SOUTHEAST ALASKA PINK AND CHUM SALMON INVESTIGATIONS, 1987-88

By

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ABSTRACT

Forecast data collection, preparation, and analysis continued to be the primary activity of the Pink and Chum Salmon Investigations Project during the period from 1 July 1987 through 30 June 1988. The 1987 pink salmon (*Oncorhynchus gorbuscha*) return to southern Southeast Alaska totaled 9.7 million with a 4.5 million harvest and an escapement index of 5.3 million. The return to northern Southeast Alaska totaled 9.2 million with a 4.8 million harvest and an escapement index of 4.4 million.

Early marine studies continued in Tenakee Inlet and in southern Southeast Alaska. In Tenakee Inlet the high correlation between survival (return per spawner) and fry lengths in May was statistically significant. In the southern Southeast Alaska studies outmigration timing appeared to be a better indication of survival, because warmer stream temperatures occasionally result in fry outmigrations before the occurrence of major spring marine plankton blooms. Studies of predation by coho smolts on pink and chum salmon fry were concluded and indicate potentially significant predation particularly on years with poor overwinter survival and few numbers of fry in the early marine environment.

Key Words: pink salmon, *Oncorhynchus gorbuscha*, Southeast Alaska, predation, early marine survival.

INTRODUCTION

The Southeast Alaska pink salmon forecast research program was initiated in 1963. This report describes project activities during the period from July 1, 1986 through June 30, 1987.

The primary objective of the forecast research project is to develop techniques and background data to provide accurate annual preseason estimates of pink salmon returns to northern and southern Southeast Alaska. Annual pink salmon forecasts are of importance to the fishing industry, both fishermen and processors, for operational planning, and to fisheries managers for regulatory decision making.

Pink salmon returns to Southeast Alaska have been forecast with variable success since 1967. The forecast has been based on egg to fry survival of preemergent fry. In 1965 preemergent fry sampling was initiated on selected streams regionwide. In 1970, the program was expanded to include 12 new sample areas in seven new streams. In 1984, the entire southern area preemergent program was deleted as a result of budget reductions and in 1986, the entire northern area preemergent sampling program was deleted, also as a result of budget reductions.

Early marine survival studies of pink and chum salmon continued in 1987 for the twelfth year in Tenakee Inlet, and the tenth year in the Ketchikan area. The primary purpose of these studies is to improve the reliability of the pink salmon adult return forecast.

One of the weaknesses of the current forecast method is that, because of lack of sufficient data, marine survival must be assumed to be constant. We know, however, that it is not constant and can vary greatly from year to year. The early marine fry survival studies are intended to help improve the forecasts by providing an index of how much and why early marine pink salmon fry survival varies from year to year.

This report describes the 1987 return and presents the 1988 pink salmon forecast. Specific project objectives include:

1. Continue developing techniques and a historical database to be used for developing techniques for accurate forecasts of the pink salmon returns to the benefit of the resource, fishermen, processors, and fisheries managers.

2. Measure abundance, distribution, and growth of pink and chum salmon fry in marine nursery areas associated with the selected streams, and relate this to abundance and survival of returning adults.

3. Measure changes in selected environmental parameters and determine if any relationship exists between these parameters and pink and chum fry migration timing, abundance and size, and the subsequent abundance of returning adults.

PINK SALMON FORECASTS

Methods

Returns to the southern and northern areas of Southeast Alaska are forecast separately because of differences in migration routes and run timing. While there are differences in the odd and even year returns, we include all years in the regression analysis because there has not been a pronounced odd even year cycle in southern Southeast since 1970 and there has never been an odd or even year cycle in northern Southeast.

The southern Southeast forecast is the result of using 26 years of data to forecast harvest. Independent variables utilized in the regression analysis included: average minimum winter air temperatures in southern Southeast Alaska, the date of the coldest 15-day moving average winter temperature, and the brood year escapement index.

The northern Southeast preemergent program was discontinued in 1986 due to budgetary constraints. Consequently, this will be the first year in which a northern Southeast prediction will be made without the benefit of an estimate of overwinter survival. The forecast for northern Southeast was made with multiple linear regression analysis utilizing escapements and average spring (April through June) air temperatures as the independent variables. As a check on the multiple regression model identified above, a Box-Jenkins time series model (Pankratz 1983) was fitted to the even-year pink salmon catch for the years 1916 through 1986. The time series model gave an estimate of 7.4 million fish and was consistent with that made with the multiple regression model.

Results and Discussion

Pink salmon returns to southern Southeast in 1987 were very disappointing, with the total run coming in 8.7 million below the lower end of the forecast range. Catches were near expectations early in the season; however, sex ratio data indicated that the run was early. By mid season it was apparent that the return did not have the strength which was forecast and the season was closed on 22 August. This was the earliest the pink salmon fishery had been closed since 1979. Due to the early closure the overall escapement index for southern Southeast was 5.4 million, which is only 0.6 million below the goal. The northern Southeast return came in very close to expectations with a total return of 8.7 million, only 1 million below expectations. The 1988 mid point return predictions for southern and northern Southeast are 44.1 and 7.9 million, respectively.

1987 Forecast Evaluation

In southern Southeast Alaska the 1987 return of 10.0 million (Figure 1) was 8.7 million below the lower end of the forecast range. Although the magnitude of the error was surprising, the fact that it came in below the forecast level was not unexpected. The narrative section of the 1987 prediction report (Eggers and Dean 1987) indicated that an error in the 1987 prediction was expected to be in the direction of over-estimating the return. The reason for this was that the escapement index was over 3 million higher than any achieved since statehood, while the winter temperatures were near record lows. Since escapements exhibited the highest partial correlation with return it was anticipated that the regression equation would overestimate the influence of escapements and underestimate the influence of winter temperatures. Two conditions made the above assumptions likely. First, mortality caused by extremely harsh winters would tend to be density independent thus negating the benefit of a record high escapement. Second, the winter of 1985-1986 was unusual in that the coldest 15 day period of the winter occurred early in November. Normally the coldest period of the winter occurs in December or January. A cold spell early in the winter may result in higher mortality than a cold spell later in the winter because most of the salmon would still be in the egg rather than alvin stage; thus unable to move deeper into the gravel to avoid freezing.

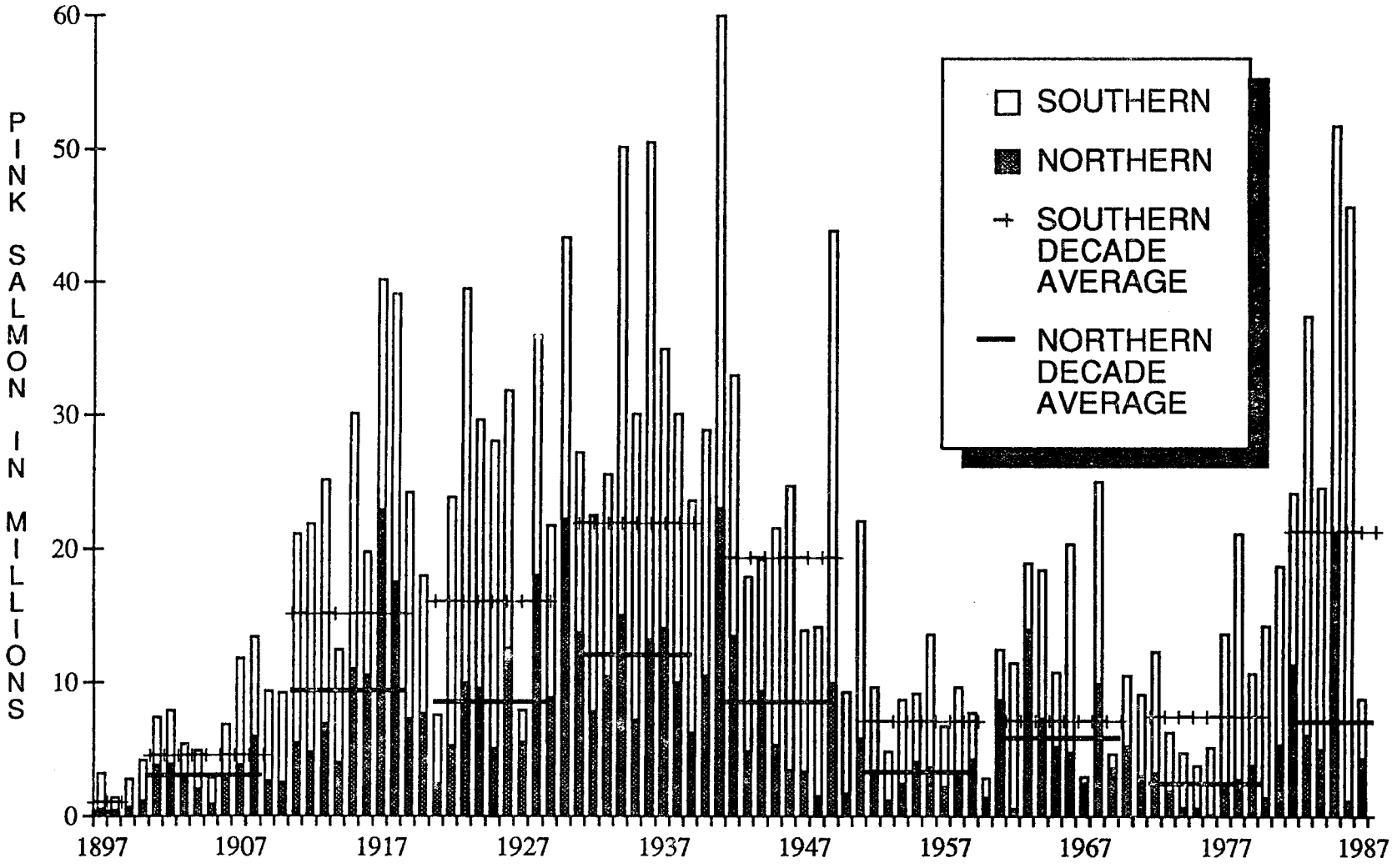

Figure 1. Northern and southern Southeast Alaska pink salmon harvest 1897 through 1987 with decade averages.

Although the above has not been experimentally verified a positive correlation does exist between date of the coldest period of the winter and return. The above correlation existed even prior to the 1987 return.

Significant post season work was done in an attempt to find a set of environmental variables which could be included into a multiple linear regression to account for the extremely poor survival which occurred in 1987. None were found which would result in a prediction lower than the one made. If similar conditions occur in the future modeling, rather than a multiple linear regression will have to be utilized in an attempt to predict return.

The 1987 pink salmon return to northern Southeast of 8.7 million (Figure 1) was 1 million below the point estimate but well within the forecast range.

1988 Forecast

The 1988 pink salmon prediction must be viewed with some caution because the most important variable, escapement, was outside of the range of anything experienced since statehood (Appendix A). The escapement index in 1986 (brood year for the 1988 return) was 1 million higher than the previous record set in 1985, which produced the disappointing return in 1987 of 10 million. This low return was presumably due to extremely harsh winter conditions during 1985-1986. In contrast, fry in the gravel during the winter of 1986-1987 experienced relatively mild winter conditions. The large forecasted return in 1988 is supported by the observation of exceptionally large numbers of fry during the early marine period.

There is no reason to expect any change in the recent years trend of harvesting the majority of returning pinks off the West Coast of Prince of Wales Island in Districts 103 and 104. It is also anticipated that it will be difficult to achieve escapement needs in Districts 105 through 108 because of interceptions in Districts 102 and 104.

The 1988 forecast differs from earlier forecasts in that harvest rather than return was predicted. The total return was estimated by summing the predicted harvest, based on methods described above, and the predicted escapement index based on a simple linear regression (R^2 = .83, n = 26) of the escapement index and harvest.

It has become apparent in recent years that the official escapement index goal of 6.0 million pink salmon is too low to achieve maximum sustained yield. The escapement index has exceeded the six million goal in every year where the catch has exceeded 19 million. The overall escapement goal was originally exceeded in an attempt to obtain adequate escapements to districts 105 through 108. Consequently, the harvest projection is likely to be high because the historical escapement achieved in years of large returns of pink salmon have tended to be higher than the goal.

Returns to the northern districts are expected to be good in Districts 109 and 112 but poor in other districts with little available harvest surplus. The overall northern Southeast parent year escapement was only 2.9 million fish with over 51% of that occurring in Districts 109 and 112. The other districts had generally poor escapements.

