ALITAK BAY TEST FISHERY
RESEARCH SUMMARY 1999–2002

By

M. B. Foster

Regional Information Report[1] No. 4K03-50

Alaska Department of Fish and Game
Division of Commercial Fisheries
211 Mission Road
Kodiak, Alaska 99615

September 2003

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished division reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

AUTHOR

Matthew Birch Foster is a Region IV Finfish Research Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, 211 Mission Road, Kodiak, AK 99615.

ACKNOWLEDGMENTS

The author is grateful to the 1999–2003 ADF&G personnel assisting with the test fishery: Bruce McIntosh, Ryan Sollee, Don Malherek, Daniel Costello, John Sikes, Mary Loewen, Paula Jackson, Amy Broderson, and Paul Kuriscak. Thanks are also extended to the reviewers: Denby Lloyd, Kevin Brennan, Jim McCullough, Mark Witteveen, and Patricia Nelson. Lucinda Neel contributed her publication expertise.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

A sockeye salmon test fishery near the mouth of Olga Narrows, in Alitak Bay, has been operated by the Alaska Department of Fish and Game since 1986. The goal of the test fishery has been to estimate the number of sockeye salmon transiting Olga Narrows into Olga Bay in advance of escapement counts at Dog Salmon Creek and Upper Station weirs, and aid in the management of the Alitak Bay District commercial salmon fishery. Previous attempts to model the passage of sockeye salmon into Olga Bay using test fishery data were unsuccessful. In 1999, the department determined that the test fishery would operate for three more seasons and, at the end of this time period, the merit of the test fishery would be reevaluated.

Test fishery cumulative catch per unit effort (CPUE) was found to be an a good indicator of sockeye salmon passage through Olga Narrows within a season but, due to seasonal fluctuations in test fishery catch rates (relative to estimated Olga Narrows sockeye salmon passage), was poor between years. Average air temperature during the test fishery (as indexed by the Booth Lake remote automated weather station) was a strong predictor of the seasonal differences in test fishery rate of catch. Average travel time (1996 to 2002 excluding 1998) for sockeye salmon from the test fishery to Olga Bay was 2.4 days, average travel time from the test fishery to Dog Salmon Creek weir was 3.5 days and travel time to Upper Station weir was 4.8 days. Data from 2002, suggests that sockeye salmon migrate through Olga Narrows more so during the morning and the evening. Also, statistical differences in age composition between eastbound and westbound sockeye salmon caught in the test fishery during a 2-week timeframe suggest possible stock specific differences in migration routes between Frazer Lake and South Olga Lakes (Upper Station) sockeye salmon stocks.

INTRODUCTION

Since 1986, the Alaska Department of Fish and Game (ADF&G) has operated a set gillnet test fishery within Alitak Bay to assist in the management of the Alitak Bay District (ABD; Figure 1) commercial sockeye salmon fishery. The objective of the test fishery has been to approximate the number of sockeye salmon transiting Olga Narrows into Olga Bay in advance of escapement counts at Dog Salmon Creek and Upper Station weirs.

Alitak Bay, on the southern end of Kodiak Island, deeply indents the Island, with Moser and Olga Bays to the west and Deadman and Portage Bays to the east (Figure 1). The commercial salmon industry has been prominent in Alitak Bay for over a century. Beginning in the late 1880s, salmon canneries have operated at Upper Station, Snug Harbor, Akalura, Chip Cove, and Lazy Bay (Roppel 1986). The processing facility at Lazy Bay is still in operation.

Sockeye Salmon Stocks

Frazer Lake (Dog Salmon Creek) and South Olga Lakes (Upper Station) are the two major sockeye salmon *Oncorhynchus nerka* systems in Alitak Bay. The minor sockeye salmon systems in the bay are Akalura, Horse Marine, and Silver Salmon Lakes. All of these systems drain into Olga Bay (Figure 1). Between 1951 and 1971, sockeye salmon were introduced into Frazer Lake, which, due to a barrier falls, was barren of Pacific salmon (Blackett 1979). In 1962, a fish pass was constructed at the falls which permitted salmon to return to the lake to spawn. This resulted in a self-sustaining population that greatly increased the number of sockeye salmon bound for Olga Bay and accessible for commercial harvest in the ABD.

Commercial Salmon Fishery

The ABD is one of seven commercial fishing districts within the Kodiak Management Area (KMA). The ABD is delimited by Low Cape on the southwest corner of Kodiak Island and Cape Trinity on the Aliulik Peninsula (Figure 1). Due, in part, to the success of the Frazer fish pass, the annual ABD sockeye salmon harvest has increased from an average of 103,412 fish in the 1970s to 673,832 fish in the 1980s, and up to 1,140,440 fish during the 1990s (Table 1). Sockeye salmon are harvested in the ABD using both gillnet and purse seine gear with gear separation by fishing section (Figure 1). The district is divided into 10 fishing sections: Cape Alitak and Humpy-Deadman Sections open to purse seiners and Alitak, Moser, and Olga Bays open to gillnetters. The remaining sections, Dog Salmon Flats, Inner and Outer Akalura, and Inner and Outer Upper Station Sections are closed to fishing unless, by emergency order, they are opened to minimize overescapement into a specific systems.

In the ABD, there are two principal early sockeye salmon runs. Migration timing for South Olga Lakes early run begins in late May and runs until mid-July and Frazer Lake migration begins in early June and runs until late July. Both runs greatly contribute to the economically important commercial salmon harvest in the district, which predominantly occurs during June and July. The Frazer Lake sockeye run is most influential because its run potential is four times that of South Olga Lakes early run (Barrett 1988) and the Frazer Lake sockeye salmon escapement goal is almost 6 times that of South Olga Lakes early run.

The ABD is currently managed under the guidelines set forth by the Alaska Board of Fisheries (BOF) in the Alitak Bay District Salmon Management Plan (5AAC 18.361). The ADF&G attempts to meet system-specific sockeye salmon escapement goals (interim objectives and overall goals) as well as allowing harvest of fish surplus to escapement needs during the commercial fishery season (Brennan et al. 2002). From 5 June to 12 June ADF&G opens short commercial fisheries (33 hours) in the Alitak Bay District to test the strength of the sockeye runs to local systems (Brennan et al. 1998). From 13 June to 15 July, the Cape Alitak, Alitak Bay, Moser Bay, and Olga Bay Sections are managed based on sockeye salmon escapement at Dog Salmon Creek and Upper Station weirs.

Alitak Bay Test Fishery

Currently, an ADF&G Alitak Bay test fishery (located in Chip Cove at the mouth of Olga Narrows; Figure 1) is utilized during June and July to provide data that aids in the management of the ABD commercial salmon fishery. A three-hour test fishery gillnet set is performed daily during the daylight high tide. The data gathered are in the form of a catch per unit effort (CPUE) of sockeye salmon in the gillnet set.

A reliable inseason run strength indicator for the ABD is necessary to ensure optimum escapement while maximizing harvest potential in traditional fishing sections. Prior to 1986, the inseason methods for assessing run strength included sockeye salmon escapement counts at the Dog Salmon Creek and Upper Station weirs, aerial surveys of escapement buildup on the Dog Salmon Flats, and the 9 June ABD commercial fishery sockeye salmon catch. This information was not always timely enough to ensure maximum harvest of surplus production in traditional fishing areas and the achievement of optimum escapement objectives. Salmon bound for both South Olga Lakes and Frazer Lake occasionally mill on Dog Salmon Flats prior to stream migration (Sagalkin and Swanton 2000). An inseason test fishery at Chip Cove, in conjunction with abundance indices from the Alitak Bay District commercial fishery, provides a more timely and accurate gauge of the run strength and timing of the Frazer Lake and Upper Station early run sockeye salmon stocks.

The test fishery CPUE serves as an index of the passage of sockeye salmon through Olga Narrows and into Olga Bay. A vast majority of salmon that move through Olga Narrows eventually will be counted as escapement at Dog Salmon Creek and Upper Station weirs or harvested in the Olga Bay commercial fishery, however this information comes two to six days after the fish have passed through commercial fishing areas. The test fishery CPUE is a good index of movement; however, the predictive ability of the index using past years' data has been poor.

Historical Background

The Alitak Bay sockeye salmon test fishery was initiated in 1986 with four different sites utilizing existing private set gillnet locations. These sites included one in Deadman Bay, two in Moser Bay, and one in Alitak Bay. The test fishery sites were fished between 14 June and 6 July with 50 fathoms of 4.75-inch stretch mesh (40 mesh deep) multistrand molnofilament gillnet. The catch at each site was summed to form a single day's index. Due to the logistics and monitoring of four different catch sites as well as standardizing fishing time, it was recommended that the test fishery be confined to one area (Barrett 1987). The test fishery was moved to Egg Island, at the mouth of Lazy Bay, in 1987 but the catches were insignificant.

In 1988, the test fishery was moved to the north side of Chip Cove at the mouth of Olga Narrows where it has remained since. The test fishery operated during the month of June only and was fished for two hours, one hour before and one hour after the high tide of the day. Starting in 1989, the test fishery set time was increased to 3 hours a day (1.5 hours before and 1.5 after the high tide of the day) and operated through the month of June, until 1991 when it was extended until mid-July.

Between 1991 and 1997, with the exception of 1995, the test fishery was conducted on a daily basis, regardless of commercial fishery openings. In an effort to subsidize the test fishery operation, fishing time during the 1997 season was extended until dark. A 1997 strike by the fishermen, in addition to the extended test fishery time, provoked criticism from local area fishermen about the value of the test fishery project (Sagalkin and Swanton 2000).

In response to public disapproval, the test fishery was reorganized for the 1998 season and returned to the 3-hour set during the daylight high tide. In addition, the test fishery was reduced to fishing only during commercial closures. In 1999, the test fishery operation was expanded to operate through the month of July though still only during commercial closures. Since 2000, the test fishery operation has remained relatively consistent. Starting on 27–29 May and going through 28–29 July, the test fishery operates, on average, at least six days a week. Normally, days off from the test fishery are selected in conjunction with commercial fishery openings, when catch rates are extremely low and far more predictable.

Research and Modeling

From the initiation of the test fishery in 1986, the main objectives have been to: 1) estimate the number of fish passing through Olga Narrows based on the magnitude of test fish catches; and 2) periodically estimate the stock contributions of Frazer and South Olga Lakes to the sockeye migration passing through Olga Narrows. Additionally, since 1985, commercial catches in the ABD have been sampled and classified to stock of origin for run reconstruction. Scale pattern analysis (SPA) and the construction of discriminant functions are used to classify the test and commercial catches to stock of origin (Swanton 1992). In 1994, stock contribution estimates were no longer generated from the test fishery due to small sample sizes and the short time frame of the test fishery (Sagalkin and Swanton 2000). In

1998, inseason stock contribution estimates were no longer generated from the Alitak Bay commercial catch samples; however, the test fishery crew has continued to play an active role sampling the commercial catch from the Cape Alitak Section. These samples are used for postseason SPA.

Modeling the passage of sockeye salmon though Olga Narrows, utilizing test fishery CPUE data, was initiated by Kodiak ADF&G research staff in 1989. After standardizing for 180 minutes, the total annual CPUE was determined. The total was divided into a Frazer Lake and South Olga Lakes component using SPA. A weighting factor was developed for each sytems by dividing the annual test fishery CPUE by the estimated total run (this included Dog Salmon Creek and Upper Station escapement plus Moser-Olga Bay catch). On a daily basis, the test fishery catch would be standardized and then multiplied by the weighting factor to estimate movement of sockeye through the narrows. The weighting factor, which was system-specific, was estimated inseason using SPA data from previous years. This method was found to be inaccurate due to the variable run sizes to Frazer Lake and South Olga Lakes and was discontinued in 1993 (Sagalkin and Swanton 2000).

In 1995, ADF&G re-established attempts to model passage of sockeye salmon through Olga Narrows. Linear regression relationships between test fishery CPUE and Dog Salmon Creek escapement, Upper Station escapement, and Olga Bay catch were evaluated. The assumption behind this model was that fish present at Olga Narrows would eventually wind up in the Olga Bay commercial catch, at the Dog Salmon Creek weir, or at the Upper Station weir, considering separate lag times (in days) for each. Lag times were estimated by graphically viewing spreadsheets of test fish and commercial catch, and escapement data. Initially, the daily estimated passage of fish through Olga Narrows was regressed against the daily test fishery CPUE but difficulties in lag time estimation persisted. In 1996, the strategy was altered such that the cumulative Olga Narrows passage was regressed against the cumulative test fishery CPUE on a daily basis using past years' data in the regression analyses. This new approach produced results that were closer to realistic values than previous efforts; however, only selected years were used and many daily values were omitted for the analysis (Sagalkin and Swanton 2000).

During the 1998 season, test fishing was limited to commercial fishery closures and modeling endeavors were discontinued. Consistent data sets (through the month of July) since 1999 have prompted reevaluation of the merit of the test fishery and modeling value. Funding for the test fishery was continued in 2000, with the stipulation that, after a three-year study, the merit of the test fishery would be re-examined.

OBJECTIVES

The objectives of this paper are to:

1) Present analysis of Alitak Bay test fishery data from 1996 to 2002.

2) Describe the conclusions resulting from the analyses and recommend direction for the test fishery in the future.

METHODS

Alitak Bay test fishery sockeye salmon CPUE (standardized to 180 minutes; Table 2) between 1999 and 2002 were individually calculated and compared, by day, to sockeye escapement at Dog Salmon and Upper Station weirs and Olga Bay commercial catch (Table 3). The relationship between test fishery CPUE and sockeye salmon passage through Olga Narrows was analyzed using simple linear regression. Cumulative daily estimated passage of sockeye salmon through Olga Narrows (utilizing lag times, by year, for each catch and escapement assembly) was regressed on cumulative daily test fishery CPUE.

