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Smolt Catch Statistics (1977) in salmonid nursery lakes under study by the Salmon Recruitment Assessment Program (S-RAP)

D.P. Rankin, K.D. Hyatt, M.R.S. Johannes and I.D. Cuthbert

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by

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ABSTRACT

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Salmonid smolts were collected during Spring 1977 using fyke nets and inclined plane traps set in the outlets of six British Columbia coastal lakes. Smolt surveys were conducted by the Salmon Recruitment Assessment Program (Canada Department of Fisheries and Oceans) as a portion of ongoing salmonid stock assessments focusing on production characteristics for a number salmon stocks. The lakes sampled during 1977 include: Great Central, Henderson, Hobiton, Kennedy, Long, and Sproat. After at least one month of preservation, individual fish from sample collections were processed and measured for species, length and weight, and scales were taken. Summary statistics were calculated for lengths and standardized fresh weights by stock, age and species. Length-at-age frequencies and portion of total run were plotted by survey date and lake system. Length-weight relationships were plotted by age and stock.

RÉSUMÉ

D.P. Rankin, K.D. Hyatt, M.R.S. Johannes and I.D. Cuthbert. 1994. Smolt catch statistics (1977) in salmonid nursery lakes under study by the Salmon Recruitment Assessment Program. Can. Data Rep. Fish. Aquat. Sci. 935:33p.

Des smolts de salmonidés ont été prélevés au printemps 1997 avec des vereux et des pièges à plan incliné disposés à l'exutoire de six lacs côtiers de la Colombie-Britannique. Les dénombrements de smolts ont été faits par l'équipe du Programme d'évaluation du recrutement chez le saumon (Pêches et Océans Canada), dans le cadre d'évaluations des stocks de salmonidés axées sur le profil de production d'un certain nombre de stocks. On avait échantillonné les lacs Great Central, Henderson, Hobiton, Kennedy, Long et Sproat. Après au moins de conservation, des sujets pris dans les collections d'échantillons ont été conditionnés, identifiés, mesurés et pesés. Des écailles ont été prélevées. On a calculé des statistiques rapides de longueur et de poids frais uniformisé en fonction du stock, de l'âge et de l'espèce. Les fréquences longueur/âge et les pourcentages par rapport à la remonte totale ont été portés en graphique en fonction de la date du prélèvement et en fonction du bassin hydrographique. Les rapports longueur/poids ont été portés en graphique en fonction de l'âge et du stock.

INTRODUCTION

The Salmon Recruitment Assessment Program (S-RAP) has been involved in a series of long-term studies on individual salmon stocks in British Columbia. Program activities have seen a diversification of science-based assessment projects since inception as the Lake Enrichment Program in 1977. Present projects encompass studies in a number of regions of B.C. and interactions with the Salmon Enhancement Program, Aboriginal Fisheries Groups across B.C., and the B.C. Ministries of Forests and Environment, Lands and Parks. This research has provided the scientific basis for: effective assessment and evaluation of salmon enhancement techniques and stock management initiatives, improved stock management decisions; evaluation of stock status responses to climate variations.

We report here data collected to assess salmonid smolt populations during Spring seaward migrations from the outlets of six coastal salmonid nursery lakes during 1977. Smolts captured during these surveys include: large numbers of sockeye (*Oncorhynchus nerka*), smaller numbers of coho (*O. kisutch*), chinook (*O. tshawytsha*), and in some cases, pink (*O. gorbuscha*) and chum (*O. keta*) fry. The results presented here are limited to sockeye smolts because samples of other species collected during 1977 have not been processed.

Smolt populations were sampled at the outlets of lakes using a fyke net or inclined plane trap (Hyatt et al. 1984, Rankin et al. 1994). The salmon populations surveyed for smolts during 1977 include: Great Central, Henderson, Hobiton, Kennedy, Long and Sproat lakes (Fig. 1). This report includes (1) smolt catch and effort summary tables; (2) plots of length/weight regressions and size and catch frequencies by species, stock and age, and; (3) a general map of sampling locations (Fig. 1).

The results reported here, along with other study data will be used to establish fish community structure, abundance and species composition in survey lakes, and as a basis for predicting lake carrying capacities and assessing and interpreting the factors which may currently limit salmon production.

METHODS

Readers are encouraged to see Hyatt et al. (1984) and Rankin et al. (1994) for details regarding smolt sample acquisition and processing methods. However, the general methodology is outlined briefly here. Sockeye smolts from Great Central Lake were collected at the Robertson Creek weir at the outlet of Boot Lagoon. An inclined plane trap attached to the weir served as the collecting device. All water flowing into Robertson Creek was directed through the trap by closing a sluice gate. All other lake systems were sampled with fyke nets set in lake outlets during spring smolt migration.

Smolt surveys were conducted in Great Central, Henderson, Hobiton, Kennedy, Long and Sproat lakes (Fig. 1) during April through June 1977 (Table 1). Survey timing has been designed to encompass the period of peak smolt migrations (Rankin et al. 1994). Sample locations were chosen in areas where lake outlets narrowed and flows restricted captured fish escape, as per the guidelines outlined in Hyatt et al. (1984). Traps were set 1 hour before sunset for a duration of 3 to 4 hours and were checked at half-hour intervals. This period includes the time of peak diel smolt migration activity (Wood et al. 1993).

A minimum sample size of 100 smolts per sample night was recommended for each system and date sampled. If fewer than 100 smolts were caught during the first 4 hours of sampling, the net was left for the remainder of the night (about 6 hours) and retrieved in the morning. All fish captured were classified by species and preserved with labels identifying system, date, start and stop time, set number, species counts, initials of collection crew and total number of collections obtained during each survey date. Sampled fish were preserved in buffered 3.7% formaldehyde for at least five weeks prior to laboratory processing for species, length, weight and scales. Fish were weighed to 0.01g and measured to 1 mm. Fish were identified to species and enumerated on site and again in the laboratory.

Smolt samples were processed in the lab using an Apple computer based caliper system which recorded species, sample counts, lengths and weights. Preserved smolt weights were automatically converted to standardized fresh weights (Rankin et al. 1994) and are reported as such here. Processed smolt data were analyzed using SAS to calculate smolt summary statistics by species and age classification including: (1) mean and variance for length and weight; (2) length/weight regressions; and to develop: (3) plots for smolt run-timing and (4) trends in mean length (cm) and weight (g) over time; and (5) smolt length and weight frequency distributions.

RESULTS and DISCUSSION

The number of sockeye smolts collected at each lake and the timing and frequency of surveys during 1977 is presented in Table 1. Table 2 contains summary statistics calculated for smolt lengths and weights by stock and age. Plots of size-at-age frequency, portion of total run by survey date, and length-weight relationships by age for each sockeye stock are presented in Appendix I. All table entries and data plots are indexed alphabetically by lake name.

ACKNOWLEDGMENTS

Throughout the years, many individuals have contributed their efforts to the field collection and laboratory processing of smolt samples, as well as management and maintenance of the resulting database. The authors wish to thank Anton Phillips, Ken Cooke and James Manzer for their contributions to the 1977 smolt data collection, sample processing, and data management.

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Table 1. Sockeye smolt sampling inventory for S-RAP study lakes sampled during 1977.

Lake System	Sampling Trips	Sampling Days	Sampling Period	Smolts Captured			
				Age 0	Age 1	Age 2	Age 3
Great Central	25	25	April 4 - July 8	3	2042	97	4
Henderson	1	1	May 18	0	19	0	0
Hobiton	4	4	May 11 - June 8	0	198	6	0
Kennedy	1	1	April 17	0	24	0	0
Long	5	5	April 4 - May 8	0	232	46	0
Sproat	3	5	May 5 - May 26	0	243	13	0

Table 2. 1977 size and age composition of sockeye smolts by stock and sampling date.

