307		19	14	14	26	0
1991															
Percent	0.0	0.0	0.1	0.0	0.1	9.9	18.1	65.3	5.9	0.0	0.0	0.0	0.6	0.0	100.0
Return	11	0	22	0	35	3,964	7,266	26,225	2,369	0	11	0	250	11	40,164 ^a
SE Return	11		17		21	517	712	894	476		11		152	11	0

^a Deep Creek marine recreational harvest is unaccounted for in 1992 until harvest estimates are available (late in 1992).

Table 5. Historical summary of harvest, angler effort, and harvest rate in the recreational fishery for late-run chinook salmon, Kenai River, 1974-1991.

Year	Harvest			Effort in Angler Hours			Harvest per Hour		
	Unguided	Guided	Total	Unguided	Guided	Total	Unguided	Guided	Total
1974			3,225			87,162			0.037
1975			2,355			53,523			0.044
1976			5,353			114,795			0.047
1977			5,148			135,082			0.038
1978			5,578			212,217			0.026
1979			4,634			205,887			0.023
1980			3,608			154,435			0.023
1981	2,755	2,530	5,285	112,569	36,727	149,296	0.024	0.069	0.035
1982	2,413	2,397	4,810	146,947	50,828	197,775	0.016	0.047	0.024
1983	4,064	5,110	9,174	197,324	51,195	248,519	0.021	0.100	0.037
1984	4,448	2,928	7,376	302,915	45,664	348,579	0.015	0.064	0.021
1985	5,010	3,045	8,055	248,517	45,936	294,453	0.020	0.066	0.027
1986	5,458	3,546	9,004	191,597	52,843	244,440	0.028	0.067	0.037
1987	6,361	5,966	12,327	231,511	79,329	310,840	0.027	0.075	0.040
1988	8,103	9,409	17,512	266,578	95,181	361,759	0.030	0.099	0.048
1989	3,799	5,328	9,127	231,085	97,966	329,051	0.016	0.054	0.028
1990 ^a	2,439	3,808	6,247	190,743	101,223	291,966	0.013	0.038	0.022
Mean	4,077	3,672	6,601	192,708	54,741	207,766	0.019	0.057	0.031
1991	2,985	3,864	6,849	147,293	82,706	229,999	0.020	0.047	0.030

^a Harvest per hour only for periods open to retention of chinook salmon.

Table 6. Estimates by age class of the number of late-run chinook salmon harvested in the recreational fishery on the Kenai River, 1991.

	Age Class					Total
	1.2	1.3	1.4	1.5	2.3	
Males						
Sample Size	8	15	71	8	2	104
Percent	3.6	6.7	31.8	3.6	0.9	46.6
SE Percent	1.2	1.7	3.1	1.2	0.6	3.3
Harvest	246	461	2,180	246	61	3,194
SE Harvest	87	118	250	87	43	298
Females						
Sample Size	3	11	99	6		119
Percent	1.3	4.9	44.4	2.7		53.4
SE Percent	0.8	1.5	3.3	1.1		3.3
Harvest	92	338	3,041	184		3,655
SE Harvest	53	101	292	75		317
Combined						
Sample Size	11	26	170	14	2	223
Percent	4.9	11.7	76.2	6.3	0.9	100.0
SE Percent	1.5	2.2	2.9	1.6	0.6	
Harvest	338	799	5,221	430	61	6,849
SE Harvest	101	155	369	114	43	410

Table 7. Estimates by age class of the number of late-run chinook salmon harvested in the recreational fishery on the Kenai River, 1976-1991.

	Age Class										Total
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	2.5 Other	
1976											
Percent	10.7	27.0	18.2	40.1	3.6		0.3				100.0
Harvest	481	1,210	817	1,794	160		15				4,477
SE Harvest	79	114	99	125	48		15				
1977											
Percent		11.5	41.4	44.8	1.7				0.6		100.0
Harvest		592	2,130	2,307	89				30		5,148
SE Harvest		125	193	195	51				30		
1978											
Percent		12.6	8.0	77.7	1.7						100.0
Harvest		701	446	4,335	96						5,578
SE Harvest		68	73	89	0						
1979											
Percent		15.1	17.8	54.8	12.3						100.0
Harvest		698	825	2,540	571						4,634
SE Harvest		195	209	272	180						
1980											
Percent		21.1	21.5	49.8	7.5						100.0
Harvest		763	776	1,797	272						3,608
SE Harvest		88	89	108	57						
1981											
Percent		12.8	22.2	62.4	2.6						100.0
Harvest		678	1,174	3,297	136						5,285
SE Harvest		164	204	238	78						

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Table 7. (Page 2 of 3).

	Age Class										Total	
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	2.5 Other		
1982												
Percent		11.8	26.0	58.8	1.7						1.7	100.0
Harvest		566	1,253	2,829	81						81	4,810
SE Harvest		143	194	218	57						57	
1983												
Percent		3.7	4.9	86.4	2.5				2.5			100.0
Harvest		340	453	7,927	227				227			9,174
SE Harvest		194	222	351	159				159			
1984												
Percent		8.8	16.0	62.5	12.7							100.0
Harvest		650	1,179	4,610	937							7,376
SE Harvest		95	122	162	111							
1985												
Percent		3.9	12.8	73.5	8.0						1.7	100.0
Harvest		315	1,031	5,923	646						140	8,055
SE Harvest		73	125	166	102						49	
1986												
Percent	0.4	10.1	38.9	45.2	5.3							100.0
Harvest	37	913	3,507	4,072	475							9,004
SE Harvest	26	131	266	289	94							458
1987												
Percent	0.4	1.0	22.8	72.7	3.1							100.0
Harvest	51	127	2,787	8,892	380							12,237
SE Harvest	36	57	292	611	99							769

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	Age Class											Total
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4	2.5	Other	
1988												
Percent	0.7	0.2	3.4	78.6	17.1							100.0
Harvest	126	42	589	13,766	2,989							17,512
SE Harvest	73	42	159	887	368							1,036
1989												
Percent		1.0	10.9	71.3	15.8				1.0			100.0
Harvest		90	994	6,507	1,446				90			9,127
SE Harvest		90	291	585	345				90			582
1990												
Percent	0.6	9.7	15.8	62.2	11.7							100.0
Harvest	37	605	989	3,883	733							6,247
SE Harvest	0	50	50	225	81							445
1991												
Percent		4.9	11.7	76.2	6.3			0.9				100.0
Harvest		338	799	5,221	430			61				6,849
SE Harvest		101	155	369	114			43				410

In 1991, release mortality was estimated at 103 (SE = 46) fish. Historical hook and release mortality estimates are presented in Table 8.

Escapement and Total Return

Spawning escapement was estimated by subtracting total fishing mortality from the inriver return. In 1991, an estimated 27,662 chinook salmon escaped all fisheries as potential spawners (Table 9). The majority (67.9%) of these spawners were age class 1.4. Except for 1986, this age class has been the predominant spawning age class since 1986. Historical (1986 to 1991) age composition of the spawning escapement is presented in Table 10.

The total return of late-run chinook salmon to the Kenai River is the sum of the commercial, recreational, personal use, and subsistence harvests plus the escapement. Table 11 presents the various components of the late run of chinook salmon to the Kenai River, 1984-1991.

Brood Relationships

Age components of measured returns are presented in Table 12 and a summary of the production from each brood year appears in Table 13. Total production from the first measured escapement (31,796 fish in 1984) exceeded replacement. Although incomplete, production from the 1985 escapement (21,708) will approach a two-fold return.

Sibling Relationships

Sonnichsen and Alexandersdottir (1991) developed a sibling model to forecast future returns (Table 14). Total return for the 1990 late run was forecast at 33,517 fish; the observed value was 39,656 or 18% greater than the expected value (Table 15). Using similar techniques, but including values observed in 1990, they predicted a return of 43,487 for 1991. The observed value was 40,165, 7.8% less than the forecast value.

Incorporating the observed 1991 values into the equations results in an expected return in 1992 of 42,281 chinook salmon to the Kenai River during the late run (Table 15).

One area that Sonnichsen and Alexandersdottir (1991) examined was the relationship between age-5 and age-6 fish at different return levels. These two age groups have contained the majority of chinook salmon returning to the Kenai River. Their analysis suggests that at lower abundance levels, the ratio of 5s to 6s is greater. From the 1981 and 1982 brood year, fish that returned as age 5 numbered 35,379 and 22,475, respectively. The following year's age 6s returned at a ratio of 1.3 and 2.3, respectively. For the brood years 1983-1985, age 6s returned at ratios of 5.9, 4.1, and 4.0, respectively. These ratios occurred at levels of age-5 fish of 4,197, 6,227, and 6,606, respectively (Figure 4). The return of age 5s from the 1986 brood was 7,285. If the assumption of a greater return ratio occurs for lower abundance levels holds true, the forecasted return of age 6s in 1992 is 34,021 (using the mean age 5 to age 6 ratio from brood years 1983-1985). This is 5% more age-6 fish than predicted by the sibling relationship.

Table 8. Estimates of the number of late-run chinook salmon mortalities attributable to hook and release fishing, Kenai River, 1986-1991.

Year	Sport Catch	Sport Harvest	Number Released	SE Released	Percent Mortality ^a	SE Percent	Hook and Release Mortality	SE Mortality
1986	15,331	9,004	6,327	872	8.3 (E)	3.39	522	220
1987	16,701	12,237	4,464	1,214	8.3 (E)	3.39	368	174
1988	23,238	17,512	5,726	1,590	8.3 (E)	3.39	472	225
1989	12,210	9,127	3,083	1,097	10.6 (M)	3.30	327	148
1990	8,637	6,247	2,390	709	5.9 (M)	3.30	141	65
1991	8,091	6,849	1,242	248	8.3 (E)	3.39	103	46

^a(E) Estimated as the mean of the 1989 and 1990 mortality ratios (Bendock and Alexandersdottir 1992).

(M) Actual estimates of mortality rate for 1990 and 1991 (Bendock and Alexandersdottir 1992).

Table 9. Estimated number of late-run chinook salmon by age group spawning in the Kenai River, 1991.

	Age Group					Total
	1.2	1.3	1.4	1.5	2.3	
Male						
Inriver return	2,580	4,192	9,353	967	215	17,307
Recreational harvest	246	461	2,180	246	61	3,194
Hook & release mortality ^a	8	12	28	3	1	52
Escapement	2,326	3,719	7,145	718	153	14,061
Female						
Inriver return	0	1,290	14,727	1,290		17,307
Recreational harvest	92	338	3,041	184		3,655
Hook & release mortality ^a	0	4	44	4		52
Escapement	0	948	11,642	1,102		13,600 ^b
Combined						
Inriver return	2,580	5,482	24,080	2,257	215	34,614
Recreational harvest	338	799	5,221	430	61	6,849
Hook & release mortality ^a	8	16	71	7	1	103
Escapement	2,326	4,667	18,788	1,820	153	27,662

^a Age/sex composition of released component of recreational fishery assumed equal to the age/sex composition of inriver return.

