

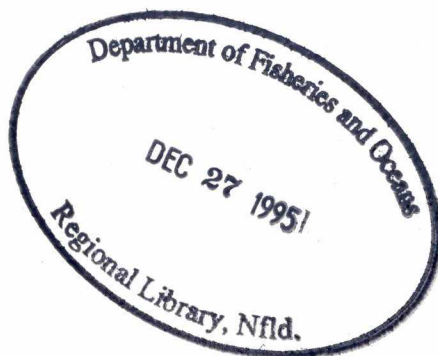
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Strait of Georgia Sport Fishery Creel Survey Statistics for Salmon and Groundfish, 1991

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1995



MANUSCRIPT

Canadian ~~Technical~~ Report of
Fisheries and Aquatic Sciences
No. 2137



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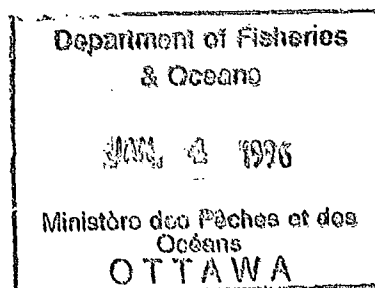
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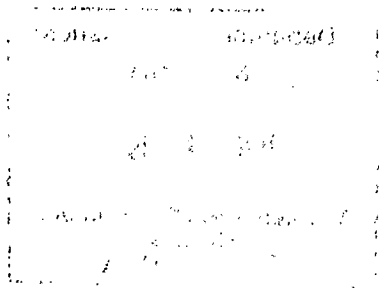
STRAIT OF GEORGIA SPORT FISHERY CREEL SURVEY
STATISTICS FOR SALMON AND GROUND FISH, 1991

by



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Cat. No. Fs 97-4/2137E ISSN 0706-6473

Correct citation for this publication:

Collicutt, L. D. and T. F. Shardlow. 1995. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1991. Can. Manuscr. Rep. Fish. Aquat. Sci. 2137: 75 p.

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ABSTRACT

Collicutt, L.D. and T.F. Shardlow. 1995. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1991. Can. Manuscr. Rep. Fish. Aquat. Sci. 2137: 75 p.

Catch and effort statistics for the Strait of Georgia tidal sport fishery are presented for each month in 1991. The statistics were derived by combining the data from 22,000 interviews and 63 aerial surveys. Anglers conducted an estimated 467,000 boat trips and kept 157,000 coho, 116,000 chinook, 250,000 pink, 24,000 sockeye and 5,000 chum salmon, as well as 173,000 rockfish and 8,000 lingcod. Among salmon examined for marks, 4.9% of chinook and 2.0% of coho had adipose fin clips. The chinook catch consisted of 66% age 3 fish, 22% age 4, 7% age 5 or older and 5% age 2 fish. The length frequency distributions of the chinook, coho and lingcod catches are also given.

Key words: salmon, groundfish, creel survey, sport fishing, catch, effort, age composition, length distribution, Strait of Georgia.

RÉSUMÉ

Collicutt, L.D. et T.F. Shardlow. 1995. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1991. Can. Manuscr. Rep. Fish. Aquat. Sci. 2137: 75 p.

Ce rapport présente des statistiques sur les prises et l'effort de pêche sportive côtière dans le détroit de Georgia pour chaque mois de 1991. Ces statistiques combinent les données recueillies au cours de 22 000 entrevues et de 63 relevés aériens. Les pêcheurs à la ligne ont effectué environ 467 000 sorties et ont ramené 157 000 saumons cohos, 116 000 saumons quinnats, 250 000 saumons roses, 24 000 saumons rouges et 5 000 saumons kétas ainsi que 173 000 sébastes et 8 000 morues-lingues. Parmi les saumons examinés, 4,9 % des saumons quinnats et 2 % des saumons cohos étaient marqués (nageoire adipeuse coupée). 66 % des prises de saumons quinnats étaient âgées de 3 ans, 22 % de 4 ans, 7 % de 5 ans ou plus et 5 % de 2 ans. Le rapport présente également la distribution de fréquence des longueurs des prises de saumons quinnats et cohos et de morues-lingues.

Mots-clefs: saumon, poisson de fond, enquête auprès des pêcheurs, pêche sportive, prises, effort de pêche, composition par âge, distribution des longueurs, détroit de Georgia.

1.0 INTRODUCTION

This report documents the 1991 catch and effort statistics for the Strait of Georgia sport fishery and presents the methodology for collecting these data. It is one of a series of annual reports documenting the activities of the creel survey and providing official Strait of Georgia tidal sport fishery catch statistics. A list of previous reports in this series may be found in Appendix E. In this report all figures, tables and appendices are located at the end of text.

1.1 BACKGROUND

The Strait of Georgia creel survey study area (see Appendix C for a complete description) comprises over 5,900 km² (2,300 square miles) of water surface area and has in excess of 2,400 km (1,500 miles) of shoreline. From its southern end near Victoria, the area extends about 290 km (180 miles) north-west to the Campbell River area. At its greatest width this area is about 32 km (20 miles) wide. Two major population centers, Vancouver and Victoria, and many smaller centers, such as Nanaimo and Campbell River, are located within the study area. Over 500 boat launch ramps, marinas and public wharves, as well as thousands of private boat launching facilities, provide access to this area.

The recreational fishery is active throughout the year but over 85% of the effort occurs in the summer months of May to September. It has become a major tourist attraction and a dominant economic force in some communities during the summer.

The size of vessel, method of fishing and terminal tackle vary widely depending on location and time of year. Vessels range from 4 m (12') car-top boats to yachts more than 17 m (50') in length, although most boats would be in the 5 m to 8 m (16' to 24') range. Popular fishing methods include trolling, mooching, bucktailing and stripcasting.

The most sought after species in the Strait of Georgia recreational fishery are the coho (*Oncorhynchus kisutch*) and chinook (*O. tshawytscha*) salmon, but in recent years significant fisheries directed at pink (*O. gorbuscha*) and sockeye (*O. nerka*) salmon have developed in certain areas.

Over the past 3 decades the recreational fishery in this area has undergone dramatic changes. Prior to 1960, the numbers of chinook and coho taken by the commercial troll fleet were almost double those taken by sport fishermen. In recent years, however, the situation has reversed with the sport fishery taking more than triple the commercial harvest of chinook and coho. The recreational fishery is now the primary harvester of chinook and coho in the Strait of Georgia. Effort in the recreational fishery

has increased from about 200,000 boat trips in early 1960s to about 600,000 boat trips in recent years. Although annual coho catches have varied widely, an increase from about 200,000 pieces in the 1960s to over 600,000 pieces in 1990 was recorded. The extremely low 1991 coho catch of 157,000 was a departure from this trend. In contrast, the chinook catch climbed through the 1960s but then declined steadily from a peak in the mid-1970's of over 400,000 pieces to its present level of just over 100,000 pieces.

From 1956 to 1976, estimates of catch and effort in the sport fishery published by the Department of Fisheries and Oceans (DFO) were based on subjective assessments completed by Fishery Officers and on small scale creel surveys. The general lack of statistical rigor and consistency associated with these methods of catch estimation, as well as the rapid growth of the recreational fishery, led to the initiation of the Strait of Georgia Creel Survey Pilot Program in 1980 (DPA 1982). The survey has been run continuously (with minor interruptions) since then. Although many details, such as sampling locations and times, are updated continuously to reflect changes in the fishery, the basic design of the survey remains similar to the pilot project conducted in 1980.

Creel survey data are used for a variety of management and reporting purposes. Catch and effort information is also used by local groups (both inside and outside DFO) to monitor the fishery in their area. Creel survey information is also used to predict the effect of regulation changes and to measure the success of conservation actions imposed. The adipose mark information collected during the survey is supplied to the Mark Recovery Program (Kuhn et al. 1988) and used in combination with other data for exploitation rate and stock distribution analyses.

1.2 OBJECTIVES

The specific objectives of the 1991 Strait of Georgia creel survey were:

1. To estimate the sport angler effort and catch of chinook, coho, pink, sockeye and chum salmon, rockfish, lingcod and other finfish by month for Statistical Areas 13 through 19, 28 and 29; and to estimate the number of chinook and coho released by anglers.
2. To estimate the mark rate for adipose clipped chinook and coho in the catch.
3. To estimate the age composition and mean length-at-age for chinook, and the length frequency for chinook, coho and lingcod.
4. To estimate the species composition of the rockfish catch.

2.0 METHODS

2.1 STUDY DESIGN

The design of the Strait of Georgia Creel Survey conducted in 1991 was similar to that used by DPA Consulting Ltd. (1982) with some modifications to the data analyzed, sampling intensity, flight routes and data processing. The study is comprised of two independent surveys: angler interviews and aerial overflights. Angler interviews provide data on sport fishing catch per unit effort (CPE) and daily activity patterns. Aerial overflights provide estimates of the total sport fishing effort in the study area at the time of the aerial survey. These data are combined to provide monthly estimates of total sport fishing effort and total catch of salmon and groundfish in the sport fishery. In its simplest form, the estimated total catch is calculated by multiplying the estimated total effort by catch per unit effort.

The fishery was stratified according to the following criteria:

1. Month. The survey operated during all months of the year, but estimates were produced for 10 time periods. January and February data were grouped together, as were November and December data because of reduced fishing activity during these months.
2. Geographic area. Catch and effort estimates were produced for Statistical Areas 13 through 19, 28 and 29. Statistical Area 19 was split into Area 19A (Saanich Inlet and Area 19B+ (the rest of Area 19 and that portion of Area 20 east of Sheringham Point, see Fig. C-1 in Appendix C).
3. Day type. Weekend and mid-week days were considered independently because sport fishing activity is known to differ for the two types of days.
4. Time of day. Sampling shifts (one shift is a set number of consecutive hours of interviewing anglers at one site by one creel surveyor) were conducted during set time periods. From March to October sampling was conducted during either an early shift (approximately 0700 to 1500 hours) or a late day shift (approximately 1500 to 2300 hours). During the winter months of January, February, November and December only one shift timing was used (approximately 1000 to 1700 hours).
5. Guided versus unguided anglers. Certain sites are known to have primarily guided fishing effort. Unpublished data from previous surveys in this series confirm that the CPE from guided boats differs markedly from unguided boats, so data from these two types of boat trips were considered independently.

In each region, various landing sites were chosen as locations for surveyors to

conduct interviews. Site selection was based on 4 criteria: representativeness, traffic volume, site accessibility and adequate observation points. Discussions with local fishermen, marina operators and Fisheries Officers, and data from previous surveys were used to choose sites that were representative of the local sport fishing activity (i.e. sites which were used by a wide cross-section of anglers). Sites with expected traffic volumes of more than 15 boats per day in the summer were considered as possible sampling locations. Expected traffic volumes for sites were compiled from previous surveys or from discussions with marina operators or local Fisheries Officers.

Site accessibility refers to whether an interviewer can easily reach a site by car or ferry during the defined shift hours. Only sites with good accessibility were selected. As a result, landing sites on most of the islands in the Strait of Georgia were excluded from the survey. This was not expected to be a major factor, however, since most of the fishing that occurs in these areas is from boats launching from an accessible site. The final criterion, adequate observation points, was essential for interviewers to obtain an accurate count of all boats returning to a landing site. At some large marinas, where the number of access points made it impossible to see all boats returning, the facility was defined and sampled as two separate sites.

Allocation of sampling effort among months followed the same general pattern as fishing effort, that is, more effort was allocated during the summer when fishing effort is at its highest. Allocation of sampling effort among regions (groups of Statistical Areas) also followed fishing effort patterns. Within each month, each chosen site was allocated between 6 and 10 shifts. These shifts were divided equally among weekend and mid-week days, and early and late daily time periods.

Data collection, entry and preliminary processing were conducted by LGL Ltd. environmental research associates. Estimation of the catch and effort statistics was conducted by the Department of Fisheries and Oceans.

2.2 DATA COLLECTION

2.2.1 Angler Interviews

Surveyors were stationed at access points for scheduled shifts to interview anglers as they returned from fishing. The number of boats returning to a site during a shift, as well as the number of interviews attempted and completed, were recorded on a tally sheet. For each boating party landing, the following information was recorded on an interview form (Fig. 3):

1. Total number of anglers in the boat.
2. Time of landing.
3. Whether the party had been sport fishing.

4. Whether the party was guided.
5. Residency of anglers.
6. Time during which fishing lines were in the water.
7. Average number of lines in the water.
8. Total number and species of kept and released fish for each of 3 sub-Statistical Areas.
9. Number of hours spent fishing in each sub-Statistical Area.
10. Number of marked and unmarked chinook and coho in the catch.
11. Number of hours directed at each species.

Interviewers, trained in fish identification, inspected each boating party's catch. Landed chinook and coho were checked for a missing adipose fin which indicates the presence of a coded-wire tag embedded in the fish nose cartilage. In addition, scale samples for age determination and measurements of nose-fork length were taken during every sampling shift. Five scales were removed from the INPFC (International North Pacific Fisheries Commission) preferred area of each biosampled chinook (Mosher 1968).

In 1991, interviews were conducted each month at a maximum of 42 of the 50 designated landing sites (boat ramps, marinas or resorts, Appendix C) representative of the sport fishing activity in the survey area. The number of sites selected in each area was dictated by targets of desired precision and number of surveyors available. For each area - day type - work block stratum, sampling shifts at a site were chosen on a near random basis from the total number of shifts available. For definition of the above terms (day type, work block, shift) see Appendix A.

2.2.2 Aerial Overflights

Aerial surveys, conducted from float planes travelling along pre-defined routes, allowed observers to count vessels actively sport fishing throughout the Strait of Georgia. Planes flew at an altitude of 150-210 m (500-700 feet) to facilitate a broad range of vision and still allow easy identification of vessel characteristics. Each plane carried three observers, two on the right side and one on the left, and each observer counted sport fishing boats to his/her side of the flight path. Figure 2 shows the flight paths used in 1991. The winter (October - April) flight path was slightly reduced to correspond with the lower winter effort.

The flight path and time of departure were designed to cover major concentrations of sport fishing activity at peak periods. Whenever possible, the route was flown to keep most of the sport fishing boats to the right side to allow averaging of the two right side counts. To maximize precision, flying times during which fishing effort was rapidly changing were avoided. The number of overflights each month was governed by budget constraints, targets of desired precision and by the expected number of interviews from a given number of sampling shifts (English et al. 1986). The days for overflights during

a month were randomly selected for each day type.

2.3 DATA ANALYSIS

Data analysis included calculation of catch and effort statistics, calculation of variance of total fishing effort and total catch, estimation of marked chinook and coho salmon, estimation of age and length composition of chinook catch, and estimation of length frequency distribution of coho and lingcod catch. Appendix A details the methods and equations used in the above data analysis.

3.0 RESULTS

3.1 DISTRIBUTION OF SAMPLING EFFORT

Table 2 shows the number of creel survey interviews conducted by month and Statistical Area with anglers who had been actively fishing in 1991, and the number of monthly overflights. A total of 27,930 interviews, of which 21,882 involved actively fishing anglers, and 63 overflights were conducted in 1991. Figure 4 shows that the monthly distribution of interviews generally reflected the monthly distribution of fishing effort (number of boat trips, Table 3). Interview effort was reduced during winter months, especially for Statistical Areas 13, 14 and 15 in the northern portion of Strait of Georgia (Table 2). The total interviews represent 6.0% of the estimated total fishing effort for the entire study area (466,749 boat trips, Table 3). The interviews involving actively fishing anglers represent 4.7% of the total fishing effort and ranged in each Statistical Area from a low of 1.5% of the estimated fishing effort in Area 18 to a high of 8.8% in Area 28 (Tables 2 and 4).

3.2 SPORT FISHING EFFORT AND CATCH

The 1991 Strait of Georgia sport fishing effort and catch statistics are summarized for each species by month in Table 3 and by Statistical Area in Table 4. Appendix B shows the fishing effort and catch statistics by species for each combination of month and Statistical Area.

Sport fishermen made 466,749 boat trips during 1991 which is lower than the average fishing effort in recent years (Fig. 1, Table 1); 1991 was the third consecutive year in which fishing effort has declined. The fishing effort followed the same general seasonal pattern as seen in previous years (Table 3, Fig. 5). Effort levels climbed steadily from April, peaked in July and August, and declined rapidly in September and October.

The overall sport catch in the Strait of Georgia was estimated at 761,559 pieces (including steelhead and cutthroat trout, Table 3) and consisted of 72% salmon and 28% groundfish. An additional 622,445 salmon of mixed species were released by anglers (Appendix B-8). Salmon and groundfish catches are discussed below.

3.2.1 Salmon

Salmon sport catches in the Strait of Georgia in 1991 totalled 551,086 pieces (Tables 3 and 4) and consisted of 29% coho, 21% chinook, 45% pink salmon, 4% sockeye and 1% chum salmon.

In 1991, anglers kept 115,519 chinook (Tables 3 and 4), compared to 111,914 in 1990 and 132,846 in 1989 (Fig. 1, Table 1). Monthly chinook catches peaked in June and then declined steadily (Fig. 6, Table 3). Seasonal catch efficiency for chinook averaged 0.25 fish per boat trip overall and peaked in the summer months at 0.52 and in the winter months at 0.54 fish per boat trip (Fig. 7, Table 5). Catch patterns were similar to those in recent years except for a lower than average catch per boat trip in the winter months and a markedly higher catch in June,

Chinook regulations in place during 1991 in the Victoria area (Cadboro Point to Sheringham Point near Sooke) included a size limit of 45 cm and an annual bag limit of 20 fish. In the remaining portion of the Strait of Georgia, the size limit was 62 cm and anglers were restricted to 15 chinook per year. There were no regulation changes in 1991. See Appendix C for a definition of the study area.

The spacial distribution of chinook catch followed a similar pattern to previous years. The highest catches were taken in Area 14 (30% of total), Area 13 (25%), and Area 19B+ (16%) (Table 4, Fig. 8). In 1991, 84% of the chinook landed during the summer months (May - September) were taken in the northern region of Strait of Georgia - Statistical Areas 13 to 17. The opposite was true in the winter months (January - April, October - December) when 61% of the winter catch came from the southern region - Statistical Areas 18, 19, 28 and 29 (Appendix B-3). During November and December, nearly all of the chinook catch came from Victoria/Sooke waters in Statistical Area 19B+ (Appendix B-3).

