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PACIFIC SALMON COMMISSION  
JOINT CHUM TECHNICAL COMMITTEE REPORT

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FINAL 1987 POST SEASON SUMMARY REPORT

November 1988

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## **INTRODUCTION**

This Joint Chum Salmon Technical Committee report presents the appropriate information for 1987 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).

The PST called for Canada to manage its 1987 chum salmon fisheries in accordance with past management plans, i.e. the clockwork strategy, while the U.S. was to manage its chum salmon fisheries in U.S. areas 7 and 7A to a negotiated ceiling, the magnitude of which was dependent on the catch level in Johnstone Strait. The PST did not contain any requirements for special action in Canadian west coast of Vancouver Island fisheries or in fisheries in U.S. areas 4B, 5, and 6C. The following summarizes the final submissions of the two countries on the 1987 chum salmon returns.

## **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 off the west coast of Vancouver Island (West Coast).

#### **Inside Chum Salmon**

The run size of fall chum salmon expected to return through Johnstone Strait was 3,125,000 of which 1,775,000 were produced from Inside wild spawning areas, 1,250,000 were from Inside enhancement facilities and 100,000 from U.S. waters. The size of the Fraser River component in the expected total run was 951,000 chum, including 454,000 from wild spawning areas and 497,000 from enhancement facilities. The remaining wild spawning areas in the Inside area were expected to produce 1,321,000 chum salmon, while the remaining enhanced return, the majority of which originate from the mid Vancouver Island area, was expected to be 753,000.

The postseason run size 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 Area 7 and 7a commercial fisheries, was

1,960,600 or 63% of the expected run size. The total return of Fraser River chum was 642,000 or 68% of the expected run size. The Fraser River run size includes estimates of catches in pertinent U.S. and Canadian commercial, test and Indian food fisheries between the northern end of Vancouver Island and the Columbia River.

#### West Coast Chum Salmon

The expected return of Nitinat enhanced origin chum salmon was 354,500. 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 537,000, including chum of enhanced and wild origin.

#### United States

The two chum production regions of concern under the PST are those waters along the U.S./Canada border from the outer Strait of Juan de Fuca to Point Roberts (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 690,000, a high prediction for an odd year return, of which 296,000 were from wild spawning areas and 394,000 were from enhancement facilities. The stocks that were expected to contribute the largest returns were: south Puget Sound (213,000); and Hood Canal (322,000).

The postseason run size, as estimated from run reconstruction, was 1,759,000 chum which was 255% of the preseason forecast. This run size was the highest observed since the start of the data base in 1968. Both enhanced and wild stocks in all regions showed higher returns.

#### 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 1987 preseason expected total run size of the Washington coastal chum salmon was 118,000. The actual return, as estimated by run reconstruction, was 185,000.

## **MANAGEMENT OF FISHERIES**

### **Southern British Columbia**

#### **Inside Fisheries**

Management of the chum salmon fisheries in Inside waters utilizes 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 run passing through Johnstone Strait. This strategy was designed to permit limited fishing while rebuilding the stocks. In 1987, the stock sizes at which various harvest rates are applied were revised upward to maintain wild stock escapement requirements in response to increasing enhanced production. Stock assessment uses commercial or test fishing information to estimate returning stock abundance required to determine if directed commercial fisheries can occur in Johnstone Strait. If additional directed chum harvests occur in Johnstone Strait, then directed chum harvests will also occur in U.S. areas 7 and 7A.

In Johnstone Strait, the September stock size assessment fishery was delayed until the fourth week of September to permit remaining Fraser River pink salmon to leave the area. Assessment data from this fishery and from subsequent test fisheries were used to provide run size estimates.

The run size of Fraser River chum was estimated from Johnstone Strait commercial assessment and test fishery data prior to the third week of October while subsequent run estimates were determined from test fishery data within the Fraser River.

The Qualicum fishery is managed as a terminal fishery for mid Vancouver Island area chum salmon. Additional objectives include limiting the catch of local coho and chinook stocks, as well as limiting the 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, management plans included provisions for conducting fisheries at

appropriate times and areas to ensure fleet safety and high product quality, as well as achieving domestic catch allocations by gear type.

Canada undertook a genetic stock identification (GSI) program to quantify the incidence of interception of passing stocks in the Nitinat net and West coast Vancouver Island troll fisheries.

### **United States**

Management of the U.S. fisheries directed at chum salmon in the Strait of Juan de Fuca (areas 4B, 5, and 6c), San Juan Islands (Area 7) and Point Roberts (Area 7A) was governed by the following objectives.

In the Strait of Juan de Fuca, the objective was to maintain the existing Treaty Indian fisheries at historic effort levels. This fishery is directed primarily at Puget Sound stocks.

In areas 7 and 7A, the objective was to conduct fisheries at a level that would limit the total catch of chum to the level in the PST. As a result of decreases in the inseason estimates of the run size passing through Johnstone Strait, the U.S. managed its fisheries in areas 7 and 7A for a catch ceiling of 20,000 chum. 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.

## **REVIEW AND EVALUATION OF FISHERIES**

### **Southern British Columbia**

#### **Inside chum**

Chum salmon fisheries occurred in Johnstone Strait (areas 11 to 13), mid Vancouver Island (Qualicum, Area 14), Nanaimo (Area 17) and Cowichan (Area 18). These fisheries, with the exception of Cowichan, have the potential to harvest U.S. origin chum incidentally during harvests directed at Canadian origin chum.

The only Johnstone Strait gill net and purse seine fishery directed at chum salmon was an assessment fishery which occurred on September 21. The catch, including early September catches incidental to fisheries directed at pink salmon, totaled 66,000. The mid Vancouver Island gill net

and purse seine fishery began in mid October and continued weekly for 5 weeks for a total catch of 345,000 chum. The Nanaimo and Cowichan gill net fisheries occurred in the second week of November and harvested a combined total of 15,000 chum.

#### West Coast Chum

Nitinat fisheries commenced on September 28 and continued weekly until November 6. Fishing times alternated between gill net and purse seines with a total catch of 393,600 chum.

The West coast troll fishery (areas 1-21 to 1-27) harvested 15,500 chum salmon in July and August.

### 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.

Gill net fisheries in areas 4B, 5, and 6C extended into late November with a total of 44,000 chum caught by Treaty Indians in these areas. This was somewhat lower than the previous two years' catches in this fishery, as there was a lengthy closure of the fishery for coho protection. All of the chum salmon harvested in areas 7 and 7A were taken in fisheries directed at other species, primarily coho. Commercial harvest from areas 7 and 7A totaled 26,000 which represents an increase over the expected catch of 20,000. This increase was a result of higher than expected catches during the last week of coho fishing.

### ESCAPEMENT

#### Southern British Columbia

##### Inside Chum

Total fall chum salmon escapement was 1,421,000, the lowest since the inception of the Clockwork in 1983. The wild spawning escapement of 1,253,000 was 76% of the 1981-86 average wild escapement and achieved 50% of the identified overall spawning ground capacity. The only area

which achieved the escapement goal was the southern Vancouver Island area. The Fraser River escapement was 62% of the spawning goal and accounted for 34% of the total inside fall chum escapement.

Inside summer run chum salmon are incidentally caught in July and August fisheries in Johnstone Strait. The escapement of 24,500 is not included in the fall chum salmon escapement total.

#### West Coast Chum

The Nitinat total escapement of chum salmon was 261,800 of which 47,000 spawned in the wild spawning areas. This escapement was below the goal of 200,000 because of a massive mortality resulting from a turn over of Nitinat Lake.

### United States

#### Puget Sound Chum

The Puget Sound chum salmon escapement of 475,000 was the second highest odd year escapement recorded since the start of the data base in 1968. Substantial escapement increases occurred for the normal timed stocks in three of the six regions. The Hood Canal, South Sound and the Stillaguamish/Snohomish systems accounted for approximately 82% of the normal timed chum escapement. Early timed chum escapements in the Strait of Juan de Fuca and Hood Canal remained in low abundance, while the South Sound early timed stocks achieved escapements 318% of expected.

#### Washington Coastal Chum

The chum escapement in Willapa Bay totaled 31,900, 10% below the expectation of 35,400. The Grays Harbor chum escapement of 9,500 was 55% below the expectation of 21,000. Escapement in the Quinault River, where hatchery contributions enhance the run, totaled 1,800 chum.

### STATUS OF TREATY REQUIREMENTS

#### Overall Fishery Management

The PST for 1987 required that Canada manage its inside chum fisheries according to its revised clockwork management strategy. At the end of the season the overall clockwork harvest rate was 9% as compared to the 10%



allowed by the clockwork plan and the run size was 1,960,600 chum.

The U.S. would manage its fisheries in Areas 7 and 7A to a catch ceiling dependent on the chum harvest levels in Johnstone Strait. The commercial catch in the U.S. fisheries in areas 7 and 7A totaled 26,000 which exceeded the PST limit of 20,000 by 6,000 chum.

### **Review of GSI Programs**

The Inside chum salmon fisheries areas sampled for GSI data included Johnstone Strait (Area 12) and Juan de Fuca (Area 20) test fisheries and mid Vancouver Island (Qualicum, Area 14) and Nanaimo (Area 17) commercial fisheries. The results were comparable with previous years with 26 of the 35 samples indicating that less than 10% of the sampled chum were of U.S. origin. Six of the nine samples with over 10% of the sampled chum of U.S. origin came from the Strait of Juan de Fuca (Area 20). There were three samples over 10% in the remaining Inside areas. One in early October in Johnstone Strait, one in early November in the Qualicum fishery and one from the fishery at Nanaimo.

On the West Coast sampling of the Nitinat (Area 21) commercial fishery, showed a range of between 0 and 11% of U.S. origin; while the West coast of Vancouver Island troll fishery (Area 1-27) samples, showed a range of between 0 and 1.5% of U.S. origin.

The GSI sampling in U.S. waters included the San Juan Islands and Point Roberts (areas 7 & 7A) test fisheries and the Strait of Juan de Fuca (Area 5) commercial and test fisheries.

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 expected to be complete in late 1988.

ATTACHMENT 1

CHAPTER 6 OF ANNEX IV OF THE PACIFIC SALMON TREATY  
1987 CHAPTER

## Chapter 6

### 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 1987, 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 1987,

- (a) for Johnstone 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%, resulting in a Johnstone Strait catch level of up to 225,000 chum;

(Tu)

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(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%, resulting in a Johnstone Strait catch level of 225,000 to 640,000 chum;

(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% or greater, resulting in a Johnstone Strait catch level of 640,000 chum or greater;

(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 inseason, in Johnstone Strait, by Canada.

(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 1987, 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 shall 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 1987 catch levels specified in paragraphs 3(a)(ii), 3(b)(ii), and 3(c)(ii), any differences shall be compensated by adjustments to the Area 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 analyses 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 1987, Canada shall expand electrophoretic sampling of chum harvested by the West Coast Vancouver Island troll fishery, including samples taken from the southern area catch (Canadian Areas 121-124).