^b The sum of the estimated escapement across age classes does not equal the estimated total for female chinook salmon. The escapement for age 1.2 female chinook salmon was set to zero, since logically the inriver return must at least equal the recreational harvest.

Table 10. Estimates by age class of the number of late-run chinook salmon in the spawning escapement to the Kenai River, 1986-1991.

	Age Class									Total Aged ^a	Hook and Release Mortality	Total Spawned
	1.1	1.2	1.3	1.4	1.5	1.6	2.2	2.3	2.4			
1986												
Spawning Escapement	0	6,096	23,634	17,340	1,525	0	0	0	0	48,559	522	48,037
SE Escapement	26	3,431	9,105	6,480	775	0	0	0	0	19,462	220	19,463
1987												
Spawning Escapement	0	771	10,620	24,226	120	99	51	0	50	35,886	368	35,518
SE Escapement	36	217	755	944	186	70	51	0	50	769	174	788
1988												
Spawning Escapement	0	586	1,299	26,095	6,643	0	0	0	0	34,496	472	34,024
SE Escapement	73	202	375	1,190	819	0	0	0	0	1,036	225	1,060
1989												
Spawning Escapement	8	3,039	2,740	11,859	2,276	76	0	0	0	19,908	327	19,581
SE Escapement	8	419	525	859	559	69	0	0	90	582	148	601
1990												
Spawning Escapement	0	3,429	3,821	19,218	794	0	0	0	0	27,227	141	27,086
SE Escapement	26	467	519	716	327	0	0	0	0	445	65	450
1991												
Spawning Escapement	0	2,242	4,683	18,859	1,827	0	0	154	0	27,765	103	27,662
SE Escapement	0	516	722	963	490	0	0	157	0	410	46	413

^a For some age classes in some years the estimate of the number harvested in the sport fishery is greater than the estimate of the number in the inriver return. The spawning escapement for the age class in this case was set to zero. When this occurred, the total spawning escapement (calculated by subtracting the total sport harvest from the total inriver return) is not the sum of the spawning escapement across age classes.

Table 11. Summary of late-run Kenai River chinook salmon population data, 1984-1991.

Year	Deep Creek Marine Harvest	Eastside Set Net Harvest	Drift Gill Net Harvest	Commercial Personal Use	Subsistence ^a	Inriver Return	Kenai River Sport Harvest	Hook and Release Mortality	Escapement	Total Return
1984	835	6,165	1,377			39,172	7,376	Unknown	31,796	47,549
1985	1,731	17,723	2,046			29,763	8,055	Unknown	21,708	51,263
1986	630	19,810	1,834			57,563	9,004	522	48,037	79,837
1987	1,097	20,588	4,551			48,123	12,237	368	35,518	74,359
1988	1,262	12,870	2,216			52,008	17,512	472	34,024	68,356
1989	1,294	10,919	0 ^b	4	22	29,035	9,127	327	19,581	41,274
1990	1,318	4,139	621	91	13	33,474	6,247	141	27,086	39,656
1991	NA ^c	4,891	241	130	288	34,614	6,849	104	27,661	40,164

^a Includes harvest in Kenaitze educational gill net fishery.

^b Drift gill net fishery closed due to Exxon Valdez oil spill.

^c Not available until late 1992.

Table 12. Age components of measured returns of Kenai River late-run chinook salmon, 1986-1991.

Year	(0.2, 1.1) Age 3	(0.3, 1.2, 2.1) Age 4	(0.4, 1.3, 2.2) Age 5	(0.5, 1.4, 2.3) Age 6	(1.5, 2.4) Age 7	(1.6, 2.5) Age 8	Total Return
1986	303	12,103	35,379	29,213	2,817	22	79,837
1987	361	3,686	22,471	46,909	833	99	74,359
1988	454	2,235	4,197	51,249	10,221		68,356
1989	108	5,052	6,227	24,907	4,900	76	41,270
1990	65	5,805	6,606	25,260	1,920		39,656
1991	46	3,975	7,288	26,475	2,380		40,164

^a Deep Creek marine recreational harvest is unaccounted for until harvest estimates are available in 1992.

Table 13. Summary of returns from each brood year, late-run Kenai River chinook salmon, 1978-1991.

Year	Spawning Escapement	Return						Measured Return To Date	Return Per Spawner
		(0.2,1.1) Age 3	(0.3,1.2,2.1) Age 4	(0.4,1.3,2.2) Age 5	(0.5,1.4,2.3) Age 6	(1.5,2.4) Age 7	(1.6,2.5) Age 8		
1978							(1986) 22	22	
1979						(1986) 2,817	(1987) 99	2,916	
1980					(1986) 29,213	(1987) 833		30,046	
1981				(1986) 35,379	(1987) 46,909	(1988) 10,221	(1989) 76	92,585	
1982			(1986) 12,103	(1987) 22,471	(1988) 51,249	(1989) 4,900		90,723	
1983		(1986) 303	(1987) 3,686	(1988) 4,197	(1989) 24,907	(1990) 1,920		35,013	
1984	31,796	(1987) 361	(1988) 2,235	(1989) 6,227	(1990) 25,260	(1991) 2,380		36,463	1.15
1985	21,708	(1988) 454	(1989) 5,052	(1990) 6,606	(1991) 26,475			38,587	1.78
1986	48,053	(1989) 108	(1990) 5,805	(1991) 7,288				13,201	0.27
1987	35,529	(1990) 65	(1991) 3,975					4,040	0.11
1988	34,038	(1991) 46						46	0.00
1989	19,593								
1990	27,086								
1991	27,661								

^a 1991 Deep Creek marine recreational harvest unaccounted for until harvest estimates are available in 1992.

Table 14. Sibling return ratios for late-run Kenai River chinook salmon from brood years 1980-1987.

Brood Year	Age 4/ Age 3	Age 5/ Age 4	Age 6/ Age 5	Age 6/ Age 4+5	Age 7/ Age 6	Age 7/ Age 5+6	Age 7/ Age 4+5+6
1980					0.03		
1981			1.33		0.22	0.12	
1982		1.86	2.28	1.48	0.10	0.07	0.06
1983	12.17	1.14	5.93	3.16	0.08	0.07	0.06
1984	6.19	2.79	4.06	2.99	0.09	0.08	0.07
1985	11.13	1.31	4.01	2.27			
1986	53.75	1.26					
1987	61.15						
Mean	28.88	1.67	3.52	2.47	0.10	0.08	0.06
SD	26.31	0.68	1.78	0.77	0.07	0.03	0.01
CV (%)	91	41	51	31	68	33	12
Maximum	61.15	2.79	5.93	3.16	0.22	0.12	0.07
Minimum	6.19	1.14	1.33	1.48	0.03	0.07	0.06

^a 1991 Deep Creek marine recreational harvest is unaccounted for until harvest estimates are available in 1992.

Table 15. Summary of expected returns based on sibling ratios versus observed returns, late-run Kenai River chinook salmon, 1990 and 1991, and 1992 projections.

	Return					Total
	Age 3	Age 4	Age 5	Age 6	Age 7	
1990						
Expected	306	1,061	9,736	19,639	2,775	33,517
Observed	65	5,806	6,606	25,259	1,920	39,656
Difference	-241	4,745	-3,130	5,620	-855	6,139
Obs. as % of Exp.	21.2	547.2	67.9	128.6	69.2	118.3
1991						
Expected	258	1,353	10,289	29,637	1,950	43,487
Observed	44	3,994	7,280	26,473	2,374	40,165
Difference	-214	2,641	-3,009	-3,164	424	-3,322
Obs. as % of Exp.	17.1	295.2	70.8	89.3	121.7	92.4
1992						
Projected	223	1,328	6,634	32,397	2,367	42,950
SE	70	1,309	3,082	10,494	501	11,028

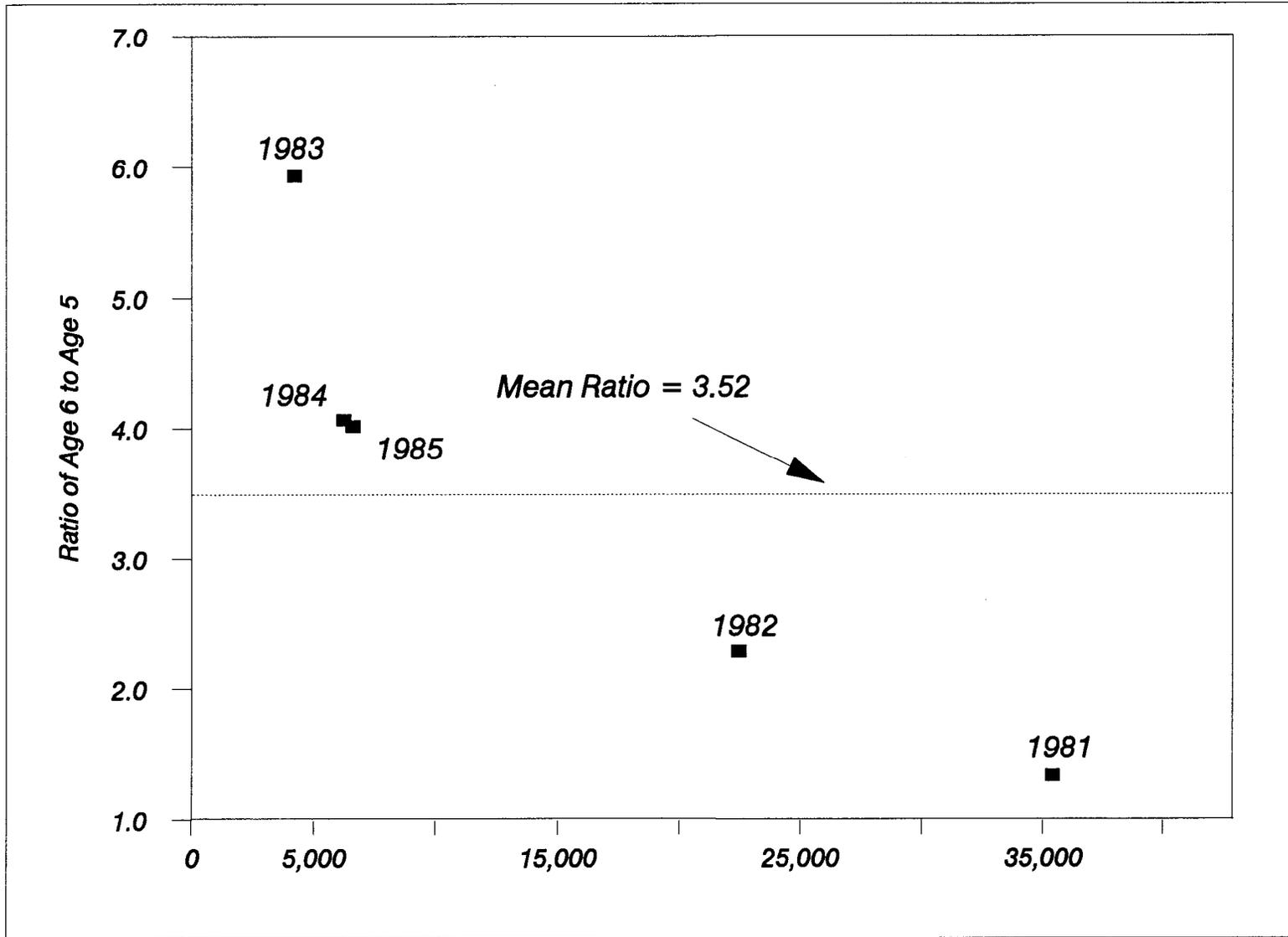


Figure 4. Ratio of the return of age 6 chinook salmon to age 5 compared to return of age 5 for the late run of chinook salmon into the Kenai River, 1981-1985.

