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FORECASTS FOR THE 1991 STIKINE RIVER SOCKEYE SALMON RUN

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By

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ABSTRACT

Preseason forecasts of the Tahltan, non-Tahltan and the entire Stikine River sockeye salmon runs for 1991 were made based on spawner-recruit and sibling analyses and on smolt analysis, for the Tahltan stock. Spawner-recruit forecasts for the Tahltan, non-Tahltan, and Stikine runs were 30,283 (R^2=.377), 51,917 (R^2=.324), and 81,753 (R^2=.306) fish, respectively. The spawner-recruit analyses were not used due to the high variability in the data and the poor fit of the regression. With only four years of data there was a large uncertainty around the smolt forecast of 43,024 Tahltan fish which precluded its use as a forecast technique. Sibling analysis was chosen as the Alaska Department of Fish and Game forecasting method. Linear regressions of the number of age-1.2 fish in year t versus the entire run in year t+1 were made based on seven brood years of age-specific catch and escapement data. The 1991 run predictions for the Tahltan, non-Tahltan, and Stikine (Tahltan + non-Tahltan) groups were 42,815 (R^2=.913; prediction interval $\pm$ 25,499), 31,422 (R^2=.615; prediction interval $\pm$ 52,957), and 72,201 (R^2=.934; prediction interval $\pm$ 45,027) sockeye salmon, respectively. Due to the limited data, these sibling forecasts are considered experimental and should not be viewed as a proven technique for forecasting the run sizes of these stocks.

INTRODUCTION

A preseason forecast of the Stikine River sockeye salmon (*Oncorhynchus nerka*) run is needed each year to determine early season fisheries management procedures for U.S. gill net fisheries near the Stikine River (Southeast Alaska Districts 106 and 108) and for the Canadian inriver gill net fisheries, as stipulated by the U.S./Canada Pacific Salmon Treaty. This paper presents the forecast method developed by the Alaska Department of Fish and Game (ADF&G) for 1991. The forecast, used jointly by the two countries since 1988, has consisted of various combinations of ADF&G time series and sibling forecasts, and Canadian Department of Fisheries and Oceans (DFO) smolt and spawner/recruit forecasts.

Sockeye salmon of transboundary Stikine River origin are harvested in U.S. marine fisheries in Southeast Alaska's Districts 106 and 108 and in Canadian fisheries in the Stikine River (Figure 1). Management of transboundary river salmon to achieve conservation and allocation objectives, as stipulated by the Pacific Salmon Treaty, requires a cooperative approach by Canada and the United States. In order to facilitate cooperative management of Stikine River sockeye salmon, the Transboundary Technical Committee (TTC) developed a management model based on preseason and in-season forecasting, catch-per-unit-effort (CPUE) data, desired escapement goals, and total allowable catch (TAC). This model was used in 1988 through 1990 and will be used in 1991 (TTC 1988; TTC 1990a; TTC 1990b; TTC 1991). The TAC output from the model is based on the preseason forecast for the first two weeks of the season and on in-season CPUE in various fisheries for the remainder of the season. There is limited data available on which to base preseason forecasts. Various methods, with varying degrees of success, have been used the past few years. Improved accuracy of the preseason forecast would be valuable to fishery managers, particularly during the early portion of the run when little other data is available to assess run strength. Two major stock groups are recognized for the Stikine River sockeye run: 1) the Tahltan group which spawns in Tahltan Lake; and 2) the non-Tahltan group which spawns in small lakes, sloughs, and side channels of the mainstem river and its tributaries. Most Stikine River sockeye salmon mature as age-1.3 fish. Other important age groups include ages -1.2, -2.2, -2.3, -0.2, and -0.3, with the latter two age classes found only in the non-Tahltan stock group.

Preseason salmon forecasts have been an integral part of fisheries management on the west coast of North America for decades. Several methods have met with varying degrees of success. Spawner-recruit analysis, although primarily a method of estimating optimum escapement levels, has been used to forecast sockeye salmon runs. In Alaska it is used to forecast the Copper River sockeye run (Geiger and Savikko 1990). The forecast for the Bristol Bay sockeye run is based on the mean or weighted (by variance) mean of linear regressions of spawner-recruit, sibling, smolt, and Japanese research vessel catches (Fried and Yuen 1987). Sibling forecasting, using the return of age n fish in year t to predict the return of age n+1 fish in year t+1, has been used as a sole technique and in conjunction with other forecasting methods. A simple linear regression has been used for the major age groups for Coghill Lake sockeye salmon, while multiple regressions incorporating numbers of spawners, numbers of smolt, and/or length data have been used for sockeye returns to Kodiak Island and Chignik (Geiger and Savikko 1990). Sibling forecasting

has worked very well for coho salmon runs in Oregon where a simple linear regression of the number of jacks in year t has been used to predict the run in year t+1 (Gunsolus 1978; GAO 1983). Bilton (1973) found that although there were positive correlations between the catch or run of 3-year-old chum salmon in year t and the catch or run of 4-year-old chum salmon in year t+1, sibling forecasting was not feasible due to the high variation. Sibling forecasting of sockeye salmon runs in Alaska has met with varying degrees of success (Geiger and Savikko 1990).

The purpose of this study was to determine if sibling, spawner/recruit, or smolt data could be used to predict the Tahltan, non-Tahltan, or entire Stikine River sockeye run.

METHODS

Database

Catch and escapement data for the Tahltan and non-Tahltan stock groups and for the entire Stikine (Tahltan + non-Tahltan) sockeye run from 1983 through 1990 were compiled (Appendix A). Inriver run size estimates for Tahltan and non-Tahltan fish are available since 1979; however, stock compositions of marine catches were not estimated prior to 1982 and in that year the Tahltan and non-Tahltan groups were not separated. Therefore, the reliable data base for age- and stock-specific catch and escapement includes 1983 and later.

Age compositions were compiled from yearly catch and escapement reports produced by the Alaska Department of Fish and Game and included the years: 1983 (McGregor et al. 1984), 1984 (McGregor and McPherson 1986), 1985 (McPherson and McGregor 1986), 1986 (McPherson et al. 1988), 1987 (McPherson et al. 1988), 1988 (McPherson et al. 1990), and 1989 (Rowse and McPherson *in press*) and 1990 (Rowse and McPherson *in prep.*). Stock compositions for catches were compiled from various published and unpublished ADF&G reports and memoranda. Stock compositions for District 106 catches were compiled for the years: 1983 (Oliver et al. 1984), 1984 (Oliver and Walls 1985), 1985 (Oliver and Jensen 1986), 1986 (Jensen et al. 1989), 1987 (Jensen and Frank 1988), 1988 (Jensen and Frank 1989), 1989 (Lynch et al. 1990), and 1990 (Jensen and Frank *in prep*). Stock compositions for District 108 catches were compiled for the years: 1985 (Jensen 1986) and 1986 through 1990 (references as listed for District 106). Stock compositions for the inriver Stikine catches were compiled for the years: 1983 (Walls 1984a), 1984 (Walls 1984b), 1985 (ADF&G data file), 1986 (Jensen et al. 1989), 1987 (TTC 1988), 1988 (TTC 1990a), and 1989 (TTC 1990b), and 1990 (TTC 1991). Catches for each fishery and the Tahltan

and non-Tahltan escapement estimates for 1983 through 1990 were taken from the most current source (TTC 1990) and, in most cases, have been updated since those listed in the original reports.

Age-specific stock compositions for the Canadian test fishery and commercial sockeye catches and for the entire inriver run in the Stikine River were calculated for 1990. Stock compositions were estimated only for females (based on egg diameter) by DFO personnel. Since the age composition of the catches of females and males were different and changed through time, weekly sex specific age compositions were estimated. The ratio of Tahltan to non-Tahltan females in each weekly sample of a specific age class was applied to the sample of male fish of that age class. The samples were then expanded to the catches or inriver run size estimates (Appendix B).

Scale collections from Tahltan weir escapements used to estimate the age compositions in the above reports were provided by the DFO; the scales from inriver catches and from non-Tahltan escapements were collected by DFO and ADF&G personnel; and scales used for age and stock composition estimates for District 106 and 108 catches were collected by ADF&G personnel.

Not all catches were analyzed in all years and some assumptions about stock and age compositions were made. It was assumed that 90% of the Canadian commercial and Indian food fishery catches in the upper Stikine River were comprised of Tahltan fish and 10% were comprised of non-Tahltan fish (based on an unpublished analysis of a limited database of scale circuli counts). The age composition of the Tahltan stock in the upper river catches was assumed to be the same as that of the escapement through Tahltan Weir in all years. The age composition of the non-Tahltan stock in the upper river catches was assumed to be the same as that of the lower river test fishery catch when that data was available (1985-1990), of the lower river commercial catch in 1983, and of the Tahltan escapement in 1984 (no other data available). Fish captured in the Kakwan Point test fisheries and the sonar test fisheries below the U.S./Canada border were accounted for elsewhere as they were released alive and, therefore, were not included in the total catch calculations. The average age and stock compositions of District 108 commercial and test fishery catches from 1985 through 1989 were used for 1983 and 1984. The age and stock compositions for the District 108 test fishery catch in 1985 were used for the commercial catch in 1985. The age and stock compositions for the District 108 commercial catches in 1987, 1989, and 1990 were used for the test fishery catches in those years. The District 106 commercial catch stock and age compositions in 1984, 1985, 1987, 1989, and 1990 were used to represent the stock and age compositions of the District 106 test fishery catches for those years.

Spawner-Recruit Analysis

The potential for spawner-recruit analysis was investigated for each of the stock groups, Tahltan and non-Tahltan, and for the entire Stikine River sockeye run. Forecasts were based on a pooled age form of the Ricker (1954) curve and a form modified for age-specific returns (Brannian et al. 1982). The pooled age spawner-recruit analysis is a single regression of total number of recruits (all ages combined) on the number of spawners in the parent brood year. The age-specific analysis results from the sum of predicted recruits for five separate regressions of recruits of a given age class (age-1.2, 1.3, 2.2, 2.3, and 0.3) on the number of spawners in the parent brood year. Analyses were performed for both forms using the log transformation to linearity.

pooled age: $\ln(R/S) = \ln(a) - bS$

or $R/S = a + e^{-(bS)}$

and age-specific: $\ln(R_{it}/S_t) = \ln(a) - bS_t$

or $R_{it}/S_{td} = a + e^{-bS_t}$

where:

R_{it} = number of recruits age *i* from spawning during brood year *t*,
S_t = number of spawners in year *t*.

The database was sufficient to analyze only six brood years, beginning with the 1980 parent year and ending with the 1985 parent year. The most recent 7-years were used for the age-specific spawner recruit regressions; years used varied among age classes.

Smolt-Recruit Analysis

Due to the limited data base (1984-1987) for smolt outmigrations from Tahltan Lake, a smolt-recruit regression analysis could not be run for the Tahltan stock. An average percent survival forecast was made by multiplying the number of smolt by the average survival rate and assuming an average marine age composition for the returns. In addition, the correlation between the number of spawners and the number of smolts was explored graphically. There is no information on smolt outmigrations for the non-Tahltan stock group.

Sibling Analysis

Although the term sibling forecast or sibling relationship is used to describe the analyses in this section, not all of the regressions tested were standard sibling relationships where the return of age n fish in year t is used to predict the return of age n+1 fish in year t+1. Linear regressions were tried for five relationships: age-1.3 versus -1.2; all age groups versus age-1.2; all ages other than age-0. versus age-1.2; all age-0. versus age-0.2; and all returning fish versus age-1.2 + age-0.2. The last three regressions were not used for the Tahltan group as age-0. fish are not present in that stock. Forecasts for the 1991 run were made for each group using data from all years (1983-1990). The accuracies of the regressions were tested by cross-validation with a "leaving-one-out" approach. The absolute error and error as a percent of actual run were estimated for each regression and group by calculating the absolute difference between the actual and predicted run size for every year (1983-1990). Errors were compared among regressions for each stock group and between stock groups.

Prediction intervals were calculated for the all age groups versus age-1.2 regressions (Kleinbaum and Kupper 1978) where:

$$P_I = \pm t_{n-1,\,1-\alpha/2} S_{Y|X} \sqrt{1 + \frac{1}{n} + \frac{(X_0 - \bar{X})^2}{(n-1)\,S_X^2}}$$

RESULTS

Spawner-Recruit Analysis

Brood tables (Appendix A.4) from each of the stock groups indicated little correlation between spawning escapement and adult return (Figure 2). The smallest escapements of the Tahltan stock, 10,211 and 11,018 fish, produced 28,664 and 122,870 fish, respectively. A non-Tahltan escapement of 30,806 produced a return of 96,508 fish, while an escapement of 29,307 fish produced a return of 35,393 fish. Stikine River escapements of 41,824 and 48,221 fish produced returns of 219,378 and 44,371 fish, respectively. The regressions for all ages combined for the Tahltan, non-Tahltan, and Stikine River groups had R^2s of .377, .324, and .306, respectively, and predicted returns of 30,283, 51,917, and 81,753 fish, respectively, from

the 1986 brood year. The age-specific regressions generally had low correlations and had R^2s ranging from .136 to .749 (Table 1). The predicted 1991 runs of the Tahltan, non-Tahltan, and Stikine River groups were 26,361, 44,745, and 72,522 fish, respectively.

Smolt-Recruit Analysis

The four years available for the Tahltan smolt-recruit model were insufficient to detect any trend (Figure 2, Appendix A.5). The 1984 and 1986 outmigrations of 219,702 and 244,330 smolt had survival rates of 6.4% and produced returns of 14,073 and 15,516 adults, respectively, while the 1985 smolt outmigration of 613,531 fish had a survival rate of 1.2% and produced a return of 7,031 adults. The smolt forecast (assuming average survival and average marine age of return) for the 1991 Tahltan run was 46,041 fish.

There does not appear to be a linear correlation between the number of spawning adults and the number of smolt outmigrating two years later (Figure 3). However, every spawning escapement of 20,000 or fewer fish has produced a smolt outmigration of greater than 550,000, while only one of three years of spawning escapements greater than 20,000 fish has produced smolt outmigrations greater than 250,000 smolt. There was a negative correlation between the number of spawners and the number of recruits per spawner (Figure 3, Appendix A.6).