The 1991 coho catch was extremely low (157,111 pieces, Tables 3 and 4). This catch represents the lowest coho catch on record since 1961 when an estimated 152,000 pieces were taken. Monthly coho catches peaked in September which is much later than in recent years (Fig. 9). Coho catch success reached a high of only 0.9 fish per boat trip in October, compared to a monthly high of over 2 fish per boat trip in 1990 (Fig. 10, Table 5). As opposed to previous years when the highest coho catches were taken in Areas 13 and 14, the highest catches in 1991 were taken in Area 19B+ (70% of total, Table 4, Fig. 8).

In 1991, Strait of Georgia anglers caught 249,662 pink salmon (Table 3). Significant pink catches were expected in 1991 because pink salmon returns to the Strait of Georgia rivers (primarily the Fraser River) are much higher in odd numbered compared to even numbered years. The highest catches were taken in Area 19B+ (68% of total) and Area 13 (23%) (Table 4).

The landings of other salmon consisted of an estimated 23,521 sockeye and 5,273 chum salmon (Table 3). A large portion of the annual sockeye catch (70% of total) was taken in Areas 19B+, 28 and 29 during August and September (Appendix B-5).

In addition to the above salmon species, an estimated 435 steelhead, cutthroat trout and unidentified salmon were caught in the Strait of Georgia in 1991, bringing the total salmonid catch to 551,521 pieces (Appendix B-7).

The average number of salmon caught during each boat trip in 1991 was 1.18 (Table 5). As seen below, this value is lower than the range of averages seen in recent years.

Year	Catch Success	Reference
1986	1.30	Shardlow and Collicutt (1989 c)
1987	1.47	Shardlow and Collicutt (1989 d)
1988	1.86	Shardlow and Collicutt (1989 e)
1989	1.28	Collicutt and Shardlow (1990)
1990	1.45	Collicutt and Shardlow (1992)
1991	1.18	This report

In 1991, Area 19B+ showed the highest effort expended and by far the most salmon landed (Fig. 11, Table 4). Boaters fishing in that area had an average catch of 3.0 salmon per trip, followed by Area 13 with 1.1 salmon per trip (Table 4). Area 14 recorded the greatest number of salmon hooked and released (229,169) with Area 13 next at 148,486 (Appendix B-8).

3.2.2 Groundfish

While salmon accounted for the majority of the total finfish sport catch in the Strait of Georgia in 1991, the groundfish catch of 210,038 pieces made up 28% of the overall catch (Tables 3 and 4). The species composition of the groundfish catch, based on the Table 4 data, was as follows:

Groundfish Species	Catch	% of Total Groundfish Catch	Major Catch Area
Rockfish (<u>Sebastes</u> spp.)	173,383	83%	16
Lingcod (<u>Ophiodon elongatus</u>)	8,214	4%	13
Dogfish (<u>Squalus acanthias</u>)	4,972	2%	29
Other finfish (Appendix D)	23,469	11%	29
Total	210,038	100%	

The majority of the groundfish catch was taken in the summer months (Table 3), reflecting the high fishing effort in the summer (Fig. 4). Catch by Statistical Area for rockfish was highest in Area 16 (28% of total, Table 4). Lingcod, as in previous years, were caught in greatest numbers in Area 13 (31% of total), while the largest dogfish catch came from Area 29 (33% of total, Table 4). Area 29 also produced the largest catch of other finfish (19%).

Rockfish species were identified for the entire survey area again in 1991 (Table 6). Applying the identification results to the 1991 rockfish catch estimates by area (Table 4) showed the catch by species and Area (Table 7). The results are summarized below.

Rockfish Species	Catch	% of Rockfish Catch	Major Catch Area
Quillback	43,594	25%	13
Copper	24,600	14%	14
Yelloweye	6,077	4%	16
Black	194	<1%	13
Other	98,918	57%	16
Total	173,383	100%	

The above "other" rockfish category consisted of tiger, yellowtail, china, canary and unidentified rockfish species.

The catch success (CPE) for rockfish was relatively constant throughout the year and averaged 0.37 fish per boat trip, while the catch success for lingcod was 0.02 fish per boat trip (Table 5). The catch success for all non-salmon species and for total finfish during 1991 was 0.45 and 1.63 fish per boat trip, respectively (Table 5).

3.3 BIOLOGICAL DATA

3.3.1 Proportion and Catch of Marked Chinook and Coho

In 1991, 5,444 chinook and 7,269 coho were examined for adipose fin-clip marks. Tables 8 and 9 show for chinook and coho, respectively, the number of marks observed and the total fish inspected by month and region. The data were presented by region since some Statistical Areas had insufficient numbers of fish examined for marks in some months, and those data were included with other Areas. Three regions were defined: the North Gulf represented by Areas 13-16; the South Gulf represented by Areas 17, 18, 28, 29, as well as Saanich Inlet portion of Area 19 (Area 19A); and the Victoria region represented by the remainder of Area 19 (Area 19B+) (see Fig. C-1 in Appendix C).

Among chinook examined for marks, 4.9% had adipose fin clips. The largest observed proportion of chinook marks was in the North Gulf catch (0.069) and the lowest proportion in the Victoria catch (0.015) (Table 8). Among coho examined for marks, 2.0% had adipose fin clips. The largest observed proportion of coho marks was in the North Gulf catch (0.062), and the lowest proportion in the Victoria region catch (0.010) (Table

9). Monthly catch estimates of marked chinook and coho are shown by region in Tables 10 and 11 respectively. The seasonal recovery pattern of marked chinook and coho salmon was generally similar to that observed in previous years (Shardlow and Collicutt 1989 e; Collicutt and Shardlow 1990, 1992).

3.3.2 Catch-At-Age for Chinook

During 1991, 4,372 chinook biological samples were collected for age and length analysis. Of this total 3,410 fish were aged. The number of chinook sampled in 1991 was almost triple the number sampled in 1990. This was mostly due to the increase in time available during a shift for sampling chinook because of the low coho catch rates. Table 12 shows the monthly number and percent age composition of chinook sampled for age. All ages shown in this report represent the total age (freshwater plus saltwater age). The age data are summarized graphically in Figure 12. The monthly age proportions were applied to the estimated monthly chinook catches to provide a breakdown by age group (Table 13).

In 1991, the chinook sport catch in the Strait of Georgia consisted primarily of age 3 fish (66.4%), followed by age 4 fish (21.6%), age 5 or older fish (6.6%), and age 2 fish (5.4%). The age composition during 1991 is compared to previous years below.

Catch Year	% Age Composition of Chinook				Reference
	2	3	4	5+	
1983	57.1	25.5	14.2	3.1	Shardlow et al. (1989)
1984	21.6	67.3	9.4	1.7	Shardlow and Collicutt (1989 a)
1985	6.6	70.8	20.6	2.0	Shardlow and Collicutt (1989 b)
1986	10.9	44.9	40.4	3.8	Shardlow and Collicutt (1989 c)
1987	7.8	62.1	25.0	5.2	Shardlow and Collicutt (1989 d)
1988	26.4	35.3	35.4	2.8	Shardlow and Collicutt (1989 e)
1989	3.1	83.3	10.5	3.1	Collicutt and Shardlow (1990)
1990	7.5	36.4	53.9	2.2	Collicutt and Shardlow (1992)
1991	5.4	66.4	21.6	6.6	This report

Figure 12 and Table 12 show a shift in the age composition of sampled chinook, and hence of chinook catch, as the year progressed. Age 4 fish were the dominant component of the catch until March, after which age 3 fish made up most of the catch.

3.3.3 Mean Length-At-Age for Chinook

Table 14 shows the monthly mean nose-fork length at age for the 3,410 chinook for which both length and age data were available. Figure 13 shows the length frequency distribution for all the measured chinook (4,372 aged and unaged fish). The largest portion of measured chinook (2,354 fish or 54% of the total sample) was in the 62-71 cm length category (the basis for using these size categories was the 62 cm size limit). This is consistent with the large catch of age 3 fish (Table 13) which were found to have an annual mean length of 68.3 cm (Table 14). The largest chinook sampled (130 cm) was a 4-year old fish landed at Sooke Harbour Marina in Statistical Area 19B+ on June 12, 1991.

As shown below, the proportion of chinook kept which were sub-legal in size (less than 45 cm in the Victoria area and less than 62 cm in the Strait of Georgia) continued to decline in 1991. This proportion was at its highest level following the introduction of the 62 cm size limit in 1989 (Collicutt and Shardlow 1990).

Region	% Sub-legal Chinook		
	1989	1990	1991
Victoria	2%	1%	0.3%
Strait of Georgia	20%	10%	6.5%

3.3.4 Length Frequency Distribution for Coho

Figure 14 shows the length frequency distribution for the 2,281 coho sampled in 1991. The largest proportion of measured coho (1,074 fish or 47% of the total sample) was in the 50-59 cm length class. This is similar to previous years when 53%, 42% and 57% (1988 to 1990, respectively) of the measured coho were in this size class. In the 1989 report (Collicutt and Shardlow 1990), an overall decline from 1986 to 1989 in the

mean size of landed coho was noted. This trend does not appear to have continued in 1990 or 1991 as shown below.

Year	Mean Length (cm)	Sample Size
1986	53.4	5,354
1987	50.5	4,997
1988	50.0	13,000
1989	49.6	6,883
1990	51.4	8,959
1991	54.2	2,281

3.3.5 Length Frequency Distribution for Lingcod

Figure 15 presents the length frequency distribution for lingcod sampled in 1991. The largest proportion of measured lingcod (21 fish or 35% of the total sample) was in the 60-69 cm length class. In previous years, the highest proportion of measured fish was in the 50-59 cm length class (Collicutt and Shardlow 1992). The increase in the size of landed lingcod is likely due to the 65 cm minimum size limit introduced in 1991.

4.0 SUMMARY

A sport fishery creel survey was conducted in the Strait of Georgia in 1991 in order to estimate the catches of all the important recreational finfish species and the total sport fishing boat trips. The numbers of chinook and coho salmon with adipose fin clips were also estimated. These data are presented by month and Statistical Area. The age composition of chinook and the length frequency distributions of chinook, coho and lingcod are also shown.

In 1991, sport fishermen made an estimated 467,000 boat trips in the Strait of Georgia. A total of 28,000 boating parties, of which 22,000 were actively fishing, were interviewed at a monthly maximum of 42 landing sites in the Strait of Georgia Creel Survey area. This sampling represents approximately 6% of the total number of boat trips conducted by sport fishermen in the Strait of Georgia in 1991. A total of 63 overflights were also conducted to take "snapshot" counts of fishing effort.

In 1991, sport fishermen in the Strait of Georgia landed an estimated total finfish catch of 762,000 pieces of which 72% were salmon and 28% were groundfish. The 551,000 landed salmon consisted of 157,000 coho, 116,000 chinook, 250,000 pink salmon, 24,000 sockeye and 5,000 chum salmon. An additional 622,000 salmon of mixed species were released by anglers. Catch success per boat trip averaged 1.2 salmon (all species) and 0.5 groundfish.

The 210,000 landed groundfish consisted of 173,000 rockfish, 8,000 lingcod, 5,000 dogfish and 23,000 other finfish. Rockfish catches were identified as quillback (25% of rockfish catch), copper (14%), yelloweye (4%) and black (less than 1%); the remaining 57% of the rockfish catch consisted of tiger, yellowtail, china, canary and unidentified species.

Among salmon examined for marks, 4.9% of chinook and 2.0% of coho had adipose fin clips. The majority of chinook sport catch in 1991 consisted of age 3 fish (66.4%), followed by age 4 (21.6%), age 5 or older (6.6%), and age 2 fish (5.4%). Of the total chinook measured in 1991, the largest proportion was in the 62-71 cm size class. Of the total chinook measured, less than 1% were sub-legal in size (less than 45 cm) in the Victoria area and 7% were sub-legal in size (less than 62 cm) in the remaining portion of the Strait of Georgia. Of the coho and lingcod sampled for length, the largest proportion was in the 50-59 cm and 60-69 cm size classes, respectively.

5.0 ACKNOWLEDGMENTS

We would like to thank the creel survey staff of LGL Ltd., particularly Karl English and Gary Searing, and private marina and boat ramp owners for their valuable assistance and cooperation. Thanks also Alice Fedorenko who reviewed and edited the final copy, and finally thanks to the many thousands of anglers who participated voluntarily in the survey.

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FIGURES

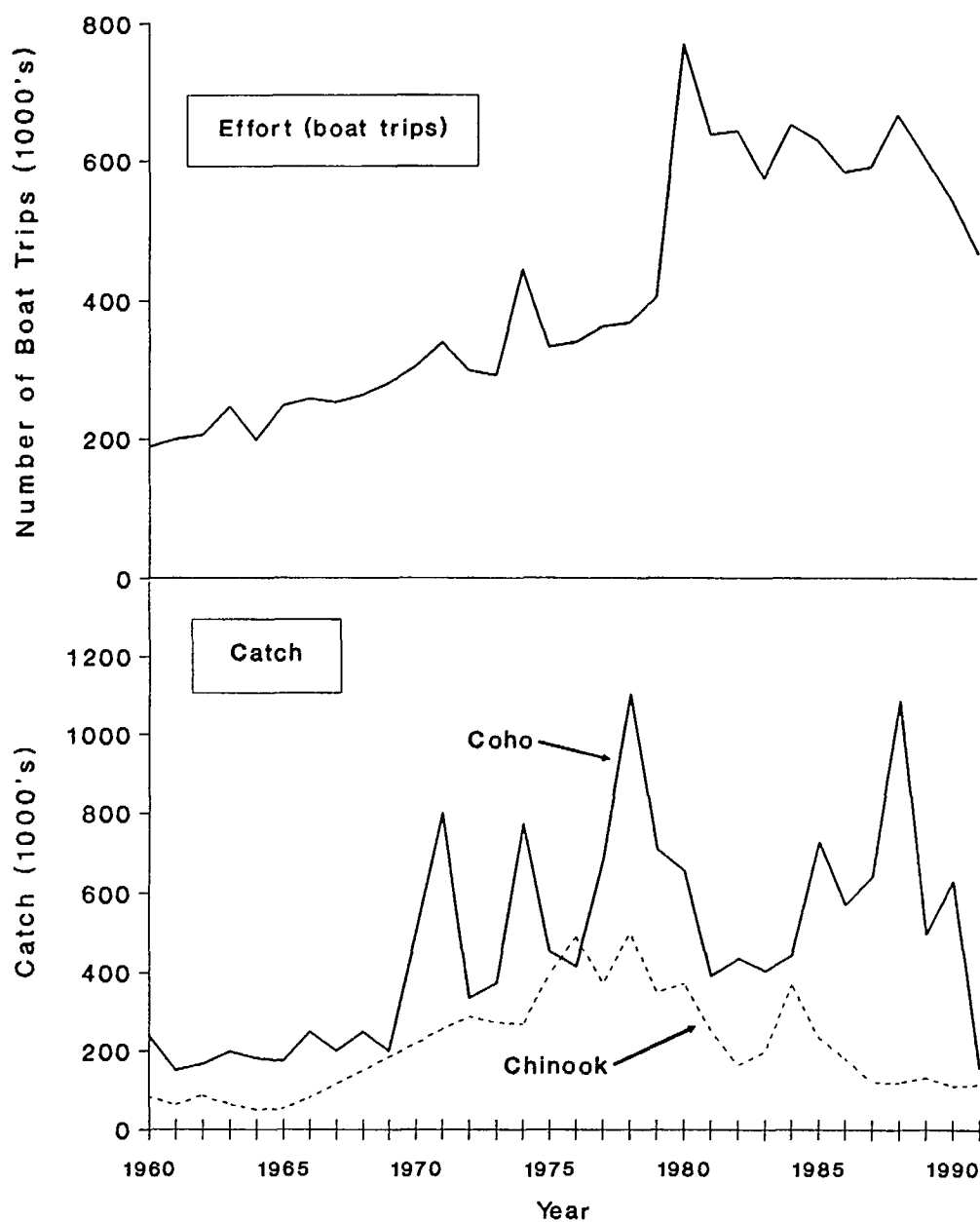


Figure 1. Tidal effort statistics and sport catches of coho and chinook salmon for the Strait of Georgia, 1960 - 1991.

