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SPORT FISH STUDIES

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TABLE OF CONTENTS

Study No. G-II	SPORT FISH STUDIES	Page
Job No. G-II-L	Evaluation of Chinook Salmon Fisheries of the Kenai Peninsula	
	By: Stephen Hammarstrom and Larry Larson	
Abstract . . . . .		1
Key Words . . . . .		2
Background . . . . .		2
Recommendations. . . . .		4
Objectives . . . . .		6
Techniques Used. . . . .		6
Fisheries . . . . .		6
Escapement Estimates. . . . .		6
Fishwheel . . . . .		7
Findings . . . . .		9
Deep Creek Marine Fishery . . . . .		9
Lower Stream Fishery. . . . .		11
Kenai River Fishery . . . . .		11
Kenai River Escapement Enumeration. . . . .		27
Fishwheel . . . . .		34
Discussion . . . . .		35
Kenai River Chinook Salmon Fishery. . . . .		35
Capture Techniques. . . . .		35
Literature Cited . . . . .		36

LIST OF TABLES AND FIGURES

Table 1.	List of Common and Scientific Names. . . . .	5
Figure 1.	Aerial Schematic of Fishwheel System, 1983. . . . .	8
Table 2.	Historical Summary of the Chinook Salmon Sport Fishery in Marine Waters off Deep Creek, 1972-1983. . . . .	10
Table 3.	Summarized Data from Readable Scales Collected from Recreationally Harvested Chinook Salmon in the Deep Creek Marine Fishery, 1983 . . . . .	12
Table 4.	Angler Harvest and Effort Summaries for the Chinook Salmon Fishery of Three Southern Kenai Peninsula Streams, 1983 . . . . .	13
Table 5.	Historical Harvest and Escapement for the Three Lower Kenai Peninsula Chinook Salmon Streams from 1966-1982. . . . .	14
Table 6.	Historical Chinook Salmon Harvest and Effort Data from three Southern Kenai Peninsula Streams (Deep Creek, Ninilchik River and Anchor River), 1971-1983. . . . .	16
Table 7.	Length Data (mid-eye to fork of tail) of Major Age Classes of Chinook Salmon taken in the Recreational Fishery on three Southern Kenai Peninsula Streams, 1983. . . . .	17

TABLE OF CONTENTS (CONT'D)

Page

Table 8. Age Composition of Chinook Salmon taken in the Recreational Harvest from Anchor River, Deep Creek and Ninilchik River, 1983. . . . . 18

Table 9. Historical Summary of Kenai River Chinook Salmon Fishery, 1974-1983 . . . . . 20

Table 10. Comparative Effort Data in Man-Hours and Man-Days for past seven years of Kenai River Chinook Salmon Fishery, 1977-1983 . . . . . 22

Table 11. Historical Harvest Comparison by river section for Kenai River Chinook Salmon Fishery, 1976-1983. . . . 23

Table 12. Summarized Age Data determined from readable Kenai River Chinook Salmon Scales, 1983. . . . . 25

Table 13. Historical Composition of Major Age Classes in percent of Chinook Salmon Harvested from the Kenai River, 1974-1982. . . . . 26

Table 14. Summary of Kenai River Chinook Salmon Fishery, Guided vs. Non-Guided Anglers, as determined by Creel Census, 1983 . . . . . 28

Table 15. Comparison between Guided and Non-Guided chinook salmon anglers, as determined by Creel Census, on the Kenai River by river section, 1981-1983. . . . . 29

Table 16. Creel Census Recoveries from Chinook Salmon tagged in successive weeks at Kenai River, divided according to week of recovery upstream; together with Total Number Tagged each Week (Mi), and the Number Recovered and Examined for Tags (Cj), 1983. . . . . 32

Table 17. Computed Estimates of Chinook Salmon based on Table 16 and using Schaefer's method (Kenai River late run, July, 1983) . . . . . 32

STUDY NO. G-I SPORT FISH STUDIES

Job No. G-II-M Chinook Salmon Population and Angler User Studies of Upper Cook Inlet Water  
By: Kelly R. Hepler & Robert W. Bentz

Abstract . . . . . 40

Key Words . . . . . 40

Background . . . . . 40

Recommendations . . . . . 42

Objectives . . . . . 42

Techniques Used . . . . . 42

Findings . . . . . 43

    Northern Cook Inlet Chinook Salmon Sport Fishery . . . . . 43

    Little Susitna River . . . . . 43

    Talkeetna River. . . . . 46

    Willow Creek . . . . . 47

    Montana Creek. . . . . 47

TABLE OF CONTENTS (CONT'D)

Page

Caswell Creek. . . . .	48
Deshka River . . . . .	48
Alexander Creek. . . . .	48
Yentna River . . . . .	49
Chuitna River. . . . .	50
Population Structure . . . . .	51
Escapements. . . . .	51
Management Recommendations . . . . .	57
Literature Cited. . . . .	57

LIST OF TABLES AND FIGURES

Figure 1. Northern Cook Inlet area . . . . .	41
Table 1. Chinook salmon sport harvest and effort estimates for northern Cook Inlet, 1979-1983 . . . . .	44
Table 2. Chinook salmon sport harvest per angler-day estimates for northern Cook Inlet, 1979-1983 . . . . .	45
Table 3. Chinook salmon age class frequency from the sport fish harvest for northern Cook Inlet, 1979-1983. . . . .	52
Table 4. Chinook salmon age class frequency from the sport fish harvest for Deshka River, Alexander Creek, Lake Creek, Chuitna River, Peters Creek and Talachulitna River, 1979-1983. . . . .	52
Table 5. Chinook salmon age class frequency from the sport fish harvest for Caswell Creek, Chunitna Creek, Little Susitna River, Montana Creek and Willow Creek, 1979-1983 . . . . .	53
Table 6. Chinook salmon mean fork lengths and sex ratios by age class from the sport fish harvest for northern Cook Inlet, 1983. . . . .	53
Table 7. Chinook salmon escapement counts for northern Cook Inlet, 1976-1983. . . . .	54
Table 8. Chinook salmon observed escapement counts and population estimates for northern Cook Inlet, 1973-1983. . . . .	56



STATE OF ALASKA  
Bill Sheffield, Governor

Annual Performance Report for  
EVALUATION OF CHINOOK SALMON FISHERIES OF THE KENAI PENINSULA

By:  
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and  
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## RESEARCH PROJECT SEGMENT

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the Kenai Peninsula

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## ABSTRACT

The recreational fishery for chinook salmon, Oncorhynchus tshawytscha (Walbaum), in the marine waters of Cook Inlet south of Deep Creek was monitored by creel census for the twelfth consecutive year. Estimated harvests from early and late runs were 1,000 and 1,707, respectively. In addition, an estimated 17,373 pacific halibut, Hippoglossus stenolepis (Schmidt), were harvested from mid-May through July 31. Estimates were calculated on the basis of 4,240 angler interviews, 166 instantaneous boat counts, 297 creel-checked chinook salmon and 2,491 creel-checked pacific halibut. Historical data for this fishery are presented.

Age composition of the recreational harvest from saltwater displayed a marked difference between early and late runs. Early-run fish showed nearly equal, 33.3 percent and 44.7 percent, representation from age classes 1.3 and 1.4 (brood years 1978 and 1977), respectively. Late run fish were predominantly (81.1 percent) from age class 1.4. Classifications were based on 178 readable scales collected during the fishery.

The freshwater spring fishery for chinook salmon on three southern Kenai Peninsula streams, Anchor River, Deep Creek and Ninilchik River, resulted in an estimated harvest of 3,185 fish by 27,370 man-days of effort. Individual stream harvest estimates, as determined by creel census are: Anchor River, 925; Deep Creek, 1,100; Ninilchik River 1,160. Effort was estimated by vehicle counts on location.

