TCCHUM 9101

February 1991

PACIFIC SALMON COMMISSION

JOINT CHUM SALMON TECHNICAL COMMITTEE REPORT

REPORT TCCHUM (91)-1

FINAL 1989 POST SEASON SUMMARY REPORT

February 1991

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INTRODUCTION

This Joint Chum Salmon Technical Committee report presents the appropriate information for 1989 chum salmon in southern British Columbia and Washington, as required in Chapter 6 of Annex IV of the Pacific Salmon Treaty (PST) (Attachment 1). Detailed information may be found in the Canadian and United States agency reports appended to this report (see Attachments 2 and 3).

STATUS OF TREATY REQUIREMENTS

Chum stocks and fisheries in southern B.C. and in U.S. areas 4B, 5, 6C, 7, and 7A are managed under the terms set out in the Pacific Salmon Treaty. The following provides a brief synopsis of the PST chum annex provisions (italics) and of Canadian and United States management actions in 1989.

1. *The Parties shall maintain a Joint Chum Technical committee to review stock status, develop new methods for stock management and report on management and research findings.*

   [Reports published in 1989 are listed under 1989 Technical Committee Publications.]

2. *Canada was to manage its Inside fisheries to provide rebuilding of depressed naturally spawning stocks and minimize increased interceptions of U.S. chum.*

   In 1989, the gross escapement of Inside chum totalled 1,053,000. Wild escapement totalled 877,000 which was 44% of the Clockwork goal of 2,000,000. The Fraser River wild escapement was 465,000 or 66% of the 700,000 goal. Although stock compositions samples were taken, the technical committee has not agreed on a method for determining whether increased interceptions were minimized.

   The only terminal area fishery scheduled by Canada to harvest specific stocks with identified surpluses was mid Vancouver Island (Area 14). This fishery was managed to limit interceptions of U.S. origin or other non-targeted stocks. In addition, a one day coho directed fishery was scheduled in Area 20.

3. *In 1989, Canada was to manage its Johnstone Strait Clockwork harvest to set levels dependent on the run size entering Johnstone Strait as determined in-season. The catch level of chum salmon in U.S. fishing areas 7 and 7A was determined by the catch of chum salmon in Johnstone Strait. In addition, the traditional proportion of effort and catch between Areas 7 and 7A was to be maintained*

The inseason estimate of Johnstone Strait run size was 3,000,000 providing for a harvest of 20% or 600,000 chum. Post season, the run size was 1,775,000 chum resulting in an overall harvest rate was 31.5% for clockwork assessment purposes. The Clockwork Harvest Plan was reviewed after the end of the 1988 fishing season; no subsequent changes were incorporated for 1989.

The total allowable catch for U.S. areas 7 and 7A was 120,000, however, this was increased by a 2,300 chum underage from the U.S. fishery in 1988. The total catch for this fishery in 1989 was 81,000 chum, resulting in a significant shortfall to be applied in future years. The U.S. catch in Areas 7 and 7A was disproportionately harvested in Area 7. The traditional proportion is an even distribution of catch between the two areas.

4. *In 1989, the U.S. was to maintain the limited effort nature of its chum fishery in U.S. Areas 4B, 5, and 6C to minimize increased interceptions of Canadian chum. In addition, the U.S. was to monitor this fishery for increasing interceptions of Canadian chum.*

The U.S. chum fishery in the Strait of Juan de Fuca (Areas 4B, 5, and 6C) was limited, as it has been in past years, to participation by gillnet fishermen from the four Tribes that fish i the Strait of Juan de Fuca. It opened nine days later than normal and closed in mid-November, as usual. The catch of 52,400 chum was below the 1988 catch level. GSI samples were taken to determine whether this catch resulted in higher interceptions of Canadian chum.

5. *When the catch of chum salmon in U.S. Areas 7 and 7A fails to achieve the specified ceiling, the ceiling in subsequent years will be adjusted accordingly.*

The U.S. fishery in Areas 7 and 7A in 1989 fell 42,300 chum short of the 123,300 ceiling for 1989.

6. *Catch compositions in fisheries covered by this chapter were to be estimated post-season using methods agreed upon by the Joint Chum Technical Committee.*

The appropriate fisheries, covered by this chapter, were sampled, however, methods for estimating stock composition are under review by the committee.

7. *In 1989, Canada was to manage the Nitinat net chum fishery to minimize the harvest of non-targeted stocks.*

The boundaries of the Nitinat fishery were the same as in 1988. Canada conducted GSI sampling to quantify the incidence of interceptions of passing stocks.

8. *In 1989, Canada was to conduct GSI sampling of the West Coast Vancouver Island troll fishery (Areas 121-124) if catch levels were predicted to reach levels similar to those in 1985 and 1986.*

Early season catch information from the West Coast Vancouver Island troll fishery did not indicate that the season's total chum catches would reach 1985/86 levels. As a result, Canada did not conduct GSI sampling of this fishery.

CHAPTER 1

JOINT SUMMARY REPORT

1.1 RUN SIZES

Southern British Columbia

The two areas of concern under the PST are those waters inside of Vancouver Island from Johnstone Strait to the southern portion of Vancouver Island (Inside) and those waters of the west coast of Vancouver Island (West Coast).

Inside Chum

The run size of fall chum salmon expected to return through Johnstone Strait was 3,329,000 of which 2,246,000 were predicted to be produced from Inside wild spawning areas, 983,000 from Inside enhancement facilities and 100,000 from Puget Sound. The size of the Fraser River component in the expected total run was predicted to be 1,350,000 chum, including 900,000 from wild spawning areas and 450,000 from enhancement facilities. The remaining wild spawning areas in the Inside area were expected to produce 1,346,000 chum salmon, while the remaining enhanced return, the majority of which originate from the mid Vancouver Island area, was expected to be 533,000.

The post-season Clockwork assessment of chum salmon, including Inside gross escapements, U.S. and Inside chum caught in Johnstone Strait and the Strait of Georgia, and the catch of Canadian chum in Areas 7 and 7A commercial fisheries, was 1,775,000 or 53% of the expected run size. The overall harvest rate for clockwork assessment purposes was 31.5%. The total return of Fraser River chum was 935,000 or 69% of the expected run size. The Fraser River run includes estimates of catches in U.S. and Canadian commercial, test and Indian food fisheries.

West Coast Chum

The expected return of Nitinat enhanced-origin chum salmon was 264,000. The return of chum salmon of wild origin to Nitinat was not predicted.

The postseason estimate of the run size of chum salmon of Nitinat origin was 411,700 including chum of enhanced and wild origin.

United States

The two regions to be reported under the PST are those waters along the U.S./Canada border from the outer Strait of Juan de Fuca to Point Roberts (including Puget Sound) and the waters along the outer coast of Washington State (Washington Coastal).

Puget Sound Chum

The total Puget Sound run size (all timing components) expected to return to Washington State waters was 1,358,000, which was the highest odd year forecast since the beginning of the data base in 1968. Of these, 835,000 were expected from wild spawning areas and 523,000 were expected from enhancement facilities. The stocks that were expected to produce the largest returns were: south Puget Sound (336,000) and Hood Canal (611,000).

The post-season run size, as estimated from run reconstruction, was 1,034,000 chum which was 76% of the preseason forecast. This run size was smaller than the 1985 brood year return of 1,455,000 and lower than both the 1987 and 1988 returns. Both enhanced and wild stocks in all regions showed declines.

Washington Coastal Chum

On the Washington coast, chum salmon return in significant numbers to Grays Harbor and Willapa Bay. In addition, a small return of enhanced origin chum salmon occurs in the Quinault River. The 1989 preseason expected total run size of the Washington coastal chum salmon was 118,400. The actual return, as estimated by run reconstruction, was 69,900.

1.2 MANAGEMENT OF FISHERIES

Southern British Columbia

Inside Fisheries

Management of the fall chum salmon fisheries in Inside waters utilized the Clockwork management strategy which combines stock assessment, harvest management, and allocation of catch.

The Clockwork is a variable harvest rate strategy directly tied to the size of the fall chum run passing through Johnstone Strait. This strategy was designed to permit limited fishing in most years while rebuilding the wild stock escapements. Maximum catch levels

for Johnstone Strait are determined by applying the appropriate Clockwork harvest rate to the estimated stock size. Fishing plans are designed to limit catches to this overall Clockwork allowable harvest.

Stock size assessment uses both commercial and test fishing information to estimate returning stock abundance. The initial in-season run size estimate is provided by a third week of September commercial assessment fishery. If the assessment indicates the fall chum run through Johnstone Strait exceeds 3 million, then further commercial harvesting will occur. If the commercial harvesting in Johnstone Strait exceeds 225,000 chum, the directed chum harvests in U.S. Areas 7 and 7A will occur.

The Fraser River Chum Harvest Management Plan, formalized in 1989, dictates management of the Fraser River terminal fishery. Under this plan, past linkages with the Johnstone Strait Clockwork have been removed and harvests in the Fraser River are dependent on escapement to the river. A preliminary estimate of the run size of Fraser River chum is estimated from Johnstone Strait commercial assessment and test fishery data prior to mid-October. Subsequent estimates of returns to the river were determined from Fraser River test fishing data.

The Qualicum fishery is managed as a terminal fishery for mid Vancouver Island area enhanced chum salmon. Objectives include limiting the catch of local coho and chinook stocks, as well as limiting the incidental catch of Fraser River chum. Genetic stock identification data were used during the season to determine stock composition.

West Coast Fisheries

The management of the Nitinat area fishery was planned to achieve the necessary escapements to both the wild spawning grounds and the hatchery. In addition to biological considerations, management plans included provisions for achieving domestic allocations and fleet safety. Canada conducted genetic stock identification (GSI) sampling to quantify the incidence of interception of passing stocks in the Nitinat net fishery.

United States

The management objective for the Strait of Juan de Fuca (Areas 4B, 5, 6C) was to maintain the limited effort nature of the Treaty Indian fisheries through limiting the fishery to gillnet gear. This fishery harvested primarily Puget Sound stocks. In 1989, Puget Sound coho management concerns delayed the opening of the chum fishery nine days.

In Areas 7 and 7A, the objective was to conduct fisheries to harvest 122,600 chum, based on the PST limit 120,000 and accounting for the 2,600 underage by the U.S. in 1988. An additional objective of the U.S. management in Areas 7 and 7A was to regulate the harvests between Treaty and non-Treaty fishermen to achieve domestic allocation.

1.3 REVIEW AND EVALUATION OF FISHERIES

Southern British Columbia

Inside chum

Fall chum salmon fishing occurred in Johnstone Strait (Areas 11 to 13) and mid Vancouver Island (Area 14). These fisheries have the potential to harvest U.S. origin chum incidentally during harvests directed at Canadian origin chum. In addition, a one day coho directed fishery was scheduled in Area 20.

In Johnstone Strait, the September stock size assessment fishery was delayed to the fourth week of September to provide for Fraser River pink salmon migration through Johnstone Strait. Data from this fishery and subsequent test and commercial fisheries were used to derive run size estimates. The in-season estimate of Johnstone Strait run size was 3,000,000 providing for a harvest of 20% or 600,000 chum. One commercial chum fishery occurred in Johnstone Strait in addition to the assessment fisheries conducted during September. The total Johnstone Strait fall chum catch was 465,000, of which 138,000 were taken in September fisheries directed at pink salmon. Summer run catches in Johnstone Strait were 40,400 chum and are not included in the Clockwork calculations.

As a result of the lower than expected production of mid Vancouver Island stocks and limited harvesting in the Johnstone Strait fishery, the mid Vancouver Island early fishery was limited to three weeks of harvesting by gillnet gear. The total Area 14 catch was 94,600 chum.

Fraser River pink salmon fisheries under PSC control harvested 14,400 chum. No additional chum fisheries were scheduled by Canada under the Fraser River Terminal Management Plan.

West Coast Chum

Nitinat fisheries commenced on September 18 and continued weekly until October 11. Fishing times alternated between gillnet and purse seines with a total catch of 294,000 chum. The Nitinat fishery area was the same as in 1988.

The West coast troll fishery (Areas 121 to 127) harvested 23,300 chum salmon in July and August. Run timing and catch information suggest that the majority of this catch is Canadian summer run stocks.

United States

The major fisheries intercepting Canadian origin chum salmon in the U.S. are in the Strait of Juan de Fuca (Areas 4B, 5, 6C), San Juan Islands (Area 7) and Point Roberts (Area 7A). A significant proportion of the chum catch in these fisheries is currently believed to be of Canadian origin.

Gillnet fisheries in Areas 4B, 5, and 6C occurred from October 11th into mid-November with a total of 52,400 chum caught by Treaty Indians in these areas. This was higher than the previous years' catch in this fishery. The commercial catch of chum in Areas 7 and 7A totalled 81,000. Of these, 19,000 were taken in PSC controlled fisheries prior to fall chum management. Four days of chum fishing by Treaty Indians and fifteen days by non-treaty fishermen during October and November caught 62,000 chum.

1.4 ESCAPEMENT

Southern British Columbia

Inside Chum

Total fall chum salmon gross escapement was 1,053,000. The wild spawning escapement of 877,000 was 44% of the Clockwork interim escapement goal of 2 million and was the lowest escapement since the inception of the Clockwork. The wild spawning escapement of 877,000 was 55% of the 1983-88 average wild escapement and achieved 34% of the identified overall spawning ground capacity. No areas achieved the target escapement goal. The total Fraser River wild escapement of 465,000 was 66% of the spawning goal and accounted for 53% of the total inside fall chum escapement.

West Coast Chum

The Nitinat total escapement of chum salmon was 146,600 of which 115,000 spawned in the wild spawning areas which was below the escapement objective of 175,000 chum. The Nitinat Hatchery eggtake was 3 million above the 24 million goal. Releases totalled 23.7 million fry, including 900,000 fry outplanted to surrounding systems.

United States

Puget Sound Chum

The Puget Sound chum salmon escapement of 240,000 was below the observed escapements of almost 500,000 in the previous two odd years. The total chum escapement was 80% of the preseason expectations.

Washington Coastal Chum

The wild chum escapements in Willapa Bay, Grays Harbor and the Quinault River totalled 29,200, 52% below the expectation of 56,400.

1.5 REVIEW OF GSI PROGRAMS

The Canadian chum salmon fishery areas sampled for GSI data included Johnstone Strait (Area 12) commercial and test fisheries, mid Vancouver Island (Qualicum, Area 14) and Nitinat (Area 21) commercial fisheries. A total of 6,341 samples was taken in 1989.