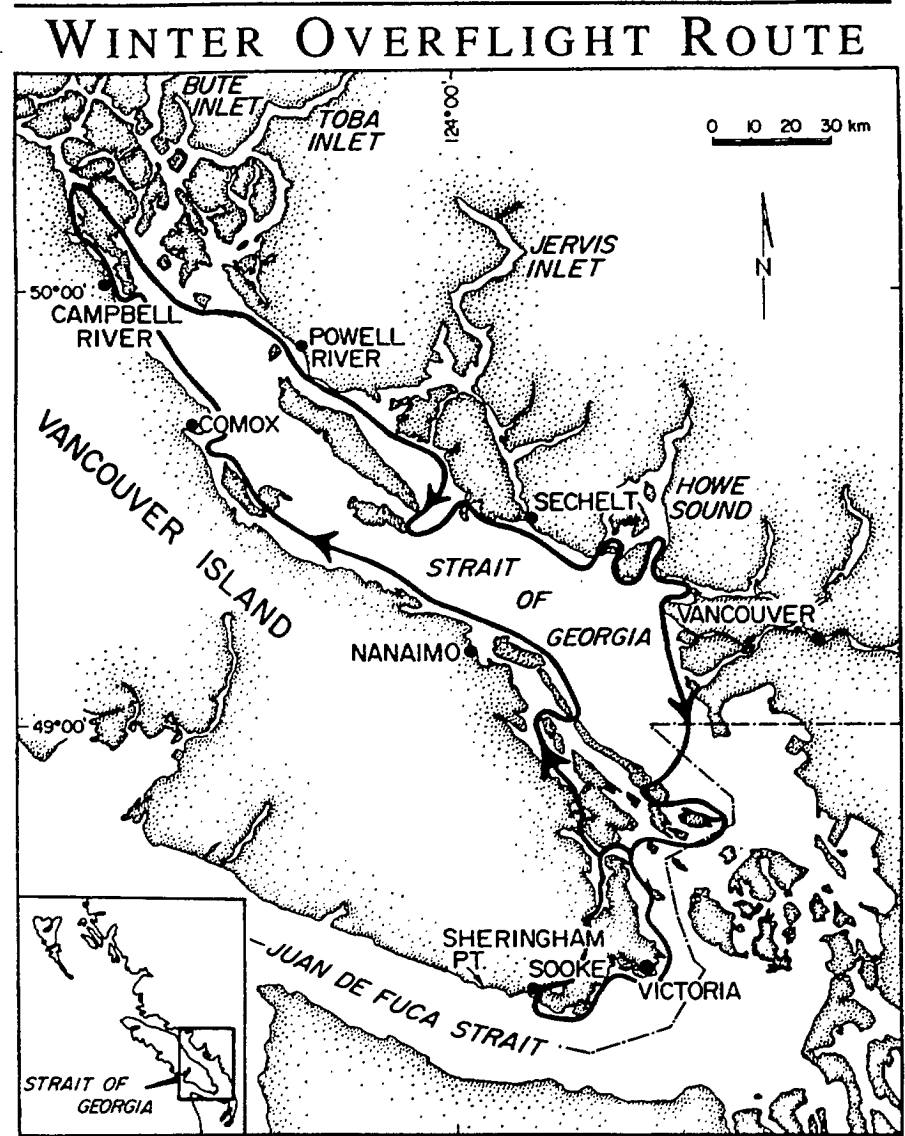
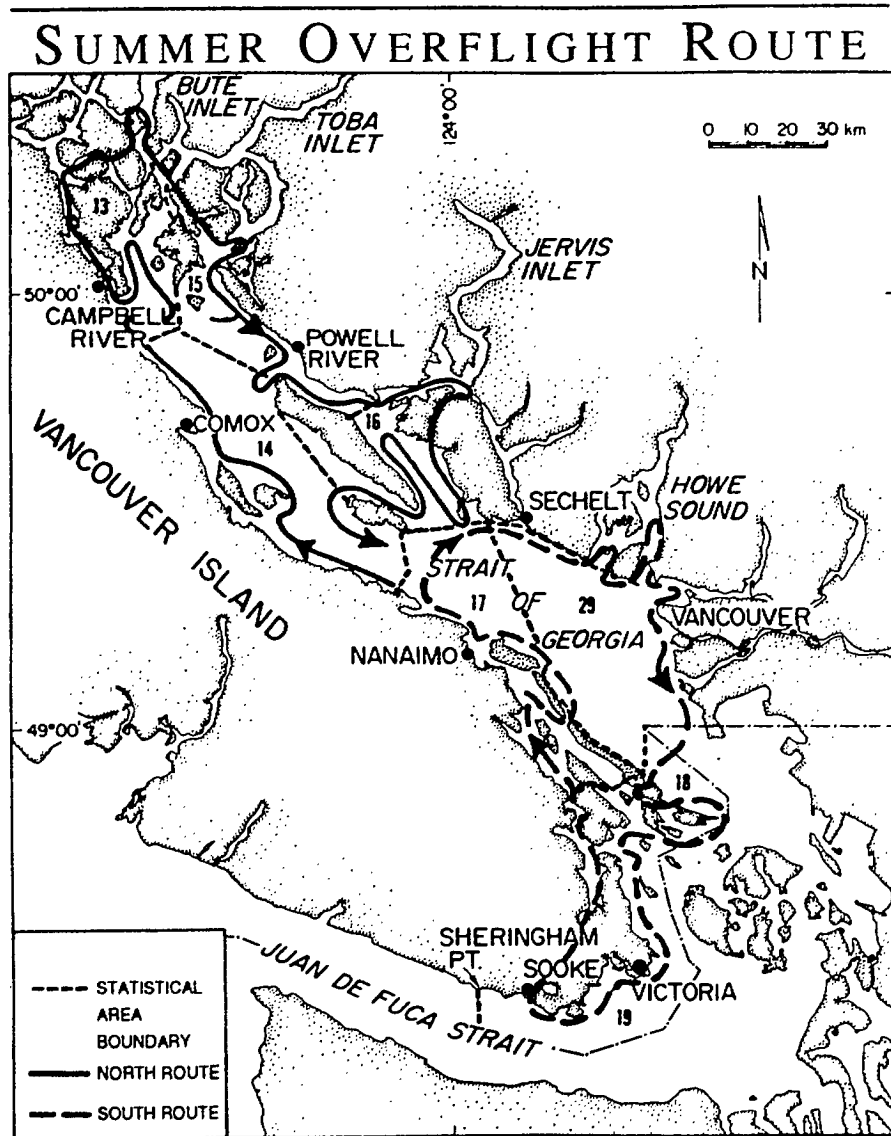


Figure 2. Summer and winter overflight routes, Strait of Georgia, 1991.

GEORGIA STRAIT SPORT FISHING CREEL SURVEY No. **78313**

Landing Area: _____ / _____ Statistical Area: _____
 Interviewer: _____ / _____ Date: _____ / _____ / _____ Time of Interview _____ AM / _____ PM
 YR MO DAY

PRESENT BOAT TRIP COMPLETED

1. Total number of individuals in party:
2. Time of landing: _____ : _____ AM / _____ : _____ PM Time block:
3. Was your party sport fishing on this trip: YES NO
4. Guided: YES NO

Assessment Code

- 0 = Complete Form
 1 = Marks Incomplete
 3 = Not Visually Inspected
 4 = Refusal

5. Residences of party: B.C. Rest of Canada Other

6. Length of boat trip: HRS.

7. Times lines were in the water: (EXCLUDE time not fishing)

- | | | | |
|---|---|--|--|
| ☐ 1) Before 7:00 | ☐ 5) 10:00 - 10:59 | ☐ 9) 2:00 - 2:59 | ☐ 13) 6:00 - 6:59 |
| ☐ 2) 7:00 - 7:59 | ☐ 6) 11:00 - 11:59 | ☐ 10) 3:00 - 3:59 | ☐ 14) 7:00 - 7:59 |
| ☐ 3) 8:00 - 8:59 | ☐ 7) 12:00 - 12:59 | ☐ 11) 4:00 - 4:59 | ☐ 15) 8:00 - 8:59 |
| ☐ 4) 9:00 - 9:59 | ☐ 8) 1:00 - 1:59 | ☐ 12) 5:00 - 5:59 | ☐ 16) 9:00 - Plus |

8. Average number of lines in the water for TOTAL boat party:

9. CATCH SUMMARY

	1ST SUB AREA	2ND SUB AREA	3RD SUB AREA
STATISTICAL SUBAREA:			
KEPT:			
RELEASED:			
TIME:	HRS.	HRS.	HRS.
SPECIFIC GEOGRAPHICAL LOCATION:			

Total catch for trip:

Total time fishing:

 HRS.

MARKS

	ADIPOSE MISSING	UNMARKED
<u>CHINOOK</u>		
<u>COHO</u>		

10. How much fishing time was directed at each of the following?

CO CN SM LC RF
 GF SF OTHER

11. NUMBER OF PREVIOUS FISHING TRIPS THIS DAY.

78313

Figure 3. Sample of 1991 interview form.

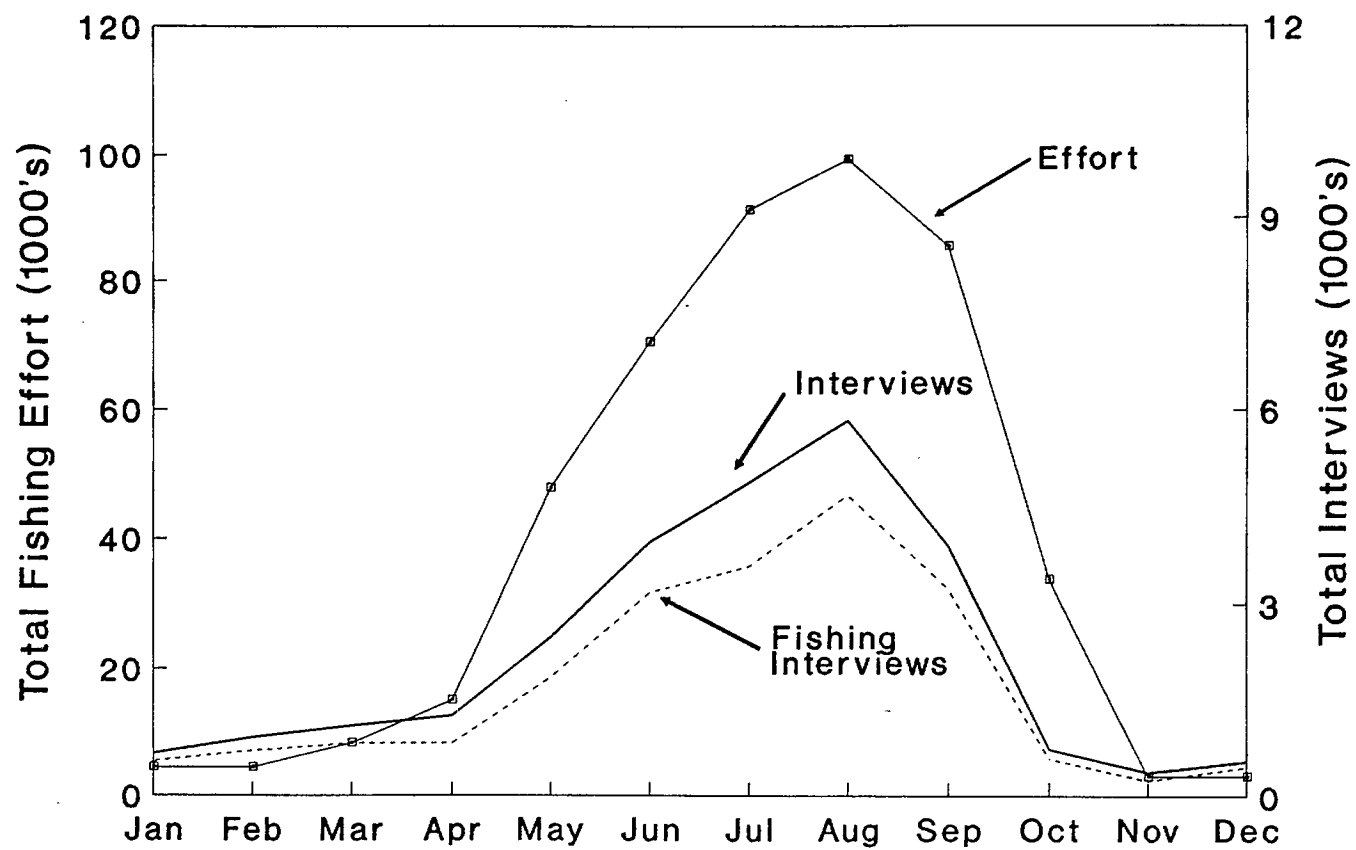


Figure 4. Comparison of monthly total fishing effort, monthly total interviews and monthly total fishing interviews, Strait of Georgia, 1991.

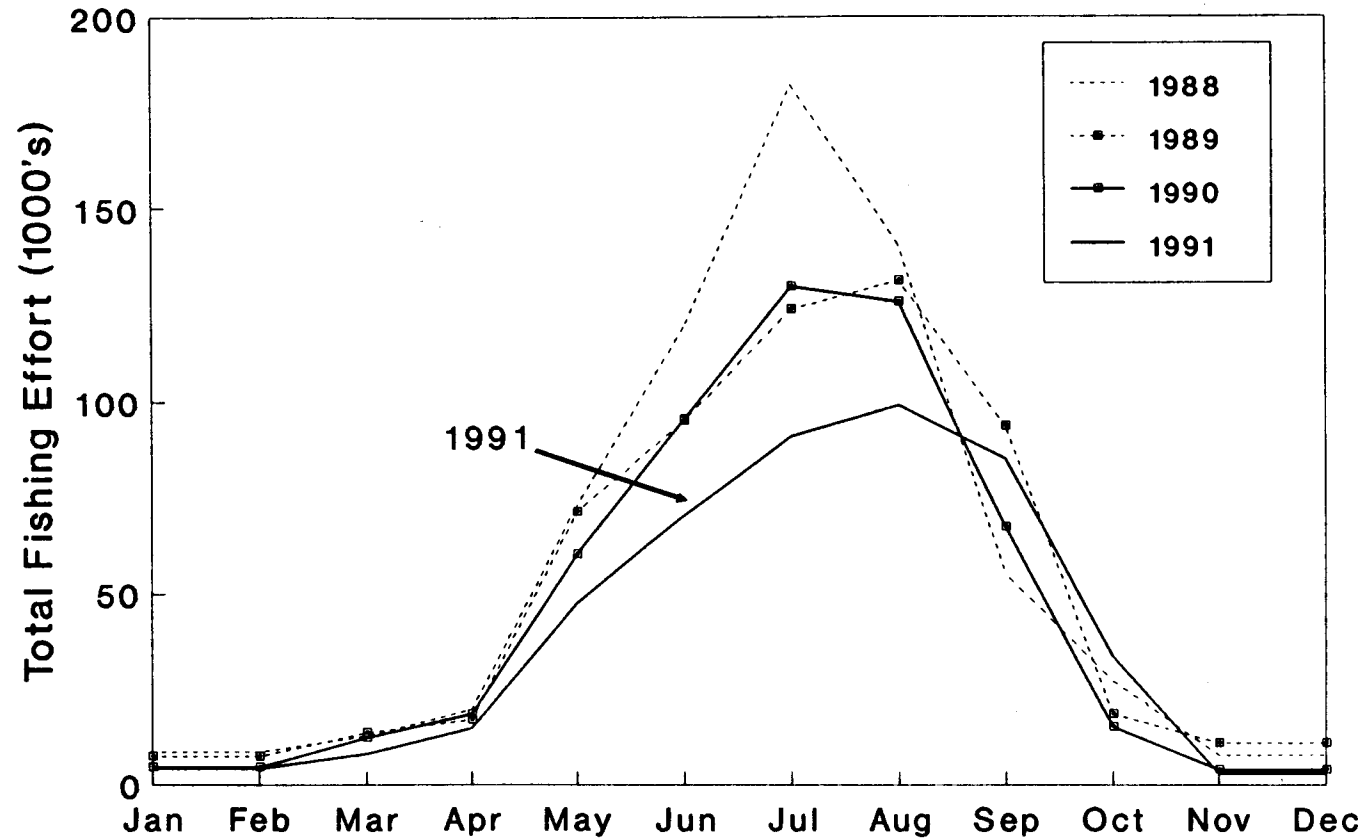


Figure 5. Monthly fishing effort estimates (number of boat trips) for the Strait of Georgia sport fishery, 1988 - 1991.

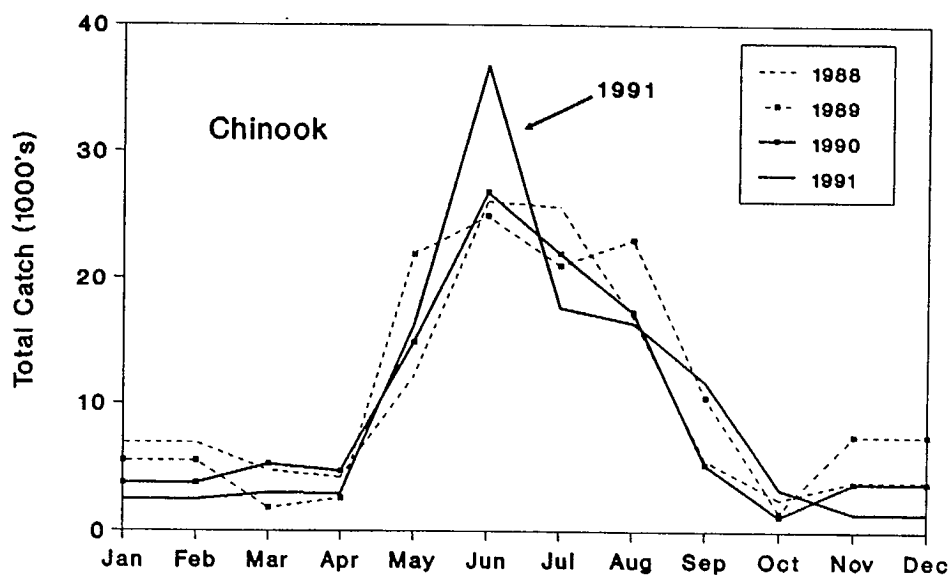


Figure 6. Monthly chinook catch for the Strait of Georgia sport fishery, 1988- 1991

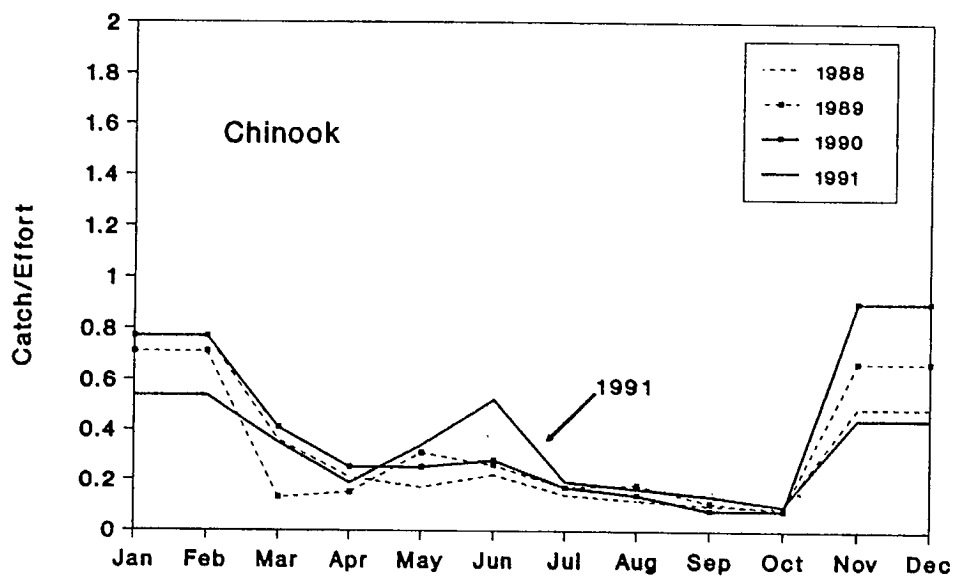


Figure 7. Monthly chinook catch per boat trip for the Strait of Georgia sport fishery, 1988 - 1991.