MIGRATORY TIMING AND IMPLEMENTATION OF THE MANAGEMENT PLAN

In 1988, the Board of Fisheries adopted the Kenai River Late King Salmon Management Plan which put into regulation escapement levels and the procedures by which the recreational fisheries would be managed to achieve those levels. Implementation of the management plan hinges upon the department's ability to project the strength of the return with confidence.

The key ingredient in the projection is the real time estimates of the inriver return of chinook salmon. The current hydroacoustic project provides daily estimates of chinook salmon entering the river. Counts during the first 2 weeks of July were some of the smallest recorded since 1987. The first daily count to exceed 1,000 was 16 July. Entry timing was very similar to 1987 in that the first half of the return appeared weak while the second half appeared quite strong. For the first 15 days of the late run (1 July to 15 July), the largest daily count was 572. For the next 14 days (16 July to 29 July), no daily count fell below 1,000. The August component, which has averaged 14.4% since 1987, was slightly smaller at 12.1% in 1991. The peak daily count was 3,114 on 18 July (Table 1).

Projections of the total inriver return fluctuated around 16,000 during the first 2 weeks of July (Figure 5) which is very close to the minimum escapement goal. The 50% point of the 1991 late run was approximately 2 days later than the mean timing curve indicated. The cumulative daily proportions remained outside (later timing) the 95% confidence intervals of the model from 1 July through 18 July (Figure 6). Although the daily count on 1 July was nearly double that of 15 July, use of bait was prohibited on 18 July to minimize the probability of falling below the minimum escapement goal while still preserving fishing opportunities. Counts continued to climb, and by the 50% point on 20 July nearly 15,000 fish had entered the river. The restriction was removed effective 25 July, and by the end of July run strength was great enough to allow additional effort. As a result, the fishery was extended until 4 August in the intertidal waters only; the remainder of the river was closed to chinook salmon fishing.

DISCUSSION

With each year's data from the sonar project, confidence in the reliability of the equipment is enhanced. The information gathered has allowed analysis that would otherwise be improbable. The ability to get real time estimates of the inriver return has greatly improved the department's ability to react to changing situations on relatively short notice. Being able to offer less severe restrictions other than total closure in response to a relatively weak return would be less likely without this hydroacoustic project.

Timely estimates of the harvest and inriver return allows for the relatively precise management techniques that are employed and required by the management plan under which the recreational fishery is conducted. Observations by survey personnel have been beneficial in observing changes in the behavior of the recreational fishery that have a significant impact. For example, in 1990 when the fishery reopened to retention and to the use of bait on 1 July, many anglers migrated to the area upstream of the Soldotna Bridge to target on

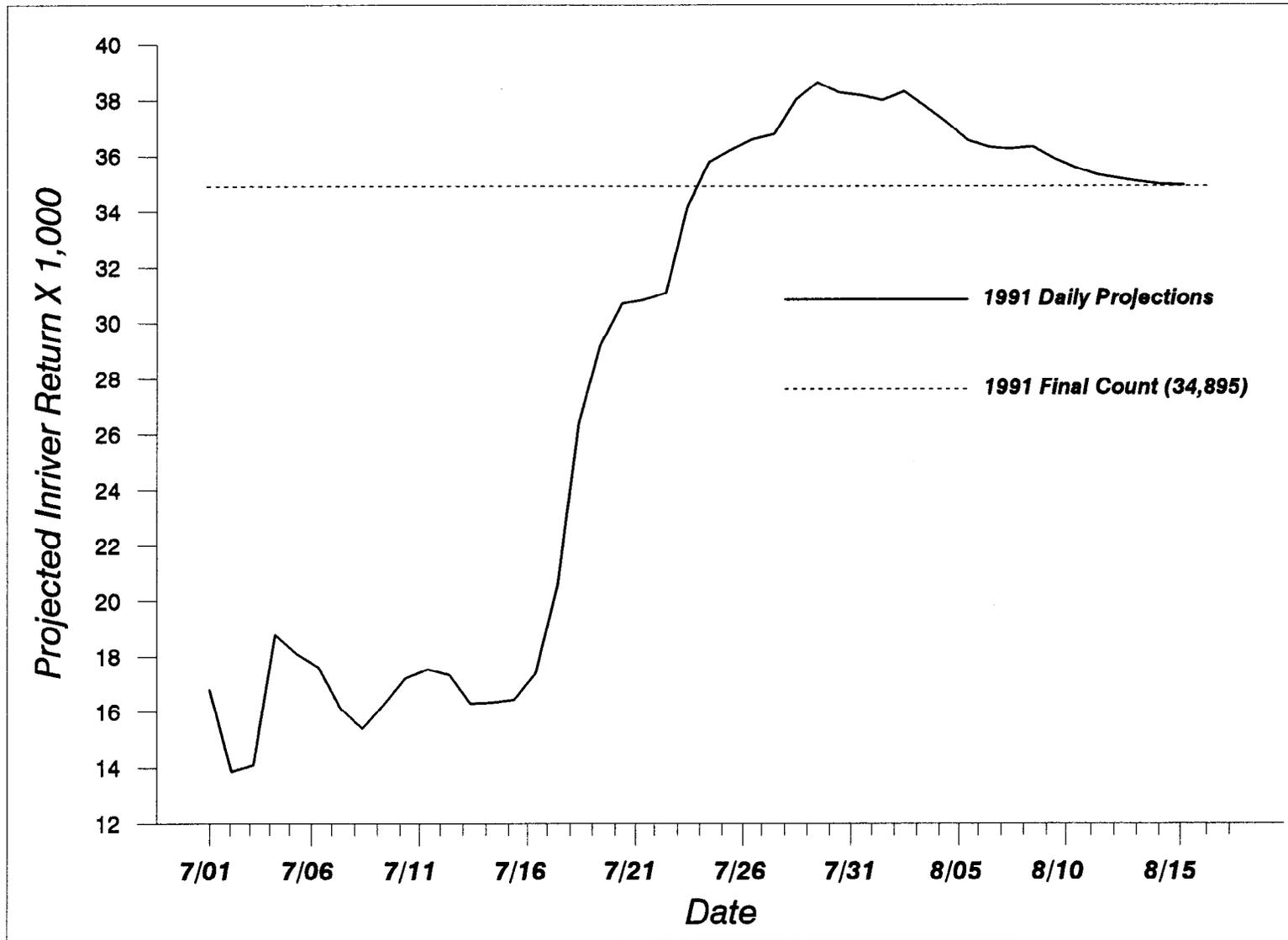


Figure 5. Daily projections of the inriver return of late-run chinook salmon based on cumulative historical proportions and current cumulative sonar counts, 1991.

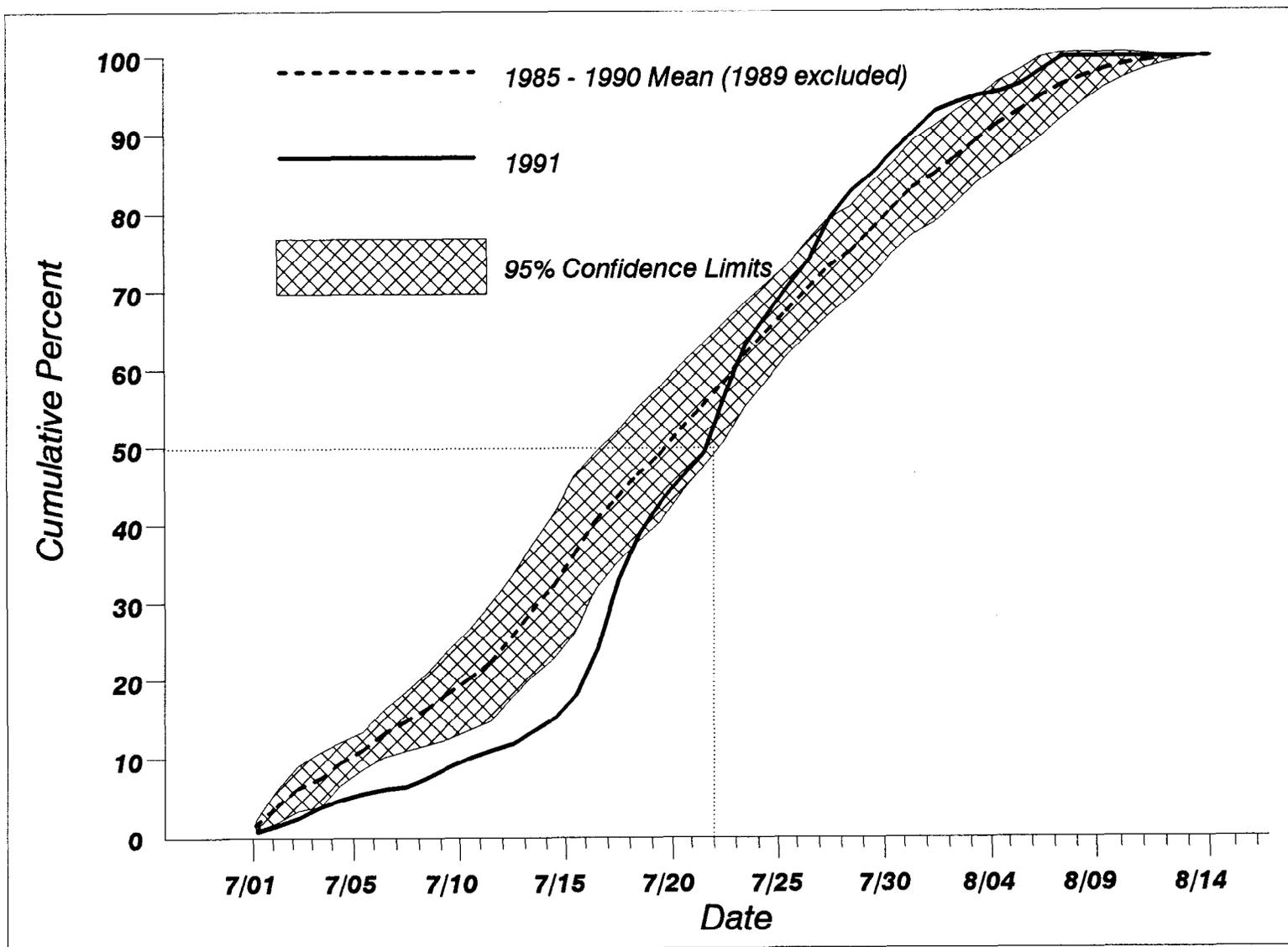


Figure 6. Cumulative percent by date of inriver return of late-run chinook salmon, Kenai River, 1985-1990 mean (1989 excluded) versus 1991.

early-run fish that were staging off the mouths of tributary streams. Appropriate actions were taken to correct this problem in 1991.

