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THE PACIFIC SALMON COMMISSION
JOINT CHUM TECHNICAL COMMITTEE REPORT
REPORT TCCHUM (87)-5
FINAL 1986 POST SEASON SUMMARY REPORT

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INTRODUCTION

This Joint Chum Salmon Technical Committee report presents the appropriate information for 1986 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 1986 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 run size passing through 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 1986 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 2,774,000 of which 1,477,000 were to be produced from Inside wild spawning areas, 1,197,000 were from Inside enhancement facilities and 100,000 from U.S. waters. The size of the Fraser River component in the expected total chum run was 977,000, of which 571,000 would be produced from wild spawning areas and 406,000 from enhancement facilities. The remaining wild spawning areas in the Inside area were expected to produce 906,000 chum salmon, while the remaining enhanced return, the majority of which originate from the mid Vancouver Island area, was expected to be 791,000.

The postseason run size of chum salmon returning to Inside waters, including U.S. origin chum salmon returning through Johnstone Strait, as determined from final catch and escapement data, was 3,820,000 fish, 43% above the expected run size. The total return of chum salmon originating from the Fraser River was also 43% above the expected run size and was estimated to be 1,421,000, including estimates of catches in pertinent U.S. and Canadian commercial net 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 239,000. The return of chum salmon of wild origin to Nitinat was not predicted.

The postseason estimate of the run size of chum salmon of Nitinat origin was 451,000, including chum of enhanced and wild origin.

United States

The two areas 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 1,239,000, a high prediction for an even year return, of which 444,000 were from wild spawning areas and 795,000 were from enhancement facilities. The stocks that were expected to contribute the largest returns were: Skagit River (244,000); south Puget Sound (289,000); and Hood Canal (372,000).

The postseason run size, as estimated from run reconstruction, was 1,529,000, a 23% increase over the preseason forecast. Both enhanced and wild stocks showed higher returns, with the exception of wild stocks returning to the Strait of Juan de Fuca tributaries and the Nooksack/Samish area.

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 1986 preseason expected total run size of the Washington coastal chum salmon was 207,000. The actual return, as estimated by run reconstruction, was 153,000.

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. 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 directed chum harvest is permitted in Johnstone Strait, directed chum harvests are also permitted in the Fraser River and in U.S. areas 7 and 7A.

In Johnstone Strait in 1986, commercial fishing data from the third week of September assessment fishery and commercial and test fishing data from subsequent fisheries were used to provide run size estimates. The run size of Fraser River chum was estimated from Johnstone Strait commercial 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 to 10% of the anticipated catch. Genetic stock identification data were used to determine stock composition.

In addition to providing for the U.S. interceptions in areas 7 and 7A, there were domestic requirements to ensure that the needs of the Indian food fishery were met and to allocate the commercial catch between the gill net and purse seine fleets in the southern British Columbia fishery areas.

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 inseason upgrades to the run size passing through Johnstone Strait, the U.S. increased its catch ceiling for the fishery in areas 7 and 7A from 10,000 to the upper limit of 80,000 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 equal sharing of Canadian origin chum taken in all U.S. catch areas.

REVIEW AND EVALUATION OF FISHERIES

Southern British Columbia

Chum salmon fisheries occurred in Johnstone Strait (areas 11 to 13), mid Vancouver Island (Qualicum, Area 14), Fraser River (Area 29) and Nitinat (Area 21). With the exception of the fisheries within the Fraser River, these fisheries have the potential to harvest U.S. origin chum incidentally during harvests directed at Canadian origin chum. Fisheries occurring within the Fraser River do not intercept U.S. origin chum salmon.

The Johnstone Strait gill net and purse seine fisheries directed at chum salmon occurred on September 16 and October 5, 13, and 23. The catch, including early September catches incidental to sockeye fisheries, totaled 1,342,000. Ninety percent of the catch occurred during the 3 days of fishing in October. The mid Vancouver Island gill net fishery began in early October and continued weekly for 5 weeks. A sixth gill net and purse seine fishery occurred in late November. Total catch was 370,000 with 26% of the catch occurring in the later fishery. Two fisheries in October in the Fraser River, one directed at sockeye and one directed at chum salmon, took 76% of the 100,000 total gill net catch in the Fraser area. Nitinat fisheries commenced on September 28 and continued weekly until October 20. Fishing times alternated between gill net and purse seines with a total catch of 390,000.

The catch, during the fall chum period (September 1 onward), for the southern British Columbia net fisheries totaled 1,991,000. This total catch was significantly higher than was expected and was primarily due to the high catches occurring in Johnstone Strait. The West coast troll fishery (areas 1-21 to 1-27) harvested 265,000 chum salmon in July and August, the highest on record. These large catches were thought to be reflective of a large return of summer chum salmon to Canadian central coast areas.

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 from July to late November with 85% of the catch occurring in October. A total of 53,800 chum were caught by Treaty Indians in these areas, which was higher than expected. Fisheries directed at chum salmon in areas 7 and 7A occurred between October 15 and 21 and included two Treaty Indian fishery openings followed by a non-Treaty opening. The catch in these directed fisheries, among all gear types (gill net, reef net and purse seine) in Area 7, and between gill nets and purse seines in Area 7A totaled 43,300 and 31,600, respectively.

Harvest from areas 7 and 7A totaled 93,000 which represents an increase over the expected catch of 80,000. This increase was partially a result of better than expected catches in the Treaty Indian fishery and additional catches in test fisheries for GSI analysis which occurred after the commercial fisheries.

ESCAPEMENT

Southern British Columbia

Inside Chum

Total fall chum salmon escapement was 2,094,000 fish, the second highest since 1950. The wild spawning escapement of 1,881,000 was 31% higher than the 1981-85 average wild escapement and achieved 73% of the identified overall spawning ground capacity. Notable increases in escapements over recent average abundances occurred in the Fraser River, Howe Sound, Johnstone Strait, and Loughborough/Bute Inlet areas. The Fraser River accounted for 38% of the total fall chum escapement.

Inside summer run chum salmon are incidentally caught in July and August fisheries in Johnstone Strait. The escapement of 160,000 is not included in the fall chum salmon escapement total.

West Coast Chum

The Nitinat total escapement of chum salmon was 159,000 of which 143,000 spawned in the wild spawning areas. This escapement exceeded the 1981-85 average of 76,000 and the escapement goal of 125,000.

United States

Puget Sound Chum

The Puget Sound chum salmon escapement of 498,000 was the second highest even 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 77% of the normal timed chum escapement. Early timed chum escapements in the Strait of Juan de Fuca remained in low abundance, while the Hood Canal and South Sound early timed stocks achieved escapements 70% above expected.

Washington Coastal Chum

The chum escapement in Willapa Bay totaled 42,900, 21% above the expectation of 35,400. The Grays Harbor chum escapement of 19,700 was below the expectation of 21,000. Escapement in the Quinault River, where hatchery contributions enhance the run, totaled 5,200 chum.

STATUS OF TREATY REQUIREMENTS

Overall Fishery Management

The PST for 1986 required that Canada manage its inside chum fisheries as it had done in the recent past under the clockwork management strategy. The U.S. would manage its fisheries in Areas 7 and 7A to a catch ceiling dependent on the run size estimated in Johnstone Strait.

The total run size entering Johnstone Strait was estimated using commercial and test fishing data; however, the elimination of some of the test fishing results was a departure from the practice used in 1985. The U.S. perceived a problem with the manner in which Canada was determining the run size and an inseason meeting between technical staffs of both countries was held to review the procedures. A formal protest from the U.S. commissioners was lodged with Canada. At the end of the season the overall harvest rate was 31% as compared to the 30% required by the clockwork plan and the run size was 3,820,000 as compared to the inseason estimate of 3,800,000.

The catch in the U.S. fisheries in areas 7 and 7A totaled 93,000, exceeding the PST limit of 80,000 by 13,000 chum.

Review of (GSI) Programs

The Inside chum salmon fisheries areas sampled for GSI data included Johnstone Strait (Area 12) test and mid Vancouver Island (Qualicum, Area 14) commercial fisheries. The results were comparable with previous years with 24 of the 26 samples indicating that less than 9% of the sampled chum were of U.S. origin. Two samples indicated 20 and 24% of the sampled chum were of U.S. origin. These two high percentages were from samples taken at the start of the run in the Qualicum fishery and from the end of the run in Johnstone Strait.

The sampling on the West Coast waters included: Juan de Fuca

(Area 20) test fishery samples, which showed a range of between 1 and 44% of U.S. origin; Nitinat (Area 21) commercial fishery samples, which showed a range of between 0 and 12% of U.S. origin; and the West coast of Vancouver Island troll fishery (Area 1-27) samples, which showed a range of between 1 and 3% of U.S. origin. This was the first year of sampling in the West coast troll fishery.

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

In addition, a GSI subcommittee was formed to review and reconcile any differences in approach to GSI by Canada and the U.S. The GSI subcommittee work is expected to be complete by February, 1988.

ATTACHMENT 1

Chapter 6 of Annex IV of the Pacific Salmon Treaty

Chapter 6

SOUTHERN BRITISH COLUMBIA - WASHINGTON CHUM FISHERIES

Considering that anticipated returns of some natural salmon stocks originating in Johnstone Strait, the Strait of Georgia, the Fraser River, Puget Sound, Juan de Fuca Strait and Nitinat Lake are expected to be weak and therefore not likely to provide a harvestable surplus in 1985, although some enhanced stocks originating in these areas may provide harvestable surpluses and anticipating locally directed fisheries on such enhanced stocks, the Parties shall

1. No later than March 31, 1985, establish a Joint Chum Technical Committee (Committee) reporting, unless otherwise agreed, to the Southern Panel and the Commission, to, inter alia,

- (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 in order 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) develop analytical methods to permit the exploration of alternative regulatory and production strategies;
- (f) identify information and research needs, to include future monitoring programs for stock assessments;
- (g) develop fishery regimes for the 1985 season and thereafter;

2. no later than August 15, 1985, instruct the Committee to present a report to the Parties on the activities set out in paragraph 1 herein.

"3. Implement the following regimes for 1986 only, which are not designed to address long term management objectives of the parties:

(a) Canada shall conduct their Johnstone Strait, Georgia Strait and Fraser River chum fisheries consistent with the clockwork management scheme developed for 1984 and 1985, except as modified herein.

(b) The United States will conduct Area 7 and 7A chum fisheries as follows:

(i) The following catch ceilings for United States fisheries will be implemented:

Allowable Total Harvest Rate	Total Stock Size	Area 7 and 7A Ceiling
10 percent	< 2.6 million	10 thousand
≥ 20 percent	≥ 2.6 million	80 thousand

It is understood that of the 80 thousand it is expected that 60 thousand chum of Fraser River origin will be harvested.

It is also understood that total stock size refers to estimated pre-season and in-season update of chum salmon passing through Johnstone Strait, Georgia Strait, Fraser River and Areas 7 and 7A calculated according to the clockwork approach.

(ii) If the Fraser River component of the total run is reduced from the current pre-season forecast by the in-season updates to the extent that, despite a total run size of greater than 2.6 million, the Fraser River component of the total run could not support a fishery and meet a minimum escapement goal, and Canada restricts fisheries in Johnstone Strait and the Fraser River to remain below a 10 percent exploitation rate on Fraser River chum, then United States Areas 7 and 7A fisheries would be limited to a catch of 10,000 chum.

(c) The fishery management plan described herein is predicated on the following assumptions:

(i) All catch of Fraser River origin chum taken in Johnstone Strait, Georgia Strait, Fraser River and Areas 7 and 7A fisheries is included in the allowable total harvest rate.

- (ii) If there is an adjustment to the run size estimates, all three components of the run (Canadian enhanced and natural, and United States stocks) will be adjusted in proportion to the change from the preseason forecast until sufficient GSI data is available to more accurately apportion the total run size.
- (iii) The escapement targets are those specified in the 1984 and 1985 clockwork management plan. All fish not harvested at the allowable harvest rate under the plan will be allowed to escape and spawn.
- (d) If during subsequent domestic consultation on the 1986 fishing plan Canadian chum salmon managers decide to make deviations from the general approach or the specific assumptions outlined in paragraph (c), the Southern Panel Chair and Vice-Chair will be notified and a decision made as to the need for convening a Southern Panel meeting to develop appropriate changes to the management plan specified in paragraph (b).
- (e) The United States fisheries will be managed in a manner that, as far as practicable:
 - (i) spreads the impact on all portions of the Fraser run,
 - (ii) maintains a traditional proportion of effort and catch between Areas 7 and 7A, and avoids concentrations of effort along the boundary."

ATTACHEMENT 2

**FINAL 1986 POST SEASON SUMMARY REPORT ON
CHUM SALMON
CANADIAN AGENCY REPORT**

Canadian Chum Salmon 1986

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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 in southern British Columbia and Washington be managed in a specified manner in 1986. Other fisheries, while not specifically mentioned in the PST, are known to harvest chum originating from the other country. This report discusses various aspects of the chum salmon 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 specifically discusses the management actions of Canada in relation to the PST requirements.

Inside Chum

I. Conservation and Harvest Management Requirements

Inside chum salmon 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 manage to achieve the present estimate of optimum wild escapements while augmenting production through enhancement of selected stocks. In practice, harvest rates in mixed stock areas are set at levels compatible with wild stock productivity while additional harvesting may occur in terminal areas when local surpluses are identified.

In past years, chum escapements to inside streams have averaged less than half the number required to provide maximum production. In order 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 1985, the PST added impetus to improving chum production from both Canadian and U.S. areas. The following describes the 1986 clockwork process and PST requirements for Inside chum and specifically discusses the Fraser River and mid Vancouver Island 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., 1987). The primary objective of the clockwork

strategy was to rebuild wild chum salmon 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 related in a specified manner 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 1986 were:

- a. below 2.6 million, up to a 10% harvest rate;
- b. 2.6 to 3.3 million, maximum of 20% harvest rate;
- c. 3.3 to 4.9 million, maximum of 30% harvest rate; and
- d. over 4.9 million, maximum of 40% harvest rate.

The clockwork strategy was developed to limit the harvest in a large area containing numerous mixed stocks; however, it was recognised that harvesting in terminal areas would be required, particularly in areas of major enhancement. In 1986, the main terminal areas to be fished were in the Fraser River (Area 29) and mid Vancouver Island (Qualicum, Area 14) areas. Other terminal harvests occurred on wild origin stocks in Bute Inlet (portions of Area 13) and on a mixture of wild and enhanced origin chum adjacent to the Cowichan River (Area 18) (Figure 1).

ii. Canada/U.S. Treaty

The 1986 changes to the PST were negotiated on the understanding that Canada would manage the 1986 Johnstone Strait, Georgia Strait and Fraser River chum fisheries consistent with the clockwork management scheme used in 1984 and 1985, while the U.S. would limit the harvest of chum salmon in areas 7 and 7A to 10,000 total chum if the Canadian run size was less than 2.6 million and to a ceiling of 80,000 total chum if the run size exceeded 2.6 million (Appendix 1).

