

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

EVALUATION OF CHINOOK SALMON FISHERIES
OF THE KENAI PENINSULA

by

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and
Larry Larson

ALASKA DEPARTMENT OF FISH AND GAME

Ronald O. Skoog, Commissioner

DIVISION OF SPORT FISH

E. Richard Logan, Director

VOLUME 23
JULY 1, 1981 - June 30, 1982
FEDERAL AID IN FISH RESTORATION
AND
ANADROMOUS FISH STUDIES

EVALUATION OF CHINOOK SALMON FISHERIES
OF THE KENAI PENINSULA

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TABLE OF CONTENTS

Job No. G-II-L	Evaluation of Chinook Salmon Fisheries of the Kenai Peninsula	PAGE
	By: Stephen Hammerstrom and Larry Larson	
Abstract		38
Key Words		40
Background		40
Recommendations		41
Objectives		41
Techniques		41
Findings		47
Lower Stream Fishery		47
Deep Creek Marine Fishery		50
Kenai River Fishery		56
Kenai River Fish Trap		65
Discussion		68
Kenai River Chinook Salmon Fishery		68
Literature Cited		68

LIST OF TABLES AND FIGURES

Table	1. List of Common Names, Scientific Names and Abbreviations	39
Figure	1. The Kenai River Fish Trap (artist's conception)	44
Figure	2. Schematic Drawing depicting the anchors and the net-lead system for the Kenai River Fish Trap, 1981.	48
Figure	3. Schematic drawing depicting the trailing lead configuration of the Kenai River Fish Trap, 1981	49
Table	2. Angler Harvest and Effort Summaries for the Chinook Salmon Fishery on the Lower Three Kenai Peninsula Streams, 1981	51
Table	3. Historical Chinook Salmon Harvest and Effort Data from Lower Three Kenai Peninsula Streams (Deep Creek, Ninilchik River, Anchor River) 1971-1981	52
Table	4. Historical Harvest and Escapement for the Three Lower Kenai Peninsula Chinook Salmon Streams from 1966-1981.	53
Table	5. Length Data (mid-eye to fork of tail) of Chinook Salmon Taken in the Recreational Fishery of Three Lower Kenai Peninsula Streams, 1981	54
Table	6. Age Composition of Chinook Salmon Taken in the Recreational Harvest from Anchor River, Deep Creek, and Ninilchik River, 1981	55
Table	7. Historical Summary of the Chinook Salmon Sport Fishery in Marine Waters off Deep Creek, 1972-1981	57
Table	8. Summarized Data from Readable Scales Collected from Chinook Salmon Harvested in the Deep Creek Fishery, 1981	58
Table	9. Historical Summary of Kenai River Chinook Salmon Fishery 1974-1981	59
Table	10. Historical Harvest Comparison by River Section for Kenai River Chinook Salmon Fishery, 1976-1981.	60

LIST OF TABLES AND FIGURES (Cont'd)

		PAGE
Table 11.	Historical Sport and Commercial Harvest of Kenai River Chinook Salmon, 1974-1981.	62
Table 12.	Comparative Effort Data in Man-Hours and Man-Days for Past Five Years of Kenai River Chinook Salmon Fishery, 1977-1981	63
Table 13.	Comparison Between Guided and Unguided Chinook Salmon Anglers on the Kenai River by River Section, 1981	64
Table 14.	Summarized Age Data Determined From Readable Chinook Salmon Scales Collected During the Recreational Fishery on the Kenai River, 1981	66
Table 15.	Historical Age Composition of Major Age Classes in Percent, of Chinook Salmon Harvested from the Kenai River, 1974-1981	67

RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish
Investigations of
Alaska

State: No.: G-9-14

Study No.: G-II Study Title: SPORT FISH STUDIES

Job No.: G-II-L Job Title: Evaluation of Chinook
Salmon Fisheries of
the Kenai Peninsula

Cooperators: Stephen Hammarstorm and Larry Larson

Period Covered: July 1, 1981 to June 30, 1982

ABSTRACT

The 4-weekend fishery for chinook salmon, Oncorhynchus tshawytscha (Walbaum), on Anchor River, Deep Creek and Ninilchik River is discussed. Total angler effort, 32,330 man-days, was estimated by vehicle counts on location. Total harvest, of 3,020 fish longer than 51 centimeters (20 inches), was derived by creel census. Harvest estimates of chinook salmon as determined by creel census were: Anchor River, 1,140; Deep Creek, 580; and Ninilchik River, 1,300.

Age structure as determined by analysis of chinook salmon scale samples collected from the recreational fishery is discussed. The predominant age class was 1.3 (brood year 1976).

The 1981 saltwater chinook salmon fishery in Cook Inlet, south of Deep Creek, was monitored by creel census for the tenth year. Harvests from both early and late runs were 2,363 and 170, respectively. Total angler effort was 14,836 man-days. Estimates were calculated on the basis of 2,463 angler interviews, 278 creel-checked fish and 177 instantaneous boat counts. Historical data for this fishery are presented.

Age composition of fish taken during the early run in saltwater was based on 98 readable scales collected during the fishery. The predominate age class was 1.3 (brood year 1976). Only 19 readable scales were collected during late run, not enough to determine the age composition.

The Kenai River chinook salmon fishery was monitored by creel census for the eighth year in 1981. Data from 11,325 angler interviews, 994 creel checked fish, 152 instantaneous angler counts and 13 aerial surveys

Table 1. List of Common Names, Scientific Names and Abbreviations.

Common Name	Scientific Name and Author	Abbreviations
Chinook salmon	<i>Onchorhynchus tshawytscha</i> (Walbaum)	KS
Sockeye salmon	<i>Onchorhynchus nerka</i> (Walbaum)	RS
Coho salmon	<i>Onchorhynchus kisutch</i> (Walbaum)	CS
Pink salmon	<i>Onchorhynchus gorbuscha</i> (Walbaum)	PS
Dolly Varden	<i>Salvelinus malma</i> (Walbaum)	DV

provided the basis for an estimated effort of 58,241 man-days and a harvest of 9,810 fish over 51 centimeters, 4,525 from the early run and 5,285 from the late run.

In compliance with a Board of Fisheries policy, the Kenai River was closed to chinook salmon fishing 5 days early. The events surrounding the closure and the results are discussed.

Sampling of the Kenai River recreational fishery produced 348 readable chinook salmon scales for age analysis. The predominant age class was 1.4 (brood year 1975) for both runs.

A floating, mobile fish trap was operated 9-1/2 miles upstream from the mouth of the Kenai River in an attempt to accurately assess the spawning population of chinook salmon utilizing this system. The fyke-type trap was operated from June 9 through August 9, 1981.

A total of three chinook salmon, 29 coho salmon, and 39 sockeye salmon were captured by the trap during this period. Problems associated with trap design and operation, migratory behavior of fish species in relation to the trap, and possible solutions are discussed.

