

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

INVENTORY AND CATALOGING OF THE SPORT FISH AND
SPORT FISH WATERS IN SOUTHWESTERN ALASKA

by

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ACKNOWLEDGEMENTS

We greatly acknowledge the assistance and cooperation of the Kodiak Commercial Fisheries Division, United States Forest Service and the National Marine Fisheries Service.

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RESEARCH PROJECT SEGMENT

State: ALASKA Name: Sport Fish Investigations
of Alaska

Project No.: F-9-13

Study No.: G-I Study Title: INVENTORY AND CATALOGING

Job No.: G-I-B Job Title: Inventory and Cataloging
of the Sport Fish and
Sport Fish Waters in
Southwestern Alaska

Cooperators: Frank Van Hulle and John B. Murray

Period Covered: July 1, 1980 to June 30, 1981

ABSTRACT

Catalog and inventory studies determined 10 of 12 waters on north Shuyak Island contained natural populations of Dolly Varden, Salvelinus malma (Walbaum), and coho salmon, Oncorhynchus kisutch (Walbaum). Four of these waters also contained rainbow trout, Salmo gairdneri Richardson, and sockeye salmon, Oncorhynchus nerka (Walbaum); and two lakes were found barren of fish. Five Afognak Island lakes were investigated and determined unsuitable for rearing rainbow trout brood stock. Follow-up surveys of Afognak River and Big Kitoi Lake rainbow trout were conducted. The Kitoi rainbow population estimate was $3,237 \pm 289$ fish and a summary of fish counted and fish age-growth data from both waters is presented.

Karluk Lagoon weir escapement from May 30 to September 11, 1980, was comprised of 902 steelhead kelts, Salmo gairdneri Richardson; 4,810 chinook salmon, Oncorhynchus tshawytscha (Walbaum); 729 coho salmon; 2,359,051 pink salmon, Oncorhynchus gorbuscha (Walbaum); 144,513 sockeye salmon; and 50 immigrant adult steelhead. Age-growth data for Karluk River steelhead and chinook salmon and a summary of the weir count are presented.

Approximately 93,259 chinook salmon fingerlings (\bar{x} wt. = 0.69 g) were stocked in Lake Rose Tead on June 9, and adults should return in 1985 and 1986. Six Age 1.1 chinook salmon were caught during June and August, and two were observed. Angler-caught fish averaged 645.3 mm.

Mark and multiple recapture population estimates indicated Age I rainbow trout (Swanson River strain, wt. = 1,516/kg) stocked in six Kodiak-Afognak Island lakes demonstrated survival rates of 10.4 to 37.1 percent. Age 0 rainbow trout (Swanson River strain, wt. = 1,516/kg) stocked in Abercrombie

Lake had a 55.8 percent survival rate after 6 weeks residency. Coho salmon (856/kg) stocked in Pony Lake had a 37.1 percent survival rate at Age I, while coho salmon (733/kg) stocked in Southern Lake had a 50.1 percent survival rate at Age 0. Rainbow trout and coho salmon approached a catchable size (131.8-200.8 mm) at Age I and are expected to enter the sport fishery at Age II. Insufficient numbers of Arctic grayling, Thymallus arcticus (Pallas), Dolly Varden and large rainbow trout were captured to compute population estimates; however, a summary of age-growth data for all fish is presented.

Salmon escapement counts indicated a minimum of 327,055 pink salmon; 19,100 chum salmon, Oncorhynchus keta (Walbaum), 38,898 sockeye salmon; and 7,714 coho salmon spawned in 18 northeast Kodiak Island streams during 1980.

BACKGROUND

The primary goal of the Sport Fish Division projects in Region IV is to optimize the survival and growth of resident and stocked game fish and to maintain the natural runs of anadromous fish.

Region IV is the Kodiak-Afognak Island group and the Alaska Peninsula, south of a line from Cape Douglas to Port Heiden, including the Aleutian Islands. The Kodiak Island complex (Figure 1) is approximately 200 km long by 120 km wide, and the Alaska Peninsula section is 1,600 km long extending 800 km into the Bering Sea. The area is mountainous with numerous bays, lakes and streams, and contains both anadromous and resident fish. Much of the area has not been surveyed and the total number of fish producing waters is unknown. Kodiak Island has over 1,609 km of coastline, over 1,000 lakes 4 ha or larger in size, and 229 known anadromous fish streams.

A fish stocking program for Kodiak area lakes was initiated in 1953 and has continued to the present. However, in order to develop more successful programs, numerous lakes have since been chemically rehabilitated and various fish species have been stocked at differential rates. Different sizes of fish have been tested, and various habitat conditions have been studied to optimize growth and survival.

The physical and biological condition of lakes on northeast Kodiak Island has been examined in some detail and the results of these observations are shown in the annual Federal Aid in Fish Restoration Reports 1953-1980. Priority for research, stocking and general survey work has been centered on the areas of intensive sport fishing effort and on areas where specific data are required to evaluate anticipated land use programs or development activities. Past stream research has centered on waters with steelhead, rainbow trout, coho salmon and chinook salmon; however, increases in fishing effort indicate these studies should be intensified. This report presents specific stream temperature, stream flow and related data which will form the basis for identifying programs to determine carrying capacity and areas of critical habitat for salmon, Dolly Varden and trout.



Figure 1. Map of the Kodiak-Afognak Island Group. Scale 1: 1,250,000

The Federal Aid in Fish Restoration Reports for the Kodiak area from 1953 to the present depict specific data concerning the size, age and growth of coho salmon, Dolly Varden, chinook salmon, sockeye salmon, rainbow trout and steelhead from the Kodiak area. Additional data concerning harvest rates and spawning escapement are presented.

These data form the foundation for most management decisions concerning sport fish regulations and recommendations pertaining to land use activities which may affect respective Kodiak area fisheries.

Table 1 presents respective Kodiak area species.

RECOMMENDATIONS

1. Creel census on Buskin and Pasagshak Rivers should be conducted in 1981 to determine angler effort and harvest of Dolly Varden and salmon.
2. The producing waters on Afognak and Shuyak Islands, that remain as public waters following total implementation of the Alaska Native Claims Settlement Act, should be surveyed.
3. Survival, growth and quality of fishing produced by various species and races of fish stocked in Kodiak and Afognak Island lakes should be evaluated.
4. A study should be developed to determine the Dolly Varden population sizes in Kodiak roadside streams and the optimum allowable sport harvest.

OBJECTIVES

1. To determine the physical, chemical and biological characteristics of existing and potential sport fishing streams and lakes in the Kodiak area.
2. To establish magnitude, distribution, timing, yearly fluctuations and angler harvest of sport fish populations on Kodiak Island, Afognak Island and areas of concern to sport fisheries management on the Alaska Peninsula.
3. To investigate, evaluate and develop plans for the enhancement of anadromous and resident fish stocks.

TECHNIQUES USED

Standard techniques described by Van Hulle and Murray (1980), were used in conducting lake surveys, gill net sampling, age analysis, determination of fish size, escapements, harvest estimates and in collecting stream flows and temperatures.

Table 1. List of Common Names, Scientific Names and Abbreviations Used in this Report.

Common Name	Scientific Name and Author	Abbreviation
Arctic grayling	<u>Thymallus arcticus</u> (Pallas)	GR
Chinook salmon	<u>Oncorhynchus tshawytscha</u> (Walbaum)	KS
Chum salmon	<u>Oncorhynchus keta</u> (Walbaum)	CS
Coho salmon	<u>Oncorhynchus kisutch</u> (Walbaum)	SS
Dolly Varden	<u>Salvelinus malma</u> (Walbaum)	DV
Pink salmon	<u>Oncorhynchus gorbuscha</u> (Walbaum)	PS
Rainbow trout	<u>Salmo gairdneri</u> Richardson	RT
Sockeye salmon	<u>Oncorhynchus nerka</u> (Walbaum)	RS
Steelhead trout	<u>Salmo gairdneri</u> Richardson	SH
Threespine stickleback	<u>Gasterosteus aculeatus</u> Linnaeus	TS
Sculpin	<u>Cottus</u> sp.	SC

Fish population estimates in all lakes studied were made by the Regier and Robson (1967) mark and multiple recapture estimator. Fish were captured for sampling and marking by fyke nets of the following design: length = 3.7 m; diameter = 1 m; and two wings = 1.2 m x 7.6 m. Two square aluminum frames and five aluminum hoops supported the entrance and body of the fyke net. The wings, body and internal throats were constructed of 9.5 mm square mesh knotless nylon.