Age composition of the recreational harvest from the southern Kenai Peninsula streams was based on 274 readable scales collected during the fishery. The predominant age class was 1.4 (59.9 percent), however, the contribution of age class 1.3 was 31.0 percent.

One of Alaska's most popular recreational fisheries, the Kenai River chinook salmon fishery, was monitored by creel census for the tenth consecutive year in 1983. During June and July of 1983, 14,258 anglers were interviewed, 159 instantaneous angler counts made, 16 aerial surveys flown and 1,192 chinook salmon were creel checked. These data were used to calculate an estimated harvest of 6,360 early run fish by 42,716 man-days of effort and 9,174 late run chinook salmon by 56,295 man-days of effort. Historical data for this fishery are presented.

Age composition of both early and late runs of chinook salmon into the Kenai River were predominantly 1.4, based on 1,242 readable scales collected from both the recreational fishery and fish captured as part of a population estimate.

For the second consecutive year estimates of the guided angler harvest, as derived by creel census and reported by guides through a log book program, have differed significantly. Methods of calculations and discrepancies in log books are discussed.

A chinook salmon tag and recovery program was conducted during July, 1983. The purpose of the program was to estimate the number of late run chinook salmon available for recreational exploitation. A total of 1,536 late run chinook salmon were tagged with Floy FT-4 spaghetti tags. During the late run creel census, 4,880 sport fishermen reported a harvest of 682 chinook salmon of which 24 were tagged. Based on this information and incorporating the Schaeffer method to estimate the population, 30,516 chinook salmon returned to the Kenai River between July 2 and July 31, 1983.

The feasibility of using a fishwheel to target on capturing chinook salmon in the intertidal zone of the Kenai River is discussed.

#### KEY WORDS

Chinook salmon, creel census, fish tagging, fish population, fish trap, spaghetti tag, Pedersen disc, Kenai River, fishwheel, gill net.

#### BACKGROUND

Chinook salmon are the most popular species of game fish on the Kenai Peninsula. Historically, significant recreational fisheries occurred only on the southern peninsula streams: Anchor River, Deep Creek and Ninilchik River. Management of these streams has ranged from unregulated to complete closures. From the mid-60's through the late 70's a punch card was utilized to enforce daily and/or seasonal bag limits. Since 1981, bag limits on chinook salmon have been enforced by requiring each angler to record the harvest of a chinook salmon over 20 inches on the back of the sport fishing license or on a special card in the case of an individual not required to possess a fishing license, i.e. juveniles.

Total harvest from each of the southern streams is controlled by the allowable fishing time. Each stream is open to fishing during the last weekend, Mondays included, in May and the first 3 weekends of June, except Ninilchik River is open 2 weekends in June. This fishery has evolved through various quota schemes and/or restricted seasons. The current 12-day fishery has been in effect since 1978. During that time, no emergency closures have been necessary, however, emergency openings of 4 days each on two occasions (1978 and 1979) were issued because surplus fish were available.

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 (1974-1983). 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 streams in Cook Inlet, but are heavily influenced by runs to the Kenai and Kasilof Rivers. In addition, fish from local streams, Deep Creek and Ninilchik River, are probably harvested and fish bound for streams in the Susitna Basin may also be present. Late run fish (mid-June through July) are bound almost entirely for the Kenai River.

The Division of Sport Fish of the Alaska Department of Fish and Game began monitoring the Deep Creek marine fishery in 1972 and has continued each year since. Because of poor launching facilities (high tide only or through the surf), the size of vessels used is limited. Local weather conditions have more influence on the fishery than run strength. On some years, available fishing time can be reduced significantly by inclement weather. Historical data pertaining to this fishery are presented by Hammarstrom (1974-1983).

Chinook salmon return to the Kenai River system in two segments, termed early run and late run. Early-run fish (mid-May through late June) are allocated almost entirely to recreational anglers by the Upper Cook Inlet Salmon Management Plan, adopted by the Alaska Board of Fisheries in 1981. The plan precludes commercial fishing along the eastern shores of Cook Inlet, the suspected route these fish travel, until June 25. As a result, only the very late portion of the early run is subject to commercial harvest. Fish are harvested by recreational anglers in the Deep Creek marine fishery and in the very intense Kenai River fishery.

Late-run fish (early July through mid-August) are harvested by commercial and recreational interests. The commercial harvest is incidental to the more abundant sockeye salmon and is predominantly by the set gill nets along the eastern beaches of Cook Inlet from Ninilchik to Boulder Point. The harvest of chinook salmon in July by the drift gill net fleet, although relatively small compared to the set net catch, is also considered to be primarily Kenai River fish as there are no other known significant stocks of late run fish in Cook Inlet.

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. For the past 6 years, angling effort for chinook salmon on the Kenai River has made this fishery the largest in Alaska. Record level harvest and effort occurred in 1983. Historical data for this increasingly popular fishery are presented by Hammarstrom (1975-1983).

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. Various adult chinook salmon capture techniques have been evaluated since 1980. These include electroshocking, drift gill net (Hammarstrom, 1980), fish trap (Hammarstrom and Larson, 1981-1982), and fishwheel. A drift gill net was found to be the most effective to date. In addition to utilizing a drift gill net during the 1983 field season, a fishwheel was also incorporated. The fishwheel was briefly tested to determine its feasibility in an intertidal zone. Fishwheels may have merit in the future, but different anchoring methods will be necessary prior to successful deployment in intertidal areas.

Chinook salmon and the associated fisheries have generated considerable controversy between user groups, especially the late run into the Kenai River. It is this segment of the return, harvested by commercial and recreational interests, that has become the center of both political and biological activities. In 1982, former Governor Jay Hammond appointed a task force to study the problems confronting fisheries and habitat. The findings of that committee and accompanying public concern prompted current Governor Bill Sheffield to appropriate additional monies for research and also introduce legislation creating a special recreation area to include over 100 miles of the Kenai River system in an attempt to solve some of the problems. Most of the concerns are allocative in nature because the stocks are currently healthy and returns have increased markedly since the mid-70's. However, the popular recreational fishery and the associated activity by anglers and their boats and streamside development pose unanswered questions regarding possible effects on the habitat. 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 and techniques further refined to insure the accuracy of the calculated estimates.
2. The effects of hook and release fishing for chinook salmon in the Kenai River should be assessed.
3. The spawning distribution of late run chinook salmon in the Kenai River should be determined.

Table 1. List of Common and Scientific Names.

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

4. 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.

#### OBJECTIVES

1. To determine the sport harvest of chinook salmon and evaluate angler pressure in four streams and one marine area from May through July.
2. To determine spawning escapement into four major chinook salmon producing streams during July and August.
3. To make recommendations for management of Kenai Peninsula chinook salmon stocks and identify potential enhancement opportunities.

#### TECHNIQUES USED

##### 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 and 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 chinook salmon harvest and effort for the Kenai River and in the Deep Creek marine fishery are the same as described by Hammarstrom (1977).

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

In 1982, the evaluation resulted in an emergency closure of six days and precluded an early closure in 1983.

##### Escapement Estimates

The drift gill-netting technique has been described by Hammarstrom (1980). Improvements to drift gill-netting in 1983 included the use of three different net mesh sizes (5 1/8 inch, 7 inch, and 8 inch stretched mesh), a portable live box to revive tagged salmon, a tagging cradle (a canvas trough, closed at one end to provide a dark chamber for the salmon's head, facilitating tagging and transporting of fish), and a different identification tag (a "Floy" FT-4 spaghetti tag as opposed to the Petersen Disc tag).

