Fishery Management Report No. 09-34

A Compilation of the 2008 Spiridon Lake Sockeye Salmon Enhancement Project Results: A Report to the Kodiak National Wildlife Refuge

by

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and

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Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye to fork	MEF
mideye to tail fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY MANAGEMENT REPORT NO. 09-34

A COMPILATION OF THE 2008 SPIRIDON LAKE SOCKEYE SALMON ENHANCEMENT PROJECT RESULTS: A REPORT TO THE KODIAK NATIONAL WILDLIFE REFUGE

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The Kodiak Regional Aquaculture Association (KRAA) funds the general operations of the Spiridon Lake sockeye salmon stocking project and Pillar Creek Hatchery. The Division of Commercial Fisheries provides biological oversight and evaluation in the management of returning adult runs to the enhanced or rehabilitated systems associated with hatchery stocking projects.

The Fishery Management Reports series was established in 1989 by the Division of Sport Fish for the publication of an overview of management activities and goals in a specific geographic area, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Fishery Management Reports are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm. This publication has undergone regional peer review.

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ABSTRACT

A sockeye salmon *Oncorhynchus nerka* enhancement stocking project was initiated at Spiridon Lake in 1990 to provide increased harvest opportunities for fishermen in the Kodiak Management Area. Because Spiridon Lake lies within the boundaries of the Kodiak National Wildlife Refuge, the Spiridon Lake Management Plan requires that the Alaska Department of Fish and Game collect water quality and zooplankton data, estimate the smolt outmigration, record juvenile salmon stocking numbers, and document the commercial salmon harvest to ensure the project remains compatible with the Kodiak National Wildlife Refuge mission.

In 2008, Spiridon Lake had a total nitrogen to total phosphorus ratio of 258:1, a total ammonia level of 4.5 µg/L at the 1m depth, and a chlorophyll-*a* concentration of 0.68 µg/L. The zooplankton community had a *Diaptomus* to *Cyclops* ratio of 0.04:1, a copepod biomass of 2.2 mg/m^3, a *Bosmina* to *Daphnia* ratio of 0.67:1, a cladoceran biomass of 4.2 mg/m^3, and a *Bosmina* size (average length) of 0.55 mm. In 2008, an estimated 538,504 sockeye salmon smolt emigrated from Spiridon Lake while a total of 1,049,809 sockeye salmon juveniles were released into the lake. A total of 154,575 adult sockeye salmon were harvested in the Spiridon Bay Special Harvest Area as reported on commercial fish harvest tickets.

The 2008 Spiridon Lake stocking project met all the criteria, except for the copepod biomass, which was slightly below the minimum biomass level specified in the Spiridon Lake Management Plan. In an attempt to improve the copepod biomass, we recommended reducing the release to approximately 1.5 million fry into Spiridon Lake for 2009.

Key words: Spiridon Lake, Telrod Cove, Spiridon Bay Special Harvest Area, SBSHA, Kodiak Management Area, *Oncorhynchus nerka*, sockeye salmon, stocking, Kodiak National Wildlife Refuge, KNWR, U.S. Fish and Wildlife Service, USFWS, Kodiak Regional Aquaculture Association, KRAA, Special Use Permit, limnology, zooplankton.

INTRODUCTION

Spiridon Lake (57° 40' N lat., 153° 39' W long.) is located on the northwest side of Kodiak Island (Figure 1), approximately 74 km west of the City of Kodiak. The lake is 9.6 km long, 1.6 km at its widest point, and has a surface area of 9.2 km^2 (Figures 1 and 2; Schrof and Honnold 2003). Spiridon Lake is at an elevation of 136 m, has a mean depth of 34.7 m, and a maximum depth of 82.0 m. The Spiridon Lake outlet stream (Telrod Creek) is approximately 2.0 km long and empties into Telrod Cove. Telrod Creek has three waterfalls that are impassable to fish. Two of the waterfalls are located approximately 0.8 km downstream of the lake outlet, and a third waterfall, located near the stream terminus, blocks salmon from migrating further upstream.

Resident fish in Spiridon Lake include: rainbow trout *Onchorhynchus mykiss*, Dolly Varden char *Salvenlinus malma*, threespine stickleback *Gasterosteus aculeatus*, and freshwater sculpin *Cottus aleuticus* (Honnold 1997).

The impetus behind starting an enhancement project at Spiridon Lake is that the system does not support an anadromous fish run due to a series of falls that prevent lake access to migrating salmonids. The stocking project was initiated to utilize the lake's freshwater rearing environment without dramatically altering the nutrient balance or forage base (macrozooplankton) of the lake. In addition to the utilization of the lake's forage, stocking a barren lake also provides researchers and managers with the opportunity to thoroughly assess the response of the macrozooplankton community to predation by juvenile salmon (Kyle 1996).

In December 1990, the Alaska Department of Fish and Game (ADF&G) in cooperation with Kodiak Regional Aquaculture Association (KRAA) submitted a proposal to the United States Fish and Wildlife Service (USFWS) to begin a sockeye salmon *O. nerka* stocking project at Spiridon Lake, located in the Kodiak Unit of the Kodiak National Wildlife Refuge (KNWR; Chatto 2000). The KNWR permitted the ADF&G to begin stocking Spiridon Lake to determine

if a stocking project would be feasible and compatible with the guiding principles of the KNWR. The KNWR prepared an environmental assessment for the proposed project, which resulted in a finding of no significant impact. The following year, the KNWR issued a temporary five-year Special Use Permit (SUP) for the Spiridon Lake project to the ADF&G. The SUP allowed the ADF&G to proceed with the stocking project, so that additional baseline data could be collected to evaluate the stocking impacts to the lake's ecological community and adult returns to Telrod Cove. In 1997, Honnold (1997) consolidated and thoroughly evaluated all available fishery and limnological data from the Spiridon Lake stocking project into one document, which was used as a reference by the KNWR to write the Spiridon Lake Management Plan (SLMP; Chatto 2000). The SLMP was authorized in June 2000 along with a 5-year renewable SUP (updated in 2005) to continue stocking sockeye salmon, monitoring the lake ecosystem, and determining sockeye salmon production from Spiridon Lake in the KNWR.

Juvenile sockeye salmon been stocked annually into Spiridon Lake, since 1990 (Foster et al. 2008). In 2008, the brood source utilized for stocking Spiridon Lake was from Saltery Lake. Historically, juvenile sockeye salmon stocked into Spiridon Lake have come from either Upper Station or Saltery Lake. Juvenile salmon are stocked aerially, via fixed-wing aircraft. Since 1991, the ADF&G has annually enumerated the smolt migrating out of Spiridon Lake and has collected samples from a portion of the smolt migration for age, weight, length (AWL) and condition. The returning adult sockeye salmon are harvested in the Spiridon Bay Special Harvest Area (SBSHA) as well as other westside harvest areas, since 1994 (Figure 1). The ADF&G has annually monitored the fishery and sampled a portion of the sockeye salmon commercial catch for age, sex, and length data (ASL) in Telrod Cove.

This report consolidates and summarizes the 2008 and historical data collected as part of the Spiridon Lake sockeye salmon enhancement project and compares them to the SLMP guidelines.

MANAGEMENT PLAN MONITORING CRITERIA

Monitoring guidelines were established from data collected at Spiridon Lake from 1987 to 1999. Specific limnological and fishery criteria were developed for comparative purposes. The SLMP contains the guidelines and criteria to be measured against to ensure that the juvenile sockeye salmon stocking levels does not substantially change Spiridon Lake. Specific attributes monitored include: lake nutrient concentrations (nitrogen, phosphorus, total ammonia, and chlorophyll-*a*); zooplankton composition, density, and biomass; smolt production; and adult harvest estimates (Chatto 2000).

The purpose of the SLMP is to document the various components of the stocking project, outline how the project will be managed to remain compatible with the KNWR's mission, and serve as a reference document to guide any proposed changes to project operations (Chatto 2000).

METHODS

LIMNOLOGICAL MONITORING

Comparative attributes specified in the SLMP included: total nitrogen (TN) to total phosphorus (TP) ratio, total ammonia (TA), chlorophyll *a* (Chl *a*), *Diaptomus* to *Cyclops* density ratio, copepod biomass, *Bosmina* to *Daphnia* density ratio, cladoceran biomass, and cladoceran (*Bosmina*) average size.

Lake Sampling Protocol

Samples were collected from Spiridon Lake five times from May to September at approximately four-week intervals. Two sampling stations were established in the deepest basins of the lake using a Global Positioning System (GPS; Figure 2). Water samples were collected at the 1 m and 50 m depths and a 50 m vertical tow was hauled to collect zooplankton. Samples were collected following standard ADF&G sampling procedures from Koenings et al. (1987) and Thomsen (2008).

Water samples for chemistry and nutrient analysis were collected from the epilimnion at 1 m below the water surface. Samples were collected using a 4 L Van Dorn bottle and emptied into separate, pre-cleaned polyethylene carboys, which were kept cool and dark in the float of the plane until processed at the laboratory in Kodiak. Vertical zooplankton hauls were made at each station using a 0.2 m diameter conical net with 153 μm mesh. The net was pulled manually at a constant speed (~0.5 m/s) from approximately 50 m to the lake surface. The contents from each tow were emptied into a 125 ml poly bottle and preserved in 10% neutralized formalin.

General Water Chemistry and Nutrients

Unfiltered water was analyzed for TP, Total Kjeldahl Nitrogen (TKN), pH, and alkalinity. Sample water was filtered through a rinsed 4.25 cm diameter Whatman GF/F filter pad and stored frozen in phosphate free soap-washed polyethylene bottles. Filtered water was analyzed for total filterable phosphorus (TFP), filterable reactive phosphorus (FRP), nitrate + nitrite (N+N), and TA. A Spectronic Genesys 5 Spectrophotometer (SG5) was used for TP, TFP, FRP, N+N, and TA analyses.

The potassium persulfate-sulfuric acid digestion method described in Koenings et al. (1987) and Thomsen (2008) adapted from methods in Eisenreich et al. (1975) was used for TP analysis. Unfiltered frozen water samples were sent to the South Dakota University laboratory for the TKN analysis using the EPA 351.3 (Nesslerization) method. The pH of water samples was measured with a Corning 430 meter, while alkalinity (mg/L as $CaCO_3$) was determined from 100 ml of unfiltered water titrated with 0.02 N H_2SO_4 to a pH of 4.5 and measured with a Mettler Toledo Seven Easy pH meter.

Determination of TFP used the same methods as those for TP utilizing filtered water. The potassium persulfate-sulfuric acid method described in Koenings et al. (1987) and Thomsen (2008) was used for FRP analysis. Samples for N+N were analyzed using the cadmium reduction column method described in Koenings et al. (1987) and Thomsen (2008). The phenol-sodium hypochlorite method described in Koenings et al. (1987) and Thomsen (2008) was used for determining TA. Total nitrogen, the sum of TKN and N+N, were calculated for each sample in addition to the ratio of total nitrogen to total phosphorus.

