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Annual Performance Report for

KODIAK AREA ANGLER USE AND STOCK ASSESSMENT STUDIES

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ABSTRACT

Swanson strain rainbow trout, Salmo gairdneri Richardson, stocked as fingerlings on August 2, 1982 (weight = 972 fish/kilogram) in four Kodiak Island lakes, demonstrated survival rates of 8.0 to 27.3 percent at Age I. Age 0 rainbow trout (Swanson strain, weight = 871 fish/kilogram) stocked in Abercrombie Lake had a 63.4 percent survival rate after 7 weeks residency. Coho salmon, Oncorhynchus kisutch (Walbaum), stocked at 571 fish/kilogram in Southern Lake had a 33.4 percent survival rate at Age I. Rainbow trout and coho salmon were a catchable size (160.9-216.8 millimeters) at Age I and exploited by the sport fishery. Insufficient numbers of Arctic grayling, Thymallus arcticus (Pallas), Dolly Varden Salvelinus malma (Walbaum), and large rainbow trout were captured to compute population estimates; however, a summary of age-growth data for all fish is presented.

A total of 156,898 juvenile chinook salmon, Oncorhynchus tshawytscha (Walbaum), of Chignik origin (number = 119,499) and Lake Rose Tead origin (number = 37,399) were stocked in Lake Rose Tead on June 1, 1983. Spawning ground surveys and a creel census indicated a minimum of 36 adult chinook salmon returned from previous chinook fingerling plants. Ten adult chinook sampled for age-growth data were all Age 1.3 fish that returned from 65,652 fingerlings stocked in 1979. Approximately 14,380 Lake Rose Tead and 87,370 Chignik River chinook salmon eggs were taken for stocking in 1984. An additional 76,260 eggs were naturally deposited in the Lake Rose Tead system.

Volumetric surveys of Buskin Lake and Southern Lake indicated surface area of 101.5 and 7.0 hectares, respectively.

A creel census conducted on Buskin River between April 18 and October 16, 1983, indicated sport anglers fished 20,136 angler-days (35,802 hours) and harvested 6,668 spring run Dolly Varden, 1,142 sockeye salmon, Oncorhynchus nerka (Walbaum), 3,727 pink salmon, Oncorhynchus gorbuscha (Walbaum), 1,555 summer Dolly Varden and 936 coho salmon. A

summary of salmon and Dolly Varden age-growth and sex composition is presented.

An egg take conducted on Buskin River coho salmon on November 2, 1983 resulted in the acquisition of 40,000 green eggs from 13 females that were fertilized with five males.

Peak salmon escapement counts in 18 northeast Kodiak Island streams during 1983 indicated a minimum escapement of 223,050 pink salmon, 54,527 sockeye salmon, 32,200 chum salmon, Oncorhynchus keta (Walbaum), and 4,011 coho salmon.

KEY WORDS

Sport, effort, harvest, escapement, enhancement, salmon, steelhead, Kodiak, chinook.

BACKGROUND

The study area is comprised of 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. 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 that contain 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 301 known anadromous fish streams.

A fish stocking program for Kodiak area lakes was initiated in 1953 and has continued to the present. In order to develop more successful programs, numerous lakes have been chemically rehabilitated and stocked with various fish species at differential rates. Different sizes of fish have been tested and various habitat conditions have been studied to determine optimal 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 1953-1983. Priority for research, stocking and general survey work has been directed toward these areas.

Past stream research has centered on waters with steelhead trout, rainbow trout, coho and chinook salmon. Substantial increases in fishing effort suggest these studies should be intensified.

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 rate of Dolly Varden, rainbow trout, steelhead trout, coho, chinook and sockeye salmon from the Kodiak area. Additional data concerning harvest rates and spawning escapement are also presented.



Figure 1 . Map of the Kodiak-Afognak Island Group.

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

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

Table 1 presents a list of the fishes observed or studied in this report.

RECOMMENDATIONS

1. A study should be implemented to determine the salmonid carrying capacity of coho salmon streams on the Kodiak road system.
2. A study should be developed to determine the Dolly Varden population sizes in Kodiak roadside streams and the optimum allowable sport harvest.
3. A creel census should be conducted on the Pasagshak River in 1984 to determine angler effort and harvest of Dolly Varden and chinook salmon.
4. The fish-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.
5. Survival, growth and quality of fishing produced by various fish species and strains that have been stocked in Kodiak and Afognak Island lakes should be evaluated.
6. Portage Creek, Gretchen Creek, Laura Creek and Afognak River rainbow trout population parameters should be determined.
7. Hydrographic mapping of selected roadside lakes should be conducted to determine volume, mean depths and morphoedaphic index values.

OBJECTIVES

1. To determine physical, chemical and biological characteristics of four lakes on Kodiak Island during July and August.
2. To determine the magnitude, distribution, timing and yearly fluctuations of coho salmon, chinook salmon, rainbow/steelhead trout and Arctic grayling in Kodiak and Afognak Island lakes and streams from May through November.
3. To determine harvests and angler effort during the Dolly Varden fishery at the Buskin River in April and May and during the Pasagshak River chinook salmon fishery from June to August.

4. To investigate, evaluate and develop plans for the enhancement of chinook salmon, coho salmon and rainbow/steelhead trout in Lake Rose Tead, Lake Genevieve and the Buskin River from June through September.
5. To ensure and enhance public access to recreational fishing waters.

TECHNIQUES USED

Standard techniques described by Murray (1983) were used in age analysis, lake mapping, egg takes, determination of fish size, escapement counts and harvest estimates.

Fish population estimates in five lakes were determined by Regier and Robson's (1967) mark and multiple recapture estimator or the Peterson estimator (Ricker, 1970). Fish were captured for sampling and marking by fyke nets of the following size: 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 support the entrance and body of the fyke net. The wings, body and internal throats are constructed of 9.5 mm square mesh knotless nylon.

Fish captured by fyke traps were anesthetized, sampled for age-growth data, marked with a caudal clip and then released in the center of the lake for dispersion.

A total of 119,499 Chignik origin chinook salmon (\bar{x} wt = 0.9 g/fish) and 37,399 Lake Rose Tead origin chinook salmon (\bar{x} wt = 1.0 g/fish) were stocked in Lake Rose Tead on June 1, 1983. Coded wire tags were put on 15,661 Lake Rose Tead fingerlings and 14,670 Chignik fingerlings. All fish were held in a 3 m x 3 m x 3 m holding pen and fed Oregon Moist Pellets for 6 days before they were released.

FINDINGS

Development and Enhancement of Resident and Anadromous Fish Populations

Abercrombie Lake:

Abercrombie Lake has been stocked annually with rainbow trout and periodically with Arctic grayling since it was chemically rehabilitated in 1972. The only exception was in 1981 when Kodiak was not allocated rainbow trout for research or management purposes. On August 2, 1982 and August 22, 1983 the lake was stocked with 3,700 rainbow trout (Swanson Strain) that weighed 972/kg and 871/kg, respectively. Arctic grayling fry (n=20,000) were also stocked on June 4, 1983. Five fyke nets set for 600 trap-hours on October 10-14, 18 and 19, 1983 captured 1,627 Age 0, 304 Age I, two Age III rainbow trout and 0 Arctic grayling. The population estimate for Age 0 rainbow trout (Table 2) was 2,347 \pm 55 fish with an estimated survival rate of 63.4%. The population estimate

Table 2. Population Estimates of Age 0 and Age I Abercrombie Lake Rainbow Trout (Swanson Strain) from a Sequence of Samples, October 10 through 14, 18 and 19, 1983.