All fish captured by the fyke trap were anesthetized, sampled for age growth data, marked (top caudal clip) and released in the center of the lake for dispersion.

One June 9, 93,259 chinook salmon (0.69 grams per fish) were introduced into Lake Rose Tead.

Lake and Stream Surveys

Afognak Island:

Ruth Lake, Midarm Lake, Upper and Lower Jennifer Lakes and Little Kitoi Lake on east Afognak Island were investigated July 28 through July 30 to determine their suitability for a rainbow trout hatchery brood program. The surveys were not extensive, however, and we found no suitable spawning areas and rainbow trout were not captured or observed (Table 2). These waters were not suitable for this program.

Rainbow trout populations in Big Kitoi Lake and Afognak River were identified as potential stocks for a pilot egg-take in 1979 (Van Hulle and Murray, 1980). These waters were subsequently resampled to gain a broader data base and further define the population parameters. Five fyke traps set in Big Kitoi Lake August 5 through August 13 for 576 fyke trap hours, captured 347 rainbow trout and 130 Dolly Varden. The population estimate presented in Table 3 indicated a population size of $3,237 \pm 829$ rainbow trout and $1,567 \pm 425$ Dolly Varden. Fifty-two Age I, 157 Age II, 95 Age III, 34 Age IV and 9 Age V rainbow trout were captured with respective mean lengths of 94.1 mm, 152.8 mm, 216.6 mm, 270.5 mm and 327.4 mm. Approximately 40 hours of hook and line sampling at Afognak River on June 4 and June 25-27 captured 425 rainbow trout or 6.1 fish per hour. The sample contained 39 Age I, 63 Age II, 35 Age III, 34 Age IV and 34 Age V trout, with respective mean lengths of 11.3 mm, 173.6 mm, 197.4 mm, 239.5 mm and 283.0 mm. Twenty trout had regenerate or unreadable scales.

Data collected for the past 2 years indicate Kitoi Lake and Afognak River have sizeable rainbow trout populations, however, for the following reasons Kitoi Lake appears to have greater potential for an experimental rainbow trout egg-take:

1. Kitoi Lake does not have an active sport fishery.
2. The lake is located within a 15-minute hike from the Kitoi Bay Fish Hatchery.

Table 2. Summary of Morphometric and Fish Sampling Data for Five Afognak Island Lakes Surveyed July 28-July 30, 1980.

Lake Name and Location	Surface Area (ha)	Volume (m ³)	Average Depth (m)	Maximum Depth (m)	Inlets Suitable for Spawning		Fish	
					Number	Flow (cms)	Species Observed	Number* Captured
Little Kitoi T23S, R19W Sec. 10	38.6	4.174 x 10 ⁷	10.8	26.8	1	0.18	TS DV RS SS	TST-226 DV - 43 RS - 5 SS - 93
Ruth T23S, R19W Sec. 12	19.2	1.245 x 10 ⁷	6.2	17.1	None	Two Bog Seeps Observed	None	NS
Midarm T23S, R19W Sec. 12	5.2	0.340 x 10 ⁷	6.6	12.2	None	One Bog Seep Observed	TS	NS
Upper Jennifer T23S, R19W Sec. 12	40.7	4.348 x 10 ⁷	10.7	26.5	None	Three Bog Seeps Observed	DV TS	NS
Lower Jennifer T23S, R19W Sec. 13	17.9	1.811 x 10 ⁷	10.1	26.2	None	Two Bog Seeps Observed	DV TS	NS

* Little Kitoi Lake fish were captured via variable mesh gill nets (25.0 hrs) and minnow traps (42.5 hrs).

DV = Dolly Varden
RS = Sockeye Salmon
SS = Coho Salmon

TS = Threespine Stickleback
NS = Not Sampled as inlets were not suitable for spawning

Table 3. Sampling Summary of 10 Kodiak-Afognak Island Lakes, 1980.

Water Name & Location	Date Sampled	Species	Number	Age	Length (mm)		Weight (g)		Population Estimate		Percent Survival	Date Stocked	Number Stocked	Per kg	Per ha
					x	+S.D.	x	+S.D.	Number	+S.E.					
Abercrombie T27S, R19W Sec. 15	10-15*	RT(S)	139	0	31.4	7.5	6.6	1.8	2,061	61	55.8	3-25-80	3,695	1,004	433
	thru	RT(S)	341	I	200.8	20.2	92.9	29.0	628	19	33.0	9-13-79	1,900	1,516	247
	10-20	RT(AE)	4	III	334.0	...	452.0	...	NE	...	NE	6-21-77	2,391	1,097	316
	10-15*	Gr	4	I	132.8	...	23.0	...	NE	...	NE	Natural Reproduction			
	thru	Gr	3	III	254.3	...	146.3	...	NE	...	NE	6-21-77	10,000	fry	1,322
	10-20	Gr	1	IV	318.0	...	342.0	...	NE	...	NE	6-25-76	25,000	fry	3,304
Bull Lake T31S, R20W Sec. 35	8-26* thru 8-29	RT(S)	113	I	182.8	27.4	78.7	30.3	156	12	15.6	9-13-79	1,000	1,516	250
Lilly Pond T28S, R20W Sec. 27	8-13* thru 8-22	RT(S)	193	I	169.8	17.0	60.0	16.5	779	29	37.1	9-13-79	2,100	1,516	656
Long Lake T27S, R19W Sec. 34	9-2*	RT(S)	221	I	131.8	22.4	24.0	10.2	370	28	10.4	9-13-79	3,550	1,516	243
	thru	RT(S)	23	II	246.3	20.9	165.9	41.8	NE	...	NE	8-24-73	5,200	976	357
	9-6	RT(AE)	15	III	287.3	15.0	276.9	49.1	NE	...	NE	6-21-77	2,689	1,097	184
		RT(O)	6	IV	358.3	33.7	437.3	30.1	NE	...	NE	8-05-76	2,700	2,436	186
	9-2	Gr	75	III	230.9	12.1	128.6	17.9	NE	...	NE	6-21-77	10,000	fry	686
	thru	Gr	6	IV	266.7	9.6	178.0	19.3	NE	...	NE	6-25-76	25,000	fry	1,714
	9-2 thru 9-6	DV	191	NA	138.5	34.0	69.8	35.0	Pop. est. for all age classes equal 494 ± 68		NE	Natural Reproduction			

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Table 3. (Continued) Sampling Summary of 10 Kodiak-Afognak Island Lakes, 1980.