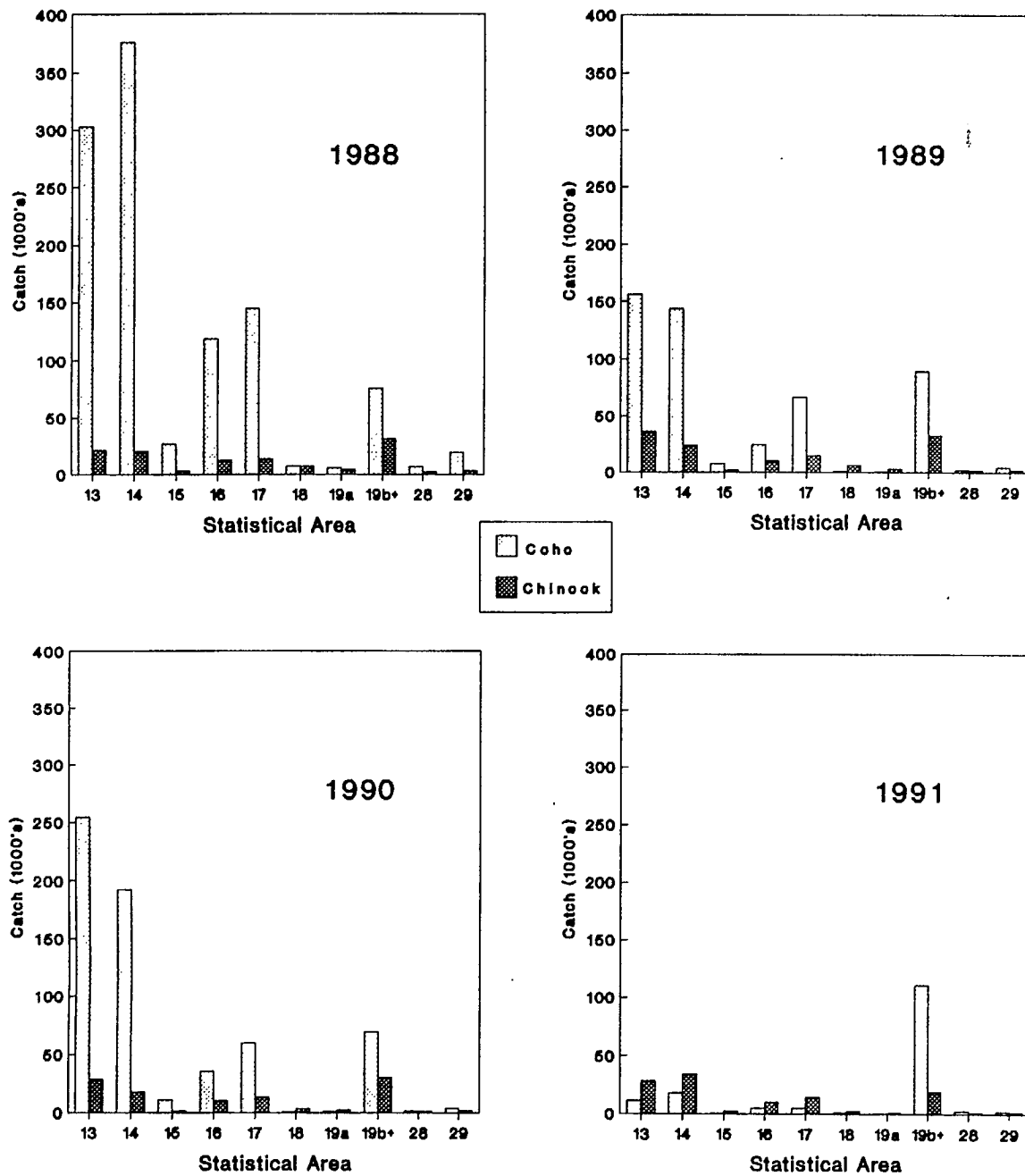


Figure 8. Annual sport catches of chinook and coho salmon by Statistical Area in the Strait of Georgia, 1988 - 1991.

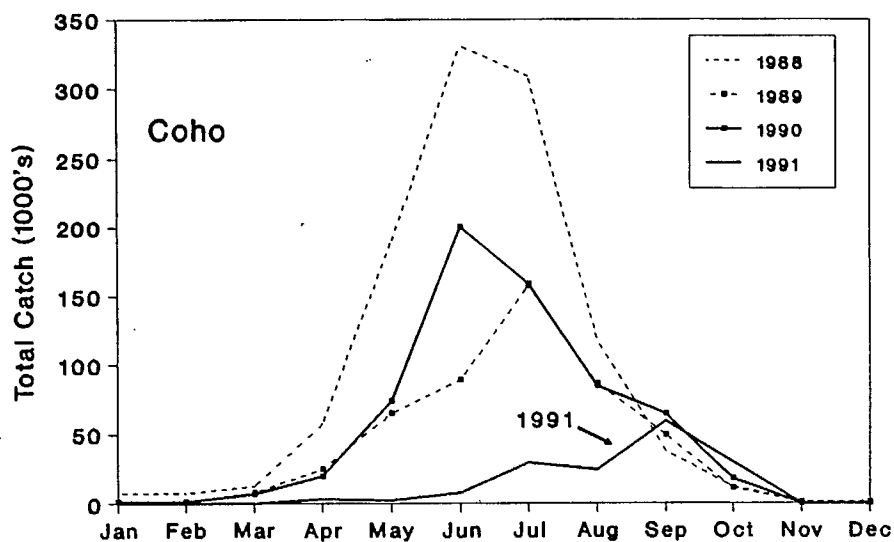


Figure 9. Monthly coho catch for the Strait of Georgia sport fishery, 1988 - 1991.

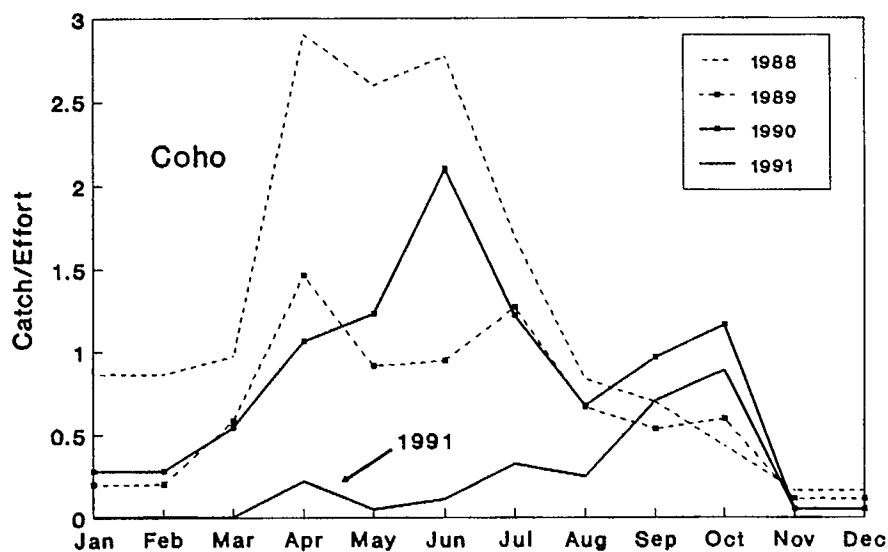


Figure 10. Monthly coho catch per boat trip for the Strait of Georgia sport fishery, 1988 - 1991.

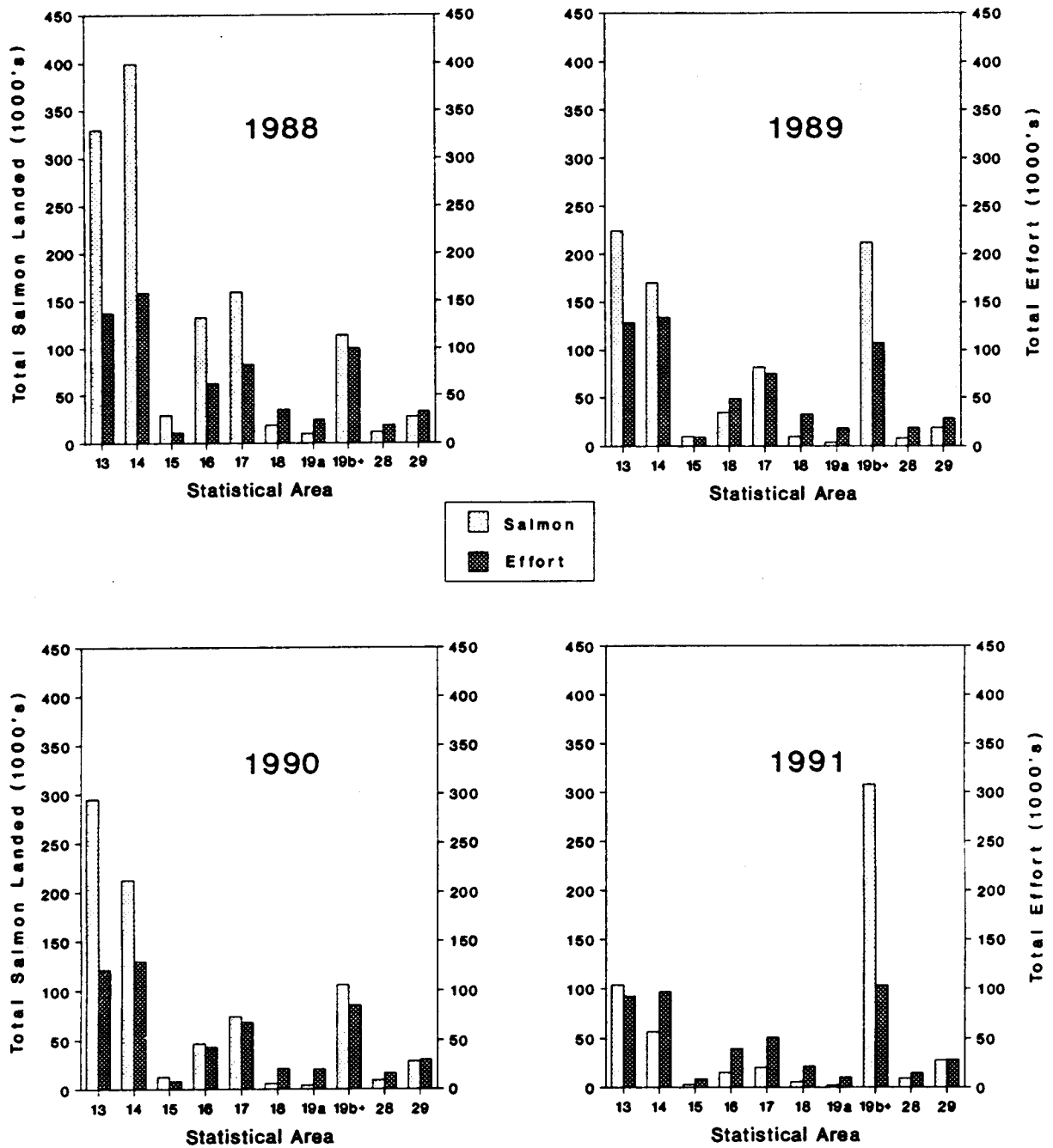


Figure 11. Total salmon landed and total fishing effort expended by Statistical Area in the Strait of Georgia sport fishery, 1988 - 1991.

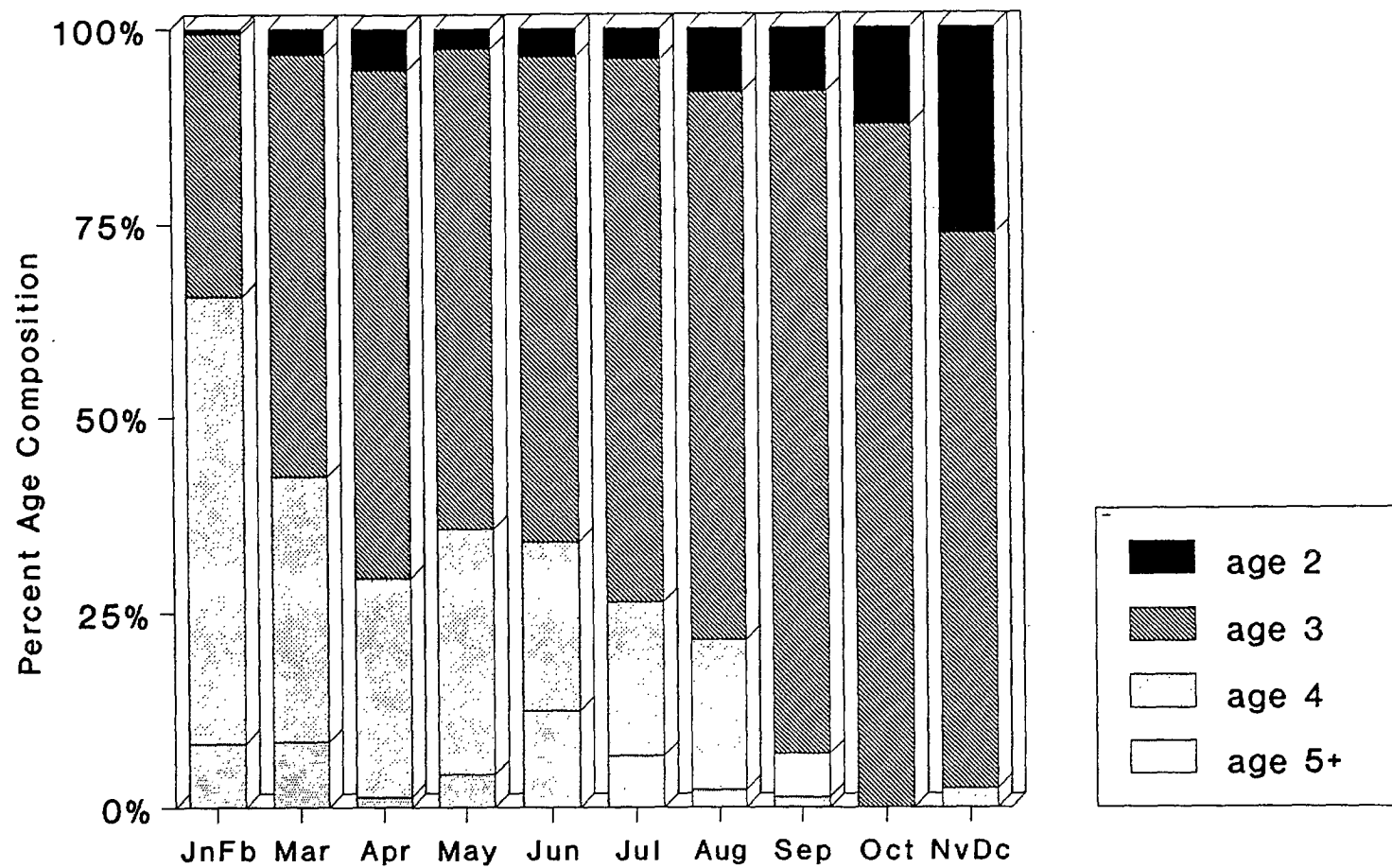


Figure 12. Monthly percent age composition of chinook salmon sampled in the Strait of Georgia Creel Survey, 1991.

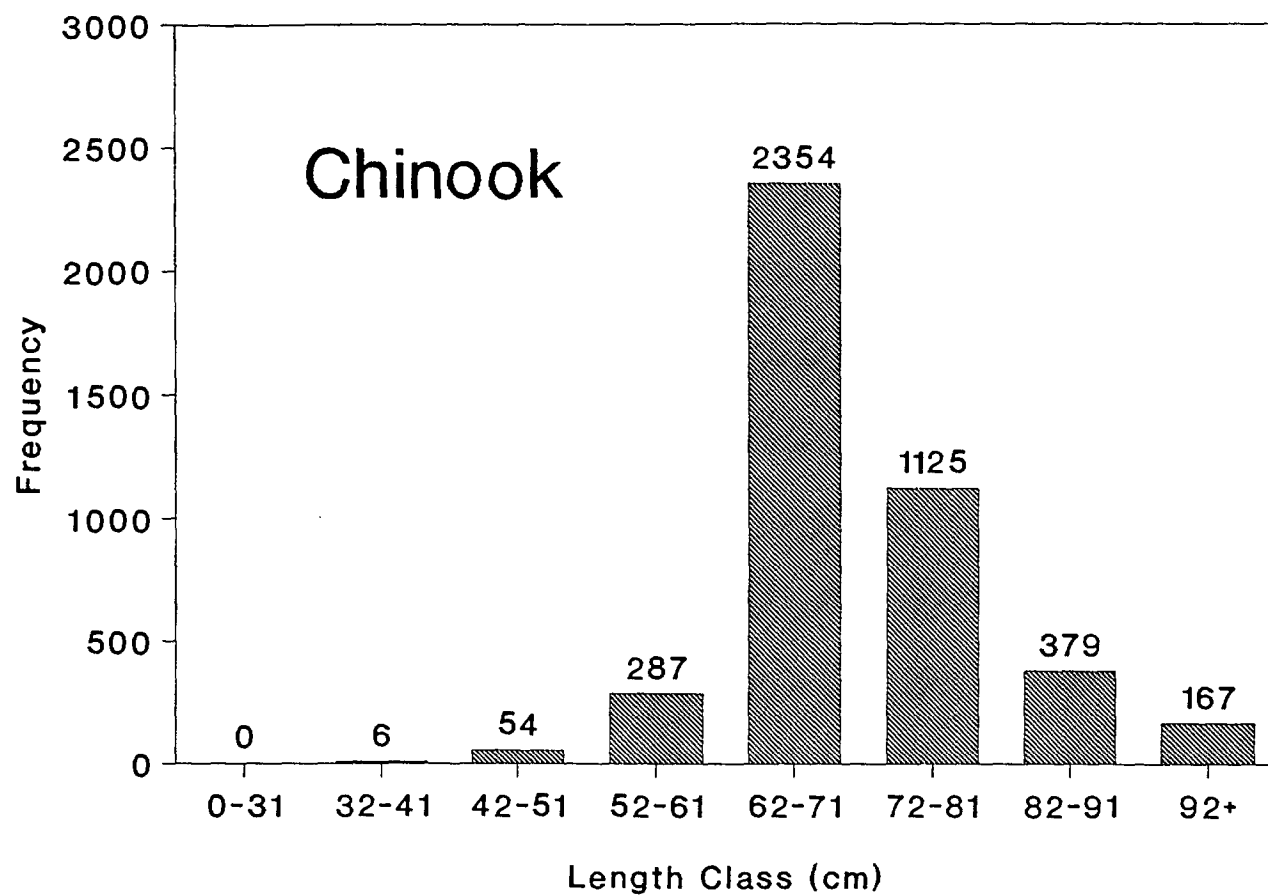


Figure 13. Length frequency distribution of chinook salmon sampled in the Strait of Georgia Creel Survey, 1991.