Chlorophyll *a*

For chl-*a* analysis, 1.0 L of water from each sample was filtered through a Whatman GF/F filter under 15 pounds per square inch of vacuum pressure. Towards the end of the filtration process, approximately 5 ml of magnesium chloride ($MgCO_3$) was added to the final 50 ml of water to preserve the sample. Filters were stored frozen and in individual plexiglass slides until analyzed. Filters were then ground in 90% buffered acetone using a mortar and pestle, and the resulting slurry was refrigerated in separate 15 ml glass centrifuge tubes for 2 to 3 hours to ensure maximum pigment extraction. Pigment extracts were centrifuged, decanted, and diluted to 15 ml with 90% acetone. The extracts were analyzed with the SGS using methods described by Koenings et al.

(1987) and Thomsen (2008). The chlorophyll-*a* measurements were averaged from water samples collected at two sampling stations.

Zooplankton

For zooplankton analysis, cladocerans and copepods were identified according to taxonomic keys in Edmondson (1959). Zooplankton were individually measured in triplicate 1 ml subsamples taken with a Hansen-Stempel pipette and placed in a Sedgewick-Rafter counting chamber. Lengths from a minimum of 15 animals of each species or group (typically animals are grouped at the genus level) were measured to the nearest 0.01 mm, a student's t-test was then employed to determine the number of measurements needed to meet sample size requirements (Thomsen 2008), and the mean was calculated. Density is the number of individuals per unit volume and reported in this publication as the number per meter cubed (No./m^3). Biomass was estimated using density and species-specific linear regression equations between length and dry weight derived by Koenings et al. (1987). Zooplankton data from the two stations were averaged for each survey date.

STOCKING

Stocking densities for Spiridon Lake were determined by estimating the lake's rearing capacity based on inseason zooplankton biomass from May through July (Duesterloh and Byrne 2008). Saltery Lake sockeye salmon eggs were collected in early September of 2007 by Pillar Creek Hatchery (PCH) personnel using standard fish culture procedures (ADF&G 1994). Eggs were flown back to Kodiak, incubated and reared at PCH, and the juvenile salmon were then aerially released into Spiridon Lake via fixed-wing aircraft.

SMOLT MONITORING

ADF&G personnel monitored, estimated, and sampled the sockeye salmon smolt emigration from Spiridon Lake. Sockeye salmon smolt that emigrated from the lake were funneled into a counting tank, enumerated, and released into a pipeline bypass system that circumvented the barrier falls. The entire bypass system consisted of two Canadian fan traps supporting frame, de-watering tanks, troughs, and diversion panels (Chatto 2000; Foster et al. 2008) installed in the Spiridon Lake outlet creek (Telrod Creek). A 15 cm diameter black polyethylene pipeline provided smolt passage around the falls carrying water and smolt approximately 0.75 km, dropping about 90 m in elevation where the pipeline terminated and smolt exited into lower Telrod Creek. As in past years, timed counts were conducted to estimate the number of emigrating smolt (Foster et al. 2008). Forty smolt were sampled five days a week for AWL data (Foster et al. 2008). Once smolt emigration ceased, the bypass system was removed from the creek and stored on the stream banks.

HARVEST MONITORING

Harvest within the SBSHA was monitored by ADG&G personnel stationed at a camp on the outer eastern shoreline of Telrod Cove (Figure 1; Chatto 2000). In 2008, the camp was operated from June 21st to August 5th.

Monitoring activities included: assessing sockeye salmon run strength, recording fishing effort, estimating the commercial catch by species, and sampling a portion of the sockeye salmon catch for ASL data (Foster et al. 2008; Schrof and Honnold 2003). The ADF&G fish ticket database was used to generate end-of-season catch summaries and to confirm on-site estimates.

ESCAPEMENT MONITORING

The field crew conducted a foot survey of Telrod Creek during the commercial fishery to estimate sockeye salmon and pink salmon *O. gorbuscha* escapements. Live and dead salmon were enumerated by species. In an effort to monitor the chum salmon escapements of surrounding systems, aerial surveys of the Spiridon River drainage and Spiridon Bay were conducted in August with fixed-wing aircraft.

RESULTS AND DISCUSSION

LIMNOLOGICAL MONITORING

Total Nitrogen to Total Phosphorus Ratio

The mean epilimnion total nitrogen to total phosphorus ratio (TN:TP) in Spiridon Lake was 258:1 in 2008 (Tables 1 and 2), which was within the desired range of 148:1 to 273:1, specified in the SLMP (Table 1). The 2008 seasonal average was slightly higher than the historical average 1990 to 2007 (224:1; Table 2).

Total Ammonia

The 2008 seasonal mean concentration for total ammonia was 4.5 µg/L at 1 m in Spiridon Lake and averaged 4.4 µg/L at Station 1 and 4.6 µg/L at Station 2 (Table 3). The 2008 seasonal mean ammonia concentration was lower than the average concentration (5.9 µg/L) during the years (1990 to 2007) of stocking, but was within the range of 1.6 to 11.2 µg/L specified in the SLMP (Tables 1 and 3).

Chlorophyll *a*

Chl-*a* levels in Spiridon Lake averaged 0.68 µg/L at the 1 m depth in 2008 (0.71 µg/L at Station 1 and 0.64 µg/L at Station 2; Table 3). The average chl-*a* concentration was within the specified range of 0.1 to 1.0 µg/L (Table 1). The average chl-*a* concentrations showed typical variation between stations and the seasonal average was higher than the historical 1990 to 2007 mean of 0.45 µg/L (Tables 1 and 3).

Copepod Biomass

The average density of copepods in Spiridon Lake in 2008 was 639 No./m^3 and the average biomass was 2.2 mg/m^3, which was slightly below the criteria range of 3.5 to 21.7 mg/m^3 identified in the SLMP (Tables 1 and 5). The average copepod density from 1990 to 2007 was 4,366 No./m^3 and the average biomass was 9.3 mg/m^3.

In the last three years (2006 to 2008), copepod biomass estimates have been at their lowest levels and below the SLMP criteria. However, in 2008 the average size of *Cyclops* (0.95 mm) is the largest recorded and may indicate signs of recovery (Table 7). Additionally, stocking levels have been reduced to allow copepod levels to increase.

Diaptomus to Cyclops Density Ratio

The *Diaptomus* to *Cyclops* ratio was 0.04:1, meeting the criteria range (0.01 to 0.54:1) specified in the SLMP (Tables 1 and 5). The average ratio from 1990 to 2007 was 0.11:1 and the average ratio from 1988 to 1989 was 0.31:1.

Cladoceran Biomass

The 2008 seasonal average cladoceran density in Spiridon Lake was 1,485 No./m^3 with an average biomass of 4.2 mg/m^3, which was within the SLMP criteria range of 2.6 to 6.8 mg/m^3 (Tables 1 and 6). The 2008 average biomass of 4.2 mg/m^3 was below the 1990 to 2007 average cladoceran biomass of 5.7 mg/m^3 and the 2008 density (1,485 No./m^3) was slightly below the 1990 to 2007 average of 1,582 No./m^3 (1990 to 2007; Table 6).

Bosmina to Daphnia Density Ratio

The *Bosmina* to *Daphnia* ratio of 0.67:1 was within the criteria range (0.22 to 1.73:1) specified in the SLMP (Tables 1 and 6). The average ratio from 1990 to 2007 was 1.01:1.

Cladoceran (Bosmina) Size

In 2008, the cladoceran *Bosmina* averaged 0.55 mm in length, which met the criteria (≥ 0.51 mm) specified in the SLMP (Tables 1 and 7). This compares to the average *Bosmina* size from 1990 to 2007 of 0.53 mm and the average pre-stocking (1988 to 1989) size of 0.58 mm.

The rationale for the minimal size requirement for *Bosmina* is that this species will decrease its reproductive size under increased predation pressure. As sockeye salmon grow, they tend to target larger zooplankton to increase their efficiency of energy transfer (Kyle 1992). The increase in *Bosmina* size may indicate a decrease in grazing pressure in 2008.

Total Zooplankton

The 2008 seasonal mean zooplankton density in Spiridon Lake was 2,070 No./m^3 and the biomass was 6.4 mg/m^3 (Table 4; Figure 3). The 2008 mean density of 2,070 No./m^3 was the second lowest density, whereas the mean biomass of 6.4 mg/m^3 was the fourth lowest biomass since the inception of zooplankton sampling began in 1988. The 2008 cladoceran to copepod biomass ratio was 1.91:1 and the cladoceran to copepod density ratio was 2.54:1.

In recent years (2001 to 2008), the zooplankton biomass was primarily comprised of cladocerans, while during the previous years (1988 to 2000; except 1997) the biomass was principally comprised of copepods (Table 4).

STOCKING

Approximately 1,049,809 (average 0.33 g) sockeye salmon fry were stocked into Spiridon Lake on June 27, 2008. The average total sockeye release into Spiridon Lake from 1991 to 2007 was 3,301,356 (Table 8).

SMOLT MONITORING

Approximately 538,504 sockeye salmon smolt emigrated from Spiridon Lake in 2008 (Table 9). The average emigration from 1992 to 2007 was 832,875 sockeye salmon smolt. Smolt mortality in the trapping/bypass system was less than average (2.1%; 1992 to 2007; Table 9) at 0.9% in 2008.

The age composition of the total 2008 outmigration was predominately age-2. (78.4 %) and the remaining smolt emigrating were age-1. (21.6 %; Table 9). This compares to the average (1992 to 2007) age composition of Spiridon Lake sockeye salmon smolt which was 79.9% age-1., followed by 19.9% age-2. and 0.2% age-3. smolt.

In 2008, age-1. smolt captured in the trap averaged 92 mm in length and weighed 5.4 g and age-2. smolt captured in the trap averaged 127 mm in length and weighed 15.6 g (Table 10). No age-3. smolt were captured in the trap in 2008. The average length, weight, and condition of age 1. smolt (0.70 K) in 2008 was the smallest in the historical record from Spiridon Lake (1991 to 2007; 108 mm; 10.8 g; 0.81 K; Table 10). The 2008 average length and condition (0.75 K) of age 2. smolt was tied with the second lowest value and the weight of age 2. smolt was the third lowest value in the historical record from Spiridon Lake (1991 to 2007;149 mm; 29.4 g; 0.81 K; Table 10).

HARVEST MONITORING

Commercial salmon harvests in the SBSHA occurred from June 23 through August 14 in 2008 (Table 11). Approximately 154,575 sockeye salmon, 33 coho salmon *O. kisutch*, 67,214 pink salmon, and 7,627 chum salmon *O. keta* were harvested in Telrod Cove (Tables 11 and 12). The 2008 harvest was higher than the 1994 to 2007 average harvest for sockeye (107,249) and chum (5,969) and lower for coho (1,642) and pink (68,341).

Age-1.3 sockeye salmon comprised the majority (62.6%) of the harvest in 2008, while the age-1.2 fish comprised 19.4% of the harvest and the age-2.2 fish comprised 16.0% of the harvest (Table 13). Historically (1994 to 2007), the age-1.2 component has averaged slightly more than half of the Telrod Cove harvest (58.1%), while the age-1.3 component has averaged 21.6% of the harvest and age-2.2 comprised 15.2%.