Sibling Analysis

The sibling forecasts for a given stock group were generally similar regardless of which ages were used (Appendices C and D). The predicted 1991 runs (all ages) for the Tahltan, non-Tahltan, and Stikine River groups were 42,815 (R^2=.913; prediction interval $\pm$ 25,499), 31,442 (R^2=.615; prediction interval $\pm$ 52,957), and 72,201 (R^2=.934; prediction interval $\pm$ 45,027) sockeye salmon (regression 2, Table 2). Graphical analysis indicated that the Tahltan regressions were strongly driven by a single data point (X in 1984 and Y in 1985) (Figure 4). The strength of the correlation without the 1984/1985 value was greatly reduced. The non-Tahltan regressions were also highly influenced by a single data point (X in 1984, Y in 1985) (Figure 4), but retain a moderate correlation even without the point of greatest influence. A strong correlation occurred between Stikine River age-1.2 fish in year t and age-1.3 fish in year t+1, and a slightly weaker relationship existed for other regressions (Appendix D.2.). Even without the point of influence, there was a correlation between the age-1.2 fish in one year and the entire run the following year (Figure 3).

The average percent forecast error for total run, estimated by cross-validation with a leaving-one-out approach, was lowest for regression 2 for all groups. The average error rate for the Tahltan group was 42.1% (Table 3), for the non-Tahltan group 40.8% (Table 4), and for the Stikine group 19.5% (Table 5).

DISCUSSION

There appears to be little correlation between the number of spawners and the number of recruits for the Stikine River sockeye salmon run as a whole, or for either of the component stock groups. It is possible that a spawner-recruit correlation exists for the Tahltan and non-Tahltan stocks but is masked due to the high variability of the data and the limited number of data points. In addition, there are potential sources of error in the age-specific catch and escapement data. The catches of Tahltan and non-Tahltan fish were estimated with proven techniques and variances can be determined. However, assumptions were made for some catches when samples were unavailable, for example, the test fish catches are assumed to have the same age and stock compositions as the commercial catches. The Tahltan escapement was known since it was counted at the weir, however, there was an unknown and potentially large uncertainty associated with the non-Tahltan escapement estimates. The estimate was based on the ratio of non-Tahltan to Tahltan fish in the inriver run, migratory timing (estimated from standardized test fishery CPUE data), and the Tahltan run strength. Potential errors in the non-Tahltan escapement would affect all forecasts for this stock and for the entire Stikine River sockeye run.

Further study is needed; however, it appears that the spawning escapement goal for this system may be larger than that which will maximize smolt production. It appears that 20,000 adults, or fewer, may consistently produce more smolt than the current escapement goal of 30,000 fish. With only four data points, however, it is not clear if there is a correlation between number of smolts and number of returning adults.

All aspects of this analysis were affected by the paucity of data. Due to the small number of data pairs, each had a very high weight and, thus, an abnormal year may have exerted an unduly high influence on any correlation present. Also, with only a few years of data, it was not possible to positively ascertain which, if any, of the years, were abnormal. A cursory sibling forecast of the Tahltan stock of Stikine River sockeye salmon in 1988 was made based on only four years of data. The return of age-1.2 Tahltan sockeye in 1987 was used to forecast the return of age-1.3 sockeye salmon in 1988, and the number of age-1.3 fish was expanded to the total run by the average (1983-1987) proportion of the run comprised of that age group. The method correctly predicted a small run and the technique was used again in 1989, based on five years of data. This forecast was incorporated into the Stikine management model and, although not as accurate as the forecast of the previous year, it correctly predicted a small run. The

sibling forecast was again incorporated into the Stikine management model for 1990. The sibling forecast for the 1990 Tahltan run (27,523 fish) was very near the total estimated run of 26,289 fish. The smolt forecast overestimated the run and the spawner-recruit forecast underestimated it. The spawner-recruit forecast for the non-Tahltan stock was 53,751, very close to the total estimated run of 53,174, while the sibling forecast was less than half the realized run. Both the sibling and spawner-recruit forecasts underestimated the entire 1990 Stikine run by more than 20,000 fish.

The cross-validation of the sibling forecast of the Tahltan run indicated a highly variable error rate (i.e., lack of precision). In general, years with low runs were overestimated and years with high runs were underestimated. The error rates for the non-Tahltan forecasts were similar to those of the Tahltan group. The similarity in error rates is puzzling since the uncertainty associated with estimates of age-specific catch and escapement are larger for the non-Tahltan group than for the Tahltan stock. In addition, the Tahltan group is a more homogeneous group than is the non-Tahltan group and inhabits a more stable environment; therefore, it seems reasonable to expect less "noise" in correlations associated with the Tahltan system. The low error rate for the entire Stikine run may be attributed in part to the small variance of the combined inriver estimates (i.e., stock composition is no longer a component). The cross-validation forecast of the 1984/1985 data pair correctly predicted a large run for all regressions, including that for the Tahltan group which had an R^2 of only 0.190. Since that data pair was far out of the range of the data points incorporated into the analyses, it indicated that x coefficients were not dramatically altered by the point of highest influence. It also indicated that, even though regressions with all data pairs included were strongly driven by the 1984/1985 data pair, the regressions without that point were still relatively strong for the non-Tahltan and Stikine River data sets.

Sibling forecasting appears to be a promising technique for predicting the sockeye salmon run to the Stikine River as a whole, and to its components, the Tahltan and non-Tahltan stock groups. However, in 1990, the spawner-recruit forecast was much more accurate in predicting the non-Tahltan run than was the sibling forecast. More years of data are requisite to determine the reliability of the forecast, particularly for years with intermediate to large runs. More data points are also required to determine what, if any, correlation exists between the number of spawners or smolts and the number of recruits.

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Walls, S. 1984a. Stikine River stock apportionment - 1983. Memorandum to B. Oliver, April 2, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau. 8p.

Walls, S. 1984b. Stikine River sockeye salmon apportionment. Memorandum to G. Oliver, December 14, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Juneau. 12p.

Table 1. Regressions for spawner-recruit forecasts of the 1991 Stikine River sockeye salmon run.

		Recruit Age				
	All Ages	1.2	1.3	2.2	2.3	0.3
Tahltan						
Constant	1.49538	-1.41036	0.96762	-3.49525	-1.35053	
Std Err of Y Est	1.18311	1.55163	1.19141	0.70484	0.43137	
R Squared	0.37658	0.21424	0.37622	0.13584	0.69835	
No. of Observations	6	7	7	7	7	
Degrees of Freedom	4	5	5	5	5	
X Coefficient(s)	-0.00005	-0.00004	-0.00004	-0.00001	-0.00004	
Std Err of Coef.	0.00003	0.00003	0.00002	0.00001	0.00001	
Spawners	20,280	6,958	20,280	20,280	67,326	
Predicted Recruits	30,283	1,306	23,605	481	969	
		Sum of Age Specific Pred.				26,361
Non-Tahltan						
Constant	1.03355	-0.83072	0.61687	-2.40577	-1.43227	-2.59600
Std Err of Y Est	0.43412	0.52661	0.48027	0.54810	0.79613	0.30354
R Squared	0.32399	0.64225	0.47710	0.74885	0.27787	0.40758
No. of Observations	6	7	7	7	7	7
Degrees of Freedom	4	5	5	5	5	5
X Coefficient(s)	-0.00002	-0.00003	-0.00002	-0.00003	-0.00003	0.00001
Std Err of Coef.	0.00001	0.00001	0.00001	0.00001	0.00002	0.00001
Spawners	30,910	21,023	30,910	30,910	90,617	21,023
Predicted Recruits	51,917	5,291	35,062	1,013	1,472	1,907
		Sum of Age Specific Pred.				44,745
Stikine						
Constant	1.19134	-0.96700	0.75624	-2.96091	-1.39226	-2.59600
Std Err of Y Est	0.71420	0.65375	0.71529	0.49144	0.59802	0.30354
R Squared	0.30610	0.54241	0.41569	0.51901	0.43906	0.40758
No. of Observations	6	7	7	7	7	7
Degrees of Freedom	4	5	5	5	5	5
X Coefficient(s)	-0.00001	-0.00001	-0.00001	-0.00001	-0.00002	0.00001
Std Err of Coef.	0.00001	0.00001	0.00001	0.00000	0.00001	0.00001
Spawners	51,190	27,981	51,190	51190	157,943	21,023
Predicted Recruits	81,753	6,994	59,499	1,587	2,535	1,907
		Sum of Age Specific Pred.				72,522
Sum of Tahltan and Non-Tahltan						
Spawners	51,190	27,981	51,190	51,190	157,943	21,023
Predicted Recruits	82,201	6,596	58,667	1,494	2,441	1,907
		Sum of Age Specific Pred.				71,106

Table 2. Regressions used in sibling forecasts of Stikine River sockeye salmon runs and forecasts for 1991.

REGRESSION

Number	Independent Age	Independent Year	Dependent Age	Dependent Year	Tahltan	non-Tahltan	Stikine
1	1.2	t	1.3	t+1	Yes	Yes	Yes
2	1.2	t	All	t+1	Yes	Yes	Yes
3	1.2	t	All non	t+1	No	Yes	Yes
4	0.2	t	All 0	t+1	No	Yes	Yes
5	1.2+0.2	t	All	t+1	No	Yes	Yes
6	Results of No.3 + No.4				No	Yes	Yes

FORECASTS

Estimate	Tahltan	non-Tahltan	Stikine	Tahltan + non-Tahltan
Regression 1: age-1.3	36,488	20,222	50,669	56,710
Regression 2: all ages	42,815	31,442	72,201	74,257
Regression 3: all non age-0.		28,418	66,918	
Regression 4: all age-0.		2,843	2,843	
Regression 5: all ages		30,552	69,469	
Estimate 6: R3+R4		31,261	69,761	
Average total run (R2, R5, E6)		31,085	70,477	

Table 3. Actual versus predicted run size for Tahltan sockeye salmon from cross-validation of sibling forecasts (1984-1990).

	Run Size		Absolute Error	
Year	Actual	Predicted	Number	Percent
Regression 1:	X=age-1.2	Y=age-1.3		
1984	24,695	13,741	10,954	44.4
1985	106,164	73,128	33,036	31.1
1986	30,501	23,216	7,285	23.9
1987	11,343	6,010	5,333	47.0
1988	5,206	9,332	4,126	79.2
1989	10,572	27,545	16,973	160.6
1990	17,808	21,298	3,490	19.6
Average			11,600	58.0
Regression 2:	X=age-1.2	Y=all ages		
1984	40,768	18,455	22,313	54.7
1985	111,211	83,947	27,264	24.5
1986	33,793	30,287	3,506	10.4
1987	14,235	13,856	380	2.7
1988	9,412	16,758	7,347	78.1
1989	15,634	34,295	18,662	119.4
1990	26,289	27,523	1,234	4.7
Average			11,529	42.1

Table 4. Actual versus predicted run size for non-Tahltan Stikine sockeye salmon from cross-validation of sibling forecasts (1984-1990).

	Run Size		Absolute Error	
Year	Actual	Predicted	Number	Percent
Regression 1:	X=age-1.2	Y=age-1.3		
1984	23,044	37,947	14,904	64.7
1985	76,500	43,930	32,571	42.6
1986	31,449	42,307	10,858	34.5
1987	18,715	39,003	20,288	108.4
1988	21,784	21,705	79	0.4
1989	53,685	42,162	11,522	21.5
1990	41,307	9,621	31,686	76.7
Average			17,415	49.8
Regression 2:	X=age-1.2	Y=all ages		
1984	43,932	52,861	8,929	20.3
1985	103,290	64,679	38,611	37.4
1986	41,684	60,760	19,075	45.8
1987	29,164	55,800	26,635	91.3
1988	35,745	32,278	3,467	9.7
1989	74,755	59,828	14,927	20.0
1990	53,174	20,674	32,500	61.1
Average			20,592	40.8
Regression 3:	X=age-1.2	Y=non age-0.		
1984	39,184	46,973	7,789	19.9
1985	92,393	52,562	39,831	43.1
1986	40,157	53,307	13,151	32.7
1987	24,819	49,786	24,968	100.6
1988	31,379	29,504	1,875	6.0
1989	61,081	53,969	7,112	11.6
1990	49,885	17,686	32,199	64.5
Average			18,132	39.8
Regression 4:	X=age-0.2	Y=age-0.		
1984	4,748	5,707	959	20.2
1985	10,897	7,108	3,789	34.8
1986	1,528	12,468	10,940	716.1
1987	4,346	4,840	494	11.4
1988	4,366	3,455	911	20.9
1989	13,674	5,964	7,710	56.4
1990	3,289	3,715	426	13.0
Average			3,604	124.7
Regression 5:	X=age-0.2 + -1.2	Y=all ages		
1984	43,932	52,085	8,154	18.6
1985	103,290	64,438	38,852	37.6
1986	41,684	63,117	21,433	51.4
1987	29,164	54,734	25,570	87.7
1988	35,745	31,844	3,901	10.9
1989	74,755	61,206	13,550	18.1
1990	53,174	19,748	33,426	62.9
Average			20,698	41.0
Predicted from R3+R4, Actual from R2				
1984	48,680	52,680	4,000	8.2
1985	114,187	59,670	54,517	47.7
1986	43,212	65,775	22,563	52.2
1987	33,510	54,626	21,116	63.0
1988	40,111	32,960	7,151	17.8
1989	88,429	59,933	28,497	32.2
1990	56,464	21,402	35,062	62.1
Average			24,701	40.5

Table 5. Actual versus predicted run size for Stikine River sockeye salmon from cross-validation of sibling forecasts (1984-1990).