Sample	Experimental Results					Summary Statistics	Estimates	
	Catch	Marked Recaptures	Number Dead or Injured on Capture	Number of Marked Released	Un-Marked Catch	Cumulative Un-Marked Catch	Number Previously Dead or Injured	N ± S.E. (N)
<u>Age 0 Rainbow Trout:</u>								
1	859	0	49	810	859	859	0	0 ± 0
2	714	247	6	708	467	1,326	49	2390 ± 101
3	683	382	0	683	301	1,627	55	2347 ± 55
<u>Age I Rainbow Trout:</u>								
1	197	0	1	196	197	197	0	0 ± 0
2	119	43	0	119	76	273	1	543 ± 58
3	64	45	0	64	19	292	1	458 ± 30
4	60	48	0	60	12	304	1	420 ± 20

for Age I rainbow trout was 420 ± 20 fish with an estimated survival rate of 11.4%. Insufficient numbers of Age III rainbow trout were captured to compute a population estimate.

The low catch of Age III rainbow trout is probably due to exploitation of larger fish by the sport fishery and net avoidance. Age-growth data presented in Table 3 indicated 291 Age 0 rainbow trout averaged 79.7 mm and 5.6 g, while 197 Age I and two Age III rainbow trout averaged 204.4 mm and 293.5 mm, respectively. The absence of Arctic grayling is probably due to net avoidance and a small grayling population size. The latter is probably due to large numbers of threespine stickleback that have reinfested the lake. Rainbow trout production will probably also decline in the next 2 or 3 years and lake rehabilitation will be necessary to achieve maximum sport fish production.

Lilly Pond:

Lilly Pond has been stocked annually with rainbow trout or coho salmon fingerlings since it was chemically rehabilitated in 1970. The only exception was in 1981 when rainbow trout were not allocated for stocking. On August 2, 1982 and August 22, 1983, the lake was stocked with 1,600 rainbow trout that weighed 972/kg and 871/kg, respectively. Five fyke traps set in the lake September 15-18, 1983 for 480 trap-hours captured 713 Age 0 and 77 Age I rainbow trout. Threespine stickleback were not captured nor were they observed in the lake. The population estimate for Age 0 and Age I rainbow trout as presented in Table 4 was $1,679 \pm 112$ and 172 ± 32 with survival rates of 104.5% and 10.8%, respectively. Age growth data presented in Table 3 indicated 271 Age 0 rainbow trout averaged 72.5 mm and 3.7 g, while 77 Age I rainbow trout averaged 216.8 mm and 107.8 g. The unreasonably high survival ($n = 104.5\%$) of Age 0 rainbow is probably due to an error in the number of fish stocked or the population estimate. However, a high survival of these fish is evident as 713 unmarked Age 0 rainbow trout were captured. The low 10.8% survival of Age I rainbow trout is attributed to exploitation by the sport fishery.

Long Lake:

Long Lake has been stocked annually with rainbow trout and periodically with Arctic grayling since it was chemically rehabilitated in 1973. Rainbow trout were not stocked in 1981 as Kodiak was not allocated fish for stocking. In 1982, 3,600 rainbow trout (Swanson strain, \bar{x} wt = 972/kg) were stocked. Rainbow trout ($n = 4,056$, \bar{x} wt = 871/kg) and Arctic grayling fry ($n = 20,000$) were also stocked in 1983. Five fyke nets set in the lake from September 20-24, 1983, for a total of 480 trap-hours, captured four Age 0, 489 Age I and 72 Age III rainbow trout and numerous threespine stickleback. The population size of Age I rainbow trout as presented in Table 5 was 984 ± 68 with a survival rate of 27.3%. Survival of other fish was not determined. The mean size of Age I rainbow trout as presented in Table 3 was approximately 160.9 mm and 40 g. Insufficient numbers of grayling, Age 0 and Age III rainbow trout were captured or recaptured to compute population sizes. The small number of Arctic grayling captured ($n=6$) probably resulted from

Table 3. Sampling Summary of Five Kodiak Island Lakes, 1983.

Water Name and Location	Date Sample	Species	Number*		Length (mm)		Weight (g)		Population Estimate		Percent Survival	Date Stocked	Number Stocked	Per kg	Per ha
			Sampled	Age	\bar{x}	\pm S.D.	\bar{x}	\pm S.D.	Number	\pm S.E.					
Abercrombie	10/10-14	RT (S)	291	0	79.7	10.6	5.6	...**	2,347	55	63.4	8-22-83	3,700	871	489
T27S, R19W	18, 19	RT (S)	197	I	204.4	28.5	100.9	44.3	420	20	11.4	8-02-82	3,700	972	489
Sec. 15		RT (S)	2	III	293.5	4.9	288.0	22.6	NE	...	NE	8-25-80	3,695	1,005	488
Lilly Pond	9/15	RT (S)	271	0	72.5	5.5	3.7	...**	1,679	112	104.5	8-22-83	1,600	871	500
T28S, R20W	thru 9/18	RT (S)	77	I	216.8	32.4	107.8	56.4	172	32	10.8	8-02-82	1,600	972	500
Long Lake	9/20	RT (S)	4	0	79.8	11.6	...	...	NE	...	NE	8-22-83	4,056	871	278
T27S, R19W	thru	RT (S)	113	I	160.9	21.2	40.0	19.9	984	66	27.3	8-02-82	3,600	972	246
Sec. 34	9/24	RT (S)	72	III	273.1	27.8	209.0	65.7	NE	...	NE	8-27-80	5,415	1,005	371
		GR (J)	1	0	102.0	...	10.0	...	NE	...	NE	6-04-83	20,000	fry	2,644
		GR	3	II	209.7	3.8	90.0	9.2	NE	...	NE	Natural Reproduction			
		GR	2	IV	273.5	6.4	205.5	29.0	NE	...	NE	Natural Reproduction			
		DV	40	NA	199.4	51.2	87.1	58.1	NE	...	NE	Natural Reproduction			
Southern Lake	9/27-29	SS	186	I	168.8	13.6	51.6	15.1	1,182	NE	33.8	6-10-82	3,500	571	493
T28S, R19W	&	SS	12	III	265.3	27.7	205.2	75.7	NE	...	NE	5-28-80	3,500	741	493
Sec. 14	10/4														
Tanignak Lake	10/4	RT (S)	103	0	69.7	5.5	3.7	...**	NE	...	NE	8-22-83	10,624	871	891
T28S, R9W	thru	RT (S)	173	I	185.0	27.4	71.5	31.7	478	33	8.0	8-02-82	6,000	972	503
Sec. 3	10/7	RT (S)	24	III	277.0	56.4	249.0	146.4	NE	...	NE	8-27-80	5,476	1,005	455

* Fish captured via fyke trap.

** No S.D. as fish were weighed in one lot.

RT = Rainbow trout
 GR = Arctic grayling
 DV = Dolly Varden
 SS = Coho salmon

J = Jack Lake stock
 NE = No estimate
 NA = No age or regenerate scales
 S = Swanson stock

Table 4. Population Estimates of Age 0 and Age I Lilly Pond Rainbow Trout (Swanson Strain) from a Sequence of Four Samples, September 15 through 18, 1983.