ESCAPEMENT MONITORING

Telrod Creek

A stream survey of Telrod Creek was conducted downstream of the terminal falls on July 7, 2008. A total of 600 sockeye salmon and no pink salmon were observed (Table 14). Stream surveys are conducted in Telrod Creek to determine the number of sockeye salmon escaping the commercial fishery and to estimate the pink salmon escapement into the creek as specified in the SLMP. The run timing for pink salmon escaping into Telrod Creek is later; typically pink salmon enter Telrod Creek from approximately mid-August to mid-September. No foot surveys were conducted after August 4, because the Telrod Cove camp was closed.

Spiridon River

The indexed peak pink salmon escapement count into the Spiridon River (stream #254-401; not a part of Spiridon Lake Drainage) was estimated by aerial survey to be 32,000 fish on August 9 (Table 15). An indexed peak chum salmon escapement count of 11,400 fish was estimated on the same aerial survey (August 9). No coho salmon were observed in the surveys. Indexed aerial salmon escapements of the Spiridon River are always difficult due to the heavily glaciated and turbid water conditions. These estimates are considered to be very conservative and may not truly reflect the total salmon abundance in the Spiridon River drainage. Using the Saltery Lake sockeye salmon brood stock for the Spiridon Lake enhancement project reduces the exploitation of pink and coho salmon bound for the Spiridon River because of the Saltery Lake stock's earlier run timing.

SUMMARY AND OUTLOOK FOR 2009

Zooplankton densities and biomass levels at Spiridon Lake have remained below historical averages in recent years. The average length, weight, and condition of smolt emigrating have declined to historically low levels and the average age of emigrating smolt has increased (Tables 9 and 10). In an effort to increase zooplankton production, the ADF&G recommended lower stocking levels and discontinued the pre-smolt releases of sockeye salmon to reduce grazing pressure on the zooplankton community. The reduction in stocking levels has allowed the zooplankton community to increase slightly. Therefore, the 2009 projected release of juvenile sockeye salmon into Spiridon Lake will be approximately 1.5 million, 0.4 g fry (personal communication; Steve Schrof, ADF&G fisheries biologist, Kodiak, Alaska).

Project activities in 2009 at the Spiridon Lake smolt site (Telrod Creek) are expected to be similar to the 2008 field season. However, for the adult monitoring portion, the ADF&G will stop conducting foot surveys of Telrod Creek to estimate pink salmon escapements. These surveys of Telrod Creek were necessary when the late-run Upper Station sockeye salmon run timing (mid-August to early September) coincided with pink salmon returns to Telrod Creek. However, with the change to an earlier run timing of sockeye salmon (mid-July) as a brood source, the commercial fishery targeting them will be closed in Telrod Cove prior to the peak of the pink salmon returns to Telrod Creek. Therefore, the foot surveys documenting the pink salmon escapement into Telrod Creek as part of the SLMP will be discontinued as previously documented in the 5-year renewal of the SUP in 2006.

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TABLES AND FIGURES

Table 1.–Spiridon Lake limnological and fishery monitoring criteria specified in the Spiridon Lake Management Plan (SLMP), and the 2008 results.

	SLMP monitoring criteria	2008 results
Limnology Monitoring		
Mean Total Nitrogen : Total Phosphorous Molar Ratio	148 - 273	258
Mean Total Ammonia (µg/L)	1.6 - 11.2	4.5
Mean Chlorophyl *a* (Chl *a*) (µg/L)	0.1 - 1.0	0.68
Diaptomus : *Cyclops* Ratio	0.01 - 0.54	0.04
Mean Copepod Biomass (mg/m^3)	3.5 - 21.7	2.2
Bosmina : *Daphnia* Ratio	0.22 - 1.73	0.67
Mean Cladoceran Biomass (mg/m^3)	2.6 - 6.8	4.2
Cladoceran (*Bosmina*) average size (mm)	$\geq$ 0.51	0.55
Stocking		
Sockeye	[a]	1,049,809
Smolt Monitoring		
Sockeye smolt outmigration estimate	[a]	538,504
Commercial Harvest from the SBSHA [b]		
Telrod Cove (254-50)		
Sockeye	[a]	154,575
Coho	[a]	33
Pink	[a]	67,214
Chum	[a]	7,627
Escapement Monitoring		
Telrod Creek (254-403)		
Sockeye	[a]	600
Pink	[a]	ns [c]
Spiridon River (254-401)		
Pink (escapement range: 15,000 - 45,000)	[a]	32,000
Chum (escapement range: 10,000 - 30,000)	[a]	11,400
Coho (escapement range: 4,000 - 12,000)	[a]	0

[a] not a specified criteria in the SLMP

[b] Spiridon Bay Special Harvest Area

[c] No surveys were conducted. The field camp is closed in early August, prior to pink salmon escaping into Telrod Creek.

Table 2.–Seasonal mean total Kjeldahl nitrogen (TKN), nitrate+nitrite (No3+No2), total phosphorus (TP) concentrations, and total nitrogen to phosphorus ratio by weight (TN:TP) from the epilimnion (1 m) and hypolimnion (>25 m) of Spiridon Lake, 1988-2008.

Year	Depth	Station	TKN (µg/L)	No_3+No_2 (µg/L)	TP (µg/L)	TN:TP Ratio	Mean TN:TP Ratio	
							Epilimnion	Hypolimnion
1988	Epilimnion	1	102.8	220.5	3.8	187		
1988	Hypolimnion	1	94.9	256.9	3.8	205		
1988	Epilimnion	2	100.5	221.3	3.5	204		
1988	Hypolimnion	2	91.4	236.2	4.0	181	195	193
1989	Epilimnion	1	103.4	207.1	3.6	189		
1989	Hypolimnion	1	97.9	242.8	4.2	179		
1989	Epilimnion	2	114.8	197.9	6.1	114		
1989	Hypolimnion	2	104.0	209.8	7.3	95	151	137
1990	Epilimnion	1	92.5	203.4	3.5	188		
1990	Hypolimnion	1	85.3	228.5	3.0	233		
1990	Epilimnion	2	83.2	185.0	2.4	245		
1990	Hypolimnion	2	87.7	187.3	2.5	244	217	238
1991	Epilimnion	1	93.7	234.0	4.9	148		
1991	Hypolimnion	1	87.5	265.1	5.2	150		
1991	Epilimnion	2	91.8	237.0	3.6	201		
1991	Hypolimnion	2	88.6	267.7	3.8	209	175	180
1992	Epilimnion	1	89.6	239.5	3.7	196		
1992	Hypolimnion	1	87.0	258.7	4.9	158		
1992	Epilimnion	2	98.4	235.2	3.6	207		
1992	Hypolimnion	2	83.2	273.4	4.5	175	201	166
1993	Epilimnion	1	93.6	231.6	2.7	267		
1993	Hypolimnion	1	90.7	240.2	3.0	248		
1993	Epilimnion	2	97.0	230.3	2.9	253		
1993	Hypolimnion	2	85.4	247.7	2.5	293	260	271
1994	Epilimnion	1	101.8	204.3	3.2	212		
1994	Hypolimnion	1	97.5	218.1	3.9	178		
1994	Epilimnion	2	105.7	202.1	2.8	245		
1994	Hypolimnion	2	105.6	225.7	3.3	219	228	199
1995	Epilimnion	1	108.8	203.1	3.4	203		
1995	Hypolimnion	1	105.6	241.6	3.4	225		
1995	Epilimnion	2	125.2	213.4	3.9	194		
1995	Hypolimnion	2	108.2	243.1	3.2	244	199	235

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Table 2.–Page 2 of 3.

Year	Depth	Station	TKN (µg/L)	No_3+No_2 (µg/L)	TP (µg/L)	TN:TP Ratio	Mean TN:TP Ratio	
							Epilimnion	Hypolimnion
1996	Epilimnion	1	113.4	183.6	2.7	242		
1996	Hypolimnion	1	90.5	210.8	3.0	222		
1996	Epilimnion	2	105.5	180.2	2.7	236		
1996	Hypolimnion	2	101.1	217.9	4.4	162	239	192
1997	Epilimnion	1	103.6	147.4	3.0	184		
1997	Hypolimnion	1	90.5	191.0	2.8	223		
1997	Epilimnion	2	106.1	168.2	3.1	198		
1997	Hypolimnion	2	107.4	188.3	3.8	171	191	197
1998	Epilimnion	1	138.3	121.5	4.8	120		
1998	Hypolimnion	1	118.4	174.4	4.0	162		
1998	Epilimnion	2	124.6	148.3	3.9	155		
1998	Hypolimnion	2	122.9	171.9	4.0	163	137	163
1999	Epilimnion	1	93.0	188.0	4.0	155		
1999	Hypolimnion	1	92.0	211.4	3.2	213		
1999	Epilimnion	2	103.5	193.4	2.7	240		
1999	Hypolimnion	2	87.9	208.1	3.0	221	197	217
2000	Epilimnion	1	ND	195.5	7.0	ND		
2000	Epilimnion	2	ND	184.0	6.1	ND	ND	ND
2001	Epilimnion	1	101.2	193.8	4.9	133		
2001	Epilimnion	2	ND	189.2	6.7	ND	133	ND
2002	Epilimnion	1	96.7	136.5	3.3	156		
2002	Epilimnion	2	ND	135.0	4.0	ND	156	ND
2003	Epilimnion	1	100.3	203.3	5.7	118		
2003	Epilimnion	2	ND	201.3	3.5	ND	118	ND
2004	Epilimnion	1	98.7	197.3	4.4	149		
2004	Hypolimnion	1	109.9	197.7	4.8	142		
2004	Epilimnion	2	ND	186.4	4.6	ND		
2004	Hypolimnion	2	ND	200.3	10.0	ND	149	142
2005	Epilimnion	1	147.4	139.5	2.7	235		
2005	Hypolimnion	1	40.1	163.7	3.9	116		
2005	Epilimnion	2	ND	142.5	4.1	ND		
2005	Hypolimnion	2	139.8	169.7	5.1	134	235	125

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Table 2.–Page 3 of 3.

Year	Depth	Station	TKN (µg/L)	No_3+No_2 (µg/L)	TP (µg/L)	TN:TP Ratio	Mean TN:TP Ratio	
							Epilimnion	Hypolimnion
2006	Epilimnion	1	255.9	182.7	1.4	694		
2006	Hypolimnion	1	183.1	190.4	1.5	551		
2006	Epilimnion	2	ND	181.8	1.7	ND		
2006	Hypolimnion	2	ND	197.5	2.4	ND	694	551
2007	Epilimnion	1	127.8	171.0	2.3	285		
2007	Hypolimnion	1	108.8	192.8	2.2	304		
2007	Epilimnion	2	ND	165.6	2.1	ND		
2007	Hypolimnion	2	ND	192.0	2.3	ND	285	304
2008	Epilimnion	1	105.8	186.6	2.1	308		
2008	Hypolimnion	1	ND	208.3	2.2	ND		
2008	Epilimnion	2	76.0	178.4	2.7	209		
2008	Hypolimnion	2	ND	183.6	19.3	ND	258	ND
Epilimnion mean 1988-1989:							173	165
Epilimnion mean 1990-2007:							224	227

Table 3.–Summary of seasonal mean epilimnion and Hypolimnion, nutrient and algal pigment concentrations by station for Spiridon Lake, 1988-2008.