While the overall District 109 escapement was excellent (739.8 thousand), it occurred primarily in streams of the Petersburg Management Area, with only 13.6% occurring in streams of the Sitka Management Area. Thus, any harvestable surplus is expected to be in the Petersburg Management Area.

District 113 had an escapement of 737 thousand pink salmon which was well below the district goal of 1.6 million. Within the district just over 502 thousand pink salmon were in the outer coastal area of Baranof and Chichagof Islands and the remainder was in the Peril Straits area. The Peril Straits area escapement was the lowest since 1976.

EARLY MARINE SURVIVAL STUDIES

Tenakee Inlet

In 1987 the early marine survival studies were continued in the Tenakee Inlet area during the period 21 April to 3 June.

Methods

Monitoring of Tenakee Inlet fry populations and physical parameters was continued in 1987. Pink and chum salmon fry migrating from the Kadashan River, which drains into Tenakee Inlet, were not sampled in 1987.

Fry abundance in Tenakee Inlet was monitored at least once each week by conducting visual surveys (Jones et al. 1982) along an index transect at Cannery Point, Trap Bay, Corner Bay, and the Tenakee Boat Harbor (Figure 2). Fry were counted by one person wearing polarized sun glasses and standing in the bow of a 4 m skiff. The skiff was driven along the shoreline in water as shallow as possible, at speeds less than 6 knots, and numbers and locations of fry were recorded directly on maps at the time of observation. When the species composition of schools of fry could not be determined visually, or when fry samples were needed for growth determination, a dip net or beach seine was used to collect the fish for identification or preservation. The beach seine measured 38.5 m long by 1.8 m deep, with a uniform rectangular mesh of 3.2 x 6.4 mm.

Fry were regularly collected during daylight hours from all four locations in Tenakee Inlet, including Cannery Point by beach seine.

Tenakee Inlet water temperatures, salinities and clarity (secchi disc readings) were monitored at least once per week from 22 April to June 2 at the primary and secondary oceanographic stations shown in Figure 2. Temperatures and salinities were measured with a Yellow Springs Instrument Model 33 temperature and salinity conductivity meter with a 15 m probe. Recordings were taken at 1 m intervals from the surface down to 10 meters. Water clarity was measured with a 20 cm diameter secchi disc.

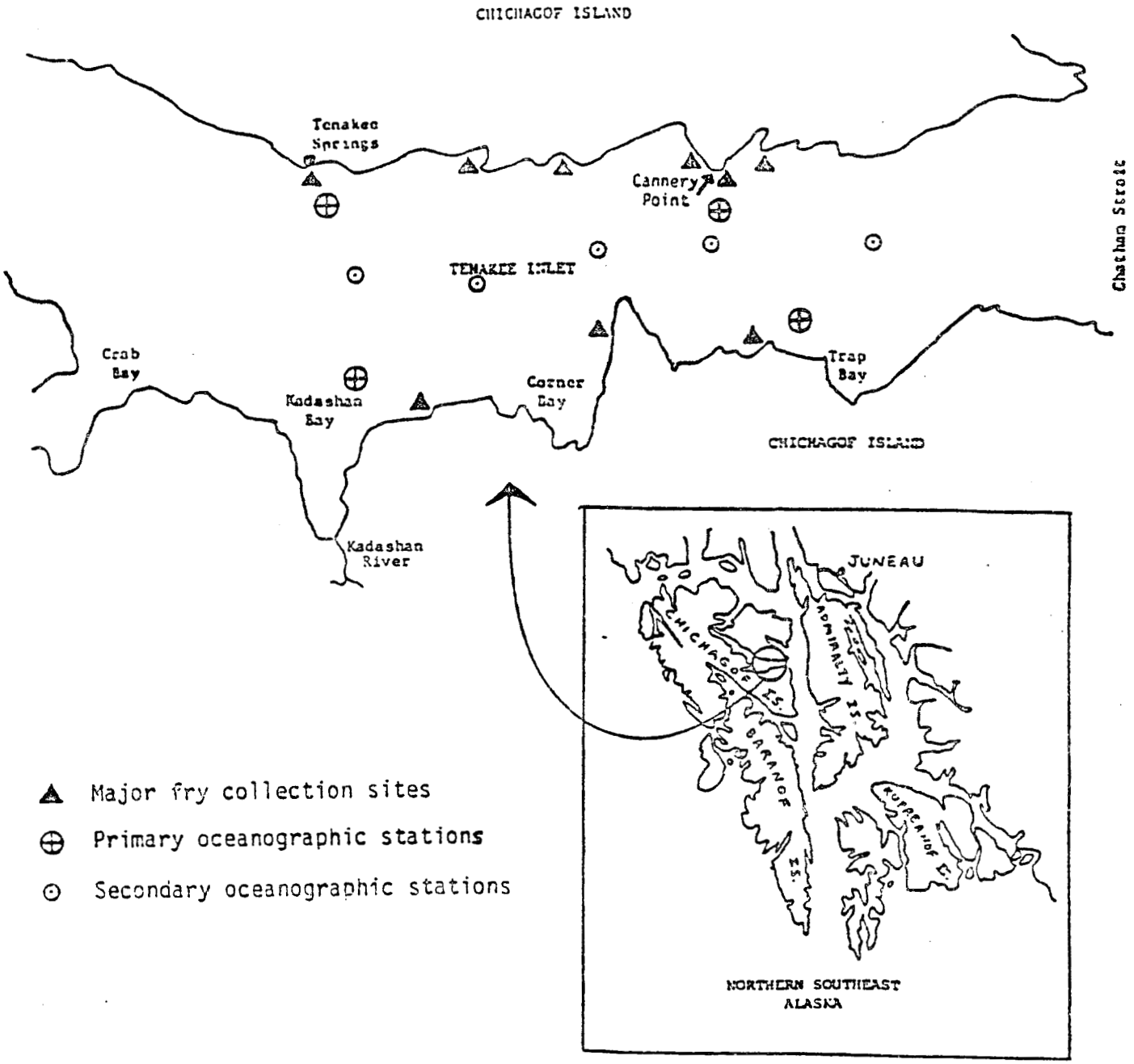

Figure 2. Major fry collection sites, primary and secondary oceanographic stations, and the location of Cannery Point in Tenakee Inlet.

Temperatures and salinities were taken at depth of 2 m. Readings at this depth are more stable than at shallower readings yet still well above the thermocline/halocline and, therefore, quite representative of waters inhabited by fry. Readings were taken from the surface to 10 m depth to insure that the thermocline/halocline was below 2 meters.

Results and Discussion

The peak number of pink salmon fry observed in Tenakee Inlet at Cannery Point in 1987 was only 165,000, considerably lower than the 1.5 million in 1986. No chum salmon fry were ever visually identified from the boat during the searches for schools to sample for lengths and weights. Nevertheless, chum fry were collected, mostly in beach seines, in association with pink salmon fry. This reinforces the previously documented unreliability of visual estimates for identifying chum fry in large schools of mixed species (Jones et al. 1982).

Pink salmon fry sampled in Tenakee Inlet increased from an average length and weight of 33.1 mm and 243.5 mg, respectively, on 21 April to 45.8 mm and 887.4 mg on 2 June for an average growth rate of 0.30 mm per day in length and 15.3 mg per day in weight. Chum salmon fry grew from an average length and weight of 39.3 mm and 475.9 mg, respectively, on 21 April, to 47.0 mm and 1034.4 mg on 2 June for an average growth rate of 0.18 mm per day in length and 13.3 gm in weight.

We computed the average pink fry fork length in May for 1977-1986 in Tenakee Inlet (Table 1) and compared it with the subsequent total adult pink salmon return per spawner ("return" is the escapement to all major spawning streams plus the commercial catch in Subdistrict 112-41 and 112-45 of Tenakee Inlet). We found a significant positive relationship between these parameters ($r = 0.638$, $P = 0.05$, $n = 10$). Thus, it appears that the average length of pink fry in Tenakee Inlet in May can continue to be used to estimate survival of the following year's return of adult pink salmon with a high degree of confidence (Jones et al. 1982).

While water temperature and level data from Kadashan River were collected too infrequently to be useful, weekly temperature and salinity observations were made in Tenakee Inlet. The average water temperature and salinity in Tenakee Inlet in 1987 was 8.25°C and 27.47 ppt, respectively, for all nearshore stations (Appendix B.1.). All mid-inlet stations

Table 1. Pink salmon return per spawner (R/S), and prior year's average fry fork length in May in Tenakee Inlet for 1978-87 adult return years.

	Subdist 41-45 Harvest	Tenakee Inlet Escapement	Estimated 41-45 Return	Parent Year Escapement	Tenakee Rtn/Sp	NSE Rtn/Sp	May 1-20 Length
1978	480,121	522,208	1,002,329	130,623	7.67	4.15	43.7
1979	94,677	253,683	348,360	193,108	1.80	2.14	39.1
1980	98,397	263,897	362,294	522,208	0.69	1.28	37.4
1981	79,586	310,958	390,544	253,683	1.54	1.85	36.8
1982	551,465	364,540	916,005	263,897	3.47	5.90	38.7
1983	267,440	467,110	734,550	310,958	2.36	2.67	36.0
1984	139,561	179,411	318,972	364,540	0.87	2.04	38.9
1985	596,437	592,259	1,188,696	467,110	2.54	6.30	41.2
1986	99,792	507,582	607,374	179,411	3.39	1.05	36.4
1987	95,599	151,981	247,580	592,259	0.42	0.90	36.5

were similar at 8.34°C and 27.38 ppt. The weekly trend of steadily rising temperatures continued as in previous years.

Conclusions and Recommendations

The implications of our 1987 results and our recommendations for the early marine survival studies of pink and chum salmon in Tenakee Inlet are as follows:

1. The strong relationship between average pink salmon fry length in May and subsequent adult return per spawner in Tenakee Inlet was further verified with the addition of 1986 fry/1987 adult return data. The positive relationship between pink fry survey counts and subsequent total adult returns was strengthened with the addition of 1987 data.

2. It is felt that because of the high positive correlation between May fry lengths in Tenakee and the overall northern southeast brood year survival that additional areas should be sampled for fry size from late April through early June. The longer sample period will insure that adequate samples are taken through the critical period of early marine residence, and additional areas are needed to verify the relationship in general.

Ketchikan Area

Early marine survival studies in the Ketchikan area continued for the tenth year in 1987. Studies conducted from 1976 through 1978 were centered in Cholmondeley Sound (Jones 1982). The program was reinitiated in 1981 with the study area expanded to include Moira Sound, Boca de Quadra, and Smeaton Bay. Since 1981, the emphasis of the study has been to obtain fry samples from marine nursery areas in the hope of finding a relationship between fry size or condition and early marine survival for use in improving forecasts. In addition, 1985 through 1987 studies included a cursory investigation on the impact of large scale releases of hatchery coho on the wild stock pink and chum salmon populations of the area. Budgetary constraints caused by including the coho study in the early marine program necessitated dropping Moria Sound from the early marine program in 1986.

Methods

The timing and abundance of outmigrant fry from Sunny (102-40-87), Nigelius (101-45-94), and Spit (101-45-75) Creeks was monitored from 2 April through 20 May using a 0.45 m by 0.9 m fyke net placed to sample a column of water 0.45 meters wide. Graphs of Sunny creeks outmigrant timing and relative abundance were made by assuming an outmigration of zero on 3 March and 23 June. This was done in an attempt to standardize outmigrant magnitude since beginning and ending fyke netting periods often did not include the entire outmigration period. The index of relative abundance was obtained by calculating the area under the outmigration curve rather than summing the catches because the number of samples varied greatly between years.

The marine fry collection technique was changed in 1986 from after dark dipnetting to daylight beach seining. The change was made after comparison of fry collected by beach seine and dip net indicated that dip netting was a size selective capture technique when compared to beach seining. The beach seine was 38 m long by 1.8 m deep, with a uniform mesh of 3.2 by 6.4 mm. No method was found to correct for the different collection techniques. Fry samples collected for length weight analysis from both fresh water and marine areas were preserved in a 10% buffered (sodium borate) formalin solution. The fry were measured and weighed approximately six months after collection. The condition index given on graphs of the fry length frequency was calculated with the formula length divided by weight raised to the power of 3.5.