Sample	Experimental Results				Summary Statistics		Estimates	
	Catch	Marked Recaptures	Number Dead or Injured on Capture	Number of Marked Released	Un-Marked Catch	Cumulative Un-Marked Catch	Number Previously Dead or Injured	N ± S.E. (N)
<u>Age I Rainbow Trout:</u>								
1	31	0	0	31	31	31	0	0 ± 0
2	30	7	1	29	23	54	0	133 ± 39
3	16	6	0	16	10	64	1	137 ± 29
4	17	4	0	17	13	77	1	172 ± 32
<u>Age 0 Rainbow Trout:</u>								
1	273	0	2	271	273	273	0	0 ± 0
2	149	21	12	137	128	401	2	1925 ± 375
3	118	32	4	114	86	487	14	1623 ± 189
4	313	87	2	311	226	713	18	1679 ± 112

Table 5. Population Estimates of Age I Long Lake Rainbow Trout from a Sequence of Four Samples, September 20 through September 24, 1983.

Sample	Experimental Results				Summary Statistics		Estimates	
	Catch	Marked Recaptures	Number Dead or Injured on Capture	Number of Marked Released	Un-Marked Catch	Cumulative Un-Marked Catch	Number Previously Dead or Injured	N ± S.E. (N)
<u>Age I Rainbow Trout:</u>								
1	111	0	1	110	111	111	0	0 ± 0
2	101	5	0	101	96	207	1	2223 ± 948
3	159	34	0	159	125	332	1	42 ± 3
4	242	85	0	242	157	489	1	984 ± 66

threespine stickleback reinhabiting the lake and devouring the sac fry plants. The 40 Dolly Varden captured had a mean length of 199.4 mm and weight of 87.1 g. Age III rainbow trout (n=72, Swanson strain) averaged 273.1 mm and 209.0 g.

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 stickleback have reestablished themselves within the last 2 years. It is significant that survival of Swanson trout to Age 0 was a minimum of 63.4% in Abercrombie Lake while less than 1% survived in Long Lake. There could be other factors; however, the long established presence of stickleback in Long Lake appears to be a significant factor in reduced survival for stocked Swanson trout.

Southern Lake:

Southern Lake has been stocked annually with coho salmon from 1971-1978 and semiannually since 1980 (n=3,500 per year). The lake has never been chemically rehabilitated and contains a large population of threespine stickleback. Fyke net trapping during September 27-29 and October 4, 1983, captured 323 landlocked coho salmon in 480 trap-hours. Age I (n=311) and Age III (n=12) fish were represented in the sample with respective mean lengths of 168.8 mm and 265.3 mm. Population size was determined by the Peterson estimator (Table 6) as a solution could not be found for the population size in sampling period number 3 (Table 7) in the mark-multiple recapture estimate. The population estimate for Age I coho salmon was 1,182 fish with a survival rate of 33.8%. Insufficient numbers of Age III coho were captured to compute a population size.

Stocking coho salmon in Southern Lake on alternate years appears to have little advantage over every year stocking; e.g., Age I coho salmon sampled from 1972 through 1979 had a mean length range of 162-179 mm (Van Hulle and Murray, 1973-1980), while Age I coho salmon averaged 173.9 mm and 168.8 mm in 1981 (Murray, 1982) and 1983 respectively. Age I survival was 31.5% in 1979, 45.2% in 1981 and 33.4% in 1983. The 1981 and 1983 survival rates (alternate year stocking) calculated over a 2-year period are only 22.6% and 16.7%, respectively. These data indicate alternate year stocking of coho salmon may produce similar sized but fewer Age I fish.

Tanignak Lake:

Tanignak Lake was stocked with 6,000 rainbow trout (Swanson strain wt = 972/kg) on August 2, 1982. It contained a threespine stickleback population and a rainbow trout population of unknown size. It was previously stocked with rainbow trout in 1977, 1979 and 1980. Five fyke nets set in the lake October 4-7, 1983, for 480 trap-hours, captured 103 Age 0 (\bar{x} ln = 69.7 mm, \bar{x} wt = 3.7 g) 292 Age I (\bar{x} ln = 185.0 mm, \bar{x} wt = 71.5 g) and 24 Age III (\bar{x} ln = 277 mm, \bar{x} wt = 249.0 g) rainbow trout. The population estimate for Age I fish (Table 8) was 478 ± 33 , with an

Table 6. Population Estimate of Southern Lake Landlocked Coho Salmon Utilizing the Peterson Estimator and Data from a Sequence of Four Samples, September 27, 28 and 29 and October 4, 1983.

Age I Landlocked Coho Salmon:

Peterson Estimator: $P = m(u+r)/r$

Population (P)	= 1,182	P = 248 (64 + 17)/17
Marked Fish (m)	= 248	P = 1,182
Unmarked Fish (u)	= 64	
Recaptured (r)	= 17	

Table 7. Population Estimates of Age I Southern Lake Landlocked Coho Salmon from a Sequence of Four Samples, September 27, 28 and 29, and October 4, 1983.

Sample	<u>Experimental Results</u>					<u>Summary Statistics</u>		<u>Estimates</u>
	Catch	Marked Recaptures	Number Dead or Injured on Capture	Number of Marked Released	Un-Marked Catch	Cumulative Un-Marked Catch	Number Previously Dead or Injured	N ± S.E. (N)
<u>Age I Landlocked Coho:</u>								
1	133	0	2	131	133	133	0	0 ± 0
2	54	1	0	54	53	186	2	7076 ± 7618
3	81	17	0	81	64	250	2	No Estimate*
4	82	21	0	82	61	311	2	No Estimate

* Iterative solution not found after 100 iterations for sampling Period No. 3.

Table 8. Population Estimates of Age 0 and Age I Tanignak Lake Rainbow Trout (Swanson Strain) from a Sequence of Three Samples, October 4 through October 7, 1983.

Sample	Experimental Results				Summary Statistics			Estimates
	Catch	Marked Recaptures	Number Dead or Injured on Capture	Number of Marked Released	Un-Marked Catch	Cumulative Un-Marked Catch	Number Previously Dead or Injured	$N \pm S.E.(N)$
<u>Age 0 Rainbow Trout:</u>								
1	16	0	1	16	16	16	0	0 ± 0
2	28	0	0	28	44	44	1	No Estimate*
3	62	3	0	62	59	103	1	No Estimate
<u>Age I Rainbow Trout:</u>								
1	105	0	0	105	105	105	0	0 ± 0
2	97	13	0	97	84	189	0	784 ± 189
3	179	76	1	178	103	292	0	478 ± 33

* Iterative solution not found after 100 iterations for sampling period No. 2.

estimated survival rate of 8.0%. Insufficient numbers of Age 0 and Age III rainbow trout were captured to compute a population size. Growth and survival of rainbow trout to Age I in Tanignak Lake has been superior to any Kodiak water infested with threespine stickleback (Murray, 1982). The only observed difference between it and other lakes is the numerous submerged trees throughout much of the bottom and shoreline. This additional cover may provide a substrate for aquatic organisms (more fish food) and shelter for small fish, both of which might increase survival. The low survival rate (8.0%) of Age I rainbow trout in 1983 is attributed to exploitation by the sport fishery.

Lake Rose Tead Chinook Salmon:

Chinook salmon have been stocked annually in Lake Rose Tead (Table 9), the headwaters of Pasagshak River, since 1976 (Murray and Van Hulle, 1977-1981). The first returning adults were observed in 1979 (n=5) and 1980 (n=8), and the largest return (n=80) occurred in 1981 (Murray, 1982). Both streamside and spot creel censuses have been and will be conducted in future years to assess angler effort and the number of sport-caught chinook salmon.