Year	Station	Depth (m)	Total-P (µg/L)	SD	Total Filterable-P (µg/L)	SD	Filterable reactive-P (µg/L)	SD	Total Kjeldahl nitrogen (µg/L)	SD	Ammonia (µg/L)	SD	Nitrate+nitrite (µg/L)	SD	Chlorophyll *a* (µg/L)	SD
1988	1	1	3.8	1.4	3.0	1.1	2.5	1.2	102.8	11.4	9.9	2.7	220.5	26.0	0.45	0.09
	1	50	3.8	0.6	2.2	0.6	1.7	0.5	94.9	9.0	11.2	5.5	256.9	9.6	0.16	0.06
	2	1	3.5	0.1	2.0	0.6	1.8	0.3	100.5	11.3	7.8	6.6	221.3	11.1	0.40	0.10
	2	50	4.0	0.6	1.9	0.6	1.8	0.5	91.4	9.9	8.6	4.4	236.2	27.5	0.29	0.12
1989	1	1	3.6	0.7	3.7	1.9	3.0	2.2	103.4	7.6	8.5	2.5	207.1	35.4	0.19	0.11
	1	50	4.2	1.0	3.2	1.2	2.4	0.4	97.9	18.6	11.5	7.3	242.8	54.9	0.32	0.18
	2	1	6.1	3.7	2.7	1.0	2.5	0.4	114.8	45.7	9.5	5.2	197.9	61.9	0.18	0.13
	2	50	7.3	7.8	2.7	0.7	2.7	0.7	104.0	40.1	12.5	11.0	209.8	50.4	0.37	0.28
1990	1	1	3.5	1.8	2.4	0.6	2.0	0.8	92.5	16.5	4.9	2.0	203.4	36.8	0.23	0.11
	1	50	3.0	0.7	2.8	0.5	2.0	0.6	85.3	10.9	6.3	2.5	228.5	24.8	0.34	0.21
	2	1	2.4	0.6	4.1	3.2	3.3	2.4	83.2	6.4	4.7	1.7	185.0	79.4	0.24	0.09
	2	50	2.5	0.8	2.8	1.1	2.9	1.9	87.7	12.3	6.6	2.8	187.3	80.1	0.24	0.12
1991	1	1	4.9	5.9	2.8	0.8	2.6	0.9	93.7	7.3	7.6	4.4	234.0	38.1	0.38	0.14
	1	50	5.2	3.7	3.3	2.0	2.8	1.4	87.5	12.9	9.4	4.8	265.1	20.9	0.20	0.09
	2	1	3.6	0.8	4.8	3.3	4.6	3.3	91.8	8.6	8.2	4.5	237.0	29.6	0.35	0.12
	2	50	3.8	1.5	3.6	3.3	3.4	3.2	88.6	7.4	11.3	5.8	267.7	7.7	0.25	0.14
1992	1	1	3.7	0.6	2.1	0.7	1.5	0.5	89.6	10.1	1.5	0.8	239.5	12.3	0.27	0.15
	1	50	4.9	1.4	4.2	3.1	3.7	3.0	87.0	8.0	4.6	3.3	258.7	16.9	0.22	0.07
	2	1	3.6	0.3	2.6	1.4	2.4	1.4	98.4	18.2	1.7	0.6	235.2	25.9	0.27	0.21
	2	50	4.5	0.8	3.1	2.8	2.0	1.1	83.2	24.8	5.3	3.7	273.4	7.7	0.23	0.11
1993	1	1	2.7	0.9	2.2	1.1	1.6	0.8	93.6	11.2	2.4	1.5	231.6	37.6	0.75	0.24
	1	50	3.0	0.9	3.0	4.0	1.8	1.8	90.7	10.8	5.2	3.4	240.2	22.8	0.42	0.20
	2	1	2.9	1.0	3.2	3.5	2.6	3.3	97.0	12.0	1.8	0.5	230.3	41.5	0.77	0.29
	2	50	2.5	0.1	3.2	2.5	2.8	2.5	85.4	3.8	5.4	3.7	247.7	30.6	0.40	0.22

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Table 3.–Page 2 of 3.

Year	Station	Depth (m)	Total-P (µg/L)	SD	Total Filterable-P (µg/L)	SD	Filterable reactive-P (µg/L)	SD	Total Kjeldahl nitrogen (µg/L)	SD	Ammonia (µg/L)	SD	Nitrate+nitrite (µg/L)	SD	Chlorophyll *a* (µg/L)	SD
1994	1	1	3.2	1.3	1.9	1.5	1.5	1.1	101.8	3.9	3.2	4.7	204.3	22.1	0.26	0.21
	1	50	3.9	2.0	1.2	0.2	1.1	0.4	97.5	16.1	6.7	3.6	218.1	18.3	0.21	0.13
	2	1	2.8	0.7	2.2	1.5	1.4	0.9	105.7	12.8	1.6	1.3	202.1	17.2	0.31	0.15
	2	50	3.3	1.2	2.2	1.3	1.9	1.1	105.6	13.2	5.8	2.5	225.7	20.6	0.20	0.07
1995	1	1	3.4	2.2	0.9	0.1	0.9	0.2	108.8	12.3	2.2	1.6	203.1	26.8	0.95	0.49
	1	50	3.4	1.3	1.5	0.3	1.4	0.4	105.6	20.4	3.5	2.4	241.6	6.6	0.58	0.44
	2	1	3.9	2.0	1.2	0.4	1.1	0.2	125.2	24.1	2.2	1.0	213.4	19.8	1.02	0.41
	2	50	3.2	0.9	0.9	0.2	0.9	0.1	108.2	18.6	4.5	3.0	243.1	9.1	0.58	0.45
1996	1	1	2.7	0.6	1.5	0.9	1.0	0.5	113.4	34.1	5.1	2.8	183.6	18.5	0.49	0.16
	1	50	3.0	1.1	1.3	0.7	1.0	0.4	90.5	18.5	9.3	5.0	210.8	9.0	0.51	0.23
	2	1	2.7	0.7	1.4	0.7	1.1	0.3	105.5	20.7	5.6	1.6	180.2	14.4	0.47	0.14
	2	50	4.4	1.7	1.5	0.7	1.5	1.3	101.1	16.9	10.2	4.1	217.9	2.4	0.57	0.33
1997	1	1	3.0	0.6	3.4	3.5	3.5	4.1	103.6	12.0	11.2	5.8	147.4	31.1	0.57	0.35
	1	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.58	0.37
	1	50	2.8	0.7	1.8	0.4	1.8	0.5	90.5	5.2	11.1	6.3	191.0	19.7	0.38	0.22
	2	1	3.1	0.9	3.2	3.3	3.1	3.2	106.1	11.3	11.2	6.4	168.2	25.2	0.59	0.35
	2	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.57	0.32
	2	50	3.8	1.5	3.1	1.0	3.2	1.0	107.4	30.3	10.7	6.2	188.3	17.5	0.44	0.24
1998	1	1	4.8	1.6	2.7	1.8	1.7	1.0	138.3	20.5	8.4	6.1	121.5	24.7	0.43	0.25
	1	50	4.0	0.4	1.6	0.8	1.3	0.5	118.4	10.1	10.2	5.4	174.4	19.6	0.14	0.04
	2	1	3.9	1.2	1.5	1.1	1.4	0.6	124.6	10.1	4.9	1.4	148.3	12.2	0.38	0.28
	2	50	4.0	1.7	1.5	0.9	1.5	0.7	122.9	12.0	9.6	4.5	171.9	26.4	0.21	0.12
1999	1	1	4.0	2.5	1.9	0.5	1.5	0.5	93.0	4.8	6.4	2.9	188.0	33.8	0.49	0.30
	1	50	3.2	0.4	1.7	0.7	1.2	0.5	92.0	2.7	6.9	3.8	211.4	6.1	0.15	0.05
	2	1	2.7	0.3	2.3	0.7	1.7	0.4	103.5	14.3	6.2	4.1	193.4	24.0	0.30	0.22
	2	50	3.0	0.6	2.3	1.6	1.7	1.4	87.9	15.3	11.2	6.0	208.1	10.1	0.25	0.14

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Table 3.–Page 3 of 3.

Year	Station	Depth (m)	Total-P (µg/L)	SD	Total Filterable-P (µg/L)	SD	Filterable reactive-P (µg/L)	SD	Total Kjeldahl nitrogen (µg/L)	SD	Ammonia (µg/L)	SD	Nitrate+nitrite (µg/L)	SD	Chlorophyll *a* (µg/L)	SD
2000	1	1	7.0	4.5	3.4	3.8	2.3	2.2	ND	–	8.7	8.6	195.5	1.8	0.58	0.14
	2	1	6.1	8.7	3.3	4.6	2.0	2.0	ND	–	7.5	8.0	184.0	15.7	0.77	0.18
2001	1	1	4.9	3.3	3.5	2.1	1.9	2.0	101.2	8.0	4.6	4.7	193.8	6.7	0.60	0.30
	2	1	6.7	5.1	3.5	3.3	2.7	3.5	ND	–	2.1	1.3	189.2	7.3	0.60	0.10
2002	1	1	3.3	2.6	1.5	0.9	3.0	1.9	96.7	14.5	5.0	2.3	136.5	7.9	0.32	0.00
	2	1	4.0	1.9	1.3	1.3	1.9	1.0	ND	–	3.4	1.7	135.0	21.2	0.45	0.18
2003	1	1	5.7	0.8	2.8	3.4	2.6	1.7	100.3	9.9	2.6	2.1	203.3	36.7	0.70	0.40
	2	1	3.5	0.7	1.4	1.1	3.6	0.8	ND	–	1.9	2.0	201.3	22.1	0.60	0.30
2004	1	1	4.4	2.9	0.9	0.9	1.5	1.1	98.7	47.6	6.8	2.1	197.3	19.1	0.60	0.25
	2	1	4.6	4.4	2.0	3.9	2.0	0.9	ND	–	7.2	1.3	186.4	19.6	0.82	0.71
2005	1	1	2.7	1.2	1.8	1.5	0.5	1.2	147.4	135.4	4.7	1.6	139.5	28.2	0.51	0.20
	2	1	4.1	0.7	1.0	0.9	0.5	0.7	152.6	62.0	4.9	2.0	142.5	15.6	0.52	0.04
2006	1	1	1.4	1.3	1.7	0.2	1.0	0.5	255.9	166.5	7.0	1.4	182.7	15.3	0.68	0.25
	2	1	1.7	1.3	1.5	0.2	0.9	0.4	ND	–	7.2	1.5	181.8	17.2	0.74	0.23
2007	1	1	2.3	0.6	1.0	0.7	0.4	0.1	127.8	27.8	5.1	1.5	171.0	23.2	0.64	0.39
	2	1	2.1	0.9	0.8	0.4	0.6	0.3	ND	–	5.8	3.4	165.6	25.6	0.58	0.42
2008	1	1	2.1	0.4	0.9	0.3	1.7	1.6	105.8	68.3	4.4	1.0	186.6	20.3	0.71	0.56
	2	1	2.7	0.4	1.1	0.8	1.0	1.1	76.0	56.2	4.6	1.6	178.4	13.5	0.64	0.39
Mean 1 m 1988-1989:			3.8	0.7	2.2	0.7	1.9	0.6	97.4	10.4	9.4	4.8	233.7	18.5	0.32	0.09
Mean 1 m 1990-2007:			4.0	2.1	2.6	1.9	2.2	1.5	104.9	27.3	5.9	3.3	206.3	27.7	0.45	0.20

Note: The Epilimnion consists of samples taken from a depth of 1 meter and the Hypolimnion consists of samples taken from a depth of 50 meters.