In essence, the PST specified that if the return was weak, Canada would limit the clockwork harvest rate to 10% and the U.S. would not have a directed chum fishery in the Point Roberts and San Juan Islands areas. The PST further provided for a U.S. fishery of up to 80,000 in the Point Roberts and the San Juan Islands areas, if the Canadian run size estimate exceeded 2.6 million chum and Canada harvested at a rate 20% or greater. During the 1986 chum season, stock size estimates increased from preseason and early inseason indications and consequently, Canada fished to the objective of a 30 percent harvest rate. An assessment of the performance of the management of the 1986 season in relation to treaty requirements is included in Section V of this report.

iii. Fraser River Chum

The chum produced from the Fraser River were of major importance during the discussions leading up to the development of the clockwork harvest strategy as well as to the negotiation of the PST. The Canadian clockwork plan includes provisions for specific escapement goals, stock size estimates, catch estimates, and fishing area limitations for Fraser River chum.

In 1986, as in earlier years of the clockwork, the minimum acceptable escapement goal for Fraser River chum was set at 500,000. The catch of Fraser River chum salmon in all fishing areas is estimated to determine run size. In some areas, estimates of the catch of Fraser River chum are determined through genetic stock identification analyses, while in other areas catch is based on traditional perceptions of catch composition. Specifically, Johnstone and Georgia strait and west coast of Vancouver Island fisheries were sampled to estimate Fraser River catch while the catch of Fraser River chum in U.S. fisheries was based on Washington Department of Fisheries (WDF) catch composition data.

In 1986, the clockwork plan specified that the commercial chum fisheries in the Fraser River was restricted to a similar number of openings as occurred in Johnstone Strait. In addition, the mid Vancouver Island chum fishery, occurring in Area 14, was reduced in area in order to limit the catch of Fraser River chum.

iv. Mid Vancouver Island Chum

The chum produced in the mid Vancouver Island area are produced primarily from the enhancement facilities. A portion of the return would be harvested, within Johnstone Strait, under the prevailing clockwork harvest rate; however, the majority of the catch was expected to occur in the mid Vancouver Island area. Terminal harvesting was directed at surplus enhanced chum; however, the conservation requirements of passing chum stocks was considered and limitations to harvest times and areas in the mid Vancouver Island fishery area were instigated. In 1986, one of the objectives was to limit the harvest of Fraser River chum to less than 10 percent of the total catch in the area. The conservation requirements of chinook and coho salmon present in the chum fishery area were also considered when determining areas and times to open the Area 14 fishery.

II. Run Size Estimation

Run size estimates are prepared prior to the season in order to develop preliminary plans to meet conservation requirements as well as domestic and international allocations.

As the season progresses revisions to the run size estimates are made to amend harvest plans in accordance with the clockwork approach.

i. Preseason

Prior to the 1986 salmon fishing season, a forecast was developed for the total return of Inside chum salmon, including wild and enhanced origin chum. Separate forecasts were developed for the wild and enhanced Fraser River and enhanced mid Vancouver Island chum.

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 1986 preseason forecast of Inside wild chum was 1,477,000 including 571,000 Fraser River chum and 906,000 non Fraser chum (Table 1).

The number of enhanced origin chum expected 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 1986 run size estimate for enhanced origin Fraser River chum was 406,000 while the mid Vancouver Island area was expected to produce 735,000 enhanced chum. In addition, there were 56,000 enhanced origin chum estimated to be returning to other areas including the Howe Sound, lower Vancouver Island, and Jervis Inlet areas. The total run size estimate for enhanced Inside chum salmon was 1,197,000 (Table 1).

The total inside chum run size was estimated at 2,674,000 million (1,477,000 wild and 1,197,000 enhanced). In addition, past data have shown that some 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 2,770,000 chum (1,477,000 wild Canadian, 1,197,000 enhanced Canadian, and 100,000 U.S. chum).

ii. Inseason

The catch of chum salmon 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 31.9 percent over the period 1969 to 1984. This is the first inseason run size estimator within the clockwork harvest management plan.

The third week of September run size estimate was 3,000,000 chum, 8% higher than the preseason forecast (Table 2). The harvest rate allowable under the clockwork plan remained at 20

percent. Canadian Inside chum stocks were assumed to be returning at an increased rate of return; however, because no qualitative forecast of U.S. chum passing through Johnstone Strait was available it was decided that the U.S. component would remain fixed at 100,000 chum. Revision to the estimated run size of Fraser River chum resulted in a new estimate of 1,082,000 as compared to the preseason estimate of 977,000. The mid Vancouver Island and other Canadian Inside wild and enhanced chum run sizes were adjusted upwards.

Subsequent inseason run size estimates were based on the chum catch and effort data from the Johnstone Strait commercial fisheries, or, from the upper Johnstone Strait test fishing results. The second inseason estimate was available following two weeks of test fishing and the commercial evaluation fishery in Johnstone Strait. The combined commercial and test fishing data to the fourth of October indicated a total run size of 3,329,000 entering Johnstone Strait which indicated the presence of a stock which could be subjected to a 30 percent harvest rate. The Fraser River and other inside wild and enhanced chum stock run size estimates were increased proportionately (Table 2). As stated earlier, the U.S. run size estimate was not increased.

During the remainder of October, test fishing continued and commercial harvests to increase the catch to 30% of the total run size were permitted. Inseason run size estimates were made on a weekly basis utilizing a combination of commercial and test fishing results. At the end of October, the combination of commercial and test fishing data indicated a run size of 3,800,000 chum. The combined data from commercial and test fisheries were used to determine the best estimate of the run size in 1986 (Table 2). The final estimate of the Fraser River run size, based on a combination of commercial and test fishing data from Johnstone Strait, was 1,338,000 chum. The remaining wild chum run size was increased to 1,355,000 while the enhanced mid Vancouver Island run size was 1,007,000 chum.

Inseason, the Fraser River chum run size is estimated from data from Johnstone Strait and also from the Fraser River. The final inseason estimate available from Johnstone Strait test fishing was 1,338,000 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 estimate of the total run size of Fraser River chum derived from inriver test fishing data was 1,523,000 chum (Table 2).

iii. Postseason

At the end of the season, catch in all Inside areas and gross escapements were summed to determine the estimated actual run size for all stocks. In addition, the total run size of Fraser River chum salmon was calculated by applying stock composition data derived from genetic stock identification (GSI) samples in selected areas.

The postseason run size estimate for chum was 3,820,000 (2,094,000 gross escapement and 1,726,000 total of all catch in Canadian Inside waters and catch of Canadian chum in U.S. areas 7 and 7A). This estimate was virtually the same as the final inseason estimate of 3,800,000 chum salmon.

The Fraser River postseason run size estimate, including the catch of Fraser River chum in U.S. and Canadian west coast of Vancouver Island waters, was 1,421,000 (823,000 gross escapement and 598,000 total of catch in Canadian and U.S. waters). The WDF estimated the catch of Fraser chum in U.S. areas 7 and 7A at 67,200, while the WDF estimate of the catch of Fraser chum in U.S. Juan de Fuca Strait area was 17,100. The catch of Fraser chum in the Nitinat commercial net fishery, estimated through analysis of GSI data, totaled 26,300 chum.

III. Catch

Inside chum salmon are harvested by commercial, Indian food, and test fishermen and by biological samplers. In 1986, the preseason run size forecast indicated that commercial, test and Indian fishermen would be limited to 20% of the total run size estimated to be passing through Johnstone Strait. Inseason run size information indicated a larger allowable harvest rate, i.e. 30 percent of the total run, and the commercial catch limit was raised. The catch by fishing group and area follows.

i. Commercial

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

The 1986 Johnstone Strait fishery (areas 11, 12 and 13), began in July and ended in mid October. During the July and August period the Johnstone Strait fishery was directed at harvesting sockeye salmon; however, during those two months 213,000 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.

In 1986, commercial harvesting was permitted in Johnstone Strait during the third week of September and 83,700 chum salmon were caught. The clockwork management plan permits a directed commercial chum assessment fishery in the third week of September. The catch and effort in this fishery was used to develop the first inseason run size estimate of 3,000,000 (Table 3).

This run size indicated that a 20% harvest rate could be allowed and a further one day fishery could be permitted in

Johnstone Strait. This further commercial fishery occurred in the second week of October and harvested 391,000 chum. The available commercial data on chum catch and effort in Johnstone Strait was used to estimate total run size and indicated a return of 3,329,000 chum which, according to the clockwork plan, indicated an allowable harvest rate of 30 percent. Further fisheries occurred in the third and fourth week of October. The seasonal total catch of chum salmon during the fall chum period in the Johnstone Strait fishery was 1,047,000.

In 1986, there was a commercial fishery directed at summer run chum salmon in Bute Inlet, a terminal fishery area located in a portion of Area 13, adjacent to lower Johnstone Strait. This fishery took place during the period September 21 to October 18 and harvested 85,000 chum salmon (Table 3).

The Strait of Georgia chum fishery was limited to two areas, the mid and southern Vancouver Island areas (portions of areas 14 and 18). These commercial fisheries were mainly directed at enhanced chum. In Area 14, the first opening occurred in the second week of October. Commercial fishing continued for the next four weeks and during those weeks of fishing a total of 275,000 chum were caught. Commercial harvesting was closed until the enhancement facilities and adjacent stream areas had received their escapement goals. At this time, a further commercial harvest was permitted and 94,700 chum were caught. This brought the total catch in the directed commercial chum fishing period to 3680,000 (Table 3). In Area 18 there was a one day fishery which caught 2,100 chum.

The 1986 Fraser river commercial net fishery began in August and harvesting from that time until the first week of October was directed at sockeye salmon surpluses. Chum were first reported in the Fraser River area in June when 11 chum were reported in the troll catch. There were no further chum reported in the Fraser River area catch until the gill net fleet began operation in the first week of August. During August, a total of 1,700 chum were harvested. During September and up to the end of the first week of October there were 35,100 chum caught in fisheries initiated by the Fraser River Panel (Table 3). These fisheries were directed at harvesting sockeye salmon and included inriver and outside of the river harvest areas.

In the fourth week of October, a commercial fishery directed at harvesting a surplus of early run chum salmon and the test fishery vessels in Area 29 caught a total of 55,100 chum. There was no further commercial salmon fishing in Area 29 for the balance of the 1986 season. The reported commercial and test fishing catch of chum in the Fraser River area totaled 98,900.

ii. Test and Sample

The abundance of chum salmon is monitored through test fishing programs in Johnstone Strait and the Fraser River. In

addition, biological sampling for genetic stock identification is conducted in Johnstone Strait and in the mid Vancouver Island area.

The abundance of chum salmon in Johnstone Strait in 1986 was assessed, in part, through test fishing by two seine vessels in Area 12. The test fishing in Area 12 began in early September and continued until early November (Table 4). During that time the two vessels caught a total of 132,000 chum, the majority of which were released unharmed while the remainder were retained as payment for the operation of the seine vessels and for biological samples.

The Area 12 test fishing catches were utilized to determine relative weekly chum abundance and the magnitude of the total run entering Johnstone Strait. The weekly pattern of abundance indicates a peak of abundance in the third week of October (Table 4). The data used in the relationship between catch per unit effort in the test fishery and the total run size was updated weekly throughout October to assist in the determination of the inseason estimates of the run size (Table 2).

Within the Strait of Georgia, there were no further biological data collection projects involving the direct capture of chum in 1986.

The remaining area to be test fished was the Fraser River. Within the river 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 overall size of the run entering the Fraser River and to monitor daily abundance of the run. This daily test fishery began on October 1 and continued until late December. During this period a total of 5,500 chum were caught (Table 5). The first estimate of the size of the run entering the river was developed in late October and indicated that approximately 1,377,000 chum would be returning (Table 2). The remaining run size estimates are shown in Table 2. Table 5 shows two peaks of abundance at Cottonwood; the first in mid October and a second in mid November.

The test fishery at Albion, which monitors the rate of upstream movement, began on October 1 and continued until late December. During this period 5,600 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 late November.

iii. Indian

Native people within British Columbia are permitted to harvest chum salmon 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. The data for Johnstone and Georgia straits includes marine and stream catches.

In 1986, the Indian food fishery in Inside waters harvested 51,000 chum salmon, of which the food fishery in Johnstone Strait harvested a total of 15,600 chum, the majority of which were taken in marine waters in October. In the Strait of Georgia there were 18,700 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 total of 16,700 chum, an average catch for this fishery.

IV. Escapement

Chum salmon which escape the commercial, test, sampling, and Indian fisheries form the gross escapement to inside chum salmon streams. This gross escapement is made up of chum which spawn in wild areas, those which are spawned in hatcheries, and those which are surplus to hatchery 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 chum stock 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 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 1,881,000; the second highest escapement recorded since systematic records began in the late 1940's. High escapements were observed in the Fraser River (791,000) and the Loughborough/Bute Inlet (302,000) stock areas. where the stated spawning escapement goals were attained (Table 6). The estimated numbers of fall chum spawning in most wild spawning areas were above the averages observed during the 1981-85 period (Table 6).

The fall chum spawning escapement in wild spawning areas was 73% of the present total spawning goal of 2,579,000 chum; there were only two of the fourteen stock areas which received escapements at or above their goals, the Fraser River and Loughborough/Bute areas.

ii. Hatchery

The enhanced escapement areas are presently limited to the mid Vancouver Island and Fraser River areas. The enhancement facilities in both these areas received 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; however, some chum are sold as surplus to hatchery requirements.

iii. Gross

The gross escapement in 1986 was estimated at 2,094,000 fall chum of which 1,881,000 spawned in wild or natural spawning areas. The remaining 213,000 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 chum PST in 1986 specified that Canadian Inside commercial fisheries were to be managed within 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 run size in Canada.

In 1986, the inseason run size estimates were based on information from test and commercial fisheries. The commercial evaluation fishery in the third week of September indicated a run size of 3,000,000 slightly higher than the preseason forecast, but still limiting the harvest rate to 20% of the total run. This estimate of the run size was not supported by the subsequent two weeks of test fishing data, which indicated a run size of only 2,300,000 and an associated allowable harvest rate of 10%. After reviewing the predictive capacities of the commercial and test fishery data, DFO decided that the commercial data was more reliable and the commercial catches in Johnstone Strait were used as the indicator of run size. Large run sizes in the commercial catches in the Canadian central coast and West coast troll fisheries tended to support the larger estimate for Inside chum.

The results of the early October commercial harvests in Johnstone Strait indicated that the run size was over 3,300,000 and that the 30% harvest rate should be permitted. The last inseason estimate of total run size of 3,800,000 was based on a combination of commercial and test fishery data and confirmed the objective of harvesting at the 30% rate.