	Run Size		Absolute Error	
Year	Actual	Predicted	Number	Percent
Regression 1:	X=age-1.2	Y=age-1.3		
1984	47,739	51,841	4,103	8.6
1985	182,664	137,086	45,578	25.0
1986	61,950	66,733	4,783	7.7
1987	30,058	46,369	16,311	54.3
1988	26,990	25,373	1,617	6.0
1989	64,256	72,459	8,203	12.8
1990	59,115	67,358	8,243	13.9
Average			12,691	18.3
Regression 2:	X=age-1.2	Y=all ages		
1984	84,700	70,493	14,207	16.8
1985	214,501	170,290	44,210	20.6
1986	75,477	91,057	15,580	20.6
1987	43,400	68,974	25,574	58.9
1988	45,156	45,336	180	0.4
1989	90,389	95,173	4,784	5.3
1990	79,463	90,564	11,101	14.0
Average			16,520	19.5
Regression 3:	X=age-1.2	Y=non age-0.		
1984	79,952	65,078	14,875	18.6
1985	203,604	150,170	53,434	26.2
1986	73,949	84,256	10,307	13.9
1987	39,054	63,923	24,869	63.7
1988	40,790	41,396	605	1.5
1989	76,715	90,103	13,388	17.5
1990	76,174	84,041	7,867	10.3
Average			17,906	21.7
Regression 4:	X=age-0.2	Y=age-0.		
1984	4,748	5,707	959	20.2
1985	10,897	7,108	3,789	34.8
1986	1,528	12,468	10,940	716.1
1987	4,346	4,840	494	11.4
1988	4,366	3,455	911	20.9
1989	13,674	5,964	7,710	56.4
1990	3,289	8,329	5,040	153.2
Average			4,263	144.7
Regression 5:	X=age-0.2 + -1.2	Y=all ages		
1984	84,700	69,370	15,330	18.1
1985	214,501	159,792	54,708	25.5
1986	75,477	94,051	18,574	24.6
1987	43,400	68,328	24,928	57.4
1988	45,156	44,032	1,125	2.5
1989	90,389	97,659	7,270	8.0
1990	79,463	92,531	13,068	16.4
Average			19,286	21.8
Predicted from R3+R4, Actual from R2				
1984	84,700	70,785	13,915	16.4
1985	214,501	157,278	57,223	26.7
1986	75,477	96,724	21,247	28.1
1987	43,400	68,762	25,363	58.4
1988	45,156	44,851	305	0.7
1989	90,389	96,067	5,678	6.3
1990	79,463	92,370	12,907	16.2
Average			19,520	21.8

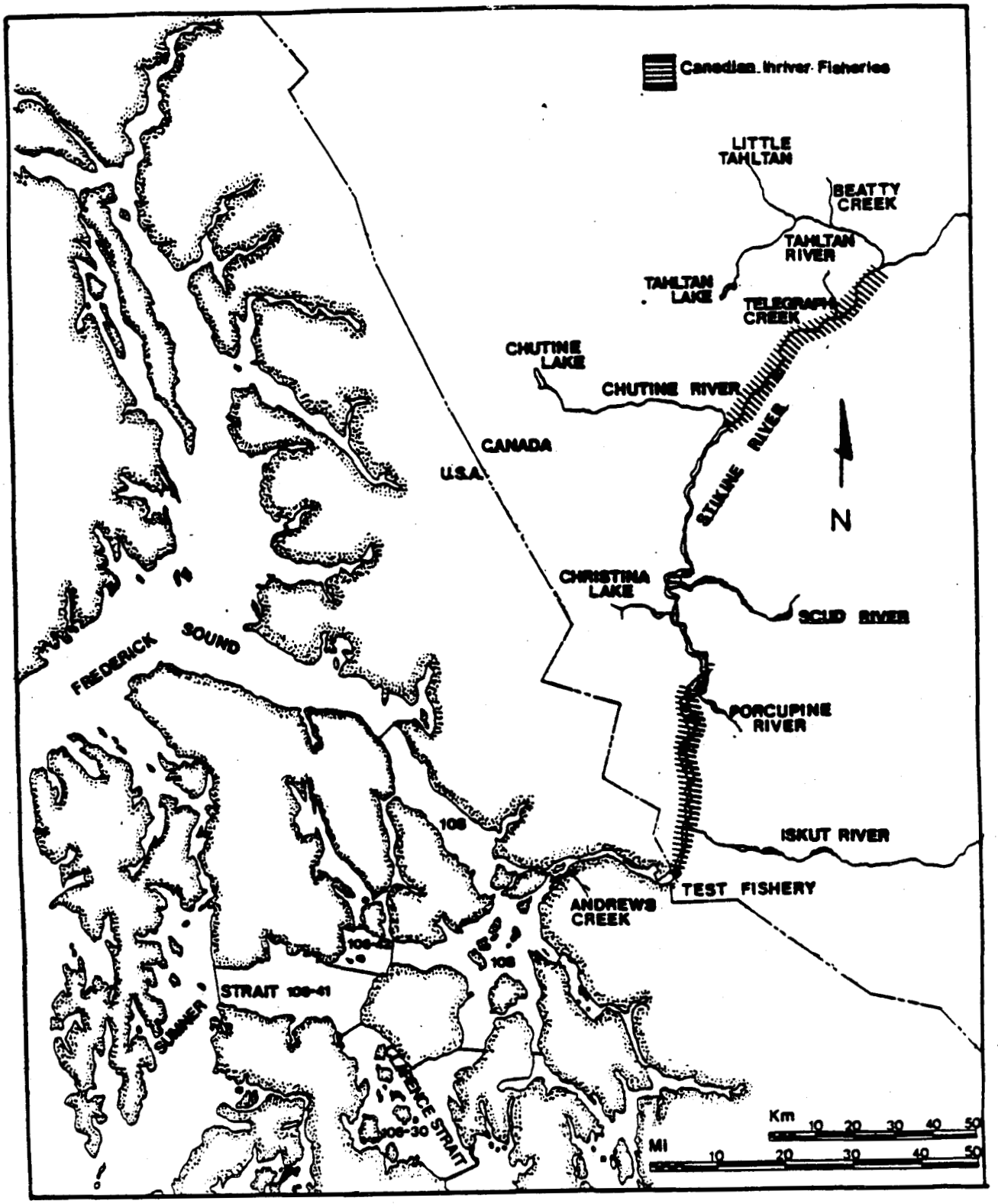


Figure 1. The transboundary Stikine River and major U.S. and Canadian fishing areas.

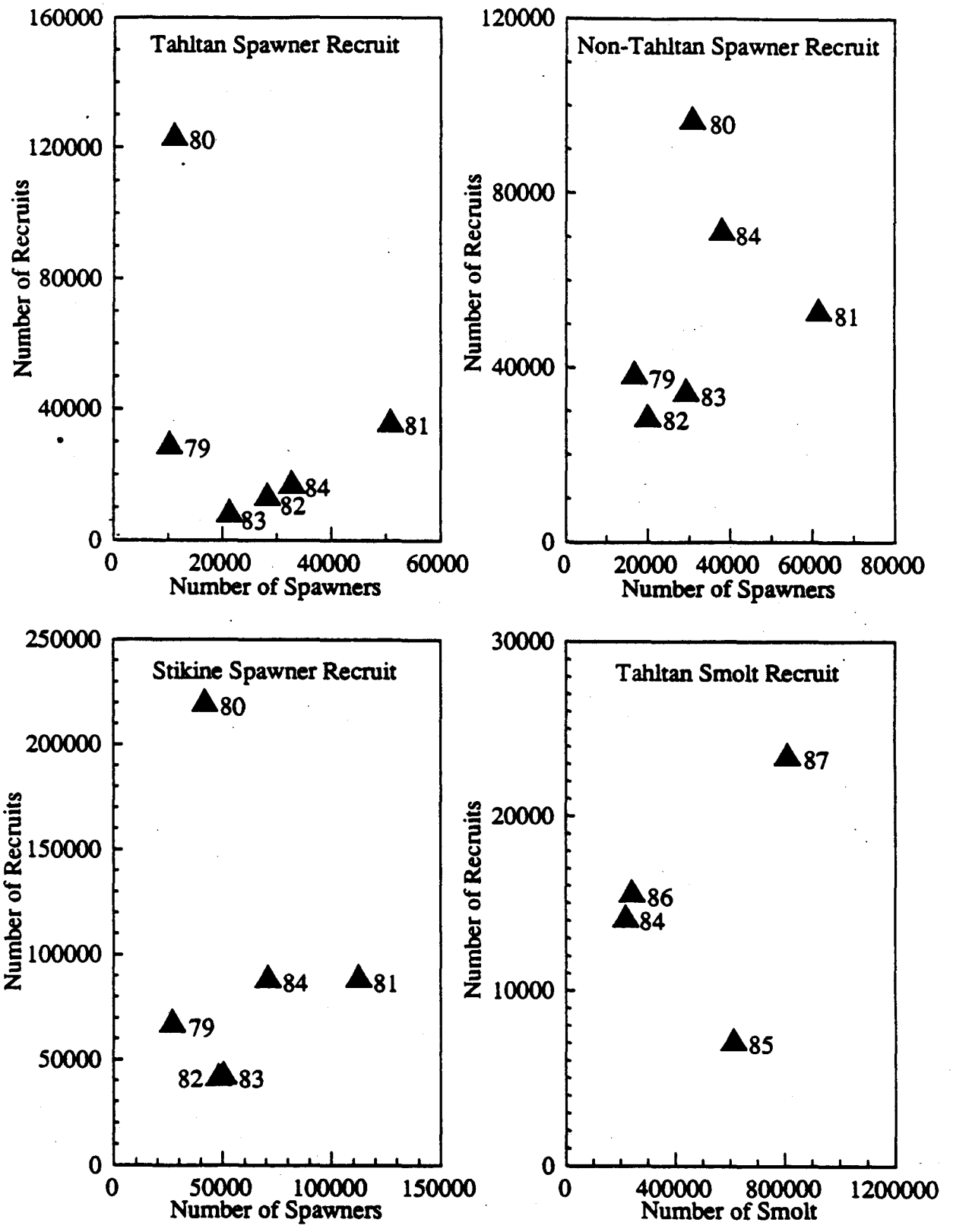


Figure 2. Spawner-recruit relationships for Tahltan, non-Tahltan, and Stikine sockeye salmon and a smolt-recruit relationship for Tahltan sockeye salmon.

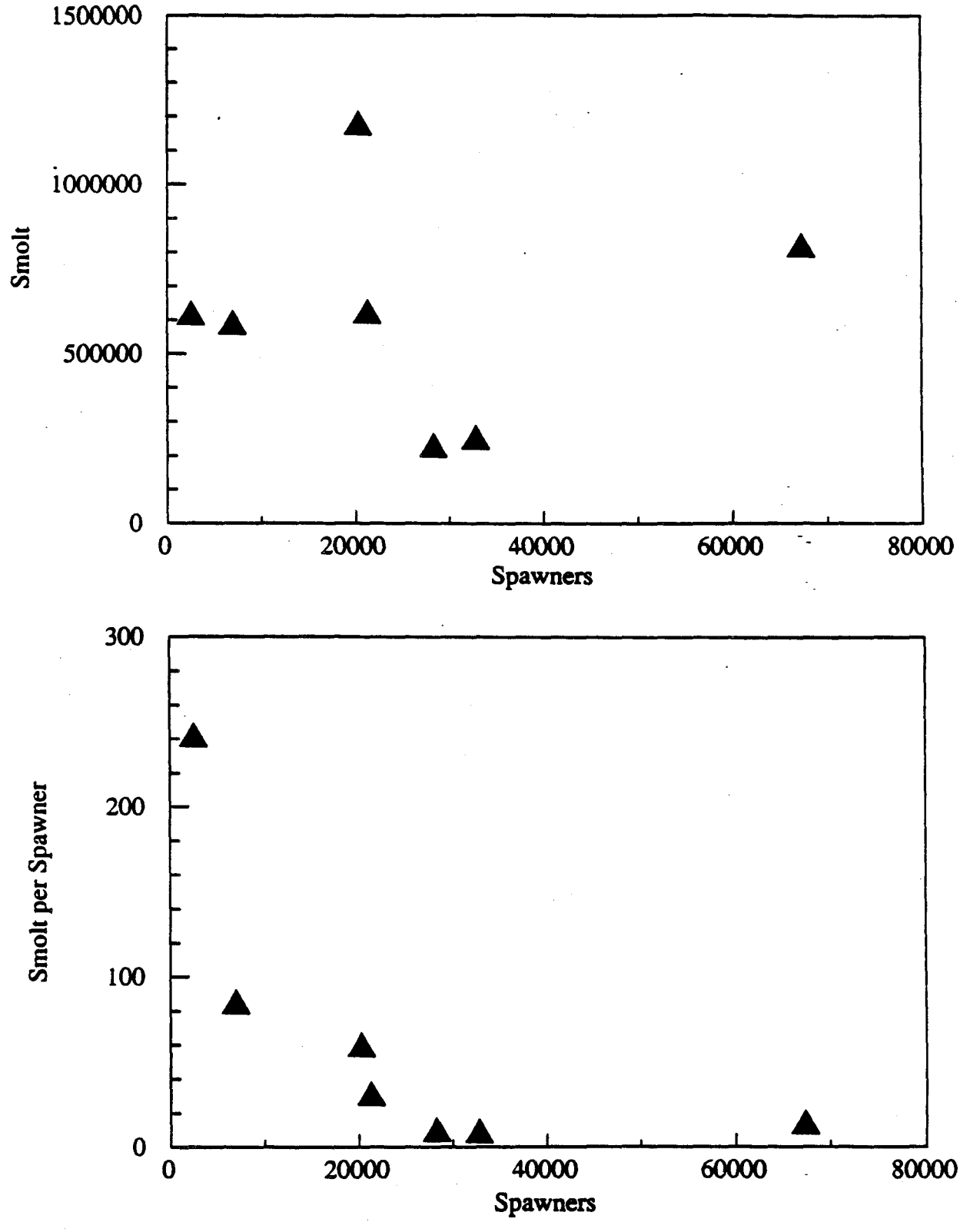


Figure 3. Correlations between Tahltan spawners in year *t* and Tahltan smolt in year *t*+1.