The West coast of Vancouver Island troll fishery sampling program was not initiated due to in-season determination of low chum troll catches. Catches did not reach 1985 or 1986 levels.

The GSI samples collected in U.S. waters were from commercial and test fisheries in the San Juan Islands and Point Roberts (Areas 7 and 7A) and the Strait of Juan de Fuca (Area 5). A total of 4,67 samples was taken in 1989.

In addition, a GSI subcommittee continued its task of reviewing and reconciling differences in approach to GSI by Canada and the U.S. The GSI subcommittee work is incomplete at this time.

1.6 1989 TECHNICAL COMMITTEE PUBLICATIONS

TCCHUM (89)-1 1989 Progress Report on Genetic Stock Identification of Chum Salmon in Southern British Columbia and Washington.

CHAPTER 2

REVIEW OF 1989 WASHINGTON CHUM SALMON FISHERIES

2.1 INTRODUCTION

This report was prepared by the United States (U.S.) section of the joint chum technical committee formed under provisions of the Pacific Salmon Treaty (PST). It provides a general overview of the 1989 chum salmon fisheries in Washington State and a more detailed review of those fisheries that intercept chum salmon of Canadian origin.

The fisheries in Washington State waters that are believed to harvest significant numbers of southern British Columbia origin chum salmon are those in the western Strait of Juan de Fuca (areas 4B,5,6C), the San Juan Islands (Area 7) and Point Roberts (Area 7A). The majority of the harvest in areas 4B,5,6C is of U.S. origin; consequently, management objectives in these areas are based primarily on the needs of stocks originating in Puget Sound. The chum fishery in these areas has been restricted in recent years to a limited Treaty Indian gillnet fishery. The harvest in areas 7 and 7A is primarily chum salmon of Canadian origin and in recent years has been managed to meet the terms of the chum annex (Chapter 6, Annex IV) of the PST. Additional U.S. fishing areas that could potentially contain chum salmon of Canadian origin include the eastern Strait of Juan de Fuca (Area 6) and West Beach (Area 6A). Little or no chum catch occurred in either area.

Other Puget Sound and Washington coastal fisheries are primarily terminal fisheries targeted on a specific stock or group of stocks, with little or no interception of non-target stocks.

2.2 MIXED STOCK FISHERIES (Strait of Juan de Fuca, San Juan Islands and Point Roberts)

2.2.1 Management Strategy

The 1989 management strategy in areas 4B, 5 and 6C remained basically unchanged from recent years, and was consistent with the requirements of the chum annex of the Pacific Salmon Treaty. The fishery was restricted to Treaty Indian gillnet gear fishing a five day per week schedule during October. Due to weak coho returns to some Puget Sound rivers, the Strait fishery was delayed beyond the beginning of the chum management period (October 2), and opened on October 11th. After November 1, when both coho catches and the amount of gear had declined, the fishing time was increased to seven days per week.

The management regime for areas 7 and 7A was established by the Pacific Salmon Commission at the February 1989 meeting. The agreement called for the fishery in these areas to be managed on the basis of catch levels in the Canadian fishery in Johnstone Strait (based on the Clockwork management plan). The 1989 regime called for an area 7/7A ceiling of 20,000 chum if the total chum catch in Johnstone Strait was less than 225,000 (10% clockwork harvest rate); a 7/7A ceiling of 120,000 chum if the total Johnstone Strait catch was between 225,000 and 640,000 (20% clockwork harvest rate); and a 7/7A ceiling of 140,000 chum if the Johnstone Strait catch was greater than 640,000 (30% or greater clockwork harvest rate). The annex also required the U.S. to attempt to maintain a traditional proportion of effort and catch between areas 7 and 7A.

2.2.2 Fishery Review

The fall chum management period for areas 4B, 5 and 6C began October 2nd. Catches of chum taken incidental to sockeye and pink fisheries, during the Fraser Panel management period, totalled 600. The start of chum fisheries was delayed until October 11th, due to concerns for weak Puget Sound wild coho stocks. Catches in the Strait were as expected throughout the chum management period, dropping off after the first week of November. The total commercial catch of chum for the season in the Strait of Juan de Fuca was 52,400 (Table 1).

Chum harvests in areas 7 and 7A occurred during both the Fraser Panel sockeye/pink fisheries as well as chum directed fisheries. The total chum catch during Fraser Panel jurisdiction was 19,000 (Table 1).

Throughout the fall chum season, U.S. and Canadian technical staffs maintained close communication with regard to the status of the chum run size entering Johnstone Strait. The cumulative chum harvest in Johnstone Strait following pink fisheries and the September evaluation fishery was over 225,000 chum, so the U.S. managers scheduled directed chum fisheries in areas 7 and 7A, beginning with a Treaty Indian opening on October 12. The target for U.S. chum fisheries in areas 7 and 7A was 123,300 chum, which included the 120,000 annual ceiling and 3,300 additional to compensate for the 1988 shortfall in areas 7 and 7A.

The first Treaty Indian fishery, from October 12 to 14, harvested 23,100 chum (Table 1). The tribes scheduled a second opening on October 24, catching an additional 12,800 chum. The first non-treaty opening was November 1 to 2; very low numbers of chum (4,000) were harvested. Fourteen additional days of non-treaty fishing and one additional Treaty Indian day throughout November resulted in additional catch of 21,300 chum. The total commercial catch in Areas 7 and 7A was 80,300 chum, plus 700 chum taken in test fisheries to collect GSI samples for a total harvest of 81,000 chum. This left 42,300 of the 1989 ceiling unharvested.

2.3 PUGET SOUND INSIDE FISHERIES

2.3.1 Preseason Expectations

Management of Puget Sound chum salmon fisheries attempts to achieve fixed spawner escapement goals for natural and/or hatchery returns to each production unit of Puget Sound. Domestic management and allocations are established for harvestable surpluses returning to several broad regions of origin. Although management within a region may address the escapement objectives of one or more specific stocks, Puget Sound fishery descriptions in this report provide only a brief overview of regional management strategies.

The preparation of annual management plans, including preseason run size forecasts and management recommendations, is developed for Puget Sound according to the Puget Sound Salmon Management Plan (PSSMP). This plan specifies a schedule for the Washington Department of Fisheries (WDF) and the Treaty Tribes to develop and exchange methodologies and recommendations on preseason forecasts, escapement goals and other aspects of preseason management planning. The planning efforts are documented in a published report each season.

The preseason expectation of abundance for 1989 Puget Sound origin chum salmon of all timing components was 1,358,100 (Table 2), of which 834,700 were expected to be of natural origin and 523,400 were expected to be of enhanced origin. This was the largest ever run size forecast for an odd year, and would represent an improvement over the previous run sizes in the 1973-77-81-85 cycle, which average 858,000 chum.

2.3.2 Fisheries Descriptions, Catches and Spawning Escapements

The actual return of 1,034,400 was 76% of the preseason forecast and was smaller than the 1985 return of 1,454,800. It represented a decrease of about 1,000,000 from the 1988 return and 750,000 from the 1987 return. Both hatchery and natural returns in 1989 were lower than the previous two years, although the majority of the decrease was attributable to lower natural stock productivity. The total Puget Sound escapement of 240,200 chum was well below the escapement levels of almost 500,000 observed in the previous two odd years.

A summary of the preseason forecasts, final inseason updates of abundance, final 1989 run sizes, and escapements is presented in Table 3. Additional information on each stock is available through the Puget Sound run reconstruction reports. These run size estimates do not include Canadian harvests of U.S. origin chum or catches (from both commercial and test fisheries) in U.S. waters of Canadian origin chum salmon. Detailed information on chum harvests in each Puget Sound catch area is provided in Table 4. A comparison of 1985 through 1989 total Puget Sound run sizes and escapements is provided

in Table 5. The following is an overview of stock status and management actions for each of the Puget Sound regions of origin.

Strait of Juan de Fuca Tributaries

Chum salmon from Strait of Juan de Fuca tributaries are of primarily natural origin and consist of two run timings: early and normal. The early stock return of 400 was 58% below the forecast, and the normal timed stock return of 4,100 was 62% below the forecast. Spawning escapements for the normal stocks met the escapement expectations, but the early stocks fell 60% below the expectation. Terminal catches were minor, and increased effort continued to be devoted to determining the amount and extent of spawning in individual streams.

Nooksack/Samish Region

The chum return, largely of natural origin, of 40,900 was 41% below the preseason expectations and was 39% below the inseason run size update. The spawning escapement was 38% below the expectation.

Skagit Region

The chum return to Skagit of 25,400 fish, was 72% below the preseason forecast of 91,600 and 25% lower than the inseason run size update. The spawning escapement was 65% below the expectation.

Stillaguamish/Snohomish Region

Chum salmon from this region are all of normal timing, and are predominantly of natural origin. The chum return of 152,800 was 36% below the preseason forecast of 238,500. However, this return was 6% larger than the inseason estimate of run size of 144,500. The resulting escapement was 15% below the expectation.

South Puget Sound Region

This region supports early, normal and late timed chum. The early and late chum are largely natural origin. The majority of the normal timed chum are also of natural origin, with some hatchery production. Returns of the early and late components exceeded preseason expectations, and resulted in spawning escapement levels above expectations. The early timed return of 60,000 was 173% above the forecast and was a continuation of the excellent survival rates for these stocks since 1986. The escapement of 12,600 was 25% larger than the expectation.

The normal timed return of 226,100 was roughly average for an odd year return, and well below the size of the previous two odd year runs. This return was 11% below the preseason forecast, and 8% below the inseason run size update, resulting in an actual escapement that was 11% below the expectation.

The late timed return of 71,600 was 22% above the preseason forecast, but 30% below the inseason run size estimate of 102,000. The spawning escapement of 28,600 chum was 35% larger than the expectation.

Hood Canal Region

Hood Canal supports stocks of early and normal timed chum salmon. The normal timed chum are predominantly of hatchery origin. The return of the normal timed segment was 447,100, which was 26% below the preseason forecast. The inseason update of run strength was 10% larger than the actual run size. This resulted in an escapement of 72,000, 14% below the expectation.

5,900 early timed chum returned to Hood Canal, exceeding the preseason forecast by 119%. This return resulted in a spawning escapement of 700, which was lower than expected.

Areas 6B and 9

Admiralty Inlet (Area 9) is a mixed stock fishing area containing stocks originating primarily from three regions of origin: Hood Canal, South Puget Sound and Stillaguamish/Snohomish. Fisheries are scheduled in this area after inseason verification of the run strengths for the stocks returning to the three regions of origin. In 1989, there were no commercial openings in either area except for an on-reservation Indian set net fishery.

2.4 WASHINGTON COASTAL FISHERIES

The 1989 coastal chum runs were at a ten year low. The three major coastal chum systems, Willapa Bay, Grays Harbor, and the Quinault River, all had extremely low returns. This was not unexpected, however, because of the very low number of three year old chum which returned in 1988 (2% compared to an expected 33%). Run sizes, catches, and escapements for Washington coastal stocks are given in Table 6.

Willapa Bay

The Willapa Bay return was only 44,300 compared to the ten year average of 76,800. Compared to a ten year average gillnet catch of 37,200 chum, the 1989 catch was 20,600. The 1990 returns are also expected to be low because of the predicted absence of the 1985 brood five year old chum.

Chum salmon are managed entirely for natural escapement in Willapa Bay, though some hatchery escapement occurs. The natural chum escapement was about one-half of the goal. Good distribution was seen in most areas. Stream flows were moderate to high and provided for good spawning conditions. Age composition information indicated there were no four year old chum in the return.

Grays Harbor

In 1989, 19,400 chum returned to Grays Harbor compared to the previous ten years average of 52,000. Compared with the previous ten year average of 33,500 chum harvest, the 1989 catch was 10,400. Grays Harbor chum are entirely of wild origin and escapement was less than one-half the goal.

Quinault

Chum salmon returning to the Quinault River are almost entirely of hatchery origin, although significant straying to wild spawning areas occurs. The return to the Quinault in 1989 was also low. The run size was 6,200 of which 2,600 were caught in the Treaty Indian net fishery. The total escapement was 3,700 with 600 returning to the Quinault National Fish Hatchery and 3,100 that strayed to wild spawning areas.

2.4 STOCK COMPOSITION AND RUN RECONSTRUCTION

During 1989, Puget Sound genetic stock identification (GSI) studies of chum salmon consisted of collecting replicate and additional baseline samples from Washington stocks (Table 7) as well as samples for stock composition analysis from test and commercial fisheries in mixed stock areas in northern Puget Sound and the Strait of Juan de Fuca (Table 8).

As in 1988, the 1989 sampling design in areas 7 and 7A was modified from earlier years to improve sampling of commercial fisheries and to increase sample size. The intent was to increase sample sizes in areas 7 and 7A to 400 samples per week from commercial fisheries to increase the precision and accuracy of stock composition estimates. A priority was placed on sampling commercial fisheries and conducting test fishing at Point Roberts when commercial fishing was closed. There was also an attempt to oversample the commercial fisheries and to separate samples by gear type. This was intended to allow the

400 samples for analysis to be selected to represent the proportions of the catch by gear type. A comparison of GSI estimates from test gillnet fishery samples and commercial purse seine and gillnet samples was conducted in Area 7A.

The results of the 1989 studies are in Phelps, et al (1990). The weekly sampling goals were reached in areas 5 and 7A, but in Area 7 the goals were achieved in one of the six weeks of fishing.

All 1989 fishery samples were assayed for 25 loci. The Chum Technical Committee is continuing its investigations into the usefulness of increasing the number of loci for GSI analysis.

Puget Sound run reconstruction was modeled using fixed stock composition proportions in mixed stock areas and do not incorporate recent GSI information. Run reconstruction estimates for individual Puget Sound stocks and the fixed stock composition proportions are available from the WDF.