ATTACHMENT 2

FINAL 1987 POST SEASON SUMMARY REPORT ON  
CHUM SALMON

UNITED STATES AGENCY REPORT

## REVIEW OF 1987 WASHINGTON CHUM SALMON FISHERIES

### I. 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. It provides a general overview of the 1987 chum salmon fisheries in Washington State and a more detailed review of those fisheries that intercept Canadian origin chum salmon.

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) (Figure 1). The majority of the harvest in areas 4B,5,6C is believed to be 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 assumed to be composed primarily of chum salmon of Canadian origin and in recent years has been managed to meet the obligations under the treaty. Two additional U.S. fishing areas that could potentially contain chum salmon of Canadian origin are the eastern Strait of Juan de Fuca (Area 6) and West Beach (Area 6A). Both of these areas remained closed to directed chum fishing in 1987 and little or no chum catch occurred.

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. Available information does not indicate any significant interceptions of Canadian origin stocks by these fisheries.

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

#### A. MANAGEMENT STRATEGY

The 1987 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, beginning the season fishing a 5 day per week schedule.

It was expected that the fishery would continue at a 5 day per week schedule until mid-November when catches and effort drop off and the fishery is closed. However, it was also anticipated that some chum fishing restrictions might be necessary due to domestic coho catch ceilings.

The management regime for areas 7 and 7A was established by the Pacific Salmon Commission at their March 1987 meeting. The agreement called for the fishery in these areas to be managed on the basis of catch levels that occur in the Canadian fishery in Johnstone Strait (based on the "clockwork" management plan). The 1987 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% harvest rate); a ceiling of 120,000 chum if the total Johnstone Strait catch was between 225,000 and 640,000 (20% harvest rate); and a ceiling of 140,000 chum if the Johnstone Strait catch was greater than 640,000 (30% or greater 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.

Because the Johnstone Strait chum catch remained below 225,000, no directed chum fisheries were scheduled. Catches were limited to those taken incidental to pink and coho salmon fisheries.

#### Fishery Review

The chum management period for areas 4B, 5 and 6C began October 4th. Catches of chum taken incidental to sockeye, pink and coho fisheries, prior to October 4th, totaled 3,289. Unlike previous seasons, the fishing schedule during the chum management period was not a consistent 5 day per week schedule due to Skagit River coho conservation concerns and the protracted coho migration pattern in 1987. The fishery opened the first two weeks for 4 days and 5 days, respectively. The third week of the chum fishery was reduced to 2 days due to coho catch limitations. No commercial fishing took place the last week of October, and a limited test fishery was implemented for species composition and GSI data collection. The chum fishery reopened November 1st based on declining coho abundance in the catch and current catch figures indicating some allowable coho catch remained. This fishery continued through the week of November 15th. Some additional late chum harvest also occurred incidental to steelhead fisheries conducted in near shore areas in December. The total commercial catch of chum for the season in the Strait of Juan de Fuca was 44,002 (Table 1).



Throughout the chum season, U.S. and Canadian technical staffs kept in close contact on the status of the chum run size entering Johnstone Strait. From the initial inseason update, indications were that the chum run was lower than expected, and although there was some improvement towards the end of the migration, the run size estimate never exceeded 3.0 million which would have allowed a greater than 10% exploitation rate. Therefore, the U.S. fisheries in areas 7/7A were managed with the objective of limiting harvest to no more than 20,000 chum.

All of the chum harvested in areas 7/7A were taken in fisheries directed at other species, primarily coho. An initial coho fishery by Treaty Indians, of 27 hours, took place in these areas on September 27th and 28th and harvested 2,455 chum. A reef net fishery for coho opened on September 28th and continued until September 30th, incidentally harvesting a total of 991 chum (Table 1). Six chum were harvested in Area 6 coincidentally with fisheries in areas 7 and 7A.

Following an assessment of the catches from this first fishery and a determination that additional coho fishing was warranted, another one day Treaty Indian and a one day Non-Indian fishery were scheduled. It was recognized by the managers that it was late in the coho season and the fishery was scheduled as quickly as possible to minimize chum catches. The fishery was designed with the intent of remaining within the allowable total chum catch of 20,000. The Treaty Indian fishery occurred on October 7th, and the Non-Indian fishery took place on October 8th. Total chum catch in these two fisheries was 22,687, bringing the season total catch up to 26,288. No additional fisheries were conducted.

### **III. PUGET SOUND INSIDE FISHERIES**

#### **A. 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 allocations are established for harvestable surpluses returning to six broad regions of origin (Figure 2). Although management within a region addresses 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 1987 Puget Sound origin chum salmon of all timing components was 690,100, of which 296,050 were of natural origin and 394,050 were of enhanced origin (Table 2 and 3). This expectation represented the second highest odd year run since the beginning of the data base in 1968, and a substantial improvement over the previous run sizes in the 1971-75-79-83 cycle, which have averaged 359,000.

#### B.FISHERIES DESCRIPTIONS, CATCHES AND SPAWNING ESCAPEMENTS

The actual return of 1,758,919 was 255% of the preseason forecast and was a record return to Puget Sound. It represented an increase of 226,000 over the 1986 return and 304,000 over the 1985 return, previously the highest observed even and odd year runs since the start of the data base in 1968. Most of the increase resulted from the very large natural runs returning to the Stillaguamish/Snohomish and South Puget Sound regions, and the large hatchery run returning to Hood Canal. The total Puget Sound escapement of 474,600 chum was the second highest odd year escapement since the start of the data base in 1968; 500,600 escapement in 1985 was the highest for odd years.

A summary of the preseason forecasts, final inseason updates of abundance, final 1987 run sizes, and escapements is presented in Table 2. 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. A total of 42,800 Canadian chum were estimated as being caught in Washington fisheries using the proportions in Table 8. Of these, 17,800 were caught in areas 4B/5/6C and 25,000 in areas 7 and 7A. Detailed information on chum harvests in each Puget Sound catch area is provided in Table 4. Following is an overview of stock status and management

actions for each of the six Puget Sound regions of origin (illustrated in Figure 2).

#### 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 2,000 was 11% above the forecast, and the normal time stock return of 6,900 was 30% above the forecast. Consequently, spawning escapements for both stocks exceeded the escapement expectations. Terminal catches were minor, and increased effort continues 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 83,000 was 40% above the preseason expectations, but was 11% below the inseason run size update. This resulted in an overharvest in the commercial fishery and a spawning escapement that was 25% below the objective.

#### Skagit Region

The chum return to Skagit was 61,000, which was almost double the preseason forecast for a very small run with no harvestable surplus. Protection measures for this natural origin stock in both mixed stock and terminal areas resulted in a spawning escapement of 43,000 chum, 36% above the preseason expectation.

#### Stillaguamish/Snohomish Region

Chum salmon from this region are all of normal timing, and are predominantly of natural origin. The chum return of 202,400 was the second largest odd year return on record for the region and almost four times the preseason forecast of 56,200, resulting in excellent commercial catches in the terminal area. The actual spawning escapement of 50,000 was over double the escapement objective of 23,500.

#### 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 all three components greatly exceeded preseason expectations, and resulted in very large spawning escapements. The early timed return of 32,300 was 19,100 above the forecast and was the largest return of early chum since 1976, resulting in an escapement of 14,000 above the escapement objective.

The normal timed return was 428,700, the largest observed for this region since the beginning of the data base in 1968. This was 250% of the preseason forecast and 69% over the inseason run size update. Commercial catches were excellent, and the escapement objective of 77,150 was exceeded by over 100,000, largely as a result of the inseason underestimation of the run size. This was the highest observed escapement in this region since the start of the data base in 1968. Most of the excess escapement was of naturally spawning chum.

The late timed return of 132,000 was 45,000 above the previous largest run of the late component. The spawning escapement of 76,000 was also the highest observed since the beginning of the data base in 1968, and was three times the objective of 23,700.

#### Hood Canal Region

Hood Canal supports stocks of early and normal timed chum salmon. The normal timed chum are predominantly of hatchery origin. As with all of the other 1987 Puget Sound chum runs, the abundance of both timing segments substantially exceeded their preseason forecasts. The normal timed segment exceeded all previous returns to the region, and was substantially larger than the inseason update. The actual run sizes were 9,200 early timed and 801,200 normal timed chum, while the preseason forecasts were 2,650 and 319,400 respectively. The early timed escapement was 1,000, meeting the expectation, while the normal timed escapement was 78,400, exceeding the expectation by 18,000. An additional 12,000 escapement contributed to the spawning levels of natural stocks.

#### 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 infrequently in this area as harvestable numbers are seldom available for each of the supporting stocks after terminal area run size updates are available. Inseason verification of the run strengths for the stocks returning to the three regions of origin is

desired before scheduling fisheries in areas 6B or 9, as the preseason forecasts do not provide sufficient accuracy for management of fisheries in these areas.

There were no directed chum fisheries in either of these areas in 1987 as preseason expectations were for relatively small runs to South Puget Sound and the Stillaguamish-Snohomish region, and the terminal area run size updates did not identify enough harvestable chum to justify opening fisheries in these areas until too late in the season to schedule an Area 9 fishery. Terminal area harvests were of such magnitude that no additional harvestable chum salmon remained in Area 9 after the in-season updates in terminal areas.

#### **IV. WASHINGTON COASTAL FISHERIES**

The 1987 coastal chum runs to Willapa Bay and Grays Harbor both returned well above the preseason forecast, the recent 10-year average, and provided an excellent season. Other Washington coastal rivers have few returning chum salmon and no significant catches except for the Quinault River which has a small return, primarily of hatchery origin. Preseason forecasts, actual run sizes, catches, and escapements for Washington coastal stocks are given in Table 5.

The chum salmon return to Willapa Bay was expected to be reduced this past season because of poor returns of 3-year olds in 1986. Returns were predicted to include 59,500 wild and 15,500 hatchery fish. An escapement goal of 35,400 wild and 14,300 hatchery fish provided for a potential harvest of 25,300.

The actual return was about 45% greater than preseason expectations. The return was, in fact, the second highest in recent history at about 109,500 fish. Scale information indicated a good mix of age classes (61% 3's, 32% 4's, and 7% 5's), very similar to preseason predictions. The gillnet fishery harvested 72,900 fish, which nearly equaled the 1982 record catch of 76,000 and was more than twice the 10-year average catch of 31,400. The chum fishery occurred at or near the peak of the return and resulted in a high harvest rate of about 67%. A 55% harvest rate would have been appropriate to achieve the hatchery escapement goal of 4,400 fish and natural escapement goal of 31,900.

The Grays Harbor chum return was about twice that of preseason projections. The inseason update predicted a

return of 71,000. While sport catch data are not yet available it is expected that the total return was about 70,200 fish. This is about 1.6 times the 10-year mean. The commercial fishery achieved a harvest rate of 84% or 58,700 fish. This is about 2.8 times the 10-year mean catch and near the previous 1982 peak catch of 59,300. Non-treaty fishermen took 29,300, Quinault fishermen 28,500, and Chehalis tribal fishermen 800 chum. Non-treaty and Quinault fishermen respective catches were 2.7 and 3.1 times their 10-year average catch. Chehalis tribal catches were near their ten-year average. Escapement to spawning areas was 45% of the 21,000 fish goal.