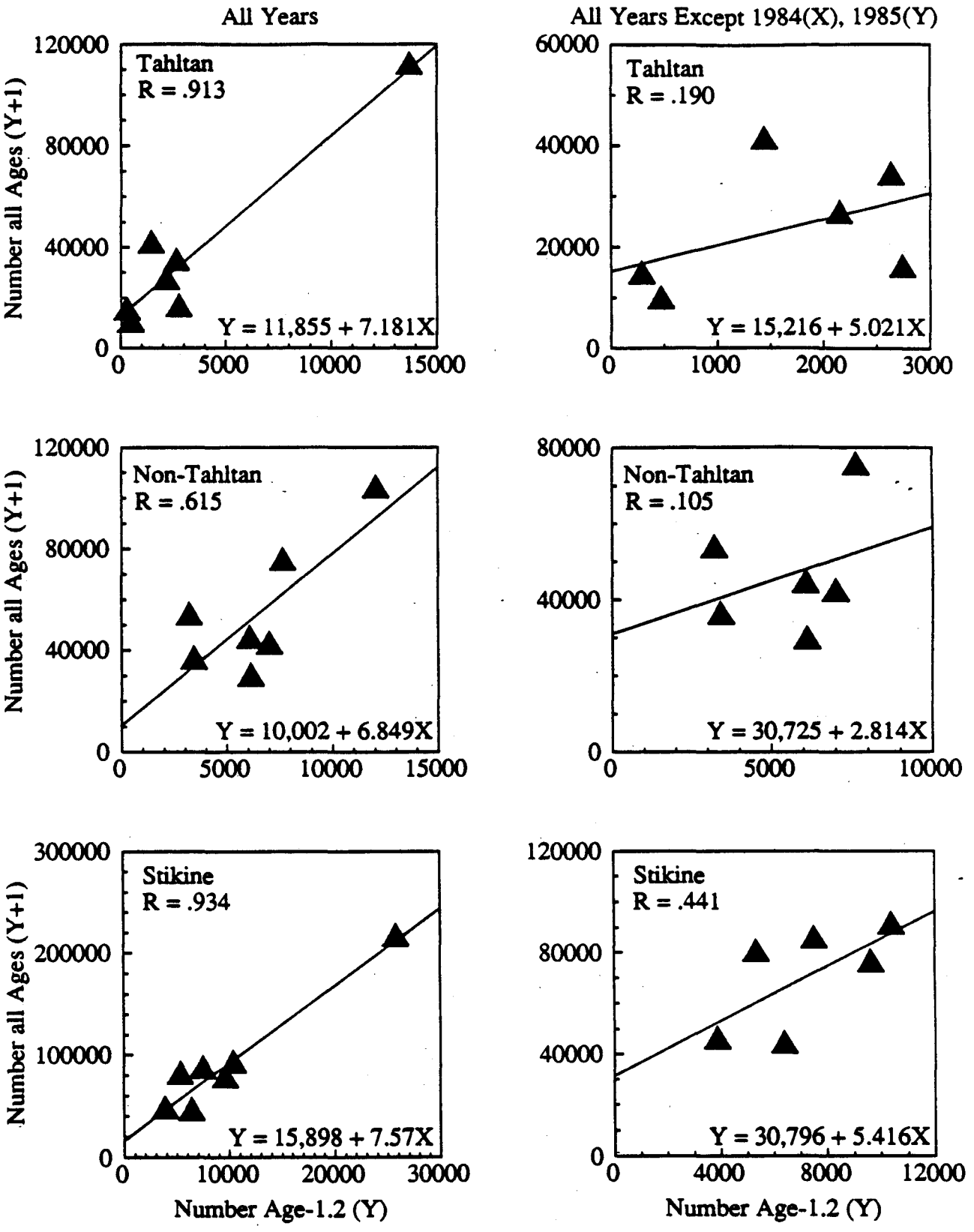


Figure 4. Correlations for age-1.2 Stikine sockeye salmon in year *t* and the entire run in year *t*+1.

Appendix A.1. Age-specific catch and escapement of Tahltan sockeye salmon, 1983-1990.

Year and Area	Age-Specific Catch and Escapement				
	1.2	1.3	2.2	2.3	Total
1983					
106	147	4,594	0	289	5,030
108	5	35	1	4	45
L.R. Commercial	720	5,364	35	573	6,692
U.R. Commercial	12	504	1	35	553
Indian Food Fish	92	3,818	6	269	4,184
Tahltan Escape.	468	19,394	29	1,365	21,256
Catch	977	14,315	42	1,169	16,504
Escapement	468	19,394	29	1,365	21,256
Totals	1,445	33,710	71	2,534	37,760
1984					
106	1,084	1,518	0	70	2,673
108	39	254	4	26	323
106-41T	16	23	0	1	40
108T	24	114	3	21	161
L.R. Commercial	0	0	0	0	0
U.R. Commercial	0	0	0	0	0
Indian Food Fish	1,598	2,908	56	233	4,794
Tahltan Escape.	10,928	19,878	381	1,590	32,777
Catch	2,762	4,817	62	350	7,991
Escapement	10,928	19,878	381	1,590	32,777
Totals	13,690	24,695	443	1,940	40,768
1985					
106-41&42	345	18,226	0	230	18,801
106-30	12	5,171	0	61	5,244
108	7	291	2	10	310
106-41T	9	460	0	6	475
108T	8	345	2	12	367
Stikine Test	23	463	5	14	505
L.R. Commercial	481	9,769	108	291	10,649
U.R. Commercial	23	931	3	19	976
Indian Food Fish	153	6,258	19	128	6,558
Tahltan Escape.	1,574	64,248	193	1,311	67,326
Catch	1,060	41,916	139	770	43,885
Escapement	1,574	64,248	193	1,311	67,326
Totals	2,634	106,164	332	2,081	111,211

Appendix A.1. (Page 2 of 3.)

Year and Area	Age-Specific Catch and Escapement 1.2	1.3	2.2	2.3	Total
1986					
106-41&42	0	1,740	0	330	2,070
106-30	0	0	0	11	11
108	0	393	0	0	393
106-41T	0	6	0	2	8
106-30T	0	0	0	0	0
108T	12	230	7	25	274
Stikine Test	3	151	3	10	167
L.R. Commercial	75	5,513	69	412	6,069
U.R. Commercial	6	665	7	56	734
Indian Food Fish	30	3,431	37	289	3,787
Tahltan Escape.	160	18,373	198	1,549	20,280
Catch	126	12,128	123	1,136	13,513
Escapement	160	18,373	198	1,549	20,280
Totals	286	30,501	321	2,685	33,793
1987					
106-41&42	0	494	0	661	1,155
106-30	0	209	0	12	221
108	107	497	36	71	710
106-41T	0	17	0	22	39
106-30T	0	3	0	0	3
108T	19	89	6	13	127
Stikine Test	15	439	14	45	513
L.R. Commercial	181	989	59	150	1,380
U.R. Commercial	8	372	10	59	448
Indian Food Fish	47	2,225	57	352	2,681
Tahltan Escape.	90	6,011	119	737	6,958
Catch	377	5,332	182	1,386	7,277
Escapement	90	6,011	119	737	6,958
Totals	468	11,343	302	2,123	14,235
1988					
106-41&42	48	881	0	144	1,073
106-30	0	694	0	51	745
108	33	139	0	50	222
106-41T	2	28	0	5	35
108T	15	22	0	22	59
Stikine Test	125	200	27	55	407
L.R. Commercial	996	608	245	212	2,062
U.R. Commercial	99	172	9	34	313
Indian Food Fish	621	1,073	55	210	1,959
Tahltan Escape.	803	1,389	71	272	2,536
Catch	1,939	3,817	336	784	6,876
Escapement	803	1,389	71	272	2,536
Totals	2,742	5,206	407	1,056	9,412

Appendix A.1. (Page 3 of 3.)

Year and Area	Age-Specific Catch and Escapement 1.2	1.3	2.2	2.3	Total
1989					
106-41&42	0	611	0	346	957
106-30	0	94	0	60	154
108	97	229	0	15	341
106-41T	0	0	0	0	0
108T	30	70	0	5	104
Stikine Test	60	255	30	37	381
L.R. Commercial	550	1,587	433	243	2,813
U.R. Commercial	58	315	27	44	444
Indian Food Fish	276	1,508	127	212	2,124
Tahltan Escape.	1,081	5,904	499	832	8,316
Catch	1,070	4,667	617	963	7,318
Escapement	1,081	5,904	499	832	8,316
Totals	2,151	10,572	1,116	1,795	15,634
1990					
106-41&42	121	274	216	190	801
106-30	70	0	0	44	114
108	165	859	99	157	1280
106-41T	1	16	6	8	31
106-30T	0	0	0	0	0
108T	12	52	6	11	81
Stikine Test	126	612	44	99	881
L.R. Commercial	1,058	3,118	439	414	5,029
U.R. Commercial	65	303	25	32	425
Indian Food Fish	415	1,938	160	207	2,720
Tahltan Escape.	2,276	10,636	879	1,136	14,927
Catch	2,031	7,172	995	1,163	11,362
Escapement	2,276	10,636	879	1,136	14,927
Totals	4,307	17,808	1,874	2,299	26,289

a/ The district test fishery stock and age compositions are estimated to be the same as the commercial catch when no other data are available.

b/ The in river test fishery stock and age compositions are estimated to be the same as commercial catch when no other data are data available.

c/ The upper river commercial and Indian food fishery catches are assumed to be 90% Tahltan origin with the Tahltan fish having the same age composition as the Tahltan escapement.

d/ Assumes all fish captured at Kakwan Point were released alive and accounted for elsewhere (numbers small).

e/ In 1983 the age composition of Tahltan sockeye salmon in the District 108 catch is assumed to be the same as in District 106.

f/ In 1983 the fraction of the District 108 sockeye catch comprised of Tahltan fish is the average of 1985-1989.

Appendix A.2. Age-specific catch and escapement of non-Tahltan Stikine sockeye salmon, 1983-1990.

Year and Area	Age-Specific Catch and Escapement							
	0.2	0.3	0.4	1.2	1.3	2.2	2.3	Total
1983								
106	0	0	0	0	308	0	324	632
108	1	26	0	8	72	1	3	111
L.R. Commercial	116	216	0	1,424	6,830	196	383	9,165
U.R. Commercial	1	1	0	10	46	1	3	61
Indian Food Fish	6	11	0	72	346	10	19	465
Mainstem Escape.	370	691	0	4,553	21,841	628	1,223	29,307
Catch	123	254	0	1,514	7,603	208	732	10,434
Escapement	370	691	0	4,553	21,841	628	1,223	29,307
Totals	493	945	0	6,067	29,444	837	1,955	39,741
1984								
106	0	0	0	2,438	983	0	656	4,078
108	4	186	2	60	527	5	24	808
106-41T	0	0	0	36	15	0	10	61
108T	2	73	0	12	239	2	16	345
L.R. Commercial	0	0	0	0	0	0	0	0
U.R. Commercial	0	0	0	0	0	0	0	0
Indian Food Fish	12	50	0	131	293	14	32	533
Mainstem Escape.	828	3,590	0	9,389	20,986	1,013	2,301	38,107
Catch	18	309	2	2,679	2,057	21	738	5,825
Escapement	828	3,590	0	9,389	20,986	1,013	2,301	38,107
Totals	846	3,899	2	12,067	23,044	1,034	3,039	43,932
1985								
106-41&42	0	0	0	0	800	0	962	1,762
106-30	0	0	0	0	744	0	507	1,251
108	2	65	2	14	576	4	20	683
106-41T	0	0	0	0	20	0	24	44
108T	0	60	5	15	703	5	22	810
Stikine Test	0	0	0	10	764	10	57	842
L.R. Commercial	59	647	2	458	4,798	127	352	6,444
U.R. Commercial	1	11	0	8	81	2	6	108
Indian Food Fish	7	73	0	52	543	14	40	729
Mainstem Escape.	835	9,100	27	6,443	67,471	1,790	4,951	90,617
Catch	69	857	9	557	9,030	162	1,990	12,673
Escapement	835	9,100	27	6,443	67,471	1,790	4,951	90,617
Totals	904	9,957	36	7,000	76,500	1,952	6,941	103,290
1986								
106-41&42	0	0	0	82	0	0	419	501
106-30	0	0	0	70	0	0	35	105
108	17	264	0	147	2,357	0	73	2,858
106-41T	0	0	0	2	2	0	5	9
106-30T	0	0	0	0	0	0	0	0
108T	1	11	0	8	149	5	16	190
Stikine Test	2	5	0	38	209	6	6	267
L.R. Commercial	103	256	0	1,303	4,148	271	262	6,342
U.R. Commercial	1	2	0	12	64	2	2	82
Indian Food Fish	3	8	0	60	329	10	10	421
Mainstem Escape.	244	611	0	4,398	24,190	733	733	30,910
Catch	127	546	0	1,722	7,258	294	827	10,774
Escapement	244	611	0	4,398	24,190	733	733	30,910
Totals	371	1,157	0	6,120	31,449	1,027	1,561	41,684

Appendix A.2. (Page 2 of 3.)

Year and Area	Age-Specific Catch and Escapement							Total
	0.2	0.3	0.4	1.2	1.3	2.2	2.3	
1987								
106-41&42	0	0	0	0	258	0	0	258
106-30	0	0	0	0	710	0	0	710
108	0	360	0	49	229	16	53	708
106-41T	0	0	0	0	9	0	0	9
106-30T	0	0	0	0	11	0	0	11
108T	0	56	0	7	52	0	12	127
Stikine Test	8	168	2	132	784	14	105	1,213
L.R. Commercial	96	533	0	899	2,843	99	288	4,758
U.R. Commercial	0	7	0	5	32	1	4	50
Indian Food Fish	2	41	1	32	193	3	26	298
Mainstem Escape.	130	2,905	37	2,290	13,593	242	1,825	21,023
Catch	106	1,165	3	1,125	5,122	133	488	8,141
Escapement	130	2,905	37	2,290	13,593	242	1,825	21,023
Totals	236	4,070	40	3,415	18,715	375	2,313	29,164
1988								
106-41&42	0	0	0	0	64	0	0	64
106-30	0	0	0	0	0	0	0	0
108	9	120	6	147	428	0	0	711
106-41T	0	0	0	0	0	0	0	0
108T	8	56	0	11	203	0	0	277
Stikine Test	18	92	0	177	561	27	20	895
L.R. Commercial	364	849	6	2,728	6,061	406	290	10,704
U.R. Commercial	1	4	0	7	22	1	1	35
Indian Food Fish	4	22	0	43	136	6	5	218
Mainstem Escape.	463	2,344	0	4,525	14,310	681	518	22,841
Catch	404	1,142	12	3,114	7,475	440	316	12,904
Escapement	463	2,344	0	4,525	14,310	681	518	22,841
Totals	867	3,486	12	7,639	21,784	1,122	834	35,745
1989								
106-41&42	0	0	0	366	2,949	0	515	3830
106-30	0	0	0	932	54	0	244	1231
108	27	2,292	0	193	5,341	0	164	8017
106-41T	0	0	0	2	13	0	2	17
108T	2	196	0	16	456	0	14	684
Stikine Test	0	236	0	29	887	16	57	1,226
L.R. Commercial	0	2,654	0	305	10,742	246	419	14,366
U.R. Commercial	0	10	0	1	36	1	2	49
Indian Food Fish	0	46	0	6	171	3	11	236
Mainstem Escape.	180	8,032	0	1,355	33,035	661	1,836	45,099
Catch	29	5,433	0	1,850	20,649	266	1,429	29,656
Escapement	180	8,032	0	1,355	33,035	661	1,836	45,099
Totals	209	13,465	0	3,205	53,685	926	3,265	74,755

Appendix A.2. (Page 3 of 3.)