KEY WORDS

Chinook Salmon, Oncorhynchus tshawytscha, Kenai Peninsula, Sport harvest, age structure, scale samples, creel census, fish trap operations.

BACKGROUND

Chinook salmon are the most desired species by sport anglers on the Kenai Peninsula. Initially, harvest was concentrated on 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, except 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 posted 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.

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 (1974-1981).

In 1972, anglers discovered chinook salmon could be harvested in the marine waters of Cook Inlet in the vicinity of Deep Creek, as they move through this area in two apparent runs, early and late. Early run fish (mid-May to mid-June) probably are 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. Fluctuation 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 (1974-1981).

The Kenai River became popular 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 the largest fishery in Alaska. Historical data are presented in reports by Hammarstrom (1975-1981).

One of the most critical management needs on the Kenai River is to define the total spawning population of chinook salmon. Sonar, in its present state-of-the-art, is unable to enumerate chinook salmon in the Kenai River. Although it works well on sockeye salmon, it is limited in use on such a large stream bed. As a result, a tag and recovery program was proposed in 1975. A large capture device, the Kenai River Fish Trap, finally received funding in 1980 and was put into operation in June 1981.

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.

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 chinook salmon population trends in the major recreational waters of the Kenai Peninsula.
4. To determine and develop plans for the enhancement of chinook salmon stocks, to provide recommendations for their management and to direct the course of future studies.

TECHNIQUES

In 1980, the Board of Fisheries eliminated the returnable punch card, although the seasonal limit of five chinook salmon was still in effect. A harvest record sticker was distributed at the time of license purchase. This sticker was to be noted each time a chinook salmon over 51 cm was retained and the date and stream entered in the appropriate boxes. The record was affixed to the back of each license. There was a separate

harvest card for those who did not need a license. Although these harvest records had no value in catch estimation, their design was enforcement in nature.

Harvest and effort for the fishery on the streams, Anchor River, Deep Creek and Ninilchik River were determined by personnel on location during each day of the fishery as it has been since 1977 (Hammarstrom 1978-1979).

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

Inseason estimates for the Kenai River fishery were compiled using two different methods, and a comparison between the two figures was evaluated in making decisions regarding compliance with a Board of Fisheries policy affecting the late run of chinook salmon into the Kenai River.

Since 1975, data are available for the percentage of total daily effort occurring each hour commencing at 0400 and terminating at 2400. Two counts are made each day and, by taking the 6 year average percentage for the two count hours, the daily effort can be extrapolated. The resultant effort in man-hours is then multiplied by the catch per hour reported for that particular day to determine the harvest. Uncensused weekdays are extrapolated by taking the average of the 3 censused days that week. All days were sampled.

The other technique is the same as that described by Hammarstrom (1977) except that it is done on a weekly basis instead of at the season's completion.

The Kenai River Fish Trap (KRFT) is a catamaran steel barge, supporting a fyke trap, which is self-powered and self-contained with all motors, generators, anchors, holding tanks and weather-tight deckhouse on board. Dimensions of the vessel are 48 ft, 6 in, long, 24 ft, wide, with a displacement of approximately 40 tons.*

The mobility of the vessel is provided by three 100 hp Johnson outboard engines. Two of the engines are mounted on the stern and provide the principle thrust when the vessel is underway. The control console for the stern engines is located forward on the starboard side to optimize visibility to the operator.

The third engine is located in the bow between the two hulls and will be referred to as the bow thruster. Although the bow thruster may be used in conjunction with the stern engines, its main purpose is for control when maneuvering the vessel in tight spaces (i.e., docking). Steering the bow thruster is accomplished by a mechanical arm which is independent of the stern engine steering system.

The superstructure is comprised of two compartments, the dayroom and the engine room, each with an independent entrance. The dayroom hosts a small

* NOTE: A complete set of blue prints are available for inspection at the Fish and Game office, Soldotna, Alaska.

galley complete with running water, hot plate, heater, closet and bench. The engine room houses two Lister diesel engine power plants which operate the hydraulic system, AC/DC power supply and water pump.

The hydraulic system is powered by an ST3 Lister diesel engine. There are four winches which are operated by hydraulic pressure. Each has an independent control lever. Two Gearmatic winches are utilized in raising and lowering the trap in the river while two Rowe winches operate the anchors, one in the bow and one in the stern. The Gearmatics are equipped with 50 ft, of 3/8 in diameter galvanized steel rope, while the Rowe winches are equipped as follows: stern winch - 300 ft, of 3/8 in diameter galvanized steel rope, 25 ft of 1/2 in galvanized chain and one 300 lb danforth anchor. Bow winch - 500 ft of 1/2 in diameter galvanized steel rope, 25 ft of 1/2 in galvanized chain and one 300 lb D anforth anchor.

The AC/DC generator and water pump are both operated by the same Lister diesel engine simultaneously. There is no provision to operate either of these systems independently of the other. The electrical generating system is provided by a Lima Series MAC-R brushless, 280 frame, synchronous, self-regulated generator, capable of 3-phase or single phase AC power and limited DC power. A breaker box located in the engine room controls all AC and DC output. One hundred and ten volt AC power is required to operate the deck flood lights dayroom lighting, and is also available from a dual outlet in the dayroom for operation of AC electrical appliances. DC current is provided to dual 12 volt storage batteries from a rectifier mounted on the generator. Running, fishing and anchor lights, as well as the electric start mechanism for the Lister engines, are all dependent on the dual storage batteries for their operation.

The water pump is a Barnes Model 15 ICU self priming centrifugal pump capable of delivering 225 gallons per minute (GPM). This system features both a dual intake and a dual outlet capability. Water intake is possible either through an orifice projecting into the river directly below the water pump or through a 25 ft suction hose on deck, which is also the method for draining the two 1,000 gal fish holding tanks. The water outlet is controlled by a deck valve which channels water into either of the two fish holding tanks (each may be filled independently of the other) or to the deck hose.

There are three hatches located on each of the hulls allowing access to the holds for excess equipment storage and inspection or repair when necessary.

Numerous lifting eyes and cleats are located around the perimeter of the vessel to facilitate docking, anchorage and removal from the water. The trap is rectangular in shape (20 ft long, 10 ft wide and 10 ft high), suspended from an A-frame and centrally located between the two hulls. The trap consists of two chambers; the rear chamber having a fyke entrance and the forward chamber having an adjustable pipe grate entrance for use in segregating captured fish by size. The forward chamber also has an additional grate centrally located on the front wall to allow specific sizes of fish to pass through the trap altogether if desired. The framework of the trap is of galvanized angle iron, channel and I-beam construction which was covered with a 1-1/8 inch poly mesh (Figure 1) which has since been replaced with welded wire.