During July and early August, chinook salmon were not observed in the Lake Rose Tead system via foot and aerial surveys. Stream flows were extremely low at this time and it is presumed that most fish did not immigrate to fresh water until the freshets commenced in early September.

A cursory creel census conducted on Pasagshak River between July 1 and August 1, 1983 indicated 76 completed anglers fished 135 hours and retained 20 pink salmon, 8 chum salmon, 24 Dolly Varden and 1 chinook salmon. Sport anglers reported or brought in 13 additional chinook salmon to the Department for sampling. On August 23, 22 chinook salmon were observed in the lake for a total of 36 chinooks known to have returned in 1983. Ten Pasagshak chinook salmon analyzed for age-growth were comprised of four males and six females. Scale analysis indicated all fish smolted at Age 1.0 and all fish were Age 1.3. The males and females had respective mean lengths of 870 mm and 932 mm. The low observed chinook return (n=36) was expected as only 14,261 smolt and 65,652 fry were stocked in 1978 and 1979, respectively.

A total of 119,499 Chignik origin chinook salmon (\bar{x} wt = 0.9 g/fish) and 37,399 Lake Rose Tead origin chinook salmon (\bar{x} wt = 1.0 g/fish) were stocked in Lake Rose Tead on June 1, 1983. Coded wire tags were put in 15,661 Lake Rose Tead fingerlings and 14,670 Chignik fingerlings. The above fish (n=156,898), which were held in a 3 m x 3 m x 3 m pen and fed Oregon Moist Pellet for 6 days weighed 1.4 g/fish upon release.

Approximately 87,370 chinook salmon eggs were taken from 13 Chignik River females and fertilized with nine males on August 28, 1983. An additional 14,380 eggs were taken from three Lake Rose Tead females and fertilized with two males September 21, 1983. These eggs are incubating in the Kitoi Bay Hatchery and will be stocked in Lake Rose Tead as fingerlings in June 1984. Age, sex and length data for Chignik brood stock chinook are presented in Table 10.

Table 9. Lake Rose Tead Chinook Salmon Stocking History and 1978-1983 Observed Adult Returns.

Year Stocked	Number of Fish Stocked	Origin	Fingerling Size(#/kg)	Observed Adult Return by Year							
				1978	1979	1980	1981	1982	1983	Total	
1976	22,500	Chignik	1,430	0	0	0	3	...	...	3
1977	133,109	Chignik	1,130	...	3	5	36	49	...	93	
1978	14,261	Chignik	77	...	1	0	1	0	0	2	
1979	65,652	Chignik	980	...	...	0	1	8	10	19
1980	93,259	Chignik	685	...	...	...	0	0	0	0
1981	134,784	Chignik	808	...	...	...	...	0	0	0
1982	96,756*	Chignik	1,399	...	...	...	...	...	0	0
	29,950*	Rose Tead	1,555	...	...	...	...	...	...	0
1983***	119,499**	Chignik	1,101	Subtotal	0	4	5	41	57	10	117
	37,399**	Rose Tead	969	Unageable	0	0	6	39	0	26	71
				Grand Total	0	4	11	80	57	36	188

* 11,657 Pasagshak KS and 11,656 Chignik KS fingerlings were coded wire tagged in 1982.

** 15,661 Pasagshak KS and 14,670 Chignik KS fingerlings were coded wire tagged in 1983.

*** Fingerlings were stocked into a 3 m x 3 m x 3 m holding pen and fed Oregon Moist Pellets for 6 days. Fish weighed 718/kg when released.

Table 10. Age, Sex and Length of Chignik River Chinook Salmon Utilized for Brood Stock, August 1983.

Age	Males				Females				n	%
	n	%	Length (mm)		n	%	Length (mm)			
			\bar{x}	\pm S.D.*			\bar{x}	\pm S.D.*		
1.3	2	22.2	811	48.1	1	7.7	960	...	3	13.6
1.4	<u>7</u>	<u>77.8</u>	1080	90.0	<u>12</u>	<u>92.3</u>	1024	62.0	<u>19</u>	<u>86.4</u>
Total	9	100.0			13	100.0			22	100.0

* Standard Deviation

In addition to the eggs obtained from Chignik and Lake Rose Tead, approximately 76,260 chinook eggs were naturally deposited in Lake Rose Tead; i.e., 13 females x 7,000 eggs/female = 91,000 eggs - 14,740 green eggs = 76,260.

Lake Genevieve Coho Salmon:

Lake Genevieve is a 47.1 acre lake, located in the Buskin Lake drainage, that historically supported a small coho and sockeye salmon population and numerous threespine stickleback and Dolly Varden (Van Hulle and Murray, 1972). The lake was chemically rehabilitated in 1972 and stocked with rainbow trout from 1973 through 1976 which produced a viable sport fishery (Van Hulle and Murray, 1974-1977). However, the lake was out of fish production for 7 years as suitable rainbow trout were not available for stocking. Subsequently it was decided to stock Lake Genevieve with coho salmon fingerlings to produce an annual return of approximately 470 adult fish; e.g., utilizing F.R.E.D. Division standard assumptions, 23,550 fingerlings x 2% fingerling to adult survival = 471 adult coho salmon.

An egg take conducted on Buskin River coho salmon November 2, 1983 for the purpose of stocking Lake Genevieve collected approximately 40,000 eggs from 13 females that were fertilized by 5 males. The eggs are currently being incubated at the Kitoi Bay Hatchery and 23,550 of the resultant fingerlings, all bearing a coded wire tag, will be stocked in Lake Genevieve during June 1984. Any excess fingerlings will be restocked in Buskin River. Age, sex and length data of the coho salmon brood stock are presented in Table 11. Ages 1.1, 2.1 and 3.1, respectively comprised 38.9%, 55.5% and 5.6% of the fish. Males and females of the dominant Age 2.1 class had mean lengths of 830 mm and 788 mm, respectively.

Volumetric Surveys:

Volumetric surveys of Buskin Lake (Figure 2) and Southern Lake (Figure 3) indicated respective surface areas of 101.5 and 7.0 hectares, maximum depths of 18.0 and 4.9 m and volumes of 1,008.3 and 49.5 hectare meters. These data will be used in future research to determine the fish rearing capacity of each lake.

Sport Fish Harvest Estimates

Buskin River:

A streamside creel census conducted on Buskin River between April 18 and October 16, 1983 (Table 12) indicated sport anglers fished 20,136 angler-days (35,802 hours) and harvested 6,668 spring Dolly Varden, 1,142 sockeye salmon, 3,727 pink salmon, 1,555 summer Dolly Varden and 936 coho salmon. Spring run Dolly Varden (n=595) randomly sampled from angler creels, as presented in Figure 4, had a mean length of 315 mm and a range of 195 mm to 565 mm. Since 1971, the spring Dolly Varden harvest has dropped by approximately 8,000 fish. In addition, the harvest rate has dropped from a high of 2.03 fish per hour in 1971 (Van