Year and Area	Age-Specific Catch and Escapement							
	0.2	0.3	0.4	1.2	1.3	2.2	2.3	Total
1990								
106-41&42	0	0	0	798	474	0	639	1911
106-30	0	0	0	559	314	0	202	1075
108	25	369	51	73	3,169	0	553	4239
106-41T	0	0	0	13	25	0	11	49
106-30T	0	0	0	1	1	0	0	2
108T	2	25	3	4	203	0	37	275
Stikine Test	4	29	2	39	889	5	92	1,060
L.R. Commercial	60	315	24	723	7,742	128	509	9,501
U.R. Commercial	0	1	0	2	40	0	4	47
Indian Food Fish	1	8	1	11	253	1	26	302
Mainstem Escape.	18	2,187	164	907	28,197	182	3,059	34,713
Catch	92	748	81	2,223	13,110	134	2,073	18,461
Escapement	18	2,187	164	907	28,197	182	3,059	34,713
Totals	111	2,935	244	3,130	41,307	316	5,132	53,174

a/ The district test fisheries stock and age compositions are estimated to be the same as the commercial catch when no other data are available.

b/ The in river test fishery stock and age compositions are estimated to be the same as the commercial catch when no other data are available.

c/ The upper river commercial and Indian food fishery catches are assumed to be 10% non-Tahltan origin with the non-Tahltan fish having the same age composition as non-Tahltan portion of the test fishery catches.

d/ Assumes all fish captured at Kakwan Point were released alive and accounted for elsewhere (numbers small).

e/ The 1983 age-composition of non-Tahltan sockeye salmon in the District 108 catch is assumed to be the same as in District 106.

f/ In 1983 the fraction of the District 108 sockeye catch comprised of Tahltan fish is the average of 1985-1989.

Appendix A.3. Age-specific catch and escapement of Stikine River sockeye salmon, 1983-1990.

Year and Area	Age-Specific Catch and Escapement							
	0.2	0.3	0.4	1.2	1.3	2.2	2.3	Total
1983								
106	0	0	0	147	4,902	0	613	5,662
108	1	26	0	14	108	1	7	156
L.R. Commercial	116	216	0	2,144	12,195	231	955	15,857
U.R. Commercial	1	1	0	22	550	2	38	614
Indian Food Fish	6	11	0	164	4,164	16	288	4,649
Escapement	370	691	0	5,020	41,236	657	2,588	50,563
Catch	123	254	0	2,491	21,918	250	1,901	26,938
Escapement	370	691	0	5,020	41,236	657	2,588	50,563
Totals	493	945	0	7,511	63,154	907	4,490	77,501
1984								
106	0	0	0	3,523	2,502	0	727	6,751
108	4	186	2	99	781	8	50	1,131
106-41T	0	0	0	53	37	0	11	101
108T	2	73	0	36	353	5	36	506
L.R. Commercial	0	0	0	0	0	0	0	0
U.R. Commercial	0	0	0	0	0	0	0	0
Indian Food Fish	12	50	0	1,730	3,201	70	265	5,327
Escapement	828	3,590	0	20,316	40,865	1,394	3,891	70,884
Catch	18	309	2	5,441	6,874	83	1,089	13,816
Escapement	828	3,590	0	20,316	40,865	1,394	3,891	70,884
Totals	846	3,899	2	25,757	47,739	1,477	4,979	84,700
1985								
106-41&42	0	0	0	345	19,026	0	1,192	20,563
106-30	0	0	0	12	5,915	0	568	6,495
108	2	65	2	21	868	6	29	993
106-41T	0	0	0	9	480	0	30	519
108T	0	60	5	23	1,048	7	34	1,177
Stikine Test	0	0	0	33	1,228	15	71	1,347
L.R. Commercial	59	647	2	939	14,567	235	643	17,093
U.R. Commercial	1	11	0	31	1,012	5	25	1,084
Indian Food Fish	7	73	0	205	6,801	33	168	7,287
Escapement	835	9,100	27	8,017	131,719	1,983	6,262	157,943
Catch	69	857	9	1,617	50,946	300	2,760	56,558
Escapement	835	9,100	27	8,017	131,719	1,983	6,262	157,943
Totals	904	9,957	36	9,634	182,664	2,283	9,022	214,501
1986								
106-41&42	0	0	0	82	1,740	0	749	2,571
106-30	0	0	0	70	0	0	46	116
108	17	264	0	147	2,750	0	73	3,251
106-41T	0	0	0	2	8	0	7	17
106-30T	0	0	0	0	0	0	0	0
108T	1	11	0	20	379	12	41	464
Stikine Test	2	5	0	41	360	9	16	434
L.R. Commercial	103	256	0	1,378	9,661	340	674	12,411
U.R. Commercial	1	2	0	17	728	9	58	815
Indian Food Fish	3	8	0	90	3,760	47	299	4,208
Escapement	244	611	0	4,558	42,563	931	2,282	51,190
Catch	127	546	0	1,848	19,386	417	1,963	24,287
Escapement	244	611	0	4,558	42,563	931	2,282	51,190
Totals	371	1,157	0	6,406	61,950	1,348	4,245	75,477

Appendix A.3. (Page 2 of 3.)

Year and Area	Age-Specific Catch and Escapement 0.2	0.3	0.4	1.2	1.3	2.2	2.3	Total
1987								
106-41&42	0	0	0	0	752	0	661	1,413
106-30	0	0	0	0	919	0	12	931
108	0	360	0	156	726	52	124	1,418
106-41T	0	0	0	0	26	0	22	48
106-30T	0	0	0	0	14	0	0	14
108T	0	56	0	26	141	6	25	254
Stikine Test	8	168	2	147	1,223	28	151	1,726
L.R. Commercial	96	533	0	1,080	3,832	158	438	6,138
U.R. Commercial	0	7	0	13	404	10	63	498
Indian Food Fish	2	41	1	80	2,417	61	377	2,979
Escapement	130	2,905	37	2,381	19,604	362	2,562	27,981
Catch	106	1,165	3	1,502	10,454	315	1,874	15,419
Escapement	130	2,905	37	2,381	19,604	362	2,562	27,981
Totals	236	4,070	40	3,883	30,058	677	4,436	43,400
1988								
106-41&42	0	0	0	48	945	0	144	1,137
106-30	0	0	0	0	694	0	51	745
108	9	120	6	180	567	0	50	933
106-41T	0	0	0	2	28	0	5	35
108T	8	56	0	26	225	0	22	336
Stikine Test	18	92	0	302	761	54	75	1,302
L.R. Commercial	364	849	6	3,725	6,669	651	502	12,766
U.R. Commercial	1	4	0	106	193	10	34	348
Indian Food Fish	4	22	0	664	1,210	62	215	2,177
Escapement	463	2,344	0	5,328	15,699	753	790	25,377
Catch	404	1,142	12	5,053	11,292	777	1,099	19,779
Escapement	463	2,344	0	5,328	15,699	753	790	25,377
Totals	867	3,486	12	10,381	26,990	1,529	1,889	45,156
1989								
106-41&42	0	0	0	366	3,559	0	862	4,787
106-30	0	0	0	932	148	0	305	1,385
108	27	2,292	0	290	5,570	0	179	8,358
106-41T	0	0	0	2	13	0	2	17
108T	2	196	0	46	526	0	19	788
Stikine Test	0	236	0	89	1,142	46	94	1,607
L.R. Commercial	0	2,654	0	855	12,329	679	662	17,179
U.R. Commercial	0	10	0	59	351	27	47	493
Indian Food Fish	0	46	0	282	1,679	131	223	2,360
Escapement	180	8,032	0	2,436	38,940	1,160	2,668	53,415
Catch	29	5,433	0	2,920	25,317	883	2,392	36,974
Escapement	180	8,032	0	2,436	38,940	1,160	2,668	53,415
Totals	209	13,465	0	5,356	64,256	2,042	5,060	90,389

Appendix A.3. (Page 3 of 3.)

Year and Area	Age-Specific Catch and Escapement							
	0.2	0.3	0.4	1.2	1.3	2.2	2.3	Total
1990								
106-41&42	0	0	0	918	749	216	829	2,712
106-30	0	0	0	629	314	0	246	1,189
108	25	369	51	238	4,028	99	710	5,519
106-41T	0	0	0	14	41	6	19	80
106-41T	0	0	0	1	1	0	0	2
108T	2	25	3	16	255	6	48	356
Stikine Test	4	29	2	165	1,501	49	191	1,941
L.R. Commercial	60	315	24	1,781	10,860	567	923	14,530
U.R. Commercial	0	1	0	67	342	25	36	472
Indian Food Fish	1	8	1	426	2,191	162	233	3,022
Escapement	18	2,187	164	3,183	38,833	1,061	4,195	49,640
Catch	92	748	81	4,255	20,282	1,130	3,236	29,823
Escapement	18	2,187	164	3,183	38,833	1,061	4,195	49,640
Totals	111	2,935	244	7,438	59,115	2,190	7,431	79,463

a/ The district test fishery stock and age compositions are estimated to be same as the commercial catch when no other data are available.
b/ The in river test fishery stock and age compositions are estimated to be the same as the commercial catch when no other data are available.
c/ The age compositions of the upper river commercial and Indian food fishery catches are assumed to be the same as the Tahltan escapement for Tahltan fish and as the lower river test or commercial catches for the non-Tahltan fish.
d/ Assumes all fish captured at Kakwan Point were released alive and accounted for elsewhere (numbers small).
e/ In 1983 the age composition of Stikine sockeye salmon in the District 108 catch is assumed to be the same as in District 106.
f/ In 1983 the fraction of the District 108 sockeye catch comprised of Stikine fish is the average of 1985-1989.

Appendix A.4. Brood table for Tahltan, non-Tahltan, and all Stikine River sockeye salmon.

Year	Spawners	Recruits							
		0.2	0.3	0.4	1.2	1.3	2.2	2.3	Total
Tahltan									
1978	22,788					33,710	71	1,940	35,720
1979	10,211				1,445	24,695	443	2,081	28,664
1980	11,018				13,690	106,164	332	2,685	122,870
1981	50,790				2,634	30,501	321	2,123	35,579
1982	28,257				286	11,343	302	1,056	12,987
1983	21,256				468	5,206	407	1,795	7,876
1984	32,777				2,742	10,572	1,116	2,299	16,729
1985	67,326				2,151	17,808	1,874		21,834
1986	20,280				4,307				4,307
1987	6,958								
Non-Tahltan									
1978	22,788			0		29,444	837	3,039	33,320
1979	16,608		945	2	6,067	23,044	1,034	6,941	38,032
1980	30,806	493	3,899	36	12,067	76,500	1,952	1,561	96,508
1981	61,615	846	9,957	0	7,000	31,449	1,027	2,313	52,592
1982	19,964	904	1,157	40	6,120	18,715	375	834	28,146
1983	29,307	371	4,070	12	3,415	21,784	1,122	3,265	34,039
1984	38,107	236	3,486	0	7,639	53,685	926	5,132	71,104
1985	90,617	867	13,465	244	3,205	41,307	316		59,404
1986	30,910	209	2,935		3,130				6,274
1987	21,023	111							111
Stikine									
1978	45,576			0		63,154	907	4,979	69,041
1979	26,819		945	2	7,511	47,739	1,477	9,022	66,696
1980	41,824	493	3,899	36	25,757	182,664	2,283	4,245	219,378
1981	112,405	846	9,957	0	9,634	61,950	1,348	4,436	88,171
1982	48,221	904	1,157	40	6,406	30,058	677	1,889	41,132
1983	50,563	371	4,070	12	3,883	26,990	1,529	5,060	41,915
1984	70,884	236	3,486	0	10,381	64,256	2,042	7,431	87,833
1985	157,943	867	13,465	244	5,356	59,115	2,190		81,238
1986	51,190	209	2,935		7,438				10,581
1987	27,981	111							111

In 1978 the mainstem brood stock is assumed to be the same as the Tahltan.

Appendix A.5. Smolt-recruit relationship for Tahltan sockeye salmon.

Year	Smolt	Recruits 1.2	1.3	2.2	2.3	Total	Survival Rate
1984	219,702	286	11,343	321	2,123	14,073	0.0641
1985	613,531	468	5,206	302	1,056	7,031	0.0115
1986	244,330	2,742	10,572	407	1,795	15,516	0.0635
1987	810,432	2,151	17,808	1,116	2,299	23,374	0.0288
1988	1170136	4,307		1,874		6,182	0.0053
1989	580,574						
1990	607,645						
Average survival			0.042				
Average Marine Age		2 =	0.124	3 =	0.876		
Forecast for 1991		3 ocean	43,024	2 ocean	3,017	Total	46,041

Appendix A.6. Spawner-smolt relationship for Tahltan sockeye salmon, 1982-1988. Calculations based on assumption of age 1. smolt.

Brood Year	Spawners	Smolt	Smolt Per Spawner
1982	28,257	219,702	8
1983	21,256	613,531	29
1984	32,777	244,330	7
1985	67,326	810,432	12
1986	20,280	1170136	58
1987	6,958	580,574	83
1988	2,536	607,645	240
Average			62

Appendix B.1. Age and stock compositions of female sockeye salmon harvested in Canada's commercial fishery in the lower Stikine River, 1990. Sex specific age compositions were calculated and the stock composition of the sampled females was expanded to the catch by age.