Table 4.–Summary of Spiridon Lake cladoceran and copepod weighted mean density, biomass, and their comparative ratios, 1988-2008.

	Cladoceran		Copepod		Total		Cladoceran to Copepod ratios [a]	
	Density	Biomass	Density	Biomass	Density	Biomass	Abundance	Biomass
Year	No./m^3	mg/m^3	No./m^3	mg/m^3	No./m^3	mg/m^3	Ratio	Ratio
1988	1,120	5.3	4,006	11.7	5,126	17.0	0.28 :1	0.45 :1
1989	1,308	4.9	9,826	15.8	11,134	20.7	0.13 :1	0.31 :1
1990	1,055	5.1	6,361	17.7	7,416	22.8	0.17 :1	0.29 :1
1991	834	3.4	8,862	18.8	9,696	22.2	0.09 :1	0.18 :1
1992	980	4.5	6,996	21.7	7,976	26.2	0.14 :1	0.21 :1
1993	878	2.9	5,616	10.3	6,494	13.2	0.16 :1	0.29 :1
1994	1,517	4.7	4,977	10.0	6,494	14.7	0.30 :1	0.47 :1
1995	1,589	6.4	4,538	12.0	6,127	18.4	0.35 :1	0.53 :1
1996	1,180	5.2	7,762	17.1	8,942	22.3	0.15 :1	0.30 :1
1997	1,531	6.7	2,477	6.3	4,008	13.0	0.62 :1	1.06 :1
1998	1,715	6.8	7,262	10.5	8,977	17.3	0.24 :1	0.65 :1
1999	726	2.6	1,450	3.5	2,176	6.1	0.50 :1	0.74 :1
2000	1,580	5.0	7,393	9.8	8,973	14.8	0.21 :1	0.51 :1
2001	1,752	7.6	1,421	4.4	3,173	11.9	1.23 :1	1.73 :1
2002	2,211	11.3	4,964	9.9	7,175	21.2	0.45 :1	1.15 :1
2003	2,785	6.8	3,779	7.1	6,564	13.9	0.74 :1	0.95 :1
2004 [b]	1,679	3.6	1,510	3.0	3,189	6.6	1.11 :1	1.19 :1
2005 [b]	3,329	10.2	1,635	2.7	4,964	12.8	2.04 :1	3.77 :1
2006 [c]	1,453	5.1	276	0.9	1,729	6.0	5.26 :1	5.67 :1
2007	1,688	4.0	556	1.7	2,244	5.7	3.04 :1	2.35 :1
2008	1,485	4.2	585	2.2	2,070	6.4	2.54 :1	1.91 :1
Mean 88-89:	1,214	5.1	6,916	13.8	8,130	18.9	0.18 :1	0.37 :1
Mean 90-07:	1,582	5.7	4,324	9.3	5,907	14.9	0.93 :1	0.61 :1

[a] Values based on seasonal mean density and biomass

[b] Values in 2004 were derived from 10, in 2005 from 8 sampling dates.

[c] Values include five sampling dates from each station only (5/23 or 5/16, 6/27, 8/1, 9/5, and 9/23).

Table 5.–Spiridon Lake weighted mean copepod density and biomass by species and the Diaptomus to Cyclops abundance ratio, 1988-2008.

Year	Number of Samples	*Epischura* Density No./m^3	*Epischura* Biomass mg/m^3	*Diaptomus* Density No./m^3	*Diaptomus* Biomass mg/m^3	*Cyclops* Density No./m^3	*Cyclops* Biomass mg/m^3	Totals Density No./m^3	Totals Biomass mg/m^3	*Diaptomus:* *Cyclops* Ratio [a]
1988	4	0	0.0	1,067	4.9	2,939	6.8	4,006	11.7	0.36 :1
1989	5	0	0.0	2,199	6.7	7,627	9.1	9,826	15.8	0.29 :1
1990	5	0	0.0	2,228	9.4	4,134	8.3	6,361	17.7	0.54 :1
1991	7	0	0.0	2,276	7.5	6,587	11.3	8,862	18.8	0.35 :1
1992	6	0	0.0	504	3.1	6,492	18.6	6,996	21.7	0.08 :1
1993	6	5	0.0	221	1.1	5,395	9.2	5,621	10.3	0.04 :1
1994	6	0	0.0	155	0.8	4,822	9.2	4,977	10.0	0.03 :1
1995	6	0	0.0	266	2.5	4,272	9.5	4,538	12.0	0.06 :1
1996	6	0	0.0	69	0.4	7,693	16.7	7,762	17.1	0.01 :1
1997	6	0	0.0	64	0.5	2,413	5.8	2,477	6.3	0.03 :1
1998	5	0	0.0	163	0.9	7,099	9.6	7,262	10.5	0.02 :1
1999	5	0	0.0	97	0.5	1,353	3.0	1,450	3.5	0.07 :1
2000	5	133	0.2	61	0.3	7,332	9.3	7,526	9.8	0.01 :1
2001	5	46	0.1	95	0.9	1,326	3.4	1,467	4.4	0.07 :1
2002	5	81	0.1	459	2.5	4,506	7.3	5,045	9.9	0.10 :1
2003	4	381	0.4	593	2.6	3,186	4.1	4,160	7.1	0.19 :1
2004	10	57	0.1	100	0.7	1,410	2.3	1,567	3.0	0.07 :1
2005	8	36	0.0	45	0.2	1,590	2.5	1,671	2.7	0.03 :1
2006 [b]	5	3	0.0	17	0.1	259	0.8	279	0.9	0.07 :1
2007	5	11	0.0	56	0.3	501	1.4	567	1.7	0.11 :1
2008	5	54	0.2	24	0.2	561	1.8	639	2.2	0.04 :1
Mean 1988-1989:	5	0	0.0	1,633	5.8	5,283	8.0	6,916	13.8	0.31 :1
Mean 1990-2007:	6	42	0.1	415	1.9	3,909	7.3	4,366	9.3	0.11 :1

[a] Values based on mean density

[b] Values include five sampling dates from each station only (5/23 or 5/16, 6/27, 8/1, 9/5, and 9/23).

Table 6.–Summary of the Spiridon Lake weighted mean density and biomass of cladocerans by species and the Bosmina to Daphnia abundance ratio, 1988-2008.

		Bosmina		*Daphnia*		*Holopedium*		Totals		*Bosmina:*
Year	Number of Samples	Density No./m^3	Biomass mg/m^3	Density No./m^3	Biomass mg/m^3	Density No./m^3	Biomass mg/m^3	Density No./m^3	Biomass mg/m^3	*Daphnia* ratio [a]
1988	4	724	2.6	381	2.6	15	0.1	1,120	5.3	1.90 :1
1989	5	759	2.2	441	1.9	108	0.8	1,308	4.9	1.72 :1
1990	5	424	1.4	601	3.6	30	0.1	1,055	5.1	0.70 :1
1991	7	144	0.4	662	2.9	28	0.1	834	3.4	0.22 :1
1992	6	298	1.0	614	3.0	68	0.5	980	4.5	0.49 :1
1993	6	324	0.9	479	1.4	75	0.6	878	2.9	0.68 :1
1994	6	561	1.5	801	2.0	155	1.2	1,517	4.7	0.70 :1
1995	6	599	1.5	591	1.6	399	3.3	1,589	6.4	1.01 :1
1996	6	571	1.9	427	1.6	182	1.7	1,180	5.2	1.34 :1
1997	6	652	1.8	526	2.2	353	2.7	1,531	6.7	1.24 :1
1998	5	474	1.2	915	4.4	326	1.2	1,715	6.8	0.52 :1
1999	5	374	1.2	216	0.7	136	0.7	726	2.6	1.73 :1
2000	5	855	2.0	442	1.2	282	1.7	1,580	5.0	1.94 :1
2001	5	664	1.9	793	2.5	294	3.2	1,752	7.6	0.84 :1
2002	5	714	2.1	485	2.4	1,012	6.9	2,211	11.3	1.47 :1
2003	4	1,671	3.2	826	1.7	288	1.9	2,785	6.8	2.02 :1
2004	10	638	1.4	999	2.0	42	0.2	1,679	3.6	0.64 :1
2005	8	1,745	4.1	1,122	1.9	462	4.2	3,329	10.2	1.56 :1
2006 [b]	5	516	1.1	559	0.9	378	3.1	1,453	5.1	0.92 :1
2007	5	653	1.3	747	1.2	288	1.5	1,688	4.0	0.87 :1
2008	5	592	1.7	880	2.3	13	0.2	1,485	4.2	0.67 :1
Mean 1988-1989:	5	741	2.4	411	2.3	62	0.5	1,214	5.1	1.80 :1
Mean 1990-2007:	6	660	1.7	656	2.1	267	1.9	1,582	5.7	1.01 :1

[a] Values based on mean density
[b] Values include five sampling dates from each station only (5/23 or 5/16, 6/27, 8/1, 9/5, and 9/23).

Table 7.–Seasonal weighted mean lengths (mm) of zooplankton taxa in Spiridon Lake, 1988-2008.

Year	*Diaptomus*	*Cyclops*	*Bosmina*	*Daphnia*	*Holopedium*
1988	1.02	0.82	0.61	1.20	0.73
1989	0.89	0.60	0.56	0.96	0.82
1990	1.00	0.76	0.59	1.10	0.69
1991	0.94	0.70	0.55	0.99	0.76
1992	1.13	0.91	0.60	1.01	0.91
1993	1.06	0.70	0.51	0.80	0.83
1994 [a]	1.09	0.75	0.55	0.75	0.85
1995 [a]	1.30	0.79	0.51	0.78	0.83
1996 [a]	0.99	0.78	0.58	0.92	0.91
1997 [a]	1.26	0.82	0.54	1.00	0.84
1998	1.09	0.63	0.52	0.90	0.58
1999	1.06	0.78	0.58	0.92	0.63
2000	1.14	0.61	0.51	0.79	0.76
2001	1.34	0.85	0.55	0.84	0.97
2002	1.12	0.69	0.55	1.02	0.80
2003	1.01	0.62	0.45	0.68	0.80
2004 [b]	1.14	0.70	0.50	0.72	0.68
2005 [b]	1.00	0.67	0.50	0.62	0.79
2006 [b]	1.10	0.93	0.47	0.60	0.86
2007	1.13	0.88	0.46	0.61	0.73
2008	1.14	0.95	0.55	0.76	0.96
Mean 1988-1989:	0.95	0.71	0.58	1.08	0.77
Mean 1990-2007:	1.11	0.75	0.53	0.82	0.79

[a] From 1994-1997 average lengths were derived from samples collected at 4 sampling stations. In most years, average lengths were derived from samples collected at 2 sampling stations.

[b] From 2004-2006 average lengths were derived from a subset of 5 sample dates, not the complete set of 8-10 samples that were collected. Only 5 sample dates were used for average length calculations to maintain interannual comparability.

