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CERTIFICATION UNIT PROFILE:
INNER SOUTH COAST CHUM SALMON
(EXCLUDING FRASER RIVER)

by

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ABSTRACT

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RÉSUMÉ

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Le présent profil comprend des données sur l'état des stocks, les points de référence pour la gestion, l'approche de gestion pour les pêches dans la région, les programmes d'évaluation et les mesures de conservation particulières.

PREFACE

MSC Ecocertification

Ecocertification is intended to link market incentives to the sustainability of fisheries, and a rapidly growing body of academic work is exploring the theoretical aspects of certification. However, substantial challenges remain in the practical implementation of certification programs, particularly in terms of transparency and consistency across different fisheries, species, and regions.

The Marine Stewardship Council (MSC) has developed a comprehensive and thoroughly documented certification process, with sufficient flexibility in the details to allow for adaptation to different settings. A standardized set of assessment criteria was recently released (www.msc.org).

This Document

This Certification Unit Profile (CUP) for Inner South Coast chum salmon includes information about stock status, management reference points, management approach for fisheries in the area, assessment programs, and specific conservation measures.

CUPs are available for all of the pink and chum certification units identified for ecocertification by the Marine Stewardship Council (MSC): North Coast and Central Coast chum salmon, West Coast Vancouver Island chum salmon, Inner South Coast chum salmon (excluding Fraser chum), Fraser chum salmon, North Coast and Central Coast pink salmon, Inner South Coast pink salmon (excluding Fraser pink), Fraser pink salmon.

A more general *Pink & Chum Management Summary* is also available. The management summary describes laws and policies, the structure of the management system, coast-wide conservation and recovery measures, as well as processes for collaboration and public consultation.

This CUP captures the official DFO position expressed in published materials, through staff interviews, and in written staff contributions. Almost all of the information contained in this document has been previously distributed to the public by DFO. Some of the text in this CUP is directly carried over from the earlier BC sockeye submissions, the departmental response to the draft assessment of BC sockeye, the 2008 IFMP, the Wild Salmon Policy, DFO websites, and DFO draft reports. Any material copied verbatim from sources other than these is put into “quotes”. Where possible, cited material is followed by a web link to the source or a catalogue number for DFO’s online library WAVES, which can be accessed at <http://inter01.dfo-mpo.gc.ca/waves2/index.html>.

Acknowledgments

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1 INTRODUCTION

1.1 Stocks covered in this document

This profile covers all chum salmon spawning in watersheds in Johnstone Strait and the Strait of Georgia (i.e. Areas 11 to 19), except for Fraser River chum. The major Inner South Coast chum systems, grouped by management area, are:

- *Johnstone Strait*: Major systems in this management area include the Fulmore River on the mainland side of Statistical Area 12, Adam River, Kokish River, and Nimpkish River on the Vancouver Island side of Area 12, as well as Amor de Cosmos Creek, Hyacinthe Creek, and Salmon River on the Vancouver Island side of Area 13.
- *Upper Vancouver Island*: Major systems in this management area include the Cluxewe River and Quatse River in Area 12.
- *Mid Vancouver Island*: Major systems in this management area include Campbell River, Quinsam River, Puntledge River, Qualicum River, and Little Qualicum River. Production of enhanced chum is concentrated in this area.
- *Lower and South Vancouver Island*: Major chum runs in this area originate from the Nanaimo River, Chemainus River, Cowichan River, and Goldstream River.
- *Kingcome Inlet*: Major systems include the Kingcome River and the Wakeman River.
- *Bond Inlet to Knight Inlet*: Major systems include the Ahta River, the Kakweiken River, and Viner Sound Creek.
- *Loughborough Inlet to Bute Inlet*: Major systems include the Southgate River, Orford River, and Heydon Creek.
- *Toba Inlet*: Major systems are the Little Toba River and the Theodosia River.
- *Jervis Inlet*: Major systems include Lang Creek and Sliammon Creek in Area 15, and Tzoonie River, Deserted River, and Skwawka River in Area 16.
- *Howe Sound / Sunshine Coast*: Persistent chum runs spread across in several small systems.
- *Burrard Inlet*: The major system in this area is the Indian River.

1.2 Fisheries covered in this document

This profile covers fisheries harvesting chum salmon in Johnstone Strait and the Strait of Georgia (statistical areas 11 to 19). Harvesting sectors include First Nations, recreational, and commercial (seine, gill net and troll). Major commercial fisheries are the Johnstone Strait mixed-stock fisheries in Areas 12 and 13, with terminal opportunities where local surpluses are identified (Areas 12, 13, 14, 16, 17, 18, 19).

First Nations harvest chum salmon in marine areas (Areas 12 to 20 and 121 to 126; Subareas 29-1 to 29-7) in food, social and ceremonial (FSC) fisheries. Long-term harvest patterns depend on the local abundance of all salmon species. Annual chum catches depend on in-season assessments of actual stock strength, management measures taken to ensure conservation of individual stocks, and targeted fishing effort by First Nations.

Recreational salmon harvests in tidal waters and freshwater occur throughout the Inner South Coast, but harvest relatively few chum salmon. Marine angler effort is spread out throughout Johnstone Strait and the

Strait of Georgia, with the majority catch and effort in Johnstone Strait. The majority of recreational harvest occurs in lower Area 13 (Deepwater Bay) and effort has been increasing in recent years. Freshwater recreational fisheries can retain chum in several of the watersheds. Total (marine and freshwater) recreational harvests have ranged from about 5,000 to about 20,000 in recent years. A complete list of freshwater fishing regulations is available at www.pac.dfo-mpo.gc.ca/recfish/Freshwater/freshmap_e.htm.

In United States Fisheries, chum are caught commercially in Panel Areas 4B, 5, 6C and 6 & 7 Net, and Washington Troll and in non-Panel Areas Washington, Oregon and California Troll and Alaska Troll and Net, and also in recreational and US Ceremonial Fisheries.

Inner South Coast chum salmon may also be caught in test fisheries in Areas 12, 13, 16, 20, 29, and 123-127.

This profile covers fisheries on the Inner South Coast (i.e. Johnstone Strait and the Strait of Georgia). in detail. The terminal fishery on the Fraser is covered in the 2009 *Fraser Chum Salmon Profile*.

2 BACKGROUND AND STOCK OBJECTIVES

2.1 Life history

2.1.1 Stock units

2.1.1.1 Definition of stock units for Inner South Coast chum

Populations of BC salmon are organized into a hierarchy of biological units: Natal streams, watershed aggregates, run-timing aggregates, statistical area and management sub-area aggregates, and Conservation Units (CU).

Different components of the management system focus on different levels within this hierarchy. The basic planning units for fisheries are watershed aggregates (e.g. escapement targets), but in-season implementation operates at the level of statistical areas and sub-areas (e.g. area closures to reduce incidental harvest of weak stocks). Stock assessment collects data at the level of natal streams and watershed aggregates. Conservation strategies under the *Wild Salmon Policy* emphasize the preservation of conservation units and their component populations.

Section 2.2.2 of the *2009 Pink & Chum Management Summary* includes more information about each of these biological units and how they are used in the management system.

Chum salmon (*Oncorhynchus keta*) are common to many streams in Johnstone Strait and the Strait of Georgia (statistical Areas 11 to 19), with persistent observations of spawning chum in more than 260 streams. Streams are identified according to the standardized stream naming and numbering system used by DFO and the Province of BC. Major runs of chum salmon originate in the following systems, grouped by management area:

- *Johnstone Strait*: 16 streams with at least one chum salmon escapement record. Major chum systems in this management area include the Fulmore River on the mainland part of Statistical Area 12, Adam River, Kokish River, and Nimpkish River on the Vancouver Island part of Area 12, as well as Amor de Cosmos Creek, Hyacinthe Creek, and Salmon River on the Vancouver Island part of Area 13.
- *Upper Vancouver Island*: 8 streams with at least one chum salmon escapement record. Major chum systems in this management area include the Cluxewe River and Quatse River in Area 12.
- *Mid Vancouver Island*: This management area is located on the east side of Vancouver Island from Courtenay to Qualicum. It includes 36 streams with at least one chum salmon escapement record. Major chum systems include Campbell River, Quinsam River, Puntledge River, Qualicum River, and Little Qualicum River, with three large enhancement facilities (Puntledge, Little Qualicum and Big Qualicum). The facilities have been in production since the early 1980s. The return timing of these fall stocks are from mid October to mid December, with Big Qualicum River returning the latest. Production of enhanced chum is concentrated in this area.
- *Lower and South Vancouver Island*: These management areas span the east side of Vancouver Island from Parksville and Nanaimo to Victoria, and include 24 streams with at least one chum salmon escapement record. The major chum rivers are the Nanaimo River, the Cowichan River and the Goldstream River. Nanaimo River has an enhancement facility located up river. Chemainus River is a smaller system with varied returns.
- *Kingcome Inlet*: 16 streams with at least one chum salmon escapement record. Major chum systems include the Kingcome River and the Wakeman River.

- *Bond Inlet to Knight Inlet*: 25 streams with at least one chum salmon escapement record. Major chum systems include the Ahta River, the Kakweiken River, and Viner Sound Creek.
- *Loughbourough Inlet to Bute Inlet*: 35 streams with at least one chum salmon escapement record. Bute Inlet is unique in that it has two separate runs of chum. The summer run, which returns to the Orford River from late August to the end of October, and the fall run, which returns to the Southgate River from the end of October to the beginning of December. Fisheries and Oceans Canada is collecting DNA samples from these systems to get a better understanding of chum distribution and timing in the inlet.
- *Toba Inlet*: 16 streams with at least one chum salmon escapement record in this management area on the mainland side of British Columbia. Major chum systems are the Little Toba River and the Theodosia River. Little information is gathered in this management area because it is extremely remote and accessible only by boat or aircraft.
- *Jervis Inlet*: 36 streams with at least one chum salmon escapement record in this management area on the mainland side of British Columbia. The majority of chum migrate into Jervis Inlet and then to the three major river systems in Area 16 (Tzoonie River, Deserter River, and Skwawka River). Major chum systems in the northern part of the management area (i.e. Area 15) are the Sliammon River system, which supports a chum stock and has a chum hatchery on the river, and Lang Creek.
- *Howe Sound / Sunshine Coast*: Persistent chum runs spread across several small systems.
- *Burrard Inlet*: The major chum system in this area is the Indian River.

Table 1 summarizes the population structure of Inner South Coast chum. Figure 1 shows management areas and conservation units.

2.1.1.2 Conservation units for Inner South Coast chum

The *Wild Salmon Policy* (DFO 2005) formally expresses many years of conceptual and practical development in the department's management of Pacific salmon. It serves as a crucial platform for launching and coordinating comprehensive planning processes for the long-term conservation and sustainability of wild Pacific salmon. The WSP maps out four key elements:

- Identifying irreplaceable groupings of salmon stocks, called Conservation Units (CU), formally defined as “a group of wild salmon sufficiently isolated from other groups that, if extirpated, is very unlikely to recolonize naturally within an acceptable timeframe” (DFO 2005). Populations within a CU are assumed to experience similar survival conditions and fishery management actions are taken to address conservation of the entire CU, with the objective of ensuring spawner abundance is distributed across populations within the area.
- Identifying upper and lower benchmarks to monitor the status of each CU. The lower benchmark will be established at a level of abundance high enough to ensure there is a substantial buffer between it and any level of abundance that could lead to a CU being considered at risk of extinction by COSEWIC. The upper benchmark will be established to identify whether harvests are greater or less than the level expected to provide, on an average annual basis, the maximum annual catch for a CU, given existing environmental conditions (DFO 2005).
- Assessing habitat and ecosystem status of conservation units.
- Implementing a public process for establishing strategic plans that cover all CUs and identify resource management actions required to address declines in status of CUs, habitat and ecosystems.

Section 3.2.2 of the 2009 *Pink and Chum Management Summary* summarizes the intent, development, and regional implementation of the *Wild Salmon Policy*, including the development of status benchmarks for each CU. Formal evaluations of CU status have not been completed, but there have been regular status assessments of Inner South Coast chum salmon (Section 5.2).

Holtby and Ciruna (2007) developed a comprehensive approach for identifying conservation units of anadromous Pacific salmon, based on a combination of the ecological context, the life history of each population, and genetic population structure. To identify CUs for each species, they applied the following considerations in sequence:

- Map out *Joint Adaptive Zones* (JAZ) based on a combination of freshwater characteristics and marine characteristics.
- Within each JAZ, species were further divided into conservation units based on differences in life history, spawning time, and other ecological characteristics.

Chum populations in Johnstone Strait and Strait of Georgia have been grouped into seven conservation units (CU) based on their evolutionary lineage, life history, productivity, and ocean migrations:

- Southern Coastal Streams
- Upper Knight
- Loughborough
- Bute Inlet
- Northeast Vancouver Island
- Strait of Georgia
- Howe Sound - Burrard Inlet

Total chum escapements and index escapements to assess population trends are evaluated within these CUs. Populations within a CU are assumed to experience similar survival conditions. Fishery management actions are taken to address conservation of the entire CU, with the objective of ensuring spawner abundance is distributed across populations within the area.

Table 1 lists the management areas and spawning sites for each of these conservation units. A complete and up-to-date list of sites for all CUs is available at http://www-comm.pac.dfo-mpo.gc.ca/pages/consultations/wsp/CUs_e.htm. [Figure 1](#) shows management areas and conservation units.

Holtby and Ciruna (2007) also document the defining characteristics for each conservation unit:

- Chapter 6 summarizes the distribution, life history, ecotypes, and genetic population structure of chum salmon.
- Figure 17 (p. 155) shows locations with records of chum salmon.
- Table 10 (p. 156) summarizes presence, relative abundance, and genetic population structure of chum salmon in each of the *Joint Adaptive Zones*.
- Table 18 (p. 188) summarizes classification criteria for chum salmon CUs, shown in Figure 27 (p. 187).

- Appendix 1 summarizes the zoological, geographic, and physical characteristics of each *Freshwater Adaptive Zone* (e.g. salmon species, other fish fauna, major drainages, geology, hydrology, temperatures).

2.1.1.3 Indicator Stocks

Most major chum stocks, both enhanced and wild, are enumerated. In terminal areas with potential commercial fisheries, the major stocks contributing to these fisheries are surveyed more intensively (e.g. Nimpkish, Cowichan). These intensively surveyed systems, in combination with a variable number of minor streams, are used to evaluate the overall stock status of Inner South Coast chum salmon.

2.1.1.4 Agreement on stock units

Extensive research has been completed to identify the population structure of BC chum salmon. The analyses were peer-reviewed and accepted through the PSARC process, which includes scientists from outside the management agency, and some have been published in peer-reviewed journals:

- Genetic studies by Beacham *et al.* (1985) and Seeb & Crane (1999) suggest two lineages of North American chum, likely resulting from isolation in separate northern and southern refugia (Bering & Columbia refuges) during the last glaciation.
- Beacham *et al.* (2008) assess the stock structure of BC chum salmon using microsatellite DNA, which they found to be more informative than other genetics-based methods such as allozymes. The study identifies 16 regional stocks based on 14 microsatellites.
- Holtby and Ciruna (2007) document the multi-criteria approach used to delineate conservation units under the Wild Salmon Policy. Their Appendix 8 lists the consultations conducted to develop the initial list of conservation units. Up-to-date materials for continuing public consultations on the definition of conservation units for BC chum salmon are available at http://www-comm.pac.dfo-mpo.gc.ca/pages/consultations/wsp/CUs_e.htm.

2.1.2 Stock characteristics

2.1.2.1 Distribution and Abundance

Chum salmon are distributed widely in the north Pacific, with BC populations mostly found north of 50°N latitude and east of 175°W longitude (Salo 1991).

Total observed spawning escapement of non-Fraser chum salmon on the Inner South Coast has averaged 830,000 since 1953, with peak escapement of 1.6 million in 1985, and a lowest observed escapement of 217,000 in 1965.

2.1.2.2 Age / size / fecundity

Chum return to spawn in natal streams after three to six summers at sea, with most chum returning to spawn as four year olds (Salo 1991). Using the Gilbert-Rich age designation system, Inner South Coast chum range in age from 3₁ to 6₁ with the greatest proportion of chum being 4₁. Age composition may vary considerably from year to year.

Chum eggs are large relative to other pacific salmon, with fecundities of between two to three thousand eggs per female, depending on size (40 – 45 eggs per cm of fork length; Salo 1991).

The egg to fry survival of Inner South Coast chum is influenced largely by fluctuations in environmental conditions, particularly rainfall and water temperature. By comparison, fry to adult survival may be related to competition for resources and predation during the marine stages (and to a lesser extent during the short period of freshwater rearing).

2.1.2.3 Migration timing

Chum fry emerge from the gravel as early as February and migrate downstream shortly after emergence, primarily in March and April. The juvenile chum rear near the estuary and in near-shore areas until approximately late May, and subsequently enter the major marine water bodies (ie. Strait of Georgia) to gradually migrate northward through Johnstone Strait. The juvenile migration continues to more off-shore waters and towards the Gulf of Alaska beginning in June and July and continues through the summer months. In the first year, chum are primarily located along the coast of North America and into the Gulf of Alaska (Salo, 1991).

Return migrations are of considerable distance, and the beginning of return migrations is not well documented. For Inner South Coast populations, some summer chum are first observed in streams in August (Ahnuhati River) while the vast majority of fall chum spawn starting in early October with the peak of spawning occurring mid to late October and ending as late as mid December.

Observed timelines for stream arrival and peak spawning have been compiled for most of the chum runs on the Inner South Coast, and are available from the DFO South Coast Area office.

2.2 Stock enhancement activities

2.2.1 Enhancement approach

DFO leads or supports enhancement activities to:

- Rebuild or re-establish salmon runs by enhancing abundance of spawners in an area (e.g. re-establishing pink and coho populations in lower Fraser tributaries where there is historic evidence of spawning populations)
- Provide fishing opportunities either in targeted fisheries or through enhancement of populations contributing to mixed stock fisheries.

In addition, some enhancement activities provide stock assessment information in regards to escapement monitoring (as in the major facilities such as Big and little Qualicum and Puntledge) and stock structure information (age, size and sex composition from the hatchery brood collections).

In recent years, the emphasis has been shifting from production to conservation and rebuilding, and many enhancement facilities do both.

The *2009 Pink & Chum Management Summary* includes additional information about salmon enhancement in BC. Specifically:

- Section 3.2.5 describes the regional approach to salmon enhancement, reviews the history of the *Salmon Enhancement Program* (SEP), summarizes coast-wide pink and chum enhancement activities, and briefly discusses enhancement in the context of the *Wild Salmon Policy*.
- Section 2.4.2 describes the regional approach to monitoring and assessing BC pink and chum salmon, including estimation of enhanced contributions to chum harvest and escapement.

- Section 2.5.2 describes the regional approach to salmon harvest and explains conservation measures implemented in fisheries that target enhanced chum (e.g. cap on total exploitation rate, terminal fisheries).

All hatchery releases are counted and made publicly available through the facility descriptions on the SEP website at http://www-heb.pac.dfo-mpo.gc.ca/facilities/salmonid_e.htm, and through integrated data resources such as *Mapster*, available at http://www-heb.pac.dfo-mpo.gc.ca/maps/maps-data_e.htm.