	Tahltan					Non-Tahltan									Grand
Week	1.2	1.3	2.2	2.3	Total	0.2	0.3	0.4	1.2	1.3	1.4	2.2	2.3	Total	Total
Age and Stock Compositions of Samples															
26	1	30	1	4	36	0	1	0	0	11	0	0	1	13	49
27	9	91	3	9	112	0	1	0	1	25	0	0	2	29	141
28	12	66	8	10	96	0	1	0	1	42	0	0	2	46	142
29	15	24	10	3	52	0	3	0	5	76	2	1	6	93	145
30	12	10	2	2	26	0	1	0	5	68	0	4	6	84	110
31	3	5	2	0	10	0	2	0	6	100	1	5	7	121	131
32	1	3	0	0	4	0	8	1	6	119	5	3	4	146	150
33	0	3	0	0	3	0	2	0	3	59	0	1	2	67	70
34	0	1	1	0	2	0	2	0	2	57	0	0	2	63	65
35	1	0	0	0	1	0	0	0	2	44	0	0	1	47	48
Total	54	233	27	28	342	0	21	1	31	601	8	14	33	709	1,051
Age and Stock Compositions of Samples															
26	1.000	0.732	1.000	0.800	0.735	1.000	1.000	1.000	0.000	0.268	1.000	0.000	0.200	0.265	
27	0.900	0.784	1.000	0.818	0.794	1.000	1.000	1.000	0.100	0.216	1.000	0.000	0.182	0.206	
28	0.923	0.611	1.000	0.833	0.676	1.000	1.000	1.000	0.077	0.389	1.000	0.000	0.167	0.324	
29	0.750	0.240	0.909	0.333	0.359	1.000	1.000	1.000	0.250	0.760	1.000	0.091	0.667	0.641	
30	0.706	0.128	0.333	0.250	0.236	1.000	1.000	1.000	0.294	0.872	1.000	0.667	0.750	0.764	
31	0.333	0.048	0.286	0.000	0.076	1.000	1.000	1.000	0.667	0.952	1.000	0.714	1.000	0.924	
32	0.143	0.025	0.000	0.000	0.027	1.000	1.000	1.000	0.857	0.975	1.000	1.000	1.000	0.973	
33	0.000	0.048	0.000	0.000	0.043	1.000	1.000	1.000	1.000	0.952	1.000	1.000	1.000	0.957	
34	0.000	0.017	1.000	0.000	0.031	1.000	1.000	1.000	1.000	0.983	1.000	0.000	1.000	0.969	
35	0.333	0.000	0.000	0.000	0.021	1.000	1.000	1.000	0.667	1.000	1.000	0.000	1.000	0.979	
Prop.	0.158	0.681	0.079	0.082	1.000	0.000	0.030	0.001	0.044	0.848	0.011	0.020	0.047	1.000	
Total	0.051	0.222	0.026	0.027	0.325	0.000	0.020	0.001	0.029	0.572	0.008	0.013	0.031	0.675	1.000
Age and Stock Compositions of Catch															
26	3	85	3	11	102	0	8	0	0	31	0	0	3	42	144
27	40	409	13	40	502	0	4	0	5	113	0	0	9	131	633
28	96	525	64	80	765	0	16	0	8	334	0	0	16	374	1,139
29	273	437	182	55	947	0	55	0	91	1,385	36	18	109	1,694	2,641
30	64	53	9	11	137	0	5	0	26	358	0	17	31	437	574
31	11	19	7	0	37	0	8	0	23	376	4	19	26	456	493
32	11	31	0	0	42	0	84	11	63	1,249	53	32	42	1,534	1,576
33	0	9	0	0	9	0	5	0	16	179	0	4	11	215	224
34	0	3	3	0	6	0	6	0	6	162	0	0	6	180	186
35	7	0	0	0	7	0	0	0	15	322	0	0	7	344	351
Total	505	1,571	281	197	2,554	0	191	11	253	4,509	93	90	260	5,407	7,961
Prop.	0.198	0.615	0.110	0.077	1.000	0.000	0.035	0.002	0.047	0.834	0.017	0.017	0.048	1.000	

Does not include 3 fish assigned to the Tahltan stock (2 age 0.3 and 1 age 0.3 sampled in weeks 26 and 28).

Appendix B.2. Age and stock compositions of male sockeye salmon harvested in Canada's commercial fishery in the lower Stikine River, 1990. Sex specific age compositions were calculated and the stock composition of the sampled females was expanded to the catch by age.

	Tahltan					Non-Tahltan									Grand
Week	1.2	1.3	2.2	2.3	Total	0.2	0.3	0.4	1.2	1.3	1.4	2.2	2.3	Total	Total
Age and Stock Compositions of Samples															
26	2	27	2	3	34	1	1	0	0	10	3	0	1	16	50
27	4	99	4	16	122	1	2	0	0	27	1	0	3	35	157
28	14	70	7	10	101	1	2	1	1	45	0	0	2	52	153
29	15	21	4	2	42	1	3	0	5	66	0	0	5	80	122
30	15	11	2	3	30	0	2	1	6	71	0	3	9	93	123
31	5	3	1	0	9	1	2	0	9	70	4	2	3	91	100
32	3	1	0	0	5	1	1	0	20	56	0	0	6	83	88
33	0	2	0	0	2	2	0	0	19	30	0	2	2	55	56
34	0	0	0	0	0	0	0	0	6	20	0	0	0	26	26
35	2	0	0	0	2	1	1	0	5	13	0	0	0	20	22
Total	60	234	19	34	347	9	14	2	71	407	8	8	31	550	897
Age and Stock Compositions of Samples															
26	1.000	0.732	1.000	0.800	0.685	1.000	1.000	1.000	0.000	0.268	1.000	0.000	0.200	0.315	1.000
27	0.900	0.784	1.000	0.818	0.777	1.000	1.000	1.000	0.100	0.216	1.000	0.000	0.182	0.223	1.000
28	0.923	0.611	1.000	0.833	0.661	1.000	1.000	1.000	0.077	0.389	1.000	0.000	0.167	0.339	1.000
29	0.750	0.240	0.909	0.333	0.343	1.000	1.000	1.000	0.250	0.760	1.000	0.091	0.667	0.657	1.000
30	0.706	0.128	0.333	0.250	0.244	1.000	1.000	1.000	0.294	0.872	1.000	0.667	0.750	0.756	1.000
31	0.333	0.048	0.286	0.000	0.090	1.000	1.000	1.000	0.667	0.952	1.000	0.714	1.000	0.910	1.000
32	0.143	0.025	0.000	0.000	0.053	1.000	1.000	1.000	0.857	0.975	1.000	0.000	1.000	0.947	1.000
33	0.000	0.048	0.000	0.000	0.027	1.000	1.000	1.000	1.000	0.952	1.000	1.000	1.000	0.973	1.000
34	0.000	0.017	0.000	0.000	0.013	1.000	1.000	1.000	1.000	0.983	1.000	0.000	0.000	0.987	1.000
35	0.333	0.000	0.000	0.000	0.106	1.000	1.000	1.000	0.667	1.000	1.000	0.000	0.000	0.894	1.000
Prop.	0.172	0.675	0.055	0.098	1.000	0.016	0.025	0.004	0.130	0.740	0.015	0.014	0.056	1.000	
Total	0.066	0.261	0.021	0.038	0.387	0.010	0.016	0.002	0.080	0.453	0.009	0.009	0.034	0.613	1.000
Age and Stock Compositions of the Catch															
26	6	76	6	9	97	3	3	0	0	28	8	0	2	44	141
27	16	445	18	70	549	4	9	0	2	122	4	0	15	156	705
28	110	559	56	80	805	8	16	8	9	356	0	0	16	413	1,218
29	273	380	66	42	761	18	55	0	91	1,205	0	7	85	1,461	2,222
30	78	55	9	16	158	0	11	5	32	377	0	17	47	489	647
31	18	13	3	0	34	4	8	0	35	262	15	8	11	343	377
32	35	15	0	0	50	11	11	0	207	583	0	0	63	875	925
33	0	3	0	0	3	4	0	0	34	50	0	4	4	96	99
34	0	1	0	0	1	0	0	0	17	56	0	0	0	73	74
35	17	0	0	0	17	7	7	0	34	96	0	0	0	144	161
Total	553	1,547	158	217	2,475	59	120	13	461	3,135	27	36	243	4,094	6,569
Prop.	0.223	0.625	0.064	0.088	1.000	0.014	0.029	0.003	0.113	0.766	0.007	0.009	0.059	1.000	

Does not include 3 fish assigned to the Tahltan stock (2 age 0.3 and 1 age 0.3 sampled in weeks 26 and 28).

Appendix B.3. Age and stock compositions of sockeye salmon harvested in Canada's commercial fishery in the lower Stikine River, 1990. Sex specific age compositions were calculated and the stock composition of the sampled females was expanded to the catch by age.

	Tahltan					Non-Tahltan									
Week	1.2	1.3	2.2	2.3	Total	0.2	0.3	0.4	1.2	1.3	1.4	2.2	2.3	Total	Grand Total
Age and Stock Compositions of the Catch															
26	9	161	9	20	199	3	11	0	0	59	8	0	5	86	285
27	56	854	31	110	1,051	4	13	0	7	235	4	0	24	287	1,338
28	206	1,084	120	160	1,570	8	32	8	17	690	0	0	32	787	2,357
29	546	817	248	97	1,708	18	110	0	182	2,590	36	25	194	3,155	4,863
30	142	108	18	27	295	0	16	5	58	735	0	34	78	926	1,221
31	29	32	10	0	71	4	16	0	58	638	19	27	37	799	870
32	46	46	0	0	92	11	95	11	270	1,832	53	32	105	2,409	2,501
33	0	12	0	0	12	4	5	0	50	229	0	8	15	311	323
34	0	4	3	0	7	0	6	0	23	218	0	0	6	253	260
35	24	0	0	0	24	7	7	0	49	418	0	0	7	488	512
Total	1,058	3,118	439	414	5,029	59	311	24	714	7,644	120	126	503	9,501	14,530
Prop.	0.210	0.620	0.087	0.082	1.000	0.006	0.033	0.003	0.075	0.805	0.013	0.013	0.053	1.000	

Appendix B.4. Age and stock compositions of female sockeye salmon caught in the Stikine River test fishery, 1990. Sex specific age compositions were calculated and the stock composition of the sampled females was expanded to the catch by age.

	Tahltan					Non-Tahltan									
Week	1.2	1.3	2.2	2.3	Total	0.2	0.3	0.4	1.2	1.3	1.4	2.2	2.3	Total	Grand Total
Age and Stock Compositions of Samples															
25	0	6	0	0	6	0	3	0	0	2	0	0	1	6	12
26	1	77	1	7	86	0	1	0	0	9	0	0	0	10	96
27	9	95	3	15	122	0	0	1	0	26	0	0	2	29	151
28	14	77	6	10	107	0	2	0	1	53	0	0	12	68	175
29	6	30	0	5	41	0	1	0	2	47	1	0	14	65	106
30	5	14	2	3	24	0	5	0	5	174	1	0	8	193	217
31	5	7	0	1	13	0	1	0	3	122	1	0	4	131	144
32	1	2	0	1	4	0	2	1	1	19	0	0	4	27	31
33	No Test Fishery														
34	0	1	0	0	1	0	2	0	1	23	0	0	0	26	27
35	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
Total	41	309	12	42	404	0	17	2	13	476	3	0	45	556	960
Age and Stock Compositions of Samples															
25	0.000	0.750	0.000	0.000	0.500	1.000	1.000	1.000	0.000	0.250	1.000	0.000	1.000	0.500	
26	1.000	0.895	1.000	1.000	0.896	1.000	1.000	1.000	0.000	0.105	1.000	0.000	0.000	0.104	
27	1.000	0.785	1.000	0.882	0.808	1.000	1.000	1.000	0.000	0.215	1.000	0.000	0.118	0.192	
28	0.933	0.592	1.000	0.455	0.611	1.000	1.000	1.000	0.067	0.408	1.000	0.000	0.545	0.389	
29	0.750	0.390	0.000	0.263	0.387	1.000	1.000	1.000	0.250	0.610	1.000	0.000	0.737	0.613	
30	0.500	0.074	1.000	0.273	0.111	1.000	1.000	1.000	0.500	0.926	1.000	0.000	0.727	0.889	
31	0.625	0.054	0.000	0.200	0.090	1.000	1.000	1.000	0.375	0.946	1.000	0.000	0.800	0.910	
32	0.500	0.095	0.000	0.200	0.129	1.000	1.000	1.000	0.500	0.905	1.000	0.000	0.800	0.871	
33	No Test Fishery														
34	0.000	0.042	0.000	0.000	0.037	1.000	1.000	1.000	1.000	0.958	1.000	0.000	0.000	0.963	
35	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	0.000	1.000	1.000	0.000	0.000	1.000	
Prop. Total	0.101	0.765	0.030	0.104	1.000	0.000	0.031	0.004	0.023	0.856	0.005	0.000	0.081	1.000	
	0.043	0.322	0.013	0.044	0.421	0.000	0.018	0.002	0.014	0.496	0.003	0.000	0.047	0.579	
Age and Stock Compositions of Catch															
25	0	6	0	0	6	0	3	0	0	2	0	0	1	6	12
26	1	87	1	8	97	0	1	0	0	10	0	0	0	11	108
27	10	108	3	17	138	0	0	1	0	29	0	0	2	32	170
28	16	91	7	12	126	0	2	0	1	63	1	0	14	81	207
29	7	36	0	6	49	0	1	0	3	56	1	0	17	78	127
30	6	16	2	3	27	0	6	0	5	198	1	0	9	219	246
31	6	8	0	1	15	0	1	0	3	142	1	0	5	152	167
32	1	2	0	1	4	0	2	1	1	22	0	0	5	31	35
33	No Test Fishery														
34	0	1	0	0	1	0	2	0	1	22	0	0	0	25	26
35	0	0	0	0	0	0	0	0	0	4	0	0	0	4	4
Total	47	355	13	48	463	0	18	2	14	548	4	0	53	639	1,102
Prop.	0.102	0.767	0.028	0.104	1.000	0.000	0.028	0.003	0.022	0.858	0.006	0.000	0.083	1.000	

Appendix B.5. Age and stock compositions of male sockeye salmon caught in the Stikine River test fishery, 1990. Sex specific age compositions were calculated and the stock composition of the sampled females was expanded to the catch by age.