Chum salmon returning to the Quinault River are almost entirely of hatchery origin, although straying to wild spawning areas occurs. The return to the Quinault was slightly above the preseason prediction. The catch of 3,500 was taken primarily in a one week treaty Indian net fishery. The total escapement of 1,800 included only 340 returns to the Cook Creek hatchery because of extremely low water and 1,500 that strayed to wild spawning area.

## **V. STOCK COMPOSITION AND RUN RECONSTRUCTION**

During 1987, Puget Sound genetic stock identification (GSI) studies of chum salmon consisted of collecting replicate and additional baseline samples from Washington and Canadian stocks (Table 6) 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 7).

Re-examination and expansion of the genetic profiles for each major baseline stock in Puget Sound was a major task priority in 1987 for the Washington Department of Fisheries (WDF). Four samples (including 3 replicates) were collected in 1987 for addition to the 53 collected previously (TCCHUM 87-4 & 87-5).

Fishery sampling in mixed stock areas was expanded considerably in 1987. Efforts were made to improve sample quality and quantity in order to provide 200 usable samples weekly from each of four sampling sites in area 5 commercial fisheries and areas 7 and 7A test fisheries (Table 7). The commercial catches of chum in areas 7 and 7A occurred during coho fisheries; they were not sampled for GSI. Efforts are continuing to increase the quality of tissue samples as well

as the representative nature of both test and commercial fishery samples.

In 1987, U.S. GSI investigators had concerns about the statistical limitations related to the use of the seven common loci in the baseline which is currently available for determining U.S./Canadian stock origins. This topic is currently being investigated by a sub-committee of the technical committee. All Washington baseline collections since 1985 have had 25 loci assayed. An effort is underway to develop a joint GSI information system. An investigation is also underway to determine the desirability and feasibility of adding more loci to the Canadian segment of the baseline.

Puget Sound run reconstruction was modeled using fixed stock composition proportions in mixed stock areas as indicated in Table 8. Insufficient GSI data have been collected from Puget Sound mixed stock areas to warrant replacing the current stock composition estimates. Run reconstruction estimates for individual Puget Sound stocks are available from the WDF.

TABLE 1. 1987 COMMERCIAL CHUM HARVEST IN SELECTED PUGET SOUND CATCH REPORTING AREAS.\*

| Areas                    | Opening/<br>Week | Indian GN       | Indian PS | Indian<br>Total | Non-Indian<br>GN | Non-Indian<br>PS | Non-Indian<br>RN | Non-Indian<br>Total | Grand<br>Total |
|--------------------------|------------------|-----------------|-----------|-----------------|------------------|------------------|------------------|---------------------|----------------|
| Area 7A                  | 9/27 - 9/28 **   | 226             | 311       | 537             |                  |                  |                  |                     |                |
|                          | 10/7 **          | 1,608           | 2,603     | 4,211           |                  |                  |                  |                     |                |
|                          | 10/8 **          |                 |           |                 | 1,678            | 5,296            | 0                | 6,974               |                |
| Area 7A Total            |                  | 1,834           | 2,914     | 4,748           | 1,678            | 5,296            | 0                | 6,974               | 11,722         |
| Area 7                   | 9/28 - 9/30 **   |                 |           |                 |                  |                  | 991              | 991                 |                |
|                          | 9/27 - 9/28 **   | 380             | 1,538     | 1,918           |                  |                  |                  |                     |                |
|                          | 10/7 **          | 1,442           | 2,172     | 3,614           |                  |                  |                  |                     |                |
|                          | 10/8 **          |                 |           |                 | 2,305            | 5,583            | 0                | 7,888               |                |
| Area 7 total             |                  | 1,822           | 3,710     | 5,532           | 2,305            | 5,583            | 991              | 8,879               | 14,411         |
| Areas 7/7A total         |                  |                 |           |                 |                  |                  |                  |                     | 26,228         |
| Areas 4B, 5<br>and 6C    | prior to 9/27 ** | 594             |           |                 |                  |                  |                  |                     |                |
|                          | 9/27 - 10/3 **   | 2,695 (2 days)  |           |                 |                  |                  |                  |                     |                |
|                          | 10/4 - 10/10     | 9,103 (4 days)  |           |                 |                  |                  |                  |                     |                |
|                          | 10/11 - 10/17    | 11,376 (5 days) |           |                 |                  |                  |                  |                     |                |
|                          | 10/18 - 10/24    | 6,564 (2 days)  |           |                 |                  |                  |                  |                     |                |
|                          | 10/25 - 10/31    | 481 (0 days)    |           |                 |                  |                  |                  |                     |                |
|                          | 11/1 - 11/7      | 7,474 (4 days)  |           |                 |                  |                  |                  |                     |                |
|                          | 11/8 - 11/14     | 4,954 (5 days)  |           |                 |                  |                  |                  |                     |                |
|                          | 11/15 - 11/21    | 742 (5 days)    |           |                 |                  |                  |                  |                     |                |
|                          | After 12/1       | 19              |           |                 |                  |                  |                  |                     |                |
| Areas 4B, 5 and 6C total |                  | 44,002          |           |                 |                  |                  |                  |                     |                |

\* - Preliminary data.

\*\* - Incidental chum catch during a directed coho fishery.

\*\*\* - An additional 95 chum were caught prior to 9/28 in areas 7/7A.



Table 2. Summary of 1987 Puget Sound chum salmon management information by region of origin (using run reconstruction).

|                         | Final     |           |           |             |            |
|-------------------------|-----------|-----------|-----------|-------------|------------|
|                         | Preseason | Inseason  | Final     | Escapement  | Observed   |
| Region                  | Forecast  | Update    | Run Size  | Expectation | Escapement |
| Strait of Juan de Fuca  |           |           |           |             |            |
| Early                   | 1,800     | 1,800     | 2,010     | 1,750       | 1,963      |
| Normal                  | 5,350     | 5,400     | 6,924     | 4,400       | 5,769      |
| Nooksack/Samish         | 59,300    | 93,500    | 82,916    | 23,100      | 17,497     |
| Skagit River            | 32,700    | 56,300    | 61,012    | 31,550      | 42,889     |
| Stillaguamish/Snohomish | 56,200    | 194,700   | 202,406   | 23,500      | 50,014     |
| South Puget Sound       |           |           |           |             |            |
| Early                   | 13,200    | 13,200    | 32,316    | 6,450       | 20,506     |
| Normal                  | 168,800   | 254,400   | 428,721   | 77,150      | 180,847    |
| Late                    | 30,700    | 100,000   | 132,228   | 23,700      | 75,733     |
| Hood Canal              |           |           |           |             |            |
| Early                   | 2,650     | 2,650     | 9,224     | 1,000       | 982        |
| Normal                  | 319,400   | 765,800   | 801,162   | 58,100      | 78,408     |
| Total                   |           |           |           |             |            |
|                         | 690,100   | 1,487,750 | 1,758,919 | 250,700     | 474,608    |

Source: WDF, Puget Sound Indian Tribes and NWIFC, Draft 1987 Puget Sound Chum Salmon Forecasts and Management Recommendations. WDF Stock Strength Calculation Summary (5/23/88).

Table 3. Final 1987 Puget Sound chum salmon run size estimates.

| Region                  | Production | Early  | Normal    | Late    | Total     |
|-------------------------|------------|--------|-----------|---------|-----------|
| Strait of Juan de Fuca  | Natural    | 2,010  | 6,046     |         | 8,056     |
|                         | Hatchery   |        | 878       |         | 878       |
| Nooksack/Samish         | Natural    |        | 78,925    |         | 78,925    |
|                         | Hatchery   |        | 3,991     |         | 3,991     |
| Skagit River            | Natural    |        | 60,961    |         | 60,961    |
|                         | Hatchery   |        | 51        |         | 51        |
| Stillaguamish/Snohomish | Natural    |        | 162,848   |         | 162,848   |
|                         | Hatchery   |        | 39,558    |         | 39,558    |
| South Puget Sound       | Natural    | 26,524 | 343,725   | 130,214 | 500,463   |
|                         | Hatchery   | 5,792  | 84,996    | 2,014   | 92,802    |
| Hood Canal              | Natural    | 9,224  | 214,228   |         | 223,452   |
|                         | Hatchery   |        | 586,934   |         | 586,934   |
| =====                   |            |        |           |         |           |
| Total                   |            | 43,550 | 1,583,141 | 132,228 | 1,758,919 |
| =====                   |            |        |           |         |           |

|          | Early  | Normal    | Late    | Total     |
|----------|--------|-----------|---------|-----------|
| Natural  | 37,758 | 866,733   | 130,214 | 1,034,705 |
| Hatchery | 5,792  | 716,408   | 2,014   | 724,214   |
| =====    |        |           |         |           |
| Total    | 43,550 | 1,583,141 | 132,228 | 1,758,919 |
| =====    |        |           |         |           |

| Region                  | Early  | Normal    | Late    | Total     |
|-------------------------|--------|-----------|---------|-----------|
| Strait of Juan de Fuca  | 2,010  | 6,924     |         | 8,934     |
| Nooksack/Samish         |        | 82,916    |         | 82,916    |
| Skagit River            |        | 61,012    |         | 61,012    |
| Stillaguamish/Snohomish |        | 202,406   |         | 202,406   |
| South Puget Sound       | 32,316 | 428,721   | 132,228 | 593,265   |
| Hood Canal              | 9,224  | 801,162   |         | 810,386   |
| =====                   |        |           |         |           |
| Total                   | 43,550 | 1,583,141 | 132,228 | 1,758,919 |
| =====                   |        |           |         |           |

Source: WDF Stock Strength Calculation Summary (5/23/88).

Off-station plant returns have been included with hatchery returns.