Annual production targets for each salmon species and enhancement facility are publicly reviewed as part of the Salmon Integrated Fisheries Management Plan (IFMP) for Southern BC, which also includes a review of enhancement activities in the previous year (e.g. Sections 4.7 and 9.7 of the 2008 Salmon IFMP for Southern BC).

The *Federal-Provincial Introductions and Transfers Committee* was formed with a Memorandum of Understanding among DFO, the BC Ministry of Environment, Lands and Parks and the BC Ministry of Agriculture, Fisheries and Food. It is a technical committee whose primary role is to advise the above agencies on fish introduction and transfer issues. It meets at least four times per year, and consists of up to six members (two from each of DFO, and the appropriate provincial ministries). New brood stock transfers and off-site releases are only implemented after approval by this committee.

The remainder of this document explains how the regional approach to the harvest and assessment of wild and enhanced chum salmon are implemented on the Inner South Coast.

2.2.2 Inner South Coast chum enhancement facilities

Chum salmon enhancement on the Inner South Coast has focused on restoring depressed runs and stabilizing terminal commercial fishing opportunities. Mixed-stock commercial fisheries do not specifically target enhanced chum salmon runs, but do catch them as part of the overall chum harvest strategy for Johnstone Strait, the Strait of Georgia, and the Fraser River (Section 3.2). At a few facilities, chum production has been supplemented by local First Nations for ESSR harvest (see fishery types in Section 2.3.1)

DFO hatcheries currently supplement chum salmon runs as follows:

- *Big Qualicum River hatchery*: This facility uses a spawning channel as well as active hatchery supplementation for all species of Pacific salmonids, including steelhead and cutthroat trout. The majority of hatchery production is chum salmon. Access to the spawning channel is controlled with a counting fence, limiting the number of spawners at about 100,000 chum, 10,000 coho, and 1,000 chinook. If there are more returning adults, the fence is used to divert them. The release target for chum fry is 54 million into the channel, with an expected return of 486,000 adults.
- *Little Qualicum River hatchery*: Release target of 28 million fry, with expected returns of 190,000 adults.
- *Puntledge River hatchery*: This facility was built to support the recovery of Puntledge River chinook, but has also been used to supplement other salmon runs. Target production is 2.7 million fed fry from Puntledge River broodstock for release in the Puntledge River, with expected returns of about 36,000 adults.

In addition to the above, Inner South Coast chum salmon populations are enhanced in small-scale supplementation programs managed by local groups. These include:

- *Gwa'ni hatchery*: Target is to release 1.8 million fry from Nimpkish River brood stock into Nimpkish River, for an expected return of about 24,000 adults.

- *Sliammon River hatchery*: Target is to release 1.7 million fry from Sliammon River brood stock into Sliammon River, for an expected return of about 18,000 adults.
- *Nanaimo River hatchery*: Target is to release about 1 million fry from Nanaimo River brood stock into Nanaimo River, for an expected return of about 7,500 adults.

A complete list of these small-scale supplementation programs is included in the annual Salmon IFMP for Southern BC. Note that additional chum eggs are collected by hatcheries beyond their own targets as brood stock for approved transfers to other projects, as listed in the IFMP.

In addition to these active supplementation programs, chum salmon are also enhanced with unmanned spawning channels (e.g. Mashiter, Stawamus, Tiempo, and Wildwood in Howe Sound).

Detailed information about chum enhancement on the Inner South Coast is publicly available, and evaluated regularly. For example, Section 4.7.4 of the 2008 South Coast Salmon IMFP lists brood production targets for chum salmon for 2008, and Section 9.7.3 reviews enhancement activities from 2007.

2.3 Fisheries intercepting Inner South Coast chum

2.3.1 Overview

Pacific salmon fisheries fall into one of three basic categories:

- *Food, Social, and Ceremonial (FSC) fisheries* are communal aboriginal fisheries. FSC fish cannot be sold legally.
- *Commercial fisheries* harvest salmon for sale during openings that are clearly delineated by time, location, gear, and sometimes even the number of vessels.
- *Recreational fisheries* target salmon for personal consumption or as a sport (i.e. catch-and-release).

Three additional types of fisheries have evolved in recent years, each with a distinct legal setting:

- *Treaty fisheries* are covered under formalized agreements that specify FSC allocations and commercial allocations to a First Nation.
- *Economic Opportunity fisheries* are designed to improve First Nations' access to economic benefits. The long-term intent is to formalize communal FSC fisheries and economic opportunity fisheries as part of the treaty process
- *Excess Salmon to Spawning Requirements (ESSR) fisheries* may occur when salmon stocks return to a system after passing through the various fisheries and are at a level in excess of their spawning target. These fisheries have occurred on a regular basis in the Skeena River for sockeye and pink, on the Nass River for sockeye, and at a number of hatchery sites throughout the South Coast (e.g. Puntledge, Qualicum).

Access priority for these different fisheries depends on the species, as set out in the *Allocation Policy*.

The *2009 Pink & Chum Management Summary* includes additional information about salmon fisheries in BC. Specifically:

- Section 1.3.2 summarizes allocation principles and their implementation.
- Section 2.2.3 provides a brief overview of fisheries targeting BC pink and chum salmon.

- Section 2.5 summarizes the planning and implementation of pink and chum fisheries, including access controls and compliance measures.

2.3.2 First Nations

First Nations target local salmon stocks for FSC purposes throughout the Inner South Coast. Sockeye salmon are a priority species for First Nations, but the overall objective expressed by First Nations in consultation is to access a diversity of fishing opportunities throughout the season and across species. Chum salmon are an important part of that diversity for First Nations in Johnstone Strait and the Strait of Georgia.

Section 1.1.5 of the *2009 Pink and Chum Management Summary* describes the different elements of First Nations' access to fishing opportunities in more detail.

First Nations access to salmon for FSC purposes is managed through communal licences. These licences are designed for the effective management and regulation of First Nations fisheries through a negotiated series of mutually acceptable conditions wherever possible. The dates, times, and locations where harvesting may occur, acceptable gear types, and other conditions are described in these licences. Communal licences can be amended in-season for resource conservation and other purposes. DFO seeks to provide for the effective management and regulation of First Nations fisheries through negotiation of mutually acceptable and time-limited Fisheries Agreements.

On the Inner South Coast, First Nations harvest of chum salmon is typically small with an aggregate communal licence harvest target of 155,000 for the South Coast, including the West Coast of Vancouver Island (Section 6.3 of the 2008 IFMP for Southern BC).

In addition to these FSC fisheries, local First Nations access chum through ESSR harvests at several hatchery facilities (see fishery types in Section [2.3.1](#)).

2.3.3 Recreational

DFO regulates sport fisheries in tidal waters, and salmon fisheries in freshwater. DFO's regulations for salmon sport fisheries in freshwater are published as a supplement to provincial regulations for all freshwater fisheries. Recreational limits and regulations are announced pre-season, with in-season updates where necessary:

- 2007-2009 BC Tidal Waters Sport Fishing Guide and the 2007 to 2009 BC Freshwater Salmon Supplement are available at http://www.pac.dfo-mpo.gc.ca/recfish/SFG_e.htm
- 2007-2008 BC Freshwater Fishing Regulations are available at www.env.gov.bc.ca/fw/fish/regulations/.
- Local in-season changes to recreational limits and regulations are announced and archived at www-ops2.pac.dfo-mpo.gc.ca/xnet/content/fns/index.cfm?pg=fishery_search&lang=en&ID=recreational.

In marine waters off the Pacific coast of British Columbia, hook and line harvest of chum salmon is open year round. Coast wide the minimum size limit for chum is 30 cm. There are area closures, listed in the Tidal Water Sport Fishing Guide, in effect for various inlets and off river mouths to protect chum stocks where there are conservation concerns. The majority of these are long-term closures.

Recreational salmon harvests in tidal waters and freshwater occur throughout the Inner South Coast, but harvest relatively few chum salmon. Marine angler effort is spread out throughout Johnstone Strait and the Strait of Georgia, with the majority catch and effort in Johnstone Strait. Freshwater recreational fisheries can retain chum in several of the watersheds (e.g. Puntledge, Cowichan, Nanaimo). A complete list is available at www.pac.dfo-mpo.gc.ca/recfish/Freshwater/freshmap_e.htm.

2.3.4 Commercial

2.3.4.1 Johnstone Strait mixed-stock fisheries

Johnstone Strait mixed-stock fisheries target fall run chum, with seine, gill net and troll gear, managed based on a fixed 20% total harvest rate; the commercial fishery is managed to 15%, whereas the remaining 5% are for the recreational, FSC, test fisheries and provide a buffer for uncertainty in the commercial harvest rate.

- *Areas 12/13 - Johnstone Strait:* The fishery targets chum spawning in Johnstone Strait, the Strait of Georgia, and Fraser River areas, but a small component are bound for Washington State systems. The main components of the harvest are the Mid Vancouver Island (MVI) and Fraser River stock groupings. The majority of chum stocks enter Johnstone Strait from September to November. This fishery also intercepts enhanced chum from Big Qualicum hatchery, Little Qualicum hatchery, Puntledge hatchery, Chehalis hatchery, Chilliwack hatchery, Inch Creek hatchery, and Weaver Creek spawning channel.

2.3.4.2 Johnstone Strait terminal fisheries

Johnstone Strait terminal fisheries targeting chum are managed in-season based on terminal abundance, and harvesting occurs by seine, gill net or troll gear.

- *Area 12 – Nimpkish River:* Chum openings are confined to a portion of Subareas 12-18 and 12-19 to minimize incidental harvest of other passing chum stocks. If commercial fishing opportunities have been exhausted and surplus stocks are still available, then an ESSR opportunity may be provided.
- *Area 13 - Bute Inlet:* Openings are confined to Subareas 13-21 and 13-22 to minimize incidental harvest of other passing chum stocks. If commercial fishing opportunities have been exhausted and surplus stocks are still available, then an ESSR opportunity may be provided.

2.3.4.3 Strait of Georgia terminal chum fisheries

Mid Vancouver Island terminal chum fisheries are managed in-season based on terminal abundance. Chum harvests focus on terminal stocks listed below, but incidentally retain some other minor local stocks in the terminal areas as well. The major systems are:

- *Area 14 - Puntledge, Big Qualicum and Little Qualicum:* The fishery is directed at the enhanced stocks of three river systems; Puntledge, Little Qualicum and Big Qualicum Rivers. Chum returning to this area have been enhanced since the late 1960s and terminal fisheries have occurred in October and November since the 1970s. ESSR fisheries are possible on enhanced stocks (e.g. Section 4.9 of 2007 IFMP for Southern BC).
- *Area 15 – Sliammon:* No targeted commercial fisheries for pink or chum
- *Area 16 - Jervis Inlet:* This terminal fishery targets wild chum stocks returning to river systems in the Jervis Inlet area. The main systems are Tzoonie, Deserted and Skwawka Rivers.
- *Area 17 – Nanaimo:* This fishery is directed primarily at Nanaimo River stocks. The Nanaimo River chum stocks are supplemented by the Nanaimo River Hatchery on poor return years.
- *Area 18 – Cowichan:* This fishery is directed primarily at Cowichan River stocks. Cowichan chum and to some extent Goldstream chum are also harvested. Chemainus River stocks are also impacted but likely to a lesser extent.
- *Area 19 – Goldstream (Saanich Inlet):* ESSR fishery is directed primarily at Goldstream River chum stocks, but some Cowichan River chum are also harvested incidentally.

2.4 Stock objectives

2.4.1 Regional objectives

Pacific salmon are managed under a comprehensive umbrella of laws, treaties, and policies. Particularly relevant for the year-to-year management of Inner South Coast chum are the *Fisheries Act*, the *Oceans Act*, the *Species at Risk Act*, the *Wild Salmon Policy*, the *Pacific Salmon Treaty*, the *Selective Fishing Policy*, and the *Allocation Policy*.

The provisions of these laws, treaties, and policies form the basis for long-term objectives that shape the management of Inner South Coast pink salmon and the fisheries that harvest them.

The *2009 Pink & Chum Management Summary* includes additional information about regional objectives. Specifically:

- Section 1 summarizes the legal and policy context for the management of Pacific salmon, with a section for each of the acts and policies listed above.
- Section 2.3 reviews long-term objectives and explains the use of management reference points for BC chum.
- Section 3 describes the different elements of DFO's conservation strategy, outlines integrated management initiatives, and includes a coast-wide inventory of major conservation initiatives.

Annual conservation objectives for specific stocks, and the resulting conservation measures in Fraser pink fisheries, are publicly reviewed each year as part of the *South Coast Integrated Fisheries Management Plan for Salmon*, which are available at <http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/MPLANS/MPlans.htm>. Draft versions are publicly available each spring through the Salmon Consultation Website at http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/consultations/salmon/sapdefault_e.htm.

2.4.2 Conservation objectives for Inner South Coast chum salmon

The fundamental conservation objectives for Pacific salmon contained in national legislation and regional policies can be summarized as follows:

- Maintain healthy and diverse populations by conserving functionally distinct groups of salmon, called *Conservation Units*.
- Protect the integrity of each conservation unit by ensuring sufficient escapement for component populations.
- Monitor the status of conservation units relative to formal benchmarks for conservation and long-term production.

DFO has established a comprehensive assessment and management system to work towards these objectives through close monitoring, adaptive management, habitat protection, and enforcement.

For Inner South Coast chum salmon, these fundamental objectives translate into a cautionary approach to fisheries management, with a 20% cap on harvest rate in the Johnstone Strait mixed-stock fishery and a focus on identifying fishing opportunities in terminal areas based on in-season abundance estimates and observed escapements into the natal streams. In these terminal fisheries, smaller stocks are protected through time and area closures. Table 6 describes the local closures for Johnstone Strait.

2.4.3 Management objectives for Inner South Coast chum fisheries

The fundamental management objectives for Pacific salmon contained in national legislation and regional policies can be summarized as follows:

- Plan and implement sustainable, equitable, and efficient fisheries.
- Minimize incidental harvest of non-target salmon stocks, and by-catch of non-target species.

The primary management tool is to control fishing effort and catch through restricting the area, the duration of the fishery, the number of licensed vessels fishing within an area (i.e. limited entry licencing) and recently in some areas and by some gear types by share based (ITQ) demonstration fisheries. Other tools include altering gear efficiency or fishing power through manipulation of permitted gears (e.g. net length or depth, mesh sizes). Any available surplus stocks are harvested by nets and troll terminally, adjacent to natal streams using knowledge of run timing as a management tool to limit by-catch of non-target stocks and species. Time and area closures, as well as selective fishing techniques, are used to protect specific non-target populations or species of concern.

Examples include:

- Table 6 lists salmon fishery closures in Johnstone Strait, and describes the reason for the each closure (e.g. finfish closure in Parson Bay to protect juvenile chinook).
- Time and area net restrictions to limit encounters of non-target stocks and species to minimize fishery impacts on stocks of concern (i.e. Thompson coho, Lower Strait of Georgia chinook, Early Stuart sockeye, Cultus Lake sockeye, and Sakinaw sockeye).
- The mandatory non-retention of coho, chinook and steelhead to minimize impacts on stocks of concern during all chum fisheries. All non-target species must be released back into the water from which they were caught in the manner that causes the least harm.
- The mandatory use of revival boxes during all chum fisheries to minimize impacts on encountered non-target species.
- In-season (field inspections) and post-season (catch analysis) monitoring of net fisheries to assess fleet compliance to fishery regulations and guidelines and confirm in-season phone-in and hail data from fishery participants.
- By-catch of non-target species is closely monitored in-season to ensure impacts on these stocks are within management goals.
- Gill net mesh restrictions to reduce coho interceptions are in effect for all chum gill net fisheries as per the Pacific Fishery Regulations.
- Limited duration soak times are in effect during all chum fisheries (except those in Area 14 occurring between November 11th and March 31st). Soak time is either 45 minutes or 1 hour maximum, depending on fishing location, to limit the encounters of non-target species and minimize impacts on species of concern.
- Daylight only fisheries to reduce chinook or coho encounters and minimize fishery impacts is an option in known areas of high by-catch encounters but is normally not required in chum fisheries.
- Mandatory brailing and sorting of catch during seine fisheries (except in Area 14 between November 11th and March 31st) to increase release survival rates of non-retention species.

- Mandatory use of barbless hooks for troll (except in Area 14 between November 11th and March 31st) to increase release survival rates of non-retention species.

Section 3.3 describes the specific management objectives for the mixed-stock fisheries in Johnstone Strait and the terminal fisheries throughout the Inner South Coast.

In recent years, commercial fisheries in some terminal areas have shifted towards more direct effort control with small-scale, share-based quota fisheries where the fleet self-determines the most efficient participation. These “demonstration fisheries” are part of regional fisheries restructuring initiatives, which are described more fully in the *2009 Pink and Chum Management Summary*.

2.4.4 Performance Measures

Performance measures for most of the ISC chum salmon objectives relate back to estimates of escapement and total returns:

- Annual escapement into major watersheds is the main performance measure for Inner South Coast chum salmon. Annual escapement is the main performance measure for management areas. Formal Limit Reference Points (LRP) or Target Reference Points (TRP) have not yet been developed for Inner South Coast chum stocks. However, operational *Management Escapement Goals* (MEG) have been identified for each of the management areas (Table 4), and the major systems within each management area (Table 5). These operational equivalents were developed by interviewing DFO managers, biologists and contract field enumeration staff who had considerable years of local knowledge of particular streams and corresponding escapements of salmonids. These MEGs have been publicly available for decades (Ryall *et al.* 1999). The MEG represents the best estimate by these local experts and are used in a non-technical way as the operational equivalent for long-term benchmarks reflecting highly productive stocks (i.e. high sustainable yields). These escapement targets drive the annual management of directed terminal chum salmon harvests.
- Performance relative to genetic diversity objectives is measured in terms of the distribution across spawning sites in each CU, as well as the proportion of returns from wild and enhanced populations.
- Escapement estimates, together with catch estimates, are also used to evaluate forecast performance.
- For hatcheries, performance is measured in terms of brood stock targets and releases, which are reported in the annual IFMP, for all but smaller Public Involvement projects.
- Post-season performance reviews are compiled annually. These reviews report catch and escapement statistics and describe whether or not the fishery met objectives. Post-season reviews are included in the annual IFMP.

Several regional policy and conservation initiatives are establishing formal performance measures (refer to the listed section in the *2009 Pink & Chum Management Summary* for details):

- Formal status benchmarks for each conservation unit are being developed under the *Wild Salmon Policy* (Section 3.2.2).
- WSP benchmarks are consistent with the precautionary reference points defined as part of Canada’s national implementation strategy for the precautionary approach to fisheries (Section 1.2.2.3).
- Operational performance measures are being developed for the sustainability checklists under the *New Resource Management Sustainable Development Framework* (Section 1.2.2.2).