This run size and the associated harvest rate indicated that the appropriate total catch should be 1,142,000 in the Canadian and U.S. clockwork area fisheries (Johnstone Strait, Fraser River, and U.S. areas 7 and 7A). At the end of commercial fishing the appropriate total catch in these areas was 1,221,000. This catch level was 79,000 higher than expected and the overall harvest rate was then estimated at 31 percent. The main areas which caught more than expected were the U.S. areas 7 and 7A (actual total catch 93,000; expected total catch of 80,000) and Johnstone Strait and Fraser river areas (actual catch 1,145,000; expected catch 1,072,000).

The total run size, reconstructed after the season, was approximately 3,820,000 chum salmon, very close to the inseason estimate of 3,800,000 using commercial and test fishing data, but higher than that estimated by test fishing data alone. The overall harvest rate within the appropriate Canadian and U.S. fisheries was 31 percent, very close to the objective of 30%.

ii. Stock Identification

Genetic stock identification was conducted in a number of areas in 1986. The majority of the GSI work concentrated on sampling of commercial fishery areas or commercial catches.

The Inside commercial fishery areas sampled in 1986 were upper Johnstone Strait (Area 12), mid Vancouver Island (Area 14). The sampling in Area 12 was from the test fishery while the Area 14 samples were from commercial fishing vessels. Table 7 summarizes the observed percentage in each of the samples which was identified as of Puget Sound origin chum for each of the areas sampled in 1986. Further details can be found in Vreeling et al, 1987.

The results indicate that the percentage of Puget Sound origin chum salmon in Area 12 was below 8 percent except for one sample in early November that indicated that 20.5% of the sample was of Puget Sound origin (Table 7). The commercial fishery was not open when this relatively high percentage was observed. The Area 14 samples were all below 9 percent Puget Sound origin chum except for one sample in early October which indicated that 24 percent of the sample was of Puget Sound origin chum (Table 7). The commercial fishery in the week of the relatively high percentage harvested a total of 8,900 chum (Table 3).

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 escapement goal of 125,000 and the hatchery obtains it's 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 share 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 1986 was that originating from the hatchery. The wild run size was not predicted.

The enhanced run size expected was 239,000 of which 228,000 were available for harvest. The remainder were to be used to fill the egg take requirements of the hatchery (11,000 adults).

There are no inseason estimates of run size made in the Nitinat area.

The postseason estimate of the run size returning to Nitinat in 1986 was determined by adding escapement to the catch of west coast chum in the Area 21 fishery as determined by genetic stock identification. The estimated size of the run was 547,000 (160,000 escapement and 387,000 catch).

III. Catch

Commercial

The commercial chum salmon fishery in Area 21 was open over a period of four weeks in September and October, 1986. 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; 12,700 chum were caught. The opening in the

following week was also restricted to gill nets. In the week following this second opening, seines were given 4 days, and gill nets 5 days. A final opening for gill net only occurred on October 19 and 20. The area was closed on October 21. The area did not reopen again in 1986.

The second and third weeks of fishing in Area 21 harvested 34,000 (gill net only) and 328,000 (combined gill and seine net) chum, respectively. The final fishery opening harvested 5,500 chum and brought the seasonal total chum catch to 380,200 which includes Nitinat and passing stocks. Seasonal total catches including commercial, indian and test fishery landings was 387,500.

In the waters off the west coast of Vancouver Island the commercial troll fishing fleet harvested 265,000 chum salmon, the highest reported catch for this fishery. 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 thirteen days of test fishing to monitor chum abundance in Area 21 in the period between the first and last openings. This test fishing harvested 7,300 chum salmon.

In addition, a total of 450 samples for genetic stock identification were taken from the commercial catch in the first three fishing weeks and a further 289 fish were taken in weeks ending October 25 and November 1 from the test fishery. The above catches are included in the total commercial catch for the area.

Indian

There were 4,000 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 143,400; significantly above the escapement goal of 125,000. In addition, there were 3,415 chum which swam into the hatchery for brood stock. Also, 13,118 chum were taken by seine net in Nitinat Lake and River and used for brood stock. Therefore, the gross escapement to the Nitinat system was 159,933 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 0.0% to 11.9% of the sampled fish were identified as Puget Sound chum (Table 7) (Vreeling et al, 1987)

Additional genetic stock identification information was taken from a test fishery in Juan de Fuca Strait (Area 20). The Juan de Fuca area was sampled over six weeks beginning in September. The observed percentages of Puget Sound origin chum in the samples ranged from 0.7% to 43.7% (Table 7) (Vreeling et al, 1987).

The troll fishery in Area 1-27, at the top end of Vancouver Island, was also sampled in 1986. The majority of the samples were identified as originating from central and north coast of British Columbia areas. The highest percentage of Puget Sound origin chum observed in the samples was 3.2 percent (Table 7).

References

Anon., 1987. Final 1985 Post Season Summary Report. Pacific Salmon Rpt. TCCHUM (87)-4

Vreeling, M.C., L. Hop Wo, A.P. Gould, W. Luedke, S.R. Heizer and T.D. Beacham, 1987. Biochemical Genetic Stock Identification of Chum Salmon In Southern British Columbia, 1986 Can. Data Rpt. Fish. Aquat. Sc. 634

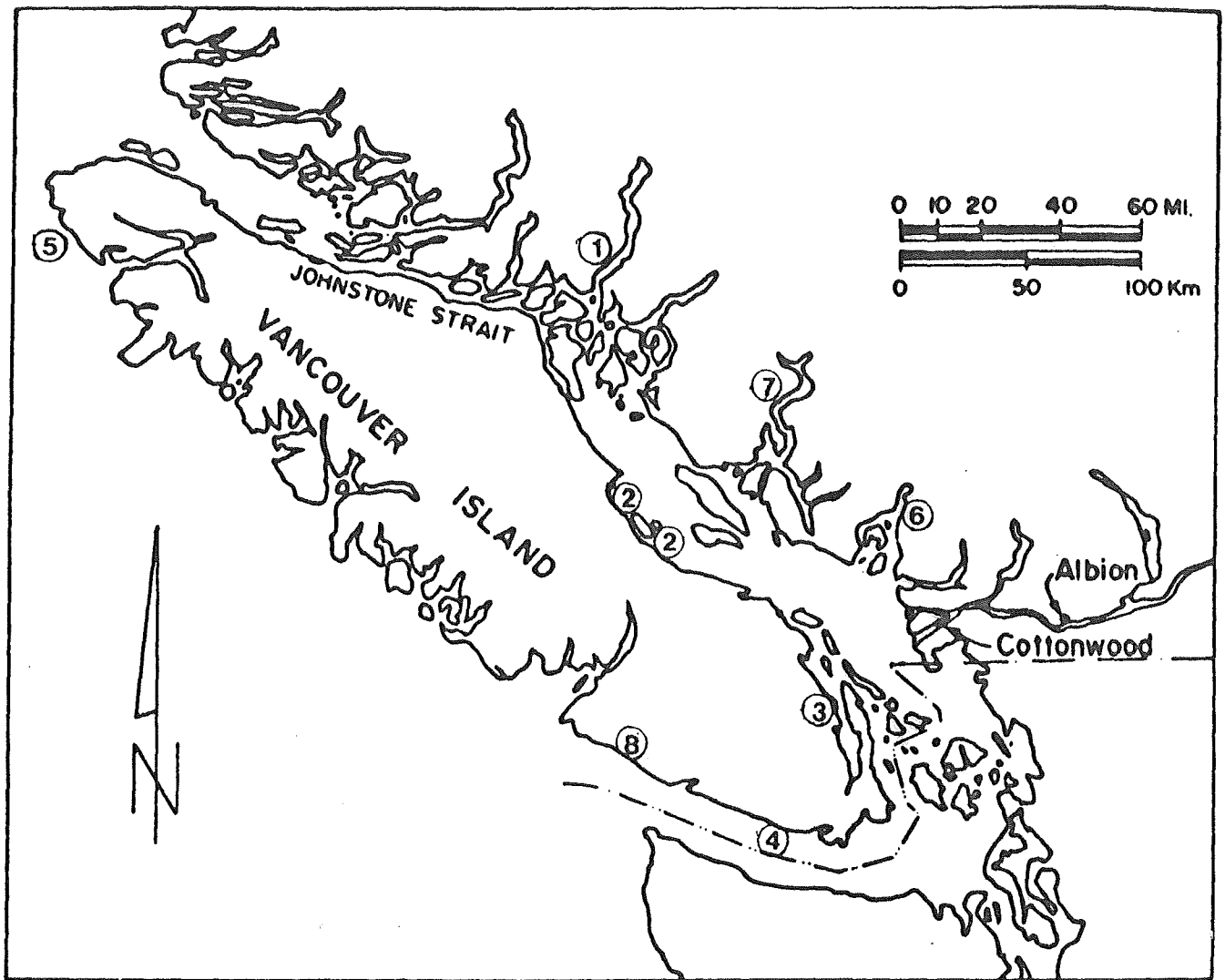


Figure 1. Major geographic locations relevant to southern British Columbia chum salmon. Numerical indicators of areas are: 1 - Bute Inlet; 2 - Mid-Vancouver Island, Qualicum, Area 14; 3 - Cowichan, Area 18; 4 - Juan de Fuca Strait, Area 20; 5 - Northwest Vancouver Island, Area 1 - 27; 6 - Howe Sound; 7 - Jervis Inlet; 8 - Nitinat, Areas 20 and 21.

Table 1. Preseason run size estimates by stock, 1986.

Stock	Origin	Estimated run size	Percentage of grand total

Canadian Inside Chum			

Fraser River :	Wild	571,000	
	Enhanced	406,000	
		sub-total	977,000 35.2%
Mid Vancouver Island :	Wild	a.	
	Enhanced	735,300	
		sub-total	735,300 26.5%
Other Stocks :	Wild	905,900	
	Enhanced	55,700	
		sub-total	961,600 34.7%
Total Inside Stocks :	Wild	1,476,900	
	Enhanced	1,197,000	
		Canadian total	2,673,900 96.4%
American Chum			

Puget Sound :		100,000	
		American total	100000 3.6%
		Grand total	2,773,900 100.0%

a. Included in Total Inside Stocks, wild total

Table 2. Summary of the preseason run size estimates, inseason run size estimates developed from test fishing, and the postseason run size estimates, 1986.

Month & Week ending	Total	American	Canadian Total	Fraser	Mid Vancouver Island	Other Inside Canadian
Preseason	2,773,900	100,000	2,673,900	977,000	735,300	961,600
Inseason						
Johnstone Strait test fishery						
September						
Sept 20	3,000,000	100,000	2,900,000	1,057,000	795,000	1,048,000
October						
Oct 4	3,000,000	100,000	2,900,000	1,057,000	795,000	1,048,000
Oct 11	3,329,000	100,000	3,229,000	1,173,000	882,000	1,174,000
Oct 18	3,600,000	100,000	3,500,000	1,268,000	954,000	1,278,000
Oct 25	3,800,000	100,000	3,700,000	1,338,000	1,007,000	1,355,000
Fraser River test fishery						
October						
Oct 25	n/a	n/a	n/a	1,377,000	n/a	n/a
November						
Nov 1	n/a	n/a	n/a	1,524,000	n/a	n/a
Nov 8	n/a	n/a	n/a	1,524,000	n/a	n/a
Nov 15	n/a	n/a	n/a	1,543,000	n/a	n/a
Nov 22	n/a	n/a	n/a	1,523,000	n/a	n/a
Postseason	3,868,000	n/a	n/a	1,421,000	a.	n/a

a. Includes estimates of Fraser chum caught in U.S. areas 4b, 5, 6, 7 & 7A and in Canadian areas 12, 13, 14, 20, 21, 29.

Note: remaining postseason run sizes cannot be determined until GSI data is analyzed.

Table 3. Catch of chum salmon by statistical area for all commercial salmon gear types and including test fish landings, 1986.

Period or Week ending	Statistical Areas							Total
	11	12	13	Bute	14	15-18	29	
06-Sep	261	12590	2776	0	1	87	745	16460
13-Sep	0	0	0	0	0	5	353	358
20-Sep	0	59129	24571	0	3	3	61	83767
27-Sep	0	11237	182	6296	10	6	8835	26566
04-Oct	0	0	75	227	60	3	25142	25507
11-Oct	0	237986	152799	45567	8958	0	905	446215
18-Oct	0	177937	115642	32947	34558	0	1073	362157
25-Oct	0	91028	157464	0	43376	2108	55132	349108
01-Nov	0	0	3285	0	93212	0	1170	97667
Nov. 2 to Nov.29	0	0	330	0	187792	2	3304	191428
Nov.30 to Dec.31	0	0	0	0	0	0	521	521
Total	261	589907	457124	85037	367970	2214	97241	1599754
Prior to 30-Aug	108986	93724	8030	0	679	151	1681	213251
Grand total	109247	683631	465154	85037	368649	2365	98922	1813005

Source: British Columbia Commercial Catch Statistics, 1986.

Table 4. Catch, effort and catch per unit effort in Johnstone Strait test fisheries, 1986.

Week ending	Catch	Effort (no. of sets)	Catch per Set
Area 12 test fishing			
Upper Johnstone Strait Vessel			
06-Sep	144	17	8
13-Sep	606	18	34
20-Sep	5645	20	282
27-Sep	3433	30	114
04-Oct	6083	30	203
11-Oct	7329	30	244
18-Oct	29291	24	1220
25-Oct	4363	24	182
01-Nov	688	30	23
08-Nov	963	26	37

sub total	58545	249	ave. 235
Area 12 test fishing			
Mid Johnstone Strait Vessel			
06-Sep	130	18	7
13-Sep	643	18	36
20-Sep	1605	18	89
27-Sep	6274	30	209
04-Oct	10888	30	363
11-Oct	10686	30	356
18-Oct	21570	24	899
25-Oct	14305	20	715
01-Nov	5325	23	232
08-Nov	2353	24	98

sub total	73779	235	ave. 314

Grand total	132324	484	273

Table 5. Total catch and weekly total catch per unit effort
in Fraser River chum test fisheries in 1986.

Week ending	Catch per unit effort	
	Cottonwood	Albion
04-Oct	20.56	19.07
11-Oct	61.53	85.19
18-Oct	109.99	85.26
25-Oct	70.70	56.09
01-Nov	84.22	82.30
08-Nov	25.67	53.42
15-Nov	9.61	36.61
22-Nov	50.62	67.25
29-Nov	30.41	54.74
06-Dec	29.58	13.97
13-Dec	1.33	2.75
20-Dec	0.00	0.00
Total	494.23	556.66
Total catch	5,528	5,635

note: rounding errors may be present.

Table 6. Number of inside chum spawning in wild areas, and number spawning in enhancement facilities or spawned or used by hatcheries, in 1986, compared to spawning capacity and to previous five year averages.