Table 1. 1989 Commercial chum harvest in selected Puget Sound catch reporting areas.*

Areas	Opening/ Week	Indian GN	Indian PS	Indian Total	Non-Indian GN	Non-Indian PS	Non-Indian RN	Non-Indian Total	Grand Total
Area 7A	PSC Control - Prior to 10/1	371	2,062	2,433	278	3,767		4,045	6,478
	10/12 to 10/14	11,720	1,488	13,208					13,208
	10/24	3,084	858	3,942					3,942
	11/1 to 11/2				1,164	140		1,304	1,304
	11/6 to 11/9				104			104	104
	11/12 to 11/13	440	377	817	191			191	1,008
	11/13 to 11/18	3		3	977	1,517		2,494	2,497
	11/19 to 11/25				201	256		457	457
Area 7A Total		15,618	4,785	20,403	2,915	5,680	0	8,595	28,998
Area 7	PSC Control - Prior to 10/1	497	4,163	4,660	655	6,840	372	7,867	12,527
	10/12 to 10/14	3,235	6,703	9,938					9,938
	10/24	3,079	5,811	8,890					8,890
	11/1 to 11/2				2,046	655		2,701	2,701
	11/6 to 11/9				2,203	5,230		7,433	7,433
	11/12 to 11/13	952	2,656	3,608	268			268	3,876
	11/13 to 11/18				3,123	1,063		4,186	4,186
	11/19 to 11/25				1,576	195		1,771	1,771
Area 7 Total		7,763	19,333	27,096	9,871	13,983	372	24,226	51,322
Areas 7/7A Total				47,499				32,821	80,320
Areas 4B, 5 and 6C	prior to 10/11	569							
	10/11 to 10/13	7,911	(2 days)						
	10/15 to 10/18	19,776	(3 days)						
	10/22 to 10/27	4,407	(5 days)						
	10/30 to 11/5	12,508	(7 days)						
	11/6 to 11/12	6,803	(7 days)						
	11/13 to 11/20	418	(7 days)						
Areas 4B, 5 and 6C total		52,392							

* - Preliminary data (12/5/90). Does not include 701 add'l chum taken in Area 7A gillnet test fisheries.

Table 2. Summary of 1989 Puget Sound chum salmon management information by region of origin (using run reconstruction).

Region	Preseason Forecast	Final Inseason Update	Final Run Size	Escapement Expectation	Observed Escapement
Strait of Juan de Fuca					
Early	1,043	1,043	435	1,023	411
Normal	10,987	10,987	4,146	9,595	3,655
Nooksack/Samish	69,700	67,032	40,891	26,130	15,375
Skagit River	91,600	34,099	25,427	40,131	13,950
Stillaguamish/Snohomish	238,500	144,531	152,814	25,478	21,580
South Puget Sound					
Early	22,000	22,000	59,869	10,100	12,561
Normal	254,800	245,897	226,134	80,207	71,351
Late	58,730	102,036	71,620	21,186	28,580
Hood Canal					
Early	2,715	2,715	5,942	1,152	695
Normal	607,980	491,175	447,142	84,212	72,018
Total	1,358,055	1,121,515	1,034,420	299,214	240,176

Source: WDF, Puget Sound Indian Tribes and NWIFC, 1989 Puget Sound Chum Salmon Forecasts and Management Recommendations. WDF Stock Strength Calculation Summary (6/13/90).

Table 3. 1989 Puget Sound post-season chum salmon run size estimates.

Region	Production	Early	Normal	Late	Total
Strait of Juan de Fuca	Natural	435	3,999		4,434
	Hatchery		147		147
Nooksack/Samish	Natural		33,222		33,222
	Hatchery		7,669		7,669
Skagit River	Natural		25,343		25,343
	Hatchery		84		84
Stillaguamish/Snohomish	Natural		77,757		77,757
	Hatchery		75,057		75,057
South Puget Sound	Natural	35,596	152,385	71,068	259,049
	Hatchery	24,273	73,749	552	98,574
Hood Canal	Natural	5,942	145,269		151,211
	Hatchery		301,873		301,873
Total		66,246	896,554	71,620	1,034,420

All Regions	Early	Normal	Late	Total
Natural	41,973	437,975	71,068	551,016
Hatchery	24,273	458,579	552	483,404
Total	66,246	896,554	71,620	1,034,420

Region	Early	Normal	Late	Total
Strait of Juan de Fuca	435	4,146		4,581
Nooksack/Samish		40,891		40,891
Skagit River		25,427		25,427
Stillaguamish/Snohomish		152,814		152,814
South Puget Sound	59,869	226,134	71,620	357,623
Hood Canal	5,942	447,142		453,084
Total	66,246	896,554	71,620	1,034,420

Source: WDF Stock Strength Calculation Summary (6/13/90).
Off-station plant returns have been included with hatchery returns.

Table 4. CHUM

WASHINGTON STATE DEPARTMENT OF FISHERIES
SALMON COMMERCIAL CATCH - PUGET SOUND AREAS

12/04/90

CUMULATIVE CATCH IN NUMBERS OF FISH — DATE RANGE USED - 1/ 1/89 TO 12/31/89

AREA CODE	ABBREVIATED AREA NAME	INDIAN GILLNET	INDIAN SETNET	INDIAN PURSE SEINE	INDIAN BEACH SEINE	INDIAN OTHER GEAR	INDIAN TROLL	INDIAN SUB-TOTAL	NON-INDIAN GILLNET	NON-INDIAN PURSE SEINE	NON-INDIAN OTHER GEAR	NON-INDIAN TROLL	NON-INDIAN SUB-TOTAL	AREA TOTAL
4B	MARINE 4B	4447	0	0	0	0	3	4450	0	0	0	0	0	4450
5	MARINE 5	46310	2	0	0	0	1	46313	0	0	0	0	0	46313
6C	MARINE 6C	1631	2	0	0	0	7	1640	0	0	0	0	0	1640
***	SUB-TOTAL	52388	4	0	0	0	11	52403	0	0	0	0	0	52403
6	MARINE 6	204	67	0	0	7	1	279	50	139	0	0	189	468
6A	MARINE 6A	0	0	0	0	0	0	0	0	0	0	0	0	0
7	MARINE 7	7618	145	19333	0	0	0	27096	9871	13983	372	0	24226	51322
7A	MARINE 7A	15378	941	4785	0	0	0	21104	2915	5680	0	0	8595	29699
60	MARINE 60	0	20	0	0	0	0	20	148	0	0	0	148	168
74B	SAIL RIVER	0	82	0	0	0	0	82	0	0	0	0	0	82
75A	CLALLAM RV	0	1	0	0	0	0	1	0	0	0	0	0	1
75B	DEEP CREEK	0	0	0	0	0	0	0	0	0	0	0	0	0
75C	HOKO RIVER	0	1	0	0	0	0	1	0	0	0	0	0	1
75D	LYRE RIVER	0	204	0	0	0	0	204	0	0	0	0	0	204
75E	PYSHT RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
75F	SEKIU RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
75G	TWIN RIVER	0	0	0	0	0	0	0	0	0	0	0	0	0
76A	DUNGENESS	0	0	0	0	0	0	0	0	0	0	0	0	0
76B	ELWHA RVR	0	138	0	0	0	0	138	0	0	0	0	0	138
76C	MORSE CRK	0	0	0	0	0	0	0	0	0	0	0	0	0
76D	SALT CREEK	0	0	0	0	0	0	0	0	0	0	0	0	0
***	SUB-TOTAL	0	446	0	0	0	0	446	148	0	0	0	148	594
7B	MARINE 7B	10054	2866	81	0	1	0	13002	2290	196	0	0	2486	15488
77B	UPP.NOOKSC	4792	109	0	0	0	0	4901	0	0	0	0	0	4901
77C	LOW.NOOKSC	2774	1033	0	0	0	0	3807	0	0	0	0	0	3807
7C	MARINE 7C	0	0	0	0	0	0	0	0	0	0	0	0	0
77D	SAMISH RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
7D	MARINE 7D	0	0	0	0	0	0	0	0	0	0	0	0	0
7E	MARINE 7E	1	0	0	0	0	0	1	2	2	0	0	4	5
77A	CALIF. CRK	0	0	0	0	0	0	0	0	0	0	0	0	0
77G	DAKOTA CRK	0	0	0	0	0	0	0	0	0	0	0	0	0
***	SUB-TOTAL	17621	4008	81	0	1	0	21711	2292	198	0	0	2490	24201
8	MARINE 8	3172	15	0	0	0	0	3187	1170	298	0	0	1468	4655
78B	SAUK RIVER	0	0	0	0	0	0	0	0	0	0	0	0	0
78C	LOW.SKAGIT	1481	317	0	0	0	0	1798	0	0	0	0	0	1798
78D	UPP.SKAGIT	312	3349	0	0	0	0	3661	0	0	0	0	0	3661
***	SUB-TOTAL	4965	3681	0	0	0	0	8646	1170	298	0	0	1468	10114
6B	MARINE 6B	0	0	0	0	0	0	0	0	0	0	0	0	0
9	MARINE 9	722	387	700	0	0	0	1809	38	0	0	0	38	1847
***	SUB-TOTAL	722	387	700	0	0	0	1809	38	0	0	0	38	1847
8A	MARINE 8A	43754	883	0	32	205	0	44874	31432	22673	0	0	54105	98979
78F	SNOHOMISH	0	0	0	0	0	0	0	0	0	0	0	0	0
78G	STILLAGUAM	2245	2600	0	0	0	0	4845	0	0	0	0	0	4845
8D	MARINE 8D	732	11249	0	120	535	0	12636	695	422	0	0	1117	13753
***	SUB-TOTAL	46731	14732	0	152	740	0	62355	32127	23095	0	0	55222	117577
10	MARINE 10	16648	79	7235	0	0	0	23962	47735	44920	0	0	92655	116617
10A	MARINE 10A	1162	202	0	0	0	0	1364	0	0	0	0	0	1364
80B	DUWA-GREEN	2	184	0	0	0	0	186	0	0	0	0	0	186
10B	LK.WA. 10B	0	1	0	0	0	0	1	0	0	0	0	0	1
10C	LK.WA. 10C	0	0	0	0	0	0	0	0	0	0	0	0	0
80A	CEDAR RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
10D	LK.SA. 10D	0	0	0	0	0	0	0	0	0	0	0	0	0
10E	MARINE 10E	8189	1146	0	0	0	0	9335	0	0	0	0	0	9335
10F	LK.UN. 10F	7	48	0	0	0	0	55	0	0	0	0	0	55
10G	LK.WA. 10G	0	43	0	0	0	0	43	0	0	0	0	0	43
11	MARINE 11	6207	0	0	0	0	0	6207	12004	20844	0	0	32848	39055
11A	MARINE 11A	114	0	0	0	0	0	114	0	0	0	0	0	114
81A	CARBON RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
81B	PUYALLUP R	4764	457	0	0	0	0	5221	0	0	0	0	0	5221
81C	WHITE RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
13	MARINE 13	191	10	0	1	0	0	202	0	0	0	0	0	202
83D	NISQUALLY	16272	32205	0	0	0	0	48477	0	0	0	0	0	48477
83F	MCALLISTER	12	702	0	0	0	0	714	0	0	0	0	0	714
13A	MARINE 13A	2290	2563	0	66	0	0	4919	0	0	0	0	0	4919
83C	MINTER CRK	0	0	0	0	0	0	0	0	0	0	0	0	0
83E	PUROY-CASE	0	0	0	0	0	0	0	0	0	0	0	0	0
13B	MARINE 13B	0	0	0	0	0	0	0	0	0	0	0	0	0
13C	MARINE 13C	37	5	0	0	0	0	42	0	0	0	0	0	42
83H	CHAMBERS C	0	0	0	0	0	0	0	0	0	0	0	0	0
13D	MARINE 13D	4155	2598	0	1111	0	0	7864	0	0	0	0	0	7864
13E	MARINE 13E	0	0	0	0	0	0	0	0	0	0	0	0	0
13F	MARINE 13F	10	2	0	0	0	0	12	0	0	0	0	0	12
83A	DESCHUTES	0	0	0	0	0	0	0	0	0	0	0	0	0
13G	MARINE 13G	230	179	0	0	0	0	409	0	0	0	0	0	409
13H	MARINE 13H	4041	730	0	21	0	0	4792	0	0	0	0	0	4792
13I	MARINE 13I	132	2173	0	0	0	0	2305	0	0	0	0	0	2305
13J	MARINE 13J	0	0	0	0	0	0	0	0	0	0	0	0	0
13K	MARINE 13K	0	214	0	0	0	0	214	0	0	0	0	0	214
***	SUB-TOTAL	64463	43541	7235	1199	0	0	116438	59739	65764	0	0	125503	241941
9A	MARINE 9A	0	1508	0	0	0	0	1508	0	0	0	0	0	1508
12	MARINE 12	139862	3710	0	0	10	0	143582	36275	110177	0	0	146452	290034
82A	BIG BEEF C	0	0	0	0	0	0	0	0	0	0	0	0	0
12A	MARINE 12A	74	272	0	2	4	0	352	223	1197	0	0	1420	1772
82F	QUILCENE R	0	5	0	0	2	0	7	0	0	0	0	0	7
12B	MARINE 12B	12747	706	0	0	0	0	13453	322	2106	0	0	2428	15881
82C	DOSEWALLIP	0	184	0	0	0	0	184	0	0	0	0	0	184
82D	DUCKABUSH	0	436	0	0	0	0	436	0	0	0	0	0	436
82E	HAMMA-HAMM	0	23	0	0	0	0	23	0	0	0	0	0	23
12C	MARINE 12C	13275	24054	0	0	0	0	37329	28	0	0	0	28	37357
82B	DEWATTO RV	0	677	0	0	0	0	677	0	0	0	0	0	677
82G	SKOKOMISH	964	5521	0	0	0	0	6485	0	0	0	0	0	6485
82J	PURDY C-HC	0	0	0	0	0	0	0	0	0	0	0	0	0
12D	MARINE 12D	0	6	0	0	0	0	6	0	0	0	0	0	6
82H	TAHUYA RVR	0	0	0	0	0	0	0	0	0	0	0	0	0
82I	UNION RVR	0	140	0	0	0	0	140	0	0	0	0	0	140
***	SUB-TOTAL	166922	37102	0	2	16	0	204042	36848	113480	0	0	150328	354370
	TOTALS	377012	105194	32134	1353	764	12	516469	145198	222637	372	0	368207	884676

Table 5. Total Puget Sound chum run sizes, catches and escapements (1985 - 1989).

Year	Total Run Size	Escapement	Total Catch*
1985	1,454,779	499,667	1,104,967
1986	1,535,101	498,890	1,151,820
1987	1,758,896	474,945	1,327,616
1988	2,037,908	621,707	1,534,617
1989	1,034,420	240,176	884,676

* - Total commercial catch in all Puget Sound areas; includes some catch from stocks originating outside Puget Sound.

Table 6. 1989 Washington coastal chum run sizes, catches, and escapements.

