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Annual Performance Report for

EVALUATION OF CHINOOK SALMON FISHERIES OF THE KENAI PENINSULA

by

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ABSTRACT

The four-weekend sport fishery for chinook salmon, Oncorhynchus tshawytscha (Walbaum), on Anchor River, Deep Creek and Ninilchik River is discussed. Total 1982 angler effort, 33,420 man-days, was estimated by vehicle counts on location. Harvest of 2,485 fish greater than 51 centimeters (20 inches) in length was derived by creel census. Total harvest estimates of chinook salmon as determined by creel census were: Anchor River, 760; Deep Creek, 660; and Ninilchik River, 1,070.

Age structure as determined by analysis of chinook salmon scale samples collected from the recreational fishery is discussed. The predominant age class was 1.4 (brood year 1976).

The 1982 saltwater chinook salmon fishery in Cook Inlet, south of Deep Creek, was monitored by creel census for the eleventh year. Harvests from both early and late runs were 2,497 and 1,173, respectively. Total angler effort was 23,766 man-days. Estimates were calculated on the basis of 3,248 angler interviews, 508 creel-checked fish and 172 instantaneous boat counts. Historical data for this fishery are presented.

Age composition of fish during the early run in saltwater was based on 119 readable scales collected during the fishery. The predominant age class of early run fish was 1.4 (brood year 1976). Based on 38 readable scales collected during the late run, the predominant age class was also 1.4.

The Kenai River chinook salmon fishery was monitored by creel census for the ninth year in 1982. Data from 10,508 angler interviews, 856 creel-checked fish, 167 instantaneous angler counts and 14 aerial surveys pro-

vided the basis for an estimated effort of 89,089 man-days and a harvest of 10,276 fish over 51 centimeters in length; 5,466 from the early run and 4,810 from the late run.

The chinook salmon season on the Kenai River was closed 6 days early by emergency order. This is the third time in 6 years the fishery has been closed. Events leading to the decision to close this fishery are discussed.

Sampling of the Kenai River recreational fishery produced 278 readable chinook salmon scales for age analysis. The predominant age class was 1.4 (brood year 1976) for both runs.

The Kenai River Fish Trap, a floating mobile trap, was operated for the second consecutive year in an attempt to capture chinook salmon for tagging. Again, the trap was plagued with problems, and various lead systems, especially electrical, were assessed and evaluated. Results are presented and discussed.

KEY WORDS

Salmon, Oncorhynchus tshawytscha, Oncorhynchus kisutch, creel census, electric weir, fish tagging, fish population, fish trap, fyke trap, Pedersen disc, Kenai River.

BACKGROUND

Chinook salmon are the species most desired by sport anglers on the Kenai Peninsula. Initially, harvest was confined to the southern streams; Anchor River, Deep Creek and Ninilchik River. Management of these streams has ranged from unregulated fisheries to complete closures and, from 1966 until 1980 excluding 1978, a punch card was utilized as a management tool. During 1978, only a daily bag and possession limit was required and, in 1981, there was also a seasonal limit utilizing a harvest record sticker printed on the back of the license. The date and body of water each chinook salmon was taken from had to be recorded immediately upon landing the fish.

Pertinent historical data regarding this fishery are presented in Reports of Progress by Dunn (1961), Logan (1962-1964), Engel and Logan (1965-1966), Engel (1967), Redick (1968), McHenry (1969), Watsjold (1970), Nelson (1971-1972a, 1972b) and Hammarstrom (1974-1982).

In 1972, anglers discovered chinook salmon could be harvested in the marine waters of Cook Inlet, in the vicinity of Deep Creek, as the fish move northward through this area. Early run fish (mid-May to mid-June) are probably bound for many systems in Cook Inlet but are heavily influenced by runs to the Kenai and Kasilof Rivers. Late run fish (mid-June through July) are bound almost entirely for the Kenai River.

Harvest and effort have been monitored by creel census since 1972. Fluctuations in harvest and effort are more a function of local weather conditions than they are of abundance of fish. Historical data pertaining to this fishery are presented by Hammarstrom (1974-1982).

Chinook salmon return to the Kenai River system in two distinct run segments, termed early and late. Early run fish are harvested almost solely by recreational anglers while either in salt water off Deep Creek as the fish move north along the shores of Cook Inlet or in the Kenai River itself. The late run is harvested commercially as an incidental species in set nets along the east side of Cook Inlet from Ninilchik to Boulder Point, as well as in the very intense recreational fishery off shore of Deep Creek and in the Kenai River.

The Kenai River became popular as a recreational fishery for chinook salmon in 1973. In 1974, the Department of Fish and Game initiated a creel census to monitor harvest and effort. That census was expanded in 1975 and has been continued each summer since. For the past 5 years, angling effort for chinook salmon on the Kenai River has made this fishery the largest in Alaska. Historical data are presented in reports by Hammarstrom (1975-1982).

Because the late run of chinook salmon into the Kenai River is subject to harvest by two user groups, it has generated considerable controversy and in years when an emergency closure on the recreational fishery is imposed to protect escapement, the conflict between user groups intensifies. The closure in 1982 contributed heavily to the current dispute surrounding this fishery.

One of the most critical management needs regarding the chinook salmon population of the Kenai River has been to accurately estimate the spawning escapement. A tag and recovery program appears to be the most promising technique; however, efforts to capture sufficient numbers of fish have been largely unsuccessful, and those escapement numbers are still unavailable.

Table 1 presents common and scientific names of species mentioned in this report.

RECOMMENDATIONS

1. Escapement of chinook salmon into the Kenai River system should be assessed.

2. The possibility of allowing anglers to harvest some of the fish entering the Kenai River in early August should be explored.

3. Techniques designed to limit the efficiency of the recreational chinook salmon fishery in the Kenai River, thus limiting the total harvest especially of the late run fish, should be explored.

Table 1. List of Common and Scientific Names.

Common Name	Scientific Name and Author
Chinook salmon	Onchorynchus tshawytscha (Walbaum)
Sockeye salmon	Onchorynchus nerka (Walbaum)
Coho salmon	Onchorynchus kisutch (Walbaum)
Pink salmon	Onchorynchus gorbuscha (Walbaum)
Dolly Varden	Salvelinus malma (Walbaum)
Pacific halibut	Hippoglossus stenolepis (Schmidt)

OBJECTIVES

1. To determine the sport harvest of chinook salmon and evaluate angler pressure in the Kenai Peninsula area.

2. To determine spawning escapement into the major chinook salmon producing streams in the area.

3. To determine and develop plans for the enhancement of chinook salmon stocks and to provide recommendations for their management.

TECHNIQUES

Fisheries

Harvest and effort for the chinook salmon fisheries on Anchor River, Deep Creek and Ninilchik River were determined by personnel on location during each day of the fishery. Similar census procedures have been used since 1977 (Hammarstrom 1978-1979).

Techniques of censusing the harvest and effort on the Kenai River and in the Deep Creek marine fishery are the same as described by Hammarstrom (1977).

In-season estimates of the chinook salmon harvest and effort estimates for the Kenai River were established using the technique described by Hammarstrom and Larson (1982). These estimates were used in evaluation of the recreational fishery and, ultimately, in closing the fishery July 25, 1982.

Kenai River Fish Trap

In addition to the basic vessel and trap operation as presented in Reports of Progress by Hammarstrom and Larson (1982), two additional improvements to the trap were incorporated in 1982. The trap was modified to maximize water flow through it, and an electric weir was instituted in an attempt to increase the sampling area of the trap.