Table 4.

| WASHINGTON STATE DEPARTMENT OF FISHERIES         |                       |         |        |             |             |            |       |            |                                      |             |            |       | 10/03/88  |            |
|--|-----------------------|---------|--------|-------------|-------------|------------|-------|------------|--------------------------------------|-------------|------------|-------|-----------|------------|
| CHUM SALMON COMMERCIAL CATCH - PUGET SOUND AREAS |                       |         |        |             |             |            |       |            |                                      |             |            |       |           |            |
| CUMULATIVE CATCH IN NUMBERS OF FISH              |                       |         |        |             |             |            |       |            | DATE RANGE USED - 4/ 1/87 TO 3/31/88 |             |            |       |           |            |
| AREA CODE  | ABBREVIATED AREA NAME | INDIAN  |        |             |             |            |       | NON-INDIAN |                                      |             |            |       |           | AREA TOTAL |
|  |                       | GILLNET | SETNET | PURSE SEINE | BEACH SEINE | OTHER GEAR | TROLL | SUB-TOTAL  | GILLNET                              | PURSE SEINE | OTHER GEAR | TROLL | SUB-TOTAL |            |
| 4B   | MARINE 4D             | 1033    | 0      | 0           | 0           | 0          | 0     | 1033       | 0                                    | 0           | 0          | 0     | 0         | 1033       |
| 5  | MARINE 5              | 43295   | 0      | 0           | 0           | 0          | 6     | 43301      | 5                                    | 0           | 0          | 0     | 5         | 43306      |
| 6C   | MARINE 6C             | 218     | 0      | 0           | 0           | 0          | 1     | 219        | 0                                    | 0           | 0          | 0     | 0         | 219        |
| ***  | SUB-TOTAL             | 44546   | 0      | 0           | 0           | 0          | 7     | 44553      | 5                                    | 0           | 0          | 0     | 5         | 44558      |
| 6  | MARINE 6              | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 6                                    | 0           | 0          | 0     | 6         | 6          |
| 6A   | MARINE 6A             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 7  | MARINE 7              | 2554    | 0      | 5822        | 0           | 0          | 0     | 8376       | 2304                                 | 5724        | 993        | 0     | 9101      | 17477      |
| 7A   | MARINE 7A             | 3056    | 0      | 3620        | 0           | 0          | 0     | 6676       | 1626                                 | 5080        | 0          | 0     | 6706      | 13362      |
| 6D   | MARINE 6D             | 138     | 0      | 0           | 0           | 0          | 0     | 138        | 32                                   | 0           | 0          | 0     | 32        | 170        |
| 74D  | SAIL RIVER            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 75A  | CLALLAM RV            | 22      | 0      | 0           | 0           | 0          | 0     | 22         | 0                                    | 0           | 0          | 0     | 0         | 22         |
| 75D  | DEEP CREEK            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 75C  | HOKO RIVER            | 9       | 0      | 0           | 0           | 0          | 0     | 9          | 0                                    | 0           | 0          | 0     | 0         | 9          |
| 75D  | LYRE RIVER            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 75E  | PYSHT RVR             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 75F  | SEKIU RVR             | 2       | 0      | 0           | 0           | 0          | 0     | 2          | 0                                    | 0           | 0          | 0     | 0         | 2          |
| 75G  | THIN RIVER            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 76A  | DUNGEHESS             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 76D  | ELWIA RVR             | 815     | 0      | 0           | 0           | 2          | 0     | 817        | 0                                    | 0           | 0          | 0     | 0         | 817        |
| 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             | 906     | 0      | 0           | 0           | 2          | 0     | 908        | 32                                   | 0           | 0          | 0     | 32        | 1020       |
| 7B   | MARINE 7B             | 21662   | 0      | 416         | 0           | 0          | 0     | 22078      | 27524                                | 3679        | 0          | 0     | 31203     | 53281      |
| 77B  | UPP. HOOKSC           | 10511   | 0      | 0           | 0           | 0          | 0     | 10511      | 0                                    | 0           | 0          | 0     | 0         | 10511      |
| 77C  | LOH. HOOKSC           | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 7C   | MARINE 7C             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 77D  | SAHISH 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             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 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             | 32173   | 0      | 416         | 0           | 0          | 0     | 32589      | 27524                                | 3679        | 0          | 0     | 31203     | 63792      |
| 8  | MARINE 8              | 4414    | 0      | 0           | 0           | 0          | 0     | 4414       | 7335                                 | 1           | 0          | 0     | 7336      | 11750      |
| 78B  | SAUK RIVER            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 78C  | LOH. SKAGIT           | 5177    | 0      | 0           | 0           | 0          | 0     | 5177       | 0                                    | 0           | 0          | 0     | 0         | 5177       |
| 78D  | UPP. SKAGIT           | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| ***  | SUB-TOTAL             | 9591    | 0      | 0           | 0           | 0          | 0     | 9591       | 7335                                 | 1           | 0          | 0     | 7336      | 16927      |
| 6B   | MARINE 6B             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 9  | MARINE 9              | 797     | 0      | 0           | 0           | 0          | 0     | 797        | 1113                                 | 0           | 0          | 0     | 1113      | 1910       |
| ***  | SUB-TOTAL             | 797     | 0      | 0           | 0           | 0          | 0     | 797        | 1113                                 | 0           | 0          | 0     | 1113      | 1910       |
| 8A   | MARINE 8A             | 64206   | 0      | 0           | 452         | 0          | 0     | 64738      | 43636                                | 25003       | 0          | 0     | 69439     | 134177     |
| 79F  | SHOHOMISH             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 78G  | STILLAGUAM            | 5796    | 0      | 0           | 0           | 0          | 0     | 5796       | 0                                    | 0           | 0          | 0     | 0         | 5796       |
| 8D   | MARINE 8D             | 7036    | 0      | 0           | 1036        | 0          | 0     | 8072       | 67                                   | 49          | 0          | 0     | 116       | 8188       |
| ***  | SUB-TOTAL             | 77116   | 0      | 0           | 1488        | 0          | 0     | 78606      | 43703                                | 25052       | 0          | 0     | 69555     | 148161     |
| 10   | MARINE 10             | 3667    | 0      | 19456       | 0           | 0          | 0     | 23123      | 42395                                | 30146       | 0          | 0     | 80541     | 103664     |
| 10A  | MARINE 10A            | 4272    | 0      | 0           | 0           | 0          | 0     | 4272       | 0                                    | 0           | 0          | 0     | 0         | 4272       |
| 80B  | DUNA-GREEN            | 1091    | 0      | 0           | 0           | 0          | 0     | 1091       | 0                                    | 0           | 0          | 0     | 0         | 1091       |
| 10B  | LK. WA. 10B           | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 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            | 11344   | 0      | 7           | 0           | 0          | 0     | 11351      | 0                                    | 0           | 0          | 0     | 0         | 11351      |
| 10F  | LK. UN. 10F           | 35      | 0      | 0           | 0           | 0          | 0     | 35         | 0                                    | 0           | 0          | 0     | 0         | 35         |
| 10G  | LK. WA. 10G           | 55      | 0      | 0           | 0           | 0          | 0     | 55         | 0                                    | 0           | 0          | 0     | 0         | 55         |
| 11   | MARINE 11             | 3944    | 0      | 0           | 0           | 0          | 0     | 3944       | 6563                                 | 13911       | 0          | 0     | 20474     | 24418      |
| 11A  | MARINE 11A            | 433     | 0      | 0           | 0           | 0          | 0     | 433        | 0                                    | 0           | 0          | 0     | 0         | 433        |
| 01A  | CARDON RVR            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 01B  | PUYALLUP R            | 6227    | 0      | 0           | 0           | 0          | 0     | 6227       | 0                                    | 0           | 0          | 0     | 0         | 6227       |
| 01C  | WHITE RVR             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 13   | MARINE 13             | 134     | 0      | 6           | 0           | 0          | 0     | 140        | 81                                   | 0           | 0          | 0     | 81        | 221        |
| 83D  | NISQUALLY             | 56634   | 0      | 0           | 0           | 0          | 0     | 56634      | 0                                    | 0           | 0          | 0     | 0         | 56634      |
| 83F  | MCALLISTER            | 541     | 0      | 0           | 10          | 0          | 0     | 551        | 0                                    | 0           | 0          | 0     | 0         | 551        |
| 13A  | MARINE 13A            | 18305   | 0      | 0           | 2307        | 0          | 0     | 20612      | 1072                                 | 561         | 0          | 0     | 1633      | 22245      |
| 83C  | MINTER CRK            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 83E  | PUDY-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            | 32      | 0      | 0           | 2           | 0          | 0     | 34         | 0                                    | 0           | 0          | 0     | 0         | 34         |
| 83H  | CHANDERS C            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 13D  | MARINE 13D            | 25202   | 0      | 0           | 1475        | 0          | 0     | 26677      | 0                                    | 0           | 0          | 0     | 0         | 26677      |
| 13E  | MARINE 13E            | 50      | 0      | 0           | 6           | 0          | 0     | 56         | 0                                    | 0           | 0          | 0     | 0         | 56         |
| 13F  | MARINE 13F            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 83A  | DESCHUTES             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 13G  | MARINE 13G            | 8895    | 0      | 0           | 0           | 0          | 0     | 8895       | 0                                    | 0           | 0          | 0     | 0         | 8895       |
| 13H  | MARINE 13H            | 23114   | 0      | 0           | 0           | 0          | 0     | 23114      | 0                                    | 0           | 0          | 0     | 0         | 23114      |
| 13I  | MARINE 13I            | 16114   | 0      | 0           | 0           | 0          | 0     | 16114      | 0                                    | 0           | 0          | 0     | 0         | 16114      |
| 13J  | MARINE 13J            | 112     | 0      | 0           | 0           | 0          | 0     | 112        | 0                                    | 0           | 0          | 0     | 0         | 112        |
| 13K  | MARINE 13K            | 157     | 0      | 0           | 0           | 0          | 0     | 157        | 0                                    | 0           | 0          | 0     | 0         | 157        |
| ***  | SUB-TOTAL             | 180358  | 0      | 19463       | 3806        | 0          | 0     | 203627     | 50111                                | 52618       | 0          | 0     | 102729    | 306356     |
| 9A   | MARINE 9A             | 1059    | 0      | 0           | 0           | 0          | 0     | 1059       | 0                                    | 0           | 0          | 0     | 0         | 1059       |
| 12   | MARINE 12             | 195026  | 0      | 209         | 0           | 0          | 0     | 195235     | 52998                                | 209077      | 0          | 0     | 342875    | 530110     |
| 82A  | DIG BEEF C            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 12A  | MARINE 12A            | 1973    | 0      | 0           | 4           | 0          | 0     | 1977       | 230                                  | 569         | 0          | 0     | 807       | 2704       |
| 82F  | QUILCENE R            | 1       | 0      | 0           | 0           | 0          | 0     | 1          | 0                                    | 0           | 0          | 0     | 0         | 1          |
| 12B  | MARINE 12B            | 20479   | 0      | 0           | 25          | 0          | 0     | 20504      | 2146                                 | 10342       | 0          | 0     | 12408     | 32992      |
| 82C  | DOSEWALLIP            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 82D  | DUCKABUSH             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 82E  | HATHA-HATH            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 12C  | MARINE 12C            | 98234   | 0      | 0           | 3181        | 0          | 0     | 101415     | 1642                                 | 7657        | 0          | 0     | 9299      | 110714     |
| 82B  | DEWATTO RV            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 82G  | SKOKOHISH             | 28354   | 0      | 0           | 0           | 0          | 0     | 28354      | 0                                    | 0           | 0          | 0     | 0         | 28354      |
| 82J  | PUDRY C-HC            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 12D  | MARINE 12D            | 13      | 0      | 0           | 0           | 0          | 0     | 13         | 0                                    | 0           | 0          | 0     | 0         | 13         |
| 82H  | TAHUYA RVR            | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| 82I  | UNION RVR             | 0       | 0      | 0           | 0           | 0          | 0     | 0          | 0                                    | 0           | 0          | 0     | 0         | 0          |
| ***  | SUB-TOTAL             | 345139  | 0      | 209         | 3210        | 0          | 0     | 348558     | 57024                                | 308445      | 0          | 0     | 365469    | 714027     |
| TOTALS   |                       | 696318  | 0      | 29530       | 8504        | 2          | 7     | 734361     | 190863                               | 401399      | 993        | 0     | 593255    | 1327616    |