Eight personnel were hired to conduct the tagging operation. They were divided into two crews and each crew into two, two-man teams. Each team was assigned to an outboard skiff. During the peak of the chinook salmon run, July 9 through July 29, both crews operated 7 days a week in an intensified effort to tag as many adult chinook salmon as possible.

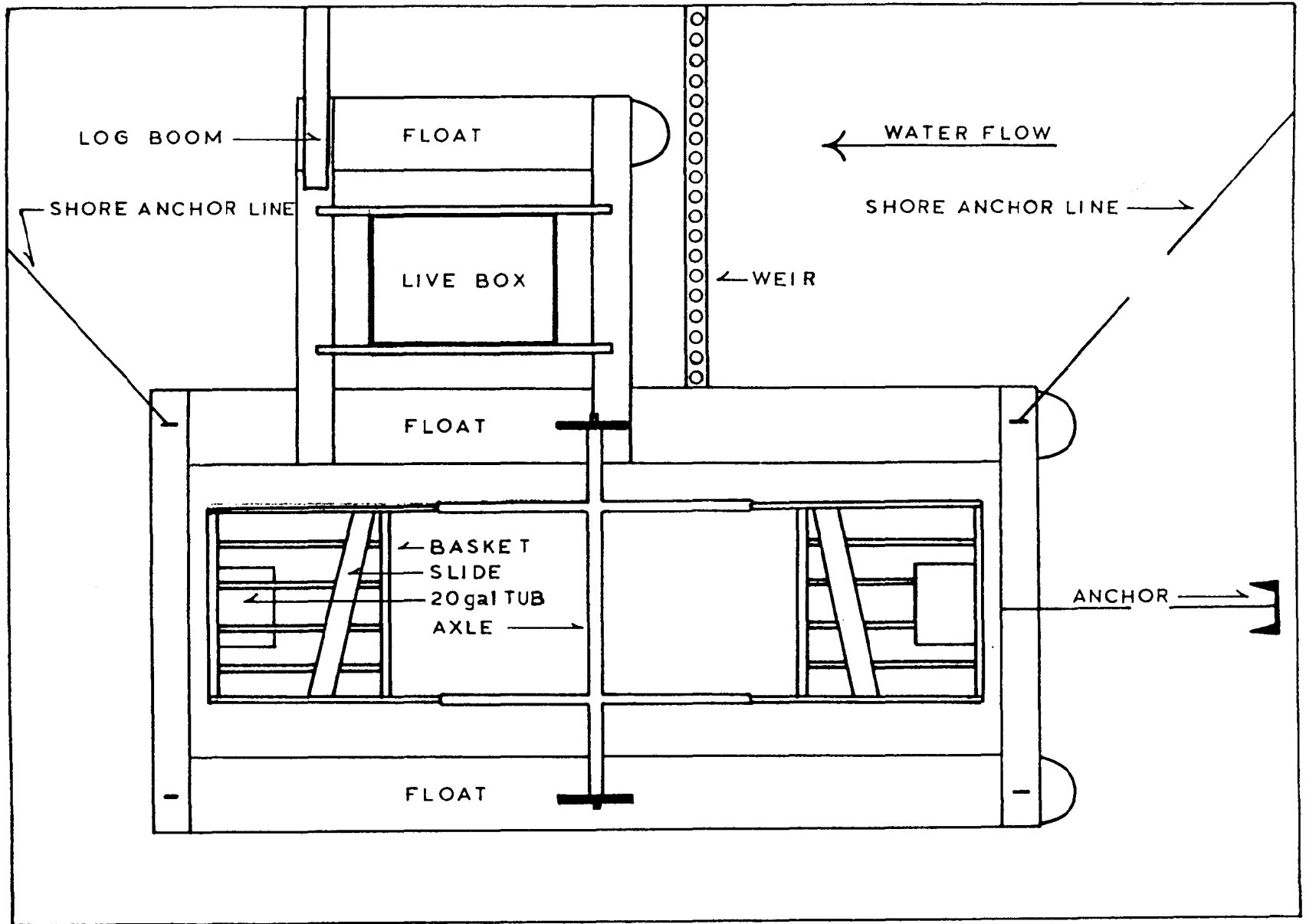
The Schaeffer method was used to determine the chinook salmon population. Data used to compute the Schaeffer estimate was gathered through the creel census (Hammarstrom, 1976).

### Fishwheel

The feasibility of utilizing a fishwheel to capture adult chinook salmon in the Kenai River intertidal zone was evaluated. This initial evaluation employed a modification of the successful fishwheel techniques utilized by Commercial Fisheries biologists on both the upper Kenai (Bruce King, Fishery Biologist, "Pers. Comm.", 1983) and Susitna (Frederick Thompson, Fishery Biologist, "Pers. Comm.", 1983) River drainages.

Rather than being fabricated from spruce logs and styrofoam, a lighter aluminum framework with adjustable polyurethane floats was used. The adjustable baskets are 6 feet wide and capable of fishing at water depths between 7 and 13 feet. Each basket frame is covered with a tarred, three-inch stretched mesh net. The adjustable paddles are of the same length and width as the baskets. Attached across the width of the paddles outer extremity are 2 x 6-inch planks. Water pressure applied to the planks provides the necessary torque to rotate the baskets. The speed of rotation is governed by the number and position of the 2 x 6 inch planks attached to the paddles and by a 20-gallon tub attached to the outside of each basket. The tub fills with water with each underwater pass of the basket, and drains after the basket emerges. The tub drains at a rate determined by the size of a hole drilled through the bottom of the tub. Regulating the hole size can influence the rotational speed. The ideal rotational speed of a fishwheel is 2.5 revolutions per minute (Bruce Barrett, Fishery Biologist, Pers. Comm., 1983). Captured fish were dumped from the baskets onto a foam rubber padded slide which deposits them into a 5-foot-long, 4-foot-wide, and 4-foot-deep live box located on the inshore side of the fishwheel (Figure 1).

The axle of the fishwheel was raised and lowered by a hand winch assembly located on each axle stand. To adjust the axle height, four bolts located on the self-aligning axle bearing housing were loosened. These four bolts were aligned with two vertical slots centered on the axle stand. By sliding the bolts along the vertical slots with the aid of the hand winch, the proper axle height was attained. The system allows an axle adjustment of 3 feet. A suitable site for operating the fishwheel was determined to be at Kenai River mile 13. This site offered a water depth of 8 feet and a minor tidal influence of up to 3 feet to test the feasibility of operating a fishwheel in the intertidal zone.



8

Figure 1. Aerial Schematic of Fishwheel System, 1983.



To prevent the fishwheel from moving downstream, a shore anchor line extended from the bow of the inshore fishwheel float to a large tree located along the river bank, upstream approximately 100 feet. Also, a 40 pound "Danforth" anchor was set immediately upstream of the fishwheel and the anchor line lashed to the bow brace midway between the floats. The fishwheel was held 30 feet offshore by two parallel booms which extended perpendicular from the shoreline and above the waterline. One boom was a 30-foot spruce log located aft of the live box; the second boom was a wooden 4 x 6 inch weir beam located forward of the live box.

The weir was comprised of two twenty foot long 4 x 6 inch beams joined together creating a span of 30 feet. Holes, 1 1/2 inches in diameter, were pre-drilled on 4-inch centers through which 3/4 inch schedule 40 steel pipe was inserted. The pipe extended vertically to the river bottom.

## FINDINGS

### Deep Creek Marine Fishery

Monitoring of the recreational fishery in the marine waters south of Deep Creek commenced May 16 and was continuous through July 31. During the time the creel census was active, 166 instantaneous counts were made, 7,286 boats were counted, 4,240 anglers interviewed, 297 chinook salmon and 2,491 pacific halibut were creel checked.