To maximize water flow through the trap, Dr. Charles Behlke, Ph.D., in Civil Engineering Hydraulics, was consulted. The wire mesh and pipe grates on the front of the trap were replaced with aluminum slats and the entrance of the trap was widened. Dr. Behlke believed the remaining framework of the trap (consisting mainly of angle and channel iron), in a stream environment, may create sufficient eddy currents to prevent salmon from entering the trap.

The trap entrance has a maximum width of 10 feet which represents 1.7% of the Kenai River width. Because adult chinook salmon utilize the entire width of the Kenai River in their upstream migration, this sampling width is believed to be too small for capturing a significant number of fish. To increase the sampling area, mechanical leads were attempted in 1981 (Hammarstrom and Larson, 1982), but vegetating debris made their application impractical.

It was hoped that an electric weir would not block vegetating debris yet would be effective in guiding chinook salmon to the trap entrance.

The electric weir selected was similar to one operated by the U.S. Fish and Wildlife Service for capturing chinook salmon in the Killey River (a tributary to the Kenai River) in 1981 (pers. comm., Aldo Palmisano). The electric weir consisted of two separate horizontal and parallel steel cables which constituted the electrodes, a 10 KW generator and a Coffelt VVP-3E control box. Only DC power was utilized. The downstream electrode constituted the cathode and the upstream electrode the anode. Both the cathode and the anode lay on the river bed 10 feet apart.

The electrodes were held in place by an anchor fastened to each end. A 55 gallon barrel, filled to one-third capacity with concrete plus sand bags, provided a dependable anchor for the vessel end of the electrode, and either a 22-pound "Danforth" style anchor or a tree (located on a river bank) secured the leading end of the electrode.

An extra 50 feet of electrode cable extended from the barrel anchor to the deck of the vessel. The extension was insulated with 50 feet of garden hose and a quick disconnect welding electrode connector was attached to the end of the electrode to provide a quick and safe method of connecting the control box leads to the electrodes. A length of 50 feet was necessary to provide adequate slack during tidal fluctuations. Insulating the electrodes prevented electrical shorts to the hull of the vessel.

The primary power source was provided by a Lima Series MAC-R brushless, 280 frame, self-regulated generator which was powered by a 2 cylinder Lister diesel engine. The system provided 240 VAC power through a 30 amp circuit breaker to the input on the Coffelt control box. An auxiliary power source was provided by a portable 3.5 KW Homelight generator when needed. The portable generator was connected directly to the Coffelt control box.

The Coffelt VVP-3E control box provided variable output voltage (0-300 VDC), current (0-10 amperes) and frequency (10-20 PPS). Although AC power was also available, it was never used. The danger of electrolysis activity to the vessel and the potentially hazardous conditions prevented AC power use.

The basic electrode configuration consisted of two sets of electric cables which fanned out from the stern of the vessel. One set was displayed off the port side and the other set off the starboard side. The electrode display varied between 40° and 90° with the direction of water flow. Forty degrees was recommended (W. Hartley and D. Simpson, 1967) as the ideal angle for guiding salmon, however, 90° would maximize the effect of the DC electrical field. Various angles were tried in an attempt to capture chinook salmon.

If the electrodes were placed too near the trap entrance, there was a danger the electrical field may be extensive enough to pinch off the entrance of the trap, therefore, the electrodes were set approximately 10 feet from the trap entrance. The gap between the start of the electrode display and the trap entrance was filled by a mechanical barrier consisting of three evenly spaced 55 gallon barrels filled to one-third capacity with concrete and two-thirds capacity with sand bags.

To test the voltage gradient developed from the electrodes, a simple measuring probe was constructed. The handle of the probe was an insulated dip net handle, 8 feet in length. A 1,000 mm wooden stick was fastened to the end, perpendicular to the axis of the handle, forming a T. Two separate 12 gauge insulated solid copper wires were taped along the length of the handle and each wire was taped to opposite ends of the wooden stick with 1,000 mm separating the bare end. The opposite end of the electrical wires were fastened to a Simpson's volt-ohm-milliameter.

The probe measures the voltage difference between two points 1,000 mm apart. A distance of 1,000 mm represents the approximate average length of a late run adult chinook salmon in the Kenai River. The actual average length lies between 900 mm and 1,000 mm; however, to simplify visualizing the voltage gradient and the mathematical conversions, a distance of 1,000 mm was selected.

FINDINGS

Lower Stream Fishery

The 1982 spring fishery for chinook salmon on Anchor River, Deep Creek and Ninilchik River was conducted under similar regulations to those which have been in effect since 1978. Each stream was open the last weekend of May and the first 3 weekends of June, except Ninilchik River which was closed after the second weekend of June. Each weekend included Saturday, Sunday and Monday. Harvest for this entire fishery was estimated at 2,485 chinook salmon over 51 cm (20 in) in length, and effort was estimated at 33,420 man-days. A man-day was approximately 4 hours.

The fishery commenced May 29, 1982. Opening weekend found Anchor River and Ninilchik River in excellent condition and harvest was good from each of these (Table 2). Deep Creek was high and turbid and produced relatively few fish the opening weekend.

Heavy rains over the Anchor River drainage between the first 2 weekends left that stream extremely high and turbid by the second weekend. As a result, effort dropped substantially and harvest was quite poor. The other two streams produced well and attracted more anglers.

All streams were quite fishable throughout the remainder of the fishery and the total harvest from each stream was above the historical mean. Historical information regarding this fishery is presented in Table 3.

Escapement surveys were conducted on the lower Kenai Peninsula streams during late July. Water conditions were relatively low and clear due to the dry weather occurring during the 2 weeks preceding the counts. Both Ninilchik River and Deep Creek had record escapements well above the 16-year average. Escapements for each river system are as follow: Anchor River, 1,540; Deep Creek 2,670; and Ninilchik River, 1,430 (see Table 4).

During the 1982 recreational fishery, 209 readable scales were collected from the three streams (Table 5 and 6). Age class 1.4 (brood year 1976) represented 66.0% of the harvest. This same brood year represented 60.9%

Table 2. Angler Harvest and Effort Summaries for the Chinook Salmon Fishery of the Lower Three Kenai Peninsula Streams, 1982.*

Date	Anchor River		Deep Creek		Ninilchik River		Total	
	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort
5/29	115	1,840	20	1,005	500	3,015	635	5,860
5/30	115	2,060	35	785	115	2,480	265	5,325
5/31	40	1,040	5	365	40	1,090	85	2,495
Subtotal	270	4,940	60	2,155	655	6,585	985	13,680
6/5	15	1,220	85	1,230	200	2,290	300	4,740
6/6	10	590	35	785	60	2,045	105	3,420
6/7	10	210	0	195	30	455	40	860
Subtotal	35	2,020	120	2,110	290	4,790	445	9,025
6/12	150	995	150	640	75	960	375	2,595
6/13	65	745	50	820	25	850	140	2,415
6/14	40	365	75	375	25	250	90	990
Subtotal	255	2,105	225	1,835	125	2,060	605	6,000
6/19	150	1,100	200	765	Closed		350	1,865
6/20	25	975	25	985	Closed		50	1,960
6/21	25	375	25	520	Closed		50	895
Subtotal	200	2,450	250	2,270			450	4,720
Grand Total	760	11,515	655	8,370	1,070	13,435	2,485	33,420

* Figures have been rounded to nearest 5.

Table 3. Historical Chinook Salmon Harvest and Effort Data from Lower Three Kenai Peninsula Streams (Deep Creek, Ninilchik River, Anchor River), 1971-1982.