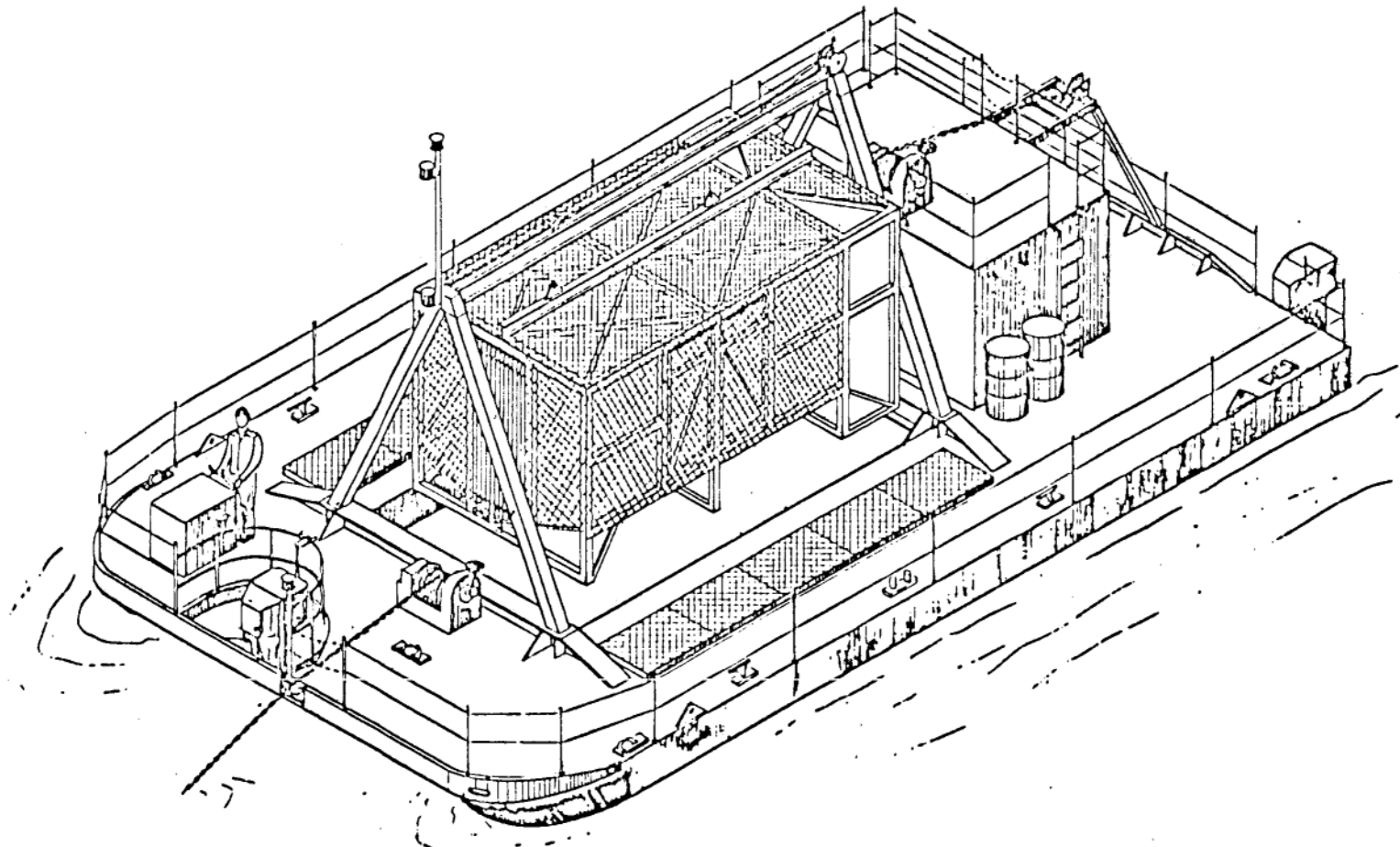


Figure 1. The Kenai River Fish Trap (artist's conception).

The operation of the trap is as follows:

1. All mooring lines are released from the trap.
2. The trap is lowered into the river via two Gearmatic hydraulic winches until the trap rests on the bottom of the Kenai River.
3. The trap is fished for a given length of time, after which it is winched out of the river.
4. When the trap is free of the water, it is hoisted to the uppermost limit of the A-frame to allow the four holding tank hatches covering each holding tank to be opened. (These opened hatches provide an inclined ramp which expedites fish removal from the trap.)
5. The trap is lowered onto the open latch doors and a trap door is released from the underside of the trap.
6. The trap is again raised which allows the contents to slide along the trap doors and hatch doors into the holding tanks. The operator may select either one or both holding tanks to be utilized depending on what trap doors he desires opened. In the event of any fish hanging up in the trap, walk-in doors to each chamber (one on each side of the trap) expedite the fish removal operation.
7. The trap is raised to the uppermost limit of the A-frame and all doors are secured. The trap is now ready for either another fishing period or mooring.

The trap is capable of sampling a 100 sq ft sectional area of the river. With the addition of leads to the entrance, the sampling area may be increased.

The KRFT was placed in operation on June 10, 1981. The trap had no history as to what fishing method would be the most efficient in capturing salmon. The trap design was a modification of the Sacramento hoop-style fyke trap (Hallock, Fry and LaFaunce, 1957) which was successfully used in the Kenai River for capturing sockeye salmon in 1966, but, because the KRFT was a modification of this original design (KRFT being rectangular in shape and built of different mesh fabric and framework), identical results using similar methods could not be relied on.

With virtually no life history studies completed on chinook salmon in the Kenai River, various assumptions were made which determined the initial methods utilized in attempting to capture chinook salmon. These assumptions include:

1. Chinook salmon migrate along a broader expanse of the river than other salmon.

2. Chinook salmon migrated along preferred routes. Once a migratory route was located, placing the trap within that zone would capture a significant percentage of chinooks utilizing the route.
3. Chinook salmon prefer swimming close to the bottom.
4. Chinook salmon prefer fast moving water.

With these assumptions in mind, the initial fishing site for the trap was selected 8-1/2 miles upstream from the mouth of the Kenai River. The river narrows to approximately 300 ft at this point and the tidal influence manageable (max. of 10 ft). However, swift flowing water and a scoured river bottom prevented the 300 lb Danforth bow anchor from holding the vessel stationary and the site was abandoned.

At mile 9.5, a safe anchorage was successful, but only after additions and Modifications to the original equipment were made. Addition include:

1. Two 40-lb Danforth anchors. Each equipped with 100 ft of 5/8 in poly line and displayed at a 45 degree angle off the forward end of the vessel. One off the starboard side and one off the port side.
2. Two 22-lb Danforth anchors. Each equipped with 100 ft of 5/8 in ploy line and displayed at a 45 degree angle off the aft end of the vessel. One off the starboard side and one off the port side.
3. Two 4-foot telephone screw anchors equipped with adjustable 3/8 inch galvanized steel rope (NOTE: utilized only when anchoring the vessel near a shoreline with an extreme water current).
4. Attachment of numerous sandbags to the 300 lb Danforth bow anchor and chain.