Estimating fry abundance along premeasured transects was added to the study in 1986. Those areas which were known to be important nursery areas from past years observations were selected as transect locations (Figure 3). Fry numbers were estimated by a person wearing polarized sunglasses, standing in the bow of a 5.2 m skiff while it traveled at idle speed along the shoreline.

A coho predation study was conducted in 1985, 1986 and 1987 to estimate the impact of large numbers of hatchery coho salmon on wild stock pink salmon populations in West Behm Canal. The study was centered in the Neets Bay area in 1985 (Figure 3). Rearing coho salmon were captured with a 38 m by 1.8 m beach seine. In 1986 and 1987 the study area was expanded to include Carroll Inlet and rearing king salmon were also sampled to determine the extent of their predation on pink and chum salmon. The beach seine used to capture the

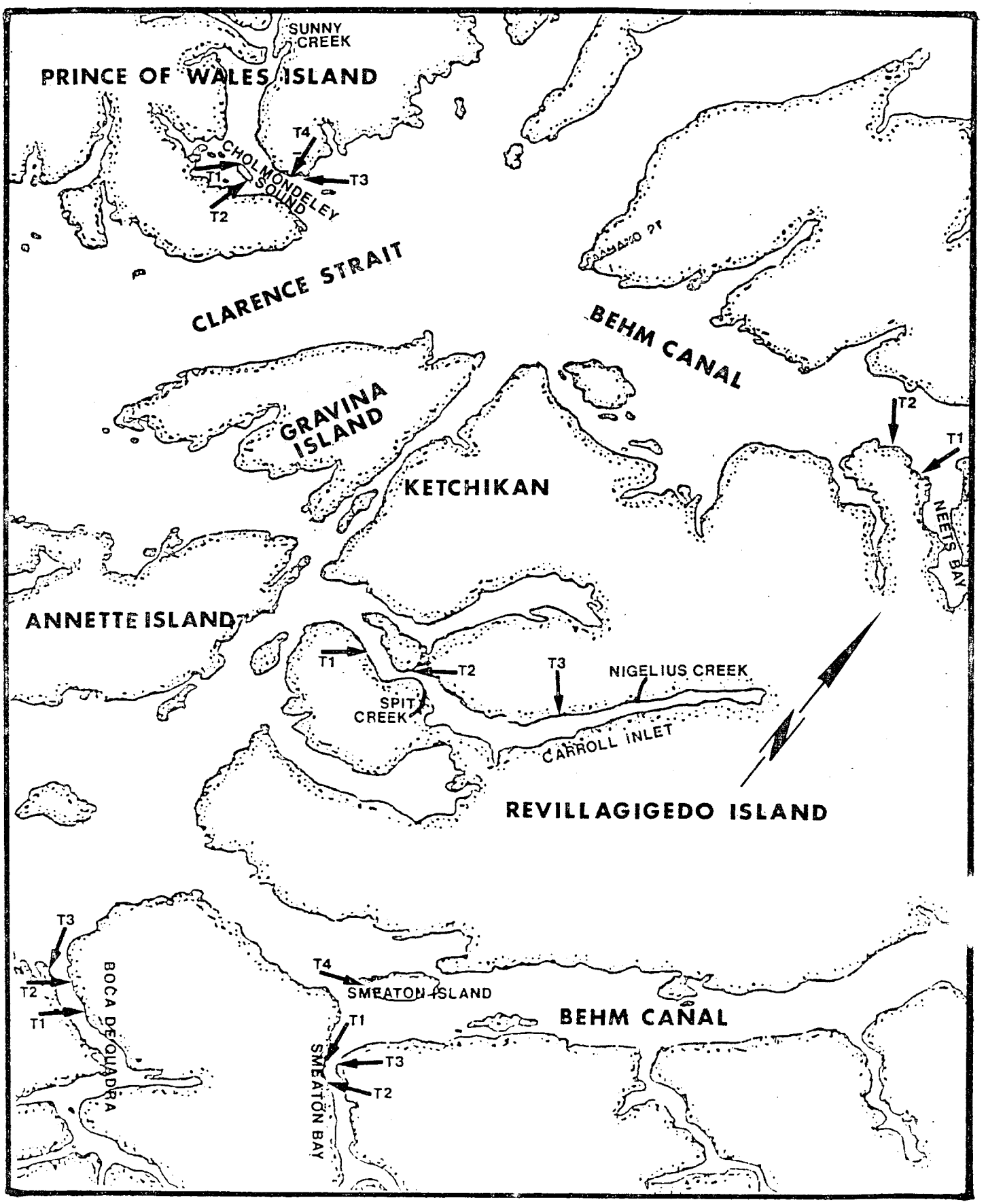

Figure 3. Map of early marine study areas and transect locations in southern Southeast Alaska.

coho and king salmon in 1986 was 76 m by 1.8 m. In addition, a commercial seiner with an anchovy seine (100 fathoms by 10 fathoms) was utilized to collect coho and king salmon in 1986 and 1987. Fry captured were preserved in 10% formalin solution, buffered to a pH of 7; formalin was also injected into the stomach cavity to halt digestion. All length measurements were from tip of snout to fork of tail.

Results and Discussion

The peak pink salmon outmigration from Sunny Creek in 1987 occurred on 9 May (Appendix B.2.). The calculated date of 50% outmigration occurred on 27 April (Appendix B.3.), which was the second earliest of the study period. The calculated pink outmigration index of 39,663 was the second largest of the study period. The chum outmigration index of 11,365 was the third largest of the study period. The data prior to 1985, however, can not be directly compared to 1985 and 1986 since a fish ladder was installed in 1984 which opened up additional spawning area.

Fyke net catches from Nigelius and Spit creeks along with stream temperatures are listed in Appendix B.4. As was the case with Sunny creek the outmigration appears to have occurred earlier in 1987 than in 1986 in both creeks. It is difficult to determine relative outmigration magnitude between the two years because the outmigration had already peaked on the first sample day (2 April) at Nigelius creek in 1987; however, peak catches were higher in 1987 than in 1986 in both creeks.

Length frequency distributions of fry collected in the marine nursery areas during the early (15 April through 14 May) and late (15 May through 31 May) time periods are presented in Appendix B.5. It should be stressed that utilizing a beach seine in 1986 may have affected the length frequency distribution of fry relative to prior years because of the change in the collection technique. The sample sizes presented in this report are larger than those presented in last year's report for two reasons. First, this year's report includes fry collected in April in the sample whereas the 1986 report included only those fry collected after May 1. The second reason is that fry collected from Carroll inlet and Neets Bay were included in this year's evaluation but were omitted from the sample in last year's report. The above changes had a very minor influence on the average lengths, with the largest change occurring during the early

sample period of 1983. Including the extra data resulted in the sample size increasing from 304 to 1256, while the average fry length decreased from 41.8 millimeters to 40.1 millimeters. Increasing the sample sizes had no affect on the relative size of fry between years.

Pink salmon fry abundance estimates by study area are listed in Appendix B.6. (Figure 3 shows the locations of the various transects). Since only one return has occurred since the visual abundance estimates were taken it is not possible to evaluate their usefulness in improving predictions. Two main problems which may restrict their reliability are the inability of different observers to accurately estimate the number of fry in large schools (100,000+); and poor weather which restricts visibility. The spring of 1987 was one of the worst in years with numerous storms moving through the area during the early marine sample period. Consequently, the transect counts are probably artificially low because counts had to be made when visibility was less than desirable. While visibility estimates are recorded along with transect counts, the estimates are to subjective too be used in any statistical evaluation.

This was the last of a three year study designed to evaluate the extent to which coho smolt utilize pink salmon fry as a food source. Figure 4 portrays the number of pink salmon fry consumed by time period in 1985; along with the length frequency distribution of hatchery coho at the time of release (1 June). Interpretation of the graph would suggest that the hatchery coho did not represent a significant proportion of the sample. However, field observations at the time of capture indicted that the beach seine utilized in 1985 was an ineffective capture method as on numerous occasions coho were observed jumping immediately prior to making a set in which no coho salmon were caught. Consequently, it was suspected that the net may have been size selective and that the samples obtained were not a true representation of the size distribution of the coho population in the sample area. A total of only 142 coho salmon were captured in 1985 but the data did suggest that a significant drop in predation could be achieved by delaying coho releases until June (0.65 fry consumed per coho day in May compared to 0.21 fry consumed per coho day in June).

Length frequency distributions of coho salmon captured in 1986 and 1987 combined are compared for beach verses anchovy seine (Figure 5). Combining the years had a very minor

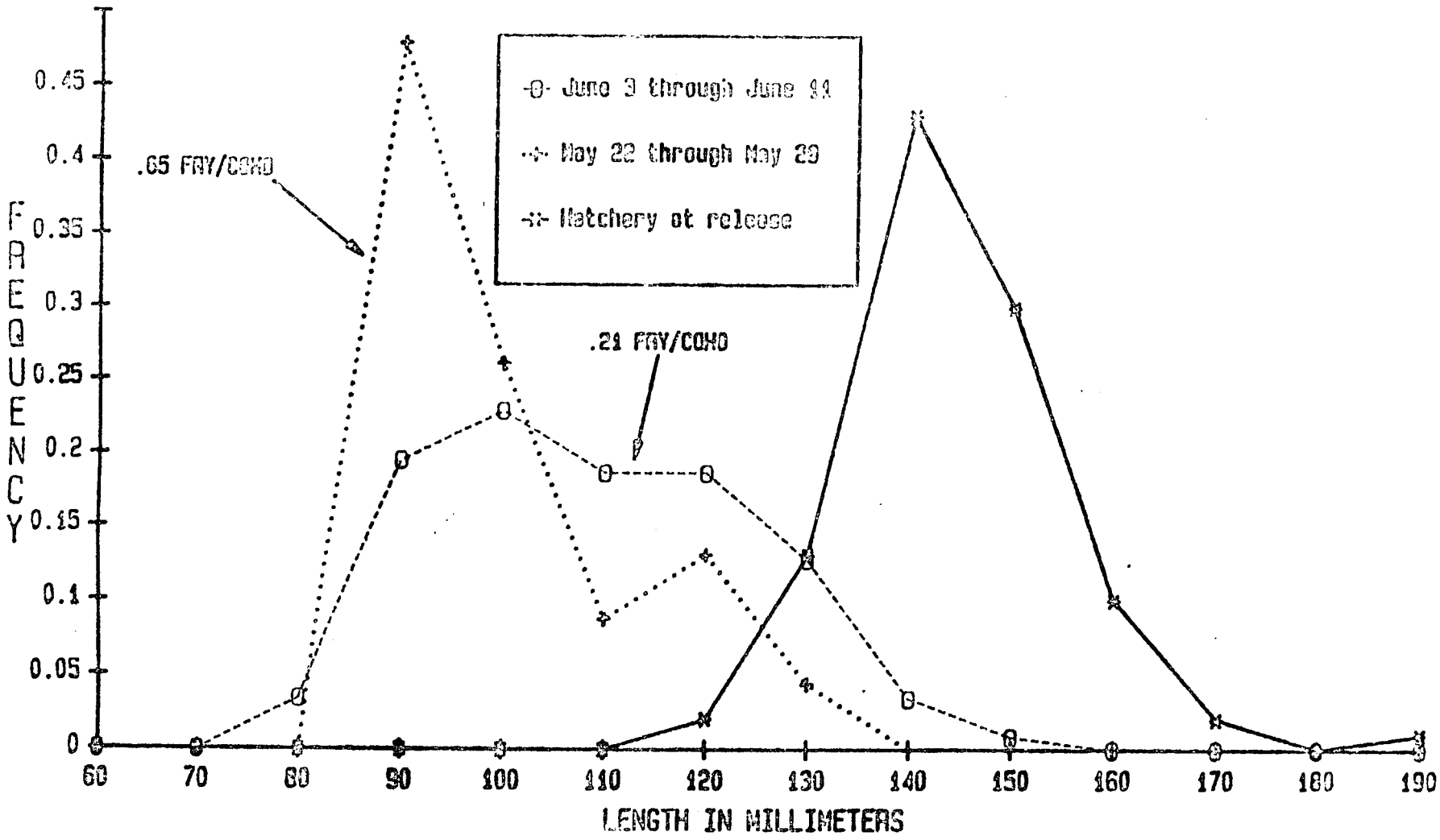

Figure 4. Length frequency of coho salmon captured in Behm Canal verses hatchery release in 1985.