Year	Effort (man-days)	Harvest	Length of Season (days)	Average Effort/Day	Average Harvest/Day	Man-Days Per Fish
1971	15,900	240	6	2,650	40	66
1972	13,520	490	4	3,380	123	28
1973	24,100	770	6	4,017	128	31
1974	21,000	1,080	6	3,500	180	19
1975	19,600	850	6	3,267	142	23
1976	36,920	1,680	8	4,615	210	22
1977	24,520	2,170	8	3,065	271	11
1978	45,540	3,400	16*	2,846	283	13
1979	36,640	2,100	16*	2,290	175	17
1980	28,787	995	12	2,399	83	29
1981	32,330	3,020	12	2,695	252	10.7
1982	33,420	2,485	12	2,785	207	13.5
Mean	27,691	1,610	9.3	2,982	169	13.3

* Anchor River only was open for four additional days.

Table 4. Historical Harvest and Escapement for the Three Lower Kenai Peninsula Chinook Salmon Streams from 1966-1982.

Year	Anchor River			Deep Creek			Ninilchik River			Total		
	Harvest	Escapement	%Harvest*	Harvest	Escapement	%Harvest*	Harvest	Escapement	%Harvest*	Harvest	Escapement	Run
1966	290	1,330	18	50	540	9	200	670	25	560	2,540	3,100
1967	240	1,200	17	180	270	40	120	360	25	540	1,830	2,370
1968	250	530	32	160	200	44	210	450	32	620	1,180	1,800
1969	80	1,800	4	40	200	4	130	760	15	250	3,520	3,770
1970	170	1,850	8	60	...	...	280	...	...	510	1,850+	2,360+
1971	60	1,220	5	40	...	...	140	...	...	240	1,220+	1,460+
1972	180	1,890	8	140	530	21	170	1,360	11	490	3,780	4,270
1973	330	1,660	17	140	220	39	300	640	32	770	2,530	3,290
1974	440	1,000	31	290	740	28	350	510	41	1,080	2,250	3,330
1975	210	1,290	14	100	610	14	540	830	39	850	2,730	3,580
1976	830	3,080	21	220	1,680	12	630	1,180	35	1,680	5,940	7,620
1977	1,020	4,170	16	240	990	21	910	1,400	40	2,170	6,560	8,730
1978	1,680	2,410	41	590	1,010	40	1,130	990	44	3,400	4,410	7,810
1979	1,030	2,000	34	370	1,750	17	700	1,390	34	2,100	5,140	7,240
1980**	425	665	39	90	475	16	480	720	40	995	1,860	2,855
1981**	1,040	1,230	48	580	920	39	1,300	830	61	3,020	2,980	6,000
Mean (excludes all 1970 and 1971 data)												
1966-81	580	1,740	25	230	780	23	510	870	37	1,320	3,380	4,700
1982	760	1,540	33	660	2,670	20	1,070	1,430	43	2,490	5,640	8,130

Figures rounded to nearest 10.

* % of total run harvested.

** Escapement count considered minimal due to high turbid water during entire summer.

Table 5. Length Data (mid-eye to fork of tail) of Major Age Classes of Chinook Salmon Taken in the Recreational Fishery on Three Lower Kenai Peninsula Streams, 1982.

	Age Class		
	1.2	1.3	1.4
Anchor River			
Number	5	23	35
Range (mm)	570-680	705-830	830-1,000
Mean (mm)	616	774	903
S.D.*	45.1	40.1	43.9
Ninilchik River			
Number	4	21	86
Range (mm)	520-575	600-830	760-1,000
Mean (mm)	558	763	888
S.D.*	31.2	53.4	46.8
Deep Creek			
Number	1	8	24
Range (mm)	605	640-770	795-965
Mean (mm)	605	740	871
S.D.*		42.1	45.8
Total			
Number	10	52	145
Range (mm)	520-680	600-830	760-1,000
Mean (mm)	592	764	882
S.D.*	45.8	55.7	51.0

* S.D. - Standard Deviation

Table 6. Age Composition of Chinook Salmon Taken in the Recreational Harvest from Anchor River, Deep Creek and Ninilchik River, 1982.

	Age Class			
Brood Year	1.2 (1978)	1.3 (1977)	1.4 (1976)	Total
Number	10	52	145	207*
Percent	4.8	25.1	70.1	100.0

* An additional 13 scales (12 age class 1.1 and 1 age class 2.3) were collected.

in 1981 as age class 1.3 (Hammarstrom and Larson, 1982) but accounted for only 11.2% of the 1980 harvest (Hammarstrom, 1981).

Review of historical age data from these three streams indicate that if a particularly successful brood year exhibits a strong return in their fourth year of life (age class 1.2), this brood year will also be strong contributors as age class 1.3 and 1.4. However, the reverse is not true. If a particular brood year does not return in large numbers as age class 1.2, that does not mean these fish will return poorly as age classes 1.3 or 1.4.

Deep Creek Marine Fishery

Creel census activities to measure the 1982 harvest and angler effort in marine waters offshore of Deep Creek commenced May 17 and terminated July 31. During that time, 172 instantaneous counts were made, 5,109 boats were counted, 3,248 anglers were interviewed, 508 chinook salmon and 1,080 pacific halibut were creel checked.

The season ran for 76 days and the creel census activities were conducted on 53 days (70%). Eight of the 53 days (15%) were considered weather days when little or no fishing activities were reported due to inclement weather. Thus the season was effectively reduced from 76 to 65 days by stormy weather.

The preceding information was used to estimate early run (May 17 through June 27) chinook salmon harvest at 2,497 fish in 14,514 man-days of effort. Corresponding figures for the late run (June 28 through July 31) indicate 1,173 fish were caught in 9,252 man-days of effort. In addition, 7,900 halibut were estimated caught during the time the creel census was conducted.

The catch rate for chinook salmon during the early run was 0.056 fish per hour (18 man-hours per fish) which compares to a 10-year mean of 0.059 (17 man-hours per fish). The late run catch per hour was 0.033 (30 man-hours per fish), about half the 10-year average of 0.061 (16 man-hours per fish); however, this average includes 1972, the first year of the fishery when there were few people, a relatively strong return and ideal weather. When compared to the 1973-1981 mean catch per hour of 0.041, then 1982 is much closer to the more representative mean. Historical data for this fishery are presented in Table 7.

During the 1982 season, 157 readable chinook salmon scales were collected, 119 from early run fish and 38 from late run fish. The predominant age class was 1.4 (brood year 1976) for both the early run (63%) and late run (68%). Data regarding age and length are presented in Table 8.

Kenai River Fishery

The 1982 creel census of chinook salmon anglers on the Kenai River commenced June 1 and was continuous through July 25, at which time the fishery was closed by emergency order. Individuals conducting the creel census enumerated 20,201 anglers during 167 instantaneous counts, creel-checked 856 chinook salmon taken during 28,680 man-hours and interviewed 10,508

Table 7. Historical Summary of the Chinook Salmon Sport Fishery in Marine Waters off Deep Creek, 1972-1982.