3 MANAGEMENT FRAMEWORK

3.1 Regional approach to salmon harvest

Pacific salmon fisheries are managed in a regular annual cycle of pre-season planning, in-season implementation, and post-season review. Each phase of this cycle incorporates extensive levels of public participation:

- Pre-season planning centers on the development and broad public review of the *Integrated Fisheries Management Plans for Salmon*. These management plans include general decision guidelines for each fishery, expectations for the year, anticipated fishing plans, and a detailed review of the previous year.
- In-season management is subject to rapidly changing, uncertain information. The department works with stakeholder representatives to develop appropriate responses to these changing circumstances, adhering, where possible, to the general decision guidelines and specific fishing plans documented in the IFMP.
- Post-season review meetings in the Fall provide a broad public forum for sharing information about the stocks and fisheries, reviewing management actions, and identifying opportunities for future improvements.

The *2009 Pink & Chum Management Summary* includes additional information about the regional approach to salmon harvest, and the participatory processes that inform each step in the planning cycle. Specifically:

- Section 2.4 outlines monitoring and assessment programs.
- Section 2.5 describes planning and implementation of Pacific salmon fisheries, including long-term decision guidelines, access controls, and conservation measures.
- Section 2.6 compares the three types of compliance mechanisms in place for Pacific salmon fisheries: incentives, education, and enforcement.
- Section 2.7 summarizes DFO's toolkit for monitoring and assessment.
- Section 3.2.4 reviews selective fishing initiatives and other impact reduction measures.
- Section 3.4 contains an inventory of major conservation efforts in the Pacific Region, and describes how they are linked to the annual management of fisheries harvesting BC pink and chum salmon.
- Chapter 4 outlines DFO's strategy for enabling public participation in the management of salmon fisheries.

3.2 Harvest strategy for Inner South Coast chum salmon

In order to limit harvest rates or to meet escapement targets for Inner South Coast chum, the primary management tool is to control fishing effort and catch through restricting the duration of fishery openings and the number of licensed vessels fishing within an area. Other tools include altering gear efficiency or fishing power through manipulation of permitted gears (e.g. net length or depth, mesh sizes).

Commercial fisheries targeting Inner South Coast chum salmon are managed as a combination of a mixed-stock fishery with a fixed harvest rate in Johnstone Strait, and terminal fisheries near major chum systems when local abundance allows. There are Inner South Coast commercial allocation targets established as per the Salmon Allocation Policy. These include an inside allocation target of 63% for the Area B seine fleet, 19% for the Area D gill net fleet, 12% for the Area E gill net fleet, and 6% for the Area H troll fleet.

The mixed-stock fishery includes all three gear types, and a new management strategy was adopted in 2002. In collaboration with licence holders (B, D, H) and other stakeholders the management of this fishery shifted away from abundance-based decision rules (a.k.a. “chum clockwork”) to an effort-based approach with a fixed harvest rate target. The major practical challenge encountered with the clockwork approach was that it was highly sensitive to in-season estimates of abundance, which not only carried substantial uncertainty but also changed as additional in-season information became available. Harvesters and DFO jointly developed a new approach, and the mixed-stock fishery is now set at a fixed harvest rate of 20%. The implementation of this approach has four distinct benefits:

- To minimize potential impacts on small stocks that are not following the aggregate abundance pattern (low abundance of one stock when aggregate abundance is high),
- To minimize potential long-term consequences of over-estimation in low abundance years,
- To improve stability and predictability for harvesters, and
- To improve data availability as the foundation for improved terminal fisheries.

Annual implementation of Inner South Coast chum fisheries follows the general approach below:

- Terminal chum fisheries are generally implemented with shorter, low impact openings early in the run, and then expanded as warranted by in-season information. For example, terminal chum fisheries in the Inner South Coast typically have short initial openings, and are either extended or closed depending on in-season escapement data and catch information from the initial opening.
- Low impact fisheries (e.g. limited number of vessels) on terminal chum stocks generally occur prior to those having a higher impact (e.g. full fleet), particularly at low run sizes, at the start of the run when run sizes are uncertain, or when stocks of concern have peaked but continue to migrate through an area.
- Terminal chum fisheries have been restructured to allow low-effort harvests on small local surpluses with “pocket fisheries” in particular inlets with less than 10 vessels. Over the last 5 years commercial harvesters and DFO have developed and refined a collaborative effort-control program (a.k.a “limited effort fisheries”). These mostly target chum stocks in terminal fisheries, with short openings and a small number of vessels that can participate. For example, 5 boats out of 240 licence holders are selected by harvesters to fish for a 1-day opening every week. This has occurred in Bute Inlet in recent years when small surpluses were anticipated. Based on agreements among licence holders, similar low-impact terminal fisheries have been designed for chum stocks along both coasts of Vancouver Island. All of these fisheries are managed based on local abundance, not aggregate abundance, and also provide improved abundance data for future management.
- Harvest opportunities in terminal fisheries are typically based on the lower quartile of the probability distribution for the abundance estimate (i.e. estimated 3 out of 4 chance that abundance is larger; 25th percentile, 75p level).
- Harvest rates on target stocks in mixed-stock fisheries are constrained to protect less productive co-migrating stocks, and harvest opportunities are shifted towards selective or effort-controlled fisheries. For example, the mixed-stock chum fishery in Johnstone Strait is managed to a 20% total harvest rate, with additional harvests on productive stocks in terminal areas, based on in-season abundance estimates.
- Gear, area, and time of each fishery are adjusted to control incidental harvests and by-catch. For example, South Coast chum fisheries are delayed to protect Interior Fraser coho and Steelhead.

3.3 Decision Guidelines for Commercial Fisheries

3.3.1 Johnstone Strait mixed-stock fisheries (Areas 12, 13)

3.3.1.1 Fisheries

Johnstone Strait mixed-stock fisheries target fall run chum. The harvest rate is set at 20% across all harvesters, regardless of total abundance.

This fishery targets chum that spawn in Johnstone Strait, Strait of Georgia, and Fraser River areas, though a small component are bound for Washington State systems. The main components of the harvest are the Mid Vancouver Island (MVI) and Fraser River stock groupings. The majority of chum stocks enter Johnstone Strait from September to November. This fishery also intercepts enhanced chum from Big Qualicum hatchery, Little Qualicum hatchery, Puntledge hatchery, Chehalis hatchery, Chilliwack hatchery, Inch Creek hatchery, and Weaver Creek spawning channel.

Other fisheries include:

- *First Nations FSC*: First Nations FSC harvest opportunities are included in the fixed harvest rate applied in Johnstone Strait. Annual FSC harvests averaged about 20,000 since 1986.
- *Recreational*: Recreational harvest opportunities are included in the fixed harvest rate applied in Johnstone Strait. The majority of recreational harvest occurs in lower Area 13 (Deepwater Bay) and effort has been increasing. The daily recreational limit is 4 chum; possession limit 8 chum. Total recreational harvests have ranged from about 5,000 to about 20,000 in recent years.

3.3.1.2 Management Objectives

Chapter 6 of the *Pacific Salmon Treaty* identifies a critical threshold of 1 Million for Inside Southern chum salmon, below which little or no harvesting occurs. For run sizes above the critical threshold, mixed stock fisheries will be conducted using a fixed harvest rate approach. The fixed harvest rate approach is based upon a 20% harvest rate on the return through Johnstone Strait. 15% are allocated to the commercial sector, and the remaining 5% are set aside to satisfy FSC, recreational, test fishing requirements, and to provide a buffer to the commercial harvest. Tagging studies conducted in 2000, 2001, and 2002 were used to develop this harvest strategy by evaluating fleet harvest rates and migration timing of chum stocks in Johnstone Strait. When run sizes are expected to be below the critical threshold commercial fisheries will be suspended and there will be only assessment fisheries and non-commercial fisheries.

This management strategy was designed to be robust against the large annual variability in chum abundance, to account for different levels of productivity among the intercepted stocks, and to stabilize fishing opportunities. Since this management strategy was implemented in 2002, annual fisheries have been planned well in advance of the actual chum return.

3.3.1.3 Planning

The fixed harvest rate fishing schedule is based upon effort, time and area. Fishing schedules are initially developed based on the assumption of normal fleet participation (recent year's maximum fleet participation in the chum fishery or trend in fleet participation).

Fishing schedule and exact fishing dates are then confirmed pre-season following consultation with commercial harvesters. Considerations are given to avoid weekend commercial fisheries, particularly seines, in order to minimize any conflicts with the recreational fishery.

Since the implementation of the new harvest strategy, the annual fishing plan has been stable and consistent, with the following timeline:

- *Seine*: Anticipated fishing effort is estimated pre-season based on consultation with harvesters and observations from previous years. Effort in recent years has ranged from 80 to 130 vessels.
 - First Fishery: A one day, 12 hour fishery at the end of September or first week of October.
 - Second Fishery: A one day, 10 hour fishery, in the third week of October. Note that the reduction in time to 10 hours is due to reduced daylight hours.
 - If effort during the first and/or second fishery is considerably less than anticipated or severe weather hampers the fishery then additional fishing time will be considered.
- *Gill net*: Gill net fisheries are scheduled to commence at the end of September or first week of October and are scheduled weekly through October. Fishing times are scheduled separate from the troll fishery when and where possible. Anticipated fishing effort is a gill net fleet size of 80 to 100 vessels. Duration of each fishing period is generally 41 hours and is to be confirmed in-season based on effort.
- *Troll*: Fisheries are scheduled to commence at the end of September or first week of October and are scheduled weekly through October. Fishing times are scheduled separately from the gill net fishery when and where possible. Anticipated fishing effort is a troll fleet size of 60 to 80 vessels. Duration of the weekly fishing period is generally three to four days and is to be confirmed in-season based on effort.

Shared-based (ITQ) demonstration fisheries have also been conducted since 2005 by the troll fleet and in 2005 by the seine fleet. Experiments on share-based management approaches are continuing.

Annual modifications to this fishing plan are discussed with advisory groups from all harvest sectors.

3.3.1.4 Implementation

License area advisors are consulted on harvesting opportunities through in-season advisory bodies. These consultations are done regularly through weekly conference calls starting late September.

In-season management decisions are based on the observed amount of effort in each fishery and time period. Effort is monitored through frequent over-flights and charter patrols. Subsequent openings may be adjusted based on observed effort. For example in 2008, the seine opening was extended due to lower than expected effort, and a gill net opening was extended due to poor weather. In 2004, gill net and troll fishing times were reduced due to considerably higher than expected effort.

A plan to minimize gear conflicts between the commercial and recreational sectors has been implemented since 2007. Sub area 13-7 (Deepwater Bay) was closed during weekends and Thanksgiving Monday to the commercial sector. During weekdays, subareas 13-6 and 13-7 were open to commercial gear. Discussions will continue in the planning process to address this potential conflict.

3.3.1.5 Conservation Measures

Commercial mixed-stock fisheries targeting chum in Johnstone Strait have been modified to include the following conservation measures:

- No commercial opportunities prior to late September due to Interior Fraser and Strait of Georgia coho conservation requirements.
- Non-possession and non-retention requirements are in place for coho, chinook, sockeye, and steelhead. Enforcement of selective fishing measures occurs on the fishing grounds (e.g. sorting requirements, use

of revival boxes, brailing for seines, short soak times for gill nets, barbless hooks for trolls). Non-retention restrictions are monitored on the ground and at landing sites by enforcement staff.

- Areas with high encounter rates of non-target species have been identified and closed areas have been implemented. (Table 6)

Section 3.4 of the *2009 Pink & Chum Management Summary* includes an inventory of regional conservation efforts and provides the context for the specific measures listed above.

3.3.1.6 On-going Developments

- Requests from industry to modify the plan in-season to provide more fishing time are common in years when there appears to be a very large return. Under the current harvest strategy, opportunities for additional harvest on larger returns are provided in terminal areas once terminal abundance estimates are available and surpluses are anticipated based on escapement target requirements.
- There have been requests by the commercial sector to review the effort based management approach and develop a revised approach that is better suited to implement share based (ITQ) fisheries. DFO is working closely with advisory groups to explore options for implementing these fisheries. For example, in 2008 the Area H troll fleet and DFO jointly developed a demonstration fishery based on a set of defined, transferable shares of effort (i.e. boat days) in the Johnstone Strait fishery. The incentive of additional fleet flexibility was balanced with additional monitoring requirements (e.g. 100% dock-side validation). This was consistent with the demonstration fishery objectives under the *Pacific Integrated Commercial Fisheries Initiative* and *Pacific Fisheries Reform*.
- Seine harvesters are interested in exploring defined-share fisheries. To-date, one such fishery has been implemented in 2005. In 2005, in addition to the two competitive seine openings a seine demonstration (IQ) fishery also occurred. This demonstration fishery provided some fish harvesters an opportunity to participate in an individual catch target fishery which occurred between the two competitive fishery openings. Fish harvesters had to declare whether they were fishing in the competitive fishery or the demonstration fishery and could not participate in both. The catch target in the demonstration fishery was based on effort and catch in the first competitive opening. There were no demonstration fisheries from 2006 to 2008. Future options for a demonstration fishery component to the fishery are under discussion with the Area B Harvest Committee. The Area B Harvest Committee is interested in exploring an abundance-based management approach to determine share-based harvest levels.
- In 2007, 15 troll vessels participated in an Individual Transferable Quota of TAC demonstration fishery. The initial quota was based on a conversion of the ITQ fisheries share of the allowable troll harvest rate into pieces based on the estimated harvest rate and catch in the first seine fishery.

3.3.2 Johnstone Strait terminal chum fisheries

3.3.2.1 Area 12 terminal chum fisheries (Nimkish)

Nimkish chum have later timing than other Johnstone Strait chum stocks and are harvested in the terminal area based on observed abundances.

The spawning escapement goal for the river is set at 110,000 chum with additional fish required as brood stock for the Gwa'ni hatchery (approximately 3,000 females).

Returning chum are assessed by scheduled over-flights of the river and in-river assessment activities (e.g. swim surveys). Collection of assessment information and river enumeration is often hampered by poor weather conditions, affecting the accuracy of in-season run size estimation and fishing opportunities. Other

assessment alternatives are currently being considered, such as gill net assessment fisheries with limited effort in years when surpluses are expected.

If a commercial fishing opportunity is identified, Area B and D fishery opportunities are based on the in-season status of licence area chum allocation guidelines, fleet participation, and expected catch levels. An ESSR opportunity may be provided once all commercial and recreational opportunities are exhausted and if a surplus remains.

Chum openings are confined to a portion of Subareas 12-18 and 12-19 to minimize incidental harvest of other local chum stocks.

3.3.2.2 Area 13 terminal chum fisheries (Bute Inlet)

Bute Inlet like many of the Mainland Inlets has a number of heavily glaciated rivers that returning chum will frequent. The three main chum producers are the Orford River, half way up the inlet, the Homathko and Southgate Rivers, both located at the head of the inlet. The Orford River escapement target for management purposes is 20,000 chum in Clear Creek. Returns and capacity of the Southgate and Homathko Rivers are significantly larger however the escapement targets are uncertain due to glacial nature of these systems impeding reliable escapement estimation. The Homalco First Nation operates an enhancement facility on the Orford River and produce chum on an annual basis with a target production of 3 million eggs per year. Assessment programs for these systems consist of mainly of over-flight and stream walk inspections.

Bute Inlet is unique in that it has two separate runs of chum. The summer run which returns to the Orford River from late August to the end of October and the fall run which returns to the Southgate River from the end of October to the beginning of December. Currently, Fisheries and Oceans Canada is obtaining DNA samples from these systems to get a better understanding of chum stock distribution and timing within the inlet.

In the 1970s and up to the late 1980s, Bute Inlet had regular commercial chum gill net fisheries. In the late 1980s chum returns were on the decline and hence commercial fishing opportunities ceased. Over the last decade chum returns have been increasing and in 2003 and 2004 commercial opportunities were provided targeting Upper and Lower Bute Inlet chum stocks. However, in 2005 and 2006 returns were below average.

Specific management measures include:

- Area of fishing confined to Subareas 13-21 and 13-22 to ensure directed terminal harvest of Bute Inlet Chum
- Ribbon boundaries are implemented to reduce impacts on returning coho.
- Consideration must be given to the Orford River hatchery to ensure that sufficient brood stock collection opportunities are provided.
- Coordination with other fisheries may be required to reduce fleet sizes.
- The initiation of commercial fisheries is dependent on in-season assessment of terminal abundances.
- Due to heavy glaciation of the rivers and surrounding waters of Bute Inlet, in-river and approach water enumeration is extremely difficult.
- In the case of Orford chum, if an escapement of 10,000 chum in Clear Creek is identified and there is evidence of a good showing of chum in Bute Inlet, consideration will be given to initiate a commercial fishery, based on licence area allocation status, anticipated participation levels and expected available harvest.

- Information collected from a small fleet fishery may assist in determining abundance levels in Bute Inlet prior to initiating a fishery.
- Implement ribbon boundaries to reduce incidental catch of coho.

If commercial fishing opportunities have been exhausted and surplus stocks are still available, then an ESSR opportunity may be provided.

3.3.3 Strait of Georgia terminal chum fisheries

3.3.3.1 Area 14 terminal chum fisheries (Puntledge, Big Qualicum, and Little Qualicum)

The commercial fishery is directed at the enhanced stocks of three river systems: Puntledge, Little Qualicum and Big Qualicum Rivers. Chum returning to this area have been enhanced since the late 1960s and terminal fisheries have occurred in October and November since the 1970s.

A harvest strategy based on limited early harvest prior to escapement observations in the river has been in place since 1981. The allowable early chum harvest is calculated as 65% of the predicted surplus, defined as terminal abundance above the escapement goal of 300,000 plus a buffer of 100,000. The buffer safeguards against forecast errors. The surplus within the 100,000 buffer and remaining 35% of the surplus may be harvested provided that escapement targets have been achieved. Since 2002, Puntledge River stock returns have been above average resulting in terminal fisheries focusing on this slightly earlier-timed stock.

Other fisheries include:

- *First Nations FSC*: Conducted in Area 14 and at the hatcheries prior to consideration of ESSR fisheries.
- *Recreational*: Tidal recreational fisheries are subject to the normal daily and possession limits (daily limit four per day/possession eight) and are open throughout the area. Once escapements have been confirmed, non-tidal recreational fisheries for chum, chinook and coho in the Puntledge and Big Qualicum Rivers are considered. These fishing opportunities may occur as early as the second to fourth week of October based upon in-season abundance estimates and past return timing of chum, chinook and coho.
- *ESSR fishery*: These have occurred at Big Qualicum, Little Qualicum and Puntledge hatchery sites, where surplus fish can easily be harvested once brood stock capture is complete.
- *Sampling*: Genetic stock identification sampling was initiated in 1981 and continued until 1992 to determine interception of Fraser and US origin chum; data are published in Fisheries Technical and Data reports (Beacham *et al.* 1985, Naylor *et al.* 1988, Hop Wo *et al.* 1989, 1990, 1991, 1992, 1993; Wylie *et al.* 1994).

The terminal fishery is managed to achieve an overall escapement of 290,000 chum in Area 14. Specifically:

- Escapement goals for the three river systems are 60,000 for Puntledge River, 130,000 for Little Qualicum River, and 100,000 for Big Qualicum River, adding up to an overall escapement goal of 290,000 chum, plus enhancement facility requirements of approximately 10,000 chum.
- The returning Area 14 chum abundance is forecasted pre-season using brood escapement, average survival and age composition. In-season run strength is assessed from any early catches, visual observations at river estuaries and by escapement counts to the three river systems.