	Willapa Bay	Grays Harbor	Quinault R.	Total
Preseason Forecast	36,300	81,800	N/A	118,400
Actual Run Size	44,300	19,400	6,200	69,900
Harvest	20,600	10,400	2,600	33,600
Wild Esc. Goal	35,400	21,000	None	56,400
Wild Escapement	17,000	9,100	3,100	29,200
Hatchery Esc. Goal	None	None	2,500	
Hatchery Escapement	6,700	0	600	7,300

Table 7. 1989 chum samples for WDF GSI Baseline

Locality	Number sampled	Collection date(s)
Washington		
North Sound		
Skagit River	100	12/15/89
Wallace Creek - Snohomish R.	100	12/11-19/89
South Sound		
Chico Creek	100	11/14-28/89
Elson Creek	50	12/1/89

Source: WDF GSI lab.

Table 8. Summary of 1989 chum salmon GSI samples taken from fisheries in northern Puget Sound.

Location	Statistical Week	No. Fish Sampled	Gear Type	Fishery Type
Strait of Juan de Fuca (Area 5)	41	87	GN	test
	42	199	GN	commercial
	43	200	GN	commercial
	44	200	GN	commercial
	45	199	GN	commercial
	46	180	GN	commercial
	47	190	GN	commercial
Salmon Banks (Area 7)	42	131	Mixed	commercial
	44	316	Mixed	commercial
	45	134	Mixed	commercial
	46	126	Mixed	commercial
Point Roberts (Area 7A)	41	254	GN	test
	42	182	GN	test
	42	194	PS	commercial
	42	224	GN	commercial
	43	365	GN	test
	44	119	GN	test
	44	278	PS	commercial
	44	186	GN	commercial
	47	403	Mixed	commercial

GN = gillnet PS = purse seine

Source: Phelps, Miller and Doughty. 1990. Genetic Stock Identification Estimates of 1989 Washington Chum Fisheries in Areas 5, 7, and 7A, and Evaluation of Test Fisheries. WDF and Nooksack Indian Tribe.

CHAPTER 3

REVIEW OF THE 1989 CANADIAN CHUM SALMON FISHERIES

3.1 INTRODUCTION

The treaty between the governments of Canada and the United States of America (U.S.) concerning Pacific salmon was designed to facilitate cooperation between the two countries in the management, research and enhancement of Pacific salmon stocks. Chapter 6 of Annex IV of the Pacific Salmon Treaty (PST) required that certain fisheries for chum salmon in southern British Columbia and Washington be managed in a specified manner in 1989. Other fisheries, while not specifically mentioned in the PST, are known to harvest chum of the other country's origin. This report discusses various aspects of the chum present in British Columbian waters between Vancouver Island and the mainland and off the west coast of Vancouver Island and discusses the management actions of Canada in relation to the PST requirements.

Southern B.C. chum salmon stocks and fishing areas are, for the purposes of management, analysis and reporting, divided into two major components. The stocks of Johnstone and Georgia Straits, herein termed Inside chum, and those of the West Coast of Vancouver Island, including Juan de Fuca Strait, termed West Coast chum. The primary fisheries of concern are the West Coast Vancouver Island net and troll fisheries and net fisheries in Johnstone, Georgia and Juan de Fuca Straits and in the Fraser River.

3.2 INSIDE CHUM

3.2.1 Conservation and Harvest Management Requirements

Inside chum are managed with the long term objective of providing maximum benefits to the fishing industry. The general approach adopted by the Department of Fisheries and Oceans (DFO) is to achieve the present estimate of optimum wild escapements, while augmenting production through enhancement of selected stocks. In practice, this approach is achieved through the application, in mixed stock fishery areas, of harvest rates which are compatible with wild stock productivity. If there are stocks which return to their area of origin in numbers above that area's escapement goal, they may be subjected to additional harvesting in the appropriate terminal area.

In the years prior to 1983, chum escapements to inside streams averaged less than half the number required to provide maximum production. To increase spawning escapements, DFO, in 1983, initiated a 12 to 15 year conservation plan, known as the clockwork management strategy which was designed to rebuild stocks by reducing harvest rates in the mixed stock areas. The initial portion of the multi-year clockwork plan

remained in effect through 1986. In 1987, the stock rebuilding objective was restated and the clockwork plan, with appropriate amendments, entered its second phase. The second phase was re-evaluated in the spring of 1989 and the clockwork plan endorsed without change, for 1989 and 1990. The following describes the clockwork strategy for 1989 and the PST requirements for Inside chum and discusses Inside, Fraser River, and mid Vancouver Island chum stocks in relation to these plans.

3.2.1.1 Clockwork Harvest Strategy

This strategy was more fully described in the Final 1985 Post Season Summary Report of the Joint Chum Technical Committee (TCCHUM 87-4). The clockwork strategy is designed to rebuild wild chum stocks to the estimated optimum escapement levels by limiting the overall harvest rate. Specific objectives of this strategy are to:

a. achieve the rebuilding objective within 12 to 15 years;
b. reduce the number of years during which no commercial chum fishing is permitted; and
c. consider wild stock production when establishing harvest management plans.

Under this scheme, harvest rates are directly related to the total run size of the chum run migrating through Johnstone Strait as estimated during the season. The allowable harvest rates for the expected magnitudes of chum salmon run sizes in 1989 were:

a. below 3.0 million, up to a 10% harvest rate;
b. 3.0 to 3.7 million, maximum of 20% harvest rate;
c. 3.7 to 5.2 million, maximum of 30% harvest rate; and
d. over 5.2 million, maximum of 40% harvest rate.

The clockwork strategy was developed to limit the harvest in those areas containing numerous mixed stocks; however, it was recognised that harvesting in terminal areas would be required, particularly in areas of major enhancement. In 1989, it was anticipated terminal harvesting would occur in the mid Vancouver Island (Qualicum, Area 14), Nanaimo (Area 17), Cowichan (Area 18) and Fraser River (Area 29) areas.

3.2.1.2 Canada/U.S. Treaty

No changes were made to the chum chapter of the PST in 1989. As in 1988, Canada was to manage the 1989 chum fisheries in Johnstone Strait, Strait of Georgia and Fraser River areas in a manner consistent with the clockwork plan and minimize, where practicable, interceptions of United States origin stocks. The U.S. would limit its harvest of Canadian chum in some areas to negotiated catch ceilings as specified in Chapter 6 of Annex IV of the PST.

During the 1989 chum season, the early Johnstone Straits stock size estimates were at the 3.0 million commercial fishing threshold. To provide additional assessment data, Canada delayed chum salmon harvesting in Johnstone Strait until late October when updated run size estimates confirmed the 3.0 million estimate and the balance of the allowed clockwork catch was harvested. As a result, Canada anticipated that the U.S. commercial fisheries in Areas 7 and 7A would reach to 120,000 chum. An assessment of the management of the 1989 season is included in Section V of this report.

3.2.1.3 Fraser River Chum

The chum produced from the Fraser River were of major importance during the development of the clockwork harvest strategy and the negotiation of the PST. While, the Canadian clockwork plan was designed to conserve all inside chum in the Johnstone Straits mixed stock fishery area, this strategy potentially results in terminal Fraser River surpluses. As part of the revisions to the 1988 clockwork, terminal harvesting of Fraser River chum was no longer directly linked to the harvesting pattern in Johnstone Strait. The removal of this linkage required the adoption of a harvesting plan for the Fraser River (Area 29).

The harvest management plan for Fraser River chum conservation was implemented to provide management goals and fishing limits for the harvest of Fraser River chum in the terminal area. In 1989, the minimum spawning escapement goal for Fraser River chum was set at 700,000 and the plan provided for the escapement goal to be increased in-season if the return to the river exceeded the gross escapement goal. Harvest of chum exceeding the gross escapement goal was limited to one half of the surplus.

3.2.1.4 Strait of Georgia Chum

The chum produced in the mid Vancouver Island area are produced primarily from enhancement facilities. In 1989, a portion of this return was harvested in Johnstone Strait, under the in-season 20% clockwork harvest rate. Minimal harvesting occurred in the mid Vancouver Island area. Terminal harvesting was directed at a mix of surplus mid Vancouver Island wild and enhanced chum, with the conservation requirements of passing chum stocks considered. In 1989, conservation requirements of local chinook and coho salmon in this fishery area were also considered in determination of terminal area closures for the Area 14 chum fishery.

3.2.2 Run Size Estimation

Pre-season run size forecasts were prepared to facilitate the planning of potential conservation actions as well as domestic and international allocations. As the season progressed, revisions to the run size projection were used to amend harvest plans in accordance with the clockwork approach.

3.2.2.1 Pre-season

The wild run size forecast was determined from the application of past average returns per spawner, adjusted for expected variations, and past average percent return by age group, to the appropriate brood year spawning abundance. The 1989 pre-season forecast of Inside chum originating from wild spawning areas was 2,246,000 including 900,000 Fraser River and 1,346,000 non Fraser chum (Table 1).

The number of Inside chum returning to enhanced spawning areas was determined through the application of average survival rates for each type of enhancement facility and the average returns by age group to the number of fry released by the facilities. The 1989 run size estimate for enhanced origin Fraser River chum was 450,000 while the mid Vancouver Island area was expected to produce 491,000 enhanced chum. In addition, there were 42,000 enhanced origin chum estimated to return to other areas, including Howe Sound, lower Vancouver Island, and Jervis Inlet areas. The total run size estimate for enhanced Inside chum was 983,000 (Table 1).

The total Inside chum run size was forecast to be 3,229,000 (2,246,000 wild and 983,000 enhanced). In addition, past data show that U.S. chum migrate through Johnstone Strait. For computational purposes, the forecasted run size of U.S. chum forecast to migrate through Johnstone Strait was set at 100,000. This brought the total run size expected to return through Johnstone Strait to 3,329,000 chum.

3.2.2.2 In-season

The chum catch and vessel effort in a commercial fishery in the third week of September in Johnstone Strait is a reasonably accurate predictor of seasonal run size, based on past correlations. This is the first in-season run size estimate used in the clockwork plan.

In 1989, the first in-season assessment fishery occurred on September 26, a delay of one week from the normal fishing period to ensure Fraser River pink salmon escapement targets would be met. This fishery indicated a Johnstone Strait run size estimate of 3,000,000 chum; 90% of the pre-season forecast (Table 2). The allowable harvest rate, under the clockwork plan, remained at the pre-season forecast estimate of 20 percent. At that time, as per clockwork rules, all Inside chum stocks were assumed to be returning at this reduced return rate (Table 2).

The subsequent in-season run size projection, made on October 5, was based on the chum catch and effort data from the upper Johnstone Strait test fishery and confirmed the run at 3.0 million. The following two weeks of test fishing did not change this projection. The harvest rate remained at 20%, and a commercial fishery was scheduled for October 23 to harvest an outstanding clockwork Johnstone Strait catch allocation of 125,000 chum.

Total stock abundance estimates from the commercial fishing during this 4th week in October combined with previous stock size estimates projected a lower total run size of 2,772,000. This decrease in stock size lowered the clockwork harvest rate from 20% to 10% and meant that the updated, allowable harvest rate had been exceeded in Johnstone Strait.

Based on this run size, no further commercial fisheries were scheduled. This catch assessment combined with the remainder of the seasonal test fishing resulted in a final in-season run size assessment of 2,635,000 chum for 1989.

Initial estimates of Fraser River total run size are made in Johnstone Strait from commercial and test fishing assessments combined with GSI estimates. The Fraser River test fishing was used after mid October to determine the estimated return to the terminal area. The final in-season projection of total Fraser River run size available from Johnstone Strait test fishing was 1,058,000 chum. Test fishing on the Fraser River was conducted from October 1 to early December. The final in-season projection of the terminal run size to the Fraser River was 400,000 chum (Table 2).

3.2.2.3 Post-season

At the end of the season, the total catch in all Inside areas plus the, catch of Canadian chum in U.S. areas 7 and 7A and Inside chum gross escapements were summed to estimate the total Clockwork assessed run size (Table 9). This estimate is limited to catch and escapements of stocks which are assessed in their migration through Johnstone Strait and does not include Study Area catches from the West Coast. In addition, the total run size of Fraser River chum was calculated by applying stock composition data derived from GSI samples in selected areas.

The post-season clockwork run size estimate was 1,776,000 chum (1,053,000 escapement and 723,000 total catch, Table 7). This figure approximates the total stock which migrates through Johnstone Strait and comprises the Clockwork assessed stock size. The post-season estimate was 67% of the final in-season projection of 2,635,000 chum salmon and 53% of the pre-season forecast of 3,329,000 chum.

The Fraser River post-season run size estimate, including the catch of Fraser River chum in U.S. and Canadian waters, was 935,000 (524,000 gross escapement and 411,000 total catch in Canadian and U.S. waters). This run size was 69% of the pre-season forecast.

Based on the assumption that the percentage of Fraser River chum caught in the U.S. Point Roberts, San Juan Islands and Juan de Fuca fisheries is 90%, 56%, 32% respectively, the total catch of Fraser River chum in these fisheries was 72,300. This includes 55,500 in areas 7 and 7a and 16,800 in areas 4B, 5, and 6C. The catches of Fraser River chum in the Johnstone Strait, Strait of Georgia, and Nitinat commercial net fisheries were estimated, through analysis of GSI data, to be 263,000 chum, 7,700 chum, and 32,000 chum, respectively. The use of current GSI analysis to determine Fraser River interceptions in the

Nitinat catch is under review. The catch of Fraser river origin chum salmon in the U.S. Juan de Fuca, Area 20 and Nitinat fisheries is not included in the clockwork estimated catch.

3.2.3 Catch

Fall chum in Inside waters are harvested by commercial, Indian food, and test fishermen and by biological samplers. In 1989, these harvests totalled 668,000. The catch by each fishing group and area is presented below.

3.2.3.1 Commercial

Commercial catch of chum in Inside waters occurs in three main areas: Johnstone Strait, Strait of Georgia and the Fraser River. A coho directed fishery also occurred in Area 20 which incidentally, harvested chum salmon.

The 1989 Johnstone Strait fishery (areas 11, 12 and 13), began in July and ended in late October. During the July and August period, the Johnstone Strait fishery was directed at harvesting Fraser River sockeye and pink salmon. During those two months, 40,400 chum salmon were harvested (Table 3). These chum are assumed to be comprised mainly of summer chum destined for streams in the Johnstone Strait and Canadian central coast areas and are not part of the clockwork management plan.