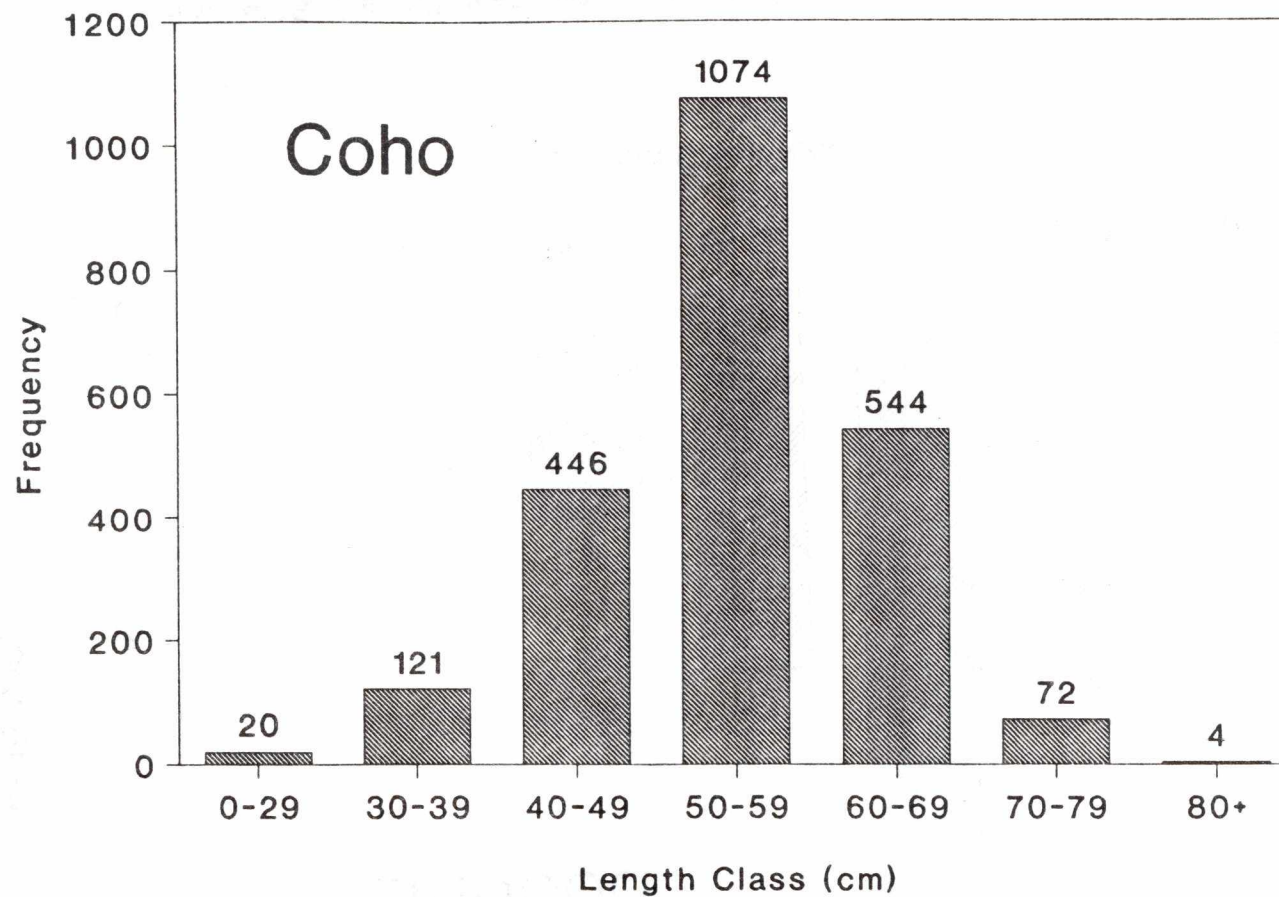


Figure 14. Length frequency distribution of coho salmon sampled in the Strait of Georgia Creel Survey, 1991.

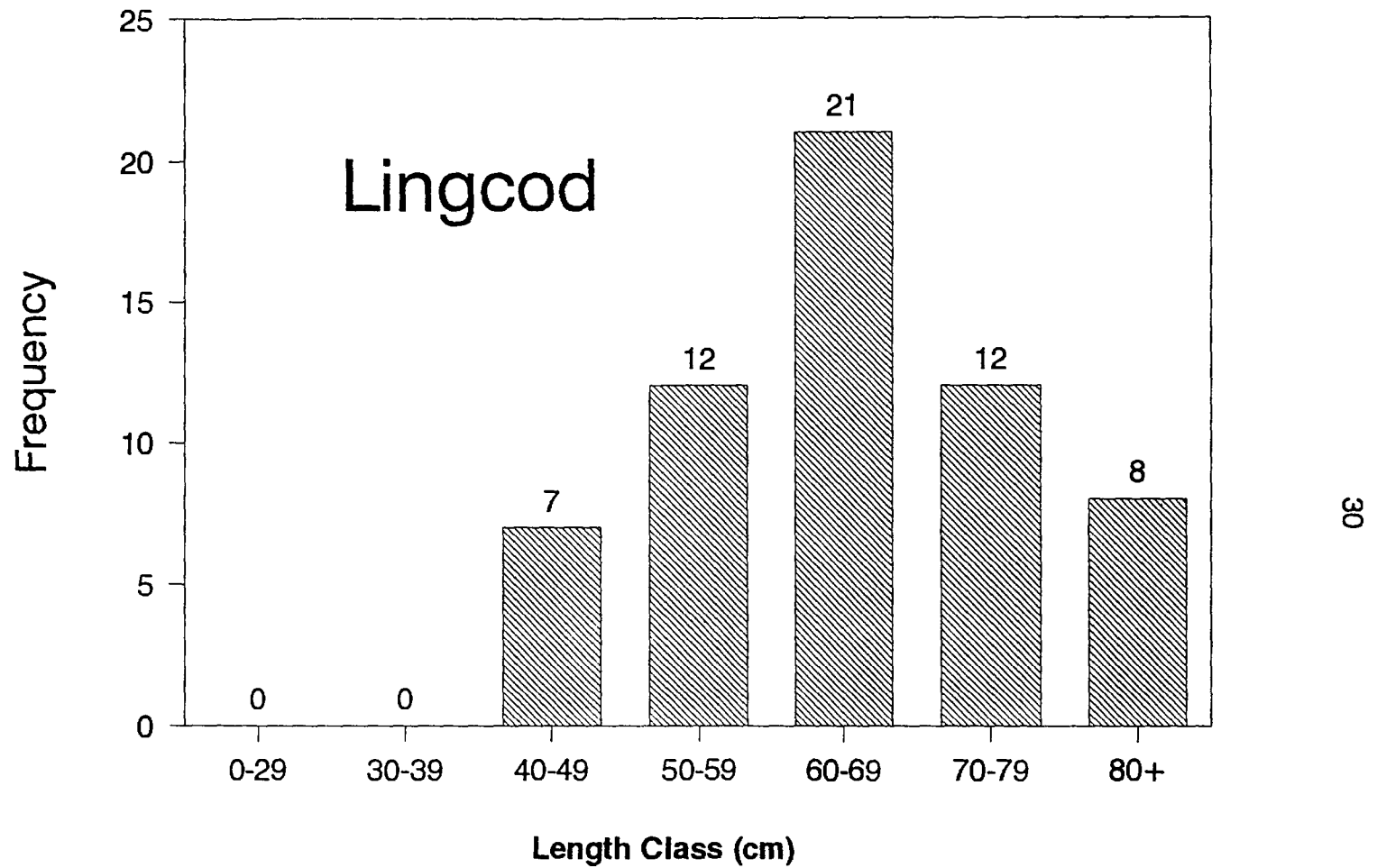


Figure 15. Length frequency distribution of lingcod sampled in the Strait of Georgia Creel Survey, 1991.

TABLES

Table 1. Tidal effort statistics and sport catches of coho and chinook salmon for the Strait of Georgia, 1960 -1991.*

Year	Effort ** (boat trips)	Catch	
		Coho	Chinook
1960	189,150	238,000	83,000
1961	199,935	152,000	63,000
1962	205,547	167,000	86,000
1963	247,590	199,000	65,000
1964	198,120	182,000	51,000
1965	250,020	175,000	53,000
1966	259,100	249,000	80,000
1967	254,500	200,000	115,000
1968	265,030	250,000	150,000
1969	281,475	200,000	185,000
1970	306,255	500,000	220,000
1971	341,123	800,000	255,000
1972	300,349	335,000	287,000
1973	293,141	373,000	272,000
1974	443,441	772,000	269,000
1975	334,490	454,000	398,000
1976	340,729	415,000	490,000
1977	363,350	682,000	372,000
1978	369,035	1,103,000	500,000
1979	404,710	708,735	350,000
1980	769,000	655,000	371,000
1981	637,000	391,200	253,300
1982	642,200	436,090	163,793
1983	574,257	404,031	198,433
1984	651,090	443,590	369,445
1985	628,513	728,197	234,838
1986	582,946	571,980	181,896
1987	589,731	641,572	121,081
1988	664,517	1,084,790	119,117
1989	603,331	497,223	132,846
1990	543,368	630,032	111,914
1991	466,749	157,111	115,519

* **SOURCE:** Coho catch statistics: 1960-1978 from Argue et al. (1983); 1979 from R. Kadowaki (pers. comm.); 1980-1982 from unpublished creel survey data; 1983-1990 from Annual Reports (Appendix E).

Chinook catch statistics: 1960-1977 from Argue et al. (1983); 1978 and 1979 from B. Riddell (pers. comm.) following the methods of Argue et al. (1983); 1980-1982 from unpublished creel survey data; 1983-1990 from Annual Reports (Appendix E).

Effort statistics: 1960-1979 from annual published and unpublished Fisheries Officer statistics; 1980-1982 from unpublished creel survey data; 1983-1990 from Annual Reports (Appendix E).

** Effort prior to 1980 (the start of the creel survey) may not represent boat trips.

Table 2. Number of fishing interviews by month and Statistical Area, and number of overflights by month, Strait of Georgia, 1991.

Month	Statistical Area										Total	Over- flights
	13	14	15	16	17	18	19A	19B+	28	29		
Jan+Feb	146	37	0	272	123	37	11	545	84	40	1,295	4
Mar	37	62	0	186	102	19	8	346	53	19	832	4
Apr	46	122	0	115	170	36	14	227	79	22	831	4
May	126	274	107	206	516	18	67	364	200	26	1,904	6
Jun	541	669	113	396	436	46	76	777	182	72	3,308	9
Jul	906	479	47	529	326	52	83	897	267	185	3,771	11
Aug	1161	591	60	382	382	56	23	1679	219	636	5,189	8
Sep	363	448	35	165	208	27	31	1586	139	414	3,416	7
Oct	53	23	0	101	25	21	5	339	34	9	610	6
Nov+Dec	43	13	0	197	85	24	9	314	31	10	726	4
Total	3,422	2,718	362	2,549	2,373	336	327	7,074	1,288	1,433	21,882	63

Table 3. Fishing effort and catch by species and month, Strait of Georgia, 1991.

Month		Effort No. Boat Trips	Coho	Chinook	Pink	Sockeye	Chum	Rock – Fish	Lingcod	Dog – Fish	Other Finfish +	Total Finfish
Jan+Feb	Estimate	8,977	78	4,835	0	0	0	2,617	1 *	77	976	8,584
	S.E.	1,734	51	1,430	0	0	0	852	0	78	256	1,687
Mar	Estimate	8,301	24	2,907	0	0	0	2,095	6 *	0	778	5,810
	S.E.	988	18	576	0	0	0	502	6	0	361	845
Apr	Estimate	15,091	3,281	2,859	5	0	0	5,872	138 *	0	2,222	14,377
	S.E.	1,201	735	374	8	0	0	899	62	0	489	1,316
May	Estimate	47,780	2,285	16,239	0	0	0	15,233	429 *	113	1,715	36,014
	S.E.	3,558	500	2,011	0	0	0	1,770	154	60	625	2,801
Jun	Estimate	70,490	7,742	36,809	177	15	0	30,925	1,686	706	2,152	80,212
	S.E.	6,321	1,323	5,281	91	13	0	3,804	311	194	532	6,673
Jul	Estimate	91,171	29,453	17,619	14,267	2,567	115	49,138	1,918	799	3,473	119,349
	S.E.	5,109	3,323	1,228	2,528	551	53	4,752	252	205	514	6,496
Aug	Estimate	99,346	24,366	16,429	127,746	13,764	114	30,844	2,551	1,518	4,794	222,126
	S.E.	4,979	2,272	1,221	12,757	1,521	43	2,617	331	435	1,225	13,430
Sep	Estimate	85,498	59,725	11,735	106,781	7,055	659	18,512	1,394	188	3,176	209,225
	S.E.	3,931	4,340	967	6,921	972	139	1,794	189	49	431	8,490
Oct	Estimate	33,752	29,843	3,267	685	120	3,243	16,759	42 *	1,448	3,192	58,599
	S.E.	3,447	6,708	670	278	0	800	6,329	40	1,012	1,323	9,434
Nov+Dec	Estimate	6,343	314	2,820	1	0	1,142	1,388	49 *	123	991	6,828
	S.E.	1,175	120	956	0	0	678	642	32	132	478	1,431
Total	Estimate	466,749	157,111	115,519	249,662	23,521	5,273	173,383	8,214	4,972	23,469	761,124 **
	S.E.	11,732	9,088	6,304	14,735	1,887	1,060	9,618	579	1,150	2,245	21,056

* A total closure for lingcod was in effect from January 1 to May 31, and October 1 to December 31. Reported figures most likely represent illegal catches by anglers.

** In addition, an estimated 435 steelhead, cutthroat trout, and unidentified salmon were caught by sport fishermen.

+ See Appendix D for list of species.

Table 4. Fishing effort and catch by species and Statistical Area, Strait of Georgia, 1991.

Statistical Area		Effort No. Boat Trips	Coho	Chinook	Pink	Sockeye	Chum	Rock— Fish	Lingcod	Dog— Fish	Other Finfish *	Total Finfish
13	Estimate	92,336	11,467	28,531	57,765	4,108	1,894	17,131	2,520	289	2,128	125,833
	S.E.	4,141	944	1,682	4,219	362	568	1,309	270	87	299	4,884
14	Estimate	97,210	18,143	34,091	4,043	36	574	23,486	1,153	467	1,345	83,338
	S.E.	7,853	2,153	5,394	800	37	406	4,624	259	191	356	7,493
15	Estimate	8,335	419	2,464	96	6	0	2,184	51	91	171	5,482
	S.E.	738	83	310	49	7	0	335	18	31	47	470
16	Estimate	39,672	4,948	10,223	84	27	0	48,318	976	936	2,946	68,458
	S.E.	1,615	715	831	27	14	0	4,056	205	410	1,169	4,385
17	Estimate	51,257	5,111	14,674	201	1	211	20,548	1,569	346	3,357	46,018
	S.E.	3,195	580	1,453	49	2	157	2,265	317	146	689	2,867
18	Estimate	21,753	866	2,546	760	330	1,214	8,475	256	170	2,088	16,705
	S.E.	1,465	253	583	185	118	682	1,366	71	60	671	1,801
19A	Estimate	10,141	722	1,131	175	107	31	4,405	154	68	1,436	8,229
	S.E.	995	310	239	125	106	35	987	70	62	592	1,231
19B+	Estimate	103,137	110,590	19,017	169,578	7,889	631	13,319	1,064	395	3,534	326,017
	S.E.	5,585	8,699	2,102	13,896	892	196	1,203	188	160	514	16,607
28	Estimate	14,652	2,634	1,162	2,573	2,332	97	11,856	178	588	2,052	23,472
	S.E.	1,361	506	179	538	643	60	1,429	50	175	349	1,786
29	Estimate	28,256	2,211	1,680	14,387	8,685	621	23,661	293	1,622	4,412	57,572
	S.E.	3,048	360	269	2,290	1,481	323	6,433	72	1,012	1,340	7,208
Total	Estimate	466,749	157,111	115,519	249,662	23,521	5,273	173,383	8,214	4,972	23,469	761,124 **
	S.E.	11,732	9,088	6,304	14,735	1,887	1,061	9,618	579	1,150	2,245	21,056

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* See Appendix D for list of species.

* In addition, an estimated 435 steelhead, cutthroat trout and unidentified salmon were caught by sport fishermen.

Table 5. Monthly catch success (catch per boat trip) by species, Strait of Georgia, 1991.*

Month	Chinook	Coho	Total ** Salmon	Rock— Fish	Lingcod	Total Non— Salmon	All Finfish
Jan+Feb	0.54	0.01	0.55	0.29	0.00	0.41	0.96
Mar	0.35	0.00	0.35	0.25	0.00	0.35	0.70
Apr	0.19	0.22	0.41	0.39	0.01	0.55	0.95
May	0.34	0.05	0.39	0.32	0.01	0.37	0.75
Jun	0.52	0.11	0.63	0.44	0.02	0.50	1.14
Jul	0.19	0.32	0.70	0.54	0.02	0.61	1.31
Aug	0.17	0.25	1.84	0.31	0.03	0.40	2.24
Sep	0.14	0.70	2.17	0.22	0.02	0.27	2.45
Oct	0.10	0.88	1.10	0.50	0.00	0.64	1.74
Nov+Dec	0.44	0.05	0.67	0.22	0.01	0.40	1.08
Total	0.25	0.34	1.18	0.37	0.02	0.45	1.63

* Calculated using Table 3 data.