Table 5. 1987 Washington Coastal Chum Run Sizes, Catches, and Escapements.

|                          | Willapa Bay | Grays Harbor | Quinault R. | Total   |
|--------------------------|-------------|--------------|-------------|---------|
| Pre-season forecast      | 75,000      | 35,000       | 8,400       | 118,400 |
| natural                  | 59,500      | 35,000       | min.        |         |
| hatchery                 | 15,500      | min.         | 8,400       |         |
| Actual run size          | 109,500     | 70,200       | 5,300       | 185,000 |
| Catch                    | 72,900      | 58,700       | 3,800       | 135,400 |
| Wild escapement goal     | 35,400      | 21,000       | none        |         |
| Wild escapement          | 31,900      | 9,500        | 1,800       | 43,200  |
| Hatchery escapement goal | n/a         | n/a          | 2,500       |         |
| Hatchery escapement      | 4,400       | 400          | 340         | 5,140   |

Table 6. 1987 Chum Samples for WDF GSI Baseline

| Locality            | N   | Collection date(s) | Timing |
|---------------------|-----|--------------------|--------|
| -----               |     |                    |        |
| North Puget Sound   |     |                    |        |
| Squire Creek        | 69  | 12/2; 12/17        | Normal |
| South Puget Sound   |     |                    |        |
| *Swift Creek        | 100 | 12/4; 12/16        | Normal |
| *Perry Creek        | 100 | 11/24; 12/15       | Normal |
| Hood Canal          |     |                    |        |
| *Hoodsport Hatchery | 100 | 11/6; 12/17        | Normal |
| West Vancouver Is.  |     |                    |        |
| Nitinat Hatchery    | 100 | 10/29; 11/4        | Normal |
| Georgia Strait      |     |                    |        |
| Slammon Hatchery    | 100 | 11/23              | Normal |
| Puntledge Hatchery  | 100 | 11/26              | Normal |
| Goldstream River    | 100 | 12/3               | Normal |
| Fraser River        |     |                    |        |
| Chilliwack Hatchery | 100 | 11/5; 11/19        | Normal |
| Chehalis Hatchery   | 100 | 11/6; 11/18        | Normal |
| -----               |     |                    |        |

(\*) = Annual repeat sample

Source: WDF GSI Laboratory

Table 7. Summary of numbers of chum salmon sampled for GSI from various gear types and fisheries, in 1987, in northern Puget Sound

| Location               | Statistical Week | No. fish Sampled | 1987 date      | Gear type |
|------------------------|------------------|------------------|----------------|-----------|
| <hr/>                  |                  |                  |                |           |
| Strait of Juan de Fuca | 40               | 203              | 10/1-2         | GN        |
| Area 5 / Commercial    | 41               | 206              | 10/6-8         | GN        |
|                        | 42               | 203              | 10/13-14       | GN        |
|                        | 43               | 179              | 10/20          | GN        |
|                        | 45               | 206              | 11/2;11/5-6    | GN        |
|                        | 46               | 206              | 11/10          | GN        |
| Area 5 / Test vessels  | 44               | 204              | 10/26-27;10/29 | GN        |
| <hr/>                  |                  |                  |                |           |
| Point Roberts          | 42               | 200              | 10/14-16       | GN        |
| Area 7A / Test vessels | 43 *             | 200              | 10/21          | GN        |
|                        | 43 *             | 200              | 10/21          | PS        |
|                        | 44 *             | 200              | 10/28          | GN        |
|                        | 44 *             | 120              | 10/28          | PS        |
|                        | 45 *             | 200              | 11/3           | GN        |
|                        | 45 *             | 200              | 11/3           | PS        |
|                        | 46               | 48               | 11/12          | GN        |
|                        | 47               | 200              | 11/17          | PS        |
| <hr/>                  |                  |                  |                |           |
| Salmon Banks           | 43               | 200              | 10/20          | PS        |
| Area 7 / Test vessels  | 44               | 199              | 10/29          | PS        |
|                        | 45               | 200              | 11/5           | PS        |
|                        | 46               | 57               | 11/11          | PS        |
|                        | 47               | 201              | 11/16          | PS        |
| <hr/>                  |                  |                  |                |           |
| West Lummi Island      | 42               | 200              | 10/13          | GN        |
| Area 7 / Test vessels  | 43               | 200              | 10/20          | GN        |
|                        | 44               | 200              | 10/26          | GN        |
|                        | 45               | 200              | 11/2           | GN        |
|                        | 46               | 200              | 11/9           | GN        |
|                        | 47               | 200              | 11/16          | GN        |

GN = Gillnet

PS = Purse seine

(\*) = Parallel Testing for Capture Gear Comparison

Source: Nooksack Tribal Fisheries Dept.

Table 8. Apportionment of 1987 preterminal chum salmon commercial net catches for Puget Sound run reconstruction.

| Area(s)   | Percent<br>Puget Sound                  | Apportionment for Puget<br>Sound Stocks  |
|-----------|---|--|
| 4B, 5, 6C | 30 - Early<br>60 - Normal<br>100 - Late | All Puget Sound units by<br>run strength.  |
| 6         | 30 - Early<br>60 - Normal<br>100 - Late | All Puget Sound units by<br>run strength.  |
| 6A        | 50 - Early<br>95 - Normal<br>100 - Late | 80% Skagit; 10% Nooksack/Samish;<br>10% all other Puget Sound units<br>by run strength |
| 7         | 25 - Early<br>30 - Normal<br>20 - Late  | All Puget Sound units by<br>run strength.  |
| 7A        | 5 - Early<br>5 - Normal<br>5 - Late     | All Puget Sound units by<br>run strength.  |

ATTACHMENT 3

FINAL 1987 POST SEASON SUMMARY REPORT ON  
CHUM SALMON  
CANADIAN AGENCY REPORT



## Canadian Chum Salmon 1987

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## 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 1987. Other fisheries, while not specifically mentioned in the PST, are known to harvest chum of the other countries origin. This report discusses various aspects of the chum present in British Columbian waters between Vancouver Island and the mainland (Inside chum) and off the west coast of Vancouver Island (West Coast chum) and discusses the management actions of Canada in relation to the PST requirements.

## Inside Chum

### I. 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 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 multiyear 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 following describes the clockwork, its 1987 revisions and the PST requirements for Inside chum and discusses Inside, Fraser River, and mid Vancouver Island chum stocks in relation to these plans.

### i. Clockwork Harvest Strategy

This strategy was more fully described in the Final 1985 Post Season Summary Report of the Joint Chum Technical Committee (Anon., 1987a). The primary objective of the clockwork strategy was to rebuild wild chum stocks to the estimated optimum escapement levels by limiting the overall harvest rate. Specific objectives within this strategy were 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 1987 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.

Each of these run size ranges is 400,000 chum higher than those reported in the Final 1986 Post Season Summary Report (Anon., 1987b). The increase included 200,000 additional chum for wild spawning grounds and 200,000 additional chum to return to enhancement facilities. The run size ranges were adjusted upwards to ensure that the rebuilding schedule for the Inside chum stock spawning in wild areas would be achieved.

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 1987, the only terminal areas to be fished were mid Vancouver Island (Qualicum, Area 14), Nanaimo (Area 17) and Cowichan (Area 18). As a result of poor returns, there was no chum harvesting in the Fraser River in 1987.

### ii. Canada/U.S. Treaty

The 1987 changes to the PST were negotiated on the understanding that Canada would manage the 1987 chum fisheries in Johnstone Strait, Strait of Georgia and Fraser

River areas in a manner consistent with the clockwork plan and that the U.S. would limit its harvest of Canadian chum in some areas to negotiated catch ceilings.

The PST required that the U.S. limit its catch in Areas 7 and 7A to: 20,000 chum taken incidentally in fisheries for other species if the catch in Johnstone Strait was less than 225,000 chum; 120,000 chum if the catch in Johnstone Strait was between 225,000 and 640,000; and 140,000 if the Johnstone Strait catch was over 640,000 chum.

In 1987, the PST also provided for compensation in subsequent years for any differences between the actual catch in these U.S. areas and the appropriate catch permitted by the PST. In addition, the 1987 PST stated that the U.S. would maintain the limited effort nature of its chum fishery in areas 4B, 5, and 6C and if practicable, maintain a traditional proportion of effort and catch between Areas 7 and 7A, and avoid concentrations of effort along the international border.

During the 1987 chum season, stock size estimates decreased from preseason expectations. Consequently, Canada did not permit directed chum salmon harvesting in Johnstone Strait after the assessment fishery in September. The Canadian objective was to limit subsequent harvest to a 10 percent harvest rate. As a result, Canada anticipated that the U.S. commercial fisheries in Areas 7 and 7A would be limited to 20,000 chum. An assessment of the performance of Canada in the management of the 1987 season is included in Section V of this report.

### iii. Fraser River Chum

The chum produced from the Fraser River were of importance during the development of the clockwork harvest strategy and the negotiation of the PST. The Canadian clockwork plan was designed to conserve all inside chum in the major mixed stock fishery areas. As part of the revisions to the 1987 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 development 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 within the Fraser River area. In 1987, the spawning escapement goal for Fraser River chum was set at 700,000. The plan provided

for the escapement goal to be increased if the returns to the river were in excess of the gross escapement goal. The strategy to permit the escapement to increase was to be accomplished by limiting the harvest to approximately one half of those chum in excess of the gross escapement goal.

The catch of Fraser River chum in all fishing areas is estimated to determine the size of the run. In some areas, catch estimates for Fraser River chum are determined through genetic stock identification (GSI) analyses, while in other areas catch estimates are based on traditional perceptions of catch composition.

In 1987, the Johnstone Strait test fishery was sampled to estimate Fraser River chum catch, while the Strait of Georgia and Nitinat fisheries were sampled to estimate the catch of Fraser River chum. The catch of Fraser River chum in the U.S. Point Roberts, San Juan Islands and Juan de Fuca fisheries was based on the assumption that 80 to 95 percent of the catch of Canadian chum in those U.S. areas are of Fraser origin. The catch of Canadian chum in those U.S. fisheries was determined through the use of the run apportionment methods (Anon., 1987b).

#### iv. Strait of Georgia Chum

The chum produced in the mid Vancouver Island area are produced primarily from enhancement facilities. In 1987, little of this return was harvested within Johnstone Strait, under the prevailing 10% clockwork harvest rate, and the majority of the catch occurred in the mid Vancouver Island area. Terminal harvesting was directed at a mix of surplus wild and enhanced chum; however, the conservation requirements of passing chum stocks was considered. In 1987, to provide harvest opportunities for Puntledge River chum prior to the anticipated late cleanup fisheries, a limited outside area fishery was conducted. It was assumed that this fishery would marginally increase the catch of passing Fraser River chum. The conservation requirements of chinook and coho salmon in this fishery area were also considered when determining limits on the Area 14 chum fishery.