Great Central Lake

	Age															
	0								1							
	Length (cm)			Std Fresh Weight (g)					Length (cm)			Std Fresh Weight (g)				
	n	Mean	Std Err	n	Mean	Std Err	Cond'n Factor	Pct of Total	n	Mean	Std Err	n	Mean	Std Err	Cond'n Factor	Pct of Total
Date																
04APR									2	6.4	0.10	2	1.8	0.07	0.70	0.1
07APR																
11APR																
14APR									1	7.1		1	2.6		0.74	0.0
21APR									1	9.4		1	7.4		0.89	0.0
25APR									53	8.0	0.07	53	4.1	0.11	0.79	2.3
28APR									2	6.4	0.55	2	2.2	0.61	0.80	0.1
02MAY									6	6.5	0.26	6	1.9	0.29	0.70	0.3
05MAY									152	7.1	0.03	152	2.8	0.04	0.80	6.5
09MAY	1	2.3		1	0.2		1.25	0.0	190	6.9	0.03	190	2.5	0.03	0.77	8.1
12MAY									60	6.7	0.05	60	2.5	0.05	0.81	2.6
16MAY	1	2.9		1	0.1		0.37	0.0	183	6.8	0.03	183	2.5	0.04	0.77	7.8
19MAY									125	7.0	0.03	125	2.7	0.03	0.82	5.3
23MAY									197	7.0	0.03	197	2.8	0.04	0.81	8.4
26MAY									228	7.2	0.03	228	2.8	0.03	0.77	9.7
30MAY									222	7.3	0.02	222	3.1	0.03	0.78	9.5
02JUN									130	6.7	0.03	130	2.6	0.04	0.85	5.5
06JUN	1	4.9		1	0.4		0.35	0.0	46	6.7	0.07	46	2.1	0.09	0.71	2.0
13JUN									203	7.0	0.03	0				8.6
16JUN									207	7.0	0.03	207	2.7	0.04	0.79	8.8
20JUN									70	6.9	0.04	70	2.9	0.04	0.87	3.0
23JUN									50	6.9	0.06	50	2.6	0.07	0.82	2.1
27JUN									55	7.0	0.06	55	3.3	0.09	0.96	2.3
30JUN									34	7.4	0.09	34	3.8	0.14	0.95	1.4
04JUL									20	7.3	0.09	20	3.7	0.15	0.94	0.9
08JUL									6	7.7	0.12	6	4.0	0.09	0.87	0.3
Pooled	3	3.4	0.79	3	0.2	0.10	0.66	0.1	2,243	7.0	0.01	2,040	2.8	0.01	0.80	95.6

(CONTINUED)

Table 2, continued. 1977 size and age composition of sockeye smolts by stock and sampling date.

Great Central Lake

	Age															
	2								3							
	Length (cm)			Std Fresh Weight (g)					Length (cm)			Std Fresh Weight (g)				
	n	Mean	Std Err	n	Mean	Std Err	Cond'n Factor	Pct of Total	n	Mean	Std Err	n	Mean	Std Err	Cond'n Factor	Pct of Total
Date																
04APR																
07APR	2	10.2	0.30	2	8.2	0.22	0.77	0.1								
11APR	2	9.5	1.10	2	7.2	3.44	0.84	0.1								
14APR	1	8.1		1	3.1		0.58	0.0								
21APR	4	9.2	0.62	4	6.5	1.66	0.83	0.2								
25APR	60	9.0	0.05	60	5.7	0.11	0.79	2.6	4	8.7	0.12	4	5.2	0.14	0.78	0.2
28APR	1	8.1		1	3.8		0.71	0.0								
02MAY																
05MAY	17	7.6	0.11	17	3.4	0.13	0.80	0.7								
09MAY																
12MAY																
16MAY	6	7.3	0.10	6	3.1	0.21	0.79	0.3								
19MAY																
23MAY	4	7.5	0.14	4	3.4	0.13	0.80	0.2								
26MAY																
30MAY																
02JUN																
06JUN																
13JUN																
16JUN																
20JUN																
23JUN																
27JUN																
30JUN																
04JUL																
08JUL																
Pooled	97	8.6	0.09	97	5.1	0.16	0.79	4.1	4	8.7	0.12	4	5.2	0.14	0.78	0.2

Table 2, continued. 1977 size and age composition of sockeye smolts by stock and sampling date.

Henderson Lake

	Age							
	1							
	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of
Date	n	Mean	Std Err	n	Mean	Std Err	Factor	Total
18MAY	19	7.0	0.09	19	2.7	0.10	0.80	100.0
Pooled	19	7.0	0.09	19	2.7	0.10	0.80	100.0

Hobiton Lake

	Age															
	1								2							
	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of
Date	n	Mean	Std Err	n	Mean	Std Err	Factor	Total	n	Mean	Std Err	n	Mean	Std Err	Factor	Total
11MAY	99	6.8	0.06	99	2.4	0.05	0.77	48.5	1	6.5		1	2.0		0.73	0.5
25MAY	29	6.9	0.13	29	2.8	0.17	0.83	14.2								
01JUN	53	7.2	0.11	53	3.2	0.17	0.85	26.0	3	7.7	0.33	3	3.8	0.50	0.83	1.5
08JUN	17	7.7	0.23	17	3.9	0.33	0.84	8.3	2	8.8	0.60	2	6.0	1.46	0.88	1.0
Pooled	198	7.0	0.05	198	2.8	0.07	0.80	97.1	6	7.9	0.41	6	4.2	0.76	0.83	2.9

Kennedy Lake

	Age							
	1							
	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of
Date	n	Mean	Std Err	n	Mean	Std Err	Factor	Total
17APR	24	6.2	0.02	24	1.8	0.02	0.78	100.0
Pooled	24	6.2	0.02	24	1.8	0.02	0.78	100.0

Long Lake

	Age															
	1								2							
	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of
Date	n	Mean	Std Err	n	Mean	Std Err	Factor	Total	n	Mean	Std Err	n	Mean	Std Err	Factor	Total
04APR	47	6.4	0.05	47	2.4	0.06	0.91	16.9	2	6.6	0.15	2	3.0	0.41	1.01	0.7
25APR	31	6.0	0.08	31	1.9	0.09	0.86	11.2	11	7.4	0.11	11	3.5	0.17	0.86	4.0
01MAY	51	6.0	0.05	51	1.9	0.06	0.84	18.3	17	7.1	0.12	17	3.1	0.17	0.85	6.1
06MAY	8	6.6	0.16	8	2.6	0.17	0.89	2.9	11	7.5	0.13	11	3.7	0.19	0.87	4.0
08MAY	95	6.5	0.05	95	2.4	0.06	0.86	34.2	5	7.6	0.16	5	3.5	0.15	0.81	1.8
Pooled	232	6.3	0.03	232	2.2	0.04	0.87	83.5	46	7.3	0.07	46	3.4	0.10	0.86	16.5

Sproat Lake

	Age															
	1								2							
	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of	Length (cm)			Std Fresh Weight (g)			Cond'n	Pct of
Date	n	Mean	Std Err	n	Mean	Std Err	Factor	Total	n	Mean	Std Err	n	Mean	Std Err	Factor	Total
05MAY	10	6.7	0.16	10	2.5	0.21	0.82	3.9								
06MAY	79	6.9	0.07	79	2.6	0.08	0.80	30.9	8	6.9	0.15	8	2.6	0.17	0.79	3.1
11MAY	137	7.0	0.04	137	2.7	0.05	0.79	53.5	4	6.9	0.26	4	2.6	0.28	0.78	1.6
25MAY	7	7.2	0.26	7	2.9	0.28	0.80	2.7	1	7.2		1	3.0		0.81	0.4
26MAY	10	7.1	0.14	10	2.9	0.20	0.82	3.9								
Pooled	243	7.0	0.03	243	2.7	0.04	0.80	94.9	13	7.0	0.12	13	2.7	0.13	0.79	5.1