The bowline was modified by replacing the 3/8 in galvanized steel rope with 1/2 in galvanized steel rope as a saftey measure when the trap was fished in swifter waters.

A problem with the raising and lowering procedure of the trap required further modification. When the trap was lowered into the river, the water current caused the trap to drift downstream where, on occasion, it would come to rest under the hull of the vessel. With fluctuating tidal influence, the trap was in danger of being crushed should the vessel settle on the trap.

The problem was resolved by lowering the focal point of the forward winch cable. A snatch block was added to the central base of the A-frame and the forward winch cable was routed through it. To assist in this operation, a safety cable centrally anchored to a brace on the A-frame was attached to the end of the I-beam on top of the trap. This safety cable was adjusted to allow the trap to descend only 10 feet in the river, thus, the top of the trap could not settle beneath the surface of the water. The safety cable allowed the forward winch cable to be "played out" and run through

the snatch block. By tightening the forward winch line, the safety cable could be removed and the trap allowed to descend deeper into the river with greatly reduced danger of drift. Retrieval of the trap was a reverse procedure.

The trap was fished throughout 24 hour periods at both high and low tides, and with and without flood lights and powerplant noise as influencing factors. Salmon were also captured from a drift gill net and released immediately behind the vessel in a futile attempt to force salmon into the trap. The trap was not successful in capturing salmon until a lead system was implemented to channel salmon from a broader area of the Kenai River.

Leads constructed of a combination of 1-1/8 in mesh seine webbing and 5-1/8 in stretched mesh gill net were utilized. The seine was attached to each side of the trap and trailed 25 ft aft, which comprised the throat of a funnel. Various configurations of gill nets were experimented with to lead salmon into the throat of the trap. Initially, the leads were fanned out for 40 feet at approximately a 45 degree angle (Figure 2) but this system, although moderately successful, quickly strained out large quantities of vegetation (leaves, grass, branches) and collapsed under the river pressure. Cleaning was a labor intensive project and resetting the leads were confined to slack water during periods of high tide.

A lead configuration, as shown in Figure 3, was also moderately successful. Sockeye salmon showed a tendency to follow the trailing lead into the throat and further into the trap. The advantage to this design was the ability to fish the trap for longer periods without the need to clean the leads. The disadvantages were its narrow sampling area and inability to capture significant numbers of salmon. The first chinook salmon was captured using this configuration.

From the beginning of the field season, it was noticed that even when the trap was thoroughly cleaned the water flow through the trap was considerably impeded. As the trap was fished, this impeded water flow was reduced even further as debris accumulated on the front of the trap. In addition, with visibility virtually nonexistent, salmon may have responded to the trap as if it were a partial blockage such as a large boulder in the river and merely swam around the apparent obstacle.

To test this hypothesis, the trap was stripped of its inner wall and reduced to a single chamber apparatus. In addition, the mesh on the front and rear was replaced with 2 in by 4 in welded wire fencing. This greatly increased the water flow through the trap.

FINDINGS

Lower Stream Fishery

The 1981 spring fishery for chinook salmon on Anchor River, Deep Creek and Ninilchik River was conducted under similar regulations that have been in effect since 1978. Each stream was open the last weekend in 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