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APPENDIX A

Supporting statistics used to prepare the migratory timing model for the return of late-run chinook salmon to the Kenai River and used in season to project the inriver return and associated harvest in the recreational fishery, 1991.

Appendix A1. Historical daily cumulative proportions of the inriver return of late-run chinook salmon to the Kenai River, 1985-1991.

Date	Daily cumulative proportions [P(t)] by year of inriver return						Mean ^a	SE	95% Confidence Interval		Rel Pre ^b	1991
	1985	1986	1987	1988	1989	1990			Low	High		
7/01	0.025	0.014	0.012	0.012	0.036	0.016	0.016	0.002	0.010	0.022	39.1%	0.008
7/02	0.049	0.070	0.028	0.031	0.072	0.025	0.041	0.008	0.019	0.062	52.7%	0.016
7/03	0.080	0.095	0.040	0.063	0.088	0.038	0.063	0.011	0.035	0.092	45.3%	0.026
7/04	0.099	0.111	0.040	0.076	0.120	0.050	0.075	0.014	0.040	0.110	46.5%	0.041
7/05	0.120	0.116	0.067	0.101	0.158	0.075	0.096	0.011	0.068	0.123	28.9%	0.050
7/06	0.138	0.122	0.086	0.117	0.198	0.096	0.112	0.009	0.088	0.136	21.5%	0.057
7/07	0.170	0.127	0.104	0.148	0.235	0.117	0.133	0.012	0.103	0.163	22.6%	0.062
7/08	0.190	0.131	0.117	0.176	0.267	0.129	0.149	0.014	0.111	0.186	25.1%	0.066
7/09	0.206	0.142	0.127	0.210	0.326	0.139	0.165	0.018	0.119	0.211	27.8%	0.077
7/10	0.232	0.154	0.139	0.243	0.386	0.150	0.184	0.022	0.127	0.241	31.1%	0.091
7/11	0.264	0.166	0.150	0.265	0.435	0.171	0.203	0.025	0.138	0.268	31.9%	0.103
7/12	0.292	0.181	0.163	0.301	0.498	0.188	0.225	0.029	0.149	0.301	33.7%	0.112
7/13	0.325	0.219	0.185	0.337	0.531	0.223	0.258	0.031	0.179	0.336	30.5%	0.121
7/14	0.376	0.250	0.204	0.362	0.603	0.267	0.292	0.033	0.206	0.377	29.3%	0.138
7/15	0.414	0.283	0.220	0.395	0.631	0.301	0.323	0.036	0.230	0.416	28.8%	0.153
7/16	0.458	0.333	0.249	0.446	0.662	0.332	0.364	0.039	0.263	0.465	27.7%	0.183
7/17	0.485	0.377	0.298	0.474	0.694	0.405	0.408	0.034	0.320	0.495	21.6%	0.241
7/18	0.495	0.397	0.328	0.498	0.727	0.469	0.437	0.033	0.353	0.522	19.3%	0.331
7/19	0.510	0.421	0.355	0.534	0.743	0.510	0.466	0.034	0.379	0.553	18.6%	0.390
7/20	0.523	0.441	0.386	0.555	0.766	0.556	0.492	0.034	0.405	0.579	17.7%	0.433
7/21	0.565	0.466	0.429	0.583	0.793	0.580	0.525	0.032	0.442	0.607	15.8%	0.464
7/22	0.596	0.490	0.469	0.620	0.811	0.596	0.554	0.031	0.474	0.634	14.4%	0.494
7/23	0.627	0.527	0.499	0.649	0.835	0.616	0.584	0.030	0.508	0.660	13.1%	0.571
7/24	0.656	0.589	0.533	0.673	0.847	0.650	0.620	0.026	0.553	0.687	10.8%	0.635
7/25	0.692	0.603	0.578	0.696	0.864	0.675	0.649	0.024	0.586	0.711	9.7%	0.672
7/26	0.723	0.629	0.616	0.717	0.883	0.695	0.676	0.022	0.618	0.734	8.6%	0.708
7/27	0.767	0.654	0.648	0.739	0.899	0.718	0.705	0.023	0.645	0.766	8.6%	0.742
7/28	0.808	0.678	0.686	0.756	0.911	0.737	0.733	0.024	0.672	0.794	8.4%	0.797
7/29	0.825	0.700	0.711	0.769	0.924	0.754	0.752	0.022	0.694	0.809	7.6%	0.830
7/30	0.865	0.728	0.751	0.783	0.937	0.766	0.778	0.023	0.718	0.839	7.7%	0.852
7/31	0.885	0.754	0.801	0.814	0.948	0.776	0.806	0.022	0.749	0.863	7.1%	0.880
8/01	0.909	0.778	0.841	0.850	0.966	0.788	0.833	0.024	0.773	0.894	7.3%	0.906
8/02	0.920	0.799	0.841	0.887	0.973	0.800	0.849	0.024	0.788	0.911	7.2%	0.930
8/03	0.929	0.829	0.864	0.917	0.977	0.816	0.871	0.023	0.813	0.930	6.7%	0.941
8/04	0.939	0.855	0.891	0.941	0.986	0.838	0.893	0.021	0.838	0.947	6.1%	0.950
8/05	0.952	0.874	0.913	0.968	0.986	0.860	0.913	0.021	0.859	0.967	5.9%	0.955
8/06	0.962	0.895	0.924	0.987	0.986	0.877	0.929	0.020	0.877	0.981	5.6%	0.965
8/07	0.984	0.917	0.945	1.000	1.000	0.893	0.948	0.020	0.896	0.999	5.4%	0.983
8/08	0.997	0.935	0.965	1.000	1.000	0.915	0.962	0.017	0.919	1.006	4.5%	1.000
8/09	1.000	0.956	0.977	1.000	1.000	0.936	0.974	0.013	0.942	1.006	3.3%	1.000
8/10	1.000	0.968	0.989	1.000	1.000	0.957	0.983	0.009	0.960	1.005	2.3%	1.000
8/11	1.000	0.975	1.000	1.000	1.000	0.974	0.990	0.006	0.973	1.006	1.6%	1.000
8/12	1.000	0.984	1.000	1.000	1.000	0.985	0.994	0.004	0.984	1.004	1.0%	1.000
8/13	1.000	0.992	1.000	1.000	1.000	0.992	0.997	0.002	0.992	1.002	0.5%	1.000
8/14	1.000	1.000	1.000	1.000	1.000	0.996	0.999	0.001	0.997	1.001	0.2%	1.000
8/15	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%	1.000

^a 1989 excluded due to abnormally early timing.

^b Relative precision.