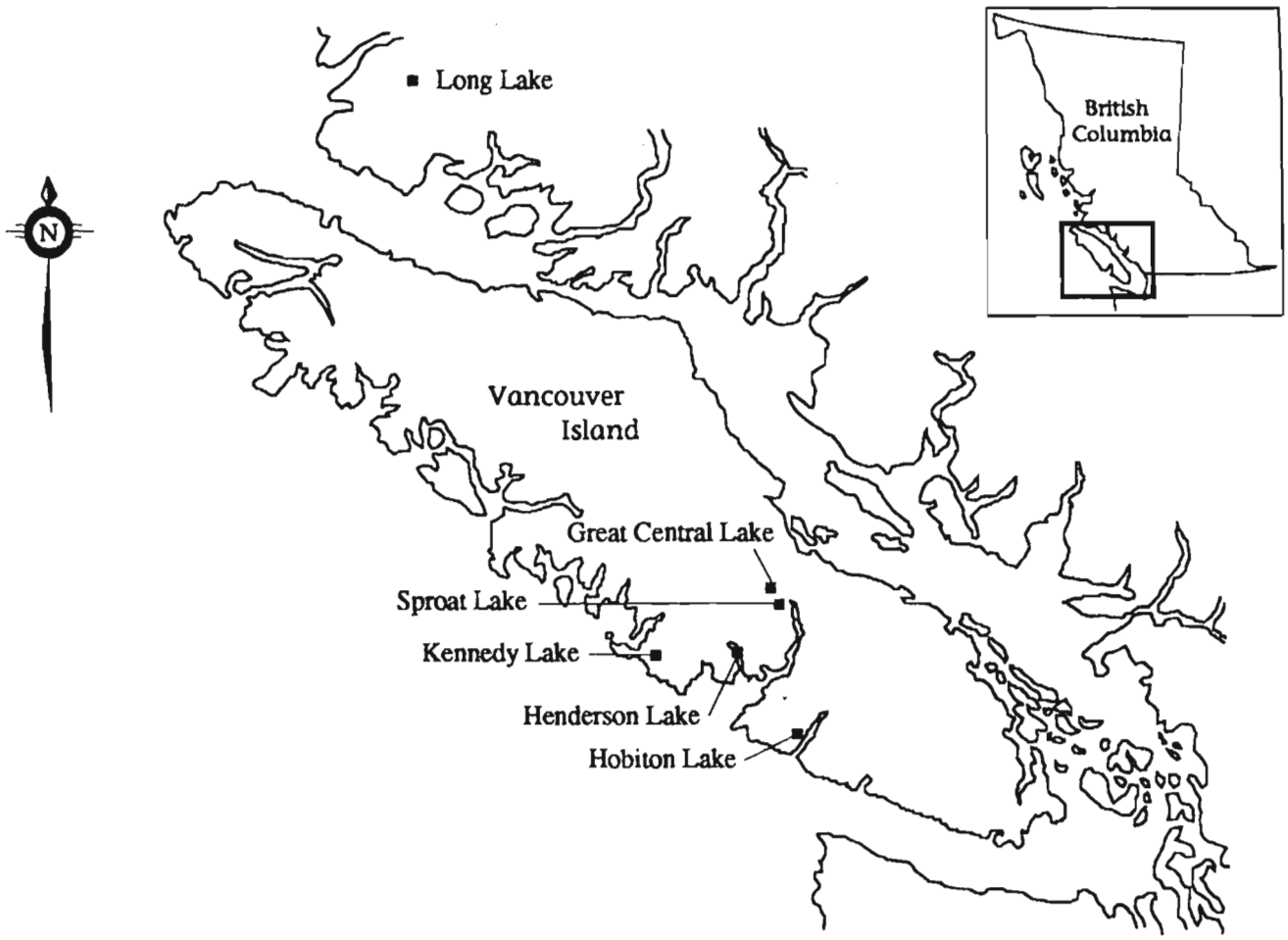
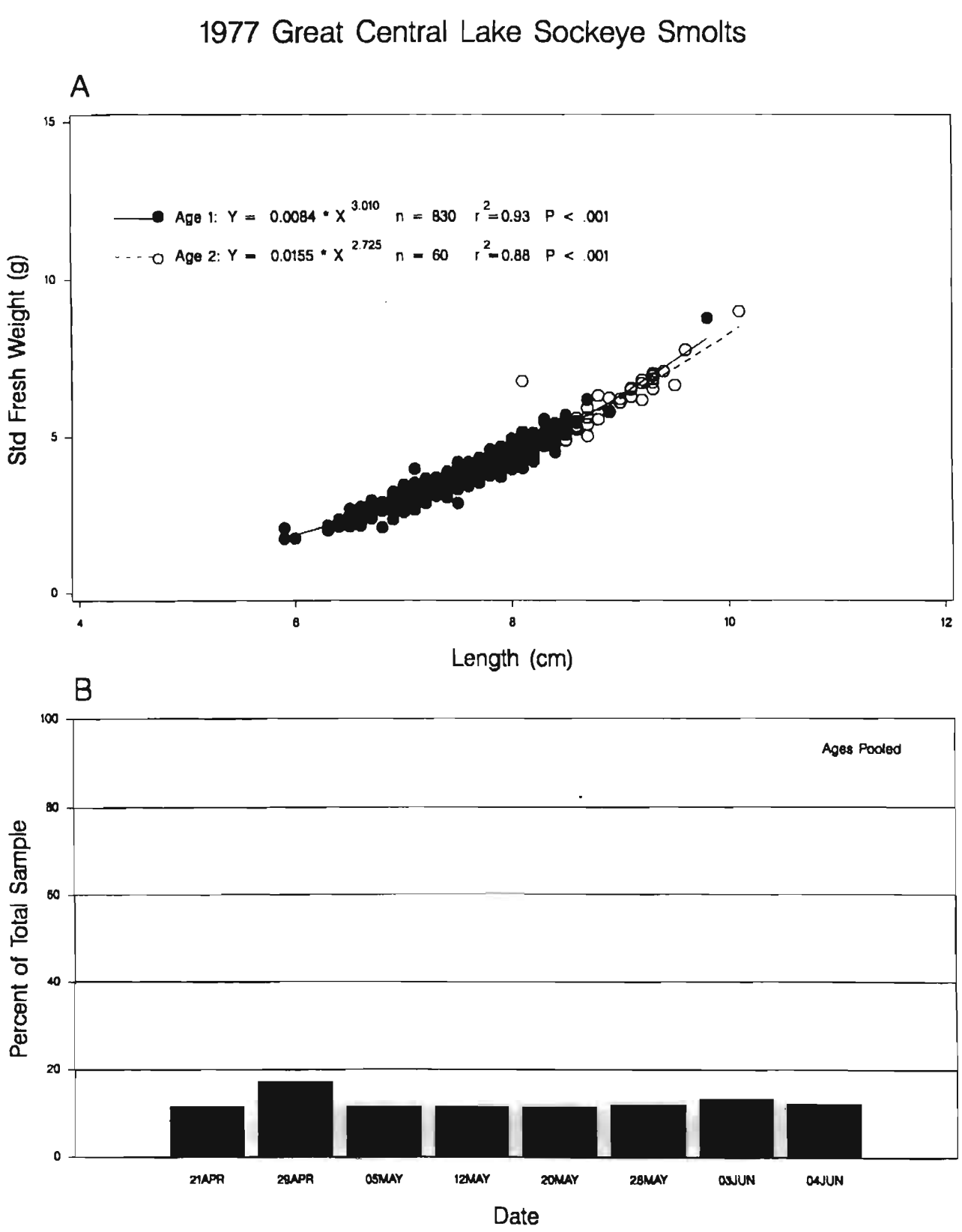
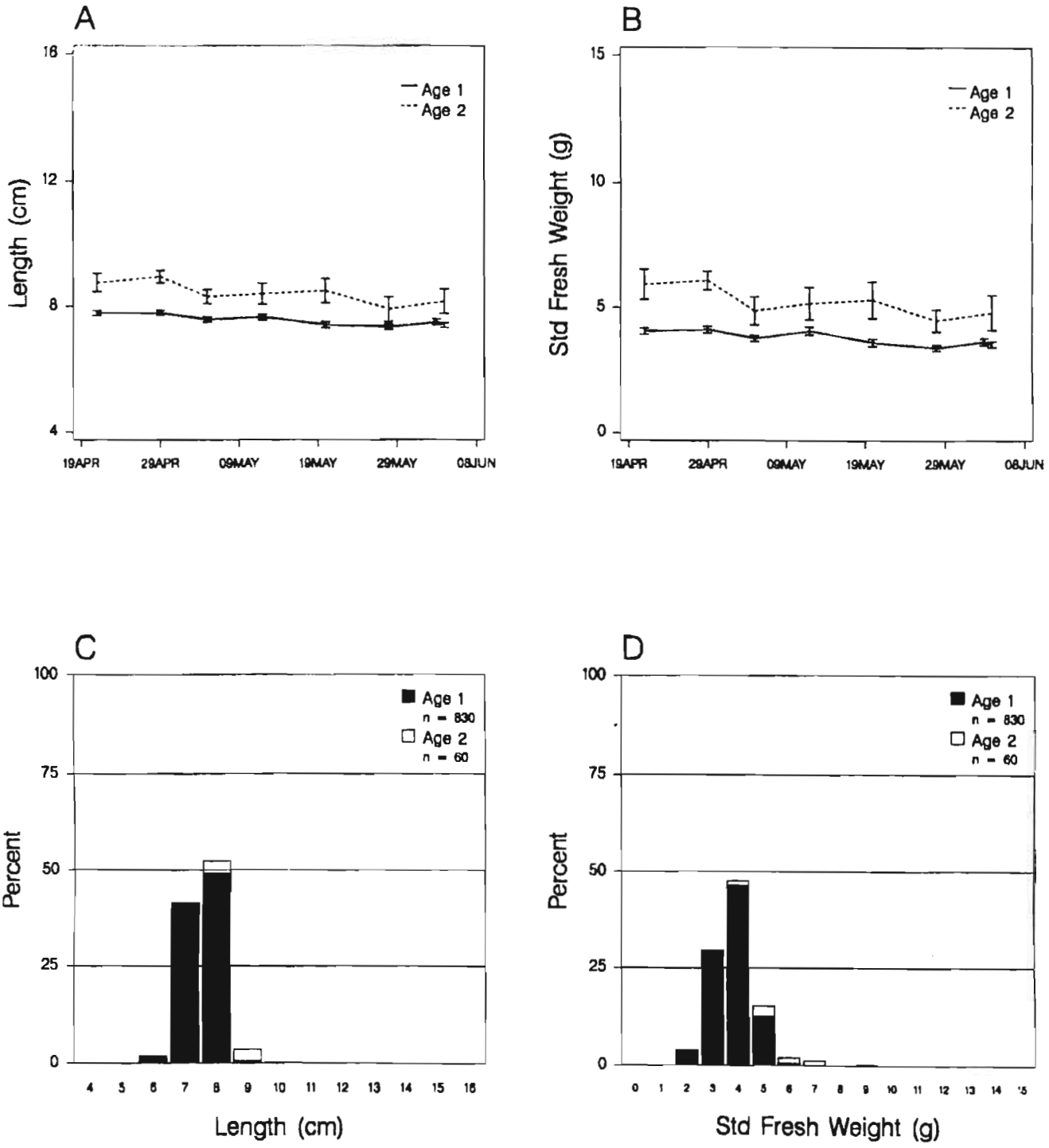