Since 2004, a Chum Working Group meets weekly to provide fishery planning advice. The Working Group includes representation from Mid Vancouver Island, Johnstone Strait, WCVI, and Fraser River fisheries, as well as representatives from DFO,

Planned opportunities for gill net, seine and troll fishery openings starting in the second or third week of October are based on pre-season forecasts of chum returning to Area 14. An anticipated harvest of chum for the “early” fishery is estimated from the expected return minus escapement targets and a buffer. These “early” chum are used to craft fisheries to provide a precautionary harvest level for assessment of the in-season return prior to the availability of escapement information. Fishing is restricted to a limited number of days per week (e.g. 48 hour opening for gill nets) which may be adjusted to accommodate early abundance indications based on catch rates and environmental factors, such as weather.

In-season run strength is assessed based on fishery catches in the terminal area, catch-per-unit-effort in the commercial chum fisheries in Johnstone Strait, as well as visual observations at river estuaries followed later by escapement counts to the three river systems. Escapement information becomes increasingly important as the season progresses when planning fisheries.

Each year’s detailed chum fishing plan for Area 14 is reviewed at the first meeting of the Chum Working Group, held in early October. If poor catches in the commercial chum fisheries in Johnstone Strait indicate low chum abundance, a more precautionary approach will be taken in determining terminal fishing opportunities. Fishing opportunities are normally considered from late October to late November, although there may be consideration of controlled fishing earlier (i.e limited effort).

Additional opportunities using in-season data are evaluated at weekly meetings of the Chum Working Group which usually occur from mid-October to late November. Each week, the following considerations guide the duration of net and troll openings:

- If gear counts indicate a modest fleet size of 50 vessels or less, gill net and troll openings may be expanded beyond one to two days per week subject to stock expectations.
- A limited-effort seine fishery with a catch target will be considered from late October to late November, based on chum escapement, abundance in the approach areas and allocation guidelines. Full fleet opportunities may also be available.
- Additional fishing days are considered if time is lost due to poor weather conditions.
- Escapement information is factored into the amount of fishing time that is provided. For example, there is a possibility for reducing or eliminating beach and creek mouth boundaries when the overall escapement goal has been reached, individual surpluses have been identified and by-catch of non-target species is not an issue.
- Escapements are monitored by Fisheries and Oceans Canada staff and local hatchery staff.

Commercial fisheries targeting Area 14 chum have been modified to include the following conservation measures:

- Beach boundaries are in effect to protect coho and chinook and to ensure adequate chinook and coho escapements to Area 14 enhancement facilities and wild chum populations. Boundaries may range from half a mile to one and a half miles depending upon by-catch concerns and time of year.
- French Creek radius boundary and Baynes Sound closures in effect to protect wild chum and coho.
- Coho conservation measures are in effect until November 10, including non-retention of coho by all gear types, the mandatory use of revival boxes by all gear types, maximum soak times for gill nets, barbless

hooks for trollers and mandatory brailing and sorting for seines. By-catch concerns for coho are minimal after November 10.

- Outside boundaries are designed to minimize impacts on passing stocks. The gill net fishery may be restricted to daylight hours only if there are significant levels of non-target species catch (e.g. coho).

Section 3.4 of the *2009 Pink & Chum Management Summary* includes an inventory of regional conservation efforts and provides the context for the specific measures listed above.

3.3.3.2 Area 16 terminal chum fisheries (Jervis)

The commercial fishery targets wild chum stocks returning to river systems in the Jervis Inlet area when runs are abundant. The main systems are Tzoonie, Deserted and Skwawka Rivers. Fishing opportunities do not occur on a regular basis.

The terminal fishery is managed to achieve an overall escapement of 110,000 chum in Area 16 and work towards the commercial allocation targets. Specifically:

- The overall escapement goal for Jervis Inlet streams is 110,000. These terminal fisheries occur when the individual or combined escapement goals have been achieved.
- Fishing opportunities are guided by commercial allocation targets for chum salmon in the south coast.

Area 16 chum fishing opportunities are guided by estimates of local abundance and coast-wide allocations of chum salmon. Specifically:

- Commercial fishing opportunities are evaluated at weekly meetings of the Chum Working Group, starting in early October.
- In-season data is reviewed on a weekly basis until the end of the season, which usually occurs around the end of November.
- Fishing opportunities will be provided in an area when the escapement goal has been achieved.
- Achievement of the escapement goal includes the numbers of fish in-river plus the amount of fish inside a designated sanctuary area. The earliest potential fishing opportunity is expected at the end of October.
- Area 16 chum fisheries are not planned based on pre-season forecasts alone. The potential implementation of a limited fleet-size (e.g. three to five vessels) weekly assessment fishery in the lower Jervis Inlet area is under discussion with the Area E and H Harvest Committees. A weekly assessment fishery in the last two weeks of October and the first week of November may, over time, provide an earlier indication of overall abundance returning to this area.

Assessment in the area is conducted by Fisheries and Oceans Canada Charter Patrol, Fisheries and Oceans Canada Stock Assessment, and Sechelt Indian Band staff.

Commercial fisheries targeting Jervis Inlet chum have been modified to include the following conservation measures:

- There is mandatory non-retention of coho.
- Harvest of local chum surpluses is limited to terminal areas to minimize impacts on passing stocks.

Section 3.4 of the *2009 Pink & Chum Management Summary* includes an inventory of regional conservation efforts and provides the context for the specific measures listed above.

3.3.3.3 Area 17 terminal chum fisheries (Nanaimo)

This fishery is directed primarily at Nanaimo River stocks. The Nanaimo River chum stocks are supplemented by the Nanaimo River Hatchery on poor return years. Escapements fluctuate annually and fishery openings are planned in-season based on escapement estimates. Management is also guided by weekly advice from the Chum Working Group as discussed for Areas 14 and 16. Area 17 chums are managed as a component of Study Area chums and fishing opportunities are guided by coast-wide allocations of chum salmon. The overall escapement goal for the Nanaimo River is 60,000. Coho are actively managed in the fishery and no other non-targeted species are returning to the Nanaimo River when fisheries are being held.

Other fisheries include:

- *First Nations FSC*: Local FSC opportunities are undertaken by Nanaimo First Nations in consultation with the Department.
- *Recreational*: Tidal recreational fisheries are subject to the normal daily and possession limits and there are no closed areas. There are no opportunities for non-tidal recreational fisheries on the Nanaimo River.
- The terminal fishery is managed to achieve an overall escapement of 60,000 chum into the Nanaimo River watershed and work towards the commercial allocation targets. Specifically, Area 17 chum are managed as a component of the mixed-stock harvest strategy for chum salmon in Johnstone Strait and the northern Strait of Georgia. Fishing opportunities are guided by commercial allocation targets for chum salmon in the south coast.

Pre-season expectations are helpful in identifying possible opportunities, but decisions to open fisheries are not based on pre-season information. Opportunities are evaluated during the weekly in-season review of Nanaimo escapement estimates within the Chum Working Group.

- Escapements fluctuate annually and fishery openings are planned in-season based on escapement estimates.
- Escapement estimates are derived from helicopter over-flights, combined DFO/Snuneymuxw in-river assessment, on-grounds charter patrol surveys of approach and terminal areas and fishery officer patrols of the river. The aerial fish counts and DFO/ Snuneymuxw in-river assessment escapement counts are used in an area under the curve estimate and compared to previous year's run curves and timing. When escapement forecasts, generated by the area under the curve estimate, are near or at the escapement goal fisheries are delayed until margins can be confirmed.
- Opportunities for gill net, troll and seine fisheries are discussed once fish have started to enter the Nanaimo River and are present in terminal areas. Final decisions are made at the weekly at the Chum Working Group meeting. If commercial opportunities are identified, management will be guided by the following considerations:
 - Gill nets open for one or two days. Fishing days and duration subject to escapement levels and expected fleet size.
 - Gill nets may be restricted to daylight hours only if coho encounters are high. Other restrictions could include short soak times, further subarea closures or a complete closure of the fishery. Restrictions would be implemented after consultation with the Chum Working Group.
 - Troll open seven days per week because of demonstrated low catch rates.

- After initial opening, continued fishing opportunities depend upon information derived from catch-per-unit-effort estimates in the commercial fisheries, and on-going approach area and in-river assessments.
- If catches remain good and the escapement goal is reached, commercial fisheries could continue however managers would try to spread the fleet effort over the run timing curve.
- Additional fishing days could be considered if time is lost due to poor weather conditions.

Commercial fisheries targeting Nanaimo River chum have been modified to include the following conservation measures:

- Sub-area boundaries protect migrating Fraser River chum and confine the fishery to the Nanaimo River stock. Outside fishery boundaries in the Strait of Georgia keep the fishing fleet away from migrating Fraser River chum. Inside boundary allows a sanctuary for returning stocks and although fish within the sanctuary are considered in the overall return they are not factored into the current week escapement estimate.
- Coho and chinook conservation measures in effect until November 10 include non-retention, maximum soak times, area closures for gill net, and barbless hooks and area closures for troll.
- The gill net and troll fishery may be restricted to daylight hours only if coho encounters are high. Restrictions would be implemented after consultation with the Chum Working Group.

Section 3.4 of the *2009 Pink & Chum Management Summary* includes an inventory of regional conservation efforts and provides the context for the specific measures listed above.

3.3.3.4 Area 18 terminal chum fishery (Cowichan)

This terminal commercial fishery is directed primarily at Cowichan River stocks, but to some extent Goldstream chum are also harvested. Fishery openings in mid to late November are limited to Satellite Channel to minimize impact on the earlier timed Goldstream stocks. Chemainus River stocks are also impacted but likely to a lesser extent. Besides Cowichan chinook and coho no other non-targeted species are returning to the Cowichan, Goldstream or Chemainus Rivers during times when the fishery would occur.

Other fisheries include:

- *First Nations FSC*: Cowichan First Nations harvest chum for FSC purposes, and are seeking economic opportunity fisheries.
- *Recreational*: Tidal recreational fisheries are subject to the normal daily and possession limits. Non-tidal recreational fisheries are considered, if escapement and FSC needs are met.

Area 18 chum are managed as a component of Inner South Coast chums and fishing opportunities are guided by coast-wide allocations of chum salmon. Fishery openings are planned in-season based on escapement estimates. Management is also guided by advice from the Cowichan Fisheries Roundtable (the Roundtable) and the Chum Working Group.

The terminal fishery is managed to achieve an overall escapement of 110,000 chum into the Cowichan River watershed and work towards the commercial allocation targets. There is a proposed escapement goal review planned to begin in 2009 and a meeting of the Cowichan Round Table April 2, 2009 to discuss revised “triggers” for commercial fisheries.

Specifically, Area 18 chum are managed as a component of the mixed-stock harvest strategy for chum salmon in Johnstone Strait and the northern Strait of Georgia. Fishing opportunities are guided by commercial allocation targets for chum salmon in the South Coast.

Pre-season expectations are helpful for identifying possible opportunities, but currently decisions to open fisheries are not based on pre-season information. Opportunities are evaluated during the weekly in-season review of Cowichan escapement estimates within the Roundtable and the Chum Working Group process.

Results from the 2007 and 2008 season show that the DIDSON counter may offer a more accurate and consistent method of gathering escapement estimates, both in-season and post-season. With this new assessment tool, the Roundtable had proposed a set of specific decision guidelines which would trigger commercial and recreational fisheries in Area 18. However, because the DIDSON counter escapement estimates have been consistently higher than other methods of assessment, the triggers for a commercial fishery will need to be re-evaluated. The re-evaluation of the in-season commercial fishery triggers will occur on April 2, 2009 by Cowichan Round Table. Invitations will be sent to all interested parties so that everyone will have input into the “triggers” for commercial fisheries. In-river abundance levels of chum which could trigger a fishery remain the same, however the actual escapement estimate seems to be more consistent since the use of the DIDSON Counter became the standard assessment tool. The DIDSON counter is able to assess abundance level even under high, dirty river flow conditions which often occur during Cowichan chum migration.

Regardless of what the in-river escapement estimates produced by the DIDSON counter and the comparison of run timing and run curve are, the assessment of marine abundance through the test fishery and/or over-flights will decide if there is an opening on Cowichan chum stocks in the 2009 season.

The following triggers were the guidelines to commercial openings in Area 18. Specific dates and boundaries are determined in season by the roundtable process. Timing of migration is also important in terms of the health of the run and in relation to mixed stocks of Goldstream chum in the Area 18 fishing area. These issues are also addressed on an in-season basis.

- 50,000 estimated escapements in the Cowichan River with the remainder of the escapement goal expected to return from the outside marine areas:
 - Gill net and troll open subject to commercial licence area allocation status.
 - Recreational fisheries in the river could also open at this time, and remain open until further notice.
 - Troll may remain open until further notice (depending on allocation).
- 75,000 estimated escapement, good in-river migration conditions, and abundance of fish in the marine area so that there is a reasonable expectation of reaching escapement goals:
 - Seine openings subject to commercial licence area allocation status.
 - Subject to fishery review and continued escapements, commercial fisheries may continue and opening type would be adjusted to meet overall guidelines such as allocation.

Specific dates and boundaries remain to be determined in-season by the roundtable process. Timing of migration is also important in terms of the health of the run and in relation to mixed stocks of Goldstream chum in the Area 18 fishing area. These issues are addressed on an in-season basis.

Commercial fisheries targeting Cowichan chum have been modified to include the following conservation measures:

- Sub area boundary closure to protect coho holding off Cherry Point.
- Near-shore boundary closures to protect coho and chinook.
- Other coho conservation measures in effect include non-retention, maximum soak times for gill nets, barbless hooks for troll, and mandatory brailing for seines.
- The gill net fishery may be either restricted to daylight hours or closed if coho encounters are high. This would be implemented after consultation with the Roundtable and the Chum Working Group. Coho are reported through the daily fishermen's reports and verified by either on grounds monitors or on board observers (or both).

Section 3.4 of the *2009 Pink & Chum Management Summary* includes an inventory of regional conservation efforts and provides the context for the specific measures listed above.

3.3.3.5 Area 19 terminal chum fishery (Goldstream - Saanich Inlet)

This terminal commercial fishery is directed primarily at Goldstream River stocks, but some Cowichan River chum are also harvested.

Other fisheries include:

- *First Nations FSC*: Saanich Tribes harvest chum for FSC purposes,.
- *First Nations Economic Opportunity*: If a surplus is identified, an economic opportunity fishery for Saanich Tribes is conducted separately from FSC fisheries under the same priority and similar rules as the commercial fishery. Fish harvested are off-set with licenses retired from the commercial fishery.

The terminal fishery is managed to achieve an overall escapement of 15,000 chum into the Goldstream River watershed and work towards the commercial allocation targets. Specifically:

- The overall escapement goal for the Cowichan River is currently 15,000 chum
- Area 19 chum are managed as a component of the mixed-stock harvest strategy for chum salmon in Johnstone Strait and the northern Strait of Georgia. Fishing opportunities are guided by commercial allocation targets for chum salmon in the south coast.

Area 19 falls under the same management regime as Area 18, which are managed as a component of Inner South Coast chums. Fishing opportunities are guided by coast-wide allocations of chum salmon. Commercial chum harvest opportunities are guided by advice from the Cowichan Fisheries Roundtable (the Roundtable) and the Chum Working Group.

Pre-season expectations are helpful for identifying possible opportunities, but decisions to open fisheries are not based on pre-season information. Opportunities are evaluated during the weekly in-season review of escapement estimates within the Roundtable and the Chum Working Group process.

There is no counting fence on the Goldstream, but escapement estimates can be derived from stream walks, because this is a relatively small system with good visibility of spawners.

If commercial opportunities are identified, management is guided by the following considerations:

- Gill nets and troll open first. Gill nets open for one or two days. Fishing days and duration are subject to escapement levels. Troll typically has low catch and low effort and has been allowed to remain open for extended periods.
- Seines open for one to two days, once a review of gill net catch and escapement estimates indicates a significant surplus is available.
- Seines and gill nets will alternate fishing days subject to escapement estimates and the Chum Working Group review process.
- After the initial opening, continued fishing opportunities depend upon information derived from catch-per-unit-effort in the commercial fisheries, and on-going approach area and in-river assessments, as well as encounters of chinook and coho.
- If catches remain good and escapement is reached, commercial fisheries can continue.

Commercial fisheries targeting Goldstream chum have been modified to include the following conservation measures:

- Fishery openings set for mid to late November are limited to the portion of Saanich Inlet (Sub area 19-8) which is outside or to the north of Squally Reach. This area restriction is implemented to minimize impact on Goldstream chinook and coho holding in Squally Reach.
- Gill nets may be restricted to daylight hours if coho encounters are high. Additional conservation measures are in effect such as non-retention of coho and chinook, maximum soak time for gill nets, barbless hooks for troll, mandatory brailing for seines, and onboard observers.

Section 3.4 of the *2009 Pink & Chum Management Summary* includes an inventory of regional conservation efforts and provides the context for the specific measures listed above.

4 ASSESSMENT FRAMEWORK

4.1 Overview

Catch and escapement of Inner South Coast chum are assessed annually. Catch in a highly mixed stock areas is sampled frequently in order to determine stock of origin (i.e. Fraser, Non Fraser, and US), enhanced or wild, and age composition. In mixed stock areas, harvest rates are assessed using catch and escapement, and related to individual fisheries. Terminal area assessments include in-season escapement monitoring to determine potential surpluses for fisheries. Escapement survey coverage in non-fishing areas is dependent on location, accessibility, funding, and historical patterns of abundance. Hatchery and wild contribution have been assessed in the past, however, more recently this information has not been gathered. Forecasting is based on escapement, historical survival rates, and relative contributions of hatchery and wild components.

The *2009 Pink & Chum Management Summary* includes general information about monitoring and assessment. Specifically:

- Section 2.4 describes the regional assessment approach (stock assessment program, catch monitoring initiatives, data management)
- Section 2.7 summarizes DFO's toolkit for assessment, monitoring, and enforcement (e.g. role of charter patrols)

The remainder of this chapter describes how this general approach is implemented for Inner South Coast chum.

4.2 Annual Monitoring

4.2.1 Escapement

The target level of coverage is to survey all major chum producing streams every year, using a combination of counting fences, sonar, visual counts from fixed-wing or helicopter over-flights, and streamwalks:

- All major chum streams with potential target fisheries are enumerated visually (primarily over-flights and stream walks). These surveys are coordinated with escapement monitoring programs for coho and chinook salmon.
- In recent years, many smaller or remote streams have not been enumerated, but the annual escapement surveys still cover the majority of chum production.
- Estimates for major systems are predominantly based on multiple observations and area-under-the-curve estimates, but for smaller systems estimates are often based on the peak count of live and dead fish.
- DIDSON are now starting to be used on some systems (e.g. Cowichan)

4.2.2 Other abundance monitoring programs

4.2.2.1 Test fisheries

Test fisheries apply a standardized fishing procedure using a commercial vessel under contract. The purpose is to develop abundance indices and collect additional information, such as run timing, stock composition, and fish condition.