	Tahltan					Non-Tahltan									Grand
Week	1.2	1.3	2.2	2.3	Total	0.2	0.3	0.4	1.2	1.3	1.4	2.2	2.3	Total	Total
Age and Stock Compositions of Samples															
25	0	3	0	0	3	0	0	0	0	1	0	0	0	1	4
26	7	55	3	13	78	0	1	0	0	6	0	0	0	7	85
27	17	75	4	17	113	1	0	0	0	21	0	0	2	24	137
28	18	52	12	8	90	1	2	0	1	36	0	0	10	50	140
29	11	25	0	2	38	0	1	0	4	38	0	1	5	49	87
30	9	8	8	3	28	0	4	0	9	96	2	0	9	120	148
31	6	4	1	1	12	2	1	0	4	65	0	2	4	78	90
32	1	2	0	0	3	0	1	0	1	14	0	0	2	18	21
33	No Test Fishery														
34	0	0	0	0	0	0	0	0	2	11	0	1	2	16	16
35	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
Total	69	223	28	44	365	4	10	0	21	290	2	4	34	364	729
Age and Stock Compositions of Samples															
25	0.000	0.750	0.000	0.000	0.750	1.000	1.000	1.000	0.000	0.250	1.000	0.000	0.000	0.250	
26	1.000	0.895	1.000	1.000	0.913	1.000	1.000	1.000	0.000	0.105	1.000	0.000	0.000	0.087	
27	1.000	0.785	1.000	0.882	0.826	1.000	1.000	1.000	0.000	0.215	1.000	0.000	0.118	0.174	
28	0.933	0.592	1.000	0.455	0.643	1.000	1.000	1.000	0.067	0.408	1.000	0.000	0.545	0.357	
29	0.750	0.390	0.263	0.263	0.436	1.000	1.000	1.000	0.250	0.610	1.000	0.737	0.737	0.564	
30	0.500	0.074	1.000	0.273	0.189	1.000	1.000	1.000	0.500	0.926	1.000	0.000	0.727	0.811	
31	0.625	0.054	0.200	0.200	0.129	1.000	1.000	1.000	0.375	0.946	1.000	0.000	0.800	0.871	
32	0.500	0.095	0.000	0.200	0.139	1.000	1.000	1.000	0.500	0.905	1.000	0.000	0.800	0.861	
33	No Test Fishery														
34	0.000	0.042	0.000	0.000	0.029	1.000	1.000	1.000	1.000	0.958	1.000	1.000	1.000	0.971	
35	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	0.000	1.000	1.000	0.000	0.000	1.000	
Sum	0.190	0.612	0.076	0.122	1.000	0.011	0.027	0.000	0.057	0.796	0.005	0.011	0.092	1.000	
Total	0.095	0.306	0.038	0.061	0.500	0.005	0.014	0.000	0.028	0.398	0.003	0.006	0.046	0.500	
Age and Stock Compositions of the Catch															
25	0	3	0	0	3	0	0	0	0	1	0	0	0	1	4
26	8	61	3	15	87	0	1	0	0	7	0	0	0	8	95
27	19	86	4	19	128	1	0	0	0	23	0	0	2	26	154
28	21	62	14	10	107	1	2	0	2	43	0	0	11	59	166
29	13	30	0	2	45	0	1	0	5	46	0	1	6	59	104
30	10	9	9	4	32	0	5	0	10	109	2	0	10	136	168
31	7	4	1	1	13	2	1	0	5	76	0	3	5	92	105
32	1	2	0	0	3	0	1	0	1	17	0	0	2	21	24
33	No Test Fishery														
34	0	0	0	0	0	0	0	0	2	10	0	1	2	15	15
35	0	0	0	0	0	0	0	0	0	4	0	0	0	4	4
Total	79	257	31	51	418	4	11	0	25	336	2	5	38	421	839
Prop.	0.189	0.615	0.074	0.122	1.000	0.010	0.026	0.000	0.059	0.798	0.005	0.012	0.090	1.000	

Appendix B.6. Age and stock compositions of sockeye salmon in the Stikine River test fishery catches and inriver run, 1990. Sex specific age compositions were calculated and the stock composition of the sampled females was expanded to the catch and run by age.

	Tahltan					Non-Tahltan									Grand
Week	1.2	1.3	2.2	2.3	Total	0.2	0.3	0.4	1.2	1.3	1.4	2.2	2.3	Total	Total
Age and Stock Compositions of Test Catch															
25	0	9	0	0	9	0	3	0	0	3	0	0	1	7	16
26	9	148	4	23	184	0	2	0	0	17	0	0	0	19	203
27	29	194	7	36	266	1	0	1	0	52	0	0	4	58	324
28	37	153	21	22	233	1	4	0	3	106	1	0	25	140	373
29	20	66	0	8	94	0	2	0	8	102	1	1	23	137	231
30	16	25	11	7	59	0	11	0	15	307	3	0	19	355	414
31	13	12	1	2	28	2	2	0	8	218	1	3	10	244	272
32	2	4	0	1	7	0	3	1	2	39	0	0	7	52	59
33	No Test Fishery														
34	0	1	0	0	1	0	2	0	3	32	0	1	2	40	41
35	0	0	0	0	0	0	0	0	0	8	0	0	0	8	8
Sum	126	612	44	99	881	4	29	2	39	884	6	5	91	1,060	1,941
Prop	0.143	0.695	0.050	0.112	1.000	0.004	0.027	0.002	0.037	0.834	0.006	0.005	0.086	1.000	
Age and Stock Compositions of the Inriver Run															
25	0.000	0.148	0.000	0.000	0.148	0.000	0.026	0.000	0.000	0.026	0.000	0.000	0.009	0.061	
26	0.012	0.192	0.005	0.030	0.239	0.000	0.001	0.000	0.000	0.012	0.000	0.000	0.000	0.013	
27	0.024	0.158	0.006	0.029	0.217	0.000	0.000	0.000	0.000	0.022	0.000	0.000	0.002	0.025	
28	0.026	0.108	0.015	0.016	0.165	0.000	0.001	0.000	0.001	0.039	0.000	0.000	0.009	0.052	
29	0.023	0.075	0.000	0.009	0.107	0.000	0.001	0.000	0.005	0.061	0.001	0.001	0.014	0.082	
30	0.010	0.016	0.007	0.004	0.038	0.000	0.004	0.000	0.005	0.103	0.001	0.000	0.006	0.119	
31	0.013	0.012	0.001	0.002	0.027	0.001	0.001	0.000	0.004	0.111	0.001	0.002	0.005	0.124	
32	0.009	0.018	0.000	0.004	0.031	0.000	0.007	0.002	0.005	0.092	0.000	0.000	0.016	0.122	
33	0.005	0.013	0.000	0.003	0.021	0.000	0.007	0.001	0.007	0.098	0.000	0.001	0.012	0.128	
34	0.000	0.006	0.000	0.000	0.006	0.000	0.007	0.000	0.010	0.108	0.000	0.003	0.007	0.135	
35	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.139	0.000	0.000	0.000	0.139	
Pro.	0.121	0.747	0.034	0.097	1.000	0.002	0.056	0.004	0.037	0.812	0.002	0.007	0.081	1.000	
Sum	2,910	17,926	809	2,336	23,982	83	2,533	190	1,679	37,030	113	315	3,680	45,623	

CPUE for week 33 were calculated from the regression of the commercial CPUE versus the drift test CPUE for weeks 26-32, 34, 35; age and sex specific stock compositions are interpolated from weeks 32 and 34.

Appendix B.7. Sex specific age composition of Tahltan Lake sockeye escapement, 1990.

	Age Composition Females						Age Composition Males						Grand
Week	1.2	1.3	1.4	2.2	2.3	Total	1.2	1.3	1.4	2.2	2.3	Total	Total
Age Composition of Samples													
29	0	1	0	0	0	1	0	2	0	0	0	2	3
30	20	123	0	7	18	168	6	88	0	2	4	100	268
31	25	46	0	12	6	89	8	40	0	3	3	54	143
32	19	12	0	4	3	38	2	10	0	1	1	14	52
33	32	9	0	13	0	54	9	9	0	5	1	24	78
34	59	12	0	41	2	114	16	3	0	6	1	26	140
Total	155	203	0	77	29	464	41	152	0	17	10	220	684
Age Composition of Samples													
29	0.000	1.000	0.000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	1.000	
30	0.119	0.732	0.000	0.042	0.107	1.000	0.060	0.880	0.000	0.020	0.040	1.000	
31	0.281	0.517	0.000	0.135	0.067	1.000	0.148	0.741	0.000	0.056	0.056	1.000	
32	0.500	0.316	0.000	0.105	0.079	1.000	0.143	0.714	0.000	0.071	0.071	1.000	
33	0.593	0.167	0.000	0.241	0.000	1.000	0.375	0.375	0.000	0.208	0.042	1.000	
34	0.518	0.105	0.000	0.360	0.018	1.000	0.615	0.115	0.000	0.231	0.038	1.000	
Prop.	0.334	0.438	0.000	0.166	0.063	1.000	0.186	0.691	0.000	0.077	0.045	1.000	
Age Composition of Escapement													
29	0	10	0	0	0	10	0	19	0	0	0	19	29
30	814	5,008	0	285	733	6,840	244	3,582	0	81	163	4,070	10,910
31	464	852	0	222	111	1,649	148	741	0	56	56	1,001	2,650
32	300	190	0	63	47	600	32	158	0	16	16	222	822
33	68	19	0	27	0	114	19	19	0	11	2	51	165
34	147	30	0	103	5	285	40	8	0	15	3	66	351
Total	1,793	6,109	0	700	896	9,498	483	4,527	0	179	240	5,429	14,927
Prop.	0.189	0.643	0.000	0.074	0.094	1.000	0.089	0.834	0.000	0.033	0.044	1.000	

Does not include 4 fish, 1 age 3.2 and 3 age 3.2 sampled in weeks 30 and 34, respectively.

Appendix C.1. Regressions for Tahltan sockeye salmon.

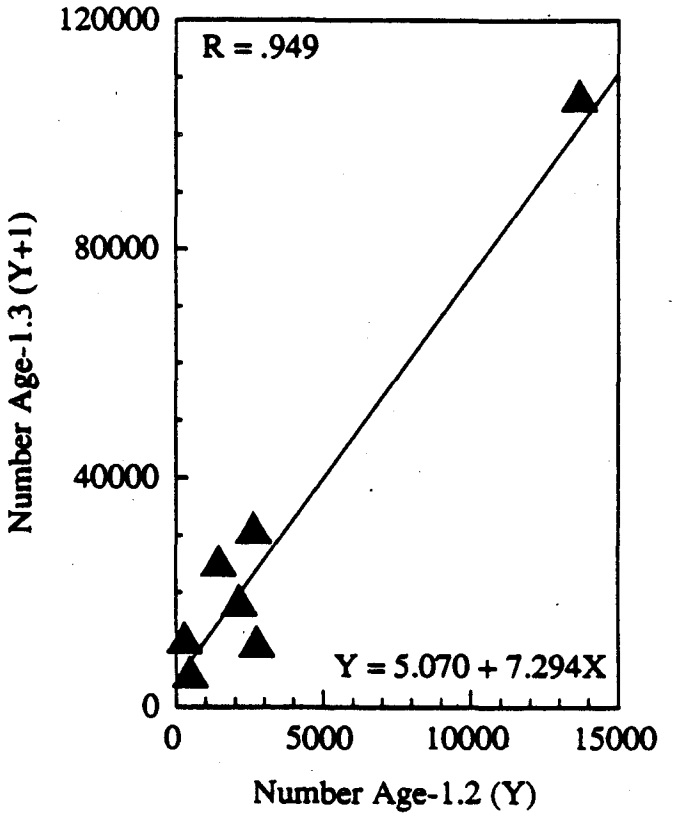
X in year t Y in year t+1	1.2 1.3	1.2 All
All years		
Constant	5,070	11,885
Std Err of Y Est	8,603	11,331
R Squared	0.949	0.913
No. of Observations	7	7
Degrees of Freedom	5	5
X Coefficient(s)	7.294	7.181
Std Err of Coef.	0.753	0.992
Predicted 1991	36,488	42,815
All years except 1983(X)-1984(Y)		
Constant	2,971	7,611
Std Err of Y Est	8,223	7,566
R Squared	0.963	0.969
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	7.454	7.506
Std Err of Coef.	0.732	0.673
Predicted 1984	13,741	18,455
All years except 1984(X)-1985(Y)		
Constant	9,107	15,216
Std Err of Y Est	9,071	12,390
R Squared	0.275	0.190
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	4.677	5.021
Std Err of Coef.	3.796	5.185
Predicted 1985	73,128	83,947
All years except 1985(X)-1986(Y)		
Constant	3,896	11,320
Std Err of Y Est	9,010	12,564
R Squared	0.956	0.914
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	7.334	7.200
Std Err of Coef.	0.790	1.102
Predicted 1986	23,216	30,287
All years except 1986(X)-1987(Y)		
Constant	3,890	11,801
Std Err of Y Est	9,323	12,667
R Squared	0.950	0.906
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	7.419	7.190
Std Err of Coef.	0.852	1.158
Predicted 1987	6,010	13,856
All years except 1987(X)-1988(Y)		
Constant	5,963	13,476
Std Err of Y Est	9,441	12,238
R Squared	0.946	0.909
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	7.203	7.019
Std Err of Coef.	0.859	1.113
Predicted 1988	9,332	16,758
All years except 1988(X)-1989(Y)		
Constant	7,756	14,839
Std Err of Y Est	5,565	9,279
R Squared	0.982	0.950
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	7.216	7.095
Std Err of Coef.	0.488	0.813
Predicted 1989	27,545	34,295
All years except 1989(X)-1990(Y)		
Constant	5,675	12,099
Std Err of Y Est	9,483	12,655
R Squared	0.950	0.912
No. of Observations	6	6
Degrees of Freedom	4	4
X Coefficient(s)	7.262	7.169
Std Err of Coef.	0.835	1.115
Predicted 1990	21,298	27,523

Appendix C.2. Regressions for non-Tahltan Stikine River sockeye salmon.