Water Name & Location	Date Sampled	Species	Number	Age	Length (mm)		Weight (g)		Population Estimate		Percent Survival	Date Stocked	Number Stocked	Per kg	Per ha	
					x	+S.D.	x	+S.D.	Number	+S.E.						
Lupine Lake T31S, R20W Sec. 35	11-4* thru 11-6	RT(T)	13	0	116.3	8.7	16.7	4.6	NE	...	NE	7-19-80	1,600	1,102	500	
		RT(S)	3	I	198.7	20.4	83.7	23.2	NE	...	NE	9-13-79	800	1,516	250	
Pony Lake T19S, R19W Sec. 36	10-22* thru 10-28	SS	286	I	152.1	7.3	37.0	7.2	594*** (Age I, II, &		37.1	6-6-79	1,600	856	276	
		SS	72	II	179.8	12.5	57.2	8.3	123	III pop. est.		7.7	6-2-78	1,600	852	276
		SS	18	III	212.6	13.3	86.1	19.9	31	= 748 ± 44)		1.9	6-21-77	1,595	1,227	275
Southern Lake T28S, R19W Sec. 14	9-22* thru 10-3	SS	210	0	105.0	10.5	13.0	3.6	1,754	119	50.1	5-28-80	3,500	733	494	
		SS	91	II	220.5	14.0	112.2	24.0	374*** (Age II & III		12.5	6-02-78	3,000	852	423	
		SS	25	III	254.9	14.9	179.8	39.4	103	pop. est. =		3.4	6-21-77	3,008	1,227	423
Delphin Bay Lake #13566 T21S, R19W Sec. 30	9-16 thru 9-19	RT(S)	397	I	174.2	27.0	66.3	30.9	1,150	477 ± 829)	31.1	9-19-79	3,695	1,516	366	
		DV	61	II	161.6	29.6	52.3	27.9	NE	...	NE	Natural Reproduction				
		DV	15	III	243.6	24.2	157.2	43.3	NE	...	NE	"	"			
		DV	5	IV	302.0	11.7	305.4	37.3	NE	...	NE	"	"			
Big Kitoi Lake T23S, R19W Sec. 16	8-5* thru 8-13	DV	130	NA	142.6	42.1	...	...	1,567	425	NE	Natural Reproduction			
		RT	52	I	94.1	10.3	...	...	(Pop. est. for all		NE	"	"		
		RT	157	II	152.8	19.3	...	...	age classes equal		NE	"	"		
		RT	95	III	216.6	18.4	...	...	3,237 ± 829)		NE	"	"		
		RT	34	IV	270.5	13.2	...	...			NE	"	"		
		RT	9	V	327.4	28.5	...	...			NE	"	"		

Table 3. (Continued) Sampling Summary of 10 Kodiak-Afognak Island Lakes, 1980.

Water Name & Location	Date Sampled	Species	Number	Age	Length (mm)		Weight (g)		Population Estimate		Percent Survival	Date Stocked	Number Stocked	Per kg	Per ha
					x	+S.D.	x	+S.D.	Number	+S.E.					
Afognak River	6-4 & **	RT	39	I	113.3	10.7	...	...	NE for all		NE for all	Natural Reproduction			
T24S, R22W	6-25	RT	63	II	173.6	18.3	age classes			all classes	"	"	
Sec. 8	thru 6-27	RT	55	III	197.4	16.7	...	...				"	"
		RT	34	IV	239.5	14.9	...	...				"	"
		RT	34	V	283.0	15.5	...	...				"	"
		RT	20	NA	...	...	...	...				"	"

* Fish captured via fyke trap.

** Fish captured via hook and line.

*** Population estimate based on a percentage of each age class in the sample.

RT = Rainbow Trout

Gr = Arctic Grayling

DV = Dolly Varden

SS = Coho Salmon

S = Swanson River Stock

AE = Alaska-Ennis Stock

O = Green River Oregon Stock

T = Talarik Creek Stock

NE = No Estimate

NA = No Age of Regenerate Scales

3. Using a strain of trout native to the hatcherie's water supply will reduce the disease and pathogen risk factors.

Kodiak Island:

Abercrombie Lake. Abercrombie Lake has been stocked annually with rainbow trout and periodically with Arctic grayling since it was chemically rehabilitated in 1972. Five fyke nets set for 360 trap hours from October 15-20, 1980 captured 1,315 Age 0, 501 Age I (Swanson River strain), four Age III (Alaska Ennis strain) rainbow trout and 8 Arctic grayling. The population estimate for Age 0 and Age I rainbow trout (Table 3) was $2,061 \pm 61$ and 628 ± 19 fish with respective survival rates of 55.8% and 33.0%. Grayling and Age III rainbow trout were not recaptured. A sample of 139 Age 0 rainbow trout averaged 81.4 mm and 6.6 g, while 341 Age I trout average 200.8 mm and 92.9 g. The lake is situated in a State Park and supports a fishery which probably harvested a portion of these fish. The grayling sampled contained 4 Age I, 3 Age II, and 1 Age IV fish with respective mean lengths of 132.8 mm, 254.3 mm, and 318.0 mm.

Bull Lake. Bull Lake was stocked with 1,000 rainbow trout (Swanson River strain, wt. = 1,516/kg) September 13, 1979. It contained only a small population of rainbow trout which were stocked in July 1977. Five fyke nets set in the lake August 26-29, 1980 for 321 trap hours captured 113 Age I rainbow trout with a mean size of 182.8 mm, and 78.7 grams. The population estimate as presented in Table 3 was 156 ± 12 fish with an estimated survival rate of 15.6%. The actual survival may have been higher. The lake has a small outlet over impassable falls to saltwater and fish may have migrated from the lake.

Lilly Pond. Lilly Pond was stocked with 2,100 rainbow trout (Swanson River strain, wt. = 1,516/kg) on September 13, 1979. It was rehabilitated in 1974 and contained a small population of rainbow trout which were stocked in 1976. Five fyke traps set in the lake August 18-22, 1980 for 420 trap hours captured 557 Age I rainbow trout with a mean size of 169.8 mm and 60.0 g. The population estimate as presented in Table 3 was 779 ± 29 fish with an estimated survival rate of 37.1%. This pond is land-locked, and probably did not receive significant angling effort on Age I trout. The survival rate is considered excellent for the size of fish and stocking techniques used.

Long Lake. Long Lake has been stocked annually with rainbow trout and periodically with Arctic grayling since it was chemically rehabilitated in 1973. Five fyke nets set in the lake from September 2-6, 1980 for 480 trap hours, captured 221 Age I and 44 Age II or older rainbow trout, 83 Arctic grayling, 191 Dolly Varden and numerous threespine stickleback. Population estimates for the above fishes, as presented in Table 3, were 370 ± 28 Age I rainbow trout with an estimated survival rate of 10.4% and 494 ± 68 Dolly Varden (all age classes). Insufficient numbers of grayling and Age II or older rainbow trout were captured or recaptured to compute population sizes. The 75 Age III grayling sampled averaged 230.9 mm and 128.6 g. The conspicuous absence of Age II grayling probably resulted from threespine stickleback reinhabiting the lake and devouring the 1978 sac fry plants.

Consequently, grayling will probably be eliminated from these waters by stickleback predation in the next 3 or 4 years. The 191 Dolly Varden captured had a mean length of 188.5 mm and a range of 82.0-305.0 mm. The 221 Age I rainbow trout (Swanson River strain) averaged 131.8 mm and 24.0 g, while 23 Age II, 15 Age III and 6 Age IV rainbow trout had respective mean lengths of 246.3 mm, 287.3 mm and 358.3 mm.

Long Lake and Abercrombie Lake are similar in size, geographic area and management history. They were both rehabilitated in 1973 and restocked with trout and grayling. The major differences in these lakes are that Abercrombie probably receives more fishing effort and has not become re-infested with stickleback. It is very significant that survival of Swanson trout to Age I was a minimum of 33.0% in Abercrombie Lake as opposed to 10.4% in Long Lake. There could be other factors, however, the presence of stickleback in Long Lake appears to be a significant factor in reduced survival for the stocked Swanson River trout.

Lupine Lake. Lupine Lake was stocked with 800 Swanson River rainbow trout (1,516/kg) on September 13, 1979. It may have contained a small population of rainbow trout (Ennis, Montana strain) that were stocked in July 1977. Three fyke nets set in the lake November 4-6, 1980 for 240 trap hours captured three Age I (\bar{x} ln = 198.7 mm, \bar{x} wt = 83.7 g) and 13 Age 0 (\bar{x} = 116.3, \bar{x} wt = 16.7 g) rainbow trout and no other fish. The population size and survival rate were undetermined as insufficient numbers of fish were captured or recaptured. However, it is obvious that few fish were in the lake. This is a 3.0 hectare pond with a maximum depth of 2.1 meters and a small outlet flows to the salt water. Fishing mortality, competition and stocking methods were probably not the reason for the apparent stocking failure. The nature of the trout or lake conditions may have caused these fish to migrate to salt water. Also the cold November water temperature (0-2° surface) may not have been conducive to fyke-trapping the trout actually in the lake.