Year	Early Run			Late Run			Total		
	Harvest	Effort Man-Days	Catch/ Hour	Harvest	Effort Man-Days	Catch/ Hour	Harvest	Effort Man-Days	Catch/ Hour
1972	1,000	2,357	0.119	1,250	1,253	0.272	2,250	3,610	0.173
1973	519	5,245	0.028	491	2,795	0.050	1,010	8,040	0.034
1974	500	3,810	0.037	100	1,280	0.034	600	5,090	0.036
1975	540	3,370	0.061	345	4,680	0.031	885	8,050	0.044
1976	5,495	12,268	0.101	1,382	6,365	0.057	6,877	16,635	0.088
1977	4,617	18,803	0.069	366	6,938	0.017	4,983	25,741	0.056
1978	2,669	14,413	0.059	2,693	9,402	0.081	5,362	23,815	0.068
1979	3,088	13,352	0.053	1,164	8,728	0.034	4,252	22,080	0.046
1980	521	8,065	0.017	747	9,104	0.021	1,268	17,169	0.019
1981	2,363	11,601	0.051	170	3,325	0.018	2,533	14,836	0.042
Mean 1972-81	2,131	9,329	0.059	871	5,378	0.061	3,002	14,707	0.061
1982	2,497	14,514	0.056	1,173	9,252	0.033	3,670	23,766	0.046

Table 8. Summarized Data from Readable Scales Collected from Chinook Salmon Harvest in the Deep Creek Marine Fishery, 1982.

Age Class Brood Year	1.2 1978	1.3 1977	1.4 1976	1.5 1975	Other	Total
			Early Run			
Number	7	35	75	0	2	119
Percent	5.9	29.4	63.0	...	1.7	100.0
Length Range (mm)*	590-660	700-960	775-1,035	...	650-890	590-1,035
Mean (mm)*	615.0	790.0	920.0	...	770	861.0
Standard Deviation	28.3	59.9	53.3	...	169.7	101.4
			Late Run			
Number	0	3	26	9	0	38
Percent	...	13.5	68.4	23.7	...	100.0
Length Range (mm)*	...	890-945	940-1,210	950-1,150	...	890-1,210
Mean (mm)*	...	917.0	1068	1074	...	1061
Standard Deviation	...	38.9	66.8	68.1	...	73.7

* Mid-eye to fork of tail.

anglers. In addition, 14 aerial surveys on angler effort and dispersion were conducted.

Analyses of the above data resulted in an estimated total chinook salmon harvest of 10,276 during 89,089 man-days of angler effort.

Early run fish were considered available in the downstream section (Beaver Creek to Soldotna Bridge) from June 1 through July 5, and in the upstream section (Naptown Rapids to Skilak Lake) from June 7 through July 11. There were chinook salmon available earlier in both sections, however, low water conditions prevailed resulting in few anglers being able to navigate efficiently with a conventional outboard. Only those boats using jet units were successful until early June.

The dates separating the two runs are obtained by analyzing catch rates then adjusting to the nearest weekly period. In the downstream section, 4th of July weekend was used. The distinct separation date is necessary to meet requirements established by a Board of Fisheries Policy regarding management of late run chinook salmon in the Kenai River.

The early run into the Kenai River was considered excellent. The total harvest of 5,466 chinook salmon was the largest since the Department began monitoring the fishery in 1974. The only year to surpass the 1982 catch per hour of 0.033 was 1974 when a catch per hour of 0.041 was recorded. However, in 1974, only 11,275 man-days of effort were estimated, while in 1982 nearly 46,000 man-days of effort was estimated. As was mentioned, water levels were relatively low and quite clear which could account for the increased efficiency.

Although no escapement estimates are generated, one stream, Benjamin Creek, a clear water tributary to the Killey River, was surveyed by helicopter and an estimated 500-800 spawning chinook salmon were counted. This compares favorably to counts made in 1980 and 1981. The Killey River is the main producer of early run chinook salmon and utilizing Benjamin Creek as an index to the overall health of the early escapement suggests that this segment of the chinook salmon return is quite healthy.

The late run harvest of chinook salmon was estimated at 4,810 fish in 43,366 man-days of effort. Catch per hour was estimated at 0.029, slightly below the 1976-1981 mean of 0.032. The system was closed by emergency order on July 25, 6 days early.

As the return began to materialize in salt water, the magnitude, as indicated by the commercial set net fishery along the eastern shore of Cook Inlet, appeared above average. Early catch rates in the downstream section (Soldotna Bridge to Beaver Creek) of the river supported the hypothesis that the return was quite strong.

As the season progressed, and the sockeye salmon return began to build, it became apparent that the 1982 run was extensive and, to keep within the escapement ranges, substantial additional commercial time on the eastside beaches (statistical area 244-20, 30, 40) would be necessary. This meant additional pressure would be put upon the chinook salmon migrating simultaneously with the sockeye salmon. At the same time it was noticed that,

although the overall catch rate in the river was not alarming, virtually the entire harvest was being taken in the very downstream reach of the fishery. Very few fish were being harvested upstream of the "Falling-in-Hole," located 3.5 miles upstream from Beaver Creek. Because of the anticipated additional commercial fishing time, apparent absence of harvest from historically productive areas and declining catch rates from the one area that was producing fish, the decision to close the fishery was made and the season ended on July 25, 6 days early.

Because of the changing length of a man-day (Table 9), effort is expressed in both man-hours and man-days. Effort (man-hours) in 1982, increased 37.6% above 1981 estimates and 32.5% during the late run. Corresponding figures for harvest indicate only a 17% increase during the early run and a 9.0% decrease during the late run. Historical harvest and effort data are presented in Tables 10 and 11.

During the 1982 fishery, 278 readable scales were collected from chinook salmon harvested in the recreational fishery on the Kenai River, 159 from early run fish and 119 from late run fish. Table 12 presents summarized data from the 1982 fishery. The predominant age class was 1.4 (brood year 1976) for both runs. The sex ratio of the harvest was 0.9 males to 1 female during the early run and 1.5 males to 1 female during the late run. Chinook salmon harvested during the early run averaged 15.8 kg (34.8 lbs) and 17.2 kg (37.8 lbs) for late run fish. Age class 1.5 (brood year 1975) was not as prevalent as in past years and thus the relative absence of many large fish (80+ lbs). Historical age class data are presented in Table 13.

At the spring 1982 Board of Fisheries meeting, the staff was instructed to devise and implement a registration program to identify Kenai River sport fishing guides and attempt to further define their impact on the salmon fishery.

Beginning in May, anyone desiring to guide on the Kenai River was required to provide the Department of Fish and Game with the following information: name and address of the business, name and address of any guides they employ, proper business license and the permanent vessel license plate and a description of their vessel. In addition they were required to keep a logbook and record the following: client's name and sport fish license number and the catch, both retained and released, by species.
During the 1982 season, 207 individuals were registered as sport fishing guides on the Kenai River, 127 businesses or firms were registered listing 179 vessels, and a total of 222 logbooks were issued.

Logbooks were required returned to the Department by October 31, 1982. As of February 1983, 209 books have been returned, 3 were reported lost and 10 were still outstanding. Of the logbooks returned, 46 showed no activity and 163 had reported at least one client and, of those, 57 reported at least 50 client-days.

According to the returned logbooks, guides and their clients reported a total 3,253 chinook salmon were retained and 615 released. This varies from the creel census harvest estimate of 5,035 chinook salmon attributed to guides and their clients. Part of the difference can be explained by the fact that there were times when vessels, identified as registered guide

Table 9. Comparative Effort Data in Man-Hours and Man-Days for the Past Six Years of the Kenai River Chinook Salmon Fishery, 1977-1982.