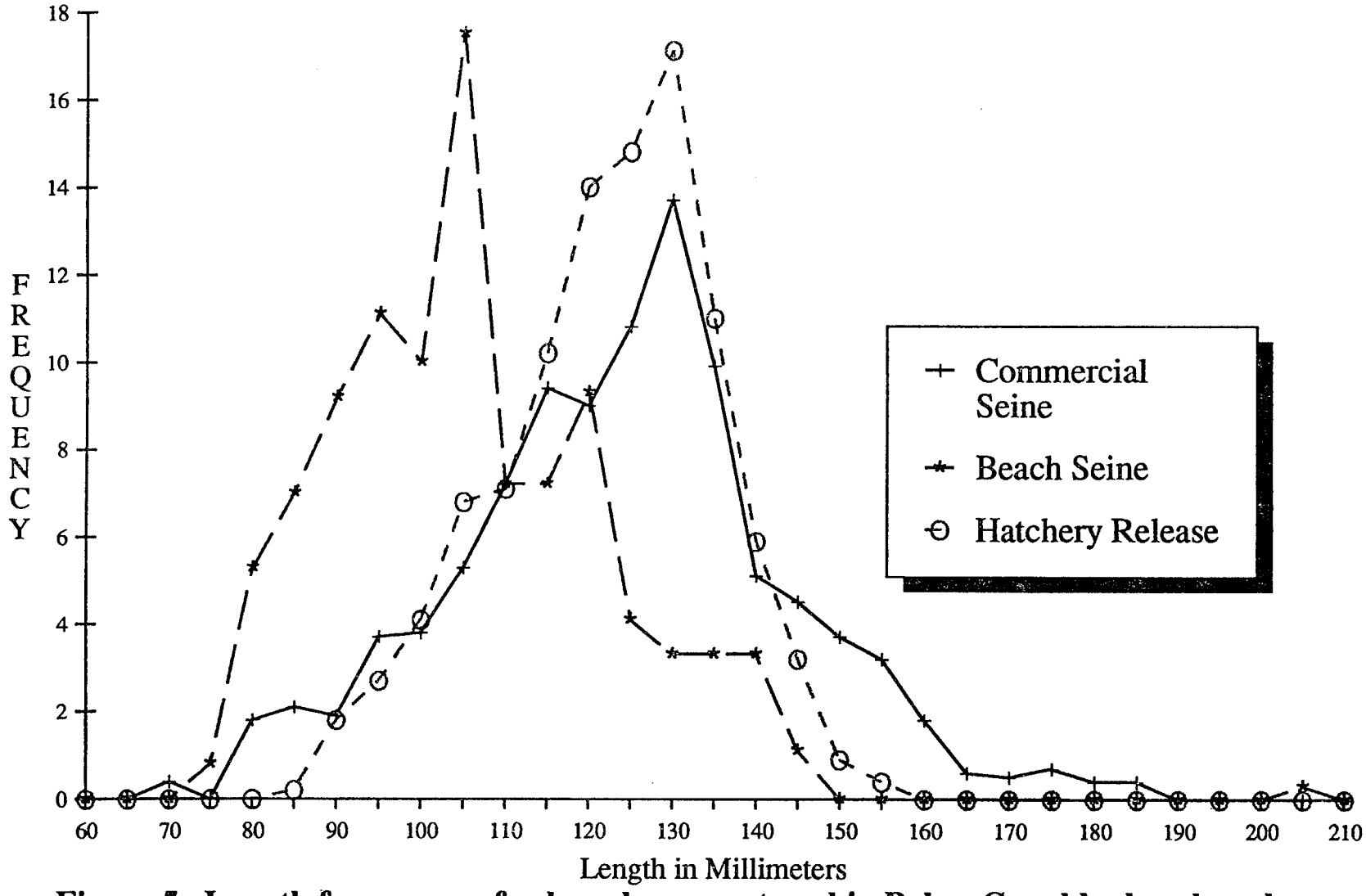

Figure 5. Length frequency of coho salmon captured in Behm Canal by beach and commercial seine from 6/1 through 6/28 compared to size of hatchery coho at release for 1986 and 1987 combined.

influence on the distribution curves since both hatchery coho and captured coho salmon exhibited similar length frequency distributions between years. The graph shows that the commercial anchovy seine captured larger fry and presumably a more representative sample of the coho population in the sample area. The beach seine utilized in 1986 and 1987 was twice as long as the seine used in 1985 (76 verses 38 meters long by 1.8 meters deep). The larger beach seine was near the maximum length which could be efficiently utilized by a two person crew from a 5.2 meter skiff; however, even the larger seine was still size selective in capturing coho.

The number of fry consumed per coho salmon captured by day for 1985 through 1987 are shown in Figure 6. The Y axis starts at -0.1 so that predation rates of 0 could be graphed and the first and last data points are not to scale on the x axis. The first data point was actually from 8 May and the last data point was from 28 June, all other data points are to scale. Coho salmon captured in both Carroll inlet and Behm Canal were combined for this graph. The graph demonstrates that the drop in predation through time noted in 1985 was also present in 1986 and 1987. The "all years" weighted average predation rate for May was 0.6 fry per coho captured, while the rate for June was 0.18 fry per coho captured. The fry consumed per coho captured parameter mentioned previously refers to both pink and chum fry. In the majority of the cases the fry in a coho stomach could only be identified to *Oncorhynchus*. In approximately 20% of the cases the fry could be identified to pink salmon and in less than 1% of the cases the fry could be definitely identified as a chum salmon.

No graphs are presented for the king salmon captured during the study because they were not relying heavily on pink salmon as a food source. A total of 122 king salmon captured in 1986 had consumed only 1 pink salmon. In 1987 72 king salmon were captured in Behm canal and none were found to contain salmon fry. A sample of 262 king salmon captured in Carroll inlet in 1987 had consumed only 10 salmon fry.

Conclusions and Recommendations

1. The information obtained to date on coho salmon predation indicates that delaying releases of coho salmon until early June greatly reduced the impact of hatchery coho on wild stock pink salmon fry. It also appeared that the impact of predation could be further reduced by delaying releases an additional two weeks.

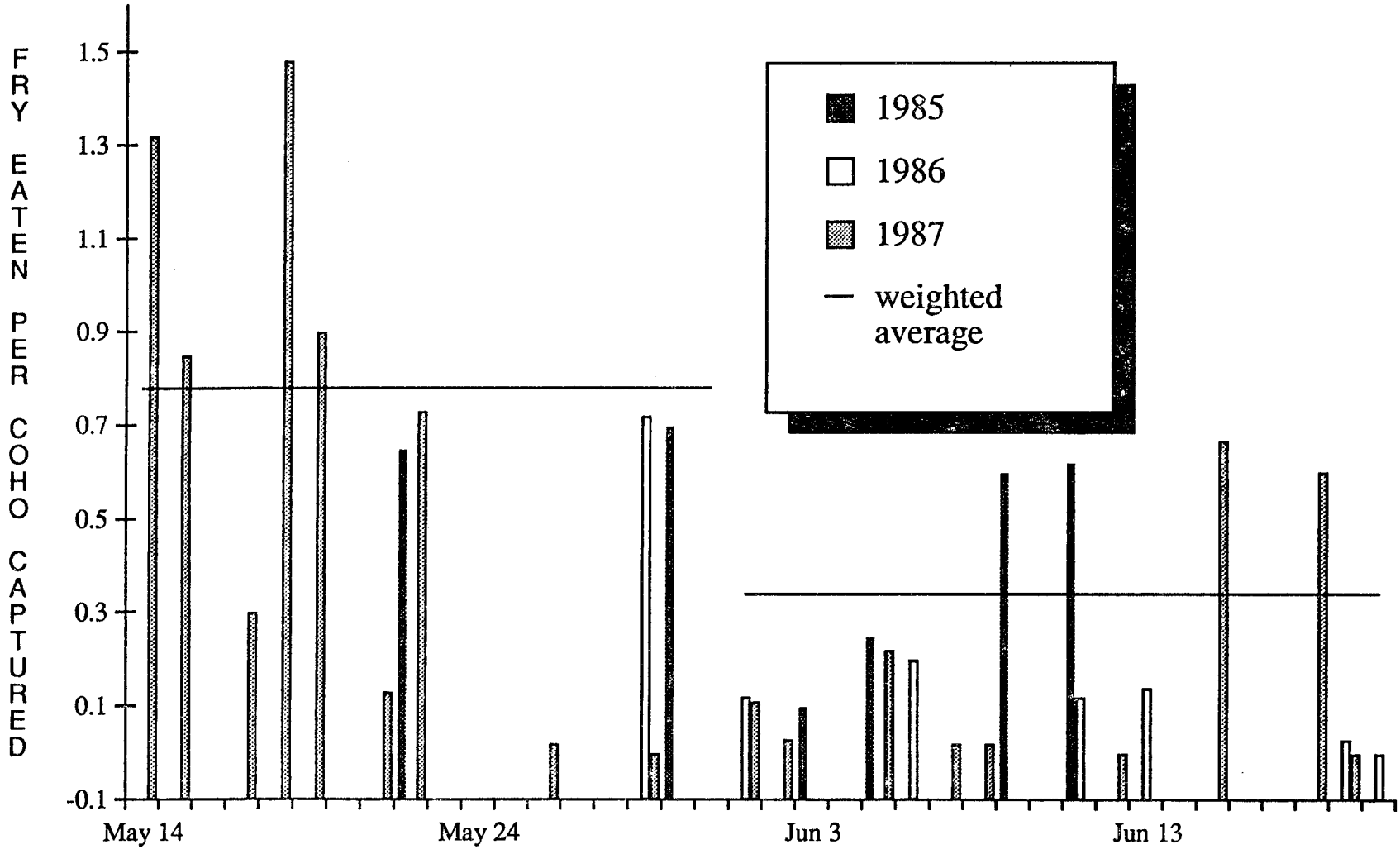

Figure 6. Pink salmon consumed per coho captured in Behm Canal and Carroll Inlet for 1985 through 1987.

2. It is to early to evaluate the reliability of visual transect estimates in southern Southeast. One of the biggest problems may be that because of the number of sample areas and a desire to sample each area at least once a week it is not possible to wait for days with excellent visibility to run the transects. The variation caused by differences in visibility may be as large as any real differences in fry abundance. Consequently, consideration should to given to using side scanning sonar in an attempt to obtain biomass estimates.