Pony Lake. Pony Lake has been stocked annually with coho salmon since 1970. The lake has never been rehabilitated and it contains a large population of threespine stickleback. Fyke net trapping during October 22-28, 1980 captured 440 landlocked coho in 362 trap hours. A total of 286 Age I, 72 Age II and 18 Age III fish were sampled with respective mean lengths of 152.1 mm, 179.8 mm and 212.6 mm. The population estimate for all age classes as presented in Table 3 indicated 748 ± 44 coho salmon were in the lake. The population size by age class (based on the age composition of Age I = 79.5%, Age II = 16.4%, Age III = 4.1%) was 594 Age I, 123 Age II and 31 Age III coho salmon. The respective survival rates were calculated at 37.1%, 7.7%, and 1.9%.

Southern Lake. Southern Lake has been stocked annually with coho salmon since 1971, except in 1979. The lake has never been rehabilitated and it contains a large population of threespine stickleback. Fyke net trapping during September 22-October 3, 1980, captured 868 landlocked coho in 480 trap hours. The 210 Age 0, 91 Age II and 25 Age III fish sampled had respective mean lengths of 105.0 mm, 220.5 mm and 254.9 mm. The population estimates for two size classes of fish identified in the field (Table 3)

were $1,754 \pm 119$ Age 0 coho salmon (small fish $F < 150$ mm), and 477 ± 105 Age II and Age III coho salmon (large fish ≥ 150). The latter population estimate broken down by a percentage of each age class sampled (Age II 78.4%, Age III - 21.6%) yielded 374 Age II and 103 Age III landlocked coho salmon. Survival rates for these age groups of fish were 50.1%, 12.5% and 3.4% respectively.

Southern and Pony Lakes have similar physical properties, water quality and stocking histories (Van Hulle and Murray, 1971-1979); however, respective stocking rates since 1975 have been 423-494 and 275-276 coho per hectare. A comparison of Age II coho shows Southern Lake fish are 18.5% longer (41 mm) and had a 4.8% better survival rate than Pony Lake fish. Also, the Age 0 Southern Lake coho had an excellent survival rate of 50.1%. These data suggest it may be more desirable to stock coho on an alternative year basis when working with landlocked lakes containing large populations of threespine stickleback.

Delphin Bay Lake #13566. Delphin Bay Lake was initially surveyed in 1974 and determined to be an excellent experimental lake for stocking rainbow trout (Van Hulle and Murray, 1975). It was chemically rehabilitated (0.5 ppm Pronox Fish) in September 1978 and stocked with 3,695 Swanson River rainbow trout at 1,516/kg on September 19, 1979. A gabion fish barrier installed on the lake outlet in October 1978 washed out and was replaced in June 1980. Fish immigration may have occurred while the barrier was inoperable; however, char were captured in the lake after rehabilitation and prior to the washout (pers. comm., 1979, Ralph Browning, USFS, Kodiak, Alaska) thus indicating an incomplete fish kill. Dolly Varden were also observed throughout the system during a September 16-19, 1980 survey while threespine stickleback were seen only in the outlet below a 1-meter falls. Fyke net traps fished for 312 hours captured 81 Dolly Varden, 650 rainbow trout and no threespine stickleback. The Dolly Varden population size was not determined; however, 61 Age II, 15 Age III and 5 Age IV char were captured with respective mean lengths of 161.6 mm, 243.6 mm and 302.0 mm. The trout population estimate as presented in Table 3 was $1,150 \pm 43$ fish (\bar{x} ln. = 174.2 mm, \bar{x} wt = 66.3 g) with a minimum estimated survival rate of 31.1%. Actual survival may have been higher, as stocked trout can migrate from this lake to the outlet. Delphin Bay Lake #13566 was the first water ever chemically rehabilitated on Afognak Island and subsequently stocked with rainbow trout. At Age I these fish had sufficient growth and survival rates to provide an excellent sport fishery. Since Lake #13566 is remote and exploitation is light, this information may be used as base line data for stocking similar Afognak Island lakes.

Roadside Stream Flows and Temperatures. Stream flows and water temperatures were collected during 1980 from five roadside streams to determine relative fluctuations in the stream discharge and the annual thermal units produced by each stream. Monthly flow readings for American River, Buskin River, Olds River, Roslyn Creek and Salonie Creek (Figures 2 and 3) indicate the highest flow occurred in Buskin River (28.5 cms) and the lowest in Roslyn River (0.2 cms). Generally speaking, flows were high in June and September and lower during August and winter months. These findings are similar to those of 1978 and 1979 (Van Hulle and Murray, 1979 and 1980),

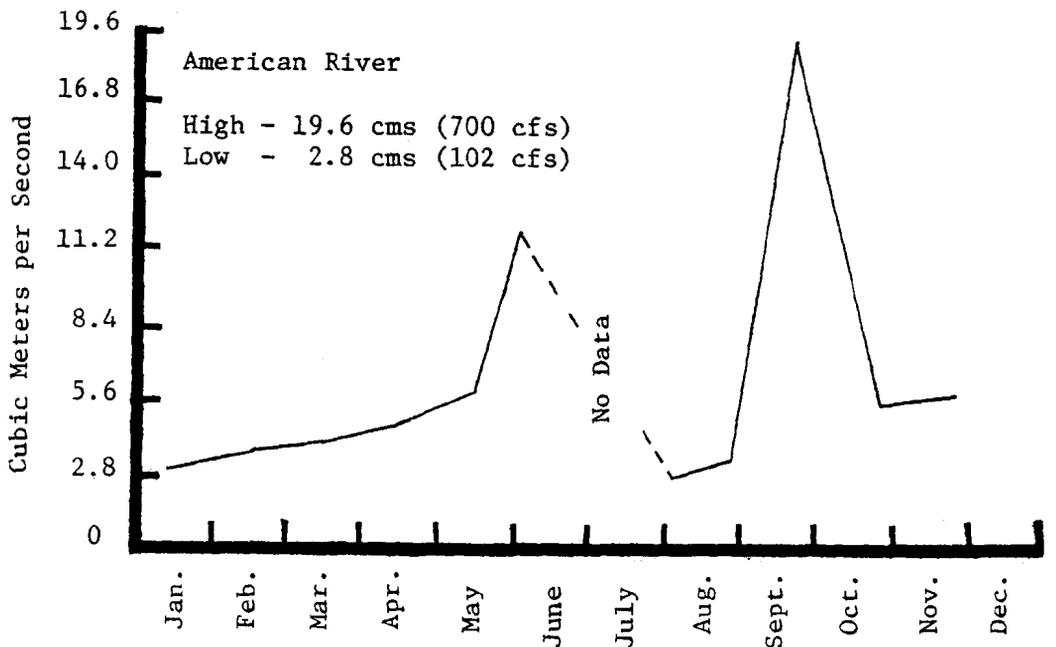
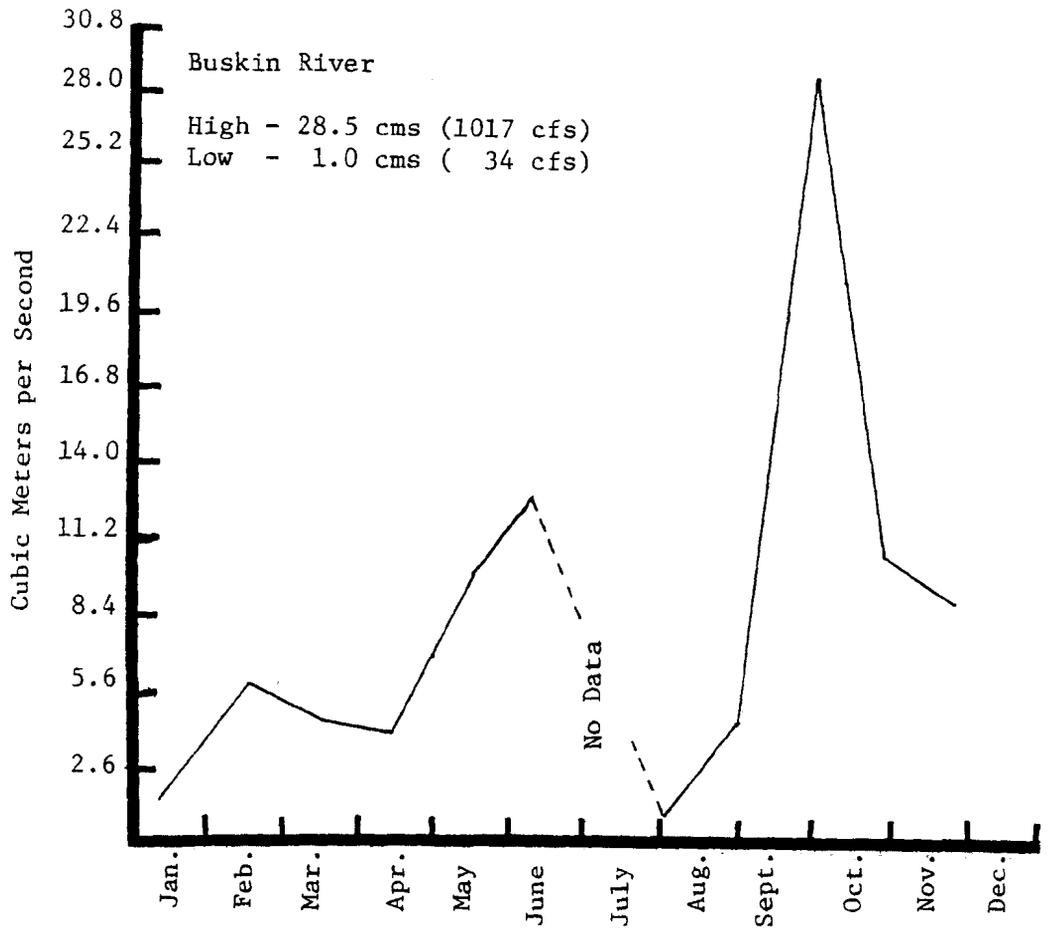