As part of the clockwork plan, a commercial assessment fishery during the third week of September is required to provide a run size estimate. In 1989, this Johnstone Strait chum assessment fishery took place in the fourth week of September. The Johnstone Strait fishery harvested 169,000 chum. The preliminary estimate of this catch was used to develop the first in-season run size estimate of 3,000,000 chum.

Subsequent in-season run size updates on October 7, 14 and the preliminary October 21 update, based on test fishing, indicated a minimum run size of 3,000,000. Under the clockwork strategy, a harvest rate of 20% was allowed and a fishery scheduled for October 23 to harvest the balance of the clockwork allocation. The catch for the fishery totalled 148,000 chum.

Fishing in the Strait of Georgia was limited to mid Vancouver Island (Area 14) in 1989. These commercial fisheries were directed at mainly enhanced chum. In Area 14, the first opening occurred on October 16. Two subsequent commercial fisheries occurred on October 23 and October 30. Catch for these fisheries was 54,000, 25,200 and 15,200 respectively (Table 3). There was no late cleanup fishery in Area 14 or any fisheries in Areas 17 or 18, as a result of reduced production and the harvest of mid Vancouver Island stocks in the earlier Johnstone Strait fisheries.

Chum salmon were incidentally harvested in an Area 20 directed coho fishery. The catch in this two day fishery was 10,800 chum of mixed Canadian and U.S. stock origins.

A Fraser River Panel opening directed at pink salmon harvested a total of 13,300*** Fraser River chum salmon. The first projection of the Fraser River terminal run size was developed mid October and indicated a run size of 710,000 (Table 2). Under the Fraser River Chum Harvest Management Plan, no commercial fisheries were permitted. Subsequent test fishing evaluations indicated a smaller terminal run size. The final in-season projection of Fraser River terminal run size was 400,000 chum.

3.2.3.2 Test and Sample

The abundance of chum was monitored through test fishing programs in Johnstone Strait and the Fraser River. In addition, sampling for GSI purposes was conducted in Johnstone Strait and the Strait of Georgia.

The abundance of chum in Johnstone Strait was assessed, in part, through test fishing by two seine vessels in Area 12. The test fishing in Area 12 began in early September and continued until early November (Table 4). During that time the two vessels enumerated a total of 121,000 chum, the majority of which were released. Included in the commercial catch reporting are 19,500 chum retained as payment for the operation of test fishing vessels. In addition 2,500 chum were sampled for biological purposes (Table 8).

The Area 12 test fishing data were utilized to determine relative weekly chum abundance and the magnitude of the total run entering Johnstone Strait. The weekly data indicated a peak of abundance in the second week of October (Table 4). The relationship between catch per unit effort in the test fishery and the total run size was monitored weekly throughout October to assist in the determination of the in-season estimates of the run size (Table 2).

Within the Strait of Georgia, 1,100 chum from the commercial fisheries in Area 14 were sampled for GSI information (Table 8).

Two test fisheries were conducted within the Fraser River. Fishing occurred daily at the Cottonwood site in the lower river near Ladner, and in the upper commercial fishery area near Albion from October 1 to early December. A total of 7,000 chum were caught in both test fisheries (Table 5).

3.2.3.3 Indian

Native people of British Columbia are permitted to harvest chum for their food fish needs. Indian food fish catches occur in Johnstone and Georgia straits and within streams flowing into these areas. The largest single system from which Indians harvest food fish is the Fraser River.

In 1989, the Indian food fishery in the Inside waters harvested 53,900 chum, of which the food fishery in Johnstone Strait harvested a total of 21,800 chum, the majority of which were taken in marine waters in October. In the Strait of Georgia there were 19,300 chum taken in the Indian food fishery. The majority of the Indian food fish caught in the Strait of Georgia are taken in streams or estuaries, often as surplus chum from enhancement facilities. The food fishery in the Fraser River system took a estimated total of 12,800 chum.

3.2.4 Escapement

Chum which elude the commercial, test, sampling, and Indian fisheries form the gross escapement to Inside chum streams. This gross escapement is made up of chum which spawn in wild areas, those which are spawned in enhancement facilities, and those which are surplus to facility requirements and are removed from the spawning areas. Gross escapement estimates are used in reconstruction of the total run size in a given year.

3.2.4.1 Spawning

Some of the streams within the Inside area contain summer run spawners. These are relatively minor stocks and because of their distinctively early run timing in Johnstone Strait, i.e. July to late August, are not included in the escapement total for the fall chum run. The total escapement of summer chum in 1989 was 12,000 chum.

The stocks which are managed within the context of the clockwork plan and of concern to the PST are the fall run chum. These chum enter Johnstone Strait during the September to November time period. The estimated number of all Study Area fall chum spawning in wild spawning areas was 877,000 chum. This escapement was 55% of the 1983 to 1988 average escapement.

With regard to specific areas, a below average escapement was reported for the Fraser River. Spawning ground enumeration effort in 1989 was again significantly reduced from previous years. The estimate of 464,700 chum in the wild spawning areas of the Fraser River was based on limited observations of spawning populations. The reliability of this estimate is unknown.

In thirteen of the fourteen major spawning areas, the 1989 chum escapement was below the average observed during the 1983-88 period (Table 6). Overall, the fall chum spawning escapement in wild spawning areas for 1989 was 44% of the present interim total spawning goal of 2,000,000 chum. None of the fourteen stock areas received an escapement at or above the goal.

Figure 1 shows total Inside chum stock size and wild escapement for the years prior to Clockwork management (1980-1982) and under Clockwork management (1983-1989). Data are provided in Table 7.

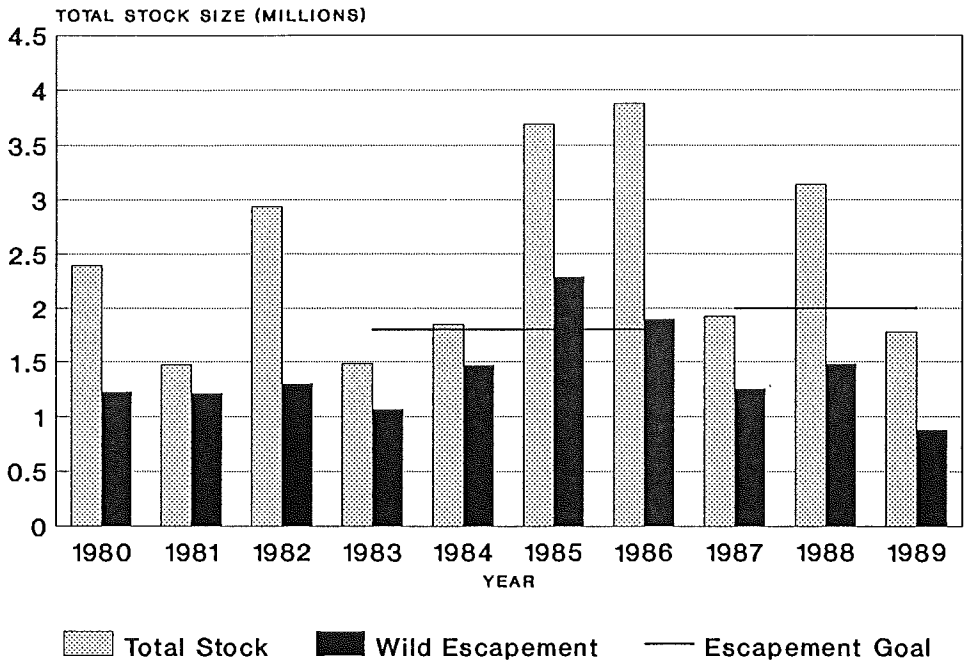


Figure 1: Inside chum wild escapement and total stock size, 1980 - 1989.

3.2.4.2 Enhanced

The primary enhanced escapement areas are presently limited to the mid Vancouver Island and Fraser River areas. The enhancement facilities in the mid Vancouver Island area received 78% of their spawning requirements (Table 6). All major Fraser River enhancement facilities met or exceeded brookstock requirement. Wherever possible, enhanced chum not required for broodstock were diverted to wild spawning areas.

3.2.4.3 Gross Escapement

The gross escapement in 1989 was estimated at 1,053,000 fall chum of which 877,000 spawned in wild or natural spawning areas. The remaining 176,000 were spawned in enhancement areas, facilities or were surplus to hatchery requirements (Table 6).

3.2.5 Status of Treaty Requirements

3.2.5.1 Overall Fishery Management

The in-season management decisions by DFO in 1989 reflected run size estimates and their revisions based on assessments of in-season data from test and commercial fishing. The commercial assessment fishery in the fourth week of September indicated a run size of 3,000,000 chum which was slightly lower than the pre-season forecast and limited the harvest rate to 20% of the total run. Early October test fishing assessment estimates supported this initial run size and the balance of the allowable Clockwork was harvested on October 23. In-season management actions were designed in Johnstone Strait achieve a 20% harvest of this total stock or a catch in all clockwork areas of 600,000. In-season, calculations of the clockwork harvest rate indicated the catch was less than this clockwork goal at 18.1%. Final test fishing assessments resulted in a seasonally estimated run size through Johnstone Strait of 2,635,000 chum. The subsequent post-season review indicated, however, that in-season assessments of run size overestimated the total returning stock size and resulted in an over-harvest of the returning Inside chum run. The post-season harvest rate was 31.5% of the total clockwork return.

The total Clockwork assessed run size includes the gross escapement of Inside chum, the total catch in Inside areas, and the apportionment of the commercial catch in U.S. areas 7 and 7A which was of Canadian origin. The 1989 gross escapement was 1,053,000; the Inside chum catch 604,000; the IFF catch 54,000 and the United States estimated catch of Canadian origin chum 63,600. This run size was estimated to be 1,774,600 chum. The total clockwork catch, as calculated, including the appropriate Canadian and U.S. fisheries, was 558,200 with an overall clockwork harvest rate of 31.5 percent (Table 9).

An assessment of Clockwork management is provided for the years 1983 to 1989 in Table 10.

3.2.5.2 Stock Identification

Genetic stock identification (GSI) was conducted in a number of areas in 1989. The majority of the GSI work concentrated on sampling of commercial fishery areas or commercial catches.

The commercial fishery areas sampled in 1989 were upper Johnstone Strait (Area 12) and mid Vancouver Island (Area 14). The samples in Areas 14 were from the commercial catch. In Area 12, the samples were from chum caught by test fishing vessels and in the commercial fishery (Table 8).

Table 1. Preseason run forecasts by stock, 1989.

Stock	Origin	Expected run size		Percent run size	
Canadian Inside Chum					
Fraser River:	Wild	900,000		27.0%	
	Enhanced	450,000		13.5%	
	sub-total		1,350,000		40.6%
Mid Vancouver Island:	Wild	a.			
	Enhanced	491,000		14.7%	
	sub-total		491,000		14.7%
Non-Fraser Stocks:	Wild	1,346,000		40.4%	
	Enhanced	42,000		1.3%	
	sub-total		1,388,000		41.7%
Total Inside Stocks:	Wild	2,246,000		67.5%	
	Enhanced	983,000		29.5%	
	Total		3,229,000		97.0%
U.S. Chum					
Puget Sound:		100,000		3.0%	3.0%
	GRAND TOTAL		3,329,000	100.0%	100.0%

a. Included in Total Inside Stocks, wild total

Table 2. Summary of pre-season, in-season and post-season chum run size estimates, 1989.

Week Ending	Total through J.St.	U.S.	Canadian Total	Fraser River	Mid Vancouver Island	Other Inside Canadian
PRESEASON	3,329,000	100,000	3,229,000	1,350,000	680,000	1,199,000
INSEASON (a)						
(Johnstone Strait fishery)						
16-Sep	3,134,000	100,000	3,034,000	1,268,000	656,000	1,110,000
30-Sep	3,000,000	100,000	2,900,000	1,212,000	640,000	1,048,000
07-Oct	3,000,000	100,000	2,900,000	1,212,000	640,000	1,048,000
14-Oct	3,000,000	100,000	2,900,000	1,212,000	640,000	1,048,000
21-Oct	3,000,000	100,000	2,900,000	1,212,000	640,000	1,048,000
28-Oct	2,772,000	100,000	2,672,000	1,116,000	613,000	943,000
04-Nov	2,635,000	100,000	2,535,000	1,058,000	597,000	880,000
(Estimates from Fraser River test fishing - terminal run size)						
Oct 15	-	-	-	710,000	-	-
Oct 29	-	-	-	600,000	-	-
Nov 11	-	-	-	510,000	-	-
Nov 26	-	-	-	430,000	-	-
Dec 10	-	-	-	390,000	-	-
POSTSEASON (b)	-	-	1,774,300	934,000	-	-

a. In-season total run size estimates based on the following:
USA assumed constant at 100,000.
Fraser river and MVI same proportion as pre-season.
Non-Fraser is remaining difference.

b. Fraser River post-season includes chum caught in US areas 4b,5,6,7,7A and in Canadian areas 12,13,14,17,20,21 and 29.

Table 3. Catch of chum salmon by statistical area for commercial and test fishing vessels and by Indian food fisheries, 1989.

Week ending	Statistical Areas 11	12	13	14	15-19	20	29	Total
09-Sep	572	27,084	7,316	0	3	3,586	276	38,837
16-Sep	73	73,238	29,902	3	13	2,270	72	105,571
23-Sep	0	110	483	74	9	25	268	969
30-Sep	0	110,979	57,706	71	152	11,884	13,353	194,145
07-Oct	0	78	1,373	38	0	90	1,104	2,683
14-Oct	0	1,179	0	0	0	225	2,486	3,890
21-Oct	0	6,275	0	53,991	647	709	1,438	63,060
28-Oct	0	41,752	106,639	25,217	174	0	2,206	175,988
04-Nov	0	381	0	15,190	0	0	601	16,172
Nov.5 to Dec. 2	0	0	0	0	2,618	0	1,850	4,468
Dec 3 to Dec.31	0	0	0	0	0	0	20	20
TOTAL	645	261,076	203,419	94,584	3,616	18,789	23,674	605,803
Prior to 02-Sep	10,214	26,353	3,846	14	218	3,119	420	44,184
Indian Food Fishery	0	3,548	18,300	1,499	17,812	0	12,785	53,944
Grand total	10,859	290,977	225,565	96,097	21,646	21,908	36,879	703,931

Source: British Columbia Catch Statistics, 1989.

Table 4. Catch, effort, and catch per unit effort in Johnstone Strait test fisheries, 1989.