In 1999, the test fishery was operated only during commercial fishery closures, while in 2002 there was no commercial effort in Moser or Olga Bays. During 2000 and 2001, the test fishery operated about six days a week, regardless of commercial fisheries. One problem in standardizing the analysis between years was how to treat days during June and July when the test fishery was not conducted. During commercial fishery closures, the average test fishery CPUE of adjacent days was used. The average test fishery CPUE while the fishery was open was calculated from the 2000-2001 season (8 sockeye) and used to estimate days when the commercial fishery was open.

Lag times, essentially travel times between the test fishery at the mouth of Olga Narrows and the Dog Salmon weir, the Upper Station weir, or the Olga Bay fishery, were calculated separately each year, by minimizing the correlation coefficient of the regressions. Lag times, in days, evaluated for each system were: between one and four days for the Olga Bay catch, between one and five days for Dog Salmon weir escapement, and between two and seven days for Upper Station weir escapement.

Climatic data from the Booth Lake remote automated weather station (RAWS) were compiled for May, June, and July 1999 through 2002 to serve as an index of weather affecting the test fishery. This station is maintained by the Alaska Fire Service (a division of the Bureau of Land Management), as part of the Alaska fire weather database, and has operated consistently since 1996.

It is approximately 10 miles northwest of Upper Olga Bay and 22 miles from the test fishery site at Chip Cove. Another RAWS, located at Cape Kiavak and maintained by the U.S. Fish and Wildlife Service, is equidistant from Chip Cove but did not come into operation until 2002. A variety of climatic conditions, including wind direction, wind velocity, and air temperature are recorded on a hourly basis at the weather station and are fully accessible (real time) on the internet.

Qualitative analysis of tidal and diurnal effects on test fishery catches was performed. Local weather data, particularly wind direction and air temperature, were quantified and investigated as possible factors effecting the test fishery CPUE. During each test fishery set, weather data are collected by the crew including: air temperature, water temperature, wind direction, wind velocity, and percent cloud cover.

Due to the success in the resulting analysis of air temperature effect on the test fishery, CPUE data from 1996 through 1998 were also examined. Booth Lake RAWS data goes back to 1996, however only 1996 and 1997 could be used for further analysis, as there were too few test fishery days in 1998 (n = 20) to be useful.

During the period of 19 June through 8 July 2002, the test fishery crew separated the sockeye salmon captured headed out of Chip Cove (eastbound) from those headed into Chip Cove (westbound); this was based on the orientation of the fish in the gillnet. Scales were collected and age composition (excluding 1-ocean jacks) was independently compared between eastbound samples, westbound samples and escapement samples from Frazer and Upper Station weirs.

RESULTS

The test fishery cumulative CPUE was found to be an excellent indicator of cumulative passage of sockeye salmon through Olga Narrows and into Olga Bay from 1996–1997 and 1999–2002 (Figures 2–7). Values of R^2 range from 0.937 in 1999 to 0.984 in 1997. Regression slope estimates ranged from 310.9 in 2000 to 124.0 in 1997 (Table 4). Two regressions were constructed for each year, one assuming that the intercept was zero and one that estimated the intercept. Regressions utilizing the intercept estimates were used for further analysis. The rationale for this was that zero fish may be caught in the test fishery though sockeye may still pass through Olga Narrows, and conversely, sockeye may be captured in the test fishery though no fish pass through the narrows. All regressions were highly significant, however regression slopes (essentially inverse rates or weighting of test fishery catch) differed annually.

From 1999 to 2002, average temperature (by hour) during the span of the test fishery, as indexed by Booth Lake RAWS (Table 4; Figure 8), regressed against the slope of the cumulative test fish CPUE and Olga Narrows passage regression, explained 96.9% of the variation (Figure 9). The slope of the cumulative passage regression is essentially an estimate of the test fishery rate of catch compared to the number of sockeye migrating through the narrows; the steeper the slope the lower the rate of test fishery catch. For example, a slope of 250 corresponds to the test fishery catching an average of about 1 out of every 250 sockeye migrating through the narrows. One divided by the slope represents a weighting factor for that year’s test fishery CPUE. Natural log transformation of both variables produced a regression with an R^2 value of 0.99 and $P \leq 0.005$ (Figure 10).

Additional investigation including 1996 and 1997 test fishery data strengthened the average air temperature relationship (Figures 11–12) with an increased sample size and continued linearity following natural log transformation of the variables (R^2 value of 0.95 and $P \leq 0.005$). The need for additional data points superceded the concern that the test fishery during those years (1996 and 1997) operated only through the 15 July, as opposed to the end of the month.

Estimated travel time (lag days) between the test fishery in Chip Cove (outside Olga Narrows) and the Olga Bay fishery and the Dog Salmon Creek or Upper Station weir varied between years, but were not apparently independent of each other (Figure 13), meaning that short travel times to Olga Bay fishery corresponded to short travel times to the weirs as well. Travel time from Chip Cove to the Olga Bay fishery ranged from 1 to 3 days; to escapement at Dog Salmon weir, travel time ranged from 2 to 4 days; to escapement at Upper Station weir, travel ranged from 3 to 6 days. Average travel time to Olga Bay was 2.4 days while travel time to Dog Salmon was 3.5 days. Travel time to Upper Station was estimated at 4.8 days.

Between 1999 and 2002, no solid correlation was found between the time of the test fish set (based on time of the high tide) and the rate of the test fishery catch. However, with the variable of commercial fishery openings removed in 2002, a scatter plot of test fishery catch versus time of day suggests that sockeye salmon migrate through Olga Narrows more so during the morning and the evening (Figure 14).

No solid relationships were discovered between tidal height and the rate of test fishery catch. Wind speed was found to affect the test fishery catch in that less fish were caught when the wind velocity was calm. Wind however, is such a dynamic and difficult variable to quantify that attempts to use wind speed and direction as a test fishery indicator was unproductive. Wind speed and direction in Alitak Bay influences the number of sockeye travelling through Olga Narrows days in advance of availability to the test fishery.

Although samples sizes were small, age comparisons from sockeye headed out of Chip Cove (eastbound) and sockeye headed into the cove (westbound) suggested that there could be stock-specific migration differences between Frazer and Upper Station bound sockeye at the mouth of Olga Narrows (Table 5). Total age differences between eastbound and westbound sockeye salmon in the test fishery were difficult to evaluate, but when separated into ocean age classes differences become more apparent. There was a significant difference (α=0.1) in the proportion of 2-ocean sockeye between the eastbound and westbound test fishery samples, as there was between the Frazer and Upper Station weirs samples of sockeye salmon ocean-age compositions.

DISCUSSION

Previous Alitak Bay test fishery modeling efforts were unsuccessful because they assumed that the test fishery weighting factor could be approximated using some sort of average of previous years. However, this analysis provides good evidence that the weighting factor is not an independent and random variable. It appears to fluctuate, indirectly or directly, with the average seasonal air temperature. Average temperature during the test fishery timeframe explained over 95% of the variation in the rate of test fishery catch (weighting factor) between years 1996 to 2002 (between 1999 and 2002, the temperature explained over 99% of the variation), and it did so under dramatic changes in run strength and relative proportions of Frazer Lake and South Olga Lakes sockeye salmon in the total run. Without exception, a higher average temperature resulted in a higher weighting factor for the test fishery catch. Moreover, the range in temperature data from 1996 to 2002 contained extreme conditions; 1997 was the warmest since 1979 and 2000 was the coldest since 1985 (Figure 8). Only recently has such a detailed weather account been available for the south end of Kodiak Island. A greater time series will yield better information about the strength of this relationship.

The results of the test fishery analyses indicate that average air temperature greatly affects the test fishery CPUE weighting factor. One hypothesis to explain this relationship is that increased temperature leads to increased plankton in the marine environment, leading to decreased water visibility and increased catchability of sockeye salmon in the vicinity of the test fishery net. However, this is only speculative because marine plankton blooms are caused by a complex balance of light, temperature, nutrients, and water stability (Waller 1996).

This visibility hypothesis will be tested during the 2003 season using a portable electronic photometer to quantify the amount of light (hence visibility) in the water adjacent to the test fishery gillnet site (Foster 2003). In addition, a 300-mm secchi disk will be utilized as an alternative measure of water clarity.

Currently the average temperature throughout the timeframe of the test fishery is an excellent estimator of Olga Narrows sockeye salmon passage; however, this estimator can only be determined postseason. Greater utility lies in the production of an inseason estimator or a daily weighting factor for test fishery CPUE. Temperature, alone, probably cannot act as a daily weighting factor for the catchability of the test fishery gillnet since it varies diurnally, but evidently can act as a seasonal indicator of the weighting factor. Accurate water clarity data from the 2003 season will be analyzed and incorporated into the Olga Narrows passage model with the goal of developing a water clarity scaling factor to produce the daily test fishery weighting factor.

Analysis of 2002 data suggests that sockeye salmon migrate through Olga Narrows primarily during morning and evening (less during mid-day). Additionally, age composition differences between eastbound and westbound test fishery catch suggest some stock-specific migration differences. Assuming there are no differences in migration routes of different age classes within the same stock, Frazer Lake sockeye may tend to migrate on the west side of Moser Bay and Upper Station sockeye may tend to migrate on the east side of Moser Bay.

RECOMMENDATIONS

This study illustrates the potential merit of the Alitak Bay test fishery that, with suitable direction, may become a much more valuable tool in the management of the ABD. It is recommended that the Alitak Bay test fishery operate for at least three additional years. During that time, additions to the operational strategy will be to collect accurate water clarity (visibility) data, separate eastbound and westbound migrating sockeye (according to gillnet orientation) scale samples, and erect a portable weather station to accurately record weather. These additions will allow analysis of the water clarity data (visibility hypothesis) and the eastbound/westbound migrating sockeye salmon. Results may yield information to more accurately estimate the movement of sockeye salmon through Olga Narrows inseason on a daily basis.

LITERATURE CITED

Barrett, B. 1987. Unpublished memorandum to Pat Holmes. Located: Alaska Department of Fish and Game Kodiak, Finfish Research Library: Box #7, Alitak.

Barrett, B. 1988. A Regulatory recommendation pertaining to a closed-waters area off Dog Salmon Creek, Alitak Bay District, Kodiak Management Area. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K88-13.

Blackett, R. 1979. Establishment of sockeye (*Oncorhynchus nerka*) and chinook (*O. tshawytscha*) salmon runs at Frazer Lake, Kodiak Island, Alaska. J. Fish. Res. Bd. Can. 36:1265-1277.

Brennan, K. 1998. The Alitak Bay District commercial salmon fishery, 1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K98-55.

Brennan, K, D. Gretsch, and J. Wadle. 2002. Kodiak management area harvest strategy for the 2002 commercial salmon fishery. Alaska Department of Fish and Game, Regional Information Report 4K02-31, Kodiak.

Foster, M. 2003. Alitak Bay Sockeye Salmon Test Fishery Operational Plan, 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K03-xx.

Roppel, P. 1986. Salmon from Kodiak: a history of the salmon fishery of Kodiak Island, Alaska. Alaska Historical Commission studies in history No. 216, Anchorage.

Sagalkin N., and C. Swanton. 2000. The Moser-Olga Bay test fishery: research, historical perspective, and management importance. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K00-29.

Swanton, C. 1992. Stock interrelationships of sockeye salmon runs, Alitak Bay District, Kodiak Island, Alaska. MS. Thesis, University of Washington, Seattle.

Waller, G. (Editor) 1996. SeaLife: A complete guide to the marine environment. Smithsonias Institution Press, Washington D.C. 504 pp.

Table 1. Commercial sockeye salmon harvest for Alitak Bay District in the Kodiak Management Area, by gear, 1970 to 2002.

	Gear Type			
Year	Purse Seine	Beach Seine	Set Gillnet	Total
1970	19,252	276	62,016	81,544
1971	55,327	187	68,966	124,480
1972	6,453	228	15,446	22,127
1973	3,700	189	6,449	10,338
1974	32,550	773	34,420	67,743
1975	4,549	197	11,752	16,498
1976	28,250	54	68,711	97,015
1977	24,421	53	54,338	78,812
1978	88,399	522	129,380	218,301
1979	156,816	1,584	158,860	317,260
1980	34,403	1,849	161,676	197,928
1981	89,489	2,036	254,548	346,073
1982	65,730	1,438	409,694	476,862
1983	189,884	892	269,311	460,087
1984	123,117	3,398	256,214	382,729
1985	261,237	1,687	440,311	703,235
1986	522,893	100	724,983	1,247,976
1987	192,947	259	322,204	515,410
1988	470,522	7	653,318	1,123,847
1989	107	0	1,284,067	1,284,174
1990	690,766	52	744,643	1,435,461
1991	864,648	296	1,197,774	2,062,718
1992	248,216	483	276,459	525,158
1993	474,096	0	524,655	998,751
1994	430,462	0	500,866	931,328
1995	890,194	0	782,998	1,673,192
1996	676,011	0	782,204	1,458,215
1997	282,047	0	403,588	685,635
1998	435,018	0	567,572	1,002,590
1999	193,096	0	438,260	631,356
2000	237,614	0	321,060	558,674
2001	166,550	0	295,235	461,785
2002	14,575	0	0	14,575
Avg. Total	241,616	502	370,363	612,481
Avg. 1970s	41,972	406	61,034	103,412
Avg. 1980s	195,033	1,167	477,633	673,832
Avg. 1990s	518,455	83	621,902	1,140,440
Avg. 2000-2002	139,580	0	205,432	345,011

Table 2. Daily estimates of catch per unit effort (CPUE) for the Alitak Bay Test Fishery at Chip Cove, 1988 to 2002.