Spawning Areas and Stock group	Capacity of Spawning Areas	1986 Estimate	1986 as percent of Capacity	1981 - 85 Average	1986 as percent of 1981 - 85 Ave.
Wild Spawning Areas					
Upper Vancouver Island	32,900	900	3%	500	180%
Kingcome Inlet	113,500	2,400	2%	9,240	26%
Bond to Knight Inlet	220,000	26,600	12%	41,160	65%
Johnstone Strait	137,000	98,100	72%	41,080	239%
Loughborough/Bute Inlet	150,000	302,400	202%	145,940	207%
Mid Vancouver Island	149,000	139,500	94%	125,600	111%
Toba Inlet	136,000	4,900	4%	16,180	30%
Jervis Inlet	149,800	92,100	61%	107,760	85%
Lower Vancouver Island	147,400	33,100	22%	72,180	46%
Southern Vancouver Island	238,500	136,000	57%	162,260	84%
Howe Sound/Sunshine Coast	350,000	221,010	63%	176,049	126%
Burrard Inlet	50,000	32,731	65%	26,397	124%
Fraser River	700,000	791,078	113%	510,954	155%
Boundary Bay	5,000	268	5%	357	75%
Wild Total	2,579,100	1,881,087	73%	1,435,657	131%
Enhanced Spawning Areas					
Mid Vancouver Island	150,000	181,200	121%	160,300	113%
Fraser River	30,000	31,568	105%	n/a	n/a
Enhanced Total	180,000	212,768	118%	160,300	133%
Grand Total	2759100	2093855	76%	1595957	131%

Table 7. Percentage of sample estimated to be of Puget Sound origin, as estimated by genetic stock identification analyses, in Canadian fishery areas, 1986.

Period or Week ending	Area and Source of GSI Samples				
	Area 12 Test	Area 14 Commercial	Area 20 Test	Area 21 Commercial	Area 127 Troll
29-Jun					
13-Jul	n/a	n/a	n/a	n/a	3.2%
14-Jul					
18-Jul	n/a	n/a	n/a	n/a	2.6%
24-Jul					
04-Aug	n/a	n/a	n/a	n/a	1.3%
06-Sep	4.5%	n/a	n/a	n/a	n/a
13-Sep	5.0%	n/a	n/a	n/a	n/a
20-Sep	0.2%	n/a	0.7%	n/a	n/a
27-Sep	0.0% 2.0%	n/a	9.5%	0.4%	n/a
04-Oct	2.0% 3.9%	n/a	10.1%	0.0%	n/a
11-Oct	3.1% 0.4%	24.0%	43.7%	2.5%	n/a
18-Oct	2.9% 1.4%	0.0% 0.0%	26.0%	11.9%	n/a
25-Oct	0.8% 8.0%	9.0% 2.0%	26.7%	5.4%	n/a
01-Nov	7.1% 1.7%	1.0% 0.0%	n/a	n/a	n/a
08-Nov	20.5% 3.9%	5.0% 2.0%	n/a	n/a	n/a

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

ATTACHMENT 3

FINAL 1986 POST SEASON SUMMARY REPORT ON
CHUM SALMON

UNITED STATES AGENCY REPORT

Washington Chum Salmon 1986

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REVIEW OF 1986 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 1986 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 effort 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 needs of these stocks, particularly stocks from the Fraser River. 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 1986 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 1986 management strategy in areas 4B, 5 and 6C remained basically unchanged from recent years. This fishery was restricted to Treaty Indian gillnet gear, fishing a five day per week schedule throughout most of the management period (9/28 - 11/29) for Puget Sound normal timed chum. The fishery tends to be limited by adverse weather conditions experienced in late October and early November, and is usually discontinued by mid-November. In 1986, the fishery was closed by November 20. No other catch restrictions were imposed on this fishery in 1986.

The management regime for areas 7 and 7A was established by the Pacific Salmon Commission at their March 1986 meeting. The agreement called for the fishery in these areas to be managed on the basis of, and consistent with, the Canadian "clockwork" plan. The 1986 regime established a ceiling of 10,000 chum in areas 7/7A if the total chum run size entering Johnstone Strait was less than 2.6 million, and a ceiling of 80,000 chum if the total was greater than 2.6 million. This ceiling was based on an assumed impact on the Fraser River run, and was contingent on Canada following the same "clockwork" management plan as in 1985. The annex also required that, as far as practicable, the fishing effort in areas 7/7A should be distributed in a normal fashion (roughly 50% of the harvest from each area), avoiding concentrations of effort along the boundary in Area 7A, and the harvest should be spread across all portions of the Fraser run.

If the total Johnstone Strait chum run was below 2.6 million, the areas 7/7A fishery was planned to include a reef net fishery and some limited test fisheries. However, the specific fishing plan for this harvest level was not developed because a Johnstone Strait run size estimate of over 2.6 million chum became available the third week of September, before the U.S. managers finalized fishing plans. The updated Johnstone Strait run size was well over 2.6 million and a fishing plan for 7/7A was established to harvest 80,000 fish. It was anticipated that this would require no more than one Non-Indian fishing day and 3 - 4 days of Indian fishing. This restrictive schedule was necessary because 19% of the allowable chum harvest had already been taken during the late September sockeye fishery scheduled by the Fraser Panel. In addition, it was decided to schedule at least one day of Indian fishing immediately prior to the Non-Indian opening to reduce fish abundance and limit the risk of a large one day Non-Indian harvest, as had occurred in 1985.

Subsequent inseason updates in mid-October of run size from the Johnstone Strait fishery indicated a run size of 3.3 million, prompting Canada to schedule fisheries at the 30% harvest rate. The 1986 chum annex did not provide for any change in the catch ceiling for areas 7/7A for "clockwork" harvest rates above 20%, and no changes were made in the U.S. fishing plans. However, the manner in which the run size was updated raised concerns with U.S. managers that Canada was deviating from the agreed upon "clockwork" management plan and that this approach could lead to a failure to meet the stock rebuilding aspects of the plan. This deviation prompted an inseason protest from the U.S. section of the Commission (Attachement I).

B. FISHERY REVIEW

The fishery in areas 4B, 5 and 6C again exhibited a higher than expected catch level, similar to that experienced in 1985. Total catch for the season was 53,790 (Table 1), which is the highest catch on record for this area. It is believed that this may

again represent an exceptional catch rate for this area due to extremely favorable fishing conditions. The month of October again provided extremely dry, mild weather allowing fishermen to maximize their fishing opportunities with good fish availability. As expected, approximately 85% of the chum harvest in these areas occurred during the month of October.

The first significant chum harvests in areas 7/7A occurred incidental to a three day sockeye fishery scheduled in the northern portion of Area 7A by the Fraser panel for September 27-30. A total of 14,854 chum were taken in this fishery, significantly reducing the number of fish available for a directed chum harvest.

The directed chum fishery in Area 7 began with a reef net fishery at the start of the chum management period (September 28), and was originally scheduled for 5 days per week. This is a limited fishery with only 15 - 20 units of reef net gear participating. The reef net fishery was curtailed following only three days of fishing because the catches from the first two days contained more coho than chum salmon. The fishery re-opened the following week and remained open for two weeks, at which time the fishery was closed because the total harvest ceiling of 80,000 chum by all gears in areas 7 and 7A had been exceeded. The total harvest by reef net gear is reported at 5,453 chum (Table 1).

Gillnet and purse seine chum fishing began in areas 7/7A with an Indian fishery the night of October 15th (Table 1) through the morning of the 17th (2 days). The fishery remained closed for a day and a half, then re-opened the night of October 18. The second Indian fishing period was also two days, terminating the evening of October 20. The closure of Indian fishing corresponded with the opening of the Non-Indian full fleet fishery the evening of October 20. The Non-Indian fishery operated 15 hours for gillnet gear and 16 hours for purse seine gear. No commercial fishing was scheduled beyond October 21, because the 80,000 catch ceiling had been exceeded.

Harvests in the Indian fishery were higher than the expected 9,000 fish per day, with catches averaging approximately 13,000 fish per day. The total catch by Indians in areas 7/7A was 55,626. The Non-Indian harvest on October 20 and 21 was slightly lower than expected with a total one day catch of 18,091 (Table 1). The Indian fishery preceding the Non-Indian fishery appears to have had a limiting effect on catch.

The total harvest in areas 7/7A exceeded the harvest ceiling of 80,000, with a total reported catch of 92,984 chum. This overharvest is due primarily to better than expected catches in the Indian fishery, and approximately 3,300 chum harvested in test fisheries for GSI analysis, which occurred mostly after the commercial harvest. An examination of the distribution of harvest between areas 7 and 7A during the directed chum fishery shows 58% of the catch being taken in Area 7 (unlike 1985 when 43% of the catch came from Area 7A). However, the total 1986

chum catch from these areas is distributed similar to the historical pattern (50% from each area) because the harvest of chum during the late sockeye fishery occurred only in Area 7A.

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, for the purposes of this report, 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 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. A copy of the "1986 Puget Sound Chum Salmon Forecasts and Management Recommendations" report is appended as Attachment II.

The 1986 Puget Sound origin preseason expected chum abundance of all timing components was 1,239,250, of which 795,00 were of natural origin and 443,750 were of enhanced origin (Table 2). This represents the third highest even-year run, and the fourth highest overall run since the beginning of the data base in 1968.

B. FISHERIES DESCRIPTIONS, CATCHES AND SPAWNING ESCAPEMENTS

The actual return of 1,529,400 was 23% higher than the preseason forecast and represents the highest Puget Sound run observed. Most of the increase resulted from the 1,058,000 return of natural origin chum. The enhanced stock return of 471,400 approximated the preseason forecast (Table 3). The total escapement of 498,000 chum was the second highest escapement recorded since the start of the data base in 1968.

A summary of the preseason forecasts, final inseason updates of abundance, final 1986 run sizes, and escapements for each of the six Puget Sound regions of origin shown in Figure 2 follows and is in Table 2. Additional information on each stock is available through the Puget Sound run reconstruction programs. The run size estimates do not include Canadian harvest of U.S. origin

chum. Detailed information on chum harvests in each Puget Sound catch area is provided in Table 4.

Strait of Juan de Fuca Tributaries

Chum salmon from Strait of Juan de Fuca tributaries consist of two run timings: early and normal. The early stock return of 1,200 in 1986 was 60% of the forecast. The normal timed stocks returned to U.S. waters at a run strength of 1,900, which is 22% of the preseason forecast. Terminal catches were minor, and an increased effort was mounted to determine the extent and amount of spawning in individual streams.

Nooksack/Samish Region

The actual chum return was 72,800, representing 61% of the preseason forecast of 119,500. Despite the lower than expected abundance, the run size substantially exceeded the escapement goal of 23,750 and allowed significant commercial harvest. Actual spawning escapement was 92% of the goal of 21,800.

Skagit Region

The Skagit chum return was 317,500, or 130% of the preseason forecast of 243,550. The inseason run size update of 329,100 was larger than the actual run size, resulting in an overharvest in the commercial fishery. The final escapement estimate was 82,200 which was 71% of the goal of 116,500.

Stillaguamish/ Snohomish Region

The actual chum return of 278,500 was 136% of the preseason forecast of 204,550, and 125% of the inseason update. This resulted in an escapement of 149,400, which is approximately double the 73,550 escapement goal.

South Puget Sound Region

This region supports early, normal and late timed chum. Returns of early and normal timed segments were above both the preseason forecasts and the inseason updates, with adequate numbers of fish escaping to the spawning grounds. The total early timed return was 29,300 which exceeded the preseason forecast of 19,200 and resulted in an escapement of 15,700, 170% of the escapement objective of 9,300. The normal timed return was 239,300 which exceeded the preseason

forecast of 220,950. Likewise, the normal-timed spawning escapement of 113,600 exceeded the goal of 97,200. Particularly noteworthy was the large escapement of the Kennedy Creek stock (22,400), which was the subject of protective management actions in 1986. This was the highest recorded escapement in Kennedy Creek, exceeding the escapement goal of 14,500. The management measures to increase escapement over the 1975-84 average escapement of 6,000 appear to have been successful. The late timed return was 44,700; 92% of the expected run size of 48,850. The spawning escapement of 22,000 was 70% of the escapement goal of 34,000.

Hood Canal Region

Hood Canal supports stocks of early and normal timed chum salmon. As with many other Puget Sound chum runs, abundance of both timing segments exceeded their preseason forecasts. Additionally, the normal timed segment was substantially larger than the inseason update. Actual run sizes were 9,500 early chum and 534,800 normal chum, exceeding the preseason forecasts of 4,300 and 368,050 respectively. Early and normal escapements were 2,700 and 88,500, exceeding the escapement objectives of 1,550 and 66,450 respectively.

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. The only directed chum fishery in this area in 1986 was a Treaty Indian fishery that occurred on November 11-13, and harvested 44,000 chum. Area 6B remained closed for the entire season.

IV. WASHINGTON COASTAL FISHERIES

The 1986 coastal chum runs to Willapa Bay and Grays Harbor both returned below the preseason forecast, but above the recent 10 year average, and generally provided for a successful 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 run to Willapa Bay was well below the preseason prediction. This appears to have been due to an almost complete failure of the three year old portion of the run. Few three year old fish were caught or appeared in the escapement. The reasons for this are not clear. The catch of 46,000 includes a Non-Treaty net catch of 45,700 and a river sport catch 300. This is well above the 10 year average. The wild escapement of 32,400 was slightly below the 35,400 fish goal. The hatchery escapement of 10,500 was excellent and met all program goals.

The return to Grays Harbor was also below the preseason prediction exhibiting a similar lack of three year old contribution as in the Willapa returns. The catch of 32,000 included 30,100 in the Treaty Indian and Non-Treaty net fisheries and 1,900 in the river sport fishery. The wild escapement of 19,550 was slightly below the goal of 21,000 and the hatchery escapement was well below the level needed to support meaningful programs.

Chum salmon returning to the Quinault River are almost entirely of hatchery origin, although significant straying to wild spawning areas occurs. The return to the Quinault was also below the preseason prediction. The catch of 7,100 was taken primarily in the Treaty Indian net fishery. The total escapement of 5,200 included 1,400 that returned to the Cook Creek hatchery and 3,800 that strayed to wild spawning areas.

V. STOCK COMPOSITION AND RUN RECONSTRUCTION

During 1986, as in 1985, Puget Sound genetic stock identification (GSI) studies of chum salmon consisted of collecting additional baseline samples from numerous Washington and two Canadian stocks (Table 6) and stock composition samples from mixed stock area fisheries in northern Puget Sound and the Strait of Juan de Fuca (Table 7).

Re-examination and expansion of the genetic profiles for each major spawning stock in Puget Sound (baseline) was a major priority in 1986 for the Washington Department of Fisheries (WDF). Twelve new samples were collected in 1986 for addition to the 41 collected in 1985 (TCCHUM (87)-4). For 1986, seven common variable loci were used in the U.S. and Canadian GSI analyses.