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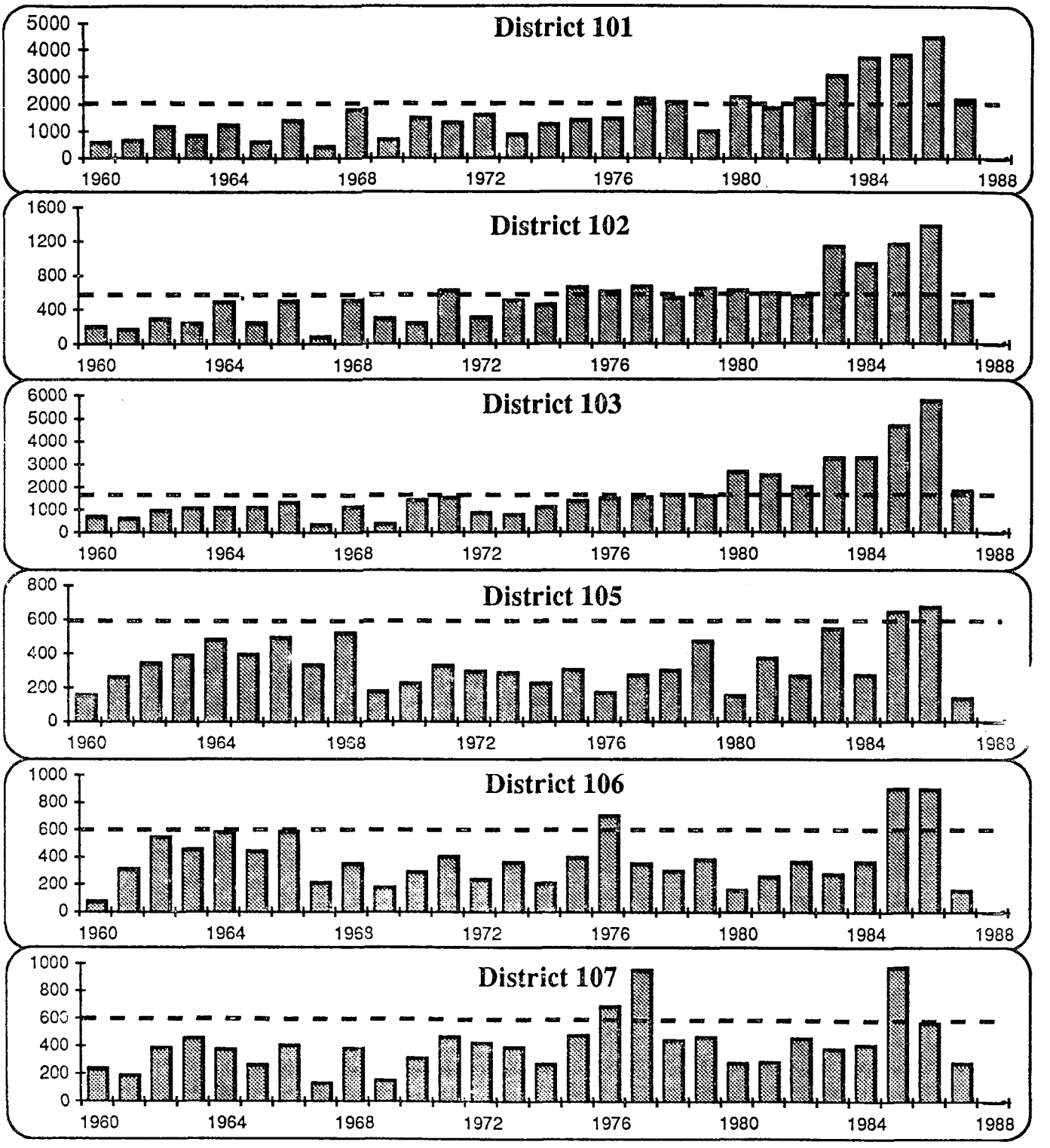
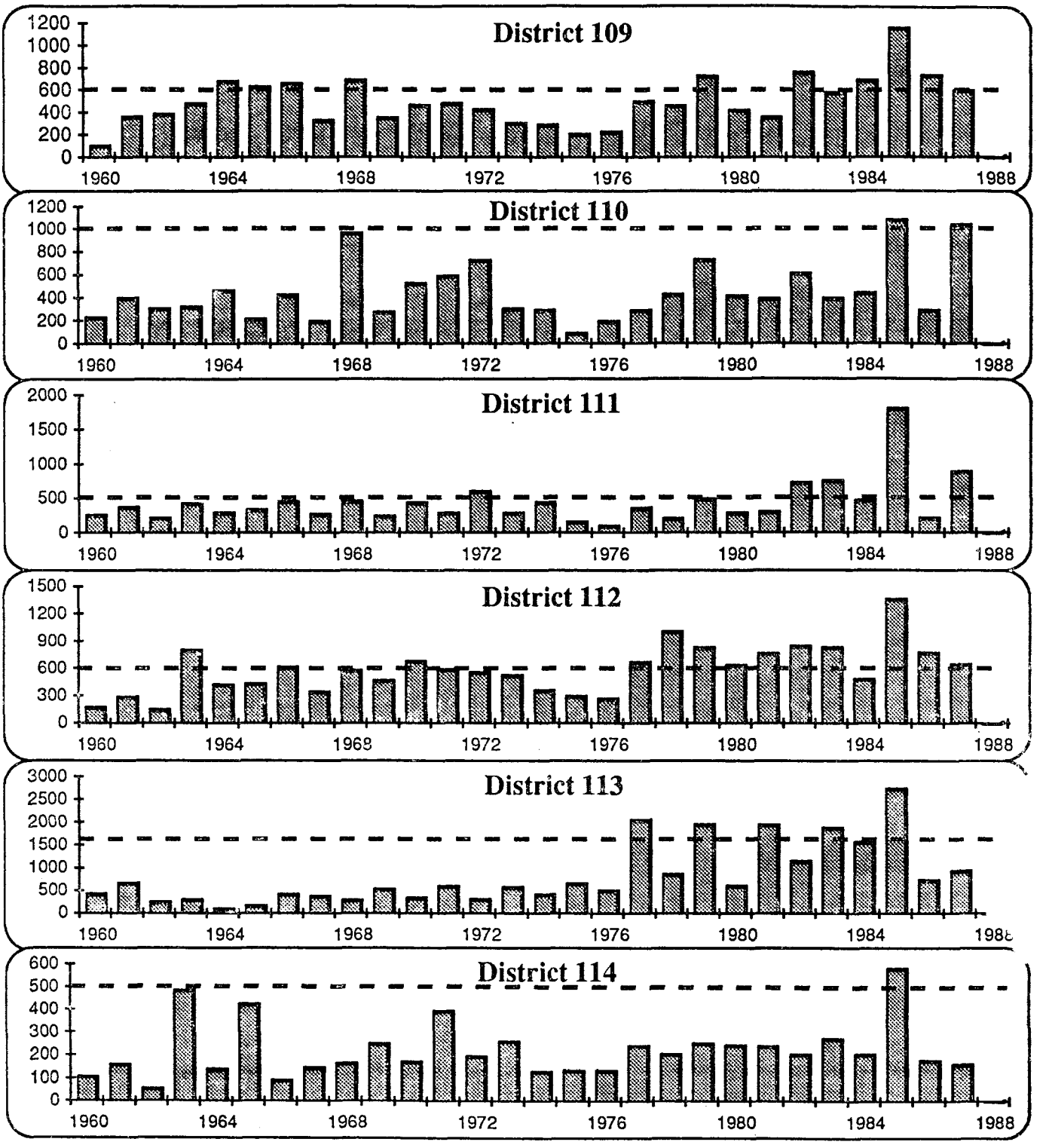
APPENDICES



Appendix A.1. Southern Southeast Alaska pink salmon escapement, and escapement goals by district in thousands of fish.



Appendix B.2. Northern Southeast Alaska pink salmon escapement, and escapement goals by district in thousands of fish.

Appendix A.3. Southern and northern Southeast Alaska harvest and escapement in thousands, and return per spawner for 1960-87.

	Southern Southeastern				Northern Southeastern			
	Harvest	Escapement	Return	RTN/SP	Harvest	Escapement	Return	RTN/SP
1960	1,542	2,023	3,565		1,428	1,326	2,753	
1961	3,873	2,491	6,364		8,697	2,237	10,934	
1962	11,007	3,952	14,960	7.39	548	1,365	1,913	1.44
1963	5,145	3,758	8,903	3.57	13,914	2,828	16,742	7.48
1964	11,258	4,434	15,693	3.97	7,279	2,107	9,385	6.87
1965	5,710	3,189	8,899	2.37	5,154	2,212	7,366	2.60
1966	15,649	4,804	20,453	4.61	4,786	2,682	7,467	3.54
1967	642	1,669	2,311	0.72	2,425	1,673	4,098	1.85
1968	15,201	4,889	20,090	4.18	9,865	3,210	13,075	4.88
1969	1,198	2,070	3,268	1.96	3,594	2,142	5,736	3.43
1970	5,412	4,166	9,578	1.96	5,239	2,700	7,939	2.47
1971	6,250	4,823	11,073	5.35	3,011	2,958	5,969	2.79
1972	9,153	4,080	13,233	3.18	3,240	2,832	6,072	2.25
1973	4,555	3,395	7,951	1.65	1,875	2,363	4,239	1.43
1974	4,221	3,696	7,917	1.94	656	1,945	2,602	0.92
1975	3,330	4,778	8,108	2.39	615	1,558	2,173	0.92
1976	5,157	5,249	10,406	2.82	137	1,434	1,571	0.81
1977	11,242	6,175	17,417	3.65	2,506	4,163	6,669	4.28
1978	18,425	5,455	23,880	4.55	2,773	3,177	5,950	4.15
1979	6,992	4,820	11,812	1.91	3,813	5,083	8,896	2.14
1980	12,907	6,293	19,200	3.52	1,425	2,652	4,077	1.28
1981	13,468	6,015	19,483	4.04	5,334	4,054	9,388	1.85
1982	12,917	6,057	18,974	3.01	11,293	4,364	15,657	5.90
1983	31,421	8,807	40,228	6.69	6,044	4,780	10,824	2.67
1984	19,637	9,108	28,745	4.75	4,992	3,902	8,894	2.04
1985	30,612	12,345	42,957	4.88	21,098	9,010	30,108	6.30
1986	44,480	13,895	58,374	6.41	1,174	2,941	4,115	1.05
1987	4,473	5,272	9,745	0.79	4,820	4,368	9,188	1.02

Appendix A.4. Southern Southeast Alaska pink salmon escapement by district and year in thousands of fish.

	District							SSE
	101	102	103	105	106	107	108	Total
1960	597.3	209.7	735.5	160.5	78.9	241.2	0.0	2,023.1
1961	671.4	174.3	653.1	268.0	317.3	193.0	213.4	2,490.5
1962	1,199.2	302.3	1,015.3	349.6	550.6	391.7	143.7	3,952.4
1963	876.1	250.0	1,104.4	395.3	464.3	462.8	205.0	3,757.9
1964	1,259.5	499.6	1,125.1	488.6	585.2	380.3	96.1	4,434.4
1965	636.5	256.6	1,138.0	402.3	447.8	269.3	38.3	3,188.8
1966	1,430.0	509.7	1,363.1	499.4	591.3	410.3	0.0	4,803.8
1967	461.7	88.6	397.6	342.8	219.9	136.3	22.5	1,669.4
1968	1,832.8	524.3	1,173.7	528.9	356.2	385.2	88.2	4,889.3
1969	717.6	309.8	414.2	182.2	183.8	159.2	103.4	2,070.2
1970	1,509.0	252.5	1,462.9	231.3	297.8	319.0	93.4	4,165.9
1971	1,347.6	636.0	1,573.2	336.6	411.6	475.1	42.8	4,822.9
1972	1,640.2	318.8	900.4	303.1	244.3	426.7	246.1	4,079.6
1973	903.5	518.1	818.8	293.9	368.3	395.4	97.4	3,395.4
1974	1,278.3	464.8	1,149.1	230.0	216.3	274.7	83.0	3,696.2
1975	1,444.0	668.8	1,438.2	309.3	403.5	483.6	30.4	4,777.8
1976	1,495.4	619.6	1,539.3	173.8	708.2	694.1	18.1	5,248.5
1977	2,235.0	673.9	1,607.6	278.7	357.4	956.6	65.8	6,175.0
1978	2,108.3	541.1	1,709.7	308.1	304.9	447.4	35.6	5,455.1
1979	1,056.9	649.7	1,654.4	475.8	389.9	475.5	117.9	4,820.1
1980	2,314.5	630.1	2,704.1	157.8	166.3	283.4	37.0	6,293.2
1981	1,904.0	594.0	2,553.3	376.5	264.4	288.9	33.4	6,014.5
1982	2,257.3	558.7	2,050.4	272.6	370.0	464.1	83.4	6,056.5
1983	3,100.4	1,140.6	3,302.8	550.7	284.0	384.5	43.5	8,806.5
1984	3,760.4	937.1	3,322.9	277.8	369.6	415.3	24.4	9,107.5
1985	3,861.1	1,163.9	4,693.2	649.1	903.2	978.6	95.4	12,344.5
1986	4,518.8	1,388.1	5,792.9	678.8	899.8	571.5	44.7	13,894.6
1987	2,220.9	503.8	1,881.2	142.7	161.7	284.4	77.5	5,272.4

Appendix A.5. Northern Southeast Alaska pink salmon escapement by district and year in thousands of fish.