Week Ending	Stat Week	Weekly Catch	Effort (sets)		Catch per set
Upper Johnstone St.					
02-Sep	9/1	NA	NA		NA
09-Sep	9/2	5,883	17		346.1
16-Sep	9/3	6,338	23		275.6
23-Sep	9/4	8,156	24		339.8
30-Sep	10/1	10,355	36		287.6
07-Oct	10/2	12,194	42		290.3
14-Oct	10/3	7,179	24		299.1
21-Oct	10/4	1,775	17		104.4
28-Oct	10/5	999	25		40.0
04-Nov	11/1	NA	NA		NA
11-Nov	11/2	NA	NA		NA
	sub total	52,879	208	avg.	247.9
Mid Johnstone St.					
02-Sep	9/1	2,746	18		152.6
09-Sep	9/2	6,973	24		290.5
16-Sep	9/3	4,523	24		188.5
23-Sep	9/4	6,858	24		285.8
30-Sep	10/1	17,277	39		443.0
07-Oct	10/2	23,351	45		518.9
14-Oct	10/3	3,036	26		116.8
21-Oct	10/4	1,542	19		81.2
28-Oct	10/5	1,126	21		53.6
04-Nov	11/1	252	5		50.4
11-Nov	11/2	NA	NA		NA
	sub total	67,684	245	avg.	218.1
	Grand Total	120,563	453	avg.	266.1

Table 5. Weekly total catch and catch per unit effort in Fraser River chum test fisheries in 1989.

Week Ending	Cottonwood		Albion	
	Catch	CPUE	Catch	CPUE
01-Oct	17	1.2	44	3.4
08-Oct	220	18.7	545	43.3
15-Oct	682	57.2	855	73.7
22-Oct	441	33.0	692	54.8
29-Oct	572	46.4	872	57.1
05-Nov	123	16.2	524	40.4
12-Nov	62	10.8	366	34.7
19-Nov	51	7.3	523	41.4
26-Nov	51	4.8	250	24.0
03-Dec	24	2.1	71	6.4
10-Dec	3	1.1	12	2.3
17-Dec	0	0.0	4	0.4
Total	3148	306.8	4265	339.7

Table 6. Number of inside chum spawning in wild areas, and number spawning in enhanced facilities or otherwise utilized by hatcheries, in 1989, compared to spawning capacity and to previous five year averages.

Spawning Areas by Stock Group	Target Escapement	1989 Estimate	1989 as percent of Target	1983 - 88 Average	1989 as percent of 83-88 Ave
Wild Spawning Areas					
Upper Vancouver Island	33,000	400	1%	500	80%
Kingcome Inlet	114,000	20,200	18%	7,300	277%
Bond to Knight Inlet	220,000	3,100	1%	38,400	8%
Johnstone Strait	137,000	31,100	23%	58,800	53%
Loughborough/Bute Inlet	150,000	28,200	19%	152,900	18%
Mid Vancouver Island	149,000	90,200	61%	136,900	66%
Toba Inlet	136,000	300	0%	12,000	3%
Jervis Inlet	150,000	49,800	33%	114,200	44%
Lower Vancouver Island	147,000	34,200	23%	70,100	49%
Southern Vancouver Island	238,000	76,000	32%	188,800	40%
Howe Sound/Sunshine Coast	350,000	63,200	18%	165,700	38%
Burrard Inlet	50,000	14,800	30%	31,800	47%
Fraser River	700,000	464,700	66%	613,600	76%
Boundary Bay	5,000	300	6%	400	75%
WILD TOTAL	2,579,000 a	876,500	34%	1,591,400	55%
Enhanced Spawning Areas					
Mid Vancouver Island	150,000	117,300	78%	159,300	74%
Fraser	30,000	59,000	197%	21,900	269%
ENHANCED TOTAL	180,000	176,300	98%	181,200	97%
GRAND TOTAL	2,759,000	1,052,800	38%	1,772,600	59%

a. Current long term goal. Interm goal for 1987-1990 is 2,000,000.

Table 7. Total stock, catch, escapement, wild escapement and Clockwork and actual harvest rate for Inside chum, 1980 - 1989.

YEAR	TOTAL STOCK	TOTAL CATCH	TOTAL ESC	WILD ESC	CLOCKW HR	ACTUAL HR
1980	2,450,800	1,125,800	1,325,000	1,231,800	NA	NA
1981	1,492,200	201,100	1,291,100	1,209,100	NA	NA
1982	3,056,400	1,576,400	1,480,000	1,333,300	NA	NA
1983	1,611,100	378,200	1,232,900	1,066,700	10.0%	12.0%
1984	1,918,100	322,900	1,595,200	1,442,700	10.0%	54.0%
1985	3,847,500	1,370,300	2,477,200	2,493,200	30.0%	19.8%
1986	3,778,000	1,691,200	2,086,800	1,885,100	30.0%	36.9%
1987	1,982,900	576,700	1,406,200	1,234,600	10.0%	8.6%
1988	3,112,600	1,496,700	1,615,900	1,425,500	20.0%	39.4%
1989	1,775,900	723,200	1,052,700	876,500	10.0%	31.5%

Wild escapement goal for 1983-86 was 1.8 million.
Wild escapement goal for 1987-90 was 2.0 million.

Table 8. Number of chum salmon sampled for GSI data, 1989.

Area	Weeks Sampled	Commercial Samples	Test fish Samples
Johnstone Strait	9	1,194	2,547
Qualicum	3	1,091	0
Nanaimo	0	0	0
Nitinat	7	993	516
Total		3,278	3,063

Table 9. Summary of Clockwork catch, escapement and harvest rate, 1989.

Fishery Type	Areas	Total Catch	Contribution to Clockwork	Clockwork Catch
Commercial and Test	12 & 13	465,140	100%	465,140
	14	94,584	8% a	7,669
	29	23,674	0%	0
	other	3,616	0%	0
	sub total	587,014		472,809
Indian Food	12 & 13	22,614	100%	22,614
	29	12,785	0%	0
	other	18,545	0%	0
	sub total	53,944		22,614
U.S.	7	51,322	70% b	35,925
	7A	29,699	95% b	28,214
	sub total	81,021		64,139
	Total Clockwork catch			560,000
	Total Escapement			1,053,000
	Total Clockwork Assessed Stock			1,775,000 c
	Clockwork Harvest Rate			31.5%
	Total Study Area Stock Size			1,833,000 d

a. Based on GSI data.
b. Based on apportionment methods as per Chum Technical Report 88-4
c. Total Clockwork Assessed Stock Size (Commercial, IFF, Test and Sampled catch, plus Hatchery Rack Sales for Area 11-20 plus the Canadian component of the US catch in Areas 7 & 7a.
d. Total Study Area Run Size (Commercial, IFF and Test catch Area 11-20 & 29 plus Canadian component of the US catch Areas 4b,5,6c,7, & 7a plus Can. Area 21(Nitinat) catch of Study Area origin minus Can. catch of US origin chum in the Study Area)

Table 10. Assessment of Clockwork management, 1983-1989.

	1983	1984	1985	1986	1987	1988	1989
1. INSEASON...							
Assessed Total Stock	1,420,000	1,810,000	2,970,000	3,806,000	2,305,600	4,217,000	3,000,000
Desired HR	10.0%	10.0%	20.0%	30.0%	10.0%	30.0%	20.0%
Apparent HR	15.7%	7.1%	27.6%	37.5%	9.1%	30.3%	18.1%
2. POST SEASON...							
Clockwork Assess Stock	1,611,000	1,918,100	3,847,500	3,778,000	1,982,900	3,112,600	1,774,600
COMM & TF A11-13	101,839	38,251	516,314	1,131,377	68,414	1,086,853	465,140
COMM & TF A29	7,778	1,976	51,800	97,241	9,633	NA	NA
COMM A 14 FR	61,817	22,451	36,552	60,743	26,729	4,743	7,669
IFF A11-19,29	49,630	64,328	76,055	59,241	83,739	76,851	22,614
US 7-7A	2,019	1,348	138,615	76,854	21,224	108,545	64,139
Total	223,083	128,354	819,336	1,425,456	209,738	1,276,992	559,562
Desired HR	10.0%	10.0%	30.0%	30.0%	10.0%	20.0%	10.0%
Actual HR	13.8%	6.7%	21.3%	37.7%	10.6%	41.0%	31.5%
3. ESCAPEMENT...							
Goal	1,800,000	1,800,000	1,800,000	1,800,000	2,000,000	2,000,000	2,000,000
Estimated wild	1,066,700	1,442,700	2,272,100	1,874,100	1,234,600	1,425,500	876,500
Difference	-733300	-357300	472,100	74,100	-765400	-574500	-1123500

Note: 1. Clockwork catch 1983-87 included commercial catches from Areas 11-13 (After Sept. 1) Area 14 Fraser origin catch and Area 29, IFF catches Areas 11-13 and 29, Test catches from Area 11-13 and 29, and U.S. catches of Can. chum in Areas 7 and 7A
2. Clockwork catches for 1988 excluded catch from the Area 29 fishery. Fraser River catches were accounted for in the Fraser River clockwork.
3. Clockwork total Stock is Commercial, IFF and Test Catches for Areas 11-20 and 29 plus the Canadian component fo US Areas 7 and 7a

3.3 WEST COAST CHUM

3.3.1 Conservation and Harvest Management Requirements

Chum salmon stocks return to most areas on the west coast of Vancouver Island. The major stock with implications for the PST is the Nitinat group of stocks, originating from river systems in the Nitinat Lake area (Statistical Area 22) and from a major hatchery in the area. The escapement requirement for the Nitinat area totals 200,000, including 150,000 in the Nitinat River itself. The hatchery brood stock requirement is currently 8,200 females (approximately 17,000 adults). Surpluses to the escapement requirements are harvested by commercial fisheries in waters adjacent to Nitinat Lake (Area 21). The fishing area is limited to inside a line two miles due south of Pachena Point and Bonilla Point. Seines and gill nets may be used to harvest the surplus and achieve the allocation between gear types.

The management of this fishery is based on a fixed escapement policy. The pre-season expected surplus to escapement requirements is based only on predicted surplus to the hatchery. Recruitment from the wild escapement component has proven too variable to predict. A seine test fishery and a commercial gillnet fishery are initiated in mid September to provide in-season information to confirm the availability of surpluses. The gillnet catch in this early fishery is limited to 50% of the projected hatchery surplus, or maximum two weeks of fishing. Subsequent fishing opportunities for seines and gillnets depend on in-season determination of available surplus, as determined from test and/or commercial fishery catch per unit effort (C.P.U.E.), and from escapements to date.

3.3.2 Run Size Estimation

The 1989 pre-season expected surplus to the hatchery was 264,000. The in-season information generally confirmed this expected surplus. Consequently, fisheries were operated as per pre-season fishing plans. The final in-season estimate of total Nitinat area stock was 463,000 (from commercial fishery hails plus early escapement estimates).

The post season estimate of the total Nitinat area chum stock (hatchery plus wild components) was determined by adding escapement and catch. Catch of Nitinat stock in the commercial fishery is determined by stock composition estimates based on uncorrected GSI samples from the fishery. The stock composition estimates are deemed "preliminary" until the Chum Technical Committee completes a definition of the use of the method. The 1989 post season estimate of total Nitinat River system and hatchery is 411,700 (see Table 1).

Escapement into the Nitinat system comprised the major portion of the total escapement. Other systems such as Caycuse, Doobah, and Little Nitinat had very poor escapements.

3.3.3 Catch

3.3.3.1 Commercial

The commercial chum salmon fishery in Area 21 was held over a period of four weeks from September 18 through October 11, 1989. The total catch for commercial and test fisheries was 294,000 chum (Table 1). Incidental catch of other species during the full fishing period was 2,100 chinook and 39,500 coho.

The first opening on September 18 was used to determine the relative abundance of chum in the fishing area. To limit the catch, the area was opened for gillnets only; 19,700 chum were caught. The opening in the following week was also restricted to gillnets. In the first two weeks, gillnets caught approximately 58,000 chum, below their early season allocation of 132,000 chum . On October 2, based on test fishery indication of a surplus, seines fished for their early season allocation of 132,000 chum. In one day of fishing, seines caught approximately 148,000 chum. In order to achieve the remaining early season allocation, the gillnet fishery restarted October 4 and continued until October 11.

In the waters off the west coast of Vancouver Island (areas 21-27), the commercial troll fishing fleet harvested 23,300 chum salmon. The majority of the catch occurred in July and August and were thought to be returning to streams in the north and central coast areas of British Columbia.

3.3.3.2 Test and Sample

There were 28 boat-days of test fishing to monitor chum abundance in Area 21 in the period October 9 to November 5. The test fishery harvested an estimated 31,379 chum salmon.

In addition, a total of 993 samples for genetic stock identification were taken from the commercial catch in the five fishing weeks. A further 516 samples were taken in the test fishery in late October. The above catches are included in the total commercial catch for the area.

3.3.3.3 Indian

There were 1,000 chum reported in the Indian food fishery in the Nitinat area.

3.3.4 Escapement

The escapement to the wild spawning grounds of the Nitinat system was 115,000. The gross escapement to the Nitinat area was 146,553 chum in 1989. The Nitinat hatchery egg take was 27 million.

3.3.5 Status of Treaty Requirements

Canada was to manage the Nitinat net chum fishery to minimize the harvest of non-targeted stocks. Samples of the commercial fishery in the Nitinat area were taken to determine stock composition (Table 8).

3.3.6 Tables

Table 1. Summary of Nitinat Catch, Escapement and Run Size, 1989.

Statistical Week	Week Ending	Catch
8/4	Sep 02	0
9/1	Sep 09	0
9/2	Sep 16	0
9/3	Sep 23	19,726
9/4	Sep 30	37,695
10/1	Oct 07	148,635
10/2	Oct 14	
10/3	Oct 21	11,633
10/4	Oct 28	3,421
10/5	Nov 04	72,480
11/1	Nov 11	0
11/2	Nov 18	253
11/3	Nov 25	0
Total Catch		293,843
Total Catch Nitinat Stock (GSI)		265,154
Total Nitinat Escapement		146,553
Nitinat Run Size		411,707

(Data from catch database on PBS VAX)

Table 2. Summary of Nitinat Catch and Escapement, 1985 - 1989.

Year	Total Catch	Total Escapement[1]
1985	1,609,364	210,000
1986	387,470	142,820
1987	395,397	50,200[2]
1988	1,795,354	256,800
1989	293,843	146,553

1. Includes both wild fish and those used for enhancement purposes.
2. High Pre-spawning mortalities high because of a lake turnover.