Year	Upstream Section Man Hours	Upstream Section Man Days	Upstream Section Hours/ Man-Day	Mid-Stream Section Man Hours	Mid-Stream Section Man Days	Mid-Stream Section Hours/ Man-Day	Downstream Section Man Hours	Downstream Section Man Days	Downstream Section Hours/ Man-Day	Shore Anglers Man Hours	Shore Anglers Man Days	Shore Anglers Hours/ Man-Day	Total Man Hours	Total Man Days	Total Hours/ Man-Day	CPUE
EARLY RUN																
1977	35,928	10,679	3.4	7,793	2,484	3.1	49,704	16,426	3.0	18,582	5,890	3.2	112,007	35,479	3.2	0.021
1978	35,698	7,761	4.6	5,885	1,199	4.9	38,800	7,321	5.3	16,241	3,288	4.9	96,624	19,569	4.9	0.017
1979	23,416	7,280	3.2	10,600	2,992	3.5	94,366	26,230	3.6	10,772	3,073	3.5	139,154	39,665	3.5	0.022
1980	30,108	6,663	4.5	18,110	4,620	3.9	61,356	17,530	3.5	13,445	3,552	3.8	123,019	32,365	3.8	0.016
1981	29,502	6,066	4.9	13,306	3,119	4.3	67,770	16,735	4.0	10,303	2,415	4.3	120,881	28,335	4.3	0.031
1982	25,562	6,228	4.1	22,444	6,224	3.6	99,128	28,348	3.5	19,200	4,923	3.9	166,334	45,723	3.6	0.033
Mean	30,035	7,446	4.0	13,023	3,440	3.8	68,521	18,780	3.6	14,758	3,857	3.8	126,337	33,523	3.8	0.024
LATE RUN																
1977	14,962	5,087	2.9	9,398	3,328	2.8	88,312	31,233	2.8	22,410	7,891	2.8	135,082	47,539	2.8	0.038
1978	24,660	7,046	3.5	15,169	4,334	3.5	137,120	39,177	3.5	35,268	10,076	3.5	212,217	60,633	3.5	0.029
1979	26,478	7,565	3.5	15,276	4,413	3.5	143,256	40,930	3.5	20,877	5,987	3.5	205,887	58,895	3.5	0.022
1980	29,416	6,742	4.4	23,684	5,311	4.5	90,200	23,401	3.9	11,135	2,806	4.0	154,435	38,260	4.0	0.018
1981	22,284	4,965	4.5	17,842	3,574	5.0	96,660	18,861	5.1	12,510	2,506	5.0	149,296	29,905	5.0	0.032
1982	14,792	3,237	4.6	17,970	3,907	4.6	127,828	28,086	4.6	37,185	8,136	4.6	197,775	43,366	4.6	0.024
Mean	22,099	5,774	3.8	16,557	4,145	4.0	113,896	30,281	3.8	23,231	6,234	3.7	175,783	46,434	3.8	0.028
Seasonal Avg.	52,134	13,220	3.9	29,580	7,585	3.9	182,417	49,061	3.7	37,989	10,091	3.8	302,120	79,057	3.8	0.026

Table 10. Historical Summary of the Kenai River Chinook Salmon Fishery, 1974-1982.

Year	Sport Fishing - Kenai River: Early Run Harvest	Early Run Effort	Early Run Catch/ Hour	Late Run Harvest	Late Run Effort	Late Run Catch/ Hour	Total Harvest	Total Effort	Total Catch/ Hour
1974	1,685	11,275	0.041	3,225	12,335	0.037	4,910	23,910	0.038
1975	615	15,047	0.011	2,355	14,943	0.044	2,970	29,990	0.024
1976	1,554	16,430	0.024	4,477	28,030	0.039	6,031	44,460	0.033
1977	2,173	35,479	0.019	5,148	47,539	0.036	7,321	83,018	0.029
1978	1,542	19,569	0.018	5,578	60,636	0.026	7,120	80,232	0.024
1979	3,661	39,665	0.022	4,634	58,895	0.022	8,295	98,560	0.022
1980	1,946	32,365	0.016	3,608	38,260	0.018	5,554	70,625	0.017
1981	4,525	28,335	0.031	5,285	29,906	0.032	9,810	58,241	0.032
Mean	2,177	24,713	0.023	4,273	36,423	0.032	6,450	61,136	0.032
1982	5,466	45,723	0.033	4,810	43,366	0.029	10,276	89,089	0.030

Table 11. Historical Harvest Comparison by River Section for the Kenai River Chinook Salmon Fishery, 1976-1982.

	Upstream Section		Midstream Section		Downstream Section		Shore Anglers		Total
	Harvest	Percent	Harvest	Percent	Harvest	Percent	Harvest	Percent	Harvest
					EARLY RUN				
1976	492	31.7	216	13.9	721	46.4	125	8.0	1,554
1977	737	33.9	166	7.6	1,083	49.9	187	8.6	2,173
1978	673	43.6	102	6.6	646	42.0	121	7.8	1,542
1979	103	3.9	290	10.9	2,156	81.0	112	4.2	2,661
1980	465	23.9	290	14.9	1,070	55.0	121	6.2	1,946
1981	346	7.6	528	11.7	3,464	76.6	187	4.1	4,525
Mean	470	19.6	265	11.0	1,523	63.5	142	5.9	2,400
1982	456	8.4	791	14.5	3,941	72.0	278	5.1	5,466
					LATE RUN				
1976	89	2.0	616	13.7	3,370	75.3	402	9.0	4,477
1977	232	4.5	389	7.6	4,046	78.6	481	9.3	5,148
1978	278	5.0	439	7.9	4,429	79.4	432	7.7	5,578
1979	226	4.9	364	7.9	3,819	82.4	225	4.8	4,634
1980	242	6.7	515	14.3	2,483	68.8	368	10.2	3,608
1981	255	4.3	660	12.6	4,150	79.0	220	4.2	5,285
Mean	220	4.6	497	10.4	3,716	77.6	355	7.4	4,788
1982	156	3.2	198	4.1	4,340	90.2	116	2.4	4,810
					BOTH RUNS				
1976	581	9.7	832	13.8	4,091	67.8	527	8.7	6,031
1977	969	13.2	555	7.6	5,129	70.1	668	9.1	7,321
1978	951	13.4	541	7.6	5,075	71.3	553	7.7	7,120
1979	329	4.5	654	9.0	5,975	81.9	337	4.6	7,295
1980	707	12.7	805	14.5	3,553	64.0	489	8.8	5,554
1981	601	5.8	1,188	12.1	7,614	77.9	407	4.2	9,810
Mean	690	9.6	762	10.6	5,239	72.9	497	6.9	7,188
1982	612	6.0	989	9.6	8,281	80.6	394	3.8	10,276

Table 12. Summarized Age Data Determined From Readable Chinook Salmon Scales Collected During the Recreational Fishery on the Kenai River, 1982.

Age Class	1.2	1.3	1.4	1.5	Other	Total
			EARLY RUN			
Number	10	37	99	7	6	159
Percent	6.2	23.3	62.3	4.4	3.8	100.0
Length Range (mm)	535-720	705-965	845-1155	940-1125	375-475	375-1155
Mean Length (mm)	633	823	968	1058	409	896
Mean Weight (kg)	5.1	9.9	19.5	22.0	1.3	15.8
			LATE RUN			
Number	14	31	70	2	2	119
Percent	11.7	26.1	58.8	1.7	1.7	100.0
Length Range (mm)	570-745	705-1025	765-1185	1040-1130	435-440	435-1185
Mean Length (mm)	644	877	1027	1085	438	934
Mean Weight (kg)	5.2	16.5	20.3	21.9	1.8	17.2
			BOTH RUNS			
Number	24	68	169	9	8	278
Percent	8.6	24.5	60.8	3.2	2.9	100.0
Length Range (mm)	535-745	705-1025	765-1185	940-1130	375-475	375-1185
Mean Length (mm)	639	848	992	1064	416	912
Mean Weight (kg)	5.2	12.8	19.8	22.0	1.5	16.4

1. Length was measured from mid-eye to fork of tail.

Table 13. Historical Composition of Major Age Classes in Percent of Chinook Salmon Harvested from the Kenai River, 1974-1982.