	Year														
Date	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
5/27	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	7	[a]	[a]
5/28	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	18	[a]	0
5/29	[a]	10	7	26	2	[a]	4	44	[a]	[a]	[a]	[a]	8	47	3
5/30	[a]	15	3	26	5	[a]	29	18	30	38	[a]	[a]	2	47	3
5/31	11	21	4	30	10	57	2	11	17	72	[a]	[a]	[a]	[a]	[a]
6/1	42	8	7	34	14	67	16	30	73	12	0	[a]	51	101	0
6/2	59	16	6	37	16	19	17	50	87	15	30	[a]	29	99	2
6/3	42	79	23	6	24	3	36	75	30	44	0	36	55	6	0
6/4	9	122	24	8	30	58	13	74	100	72	0	89	44	[a]	[a]
6/5	36	42	30	12	12	87	32	30	62	47	2	24	40	[a]	41
6/6	8	92	44	22	6	18	8	132	102	91	33	21	77	121	12
6/7	24	61	52	25	63	77	4	40	26	95	0	8	3	104	1
6/8	13	42	34	41	90	59	58	61	120	33	0	12	35	82	15
6/9	26	54	14	11	20	2	1	[a]	98	0	[a]	[a]	[a]	5	0
6/10	[a]	58	14	19	0	3	0	[a]	0	0	[a]	[a]	4	[a]	10
6/11	17	20	57	36	7	89	26	185	75	49	1	15	0	29	2
6/12	65	55	16	29	66	1	6	[a]	40	56	5	33	2	203	88
6/13	48	71	6	12	10	23	47	[a]	18	65	60	83	37	123	19
6/14	191	20	2	22	53	27	111	[a]	10	48	[a]	20	85	139	31
6/15	[a]	59	5	24	100	5	75	[a]	9	79	[a]	23	1	[a]	37
6/16	22	40	16	37	60	3	120	[a]	6	83	61	35	[a]	[a]	12
6/17	48	21	18	43	22	4	45	[a]	2	115	[a]	32	2	4	26
6/18	35	76	22	19	14	8	0	[a]	0	125	[a]	70	1	0	12
6/19	89	[a]	27	5	3	130	2	[a]	8	62	[a]	48	1	0	36
6/20	19	[a]	26	4	1	97	5	[a]	1	37	[a]	[a]	[a]	16	23
6/21	66	[a]	92	3	18	27	0	[a]	3	135	[a]	[a]	9	[a]	40
6/22	15	[a]	98	4	24	7	11	[a]	5	12	[a]	51	18	66	40
6/23	61	[a]	26	12	1	35	48	[a]	83	6	[a]	60	12	46	35
6/24	39	90	45	15	2	39	35	[a]	57	3	[a]	36	2	0	2
6/25	27	54	26	41	2	54	121	[a]	120	4	[a]	[a]	0	[a]	4
6/26	[a]	63	12	27	0	4	35	[a]	50	2	103	[a]	4	31	16
6/27	[a]	104	4	106	[a]	0	2	[a]	26	5	40	[a]	[a]	39	4
6/28	[a]	82	42	97	2	8	4	[a]	12	6	56	[a]	4	12	30
6/29	8	72	16	47	33	22	0	[a]	14	2	[a]	19	3	[a]	23
6/30	5	81	2	90	100	56	0	[a]	16	4	[a]	69	6	0	1
7/1	[a]	123	10	53	93	89	0	[a]	45	44	[a]	24	14	5	23
7/2	[a]	72	1	122	10	13	1	[a]	18	48	27	28	15	24	25

-Continued-

Table 2. (page 2 of 2)

	Year														
Date	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
7/3	[a]	22	1	74	5	41	18	76	7	54	49	22	4	28	14
7/4	[a]	18	1	40	10	31	17	89	[a]	[a]	43	53	7	17	[a]
7/5	[a]	48	3	46	0	5	114	52	84	89	[a]	95	[a]	[a]	49
7/6	[a]	30	2	6	0	2	105	27	0	113	[a]	29	0	3	16
7/7	[a]	51	3	19	2	4	5	[a]	0	105	[a]	50	0	0	11
7/8	[a]	28	2	17	1	2	1	[a]	5	6	[a]	64	0	0	18
7/9	[a]	38	2	14	19	3	1	[a]	0	0	[a]	126	12	1	[a]
7/10	[a]	34	2	5	12	1	0	[a]	0	15	[a]	64	43	[a]	3
7/11	[a]	34	2	46	62	1	[a]	[a]	0	20	[a]	84	35	0	1
7/12	[a]	28	[a]	2	72	1	[a]	[a]	1	120	[a]	76	45	41	10
7/13	[a]	15	[a]	5	37	0	[a]	[a]	0	103	76	84	33	31	2
7/14	[a]	[a]	[a]	2	27	0	[a]	[a]	0	64	78	69	2	57	4
7/15	[a]	[a]	[a]	3	6	1	[a]	[a]	2	4		54	[a]	1	4
7/16	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	56	1	5	4
7/17	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	35	20	[a]	2
7/18	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	56	14	1	6
7/19	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	66	65	[a]	0
7/20	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	71	1	6	0
7/21	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	89	1	42	8
7/22	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	2	26	4
7/23	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	8	2
7/24	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	10	2	2	10
7/25	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	83	49	[a]	1
7/26	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	72	27	53	3
7/27	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	42	22	8
7/28	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	4	14	4
7/29	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	45	[a]
7/30	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]		[a]	[a]
7/31	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]			[a]	[a]

[a] Test Fishery not conducted.

Table 3. Estimated escapement for Upper Station and Dog Salmon weirs and Olga Bay commercial sockeye salmon catch, 1999 through 2002.

	Upper Station Weir				Dog Salmon Weir				Olga Bay Catch			
Date	1999	2000	2001	2002	1999	2000	2001	2002	1999	2000	2001	2002
5/25			876									
5/26		210	739									
5/27		0	338	412								
5/28		0	2,678	272			2,500					
5/29	6	1,084	1,572	138			1,537					
5/30	9	1,615	1,618	969			9,564					
5/31	27	1,006	4,322	1,106			898					
6/1	0	1,581	2,589	1,136			914					
6/2	0	655	4,916	664			10,649					
6/3	15	2,944	4,126	1,178			3,101					
6/4	396	2,039	3,134	452			11,059					
6/5	305	3,445	2,494	1,295			3,872	5,060				
6/6	657	6,798	3,262	610			3,812	1,798				
6/7	44	5,929	5,623	1,807			15,605	506				
6/8	73	3,762	4,936	427		144	7,730	655				
6/9	63	4,252	2,713	1,923		0	9,017	4,500	1,119	5,716	5,153	0
6/10	1	5,788	2,786	1,552		33	8,104	1,500	3,936	5,358	4,705	0
6/11	398	465	2,088	1,652		12	2,970	3,560	0	0	0	0
6/12	1,615	1,250	2,529	1,503		91	4,249	4,521	0	0	0	0
6/13	2,210	1,270	3,625	1,365		3,629	14,817	4,048	0	0	0	0
6/14	674	662	2,550	673		10,106	10,493	1,226	0	4,116	3,523	0
6/15	302	3,475	2,293	2,279		23,897	5,718	2,238	0	2,223	2,737	0
6/16	210	985	968	1,207		24,014	133	2,889	0	616	956	0
6/17	5,024	198	702	1,341		10,008	394	2,020	0	1,139	630	0
6/18	371	310	326	964	0	7,690	202	1,821	0	467	145	0
6/19	1,592	572	311	1,029	0	2,202	297	1,475	0	471	268	0
6/20	2,186	581	81	950	0	3,215	251	1,921	17,198	1,271	335	0
6/21	5,616	61	62	820	0	5,450	116	3,052	19,382	421	159	0
6/22	3,494	106	39	657	0	329	101	2,574	0	0	0	0
6/23	582	178	180	568	80	453	1,432	774	0	0	0	0
6/24	0	373	204	669	0	2,128	2,362	1,602	0	1,730	2,418	0
6/25	122	315	149	1,062	0	4,762	2,375	2,249	7,056	2,455	1,345	0
6/26	1,629	94	341	601	13,142	5,907	222	2,396	7,026	646	448	0
6/27	2,219	225	255	151	12,059	591	2,157	1,243	8,967	848	471	0
6/28	913	146	205	143	13,132	1,323	166	2,654	2,821	268	950	0
6/29	107	98	197	157	6,508	781	291	509	0	219	621	0
6/30	0	72	173	1,082	7,469	203	61	1,762	0	164	294	0
7/1	11	46	107	345	476	263	1,287	2,984	0	0	203	0
7/2	0	30	34	349	1,572	1,564	306	2,435	0	0	0	0
7/3	0	37	39	229	392	579	129	2,243	0	2,297	0	0
7/4	13	20	38	148	74	2,307	1,976	1,791	0	1,045	4,909	0
7/5	2,462	81	108	363	513	1,878	4,771	851	0	436	2,747	0
7/6	1,596	12	84	53	1	3,529	1,761	629	0	129	448	0

-Continued-

Table 3. (page 2 of 3)

	Upper Station Weir				Dog Salmon Weir				Olga Bay Catch			
Date	1999	2000	2001	2002	1999	2000	2001	2002	1999	2000	2001	2002
7/7	811	22	72	502	133	801	681	3,269	0	42	201	0
7/8	279	83	28	263	7	19	529	2,113	0	82	400	0
7/9	62	144	33	98	24	1,197	346	636	0	0	325	0
7/10	226	52	19	347	42	1,300	128	2,927	0	0	187	0
7/11	17	37	16	254	42	8,013	566	895	0	0	152	0
7/12	34	72	0	170	223	8,219	529	3,460	0	0	0	0
7/13	98	1,844	3	259	1,909	8,511	212	16	0	0	0	0
7/14	34	528	62	217	2,100	7,167	2,130	1,308	0	3,324	2,503	0
7/15	18	208	151	391	5,141	325	1,159	665	0	869	1,304	0
7/16	4	271	42	343	743	963	1,785	781	0	52	345	0
7/17	49	680	77	302	6,535	525	790	1,786	0	0	237	0
7/18	69	11	54	416	11,578	1,099	82	1,683	0	0	183	0
7/19	1,050	321	19	657	16,896	3,315	0	377	0	0	89	0
7/20	9,513	171	18	178	18,779	1,413	195	826	0	4,204	0	0
7/21	12,291	5,883	0	715	21,682	1,874	261	713	0	1,900	0	0
7/22	3,024	1,223	0	490	12,881	375	357	1,001	3,504	130	3,721	0
7/23	2,279	106	104	312	20,894	118	390	385	1,914	64	1,709	0
7/24	117	110	195	971	4,172	256	452	853	0	86	304	0
7/25	346	142	301	743	2,972	562	347	269	0	0	231	0
7/26	54	1,311	70	1,395	4,035	1,114	142	151	0	0	0	0
7/27	2,403	2,890	131	798	4,657	1,354	411	1,487	5,356	2,144	0	0
7/28	8,543	4,578	383	803	4,053	490	384	977	4,621	617	0	0
7/29	2,965	1,411	846	2,092	5,468	461	822	1,112	358	364	0	0
7/30	826	321	1,882	1,162	3,733	410	574	700	320	0	1,878	0
7/31	0	220	1,322	169	1,755	266	674	669	238	0	1,102	0
8/1	0	645	218	3,027	1,409	712	73	613	0	0	515	0
8/2	0	390	165	1,982	2,397	438	82	449	0	0	380	0
8/3	300	3,515	161	3,242	3,067	290	64	893	3,488	2,649	0	0
8/4	0	13,328	541	3,993	544	313	68	701	878	1,135	0	0
8/5	7,704	3,003	890	2,635	389	205	97	766	519	363	0	0
8/6	2,131	456	2,267	4,831	776	199	138	348	743	181	0	0
8/7	1,136	423	1,247	2,760	92	362	141	621	509	198	0	0
8/8	94	408	2,703	7,003	291	97	46	602	0	0	0	0
8/9	34	3,225	3,897	5,873	82	461	161	396	0	0	0	0
8/10	316	7,497	3,941	6,130	999	263	90	302	0	0	1,369	0
8/11	17,078	5,234	3,997	4,359	0	372	25	176	4,621	0	2,165	0
8/12	3,981	4,988	543	2,979	819	211	81	170	3,694	0	0	0
8/13	22	7,850	221	4,264	1,901	328	51	123	1,245	1,906	0	0
8/14	0	3,749	680	3,197	187	116	39	226	1,094	949	0	0
8/15	163	5,351	4,336	7,801	201	62	26	126	1,125	0	0	0
8/16	2,549	3,890	3,003	3,095	493	180	155	73	982	0	0	0
8/17	62	5,331	4,195	5,950	190	316	121	85	916	0	0	0
8/18	0	7,862	2,402	6,289	251	188	41	152	0	0	0	0
8/19	10,498	6,621	3,057	4,404	123	115	35	120	0	0	0	0
8/20	14,166	7,476	3,014	5,302	169	79	71	63	0	0	0	0

-Continued-

Table 3. (page 3 of 3)