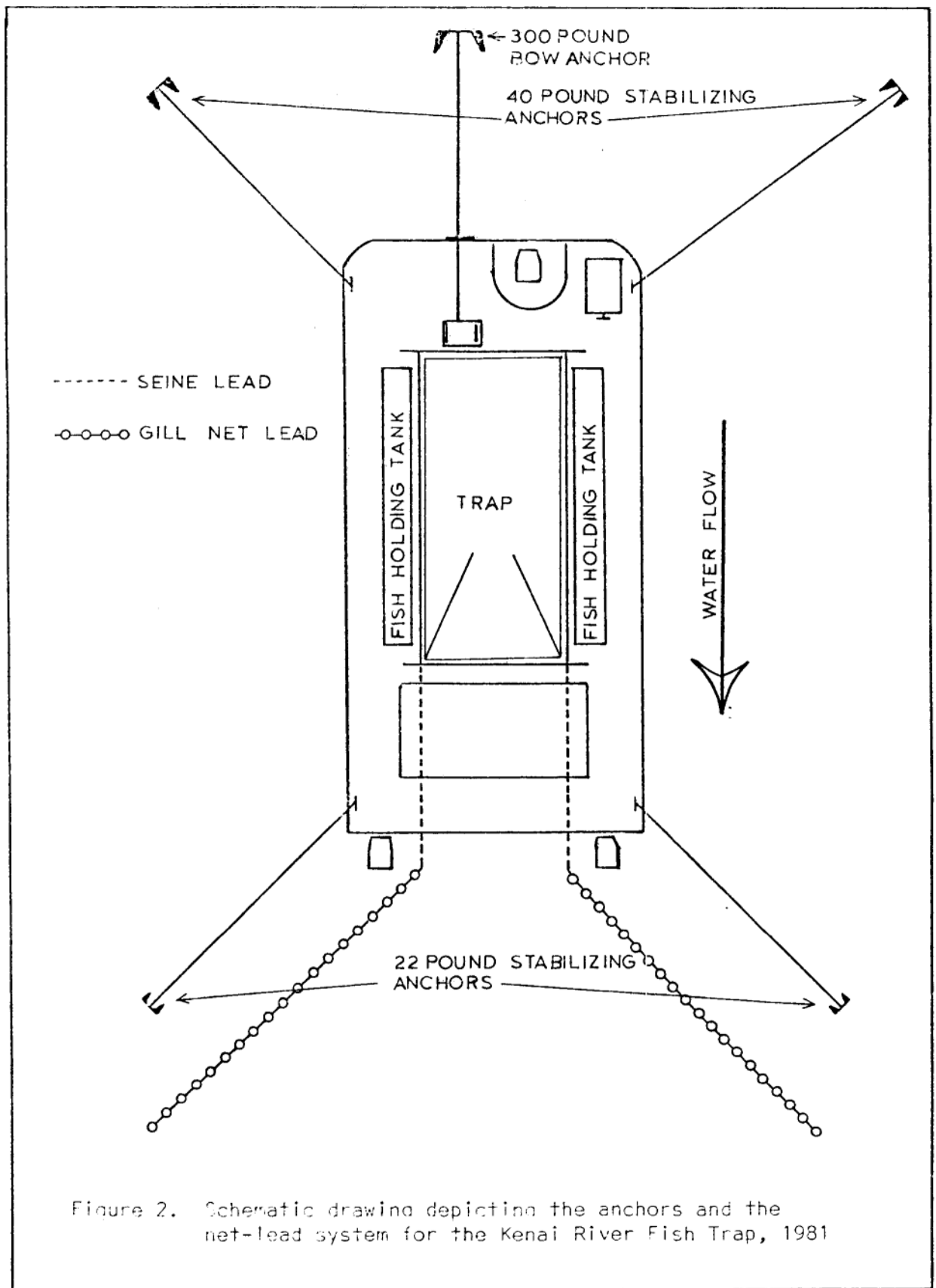
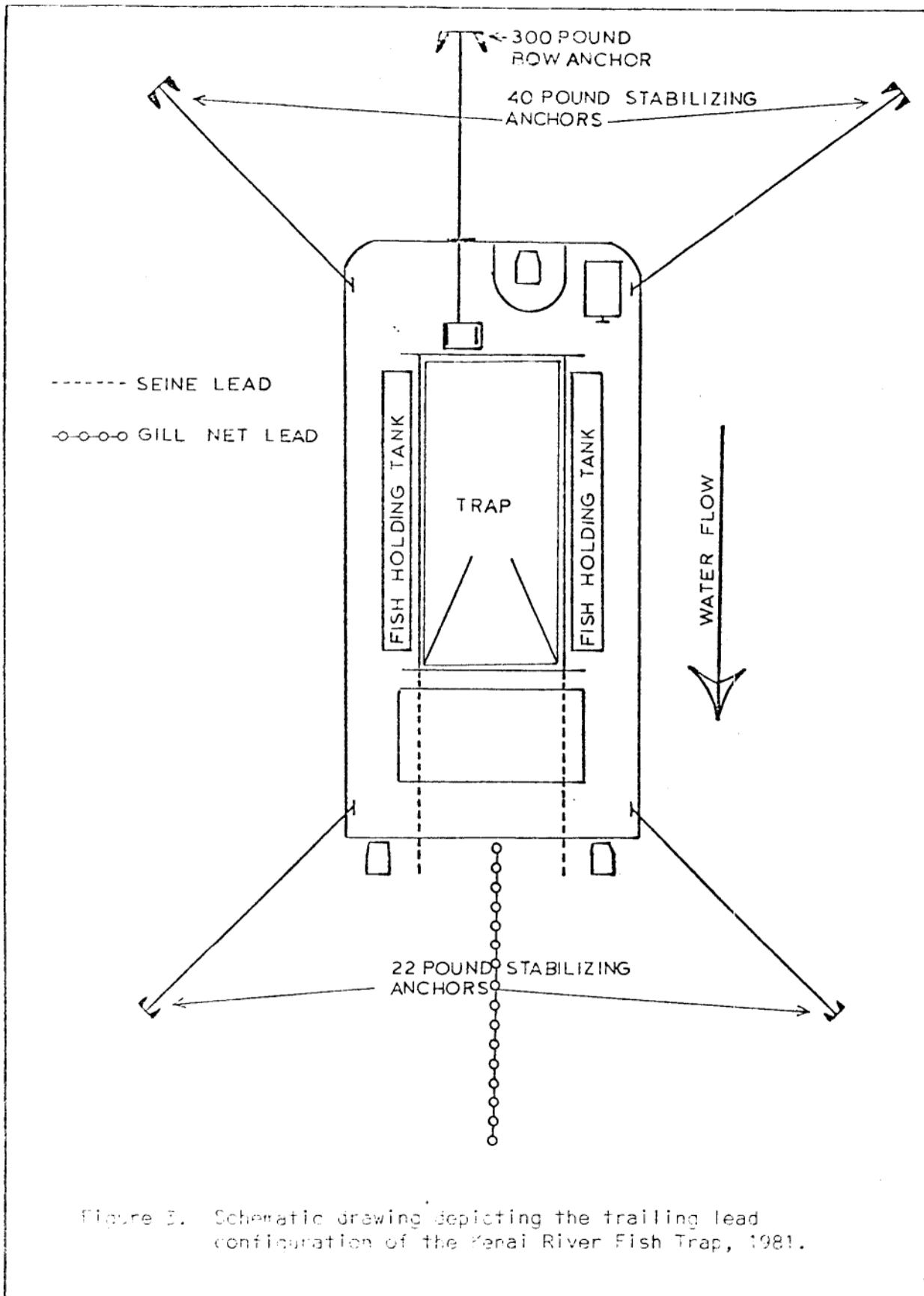


Figure 2. Schematic drawing depicting the anchors and the net-lead system for the Kenai River Fish Trap, 1981



Monday. Harvest for this entire fishery was estimated at 3,020 chinook salmon, over 51 cm (20 in) in length and effort was estimated at 32,330 man-days. A man-day was approximately 4.0 hours.

Stream conditions were much improved over last year's (1980) fishery. A relatively early and dry spring contributed to water levels and conditions being nearly ideal throughout the entire fishery. Apparent returns seemed healthy and harvests were distributed over most of the open days. Although runs appeared strong, data evaluation did not indicate sufficient numbers to warrant any additional fishing time.

The fishery followed a typical year in that the first weekend (Table 2) was the most productive due to the fact the last weekend of May fell on May 30 as opposed to May 24 as it did in 1980. This year's fishery commenced, in essence, a week later than last year's, and thus the waters were clearer during

the early days of the fishery. Also, Deep Creek was fishable throughout the entire fishery, which is an unusual situation. Historical data for this fishery are presented in Table 3.

Escapement surveys were attempted during the last week of July. Weather conditions during the late summer of 1981 were extremely wet and the sky remained overcast, similar to what happened in 1980. The surveys were attempted on the only sunny days that occurred during the spawning period. Stream conditions were high and visibility was reduced by the amount of water. Conditions were however, better than in 1980 and, although the figures should be considered minimal, the author feels confident the escapement estimates are indicative of the numbers of fish actually present (Table 4).

During 1981, a total of 346 readable scales were collected from sport-caught chinook salmon from the three streams. Age class 1.3 (brood year 1976) represented 60.9% of the harvest while Age class 1.4 (brood year 1975) represented 30.3% of the harvest. Age class data are presented in Tables 5 and 6.

Deep Creek Marine Fishery

In 1981, the creel census was operated to measure angler harvest and effort for chinook salmon in the marine waters off Deep Creek. The fishery commenced May 16 and was continuous through July 31.

The season ran for 77 days and creel census activities were conducted on 53 days (69%). Weather was considered good during the early run and poor during the late run.

During 1981, 177 instantaneous boat counts were conducted, 2,463 anglers were interviewed, 278 chinook salmon were creel-checked and 8,294 angler hours were reported. These figures were used to arrive at the following seasonal estimates: effort - 14,836 man-days; harvest - 2,533 chinook salmon.