Figure 2. Flow Readings for American River and Buskin River January, 1980 through December, 1980.

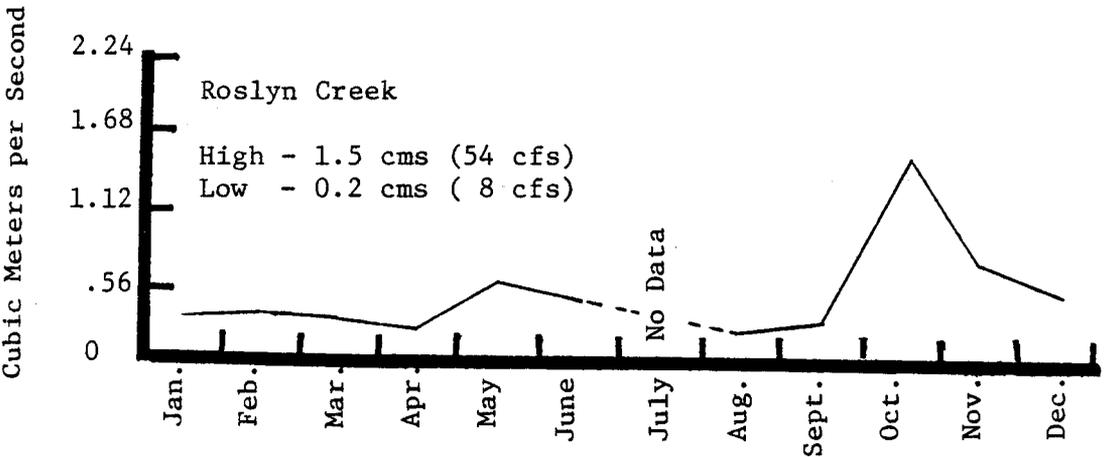
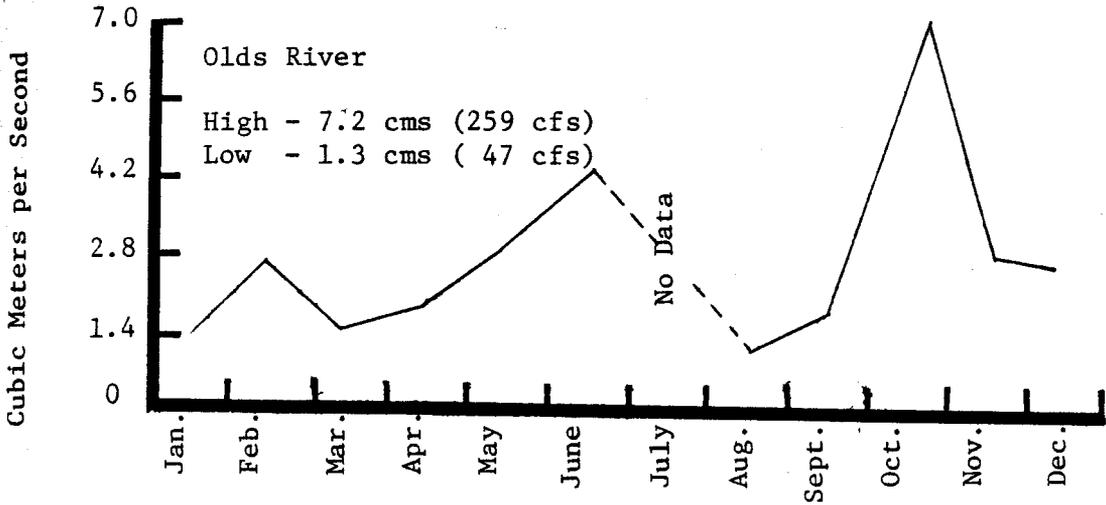
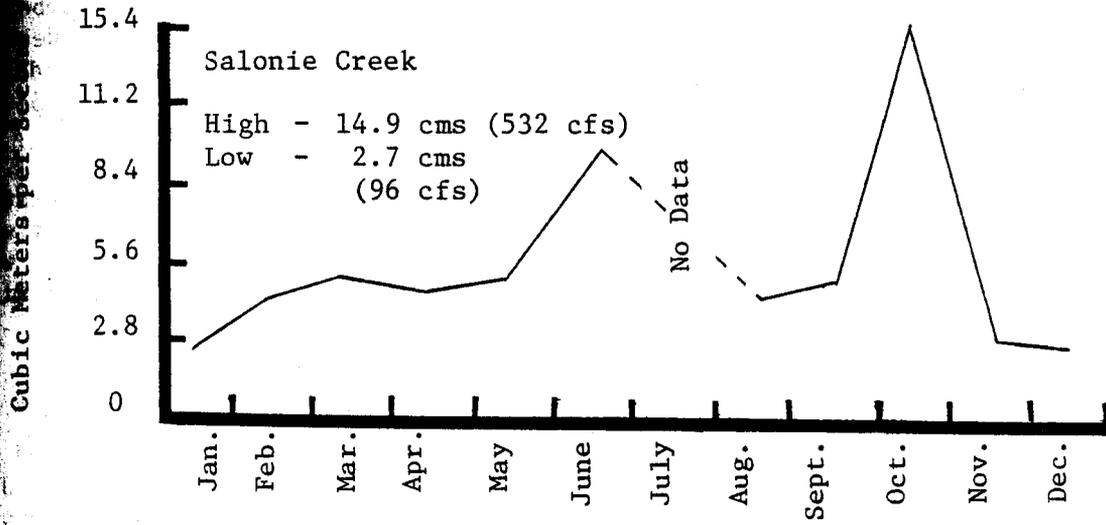


Figure 3. Flow Readings for Roslyn Creek, Olds River and Salonie Creek January, 1980 through December, 1980.

suggesting an annual winter and mid-summer low flow period with freshets occurring in the spring and fall. A summary of daily water temperatures for the above waters as presented in Table 4 shows the highest number of temperature units occurred in Buskin River (2,084.0°C) and the lowest in Salonie Creek (1,444.5°C). All streams reached a daily low of 0.0°C during January and/or February while only Buskin River reached a high of 16.5°C in August.

The above physical data provide vital information regarding the temperature and flow regimes under which fishes of the specific waters live. It will be helpful in establishing minimum flows and useful to correlate with annual fish production once stream surveys and specific fish survival information are completed and analyzed.

Shuyak Island:

Figure 4 shows the total length of Shuyak Island coastline inventoried for fish producing streams in 1975 (Van Hulle and Murray, 1976) and from July 8-13, 1980. Table 5 shows the fish sampling results of the 1980 surveys and Table 6 presents minimum estimate of the adult fish produced annually by these Shuyak Island streams. Field notes and more detailed descriptions of these waters are available in the Kodiak lake and stream file.