Appendix A2. Historical daily cumulative proportions of the effort by unguided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of unguided angler effort								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.009	0.005	0.015	0.004	0.018	0.032	0.051	0.000	0.017	0.006	0.002	0.031	86.2%
7/02	0.022	0.011	0.026	0.016	0.044	0.070	0.051	0.022	0.033	0.007	0.016	0.050	51.6%
7/03	0.040	0.013	0.046	0.053	0.069	0.070	0.091	0.036	0.052	0.009	0.032	0.072	38.5%
7/04	0.063	0.024	0.069	0.090	0.069	0.101	0.109	0.059	0.073	0.010	0.051	0.096	30.8%
7/05	0.092	0.046	0.112	0.142	0.089	0.129	0.138	0.084	0.104	0.012	0.077	0.131	26.3%
7/06	0.108	0.084	0.124	0.142	0.102	0.151	0.169	0.118	0.125	0.010	0.101	0.148	18.8%
7/07	0.163	0.102	0.124	0.162	0.123	0.181	0.209	0.141	0.151	0.012	0.121	0.180	19.4%
7/08	0.214	0.102	0.151	0.184	0.147	0.228	0.242	0.141	0.176	0.017	0.135	0.217	23.2%
7/09	0.214	0.121	0.169	0.211	0.204	0.280	0.242	0.164	0.201	0.017	0.159	0.242	20.5%
7/10	0.237	0.148	0.188	0.250	0.252	0.280	0.269	0.188	0.226	0.016	0.188	0.265	17.2%
7/11	0.260	0.180	0.209	0.299	0.252	0.323	0.297	0.215	0.254	0.018	0.212	0.296	16.5%
7/12	0.280	0.206	0.248	0.336	0.285	0.357	0.331	0.243	0.286	0.019	0.242	0.330	15.4%
7/13	0.306	0.278	0.298	0.336	0.314	0.394	0.361	0.300	0.324	0.014	0.292	0.356	9.9%
7/14	0.367	0.354	0.298	0.387	0.352	0.425	0.422	0.366	0.371	0.014	0.337	0.405	9.2%
7/15	0.431	0.354	0.350	0.418	0.384	0.484	0.490	0.366	0.410	0.020	0.363	0.456	11.4%
7/16	0.431	0.413	0.376	0.450	0.445	0.530	0.490	0.403	0.442	0.017	0.401	0.483	9.3%
7/17	0.462	0.477	0.426	0.491	0.491	0.530	0.542	0.451	0.484	0.014	0.451	0.516	6.7%
7/18	0.506	0.503	0.470	0.547	0.491	0.583	0.590	0.483	0.522	0.016	0.483	0.560	7.4%
7/19	0.556	0.525	0.525	0.595	0.583	0.618	0.645	0.532	0.572	0.016	0.535	0.610	6.6%
7/20	0.594	0.556	0.590	0.595	0.620	0.638	0.679	0.581	0.607	0.014	0.575	0.639	5.3%
7/21	0.649	0.575	0.590	0.633	0.659	0.678	0.766	0.641	0.649	0.021	0.600	0.698	7.5%
7/22	0.705	0.575	0.615	0.654	0.689	0.727	0.836	0.641	0.680	0.028	0.613	0.747	9.8%
7/23	0.705	0.616	0.649	0.686	0.741	0.761	0.836	0.682	0.710	0.024	0.652	0.767	8.2%
7/24	0.741	0.663	0.696	0.727	0.785	0.761	0.881	0.722	0.747	0.023	0.692	0.802	7.4%
7/25	0.778	0.717	0.746	0.790	0.785	0.807	0.930	0.759	0.789	0.022	0.736	0.842	6.7%
7/26	0.801	0.761	0.812	0.840	0.827	0.838	0.975	0.804	0.832	0.022	0.779	0.885	6.3%
7/27	0.842	0.845	0.874	0.840	0.858	0.875	0.986	0.852	0.871	0.017	0.831	0.912	4.6%
7/28	0.894	0.903	0.874	0.884	0.892	0.915	0.992	0.967	0.915	0.015	0.880	0.950	3.8%
7/29	0.957	0.903	0.923	0.920	0.929	0.960	0.996	0.967	0.944	0.011	0.918	0.970	2.7%
7/30	0.957	0.962	0.959	0.959	0.967	1.000	0.996	0.990	0.974	0.006	0.958	0.989	1.6%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A3. Historical daily cumulative proportions of the HPUE (harvest per hour) for chinook salmon by unguided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of unguided angler HPUE								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.010	0.018	0.044	0.018	0.055	0.026	0.063	0.000	0.029	0.008	0.011	0.048	63.5%
7/02	0.037	0.018	0.073	0.018	0.068	0.053	0.063	0.045	0.047	0.007	0.029	0.064	37.9%
7/03	0.072	0.028	0.096	0.121	0.078	0.053	0.161	0.064	0.084	0.015	0.049	0.119	41.4%
7/04	0.101	0.033	0.103	0.138	0.078	0.071	0.188	0.064	0.097	0.017	0.057	0.137	41.4%
7/05	0.123	0.033	0.139	0.190	0.100	0.099	0.188	0.068	0.117	0.019	0.072	0.163	39.0%
7/06	0.142	0.060	0.159	0.190	0.136	0.168	0.298	0.074	0.153	0.026	0.092	0.215	40.1%
7/07	0.154	0.075	0.159	0.229	0.171	0.253	0.307	0.126	0.184	0.026	0.122	0.246	33.7%
7/08	0.191	0.075	0.188	0.250	0.183	0.253	0.327	0.126	0.199	0.028	0.134	0.265	32.9%
7/09	0.191	0.107	0.203	0.284	0.196	0.366	0.327	0.210	0.236	0.030	0.165	0.306	29.8%
7/10	0.206	0.153	0.240	0.352	0.225	0.366	0.339	0.235	0.265	0.027	0.200	0.330	24.6%
7/11	0.221	0.214	0.315	0.358	0.225	0.463	0.339	0.253	0.298	0.031	0.226	0.371	24.4%
7/12	0.238	0.237	0.323	0.398	0.294	0.519	0.375	0.270	0.332	0.034	0.252	0.412	24.2%
7/13	0.250	0.264	0.369	0.398	0.369	0.578	0.414	0.270	0.364	0.038	0.274	0.454	24.7%
7/14	0.260	0.333	0.369	0.407	0.384	0.584	0.440	0.305	0.385	0.035	0.303	0.468	21.4%
7/15	0.288	0.333	0.476	0.455	0.441	0.584	0.521	0.305	0.425	0.038	0.336	0.515	21.0%
7/16	0.288	0.434	0.528	0.477	0.453	0.592	0.521	0.342	0.455	0.035	0.371	0.538	18.4%
7/17	0.376	0.476	0.556	0.511	0.471	0.592	0.613	0.438	0.504	0.028	0.437	0.571	13.3%
7/18	0.422	0.501	0.585	0.527	0.471	0.592	0.667	0.514	0.535	0.027	0.470	0.599	12.1%
7/19	0.466	0.501	0.604	0.550	0.502	0.677	0.717	0.521	0.567	0.032	0.492	0.643	13.3%
7/20	0.555	0.525	0.620	0.550	0.536	0.677	0.726	0.566	0.594	0.026	0.533	0.655	10.3%
7/21	0.634	0.541	0.620	0.585	0.646	0.725	0.732	0.597	0.635	0.023	0.580	0.690	8.7%
7/22	0.713	0.541	0.627	0.640	0.764	0.733	0.798	0.597	0.677	0.031	0.602	0.751	11.0%
7/23	0.713	0.621	0.658	0.662	0.794	0.762	0.798	0.611	0.702	0.027	0.640	0.765	8.9%
7/24	0.786	0.660	0.697	0.713	0.837	0.762	0.899	0.669	0.753	0.030	0.682	0.824	9.4%
7/25	0.840	0.722	0.744	0.733	0.837	0.768	0.935	0.669	0.781	0.030	0.710	0.852	9.0%
7/26	0.866	0.810	0.772	0.769	0.900	0.800	0.952	0.732	0.825	0.026	0.763	0.888	7.6%
7/27	0.890	0.857	0.812	0.769	0.913	0.816	1.000	0.829	0.861	0.026	0.800	0.921	7.0%
7/28	0.906	0.936	0.812	0.821	0.916	0.968	1.000	0.891	0.906	0.023	0.851	0.961	6.0%
7/29	0.941	0.936	0.876	0.868	0.946	0.982	1.000	0.891	0.930	0.017	0.890	0.970	4.3%
7/30	0.941	0.966	0.930	0.911	0.966	1.000	1.000	0.949	0.958	0.011	0.931	0.984	2.8%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A4. Historical daily cumulative proportions of the CPUE (catch per hour) for chinook salmon by unguided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of unguided angler CPUE								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.007	0.023	0.034	0.014	0.043	0.017	0.050	0.000	0.023	0.006	0.009	0.038	62.5%
7/02	0.029	0.023	0.050	0.014	0.053	0.047	0.050	0.062	0.041	0.006	0.027	0.055	34.6%
7/03	0.059	0.029	0.082	0.093	0.068	0.047	0.115	0.078	0.071	0.010	0.049	0.094	31.7%
7/04	0.089	0.032	0.104	0.122	0.068	0.108	0.133	0.091	0.093	0.011	0.067	0.120	28.7%
7/05	0.119	0.032	0.133	0.171	0.084	0.162	0.133	0.101	0.117	0.016	0.079	0.154	32.1%
7/06	0.144	0.050	0.163	0.171	0.127	0.213	0.244	0.109	0.153	0.021	0.102	0.203	33.1%
7/07	0.164	0.066	0.163	0.206	0.170	0.294	0.264	0.153	0.185	0.025	0.126	0.244	32.0%
7/08	0.193	0.066	0.211	0.229	0.189	0.294	0.288	0.153	0.203	0.026	0.141	0.264	30.3%
7/09	0.193	0.098	0.224	0.264	0.203	0.367	0.288	0.223	0.232	0.028	0.167	0.298	28.1%
7/10	0.205	0.149	0.244	0.317	0.244	0.367	0.304	0.245	0.259	0.024	0.202	0.316	22.0%
7/11	0.220	0.216	0.309	0.326	0.244	0.450	0.327	0.259	0.294	0.027	0.229	0.359	22.0%
7/12	0.234	0.244	0.316	0.377	0.326	0.527	0.397	0.274	0.337	0.034	0.256	0.417	23.9%
7/13	0.246	0.265	0.385	0.377	0.426	0.564	0.437	0.274	0.372	0.038	0.282	0.462	24.2%
7/14	0.254	0.338	0.385	0.397	0.444	0.571	0.476	0.303	0.396	0.036	0.312	0.481	21.3%
7/15	0.277	0.338	0.516	0.436	0.488	0.571	0.530	0.303	0.432	0.040	0.339	0.526	21.7%
7/16	0.277	0.449	0.555	0.462	0.500	0.578	0.530	0.405	0.470	0.034	0.389	0.550	17.2%
7/17	0.382	0.501	0.582	0.506	0.514	0.578	0.690	0.485	0.530	0.032	0.455	0.605	14.2%
7/18	0.446	0.524	0.602	0.525	0.514	0.674	0.732	0.548	0.571	0.033	0.492	0.649	13.7%
7/19	0.492	0.528	0.614	0.550	0.551	0.729	0.766	0.555	0.598	0.035	0.516	0.681	13.8%
7/20	0.575	0.554	0.623	0.550	0.577	0.729	0.786	0.599	0.624	0.031	0.551	0.697	11.6%
7/21	0.638	0.570	0.623	0.590	0.681	0.760	0.800	0.625	0.661	0.029	0.593	0.729	10.3%
7/22	0.723	0.570	0.633	0.639	0.783	0.774	0.853	0.625	0.700	0.035	0.618	0.782	11.7%
7/23	0.723	0.644	0.656	0.662	0.806	0.798	0.853	0.636	0.722	0.030	0.651	0.794	9.9%
7/24	0.790	0.682	0.683	0.705	0.844	0.798	0.927	0.703	0.766	0.031	0.692	0.841	9.7%
7/25	0.841	0.733	0.730	0.729	0.844	0.802	0.956	0.703	0.792	0.030	0.721	0.864	9.0%
7/26	0.876	0.809	0.754	0.770	0.910	0.843	0.968	0.755	0.836	0.028	0.770	0.901	7.8%
7/27	0.900	0.854	0.786	0.770	0.923	0.853	1.000	0.837	0.865	0.026	0.803	0.928	7.2%
7/28	0.921	0.914	0.786	0.827	0.927	0.975	1.000	0.905	0.907	0.025	0.848	0.966	6.5%
7/29	0.951	0.914	0.847	0.874	0.950	0.984	1.000	0.905	0.928	0.019	0.884	0.973	4.8%
7/30	0.951	0.970	0.921	0.914	0.972	1.000	1.000	0.958	0.961	0.011	0.934	0.987	2.8%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A5. Historical daily cumulative proportions of the harvest of chinook salmon by unguided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of unguided angler harvest								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.002	0.002	0.017	0.002	0.028	0.022	0.071	0.000	0.018	0.008	0.000	0.038	111.7%
7/02	0.011	0.002	0.025	0.002	0.037	0.049	0.071	0.024	0.028	0.009	0.008	0.048	72.7%
7/03	0.027	0.002	0.037	0.102	0.044	0.049	0.157	0.031	0.056	0.018	0.015	0.098	73.8%
7/04	0.044	0.003	0.042	0.119	0.044	0.064	0.168	0.031	0.064	0.019	0.020	0.109	69.2%
7/05	0.060	0.003	0.082	0.193	0.056	0.084	0.168	0.033	0.085	0.023	0.031	0.139	63.7%
7/06	0.067	0.025	0.088	0.193	0.070	0.125	0.245	0.038	0.106	0.027	0.042	0.171	60.5%
7/07	0.083	0.031	0.088	0.213	0.090	0.193	0.253	0.069	0.127	0.028	0.060	0.194	52.6%
7/08	0.131	0.031	0.108	0.226	0.099	0.193	0.268	0.069	0.141	0.029	0.073	0.209	48.4%
7/09	0.131	0.044	0.115	0.250	0.120	0.350	0.268	0.115	0.174	0.036	0.088	0.260	49.4%
7/10	0.140	0.070	0.133	0.321	0.158	0.350	0.275	0.130	0.197	0.036	0.111	0.283	43.7%
7/11	0.149	0.112	0.174	0.328	0.158	0.460	0.275	0.142	0.225	0.042	0.124	0.325	44.7%
7/12	0.157	0.124	0.183	0.367	0.223	0.510	0.303	0.154	0.253	0.047	0.142	0.363	43.9%
7/13	0.165	0.165	0.242	0.367	0.284	0.569	0.328	0.154	0.284	0.049	0.167	0.401	41.2%
7/14	0.179	0.276	0.242	0.380	0.300	0.574	0.364	0.210	0.316	0.044	0.211	0.421	33.2%
7/15	0.225	0.276	0.385	0.419	0.351	0.574	0.487	0.210	0.366	0.045	0.260	0.472	29.1%
7/16	0.225	0.402	0.420	0.438	0.372	0.584	0.487	0.244	0.396	0.042	0.297	0.496	25.0%
7/17	0.294	0.459	0.457	0.476	0.394	0.584	0.593	0.356	0.451	0.037	0.365	0.538	19.2%
7/18	0.345	0.473	0.490	0.499	0.394	0.584	0.650	0.416	0.481	0.035	0.398	0.565	17.4%
7/19	0.401	0.473	0.516	0.529	0.476	0.663	0.711	0.426	0.524	0.039	0.432	0.616	17.5%
7/20	0.485	0.488	0.543	0.529	0.510	0.663	0.718	0.480	0.552	0.032	0.477	0.627	13.6%
7/21	0.595	0.494	0.543	0.565	0.632	0.714	0.730	0.525	0.600	0.031	0.528	0.672	12.0%
7/22	0.705	0.494	0.548	0.596	0.731	0.725	0.832	0.525	0.644	0.043	0.544	0.745	15.6%
7/23	0.705	0.565	0.574	0.615	0.774	0.751	0.832	0.539	0.669	0.039	0.577	0.761	13.8%
7/24	0.771	0.602	0.623	0.670	0.827	0.751	0.932	0.596	0.721	0.042	0.621	0.822	13.9%
7/25	0.820	0.674	0.683	0.704	0.827	0.758	0.971	0.596	0.754	0.041	0.657	0.852	13.0%
7/26	0.835	0.755	0.731	0.752	0.902	0.784	0.989	0.664	0.802	0.037	0.715	0.888	10.8%
7/27	0.860	0.838	0.794	0.752	0.913	0.800	1.000	0.779	0.842	0.029	0.774	0.910	8.1%
7/28	0.881	0.935	0.794	0.813	0.915	0.964	1.000	0.954	0.907	0.026	0.846	0.968	6.7%
7/29	0.936	0.935	0.875	0.858	0.947	0.981	1.000	0.954	0.936	0.017	0.895	0.976	4.3%
7/30	0.936	0.972	0.926	0.903	0.969	1.000	1.000	0.987	0.962	0.013	0.932	0.992	3.1%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A6. Historical daily cumulative proportions of the catch of chinook salmon by unguided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of unguided angler catch								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.002	0.002	0.013	0.001	0.021	0.014	0.057	0.000	0.014	0.007	0.000	0.030	115.3%
7/02	0.009	0.002	0.017	0.001	0.029	0.044	0.057	0.033	0.024	0.007	0.007	0.041	69.9%
7/03	0.023	0.003	0.034	0.077	0.039	0.044	0.115	0.039	0.047	0.012	0.018	0.076	61.7%
7/04	0.040	0.003	0.048	0.106	0.039	0.094	0.122	0.046	0.062	0.014	0.029	0.096	54.2%
7/05	0.061	0.003	0.080	0.173	0.048	0.133	0.122	0.052	0.084	0.019	0.038	0.130	54.5%
7/06	0.072	0.018	0.089	0.173	0.064	0.163	0.200	0.059	0.105	0.023	0.050	0.159	52.0%
7/07	0.100	0.024	0.089	0.191	0.090	0.227	0.217	0.084	0.128	0.026	0.066	0.190	48.4%
7/08	0.137	0.024	0.122	0.205	0.102	0.227	0.235	0.084	0.142	0.026	0.080	0.204	43.9%
7/09	0.137	0.038	0.128	0.230	0.124	0.327	0.235	0.123	0.168	0.032	0.092	0.243	45.0%
7/10	0.144	0.066	0.138	0.283	0.178	0.327	0.245	0.136	0.190	0.031	0.116	0.263	38.6%
7/11	0.153	0.112	0.174	0.295	0.178	0.420	0.259	0.146	0.217	0.036	0.132	0.302	39.2%
7/12	0.160	0.127	0.180	0.344	0.256	0.487	0.313	0.156	0.253	0.043	0.150	0.356	40.7%
7/13	0.168	0.159	0.270	0.344	0.336	0.524	0.340	0.156	0.287	0.045	0.181	0.393	37.0%
7/14	0.180	0.276	0.270	0.370	0.356	0.529	0.393	0.203	0.322	0.040	0.227	0.417	29.5%