	District							NSE
	109	110	111	112	113	114	115	Total
1960	103.8	228.9	260.2	173.3	430.8	108.9	19.9	1,325.8
1961	360.6	398.2	371.1	285.4	663.6	158.2	0.0	2,237.1
1962	388.8	307.1	215.1	145.4	252.4	56.1	0.3	1,365.2
1963	484.3	323.7	426.0	805.3	303.0	486.1	0.0	2,828.4
1964	681.5	466.2	289.6	424.6	104.7	140.0	0.0	2,106.6
1965	630.5	216.4	337.3	436.3	165.4	425.7	0.0	2,211.6
1966	659.7	431.2	455.4	620.3	420.9	94.0	0.0	2,681.5
1967	333.9	197.7	269.6	340.7	380.3	147.5	3.5	1,673.2
1968	694.0	967.7	458.6	580.0	298.2	164.6	47.2	3,210.3
1969	355.9	275.7	241.8	471.3	536.5	251.0	10.1	2,142.3
1970	469.1	529.5	443.5	684.0	348.5	171.5	54.2	2,700.3
1971	487.5	595.6	283.0	594.5	604.0	393.6	0.0	2,958.2
1972	430.0	727.2	606.2	558.2	316.7	194.0	0.0	2,832.3
1973	309.1	302.8	288.0	526.9	586.5	261.4	89.1	2,363.8
1974	292.0	290.9	444.6	358.9	427.1	132.3	0.0	1,945.8
1975	209.0	88.1	157.0	294.0	663.4	136.8	10.1	1,558.4
1976	230.9	192.5	103.4	267.9	502.8	136.4	0.0	1,433.9
1977	503.5	283.9	352.1	671.5	2,058.9	242.5	50.3	4,162.7
1978	463.7	428.0	205.5	1,005.5	867.4	206.7	0.1	3,176.9
1979	730.8	731.7	493.1	830.0	1,964.5	251.8	80.7	5,082.6
1980	428.7	415.3	283.3	639.2	608.7	243.6	33.5	2,652.3
1981	363.8	389.3	299.1	767.9	1,948.5	240.0	45.4	4,054.0
1982	764.1	614.9	731.2	844.8	1,155.9	203.5	49.6	4,364.0
1983	586.0	396.0	761.0	829.3	1,880.5	272.9	54.7	4,780.4
1984	695.5	443.5	466.5	483.9	1,577.2	205.4	30.0	3,902.0
1985	1,162.6	1,084.2	1,803.3	1,363.4	2,749.8	581.0	265.5	9,009.8
1986	739.8	287.8	215.1	780.6	737.4	179.3	0.7	2,940.7
1987	600.5	1,040.6	892.9	656.4	942.1	160.1	75.1	4,367.7

Appendix A.6. Southeast Alaska 1987 pink salmon harvest by district and fishery.

District	Seine	Gillnet	Hand Troll	Power Troll	Trap	Total
101	908,396	806,553	2,268	8,281	83,087	1,808,585
102	409,601		473	6,116		416,190
103	228,370		3,457	5,489		237,316
104	1,690,146		6,447	52,886		1,749,479
105	471		852	3,221		4,544
106		247,781	1,406	1,350		250,537
107			1,423	138		1,561
108		4,883				4,883
109	332,581		12,558	23,182		368,321
110	866,148		391	1,665		868,204
111	50,659	360,219	10	110		410,998
112	1,742,140		4,912	2,574		1,749,626
113	367,733		14,492	109,964		492,189
114	541,592		85,478	113,061		740,131
115		165,941		10		165,951
116			614	7,498		8,112
150				1,641		1,641
152			70	6,414		6,484
154			130	6,018		6,148
156			21	598		619
157				702		702
181			34	296		330
183			60	37		97
186				20		20
189			13	619		632
191				8		8
SSE	3,236,984	1,059,217	16,326	77,481	83,087	4,473,095
NSE	3,900,853	526,160	118,783	274,417	0	4,820,213
Region	7,137,837	1,585,377	135,109	351,898	83,087	9,293,30

Appendix B.1. Water temperatures and salinities at two meters depth, and associated secchi disk readings, Tenakee Inlet in 1987.

Location	Date	Temperature	Salinity	Secchi
Nearshore Stations:				
Trap Bay	April 22	5.6	28.8	7.0
	April 28	6.5	31.1	7.0
	May 5	7.0	29.4	6.0
	May 12	7.1	31.2	5.1
	May 19	9.8	24.3	6.6
	May 26	9.8	25.2	4.5
	May 28	8.1	27.8	6.7
	June 2	10.5	25.3	4.8
Mean		8.05	27.89	5.96
Standard Deviation		1.68	2.53	0.96
Cannery Point	April 22	5.8	26.1	9.2
	April 28	6.6	32.9	6.0
	May 5	6.9	28.1	6.4
	May 12	7.7	26.9	5.0
	May 19	8.0	24.4	5.0
	May 26	8.9	25.3	5.0
	May 28	8.3	26.5	6.0
	June 2	9.0	27.5	4.8
Mean		7.65	27.21	5.93
Standard Deviation		1.06	2.41	1.36
Tenakee	April 22	6.1	28.7	6.0
	April 30	7.0	33.0	5.0
	May 5	7.9	30.8	4.2
	May 14	8.0	26.6	5.0
	May 19	9.8	25.0	6.9
	May 27	9.4	23.6	5.1
	May 28	9.9	27.9	5.0
	June 2	11.1	26.2	4.9
Mean		8.65	27.73	5.26
Standard Deviation		1.57	2.88	0.77
Kadashan	April 22	6.1	28.9	5.8
	April 30	7.1	30.3	4.2
	May 5	7.7	30.1	4.4
	May 19	10.2	19.0	6.7
	May 27	8.1	27.4	4.5
	May 28	9.8	27.0	5.7
	June 2	11.8	26.2	6.0
Mean		8.69	26.99	5.33
Standard Deviation		1.84	3.56	0.89
All Nearshore Stations				
Mean		8.25	27.47	5.63
Standard Deviation		1.61	2.88	1.07
Sample Size		31	31	31

-Continued-

Appendix B.1. (p. 2 of 3)

Location	Date	Temperature	Salinity	Secchi
Mid-Inlet Stations:				
Hill Point	April 22	5.7	29.8	7.8
	April 28	6.5	30.1	7.4
	May 5	6.9	28.1	6.6
	May 12	7.8	29.3	4.0
	May 19	9.5	23.6	4.9
	May 26	8.9	25.8	4.9
	May 28	8.1	28.1	6.1
	June 2	9.9	26.9	5.0
Mean		7.91	27.71	5.84
Standard Deviation		1.39	2.06	1.26
Cannery Point	April 22	5.8	29.0	6.0
	April 28	6.5	32.8	6.5
	May 5	6.9	28.1	6.4
	May 12	7.3	28.3	4.0
	May 19	9.8	23.0	5.5
	May 26	10.3	24.8	5.4
	May 28	8.3	27.8	5.6
	June 2	10.9	24.9	5.3
Mean		8.23	27.34	5.59
Standard Deviation		1.78	2.86	0.73
Columbia Point	April 22	5.9	28.3	8.0
	April 28	6.9	30.9	7.9
	May 5	7.4	29.9	4.6
	May 12	7.8	30.4	4.7
	May 19	10.1	22.8	6.4
	May 27	9.5	26.3	5.3
	May 28	9.0	28.6	5.5
	June 2	11.3	23.2	5.2
Mean		8.49	27.55	5.95
Standard Deviation		1.68	2.95	1.26
Sunshine Point	April 22	5.9	28.6	5.5
	April 30	6.1	29.0	9.5
	May 5	8.0	26.3	3.9
	May 12	8.0	28.1	6.0
	May 19	10.1	23.8	6.4
	May 27	8.1	27.2	4.6
	May 28	9.4	28.4	5.1
	June 2	11.3	22.7	6.9
Mean		8.36	26.76	5.99
Standard Deviation		1.74	2.19	1.61
Tenakee-Kadashan	April 22	6.2	29.1	6.0
	April 30	6.8	31.8	6.5
	May 5	7.9	30.2	4.3
	May 19	9.9	24.0	6.2
	May 27	9.2	25.5	4.8
	May 28	9.9	27.3	4.2
	June 2	11.4	25.2	5.8
Mean		8.76	27.59	5.40
Standard Deviation		1.73	2.67	0.88

-Continued-

Appendix B.1. (p. 3 of 3)

Location	Date	Temperature	Salinity	Secchi
All Mid-Inlet Stations				
Mean		8.34	27.38	5.76
Standard Deviation		1.69	2.59	1.22
Sample Size		39	39	39

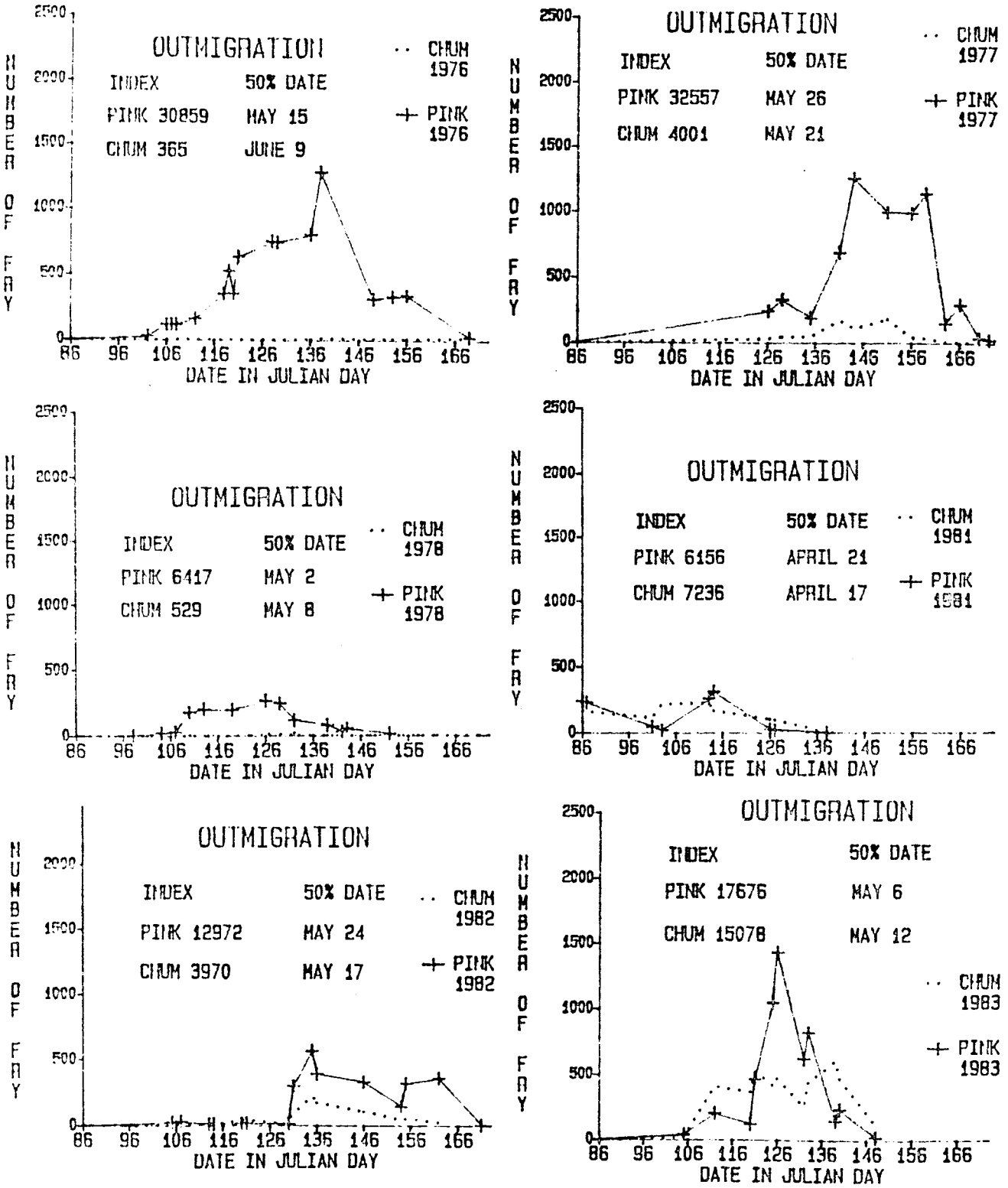
Appendix B.2. Number of pink and chum salmon fry trapped by fyke nets in Sunny Creek in Cholmondeley Sound with stream temperature, 1976-1987.