Mixed stock fishery sampling was expanded considerably in 1986. Efforts were made to increase sample quality and quantity to provide 200 samples weekly from four sites in areas 5, 7, and 7A (Table 7). Efforts are continuing to increase tissue quality and the representative nature of both test and commercial samples.

U.S. GSI investigators still have concerns about statistical limitations of the seven common locus baseline currently available for determining U.S./Canada stock origins. All U.S. collections since 1985 have had 25 loci assayed. An effort is

currently underway to develop a joint GSI information system. An investigation will be conducted into the desirability of adding more loci to the Canadian portion of this new baseline.

Puget Sound run reconstruction is modeled using stock compositions for mixed stock areas as defined in Table 8. Sufficient GSI data have not been collected from Puget Sound mixed stock areas to warrant replacing existing stock composition estimates. Run reconstructions for individual Puget Sound stocks are available from WDF.

TABLE 1. PRELIMINARY 1986 CHUM HARVEST IN SELECTED PUGET SOUND CATCH REPORTING AREAS.

Areas	Type	Opening	Indian GN	Indian PS	Indian Total	Non-Indian GN	Non-Indian PS	Non-Indian RN	Non-Indian Total	Grand Total
Area 7A	Indian	9/28 - 9/30 **	296	600	896					
	Non-Ind.	9/28 - 9/30 **				2,762	11,190		13,952	
	Indian	10/15 - 10/16	6,141	7,959	14,100					
	Indian	10/19 - 10/20	7,037	2,329	9,366					
	Non-Ind.	10/21				6,641	1,486		8,127	
	Test-Fish.	10/24 - 11/10	616	231	847					
Area 7A Total			14,090	11,119	25,209	9,403	12,676		22,079	47,288
Area 7	Non-Ind.	9/28 - 10/1						555	555	
	Non-Ind.	10/12 - 10/16						4,760	4,760	
	Indian	10/15 - 10/16	5,830	9,202	15,032					
	Indian	10/19 - 10/20	5,009	7,956	12,965					
	Non-Ind	10/21				4,564	5,262	138	9,964	
	Test-Fish.	10/24 - 11/20	611	1,809	2,420					
Area 7 total			11,450	18,967	30,417	4,564	5,262	5,453	15,279	45,696
Areas 4B, 5 and 6C										
	Indian	<9/28 + test fish	493							
	Indian	9/28 - 10/2	1,814							
	Indian	10/5 - 10/9	5,759							
	Indian	10/12 - 10/16	12,192							
	Indian	10/19 - 10/23	16,283							
	Indian	10/26 - 10/30	11,291							
	Indian	11/2 - 11/6	5,691							
	Indian	11/9 - 11/20	267							
Areas 4B, 5 and 6C total			53,790							

* - Preliminary figures subject to change.

** - Fraser Panel regulated sockeye fishery.

Table 2. Audit of 1986 Puget Sound chum salmon management by region of origin.

Region	Preseason forecast	Final inseason update	Final run size	Escapement objective	Actual escapement
Strait of Juan de Fuca					
Early	1,900		1,200	1,300	1,122
Normal	8,450		1,900	4,400	1,390
Nooksack/Samish	119,500	89,300	72,800	23,750	21,800
Skagit	243,550	329,100	317,500	116,000	82,200
Stillaguamish/Snohomish	204,550	222,800	278,500	73,550	149,400
South Puget Sound					
Early	19,200		29,300	9,300	15,700
Normal	220,950	211,500	239,300	97,200	113,600
Late	48,850	48,300	44,700	34,000	22,000
Hood Canal					
Early	4,250		9,500	1,550	2,700
Normal	368,050	477,800	534,800	66,450	88,500
Total	1,239,250		1,529,500		498,412

Source: WDF, Puget Sound Indian Tribes and NWIFC, 1986 Puget Sound Chum Salmon Forecasts and Management Recommendations: WDF Stock Strength Calculation Summary.

Table 3. Final 1986 Puget Sound chum salmon run size estimates.

Region	Production	Early	Normal	Late	Total
Nooksack/Samish	Natural		68,906		68,906
	Hatchery		3,916		3,916
Skagit	Natural		316,133		316,133
	Hatchery		1,332		1,332
Still/Snoh	Natural		267,666		267,666
	Hatchery		10,800		10,800
South Sound	Natural	18,480	173,066	44,443	235,989
	Hatchery	10,787	66,244	304	77,335
Hood Canal	Natural	9,473	157,050		166,523
	Hatchery		377,742		377,742
J de F tribs	Natural	1,155	1,621		2,776
	Hatchery		282		282
Total		39,895	1,444,758	44,747	1,529,400

Production	Early	Normal	Late	Total
Natural	29,108	984,442	44,443	1,057,993
Hatchery	10,787	460,316	304	471,407

Region	Early	Normal	Late	Total
Nooksack/Samish	0	72,822	0	72,822
Skagit	0	317,465	0	317,465
Still/Snoh	0	278,466	0	278,466
South Sound	29,267	239,310	44,747	313,324
Hood Canal	9,473	534,792	0	544,265
J de F tribs	1,155	1,903	0	3,058

(from WDF Run Reconstruction Tables of 6/16/87)

Table 4. PUGET SOUND COMMERCIAL CHUM SALMON CATCHES, 1986 PRELIMINARY DATA

AREA DESCRIPTION	NON-INDIAN				INDIAN					TOTAL
	GILL NET	PURSE SEINE	OTHER	SUBTOTAL	GILL NET	PURSE SEINE	TROLL	OTHER	SUBTOTAL	
PRE-TERMINAL										
4B (Tatoosh-Sail Rock)	2	0	0	2	1,469	0	2	0	1,471	1,473
5 (Clallam Bay)	2	0	0	2	51,385	0	2	0	51,387	51,389
6 (Partridge Bank)	1	0	0	1	0	0	0	0	0	1
6A (West Beach)				0					0	0
6C (Port Angeles)	0	0	0	0	560	0	0	0	560	560
SUBTOTAL	5	0	0	5	53,414	0	4	0	53,418	53,423
7 (San Juans)	4,618	5,213	5,325	15,156	11,281	18,319	0	137	29,737	44,893
7A (Point Roberts)	9,169	12,912	0	22,081	14,335	10,745	0	0	25,080	47,161
SUBTOTAL	13,787	18,125	5,325	37,237	25,616	29,064	0	137	54,817	92,054
6B (Discovery Bay)				0					0	0
9 (Admiralty Inlet)	381	0	0	381	20,475	23,583		265	44,323	44,704
SUBTOTAL	381	0	0	381	20,475	23,583	0	265	44,323	44,704
GRAND TOTAL: PRE-TERMINAL	14,173	18,125	5,325	37,623	99,505	52,647	4	402	152,558	190,181
TERMINAL										
Strait--										
6D (Dungeness Bay)	7	0	0	7	85	0	0	0	85	92
Strait Rivers	0	0	0	0	360	0	0	0	360	360
SUBTOTAL: Strait term.	7	0	0	7	445	0	0	0	445	452
7E (East Sound)				0					0	0
Hooksett/Sawish--										
7B (Bellingham Bay)	16,884	2,033	0	18,917	15,708	209	0	0	15,917	34,834
7C (Samish Bay)	0	0	0	0	54	0	0	0	54	54
7D (Lummi Bay)	0	0	0	0	1,200	0	0	0	1,200	1,200
Hooksett River	0	0	0	0	15,591	0	0	0	15,591	15,591
Samish River				0					0	0
SUBTOTAL: Hook./Sam. term.	16,884	2,033	0	18,917	32,553	209	0	0	32,762	51,679
Skagit--										
8 (Skagit Bay)	58,216	54,248	0	112,464	44,305	390	0	0	44,695	157,159
Skagit River	0	0	0	0	67,875	0	0	0	67,875	67,875
SUBTOTAL: Skagit term.	58,216	54,248	0	112,464	112,180	390	0	0	112,570	225,034
Stillaguamish/Snohomish--										
8A (Port Susan/Port Gardner)	21,927	35,256	0	57,183	44,496	281	0	238	45,015	102,198
8D (Tulalip Bay)	803	1,274	0	2,077	350	0	0	153	503	2,580
Stillaguamish River	0	0	0	0	3,846	0	0	0	3,846	3,846
Snohomish River				0					0	0
SUBTOTAL: Still./Snoh. term.	22,730	36,530	0	59,260	48,692	281	0	391	49,364	108,624
South Sound--										
10 (Seattle)	24,404	16,025	0	40,429	1,669	1,757	0	0	3,426	43,855
11 (East-West Passage)	7,031	16,079	0	23,110	3,060	72	0	0	3,132	26,242
SUBTOTAL	31,435	32,104	0	63,539	4,729	1,829	0	0	6,558	70,097
10A (Elliott Bay)	0	0	0	0	2,381	0	0	0	2,381	2,381
10E (East Kitsap)	0	0	0	0	4,792	204	0	0	4,996	4,996
11A (Commencement Bay)	0	0	0	0	367	0	0	0	367	367
13 (Misqually Reach)	0	0	0	0	1,232	0	0	4	1,236	1,236
13A (Carr Inlet)	0	0	0	0	16,970	0	0	929	17,899	17,899
13C-K (South Sound Inlets)	0	0	0	0	26,710	0	0	299	27,009	27,009
SUBTOTAL S.S. marine ext. term.	0	0	0	0	52,452	204	0	1,232	53,888	53,888
SUBTOTAL S.S. marine term.	31,435	32,104	0	63,539	57,181	2,033	0	1,232	60,446	123,985
10G&F=10B (N. Lk. Wash. & Canal)	0	0	0	0	72	0	0	0	72	72
10C (S. Lk. Washington)				0					0	0
10D (Lake Sammamish)				0					0	0
Green-Duwamish River	0	0	0	0	2,258	0	0	0	2,258	2,258
Puyallup River	0	0	0	0	305	0	0	0	305	305
White River				0					0	0
Misqually River	0	0	0	0	34,307	0	0	0	34,307	34,307
Misc. freshwater				0	1,375				1,375	1,375
SUBTOTAL: S.S. freshwater	0	0	0	0	38,317	0	0	0	38,317	38,317
SUBTOTAL: S.S. terminal	31,435	32,104	0	63,539	95,498	2,033	0	1,232	98,763	162,302
Hood Canal--										
12 (Upper H.C.)	38,586	159,909	0	198,495	129,847	126	0	0	129,973	328,468
12B (Central H.C.)	22	2,506	0	2,528	19,947	0	0	0	19,947	22,475
SUBTOTAL:	38,608	162,415	0	201,023	149,794	126	0	0	149,920	350,943
12A (Quilcene-Dabob Bays)	0	0	0	0	631	0	0	0	631	631
12C (Lower Hood Canal)	268	8,475	0	8,743	35,375	0	0	0	35,375	44,118
12D (SE Hood Canal)	0	0	0	0	49	0	0	0	49	49
9A (Port Gamble)	165	0	0	165	5,235	0	0	0	5,235	5,400
SUBTOTAL: H.C. marine ext. term.	433	8,475	0	8,908	41,290	0	0	0	41,290	50,198
SUBTOTAL: marine terminal	39,041	170,890	0	209,931	191,084	126	0	0	191,210	401,141
Skokomish River	0	0	0	0	12,407	0	0	0	12,407	12,407
Quilcene River				0					0	0
Misc. freshwater				0					0	0
SUBTOTAL: H.C. freshwater	0	0	0	0	12,407	0	0	0	12,407	12,407
SUBTOTAL: H.C. terminal	39,041	170,890	0	209,931	203,491	126	0	0	203,617	413,548
TOTAL: Terminal Marine	168,313	295,805	0	464,118	354,463	3,039	0	1,623	359,125	823,243
TOTAL: Terminal Freshwater	0	0	0	0	138,396	0	0	67,875	206,271	206,271
GRAND TOTAL TERMINAL	168,313	295,805	0	464,118	492,859	3,039	0	1,623	497,521	961,639
GRAND TOTAL PRE-TERMINAL	14,173	18,125	5,325	37,623	99,505	52,647	4	402	152,558	190,181
GRAND TOTAL COMMERCIAL	182,486	313,930	5,325	501,741	592,364	55,686	4	2,025	650,079	1,151,820

TABLE 5. 1986 WASHINGTON COASTAL CHUM RUN SIZES, CATCHES AND ESCAPEMENTS.

	Willapa Bay	Grays Harbor	Quinault R.	Total
Preseason forecast	121,500	67,300	17,800	206,600
natural	85,800	67,300	min.	
hatchery	34,700	min.	17,800	
Actual run size	88,900	51,700	12,300	152,900
Catch	46,000	32,000	7,100	85,100
Wild esc. goal	35,400	21,000	None	
Wild escapement	32,400	19,550	3,800	55,750
Hatchery esc. goal	N.A.	N.A.	3,800	
Hatchery escapement	10,500	150	1,400	12,050

Table 6. 1986 Chum Samples for WDF GSI Baseline

Locality	N	Collection Date	Run Time
North Puget Sound			
Fortson Crk (NF Stillaguamish)	100	6&7 Dec 86	N
Strait of Juan de Fuca			
Jimmy Come Lately Creek	100	26 Sep 86	E
Salmon Creek & Snow Creek	100	3 Oct 86	N
Pysht River	100	4 Dec 86	N
South Puget Sound			
*Swift Creek & Perry Creek	100	29&30 Nov 86	N
Hood Canal			
Lilliwaup Creek, Duckabush & Hamma Hamma Rivers	100	28 Sep - 8 Oct 86	E
Union River	100	16-18 Sep 86	E
*Hoodsport Hatchery	100	14 Nov 86	N
Willapa Bay			
Ellsworth Creek	100	3 Nov 86	N
Bitter Creek (North River)	100	13 Nov 86	N
Grays Harbor			
Stevens Creek	100	20 Nov & 2 Dec 86	N
Satsop River	100	5&8 Dec 86	N
Vancouver Island, B.C.			
Big Qualicum Hatchery	100	16 Dec 86	
Mainland British Columbia			
Inch Creek (Fraser River)	100	17 Dec 86	

* = annual repeat sample
(to monitor temporal stability of allele frequencies in stocks)

N = normal timed; E = early timed

(data are from WDF GSI Lab - 15 Jan 87)

Table 7. Numbers of chum salmon GSI sampled from different gear types by week in northern Puget Sound in 1986

Location	Statistical week	No. fish sampled	1986 date	Gear
Strait of Juan de Fuca	40	202	10/2-3	GN
Area 5 / Commercial	41	207	10/6-8	GN
	42	206	10/13-16	GN
	43	205	10/21-23	GN
	44	205	10/28-30	GN
	45	202	11/4-5	GN
Point Roberts	42	47	10/15	GN
Area 7A / Commercial	42	101	10/16	mixed
	42	68	10/17	GN
	43	87	10/20	GN
	43	119	10/21	GN
/Test vessel	42	200	10/14	GN
	43	93	10/24	GN
	44	201	10/28	GN
	45	41	11/04	GN
	45	160	11/06	GN
	46	199	11/10	GN
Salmon Banks				
Area 7 / Commercial	42	200	10/18	mixed
	43	211	10/22	mixed
/Test vessel	42	85	10/13	PS
	44	200	10/29	PS
	45	35	11/05	PS
	46	202	11/12	PS
	47	138	11/23	PS
West Lummi Island				
Area 7 / Test vessel	42	119	10/14	PS
	43	215	10/24	PS
	44	138	10/31	PS
	46	147	11/12	GN
	46	60	11/14	GN
	47	51	11/20	PS

GN = gillnet

PS = Purse seine

mixed = gillnet and purse seine

Table 8. Apportionment of 1986 preterminal chum salmon commercial net catches for Puget Sound run reconstruction.