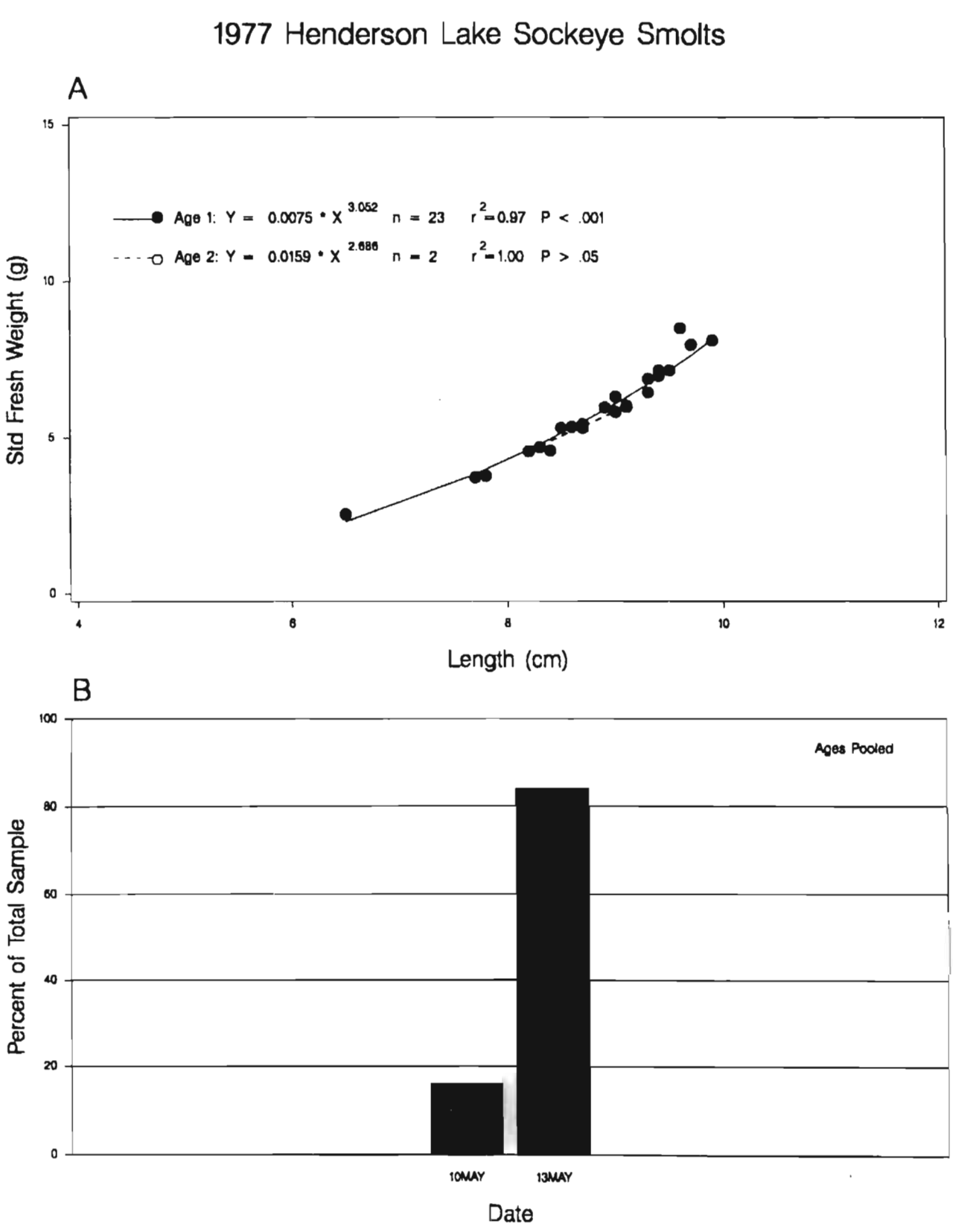
Figure 1. Locations of lakes sampled for salmonid smolts during 1977.