The season lasted 77 days and creel census activities were conducted on 46 days (60%). Two of the 46 days (4.3%) were considered weather days when rough seas prevented virtually any effort. Thus the fishery was active for 73 days during 1983. A reduction of only 4 days is considered minimal, compared with the last few years when weather has reduced the effective season by 41% (1981) and 35% (1980).

The early run was considered available from May 16 through June 26 (42 days). During that time, an estimated 1,000 chinook salmon were harvested by 21,707 man-days of effort; each man-day was approximately 4.2 man-hours. Catch per hour for the early run was 0.011 (90.9 man-hours per fish). The 1983 catch rate was the poorest since 1972, with no apparent reason. Weather was considered good and chinook salmon returns to the various streams were above average.

The late run was considered available from June 27 through July 31. Estimates for harvest and effort based on creel census data were 1,707 chinook salmon by 10,640 man-days; a man-day being approximately 3.6 man-hours. Catch per hour of late run fish was 0.045 (22 man-hours per fish). The 1983 catch rate was less than the 1972-1982 mean (Table 2), however, the catch in both the commercial fishery and the recreational fishery in the Kenai River was reported at record levels. During 1983, 178 readable scales were collected from chinook salmon captured in the Deep Creek marine fishery. Early run fish had good contributions from both age class 1.3 (brood year 1978) and 1.4 (brood year 1977), 37.3% and 44.7%, respectively. The late run was predominantly made up of age class 1.4 (81.1%). Table 3 presents summarized information collected during the 1983 fishery.

Table 2. Historical Summary of the Chinook Salmon Sport Fishery in Marine Waters off Deep Creek, 1972-1983.

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
1982	2,497	14,514	0.056	1,173	9,252	0.033	3,670	23,766	0.046
<b>Mean</b> 1972-82	2,164	9,800	0.059	898	5,730	0.058	3,062	15,530	0.059
1983	1,000	21,707	0.011	1,707	10,640	0.045	2,707	32,347	0.021

### Lower Stream Fishery

The 1983 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 in May and the first 3 weekends in June, except Ninilchik River which was closed after the second weekend in June. Each weekend included Saturday, Sunday and Monday. Harvest for this entire fishery was estimated at 3,185 chinook salmon over 51 cm (20 in) in length, and effort was estimated at 27,370 man-days (Table 4).

Fishing began May 28 with all streams being fishable. Under normal conditions, both the Anchor River and Deep Creek are usually high and turbid due to spring runoff. By the second weekend, the Anchor River is in better condition, and by the third weekend Deep Creek begins to produce a harvest. In 1983, however, by the third weekend, the flow in the Anchor River was reduced enough that many anglers were moving to the more fishable Deep Creek. Harvest was weak during the fourth weekend in both Anchor River and Deep Creek. This can be explained by reduced flows in both streams which created inefficient fishing conditions and runs into both streams are almost over by that time. Historical information regarding this fishery is presented in Tables 5 and 6. Escapement surveys were conducted on all three streams in late July. Observation conditions were considered good, streams were relatively low and clear and the weather was also clear and sunny. Both Anchor River and Ninilchik River had less than average escapement and higher than average harvest, however, both were felt to have adequate escapement based on the returns from similar escapement levels. Escapement for each stream are as follows: Anchor River, 1,490; Deep Creek, 1,010; Ninilchik River, 710.

During the 1983 fishery, a total of 274 readable scales were collected from recreationally harvested chinook salmon. Fish from age class 1.4 (brood year 1977) were the largest contributors consisting of 59.9% of the harvest. In 1982, the production from this same brood year contributed only 25% of the harvest (Hammarstrom and Larson, 1983). The unusually large number of fish that had spent two winters in freshwater is of interest because these fish are considered uncommon. Age data regarding the 1983 fishery are presented in Tables 7 and 8.

### Kenai River Fishery

The Department of Fish and Game, Sport Fish Division, began its tenth year of monitoring the Kenai River recreational chinook salmon fishery June 1, 1983. The creel census was continuous through September 30, however, chinook salmon fishing closed by regulation July 31. Information regarding the fishery after July 31 and the harvest of other species is presented in another report by Wallis and Hammarstrom.

During the 2 months that chinook salmon were the primary target of anglers, individuals conducting the creel census enumerated 9,432 boats and 24,027 anglers during 159 instantaneous counts. In addition, 2,290 boats were enumerated during 16 aerial surveys. Census takers stopped 5,266 boats, interviewed 14,258 anglers who reported taking 1,192 adult (greater than 51 cm) chinook salmon during 36,530 man-hours of fishing.

Table 3. Summarized Data from Readable Scales Collected from Recreationally Harvested Chinook Salmon in the Deep Creek Marine Fishery, 1983.

Age Class Brood Year	1.2 1979	1.3 1978	1.4 1977	1.5 1976	Other	Total
Number	8	31	37	0	7	83
Percent	9.6	37.3	44.7	0	8.4	100.0
Length Range (mm)*	680-800	760-960	900-1,000	--	330-1,130	330-1,200
Mean Length (mm)*	718	877	949	--	881	873
Mean Weight (kg)	5.8	9.2	13.7	--	8.9	10.6
	EARLY RUN					
Number	3	8	77	5	2	95
Percent	3.2	8.4	81.1	5.2	2.1	100.0
Length Range (mm)*	710-750	810-990	980-1,370	1,050-1,250	305-1,180	305-1,370
Mean Length (mm)*	728	900	1,170	1,180	742	1,125
Mean Weight (kg)	6.0	9.2	21.5	22.8	12.0	19.8
	LATE RUN					

\* Mid-eye to fork of tail

Table 4. Angler Harvest and Effort Summaries for the Chinook Salmon Fishery of Three Southern Kenai Peninsula Streams, 1983.\*

Date	Anchor River		Deep Creek		Ninilchik River		Total	
	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort
5/28	225	1,710	250	820	500	2,335	975	4,865
5/29	125	1,390	100	1,455	125	1,980	350	4,825
5/30	<u>100</u>	<u>950</u>	<u>50</u>	<u>560</u>	<u>50</u>	<u>1,190</u>	<u>200</u>	<u>2,700</u>
Subtotal	450	4,050	400	2,835	675	5,505	1,525	12,390
6/4	100	990	190	505	200	825	490	2,320
6/5	50	825	50	865	50	715	150	2,405
6/6	<u>50</u>	<u>430</u>	<u>30</u>	<u>520</u>	<u>25</u>	<u>295</u>	<u>105</u>	<u>1,245</u>
Subtotal	200	2,245	270	1,890	275	1,835	745	5,970
6/11	75	1,235	125	460	150	860	350	2,555
6/12	50	900	110	1,050	40	705	200	2,655
6/13	<u>50</u>	<u>320</u>	<u>95</u>	<u>435</u>	<u>20</u>	<u>365</u>	<u>165</u>	<u>1,120</u>
Subtotal	175	2,455	330	1,945	210	1,930	715	6,330
6/18	40	560	50	470		Closed	90	1,030
6/19	30	320	25	655		Closed	55	975
6/20	<u>30</u>	<u>300</u>	<u>25</u>	<u>375</u>		Closed	<u>55</u>	<u>675</u>
Subtotal	100	1,180	100	1,500			200	2,680
Grand Total	925	9,930	1,100	8,170	1,160	9,270	3,185	27,370

\* Figures have been round to nearest 5.