Table 2. Angler Harvest and Effort Summaries for the Chinook Salmon Fishery on the Lower Three Kenai Peninsula Streams, 1981.*

Date	Anchor River		Deep Creek		Ninilchik River		Total	
	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort
5/30	350	2,280	30	550	450	1,650	830	4,480
5/31	60	2,050	20	690	100	2,280	180	5,020
6/1	40	610	50	310	100	980	190	1900
Subtotal	450	4,940	100	1,550	650	4,910	1,200	11,400
6/6	310	1,880	100	1,000	300	2,350	710	5,330
6/7	40	1,350	100	950	80	1,820	220	4,120
6/8	30	490	50	500	70	780	150	1,770
Subtotal	380	3,720	250	2,450	450	4,950	1,080	11,120
6/13	150	1,090	100	880	130	1,520	380	3,490
6/14	30	860	30	780	50	860	110	2,500
6/15	20	420	20	360	20	460	60	1,240
Subtotal	200	2,370	150	2,020	200	2,840	550	7,230
6/20	70	820	40	520	...	...	110	1,340
6/21	20	420	20	320	...	...	40	740
6/22	20	300	20	200	...	...	40	500
Subtotal	110	1,540	80	1,040			190	2,580
Grand Total	1,140	12,570	580	7,060	1,300	12,700	3,020	32,300

* Figures have been rounded to nearest 10.

Table 3. Historical Chinook Salmon Harvest and Effort Data from Lower Three Kenai Peninsula Streams (Deep Creek, Ninilchik River, Anchor River), 1971-1981.

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
Mean	27,170	1,530	9.1	3,000	166	18.3

* 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 1966-1981.

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	960	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	9	140	530	21	170	1,360	11	490	3,780	4,270
1973	330	1,660	17	140	220	39	300	640	32	770	2,520	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
Mean (excludes all 1970 and 1971 data)												
1966-80	540	1,770	23	200	770	23	450	865	32	1,190	3,405	4,595
1981**	1,140	1,230	48	580	920	39	1,300	830	61	3,020	2,980	6,000

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 Chinook Salmon Taken in the Recreational Fishery of Three Lower Kenai Peninsula Streams, 1981.

	Age Class		
	<u>1.2</u>	<u>1.3</u>	<u>1.4</u>
<u>Anchor River</u>			
Number	16	71	36
Range (mm)	485-640	700-890	795-1030
Mean (mm)	580.9	787.5	884.4
S.D.*	56.2	43.2	59.7
<u>Ninilchik River</u>			
Number	9	89	52
Range (mm)	515-640	560-885	650-1000
Mean (mm)	568.9	784.5	850.1
S.D.*	46.4	53.9	65.6
<u>Deep Creek</u>			
Number	6	42	15
Range (mm)	520-630	650-860	780-910
Mean (mm)	577.5	770.2	851.0
S.D.*	40.2	47.0	35.9
<u>Total</u>			
Number	31	202	103
Range (mm)	485-640	560-890	650-1030
Mean (mm)	576.8	782.5	865.2
S.D.*	49.5	49.1	61.3

* S.D. - Standard Deviation

Table 6. Age Composition of Chinook Salmon Taken in the Recreational Harvest from Anchor River, Deep Creek, and Ninilchik River, 1981

	Age Class					Total
	1.2	1.3	1.4	1.5	Other	
Number	30	209	104	1	2	346
Percent	8.7	60.4	30.1	0.2	0.6	100.0
	Brood Year				Total	
	1977	1976	1975	1974		
Number	30	209	106	1	346	
Percent	8.7	60.4	30.7	0.2	100.0	

Since 1973, the early run (mid-May through late June) has attracted the majority of anglers and produced the majority of the harvest. This year 1981, followed a similar pattern. Weather, as was mentioned, accounted for the drastic reduction in effort shown for the late run. Early run fish were available through June 19 for a total of 42 days. Ten of those were regarded as poor weather days. Thus, harvest was estimated at 2,363 and effort was estimated at 11,601 man-days.

Corresponding figures for the late run reflect an estimated harvest of 170 chinook salmon by 3,235 man-days of effort. During the late run, 23 of 35 days were regarded as poor weather days.

The average (1972-1980) time required to capture a chinook salmon in this fishery has been 16 hours. In 1981, it required nearly 24 hours to capture one fish. Catch per hour dropped in the early run from a mean of 0.060 to 0.051 in 1981 and for the late run from 0.066 to 0.018. Table 7 presents a historical summary of the fishery in comparison to the 1981 results.

During the 1981 season, 117 readable scales were collected from the sport harvest; all but 19 were from the early run. The predominant age class for the early run was 1.3 (brood year 1976) representing 53.1% of the harvest. Since only 19 scales were readable from the late run, data were insufficient to represent the age structure. Summarized age and length data are presented in Table 8. Sex ratios of the total harvest, both early and late was 1.3:1 males to females.

Kenai River Fishery

The creel census of chinook salmon anglers on the Kenai River commenced June 1, 1981, and was continuous through July 26, at which point the fishery was closed by emergency order. During that time, 152 instantaneous angler counts were made; 16,364 anglers were enumerated; 11,325 anglers were interviewed; 13 aerial surveys were conducted; and 994 chinook salmon over 508 mm total length were creel-checked.

The run into the Kenai River is comprised of two segments, early and late. Because of the distance traveled and the characteristic behavior of the migration, timing in each segment of the river differs.

During 1981, early run fish were available in the lower section of the river (Beaver Creek to Soldotna Bridge) from June 1 through July 5, and in the upstream section (Naptowne Rapids to Skilak Lake) from June 1 through July 12. Late run fish were available in each section from the end of the early run through July 26 when the season was closed. Timing dates were assigned by analyzing catch rates then adjusting to nearest weekly period, in this case, Sunday. Since the two runs overlap, assigning a date for separation is for convenience in meeting the requirements prescribed by the Board of Fisheries in managing the late run.

Total early run harvest was estimated at 4,525 chinook salmon, nearly 2.5 times greater than the 1974-1980 mean (Table 9). Effort was estimated at 28,335 man-days. The majority of the fish were harvested in the downstream section (Table 10).

Table 7. Historical Summary of the Chinook Salmon Sport Fishery in Marine Waters off Deep Creek, 1972-1981.

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	1.101	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
Mean 1972-80	2,105	9,076	0.060	949	5,616	0.066	3,054	14,692	0.063
1981	2,363	11,601	0.051	170	3,235	0.018	2,533	14,836	0.042

Table 8. Summarized Data from Readable Scales Collected from Chinook Salmon Harvested in the Deep Creek Fishery, 1981.