LITERATURE CITED

Phelps, S.R., M. Miller and K. Doughty. 1990. Genetic Stock Identification Estimates of 1989 Washington Chum Fisheries in Areas 5, 7, and 7A and Evaluation of Test Fisheries. Washington Department of Fisheries and Nooksack Indian Tribe.

ATTACHMENT 1

CHAPTER 6 OF ANNEX IV OF THE PACIFIC SALMON TREATY

1989 CHAPTER

Chapter 6

SOUTHERN BRITISH COLUMBIA AND WASHINGTON STATE CHUM SALMON

1. The Parties shall maintain a Joint Chum Technical Committee (Committee) reporting, unless otherwise agreed, to the Southern Panel and the Commission. The Committee, inter alia, will undertake to

   (a) identify and review the status of stocks of primary concern;

   (b) present the most current information on harvest rates and patterns on these stocks, and develop a joint data base for assessments;

   (c) collate available information on the productivity of chum stocks to identify escapements which produce maximum sustainable harvests and allowable harvest rates;

   (d) present historical catch data, associated fishing regimes, and information on stock composition in fisheries harvesting those stocks;

   (e) devise analytical methods for the development of alternative regulatory and production strategies;

   (f) identify information and research needs, to include future monitoring programs for stock assessment; and,

   (g) for each season, make stock and fishery assessments and evaluate the effectiveness of management.

2. In 1989, Canada will manage its Johnstone Strait, Strait of Georgia, and Fraser River chum fisheries to provide continued rebuilding of depressed naturally spawning chum stocks, and, to the extent practicable, minimize increased interceptions of United States origin chum. Terminal fisheries conducted on specific stocks with identified surpluses will be managed to minimize interception of non-targeted stocks.

3. In 1989,

   (a) for Johnston Strait run sizes less than 3.0 million

      (i) Canada, taking into account the catch of Canadian chum in United States Areas 7 and 7A, will limit its harvest rate in Johnstone strait to less than 10 percent, resulting in a Johnstone Strait catch level of up to 225,000 chum; and,

(ii) when the catch in Johnstone Strait is 225,000 chum or less, the United States catch of chum in Areas 7 and 7A shall be limited to chum taken incidentally to other species and in other minor fisheries, but shall not exceed 20,000, provided, however, that catches for the purposes of electrophoretic sampling shall not be included in the aforementioned limit;

(b) for Johnstone Strait run sizes from 3.0 million to 3.7 million

(i) Canada, taking into account the catch of Canadian chum in United States Areas 7 and 7A, will limit its harvest rate in Johnstone Strait to 20 percent resulting in a Johnstone Strait catch level of 225,000 to 640,000 chum; and,

(ii) when the catch in Johnstone Strait is from 225,000 to 640,000 chum, the United States catch of chum in Areas 7 and 7A shall not exceed 120,000;

(c) for Johnstone Strait run sizes of 3.7 million and greater

(i) Canada, taking into account the catch of Canadian chum in United States Areas 7 and 7A, will harvest at a rate in Johnstone Strait of 30 percent or greater, resulting in a Johnstone Strait catch level of 640,000 chum or greater; and,

(ii) when the catch in Johnstone Strait is 640,000 chum or greater, the United States catch of chum in Areas 7 and 7A shall not exceed 140,000;

(d) it is understood that the Johnstone Strait run sizes, harvest rates, and catch levels referred to in 3(a), 3(b), and 3(c) are those determined in season, in Johnstone Strait, by Canada; and,

(e) the United States shall manage in a manner that, as far as practicable, maintains a traditional proportion of effort and catch between United States Areas 7 and 7A, and avoids concentrations of effort along the boundary in Area 7A.

4. In 1989, the United States shall conduct its chum fishery in the Strait of Juan de Fuca (United States Areas 4B, 5 and 6C) so as to maintain the limited effort nature of this fishery, and, to the extent practicable, minimize increased interceptions of Canadian origin chum. The United States shall continue to monitor this fishery to determine if recent catch levels indicate an increasing level of interception.

5. If the United States chum fishery in Areas 7 and 7A fails to achieve the 1989 catch levels specified in paragraphs 3(a)(ii), 3(b)(ii), and 3(c)(ii), any differences shall be compensated by adjustments to the Areas 7 and 7A fishery in subsequent years, except that chum catches below the level specified in paragraph 3(a)(ii) shall not be compensated.

6. Catch compositions in fisheries covered by this chapter will be estimated by post-season analysis using methods agreed upon by the Joint Chum Technical Committee.

7. Canada will manage the Nitinat net chum fishery to minimize the harvest of non-targeted stocks.

8. In 1989, Canada shall conduct electrophoretic sampling of chum taken in the West Coast Vancouver Island troll fishery if early-season catch information indicates that catch totals for the season may reach levels similar to 1985 and 1986. Sampling, should it occur, will include catches taken from the southern areas (Canadian Areas 121-124).

ATTACHMENT 2

U.S. AND CANADIAN STATISTICAL AREA MAPS

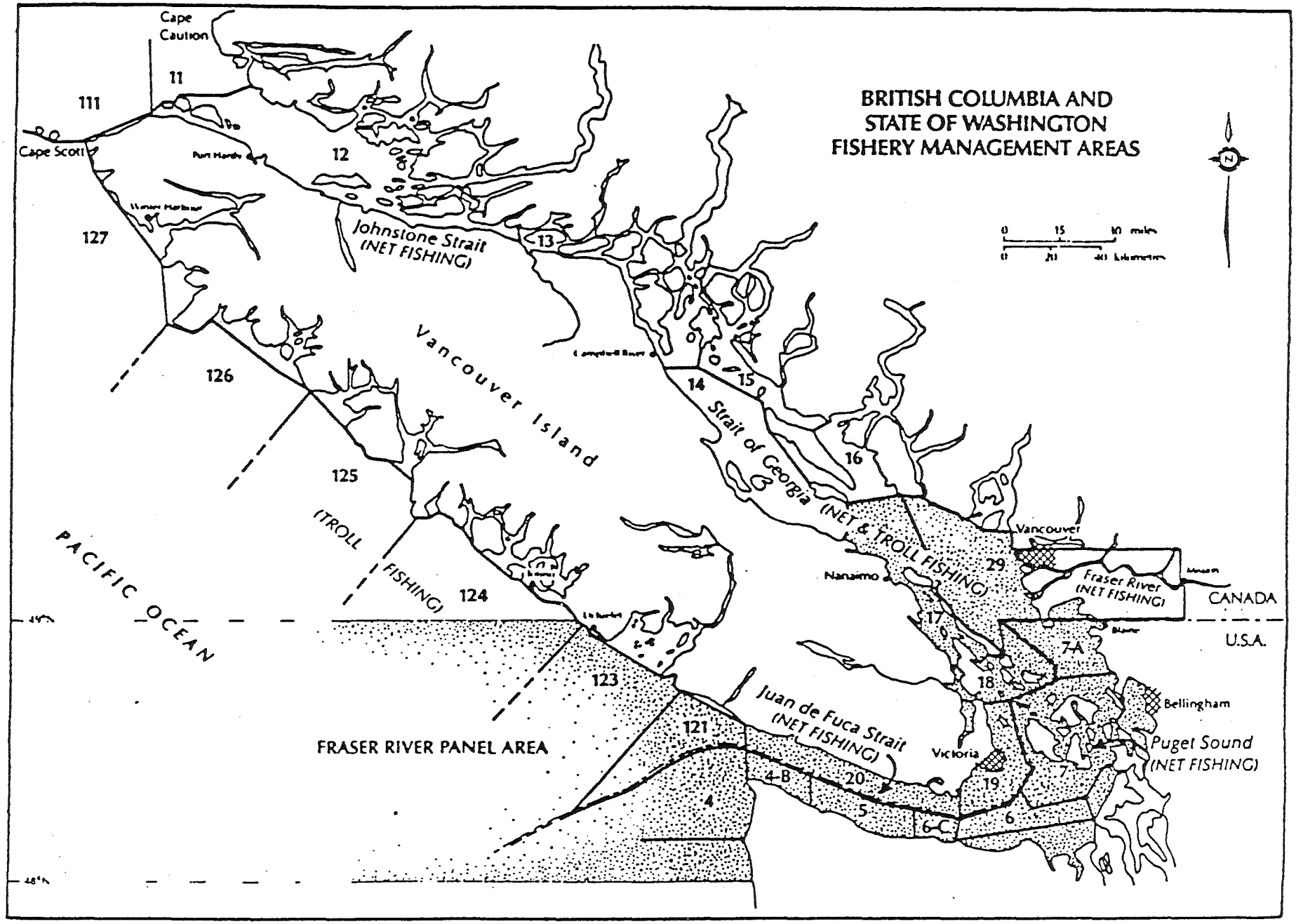
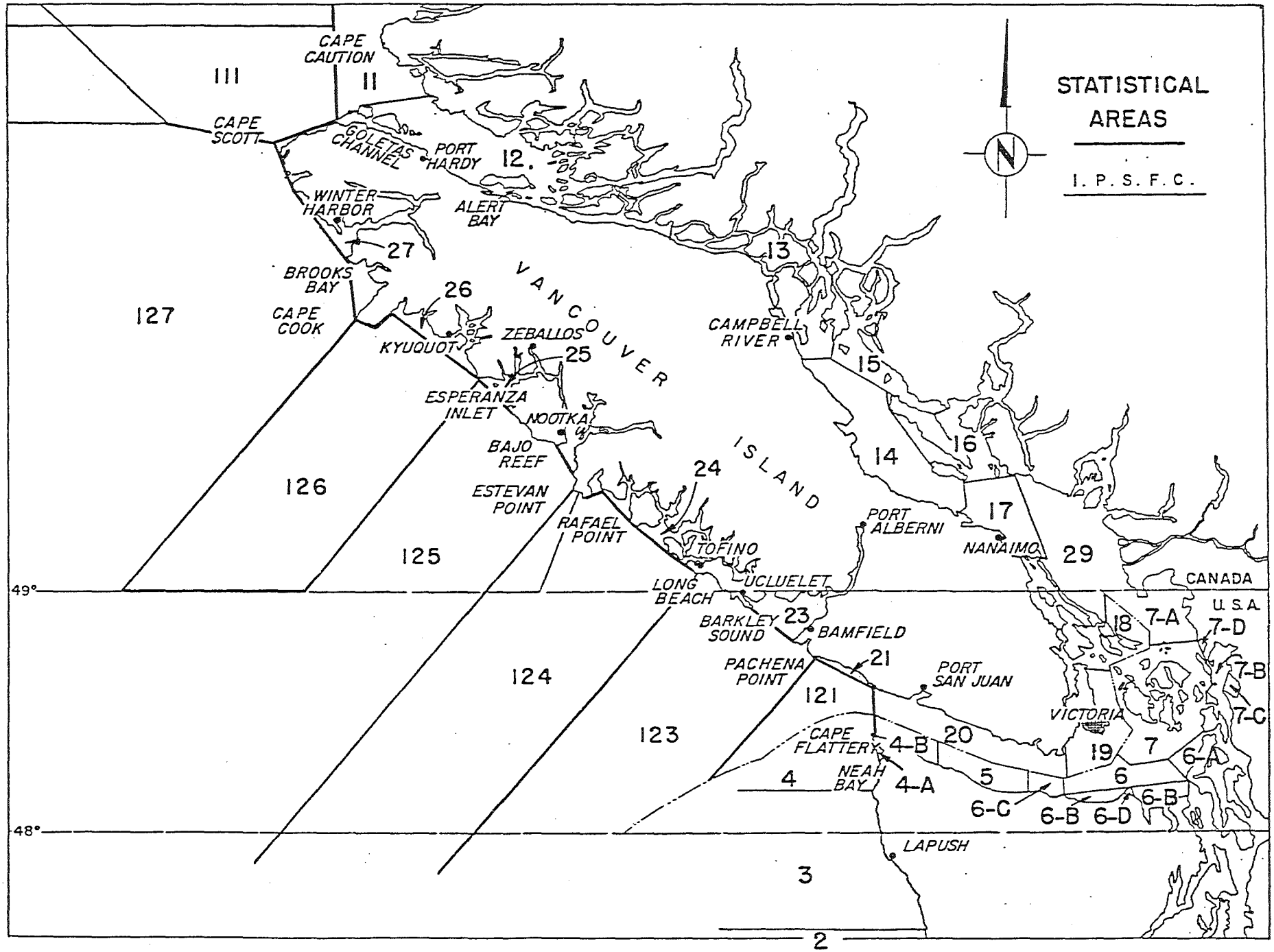


FIGURE 1. Fishery management areas in the Fraser River Panel Area, along Canada's south coast and in United States waters. The type of fishery (net or troll) that operates in each area is also indicated.