Table 5. 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	1,960	2,855

Table 5 (cont.). 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
1981**	1,040	1,230	48	580	920	39	1,300	830	61	3,020	2,980	6,000
1982	760	1,540	33	660	2,670	20	1,070	1,430	43	2,490	5,640	8,130
Mean (excludes all 1970 and 1971 data)												
1966-82	590	1,720	26	260	850	23	550	900	36	1,400	3,530	4,930
1983	930	1,490	33	1,100	1,010	52	1,160	710	62	3,190	3,210	6,400

Figures rounded to nearest 10

\* % of total run harvested.

\*\* Escapement count considered minimal due to high turbid water during escapement surveys.

Table 6. Historical Chinook Salmon Harvest and Effort Data from Three Southern Kenai Peninsula Streams (Deep Creek, Ninilchik River, Anchor River), 1971-1983.

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	28,790	995	12	2,399	83	29
1981	32,330	3,020	12	2,695	252	11
1982	33,420	2,485	12	2,785	207	14
1983	27,370	3,185	12	2,280	265	9
Mean	27,665	1,730	9.5	2,912	181	16

\* Anchor River only was open for four additional days.



Table 7. Length Data (mideye to fork of tail) of Major Age Classes of Chinook Salmon Taken in the Recreational Fishery on Three Southern Kenai Peninsula Streams, 1983.

	Age Class		
	1.2	1.3	1.4
<u>Anchor River</u>			
Number	0	23	52
Range (mm)		690-860	790-1,005
Mean (mm)		779	884
S.D.*		38.2	56.7
<u>Ninilchik River</u>			
Number	3	21	34
Range (mm)	565-645	705-835	800-920
Mean (mm)	600	771	870
S.D.*	40.9	34.7	42.6
<u>Deep Creek</u>			
Number	8	31	78
Range (mm)	530-620	680-835	760-1,025
Mean (mm)	559	767	867
S.D.*	30.4	47.6	56.5
<u>Total</u>			
Number	11	85	164
Range (mm)	530-645	680-860	760-1,025
Mean (mm)	570	773	873
S.D.*	36.6	40.9	54.2

\* S.D. - Standard Deviation

Table 8. Age Composition of Chinook Salmon Taken in the Recreational Harvest from Anchor River, Deep Creek and Ninilchik River, 1983.

	Age Class			Total*	
	Brood Year	1.2 (1979)	1.3 (1978)		1.4 (1977)
Number		11	85	164	260
Percent		4.0	31.0	59.9	94.9

\* An additional 14 scales (5 age class 1.1, 2 age class 2.2, 2 age class 2.3 and 5 age class 2.4) were collected and not included in total.

Analysis of the above data resulted in an estimated harvest of 15,534 chinook salmon by 99,011 man-days of effort. Both these figures are the largest recorded since the creel census was begun in 1974 (Table 9).

Early run fish were considered available in the downstream section (Soldotna Bridge to Beaver Creek) from June 1 through July 1, and in the upstream section (Naptowne Rapids to Skilak Lake) from June 1 through July 10. There is some fishing prior to the initiation of creel census activities, however, the harvest is considered insignificant. Total early run harvest was estimated at 6,360 chinook salmon and effort at 42,716 man-days of effort with each man-day equal to 4.0 man-hours of fishing. Catch per hour during this fishery was 0.037 or 27 man-hours of fishing to harvest one fish. This is the second highest catch rate recorded in the decade the creel census has been in effect.

Escapement estimates for the entire early run are not generated, however, one clearwater stream, Benjamin Creek, a tributary to the Killey River, was surveyed by helicopter in mid-July and 650-800 spawning chinook salmon were estimated to be using that stream. This number compares favorably with results of surveys conducted in 1980, 1981 and 1982. The Killey River is the primary producer of early run chinook salmon in the Kenai River, and Benjamin Creek is an excellent index stream to check the spawning escapement into the Killey River. Escapement of early run Kenai River chinook salmon was considered excellent and the general status of the early run is quite healthy. Harvest and catch per hour has increased steadily since 1980.

Late run fish were considered present in each section of the Kenai River from the end of the early run until the season closed July 31. The separation date is obtained by examining daily catch rates, then adjusting to the nearest weekly periods. The harvest of late run chinook salmon was estimated to be 9,174 fish by 56,295 man-days of effort. A man-day during the late run was equal to 4.5 man-hours of fishing. The catch rate for late run fish was 0.036, nearly the same as the early run.

Unlike 1982, no emergency closure was necessary, although sockeye salmon returned to the Kenai River at record levels and considerable extra fishing time was granted to both commercial drift and set net gear. The return of chinook salmon was also extremely strong. The commercial set net fishery along the eastern shore of Cook Inlet from Ninilchik to Boulder Point harvested 14,406 chinook salmon, which was a recent (since 1966) record for late run fish.

As in the past, the majority of the recreational effort occurred in the downstream section. In 1983, this section received 59% of the effort in the early run and produced 83% of the harvest. Corresponding figures for the upstream section are 23% of the effort and 6% of the harvest. The late run had similar harvest and effort distribution; downstream represented 64% of the effort and 91% of the harvest and upstream represented 16% of the effort and 1.4% of the harvest. The remaining harvest and effort occurred in the midstream section and from shore.

Table 9. Historical Summary of Kenai River Chinook Salmon Fishery , 1974-1983.

Year	Sport Fishing- Kenai 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
1981	4,525	28,335	0.031	5,285	29,906	0.032	9,810	58,241	0.032
1982	5,466	45,723	0.033	4,810	43,366	0.029	10,276	89,089	0.030
Mean	2,574	27,099	0.024	4,347	37,101	0.031	6,921	64,236	0.028
1983	6,360	42,716	0.037	9,174	56,295	0.036	15,534	99,011	0.037

The 1983 fishery was conducted under slightly different regulations than have occurred in the past. In December of 1982, the Board of Fisheries put restrictions on the amount of time open to fishing on late run chinook salmon in the Kenai River. All Mondays in July, after July 4, were closed to fishing from boats and fishing from registered guide vessels was prohibited on all Sundays in July. Based on average catch per day, it is speculated these restrictions prevented or redistributed approximately 1,700 late run fish from being harvested.

Historical data regarding harvest and effort for the Kenai River chinook salmon fishery is presented in Table 9. Additional information concerning the distribution of catch and effort is presented in Tables 10 and 11.

During 1983, 69 readable scales were collected from early run chinook salmon taken by recreational anglers. The predominant age class was 1.4 (brood year 1977) which contributed 59% of the harvest. Sex ratio for the early run harvest was 0.94 males to 1 female. Because of the extensive tagging effort on late run fish conducted in 1983, scale samples were taken from these fish as well as from the recreational harvest. Again, 1.4 was the dominant age class accounting for 58% of the 342 readable scales collected. Sex ratio for the late run was 0.90 to 1, males to females. Average weight of a chinook salmon harvested in the Kenai River was 18.5 kg (40.6 lb), 15.7 kg (34.5 lb) during the early run and 20.4 kg (44.9 lb) during the late run. Age composition data are presented in Table 12 and historical composition of major components is presented in Table 13.

For the second year, sport fishing guides on the Kenai River were required to register with the Department of Fish and Game's Soldotna office. There has been no fee, however, individuals are required to produce a current Alaska business license and proof that any vessel to be used in the guiding operation has been registered with the Fisheries Entry Commission as a charter vessel. The combined fee for both is \$45.00. Individual guides are required to keep a logbook recording clients' names, sport fish license numbers and catch by species and date.

During 1983, 123 guiding operations registered 198 guides utilizing 183 vessels. These numbers are just slightly different from 1982 when 125 operations registered 207 guides utilizing 179 vessels (Hammarstrom and Larson, 1983). In 1983, 236 logbooks were issued, an increase of 14 from 1982. However, in 1983 guides who received logbooks prior to the close of chinook salmon fishing were required to return their books by August 15. If they planned on guiding after they turned in their books they were issued a second book. As of March 1984, 215 logbooks have been returned, six were reported lost and 15 are still outstanding.