Age Class Brood Year	1.2 1977	1.3 1976	1.4 1975	1.5 1974	Other	Total
			<u>Early Run</u>			
Number	9	52	32	1	4	98
Percent	9.2	53.1	32.7	1.0	4.0	100.0
Length Range (mm)*	560-690	680-960	780-1080	940	660-930	560-1080
Mean (mm)*	645.6	836.0	929.4	940.0	810.0	850.0
Standard Deviation	54.1	65.5	71.4	...	137.5	103.1
			<u>Late Run</u>			
Number	0	2	14	3	0	19
Percent	...	10.5	73.7	15.8	...	100.0
Length Range (mm)*	...	780-915	885-1170	1000-1145	...	780-1170
Mean (mm)*	...	847.5	1022.8	1005	...	1008.7
Standard Deviation	...	95.4	73.7	82.3	...	92.2

* Mid-eye to fork of tail.

Table 9. Historical Summary of Kenai River Chinook Salmon Fishery, 1974-1981.

Year	Sport Fishing Kinai River								
	Early Run			Late Run			Total		
	Harvest	Effort	Catch/ Hour	Harvest	Effort	Catch/ Hour	Harvest	Effort	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
Mean	1,883	24,260	0.022	4,146	37,238	0.032	6,029	61,500	0.027
1981	4,525	28,335	0.031	5,285	29,906	0.032	9,810	58,241	0.032

Table 10. Historical Harvest Comparison by River section for Kenai River Chinook Salmon Fishery, 1976-1981.

	<u>Upstream Section</u>		<u>Midstream Section</u>		<u>Downstream Section</u>		<u>Shore Anglers</u>		<u>Total Harvest</u>
	<u>Harvest</u>	<u>Percent</u>	<u>Harvest</u>	<u>Percent</u>	<u>Harvest</u>	<u>Percent</u>	<u>Harvest</u>	<u>Percent</u>	
<u>EARLY RUN</u>									
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
Mean	494	25.0	213	10.8	1,135	57.5	133	6.7	1,975
1981	346	7.6	528	11.7	3,464	76.6	187	4.1	4,525
<u>LATE RUN</u>									
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
Mean	213	4.5	465	9.9	3,629	77.4	382	8.1	4,689
1981	255	4.3	660	12.6	4,150	79.0	220	4.2	5,285
<u>BOTH RUNS</u>									
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
Mean	707	10.6	678	10.2	4,764	71.5	515	7.7	6,664
1981	601	5.8	1,188	12.1	7,614	77.9	407	4.2	9,810

The Kenai River remained relatively clear through the month of June which allowed for more productive angling. In addition, although no definitive data are available concerning the total size of the early run, it appears as though the return was larger than most years. The U. S. Fish and Wildlife Service, in their research on the Killey River, a tributary to the Kenai River, estimated the escapement into that system of 5,000 to 8,000 per. comm., 1981). It is felt that the Killey River is the major producer of early run fish and that contribution could approach 60% of the total run.

The technique called "tad pollying" or working a bright diving plug through a hole really developed in popularity. It appeared in 1980, but this past year, approximately half the anglers were using the technique and it appeared to be quite successful. In addition, many of the fishing guides were utilizing this technique which accounted for a substantial share of the harvest.

Late run harvest was estimated at 5,285 chinook salmon and effort was estimated at 29,906 man-days. Undoubtedly these figures would have been higher had the season remained open through July 31.

The emergency order closing the fishery was in compliance with a Board of Fisheries policy that allows the sport harvest and commercial harvest to equate unless additional commercial time, beyond the scheduled periods, is required. In that situation, the allowable sport harvest would be reduced by the number of chinook salmon taken during the additional periods in the set nets on the east side beaches. Scheduled commercial chinook salmon harvest from set net areas (244-20,30,40) totaled 6,203. Additional periods accounted for 1,196 chinook salmon. Thus, the allowable sport harvest was 5,007 + 10%. The final estimate of 5,285 was only 278 (5.5%) fish above the total allowed, well within the limits of the policy. A historical comparison of the fisheries that harvest Kenai River chinook salmon is presented in Table 11.

Another point of interest is the increasing length of an average man-day (Table 12). An average man-day in 1977 was 3.2 man-hours, while in 1981 it was 4.3 man-hours. Corresponding figures for the late run; a man-day in 1977 was 2.8 man-hours and in 1981 5.0 man hours. Thus, the apparent decrease in effort as expressed in man-days is not as great when man-hours are compared. Effort in man-days in 1981 was 29.9% lower than the 1977-1980 mean. However, man-hours were reduced by only 8.3% from the 1977-1980 mean.

The guiding industry on the Kenai River is increasing very rapidly. In 1974 and 1975, although we have no documentation, guides probably numbered less than 10. In 1981, nearly half (49.8%) the total harvest and approximately 25% of the effort was by guided anglers (Table 13). Although there is no way to determine the number of individual guides operating on the river, by asking each boat if they were being guided at the time of the interview the proportion of guided to unguided anglers was possible to determine. Guided anglers were also nearly three times as efficient as the unguided angler; catch per hour for guided anglers was 0.068 and 0.022 for unguided anglers.

Table 11. Historical Sport and Commercial Harvest of Kenai River Chinook Salmon, 1974-1981.

Year	Deep Creek Marine	(244-20,30,40) Commercial Set Net	Kenai River	Total
<u>Early Run</u>				
1974	500	211	1,685	2,396
1975	540	185	615	1,340
1976	5,495	876	1,554	7,925
1977	4,617	1,075	2,173	7,865
1978	2,669	858	1,542	5,069
1979	3,088	1,062	3,661	7,811
1980	521	663	1,946	3,130
1981	2,363	946*	4,525	7,834
Mean	2,474	735	2,212	5,421
<u>Late Run</u>				
1974	100	5,404	3,225	8,729
1975	345	3,497	2,355	6,197
1976	1,382	7,361	4,477	13,220
1977	366	7,631	5,148	13,145
1978	2,693	10,786	5,578	19,057
1979	1,164	6,840	4,634	12,638
1980	747	8,055	3,608	12,410
1981	170	8,765	5,285	14,220
Mean	871	7,292	4,288	12,451
<u>Both Runs</u>				
1974	600	5,615	4,910	11,125
1975	885	3,682	2,970	7,537
1976	6,877	8,237	6,031	21,145
1977	4,983	8,706	7,321	21,010
1978	5,362	11,644	7,120	24,126
1979	4,252	7,902	8,295	20,449
1980	1,268	8,718	5,554	15,540
1981	2,533	9,711	9,810	22,054
Mean	3,345	8,027	6,500	17,872

Table 12. Comparative Effort Data in Man-Hours and Man-Days for Past Five Years of Kenai River Chinook Salmon Fishery, 1977-1981.