These surveys indicate that there are at least 10 streams on North Shuyak Island producing a minimum of 6,700-11,200 sockeye and coho salmon, 21,000 or more steelhead/rainbow trout and over 30,000 Dolly Varden char. None of the systems surveyed contained chinook, pink or chum salmon.

Development and Enhancement of Anadromous Fish Populations:

Lake Rose Tead. Chinook salmon have been stocked annually in Lake Rose Tead, the head waters of Pasagshak River, since 1976 (Murray and Vav Hulle, 1977-1980). Five returning adults from these plants were observed in 1979 (Van Hulle and Murray, 1980), and the largest predicted return (based on fry smolting at Age 1.0) should occur in 1981 (Table 7). A streamside creel census will be conducted at this time to assess the number of sport caught chinook salmon.

A cursory creel census conducted on Pasagshak River June 22 through September 7, 1980 indicated 146 completed anglers fished 283 hours and retained 45 pink salmon, 32 Dolly Varden, 2 chum salmon, 17 coho salmon and 1 chinook salmon. Sport anglers brought in six chinook salmon and two additional chinooks were observed below the river bridge for a total of eight chinooks known to have returned in 1980.

The five sport caught Pasagshak chinook salmon were analyzed for age-growth, and were Age 1.1 with a mean length and weight (n=3) of 645.3 mm and 5.5 kg. Chinook salmon fry (n=93,259) stocked in Lake Rose Tead on June 9, 1980, averaged 0.69 g per fish or 1,449 fish/kg. Approximately 120 hours of minnow trapping in the lake shoals and inlets July 25, captured numerous Dolly Varden, threespine stickleback, juvenile coho salmon and no chinook salmon. Consequently, relative growth rates of the 1980 experimental chinook plant were undetermined.

Table 4. Temperature Data for Five Kodiak Streams as Determined by Ryan Recording Thermographs January 1, 1980 through December 31, 1980.

Temp °C	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
<u>Stream: American River</u>													
TU*	77.5	77.0	107.5	109.0	127.7	180.0	172.5	167.5	...	...	86.5	58.0	***
High	4.0	4.5	6.0	5.5	7.0	9.0	9.0	10.0	...	...	3.5	3.0	***
Low	0.5	0.0	2.0	2.0	2.5	3.0	3.5	4.0	...	...	2.0	1.5	***
Mean	2.0	2.7	3.5	3.5	4.1	6.0	5.7	5.8	...	...	2.9	1.9	...
<u>Stream: Buskin River</u>													
TU*	17.0	22.0	69.0**	110.0	133.0	254.0	393.0	390.0	341.5	212.0	101.0	41.5	2,084.0
High	1.0	1.0	...	4.0	5.5	10.5	15.5	16.5	13.0	9.0	5.0	2.0	16.5
Low	0.0	0.0	...	2.0	3.5	7.0	10.0	12.2	9.0	5.5	1.5	1.0	0.0
Mean	0.3	0.8	2.2	3.7	4.3	8.5	12.7	12.6	10.6	6.8	3.4	1.3	...
<u>Stream: Olds River</u>													
TU	55.0	42.5	83.0	78.5	139.5	191.0	298.5	289.5	228.0	173.0	131.0**	98.5	1,808.0
High	4.0	4.0	5.5	6.5	10.0	11.5	15.0	15.0	9.5	7.5	...	4.0	15.0
Low	0.0	0.0	0.5	1.5	3.0	4.0	6.0	6.0	5.5	3.0	...	1.0	0.0
Mean	1.8	1.5	2.7	2.6	4.5	6.4	9.6	9.3	7.6	5.4	4.4	3.2	...
<u>Stream: Roslyn Creek</u>													
TU	20.0	42.0**	70.5	105.0	155.5	216.5	301.5	291.0	226.0	170.5**	103.5	54.0	1,756.0
High	1.0	...	6.5	6.5	10.0	13.0	15.0	15.0	10.5	...	5.0	4.5	15.0
Low	0.0	...	0.5	2.5	4.0	4.0	5.5	5.5	4.5	...	1.0	0.5	0.0
Mean	0.6	1.5	2.4	3.5	5.0	7.0	9.7	9.4	7.3	5.5	3.3	1.7	...
<u>Stream: Salonie Creek</u>													
TU	55.5	83.5	112.5	114.0	122.0	134.5	160.0	172.5	163.5	148.0	117.5	62.0	1,444.5
High	3.0	4.5	7.5	7.5	6.5	7.5	8.5	9.5	8.5	6.0	5.0	2.5	9.5
Low	0.0	0.0	1.0	1.0	3.0	3.5	3.0	4.0	4.0	4.0	3.0	1.5	0.0
Mean	1.8	2.9	3.6	3.8	3.9	4.5	5.2	5.6	5.5	4.8	4.0	2.0	...

* TU = Temperature Units

** Thermograph inoperable .'. x temp. and TU are based on an average of data from the preceding and following month.

*** Data not available - thermograph inoperable for two months.

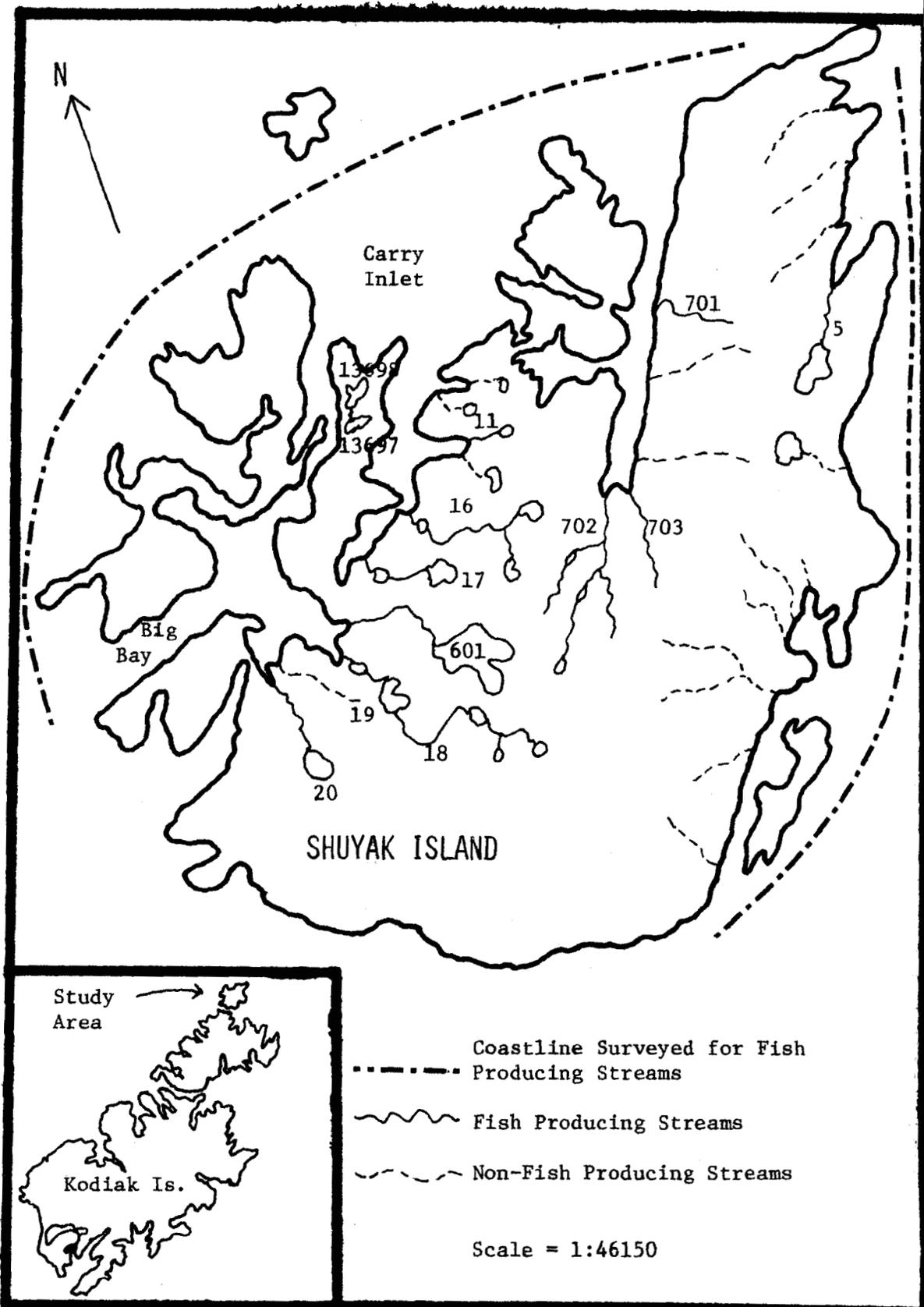


Figure 4. Location of Lakes Surveyed on Shuyak Island, 1980.