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

16-Nov-87



WASHINGTON
Department of
FISHERIES

NORTHERN
PUGET SOUND COMMERCIAL SALMON
MANAGEMENT AND CATCH REPORTING AREAS

FIS-87-868

ADOPTED 1984

NOT FOR USE IN NAVIGATION

NOTE: NO SCALE GIVEN BY NAME

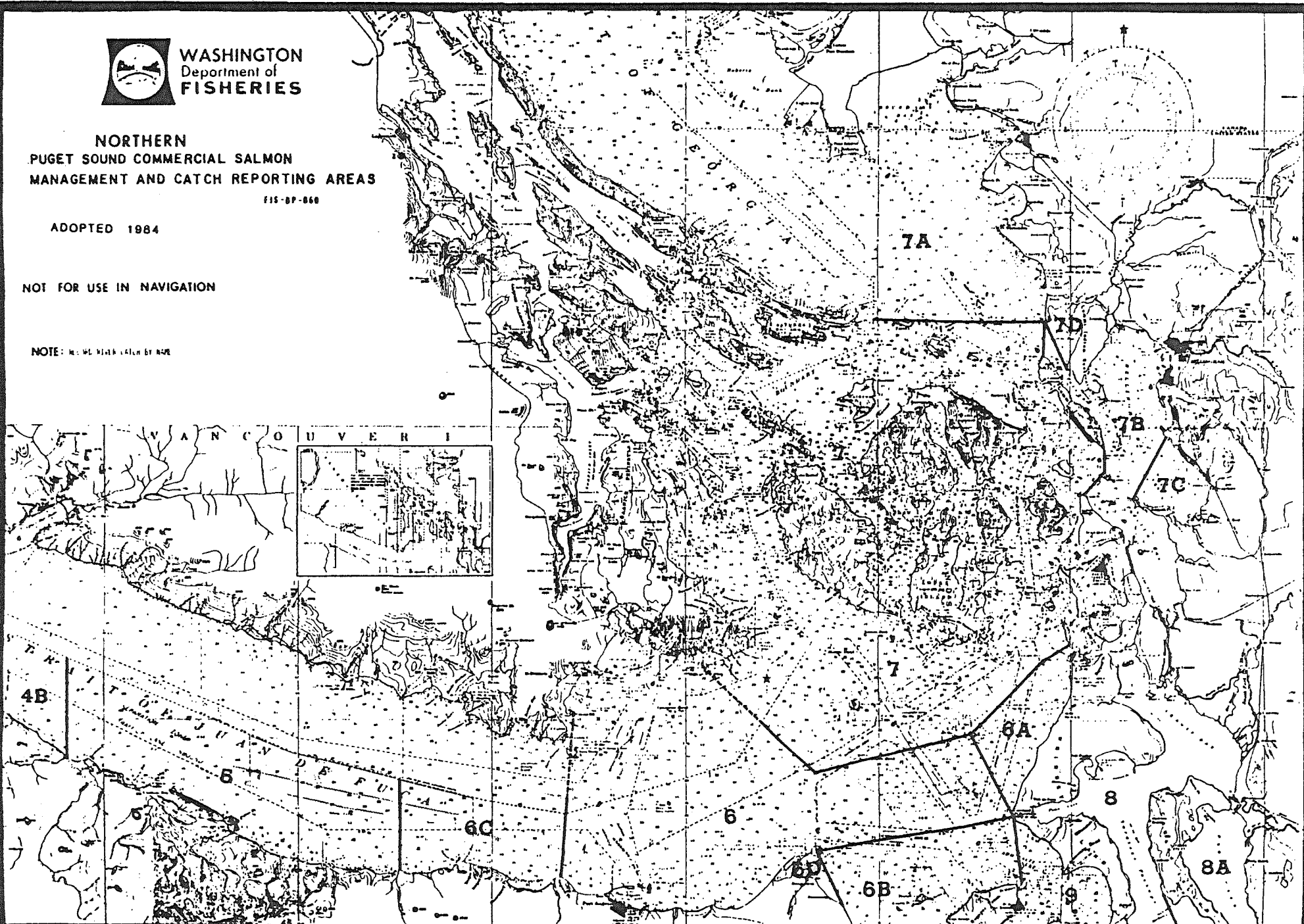
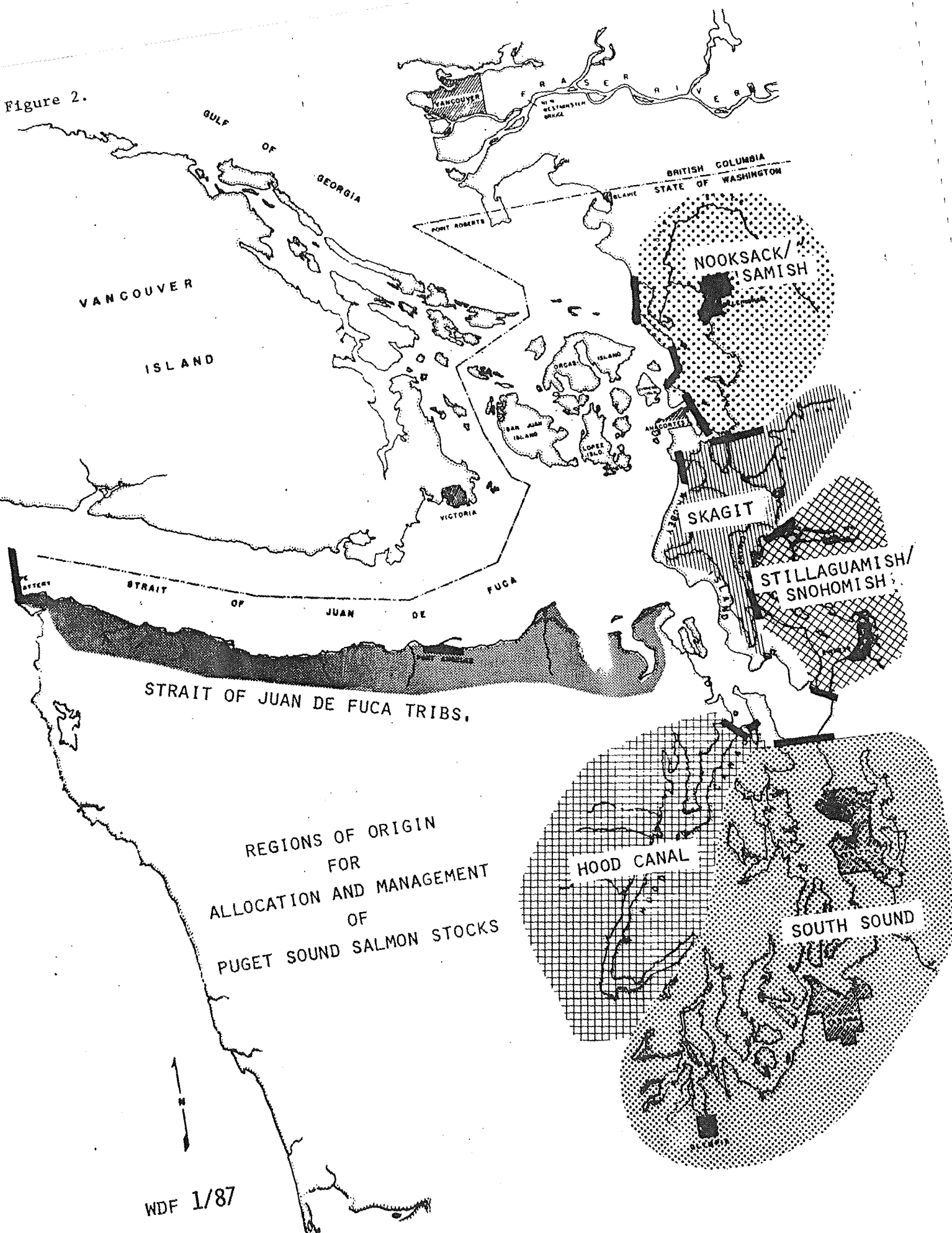


Figure 2.



ATTACHMENT I.

U.S. Commissioners
Don Collinsworth
David Colson
S. Timothy Wapato
William Wilkerson

UNITED STATES SECTION
of the
PACIFIC SALMON COMMISSION

Northwest Indian Fisheries Commission
Office of the Chairman
975 S.E. Sandy Blvd.
Portland, OR 97214

November 10, 1986

Mr. C. Wayne Shinnars, Chairman
Canadian Section, Pacific Salmon Commission
c/o Department of Fisheries and Oceans
6640 N.W. Marine Drive
Vancouver, British Columbia
Canada V6T 1X2

Dear Chairman Shinnars,

On behalf of the United States Section of the Pacific Salmon Commission, we would like to raise several points of objection relating to the conduct of the Canadian chum fisheries in Johnstone Strait. In general, it is our view that Canadian chum management has proceeded in a manner that departs from the agreement reached earlier this year within the Southern Panel and Pacific Salmon Commission. Our particular concerns are these:

* We agreed that "Canada shall conduct their Johnstone Strait, Georgia Strait and Fraser River chum fisheries consistent with the clockwork management scheme developed for 1984 and 1985...." Nevertheless, it appears that Canadian managers have applied inseason run size estimation methodologies different from those described in the 1984/85 clockwork management plan.

* Canadian members of the Southern Panel and DFO technical staff represented the "clockwork" plan as a structured management approach designed to achieve chum stock rebuilding. The U.S. was told that, under the "clockwork" plan if additional information became available subsequent to the defined run size updates indicating a higher run size, the additional fish would be passed through to spawning escapement. Strict adherence to the "clockwork" plan was anticipated and would allow timely rebuilding of depressed natural stocks. The U.S. relied on those representations from Canada when we accepted a fixed harvest ceiling on our fishery in areas 7 and 7A. Our technical analysis indicates that had Canada adhered to the run size updating procedures expressed in the "clockwork" plan, another 325,000 wild fish would have escaped harvest to spawn. This level of wild spawners would nearly have achieved the 1.8 million minimum escapement level called for in the "clockwork" plan. Instead, however, 1986 is yet another year of significant underescapement.

Mr. C. Wayne Shinnors

November 10, 1986

Page 2

* We agreed that "If during subsequent domestic consultation on the 1986 fishing plan Canadian chum salmon managers decide to make deviations . . . the Southern Panel Chair and Vice-Chair will be notified and a decision made as to the need for convening a Southern Panel meeting to develop appropriate changes to the management plan...." Although Canadian managers decided to make significant deviations from the preseason fishing plan, inadequate notice of the deviation was given to the U.S. Section. In particular, changes were made without prior opportunity for U.S. technicians to review and fully understand the rationale behind such changes. Moreover, Canada would not agree to the need for a meeting of the Southern Panel, despite the October 23 U.S. request for such a meeting.

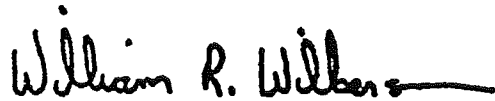
* The dramatically expanded Canadian chum fisheries are likely to increase interceptions of U.S. origin chum stocks above levels anticipated preseason.

The United States is anxious to raise these and other issues during the November meetings of the Southern Panel and Pacific Salmon Commission.

Sincerely,



S. Timothy Wapato
Chairman, U.S. Section
Pacific Salmon Commission



William R. Wilkerson
Commissioner, U.S. Section
Pacific Salmon Commission

ATTACHMENT II.

1986 PUGET SOUND CHUM SALMON FORECASTS
AND MANAGEMENT RECOMMENDATIONS

Joint report prepared by:

Puget Sound Treaty Indian Tribes
Northwest Indian Fisheries Commission
Washington Department of Fisheries

January 1987



WASHINGTON
Department of
FISHERIES

NORTHERN
PUGET SOUND COMMERCIAL SALMON
MANAGEMENT AND CATCH REPORTING AREAS

FIS-DP-060

ADOPTED 1985

NOT FOR USE IN NAVIGATION

NOTE: RIVER CATCH BY NAME

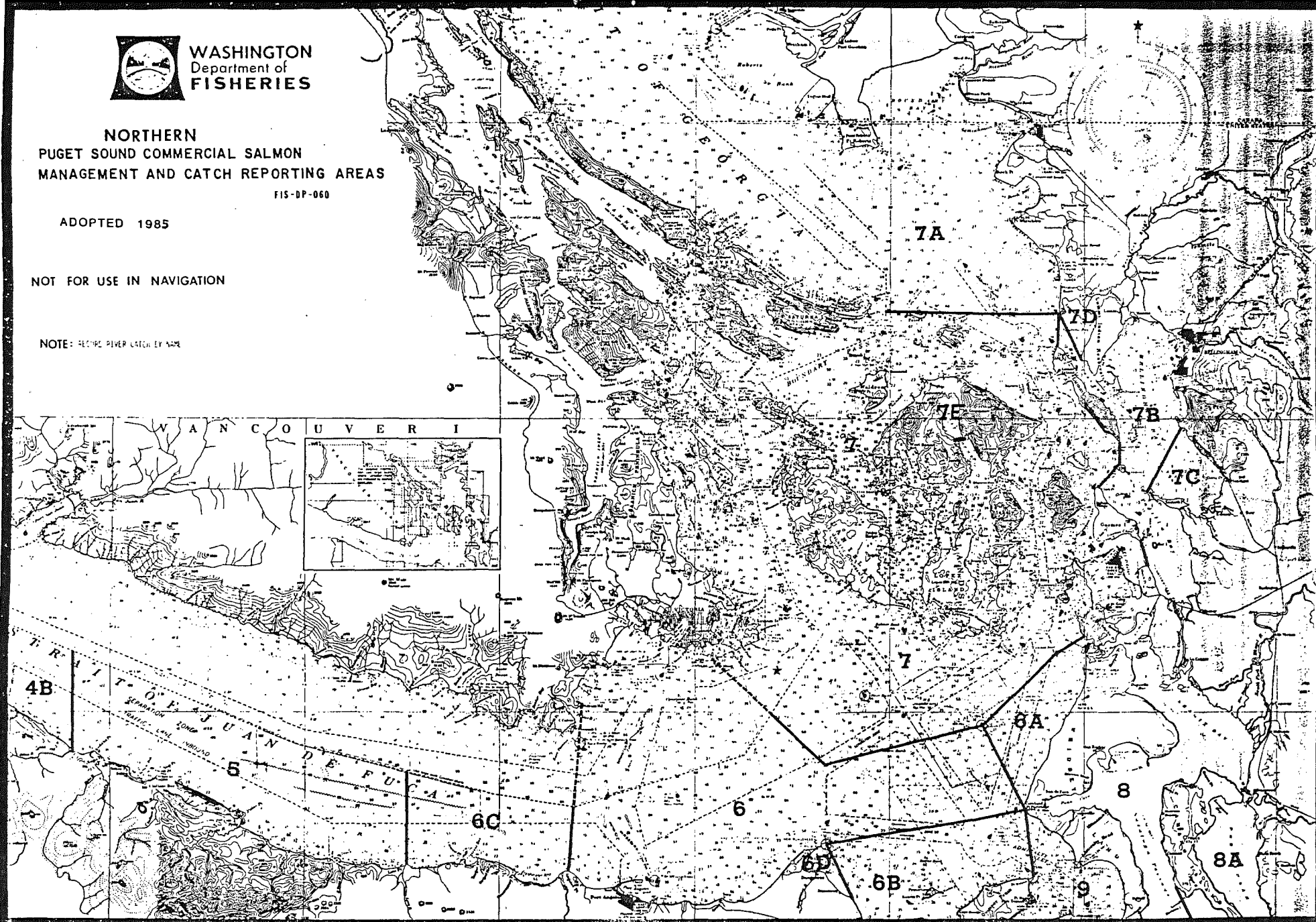


Figure 1. Northern Puget Sound commercial salmon management and catch reporting areas.