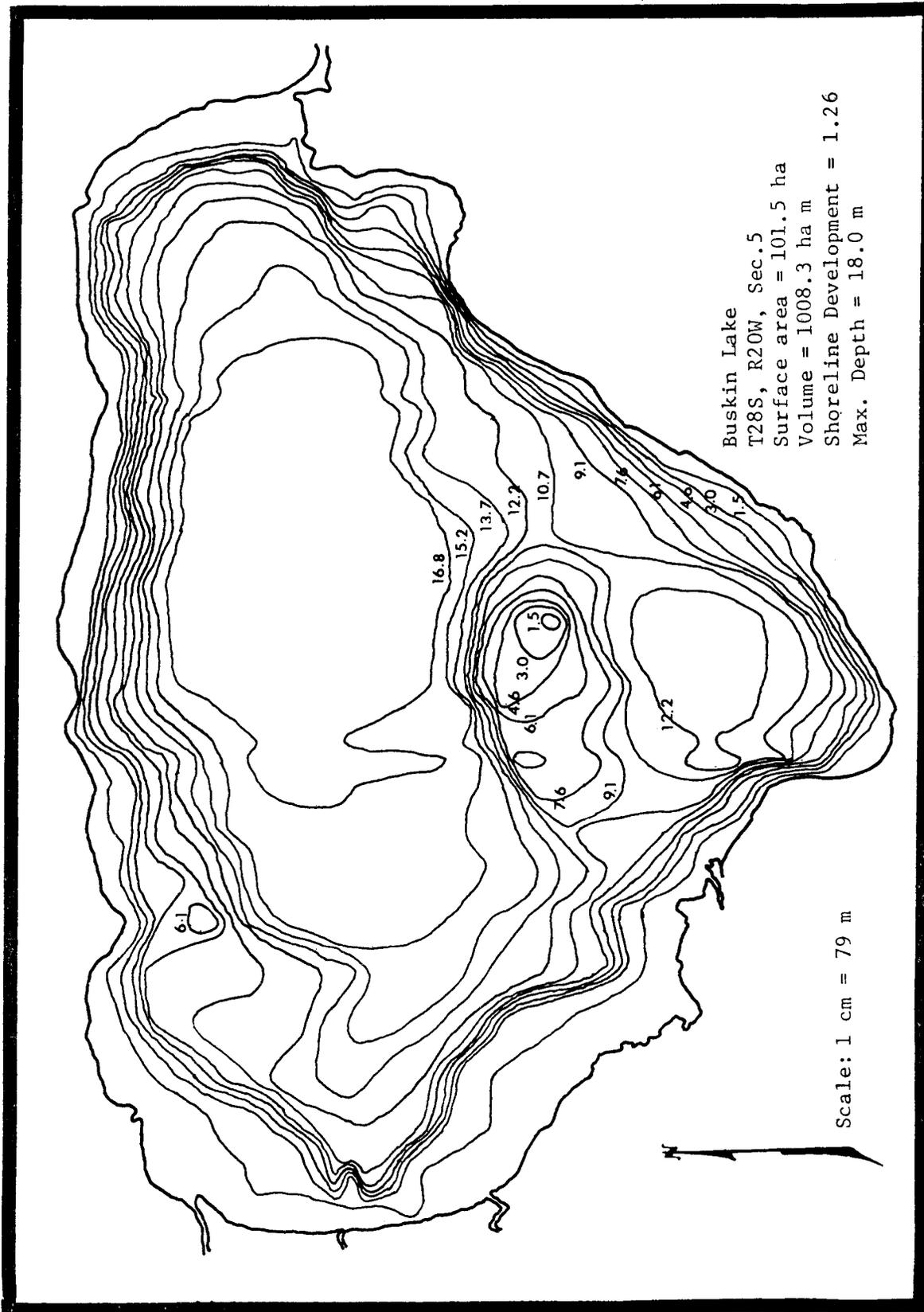


Figure 2. Volumetric Map of Buskin Lake.

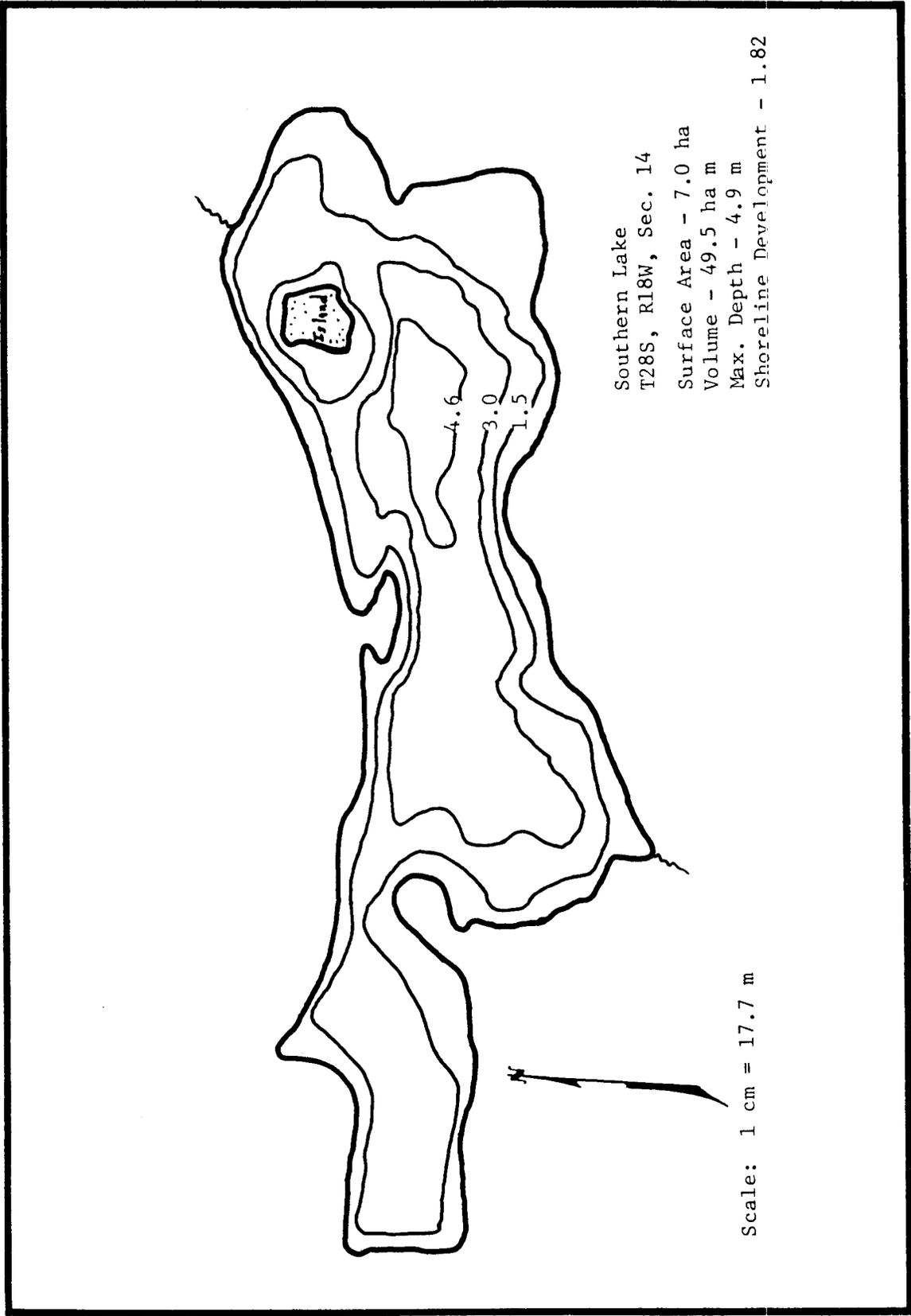


Figure 3. Volumetric Map of Southern Lake.