	Upper Station Weir				Dog Salmon Weir				Olga Bay Catch			
Date	1999	2000	2001	2002	1999	2000	2001	2002	1999	2000	2001	2002
8/21	28,503	11,932	1,521	3,311	320	133	11	29	0	0	0	0
8/22	12,603	7,093	2,878	1,894	451	83	31	85	3,116	0	0	0
8/23	19,779	3,358	1,893	1,910	154	50	10	61	3,000	0	0	0
8/24	10,962	9,934	1,691	4,300	17	51	7	45	509	0	0	0
8/25	205	4,993	1,762	2,345	36	44	300[a]	54	303	840	0	0
8/26	398	2,152	1,664	2,959	43	9		14	2,072	186	0	0
8/27	1,638	3,619	1,453	2,749	97	31		150[a]	1,399	305	0	0
8/28	778	1,101	1,732	2,409	1,600[a]	400[a]			528	0	0	0
8/29	85	1,477	1,563	3,615					595	599	0	0
8/30	148	1,781	836	3,676					352	370	0	0
8/31	2,089	1,815	1,579	1,943					289	226	0	0
9/1	840	236	1,806	1,840					0	0	0	0
9/2	3,985	1,848	2,105	3,634					0	0	0	0
9/3	7,549	4,003	880	1,127					568	0	0	0
9/4	6,281	2,849	1,019	1,163					1,150	0	0	0
9/5	3,712	2,247	282	2,399					1,010	0	0	0
9/6	1,549	987	677	83					361	0	0	0
9/7	1,111	2,271	964	0					490	0	0	0
9/8	1,399	1,357	159	1,302					41	0	0	0
9/9	835	53	233	196					200	0	0	0
9/10	1,800[a]	282	228	2,051					74	0	0	0
9/11		266	260	190					118	0	0	0
9/12		38	300[a]	594					19	0	0	0
9/13		200[a]		1,083					0	0	0	0
9/14				401					0	0	0	0
9/15				347					0	0	0	0
9/16				561					153	0	0	0
9/17				372					0	0	0	0
9/18				126					0	0	0	0
9/19				687					0	0	0	0
9/20				420[a]					0	0	0	0
Total	244,737	232,343	140,901	186,731	221,370	172,943	163,009	105,838	119,977	55,820	52,765	0

[a] Post-weir estimate

Table 4. Linear regression statistics from the relationship between cumulative test fishery CPUE and estimated cumulative passage of sockeye salmon through Olga Narrows, start and end dates, average temperature, and travel time from the test fishery location to catch and escapement locations by year (excluding 1998).

Statistic	Year											
	1996*		1997*		1999		2000		2001		2002	
	Intercept		Intercept		Intercept		Intercept		Intercept		Intercept	
	Estimated	Set to 0	Estimated	Set to 0	Estimated	Set to 0	Estimated	Set to 0	Estimated	Set to 0	Estimated	Set to 0
Multiple *R*	0.983	0.977	0.992	0.987	0.968	0.966	0.975	0.971	0.991	0.989	0.988	0.974
R Square	0.967	0.954	0.984	0.975	0.937	0.933	0.950	0.944	0.982	0.978	0.976	0.949
Adjusted *R* Square	0.966	0.932	0.983	0.953	0.936	0.915	0.949	0.928	0.982	0.961	0.975	0.933
Standard Error	14,370	16,800	10,296	12,648	27,963	28,509	20,117	21,172	9,047	10,111	6,956	9,949
Observations	47	47	47	47	54	54	63	63	62	62	62	62
Significance	5.41E-35	6.28E-32	5.88E-42	6.28E-38	6.46E-33	1.83E-32	2.18E-41	5.08E-40	2.36E-54	1.89E-51	3.81E-50	8.38E-41
Slope	175.6	156.9	124.0	113.7	153.8	145.8	310.9	288.0	125.1	133.2	139.6	159.0
Standard Error	4.8	2.3	2.4	1.4	5.5	3.2	9.1	4.1	2.2	0.9	2.8	2.2
P	5.41E-35	3.98E-48	5.88E-42	2.87E-51	6.46E-33	2.27E-44	2.18E-41	6.40E-61	2.36E-54	1.84E-80	3.81E-50	2.45E-61
Intercept	-22,047.7	0.0	-15,380.4	0.0	-11,874.9	0.0	-16,529.6	0.0	12,776.4	0.0	13,410.8	0.0
Standard Error	5,215.9	N/A	3,112.2	N/A	6,752.2	N/A	5,965.8	N/A	3,174.7	N/A	1,666.1	N/A
P	1.14E-04	N/A	1.12E-05	N/A	8.45E-02	N/A	7.40E-03	N/A	1.63E-04	N/A	4.04E-11	N/A
Weighting (1/slope)	0.0057	0.0064	0.0081	0.0088	0.0065	0.0069	0.0032	0.0035	0.0080	0.0075	0.0072	0.0063
Test Fishery	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
Dates	30-May	15-Jul	30-May	15-Jul	3-Jun	31-Jul	27-May	28-Jul	29-May	29-Jul	28-May	28-Jul
Avg. Temp. (F)*	50.1		52.5		50.7		48.2		51.9		51.2	

* Note: 1996 and 1997 data does not represent the same timeframe as the 1999 through 2002.

* Note: Average temperature indexed from Booth Lake remote automated weather station (RAWS) and is calculated from start to end date of test fishery.

Table 5. Age compositions of test fishery catch, by migration direction, and associated sockeye salmon escapement at Frazer Lake and Upper Station, 2002.

Location Date	Sample Size		Total Age 1.2	1.3	1.4	2.2	2.3	3.3	Total
Test Fishery Eastbound		Percent	2.8	12.7	1.7	14.4	59.1	9.4	100.0
6/19-7/8	183	Number	5	23	3	26	107	17	181
Test Fishery Westbound		Percent	3.6	9.7	1.8	24.8	57.0	3.0	100.0
6/19-7/8	168	Number	6	16	3	41	94	5	165
Frazer Lake		Percent	1.4	9.5	2.1	22.6	57.1	7.2	100.0
6/26-7/15	655	Number	327	2,267	504	5,369	13,562	1,720	23,749
Upper Station	543	Percent	3.7	0.3	0.0	57.4	37.5	1.2	100.0
6/23-7/12		Number	56	4	0	885	579	18	1,542

		Ocean Age 2-ocean	3-ocean		Ocean Age 2-ocean	3-ocean
Test Fishery Eastbound				*Frazer Lake*		
6/19-7/8	Percent	17.1	81.2	6/26-7/15	24.0	73.9
Test Fishery Westbound				*Upper Station*		
6/19-7/8	Percent	28.5	69.7	6/23-7/12	61.0	39.0

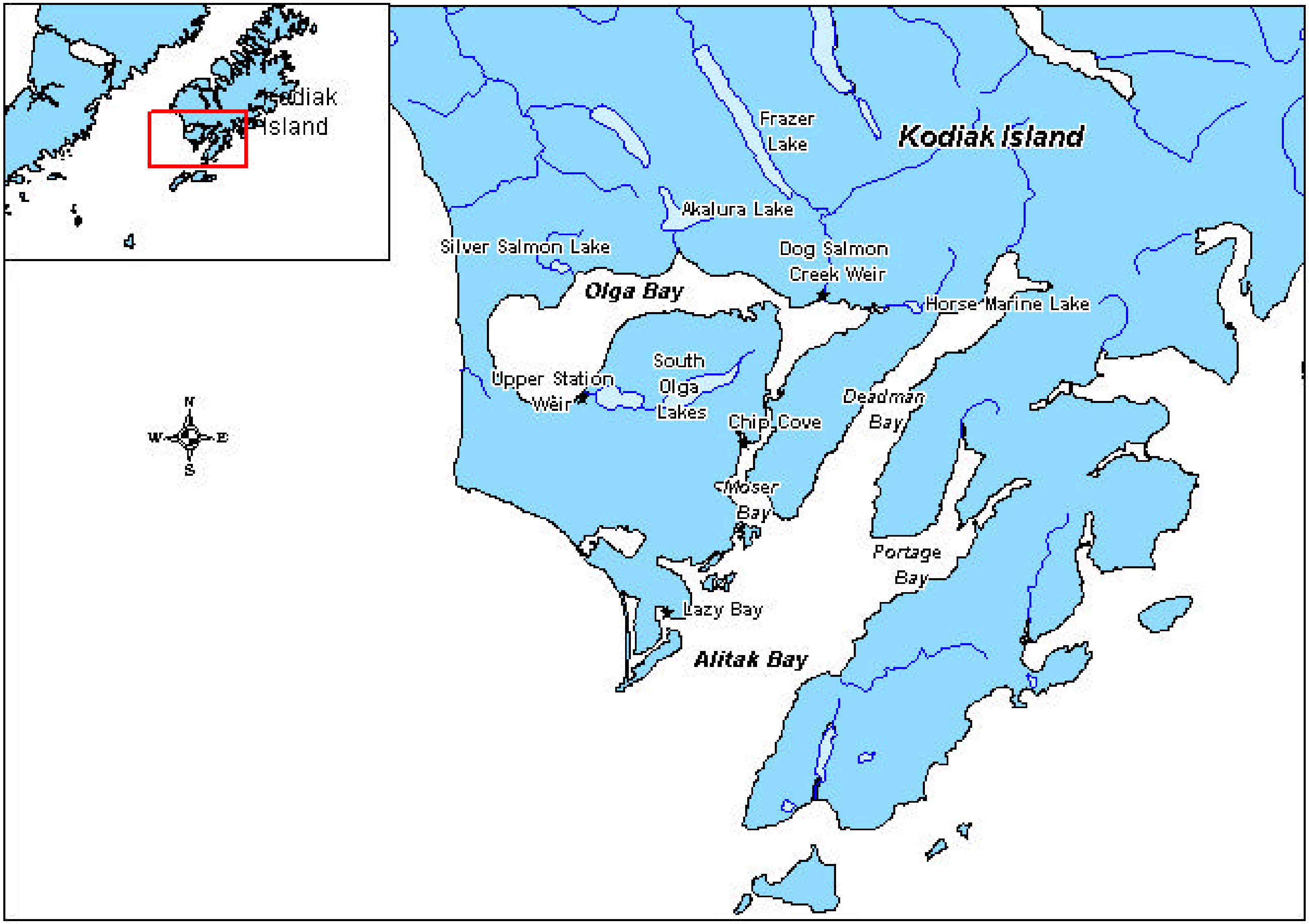
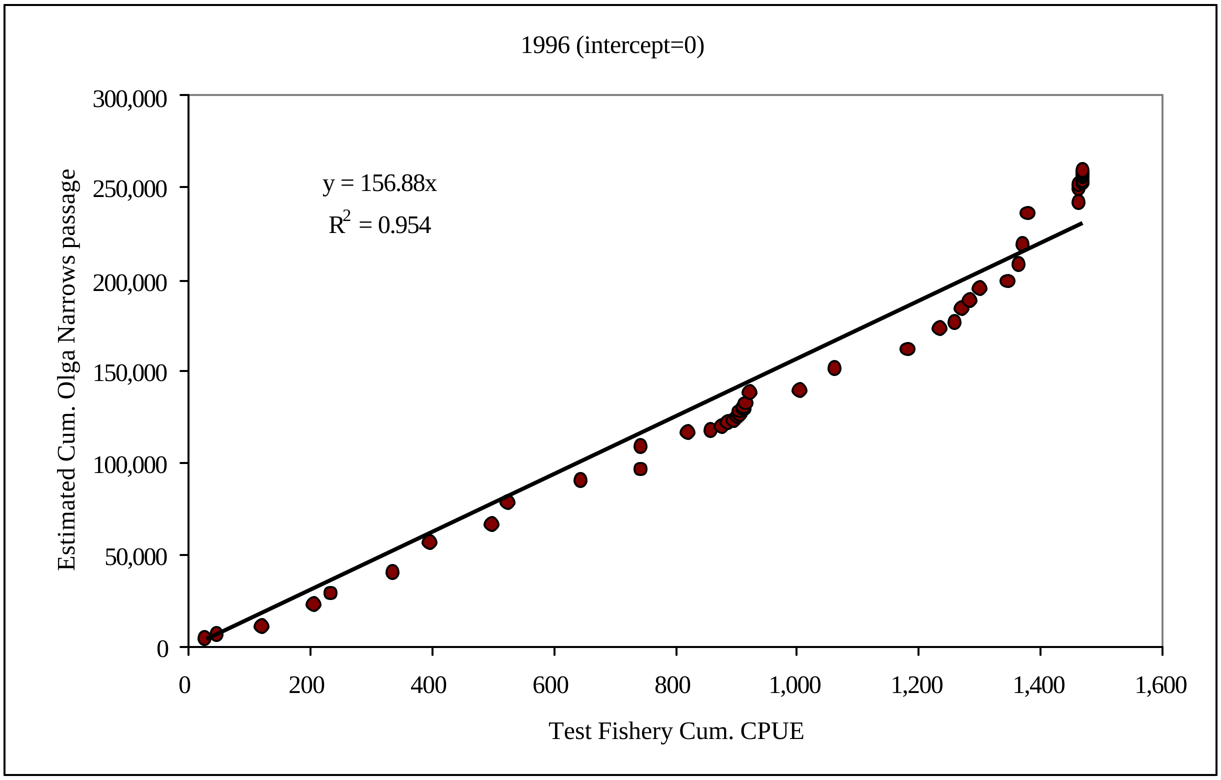


Figure 1. Map of Alitak Bay.