** Includes coho, chinook, pink, chum and sockeye.

Table 6. Identification of rockfish by species in each Statistical Area, Strait of Georgia, 1991.

Species	Statistical Area										Total Sample
	13	14	15	16	17	18	19A	19B+	28	29	
Quillback (<u>Sebastes maliger</u>)	357	131	96	235	122	55	44	153	101	9	1,303
Copper (<u>S. caurinus</u>)	101	95	0	0	122	68	14	69	266	14	749
Yelloweye (<u>S. ruberrimus</u>)	6	22	16	66	30	0	2	32	2	0	176
Black (<u>S. melanops</u>)	4	0	0	0	0	0	0	4	2	0	10
Tiger (<u>S. nigrocinctus</u>)	0	3	1	9	3	0	0	0	0	0	16
Yellowtail (<u>S. flavidus</u>)	0	0	0	0	0	0	0	0	0	0	0
China (<u>S. nebulosus</u>)	0	0	0	0	0	0	2	8	0	0	10
Canary (<u>S. pinniger</u>)	0	0	0	0	0	0	0	4	6	0	10
Unidentified	91	123	18	970	214	53	187	682	1162	62	3,562
Total sample	559	374	131	1,280	491	176	249	952	1,539	85	5,836

Table 7. Estimated catch of rockfish by species and Statistical Area, Strait of Georgia, 1991. *

Species		Statistical Area										Total
		13	14	15	16	17	18	19A	19B+	28	29	
Quillback	Catch	10,941	8,226	1,600	8,871	5,106	2,648	778	2,141	778	2,505	43,594
	S.D.	906	1,724	260	911	692	522	206	250	120	1,065	2,588
Copper	Catch	3,095	5,966	0	0	5,106	3,274	248	965	2,049	3,897	24,600
	S.D.	366	1,292	0	0	692	615	86	142	272	1,448	2,204
Yelloweye	Catch	184	1,382	267	2,491	1,255	0	35	448	15	0	6,077
	S.D.	76	398	75	365	263	0	27	88	11	0	617
Black	Catch	123	0	0	0	0	0	0	56	15	0	194
	S.D.	62	0	0	0	0	0	0	28	11	0	69
Other **	Catch	2,788	7,912	317	36,956	9,081	2,553	3,344	9,709	8,999	17,259	98,918
	S.D.	865	4,072	197	3,935	2,026	1,102	961	1,164	1,398	6,177	8,976
Total	Catch	17,131	23,486	2,184	48,318	20,548	8,475	4,405	13,319	11,856	23,661	173,383
	S.D.	1,309	4,624	335	4,056	2,265	1,366	987	1,203	1,429	6,433	9,618

* Calculated using data from Tables 4 and 6.

** Other includes tiger, yellowtail, china, canary and unidentified rockfish.

Table 8. Monthly number of marked chinook observed and total chinook inspected by region, Strait of Georgia, 1991.

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Obs *	14	8	4	26
	Insp **	157	43	508	708
Mar	Obs	9	1	1	11
	Insp	109	16	153	278
Apr	Obs	4	4	0	8
	Insp	62	78	33	173
May	Obs	13	13	4	30
	Insp	296	349	67	712
Jun	Obs	53	7	6	66
	Insp	840	258	350	1,448
Jul	Obs	38	4	1	43
	Insp	418	86	138	642
Aug	Obs	23	13	4	40
	Insp	426	151	105	682
Sep	Obs	20	4	3	27
	Insp	183	54	73	310
Oct	Obs	0	0	0	0
	Insp	33	3	24	60
Nov+Dec	Obs	8	3	4	15
	Insp	107	26	298	431
Total	Obs	182	57	27	266
	Insp	2,631	1,064	1,749	5,444
Proportion of marks		0.069	0.054	0.015	0.049

* Obs – marks observed.

** Insp – fish inspected.

Table 9. Monthly number of marked coho observed and total coho inspected by region
Strait of Georgia, 1991.

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Obs *	0	0	0	0
	Insp **	1	1	6	8
Mar	Obs	0	0	0	0
	Insp	0	0	0	0
Apr	Obs	0	1	1	2
	Insp	7	28	135	170
May	Obs	1	1	1	3
	Insp	24	50	8	82
Jun	Obs	6	6	7	19
	Insp	232	38	143	413
Jul	Obs	14	12	15	41
	Insp	207	170	816	1,193
Aug	Obs	16	9	7	32
	Insp	281	167	932	1,380
Sep	Obs	25	0	26	51
	Insp	214	27	3,136	3,377
Oct	Obs	0	0	1	1
	Insp	27	8	592	627
Nov+Dec	Obs	0	0	0	0
	Insp	1	11	7	19
Total	Obs	62	29	58	149
	Insp	994	500	5,775	7,269
Proportion of marks		0.062	0.058	0.010	0.020

* Obs – marks observed.

** Insp – fish inspected.

Table 10. Monthly estimated catch of marked chinook by region, Strait of Georgia, 1991. *

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Catch	75	154	25	254
	S.D.	34	109	17	115
Mar	Catch	80	36	9	125
	S.D.	36	37	10	53
Apr	Catch	56	70	0	126
	S.D.	31	37	0	48
May	Catch	422	206	65	693
	S.D.	137	70	37	158
Jun	Catch	1,747	126	76	1,949
	S.D.	402	50	36	407
Jul	Catch	1,212	69	20	1,301
	S.D.	212	35	21	216
Aug	Catch	585	351	58	994
	S.D.	129	115	31	176
Sep	Catch	950	141	46	1,137
	S.D.	224	73	28	237
Oct	Catch	0	0	0	0
	S.D.	0	0	0	0
Nov+Dec	Catch	12	64	28	104
	S.D.	7	45	20	50
Total	Catch	5,139	1,217	327	6,683
	S.D.	544	209	75	587

* Calculated using data from Table 8 and Appendix B-3.

Table 11. Monthly estimated catch of marked coho by region, Strait of Georgia, 1991. *

Month		North Gulf	South Gulf	Victoria	Total Sample
Jan+Feb	Catch	0	0	0	0
	S.D.	0	0	0	0
Mar	Catch	0	0	0	0
	S.D.	0	0	0	0
Apr	Catch	0	25	19	44
	S.D.	0	27	20	34
May	Catch	42	20	36	98
	S.D.	45	22	43	66
Jun	Catch	138	87	91	316
	S.D.	65	39	43	87
Jul	Catch	600	269	308	1,177
	S.D.	178	85	98	220
Aug	Catch	431	166	103	700
	S.D.	114	61	42	136
Sep	Catch	1,100	0	407	1,507
	S.D.	235	0	87	251
Oct	Catch	0	0	44	44
	S.D.	0	0	47	47
Nov+Dec	Catch	0	0	0	0
	S.D.	0	0	0	0
Total	Catch	2,311	567	1,008	3,886
	S.D.	326	117	159	381

* Calculated using data from Table 9 and Appendix B-2.

Table 12. Monthly number and percent age composition of chinook sampled for age in the Strait of Georgia Creel Survey, 1991 (n gives sample size).

Month	Age 2		Age 3		Age 4		Age 5+		Total Sample
	n	%	n	%	n	%	n	%	
Jan+Feb	1	0.6%	53	33.8%	90	57.3%	13	8.3%	157
Mar	2	3.4%	32	54.2%	20	33.9%	5	8.5%	59
Apr	4	5.3%	49	65.3%	21	28.0%	1	1.3%	75
May	7	2.7%	161	61.7%	82	31.4%	11	4.2%	261
Jun	40	3.7%	680	62.4%	234	21.5%	136	12.5%	1,090
Jul	24	4.0%	418	69.7%	118	19.7%	40	6.7%	600
Aug	50	8.3%	424	70.2%	116	19.2%	14	2.3%	604
Sep	24	8.3%	246	84.8%	16	5.5%	4	1.4%	290
Oct	4	12.5%	28	87.5%	0	0.0%	0	0.0%	32
Nov+Dec	64	26.4%	172	71.1%	6	2.5%	0	0.0%	242
Total	220	—	2,263	—	703	—	224	—	3,410
Overall age composition of catch *	—	5.4%	—	66.4%	—	21.6%	—	6.6%	—

* Overall age composition of estimated catch based on data from Table 13.

Table 13. Monthly estimated catch at age of chinook in the Strait of Georgia, 1991. *

Month		Age 2	Age 3	Age 4	Age 5+	Total **
Jan+Feb	Catch	31	1,632	2,772	400	4,835
	S.D.	33	519	844	162	1,430 ++
Mar	Catch	99	1,577	985	246	2,907
	S.D.	72	367	267	118	576 ++
Apr	Catch	152	1,868	801	38	2,859
	S.D.	77	291	183	39	374 ++
May	Catch	436	10,017	5,102	684	16,239
	S.D.	172	1,335	788	220	2,011 ++
Jun	Catch	1,351	22,963	7,902	4,593	36,809
	S.D.	287	3,339	1,224	757	5,281 ++
Jul	Catch	705	12,274	3,465	1,175	17,619
	S.D.	150	957	383	199	1,228 ++
Aug	Catch	1,360	11,533	3,155	381	16,429
	S.D.	211	910	353	105	1,221 ++
Sep	Catch	971	9,955	647	162	11,735
	S.D.	207	857	167	82	967 ++
Oct	Catch	408	2,859	0	0	3,267
	S.D.	212	618	0	0	670 ++
Nov+Dec	Catch	746	2,004	70	0	2,820
	S.D.	267	685	38	0	956 ++
Total	Catch	6,259	76,682	24,899	7,679	115,519
	S.D.	592	4,093	1,799	849	6,304 ++
Overall age composition		5.4%	66.4%	21.6%	6.6%	100.0%

* Calculated by applying to the total monthly chinook catch the monthly age proportions from Table 12.

** Monthly total catch and S.E. from Table 3.

++ S.E.

Table 14. Monthly mean nose–fork length (L) at age of chinook sampled in the Strait of Georgia Creel Survey, 1991
(n gives sample size).

Month	Age 2		Age 3		Age 4		Age 5		Age 6		Total Sample
	L (cm)	n	L (cm)	n	L (cm)	n	L (cm)	n	L (cm)	n	
Jan+Feb	63.0	1	61.6	53	69.9	90	71.7	13	—	0	157
Mar	67.0	2	62.9	32	69.1	20	70.4	5	—	0	59
Apr	64.8	4	63.1	49	73.2	21	70.0	1	—	0	75
May	64.4	7	64.7	161	74.1	82	78.4	5	99.3	6	261
Jun	68.9	40	68.1	680	79.1	234	84.3	106	96.5	30	1,090
Jul	67.4	24	70.2	418	79.5	118	86.8	36	93.5	4	600
Aug	64.2	50	70.8	424	81.6	116	95.6	14	—	0	604
Sep	59.9	24	68.1	246	89.0	16	93.0	4	—	0	290
Oct	62.5	4	66.2	28	—	0	—	0	—	0	32
Nov+Dec	62.5	64	65.9	172	67.7	6	—	0	—	0	242
Total	64.5	220	68.3	2,263	77.5	703	84.3	184	96.7	40	3,410

APPENDICES

APPENDIX A

METHODS AND EQUATIONS USED IN ANALYSIS OF CATCH AND EFFORT
STATISTICS FOR THE STRAIT OF GEORGIA SPORT FISHERY
CREEL SURVEYS, 1983-1991¹

¹ Adapted from:

Shardlow, T. F., K. K. English, T. Hoyt, G. E. Gillespie and T. A. Calvin. 1989. Strait of Georgia Creel Survey sport fishery statistics, 1983. Can. MS Rep. Fish. Aquat. Sci. 1872:53 p.

APPENDIX A. METHODS AND EQUATIONS USED IN ANALYSIS OF CATCH AND EFFORT STATISTICS FOR THE STRAIT OF GEORGIA SPORT FISHERY CREEL SURVEYS, 1983-1991.

The description of terms, variables and subscripts used in the data analysis is given in Table A-1.

Calculation of Catch and Effort Statistics

To estimate the monthly catch and effort, three components had to be calculated from that month's data:

- (1) the weighted mean daily fishing pattern from interview data,
- (2) the weighted mean catch per unit effort from interview data and
- (3) the mean sport count from overflight data.

The equations used to estimate the means and variances for all catch and effort statistics are shown below.

Weighting factors used to estimate the daily fishing activity pattern and mean catch per unit effort were calculated using the equations derived from DPA Consulting Ltd. (1982).

The data obtained from each shift were multiplied by the following weighting factor (W1) to expand for all possible stints at each site. The formula reads:

$$W1_{dij} = \frac{N_d}{n_{dij}} \quad (1)$$

where N_d is the total number of days of type d in that month and n_{dij} is the number of times the jth work block at the ith site was sampled on type d days.

The interviews aggregated by work block were multiplied by the weighting factor W2 to expand for all boats that landed in each work block. The formula reads:

$$W2_{dijk} = \frac{L_{dijk}}{I_{dijk}} \quad (2)$$

Table A-1. Description of terms, variables and subscripts used in this report.

DESCRIPTION OF TERMS	
Shift/Stint	- Represents a combination of a day type and landing site which was sampled on a single day. i.e. one sampling stint performed by an interviewer.
Work block	- Represents one of four possible periods at a particular site of a given day type. Work Block 1 is before 11 am Work Block 2 is 11 am - 3 pm Work Block 3 is 3 pm - 7 pm Work Block 4 is after 7 pm
Day type	- There are two possible day types: weekdays and weekends; holidays are considered to be weekend days.
Time block	- Each day is divided into 16 time blocks which are: 1) before 7 am 2) 7:00 - 7:59 am 3) 8:00 - 8:59 am . . . 15) 8:00 - 8:59 pm 16) after 9 pm
DESCRIPTION OF VARIABLES	
A	- Number of boats actively fishing
B	- Number of boats observed on a flight
C	- Catch
C	- Catch of marked salmon
CPE	- Catch per boat trip
E	- Effort (estimated total number of boat trips)
I	- Number of boats interviewed and found to have been fishing
L	- Number of boats landing
n	- Number sampled
N	- Population size from which n samples were observed
P	- Proportion
T	- Number of boat trips
V	- Number found to be marked
W1	- Weighting factor to expand for all possible stints at each site
W2	- Weighting factor to expand for all boats that landed in each work
DESCRIPTION OF SUBSCRIPTS	
a	- age
g	- a set of landing sites
d	- day type
i	- site
j	- work block
k	- stint
l	- landing time block
m	- month
q	- the next boat landing at site i and upon interviewing, found to have been fishing (q ranges from 1 to n)
r	- species
s	- sub-Statistical Area
t	- time block
u	- flight
x	- region
y	- annual

where L_{dijk} is the number of boats landed and I_{dijk} is the number of boats interviewed on the k th stint in the j th work block at the i th site on a day type d .

Therefore, the following equations can be used to calculate an unbiased estimate of the total monthly catch ($\hat{C}_{dgr}$), fishing trips ($\hat{T}_{dg}$) and fishing activity in time block $\hat{A}_{dgt}$ for each day type (d) where g is a set of landing sites (i). These formulas read:

$$\hat{C}_{dgr} = \sum_i \sum_j \left[W1_{dij} \sum_k \sum_q (W2_{dijk} C_{dijklqr}) \right] \quad (3)$$

$$\hat{T}_{dg} = \sum_i \sum_j \left[W1_{dij} \sum_k \sum_q (W2_{dijk}) \right] \quad (4)$$

$$\hat{A}_{dgt} = \sum_i \sum_j \left[W1_{dij} \sum_k \sum_q (W2_{dijk} A_{dijkqt}) \right] \quad (5)$$

where C_{dijkqr} is the catch of species r by the q th fishing party, and A_{dijkqt} can equal 0 or 1, thereby indicating whether the q th fishing party was actively fishing in time block t . Thus, the mean monthly catch per unit effort (CPE_{dgr}) measured in terms of numbers of fish kept per completed boat trip, and proportion of daily fishing effort active during the hour of the aerial survey (P_{dgt}) can be calculated with the following equations:

$$CPE_{dgr} = \frac{\hat{C}_{dgr}}{\hat{T}_{dg}} \quad (6)$$

$$P_{dgt} = \frac{\hat{A}_{dgt}}{\hat{T}_{dg}} \quad (7)$$

where CPE_{dgr} and P_{dgt} are calculated for each day type (d) and group of landing sites (g).

The groups of landing sites reflect geographic areas with similar catch rates and/or activity patterns.

The estimated mean number of boats fishing during the hour of the sport boat count by overflight was calculated for each sub-Statistical Area using the following equation:

$$\bar{B}_{dst} = \frac{\sum_u B_{dstu}}{n_{ds}} \quad (8)$$

where B_{dstu} is the number of boats observed fishing on flight u at time t , in sub-Statistical Area s for day type d .

The mean sport boat count at the time of the overflight ($\bar{B}_{dst}$) and proportion of daily fishing effort active during the hour of the overflight (P_{dgt}) were used in the following equation to calculate the total fishing effort for sub-Statistical Area s on day type d :

$$E_{ds} = \bar{B}_{dst} \frac{1}{P_{dgt}} N_d \quad (9)$$

where N_d is the number of type d days in the month. Interview data for the sub-Statistical Areas fished (s) by anglers landing at each of the sites (i) within a landing group (g) were used to select the proportions (P_{dgt}) that are appropriate for each mean boat count ($\bar{B}_{dst}$).

The estimate for total effort by sub-Statistical Area and day type (E_{ds}) and the weighted catch per boat trip for a group of landing sites by day type, area and species (CPE_{dgr}) were used to calculate total catch for each species (r) and each sub-Statistical Area (s):

$$C_{sr} = \sum_d (E_{ds} CPE_{dgr}) \quad (10)$$

The interview data were also used to select the catch per effort estimates (CPE_{dgr}) that should be applied to the effort estimates (E_{ds}) for a specific sub-Statistical Area (s).