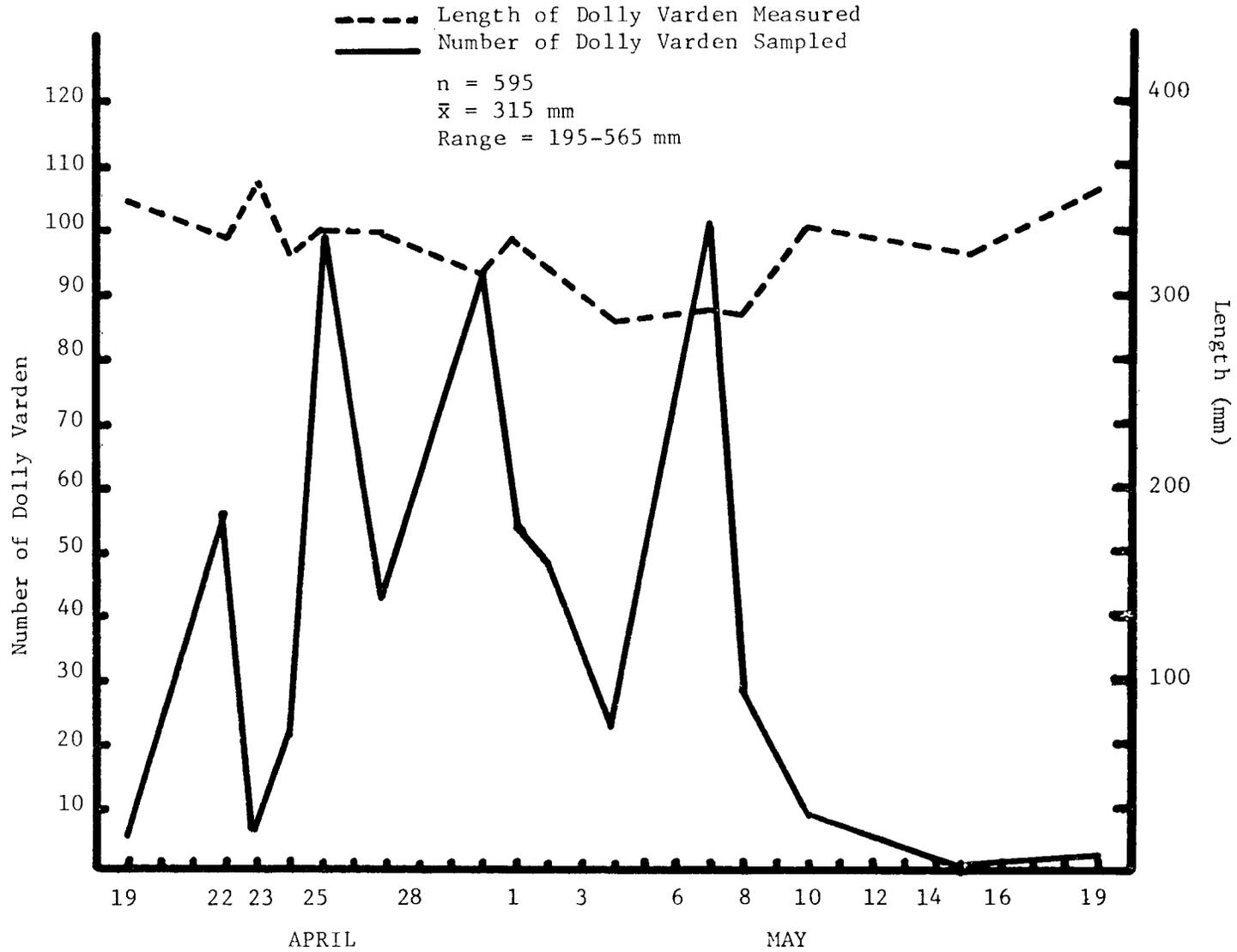


Figure 4. Number and Mean Length of Buskin River Dolly Varden Sampled from Angler Creeks, April and May, 1983.

Table 11. Age, Sex and Length of Buskin River Coho Salmon Used for Brood Stock, 1983.

Age Class	Males				Females				Total	
	n	%	\bar{x}	\pm S.D.*	n	%	\bar{x}	\pm S.D.*	n	%
1.1	2	40.0	801	15.5	5	38.5	760	36.0	7	38.9
2.1	3	60.0	830	34.2	7	53.8	788	28.4	10	55.5
3.1	0	0.0	...	...	1	7.7	790	...	1	5.6
Total	5	100.0			13	100.0			18	100.0

* Standard Deviation

Table 12. Sport Harvest of Buskin River Salmon and Dolly Varden as Determined by a Streamside Creel Census, April 18 Through October 16, 1983.

Two Week Harvest Period	Angler Trips	Angler Hours	Fish Harvested by Two Week Time Period				
			Spring DV	Sockeye	Pink	Summer DV	Coho
April 18-May 1	1,458	2,249	3,272	...	...	...	...
May 2-May 15	1,084	1,738	3,316	...	...	...	...
May 16-May 29	1,174	1,648	80	114	...	...	...
May 30-June 12	1,364	2,282	0	246	...	...	...
June 13-June 26	1,108	2,042	...	94	8	...	...
June 27-July 10	1,584	2,724	...	250	191	387	...
July 11-July 24	2,334	4,840	...	248	374	774	...
July 25-August 7	3,482	6,722	...	190	2,322	70	...
August 8-August 21	2,154	3,506	...	0	690	240	0
August 22-September 4	1,504	2,556	...	...	142	0	166
September 5-September 18	1,406	2,813	...	...	0	20	140
September 19-October 2	1,025	1,858	...	...	...	52	487
October 3-October 16	<u>459</u>	<u>824</u>	<u>...</u>	<u>...</u>	<u>...</u>	<u>12</u>	<u>143</u>
Season Total	20,136	35,802	6,668	1,142	3,727	1,555	936

Hulle and Murray, 1972) to a low of 1.18 fish per hour in 1983. Because of increased fishing pressure, a reduction in Dolly Varden catch per hour and a lack of population data, there is concern the population may be overharvested. To protect Buskin River Dolly Varden and concurrently permit optimum sport harvest, it is mandatory that more biological information be collected to formulate prudent regulatory guidelines and a sound management program.

To help protect Buskin River Dolly Varden, the bag limit was reduced from 15 to 10 fish in 1981 (Murray, 1982). This 33.3% bag limit reduction probably reduced the overall harvest by about 10%. Census data obtained in 1979 indicated only 10.7% of the total harvest came from that portion of the bag limit which exceeded 10 fish in number. Coho salmon sampled (n=53) from angler creels, as presented in Table 13, were comprised of four age classes (Ages 2.0, 1.1, 2.1 and 3.1) with Age 1.1 and 2.1 comprising 50.9% and 41.5% of the sample, respectively. Age 1.1 and 2.1 males were approximately 756 mm and 783 mm in length, respectively, while females were 732 mm and 760 mm in length, respectively.

The 1983 coho salmon sport harvest (n=936) combined with the escapement (n=243) comprised the smallest total coho run (n=1,179) since data have been collected on the system.

Sockeye salmon (n=72) sampled from angler creels, as presented in Table 14, were comprised of six age classes (Ages 1.1, 1.2, 1.3, 2.2, 2.3 and 3.2) with Age 1.3 (n=53, \bar{x} ln = 609.9 mm) comprising 73.6% of the sample.