7/15	0.218	0.276	0.444	0.402	0.395	0.529	0.475	0.203	0.368	0.043	0.266	0.469	27.6%
7/16	0.218	0.414	0.470	0.424	0.415	0.539	0.475	0.294	0.406	0.037	0.320	0.493	21.3%
7/17	0.301	0.484	0.505	0.471	0.433	0.539	0.662	0.388	0.473	0.038	0.384	0.562	18.9%
7/18	0.372	0.497	0.528	0.499	0.433	0.672	0.707	0.439	0.518	0.041	0.421	0.616	18.8%
7/19	0.430	0.499	0.545	0.530	0.529	0.723	0.748	0.446	0.556	0.042	0.458	0.655	17.7%
7/20	0.509	0.516	0.559	0.530	0.556	0.723	0.763	0.500	0.582	0.036	0.497	0.667	14.7%
7/21	0.598	0.522	0.559	0.571	0.669	0.755	0.790	0.538	0.625	0.036	0.540	0.710	13.6%
7/22	0.718	0.522	0.566	0.598	0.754	0.773	0.874	0.538	0.668	0.046	0.560	0.776	16.2%
7/23	0.718	0.587	0.586	0.617	0.787	0.795	0.874	0.549	0.689	0.043	0.588	0.790	14.6%
7/24	0.778	0.625	0.619	0.663	0.834	0.795	0.948	0.614	0.734	0.043	0.632	0.837	14.0%
7/25	0.826	0.683	0.679	0.704	0.834	0.799	0.981	0.614	0.765	0.042	0.667	0.863	12.8%
7/26	0.846	0.754	0.719	0.757	0.912	0.833	0.992	0.671	0.811	0.038	0.722	0.899	11.0%
7/27	0.871	0.833	0.770	0.757	0.923	0.843	1.000	0.768	0.845	0.030	0.775	0.916	8.4%
7/28	0.898	0.907	0.770	0.823	0.927	0.973	1.000	0.960	0.907	0.027	0.842	0.972	7.1%
7/29	0.946	0.907	0.847	0.867	0.951	0.984	1.000	0.960	0.933	0.019	0.887	0.978	4.9%
7/30	0.946	0.975	0.917	0.908	0.974	1.000	1.000	0.989	0.964	0.013	0.933	0.994	3.1%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A7. Historical daily cumulative proportions of the effort by guided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of guided angler effort								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.000	0.023	0.025	0.006	0.025	0.032	0.000	0.000	0.014	0.005	0.003	0.025	81.5%
7/02	0.014	0.029	0.039	0.028	0.045	0.032	0.000	0.033	0.028	0.005	0.016	0.040	43.7%
7/03	0.027	0.033	0.055	0.055	0.045	0.032	0.045	0.063	0.044	0.005	0.034	0.055	24.1%
7/04	0.047	0.044	0.079	0.077	0.045	0.073	0.076	0.092	0.067	0.006	0.051	0.082	22.9%
7/05	0.073	0.064	0.103	0.077	0.079	0.104	0.102	0.131	0.092	0.008	0.073	0.110	20.2%
7/06	0.123	0.087	0.103	0.077	0.111	0.140	0.134	0.162	0.117	0.010	0.093	0.141	20.3%
7/07	0.199	0.087	0.103	0.107	0.138	0.179	0.173	0.162	0.143	0.014	0.109	0.178	23.9%
7/08	0.199	0.087	0.152	0.129	0.173	0.213	0.173	0.162	0.161	0.014	0.128	0.194	20.6%
7/09	0.199	0.122	0.181	0.172	0.211	0.213	0.173	0.223	0.187	0.011	0.160	0.214	14.5%
7/10	0.252	0.169	0.206	0.204	0.211	0.213	0.232	0.263	0.219	0.011	0.194	0.244	11.4%
7/11	0.320	0.228	0.242	0.225	0.211	0.276	0.290	0.309	0.263	0.015	0.228	0.297	13.2%
7/12	0.360	0.279	0.294	0.225	0.267	0.335	0.349	0.344	0.307	0.017	0.267	0.347	13.0%
7/13	0.412	0.322	0.294	0.225	0.319	0.388	0.409	0.388	0.345	0.023	0.289	0.400	16.0%
7/14	0.484	0.322	0.294	0.308	0.374	0.444	0.459	0.388	0.384	0.026	0.323	0.445	15.8%
7/15	0.484	0.322	0.339	0.384	0.408	0.493	0.459	0.388	0.410	0.023	0.356	0.463	13.1%
7/16	0.484	0.416	0.392	0.437	0.461	0.493	0.459	0.444	0.448	0.012	0.420	0.476	6.3%
7/17	0.534	0.485	0.455	0.486	0.461	0.493	0.507	0.509	0.491	0.009	0.470	0.513	4.4%
7/18	0.609	0.530	0.510	0.538	0.461	0.565	0.628	0.551	0.549	0.019	0.504	0.594	8.1%
7/19	0.654	0.577	0.569	0.538	0.527	0.621	0.692	0.604	0.598	0.020	0.550	0.645	7.9%
7/20	0.723	0.627	0.569	0.538	0.591	0.674	0.736	0.655	0.639	0.025	0.579	0.699	9.3%
7/21	0.737	0.627	0.569	0.596	0.650	0.724	0.793	0.655	0.669	0.027	0.605	0.732	9.5%
7/22	0.737	0.627	0.617	0.630	0.685	0.774	0.793	0.655	0.690	0.025	0.631	0.748	8.5%
7/23	0.737	0.677	0.645	0.679	0.745	0.774	0.793	0.713	0.720	0.018	0.677	0.763	6.0%
7/24	0.793	0.731	0.705	0.735	0.745	0.774	0.866	0.767	0.765	0.018	0.723	0.806	5.4%
7/25	0.842	0.790	0.770	0.782	0.745	0.837	0.918	0.813	0.812	0.019	0.767	0.857	5.6%
7/26	0.874	0.841	0.829	0.782	0.807	0.884	0.962	0.859	0.855	0.019	0.809	0.901	5.4%
7/27	0.926	0.918	0.829	0.782	0.864	0.922	0.990	0.912	0.893	0.023	0.838	0.947	6.1%
7/28	0.951	0.918	0.829	0.842	0.915	0.961	0.995	0.912	0.915	0.020	0.868	0.963	5.2%
7/29	0.951	0.918	0.902	0.894	0.960	1.000	0.995	0.912	0.942	0.015	0.907	0.976	3.7%
7/30	0.951	0.960	0.961	0.944	1.000	1.000	0.995	0.960	0.971	0.008	0.952	0.991	2.0%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A8. Historical daily cumulative proportions of the HPUE (harvest per hour) for chinook salmon by guided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of guided angler HPUE								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.000	0.075	0.025	0.050	0.047	0.020	0.000	0.000	0.027	0.010	0.004	0.050	86.0%
7/02	0.026	0.092	0.046	0.113	0.064	0.020	0.000	0.042	0.050	0.013	0.019	0.082	62.5%
7/03	0.091	0.118	0.079	0.182	0.064	0.020	0.027	0.098	0.085	0.018	0.042	0.128	51.0%
7/04	0.144	0.142	0.118	0.244	0.064	0.075	0.091	0.116	0.124	0.020	0.077	0.172	37.9%
7/05	0.186	0.166	0.130	0.244	0.104	0.115	0.151	0.116	0.152	0.017	0.113	0.191	25.8%
7/06	0.226	0.211	0.130	0.244	0.173	0.184	0.233	0.189	0.199	0.013	0.167	0.230	15.7%
7/07	0.264	0.211	0.130	0.298	0.201	0.288	0.271	0.189	0.232	0.021	0.183	0.280	21.0%
7/08	0.264	0.211	0.163	0.341	0.253	0.319	0.271	0.189	0.252	0.022	0.200	0.303	20.4%
7/09	0.264	0.251	0.187	0.375	0.282	0.319	0.271	0.189	0.267	0.022	0.215	0.320	19.5%
7/10	0.285	0.296	0.201	0.404	0.282	0.319	0.298	0.216	0.288	0.022	0.235	0.340	18.2%
7/11	0.301	0.346	0.246	0.417	0.282	0.377	0.318	0.272	0.320	0.020	0.272	0.368	15.0%
7/12	0.317	0.373	0.266	0.417	0.345	0.419	0.379	0.302	0.352	0.019	0.306	0.398	13.0%
7/13	0.347	0.409	0.266	0.417	0.368	0.512	0.425	0.315	0.382	0.027	0.319	0.446	16.6%
7/14	0.365	0.409	0.266	0.444	0.409	0.536	0.456	0.315	0.400	0.030	0.329	0.471	17.7%
7/15	0.365	0.409	0.313	0.470	0.468	0.547	0.456	0.315	0.418	0.029	0.349	0.487	16.6%
7/16	0.365	0.455	0.382	0.502	0.496	0.547	0.456	0.374	0.447	0.024	0.391	0.504	12.6%
7/17	0.408	0.492	0.419	0.549	0.496	0.547	0.537	0.392	0.480	0.023	0.426	0.534	11.3%
7/18	0.438	0.508	0.487	0.575	0.496	0.634	0.581	0.472	0.524	0.023	0.469	0.579	10.5%
7/19	0.481	0.533	0.519	0.575	0.542	0.698	0.622	0.552	0.565	0.024	0.509	0.622	10.0%
7/20	0.538	0.556	0.519	0.575	0.569	0.708	0.648	0.601	0.589	0.022	0.537	0.641	8.8%
7/21	0.626	0.556	0.519	0.603	0.618	0.740	0.716	0.601	0.622	0.026	0.560	0.684	10.0%
7/22	0.626	0.556	0.569	0.638	0.731	0.794	0.716	0.601	0.654	0.030	0.583	0.725	10.8%
7/23	0.626	0.661	0.593	0.703	0.805	0.794	0.716	0.623	0.690	0.028	0.624	0.756	9.6%
7/24	0.688	0.719	0.635	0.750	0.805	0.794	0.752	0.663	0.726	0.022	0.675	0.777	7.0%
7/25	0.739	0.773	0.685	0.804	0.805	0.840	0.781	0.711	0.767	0.018	0.724	0.811	5.7%
7/26	0.833	0.789	0.716	0.804	0.867	0.873	0.835	0.768	0.811	0.019	0.766	0.855	5.5%
7/27	0.901	0.859	0.716	0.804	0.901	0.929	0.857	0.847	0.852	0.024	0.795	0.908	6.6%
7/28	0.934	0.859	0.716	0.839	0.917	1.000	0.881	0.847	0.874	0.029	0.804	0.944	8.0%
7/29	0.934	0.859	0.817	0.886	0.950	1.000	0.881	0.847	0.897	0.021	0.846	0.947	5.6%
7/30	0.934	0.925	0.906	0.930	1.000	1.000	0.881	0.938	0.939	0.015	0.904	0.974	3.7%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A9. Historical daily cumulative proportions of the CPUE (catch per hour) for chinook salmon by guided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of guided angler CPUE								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.000	0.067	0.032	0.042	0.036	0.017	0.000	0.000	0.024	0.009	0.004	0.044	84.2%
7/02	0.030	0.079	0.068	0.106	0.049	0.017	0.000	0.046	0.049	0.012	0.021	0.078	58.4%
7/03	0.082	0.097	0.095	0.169	0.049	0.017	0.031	0.091	0.079	0.017	0.039	0.118	50.4%
7/04	0.129	0.114	0.141	0.234	0.049	0.062	0.084	0.106	0.115	0.020	0.067	0.163	42.0%
7/05	0.172	0.131	0.159	0.234	0.085	0.111	0.142	0.129	0.145	0.016	0.108	0.183	25.9%
7/06	0.210	0.167	0.159	0.234	0.148	0.173	0.219	0.189	0.187	0.011	0.162	0.213	13.8%
7/07	0.244	0.167	0.159	0.299	0.177	0.258	0.260	0.189	0.219	0.019	0.175	0.263	20.0%
7/08	0.244	0.167	0.204	0.333	0.217	0.293	0.260	0.189	0.238	0.020	0.192	0.285	19.6%
7/09	0.244	0.241	0.225	0.371	0.240	0.293	0.260	0.192	0.258	0.019	0.213	0.303	17.4%
7/10	0.265	0.311	0.239	0.393	0.240	0.293	0.281	0.225	0.281	0.019	0.236	0.326	16.1%
7/11	0.289	0.374	0.276	0.407	0.240	0.373	0.303	0.277	0.317	0.021	0.268	0.367	15.7%
7/12	0.307	0.396	0.294	0.407	0.301	0.419	0.369	0.307	0.350	0.019	0.305	0.394	12.7%
7/13	0.331	0.435	0.294	0.407	0.325	0.528	0.417	0.317	0.382	0.028	0.316	0.448	17.3%
7/14	0.350	0.435	0.294	0.427	0.370	0.547	0.454	0.317	0.399	0.029	0.330	0.469	17.4%
7/15	0.350	0.435	0.365	0.457	0.438	0.567	0.454	0.317	0.423	0.028	0.357	0.488	15.5%
7/16	0.350	0.503	0.451	0.490	0.461	0.567	0.454	0.408	0.460	0.023	0.407	0.514	11.7%
7/17	0.407	0.549	0.500	0.533	0.461	0.567	0.543	0.430	0.499	0.021	0.449	0.549	10.0%
7/18	0.447	0.564	0.551	0.554	0.461	0.649	0.610	0.496	0.541	0.025	0.483	0.600	10.8%
7/19	0.497	0.581	0.578	0.554	0.503	0.709	0.656	0.564	0.580	0.025	0.520	0.641	10.4%
7/20	0.561	0.600	0.578	0.554	0.531	0.717	0.687	0.613	0.605	0.023	0.550	0.660	9.1%
7/21	0.644	0.600	0.578	0.583	0.626	0.748	0.747	0.613	0.642	0.024	0.585	0.699	8.9%
7/22	0.644	0.600	0.611	0.621	0.743	0.792	0.747	0.613	0.671	0.027	0.607	0.735	9.5%
7/23	0.644	0.705	0.630	0.683	0.812	0.792	0.747	0.632	0.706	0.025	0.646	0.766	8.5%
7/24	0.714	0.754	0.660	0.725	0.812	0.792	0.782	0.685	0.741	0.019	0.696	0.786	6.1%
7/25	0.763	0.805	0.703	0.798	0.812	0.832	0.823	0.734	0.784	0.016	0.745	0.822	4.9%
7/26	0.847	0.819	0.735	0.798	0.873	0.879	0.866	0.801	0.827	0.017	0.786	0.868	5.0%
7/27	0.908	0.892	0.735	0.798	0.916	0.930	0.884	0.875	0.867	0.024	0.811	0.923	6.4%
7/28	0.937	0.892	0.735	0.849	0.928	0.993	0.903	0.875	0.889	0.027	0.826	0.953	7.1%
7/29	0.937	0.892	0.830	0.891	0.956	1.000	0.903	0.875	0.910	0.019	0.866	0.955	4.8%
7/30	0.937	0.947	0.912	0.940	1.000	1.000	0.903	0.949	0.949	0.013	0.919	0.978	3.1%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix A10. Historical daily cumulative proportions of the harvest of chinook salmon by guided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of guided angler harvest								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.000	0.037	0.013	0.008	0.026	0.013	0.000	0.000	0.012	0.005	0.001	0.023	93.1%
7/02	0.008	0.039	0.019	0.041	0.034	0.013	0.000	0.031	0.023	0.005	0.010	0.036	54.8%
7/03	0.030	0.041	0.030	0.085	0.034	0.013	0.027	0.068	0.041	0.008	0.021	0.061	48.4%
7/04	0.055	0.047	0.049	0.118	0.034	0.060	0.072	0.079	0.064	0.009	0.043	0.086	33.9%
7/05	0.080	0.058	0.055	0.118	0.064	0.085	0.107	0.079	0.081	0.008	0.062	0.100	23.5%
7/06	0.128	0.079	0.055	0.118	0.111	0.136	0.167	0.129	0.115	0.012	0.086	0.144	25.1%
7/07	0.197	0.079	0.055	0.157	0.129	0.220	0.201	0.129	0.146	0.021	0.096	0.195	34.0%
7/08	0.197	0.079	0.088	0.179	0.169	0.241	0.201	0.129	0.160	0.020	0.113	0.208	29.7%
7/09	0.197	0.109	0.102	0.215	0.193	0.241	0.201	0.129	0.173	0.018	0.130	0.217	25.2%
7/10	0.223	0.155	0.109	0.237	0.193	0.241	0.237	0.154	0.194	0.018	0.152	0.235	21.4%
7/11	0.249	0.217	0.143	0.244	0.193	0.316	0.262	0.211	0.229	0.018	0.186	0.272	18.8%
7/12	0.264	0.248	0.164	0.244	0.271	0.367	0.343	0.234	0.267	0.023	0.213	0.320	20.0%
7/13	0.301	0.281	0.164	0.244	0.297	0.469	0.407	0.246	0.301	0.034	0.221	0.382	26.7%
7/14	0.332	0.281	0.164	0.297	0.346	0.496	0.442	0.246	0.326	0.037	0.237	0.414	27.2%
7/15	0.332	0.281	0.207	0.345	0.392	0.508	0.442	0.246	0.344	0.036	0.260	0.428	24.5%
7/16	0.332	0.374	0.283	0.387	0.424	0.508	0.442	0.321	0.384	0.026	0.323	0.445	15.9%
7/17	0.384	0.428	0.330	0.442	0.424	0.508	0.528	0.347	0.424	0.025	0.365	0.483	13.9%
7/18	0.438	0.444	0.407	0.475	0.424	0.635	0.649	0.422	0.487	0.035	0.405	0.569	16.9%
7/19	0.483	0.469	0.446	0.475	0.490	0.709	0.709	0.514	0.537	0.038	0.447	0.627	16.8%
7/20	0.578	0.493	0.446	0.475	0.529	0.720	0.734	0.571	0.568	0.038	0.478	0.658	15.9%
7/21	0.606	0.493	0.446	0.513	0.592	0.753	0.821	0.571	0.599	0.046	0.492	0.707	18.0%
7/22	0.606	0.493	0.495	0.541	0.680	0.809	0.821	0.571	0.627	0.046	0.518	0.736	17.4%
7/23	0.606	0.607	0.509	0.619	0.778	0.809	0.821	0.600	0.668	0.041	0.571	0.766	14.6%
7/24	0.688	0.675	0.561	0.682	0.778	0.809	0.882	0.647	0.715	0.036	0.630	0.800	11.9%
7/25	0.748	0.743	0.627	0.742	0.778	0.868	0.916	0.696	0.765	0.032	0.688	0.841	10.0%
7/26	0.820	0.761	0.664	0.742	0.863	0.899	0.969	0.754	0.809	0.035	0.727	0.891	10.2%
7/27	0.903	0.876	0.664	0.742	0.905	0.943	0.983	0.848	0.858	0.037	0.769	0.947	10.3%
7/28	0.924	0.876	0.664	0.794	0.923	1.000	0.985	0.848	0.877	0.039	0.785	0.968	10.5%
7/29	0.924	0.876	0.818	0.853	0.956	1.000	0.985	0.848	0.907	0.024	0.850	0.965	6.3%
7/30	0.924	0.936	0.924	0.906	1.000	1.000	0.985	0.945	0.952	0.013	0.921	0.984	3.3%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