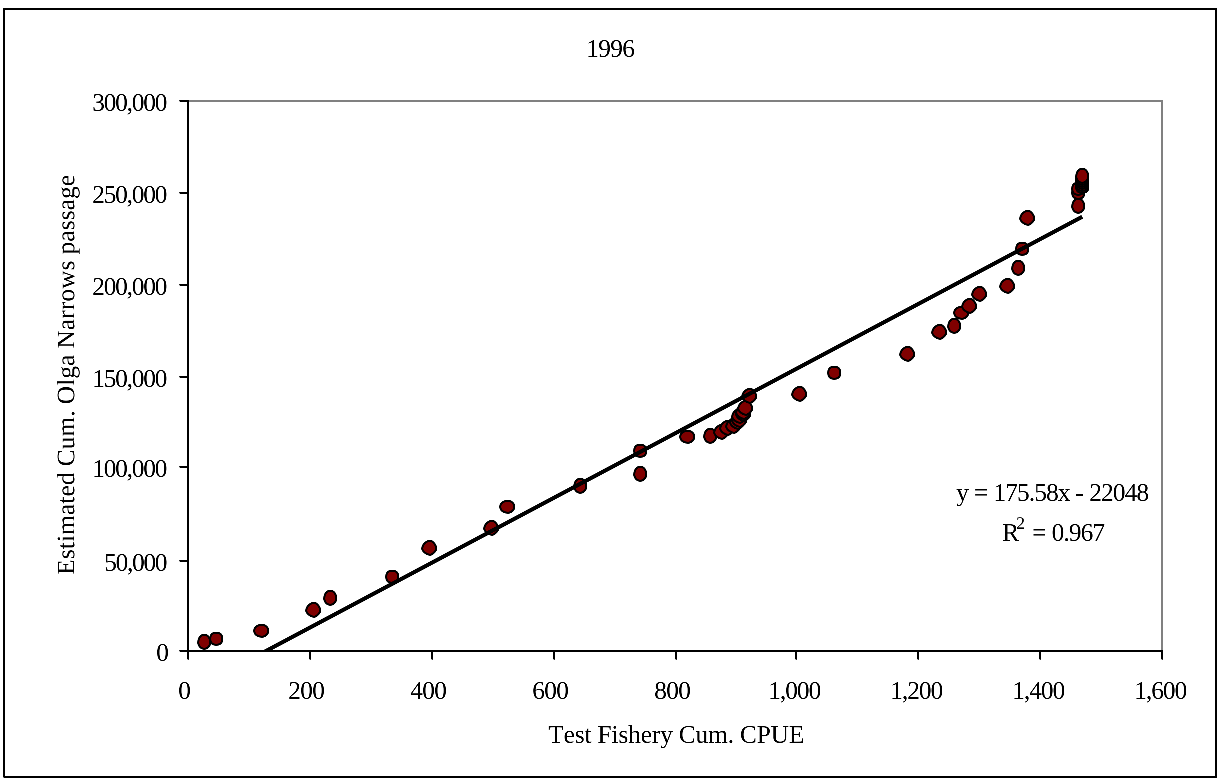
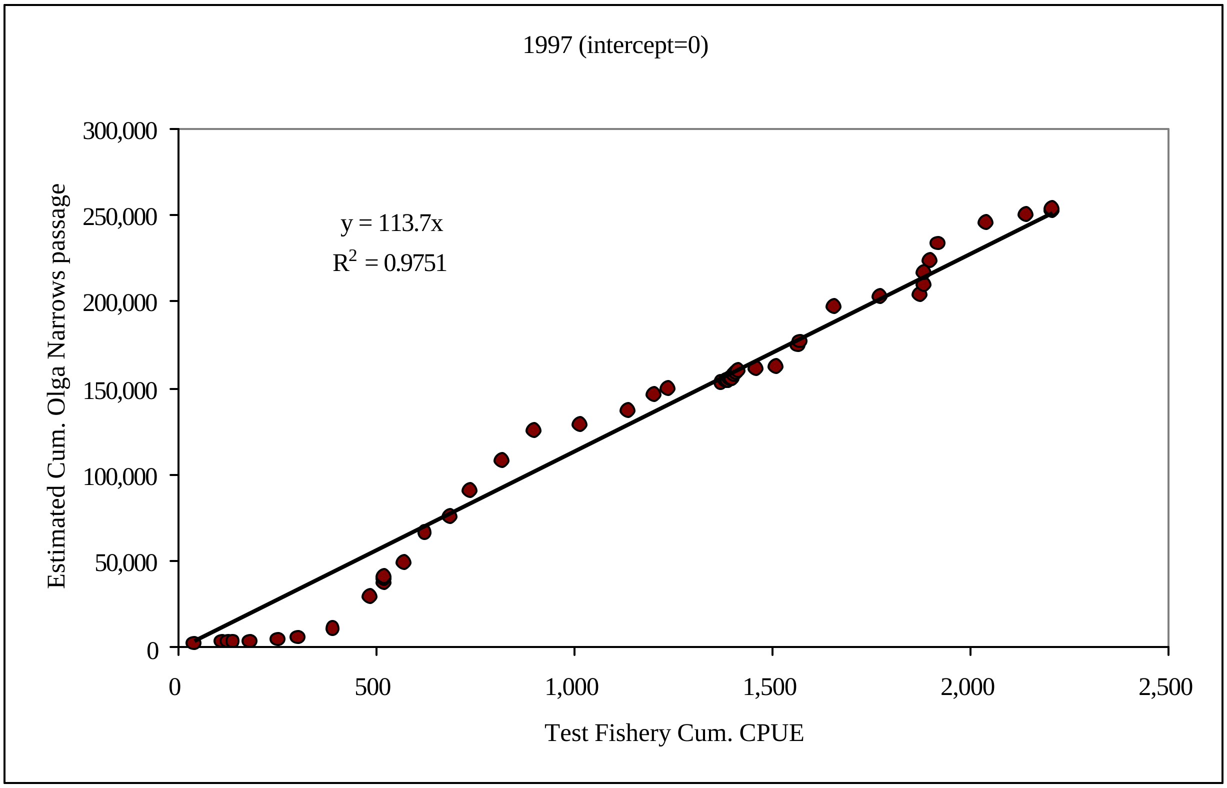


Figure 2. Cumulative test fishery CPUE versus cumulative estimated passage of sockeye salmon through Olga Narrows, 1996.



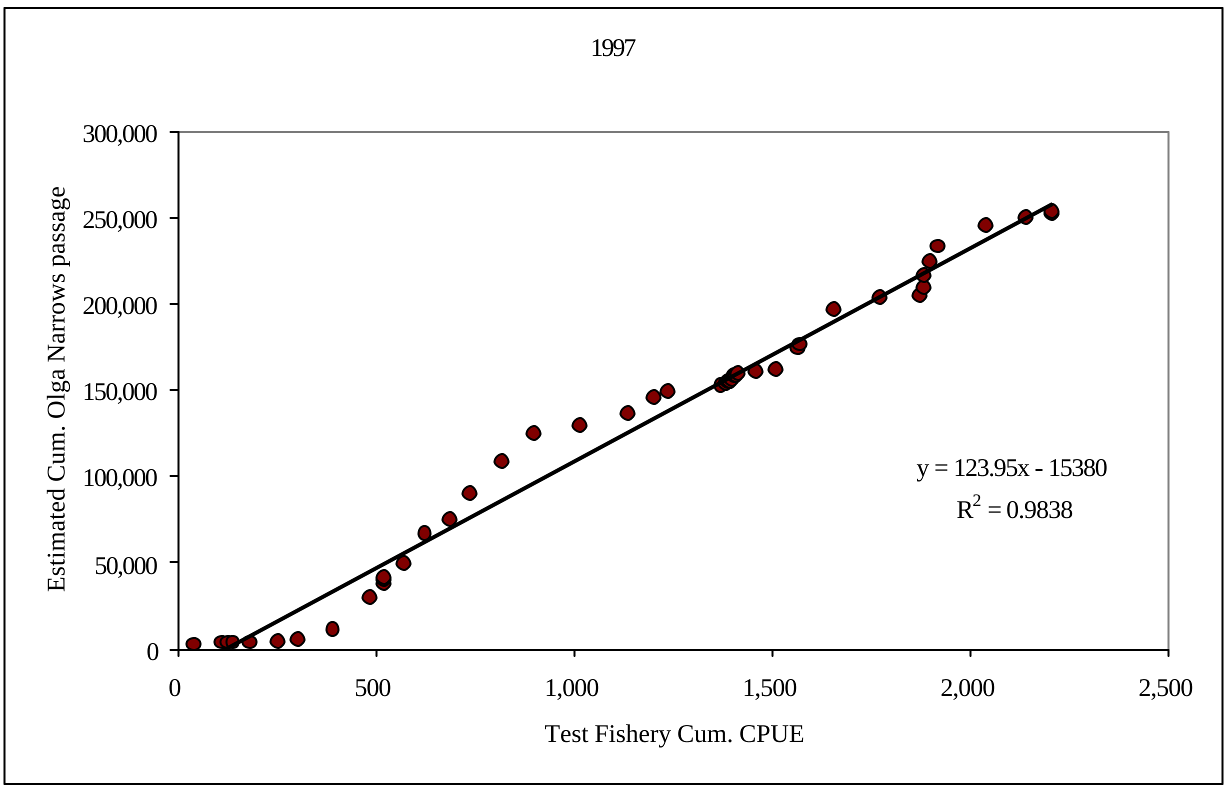
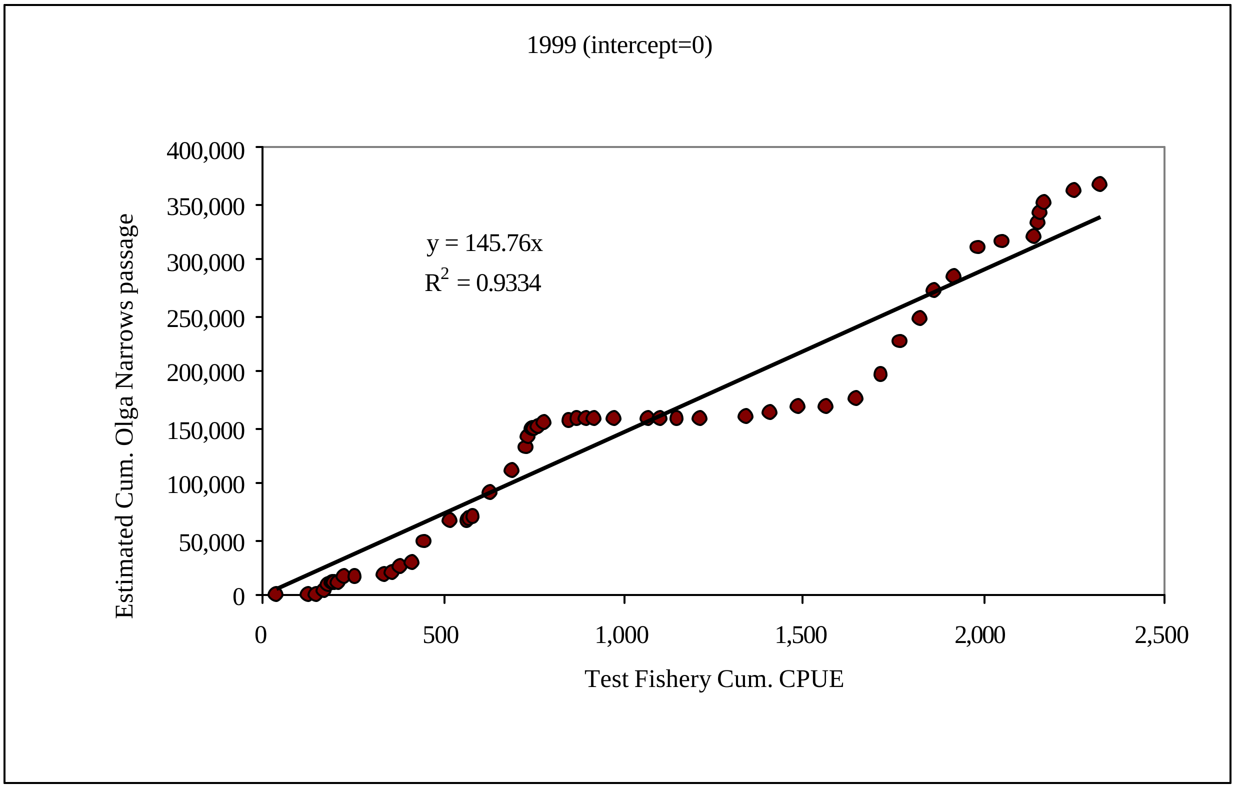


Figure 3. Cumulative test fishery CPUE versus cumulative estimated passage of sockeye salmon through Olga Narrows, 1997.