APPENDIX I

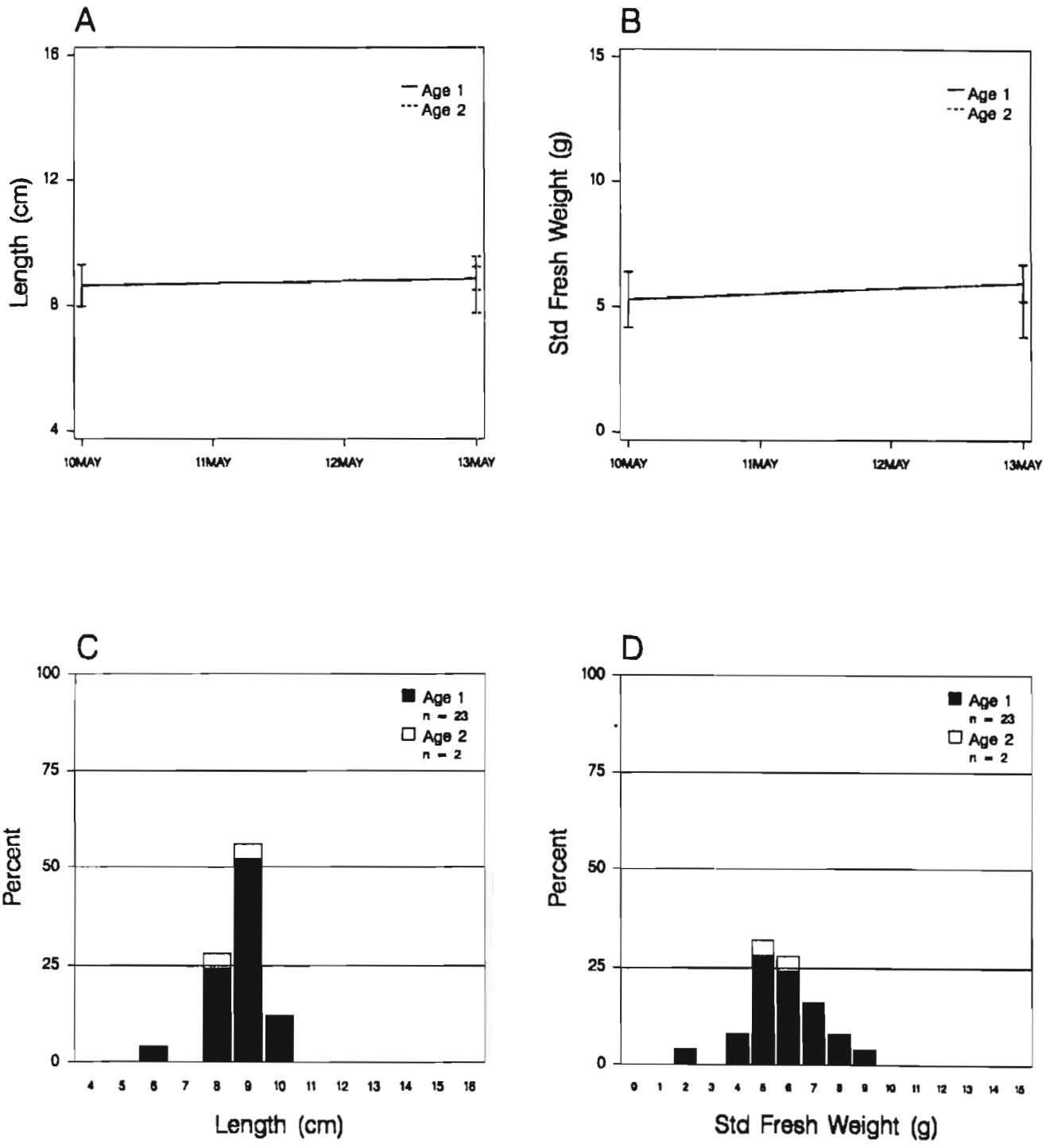

1977 Great Central Lake Sockeye Smolts
A
Age 1: Y = 0.0084 * X 3.010 n = 830 r 2 =0.93 P < .001
Age 2: Y = 0.0155 * X 2.725 n = 60 r 2 =0.88 P < .001
Std Fresh Weight (g)
Length (cm)
B
Ages Pooled
Percent of Total Sample
21APR
29APR
05MAY
12MAY
20MAY
28MAY
03JUN
04JUN
Date

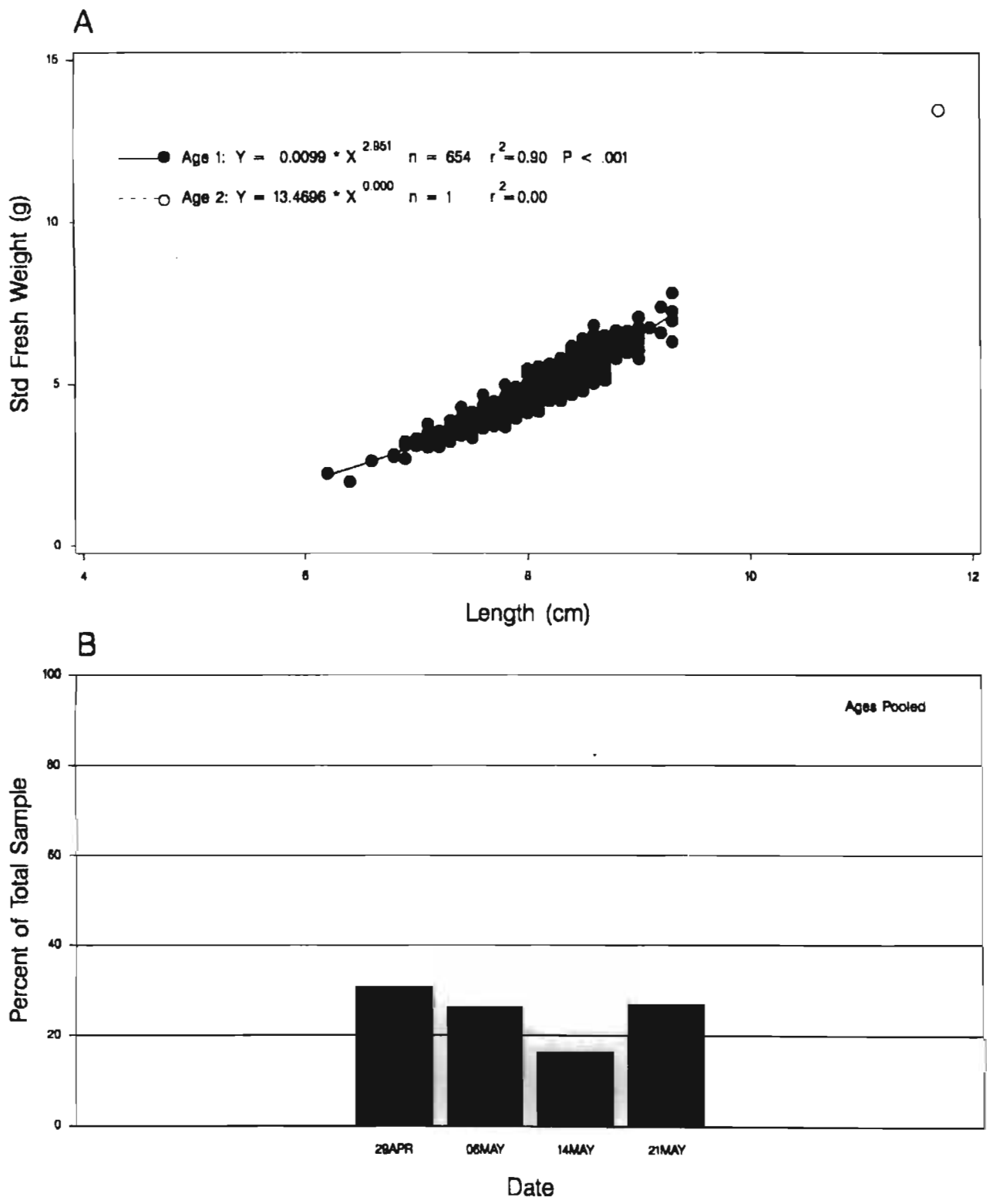
1977 Great Central Lake Sockeye Smolts



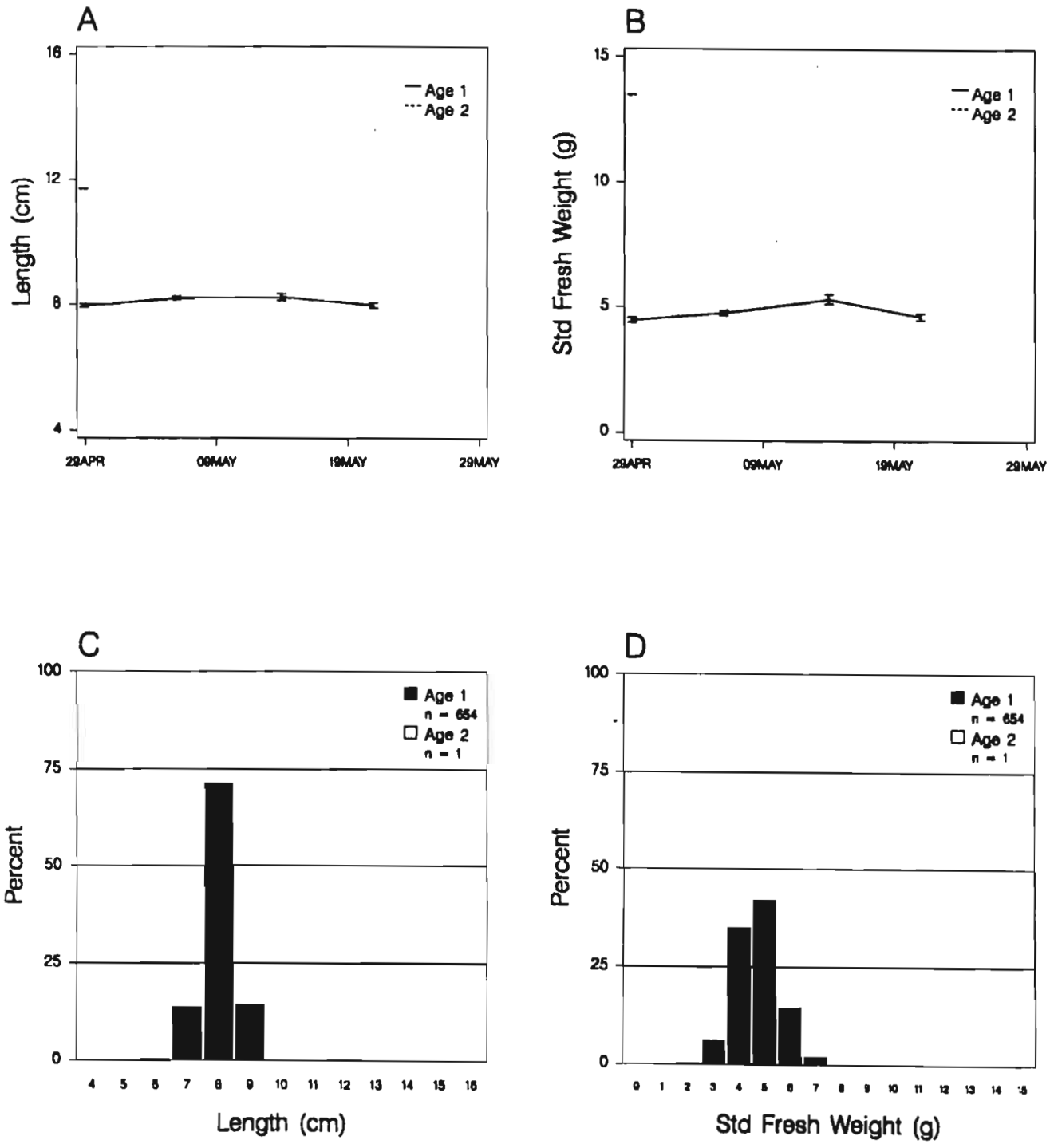

1977 Henderson Lake Sockeye Smolts
A
Age 1: Y = 0.0075 * X 3.052 n = 23 r 2 = 0.97 P < .001
Age 2: Y = 0.0159 * X 2.686 n = 2 r 2 = 1.00 P > .05
Std Fresh Weight (g)
Length (cm)
B
Ages Pooled
Percent of Total Sample
10MAY
13MAY
Date