Test fisheries in the mixed-stock area:

- The Upper Johnstone Strait (Area 12) chum seine test fishery was initiated in 1965, and has been conducted annually since then, except in 1970 and 1973. During the initial years, standardized methods of test fishing were developed, based on specific set locations.
- Prior to 1980, test fishing was conducted primarily in years of expected low abundance, beginning in late September, and was arranged around commercial openings. Since that time, the test fishing program has been standardized to begin each year in early September and continue to early November, regardless of stock size and potential commercial fisheries.
- In 1985, at the request of local fishermen and Chum Advisory Board members, a second seine vessel (No. 2) commenced chum test fishing in the Blinkhorn area of Upper Johnstone Strait. This program is conducted annually in conjunction with the Double Bay test vessel No. 1, but utilized a different set of standardized set locations, focusing primarily on the Vancouver Island shore sites (Blinkhorn-Robson Bight). This additional test fishery was initiated to further assess the total stock passing through upper Johnstone Strait area and to corroborate information provided by the Double Bay test vessel No. 1.
- A map of test fishing locations and up-to-date catch data are available at http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/salmon/testfish/Chum/Area12_Seine.htm.
- Note that this test fishery was operated in 2005, but not in 2006 or 2007.

Test fisheries in the terminal areas:

- Historically many terminal areas with potential fisheries supported gill net test fisheries. However, over the last 10 years the quality of gill net test fishing results has eroded, due to seals and sea lions interfering and removing fish from nets. This resulted in extensively damaged nets as well as inaccurate catch results. Historically gill net test fisheries have occurred in the following areas: Nimpkish, Bute, Qualicum, Jervis, Nanaimo, and Cowichan. Currently seine test fishing has continued and/or replaced gill net testing. Recently seine test fishing in terminal areas occurred in the vicinity of Nimpkish, Qualicum, Cowichan and Goldstream Rivers.

4.2.2.2 Assessment Fisheries

Assessment fisheries are regular commercial fisheries, but with a strict effort limitation (e.g. number of vessels, short opening). The purpose is to collect abundance information and provide low-impact fisheries.

Assessment fisheries may be implemented in terminal areas where local surplus abundance of chum is expected. For example, assessment fisheries were implemented in Bute Inlet in 2004 and 2005, with 5 gill nets in a geographically assigned pattern to get earlier indication of abundance.

4.2.2.3 Intensive Enumeration Programs

The following enumeration facilities currently collect chum data:

- Big Qualicum River Counting Fence: During the fall and winter, adult salmonids are counted as they pass through the fence. Their offspring are also counted as they swim downstream to the ocean in the spring.
- Little Qualicum has a spawning channel which is enumerated.
- DIDSON on Cowichan

4.2.3 Catch

4.2.3.1 Commercial

Ocean and terminal fisheries are monitored to estimate both catch and effort. Fisheries may also be sampled to determine the stock composition of the catch (DNA), either directly from boats in the fishery or from combined catch at processing plants.

Commercial gill net, seine and troll catch data is collected through a comprehensive monitoring and reporting framework:

- Daily harvest logs documenting date, location, set duration, species encounters, species kept, and species released are completed by each fishery participant. These data are collated and accessible at the regional level. Appendix 9 of the 2008 Salmon IFMP for Southern BC includes sample logbook pages for each licence area.
- Daily or weekly phone-in of in-season harvest information by all fishery participants is collated and accessed at the regional level.
- Frequent inspections by enforcement patrol staff to determine compliance with the Fisheries Act and associated regulations, including the conditions of licence. This may include, but is not limited to, requirements for catch reporting, and requirements for release on non-target species, and use of selective fishing techniques.
- Charter patrols collect daily hail information and observe the implementation of the fishery.
- Sales slip data encompassing information such as catch by species, statistical area of catch, date of catch, and gear type is generated as each fishery participant lands catch. The data is available at the regional level through database queries.

Commercial catch data are verified occasionally by on-water inspections of catch by Fishery Officers, dock-side monitoring programs and auditing of sales slip data. All commercial harvesters are required to submit catch information to DFO.

The *2009 Pink & Chum Management Summary* describes on-going regional catch monitoring initiatives. Specifically:

- Section 1.2.9 describes the changing structure of Pacific Fisheries. Catch monitoring and enhanced accountability are key elements of *Pacific Fisheries Reform* (PFR), the *Pacific Integrated Commercial Fisheries Initiative* (PICFI), and the pilot projects for operational implementation.
- Section 2.4.2.6 summarizes fishery monitoring and catch reporting programs.
- Section 2.4.3.2 describes how catch data are compiled and managed. Detailed commercial catch records are available at www.pac.dfo-mpo.gc.ca/sci/sa/Commercial/AnnSumm_e.htm.

Catch monitoring in commercial salmon fisheries on the Inner South Coast is sufficient for estimating total removals of chum salmon originating from the South Coast (including Fraser).

Removal estimates at a finer level of detail are highly uncertain for Inner South Coast chum stocks due to the high variability in migration routes, run timing, and abundance of individual populations. However, the harvest strategy for Inner Coast chum limits the risk associated with this uncertainty through the fixed 20% harvest rate in the Johnstone Strait mixed-stock fishery, combined with terminal fisheries on local abundances identified in-season.

Catch monitoring programs also track by-catch and monitor compliance with conservation restrictions to assess impacts of fishing on non-target species for use in determining conservation measures on stocks of concern. For example, post-season estimates of coho and chinook by-catch are derived from in-season monitoring by charter patrol boats, weekly call-in by individual harvesters, log book data, and sale slip data. Any share-based fishing projects are implemented with 100% dockside validation of catch.

4.2.3.2 Recreational

Chum are generally not targeted by recreational harvesters, however there has been a growing fishery for chum in the Campbell River area. All recreational catch is monitored through the Inner South Coast Creel Survey. Creel surveyors gather catch-per-unit-effort data and take biological samples from boat landing sites throughout Inner South Coast area. These data are augmented by logbook and manifest records of catch and effort submitted by lodges operating guided trips. Effort is determined through periodic aerial surveys of fishing areas. These data are compiled and analyzed to produce catch and effort statistics by area and species. The Johnstone Strait Creel program generally runs in July and August and surveys the area around Port Hardy. The Strait of Georgia survey starts in April or May and ends in October, while the Victoria survey generally runs all year round.

4.2.3.3 First Nations

First Nations fishing opportunities on these stocks are provided on a regular basis. First Nations harvest opportunities are provided to meet FSC requirements. In most cases, First Nations are required to provide catch reports on a weekly basis as a condition of their communal licences. In some cases, electronic logbooks have been implemented and are in use by Aboriginal Fishery Guardians.

4.3 Analysis

4.3.1 Stock composition

Genetic Stock Identification (GSI) is a method of analyzing chum tissue to determine the origin (e.g. Fraser River, U.S., east coast Vancouver Island) of chum caught in major fisheries. GSI sampling is conducted in both the Canadian and U.S. chum fisheries and results are available from 1985. Since 1994, this program has been undertaken irregularly (i.e. 1996, 1998, 2000 and 2001). A comprehensive coast-wide GSI program is on-going for BC chum salmon, summarized in the publications listed in Section 2.1.1.4.

GSI data indicate that the proportion of Fraser chum in Johnstone Strait fisheries can be more than 50% and that the year to year variation in the proportion of Fraser fish in the Johnstone Strait catch can vary between 20% and 80%. It is not known what causes the annual variation in the proportion of Fraser River fish.

In the past, catch was assessed for stock composition based on genetic stock identification (allozyme). In recent years, the stock ID program has switched microsatellite DNA, but that approach has not been fully implemented. Until the new program is fully operational, stock composition is estimated based on historic contributions. Trends in catch and exploitation rate are discussed in Section 5.3.

4.3.2 Pre-season Outlook

The practice of providing forecasts for Inner South Coast chum has been discontinued in recent years for several reasons (as discussed in Beacham *et al.* 1987).:

- Chum salmon typically have highly variable survival and maturation rates, so that chum forecasts are relatively inaccurate compared to forecasts for other salmon species.

- The management approach in terminal fisheries is designed around decision guidelines that respond directly to in-season estimates of abundance.
- The harvest strategy in the mixed-stock fishery has been modified to a fixed 20% harvest rate.

Currently, a more general outlook is provided based on observed trends in each cycle, the trajectory of those trends and the relative performance of the returns in recent years. Each year's stock outlook is available at <http://www.pac.dfo-mpo.gc.ca/fm-gp/species-especes/salmon-saumon/index-eng.htm>.

4.3.3 Trend Summaries

This section describes the time series shown in Figure 3 to Figure 13.

4.3.3.1 Escapement and survey coverage

Chum salmon abundance is highly variable from year to year and across systems, and survey coverage for chum salmon escapement also fluctuates over time. Comparisons of annual estimates must therefore be approached with caution.

Time series of survey coverage for each management area plot the number of systems surveyed, and the % of long-term escapement covered by those systems. Note that the resulting trend in survey coverage only reflects the number of assessed systems, not the intensity of monitoring at each site (e.g. reduced number of inspections may miss the actual peak of spawning). System-by-system inspection records are available upon request. Note that 2007 and 2008 survey coverage hasn't been compiled yet, but remained at a similar level as the 2005 to 2006 period.

Escapement reconstructions account for the fluctuation in survey coverage. Briefly, total escapements for each statistical area are estimated by adjusting observed escapement index streams by expansion factors that reflect the relative annual contribution of each index stream, the contribution of all index streams to the total observed escapement, and the estimated observer efficiency for the predominant survey type.

4.3.3.2 Catch and exploitation rate

Aggregate exploitation rates for Inner South Coast chum are estimated based on total recorded catch / (total recorded catch + total observed escapement), which includes Fraser chum stocks and terminal harvests (e.g. Table 1 of PSC 2008). Aggregate exploitation rates are likely an overestimate for many systems, because escapement estimates are not available for all systems, and catch estimates include terminal harvests on enhanced stocks.

4.3.3.3 Index of escapement by population (P_{avg})

In addition to aggregate trends in observed and reconstructed escapement (bottom panel), Figure 3 to Figure 13 also show an index of escapement by population (P_{avg}), calculated as follows:

- Calculate the long-term average escapement for each stream (geomean, numerical records only). This establishes a more robust reference point for scaling annual escapements from many diverse and highly variable streams than the largest observed escapement (i.e. less sensitive to a single outlier). Also, the axis of the P_{avg} figure is more intuitive this way: if the index is around 1, then the individual populations are around their long-term average (on average).
- P_{avg} = Average of annual escapements scaled as a percentage of long-term escapement across all streams with a numerical escapement record in a given year.

Figure 3 to Figure 13 show two versions of P_{avg} :

- *Unweighted P_{avg}* treats all index streams equally, so that good escapements on abundant stocks do not mask poor escapements on small stocks.
- *Weighted P_{avg}* weighs the annual escapement proportions based on the long-term average, so that the performance of abundant stocks can be isolated and compared to catch patterns.

5 STOCK STATUS

5.1 Regular status evaluations

DFO evaluates the status of Inner South Coast chum salmon annually as part of the public post-season review process. These reviews report catch and escapement statistics and describe whether or not the fishery met objectives. Post-season summaries are included in the annual Salmon IFMP for Southern BC, as well as the annual reports of the Pacific Salmon Commission and its Joint Chum Technical Committee, available at www.psc.org.

More detailed status evaluations are completed regularly by DFO scientists and stock assessment biologists in collaboration with external experts. These status evaluations are publicly available, and are peer-reviewed through the *Pacific Science Advice Review Committee* (PSARC) where appropriate. Recent evaluations of Inner South Coast chum include:

- Godbout *et al.* (2004) *Stock Status of Wild Chum Salmon (*Oncorhynchus keta* Walbaum) Returning to British Columbia's Central Coast and Johnstone and Georgia Straits (excluding the Fraser River)*. Canadian Science Advisory Secretariat Research Document - 2004/007, available at http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2004/RES2004_007_E.pdf
- DFO (1999) *Inner South Coast Chum Salmon*. DFO Science Stock Status Report D6-09, available at <http://www.dfo-mpo.gc.ca/csas/Csas/status/1999/D6-09e.pdf>
- Ryall *et al.* (1999) *Status of Clockwork Chum Salmon Stock and Review of the Clockwork Management Strategy*. Canadian Science Advisory Secretariat Research Document 99/169, available at http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/1999/pdf/99_169e.pdf
- Annual post-season summary reports by the Joint Chum Technical Committee of the Pacific Salmon Commission, available at www.psc.org/publications_tech_techcommitteereport.htm

The remainder of this section briefly summarizes status and trends. For a more detailed evaluation, refer to the latest post-season report.

Formal status evaluations will be completed for each conservation unit as part of the *Wild Salmon Policy* implementation process.

5.2 Present Status

5.2.1 Conservation priorities

Currently, Inner South Coast chum populations are healthy enough not to warrant a legislated level of protection. The major factor contributing to low production in recent years is low marine productivity. Even with low productivity, the persistence of Inner South Coast chum populations is not immediately threatened. However, if any of the conservation units declined to a point where its persistence was threatened, the *Species at Risk Act* (SARA) provides a legislative and policy framework for recovery.

5.2.2 Production objectives

Chum production is generally quite variable. Productivity of the Inner South Coast chum aggregate has been average to below average in recent years, most likely related to lower than normal marine survival rates. Marine conditions in 2005 appear to have been particularly poor for juvenile chum and other salmonids. Recent fisheries management has responded appropriately to fluctuations in productivity: in years of low returns, fishing mortality has been constrained.

5.3 Trends

5.3.1 Escapement

Chum salmon escapement is highly variable from year to year and across systems. Figure 2 shows the aggregate escapement trend for Inner South Coast chum salmon (including both wild and enhanced fish, but excluding Fraser River chum). Figure 3 to Figure 13 show escapement trends for each management area:

- Aggregate chum escapement for the Inner South Coast appears to be improving since the 1990s..
- Stocks in Upper Vancouver Island (UVI) have low, but stable, abundance over all of the years in the time series. There is some recent indication of improvement since 2004, but this trend is uncertain due to the low survey coverage in most years.
- Johnstone Strait chum stocks show highly variable escapement, with both the highest and lowest observed escapements occurring in the last 5 years.
- Stocks in Mid Vancouver Island and Lower Vancouver Island experienced an improving trend since the late 1990s, but with a recent decline.
- Stocks in Kingome Inlet appear low, but are highly variable with fairly strong recovery observed in 2006.
- Stocks in Bond/Knight and Loughborough to Bute Inlets show a declining trend over the entire duration of the time series, however recent years shows signs of improvement (2004-2006).
- Fairly stable trend in Jervis Inlet
- Toba Inlet stocks have experienced strong recovery since the 1990s with fairly significant abundances in 2003, however since 2003 stocks have been lower but still above the average throughout the 1990s.
- Howe Sound and Burrard Inlet stocks also demonstrated improvements over the time series. However, survey coverage in these areas is not consistent and these trends should be interpreted with caution..

5.3.2 Catch and exploitation rate

Exploitation on the whole has fluctuated over the years with more stability in recent years. Mixed stock fisheries in Johnstone Strait (Areas 11 and 13) have averaged around 23% harvest rate for the Inner South Coast aggregate, including Fraser stocks (Figure 2). Terminal fisheries in Areas 15 to 19 are triggered by observed local abundances, and catches fluctuate accordingly (Table 3).

5.3.3 Survey coverage

Survey coverage varies across a lot from one year to the next in many of the areas, but has generally declined since the 1950s. Typically, assessments have focused on more abundant systems, so that the proportion of escapement covered by surveys has declined less than the number of systems surveyed

These overall declines in survey coverage concurred with changing harvest strategies.

5.3.4 Index of escapement by population (Pavg)

The escapement index by population tends to track the aggregate abundance closely in all areas for most of the available time series. Abundant stocks generally follow a similar pattern as smaller stocks, with some exceptions (e.g. enhanced Nimpkish stock in Johnstone Strait; Figure 6)

6 CONSERVATION MEASURES IN INNER SOUTH COAST CHUM FISHERIES

6.1 Coast-wide conservation strategy

The *2009 Pink & Chum Management Summary* describes the elements of DFO's conservation strategy (Section 3.2), summarizes integrated management initiatives (Section 3.3), and provides an inventory of major conservation and recovery efforts (Section 3.4). The management summary also includes an appendix that lists local conservation measures by statistical area.

Coast-wide conservation strategies are reflected in the fishery management plans for each area. Pre-season fishing plans use existing data from previous years to anticipate stock levels returning in any given year. These pre-season plans are established through consultation with Departmental managers, biologists and scientists as well as with industry and First Nations representatives. Fisheries commence each year using the established pre-season plan. As in-season catch and escapement data become available through the season, fishing plans are adjusted on a daily or weekly basis to reflect these 'real time' data.

General conservation measures in salmon fisheries include:

- In-season (field inspections) and post-season (catch analysis) monitoring of net fisheries to assess fleet compliance with fishery regulations and to confirm in-season phone-in data from fishery participants.
- By-catch of non-target species is closely monitored in-season to ensure impacts on these stocks are within management goals. Commercial harvesters are required to report all by-catch species both in their logbooks and during their verbal daily catch reports to DFO.
- In-season information may not provide a clear-cut indication of run status. In this case, management actions use a precautionary approach on stocks of concern.

This section highlights some examples of local conservation measures in Inner South Coast chum salmon fisheries. The decision guidelines in Section 3.3 describe the details..

6.2 Chum conservation measures

Inner South Coast chum fisheries are managed to address conservation objectives through the fixed 20% harvest rate in mixed-stock fisheries, and terminal harvests that are based on observed, rather than forecasted, abundance.

Fisheries are structured to avoid disproportionate impacts on individual components of the extended return migration.

Boundaries for terminal fisheries are established to specifically target those systems with identified surpluses and to protect smaller chum populations. For example:

- Mid Vancouver Island: Protect Little Qualicum and Big Qualicum stocks by fishing Puntledge stocks both early in the season as well as in close proximity to mouth of Puntledge River.
- Cowichan: Protect Goldstream stocks by fishing Cowichan stocks later and in close proximity to the mouth of the Cowichan River.
- Area 14 fishery focuses on Puntledge stocks, while avoiding smaller stocks in that general area through specific local area closures (e.g. radius boundary around French Creek).

6.3 Measures to reduce incidental harvest and by-catch in chum fisheries

Time and area closures as well as selective fishing techniques are used to protect specific non-target populations or species of concern. For example, constraints on the Inner South Coast for chum salmon include conservation concerns for Interior Fraser and Strait of Georgia coho, LGS chinook and steelhead:

- To reduce harvest rates on Interior Fraser and Strait of Georgia coho, LGS chinook and steelhead, selective fishing requirements (e.g. brailing, sorting, short soak times, and revival boxes) have been made mandatory in commercial marine chum fisheries.
- Coho interceptions in South Coast salmon fisheries are being managed to stay below a 3% exploitation rate ceiling for Interior Fraser coho which also provides protection to other coho stocks such as Strait of Georgia coho.
- Coho and chinook encounters are actively tracked during all troll and net fisheries, and non-retention is in place for both species. By-catch encounters are tracked by on-grounds observations as well as log book information.
- In terminal area chum fisheries, chinook and coho encounters are very low and have been verified through both observers and test fisheries.
- Coho protection measures have also reduced steelhead encounters in the JS mixed stock fishery (e.g. No fishing prior to late September).