The logbooks were forwarded to the biometrics section for analysis. At this writing analysis is incomplete, however, through personal communications with the biometrician in charge of logbook analysis, a total of 4,190 chinook salmon by 10,262 client-days of effort were reported during June and July of 1983.

Table 10. Comparative Effort Data in Man-Hours and Man-Days for Past Seven Years of Kenai River Chinook Salmon Fishery, 1977-1983.

Year	Upstream Section			Midstream Section			Downstream Section			Shore Anglers			Total			C.P.U.E.
	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	
<u>EARLY RUN</u>																
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	123,029	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
1983	31,550	9,940	3.2	15,963	3,996	4.0	108,474	25,109	4.3	14,010	3,671	3.8	170,002	42,716	4.0	0.037
Mean	30,252	7,802	3.9	13,443	3,519	3.8	74,228	19,671	3.8	14,650	3,830		132,573	34,836	3.8	0.024
<u>LATE RUN</u>																
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	56,895	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	29,906	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
1983	29,376	8,640	3.4	11,270	2,429	4.6	164,928	33,236	5.0	42,945	11,990	3.6	253,519	56,295	4.5	0.036
Mean	23,138	6,183	3.8	15,801	3,900	4.1	121,186	30,703	3.9	26,047	7,056	3.7	186,172	47,842	3.9	0.028
Seasonal Avg.	53,390	13,947	3.8	29,244	7,418	3.9	195,414	50,374	3.9	40,697	10,873	3.7	318,745	82,702	3.9	0.027

Table 11. Historical Harvest Comparison by River Section for Kenai River Chinook Salmon Fishery, 1976-1983.

	<u>Upstream Section</u>		<u>Midstream Section</u>		<u>Downstream Section</u>		<u>Shore Anglers</u>		Total Harvest
	Harvest	Percent	Harvest	Percent	Harvest	Percent	Harvest	Percent	
<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
1981	346	7.6	528	11.7	3,464	76.6	187	4.1	4,525
1982	456	8.4	791	14.5	3,941	72.0	278	5.1	5,466
Mean	467	21.9	340	11.4	1,869	60.4	162	6.3	2,838
1983	400	6.3	645	10.1	5,255	82.7	60	0.9	6,360
<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
1981	255	4.3	660	12.6	4,150	79.0	220	4.2	5,285
1982	156	3.2	198	4.1	4,340	90.2	116	2.4	4,810
Mean	211	4.4	454	9.7	3,805	79.1	321	6.8	4,791
1983	133	1.4	490	5.3	8,324	90.8	227	2.5	9,174

Table 11 (cont.). Historical Harvest Comparison by River Section for Kenai River Chinook Salmon Fishery, 1976-1983.

	<u>Upstream Section</u>		<u>Midstream Section</u>		<u>Downstream Section</u>		<u>Shore Anglers</u>		Total Harvest
	Harvest	Percent	Harvest	Percent	Harvest	Percent	Harvest	Percent	
<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
1981	601	5.8	1,188	12.1	7,614	77.9	407	4.2	9,810
1982	612	6.0	989	9.6	8,281	80.6	394	3.8	10,276
Mean	678	9.3	794	10.6	5,674	73.4	483	6.7	7,629
1983	533	3.4	1,135	7.3	13,579	87.5	287	1.8	15,534



Table 12. Summarized Age Data Determined from Readable Kenai River Chinook Salmon Scales, 1983.

Age Class	1.2	1.3	1.4	1.5	Other	Total
EARLY RUN*						
Number	5	10	44	3	8	70
Percent	7.1	14.3	62.9	4.3	11.4	100.0
Length Range (mm)***	500-600	750-930	760-1,130	900-1,130	760-1,000	560-1,130
Mean Length (mm)***	582	843	993	1,033	898	933
Mean Weight (kg)	5.2	11.3	17.9	20.7	13.6	15.7
LATE RUN**						
Number	64	120	921	45	11	1,161
Percent	5.5	10.3	79.4	3.9	0.9	100.0
Length Range (mm)***	500-710	810-1,040	850-1,210	1,070-1,160	405-1,150	405-1,210
Mean Length (mm)***	673	890	1,017	1,115	889	987
Mean Weight (kg)	5.6	17.0	21.7	24.6	16.8	20.4

\* Collected from recreationally harvested fish.

\*\* Data regarding length and weight were determined from 80 readable scales collected from the recreational fishery. The remainder, 1,081, were taken in conjunction with the escapement study which did not collect length and weight information.

\*\*\* Lengths were measured mideye 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
<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
1982	6.5	24.2	64.7	4.6
1983	8.2	16.4	70.5	4.9
Mean	12.8	24.1	59.0	4.1
<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	49.9	7.5
1981	12.8	22.2	62.4	2.6
1982	12.0	26.5	59.8	1.7
1983	4.4	26.3	68.7	0.6
Mean	15.0	23.1	57.9	4.0
<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	13.1	35.6	49.7	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
1983	5.0	24.8	69.0	1.2
Mean	15.9	22.9	57.1	4.1

During the creel census interviews, a total of 5,266 boats were approached for interviews. Of these, 719 (14%) were registered guide vessels, identified by the decal required to be displayed. If the census taker did not personally recognize the boat or guide, the census taker asked the party if they were on a guided trip. The 719 vessels approached contained 1,490 anglers, the guide was not included as he was prohibited from fishing while engaged in an active charter. These guided anglers reported they had fished for 8,621 hours and had retained 706 chinook salmon which results in an absolute catch per hour of .082 fish. The average guided vessel contained 3.4 anglers.

Guided vessels represented 14% of the boat traffic approached during the creel census, while guided anglers represented 17% of the anglers contacted and accounted for 24% of the hours fished and 59% of the harvest reported. When these data are weighed by river section, guided anglers harvested 9,195 fish during 23,821 man-days for a catch per hour of 0.080. Corresponding figures for non-guided anglers are a harvest of 6,339 fish in 75,190 man-days and a catch per hour of 0.017.

There is a diversity in the fishery between upstream and downstream sections of the Kenai River. In the downstream section guided boats accounted for 23% of the traffic, guided anglers represented 36.3% of the effort reported and 62.2% of the chinook salmon harvested. Corresponding figures for the upstream section are: guided boats, 3.9%; guided effort reported, 6.5%, and guided harvest, 38.1%.

The difference between the creel census estimate and that reported in the logbooks is not readily explainable. However, when compared with the Statewide Harvest Survey (Mills, 1979-1983), the creel census estimates for harvest differ by an average of 0.4% for chinook salmon since 1977. Estimates are derived entirely independently between the two methods. In personal communication with Mills, he noted many logbooks (73%) had not been completed in accordance with the instructions printed on each logbook. It is of interest to note that 58 chinook salmon were reported retained in the logbooks after August 1; chinook salmon fishing on the Kenai River closed July 31.

A summary of data for guided and nonguided anglers, as determined by creel census, is presented in Tables 14 and 15.

#### Kenai River Escapement Enumeration

A total of 1,552 adult chinook salmon were tagged utilizing a drift gill net from June 23 through July 29, 1983. Of this number, 1,535 were late run and 17 were early run fish.

Table 14. Summary of Kenai River Chinook Salmon Fishery, Guided vs. Non-Guided Anglers, as Determined by Creel Census, 1983.