Variance of Total Fishing Effort

The variance for estimates of total fishing effort has two components:

- (1) the variance in aerial sport boat counts:

$$S^2_{B_{dst}} = \frac{\sum_u B^2_{dstu} - \frac{\left(\sum_u B_{dstu}\right)^2}{n_{ds}}}{n_{ds}(n_{ds}-1)} \left[\frac{N_d - N_{ds}}{N_d - 1} \right] \quad (11)$$

where B_{dstu} is the aerial sport boat count at time t during an aerial survey u on a type d day in sub-area s ; n_{ds} is the number of aerial surveys in which boats were counted on type d days, in sub-Statistical Area s ; and N_d is the total number of type d days in the months.

- (2) the variance in the proportion of boats fishing during the hours of the aerial boat counts:

$$S^2_{P_{dgt}} = \frac{P_{dgt}(1 - P_{dgt})}{I_{dg}} \quad (12)$$

where P_{dgt} is the mean proportion of boats fishing for a group of landing sites g during the hour of the aerial boat count t on type d days, and I_{dg} is the total number of sport fishing boats interviewed. The above formula assumes P_{dgt} is unbiased and normally distributed where the number of interviews is large.

The variances for boat counts ($S^2_{B_{dst}}$) and proportion of boats fishing ($S^2_{P_{dgt}}$) were combined in the following equation to calculate variance for effort:

$$S^2_{E_{ds}} = N^2_d \left(\frac{B^2_{dst}}{P^2_{dgt}} \right) \left(\frac{S^2_{B_{dst}}}{B^2_{dst}} + \frac{S^2_{P_{dgt}}}{P^2_{dgt}} \right) \quad (13)$$

where $S^2_{E_{ds}}$ is the variance for total effort on type d days in sub-area s, and the formula is the standard formula for the variance of a ratio of two independent random variables.

Variance of Total Catch

The variance for estimates of total catch had two components: (1) the variance for total effort (presented above), and (2) the variance for catch per boat trip.

The variance for catch per boat trip ($S^2_{CPE_{dgr}}$) was calculated using the following equation:

$$S^2_{CPE_{dgr}} = \frac{SS_{CPE_{dgr}} - \frac{(S_{CPE_{dgr}})^2}{I_{dg}}}{I_{dg}(I_{dg} - 1)} \quad (14)$$

where $SS_{CPE_{dgr}}$ is the weighted sum of squares for CPE_{dgr} , and $S_{CPE_{dgr}}$ is the weighted sum for CPE_{dgr} , such that the sum of the weighting factors used to estimate CPE_{dgr} was equal to the number of interviewed boat trips (I_{dg}).

The variance for total effort and the variance in the catch per boat trip for the appropriately grouped landing sites were combined in the following equation to calculate variance for total catch:

$$S^2_{C_{sr}} = \sum_d (E^2_{ds} S^2_{CPE_{dgr}} + CPE^2_{dgr} S^2_{E_{ds}} + S^2_{CPE_{dgr}} S^2_{E_{ds}}) \quad (15)$$

which is the standard formula for the variance of the product of two independent random variables, and where $S^2_{C_{sr}}$ is the variance for total number of species r in sub-Statistical Area s .

Estimation of Marked Chinook and Coho Salmon

The incidence of marked (adipose-clipped) chinook and coho was recorded in each interview. The proportion of marks observed for each region, month and species (P_{xmr}) was calculated as:

$$P_{xmr} = \frac{V_{xmr}}{n_{xmr}} \quad (16)$$

where V is the number of marked fish observed and n is the number of fish inspected by region (x), month (m) and species (r).

The variance of each proportion was calculated as:

$$S^2_{P_{xmr}} = \frac{P_{xmr} (1 - P_{xmr})}{n_{xmr}} \quad (17)$$

Monthly catch estimates of marked salmon were calculated as:

$$\hat{C}_{xmr} = P_{xmr} C_{xmr} \quad (18)$$

where C_{xmr} is the estimated catch of species r in region x and month m .

The variance of the marked catch estimates was calculated as:

$$S^2 \hat{c}_{xmr} = P^2_{xmr} S^2_{C_{xmr}} + C^2_{xmr} S^2_{P_{xmr}} + S^2_{C_{xmr}} S^2_{P_{xmr}} \quad (19)$$

where $S^2_{C_{xmr}}$ is the variance of the catch estimates of species r in region x and month m .

The estimate annual proportions of marked salmon caught in each region (weighted by the corresponding regional annual catch estimates) were calculated as:

$$P_{xry} = \frac{\hat{C}_{xry}}{C_{xry}} \quad (20)$$

where

$$\hat{C}_{xry} = \sum_m \hat{C}_{xmr} \quad \text{and} \quad C_{xry} = \sum_m C_{xmr} \quad (21)$$

The variance of the annual proportions was calculated as:

$$S^2_{P_{xry}} = \left(\frac{\hat{C}_{xry}}{C_{xry}} \right)^2 \left[\frac{S^2_{\hat{C}_{xry}}}{(\hat{C}_{xry})^2} + \frac{S^2_{C_{xry}}}{(C_{xry})^2} \right] \quad (22)$$

where $S^2_{C_{xry}}$ is the variance of the annual estimated catch of species r in region x .

Estimation of Age Composition of Chinook Catch

Scale samples and length measurements were taken in a sub-sampling program during the interview process. Ages used in this report represent total age of the fish (including both freshwater and oceanic life) according to the Gilbert-Rich (1927) recording convention.

The proportion of chinook at each age and month (P_{am}) was calculated as:

$$P_{am} = \frac{a_m}{n_m} \quad (23)$$

where a_m represents the number of fish observed at age a during month m , and n_m is the total number of fish bio-sampled in that month.

The variance of each proportion was calculated as:

$$S^2_{am} = \frac{P_{am}(1 - P_{am})}{n_m} \quad (24)$$

The catch at age of chinook in each month was calculated as:

$$C_{am} = P_{am} C_m \quad (25)$$

where C_m is the estimated catch of chinook salmon in a given month m .

The variance of the catch at age estimate was calculated as:

$$S^2_{C_{am}} = P^2_{am} S^2_{C_m} + C^2_m S^2_{P_{am}} + S^2_{C_m} S^2_{P_{am}} \quad (26)$$

where $S^2_{C_m}$ is the variance of the month catch estimate C_m .

The annual catch at age was calculated as:

$$C_{ay} = \sum_m C_{am} \quad (27)$$

with a variance:

$$S^2_{C_{ay}} = \sum_m S^2_{C_{am}} \quad (28)$$

The annual proportion at age (weighted by monthly catch) was calculated as:

$$P_{ay} = \frac{C_{ay}}{C_y} \quad (29)$$

with a variance:

$$S^2_{P_{ay}} = \left(\frac{C_{ay}}{C_y} \right)^2 \left[\frac{S^2_{C_{ay}}}{(C_{ay})^2} + \frac{S^2_{C_y}}{(C_y)^2} \right] \quad (30)$$

APPENDIX B

CATCH AND EFFORT STATISTICS BY MONTH AND STATISTICAL AREA
FOR THE STRAIT OF GEORGIA, 1991.

APPENDIX B-1. STRAIT OF GEORGIA FISHING EFFORT (NO. BOAT TRIPS), 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Estimate	1,092	275	38	736	905	1,301	564	3,430	483	153	8,977
	S.E.	593	143	37	215	379	991	57	1,205	75	35	1,734
March	Estimate	610	417	246	1,692	1,120	837	220	2,375	472	312	8,301
	S.E.	176	149	173	361	299	187	74	725	292	145	988
April	Estimate	801	1,563	312	2,028	2,978	1,073	689	3,439	1,286	922	15,091
	S.E.	158	387	77	378	583	294	164	486	554	351	1,201
May	Estimate	7,435	11,930	1,320	5,856	10,220	1,821	1,422	5,759	597	1,420	47,780
	S.E.	1,036	2,246	284	720	2,081	201	348	1,096	105	486	3,558
June	Estimate	11,447	24,958	1,237	6,401	9,323	1,885	1,186	10,219	1,617	2,217	70,490
	S.E.	1,303	5,739	223	597	818	161	210	1,976	306	417	6,321
July	Estimate	26,849	17,717	2,914	9,011	6,315	2,648	1,358	16,762	5,330	2,267	91,171
	S.E.	2,652	3,231	534	701	696	395	266	2,508	831	402	5,109
August	Estimate	24,532	18,934	1,041	6,313	9,906	4,732	1,884	22,935	2,662	6,407	99,346
	S.E.	1,881	2,656	167	679	1,424	536	525	2,740	782	1,731	4,979
September	Estimate	16,032	17,166	918	5,462	6,073	2,917	1,980	24,157	1,100	9,693	85,498
	S.E.	1,542	2,248	214	461	943	305	636	1,921	122	1,634	3,931
October	Estimate	3,378	3,924	309	1,907	3,377	2,698	634	11,951	855	4,719	33,752
	S.E.	1,004	956	135	495	1,027	540	193	2,322	157	1,702	3,447
Nov+Dec	Estimate	160	326	0	266	1,040	1,841	204	2,110	250	146	6,343
	S.E.	99	184	0	71	424	386	30	997	92	96	1,179
Total	Estimate	92,336	97,210	8,335	39,672	51,257	21,753	10,141	103,137	14,652	28,256	466,749
	S.E.	4,141	7,853	738	1,615	3,195	1,465	995	5,585	1,361	3,048	11,732

APPENDIX B-2. STRAIT OF GEORGIA COHO CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	0	20	0	0	0	4	0	54	0	0	78
	S.E.	0	24	0	0	0	4	0	45	0	0	51
March	Catch	0	0	0	0	0	0	0	24	0	0	24
	S.E.	0	0	0	0	0	0	0	18	0	0	18
April	Catch	0	64	0	0	571	89	48	2,509	0	0	3,281
	S.E.	0	41	0	0	202	74	41	700	0	0	735
May	Catch	126	499	2	386	949	0	28	285	0	10	2,285
	S.E.	44	210	3	208	368	0	24	158	0	9	500
June	Catch	1,084	4,164	16	62	451	25	0	1,862	35	43	7,742
	S.E.	193	1,197	7	25	123	26	0	513	19	26	1,323
July	Catch	1,945	4,919	142	1,872	621	0	0	16,761	2,253	940	29,453
	S.E.	240	1,157	51	419	93	0	0	3,029	495	195	3,323
August	Catch	3,050	3,154	206	1,155	1,411	110	514	13,724	302	740	24,366
	S.E.	317	636	62	252	285	65	295	2,086	101	239	2,272
September	Catch	3,905	4,013	50	1,446	854	15	76	49,119	18	229	59,725
	S.E.	527	617	21	477	201	11	70	4,230	6	84	4,340
October	Catch	1,356	1,300	3	27	218	481	0	26,211	25	222	29,843
	S.E.	645	1,016	3	13	119	208	0	6,593	22	161	6,708
Nov+Dec	Catch	1	10	0	0	36	142	56	41	1	27	314
	S.E.	3	13	0	0	23	100	42	33	1	28	120
Total	Catch	11,467	18,143	419	4,948	5,111	866	722	110,590	2,634	2,211	157,111
	S.E.	944	2,153	83	715	580	253	310	8,699	506	360	9,088

APPENDIX B-3. STRAIT OF GEORGIA CHINOOK CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	614	39	11	179	150	356	219	3,166	69	32	4,835
	S.E.	301	34	13	69	69	488	66	1,304	25	13	1,430
March	Catch	94	66	190	623	156	242	106	1,353	47	30	2,907
	S.E.	56	44	164	238	47	81	90	474	39	18	576
April	Catch	65	246	57	498	707	60	234	621	216	155	2,859
	S.E.	37	102	27	193	146	35	133	181	112	70	374
May	Catch	2,894	4,591	573	1,557	4,400	222	316	1,085	191	410	16,239
	S.E.	733	1,440	153	388	1,062	53	131	285	42	166	2,011
June	Catch	5,829	18,563	668	2,633	3,141	461	92	4,462	408	552	36,809
	S.E.	764	5,071	128	430	537	126	46	1,018	107	172	5,281
July	Catch	8,064	2,922	521	1,822	970	266	41	2,817	136	60	17,619
	S.E.	800	652	133	297	147	86	29	552	58	17	1,228
August	Catch	5,749	3,920	118	1,056	3,326	577	0	1,513	43	127	16,429
	S.E.	589	679	32	211	729	173	0	273	18	47	1,221
September	Catch	4,082	3,175	228	1,212	1,397	119	112	1,128	23	259	11,735
	S.E.	638	563	82	285	276	59	82	177	7	76	967
October	Catch	1,048	569	98	570	208	0	0	774	0	0	3,267
	S.E.	463	306	56	205	157	0	0	266	0	0	670
Nov+Dec	Catch	92	0	0	73	219	243	11	2,098	29	55	2,820
	S.E.	64	0	0	23	112	187	10	928	17	41	957
Total	Catch	28,531	34,091	2,464	10,223	14,674	2,546	1,131	19,017	1,162	1,680	115,519
	S.E.	1,682	5,394	310	831	1,453	583	239	2,102	179	269	6,304

APPENDIX B-4. STRAIT OF GEORGIA PINK CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
April	Catch	0	5	0	0	0	0	0	0	0	0	5
	S.E.	0	8	0	0	0	0	0	0	0	0	8
May	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
June	Catch	6	164	0	0	0	0	0	7	0	0	177
	S.E.	6	90	0	0	0	0	0	9	0	0	91
July	Catch	500	232	3	8	29	40	35	13,335	61	24	14,267
	S.E.	120	114	3	5	19	36	27	2,522	30	10	2,528
August	Catch	28,724	2,467	16	48	110	429	0	91,632	1,304	3,016	127,746
	S.E.	2,364	739	9	23	39	141	0	12,474	509	857	12,757
September	Catch	28,229	1,044	77	27	62	291	140	64,453	1,194	11,264	106,781
	S.E.	3,486	240	48	13	23	115	122	5,579	171	2,124	6,921
October	Catch	306	131	0	0	0	0	0	151	14	83	685
	S.E.	208	123	0	0	0	0	0	96	12	97	278
Nov+Dec	Catch	0	0	0	1	0	0	0	0	0	0	1
	S.E.	0	0	0	0	0	0	0	0	0	0	0
Total	Catch	57,765	4,043	96	84	201	760	175	169,578	2,573	14,387	249,662
	S.E.	4,219	800	49	27	49	185	125	13,896	538	2,292	14,735

APPENDIX B-5. STRAIT OF GEORGIA SOCKEYE CATCH SUMMARY, 1991.

Month		Statistical Area										Total
		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
April	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
May	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
June	Catch	0	0	0	0	0	0	0	15	0	0	15
	S.E.	0	0	0	0	0	0	0	13	0	0	13
July	Catch	104	0	0	0	1	40	15	2,359	35	13	2,567
	S.E.	44	0	0	0	2	36	17	547	25	7	551
August	Catch	2,889	21	0	0	0	190	0	4,625	1,824	4,215	13,764
	S.E.	280	26	0	0	0	68	0	687	638	1,162	1,521
September	Catch	1,115	15	4	15	0	100	92	890	450	4,374	7,055
	S.E.	225	27	7	14	0	89	105	155	77	919	972
October	Catch	0	0	2	12	0	0	0	0	23	83	120
	S.E.	0	0	0	0	0	0	0	0	0	0	0
Nov+Dec	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
Total	Catch	4,108	36	6	27	1	330	107	7,889	2,332	8,685	23,521
	S.E.	362	37	7	14	2	118	106	892	643	1,482	1,887

APPENDIX B-6. STRAIT OF GEORGIA CHUM CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
April	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
May	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
June	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
July	Catch	23	0	0	0	0	0	0	92	0	0	115
	S.E.	17	0	0	0	0	0	0	50	0	0	53
August	Catch	14	0	0	0	0	26	0	62	4	8	114
	S.E.	9	0	0	0	0	16	0	37	5	9	43
September	Catch	397	44	0	0	1	34	31	39	10	103	659
	S.E.	117	31	0	0	1	30	35	23	4	44	139
October	Catch	1,460	530	0	0	210	75	0	403	82	483	3,243
	S.E.	555	405	0	0	157	69	0	183	60	319	800
Nov+Dec	Catch	0	0	0	0	0	1,079	0	35	1	27	1,142
	S.E.	0	0	0	0	0	677	0	25	1	28	678
Total	Catch	1,894	574	0	0	211	1,214	31	631	97	621	5,273
	S.E.	568	406	0	0	157	681	35	196	60	323	1,060

APPENDIX B-7. STRAIT OF GEORGIA CATCH SUMMARY FOR TOTAL SALMONIDS, 1991. *

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	614	59	11	179	150	359	219	3,219	69	32	4,911
	S.E.	301	55	13	69	69	488	66	1,322	25	13	1,447
March	Catch	94	66	190	623	156	242	106	1,379	47	30	2,933
	S.E.	56	44	164	238	47	81	90	477	39	18	579
April	Catch	65	315	57	498	1,276	149	282	3,131	216	155	6,144
	S.E.	37	124	27	193	305	87	139	773	112	70	889
May	Catch	3,019	5,091	575	1,942	5,349	222	344	1,370	191	420	18,523
	S.E.	739	1,516	153	448	1,387	53	133	352	42	166	2,273
June	Catch	6,918	22,892	684	2,696	3,594	486	92	6,346	442	596	44,746
	S.E.	889	5,578	132	434	603	129	46	1,473	114	181	5,891
July	Catch	10,659	8,068	666	3,701	1,633	346	93	35,362	2,595	1,078	64,201
	S.E.	1,040	1,605	162	635	210	117	44	6,236	547	218	6,586
August	Catch	40,431	9,570	340	2,259	4,845	1,334	514	111,560	3,474	8,106	182,433
	S.E.	3,082	1,585	85	368	908	264	295	15,196	1,215	2,212	15,825
September	Catch	37,730	8,338	371	2,741	2,317	556	451	115,668	1,695	16,226	186,093
	S.E.	4,353	1,234	122	582	446	217	276	9,488	233	3,003	10,965
October	Catch	4,210	2,529	109	666	635	556	0	27,538	144	869	37,256
	S.E.	1,517	1,336	58	214	317	218	0	6,864	73	442	7,183
Nov+Dec	Catch	93	10	0	74	257	1,464	67	2,175	32	109	4,281
	S.E.	65	13	0	23	119	734	44	946	17	72	1,208
Total	Catch	103,833	56,938	3,003	15,379	20,212	5,714	2,168	307,748	8,905	27,621	551,521
	S.E.	5,768	6,468	347	1,188	1,889	994	468	20,315	1,366	3,772	22,588

CS

* Includes coho, chinook, pink, chum, sockeye, steelhead and cutthroat trout.