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TABLES

Table 1. Population Structure of Inner South Coast chum

Bold font indicates systems for which four or more annual escapement observations are available over the period 1998 to 2006. Underlined italic font with an asterisk* marks systems with active hatchery enhancement. Methods for identifying CUs are documented in Holtby and Ciruna (2007). A complete list of sites for each Conservation Unit (CU) is available at http://www-comm.pac.dfo-mpo.gc.ca/pages/consultations/wsp/CUs_e.htm.

Conservation Unit	Management Area	Stat Area	Spawning Sites
Southern Coastal Streams	Johnstone Strait	11/12	Driftwood Creek (Area 11), Waldon Creek (Area 12)
	Kingcome	12	Bughouse Creek, Charles Creek, Cohoe Creek, Embley Creek, Hauskin Creek, Jennis Bay Creek, Kenneth River, Kingcome River , Mackenzie River , Nimmo Creek, <u><i>Scott Cove Creek</i></u> *, Shelter Bay Creek, Simoom Sound Creek, Sullivan Bay Creek, Wakeman River
	Bond/Knight	12	Ahta River , Ahta Valley Creek, , Gilford Creek, Hoeya Sound Creek, Kakweiken River , Kamano Bay Creek, Lull Creek, Maple Creek, Matsiu Creek, Mcalister Creek, Shoal Harbour Creek , <u><i>Yiner Sound Creek</i></u> *, Wakhana Bay Creek
Upper Knight	Bond/Knight	12	Ahnuhati River, Franklin River, Klinaklini River , Kwalate Creek , Sim River
Loughborough	Bond/Knight	12	Boughey Creek, Call Creek, Cracroft Creek, Glendale Creek , Port Harvey Lagoon Creeks, Protection Point Creek, Shoal Creek
	Johnstone Strait	12	Fulmore River , Potts Lagoon Creek, Robbers Knob Creek, Tuna River
	Loughborough to Bute	13	Apple River , Bachus Creek, Cameleon Harbour Creek, Chonat Creek, Elephant Creek, Fanny Bay Creek, Frazer Creek , Frederick Arm Creek, Granite Bay Creek , Grassy Creek , Gray Creek , Hanson's Creek, Hemming Bay Creek, Heydon Creek , Kanish Creek, Knox Bay Creek, Owen Creek, Phillips River , Read Creek , St. Aubyn Creek, Stafford River, Thurston Bay Creek, Village Bay Creek , Waiatt Bay Creek, Willow Creek , Wortley Creek
Northeast Vancouver Island	Upper VI	12	Cluxewe River, Keogh River, Nahwitti River, <u><i>Quatse River</i></u> *, Shushartie River, Songhees Creek, Stranby River, Tsulquate River
	Johnstone Strait	12	Adam River , Hyde Creek, Kokish River , Mills Creek, New Vancouver Creek, <u><i>Nimkish River</i></u> *, Tsitika River,
		13	Amor De Cosmos Creek , Hyacinthe Creek , Salmon River
	Mid-VI	13	Pye Creek
Strait of Georgia	Mid Vancouver Island	13	Campbell River , Kingfisher Creek , Menzies Creek , Mohun Creek , Quinsam River , Simms Creek
	Loughborough to Bute	13	Bird Cove Creek , Drew Creek , Open Bay Creek , Quatam River , Whiterock Pass Creek
Bute Inlet	Loughborough to Bute	13	Cumsack Creek, Homathko River, Orford River, Southgate River , Teaquahan River
Strait of Georgia	Mid Vancouver Island	14N	Bob Creek , Brooklyn Creek, Chef Creek , Cook Creek , Cowie Creek , Hart Creek , Kitty Coleman Creek, McNaughton Creek , Millard Creek , Morrison Creek , <u><i>Oyster River</i></u> *, Portuguese Creek, <u><i>Puntledge River</i></u> *, <u><i>Rosewall Creek</i></u> *, Roy Creek, Sandy Creek, Storie Creek, Trent River , Tsable River , Tsolum River , Waterloo Creek , Wilfred Creek , Woods Creek

Conservation Unit	Management Area	Stat Area	Spawning Sites
Strait of Georgia		14S	Annie Creek, Englishman River , French Creek , <u><i>Little Qualicum River</i></u> *, Nile Creek, <u><i>Qualicum River</i></u> *
	Toba Inlet	15	Black Lake Creek, Brem River , Brem River Tributary, Filer Creek, Forbes Bay Creek, Forbes Creek, Klite River, Little Toba River, Okeover Creek , Pendrell Sound Creek, Refuge Cove Creek, Store Creek , Tahumming River, Theodosia River , Toba River, Twin Rivers
	Jervis Inlet	15	<u><i>Lang Creek</i></u> *, Lois River, <u><i>Sliammon Creek</i></u> *, Whittall Creek
		16	Albion Creek , Angus Creek , Baker Creek, Brittain River , Burnet Creek , Carlson Creek , Cranby Creek, Deighton Creek, Deserted River , Doriston Creek, Earle Creek, Frock Creek , Gray Creek, Halfmoon Creek , High Creek, Hunaechin Creek , Jefferd Creek , Mill Creek, Mouat Creek, Park Creek , Pender Harbour Creeks, Ruby Creek, Sechelt Creek, , Skwawka River , Snake Bay Creek , Storm Creek, Tsuahdi Creek, Tzoonie River , Vancouver River , West Creek
	Howe Sound / Sunshine Coast	16	Dakota Creek, McNab Creek, McNair Creek, Potlatch Creek, Rainy River, Twin Creek,
	Lower Vancouver Island	17	Beck Creek, Bloods Creek, Bonell Creek , <u><i>Bonsall Creek</i></u> *, Bush Creek , Chase River , Departure Creek, Haslam Creek , Holland Creek , Knarston Creek, Millstone River , <u><i>Nanaimo River</i></u> *, Nanoose Creek , Napoleon Creek , Porter Creek, Stocking Creek , Tyee Creek, Walker Creek
	South Vancouver Island	17	<u><i>Chemainus River</i></u> *
		18	Cowichan River , Fulford Creek, Koksilah River, Shawnigan Creek
		19	<u><i>Goldstream River</i></u> *
Howe Sound – Burrard Inlet	Jervis Inlet	16	Bishop Creek , Shannon Creek
	Howe Sound / Sunshine Coast	16	Wilson Creek
		28A	Avalon Creek, Centre Creek, Eagle Creek, Hutchinson Creek, Langdale Creek , Long Bay Creek, Mannion Creek, Nelson Creek, Ouillet Creek , Terminal Creek, West Bay Creek, Whispering Creek
	Burrard Inlet	28A	Brothers Creek, Capilano River, Hastings Creek, Indian River , Lynn Creek, Mackay Creek, Maplewood Creek, McCartney Creek, Mosquito Creek, Mossom Creek, Noons Creek, Richards Creek, Seymour River
Strait of Georgia	Howe Sound / Sunshine Coast	28A	Chapman Creek, Chaster Creek , Flume Creek, Roberts Creek , Wakefield Creek,
		28B	Ashlu Creek, B.C. Rail Spawning, Branch 100 Creek, Brennan Channel, Brohm River, Cheakamus River, Chuk-Chuk Creek, Dryden Creek, Fries Creek, Hop Ranch Creek, July Creek, Lower Paradise Channel, Mamquam River, Mashiter Creek, Mashiter Spawning Channel, Meighan Creek, Mission Creek, Moody Channel, Pillchuck Creek, Raffuse Creek, Shovelnose Creek, Spring Creek, Squamish River, Stawamus River, Stawamus Spawning Channel, Tenderfoot Creek, Thirty Seven Mile Creek, Thirty-Six Mile Creek, Tiempo Spawning Channel, Twenty Eight Mile Creek, Upper Paradise Channel, Wildwood Spawning Channel
	Burrard Inlet	29B	Serpentine River

Table 2. Escapement summary for Inner South Coast chum salmon.

Note that survey coverage fluctuates across years, and comparisons of annual estimates must be approached with caution. Section 4.3 briefly describes how the observed escapements presented here are standardized to identify the escapement trends shown in Figure 3 to Figure 13.

Table 1 lists the major systems within each of these management areas.

Year	Total	Upper VI	Mid VI		Lower VI	Johnstone Strait	Kingcome Inlet	Bond to Knight	L-borough to Bute	Toba Inlet	Jervis Inlet	Howe Sound / Sunshine	Burrard Inlet
			unen-hanced	en-hanced									
1953	800,625	13,250	161,750		126,675	108,600	47,425	121,550	38,850	91,125	68,150	20,225	3,025
1954	988,200	44,400	174,750		232,725	62,050	44,675	176,750	43,550	85,725	56,425	24,950	42,200
1955	495,250	16,600	125,525		77,900	86,350	28,275	67,175	12,725	22,400	27,800	26,375	4,125
1956	439,676	14,650	84,100		90,451	52,200	24,550	77,575	13,675	31,875	36,100	12,775	1,725
1957	920,575	28,900	149,900		159,650	56,100	34,200	139,100	130,175	56,075	87,600	74,950	3,925
1958	1,037,950	35,500	135,975	35,000	268,525	60,400	50,050	186,875	62,200	46,425	69,050	72,275	15,675
1959	755,950	9,625	102,625	75,000	107,825	24,775	24,825	43,050	41,025	32,000	101,050	158,925	35,225
1960	481,145	13,700	90,500	75,000	32,525	40,370	17,275	45,825	11,600	20,100	103,800	26,375	4,075
1961	476,354	20,450	65,329	15,000	66,000	42,025	25,925	108,250	24,075	12,825	72,775	21,125	2,575
1962	534,277	5,675	82,627	35,000	120,450	22,775	22,825	109,075	24,050	11,125	46,550	50,550	3,575
1963	477,075	2,050	123,475	35,000	59,375	19,900	25,000	94,175	32,250	7,275	33,700	41,700	3,175
1964	567,525	14,250	88,575	35,000	76,300	21,000	19,100	153,350	58,600	15,625	46,500	34,150	5,075
1965	216,625	9,825	21,800	18,900	80,850	17,400	5,325	5,025	8,150	16,575	18,925	10,275	3,575
1966	573,775	3,675	93,775	53,850	221,425	53,175	14,325	28,300	27,000	21,800	29,200	23,675	3,575
1967	504,282	1,925	77,000	43,200	126,507	29,750	20,200	86,400	36,850	18,500	17,275	43,100	3,575
1968	1,071,673	16,000	195,100	143,400	168,998	63,650	21,700	68,375	94,900	75,050	98,850	110,400	15,250
1969	705,105	5,050	132,950	101,000	142,735	18,650	8,700	75,375	31,925	18,470	100,250	54,800	15,200
1970	878,906	4,375	164,250	132,300	104,281	31,575	24,100	89,675	120,250	8,700	67,375	116,950	15,075
1971	387,664	525	60,350	106,000	55,537	11,850	6,150	10,250	25,425	23,150	42,437	38,390	7,600
1972	1,418,869	4,650	169,375	80,300	226,484	35,405	52,800	128,125	214,525	46,250	96,210	327,895	36,850
1973	1,322,756	2,150	158,975	163,950	177,874	44,350	91,100	179,775	125,450	7,900	93,960	241,122	36,150
1974	889,212	1,740	138,600	96,400	158,803	15,200	68,800	63,681	71,975	23,700	95,113	146,175	9,025
1975	481,026	195	72,570	109,950	80,775	12,800	18,600	19,300	31,725	12,250	51,886	55,550	15,425
1976	630,672	148	76,125	92,000	69,327	14,625	66,000	98,950	25,225	11,765	41,834	114,633	20,040
1977	858,139	55	103,253	100,000	179,224	37,825	31,050	16,180	120,350	16,019	115,703	124,125	14,355
1978	1,079,190	150	179,500	124,600	269,202	41,350	38,750	26,815	191,350	4,888	79,522	115,539	7,524
1979	507,093		80,130	127,000	100,494	8,600	2,705	50,375	46,375	3,096	50,412	29,774	8,132
1980	1,059,166		158,250	92,945	217,614	19,325	14,125	34,650	163,375	6,300	105,370	231,693	15,519
1981	865,399		154,126	83,741	178,731	18,600	11,550	9,860	150,534	16,505	92,680	130,196	18,876
1982	1,128,587		112,986	150,731	257,471	64,870	14,455	70,115	237,340	12,450	50,022	133,791	24,356
1983	829,888	250	125,713	159,335	186,875	10,100	8,020	32,612	102,150	17,700	73,550	86,453	27,130
1984	1,052,032	375	123,825	141,808	227,734	47,600	6,388	50,300	124,760	19,565	122,460	156,225	30,992
1985	1,619,174	850	197,009	240,076	350,135	82,420	5,733	43,019	118,157	11,400	166,128	373,608	30,639
1986	1,336,598	925	148,990	246,784	162,438	99,562	2,341	25,274	302,555	4,300	89,688	221,010	32,731
1987	937,699	580	102,812	142,671	324,160	17,885	5,093	33,015	95,552	6,200	110,597	60,726	38,408
1988	1,132,835	250	96,672	136,514	293,545	108,550	16,650	46,250	182,160	5,580	121,185	94,336	31,143
1989	479,474	242	55,890	103,428	100,971	31,100	20,150	3,090	27,419	333	59,240	62,837	14,774

Table 2 continued...

Year	Total	Upper VI	Mid VI		Lower VI	Johnstone Strait	Kingcome Inlet	Bond to Knight	L-borough to Bute	Toba Inlet	Jervis Inlet	Howe Sound / Sunshine	Burrard Inlet
			unen-hanced	en-hanced									
1990	966,313	280	114,959	150,507	251,519	80,212	250	19,395	73,317	62	159,848	72,546	43,418
1991	893,747	200	113,707	156,703	271,897	76,500	7,874	10,450	19,981	690	75,605	133,162	26,978
1992	1,207,789	150	169,046	191,932	256,112	121,413	800	19,575	222,044	508	154,575	34,191	37,443
1993	1,283,388	500	191,212	266,897	307,600	62,675	312	17,133	199,829	827	168,253	33,862	34,288
1994	1,286,131	425	150,899	280,010	208,141	96,425	1,674	2,427	109,571	158	148,114	226,938	61,349
1995	602,562	690	105,104	104,747	111,850	63,355	3,717	9,169	63,485	212	60,078	37,321	42,834
1996	545,948	250	82,630	68,409	153,292	10,575	182	1,962	27,096	177	50,656	110,374	40,345
1997	715,218	1,730	191,905	143,634	126,410	74,192	6	4,461	32,149	9,287	64,346	5,948	61,150
1998	1,342,050	1,400	377,810	325,060	205,302	153,345	10,850	14,475	47,518	11,585	193,486	1,219	
1999	516,949	150	219,885	110,153	107,016	3,832	388	2,458	16,403	2,785	53,615	264	
2000	309,883	15	70,315	26,808	79,710	4,959	9,689	14,500	9,977	7,320	18,838	120	67,632
2001	1,059,071	90	253,839	182,073	265,372	67,505	1,551	7,909	37,611	7,894	119,112	588	115,527
2002	1,244,132	754	272,312	216,976	195,739	176,736	12,416	20,107	79,471	15,576	133,235	1,276	119,534
2003	720,518	543	205,525	97,209	112,579	2,400	1,502	12,550	39,810	20,364	92,070	1,523	134,443
2004	977,761	243	353,996	82,325	95,098	2,128	4,263	1,914	4,193	48,210	123,977	3,086	258,328
2005	517,354	923	206,380	55,742	50,005	43,571	392	10,717	4,111	9,346	69,760	1,969	64,438
2006	550,705	866	225,653	100,558	51,870	42,771	24,116	29,238	4,400	17,270	53,605	358	

Summary (Rounded)												Howe Sound /	Burrard Inlet
Total	Upper VI	unen-hanced	en-hanced	Lower VI	Johnstone Strait	Kingcome Inlet	Bond to Knight	L-borough to Bute	Toba Inlet	Jervis Inlet	Sunshine Coast		
Before 1990													
Min	216,625	55	21,800	15,000	32,525	8,600	2,341	3,090	8,150	333	17,275	10,275	1,725
Avg	809,201	8,272	118,518	102,996	158,935	41,426	25,377	70,744	85,628	22,730	74,037	99,126	16,224
Max	1,619,174	44,400	197,009	246,784	350,135	108,600	91,100	186,875	302,555	91,125	166,128	373,608	42,200
Since 1990													
Min	309,883	15	70,315	26,808	50,005	2,128	6	1,914	4,111	62	18,838	120	26,978
Avg	867,031	542	194,422	150,573	167,618	63,682	4,705	11,673	58,292	8,957	102,304	39,103	79,122
Max	1,342,050	1,730	377,810	325,060	307,600	176,736	24,116	29,238	222,044	48,210	193,486	226,938	258,328
Change	7.1%	-93.5%	64.0%	46.2%	5.5%	53.7%	-81.5%	-83.5%	-31.9%	-60.6%	38.2%	-60.6%	387.7%

Note: Changes in observed escapement need to be interpreted with caution. Section 4.3.3 briefly describes how the observed escapements presented here are standardized to identify the escapement trends shown in Figure 3 to Figure 13. The “before 1990” average is high for Upper Vancouver Island, Kingcome Inlet, and Bond to Knight, because of large escapements observed in the 1950s to 1960s. Kingcome Inlet and Bond to Knight also show some recent improvements in escapement.

Table 3. Catch summary for Inner South Coast chum salmon.

Catch information is based on a combination of sources, including sales slips, logbooks, and phone-in hails. Catch is separated between Fraser and non-Fraser chum salmon (Section 4.3.1). Catches of outside chum (i.e. originating from the West Coast of Vancouver Island) have been excluded, based on past stock composition samples and changes in fishery locations (e.g. Area 21 fisheries shifted towards more terminal harvest of Nitinat chum, and interceptions of Inner South Coast chum have been very small since 1990).

Brood Year	Catch (Non-Fraser South Coast Chum)									
	Area 11-13	Area 14	Area 15	Area 16	Area 17	Area 18	Area 19	Area 7 and 7a	Area 20-21	Area 4b, 5, 6c
1953	1,054,838	67,206	10,375	184,567	85,706	24,052	0	0	2,654	0
1954	1,335,264	61,278	12,570	147,452	248,328	72,445	0	0	1,349	0
1955	295,978	3,147	5,707	25,037	37,307	7,452	0	0	5,306	0
1956	327,434	3,623	4,403	16,812	11,353	10,868	0	0	444	0
1957	209,605	4,157	4,455	6,973	27,168	32,790	0	0	923	0
1958	560,784	61,560	4,712	92,281	59,064	45,667	0	0	7,753	0
1959	460,424	31,559	15,139	105,087	38,285	41,194	0	0	9,878	0
1960	340,511	7,847	3,910	33,357	14,847	14,323	0	1,875	4,510	46
1961	147,431	8,790	3,728	28,583	3,628	19,133	0	1,955	3,776	5
1962	76,224	9,271	1,274	29,571	0	40,818	0	1,200	4,126	8
1963	181,773	1	21	84	86	13,695	0	1,157	5,417	90
1964	52,629	1	3	99	95	3,262	0	1,294	11,129	109
1965	9,292	0	0	14	276	22	0	836	6,195	51
1966	17,352	0	3	16	412	151	0	916	8,836	54
1967	83,435	0	1	107	2	1	0	802	4,896	172
1968	367,210	0	1	12	25	11,882	0	6,507	7,774	216
1969	323,981	0	0	21,116	9,059	4,470	0	3,907	5,735	184
1970	474,403	5,333	5,464	57,910	19,632	5,962	0	5,466	7,136	0
1971	59,265	0	3	310	813	136	0	2,487	5,900	0
1972	934,689	111,550	26,129	27,906	90,827	38,267	0	31,346	64,550	0
1973	1,434,519	128,117	60	169,020	22,596	33,375	0	25,568	45,862	0
1974	150,298	9,014	5	108	17,325	1	0	19,305	21,350	0
1975	218,530	27,740	2	705	8,743	449	0	8,286	11,673	0
1976	446,039	31,903	2	1,378	445	4,381	0	29,016	31,895	0
1977	75,818	1	25	2	25	37	0	5,039	6,925	0
1978	712,769	5,227	27	1	293	48	0	38,930	15,767	0
1979	32,709	0	70	7	37	0	0	478	814	0
1980	406,221	58,492	6	1	123	4	0	34,954	20,987	0
1981	35,209	27,195	1	494	1,934	0	0	1,098	2,034	0
1982	819,058	92,095	2	448	36,026	4,640	0	7,431	4,585	0
1983	46,561	102,514	7	12	19	0	0	332	13	0
1984	27,241	136,519	0	0	0	0	0	156	0	0

Table 3 continued...