During the 1987 season chum salmon surplus to the spawning escapement goals for the Nanaimo and Cowichan rivers were identified and terminal harvesting was permitted for one day in each of the areas.

## II. Run Size Estimation

Run size estimates were prepared prior to the season in order to plan the necessary conservation actions as well as domestic and international allocations. As the season progressed, revisions to the run size estimates were used to amend harvest plans in accordance with the clockwork approach.

### i. Preseason

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 1987 preseason forecast of Inside chum originating from wild spawning areas was 1,775,000 including 454,000 Fraser River and 1,321,000 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 1987 run size estimate for enhanced origin Fraser River chum was 497,000 while the mid Vancouver Island area was expected to produce 669,000 enhanced chum. In addition, there were 84,000 enhanced origin chum estimated to return to other areas, including the Howe Sound, lower Vancouver Island, and Jervis Inlet areas. The total run size estimate for enhanced Inside chum was 1,250,000 (Table 1).

The total Inside chum run size was estimated at 3,025,000 million (1,775,000 wild and 1,250,000 enhanced). In addition, past data show that U.S. chum migrate through Johnstone Strait. For computational purposes, the estimated 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 3,125,000 chum.

### ii. Inseason

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 the magnitude of the run size for the entire season with an average error of 32 percent over the period 1969 to 1984. This is the first inseason run size estimate used in the clockwork plan.

In 1987, because of a conservation requirement for late run Fraser River pink salmon, the fishery scheduled for the third week of September was delayed until the fourth week of September. The results of that fishery indicated a run size estimate of 2,223,000 chum, 71% of the preseason forecast (Table 2); therefore, the harvest rate allowable under the clockwork plan dropped to 10 percent. All Inside chum stocks were assumed to be returning at this decreased rate of return. Revision of the estimated run size of Fraser River chum resulted in a new estimate of 676,000 as compared to the preseason estimate of 951,000. The mid Vancouver Island and other Inside wild and enhanced chum run sizes were also adjusted downwards. The U.S. run size passing through Johnstone Strait, because no quantitative method of estimation revision was available, remained constant throughout the season at 100,000 chum.

Subsequent inseason run size estimates were based on the chum catch and effort data from the upper Johnstone Strait test fishery. The first estimate was available following two weeks of test fishing. The data to the tenth of October indicated a total run size of 2,264,000 chum entering Johnstone Strait. The Fraser River and other Inside wild and enhanced chum stock run size estimates were adjusted proportionately (Table 2). During the remainder of October, test fishing continued and inseason run size estimates were made on a weekly basis utilizing test fishing results. The final test fishing data derived run size estimate was 2,342,000 chum (Table 2).

Inseason, the Fraser River chum run size was estimated from data from Johnstone Strait and also from the Fraser River. The final inseason estimate available from Johnstone Strait test fishing was 713,000 Fraser River chum. Test fishing within the Fraser River provided additional run size estimates until the test fishery was terminated in late December. The final inseason estimate of the total run size of Fraser River chum, derived from inriver test fishing data, was 622,000 chum (Table 2).

### iii. Postseason

At the end of the season, total catch in all Inside areas, catch of Canadian chum in U.S. areas 7 and 7A and Inside chum gross escapements were summed to estimate the actual run size. 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 postseason run size estimate for chum was 1,960,000 chum (1,421,000 gross escapement and 539,000 total catch). This estimate was 84% of the final inseason estimate of 2,342,000 chum salmon and 63% of the preseason forecast of 3,125,000 chum.

The Fraser River postseason run size estimate, including the catch of Fraser River chum in U.S. and Canadian waters, was 642,000 (474,000 gross escapement and 168,8000 total of catch in Canadian and U.S. waters). This run size was 68% of the preseason forecast.

Based on the assumption that 80 to 95% of the Canadian origin apportion of the total catch in the U.S. Point Roberts, San Juan Islands and Juan de Fuca fishery areas is of Fraser River origin, the estimated catch of Fraser chum in U.S. areas 7 and 7A was 21,900 while the catch of Fraser chum in the U.S. Juan de Fuca Strait fishery area was 14,300. The catch 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 34,700 chum, 31,400 chum, and 13,700 chum, respectively.

### III. Catch

Chum in Inside waters are harvested by commercial, Indian food, and test fishermen and by biological samplers. In 1987, inseason run size information limited these harvests to a total of 520,400. The catch by each fishing group and area is presented below.

#### i. Commercial

Commercial catch of chum in Inside waters occurs in three main areas: Johnstone Strait, Strait of Georgia and the Fraser River.

The 1987 Johnstone Strait fishery (areas 11, 12 and 13), began in July and ended in late September. During the July and August period the Johnstone Strait fishery was directed at harvesting sockeye and pink salmon. During those two months 36,500 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 1987, because of the presence



of late migrating pink salmon, the assessment fishery was delayed until the 21st of September when 51,500 chum were caught (Table 3). The catch in this fishery was used to develop the first inseason run size estimate of 2,223,000 chum. This run size indicated that a 10% harvest rate could be allowed and no further commercial fishing occurred in Johnstone Strait.

The Strait of Georgia fishery was limited to three areas, mid Vancouver Island (Area 14), Nanaimo (Area 17) and Cowichan (Area 18). These commercial fisheries were directed at a mix of wild and enhanced chum. In Area 14, the first opening occurred on October 17. Commercial fishing continued for the next four weeks and during those weeks of fishing a total of 345,000 chum were caught (Table 3). There was no late cleanup fishery in Area 14 in 1987.

In Area 17, adjacent to the Nanaimo River, a one day fishery harvested approximately 10,000 chum while adjacent to the Cowichan River (Area 18) there was a one day fishery which caught approximately 5,000 chum.

The Fraser river commercial net fishery was not opened during the 1987 chum salmon season. In Fraser River Panel openings for sockeye and pink salmon, less than 1,000 chum were caught. The balance of the catches reported in Table 3 were taken by test fishing vessels.

## ii. 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, Georgia, and Juan de Fuca straits.

The abundance of chum in Johnstone Strait in 1987 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 mid November (Table 4). During that time the two vessels enumerated a total of 96,000 chum, the majority of which were released unharmed. There were 14,000 chum retained as payment for the operation of the seine vessels and 2,500 for biological samples (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 indicate 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 inseason estimates of the run size (Table 2).

Within the Strait of Georgia, 1,600 chum from the commercial fisheries in areas 14 and 17 were sampled for GSI information (Table 8).

The Juan de Fuca Strait GSI sampling program started in late September and continued weekly until early November during which 1000 chum were sampled (Table 8).

The remaining area to be test fished was the Fraser River, where there were two test fisheries, the first at Cottonwood in the lower river near Ladner, while the second operated in the upper commercial fishery area near Albion.

The chum test fishery at Cottonwood was used to determine the size of Fraser River chum run and to monitor daily abundance. This daily test fishery began on October 1 and continued until late December. During this period a total of 2,900 chum were caught (Table 5). The first estimate of the size of the run was developed in mid October and indicated that approximately 750,000 chum were returning (Table 2). Subsequent run size estimates decreased to 620,000 chum. Table 5 shows two peaks of abundance at Cottonwood; the first in mid October and a second in early November.

The test fishery at Albion, which monitors abundance and the rate of upstream movement, began on October 1 and continued until late December. During this period 5,000 chum were caught (Table 5). The timing of the run past Albion, as determined by the test fishery is shown in Table 5 and indicates peaks in mid October and mid November.

### iii. Indian

Native people within 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 main stream system from which Indians harvest food fish is the Fraser River; however, there are stream harvests in other areas.

In 1987, the Indian food fishery in Inside waters harvested 82,100 chum, of which the food fishery in Johnstone Strait harvested a total of 22,300 chum, the majority of which were taken in marine waters in October. In the Strait of Georgia there were 33,600 chum taken in the Indian food fishery. The majority of the Indian food fish caught in the

Strait of Georgia are taken in stream estuaries or within the streams. The food fishery within the Fraser River took a estimated total of 26,300 chum, a record high catch for this fishery.

#### IV. Escapement

Chum which escape 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.

##### i. 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 goal for the fall chum run. The total escapement of summer chum in 1987 was 24,500 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 fall chum spawning in wild spawning areas was 1,253,000 chum, 76% of the 1981 to 1986 average and the lowest since the clockwork plan began in 1983.

A below average escapement was reported for the Fraser River. Spawning ground enumeration effort in 1987 was significantly reduced from previous years and therefore observed number of spawners was not usable. The estimate of 431,000 chum in the wild spawning areas of the Fraser River was based on analysis of test fishery data.

In nine of the fourteen major spawning areas the 1987 chum escapement was below the average observed during the 1981-86 period (Table 6). The fall chum spawning escapement in wild spawning areas was 49% of the present total spawning goal of 2,579,000 chum, there was only one of the fourteen stock areas (southern Vancouver Island) which received an escapement at or above the goal.

## ii. Enhanced

The 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 84% of their spawning requirements (Table 6). The chum returning to enhancement facilities within the Fraser River are, wherever possible, diverted to wild spawning areas to spawn.

## iii. Gross

The gross escapement in 1987 was estimated at 1,421,000 fall chum of which 1,253,000 spawned in wild or natural spawning areas. The remaining 168,000 were spawned in enhancement areas, facilities or were surplus to hatchery requirements (Table 6).

# V. Status of Treaty Requirements

## i. Overall Fishery Management

The PST specified that Canadian Inside commercial fisheries were to be managed consistent with the context of the clockwork plan, while the United States was to limit its fishery in the San Juan Islands and Point Roberts areas to a number dependent on the catch levels in Johnstone Strait.

The inseason management decisions by DFO in 1987 reflected run size estimates based on information from test and commercial fishing. The commercial evaluation fishery in the fourth week of September indicated a run size of 2,223,000 chum which was lower than the preseason forecast and limited the harvest rate to 10% of the total run. No further directed commercial fishing occurred in Johnstone Strait and it was assumed that the U.S. fisheries in areas 7 and 7A would be limited to a commercial catch of 20,000 chum.

The total run size, appropriate to the clockwork harvest plan, 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. This run size was estimated to be 1,960,000 chum. The overall harvest rate as calculated including the appropriate Canadian and U.S. fisheries catches was 9 percent, very close to the objective of 10% (Table 9).

## ii. Stock Identification

Genetic stock identification (GSI) was conducted in a number of areas in 1987. The majority of the GSI work concentrated on sampling of commercial fishery areas or commercial catches.

The commercial fishery areas sampled in 1987 were upper Johnstone Strait (Area 12), mid Vancouver Island (Area 14), Nanaimo (Area 17) and Juan de Fuca Strait (Area 20). The samples in areas 14 and 17 were from the commercial catch. In areas 12 and 20, the samples were from chum caught by test fishing vessels (Table 8). The observed percentage in each of the samples which was identified as Puget Sound origin chum for each of the areas sampled in 1987 is shown in Table 7. Further details can be found in Naylor et al., 1988.