1977 Henderson Lake Sockeye Smolts

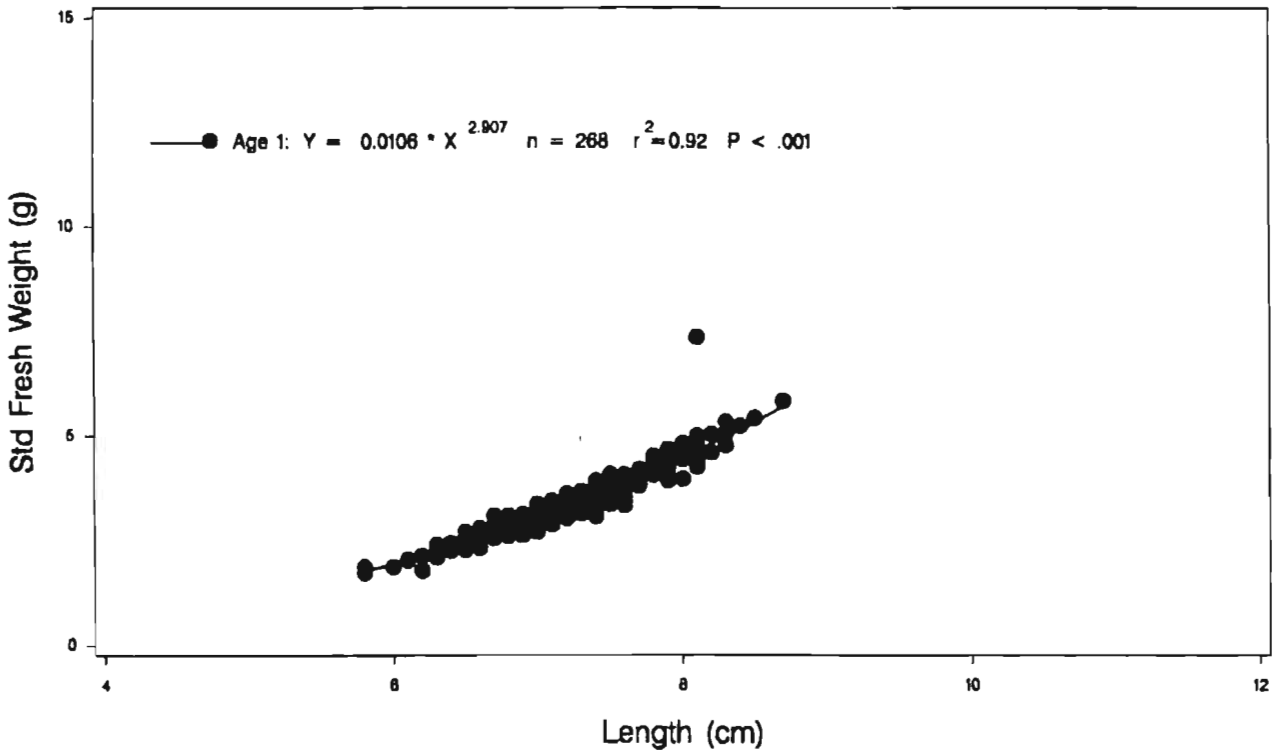



1977 Hobiton Lake Sockeye Smolts
A
Age 1: Y = 0.0099 * X 2.951 n = 654 r 2 = 0.90 P < .001
Age 2: Y = 13.4696 * X 0.000 n = 1 r 2 = 0.00
Std Fresh Weight (g)
Length (cm)
B
Ages Pooled
Percent of Total Sample
29APR
06MAY
14MAY
21MAY
Date