Table 8.–Sockeye salmon stocking numbers, life stage, size and release date, by year into Spiridon Lake, 1990-2008.

	Fry			Fingerling			Pre-Smolt			
	Date Stocked	Number	Size (g)	Date Stocked	Number	Size (g)	Date Stocked	Number	Size (g)	Total Stocked
1990	ND	249,346	ND		0			0		249,346
1991	7-Jul	3,480,000	0.3		0			0		3,480,000
1992	20-Jun	2,200,000	0.2		0			0		2,200,000
1993	9-Jun	4,246,000	0.2		0			0		4,246,000
1994	24-May	4,400,000	0.2		0			0		5,676,000
	9-Jun	1,276,000	0.2							
1995	26-Jun	2,813,000	0.3	5-Jul	1,786,000	0.4		0		4,599,000
1996	21-May	1,100,000	0.2	26-Jun	3,744,000	0.4		0		4,844,000
1997	28-Jun	4,200,000	0.2	24-Jul	1,200,000	0.5		0		6,700,000
	12-Jul	1,300,000	0.3							
1998	18-Jun	784,000	0.4	13-Jul	2,556,000	0.9		0		3,340,000
1999	18-Jun	600,000	0.3	8-29 Jul	2,160,000	1.0		0		3,564,000
				2-17 Jul	804,000	2.0				
2000	25-May	535,000	0.3	23-Aug	507,100	3.0		0		4,397,100
	11-Jun	3,355,000	0.4							
2001		0		21-Jun	1,700,600	0.8		0		1,700,600
2002		0		30-Jul	366,000	1.2	4-Oct	586,900	8.5	952,900
2003		0		29-Jun	730,744	1.2	9-Oct	686,775	11.8	1,417,519
2004		0		19-Jun	2,008,205	0.5	5-7 Oct	501,220	11.5	2,797,644
				16-Aug	288,219	4.1				

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	Fry			Fingerling			Pre-Smolt			
	Date Stocked	Number	Size (g)	Date Stocked	Number	Size (g)	Date Stocked	Number	Size (g)	Total Stocked
2005		0		23-Jun	693,176	0.8	2-3 Oct	508,492	8.4	1,201,668
2006	23-24 Jun	2,765,088	0.4		0		5-6 Oct	431,424	9.9	3,196,512
2007	17-Jun	1,559,868	0.3		0		28-Sep	250,243	5.7	1,810,111
2008	27-Jun	1,049,809	0.3		0			0		1,049,809
Mean 1991-2007		2,036,115			1,090,826			174,415		3,301,356

Note: Life stages are determined by emergent weight (g). Two times emergent weight is called a Fingerling and 20 times emergent weight is called a pre-smolt. Release dates typically spanned several days due to the large number of juveniles to be released and weather delays. Therefore, weights were averaged for multiple release dates.

Table 9.–Spiridon Lake sockeye salmon total smolt emigration and mortality estimates by year and age, 1992-2008.

Year	Number and Proportions of Smolt by Age Class			Total Smolt	Total Mortality	Number and Proportions of Live Smolt by Age Class			Total Live Smolt
	1.	2.	3.			1.	2.	3.	
1992	1,466,995	17,826	0	1,484,821	87,169	1,380,321	17,331	0	1,397,652
	98.8%	1.2%	0.0%	100.0%	5.9%	98.8%	1.2%	0.0%	100.0%
1993	260,115	85,443	0	345,558	15,433	249,784	80,341	0	330,125
	75.3%	24.7%	0.0%	100.0%	4.5%	75.7%	24.3%	0.0%	100.0%
1994	599,717	244,360	6,271	850,348	3,123	597,502	243,464	6,259	847,225
	70.5%	28.7%	0.7%	100.0%	0.4%	70.5%	28.7%	0.7%	100.0%
1995	314,604	299,556	831	614,992	21,030	304,326	288,822	813	593,961
	51.2%	48.7%	0.1%	100.0%	3.4%	51.2%	48.6%	0.1%	100.0%
1996	918,540	135,414	1,232	1,055,186	23,120	897,762	133,097	1,207	1,032,066
	87.1%	12.8%	0.1%	100.0%	2.2%	87.0%	12.9%	0.1%	100.0%
1997	654,293	237,492	2,934	894,719	25,551	635,650	230,685	2,833	869,168
	73.1%	26.5%	0.3%	100.0%	2.9%	73.1%	26.5%	0.3%	100.0%
1998	529,726	216,923	301	746,950	21,321	514,606	210,731	292	725,629
	70.9%	29.0%	0.0%	100.0%	2.9%	70.9%	29.0%	0.0%	100.0%
1999	812,267	123,458	373	936,118	37,331	779,875	118,534	358	898,787
	86.8%	13.2%	0.0%	100.0%	4.0%	86.8%	13.2%	0.0%	100.0%
2000	792,029	493,529	5,133	1,290,692	4,384	788,909	492,275	5,122	1,286,306
	61.4%	38.2%	0.4%	100.0%	0.3%	61.3%	38.3%	0.4%	100.0%

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Year	Number and Proportions of Smolt by Age Class 1.	2.	3.	Total Smolt	Total Mortality	Number and Proportions of Live Smolt by Age Class 1.	2.	3.	Total Live Smolt
2001	1,093,246	442,975	0	1,536,221	7,305	1,087,695	441,221	0	1,528,916
	71.2%	28.8%	0.0%	100.0%	0.5%	71.1%	28.9%	0.0%	100.0%
2002	441,964	92,484	0	534,448	12,523	431,542	90,384	0	521,925
	82.7%	17.3%	0.0%	100.0%	2.3%	82.7%	17.3%	0.0%	100.0%
2003	228,857	34,854	914	264,624	1,777	227,363	34,696	789	262,847
	86.5%	13.2%	0.3%	100.0%	0.7%	86.5%	13.2%	0.3%	100.0%
2004	540,748	36,882	1,274	578,904	1,249	539,582	36,804	1,269	577,655
	93.4%	6.4%	0.2%	100.0%	0.2%	93.4%	6.4%	0.2%	100.0%
2005	1,368,763	48,326	4,264	1,421,353	11,979	1,357,702	47,636	4,036	1,409,374
	96.3%	3.4%	0.3%	100.0%	0.8%	96.3%	3.4%	0.3%	100.0%
2006	471,241	94,932	0	566,173	1,214	470,231	94,728	0	564,959
	83.2%	16.8%	0.0%	100.0%	0.2%	83.2%	16.8%	0.0%	100.0%
2007	387,179	96,795	0	483,974	4,563	383,529	95,882	0	479,411
	80.0%	20.0%	0.0%	100.0%	0.9%	80.0%	20.0%	0.0%	100.0%
2008	117,370	426,010	0	543,380	4,876	116,491	422,013	0	538,504
	21.6%	78.4%	0.0%	100.0%	0.9%	21.6%	78.4%	0.0%	100.0%
Average	680,018	168,828	1,470	850,318	17,442	665,399	166,039	1,436	832,875
1992-2007	80.0%	19.9%	0.2%	100.0%	2.1%	79.9%	19.9%	0.2%	100.0%

Note. Age percentages may not match those in Table 10. Values in Table 9 have been adjusted to account for non-aged emigrating smolt. Percentages in table 9 may not add up exactly due to rounding.

Table 10.–Mean length, weight, and condition coefficient by age of sockeye salmon smolt captured by trap emigrating from Spiridon Lake, 1991-2008.

	Age-1.						Age-2.						Age-3.					
Year	N [a]	N [b]	% Captured	Length (mm)	Weight (g)	Condition (K)	N [a]	N [b]	% Captured	Length (mm)	Weight (g)	Condition (K)	N [a]	N [b]	% Captured	Length (mm)	Weight (g)	Condition (K)
1991	596	596	100.0	127	19.3	1.08	0	0	0.0	–	–	–	0	0	0.0	–	–	–
1992	1393	1389	98.8	115	12.7	0.81	16	14	1.1	183	58.9	0.80	0	0	0.0	–	–	–
1993	817	493	66.8	116	13.4	0.83	404	240	33.0	155	33.8	0.88	2	2	0.2	178	50.7	0.90
1994	1477	929	73.5	106	9.3	0.78	526	344	26.2	152	28.5	0.79	6	4	0.3	254	145.8	0.88
1995	1697	999	60.9	104	9.2	0.81	1081	667	38.8	138	25.1	0.95	6	5	0.2	244	102.8	0.84
1996	2224	1573	76.1	109	10.3	0.79	694	513	23.7	141	20.7	0.73	6	5	0.2	221	85.6	0.77
1997	1428	876	66.2	102	8.6	0.80	720	441	33.4	137	20.6	0.80	11	6	0.5	169	41.9	0.81
1998	2205	1496	77.4	93	6.3	0.76	727	414	22.5	127	15.4	0.75	3	0	0.1	–	–	–
1999 [c]	1452	799	73.6	95	7.0	0.80	518	336	26.3	122	14.1	0.78	2	1	0.1	126	15.0	0.75
2000	2263	1700	81.1	94	6.8	0.79	507	325	18.2	132	18.5	0.80	22	8	0.8	142	22.4	0.77
2001	2037	2037	80.1	104	8.8	0.78	506	506	19.9	136	20.2	0.79	0	0	0.0	–	–	–
2002	1716	1716	86.6	118	12.7	0.77	266	266	13.4	155	30.2	0.80	0	0	0.0	–	–	–
2003	1226	1197	80.0	131	20.4	0.89	288	277	18.8	165	42.4	0.87	19	19	1.2	168	42.7	0.84
2004	1325	1325	89.0	127	16.8	0.80	160	160	10.8	184	51.3	0.80	3	3	0.2	227	97.7	0.84
2005	1068	1068	88.6	106	9.6	0.79	119	119	9.9	178	51.1	0.83	18	18	1.5	195	61.8	0.84
2006	871	871	88.1	107	9.7	0.75	118	118	11.9	158	32.6	0.82	0	0	0.0	–	–	–
2007	1063	1063	81.6	101	8.4	0.77	240	240	18.4	139	21.0	0.80	0	0	0.0	–	–	–
2008	371	371	46.8	92	5.4	0.70	422	422	53.2	127	15.6	0.75	0	0	0.0	–	–	–
Average 1991-2007			78.6	108	10.8	0.81			21.1	149	29.4	0.81			0.3	192	66.6	0.82

Note. Age percentages may not match those in Table 9. Values in Table 9 have been adjusted to account for non-aged emigrating smolt.

[a] the number of smolt aged

[b] the number of smolt sampled for length, weight, and condition

[c] One smolt sampled was age 0. and was 96 mm; 6.6 g; 0.75 K.

Table 11.–Commercial harvest of salmon by species and day in the Spiridon Bay Special Harvest Area (statistical area 254-50), 2008.