Table 5. Summary of Fish Sampling Data for Shuyak Island Lakes, 1980.

Water, Map* Reference & Location	Survey Date	Sur Water °C	Trap Hours	Net Hours	Fish** Species	Number Fish Captured	Length (mm)	
							x	Range
Carry Inlet, 17 T19S, R20W, Sec. 2	7/08	15 °	30.0	29.5	DV	11	228	112-282
					TS	29		
					SS	80	101	60-75mm
					RS	6	407	360-405
					RT	3	203	109-303
Skiff Passage Lake Numbers 13698 & 13697 T18S, R20W, Sec. 26	7/09	16 °	0.0	45.0	NO FISH			
Big Bay, 601 T19S, R20W, Sec. 10	7/11	16 °	54.0	23.0	DV	30	215	94-301
					SS	16	94	60-123
					RS	6	551	499-585
					RT	10	139	80-211
Big Bay, 18 T19S, R20W, Sec. 10	7/13	15 °	3.0	0.0	DV	3	...	65-100
					SS	16	...	55-90
					Sculpin	1	...	...
Big Bay, 20 T19S, R20W, Sec. 9	7/13	15 °	4.0	0.0	DV	16	...	30-150
					SS	20	...	60-125
					Sculpin	2	...	...

* See Figure

DV = Dolly Varden
 TS = Threespine Stickleback
 RS = Sockeye Salmon
 SS = Coho Salmon
 RT = Rainbow Trout
 SC = Sculpin

Table 6. An Estimate of the Number of Adult Fish Produced Annually by Surveyed Shuyak Island Stream-Lakes.

Area	Stream I.D.	Species			
		Coho	Sockeye	RT-SH	Dolly Varden
Shangin Bay	702	100-500	100-200	500+	5,000
	703	100	0	0	1,000
	701	100	0	0	500-1,000
Carry Inlet	11	100-300	0	0	1,000-2,000
	16	100-500	0	0	1,000-2,000
	17	500-1,000	1,000+	500+	5,000+
Big Bay	601	1,000-3,000	1,000	1,000-1,500	10,000
	18	1,000	0	0	5,000+
	20	1,000-1,500	0	0	1,000
	5	<u>500</u>	<u>100-500</u>	<u>100+</u>	<u>1,000</u>
Total		4,500-8,500	2,200-2,700	2,100-2,600	30,000-32,000

Table 7. Lake Rose Tead Chinook Salmon Plants and Year of Expected Return, Kodiak Island.

<u>Year Stocked</u>	<u>Number of Salmon Stocked</u>	<u>Year of Expected Return</u>	
		<u>Three Ocean Salmon</u>	<u>Four Ocean Salmon</u>
1976	22,500 fry	1980	1981
1977	133,109 fry	1981	1982
1978	14,261 smolt	1981	1984
1979	65,562 fry	1983	1984
1980	93,259 fry	1984	1985

Approximately 158,542 chinook salmon eggs were taken from 30 Chignik River females and fertilized with three males on September 2, 1980. These eggs are incubating in the Kitoi Bay Hatchery and will be stocked in Pasagshak as fry in June 1981.

Sport Fish Harvest Estimates

Creel censuses conducted at weir camps on southeast Kodiak Island and Afognak Island (Table 8) indicated fishing effort and harvest were low in relation to magnitude of available fish (Table 9). Fishing quality in all waters was considered excellent, and anglers usually released more fish than they retained. Karluk Lagoon received the most fishing pressure with a minimum of 382 anglers fishing 8,172 hours for an estimated harvest of 23 steelhead, three rainbow trout, 29 Dolly Varden, 270 coho salmon, 164 chinook salmon and 225 sockeye salmon. Total harvest for Karluk River was not determined as Karluk Portage was not included in the census.

Assessment and Inventory of Anadromous Fish Populations

Fish escapement estimates through the Karluk Lagoon weir between May 30 and September 11, 1980 were comprised of 4,810 chinook salmon, 902 steelhead kelts, 729 coho salmon, 50 immigrant steelhead, 2,359,051 pink salmon and 144,513 sockeye salmon. Table 10 presents weekly counts of the former three species, while Table 11 and 12 display age-growth and sex composition of angler-caught chinook salmon and steelhead trout. Age-growth and sex composition of 31 immigrant steelhead caught at Karluk Portage are presented in Table 13.

Age 1.3, 1.4 and 1.5 chinook salmon comprised 81.3% of the 80 fish sampled, while Age 1.2, 2.2, 2.3 and 2.4 comprised the remaining 18.7%. The dominant 1.4 age class contained 13 males and 27 females with respective mean lengths of 864.0 mm and 885.1 mm.

Steelhead kelts (n=12) sampled at Karluk Lagoon weir during June and July contained five age classes with only one repeat spawner, eight initial spawners and three unageable fish. The dominant 2.1S age class (n=4, 33.3%) contained one male (\bar{x} ln = 568.0 mm) and three females (\bar{x} ln = 548.3 mm) while Age 2.2S contained two males (\bar{x} ln = 722.5 mm). The male repeat spawner (Age 2.1S1S) spent 1 year plus (15 or 16 months) at sea spawning a second time.

Steelhead (n=31) sampled at Karluk Portage from October 10 through October 14 contained six age classes with five repeat spawners, 23 initial spawners and three unageable fish. The dominant Age class 2.2 (61.3%) contained 11 females and six males that respectively averaged 697.1 mm and 726.2 mm in length. Two additional Age 2.2 fish were captured but not sexed. The Age 2.1S1 male was one of 284 steelhead tagged in June 1979. It had grown 173 mm in length (532 mm to 705 mm) during 16 months residency at sea. One other tagged steelhead (#594) was reported captured by a native subsistence fisherman, however, age-growth data were not collected.

Table 8. Creel Census Estimates from Weir Camps at Afognak River, Ayakulik River, Olga Creek and Karluk Lagoon, 1980.

Area	Date	Number Anglers	Total		Steelhead*		Rainbow Trout		Dolly Varden		Coho		Chinook		Sockeye		Pink	
			Days	Hours	Rel.	Ret.	Rel.	Ret.	Rel.	Ret.	Rel.	Ret.	Rel.	Ret.	Rel.	Ret.	Rel.	Ret.
Afognak River	May 31- Aug. 3	22	66	252	0	1	45	130	46	52	0	0	0	0	37	63	5	13
Ayakulik River	June 1- July 4	20	52	244	95	1	0	0	0	0	0	0	146	4	94	15	0	0
Olga Creek	June 1- Sept. 6	14	14	46	0	0	31	38	49	5	0	13	0	0	0	1	0	0
Karluk River Lagoon	June 4- Sept. 21	204	627	3,200	33	19	3	3	12	29	0	0	131	156	54	66	0	0
Karluk Lodge	June 1- Oct. 9	178	586	4,972	154	4	0	0	0	0	4,739	270	148	38	811	159	0	0

Rel. = Released
Ret. = Retained

* Kelt steelhead (52) were caught between June 6 and July 4.

Table 9. Fish Escapement Counts Through Weirs on Kodiak and Afognak Islands, 1980.