Brood Year	Catch (Non-Fraser South Coast Chum)									
	Area 11-13	Area14	Area 15	Area 16	Area 17	Area 18	Area 19	Area 7 and 7a	Area 20- 21	Area 4b, 5, 6c
1985	228,012	172,316	0	48	256	1	0	14,440	1,391	0
1986	784,334	206,837	2	101	98	2,111	0	8,681	1,420	0
1987	59,167	317,189	4	44	9,968	7,973	0	3,122	4,873	0
1988	783,541	32,523	0	137	23,856	60,761	0	12,483	2,871	0
1989	240,254	86,194	7	3,164	667	1,187	0	8,550	6,240	0
1990	670,355	126,407	0	2,285	632	46,558	0	13,860	3	0
1991	171,739	207,849	3	504	17,765	155,461	0	10,357	49	0
1992	962,441	356,804	1	21,844	22,014	85,275	0	10,629	80	0
1993	964,151	205,684	1	118,914	18,085	80,200	0	14,008	18	0
1994	912,335	174,963	40	470	8,794	602	0	5,932	0	0
1995	202,149	17,502	10	454	23	471	0	5,168	321	0
1996	87,188	0	9	135	154	1,409	0	4	0	0
1997	64,214	0	1	531	57	316	0	21	12	0
1998	1,173,237	599,566	0	377	416	549	0	4,785	0	0
1999	37,322	0	0	66	0	196	0	4	0	0
2000	127,548	140	0	0	0	0	0	60	1	0
2001	146,274	45,950	13	7,681	1,365	26,036	0	362	2,037	0
2002	462,964	186,257	0	0	309	229,986	25,383	11,745	71	0
2003	490,467	44,731	0	4	3,247	0	3	7,574	30	0
2004	831,107	105,586	0	0	9,374	33,982	27	15,054	55	0
2005	474,527	25,548	0	294	3,797	0	9	8,947	124	0
2006	386,113	70,956	0	0	58	131	0	11,031	62	0

Table 4. Operational Management Escapement Goals (MEG) for Inner South Coast chum salmon – Management Areas.

Operational goals are intended as long-term benchmarks reflecting highly productive stocks (i.e. high sustainable yields). Fisheries are adjusted in areas where escapement consistently falls short of the operational goals. Aggregate MEG are calculated as the sum of all stream-specific MEG, which are listed in Table 5. Note that formal benchmarks are under development for each Conservation Unit (see Table 1) as part of the coast-wide implementation of the *Wild Salmon Policy* (Section 2.4.4). Also note that chum salmon abundance is variable across systems within an area (i.e. don't expect all systems to have strong runs in the same year, but assume that achieving aggregate MEGs translates into strong runs on some systems each year, and frequent strong runs on all systems). Table 1 lists the major systems within each of these management areas. Finally, note that survey coverage fluctuates across years, and comparisons of annual estimates must be approached with caution, especially for minimum values. Section 4.3 briefly describes how the observed escapements presented here are standardized to identify the escapement trends shown in Figure 3 to Figure 13. Run reconstructions for North Coast and Central Coast chum salmon use expansion factors ranging from 1.52 to 2.83 to account for observer efficiency and changes in survey coverage (Gazey and English 1999, English *et al.* 2006). Similar analyses have not been completed for Inner South Coast chum salmon.

Management Area	Long-term Escapement Goal	Recent Observed Escapement (1997 - 2006)		
		Min	Avg	Max
Upper Vancouver Island	67,000	15	671	1,730
Mid Vancouver Island (unenhanced)	239,000	70,315	237,762	377,810
Mid Vancouver Island (enhanced)	135,000	26,808	134,054	325,060
Lower Vancouver Island	134,000	50,005	128,910	265,372
Johnstone Strait	190,000	2,128	57,144	176,736
Kingcome Inlet	195,000	6	6,517	24,116
Bond to Knight	346,000	1,914	11,833	29,238
Loughborough to Bute	436,000	4,111	27,564	79,471
Toba Inlet	172,000	2,785	14,964	48,210
Jervis Inlet	140,000	18,838	92,204	193,486
Howe Sound / Sunshine Coast	358,000	120	1,635	5,948
Burrard Inlet	33,000	61,150	117,293	258,328
Total***	2,445,000	309,883	795,364	1,342,050

*** Range of total observed escapements is calculated from total annual escapement, not as the sum of the area-specific ranges (i.e. last row is not the sum of the other rows, except in first column).

Table 5. Operational Management Escapement Goals (MEG) for Inner South Coast chum salmon – Major Systems.

All escapement numbers rounded to the nearest 1000. Operational goals are intended as long-term benchmarks reflecting highly productive stocks (i.e. high sustainable yields). These MEGs have been publicly available for decades (PSC 1988, Ryall *et al.* 1999). Fisheries are adjusted if escapement falls short of the operational goals. MEGs are available for all of the streams listed in Table 1, but included here only for major systems with MEG $\geq 10,000$. Note that formal benchmarks are under development for each Conservation Unit (see Table 1) as part of the coast-wide implementation of the *Wild Salmon Policy* (Section 2.4.4).

Area	System	MEG	Area	System	MEG	Area	System	MEG
<u>Upper Vancouver Island</u>			<u>Kingcome Inlet</u>			<u>Toba Inlet</u>		
	Stranby River	25,000		Kingcome River	150,000		Toba River	90,000
	Keogh River	15,000		Wakeman River	25,000		Theodosia River	21,000
	Quatse River	10,000					Little Toba River	20,000
<u>Mid Vancouver Island (unenhanced)</u>			<u>Bond to Knight</u>				Brem River	15,000
	Campbell River	10,000		Klinaklini River	100,000		Klite River	15,000
	Puntledge River	60,000		Glendale Creek	75,000	<u>Jervis Inlet</u>		
	Little Qualicum River	85,000		Kakweiken River	75,000		Deserted River	25,000
<u>Mid Vancouver Island (enhanced)</u>				Viner Sound Creek	40,000		Skwawka River	25,000
	Little Qualicum River (channel)	45,000		Ahta River	20,000		Tzoonie River	25,000
	Qualicum River	100,000		Ahta Valley Creek	20,000		Pender Harbour Creeks	17,000
	Puntledge River	60,000		Sim River	10,000		Sliammon Creek	14,000
<u>Lower Vancouver Island</u>			<u>Loughborough to Bute</u>				Bishop Creek	12,000
	Nanaimo River	65,000		Southgate River	250,000	<u>Howe Sound / Sunshine Coast</u>		
	Nanoose Creek	15,000		Homathko River	100,000		Squamish River	200,000
	Bonell Creek	10,000		Heydon Creek	35,000		Cheakamus River	100,000
	Bush Creek	10,000		Apple River	20,000		Mamquam River	40,000
	Holland Creek	10,000		Phillips River	20,000		McNab Creek	10,000
<u>Johnstone Strait</u>			<u>Burrard Inlet</u>					
	Nimpkish River	110,000					Indian River	28,000
	Salmon River	20,000						
	Amor de Cosmos Creek	10,000						
	Fulmore River	10,000						
	Hyacinthe Bay Creek	10,000						
	Tsitika River	10,000						

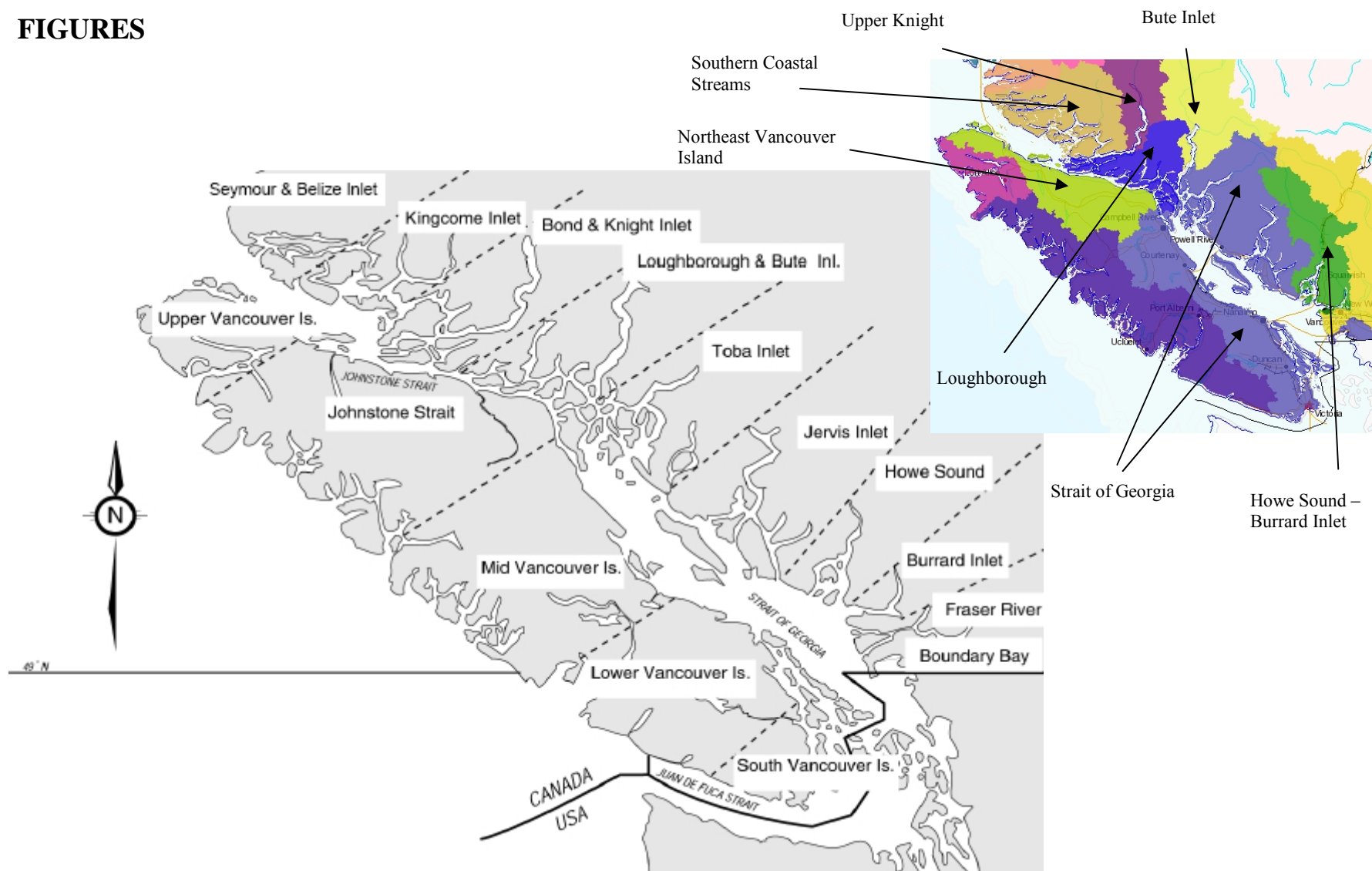
Table 6. Salmon fishery closures in Johnstone Strait

This table includes current salmon closures in Johnstone Strait (Areas 12 and 13) that apply commercial or recreational fisheries.

Closure	Applies to	Description	Reason for Closure	Length of Closure
Ribbon Boundary	Seine	The 0.5 nautical mile seine ribbon boundary is in effect in Areas 12 and 13 from Cracroft Point east to Brougham Point.	Protection of mainland pinks	End of July - end of August
Tsitika River Mouth (Robson Bight)	Seine, Gill net, Recreational	The boundary is from the inside a line drawn from two triangular yellow boundary signs located approximately 1 nautical mile on each side of the mouth of the Tsitika River.	Protection of all salmon species	All year
Box Boundary	Seine, Gill net	Close Sub Area 12-2	Protection of Eve/Adam River pinks	End of July - end of August
Port McNeil Bay	Recreational	Those waters of Port McNeill Bay westerly of a line from a boundary sign at the north end of the Western Forest Products jetty, true north to a boundary sign on the opposite shore of Ledge Point Peninsula	Finfish closure to protect of Bear Creek coho.	From Aug 15 to Dec 31
Klinaklini River (Knight Inlet)	Recreational	The mouth of the Klinaklini River (Knight Inlet) shoreward of a line from a fishing boundary signs at the southern entrance to Wahshihlas Bay to a fishing boundary sign at Rubble Point	Finfish closure to protect chinook.	All year.
Kingcome River	Recreational	The mouth of the Kingcome River shoreward of a line from a fishing boundary signs on Petley Point to a fishing boundary sign on a point on the opposite shore of Kingcome Inlet	Finfish closure to protect chinook.	All year
Wakeman River	Recreational	The mouth of the Wakeman River north of a line connecting two fishing boundary signs on opposite shores approx. 6 km from the head of Wakeman Sound	Finfish closure to protect chinook.	All year
Parson Bay (Sub area 12-20)	Seine, Gill net, Recreational	Parson Bay bounded inside a line from Red Point on Harbledown Island to a marker on the most northwest point of Parson Island, from there following the northern shore to the most easterly point and from there true east to Harbledown Island	Finfish closure to protect juvenile chinook.	June 15 to October 13
Nimpkish River (sn/gn/rec)	Seine, Gill net, Recreational	The mouth of Nimpkish River inside a line from a fishing boundary sign at a point on the shore of Vancouver Island approximately 1.5 km east of Broad Point, then to a navigational aid in the middle of Haddington Passage, then to a fishing boundary sign at a point approximately 1 km east of Willow Creek, then to the tidal water boundary signs approximately 100 m upstream of the Highway 19 bridge	Finfish closure to protect all returning stocks.	June 1 to November 30.
Scott Cove Creek	Recreational	The mouth of Scott Cove Creek and Viner Sound shoreward of a line between fishing boundary signs located at King Point and on the point 1 km south from the mouth of Scott Cove Creek	Finfish closure to protect chum and coho.	August 15 to September 30
Hardy Bay (Subarea 12-16)	Recreational	The waters of Hardy Bay shoreward of a line from a boundary sign on the Keltic Seafoods wharf to a boundary sign on the opposite shore non-retention of all salmon is in effect from August 15 to September 30, and only one single-pointed hook that measures no more than 15 mm between the point and shank may be used	non-retention of all salmon. Reviewed annually – stock dependent (enhanced)	August 15 to September 30.
Keogh River	Recreational	The mouth of the Keogh River within a 400 m radius of the shore only one single-pointed hook that measures no more than 15 mm between the point and shank may be used	Salmon closure to protect off year pink salmon.	August 1 to October 15.
Broughton Strait (Sub-area 12-19)	Recreational	Sub-area 12-19: Broughton Strait southerly of a line from Ledge Pt. to the light on the southern end of Haddington Island, then to the light on Yellow Bluff on Cormorant Island, then following the southerly shoreline to a marker on Gordon Bluff, then to Lewis Pt. on Vancouver Island	Non-retention of chinook	August 1 to October 31
Cluxewe River	Recreational	Those waters inside of a line that starts at a boundary sign approximately 1.9 km northwest of the Cluxewe river mouth, thence 35° true for 400 m to a position of 50° 37.57'N and 127°12.21'W, thence 108° true for approximately 3.3 km to a position of 50°36.98'N and 127°09.53'W, thence 200° true for approximately 400 m to the boundary sign on the shore. Only one single-pointed hook may be used during this period.	Non-retention of pink salmon during odd year cycles (ie: 2003, 2005).	July 14 to September 15

Closure	Applies to	Description	Reason for Closure	Length of Closure
Loughborough Inlet	Recreational	The waters in Loughborough Inlet from Cosby Point to head of inlet	Finfish closure to protect chinook and coho.	All year
Deepwater Bay	Seine, Gill net, Recreational	Deepwater Bay inside a line from a fishing boundary sign at Separation Head to a fishing boundary sign at the northerly entrance of Deepwater Bay	Rockfish Conservation Area	All year
Phillips Arm (Sub-area 13-24)	Recreational	Phillips Arm northerly of a line from Picton Point true east to the opposite shore.	Finfish closure to protect chinook. Open on even years for pink salmon only.	All year
Bute Inlet	Seine, Gill net, Recreational	The waters in Bute Inlet from Alpha Bluff to the head of the inlet	Finfish closure to protect chinook and coho.	All year
Village Bay	Recreational	The waters of Village Bay inside a line from a fishing boundary sign at the north entrance of Village Bay, Quadra Island, to a boundary sign at the south entrance of Village Bay	Finfish closure to protect sockeye and coho.	June 30 to October 31
Discovery Passage	Recreational	In those waters of Discovery Passage and the Campbell River, inside a line true east of the fishing boundary sign at Orange Point to the middle of the channel, then southeasterly down the middle of the channel to the intersection of a line running from a boundary sign on the southern end of Hidden Harbour breakwater, then true east to Quadra Island, , except for the Campbell River Discovery Pier	Finfish closure to protect coho.	October 1 to October 31
Salmon Bay	Recreational	The waters of Salmon Bay, bounded on the north by a line from Graveyard Point to the ferry landing on the opposite shore, and on the south by the downstream side of the first bridge upstream on the Salmon River	Finfish closure to protect all salmon species.	June 1 to December 1
Cape Mudge	Recreational	Those waters inside a line from the float at Yaculta Indian Village on Quadra Island true west one nautical mile, thence southeast 160° true to the intersection with a line drawn from the fishing boundary sign on Willow Point to the Wilby Shoal light buoy, thence to the Cape Mudge light on Quadra Island	Finfish closure to protect LGS chinook.	July 15 to August 31