Date	Sockeye	Coho	Pink	Chum	Total
23-Jun	18,313	0	92	15	18,420
24-Jun	5,024	0	72	1	5,097
25-Jun	2,137	0	37	3	2,177
26-Jun	30	0	0	0	30
27-Jun	81	0	0	0	81
28-Jun	2,281	0	3	0	2,284
29-Jun	2,545	0	4	2	2,551
30-Jun	7,568	0	35	0	7,603
1-Jul	7,532	0	41	3	7,576
2-Jul	5,623	0	76	1	5,700
3-Jul	4,535	0	101	4	4,640
4-Jul	6,316	0	115	6	6,437
5-Jul	5,086	0	113	6	5,205
6-Jul	6,275	0	296	54	6,625
7-Jul	6,846	0	628	121	7,595
8-Jul	6,653	16	716	88	7,473
9-Jul	3,476	0	156	11	3,643
10-Jul	5,141	0	298	35	5,474
11-Jul	5,580	0	316	34	5,930
12-Jul	8,174	0	812	102	9,088
13-Jul	2,926	0	264	46	3,236
14-Jul	2,482	0	1,009	226	3,717
15-Jul	799	0	310	67	1,176
16-Jul	4,343	0	1,734	444	6,521
17-Jul	4,885	0	3,928	396	9,209
18-Jul	1,222	0	739	128	2,089
19-Jul	4,084	0	2,701	644	7,429
20-Jul	3,172	0	2,662	832	6,666
21-Jul	1,538	3	3,087	584	5,212
22-Jul	2,689	0	3,495	585	6,769
23-Jul	2,255	0	4,277	937	7,469
24-Jul	682	0	1,235	267	2,184
25-Jul	214	0	359	55	628
26-Jul	3,975	0	7,940	1,013	12,928
27-Jul	1,338	0	1,327	95	2,760
29-Jul	1,736	0	2,996	169	4,901
30-Jul	46	0	78	3	127
31-Jul	1,843	0	2,900	88	4,831
1-Aug	868	0	5,530	216	6,614
2-Aug	1,189	0	4,409	87	5,685
3-Aug	867	0	3,393	34	4,294
4-Aug	87	0	776	23	886
5-Aug	662	2	2,329	151	3,144
6-Aug	451	2	1,780	24	2,257
8-Aug	310	1	1,482	12	1,805
10-Aug	489	4	1,095	8	1,596
14-Aug	207	5	1,468	7	1,687
Total	154,575	33	67,214	7,627	229,449

Table 12.–Commercial harvest of salmon by species and year in the Spiridon Bay Special Harvest Area (statistical area 254-50), 1994-2008.

Year	Sockeye	Coho	Pink	Chum
1994	130,891	4,584	32,331	2,291
1995	11,889	2,194	46,422	2,169
1996	164,114	3,622	44,701	4,684
1997	66,480	4,889	54,236	2,575
1998	90,447	2,211	103,715	4,812
1999	192,773	2,149	61,004	13,700
2000	81,931	565	108,254	13,070
2001	59,733	345	70,883	12,885
2002	201,534	2,331	222,860	8,189
2003	259,714	66	73,549	10,643
2004	75,775	12	23,644	2,105
2005	59,494	0	33,254	2,106
2006	36,467	7	29,281	1,099
2007	70,250	15	52,638	3,233
2008	154,575	33	67,214	7,627
Mean 1994-2007	107,249	1,642	68,341	5,969

Table 13.–Estimated age composition of adult sockeye salmon harvest from Spiridon Bay Special Harvest Area (statistical area 254-50), 1994-2008.

Year	Sample Size		Ages													Total[a]
			0.2	1.1	0.3	1.2	2.1	1.3	0.4	2.2	2.3	3.1	3.2	1.4	2.4	
1994	1,329	Percent	0.0	0.1	0.0	99.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
		Numbers	0	149	0	114,624	356	30	0	21	9	0	0	0	0	115,189
1995	1,313	Percent	0.1	19.9	0.1	60.2	1.9	4.9	0.0	11.6	1.3	0.0	0.0	0.0	0.0	100.0
		Numbers	19	6,312	37	19,089	595	1,563	0	3,667	409	0	0	0	0	31,691
1996	1,875	Percent	0.0	1.8	0.0	79.0	4.6	0.2	0.0	14.3	0.0	0.1	0.0	0.0	0.0	100.0
		Numbers	0	2,846	0	128,123	7,448	303	0	23,192	0	111	97	0	0	162,120
1997	1,703	Percent	0.0	2.8	0.0	62.6	2.8	2.4		29.3	0.0	0.0	0.0	0.0	0.0	99.9
		Numbers	0	1,795	0	40,359	1,824	1,558	0.0	18,908	25	7	7	0	0	64,483
1998	1,943	Percent	0.0	4.2	0.0	81.8	2.0	0.6	0.0	10.7	0.5	0.0	0.1	0.0	0.0	99.9
		Numbers	0	3,726	0	72,354	1,785	543	0	9,448	485	0	111	0	0	88,452
1999	2,345	Percent	0.0	0.4	0.0	47.8	0.2	32.7	0.0	17.4	1.5	0.0	0.1	0.0	0.0	100.1
		Numbers	0	689	86	91,129	298	62,405	0	33,167	2,836	0	168	0	0	190,778
2000	1,997	Percent	0.0	0.1	0.1	71.5	0.2	3.0	0.0	18.3	6.6	0.0	0.1	0.1	0.0	100.0
		Numbers	9	122	60	58,559	176	2,419	0	14,987	5,446	0	110	42	0	81,930
2001	1,534	Percent	0.0	1.1	0.1	58.5	3.4	17.2	0.0	19.0	0.7	0.0	0.0	0.0	0.0	100.0
		Numbers	0	674	51	34,921	2,022	10,300	28	11,334	391	0	0	7	7	59,735
2002	1,572	Percent	0.0	0.2	0.0	36.1	2.0	35.8	0.0	24.7	1.0	0.0	0.1	0.1	0.0	100.0
		Numbers	0	466	59	71,962	4,077	71,479	0	49,330	1,909	0	119	139	0	199,539
2003	1,782	Percent	0.0	0.3	0.0	46.3	0.0	26.9	0.0	21.2	5.1	0.0	0.0	0.1	0.0	100.0
		Numbers	0	849	0	120,346	68	69,908	0	55,122	13,201	0	68	151	0	259,714
2004	1,761	Percent	0.0	0.1	0.0	27.8	0.0	54.6	0.0	7.8	9.4	0.0	0.0	0.2	0.0	100.0
		Numbers	0	101	29	21,029	22	41,349	0	5,880	7,156	0	29	160	0	75,775
2005	1,272	Percent	0.0	7.5	0.0	38.3	0.0	52.2	0.0	1.5	0.3	0.0	0.0	0.0	0.0	100.0
		Numbers	0	4,475	0	22,812	25	31,081	0	909	193	0	0	0	0	59,494
2006	999	Percent	0.0	0.4	0.0	83.0	0.4	11.9	0.0	3.0	0.3	0.0	0.0	1.0	0.0	100.0
		Numbers	0	157	0	30,277	141	4,354	0	1,082	92	0	0	363	0	36,467
2007	1,203	Percent	0.0	0.0	0.0	62.2	0.0	36.5	0.0	0.9	0.4	0.0	0.0	0.0	0.0	100.0
		Numbers	0	0	0	43,696	0	25,641	0	632	281	0	0	0	0	70,250
2008	1,482	Percent	0.0	0.0	0.0	19.4	0.0	62.6	0.0	16.0	1.6	0.0	0.0	0.4	0.0	100.0
		Numbers	0	0	0	29,968	0	96,701	0	24,716	2,472	0	0	281	0	154,475
1994-2007	1,616	Percent	0.0	1.5	0.0	58.1	1.3	21.6	0.0	15.2	2.2	0.0	0.0	0.1	0.0	100.0
Average		Numbers	2	1,597	23	62,091	1,346	23,067	2	16,263	2,317	8	51	62	1	106,828

[a] Totals may not add up exactly due to rounding.

Table 14.–Indexed foot survey peak salmon escapements by species at Telrod Creek (254-403), 1994-2008.

Year	Date	Sockeye [a]	Pink [a]
1994	ND	ND	ND
1995	15-Aug	120	233
1996	15-Sep	10	238
1997	11-Sep		350
	9-Oct	3,000	
1998	17-Aug	5,013	327
1999	31-Aug	1,220	
	10-Sep		60
2000	4-Sep	1,321	353
2001	18-Aug	1,600	450
2002	13-Aug		1,710
	17-Aug	1,880	
2003	14-Aug	5,252	450
2004	3-Aug	1,200	0
2005	11-Jul	500	100
2006 [b]	30-Jul	500	0
2007	29-Jul	300	0
2008	7-Jul	600	0

[a] Survey estimates include salmon in stream mouth.

[b] The 30 July survey was an estimate of salmon in the plunge pool at the first waterfall barrier and does not represent a survey of the entire stream to the barrier.

Table 15.–Indexed aerial peak salmon escapements by species at Spiridon River (254-401), 1994-2008.

Year		Date	Observer	Survey Conditions	Survey counts [a] pink	chum	coho
1994		ND	ND	ND	ND	ND	ND
1995		17-Aug	ADF&G	good	87,800	22,000	
		13-Oct	FWS	good			10,300
1996		29-Aug	FWS	good	5,700	8,000	
		16-Oct	FWS	excellent			10,600
1997		1-Aug	ADF&G	good	18,100	5,500	
		9-Oct	ADF&G	excellent			13,300
1998		14-Aug	ADF&G	fair	29,500	6,150	
		14-Sep	FWS	good			1,750
1999		11-Aug	ADF&G	fair		15,000	
		27-Aug	ADF&G	fair	15,500		
2000		21-Aug	FWS	fair	1,000	16,500	
		20-Oct	FWS	good			2,900
2001		1-Aug	ADF&G	poor		3,000	
		7-Aug	ADF&G	fair	18,000		
		29-Oct	FWS	good			4,550
2002		2-Sep	ADF&G	fair to poor	32,000	6,500	
		3-Sep	ADF&G	poor		7,380	
						13,880 [b]	
2003		5-Aug	ADF&G	poor	5,000	5,700	
		5-Sep	ADF&G	poor			700
2004		ND	ND	ND	ND	ND	ND
2005	[c]	8-Aug	ADF&G	poor	5,000	6,400	0
		26-Aug	ADF&G	good to excellent	50	15,500	
2006		17-Aug	ADF&G	fair	14,700		
		26-Aug	ADF&G	fair		5,000	
2007		7-Aug	ADF&G	poor	10,000		
		6-Sep	ADF&G	fair	1,000	7,900	
2008		31-Jul	ADF&G	fair	9,400	200	0
		9-Aug	ADF&G	fair	32,000	11,400	0

[a] Survey counts include stream, mouth, and bay areas.

[b] The 2002 peak chum estimate was a sum of the September 2 and 3 survey estimates. ADF&G manager's sum estimates were from surveys conducted on two consecutive days in determining the indexed peak count.

[c] The August 8 survey only included the upper river drainage.