Coho Salmon Derby:

The Lions Club Salmon Derby was conducted September 3-4 and 10-11, 1983. A total of 53 coho were reported harvested from six streams with most of the catch coming from Pasagshak River (56.6%), Buskin River (15.1%) and Womens Bay (15.1%). A comparison of this derby with previous derbies (Table 15) shows that Pasagshak and Buskin Rivers consistently produce most of the salmon; however, the number of fish reported does not reflect the total harvest as numerous fish are not entered once a large salmon has been weighed in. To gain better data, the 1984 Derby sponsor will be advised to offer a lottery type prize for any coho salmon entered which should encourage anglers to report their catch. The sponsor will also be encouraged to hold the derby prior to September 11 when most roadside streams are closed to salmon fishing. This will reduce the coho catch on heavily utilized roadside streams, reduce the total angler effort and harvest and spread the angler effort to additional streams.

Assessment and Inventory of Anadromous Fish Populations

Data reflected in Table 16 show escapement counts of the respective salmon species through weirs operated on Kodiak and Afognak Islands.

Table 13. Age, Sex and Size of Angler Caught Buskin River Coho Salmon, 1983.

Age*	Males				Females				Total			
	n	%	\bar{x}	\pm S.D.*	n	%	\bar{x}	\pm S.D.*	\bar{x}	\pm S.D.	n	%
2.0	1	3.5	386	...	0	0.0	...	...	...	...	1	1.9
1.1	13	44.8	756	29.3	14	58.3	732	49.7	4.7	0.9	27	50.9
2.1	12	41.4	783	51.5	10	41.7	760	22.8	5.1	0.5	22	41.5
3.1	<u>3</u>	<u>10.3</u>	669	198.8	<u>0</u>	<u>0.0</u>	...	...	...	...	<u>3</u>	<u>5.7</u>
Total	29	100.0			24	100.0					53	100.0

* Standard Deviation

Table 14. Age and Length of Angler Caught Buskin River Sockeye Salmon, 1982.

Age	n	%	\bar{x}	S.D.*
1.1	3	4.2	356.3	35.6
1.2	6	8.3	566.7	44.4
1.3	53	73.6	609.9	36.7
2.2	3	4.2	572.3	27.8
2.3	3	4.2	542.3	21.1
3.2	1	1.4	588.0	...
Regenerate Scales	<u>3</u>	<u>4.2</u>	589.7	66.1
Total	72	100.1		

* Standard Deviation

Table 15. A Comparison of the Number and Percent of Coho Salmon Entered in the 1979, 1981, 1982 and 1983 Kodiak Salmon Derbies.

Area	Number of Fish Harvested							
	1979*		1981**		1982***		1983****	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Buskin River	68	40.3	5	6.9	12	32.5	8	15.1
Pasagshak River	32	18.9	54	75.0	10	27.0	30	56.6
Roslyn Creek	12	7.1	2	2.8	1	2.7	0	0.0
Womans Bay	22	13.0	3	4.2	2	5.4	8	15.1
Chiniak Creek	6	3.6	0	0.0	0	0.0	0	0.0
Olds River	8	4.7	0	0.0	0	0.0	0	0.0
Pillar Creek	0	0.0	0	0.0	2	5.4	1	1.9
Saltery River	21	12.4	1	1.4	1	2.7	2	3.8
Myrtle Creek	0	0.0	0	0.0	1	2.7	0	0.0
Kalsin	0	0.0	4	5.5	2	5.4	0	0.0
Kizhuyak Bay	0	0.0	0	0.0	1	2.7	0	0.0
American	0	0.0	1	1.4	0	0.0	0	0.0
Middle Bay	0	0.0	1	1.4	0	0.0	0	0.0
Selief Bay	0	0.0	1	1.4	0	0.0	0	0.0
Unknown	0	0.0	0	0.0	5	13.5	4	7.5
Total	169	100.0	72	100.0	37	100.0	53	100.0

* Held September 8-9 and 15-16 and Sponsored by United States Coast Guard.

** Held August 29-30 and September 5-6 and Sponsored by the Lions Club.

*** Held August 28-29 and September 4-5 and Sponsored by the Lions Club.

**** Held September 3-4 and 10-11 and Sponsored by the Lions Club.

Table 16. Fish Escapement Counts Through Weirs on Kodiak and Afognak Islands, 1983.

<u>River</u>	<u>Sockeye Salmon</u>	<u>Chinook Salmon</u>	<u>Pink Salmon</u>	<u>Chum Salmon</u>	<u>Coho* Salmon</u>	<u>Steelhead* Kelts</u>	<u>Up</u>
Afognak	40,049	2	21,239	0	112	0	0
Upper Station	289,250	0	424	0	454	1	2
Ayakulik	171,415	15,511	17,702	22	17,702	1,351	181
Dog Salmon	166,655	169	72,000	17,314	5,033	274	39
Karluk Lagoon	436,145	11,747	38,900	67	21,278	4,215	173

* Total coho and steelhead escapements were not counted as all weirs were installed in May and removed in August or September.

Karluk River:

Fish escapement estimates through the Karluk Lagoon weir between May 15 and September 25, 1983 were comprised of 11,747 chinook salmon, 4,215 steelhead kelts, 21,278 coho salmon, 173 upmigrant steelhead trout, 38,900 pink salmon, 67 chum salmon and 436,145 sockeye salmon. Table 17 presents weekly counts of the former three species, while Table 18 displays age, length and sex composition of chinook salmon. The chinook escapement (n=11,747) was the largest number of chinook known to have spawned in Karluk River since the first weir was installed at Karluk Lagoon in 1921. This high escapement and the increase in escapements during the last few years is attributed to the spring commercial fish closure in the Karluk district. Once Karluk sockeye salmon have been reestablished and normal commercial fishing resumes, the chinook salmon escapement will probably be substantially reduced in number.

Karluk chinook sampled (n=109) for age and growth were comprised of five age classes (1.2, 1.3, 1.4, 2.4 and 1.5) and 14 fish had unreadable scales. The dominant 1.4 Age class (n=79 or 72.5%) contained 38 males and 41 females with mean lengths of 945 mm and 904 mm, respectively.

Ayakulik River:

Fish escapement estimates through Ayakulik River weir between May 22 and August 27, 1983 were comprised of 171,415 sockeye salmon, 15,511 chinook salmon, 17,702 pink salmon, 22 chum salmon, 17,702 coho salmon, 1,351 kelt steelhead and 181 upmigrant steelhead. Tables 19 and 20 display the age, length and sex composition of chinook salmon and kelt steelhead, respectively.

The Ayakulik chinook escapement (n=15,511) was the largest number of chinook salmon known to have spawned in Ayakulik River and on Kodiak Island in the history of salmon management. This record escapement is attributed to reduced commercial fishing in the Red River and Karluk River districts.

Ayakulik chinook salmon (n=253) sampled for age and growth data contained six age classes (Table 19). The dominant 1.4 age class (n=127 or 50.2%) contained 60 males (\bar{x} ln = 1,021 mm) and 67 females (\bar{x} ln = 914 mm), while Age 1.2 contained 23 males with a mean length of 592 mm. Ages 1.1, 2.1, 1.3 and 1.5 comprised 9.1% of the sample while 80 fish (31.6%) had regenerate or unreadable scales.

Steelhead kelts sampled from Ayakulik River (n=77) contained nine age classes (Table 20). The dominant 2.2S age class contained six males (\bar{x} ln = 700 mm) and 14 females (\bar{x} ln = 674 mm), while Age 2.1S contained nine males and four females with mean lengths of 586 mm and 571 mm, respectively. Most fish (n=39 or 50.6%) spent 2 years in fresh water and 10 fish (12.9%) had returned to spawn a second time.

Table 17. Summary of Chinook, Coho and Steelhead Migrational Timing as Determined by Partial Enumeration Through Karluk Lagoon Weir, 1983.