Harvest Year	Age Class 1.2	1.3	1.4	1.5
Early Run				
1976	27.8	25.3	44.3	2.6
1977	14.4	30.3	53.7	1.5
1978	15.9	18.8	65.3	0
1979	5.8	30.8	51.9	11.5
1980	9.0	14.9	69.8	6.3
1981	14.7	32.1	51.4	1.8
1982	6.5	24.2	64.7	4.6
Mean	13.4	25.1	57.4	4.1
Late Run				
1976	30.4	20.5	45.1	4.0
1977	11.6	41.6	45.0	1.7
1978	12.6	8.0	77.7	1.7
1979	15.1	17.8	54.8	12.3
1980	21.1	21.5	49.7	7.5
1981	12.8	22.2	62.4	2.6
1982	12.0	26.5	59.8	1.7
Mean	16.5	22.6	56.5	4.4
Total Both Runs				
1974	5.9	4.7	83.5	5.9
1975	44.5	32.5	20.0	3.0
1976	29.3	22.5	44.8	3.4
1977	12.9	35.0	48.9	1.6
1978	13.5	11.1	74.2	1.2
1979	9.6	25.4	53.1	11.9
1980	15.7	18.6	58.7	7.0
1981	14.0	28.7	55.2	2.1
1982	8.9	25.2	62.6	3.3
Mean	17.2	22.6	55.8	4.4

vessels by a Department provided decal, were termed "guide boats" by the census taker when, in fact, the vessel was used for personal pleasure or with non-paying friends. Any harvest on that day would have been attributed to the category "guided anglers". Postal inquiries have been sent to a randomly selected sample of "guided anglers" in an attempt to verify the accuracy of the information provided by the guides in their logbook. Table 14 presents data concerning guides and their clients from 1981 and 1982 as determined by creel census activities.

Kenai River Escapement Enumeration

The Kenai River Fish Trap, aided by an electric weir, was placed in operation on June 16, 1982. The electric weir produces a voltage gradient which decreases in intensity away from the electrode. The voltage gradient necessary to guide fish varies with the length of the fish, larger fish requiring a lower voltage gradient than smaller fish. As an example, for an upstream migrating fish to detect an electrical field, a fish with a length of 150 mm would require a voltage gradient of 0.07 volts/cm, while a 500 mm fish requires only 0.028 volts/cm (Chmielewski, 1967).

Voltage gradient readings were generally confined to the water surface. Because the electrodes lay on the river bed, the voltage gradient would be the strongest low in the water column at the electrodes and weakest high in the water column at the water surface. Therefore, if the voltage gradient on the water surface was adequate, it could be assumed the voltage gradient throughout the water column would be adequate.

It was difficult to maintain a constant water surface voltage gradient. Variations were attributed to the following variables:

1. Tidal fluctuations altered the electrical resistance of the water. Differences of 8,000 ohms/1,000 mm have been recorded between high and low tide (mile 9.5 Kenai River).

2. Tidal fluctuation altered the distance the surface water was from electrodes.

3. Difference in the distance between the anode and cathode electrodes varied with each setting.

4. The exposed surface area of the electrodes changed as the length and diameter varied with the size of the cables used.

Even with the surface voltage gradient of 0.05 v/cm, nearly double the recommended 0.028 v/cm recommended by Chemielewski, the electric weir failed to increase the catch of the KRFT.

To visualize the effects of the electric weir on the upstream migrating adult salmon, captured salmon were marked with an inflated balloon. A balloon was tied to one end of a 20-foot line and a fish hook was tied to the other end. This fish hook was inserted between the rays of the dorsal fin in such a manner that if the line should become entangled in debris, it would pull out easily. By visualizing the balloon's migration on the surface of the water, the salmon's migration could also be observed.

Table 14. Comparison Between Guided and Unguided Chinook Salmon Anglers on the Kenai River by River Section, 1981-1982.

	1981								
	Early Run			Late Run			Both Runs		
	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour
Downstream Section									
Guided	53.0	28.5	0.087	52.1	31.0	0.072	52.5	30.3	0.076
Unguided	47.0	71.5	0.030	47.9	69.0	0.030	47.5	69.7	0.030
Upstream Section									
Guided	25.0	13.3	0.013	26.1	10.8	0.030	25.6	11.8	0.023
Unguided	75.0	86.7	0.006	73.9	89.2	0.010	74.4	88.2	0.009
Total River									
Guided	51.1	23.2	0.072	49.1	24.6	0.066	49.8	24.2	0.070
Unguided	48.9	76.8	0.021	50.9	75.4	0.022	50.2	75.8	0.022
	1982								
	Early Run			Late Run			Both Runs		
	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour
Downstream Section									
Guided	44.5	23.0	0.075	52.0	37.5	0.064	48.4	30.0	0.068
Unguided	55.5	77.0	0.028	48.0	62.5	0.035	51.6	70.0	0.031
Upstream Section									
Guided	56.0	28.8	0.040	40.0	22.7	0.018	52.1	26.4	0.032
Unguided	44.0	71.2	0.013	60.0	77.3	0.008	47.9	73.6	0.011
Total River									
Guided	46.9	25.0	0.061	51.1	33.6	0.056	49.0	28.9	0.058
Unguided	53.1	75.0	0.023	48.9	66.7	0.027	51.0	71.1	0.025

Salmon were captured for "ballooning" either with a drift gill net or with the KRFT. Unfortunately, either trauma in handling or the downstream pull of the balloon or a combination of the two may have been too great. Most "ballooned" salmon (chinook, sockeye and coho) drifted downstream after release and failed to return to the weir site during the course of a fishing day. Observations utilizing this technique were limited.

Various electrode lengths and configurations were tried throughout the course of the field season. The first chinook salmon was captured utilizing the arrangement shown in Figure 1. However, duplication of this arrangement and additional arrangements, as shown in Figures 2 and 3, failed to capture a significant number of chinook salmon.

By July 19, 1982 only one chinook salmon had been captured with the aid of the electric weir. Various individuals and firms were contacted. The advice of the contacted experts was used throughout the remainder of the field season.

To eliminate the possibility of chinook salmon detecting the electric field and swimming around the outer extremities, the electrodes were lengthened to cover the entire width of the Kenai River, however, this increased the surface area of the electrodes beyond the amper output capabilities of the control box and an inadequate voltage gradient was produced.

To increase the voltage gradient three techniques were utilized. First, the additional steel cables to extend the electrodes were reduced from 3/8-inch diameter to 1/4-inch diameter. Second, electrical tape was applied intermittently along the entire length of the cathode (6 inches of taped cable followed by 6 inches of exposed cable). Third, a second control box was used for one leg of the electric weir. This final technique required the use of an auxiliary power supply.