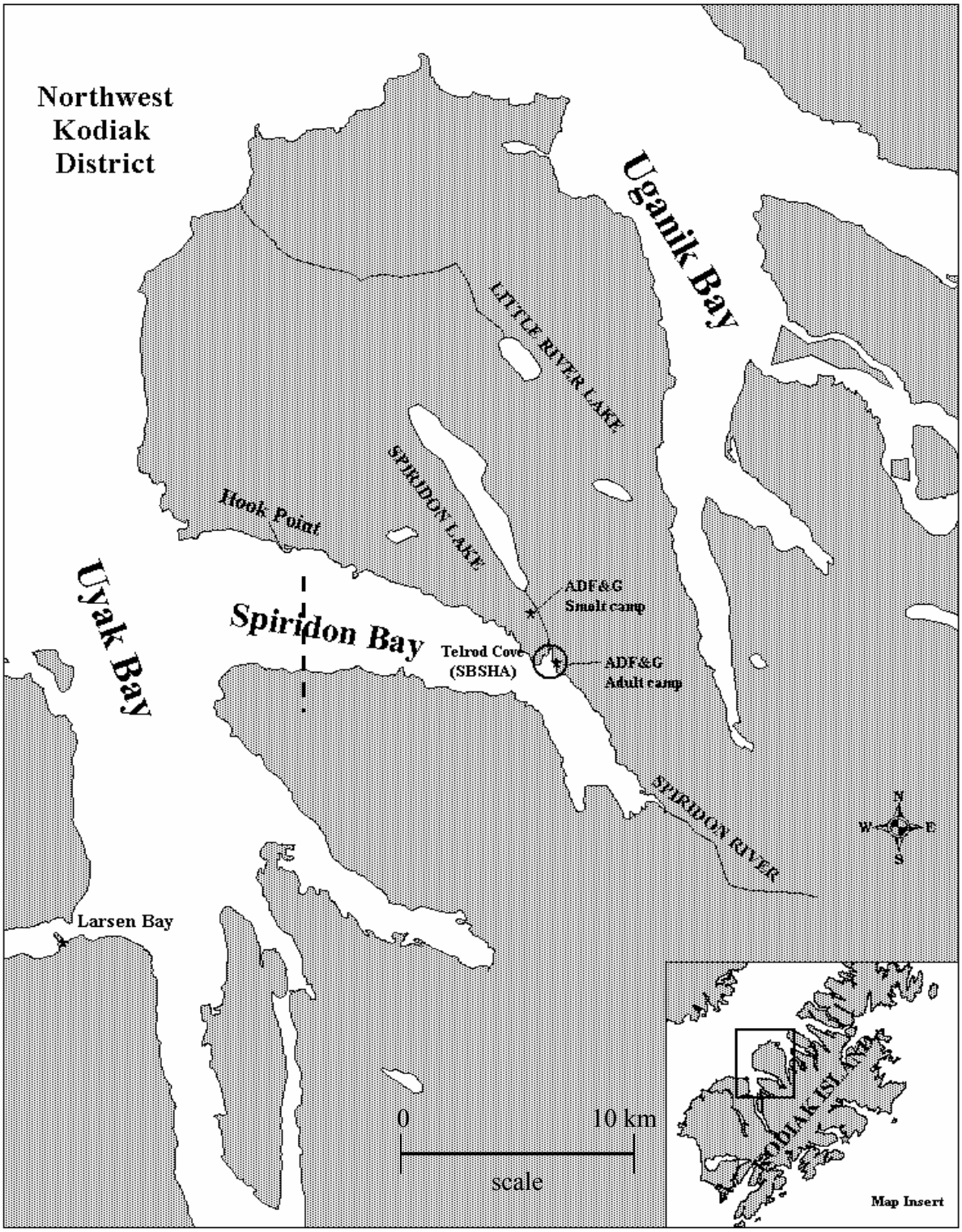

Figure 1.–Locations of the ADF&G smolt and adult salmon field camps, Spiridon Lake, Telrod Cove, and Spiridon Bay in the Northwest Kodiak District.

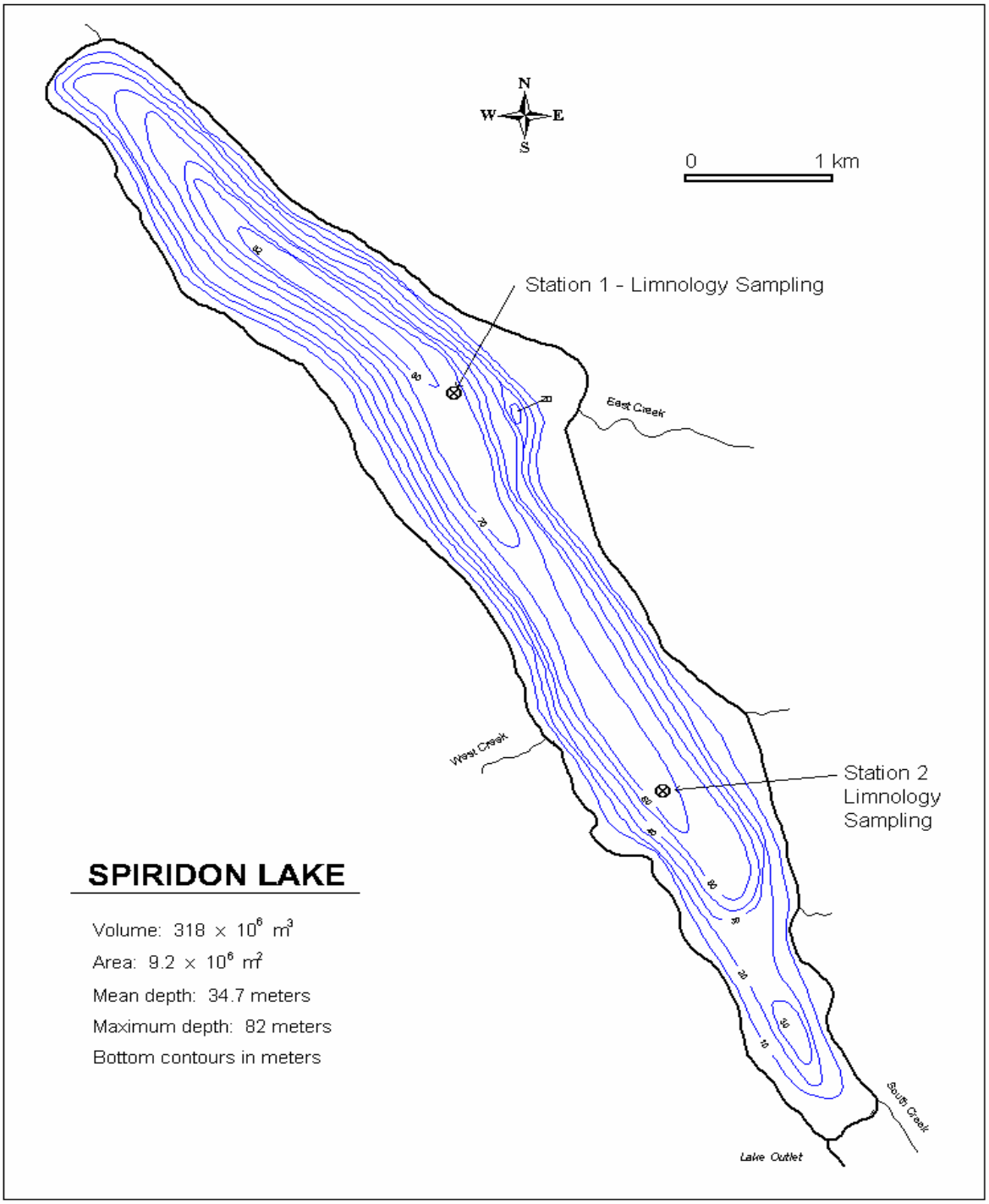

Figure 2.–Morphometric map showing the location of limnology sampling stations on Spiridon Lake.

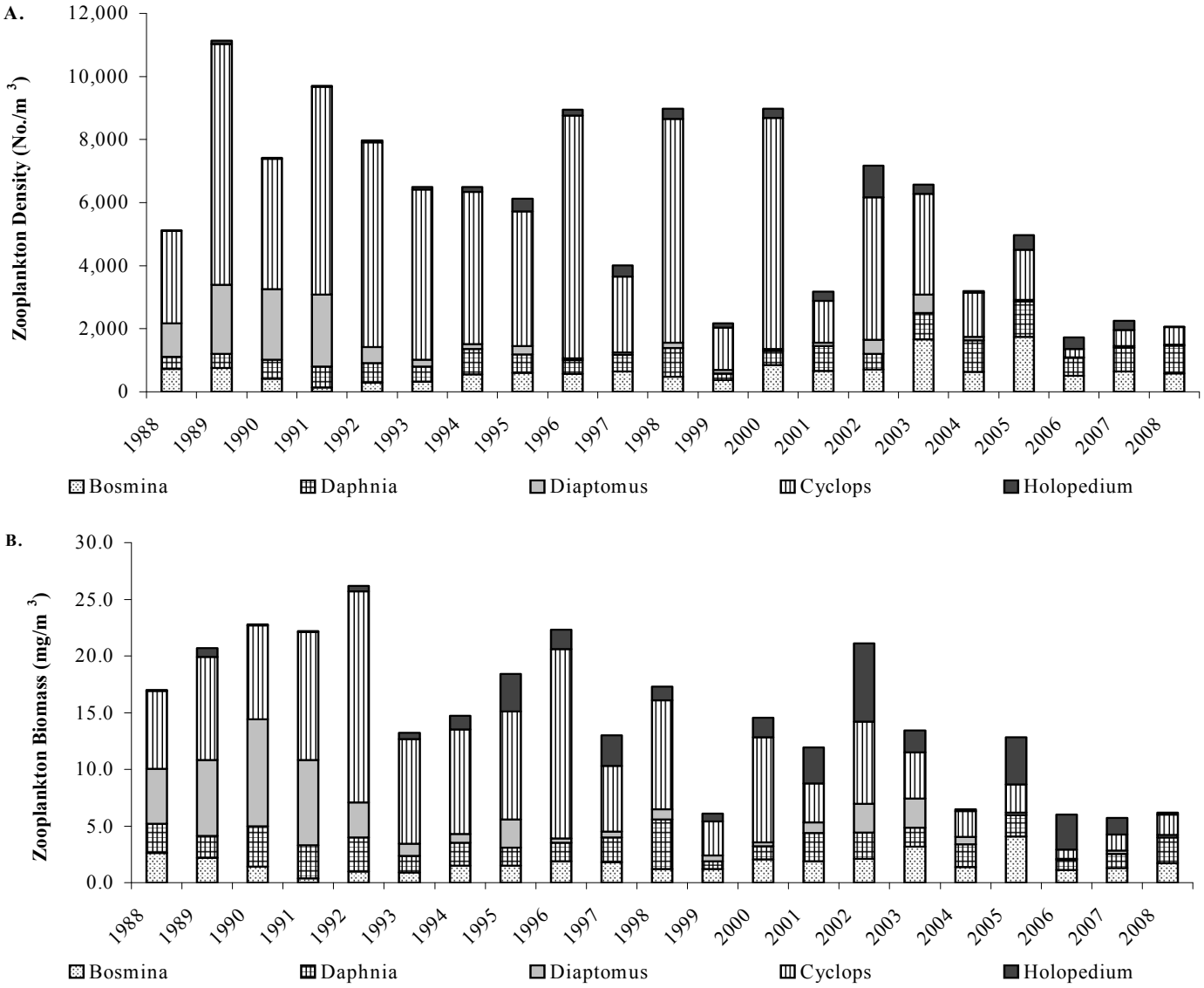

Figure 3.–Zooplankton density (A) and biomass (B) estimates for Spiridon Lake, 1988-2008.