INTRODUCTION

This report has been prepared by the staffs of the Washington Department of Fisheries, Puget Sound Tribes, and Northwest Indian Fisheries Commission to facilitate management of 1986 Puget Sound origin chum salmon within Puget Sound. It reflects agreements on management planning except where indicated in brackets.

Predicted returns of chum salmon to Puget Sound (excluding troll, sport, some ceremonial and subsistence catches, and non-catch net mortality) are outlined in this report by stock. Desired escapements for hatchery and natural runs, allowable harvests, fishery management recommendations, test fishing needs, and prediction methods utilized are also included. A detailed breakdown of predicted returns, escapement goals, expected harvests, brood year escapement levels, and artificial production releases are presented in Appendix 1. Inseason runsize update methods will be detailed in a separate report. Anticipated test fishing details are included in the text.

Recommendations in this report apply primarily to net fisheries unless otherwise indicated. The Washington Department of Fisheries adopted 1986 Puget Sound recreational salmon fishery regulations prior to preparation of this report. Emergency regulation of recreational salmon fisheries that impact significant numbers of adult chum may be necessary if conservation or allocation problems are identified inseason.

Preseason forecasts are provided primarily as a guide for the establishment of fishing schedules prior to obtaining inseason estimates (where available). It is recommended that harvests should be conservative prior to obtaining inseason estimates of abundance. Actual run size may deviate from a forecast because of statistical variability, unusual survival rates, or unanticipated fishing rates in intercepting fisheries.

Run size forecasts represent the run entering Area 4B and result from examination of numerous prediction methods. Detailed run forecasting methods are provided in Appendix 2.

Strait of Juan de Fuca Tributaries

Early Chum

Early chum returning to tributaries of Area 6B, originate primarily from natural production in Snow Creek, Salmon Creek, and Jimmy-Come-Lately Creek.

Management Periods

<u>Area</u>	<u>Dates</u>
Discovery Bay, Sequim Bay	September 14 - November 1

Normal Chum

Management Periods

<u>Area</u>	<u>Dates</u>
Area 6D	October 26 - December 6
Dungeness River	November 16 - December 20
Elwha River	November 23 - December 20
Other tribs.	November 2 - November 29

Predictions, Harvests, and Escapements

<u>Production Unit</u>	<u>Total Run Size</u>	<u>Expected Escapement</u>	<u>Expected Harvest</u>	<u>Escapement Goal</u>
Elwha River natural/hatchery	1,550	700	850	700
Dungeness River	1,500	900	600	900
Hoko River	500	450	50	500
Pysht River	3,000	900	2,100	900
East Twin River	250	200	50	200
West Twin River	250	200	50	200
Lyre River	850	600	250	600
Deep Creek	250	200	50	200
Misc. Tribs.	<u>250</u>	<u>200</u>	<u>50</u>	200
Total	8,400	4,350	4,050	

Management Recommendations

The information available to estimate returning run sizes and the required escapement levels for natural stocks is very limited. Due to the uncertainty of the forecasts, no terminal area fisheries (with the possible exception of the Pysht River) directed at the harvest of

The return in 1986 is based on escapement of 32,780 in 1982 and 11,050 in 1983. Various methods were used to estimate the 1986 run size, including recruits per spawner, successive cohort derivations, three year average, and the regional allocation method. All estimates provided similar levels of predicted returns. The one chosen was the regional allocation method, which provided a mid-range prediction.

Management Recommendations

Harvest will be confined to Areas 7B, 7D, and the Nooksack River. Area 7C will remain closed to provide additional protection to the Samish River stock. This closure is expected to result in achievement of the escapement goal. There is a need to limit fisheries in Northern Bellingham Bay (Nooksack River Flats) and the Nooksack River, downstream of the Slater Bridge to 4 days per week to preserve the integrity of an in-river run size update currently in use.

Skagit

Chum stocks in the Skagit Region originate almost exclusively from natural stocks. Management will be based on the exploitation rate necessary to achieve the natural escapement goal for the Skagit River.

Management Periods

<u>Area</u>	<u>Dates</u>
Area 8 & Skagit River Zone 1 (below Mt. Vernon Bridge)	October 26 - November 29

impacts on coho. Catch will be monitored for age composition as the returns from the 1983 brood are expected to be minimal.

Test fisheries may be conducted in Skagit Bay and Skagit River at 1 day per week during the first three weeks of the management period. Sites may be as follows:

<u>Site</u>	<u>Number of boats</u>
Skagit Bay	2 (1 Treaty, 1 Non-treaty)
Jetty Drift	1
Spud House	1

The purpose of these test fisheries will be to obtain information on run timing, abundance, species composition, and mesh selectivity.

Stillaguamish Snohomish

Management Periods

<u>Area</u>	<u>Dates</u>
Area 8A and Snohomish River	October 19 - November 29
Area 8D	October 26 - December 27
Stillaguamish River	October 26 - December 6

Predictions, Harvests, and Escapements

<u>Production Unit</u>	<u>Total Run Size</u>	<u>Expected Escapement</u>	<u>Expected Harvest</u>	<u>Escapement Goal</u>
Stillaguamish River				
natural	64,000	34,750	30,000	33,100
hatchery	750			1,650
Snohomish River				
natural	132,500	35,500	97,800	28,000
hatchery	800			300

Area 8D will remain closed to fishing until an escapement of 3,300 for hatchery broodstock is assured. After this point Area 8D will be open so that remaining harvestable fish can be taken.

The expected escapement of 35,500 to the Snohomish River includes 28,000 fish for natural spawning and 7,500 additional spawners to provide 2.0 million additional emergent fry as a substitute for the previously planned egg take/outplant in this river system. In previous years the egg take goal for chums on the Snohomish system has not been reached due to difficult conditions. Since the harvest level in the mixed stock marine area is limited by the Stillaguamish River, harvest of remaining harvestable Snohomish River fish must occur in portions of Area 8A which can be assumed to be primarily composed of Snohomish River stocks.

Stillaguamish River will be open to commercial chum harvest throughout the management period or until the harvestable number is taken.

Stillaguamish Hatchery egg take requirements will be met through the aquisition of 1,650 wild adult chum for broodstock.

Assuming that the pattern of steelhead fisheries is the same as in 1984 and 1985, 3,000 chum salmon should be reserved for harvest during marine steelhead fisheries and 150 chum salmon should be reserved for harvest during Stillaguamish River steelhead fisheries. If significant changes occur in planned steelhead fisheries then this number will be adjusted.

Ferry Terminal and a line projected due north from the Port Orchard Marina should remain closed for the duration of the early chum management period to protect milling fish. The remainder of Sinclair Inlet can remain open through the end of September to maximize chinook fishing opportunities. Coho management needs shall prevail in the remaining portions of Area 10E through October 11.

Early chum returns to Hammersley Inlet (13J) and Case Inlet (13K) will be heavily impacted by terminal area coho fisheries, which are managed for full harvest of hatchery stocks. Although fisheries for coho in Area 13D will be conducted at the hatchery rate, coho fisheries scheduled in Areas 13J and 13K should be managed to minimize early chum incidental harvests. Fisheries in Areas 13J and 13K should be restricted to beach seines only, requiring the release of all early chum salmon during the period of September 21st through October 25th.

Normal Chum

Management Periods

<u>Area</u>	<u>Dates</u>
Area 10	October 12 - November 22
Area 10A, Duwamish/Green River	November 2 - November 29
Area 10E	October 12 - December 27
Area 11	October 12 - November 29
Area 11A	October 18 - December 13
Puyallup River	October 26 - December 13
Area 13, Nisqually River	October 12 - November 29
Area 13A	October 19 - November 29
Area 13C	October 12 - November 29
Areas 13D (Dana, Pickering, Southern Case), 13E, 13H, 13I	October 12 - December 27
Areas 13D (Peale), 13F, 13G	November 9 - December 13
Areas 13J and 13K	November 9 - December 27

Management Recommendations

The return of normal-timed chum to South Puget Sound will depend upon the interception rates in mixed stock areas. Fisheries in Area 10 and 11 should be conservative prior to obtaining an in-season estimate of abundance (the last week of October). Effort should also be light during the early part of the season to protect weak early components of the run. A one day full fleet evaluation fishery is expected the week of October 26, and a one boat purse seine test fishery at Apple Cove Point will be conducted one day per week throughout the normal chum management period. That portion of Area 10 northwest of a line from the flashing light at the mouth of Agate Pass to the end of the Indianola dock should remain closed through December 31 to protect chum salmon milling in front of the Suquamish Hatchery.

The Duwamish/Green native chum salmon run is severely depressed. A limited enhancement program for chum in the Duwamish/Green is being conducted to evaluate the potential of long term production. Existing data is not yet sufficient for estimating pre-season run strength.

Based on the pre-season forecast, no directed chum fisheries should occur in Area 11A and the Puyallup River. All available harvest will likely be taken as incidental catch during coho and steelhead fisheries.

The normal timed Nisqually River chum production is entirely of hatchery origin. Any harvest will be taken incidental to directed coho

12th, native chum will have cleared the fishery (central 80% is 10/28 - 12/12) and appropriate harvest rates will be dependent upon escapements to Elson Creek Hatchery. Test fisheries will be conducted in Area 13D (Dana) and Area 13D (Pickering) to obtain needed species composition and catch per effort data. Two drift gillnets will fish in each area one day per week during the period October 11th through November 12th.

Late Chum

Management Periods

<u>Area</u>	<u>Dates</u>
Areas 10 and 11	November 23 - January 10
Puyallup River	December 14 - January 17
Area 13	November 30 - January 17
Nisqually River	November 30 - January 31
Area 13C	November 30 - January 17
McCallister Creek	November 30 - January 31

Predictions, Harvests, and Escapements

<u>Production Unit</u>	<u>Total Run Size</u>	<u>Expected Escapement</u>	<u>Expected Harvest</u>	<u>Escapement Goal</u>
Chambers Creek				
natural	2,600	2,600	0	1,700
hatchery	2,300	2,300	0	1,050
Puyallup River				
hatchery	500	300	200	0
Nisqually River				
natural	41,000	27,000	14,000	27,000
hatchery	450	300	150	400
Red Salmon Creek	600	600	0	400
McAllister Creek	<u>1,400</u>	<u>900</u>	<u>500</u>	900
Total	48,850	34,000	14,850	

Predictions, Harvests, and Escapements

<u>Production Unit</u>	<u>Total Run Size</u>	<u>Expected Escapement</u>	<u>Expected Harvest</u>	<u>Escapement Goal</u>
Area 12A tribs.	850	100	750	2,300
Area 12B tribs.	2,400	1,100	1,300	11,100
Area 12C tribs.	300	100	200	3,300
Area 12D tribs.	<u>700</u>	<u>250</u>	<u>450</u>	3,300
Total	4,250	1,550	2,700	20,000

Management Recommendations

The forecasted return of early chum to Hood Canal is less than the desired level of escapement. However the early chum run will be managed as a secondary stock and no restriction will be placed on non-selective gear during the chinook and coho management period.

All harvest indicated will occur incidentally during preterminal fisheries and terminal area chinook and coho fisheries.

Normal Chum

Two components of the normal chum run, normal and late-normal, are recognized in Hood Canal. The normal chum run consists primarily of hatchery stocks originating from the Hoodsport, George Adams, McKernan, and Little Boston hatcheries. Late-normal stocks are primarily of natural origin with some hatchery contribution from the Enetai Hatchery, Walcott Slough, and the Quilcene National Fish Hatchery.

Enetai Hatchery	13,000	5,800	7,200	1,900
Area 12D tribs.				
natural	7,500	1,300	8,000	7,300
augmented	1,800			
Skokomish River				
natural	12,500	5,600	6,800	7,500
George Adams/ McKernan Hatchery	<u>77,000</u>	<u>6,000</u>	<u>71,000</u>	6,000
Total	368,050	66,450	301,500	

The proportion of the escapement to be taken at the Hoodsport Hatchery versus George Adams/Mckernan is the average of the relative run size to escapement ratios observed in the years 1982-1984. Natural stock escapement goals are those which would provide for the maximum sustainable harvest. These were estimated using a Ricker spawner recruit model. The region-wide escapement requirement for natural stocks was apportioned to management units on the basis of the average escapements observed in the years 1979-1984.

The expected escapement values were computed using the run timing information in Appendix Table 5 and the appropriate rates of harvest. The expected escapement to the Little Boston Hatchery assumes a 90 percent rate of harvest in Port Gamble Bay.

Management Recommendations

In accordance with the Hood Canal Plan, fisheries during the normal management period in Areas 12, 12B, 12C, and the Skokomish River will be managed to achieve the desired level of escapement at the Hoodsport,

Pre-terminal Areas

Normal Chum

Management Periods

<u>Area</u>	<u>Dates</u>
Areas 4B, 5, 6, 6A, 6C, 7	September 28 - December 6
Areas 6B, 9	October 12 - November 22

Management Recommendations

Fisheries in Areas 4B, 5, 6, 6C, and 7 should be based on the status of both Canadian and Puget Sound origin stocks. Treaty Indian marine gill net fisheries are anticipated in Areas 4B, 5, and 6C.