Appendix All. Historical daily cumulative proportions of the catch of chinook salmon by guided anglers during the return of late-run chinook salmon to the Kenai River, 1984-1991.

Date	Daily cumulative proportions [P(t)] by year of guided angler catch								95% Confidence Interval				Rel Pre ^a
	1984	1985	1986	1987	1988	1989	1990	1991	Mean	SE	Low	High	
7/01	0.000	0.031	0.017	0.006	0.019	0.011	0.000	0.000	0.011	0.004	0.001	0.020	89.4%
7/02	0.010	0.033	0.027	0.040	0.025	0.011	0.000	0.033	0.022	0.005	0.011	0.034	52.3%
7/03	0.026	0.034	0.036	0.080	0.025	0.011	0.030	0.063	0.038	0.008	0.019	0.057	49.2%
7/04	0.047	0.038	0.059	0.114	0.025	0.049	0.064	0.072	0.059	0.010	0.036	0.081	38.4%
7/05	0.072	0.045	0.069	0.114	0.051	0.080	0.095	0.092	0.077	0.008	0.058	0.097	25.0%
7/06	0.117	0.061	0.069	0.114	0.094	0.125	0.148	0.132	0.108	0.011	0.082	0.133	23.7%
7/07	0.176	0.061	0.069	0.160	0.112	0.193	0.181	0.132	0.136	0.018	0.093	0.178	31.5%
7/08	0.176	0.061	0.114	0.179	0.141	0.217	0.181	0.132	0.150	0.017	0.110	0.191	27.0%
7/09	0.176	0.115	0.127	0.217	0.160	0.217	0.181	0.136	0.166	0.014	0.134	0.199	19.5%
7/10	0.202	0.181	0.135	0.234	0.160	0.217	0.208	0.165	0.188	0.012	0.160	0.216	14.8%
7/11	0.239	0.257	0.163	0.241	0.160	0.320	0.234	0.218	0.229	0.018	0.186	0.272	18.9%
7/12	0.256	0.280	0.182	0.241	0.234	0.376	0.315	0.241	0.266	0.021	0.216	0.315	18.5%
7/13	0.285	0.315	0.182	0.241	0.260	0.493	0.377	0.251	0.300	0.034	0.220	0.381	26.8%
7/14	0.316	0.315	0.182	0.282	0.314	0.516	0.415	0.251	0.324	0.036	0.239	0.409	26.3%
7/15	0.316	0.315	0.249	0.335	0.365	0.535	0.415	0.251	0.348	0.033	0.269	0.426	22.5%
7/16	0.316	0.443	0.345	0.377	0.391	0.535	0.415	0.363	0.398	0.024	0.341	0.455	14.3%
7/17	0.382	0.507	0.409	0.428	0.391	0.535	0.504	0.395	0.444	0.022	0.392	0.495	11.6%
7/18	0.452	0.521	0.468	0.454	0.391	0.655	0.676	0.454	0.509	0.036	0.423	0.595	16.9%
7/19	0.503	0.538	0.501	0.454	0.451	0.724	0.738	0.533	0.555	0.040	0.461	0.650	17.0%
7/20	0.606	0.557	0.501	0.454	0.489	0.733	0.766	0.588	0.587	0.040	0.492	0.681	16.1%
7/21	0.631	0.557	0.501	0.494	0.610	0.763	0.837	0.588	0.623	0.043	0.521	0.724	16.3%
7/22	0.631	0.557	0.534	0.524	0.698	0.809	0.837	0.588	0.647	0.043	0.545	0.750	15.8%
7/23	0.631	0.665	0.545	0.598	0.788	0.809	0.837	0.613	0.686	0.039	0.594	0.778	13.4%
7/24	0.721	0.719	0.583	0.654	0.788	0.809	0.893	0.675	0.730	0.035	0.649	0.812	11.2%
7/25	0.777	0.780	0.641	0.735	0.788	0.860	0.937	0.724	0.780	0.031	0.706	0.855	9.5%
7/26	0.840	0.794	0.681	0.735	0.869	0.905	0.977	0.792	0.824	0.033	0.745	0.903	9.6%
7/27	0.912	0.910	0.681	0.735	0.921	0.945	0.987	0.878	0.871	0.038	0.782	0.960	10.2%
7/28	0.929	0.910	0.681	0.809	0.935	0.995	0.989	0.878	0.891	0.037	0.804	0.977	9.7%
7/29	0.929	0.910	0.826	0.861	0.962	1.000	0.989	0.878	0.919	0.022	0.867	0.972	5.7%
7/30	0.929	0.957	0.927	0.919	1.000	1.000	0.989	0.955	0.960	0.012	0.932	0.987	2.9%
7/31	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.000	1.000	1.000	0.0%