1977 Hobiton Lake Sockeye Smolts



1977 Kennedy Lake Sockeye Smolts



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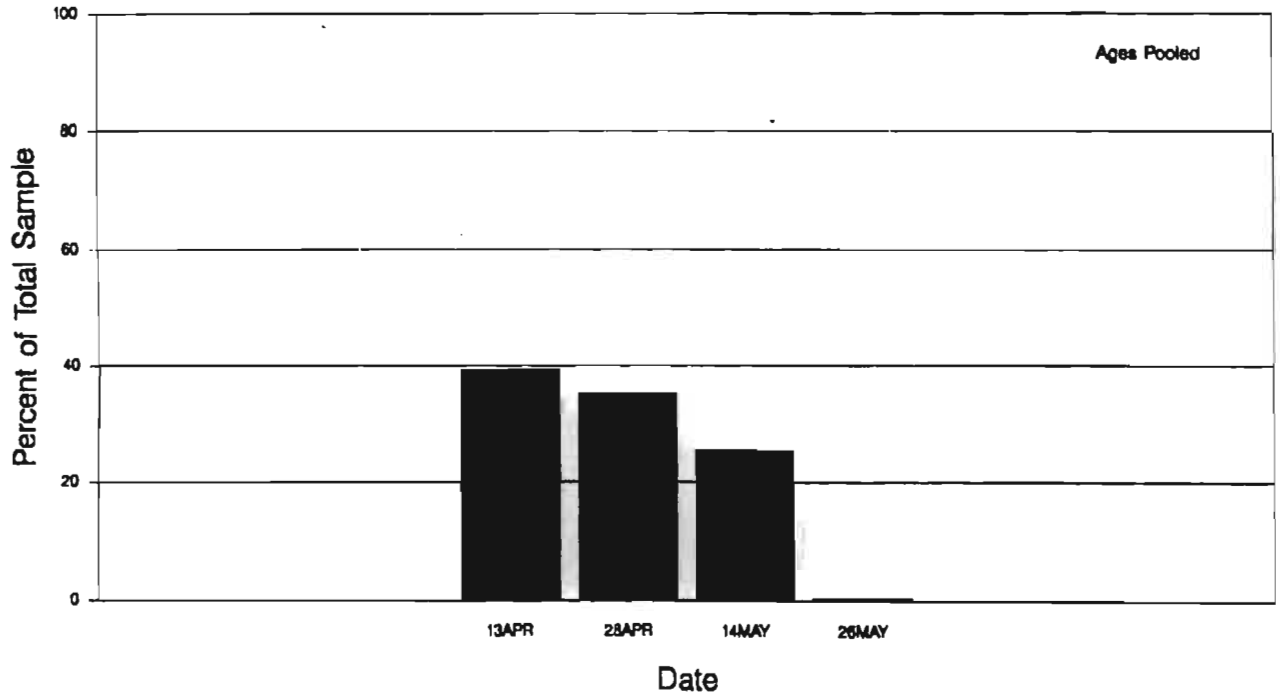
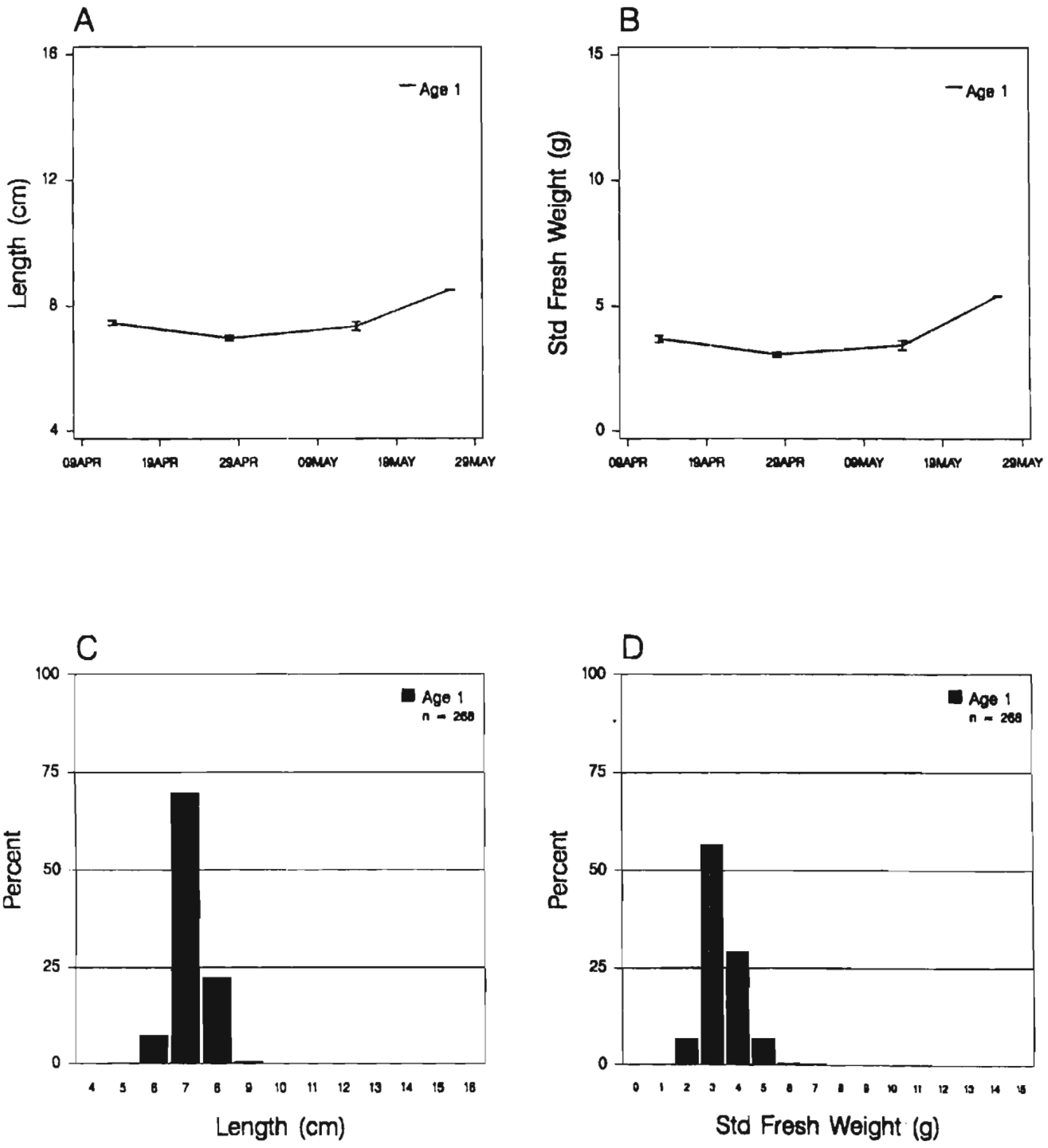
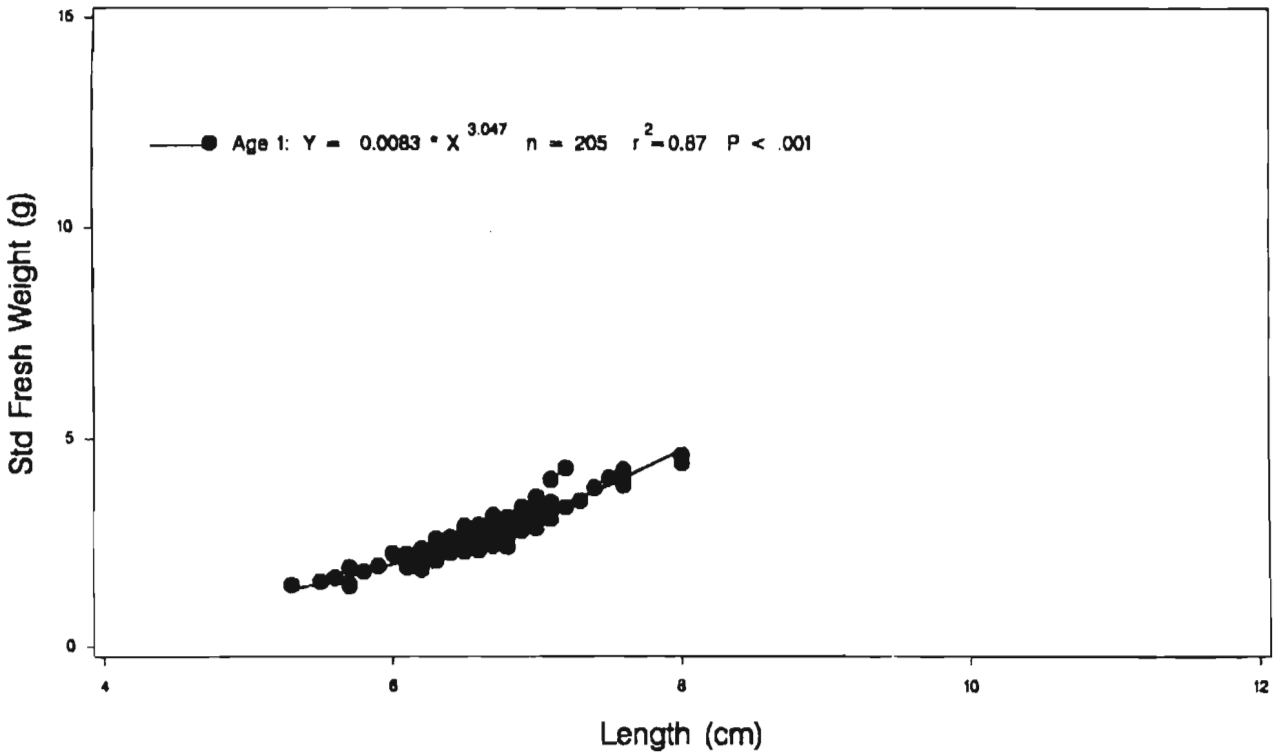