	1976			1977			1978			1981			1982		
DATE	CHUM	PINK	TEMP	CHUM	PINK	TEMP	CHUM	PINK	TEMP	CHUM	PINK	TEMP	CHUM	PINK	TEMP
06 Mar	-	-	-	-	-	-	-	-	-	15	16	-	-	-	-
26 Mar	-	-	-	-	-	-	-	-	-	169	240	5.0	-	-	-
27 Mar	-	-	-	-	-	-	-	-	-	161	229	-	-	-	-
07 Apr	-	-	-	-	-	-	0	2	4.0	-	-	-	-	-	-
10 Apr	-	-	-	-	-	-	-	-	-	113	48	5.0	-	-	-
11 Apr	0	28	-	-	-	-	-	-	-	-	-	-	-	-	-
12 Apr	-	-	-	-	-	-	-	-	-	219	19	-	-	-	-
13 Apr	-	-	-	-	-	-	1	21	4.0	-	-	-	-	-	-
14 Apr	-	-	-	-	-	-	-	-	-	-	-	-	2	20	2.0
15 Apr	0	116	-	-	-	-	-	-	-	-	-	-	-	-	-
16 Apr	0	116	-	-	-	-	-	-	-	-	-	-	0	28	2.0
17 Apr	0	116	-	-	-	-	-	-	-	-	-	-	-	-	-
19 Apr	-	-	-	-	-	-	7	178	4.0	-	-	-	-	-	-
21 Apr	0	163	1.1	-	-	-	-	-	-	-	-	-	-	-	-
22 Apr	-	-	-	-	-	-	0	203	6.0	230	260	7.0	16	9	3.0
23 Apr	-	-	-	-	-	-	-	-	-	167	314	-	15	13	2.0
27 Apr	0	352	-	-	-	-	-	-	-	-	-	-	-	-	-
28 Apr	0	528	-	-	-	-	6	197	6.0	-	-	-	-	-	-
29 Apr	0	356	-	-	-	-	-	-	-	-	-	-	43	16	3.5
30 Apr	0	633	-	-	-	-	-	-	-	-	-	-	43	19	3.0
05 May	-	-	-	33	242	3.5	40	268	5.5	102	25	10.0	-	-	-
06 May	-	-	-	-	-	-	-	-	-	98	20	11.0	-	-	-
07 May	0	753	3.3	-	-	-	-	-	-	-	-	-	-	-	-
08 May	0	744	2.8	46	329	3.0	14	246	6.0	-	-	-	-	-	-
09 May	-	-	-	-	-	-	-	-	-	-	-	-	38	12	4.0
10 May	-	-	-	-	-	-	-	-	-	-	-	-	94	304	4.0
11 May	-	-	-	-	-	-	25	117	8.0	-	-	-	-	-	-
14 May	-	-	-	50	190	-	-	-	-	-	-	-	222	570	3.0
15 May	4	802	2.8	-	-	-	-	-	-	-	-	-	172	397	4.5
17 May	11	1281	2.8	-	-	-	-	-	-	1	0	9	-	-	-
18 May	-	-	-	-	-	-	5	80	7.0	-	-	-	-	-	-
20 May	-	-	-	173	691	3.5	-	-	-	-	-	-	-	-	-
21 May	-	-	-	-	-	-	1	30	8.0	-	-	-	-	-	-
22 May	-	-	-	-	-	-	7	53	7.0	-	-	-	-	-	-
23 May	-	-	-	111	1262	-	-	-	-	-	-	-	-	-	-
25 May	-	-	-	-	-	-	-	-	-	-	-	-	105	336	4.0
28 May	3	314	3.9	-	-	-	-	-	-	-	-	-	-	-	-
30 May	-	-	-	184	999	4.8	-	-	-	-	-	-	-	-	-
31 May	-	-	-	-	-	-	3	15	8.5	-	-	-	-	-	-
01 Jun	4	331	3.3	-	-	-	-	-	-	-	-	-	-	-	-
02 Jun	-	-	-	-	-	-	-	-	-	-	-	-	40	145	6.0
03 Jun	-	-	-	-	-	-	-	-	-	-	-	-	52	324	5.0
04 Jun	5	341	-	42	992	4.5	-	-	-	-	-	-	-	-	-
06 Jun	-	-	-	-	-	-	1	0	10.0	-	-	-	-	-	-
07 Jun	-	-	-	35	1144	5.8	-	-	-	-	-	-	-	-	-
10 Jun	-	-	-	-	-	-	-	-	-	-	-	-	19	364	6.0
11 Jun	-	-	-	4	151	4.3	-	-	-	-	-	-	-	-	-
14 Jun	-	-	-	3	294	7.0	-	-	-	-	-	-	-	-	-
17 Jun	19	23	-	-	-	-	-	-	-	-	-	-	-	-	-
18 Jun	-	-	-	3	36	-	-	-	-	-	-	-	-	-	-
19 Jun	-	-	-	-	-	-	-	-	-	-	-	-	0	3	7.5
20 Jun	-	-	-	2	24	5.0	-	-	-	-	-	-	-	-	-

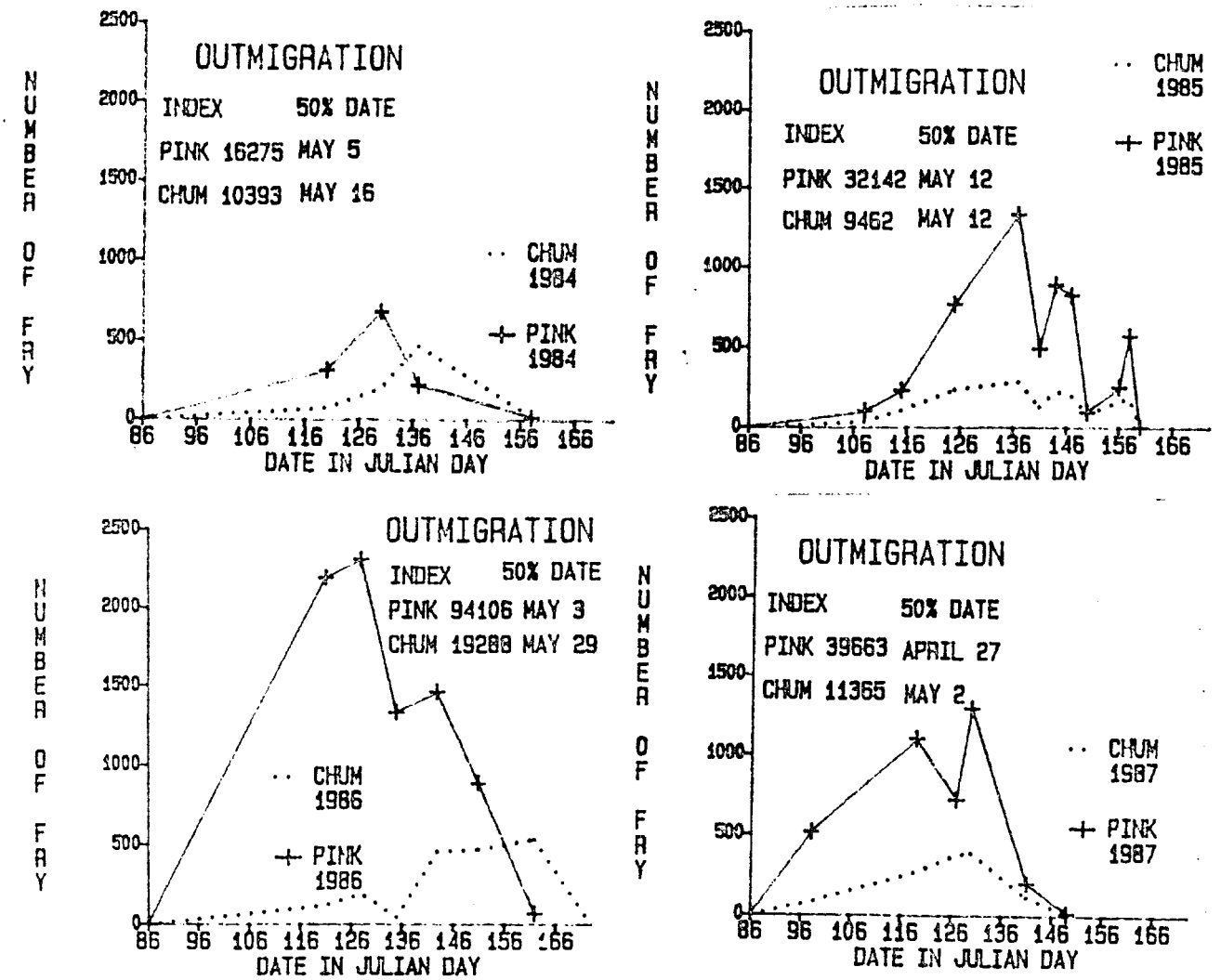
-Continued-

Appendix B.2. (p. 2 of 2)

DATE	1983 CHUM	1983 PINK	1983 TEMP	1984 CHUM	1984 PINK	1984 TEMP	1985 CHUM	1985 PINK	1985 TEMP	1986 CHUM	1986 PINK	1986 TEMP	1987 CHUM	1987 PINK	1987 TEMP
07 Apr	-	-	-	-	-	-	-	-	-	-	-	-	-	517	4.0
14 Apr	17	41	6.0	-	-	-	-	-	-	-	-	-	-	-	-
17 Apr	-	-	-	-	-	-	35	100	1.0	-	-	-	-	-	-
21 Apr	410	205	7.5	-	-	-	-	-	-	-	-	-	-	-	-
24 Apr	-	-	-	-	-	-	106	232	1.0	-	-	-	-	-	-
28 Apr	-	-	-	-	-	-	-	-	-	-	-	-	-	271	6.0
29 Apr	367	120	11.0	75	312	6.0	-	-	-	-	-	-	-	-	-
30 Apr	523	465	11.0	-	-	-	-	-	-	120	2188	4.0	-	-	-
04 May	417	1051	-	-	-	-	239	772	1.0	-	-	-	-	-	-
05 May	468	1436	7.5	-	-	-	-	-	-	-	-	-	-	-	-
06 May	-	-	-	-	-	-	-	-	-	-	-	-	-	722	7.5
07 May	-	-	-	-	-	-	-	-	-	192	2306	3.0	-	-	-
09 May	-	-	-	198	681	-	-	-	-	-	-	-	-	1294	6.0
11 May	255	621	10.0	-	-	-	-	-	-	-	-	-	-	-	-
12 May	438	820	7.0	-	-	-	-	-	-	-	-	-	-	-	-
14 May	-	-	-	-	-	-	-	-	-	42	1329	4.0	-	-	-
16 May	-	-	-	463	219	7.0	287	1337	5.0	-	-	-	-	-	-
18 May	606	148	7.0	-	-	-	-	-	-	-	-	-	-	-	-
19 May	468	236	7.0	-	-	-	-	-	-	-	-	-	-	-	-
20 May	-	-	-	-	-	-	129	495	5.5	-	-	-	-	204	8.0
22 May	-	-	-	-	-	-	-	-	-	458	1459	5.0	-	-	-
23 May	-	-	-	-	-	-	224	894	5.0	-	-	-	-	-	-
26 May	-	-	-	-	-	-	194	831	7.5	-	-	-	-	-	-
27 May	119	22	9.0	-	-	-	-	-	-	-	-	-	-	-	-
28 May	-	-	-	-	-	-	-	-	-	-	-	-	-	15	8.5
29 May	-	-	-	-	-	-	81	94	7.0	-	-	-	-	-	-
30 May	-	-	-	-	-	-	-	-	-	469	884	6.0	-	-	-
04 Jun	-	-	-	-	-	-	166	252	8.0	-	-	-	-	-	-
06 Jun	-	-	-	27	20	8.0	184	572	8.0	-	-	-	-	-	-
08 Jun	-	-	-	-	-	-	1	3	-	-	-	-	-	-	-
10 Jun	-	-	-	-	-	-	-	-	-	533	68	10.0	-	-	-



Appendix B.3. Pink and chum salmon outmigration from Sunny Creek 1976 through 1987.