The results indicate that the percentage of Puget Sound origin chum in the Johnstone Strait and Qualicum areas was generally below 10% (Table 7). A single sample from the Nanaimo area indicated 16.8% were of Puget Sound origin.

The Area 20 results showed a seasonal increase in the percentage of Puget Sound origin chum in the samples. The Area 20 samples ranged from 7% to 56% Puget Sound origin chum (Table 7).

Table 1. Preseason run forecasts by stock, 1987.

| Stock                 | Origin    | Expected run size | Percent run size |        |
|-----------------------|-----------|-------------------|------------------|--------|
| -----                 |           |                   |                  |        |
| Canadian Inside Chum  |           |                   |                  |        |
| -----                 |           |                   |                  |        |
| Fraser River:         | Wild      | 454,000           | 14.5%            |        |
|                       | Enhanced  | 497,000           | 15.9%            |        |
|                       | sub-total | 951,000           |                  | 30.4%  |
|                       |           |                   |                  |        |
| Mid Vancouver Island: | Wild      | a.                |                  |        |
|                       | Enhanced  | 669,000           | 21.4%            |        |
|                       | sub-total | 669,000           |                  | 21.4%  |
|                       |           |                   |                  |        |
| Other Stocks:         | Wild      | 1,321,000         | 42.3%            |        |
|                       | Enhanced  | 84,000            | 2.7%             |        |
|                       | sub-total | 1,405,000         |                  | 45.0%  |
|                       |           |                   |                  |        |
| Total Inside Stocks:  | Wild      | 1,775,000         | 56.8%            |        |
|                       | Enhanced  | 1,250,000         | 40.0%            |        |
|                       | Total     | 3,025,000         |                  | 96.8%  |
|                       |           |                   |                  |        |
| U.S. Chum             |           |                   |                  |        |
| -----                 |           |                   |                  |        |
| Puget Sound:          |           | 100,000           | 3.2%             | 3.2%   |
|                       |           |                   |                  |        |
| GRAND TOTAL           |           | 3,125,000         | 100.0%           | 100.0% |

a. Included in Total Inside Stocks, wild total

Table 2. Summary of pre-season and in-season chum run size estimates and the post-season run size estimates, 1987.

| Week<br>Ending                             | Total<br>through<br>J.St. | U.S.    | Canadian<br>Total | Fraser<br>River | Mid<br>Vancouver<br>Island | Other<br>Inside<br>Canadian |
|--|---------------------------|---------|-------------------|-----------------|----------------------------|-----------------------------|
| PRESEASON                                  | 3,125,000                 | 100,000 | 3,025,000         | 951,000         | 669,000                    | 961,600                     |
| INSEASON                                   |                           |         |                   |                 |                            |                             |
| (Estimates from Johnstone Strait data)     |                           |         |                   |                 |                            |                             |
| Sept 26                                    | 2,222,800                 | 100,000 | 2,122,800         | 676,442         | 475,857                    | 970,500                     |
| Oct 10                                     | 2,263,900                 | 100,000 | 2,163,900         | 688,950         | 484,656                    | 990,294                     |
| Oct 17                                     | 2,335,900                 | 100,000 | 2,235,900         | 710,861         | 500,069                    | 1,024,969                   |
| Oct 24                                     | 2,341,500                 | 100,000 | 2,241,500         | 712,565         | 501,268                    | 1,027,666                   |
| (Estimates from Fraser River test fishing) |                           |         |                   |                 |                            |                             |
| Oct 16                                     | -                         | -       | -                 | 752,000         | -                          | -                           |
| Oct 31                                     | -                         | -       | -                 | 642,000         | -                          | -                           |
| Nov 14                                     | -                         | -       | -                 | 632,000         | -                          | -                           |
| Nov 28                                     | -                         | -       | -                 | 622,000         | -                          | -                           |
| Dec 15                                     | -                         | -       | -                 | 622,000         | -                          | -                           |
| POSTSEASON                                 | -                         | -       | 1,960,600         | 641,800         | -                          | -                           |

In-season total run size estimates based on following:

USA assumed constant at 100,000

Fraser River and MVI same proportion as pre-season.

non-Fraser is remaining difference.

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

Table 3. Catch of chum salmon by statistical area for commercial and test fishing vessels and by Indian food fisheries, 1987.

| Period<br>or Week<br>ending | Statistical Areas |        |        |         |        |        |        |         |
|-----------------------------|-------------------|--------|--------|---------|--------|--------|--------|---------|
|                             | 11                | 12     | 13     | 14      | 15-19  | 20     | 29     | Total   |
| 05-Sep                      | 0                 | 3,074  | 664    | 34      | 10     | 464    | 352    | 4,598   |
| 12-Sep                      | 0                 | 0      | 0      | 0       | 0      | 54     | 28     | 82      |
| 19-Sep                      | 0                 | 0      | 1      | 0       | 0      | 46     | 62     | 109     |
| 26-Sep                      | 0                 | 36,700 | 14,512 | 1       | 0      | 132    | 122    | 51,467  |
| 03-Oct                      | 0                 | 0      | 2      | 2       | 0      | 13,667 | 663    | 14,334  |
| 10-Oct                      | 0                 | 0      | 3,275  | 0       | 0      | 0      | 1,051  | 4,326   |
| 17-Oct                      | 0                 | 0      | 0      | 64,601  | 235    | 1,318  | 1,615  | 67,769  |
| 24-Oct                      | 0                 | 8,000  | 0      | 55,519  | 28     | 0      | 696    | 64,243  |
| 31-Oct                      | 0                 | 0      | 0      | 91,645  | 54     | 0      | 650    | 92,349  |
| Nov.1 to<br>Nov.28          | 0                 | 0      | 0      | 133,232 | 14,664 | 0      | 3,884  | 151,780 |
| Nov 29 to<br>Dec.31         | 0                 | 0      | 0      | 0       | 0      | 0      | 249    | 249     |
| TOTAL                       | 0                 | 47,774 | 18,454 | 345,034 | 14,991 | 15,681 | 9,372  | 451,306 |
| Prior to<br>29-Aug          | 6,324             | 25,906 | 4,276  | 3       | 87     | 660    | 102    | 37,358  |
| Indian Food<br>Fishery      | 0                 | 7,109  | 15,150 | 123     | 33,477 | 3,300  | 26,312 | 85,471  |
| Grand total                 | 6,324             | 80,789 | 37,880 | 345,160 | 48,555 | 19,641 | 35,786 | 574,135 |

Source: British Columbia Catch Statistics, 1987.



Table 4. Catch, effort, and catch per unit effort in  
in Johnstone Strait test fisheries, 1987.

| Week<br>ending                | Catch | Effort<br>(no. of sets) | Catch per<br>Set |
|-------------------------------|-------|-------------------------|------------------|
| Area 12 test fishing          |       |                         |                  |
| Upper Johnstone Strait Vessel |       |                         |                  |
| 06-Sep                        | 44    | 18                      | 2                |
| 12-Sep                        | 59    | 18                      | 3                |
| 19-Sep                        | 1818  | 18                      | 101              |
| 27-Sep                        | 4130  | 23                      | 180              |
| 03-Oct                        | 4382  | 36                      | 122              |
| 10-Oct                        | 20453 | 30                      | 682              |
| 17-Oct                        | 8013  | 40                      | 200              |
| 24-Oct                        | 2898  | 30                      | 97               |
| 31-Oct                        | 5441  | 25                      | 218              |
| 07-Nov                        | 5604  | 30                      | 187              |
| 14-Nov                        | 123   | 19                      | 7                |
| sub total                     | 52965 | 287                     | ave. 163         |
| Area 12 test fishing          |       |                         |                  |
| Mid Johnstone Strait Vessel   |       |                         |                  |
| 06-Sep                        | 92    | 18                      | 5                |
| 12-Sep                        | 290   | 36                      | 8                |
| 19-Sep                        | 870   | 36                      | 24               |
| 27-Sep                        | 2016  | 24                      | 84               |
| 03-Oct                        | 3063  | 30                      | 102              |
| 10-Oct                        | 11838 | 42                      | 282              |
| 17-Oct                        | 8687  | 26                      | 334              |
| 24-Oct                        | 8355  | 38                      | 220              |
| 31-Oct                        | 5355  | 21                      | 255              |
| 07-Nov                        | 2023  | 28                      | 72               |
| 14-Nov                        | 660   | 17                      | 39               |
| sub total                     | 43249 | 316                     | ave. 130         |
| Grand total                   | 96214 | 603                     | 147              |

Table 5. Total catch and weekly total catch per unit effort  
in Fraser River chum test fisheries in 1987.

| Week<br>Ending | Catch per unit effort |        |
|----------------|-----------------------|--------|
|                | Cottonwood            | Albion |
| 03-Oct         | 8.6                   | 14.6   |
| 10-Oct         | 23.1                  | 45.4   |
| 17-Oct         | 51.5                  | 74.1   |
| 24-Oct         | 23.3                  | 52.9   |
| 31-Oct         | 29.3                  | 65.2   |
| 07-Nov         | 41.6                  | 49.0   |
| 14-Nov         | 35.8                  | 83.5   |
| 21-Nov         | 25.2                  | 43.4   |
| 28-Nov         | 28.4                  | 59.9   |
| 05-Dec         | 9.4                   | 18.0   |
| 12-Dec         | 3.0                   | 5.0    |
| 19-Dec         | 0.0                   | 0.5    |
| Total          | 279.1                 | 511.4  |
| Total catch    | 2945                  | 5038   |

Note: rounding errors may be present.