APPENDIX B-8. STRAIT OF GEORGIA SUMMARY FOR RELEASED SALMON, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	655	35	23	121	297	1,075	295	3,968	345	22	6,836
	S.E.	345	30	23	52	163	909	214	1,587	199	11	1,892
March	Catch	772	145	151	609	259	432	106	585	47	55	3,161
	S.E.	258	104	125	204	90	137	85	223	38	39	471
April	Catch	134	603	90	425	1,364	293	132	1,879	473	244	5,637
	S.E.	59	197	47	201	284	190	89	698	245	107	877
May	Catch	4,611	5,990	274	783	8,883	863	1,473	281	207	361	23,726
	S.E.	1,096	1,559	105	277	2,382	414	643	108	53	149	3,165
June	Catch	4,569	19,535	594	1,316	4,856	220	571	1,546	425	631	34,263
	S.E.	642	4,384	128	270	775	69	227	402	124	259	4,541
July	Catch	13,073	42,039	1,867	3,294	6,680	448	144	6,540	956	417	75,458
	S.E.	1,576	8,482	483	439	1,269	161	82	1,371	261	95	8,857
August	Catch	50,025	71,164	1,658	5,961	23,111	1,903	1,138	20,557	1,853	4,428	181,798
	S.E.	4,212	12,260	365	1,065	4,398	380	648	2,809	593	1,235	14,106
September	Catch	52,495	77,045	1,837	4,908	23,697	1,996	3,165	55,857	319	2,959	224,278
	S.E.	5,687	10,715	582	795	4,068	550	1,280	5,936	60	659	14,223
October	Catch	21,832	12,327	1,625	9,192	8,221	1,744	296	4,840	285	1,183	61,545
	S.E.	7,483	4,733	861	3,069	3,309	617	199	1,235	152	597	10,091
Nov+Dec	Catch	320	286	0	240	513	1,125	753	2,372	25	109	5,743
	S.E.	232	233	0	75	204	516	338	856	14	117	1,132
Total	Catch	148,486	229,169	8,119	26,849	77,881	10,099	8,073	98,425	4,935	10,409	622,445
	S.E.	10,508	19,525	1,222	3,408	7,408	1,475	1,657	7,106	752	1,562	24,861

APPENDIX B-9. STRAIT OF GEORGIA ROCKFISH CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	194	0	8	584	148	806	148	615	41	73	2,617
	S.E.	147	0	10	197	78	767	150	221	31	23	853
March	Catch	200	44	18	983	168	45	0	418	96	123	2,095
	S.E.	99	39	19	441	65	25	0	157	78	103	502
April	Catch	56	169	78	1,307	1,385	705	0	998	777	397	5,872
	S.E.	45	51	45	604	318	186	0	306	413	193	899
May	Catch	2,782	1,377	330	2,271	3,759	338	721	2,286	460	909	15,233
	S.E.	582	797	107	683	1,001	131	330	605	125	415	1,770
June	Catch	2,637	6,612	268	7,313	5,273	987	1,132	1,654	2,271	2,778	30,925
	S.E.	425	3,160	60	1,278	1,060	478	547	501	499	718	3,804
July	Catch	5,030	7,593	376	20,134	4,750	800	1,680	2,515	4,376	1,884	49,138
	S.E.	653	2,855	121	3,122	1,548	195	647	540	977	382	4,752
August	Catch	3,823	5,623	681	9,826	2,988	1,376	128	1,453	1,491	3,455	30,844
	S.E.	506	1,528	234	1,541	528	368	169	317	469	1,033	2,617
September	Catch	2,391	1,995	220	4,752	1,425	1,275	552	1,792	544	3,566	18,512
	S.E.	692	512	80	1,176	316	288	308	366	95	818	1,794
October	Catch	0	73	205	1,130	530	1,265	0	1,286	1,794	10,476	16,759
	S.E.	0	104	138	502	339	599	0	339	646	6,226	6,329
Nov+Dec	Catch	18	0	0	18	122	878	44	302	6	0	1,388
	S.E.	23	0	0	10	71	619	27	147	6	0	641
Total	Catch	17,131	23,486	2,184	48,318	20,548	8,475	4,405	13,319	11,856	23,661	173,383
	S.E.	1,309	4,624	335	4,056	2,265	1,367	987	1,203	1,429	6,433	9,618

APPENDIX B—10. STRAIT OF GEORGIA LINGCOD CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	0	0	0	0	0	0	0	1	0	0	1 *
	S.E.	0	0	0	0	0	0	0	0	0	0	0
March	Catch	0	0	0	0	6	0	0	0	0	0	6 *
	S.E.	0	0	0	0	6	0	0	0	0	0	6
April	Catch	0	14	0	0	43	25	0	50	0	6	138 *
	S.E.	0	13	0	0	18	22	0	53	0	4	62
May	Catch	261	9	0	0	130	0	0	0	11	18	429 *
	S.E.	138	11	0	0	64	0	0	0	7	18	154
June	Catch	379	372	2	338	311	0	36	155	25	68	1,686
	S.E.	102	186	2	111	174	0	25	86	12	29	311
July	Catch	713	199	10	226	60	16	92	478	86	38	1,918
	S.E.	135	119	7	103	27	16	52	122	40	12	252
August	Catch	784	348	33	345	686	104	0	74	53	124	2,551
	S.E.	122	114	16	135	239	41	0	31	27	54	331
September	Catch	372	211	6	67	333	81	26	284	2	12	1,394
	S.E.	101	71	4	30	88	42	39	91	2	13	189
October	Catch	0	0	0	0	0	30	0	12	0	0	42 *
	S.E.	0	0	0	0	0	30	0	27	0	0	40
Nov+Dec	Catch	11	0	0	0	0	0	0	10	1	27	49 *
	S.E.	10	0	0	0	0	0	0	10	1	28	31
Total	Catch	2,520	1,153	51	976	1,569	256	154	1,064	178	293	8,214
	S.E.	270	259	18	205	317	71	70	188	50	72	579

* A total closure for lingcod was in effect from January 1 to May 31, and October 1 to December 31, 1989; see Table 3 footnote.

APPENDIX B-11. STRAIT OF GEORGIA DOGFISH CATCH SUMMARY, 1991.

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	0	0	0	0	0	0	0	77	0	0	77
	S.E.	0	0	0	0	0	0	0	78	0	0	78
March	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
April	Catch	0	0	0	0	0	0	0	0	0	0	0
	S.E.	0	0	0	0	0	0	0	0	0	0	0
May	Catch	62	0	0	0	30	0	0	0	7	14	113
	S.E.	47	0	0	0	32	0	0	0	5	18	60
June	Catch	0	212	7	19	78	23	68	20	140	139	706
	S.E.	0	155	3	35	31	21	62	23	52	61	194
July	Catch	46	150	20	36	26	40	0	237	175	69	799
	S.E.	25	95	17	21	12	36	0	135	105	32	205
August	Catch	181	105	8	881	56	78	0	44	52	113	1,518
	S.E.	69	59	6	408	40	37	0	24	54	90	435
September	Catch	0	0	56	0	33	29	0	17	8	45	188
	S.E.	0	0	25	0	19	23	0	15	4	26	49
October	Catch	0	0	0	0	0	0	0	0	206	1,242	1,448
	S.E.	0	0	0	0	0	0	0	0	118	1,005	1,012
Nov+Dec	Catch	0	0	0	0	123	0	0	0	0	0	123
	S.E.	0	0	0	0	132	0	0	0	0	0	132
Total	Catch	289	467	91	936	346	170	68	395	588	1,622	4,972
	S.E.	87	191	31	410	147	60	62	160	175	1,012	1,150

APPENDIX B-12. STRAIT OF GEORGIA CATCH SUMMARY FOR OTHER FINFISH, 1991. *

		Statistical Area										Total
Month		13	14	15	16	17	18	19A	19B+	28	29	
Jan+Feb	Catch	19	3	0	322	98	255	0	208	16	55	976
	S.E.	14	4	0	130	64	154	0	141	13	21	256
March	Catch	0	48	3	235	116	11	242	76	31	16	778
	S.E.	0	45	7	142	44	7	322	36	28	14	361
April	Catch	10	346	29	247	270	274	144	537	251	114	2,222
	S.E.	10	273	23	186	147	144	174	162	149	93	489
May	Catch	62	137	6	103	482	538	150	164	24	49	1,715
	S.E.	47	57	6	65	165	565	174	53	12	38	625
June	Catch	103	222	5	8	572	48	484	215	243	252	2,152
	S.E.	36	80	3	6	329	22	371	77	86	123	532
July	Catch	548	195	58	93	327	133	260	972	639	248	3,473
	S.E.	147	165	31	44	110	64	178	343	202	76	514
August	Catch	617	175	45	1,546	370	597	0	323	341	780	4,794
	S.E.	103	68	21	1,124	123	260	0	120	163	312	1,225
September	Catch	761	204	17	316	48	86	145	786	107	706	3,176
	S.E.	231	90	12	154	21	46	128	205	23	197	431
October	Catch	0	15	8	67	414	0	0	96	400	2,192	3,192
	S.E.	0	19	9	42	314	0	0	50	152	1,276	1,325
Nov+Dec	Catch	8	0	0	9	660	146	11	157	0	0	991
	S.E.	14	0	0	4	430	110	10	177	0	0	478
Total	Catch	2,128	1,345	171	2,946	3,357	2,088	1,436	3,534	2,052	4,412	23,469
	S.E.	299	356	47	1,169	689	671	592	514	349	1,340	2,245

* See Appendix D for list of species.

APPENDIX C. STRAIT OF GEORGIA CREEL SURVEY STUDY AREA.

The Strait of Georgia Creel Survey study area and landing site locations used in 1991 are shown in Figure C-1. The study area includes those waters of Juan de Fuca Strait and the Strait of Georgia bounded in the south by a line from Sheringham Pt. on Vancouver Island due south to an intersection with the International Boundary and along the International Boundary to the B.C. Mainland coast at Blaine (Boundary Bay) and in the north by the following 3 boundary lines:

- 1) in Discovery Passage from Granite Pt. on Quadra Island to the stream mouth west of Moriarty Pt. on Vancouver Island.
- 2) in Okisollo Channel from Granite Pt. on Quadra Island due north to Sonora Island.
- 3) in Cordero Channel from Burnt Bluff on the mainland 214° passing west of Dent Island to Sonora Island.

The area for which the Strait of Georgia Creel Survey statistics apply includes the above listed administrative area with the exception of the following areas:

- 1) Bute Inlet above a line from Lawrence Pt. running across the inlet. This area coincides with management units 13-21 and 13-22.
- 2) Waters of Pryce Channel, Waddington Channel, Pendrell Sound, Homfray Channel and Toba Inlet bounded by a line drawn from Horace Head on East Redonda Island at the south end of Waddington Channel to the northern point of Roscoe Bay on West Redonda Island and a line drawn within Homfray Channel from Price Pt. on the eastern shore of the channel by a line drawn from George Head at the easterly entrance of Ramsay Arm to Sutil Pt. on Cortes Island.
- 3) Hotham Sound above a line drawn from Elephant Point on the western shore of the Sound to the southern point of Granville Bay on the eastern shore of the Sound.
- 4) Jervis Inlet above a line drawn within Prince of Whales Reach from the mouth of Treat Creek on the east shore across the Reach to the summit (1625') at the head of Goliath Bay.
- 5) Sechelt Inlet including Narrows Inlet and Salmon Inlet above a line drawn within Skookumchuck Narrows from the "dog-leg" point southeast of the Egmont Pt. 224° across the Narrows to Sechelt Peninsula.

Statistical Areas

The Strait of Georgia Creel Survey produces sport fishery data for 10 catch areas (Figure C-1). Statistical Areas 13 - 18, 28 and 29 match the Pacific Fishery Management Areas. Statistical Area 19A is defined as Saanich Inlet and includes Management Subareas 19-7 to 19-12. Statistical Area 19B+ includes the rest of Area 19 and that portion of Area 20 east of Sheringham Point (Management Subarea 20-5).

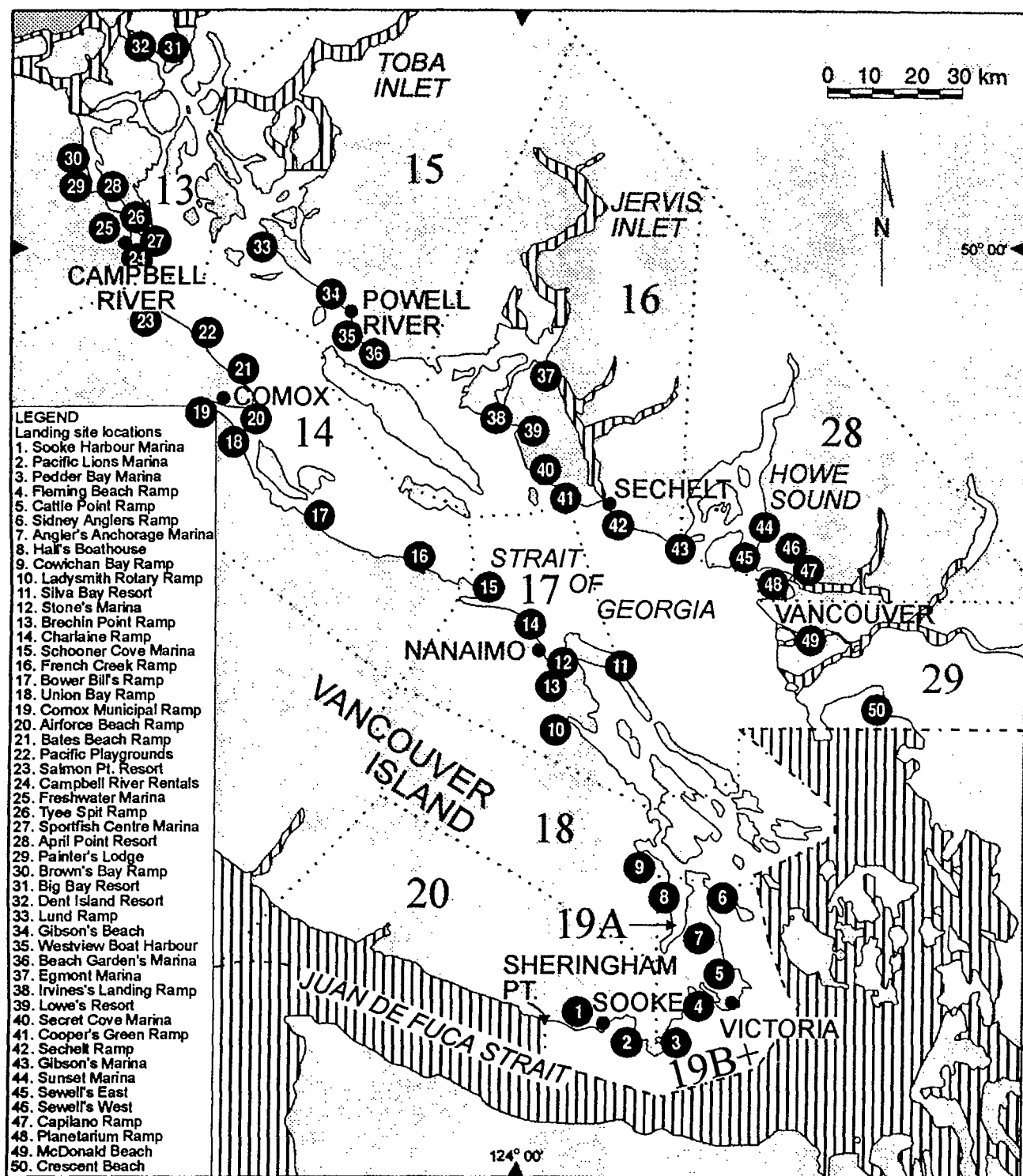


Figure C-1. Strait of Georgia Creel Survey study area and landing site locations; hatched areas are not included in the survey area.

APPENDIX D. SPECIES COMMONLY INCLUDED WITH OTHER FINFISH.

Pacific Herring
Pacific Cod
Pacific Tomcod
Walleye Pollock
Pacific Hake
Perches - any perch, seaperch or surfperch
Greenlings
Flounders - Pacific Halibut, any flounder or sole

APPENDIX E. PREVIOUS STRAIT OF GEORGIA CREEL SURVEY REPORTS.

- Shardlow, T. F., K. K. English, T. Hoyt, G. E. Gillespie and T. A. Calvin. 1989. Strait of Georgia Creel Survey sport fishery statistics, 1983. Can. Manuscr. Rep. Fish. Aquat. Sci. 1872 : 53 p.
- Shardlow, T. F. and L.D. Collicutt. 1989 a. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1984. Can. Manuscr. Rep. Fish. Aquat. Sci. 2032 : 61 p.
- Shardlow, T. F. and L.D. Collicutt. 1989 b. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1985. Can. Manuscr. Rep. Fish. Aquat. Sci. 2033 : 60 p.
- Shardlow, T. F. and L.D. Collicutt. 1989 c. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1986. Can. Manuscr. Rep. Fish. Aquat. Sci. 2034 : 61 p.
- Shardlow, T. F. and L.D. Collicutt. 1989 d. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1987. Can. Manuscr. Rep. Fish. Aquat. Sci. 2035 : 62 p.
- Shardlow, T. F. and L.D. Collicutt. 1989 e. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1988. Can. Manuscr. Rep. Fish. Aquat. Sci. 2036 : 63 p.
- Collicutt, L.D. and T.F. Shardlow. 1990. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1989. Can. Manuscr. Rep. Fish. Aquatic Sci. 2087 : 75 p.
- Collicutt, L.D. and T.F. Shardlow. 1992. Strait of Georgia sport fishery creel survey statistics for salmon and groundfish, 1990. Can. Manuscr. Rep. Fish. Aquatic Sci. 2109 : 76 p.