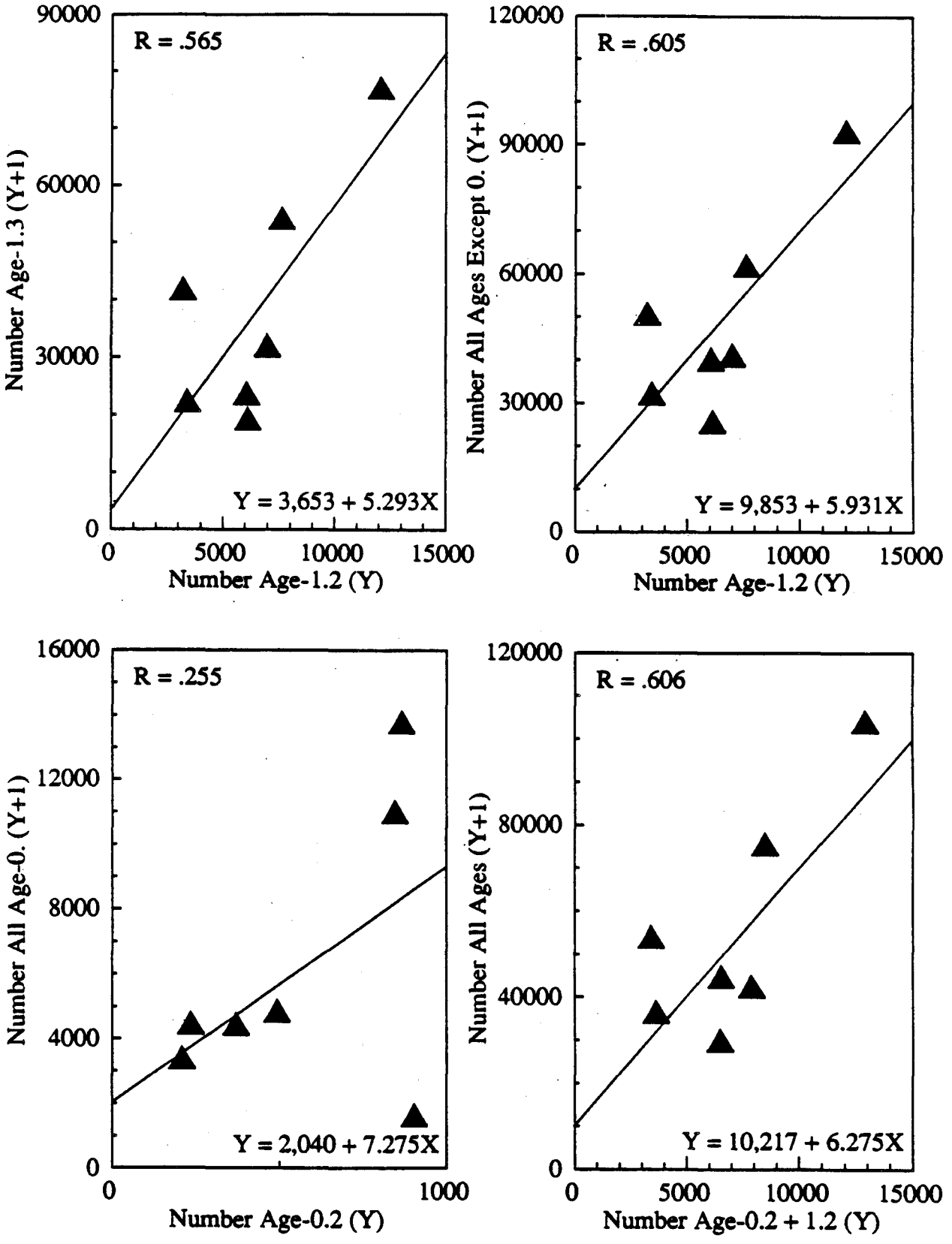
X in year t Y in year t+1	1.2 1.3	1.2 All	1.2 All non 0	0.2 All 0	0.2+1.2 All
All years					
Constant	3,653	10,002	9,853	2,040	10,217
Std Err of Y Est	15,157	17,686	15,647	4,178	17,882
R Squared	0.565	0.615	0.605	0.255	0.606
No. of Observations	7	7	7	7	7
Degrees of Freedom	5	5	5	5	5
X Coefficient(s)	5.293	6.849	5.931	7.275	6.275
Std Err of Coef.	2.077	2.424	2.144	5.566	2.261
Predicted 1991	20,222	31,442	28,418	2,843	30,552
All years except 1983(X)-1984(Y)					
Constant	6,574	11,753	11,380	2,250	8,469
Std Err of Y Est	15,485	19,339	17,120	4,668	20,450
R Squared	0.597	0.619	0.609	0.191	0.574
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	5.171	6.776	5.867	7.009	6.649
Std Err of Coef.	2.126	2.656	2.351	7.212	2.861
Predicted 1984	37,947	52,861	46,973	5,707	52,085
All years except 1984(X)-1985(Y)					
Constant	21,134	30,725	31,231	2,575	30,331
Std Err of Y Est	14,633	16,981	14,028	4,389	16,816
R Squared	0.067	0.105	0.064	0.148	0.122
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	1.889	2.814	1.768	5.356	2.641
Std Err of Coef.	3.537	4.105	3.391	6.413	3.536
Predicted 1985	43,930	64,679	52,562	7,108	64,438
All years except 1985(X)-1986(Y)					
Constant	4,544	11,568	10,932	(137)	11,243
Std Err of Y Est	16,188	17,705	16,406	1,558	17,395
R Squared	0.595	0.676	0.643	0.895	0.687
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	5.395	7.028	6.054	13.939	6.563
Std Err of Coef.	2.224	2.433	2.254	2.388	2.214
Predicted 1986	42,307	60,760	53,307	12,468	63,117
All years except 1986(X)-1987(Y)					
Constant	7,497	15,048	14,583	2,204	15,520
Std Err of Y Est	14,116	15,475	13,148	4,666	16,139
R Squared	0.638	0.711	0.717	0.232	0.685
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	5.148	6.658	5.752	7.108	6.041
Std Err of Coef.	1.937	2.124	1.805	6.463	2.047
Predicted 1987	39,003	55,800	49,786	4,840	54,734
All years except 1987(X)-1988(Y)					
Constant	3,612	8,200	8,879	1,615	8,157
Std Err of Y Est	16,946	19,722	17,477	4,656	19,929
R Squared	0.507	0.574	0.557	0.236	0.565
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	5.298	7.050	6.039	7.800	6.488
Std Err of Coef.	2.611	3.038	2.692	7.019	2.848
Predicted 1988	21,705	32,278	29,504	3,455	31,844
All years except 1988(X)-1989(Y)					
Constant	3,607	9,942	9,825	3,291	10,489
Std Err of Y Est	16,110	18,564	17,190	3,400	19,024
R Squared	0.559	0.616	0.594	0.085	0.596
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	5.047	6.530	5.779	3.082	5.962
Std Err of Coef.	2.240	2.581	2.390	5.046	2.453
Predicted 1989	42,162	59,828	53,969	5,964	61,206
All years except 1989(X)-1990(Y)					
Constant	(13,630)	(7,724)	(7,709)	2,250	(8,329)
Std Err of Y Est	11,103	14,784	11,695	4,668	14,824
R Squared	0.812	0.785	0.823	0.191	0.783
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	7.255	8.862	7.924	7.009	8.225
Std Err of Coef.	1.743	2.321	1.836	7.212	2.162
Predicted 1990	9,621	20,674	17,686	3,715	19,748

Appendix C.3. Regressions for Stikine River sockeye salmon.

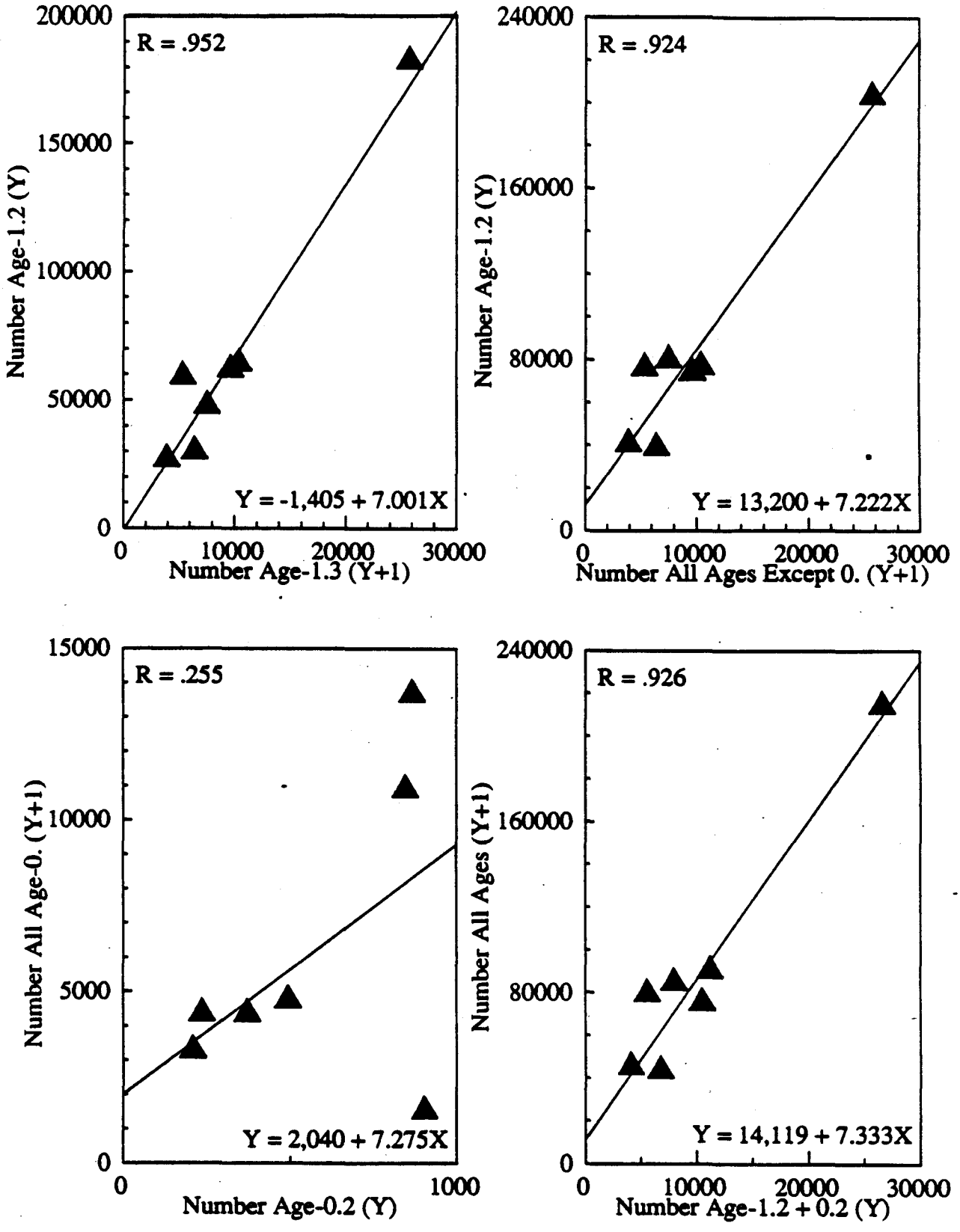
X in year t Y in year t+1	1.2 1.3	1.2 All	1.2 All non 0	0.2 All 0	0.2+1.2 All
All years					
Constant	(1,405)	15,898	13,200	2,040	14,119
Std Err of Y Est	12,669	16,256	16,684	4,178	17,209
R Squared	0.952	0.934	0.924	0.255	0.926
No. of Observations	7	7	7	7	7
Degrees of Freedom	5	5	5	5	5
X Coefficient(s)	7.001	7.570	7.222	7.275	7.333
Std Err of Coef.	0.701	0.900	0.923	5.566	0.927
Predicted 1991	50,699	72,102	66,918	2,843	69,469
All years except 1983(X)-1984(Y)					
Constant	(530)	12,868	10,027	2,250	7,529
Std Err of Y Est	14,040	16,968	17,363	4,668	17,349
R Squared	0.952	0.942	0.934	0.191	0.940
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	6.972	7.672	7.329	7.009	7.726
Std Err of Coef.	0.785	0.948	0.970	7.212	0.978
Predicted 1984	51,841	70,493	65,078	5,707	69,370
All years except 1984(X)-1985(Y)					
Constant	13,954	30,796	31,206	2,575	33,034
Std Err of Y Est	12,575	17,039	17,015	4,389	17,255
R Squared	0.530	0.441	0.365	0.148	0.426
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	4.780	5.416	4.619	5.356	4.765
Std Err of Coef.	2.252	3.052	3.047	6.413	2.764
Predicted 1985	137,086	170,290	150,170	7,108	159,792
All years except 1985(X)-1986(Y)					
Constant	(691)	18,224	14,739	(137)	16,699
Std Err of Y Est	13,991	16,683	18,033	1,558	17,212
R Squared	0.953	0.944	0.929	0.895	0.940
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	6.998	7.560	7.216	13.939	7.340
Std Err of Coef.	0.774	0.923	0.998	2.388	0.927
Predicted 1986	66,733	91,057	84,256	12,468	94,051
All years except 1986(X)-1987(Y)					
Constant	2,618	22,206	19,334	2,204	20,411
Std Err of Y Est	12,085	14,004	14,867	4,666	15,587
R Squared	0.961	0.955	0.945	0.232	0.944
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	6.830	7.301	6.960	7.108	7.071
Std Err of Coef.	0.683	0.792	0.841	6.463	0.859
Predicted 1987	46,369	68,974	63,923	4,840	68,328
All years except 1987(X)-1988(Y)					
Constant	(1,927)	15,956	13,395	1,615	13,745
Std Err of Y Est	14,148	18,175	18,651	4,656	19,234
R Squared	0.946	0.925	0.914	0.236	0.916
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	7.031	7.567	7.211	7.800	7.353
Std Err of Coef.	0.838	1.077	1.105	7.019	1.113
Predicted 1988	25,373	45,336	41,396	3,455	44,032
All years except 1988(X)-1989(Y)					
Constant	(365)	16,505	14,897	3,291	14,973
Std Err of Y Est	13,647	18,040	17,595	3,400	18,944
R Squared	0.956	0.935	0.933	0.085	0.928
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	7.015	7.578	7.244	3.082	7.351
Std Err of Coef.	0.756	0.999	0.974	5.046	1.021
Predicted 1989	72,459	95,173	90,103	5,964	97,659
All years except 1989(X)-1990(Y)					
Constant	(9,459)	7,844	4,701	2,250	5,135
Std Err of Y Est	5,838	12,798	12,748	4,668	13,397
R Squared	0.992	0.967	0.965	0.191	0.964
No. of Observations	6	6	6	6	6
Degrees of Freedom	4	4	4	4	4
X Coefficient(s)	7.400	7.968	7.643	7.009	7.769
Std Err of Coef.	0.335	0.735	0.732	7.212	0.752
Predicted 1990	67,258	90,564	84,041	8,329	92,531



Appendix D.1. Sibling correlation for Tahltan sockeye salmon.



Appendix D.2. Sibling correlation for non-Tahltan sockeye salmon.



Appendix D.3. Sibling correlation for Stikine River sockeye salmon.