1977 Kennedy Lake Sockeye Smolts



1977 Long Lake Sockeye Smolts



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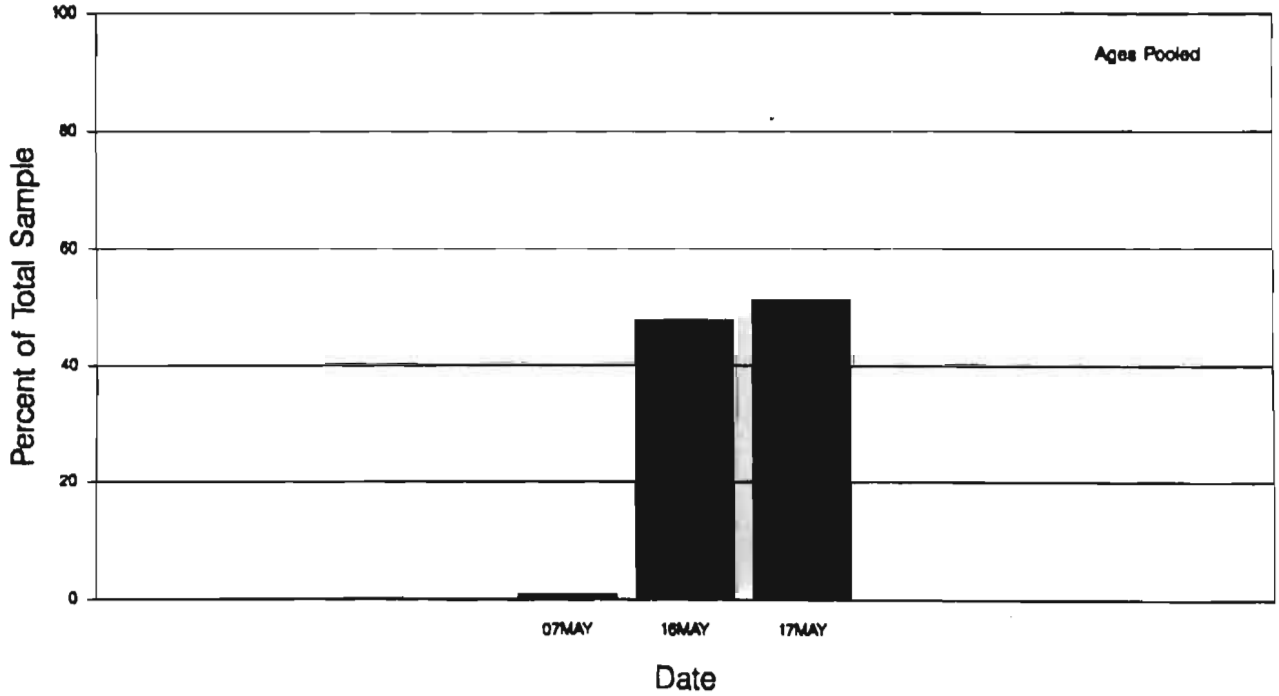
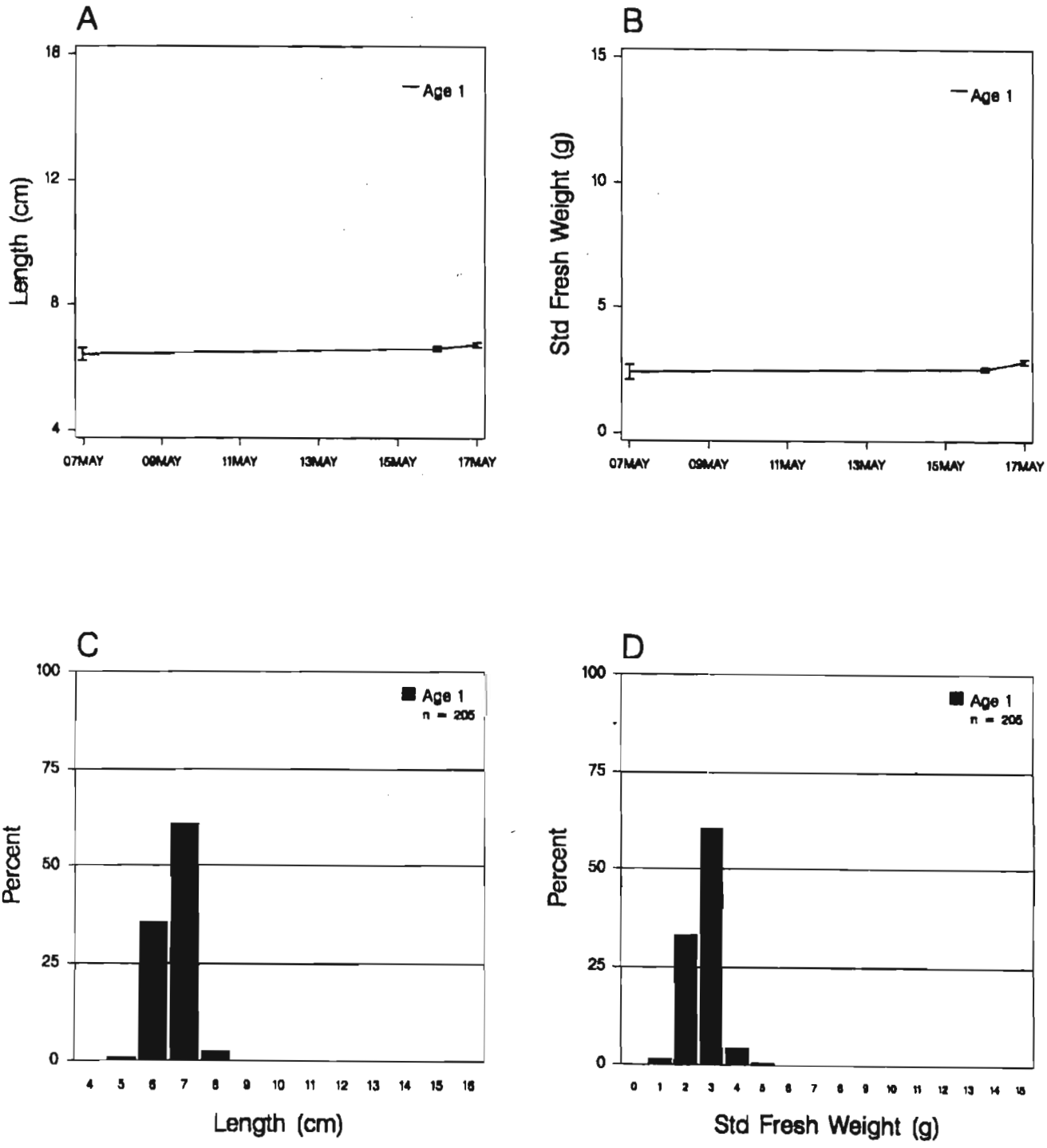
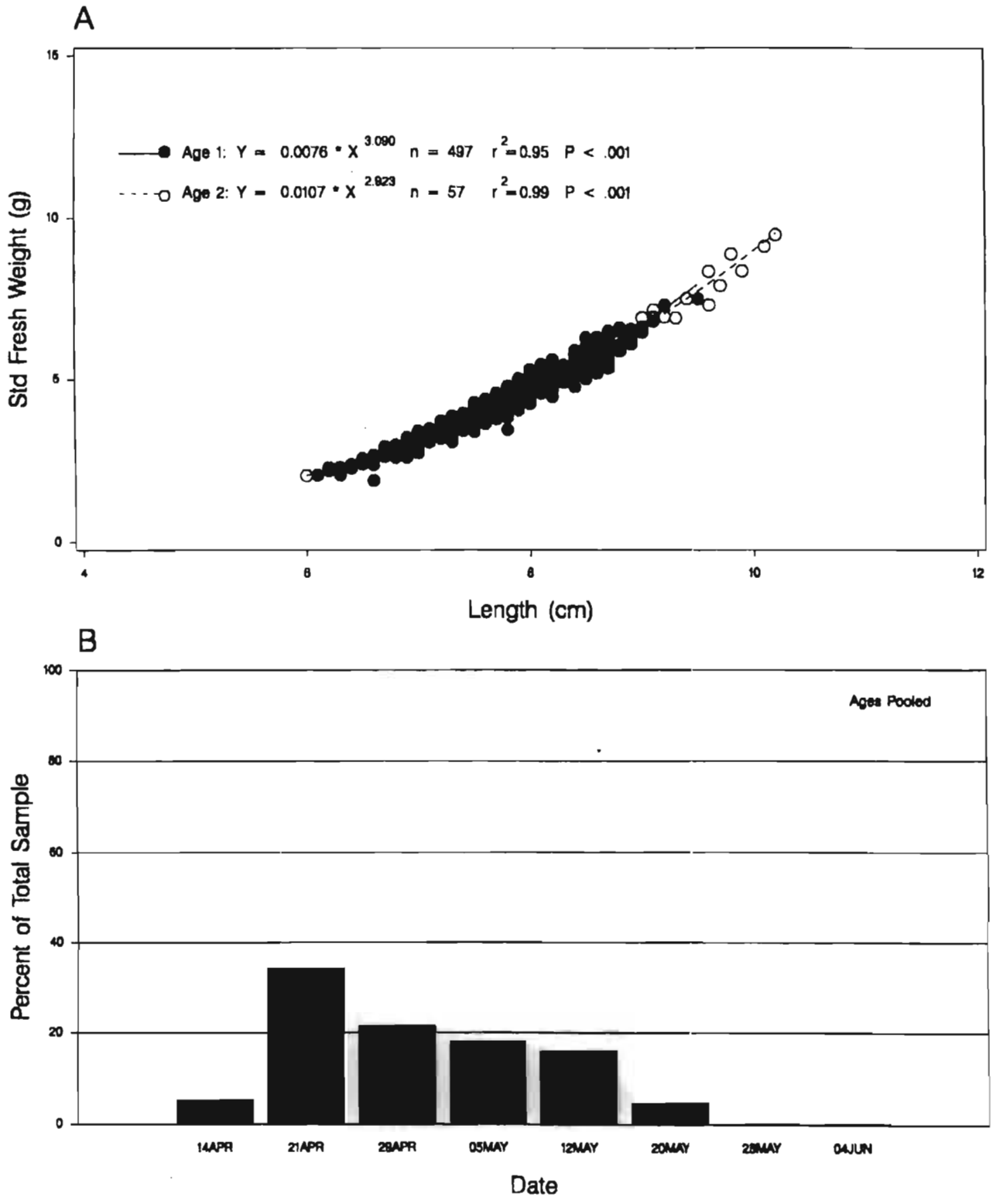


1977 Long Lake Sockeye Smolts



1977 Sproat Lake Sockeye Smolts



1977 Sproat Lake Sockeye Smolts