^a Relative precision.

APPENDIX B

Kenai River Late King Salmon Management Plan

Appendix B. Kenai River Late King Salmon Management Plan.

5 AAC 21.359 KENAI RIVER LATE KING SALMON MANAGEMENT PLAN.

(a) The purpose of this management plan is to insure an adequate escapement of late run chinook salmon into the Kenai River system and to provide management guidelines to the department.

(b) The department shall manage the late run Kenai River chinook salmon to achieve a minimum spawning escapement level of 15,500 salmon and an optimum spawning escapement level of 22,300 salmon as follows:

(1) if the projected spawning escapement level is less than 15,500, the department shall

(A) close the recreational fisheries in the Kenai River and in the salt waters of Cook Inlet north of the latitude of Bluff Point to the taking of chinook salmon;

(B) close the drift gill net fishery in the Central District within 3 miles of the Kenai Peninsula shoreline; and

(C) close the set gill net fishery in the Upper Subdistrict of the Central District;

(2) if the projected spawning escapement level is between 15,500 and 22,300 chinook salmon, the department shall restrict the taking of chinook salmon in the Kenai River recreational fisheries as necessary to achieve the optimum escapement; the department shall establish periods by emergency order during which

(A) time or area is reduced;

(B) bag or possession limits are zero; when the sport fishery is restricted to catch and release only, king salmon 52 inches or more in length may be retained; or

Note: changed from "(B) bag or possession limits are zero; or" in 1990

(C) only artificial lures may be used.

Note: The following sections modified the original plan above and were adopted at the December 1990 meeting of the Board of Fisheries.

(3) if the projected spawning escapement of chinook salmon is between 15,500 and 19,900, the department shall restrict the commercial fisheries as follows;

(A) within three miles of the Kenai Peninsula shoreline, the department shall limit the drift gill net fishery to regular periods;

-continued-

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(B) the department shall limit the set gill net fishery in the Upper Subdistrict of the Central District to regular periods;

(c) however, if the final inriver sonar count is projected to exceed 700,000 sockeye salmon, then the drift gill net fishery and the set gill net fishery will not be restricted to conserve Kenai River chinook salmon unless the projected spawning escapement is less than 15,500, consistent with (b)(1).

(d) consistent with the purpose of this management plan, the department shall not reduce closed waters at the mouth of the Kenai River when the projected escapement level is less than 22,300 chinook salmon.

(e) the Kasilof River Sockeye Salmon Special Harvest Area Management Plan (5 AAC 21.356) is exempt from all provisions of this management plan.

Effective 1989, modified 1991.