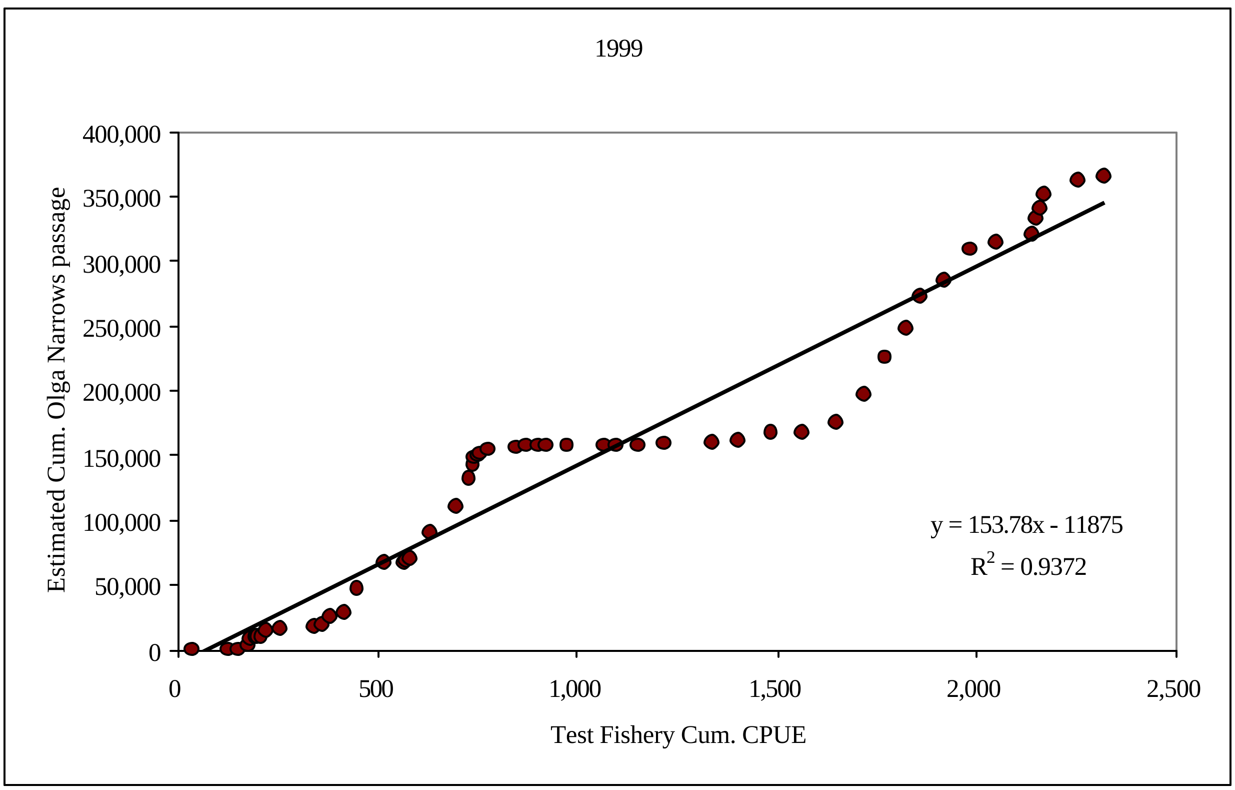
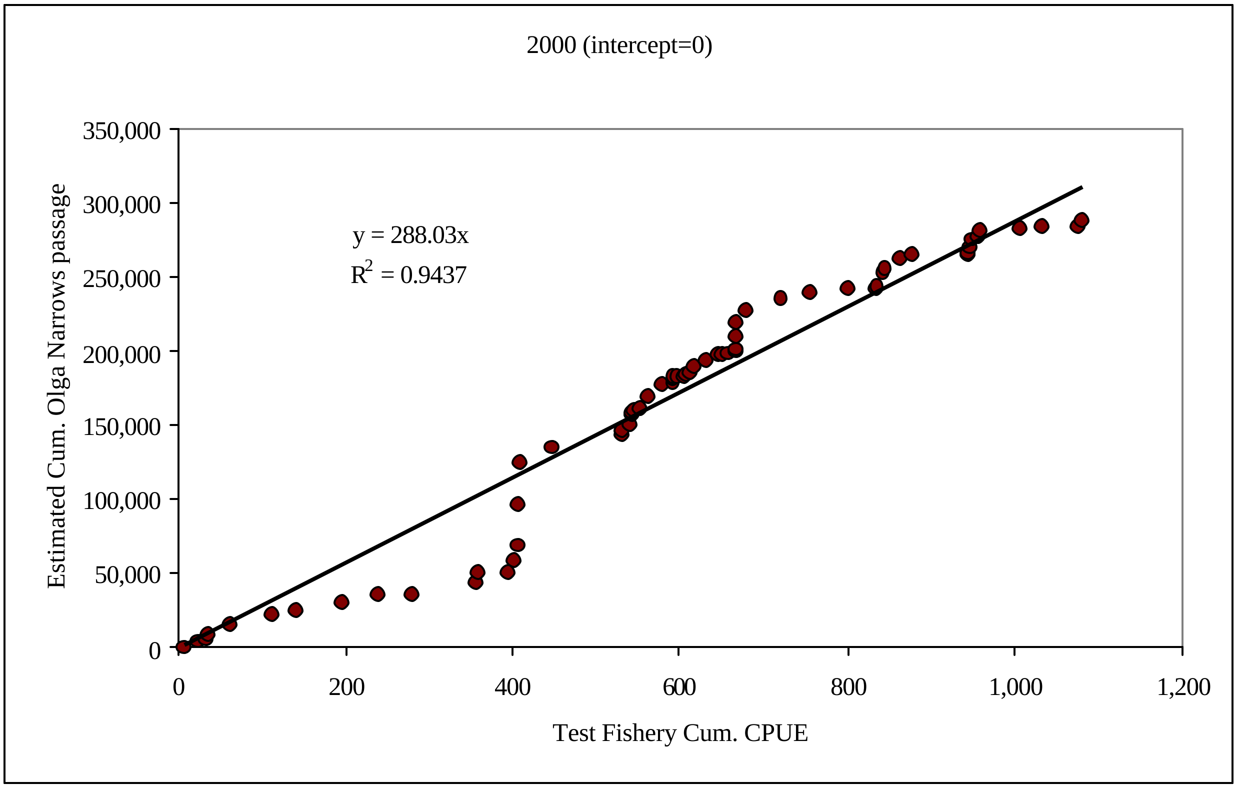


Figure 4. Cumulative test fishery CPUE versus cumulative estimated passage of sockeye salmon through Olga Narrows, 1999.



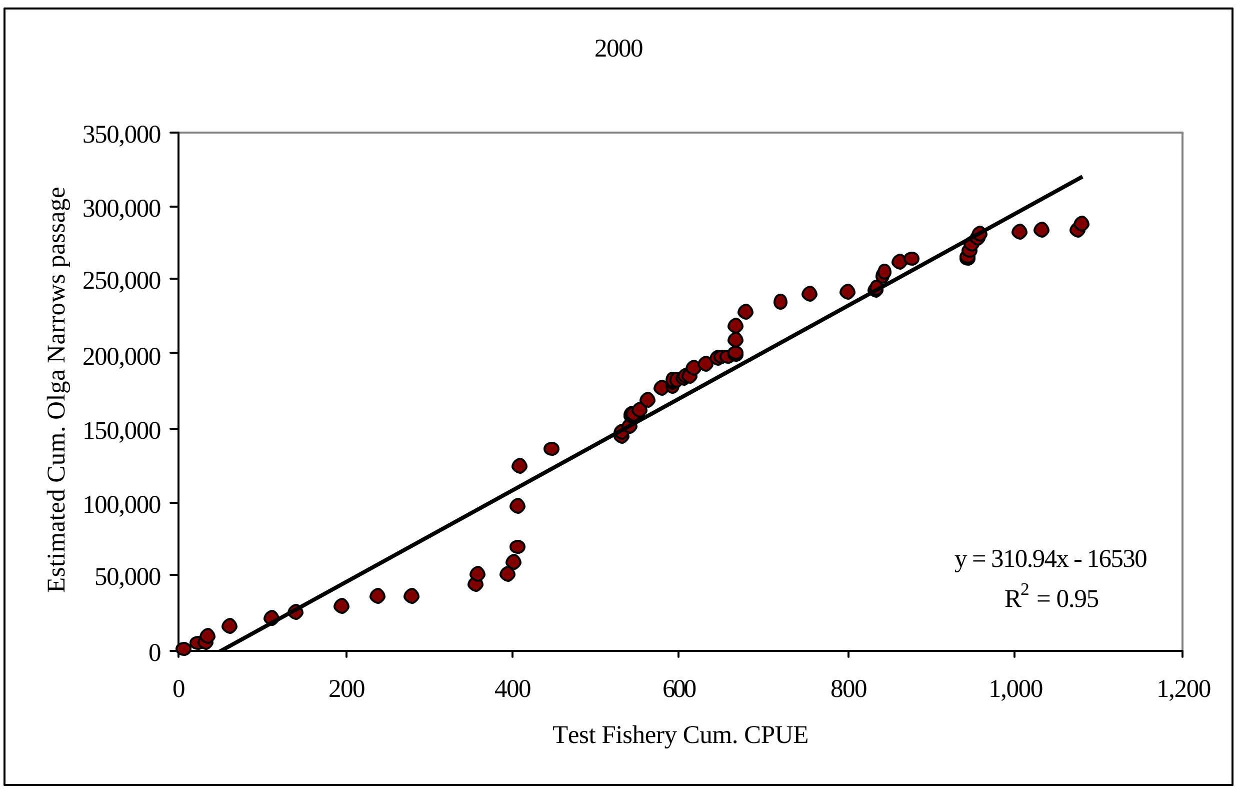
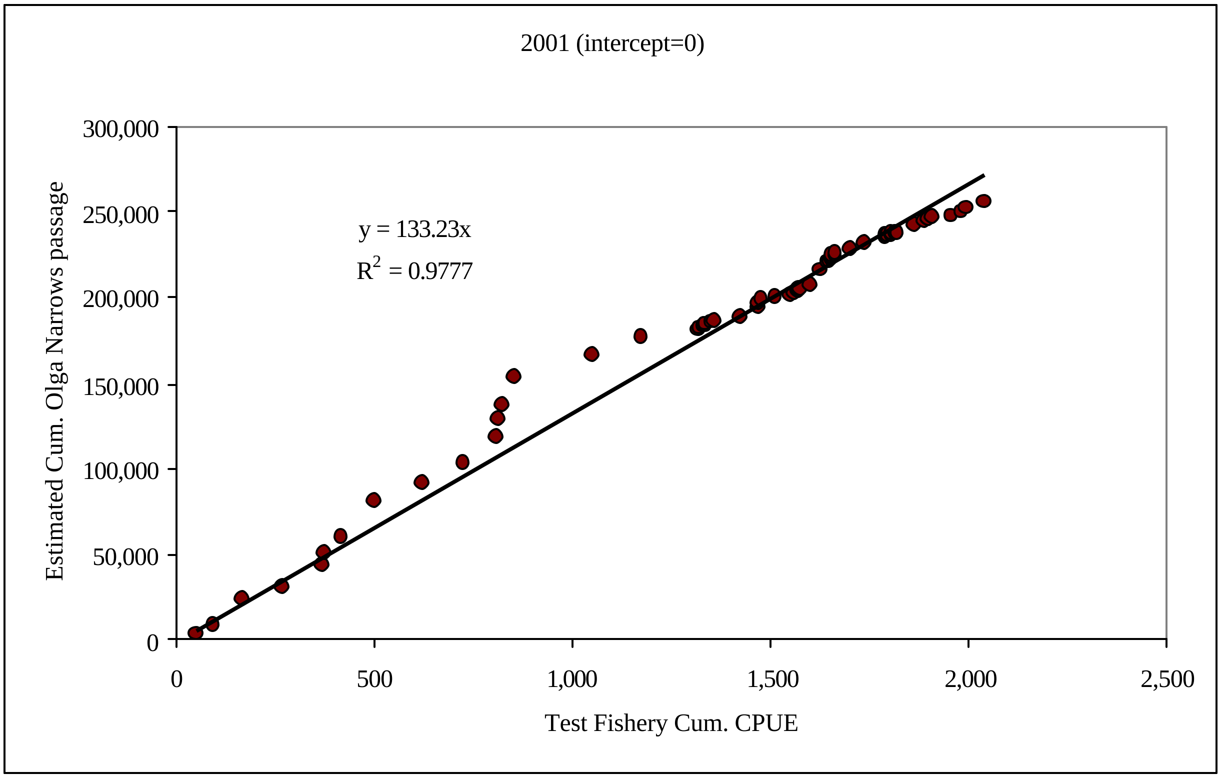


Figure 5. Cumulative test fishery CPUE versus cumulative estimated passage of sockeye salmon through Olga Narrows, 2000.



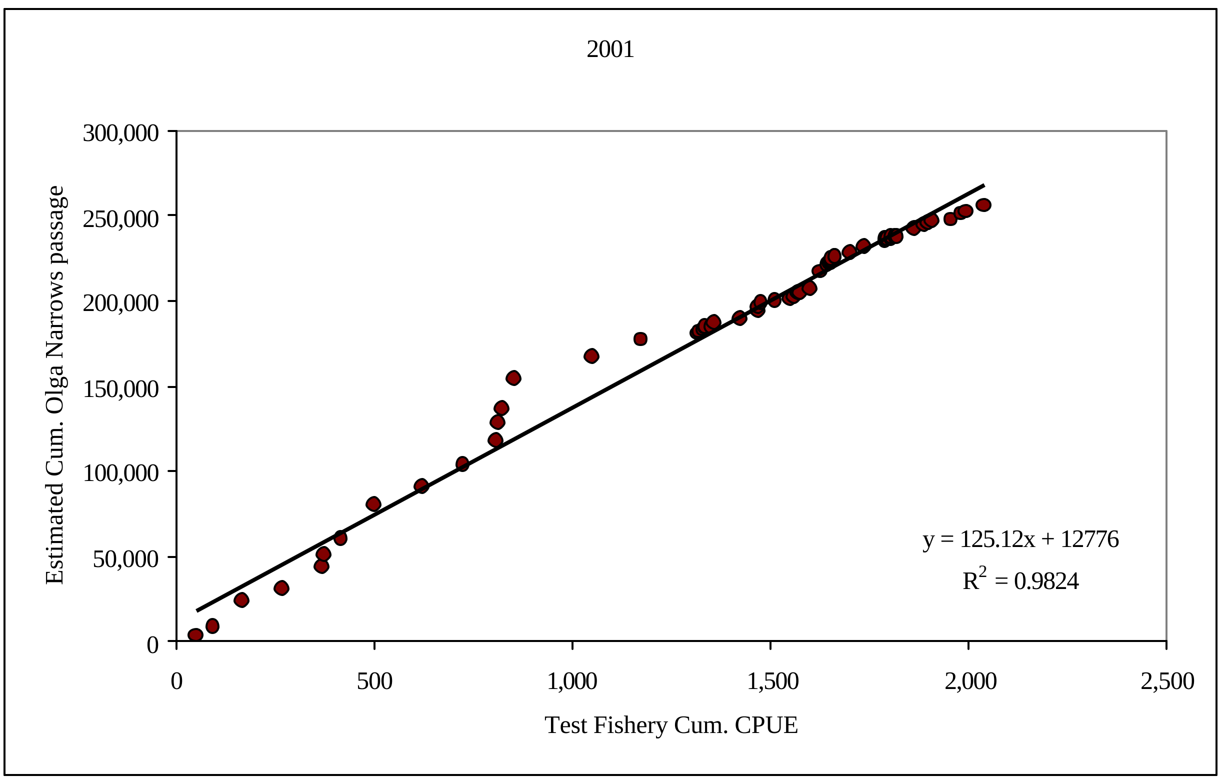


Figure 6. Cumulative test fishery CPUE versus cumulative estimated passage of sockeye salmon through Olga Narrows, 2001.