Table 6. Number of inside chum spawning in wild areas, and number spawning in enhanced facilities or spawned or used by hatcheries, in 1987, compared to spawning capacity and to previous five year averages.

| Spawning Areas<br>by Stock Group | Target<br>Escapement | 1987<br>Estimate | 1987 as<br>percent of<br>Target | 1981 - 86<br>Average | 1987 as<br>percent of<br>81-86 Ave |
|----------------------------------|----------------------|------------------|---------------------------------|----------------------|------------------------------------|
| Wild Spawning Areas              |                      |                  |                                 |                      |                                    |
| Upper Vancouver Island           | 33,000               | 580              | 2%                              | 700                  | 83%                                |
| Kingcome Inlet                   | 114,000              | 5,056            | 4%                              | 5,820                | 87%                                |
| Bond to Knight Inlet             | 220,000              | 32,975           | 15%                             | 33,880               | 97%                                |
| Johnstone Strait                 | 137,000              | 16,850           | 12%                             | 69,590               | 24%                                |
| Loughborough/Bute Inlet          | 150,000              | 96,900           | 65%                             | 224,170              | 43%                                |
| Mid Vancouver Island             | 149,000              | 100,544          | 67%                             | 132,550              | 76%                                |
| Toba Inlet                       | 136,000              | 11,961           | 9%                              | 10,540               | 113%                               |
| Jervis Inlet                     | 150,000              | 124,282          | 83%                             | 99,930               | 124%                               |
| Lower Vancouver Island           | 147,000              | 67,935           | 46%                             | 52,640               | 129%                               |
| Southern Vancouver Island        | 238,000              | 263,100          | 111%                            | 149,130              | 176%                               |
| Howe Sound/Sunshine Coast        | 350,000              | 70,208           | 20%                             | 198,530              | 35%                                |
| Burrard Inlet                    | 50,000               | 31,000           | 62%                             | 29,564               | 105%                               |
| Fraser River                     | 700,000              | 431,100          | 62%                             | 651,016              | 66%                                |
| Boundary Bay                     | 5,000                | 246              | 5%                              | 313                  | 79%                                |
| WILD TOTAL                       | 2,579,000            | 1,252,737        | 49%                             | 1,658,372            | 76%                                |
| Enhanced Spawning Areas          |                      |                  |                                 |                      |                                    |
| Mid Vancouver Island             | 150,000              | 125,631          | 84%                             | 170,750              | 74%                                |
| Fraser                           | 30,000               | 42,900           | 143%                            | n/a                  | n/a                                |
| ENHANCED TOTAL                   | 180,000              | 168,531          | 94%                             | 170,750              | 99%                                |
| GRAND TOTAL                      | 2,759,000            | 1,421,268        | 52%                             | 1,829,122            | 78%                                |

Table 7. Percentage of sample estimated to be of Puget Sound origin, as estimated by genetic stock identification analyses, in Canadian fishery areas, 1987.

| Period or<br>Week<br>ending | Area and Source of GSI Samples |                       |                       |                 |                       |                   |
|-----------------------------|--------------------------------|-----------------------|-----------------------|-----------------|-----------------------|-------------------|
|                             | Area 12<br>Test                | Area 14<br>Commercial | Area 17<br>Commercial | Area 20<br>Test | Area 21<br>Commercial | Area 127<br>Troll |
| 11-Jul                      | n/a                            | n/a                   | n/a                   | n/a             | n/a                   | 0.0%              |
| 18-Jul                      | n/a                            | n/a                   | n/a                   | n/a             | n/a                   | 0.0%              |
| 25-Jul                      | n/a                            | n/a                   | n/a                   | n/a             | n/a                   | 0.1%              |
| 01-Aug                      | n/a                            | n/a                   | n/a                   | n/a             | n/a                   | 1.5%              |
| 08-Aug                      | n/a                            | n/a                   | n/a                   | n/a             | n/a                   | 0.1%              |
| 19-Sep                      | 2.9%<br>5.5%                   | n/a                   | n/a                   | n/a             | n/a                   | n/a               |
| 26-Sep                      | 3.3%<br>4.1%                   | n/a                   | n/a                   | 7.1%            | n/a                   | n/a               |
| 03-Oct                      | 0.7%<br>14.8%                  | n/a                   | n/a                   | 16.7%           | 3.9%                  | n/a               |
| 10-Oct                      | 1.7%<br>6.1%                   | n/a                   | n/a                   | 22.5%           | 9.0%                  | n/a               |
| 17-Oct                      | 2.9%<br>6.4%                   | 1.8%<br>2.2%          | n/a                   | 27.4%           | 1.6%<br>0.0%          | n/a               |
| 24-Oct                      | 6.9%<br>8.1%                   | 2.9%<br>1.3%          | n/a                   | 43.5%           | 0.0%<br>0.4%          | n/a               |
| 31-Oct                      | 1.7%<br>1.1%                   | 2.0%<br>0.9%          | n/a                   | 31.4%           | 2.3%                  | n/a               |
| 07-Nov                      | 4.4%<br>4.5%                   | 5.5%<br>10.0%         | n/a                   | 55.9%           | 10.8%<br>3.2%         | n/a               |
| 14-Nov                      | 5.2%                           | 0.3%                  | 16.8%                 | n/a             | n/a                   | n/a               |
| 21-Nov                      | n/a                            | 3.0%                  | n/a                   | n/a             | n/a                   | n/a               |

note : Areas with more than one value in a week indicate more than one sample was obtained.

Table 8. Number of chum salmon sampled for GSI data, 1987.

| Area                                 | Weeks<br>Sampled | Commercial<br>Samples | Test fish<br>Samples |
|--------------------------------------|------------------|-----------------------|----------------------|
| Johnstone Strait                     | 9                | 0                     | 2509                 |
| Qualicum                             | 6                | 1510                  | 0                    |
| Nanaimo                              | 1                | 135                   | 0                    |
| Juan de Fuca                         | 7                | 0                     | 1021                 |
| Nitinat                              | 6                | 985                   | 276                  |
| West coast Vancouver<br>Island Troll | 5                | 0                     | 961                  |

Table 9. Summary of Clockwork catch, escapement and harvest rate, 1987.

| Fishery<br>Type        | Areas     | Total Catch | Contribution to<br>Clockwork | Clockwork<br>Catch |
|------------------------|-----------|-------------|------------------------------|--------------------|
| <hr/>                  |           |             |                              |                    |
| Commercial<br>and Test | 12 & 13   | 66,228      | 100%                         | 66,228             |
|                        | 14        | 345,034     | 9% a                         | 31,053             |
|                        | 29        | 9,474       | 100%                         | 9,474              |
|                        | other     | 15,191      | 0%                           | 0                  |
|                        | sub total | 435,927     |                              | 106,755            |
| <hr/>                  |           |             |                              |                    |
| Indian Food            | 12 & 13   | 22,259      | 100%                         | 22,259             |
|                        | 29        | 26,312      | 100%                         | 26,312             |
|                        | other     | 33,600      | 0%                           | 0                  |
|                        | sub total | 82,171      |                              | 48,571             |
| <hr/>                  |           |             |                              |                    |
| U.S.                   | 7         | 14,411      | 70% b                        | 10,088             |
|                        | 7A        | 11,722      | 95% b                        | 11,136             |
|                        | sub total | 26,133      |                              | 21,224             |
| <hr/>                  |           |             |                              |                    |
| Total Clockwork catch  |           |             |                              | 176,550            |
| Total Escapement       |           |             |                              | 1,421,295          |
| Total Stock            |           |             |                              | 1,960,617          |
| Harvest Rate           |           |             |                              | 9.0%               |

a. Based on GSI data.

b. Based on apportionment methods as per Chum Technical Report 88-4

## West Coast Chum

### I. Conservation and Harvest Management Requirements

West Coast chum return to a number of inlets on the west coast of Vancouver Island. For the purposes of the PST the main stock of concern originates from the Nitinat system, while the commercial fisheries of concern are net harvests adjacent to Nitinat (Areas 21 and 22).

The chum returning to Nitinat are managed so that the wild spawning areas receive their recently revised escapement goal of 200,000 chum, of which 150,000 are required in the Nitinat River, and so that the hatchery obtains its required egg supply. Surpluses are harvested in commercial fishing areas in Area 21, adjacent to the entrance to Nitinat Lake. This commercial fishing area is used instead of fishing in the lake to increase the safety of fishing conditions for the fleet and to improve the quality of the catch. In addition, the commercial fishery for Nitinat chum is managed to allocate the catch between gill and seine net gear types.

An additional ongoing management objective is to quantify the incidence of chum originating in other areas in the Nitinat commercial fishery. This quantification is required for PST information exchange and for domestic stock management purposes.

### II. Run Size Estimation

The only harvestable surplus expected in 1987 was that originating from the hatchery. The wild run size was not predicted. However, some returns were expected.

The enhanced run size expected was 354,500 of which 338,000 were available for harvest. The remainder were to be used to fill the egg take requirements of the hatchery (anticipated to require 16,500 adults).

There are no inseason estimates of run size made in the Nitinat area. Catch and escapement are monitored and commercial harvesting is adjusted accordingly.

The postseason estimate of the run size returning to Nitinat in 1987 was determined by adding escapement to the catch of west coast chum in the Area 21 fishery as determined by genetic stock identification. These are preliminary estimates. Further work is required to determine the accuracy of these estimates. The estimated size of the run was

537,000 (230,000 escapement and 307,000 catch). Nitinat Lake turned over in 1987 causing prespawning mortality of chum adults. The net effective escapement was estimated to be 47,000 chum.

### III. Catch

#### Commercial

The commercial chum salmon fishery in Area 21 was open over a period of five weeks from September 28 to November 6, 1987. The first opening was used to determine the relative abundance of chum in the fishing area. To limit the catch, the area was opened for gill nets only; 29,500 chum were caught. The opening in the following week was also restricted to gill nets. In the weeks following this second opening, both purse seines and gill nets fished the area.

The second week of fishing in Area 21 harvested 59,800 (gill net only). The third week harvested 169,500 chum (combined gill and seine net). The fourth fishery opening harvested 59,800 chum while the final fishery harvested 19,700 chum. Seasonal total catches including commercial, Indian and test fishery landings was 393,600 chum. Incidental catch of other species during the full fishing period were 450 chinook and 6,600 coho.

In the waters off the west coast of Vancouver Island (areas 21-27) the commercial troll fishing fleet harvested 15,500 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.

#### Test and Sample

There were twenty six days of test fishing to monitor chum abundance in Area 21 in the period between the first and last openings. This test fishing harvested an estimated 23,300 chum salmon.

In addition, a total of 985 samples for genetic stock identification were taken from the commercial catch in the five fishing weeks. A further 150 chum were taken in the week of November 7 from the test fishery. The above catches are included in the total commercial catch for the area.

#### Indian

There were 2,500 chum reported in the Indian food fishery in the Nitinat area.



#### IV. Escapement

The escapement to the wild spawning grounds of the Nitinat system was 47,400 after a large mortality of most of the 230,000 chums which had entered Nitinat Lake. This number of spawners was well below the revised escapement goal of 200,000 chum.

There were 5,600 chum which swam into the hatchery. Also, 26,200 chum were taken by seine net in Nitinat Lake and River and used for brood stock. The Nitinat hatchery fell short of its egg take requirement of 23 million; 14.2 million eggs were actually taken.

The gross escapement to the Nitinat system was 261,800 chum.

#### V. Status of Treaty Requirements

There was no specific requirements within the PST to amend domestic management plans for the Nitinat area; however, the treaty required the exchange of information on commercial fisheries that had the potential to intercept chum produced by the other country. To meet this information exchange requirement samples of the commercial fishery in the Nitinat area were taken. These samples were analyzed to determine the pattern of genetically based stock characters and the proportions of the major stocks of concern were identified on a weekly basis.

The genetic stock identification analyses of samples taken in Area 21 indicated that Puget Sound origin chum salmon were present in the area and a range of 0% to 11% of the sampled fish were identified as Puget Sound chum (Table 7) (Naylor et al., 1988).

The troll fishery in Area 1-27, at the top end of Vancouver Island, was also sampled in 1987. The majority of the samples were identified as originating from central and northern British Columbia. The highest percentage of Puget Sound origin chum observed in the samples was 1.5 percent (Table 7).

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**ATTACHMENT 4**

**LOCATION MAPS**



Figure 2.