Utilizing the above techniques, an electrical field powerful enough to stop salmon was created. The output to the electrodes was:

Voltage: 125 VDC
Current: 7 amperes
Pulse: 20 pulses per second

However, it was not only too abrupt, but also ineffective beyond the immediate vicinity of the electrodes. When the voltages were high enough to kill salmon migrating near the electrodes, salmon with balloons attached and swimming higher in the water column were observed unaffected by the electrical field. The carcasses of 11 chinook, 2 coho, 3 sockeye and 1 pink salmon were retrieved downstream of the electric weir. Autopsies of the carcasses revealed ruptures along the spinal column which were attributed to severe muscle contractions from exposure to an intense electrical field. A voltage gradient as high as 35 V/1,000 mm was observed near the shoreline where most fish activity was observed. The electric weir was removed from operation on July 20.

In addition to the electric weir, two different attractants were tried independent of each other in an effort to lure salmon into the trap. Sockeye salmon eggs and a chemical attractant, Morpholine, were tried.

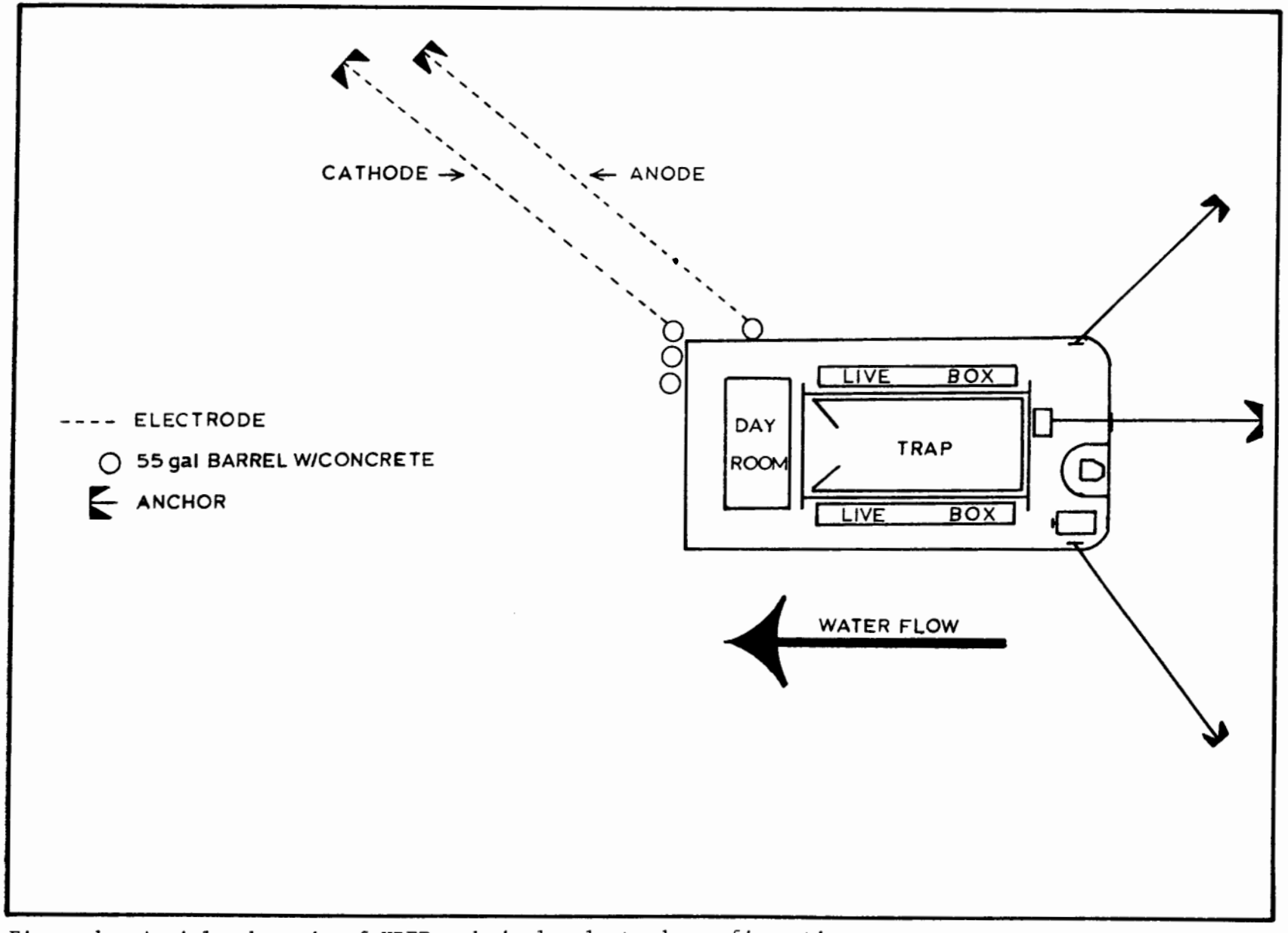

Figure 1. Aerial schematic of KRFT and single electrode configuration.