	Downstream		Midstream		Upstream		Shore		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<b>Early Run</b>										
<b>Harvest</b>										
Guided	3,526	67.1	374	58.0	188	47.0	--	0	4,088	64.3
Unguided	1,729	32.9	271	42.0	212	53.0	60	100.0	2,272	35.7
<b>Effort</b>										
Guided	10,144	40.4	1,019	25.5	1,044	10.5	--	0	12,207	28.6
Unguided	14,965	59.6	2,977	74.5	8,896	89.5	3,671	100.0	30,509	71.4
<b>Late Run</b>										
<b>Harvest</b>										
Guided	4,919	59.1	173	35.3	15	11.3	--	0	5,107	55.7
Unguided	3,405	40.9	317	64.7	118	88.7	227	100.0	4,067	44.3
<b>Effort</b>										
Guided	11,034	33.2	425	17.5	155	1.8	--	0	11,614	20.6
Unguided	22,202	66.8	2,004	82.5	8,845	98.2	11,990	100.0	44,681	79.4
<b>Both Runs</b>										
<b>Harvest</b>										
Guided	8,445	62.2	547	48.2	203	38.1	--	0	9,195	59.2
Unguided	5,134	37.8	588	51.8	330	61.9	287	100.0	6,339	40.8
<b>Effort</b>										
Guided	21,178	36.3	1,444	22.5	1,199	6.5	--	0	23,821	24.1
Unguided	37,167	63.7	4,981	77.5	17,381	93.5	15,661	100.0	75,190	75.9

Table 15. Comparison Between Guided and Non-Guided Chinook Salmon Anglers, as Determined by Creel Census, on the Kenai River by River Section, 1981-1983.

	Early Run			Late Run			Both Runs		
	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour
<u>1981</u>									
Downstream Section									
Guided	53.3	29.3	0.087	52.1	31.4	0.072	52.7	30.4	0.076
Unguided	46.7	70.7	0.030	47.9	68.6	0.030	47.3	69.6	0.030
Upstream Section									
Guided	28.0	12.9	0.013	26.7	11.1	0.030	27.5	12.1	0.023
Unguided	72.0	87.1	0.006	73.3	88.9	0.010	72.5	87.9	0.009
Total River									
Guided	49.0	22.6	0.072	48.5	24.9	0.066	48.7	23.9	0.070
Unguided	51.0	77.4	0.021	51.5	75.1	0.022	51.3	76.1	0.022
<u>1982</u>									
Downstream Section									
Guided	45.6	23.0	0.075	52.0	27.3	0.064	49.0	25.1	0.068
Unguided	54.4	77.0	0.028	48.0	72.7	0.035	51.0	74.9	0.031
Upstream Section									
Guided	56.0	28.9	0.040	40.0	22.7	0.018	51.8	26.8	0.032
Unguided	44.0	71.1	0.013	60.0	77.3	0.008	48.2	73.2	0.011
Total River									
Guided	44.9	21.7	0.061	50.1	21.6	0.056	47.3	21.7	0.058
Unguided	55.1	78.3	0.023	49.9	78.4	0.027	52.7	78.3	0.025

Table 15 (cont.). Comparison Between Guided and Non-Guided Chinook Salmon Anglers, as Determined by Creel Census, on the Kenai River by River Section, 1981-1983.

	Early Run			Late Run			Both Runs		
	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour	Percent Harvest	Percent Effort	Catch/ Hour
<u>1983</u>									
Downstream Section									
Guided	67.1	40.4	0.076	59.1	33.2	0.087	62.2	36.3	0.083
Unguided	32.9	59.6	0.025	40.9	66.8	0.030	37.8	63.7	0.029
Upstream Section									
Guided	47.0	10.5	0.057	11.3	1.8	0.031	38.1	6.5	0.053
Unguided	53.0	89.5	0.008	88.7	98.2	0.004	61.9	93.5	0.006
Total River									
Guided	64.3	28.6	0.072	55.7	20.6	0.086	59.2	24.1	0.080
Unguided	35.7	71.4	0.015	44.3	79.4	0.019	40.8	75.9	0.017

A total of 153 tags were recovered from the following sources:

	<u>No. of Tags Returned</u>
1. Sport fishermen (creel census)	27
2. Sport fishermen (voluntary returns)	43
3. Cook Inlet commercial fishermen	29
4. In-season carcasses	16
5. Post-season carcasses	30
6. Post-season drift gill net sampling (river mile 10-47)	4
7. Russian River (weir & river)	3
8. Quartz Creek weir	1
9. Unknown	4
Total	<u>157</u>

Of the 27 tags recovered from the creel census, 24 could be used in the late run Schaeffer population estimate. One tag was recovered from an early run salmon and two tags were removed from non-harvested salmon.

During the late run creel census, 4,880 sport fishermen reported a harvest of 682 chinook salmon of which 24 were tagged. Based on this information, and incorporating Schaeffer's method (Ricker, 1975 p. 101) to estimate the population (Tables 16 and 17), 30,516 chinook salmon returned to the Kenai River between July 2 and July 31, 1983. This population estimate is the total number of chinook salmon available to recreational exploitation and does not include chinook salmon which entered the Kenai River after the recreational fishery was closed. Chinook salmon continue to enter the Kenai River until mid-August. This segment of the run has not been accurately estimated, however, based on analysis on commercial fisheries data may represent 20-30% of the total late run population.

Although all chinook salmon were tagged in the freshwater environment of the Kenai River, commercial fishermen harvested a portion in Cook Inlet saltwater, which was expected. During the U.S. Fish and Wildlife Service's 1979-1981 Kenai River radiotelemetry study (Burger et al., 1983, p. 10), of 139 adult chinook salmon radio tagged, 11 returned to Cook Inlet. Although tagging methodology differed, both studies tagged chinook salmon in similar locations (the intertidal zone) and in both studies fish returned to Cook Inlet. One possible explanation is that salmon tagged in the intertidal zone may not be fully adjusted to a freshwater environment and are carried in and out of the river system with each tidal change. This would subject them to both the recreational and commercial fishery. Of the 29 tagged chinook salmon captured by the commercial fishery, 45% were harvested by set nets within 5 miles of the Kenai River mouth and 69% by set nets within 10 miles of the Kenai River mouth. The remaining 31% were captured beyond 10 miles of the Kenai River mouth by set net and drift fishermen. The average elapsed period from time of tagging to time of commercial capture was 8.9 days. Another possible explanation includes

Table 16. Creel Census Recoveries from Chinook Salmon Tagged in Successive Weeks at Kenai River, Divided According to Week of Recovery Upstream; Together with Total Number Tagged Each Week (Mi), and the Number Recovered and Examined for Tags (Cj), 1983.

Week of Recovery (j)	Week of Tagging (i)					Tagged Fish Recovered Rj	Total Fish Recovered Cj	Cj/Rj
	1	2	3	4	5			
July								
1-2	1					0	23	
3-9	2	1				1	117	117.00
10-16	3	2				2	211	105.50
17-23	4	1	3	4		8	171	21.38
24-30	5	2	1	8	2	11	134	10.31
31	6		1		1	2	26	13.00
Tagged Fish Recovered (Ri)								
	0	6	5	10	3	24		
Total Fish Tagged (Mi)								
	4	152	406	672	302			

Table 17. Computed Estimates of Chinook Salmon Based on Table 16 and Using Schaefer's Method (Kenai River late run, July, 1983).

Week of Recovery (j)	Week of Tagging (i)					Total	
	1	2	3	4	5		
July							
1-2	1						
3-9	2		2,964			2,964	
10-16	3		5,345			5,345	
17-23	4		541	5,208	5,747	11,496	
24-30	5		522	837	4,911	2,076	8,346
31	6			1,056		1,309	2,365
Total							
			9,372	7,101	10,658	3,385	30,516



handling stress related to both the tagging process and the recreational fishery. This stress would cause the fish to "drop out" of the Kenai River. Additional studies will be necessary to fully evaluate behavior.