Early Run																
Upstream Section			Mid-Stream Section			Downstream Section			Shore Anglers			Total				
Year	Man Hours	Man Days	Hours/Man-Day	Man Hours	Man Days	Hours/Man-Day	Man Hours	Man Days	Hours/Man-Day	Man Hours	Man Days	Hours/Man-Day	Man Hours	Man Days	Hours/Man-Day	C.P.U.E.
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
Mean	30,930	7,690	4.0	11,139	2,883	3.9	62,400	16,866	3.8	13,869	3,644	3.8	118,338	31,083	3.9	0.022
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
Mean	23,560	6,281	3.8	16,274	4,192	3.9	111,110	30,720	3.6	20,440	5,853	3.5	171,384	47,046	3.6	0.028
Seasonal Ave.	54,490	13,951	4.0	27,413	7,024	3.9	173,510	47,155	3.7	34,309	9,497	3.6	289,722	77,627	3.7	0.025

Table 13. Comparison Between Guided and Unguided Chinook Salmon Anglers on the Kenai River by River Section, 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

During June and July, a total of 340 readable scales were collected from chinook salmon harvested in the recreational fishery in the Kenai River, 223 from early run fish and 117 from late run fish. Table 14 presents summarized data from the 1981 fishery. The predominant age class was 1.4 (brood year 1975). Age composition appeared to follow the historical pattern (Table 15), although the contribution by age class 1.5 was not as strong as has been in some years and hence the absence of any really large fish (80+ lbs). An average fish during the early run weighed 12.7 kg (28 lbs), while late run fish averaged 15.4 kg (33.9 lbs).

Kenai River Fish Trap

The KRFT initially captured very few fish. One Dolly Varden was captured on June 17 and the first salmon (four sockeye) were captured on July 8. By July 8, the early run of chinook salmon was past the trap site and it was apparent that the KRFT would not be capable of capturing a statistically significant number of fish without considerable experimentation and modification during its first field season.

In an attempt to gather some data from the late run, an additional capturing technique was implemented whenever time permitted. This technique was the same one utilized during the 1980 field season (Hammarstrom, 1981). A 25 ft section of 5-1/8 in stretched mesh gill net was drifted perpendicular to the river current from the bow of a powered skiff. Using this technique, 98 chinook salmon were captured and tagged with "Petersen" discs between July 9 and August 4, 1981. This represented a total of 13 operational days.

The KRFT captured a total of 38 sockeye salmon, 29 coho salmon and three chinook salmon from June 9 through August 9, 1981. Leads constructed of mesh material increased the catch rate only slightly. Increasing the water flow through the trap showed the greatest single improvement in trap design for capturing salmon. Forty-one (56%) of the total 73 salmon were captured after the water flow was initially increased. Unfortunately this modification was the final one implemented 12 days before the season was terminated.

The drift gill net catches showed chinook salmon migrating through the entire width of the Kenai River, however, there were some "preferred" areas where fish were captured in greater numbers. These "preferred" areas became sites for fish trap operations. Generally, when "preferred" areas were discovered near the shoreline, the KRFT was set at these locations as anchorage was assurable, and the operation obstructed less boat traffic. Along the cut bank, with the water flow maximized through the trap, coho and sockeye salmon catches increased substantially, however, chinook salmon catches remained low.

Because of the wide migratory routes observed to be utilized by chinook salmon, future operations will require a lead system to be used in conjunction with the improved waterflow through the trap. A lead system which can withstand the water pressure, avoid accumulating debris and be practical economically without obstructing navigability will improve the effectiveness of the trap and hopefully result in the capture of

Table 14. Summarized Age Data Determined From Readable Chinook Salmon Scales Collected During the Recreational Fishery on the Kenai River, 1981.

Age Class	1.2	1.3	1.4	1.5	Other	Total
<u>Early Run</u>						
Number	32	70	112	7	5	223
Percent	14.3	31.4	50.3	1.8	2.2	100.0
Length Range* (mm)	410-675	670-955	760-1425	1040-1160	640-990	410-1425
Mean Length* (mm)	584.4	810.4	976.6	1105.0	826.0	867.0
Mean Weight* (kg)	4.0	10.2	16.5	24.6	7.4	12.7
<u>Late Run</u>						
Number	15	26	73	3	0	117
Percent	12.8	22.2	62.4	2.6	0	100.0
Length Range* (mm)	535-760	635-960	765-1145	950-1015	...	535-1145
Mean Length* (mm)	629.7	835.8	1011.4	993	...	897.9
Mean Weight* (kg)	5.0	11.5	18.9	15.6	...	15.4
<u>Both Runs</u>						
Number	47	96	185	7	5	340
Percent	13.8	28.2	54.4	2.1	1.5	100.0
Length Range* (mm)	410-760	635-960	760-1425	950-1160	640-990	410-1425
Mean Length* (mm)	598.9	817.3	990.3	1057.1	826.0	886.3
Mean Weight* (kg)	4.3	10.6	17.4	20.7	7.4	13.6

Table 15. Historical Age Composition of Major Age Classes in Percent, of Chinook Salmon Harvested from the Kenai River, 1974-1981.

Harvest Year	Age Class			
	1.2	1.3	1.4	1.5
<u>Early Run</u>				
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
Mean	14.6	25.3	56.1	4.0
<u>Late Run</u>				
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
Mean	17.3	21.9	55.9	4.9
<u>Total Both Runs</u>				
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
Mean	18.2	22.3	54.9	4.6

statistically significant numbers of chinook salmon to more accurately assess the total spawning population in the Kenai River.

DISCUSSION

Kenai River Chinook Salmon Fishery

The 5% day closure on the river was received with very few complaints from the general public. The fishing guides registered most of the resistance to the closure. Many people reported fair numbers of chinook salmon around in early August, especially in that section of the river downstream from the Soldotna bridge. It was thought the closure was successful in allowing an additional 1,500 fish to spawn which otherwise would have been harvested had the fishery remained open.

There is a very strong possibility of a similar closure in 1982. The closure is a result of the commercial set nets on the east side of Cook Inlet incidentally harvesting chinook salmon in their pursuit of sockeye salmon. The sockeye salmon return to the Kenai River should be strong once again and if so the set net could once again be needed to adequately harvest that return. In 1981, strong winds throughout the period when sockeye salmon are available in Cook Inlet prevented the commercial drift fleet from its usual efficiency. The fish that normally would be harvested by that drift fleet, which does not harvest significant numbers of chinook salmon, had to be harvested by the in-shore set nets during additional periods. The limits of the Board policy were reached and the river closed.

At the December 1981 Board of Fisheries meeting, the Division of Sport Fish was directed to devise a registration system that would effectively determine the number of commercial fishing guides operating on the Kenai River. The regulations have been drafted and will be presented to the Board in March 1982 for adoption. Thus, the 1982 fishery would be conducted under a registration system for commercial guides.

There has been substantial support from the local guides. Much of the support has been provincial in nature. Many of the local guides have voiced opinions stating that they would like to see guiding limited to local residents only.

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