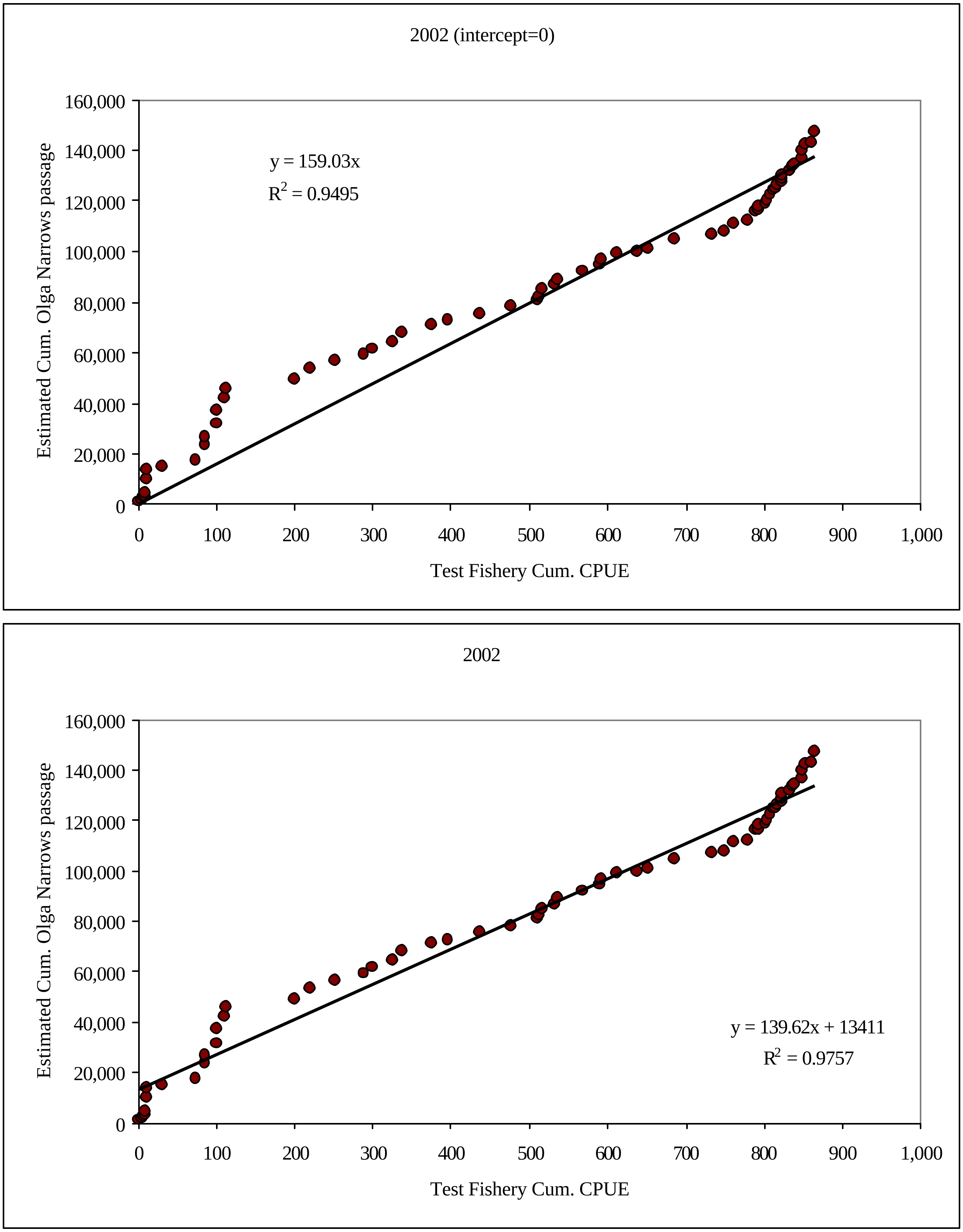


Figure 7. Cumulative test fishery CPUE versus cumulative estimated passage of sockeye salmon through Olga Narrows, 2002.

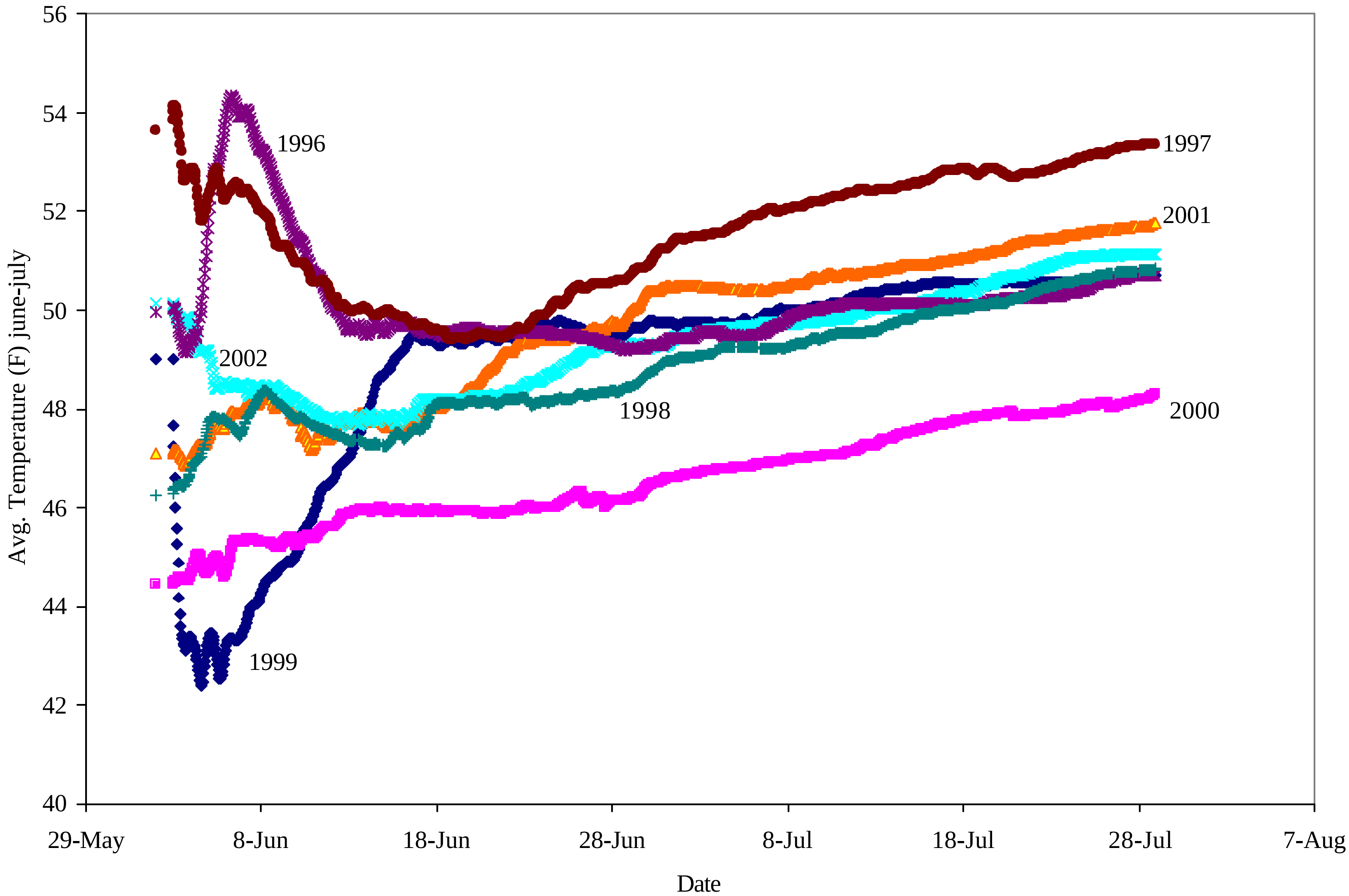


Figure 8. Average hourly temperature, during June and July, at Booth lake remote automated weather station (RAWS), southern Kodiak Island, from 1996 to 2002.

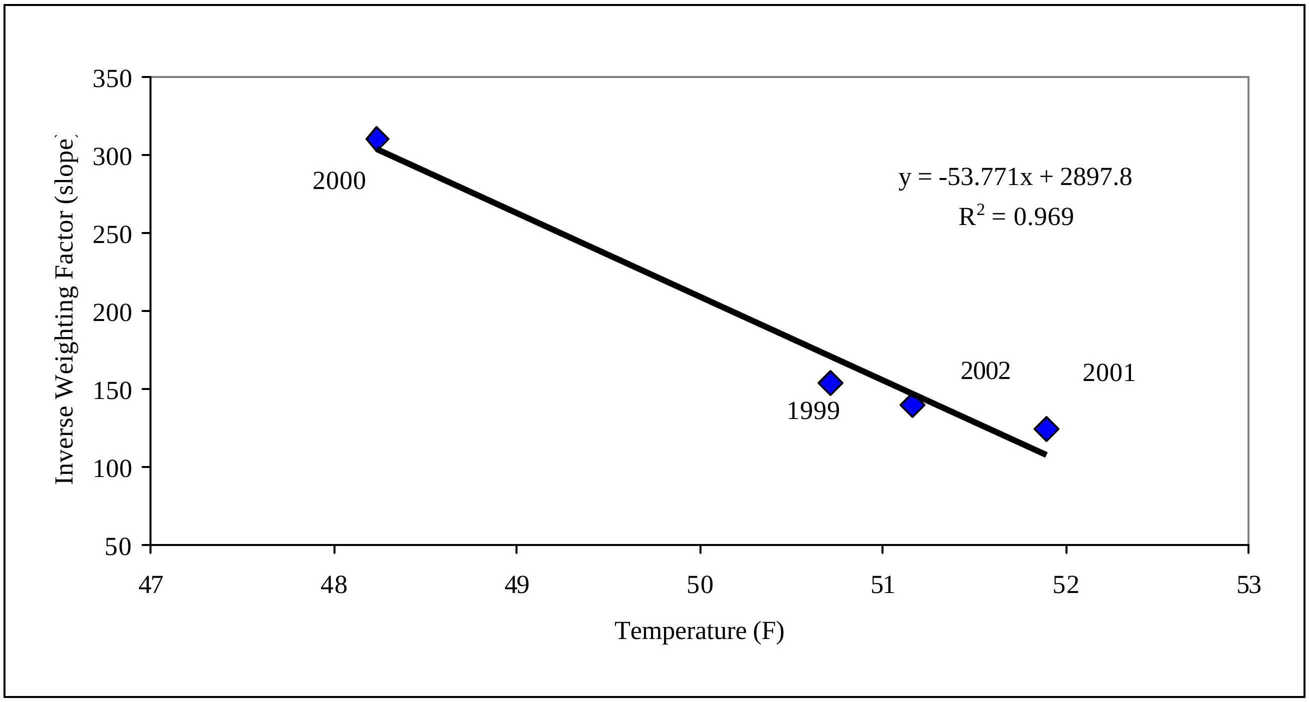


Figure 9. Linear regression of average temperature versus test fishery inverse weighting factor (slope) 1999-2002.