Most in-season carcass tag recoveries are believed related to handling stress from the tagging process and encounters with the sport fishery. Post-season carcass recoveries were probably a direct result of spawning activity.

In late August, a number of chinook salmon carcasses were observed by creel census personnel along the banks of the Kenai River. A ground survey was conducted on August 26 on Kenai River, from mile 12.5 through 21. The number of tagged and untagged carcasses were counted and tagged salmon were cut open to determine spawning success. Of the 156 carcasses observed, 10 were tagged. Nine out of the ten tagged salmon were void of milt or eggs.

A post-season tag recovery program was conducted from August 11-15, 1983. A gill net was used to sample chinook salmon populations on Kenai River, from mile 8 through 47. Of the 152 chinook salmon captured, four displayed spaghetti tags. No chinook salmon were captured downstream of river mile 12.

The large size of chinook salmon found in the Kenai River drainage permits selective capture with drift gill nets. By varying the mesh size of the gill net used, a significant number of chinook salmon were captured even when other species were present. The following describes the potential of each mesh size used:

1. The 5 1/8-inch stretched mesh net was the least effective mesh for capturing chinook salmon, but the least harmful to the species. The mesh size was too small to gill chinook salmon but chinook salmon became entangled in the net. Males were more readily captured than females. As the males sexually matured, their snouts elongated and developed protruding teeth which entangled more readily. Sockeye, coho and jacks (one year ocean chinook salmon) were easily gilled by this mesh size. When multiple species were present, capturing chinook salmon was hampered by the increased labor necessary to release sockeye, coho and jack salmon from the nets. Finally, the net depth available in this mesh size was too shallow. To effectively capture adult chinook salmon, a drift gill net must extend to the river bottom.
2. The 7-inch stretched mesh net was the preferred net size. It was deep enough to reach the river bottom, effective in entangling both male and female chinook salmon regardless of sexual maturity without excessive gilling, and capable of passing most sockeye salmon through without harm. However, it gilled salmon 10-20 pounds in size which included most of the coho salmon and age class 1.2 chinook salmon.

3. The 8-inch stretched mesh net was the most effective gear for capturing large adult chinook salmon. However, it was also the most harmful to the species. This net was deep enough to reach the river bottom and retained nearly all chinook salmon that encountered it. Sockeye, chinook jacks, and most coho salmon readily passed through the mesh. However, the net usually needed to be cut to release captured chinook salmon. The mesh was either bound tightly around the mid-section, or on the larger fish, around the outside of the operculum, limiting respiration. Damage to gill filaments was also more prevalent using this mesh size.

The tagging time necessary to process a chinook salmon was improved by converting to the Floy FT-4 spaghetti tag. These tags were easier to apply than the previously used Petersen Disc tags. Two different applicator needles were used. One needle was solid with a barbed end and the other hollow. The hollow needles were preferred; they were stronger, lasted longer and were easier to handle.

#### Fishwheel

The fishwheel captured two sockeye salmon after 5 days of intermittent operation. Chinook salmon were observed surfacing in the area of the fishwheel, but none were captured. Factors contributing to a poor chinook salmon catch include:

1. Clear water conditions may have rendered the fishwheel baskets visible to migrating salmon. Fishwheels used on the Kenai River are less effective during clear water conditions (Bruce King, Fishery Biologist, Pers. Comm., 1983).
2. Tidal fluctuations continually washed sections of the weir out.
3. The fishwheel was operated after the peak of the salmon run, therefore, a low volume of migrating salmon were available for capture.
4. The site may not have been optimally located.

Mechanically the fishwheel operated as designed. An ideal rotation of 2.5 revolutions per minute was maintained. A new, self-aligning axle bearing proved superior to the previous systems. Formerly, the axle bearings were rigidly mounted. Wind and wave action oscillated the fishwheel craft applying stress to the axle bearing mounts, which eventually sheared the mounting bolts. The self-aligning bearings corrected this problem. Finally, the hand winch assembly, used to raise and lower the fishwheel axle, provided a quick and safe mechanism for regulating the fishing depth of the fishwheel baskets.

The versatility of the adjustable polyurethane floats allowed the construction of a stable platform for not only the fishwheel, but also a live box and work sampling area. The dimension of these applications is only limited by the number of polyurethane segments available. The floats were very durable. They could withstand the impact of boats, logs and being dragged both in and out of the water.

## DISCUSSION

### Kenai River Chinook Salmon Fishery

The Kenai River and its fishery resources have been the center of controversy for many years. The popularity of this system has caused concern for all user groups. It has been the subject of a Governor-appointed task force and the cause for legislation introduced by the current administration designed to place controls on the development of streamside habitat.

No group has been spared adverse publicity from one factor or another. The commercial fishermen blame the sport fishermen, the landowners blame the large powerboats, the local anglers blame the commercial guides, etc. The solution is not going to be simple and no solution will be satisfactory to all concerned. In March of 1984, the Board of Fisheries will take testimony on proposals concerning only the Kenai River recreational fishery. These proposals range from closing the commercial fishery, to closing the recreational fishery, to in-river allocation schemes. So much interest has been generated that the Board has decided to designate 2 days for public testimony in the local Kenai-Soldotna area in addition to the time spent receiving testimony in Anchorage as originally scheduled. Biologically, the salmon stocks are healthy and have shown an increasing trend in recent years. The major problems are allocative in nature. The concerns of the Department of Fish and Game centers around the possibility that runs may return to historic levels. At current effort levels, returns of chinook salmon at or near historic levels would be in jeopardy of overharvest if the various fisheries were conducted as they were in 1983. The immediate response of the Department would be extensive closures in either the recreational, commercial, or both fisheries. Although, this may be biologically acceptable, it is not going to be socially or politically acceptable as a long-term solution.

If current fishing pressure remains constant or increases and the chinook salmon runs return at levels reduced from the last few years, some method of restricting efficiency of the recreational fishery while not restricting the opportunity offers one of the more reasonable solutions. Some suggestions have been various forms of a drift fishery in the river, similar to that used by many streams in the Pacific Northwest. The only certainty is that the status quo is not suitable as a long-term solution. Some changes will be necessary in future years.

### Capture Techniques

Utilizing drift gill nets in the Kenai River has proven successful in capturing large numbers of adult chinook salmon. However, this technique may be physically detrimental to the fish captured. Other capturing techniques should be explored. Two additional capture techniques which may have merit are fishwheels and seines. The fishwheel, used briefly during August, 1983, may be practical for intertidal use if the following improvements are incorporated:

1. The weir must be independent of the fishwheel. This would prevent the fishwheel from raising the weir during periods of high tide.
2. The weir should be a semipermanent structure capable of being installed and dismantled seasonally, yet stout enough to withstand river debris, tidal changes and strong water pressures.
3. The live box float assembly should be independent of the fishwheel float assembly. This would prevent unnecessary stress to fishwheel floats which tend to offset the fishwheel axle.
4. The fishwheel and live box assemblies need to slide vertically on a guide with each tidal fluctuation. This would keep them in proper alignment with the weir. Driving pilings may be a solution.
5. The basket fabric should be replaced with a more rigid material. The net material currently used stretches and delays the removal of fish. This observation was made when captured fish were passed repetitively through the fishwheel system.
6. Baskets and paddles should be painted with camouflage paint to reduce underwater visibility.

Beach seining has been explored (Hammarstrom, 1980) with poor success. A commercial seine vessel may be more practical. A commercial vessel at the mouth of the Kenai River may be able to sample a large percentage of the river width. Also, the sport fishery does not extend to the mouth of the Kenai River. If successful, adult chinook salmon would be tagged well below the sport fishery, and all tagged salmon would be equally available to the sport fishery.

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