Period	Chinook		SH Kelts		UP SH		Coho	
	No.	%	No.	%	No.	%	No.	%
May 15-21	43	0.4	30	0.7	...	...	...	...
May 22-28	331	2.8	86	2.0	...	...	...	...
May 29-June 4	905	7.7	110	2.6	...	...	...	...
June 5-11	2,746	23.4	1,846	43.8	...	...	...	...
June 12-18	2,905	24.7	1,248	29.6	...	...	...	...
June 19-25	2,433	20.7	592	14.0	...	...	...	...
June 26-July 2	1,394	11.9	260	6.2	...	...	...	...
July 3-9	530	4.5	23	0.5	...	...	...	...
July 10-16	227	1.9	8	0.2	...	...	...	...
July 17-23	100	0.9	7	0.2	...	...	...	...
July 24-30	65	0.5	3	0.1	...	...	...	...
July 31-August 6	35	0.3	2	0.1	...	...	...	...
August 7-13	20	0.2	...	...	3	1.7	28	0.1
August 14-20	9	0.1	...	...	0	0.0	37	0.2
August 21-27	3	0.0	...	...	1	0.6	59	0.3
August 28-Sept. 3	1	0.0	...	...	3	1.7	264	1.2
September 4-10	...	...	...	...	6	3.5	1,576	7.4
September 11-17	...	...	...	...	21	12.1	6,275	29.5
September 18-24*	...	...	...	...	139	80.4	13,039	61.3
Total	11,747	100.0	4,215**	100.0	173	100.0	21,278	100.0

* Weir removed on September 25.

** 103 additional dead kelts were removed from the weir.

Table 18. Age, Sex and Length of Angler-Caught Chinook Salmon from Karluk River, June and July, 1983.

Age	Males				Females				Total	
	n	%	\bar{x}	\pm S.D.	n	%	\bar{x}	\pm S.D.	n	%
1.2	2	3.8	640	24.7	0	0.0	...	...	2	1.8
1.3	6	11.3	808	82.3	4	7.1	844	18.9	10	9.2
1.4	38	71.7	945	47.9	41	73.2	904	44.4	79	72.5
2.4	1	1.9	1020	...	1	1.8	932	...	2	1.8
1.5	0	0.0	...	...	2	3.6	958	30.4	2	1.8
Regenerate Scales	<u>6</u>	<u>11.3</u>	...	...	<u>8</u>	<u>14.3</u>	...	...	<u>14</u>	<u>12.9</u>
Total	53	100.0			56	100.0			109	100.0

Table 19. Age, Sex and Length of Angler Caught Chinook Salmon from Ayakulik River, June and July and August 1983.

Age	Males			Females			Total	
	n	%	Length(mm) x ± S.D.	n	%	Length(mm) x ± S.D.	n	%
1.1	2	1.5	381 71.1	0	0.0	...	2	0.8
2.1	1	0.7	457 ...	0	0.0	...	1	0.4
1.2	23	17.3	592 63.5	0	0.0	...	23	9.1
1.3	9	6.8	823 132.1	4	3.3	858 43.2	13	5.1
1.4	60	45.1	1021 73.7	67	55.8	914 68.6	127	50.2
1.5	5	3.8	1080 68.6	2	1.7	940 35.6	7	2.8
Regenerate Scales	<u>33</u>	<u>24.8</u>	...	<u>47</u>	<u>39.2</u>	...	<u>80</u>	<u>31.6</u>
Total	133	100.0		120	100.0		253	100.0

Table 20. Age, Sex and Length of Kelt Steelhead Sampled from Ayakulik River, June and July 1983.

Age*	Males				Females				Total	
	n	%	Length (mm)		n	%	Length (mm)		n	%
			\bar{x}	\pm S.D.			\bar{x}	\pm S.D.		
2.1S	9	22.5	586	17.1	4	10.8	571	25.4	13	16.9
2.2S	6	15.0	700	47.7	14	37.9	674	53.0	20	25.9
2.1S1S	1	2.5	685	...	3	8.1	685	64.7	4	5.2
2.2S1S	1	2.5	775	...	1	2.7	810	...	2	2.6
3.1S	11	27.5	584	18.4	2	5.4	536	7.8	13	16.9
3.1SS	1	2.5	811	...	0	0.0	...	...	1	1.3
3.2S	1	2.5	775	...	5	13.5	670	79.7	6	7.8
3.1S1S	0	0.0	...	...	1	2.7	720	...	1	1.3
3.2S1S	1	2.5	711	...	1	2.7	775	...	2	2.6
Regenerate Scales	<u>9</u>	<u>22.5</u>	...	...	<u>6</u>	<u>16.2</u>	...	...	<u>15</u>	<u>19.5</u>
Total	40	100.0			37	100.0			77	100.0

Table 21. Peak Salmon Escapement Estimates, Northeast Kodiak Island, 1983.

System	Chum Salmon		Coho Salmon		Pink Salmon		Sockeye Salmon	
	Date	Escpmt.***	Date	Escpmt.*	Date	Escpmt.***	Date	Escpmt.
American	September 7	10,000	October 25	114	September 7	71,000	NA	...
Buskin	NC	...	October 26	243	August 23	53,000	August 30	4,669
Chiniak	August 23	20	October 21	25	August 23	3,000	NA	...
Hurst	August 17	3,000	November 15	48	August 23	3,500	NA	...
Kalsin	August 23	0	November 16	32****	August 23	0	NA	...
Monashka	NC	...	October 20	24	August 31	1,250	NA	...
Myrtle	NC	...	NC	...	September 7	1,390	NA	...
Olds	September 7	11,000	October 25	173	August 23	30,020	NA	...
Panamaroff	NC	...	October 24	2	NC	...	NA	...
Pasagshak	NC	...	October 28	1,920	July 31	400	September 2	3,458**
Pillar	August 31	30	October 20	15	August 31	430	NA	...
Roslyn	September 7	500	October 21	49	September 7	2,800	NA	...
Russian	August 23	500	October 24	23	August 23	2,000	NA	...
Sacramento	NC	0	September 7	500	September 7	5,400	NA	...
Salonie	August 23	2,000	October 24	127	August 23	5,500	NA	...
Saltery	August 23	5,000	September 9	700***	September 9	39,000	August 10	46,400***
Sargent	August 11	50	October 24	16	August 11	300	NA	...
Twin	NC	...	NC	...	August 23	260	NA	...
#410	September 7	100	NC	...	August 23	3,800	NA	...
Total		32,200		4,011		223,050		54,527

* Foot Survey

** Boat Survey

*** Aerial Survey

**** Includes 32 coho observed in Kalsin Pond

NC = No Count

NA = Not Applicable

Note: 18 chinook salmon were observed via aerial survey August 23 in Pasagshak River.

Northeast Kodiak Island Streams:

Peak salmon escapement estimates for northeast Kodiak Island, as presented in Table 21, indicated 223,050 pink salmon, 32,200 chum salmon, 54,527 sockeye salmon and 4,011 coho salmon spawned in 19 roadside streams. These peak counts were similar to previous years' escapements with the exception of coho salmon which reflected the lowest escapement since counts were initiated in 1966. A total of 45 adult steelhead trout were observed in Buskin River via foot and boat surveys on May 26, 1983. Thirty-six fish were observed between Buskin Lake and the Beaver Pond, and the balance (n=9) was seen between the pond and Buskin Lagoon. This was the largest spawning escapement observed since the river was closed to steelhead trout fishing in 1970.

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