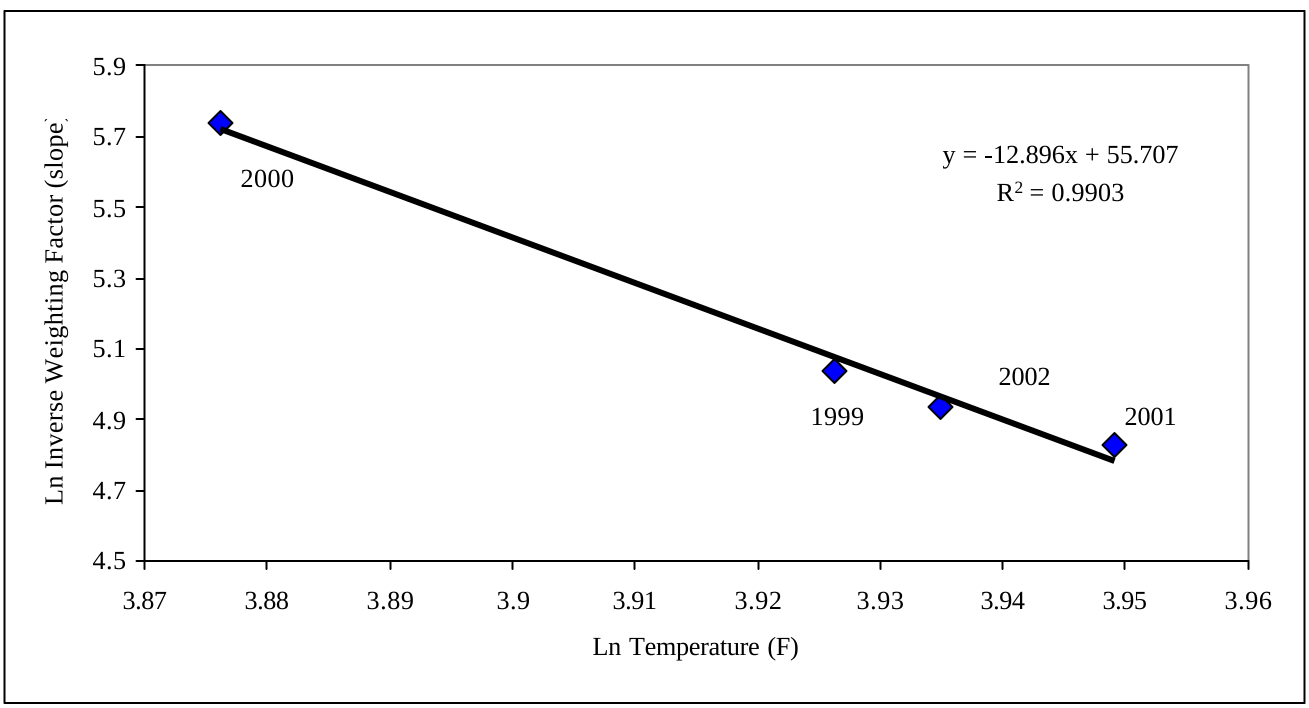


Figure 10. Linear regression of average temperature versus test fishery inverse weighting factor (slope), with natural log transformed variables 1999 - 2002.

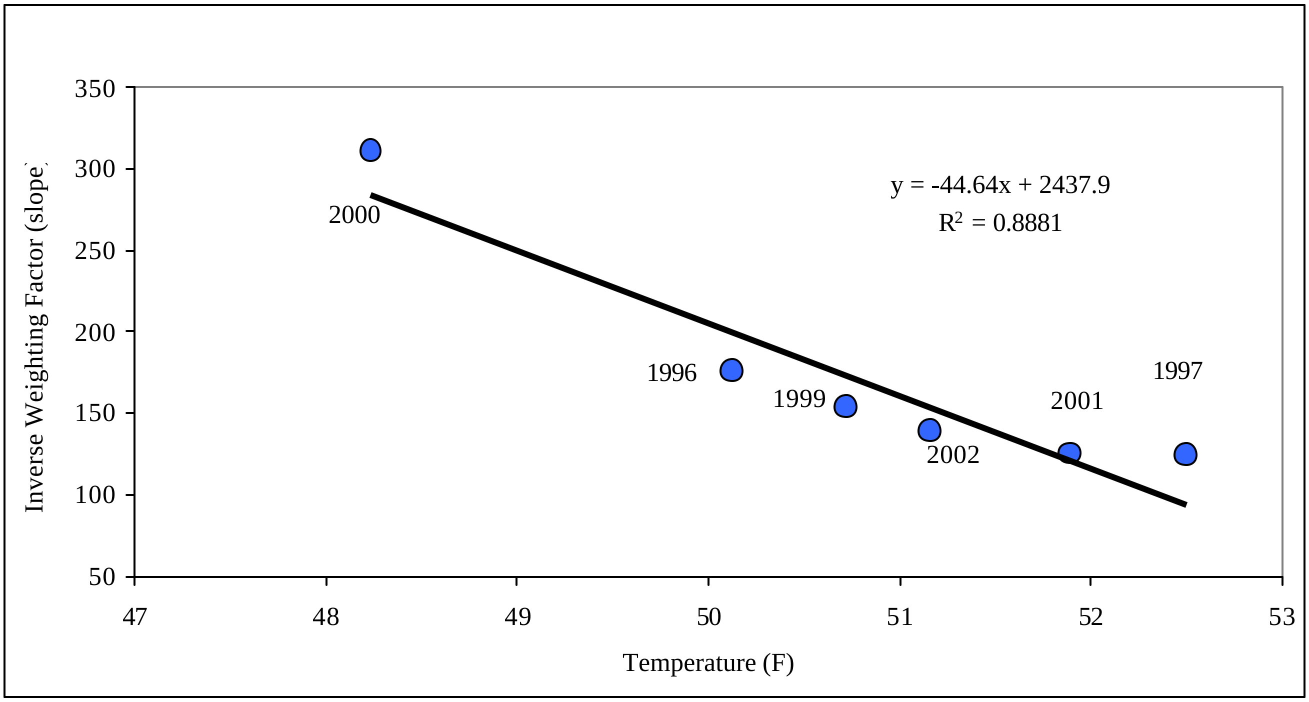


Figure 11. Linear regression of average temperature versus test fishery inverse weighting factor (slope) 1996-2002 (excludes 1998).

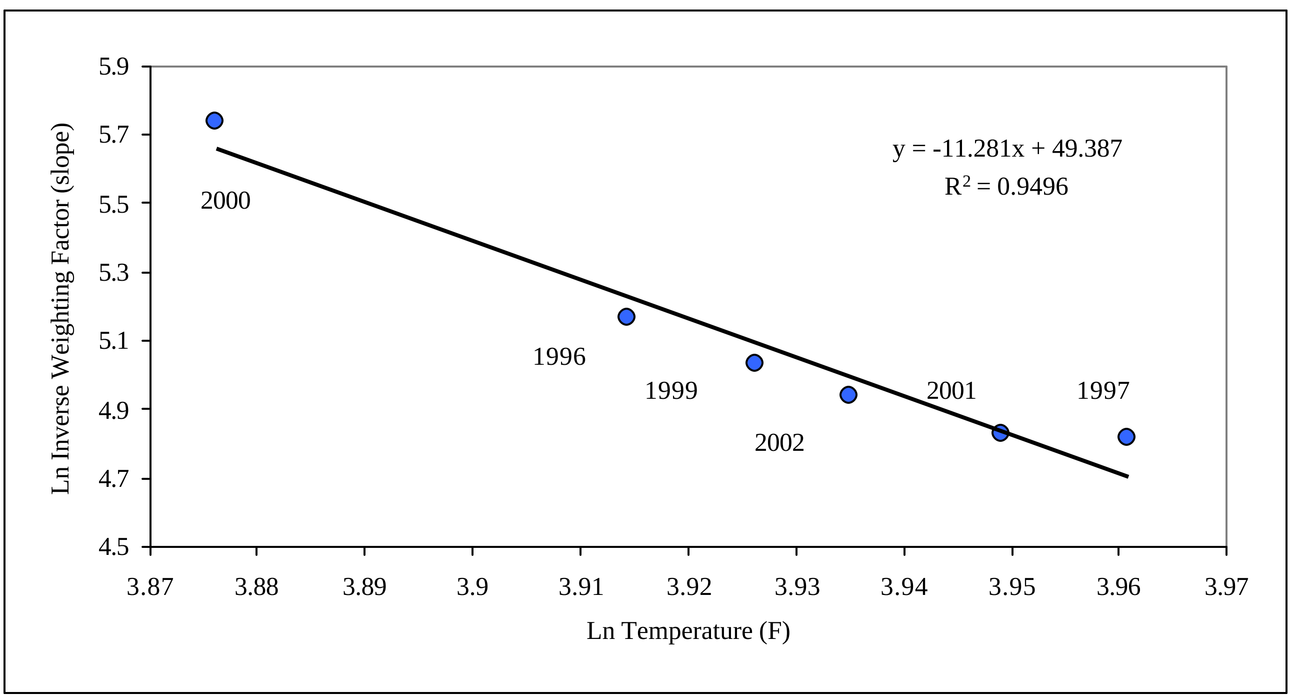


Figure 12. Linear regression of average temperature versus test fishery inverse weighting factor (slope), with natural log transformed variables 1996-2002 (excludes 1998).

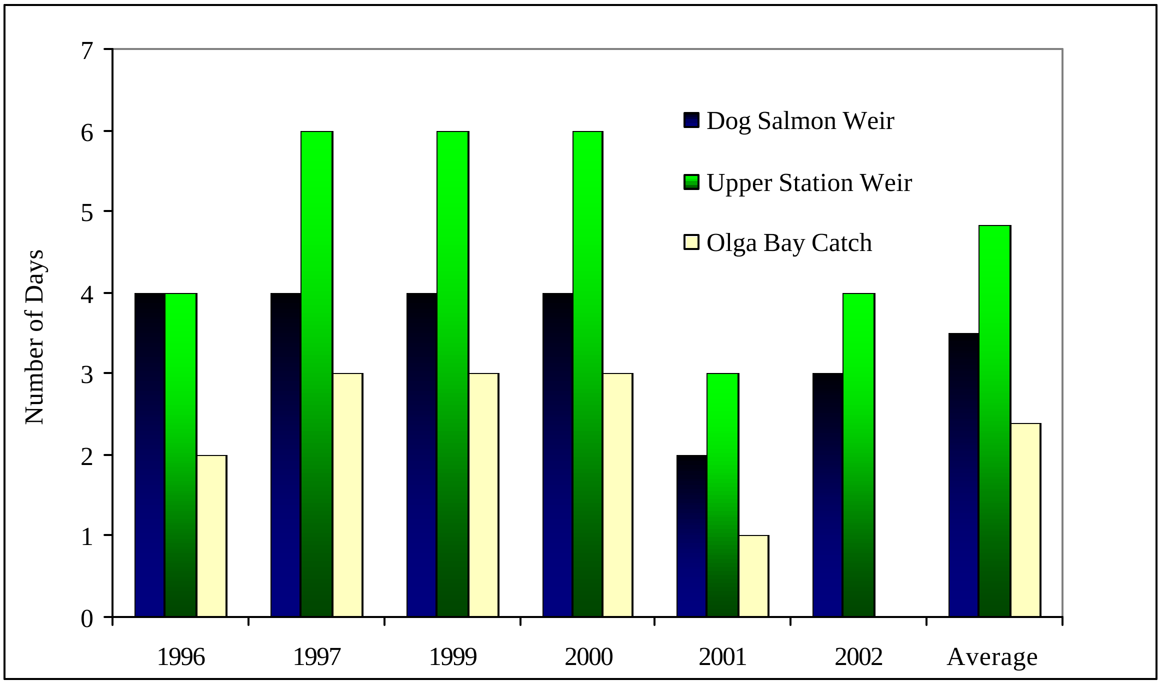


Figure 13. Lag times, in days, between the test fishery (Chip Cove) to commercial catch in Olga Bay or escapement at Dog Salmon or Upper Station weirs, 1996-2002 (excludes 1998).

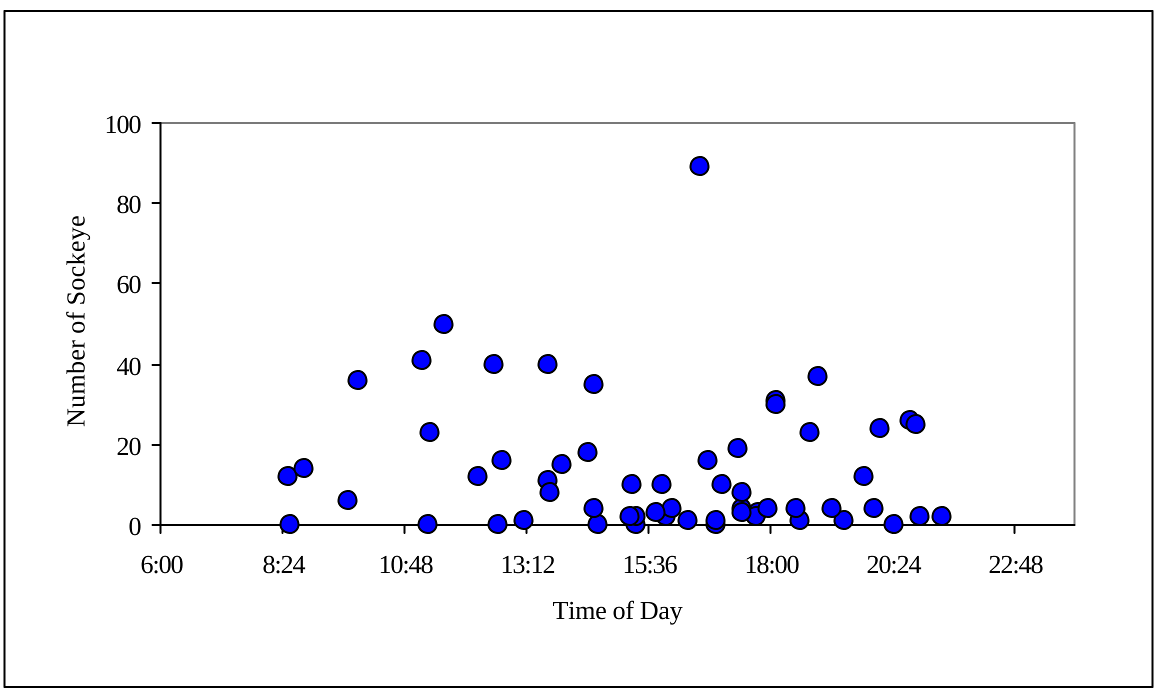


Figure 14. Scatterplot of test fishery catch versus time of day, 2002.