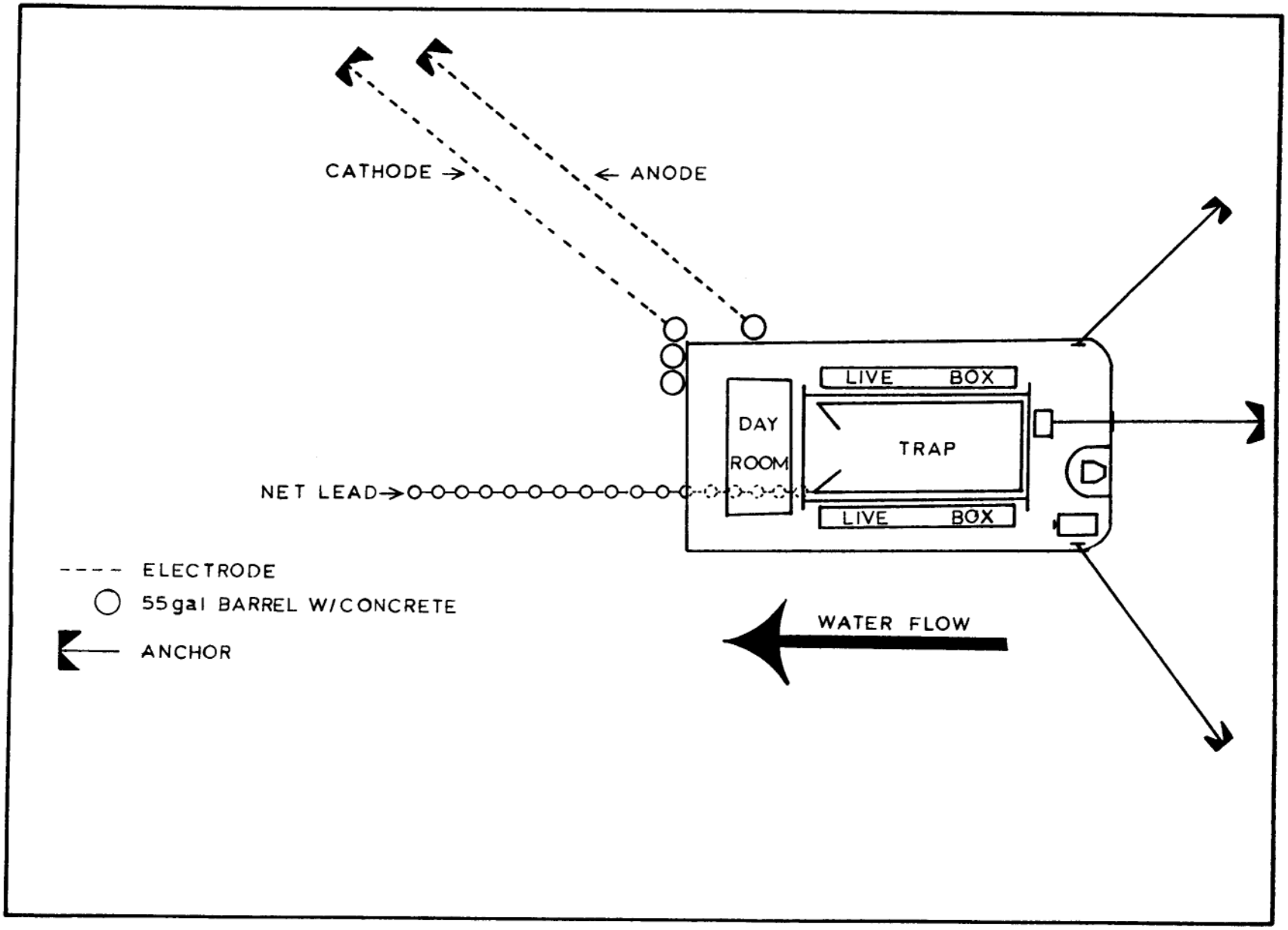

Figure 2. Aerial schematic of KRFT and single electrode configuration with net lead.

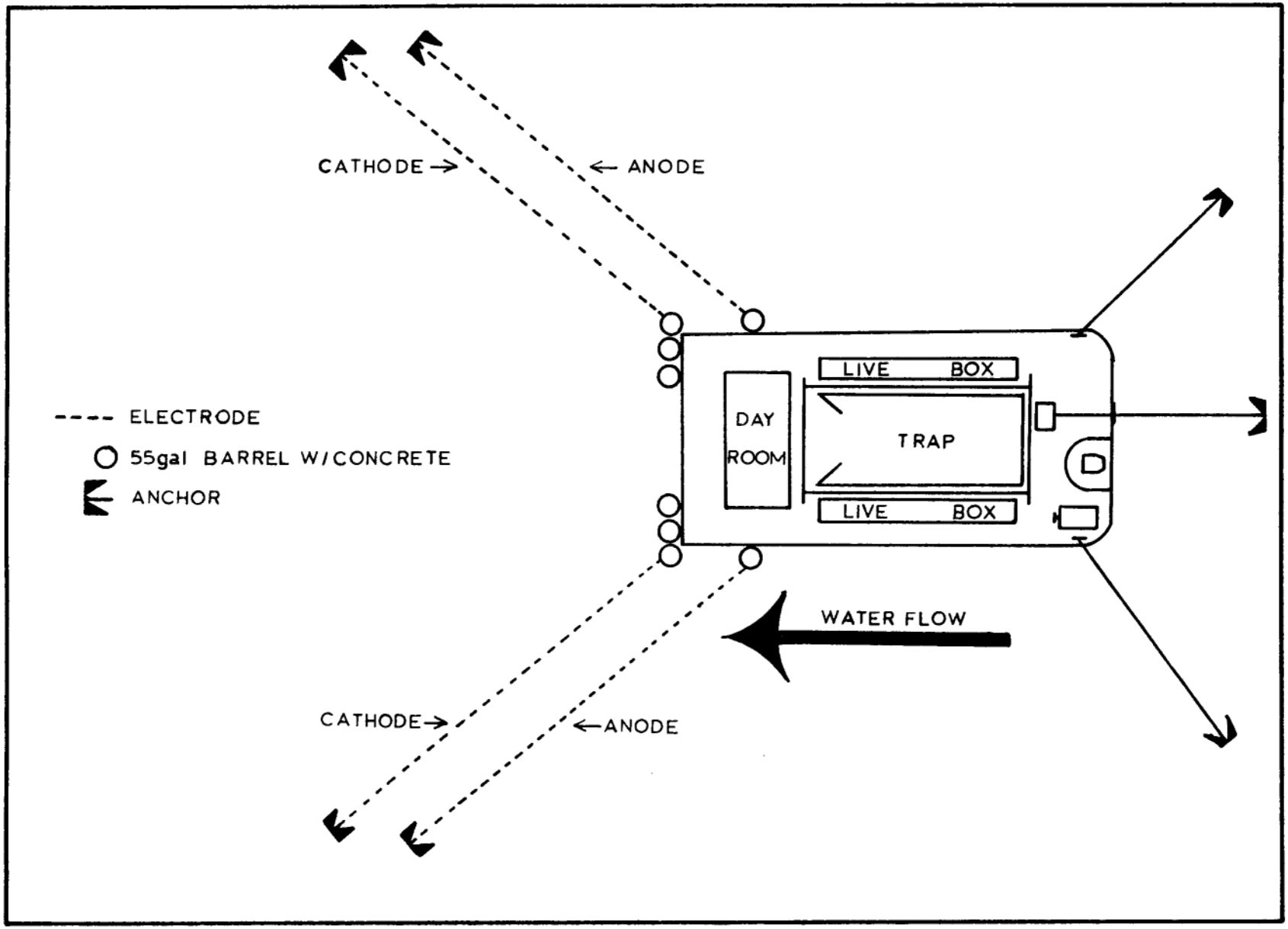

Figure 3. Aerial schematic of KRFT and double electrode configuration.

Salmon eggs from 10 adults were placed in a fine mesh net and the net was fastened to the inside of the trap. The Morpholine was diluted 10:1 and absorbed by a foam rubber sponge in a perforated plastic bottle. Each attractant was allowed to leach into the river system. Although salmon were captured by the trap when these attractants were used, there was no noticeable increase in the catch rate. The necessary equipment to control the rate of leaching and compute the concentration of attractant to the water volume were not available. Failure of these attractants to provide a noticeable increase in catch rates are not intended to be viewed as conclusive.

DISCUSSION

Kenai River Chinook Salmon Fishery

The 6-day closure on the chinook salmon recreational fishery in the Kenai River was the second consecutive closure on this fishery. Although anglers realized the need for an emergency closure, the fact that the commercial fishery was allowed to fish for 19 consecutive days starting July 16 was not received very well by the angling public. Much heated discussion by the various parties concerned, sport fishermen, commercial fishermen and sport fish guides, took place at numerous assemblies designed to approach some acceptable solution.

At the December 1982 Board of Fisheries meeting, the Department of Fish and Game staff, both Sport and Commercial, was instructed to obtain from the public various options for management of late run chinook salmon in the marine waters (reduce the incidental harvest of chinook salmon while not seriously affecting the management of the more important commercial species) and in the Kenai River (distribute the harvest more equitably among the various river sections).

All options have been consolidated and will be presented to the Board of Fisheries at the Spring 1983 meeting. The options range from suggested buy-back of the east side set net commercial fishing permits by the State to elimination of all recreational chinook salmon fishing above saltwater. The Board of Fisheries will consider nearly 50 various options that have been received from concerned individuals. The result of their decisions will be the methods under which the 1983 fisheries, both sport and commercial, will be conducted.

Because the Kenai River is so vital to both the recreational and commercial fisheries of the Kenai Peninsula, it became the subject of a Governor appointed task force. Since September 1982 this task force has been gathering information through public hearings and written public input. The task force's final recommendations will be presented to the Board of Fisheries in April 1983 and then forwarded to the Governor.

Many of the decisions reached by the Board of Fisheries and the action the Governor takes with regard to the task force will determine the immediate future of the Kenai River. These decisions may have some severe ramifications to the conduct of the fisheries as we know them. The intense interest in the Kenai River further reflects the necessity to obtain answers to some longstanding questions.

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