STATISTICAL AREAS
I. P. S. F. C.
N
CAPE CAUTION
CAPE SCOTT
GOLETAS CHANNEL
PORT HARDY
WINTER HARBOR
ALERT BAY
BROOKS BAY
CAPE COOK
KYUQUOT
ZEBALLOS
ESPERANZA INLET
NOOTKA
BAJO REEF
ESTEVAN POINT
RAFAEL POINT
TOFINO
LONG BEACH
UCLUELET
BARKLEY SOUND
BAMFIELD
PACHENA POINT
CAPE FLATTERY
NEAH BAY
LAPUSH
CAMPBELL RIVER
PORT ALBERNI
NANAIMO
PORT SAN JUAN
VICTORIA
VANCOUVER ISLAND
CANADA
U.S.A.
49°
48°
111
11
12.
13
14
15
16
17
18
19
20
21
23
24
25
26
27
29
127
126
125
124
123
121
7
7-A
7-B
7-C
7-D
6
6-A
6-B
6-C
6-D
5
4
4-A
4-B
3
2

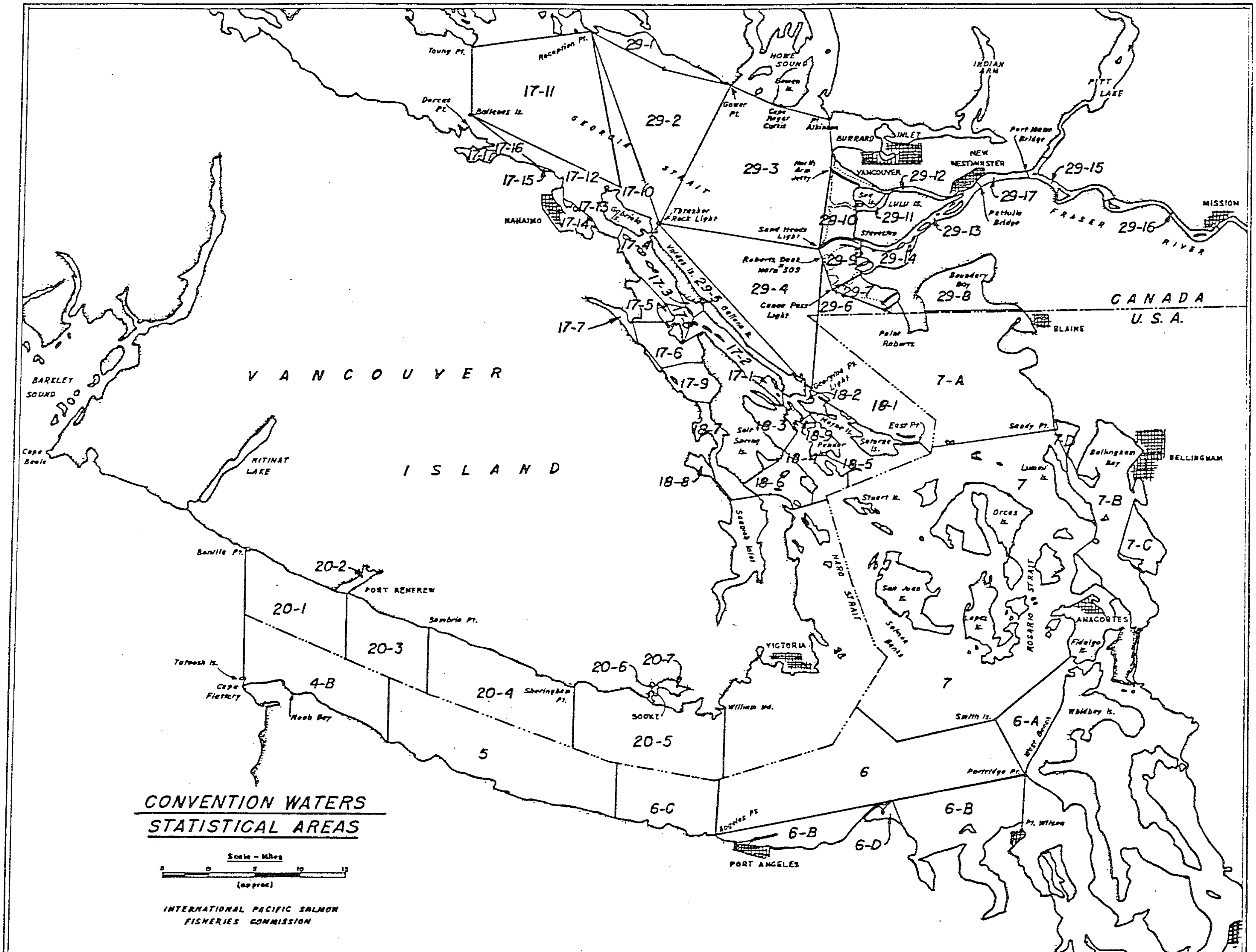
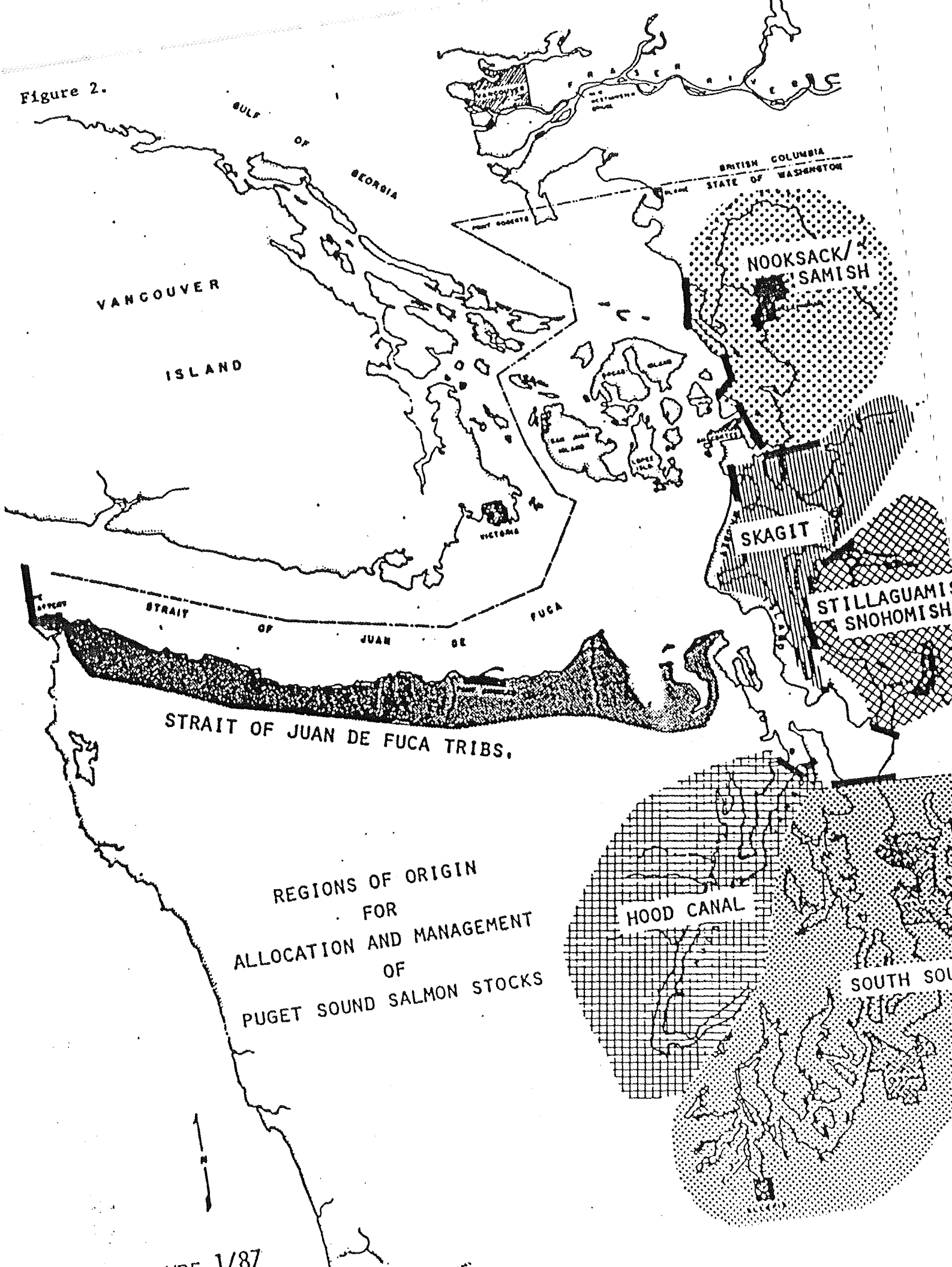
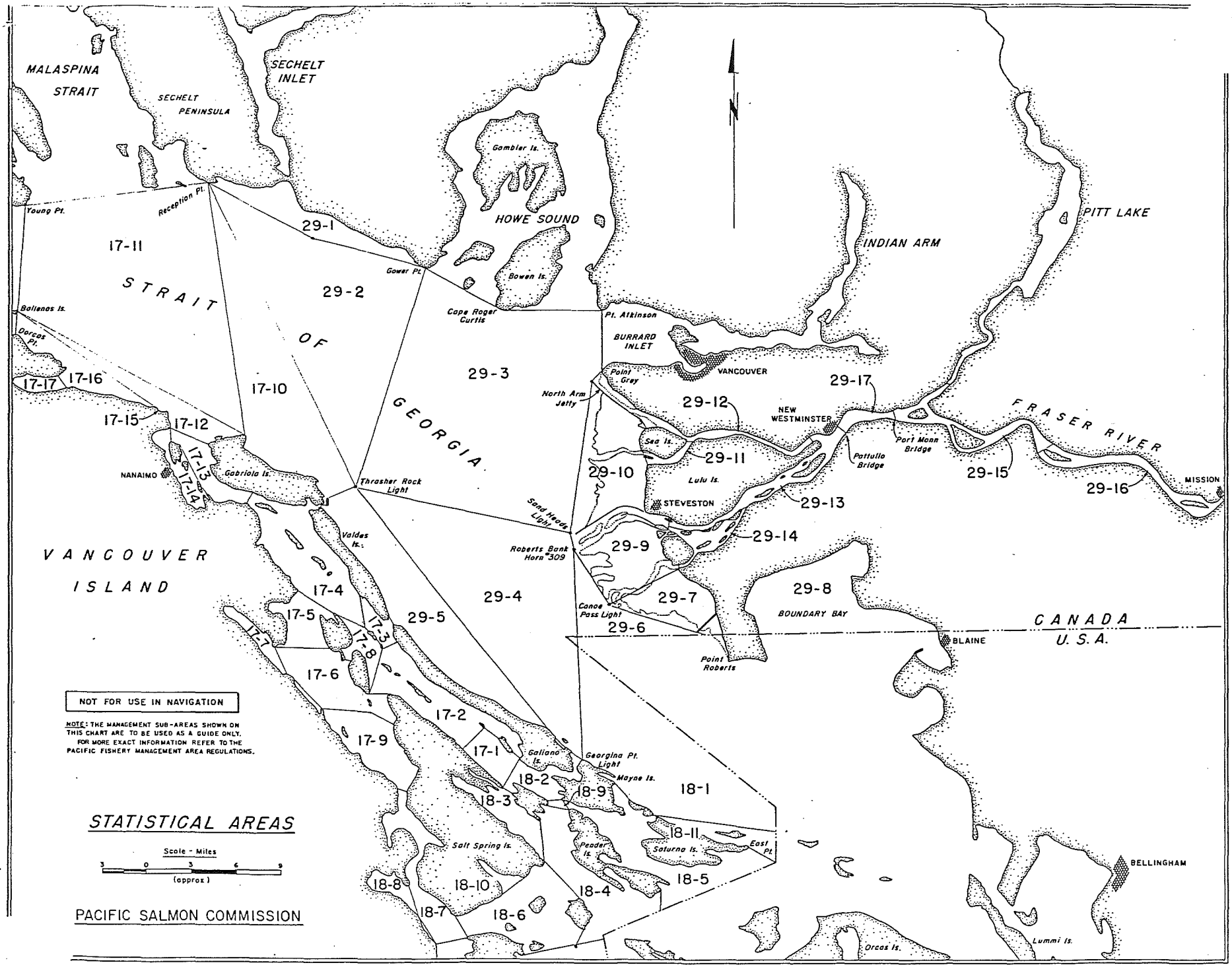

CONVENTION WATERS
STATISTICAL AREAS
Scale - Miles
(approx)
INTERNATIONAL PACIFIC SALMON
FISHERIES COMMISSION
VANCOUVER
ISLAND
CANADA
U. S. A.
GEORGIA STRAIT
HARO STRAIT
ROSARIO STRAIT
FRASER RIVER
VANCOUVER
NEW WESTMINSTER
MISSION
BLAINE
BELLINGHAM
ANACORTES
VICTORIA
SOOKE
PORT RENFREW
PORT ANGELES
NANAIMO
BURRARD INLET
HOWE SOUND
INDIAN ARM
PITT LAKE
NITINAT LAKE
BARKLEY SOUND
17-1
17-2
17-3
17-5
17-6
17-7
17-9
17-10
17-11
17-12
17-13
17-14
17-15
17-16
18-1
18-2
18-3
18-5
18-7
18-8
18-9
20-1
20-2
20-3
20-4
20-5
20-6
20-7
29-1
29-2
29-3
29-4
29-5
29-6
29-7
29-8
29-9
29-10
29-11
29-12
29-13
29-14
29-15
29-16
29-17
4-B
5
6
6-A
6-B
6-C
6-D
7
7-A
7-B
7-C

Figure 2.


GULF OF GEORGIA
BRITISH COLUMBIA
STATE OF WASHINGTON
VANCOUVER ISLAND
NOOKSACK/ SAMISH
SKAGIT
STILLAGUAMISH
SNOHOMISH
HOOD CANAL
SOUTH SOUND
STRAIT OF JUAN DE FUCA
STRAIT OF JUAN DE FUCA TRIBS.
REGIONS OF ORIGIN
FOR
ALLOCATION AND MANAGEMENT
OF
PUGET SOUND SALMON STOCKS


MALASPINA STRAIT
SECHELT PENINSULA
SECHELT INLET
Gambier Is.
HOWE SOUND
INDIAN ARM
PITT LAKE
Young Pt.
Reception Pt.
29-1
17-11
Gower Pt.
Bowen Is.
STRAIT OF GEORGIA
29-2
Cape Roger Curtis
Pt. Atkinson
BURRARD INLET
Ballenas Is.
Orcas Pt.
17-17
17-16
17-10
29-3
Point Grey
VANCOUVER
29-17
North Arm Jetty
29-12
NEW WESTMINSTER
FRASER RIVER
17-15
17-12
Sea Is.
Port Mann Bridge
Pattullo Bridge
29-15
29-16
MISSION
NANAIMO
17-13
17-14
Gabriola Is.
Thrasher Rock Light
29-10
Lulu Is.
29-11
STEVESTON
29-13
Sand Heads Light
29-14
Valdes Is.
Roberts Bank Horn #309
29-9
VANCOUVER ISLAND
17-4
29-4
29-7
29-8
Canoe Pass Light
BOUNDARY BAY
17-5
17-3
29-5
29-6
CANADA
U. S. A.
BLAINE
17-7
17-8
Point Roberts
17-6
17-2
17-9
17-1
Galiano Is.
Georgina Pt. Light
Mayne Is.
18-2
18-9
18-1
18-3
18-11
Saturna Is.
East Pt.
Salt Spring Is.
Pender Is.
BELLINGHAM
18-8
18-10
18-4
18-5
18-7
18-6
Orcas Is.
Lummi Is.
NOT FOR USE IN NAVIGATION
NOTE: THE MANAGEMENT SUB-AREAS SHOWN ON THIS CHART ARE TO BE USED AS A GUIDE ONLY. FOR MORE EXACT INFORMATION REFER TO THE PACIFIC FISHERY MANAGEMENT AREA REGULATIONS.
STATISTICAL AREAS
Scale - Miles
3 0 3 6 9
(approx)
PACIFIC SALMON COMMISSION