<u>River</u>	<u>Sockeye Salmon</u>	<u>Chinook Salmon</u>	<u>Pink Salmon</u>	<u>Chum Salmon</u>	<u>Coho*</u> <u>Salmon</u>	<u>Steelhead*</u> <u>Trout</u>
Afognak	93,861	...	8,215	...	402	...
Upper Station	110,119	...	1,755	...	2,200	24
Ayakulik	363,229	974	857,627	46	511	29
Dog Salmon	405,525	66	6	28	...	...
Karluk Lagoon	144,513	4,810	2,359,051	262	729	50**

* Total coho and steelhead escapements were not counted as all weirs were pulled in August or early September.

** An additional 902 steelhead kelts moved down through the weir.

Table 10. Summary of Chinook, Coho and Steelhead Enumerated through Karluk Lagoon Weir, 1980.

Period	Chinook		SH Kelts				Up SH		Coho	
	No.	%	No.	%	Mortalities****	%	No.	%	No.	%
May 30 - June 5	691*	14.4	19	2.1	9	14.5	...	...	...	...
June 6 - 12	1,296**	26.9	14	1.6	5	8.1	...	...	...	...
June 13 - 19	1,171	24.4	13	1.4	6	9.7	...	...	...	...
June 20 - 26	708	14.7	50	5.6	14	22.6	...	...	...	...
June 27 - July 3	514	10.7	427	47.3	8	12.9	...	...	...	...
July 4 - 10	208	4.3	352	39.0	16	25.8	...	...	...	...
July 11 - 17	72	1.5	9	1.0	0	...	...	...	...	...
July 18 - 24	114	2.4	12	1.3	2	3.2	...	...	...	...
July 25 - 31	22	0.5	1	0.1	0	...	...	...	...	...
August 1 - 7	6	0.1	3	0.3	2	3.2	3	6.0	...	...
August 8 - 14	2	...	1	0.1	0	...	1	2.0	4	0.5
August 15 - 21	2	...	0	...	0	...	13	26.0	64	8.8
August 22 - 28	3	0.1	1	0.1	0	...	10	20.0	46	6.3
August 29 - Sept. 4	1	...	...	...	0	...	22	44.0	438	60.1
Sept. 5 - 11***	...	...	...	...	0	...	1	2.0	177	24.3
Total	4,810	100.0	902	99.9	62	100.0	50	100.0	729	100.0

* Weir not fish tight 5/28 to 6/04 - counts estimated.

** Weir not fish tight 6/06 to 6/07 - counts estimated.

*** Weir pulled on September 11.

**** Mortalities = Spawned-out, dead steelhead washed up on weir.

Table 11. Age, Sex and Composition of Karluk River Chinook Salmon, 1980.

Age Class	Males				Females				Total	%
	n	%	Length (mm)		n	%	Length (mm)			
			x	+S.D.			x	+S.D.		
1.2	3	7.5	621.7	36.2	2	5.0	655.0	49.5	5	6.2
1.3	15	37.5	753.1	82.5	...	...	...	...	15	18.8
1.4	13	32.5	864.0	57.2	27	67.5	885.1	75.9	40	50.0
1.5	4	10.0	940.3	25.7	6	15.0	919.7	40.4	10	12.5
2.2	...	...	...	...	1	2.5	558	0.0	1	1.2
2.3	2	5.0	688.5	176.1	2	5.0	761.5	161.9	4	5.0
2.4	<u>3</u>	<u>7.5</u>	839.0	52.4	<u>2</u>	<u>5.0</u>	824.0	161.2	<u>5</u>	<u>6.2</u>
Total	40	100.0			40	100.0			80	99.9

Table 12. Age, Sex and Size Composition of Karluk River Steelhead and Rainbow Trout, June and July, 1980.

Age	Brood* Year	Males				Females				Total	
		n	Percent	Length (mm)		n	Percent	Length (mm)		n	Percent
				x	+S.D.			x	+S.D.		
2.1S	1975	1	33.3	560	0.0	3	33.3	548.3	27.5	4	33.3
2.1S1S	1973	1	33.3	750	0.0	0	...	...	...	1	8.3
2.2S	1974	0	...	...	...	2	22.2	722.5	10.6	2	16.7
3.1S	1974	0	...	...	...	1	11.1	570	0.0	1	8.3
3.2S	1973	0	...	...	...	1	11.1	700	0.0	1	8.3
Regenerate ...		<u>1</u>	<u>33.3</u>	...	...	<u>2</u>	<u>22.2</u>	...	...	<u>3</u>	<u>25.0</u>
Total		3	99.9			9	99.9			12	99.9

* Brood Year = Year adults returned to spawn.

Table 13. Age, Sex and Size Composition of Karluk River Steelhead, October, 1980.

Age	Brood* Year	Males				Females				Unknown				Total	
		n	%	<u>Length (mm)</u> x	<u>+S.D.</u>	n	%	<u>Length (mm)</u> x	<u>+S.D.</u>	n	%	<u>Length (mm)</u> x	<u>+S.D.</u>	n	%
2.1	1976	0	...	...	...	0	...	...	...	2	40.0	546.0	18.4	2	6.4
2.1S	1975	3	23.1	628.3	16.1	0	...	...	...	0	...	...	...	3	9.7
2.1S1	1974	1	7.7	705.0	...	0	...	...	...	0	...	...	...	1	3.2
2.1SS	1974	1	7.7	760.0	0.0	0	...	...	...	0	...	...	...	1	3.2
2.2	1975	6	46.2	726.2	91.6	11	84.6	697.1	41.0	2	40.0	736.5	71.4	19	61.3
3.2	1974	1	7.7	610.0	0.0	0	...	...	...	1	20.0	826.0	0.0	2	6.4
Regenerate...		<u>1</u>	<u>7.7</u>	695.0	0.0	<u>2</u>	<u>15.4</u>	660.5	36.1	<u>0</u>	<u>...</u>	...	...	<u>3</u>	<u>9.7</u>
Total		13	100.1			13	100.0			5	100.0			31	99.9

* Brood Year = Year adults returned to spawn.

Northeast Kodiak Island Salmon Escapement

Peak salmon escapement estimates for Northeast Kodiak Island as presented in Table 14 indicated 327,055 pink salmon, 19,100 chum salmon, 38,898 sockeye salmon and 7,714 coho salmon spawned in 18 roadside streams. These peak counts were similar to previous escapements and considered sufficient to sustain the traditional sport harvest.

Table 14. Peak Salmon Escapement Estimates, N.E. Kodiak Island, 1980.

System	Chum Salmon		Coho Salmon		Pink Salmon		Sockeye Salmon	
	Date	Escpmt.***	Date	Escpmt.*	Date	Escpmt.	Date	Escpmt.
American	September 1	4,000	October 30	903	August 23	47,000	NA	...
Buskin	NC	...	October 27	1,021	August 20	95,000	August 15	3,814**
Chiniak	NC	...	November 8	32	August 20	5,500	NA	...
Hurst	NC	...	October 31	218	August 8	10,000	NA	...
Kalsin	NC	...	November 6****	240	July 13	75	NA	...
Monashka	NC	...	October 20	72	August 25	3,800	NA	...
Myrtle	NC	...	November 9	12	August 20	450	NA	...
Olds	August 23	8,500	October 28	780	August 8	67,700	NA	...
Panamaroff	NC	...	November 5	74	NC	...	NA	...
Pasagshak	NC	...	October 20- November 20	2,664	NC	...	August 19	3,484**
Pillar	NC	...	October 20	68	August 25	30	NA	...
Roslyn	NC	...	November 7	628	August 23	52,000	NA	...
Russian	August 20	4,000	October 30	30	August 20	8,000	NA	...
Salonie	August 20	1,400	October 30	741	August 20	3,000	NA	...
Saltery	August 8	1,200	November 7	212*****	Aug. 8	31,000	August 3	31,600***
Sargent	NC	...	October 30	18	August 20	2,800	NA	...
Twin	NC	...	November 18	1	August 23	350	NA	...
#410	NC	...	NC	...	August 23	350	NA	...
TOTAL		19,100		7,714		327,055		38,898

* Foot Survey
 ** Boat Survey
 *** Aerial Survey
 **** Includes 107 SS observed in Kalsin Pond
 ***** Outlet only
 NC = No Count
 NA = Not applicable

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