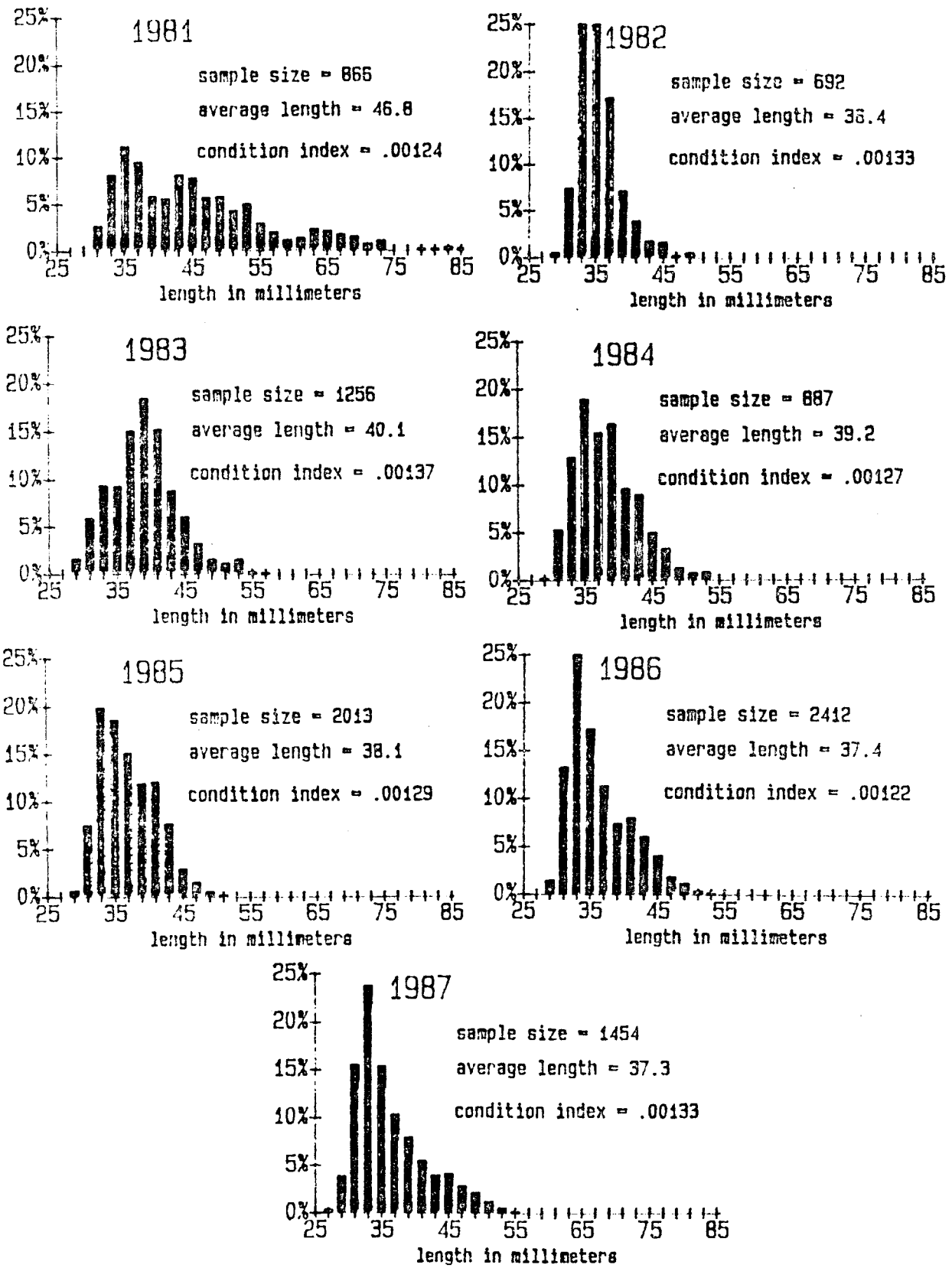
Appendix B.3. (p. 2 of 2)

Appendix B.4. Number of pink and chum salmon fry trapped by fyke nets in Nigelius and Spit Creeks in Cholmondeley Sound with stream temperature, 1986 and 1987.

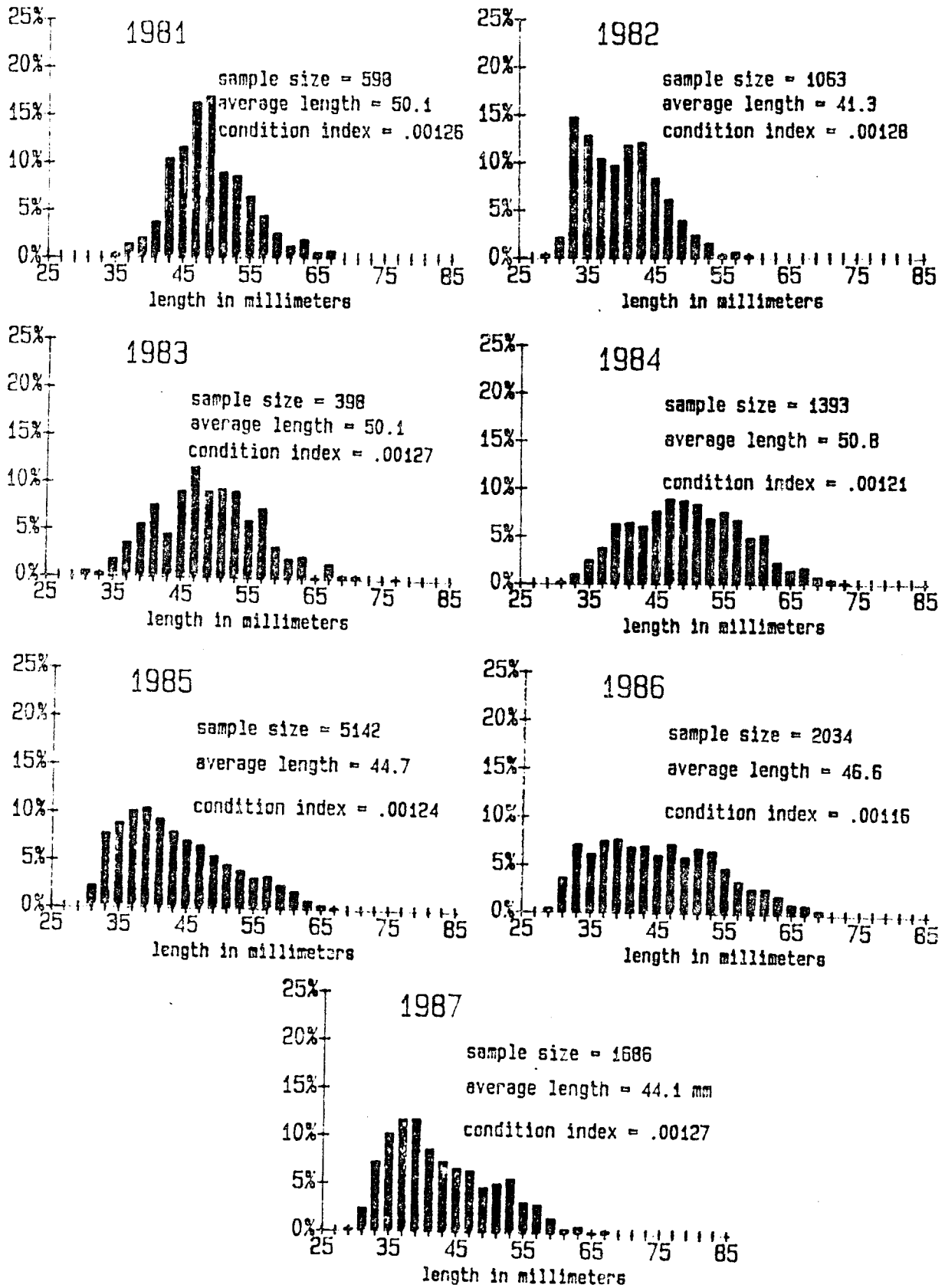
	Nigelius Creek				Spit Creek			
	1986		1987		1986		1987	
DATE	PINK	TEMP	PINK	TEMP	PINK	TEMP	PINK	TEMP
02-Apr	-	-	4166	5	-	-	1941	5
10-Apr	-	-	- [2]	-	-	-	4373	4 [1]
22-Apr	-	-	1010	5.5	-	-	3010	4.2
23-Apr	-	-	1874	5.5	-	-	2720	3.3
30-Apr	-	-	342	7.5	-	-	3068	8
01-May	-	-	312	8	-	-	1838	9
02-May	1961	6	-	-	1208	6	-	-
03-May	2210	7	-	-	2590	8	-	-
05-May	-	-	94	7.8	-	-	575	7.5
06-May	-	-	80	7	-	-	219	6.8
07-May	-	-	- [2]	9	-	-	-	8
08-May	2766	9	-	-	1533	8	-	-
09-May	-	9.8	-	-	-	8	-	-
13-May	384	9	-	-	616	6.5	-	-
14-May	302	9.5	-	-	303 [3]	7.5	-	-
16-May	-	-	-	-	-	-	14	6
19-May	-	-	0	9.5	48 [4]	8.5	1	6.5
20-May	-	-	-	-	-	-	0	11.5
25-May	18	11	-	-	53	9	-	-

Counts influenced by unusual circumstances.

[1] 2 DAY SET
[2] NO COUNT BECAUSE OF HOLE IN NET
[3] BEAVER IN NET
[4] 5 STEELHEAD IN NET



Appendix B.5. Length frequency of pink salmon fry collected in early marine study areas of southern Southeast Alaska, April 15 through May 14.



Appendix B.6. Length frequency of pink salmon fry collected in early marine study areas of southern Southeast Alaska, May 15 through May 31.

Appendix B.7. Visual estimates of pink salmon abundance in the early marine study areas of southern Southeast Alaska.

Area	Date	Transect 1	Transect 2	Transect 3	Transect 4
Cholmondeley Sound	May 1, 1986	20	150	-	-
	May 7, 1986	2,000	610	1,360	490
	May 14, 1986	200	2,600	150	1,150
	May 21, 1986	1,500	8,800	-	19,400
	May 30, 1986	300	25,000	1,100	123,000
	June 9, 1986	2,200	4,600	5,400	71,500
	June 10, 1986	1,100	2,800	6,500	89,600
	April 8, 1987	14	3,570	380	-
	April 27, 1987	2,000	22,200	2,100	14,400
	April 28, 1987	34,900	41,000	7,740	24,400
	May 9, 1987	9,000	56,000	15,300	9,800
	May 19, 1987	7,700	38,700	14,700	15,900
	May 28, 1987	3,760	6,590	2,110	9,200
Boca de Quadra	May 9, 1986	600	-	-	-
	May 16, 1986	-	-	3	-
	May 22, 1986	500	50	0	-
	May 30, 1986	250	0	65	-
	June 5, 1986	300	0	15	-
	April 23, 1987	2,000	-	2,000	-
	April 30, 1987	1,420	2,630	-	-
	May 7, 1987	5,400	2,400	-	-
	May 18, 1987	363,000	22,000	-	-
Smeaton Bay	May 2, 1986	-	30	100	20
	May 8, 1986	30	1,800	-	-
	May 15, 1986	15	2,700	400	11,200
	May 29, 1986	200	0	300	700
	June 4, 1986	94	3,000	1,300	2,500
	April 22, 1987	6,400	1,000	2,500	250,000
	April 23, 1987	0	200,000	4,000	3,200
	April 30, 1987	30	20	120	14,400
	May 7, 1987	8,700	300	75	3,400
	May 17, 1987	9,100	-	-	-
	May 18, 1987	9,100	450	600	11,700
	May 29, 1987	750	500	400	30,700
Carroll Inlet	May 3, 1986	0	150	25	-
	May 8, 1986	500	50	2,000	-
	May 12, 1986	1,100	4,800	500	-
	May 13, 1986	2,300	4,600	-	-
	May 14, 1986	500	3,000	3,500	-
	May 23, 1986	17,400	700	125	-
	May 28, 1986	240,000	300	25	-
	June 4, 1986	150	300	150	-
	June 6, 1986	8	200	-	-
	June 12, 1986	4,800	6,000	0	-
	June 16, 1986	50	400	0	-
	April 2, 1987	-	20,000	-	-
	April 8, 1987	14	3,570	380	-
	April 10, 1987	-	-	0	-
	April 17, 1987	230	2,830	-	-
	April 22, 1987	2,870	5,010	0	-
	April 23, 1987	120	620	125	-
	April 29, 1987	860	-	-	-
	April 30, 1987	3,400	11,300	40	-
	May 5, 1987	3	43,800	27	-
	May 7, 1987	90	139,000	5	-
	May 18, 1987	160	4,300	260	-
	May 19, 1987	1,350	2,500	5,700	-
	May 20, 1987	19,400	1,200	700	-
	May 21, 1987	800	4,300	370	-
	May 22, 1987	6,000	6,200	-	-
	June 4, 1987	50	259	220	-
Neets Bay	May 28, 1986	1,400	1,200	-	-
	June 1, 1986	400	-	-	-
	June 7, 1986	1,200	-	-	-
	June 8, 1986	4,800	15,800	-	-
	June 14, 1986	2,100	7,100	-	-
	April 24, 1987	11	200	-	-
	May 8, 1987	6,540	22,300	-	-
	May 17, 1987	5,600	2,400	-	-