Management in Area 6A should be based on the needs of Puget Sound origin stocks.

Fisheries in Areas 6B and 9 may be conducted if harvestable surpluses are available from Hood Canal, South Puget Sound, and Stillaguamish-Snohomish regions. No fisheries should be scheduled until inseason runsize updates are available and demonstrate that harvestable numbers remain in all three regions. Data used in inseason updates precludes any opening in Areas 6B and 9 prior to November 6.

APPENDIX TABLE 1: 1986 PUGET SOUND CHUM SALMON FORECASTS, ESCAPEMENT GOALS, AND EXPECTED HARVESTS

Production Unit	Predicted Total Return	Escapement Goal	Expected Harvest	Brood or Cycle year Natural Escapement	Artificial Production Brood Lbs. Released	Comments
<u>Strait of Juan De Fuca</u>						
<u>Early Timed Stocks</u>						
Area 6B Tribs - Natural	1,900	1,300	150	1981 - 952 1982 - 2,003 1983 - 1,581		
<u>Normal Timed Stocks</u>						
Elwha River Natural/Hatchery	1,600	700	850	See Comments	1981 - 2,235 1982 - 529 1983 - 220	Brood year escapements for Straits total natural run including Elwha are as follows: 1981 - 7,950 1982 - 2,650 1983 - 5,406
Dungeness River - Natural	1,500	900	600	See Comments		Escapements goal for the Elwha River includes Natural fish and 750 for Tribal egg take.
Hoko River - Natural	500	500	50	See Comments		
Pysht River - Natural	3,000	900	2,100	See Comments		
East Twin River - Natural	250	200	50	See Comments		
West Twin River - Natural	250	200	50	See Comments		
Lyre River - Natural	850	600	250	See Comments		
Deep Creek - Natural	250	200	50	See Comments		Note: Actural Strait Normal Goal is 3,600. Extra 20 fish from rounding error.
Misc. Tribes - Natural	250	200	50	See Comments		
<u>Total Normal Timed</u>	<u>8,450</u>	<u>4,400</u>	<u>4,050</u>			
<u>Nooksack - Samish</u>						
Nooksack River - Natural	94,500	18,000	77,950	1981 - 57,822 1982 - 32,780 1983 - 11,050		
Nooksack River - Hatchery	2,300	850			1981 - 1,915 1982 - 3,179 1983 - 1,858	Kendall, Rutsatz Slough, and numerous minor releases in small Nooksack Tributaries. Goal includes eggs for brood- stock program and for Rutsatz slough.
Samish River - Natural	15,500	1,000 (1,700)	14,500	1981 - 2,243 1982 - 7,350 1983 - 4,501		1,700 enhancement escapement goal on if available basis.

APPENDIX TABLE 1: 1986 PUGET SOUND CHUM SALMON FORECASTS, ESCAPEMENT GOALS, AND EXPECTED HARVESTS
(Con't)

Production Unit	Predicted Total Return	Escapement Goal	Expected Harvest	Brood or Cycle year Natural Escapement	Artificial Production Brood Lbs. Released	Comments
<u>Upper South Puget Sound</u>						
<u>Early Timed Stocks</u>						
East Kitsap - Natural	1,500	1,500	700	1981 - 831 1982 - 900 1983 - 258		Blackjack Creek
Subtotal	1,500	1,500	700			
<u>Normal Timed Stocks</u>						
Duwamish River - Natural	Few			Few		
Duwamish River - Hatchery	10,500	350	3,900	1981 - 158 1982 - 2,618 1983 - 770		Crisp Creek - Muckleshoot Tribal Program
Puyallup River - Natural	3,300	1,900	1,400	1981 - 1,409 1982 - 1,121 1983 - 538		
Puyallup River - Hatchery	300	None	150		1981 - 510 1982 - 46	
East Kitsap - Natural	37,500	21,500	16,000	1981 - 16,316 1982 - 10,236 1983 - 10,365		
East Kitsap - Hatchery	9,200	3,300	5,900		1981 - 1,829 1982 - 1,695 1983 - 1,811	
Subtotal	60,800	27,050	27,350			
<u>Late Timed Stock</u>						
Puyallup - Hatchery	500	0	200		1983 - 358	Puyallup Tribal Program 1983 Brood release from late stock (Chambers Cr.)
Total - Upper South Puget Sound	62,800	28,550	28,250			
<u>Lower South Puget Sound</u>						
<u>Early /Timed Stocks</u>						
<u>Hammersley Inlet</u>						
Natural & Hatchery combined	8,500	16,500		1981 - 3,052 1982 - 1,513 1983 - 731	1981 - 2,676 1982 - 6,080 1983 - 2,676	
			9,200			
<u>Case Inlet</u>						
Natural & Hatchery combined	9,200	14,000 (800)		1981 - 2,049 1982 - 1,675 1983 - 780	1981 - 5,940 1982 - 3,281 1983 - 5,940	Escapement goal 14,000 natural and 800 for Coulter Cr. Hatchery.
Subtotal	17,700	31,300	9,200			

APPENDIX TABLE 1: 1986 PUGET SOUND CHUM SALMON FORECASTS, ESCAPEMENT GOALS, AND EXPECTED HARVESTS
(Con't)

Production Unit	Predicted Total Return	Escapement Goal	Expected Harvest	Brood or Cycle year Natural Escapement	Artificial Production Brood Lbs. Released	Comments
Nisqually River - Hatchery	550	None	550		1981 - None 1982 - 228 1983 - 210	Cleak Cr. and Unnamed (11.0015)
Subtotal	160,150	64,550	96,450			
<u>Late Timed Stocks</u>						
Chambers Creek - Natural	2,600	1,700		1981 - 1,686 1982 - 3,204 1983 - 1,617		
Chambers Creek - Hatchery	2,300	1,050			1981 - None 1982 - 640 1983 - None	
Nisqually River - Natural	41,000	27,000	14,000	1981 - 28,914 1982 - 25,773 1983 - 12,171		
Nisqually River - Hatchery	450	400	150		1981 - 91 1982 - 765 1983 - 22	Lacamas and Johnson Creeks
Misc. Streams - Natural	2,000	1,300		1981 - 726 1982 - 1,596 1983 - 225		<u>Mounts Creek</u> 600 return with a 400 fish goal. <u>McAllister Creek</u> 1,400 return with 900 fish goal
Subtotal	48,350	31,450	14,150			
Total Lower South						
Puget Sound	226,200	127,300	119,800			
Grand Total						
South Puget Sound	289,000	155,850	148,050			
<u>Hood Canal</u>						
<u>Early Timed Stocks</u>						
Area 12A Tribs. - Natural	850	2,300	750	1981 - 401 1982 - 303 1983 - 358		
Area 12B Tribs. - Natural	2,400	11,100	1,300	1981 - 1,289 1982 - 2,596 1983 - 522		
Area 12C Tribs. - Natural	300	3,300	200	1981 - 617 1982 - 162 1983 - 76		
Area 12D Tribs. - Natural	700	3,300	450	1981 - 574 1982 - 256 1983 - 344		
Subtotal	4,250	20,000	2,700			

APPENDIX TABLE 1: 1986 PUGET SOUND CHUM SALMON FORECASTS, ESCAPEMENT GOALS, AND EXPECTED HARVESTS
(Con't)

Production Unit	Predicted	Escapement	Expected	Brood or Cycle year		Artificial Production	Comments
	Total Return	Goal	Harvest	Natural	Escapement	Brood Lbs. Released	
Skokomish River - Natural	12,500	7,500	6,800	1981 -	1,596		
				1982 -	4,601		
				1983 -	1,026		
George Adams McKernan - Hatchery	77,000	6,000	71,000			1981 - 12,028	
						1982 - 26,780	
						1983 - 25,917	
Area 12D - Natural	7,500	7,300		1981 -	4,428		
				1982 -	1,818		
			8,000	1983 -	1,179		
Area 12D - Hatchery	1,800	None				1981 - None	Caldervin, Tahuya, Stimson, and and Twanoh Creeks
						1982 - 1,010	
						1983 - None	
Subtotal	368,050	69,000	301,500				
Total							
Hood Canal	372,300	89,200	304,500				

forecasts were developed for South Puget Sound and Stillaguamish/Snohomish regions and although these were not used they are described later in this appendix.

The 1986 forecasts represent the predicted returns of three age classes from brood years 1981 (age-5), 1982 (age-4), and 1983 (age-3). The total Puget Sound return of naturally produced chum was forecast using observed correlations between brood return and a variety of variables including: parent-year escapement, recruits per spawner, indices of juvenile abundance, and sea surface salinities during spring and summer months. Average age compositions were used to estimate the proportion of each brood forecast expected to return in 1986 (e.g. the number of 1982 brood age-4 chum). Within each stock timing, the total forecast for each of the three returning broods was allocated to major management areas using parent-year escapement. More detailed stock break-outs (within major management areas) are based on escapement goal proportions, with the exception of Totten Inlet, Skookum Inlet, and Hood Canal which were allocated to individual stock units based on parent-year escapement. The 1986 total Puget Sound forecast is 771,200 natural produced chum: 16,500 early-timed fish, 709,100 normal-timed fish, and 54,600 late-timed fish. The combined forecast would be an above average even-year return (average even-year run size 1968-1984 equals 624,200 naturally produced chum).

Artificial production returns were predicted using survival rates from previous broods of chum salmon released from established production sites. The returns to two tribal facilities, the Tulalip and Enetai

The return of normal-timed chum to the Elwha River was estimated by first computing the average of the total of in-river catch and hatchery rack counts for even years from 1980 through 1984. The total Elwha River runsize was then estimated by dividing by 0.80. This was based on the assumption that the in-river catch plus hatchery take represents 80% of the total run with the rest being apportioned between pre-terminal catch and escapement. The return estimate to the Dungeness River and all other tribs. were based on the average of the 1980 through 1984 return estimated through run reconstruction. These miscellaneous tribs. were then broken down using distributional escapement collected during a spawner survey program conducted in 1983 and 1984 (Table 4).

The run size of Hood Canal normal-timed natural stocks for all areas (Table 3) was estimated using average return per spawner rates for each age at return. The return rate used for age 3 fish was the average of rates observed during odd brood years 1973 through 1981; for age 4 fish all brood years 1970 through 1981; and for age 4 fish all brood years from 1970 through 1980. The total run returning to each management unit was estimated by applying the age specific return rates to observed escapements in each management unit during brood years 1981-1983.

The return of chum salmon planted in egg boxes in 1982 (included with natural augmented) was estimated by first converting the number of eggs planted in egg boxes to spawner equivalents by dividing by 1500 eggs per spawner to approximate the number of naturally spawning adults

also used for Little Boston Hatchery and the George Adams /McKernan complex since limited station specific information is available for these facilities.

A model relating size at release (S) to the return per pound released rate (R) was used to estimate the run returning to Walcott Slough. The model used for age 3 and age 4 fish has the form:

$$R = aS^b e^{CS}$$

where R is the return rate and S is the number of fish per pound at the time of release. Brood years 1973 through 1982 were used for age three fish and years 1973 through 1981 for age 4 fish. The age 5 return rate was estimated using the average rate observed for brood years 1965 through 1980 (Table 5).

The rates developed from the Walcott Slough data were also used to predict the return rates for fish released from the Quilcene National Fish Hatchery.

Pre-terminal interception rates for Skagit chum were estimated assuming a catch of 80,000 in Areas 7 and 7A and a catch of 20,000 normal timed chum in Areas 4B, 5, 6, and 6C. The Skagit component of pre-terminal harvest are detailed in Table 6, and the forecasted terminal runsize would then be 234,100.

An alternative forecast for returns to the Stillaguamish/Snohomish that was not used was reviewed and the results ($\hat{N} = 195,151$) were similar to those obtained by the previously described method, which

Table 1. 1986 Chum Salmon Forecasts

<u>Region</u>	<u>Natural Chum Forecasts</u>			<u>Total</u>
	<u>Early</u>	<u>Normal</u>	<u>Late</u>	
Nooksack		113,600		
Skagit		243,000		
Stillaguamish		64,000		
Snohomish		132,500		
Upper South				
Puget Sound	1,500	40,800		
Lower South				
Puget Sound	8,850	57,600	45,600	
Hood Canal	4,250	49,150		
Strait	1,900	8,450		
Total	16,500	709,100	45,600	771,200

<u>Region</u>	<u>Hatchery Chum Forecasts</u>			<u>Total</u>
	<u>Early</u>	<u>Normal</u>	<u>Late</u>	
Nooksack		5,900		
Skagit		550		
Stillaguamish		750		
Snohomish		7,300		
Upper South				
Puget Sound		20,500		
Lower South				
Puget Sound	8,850	77,700	2,750	
Hood Canal		318,900		
Strait				
Total	8,850	431,600	2,750	443,200

<u>Region</u>	<u>Combined Natural and Hatchery Forecasts</u>			<u>Total</u>
	<u>Early</u>	<u>Normal</u>	<u>Late</u>	
Nooksack		119,500		
Skagit		243,550		
Stillaguamish		64,750		
Snohomish		139,800		
Upper South				
Puget Sound	1,500	61,300		
Lower South				
Puget Sound	17,700	135,300	48,350	
Hood Canal	4,250	368,050		
Straits	1,900	8,450		
Total	25,350	1,140,700	48,350	1,214,400

Table 5. Hatchery Releases, average return rates and standard deviations used in developing the 1986 Hood Canal pre-season hatchery chum forecasts.

Brood Year	<u>Hoodsport</u>			<u>Walcott</u>			<u>Enetai</u>		
	Pounds Rel'sed	Return Rate	S	Pounds Rel'sed	Return Rate	S	Pounds Rel'sed	Return Rate	S
81	23589	.142	.204	4658	.093	.202	4702	.067	.041
82	32058	2.647	.902	1804	2.767	1.400	6130	1.742	1.193
83	34275	3.156	.615	2091	1.072	1.005	1702	1.434	.836

Table 6. Pre-terminal area catch estimates, estimated percent Skagit and estimated Skagit preterminal catch

	<u>Area</u>	<u>Catch</u>	<u>% Skagit</u>	<u># Skagit</u>
	4B, 5, 6, 6C	20,000	20.00	4,000
	7	40,000	10.00	4,000
	7A	40,000	1.67	700
Total				8,700

Table 7. Alternate Stillaguamish/Snohomish wild chum forecast from return per spawner rates by age class

<u>Age</u>	<u>Forecast</u>		
	<u>Total</u>	<u>Stilly</u>	<u>Sno</u>
3	5,936	2,162	3,774
4	186,781	59,945	126,836
5	2,434	887	1,547
Total	195,151	62,994	132,157