FIGURES



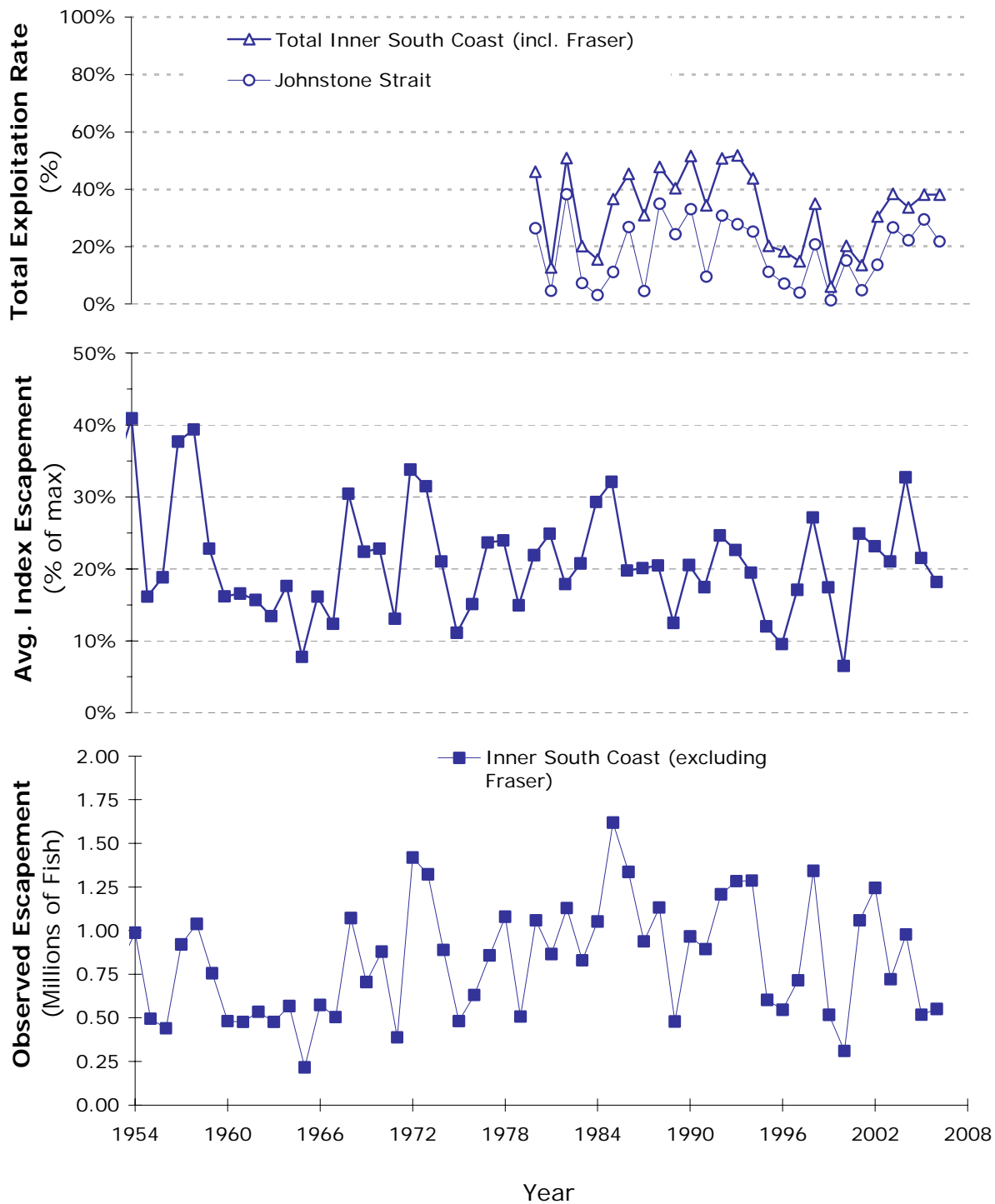


Figure 2. Aggregate escapement and exploitation rate trends for Inner South Coast chum salmon

Observed escapements are the sum of escapement estimates for all streams surveyed in a given year. The Average Index Escapement corrects for year-to-year differences in survey coverage and high variability in abundance across systems. Exploitation rate estimates taken from Table 1 of PSC (2008).

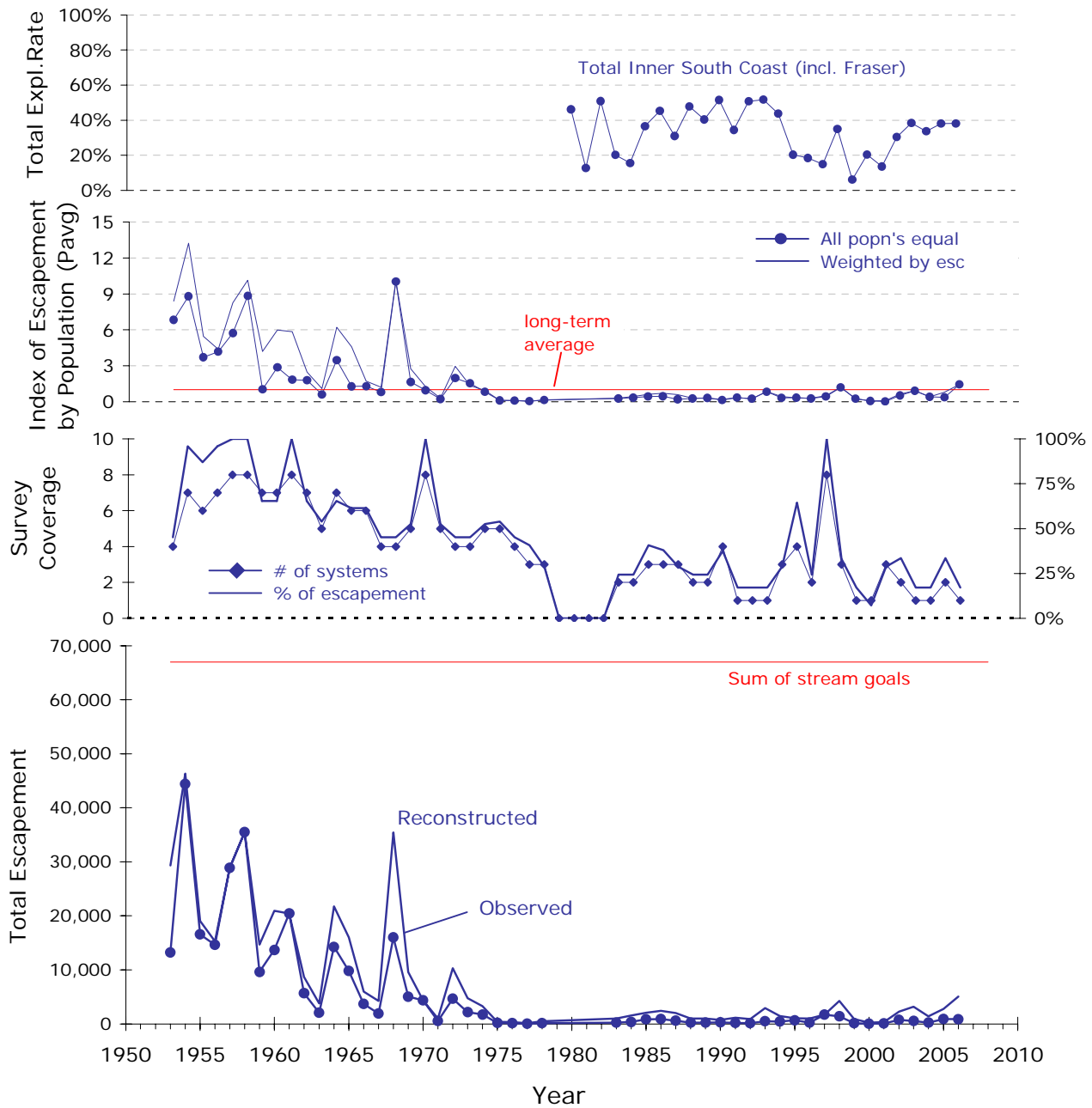


Figure 3. Trend summary for Inner South Coast chum salmon – Upper Vancouver Island
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

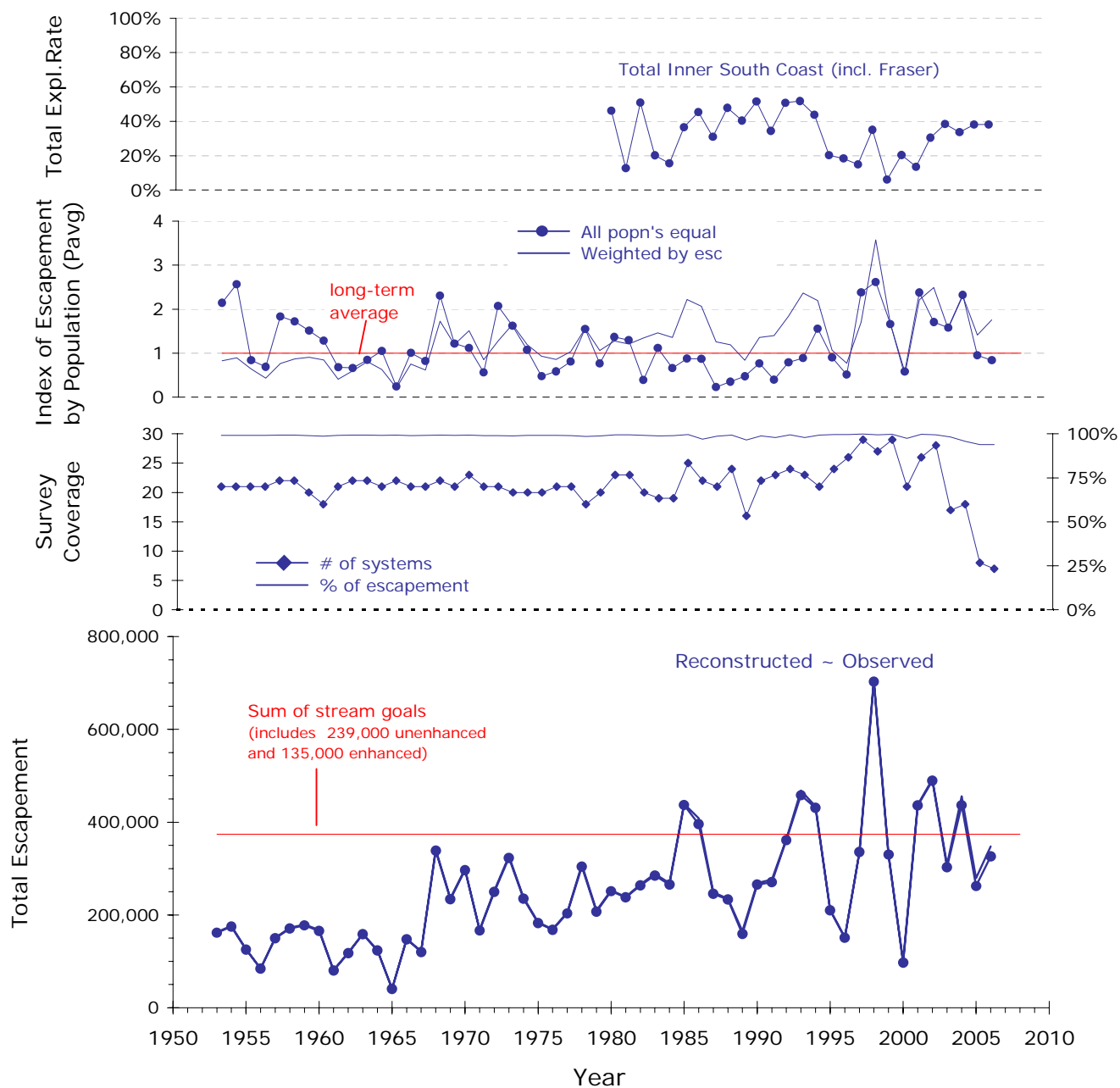


Figure 4. Trend summary for Inner South Coast chum salmon – Mid Vancouver Island

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

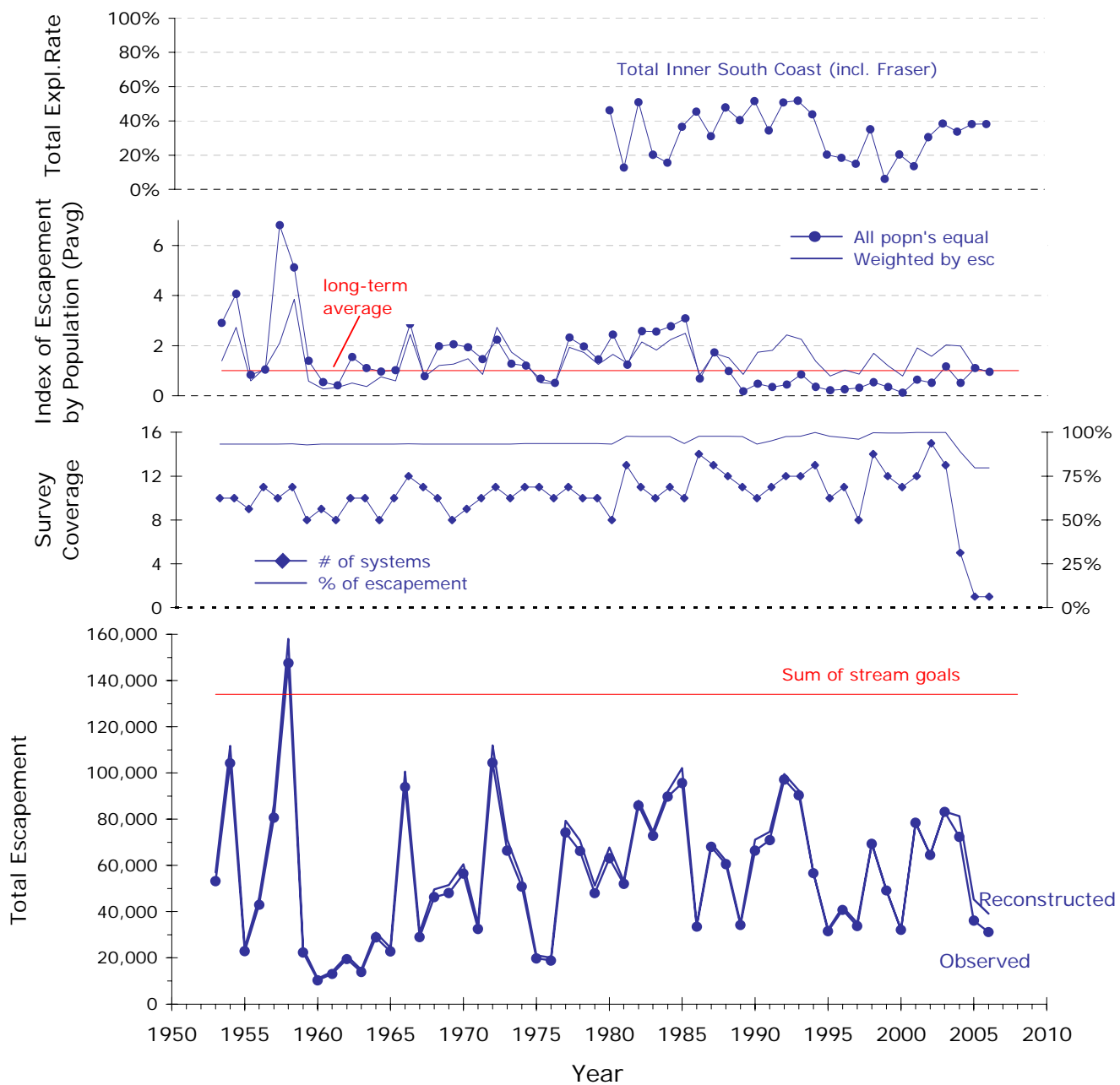


Figure 5. Trend summary for Inner South Coast chum salmon – Lower & South Vancouver Island

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

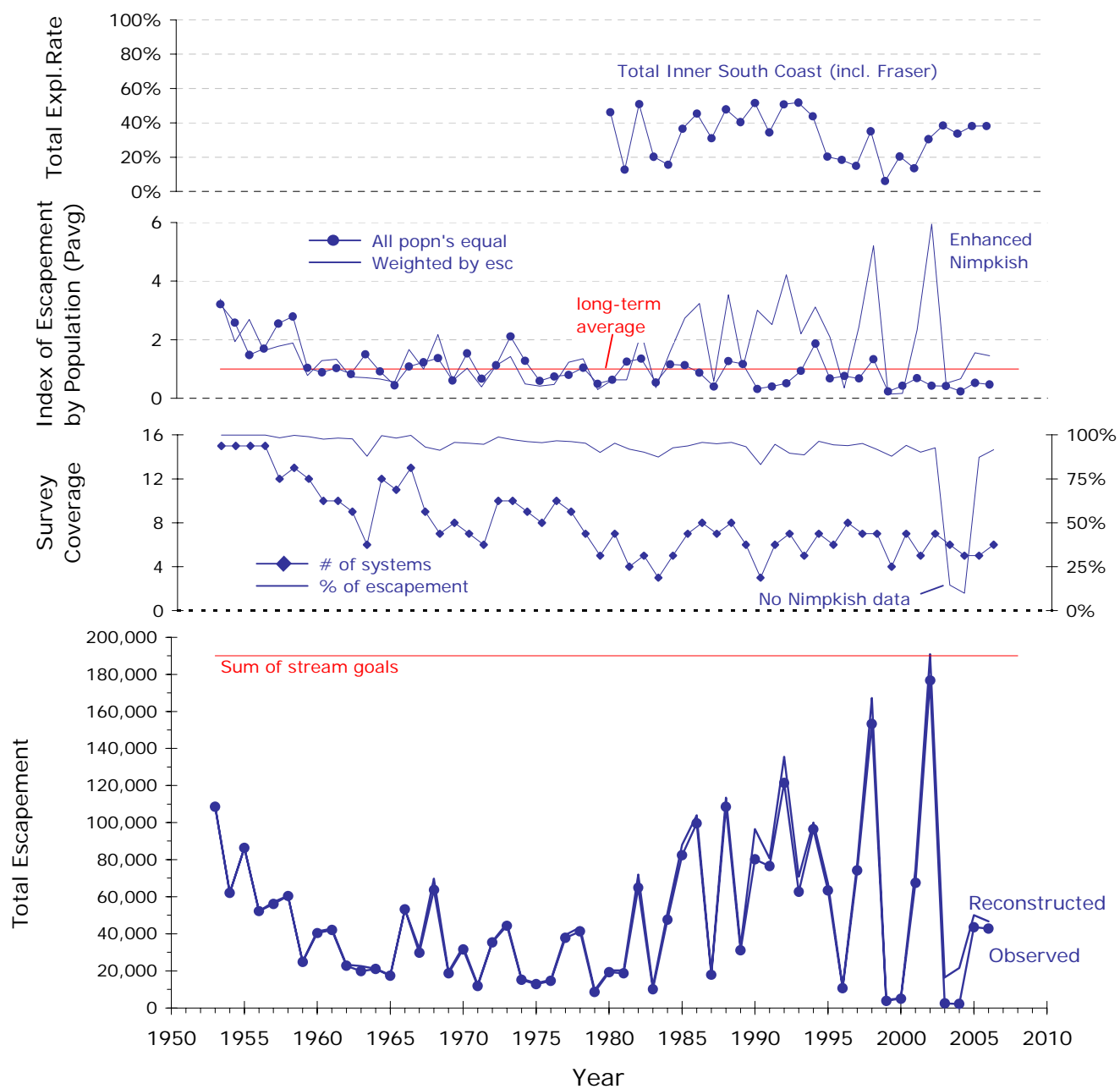


Figure 6. Trend summary for Inner South Coast chum salmon – Johnstone Strait

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

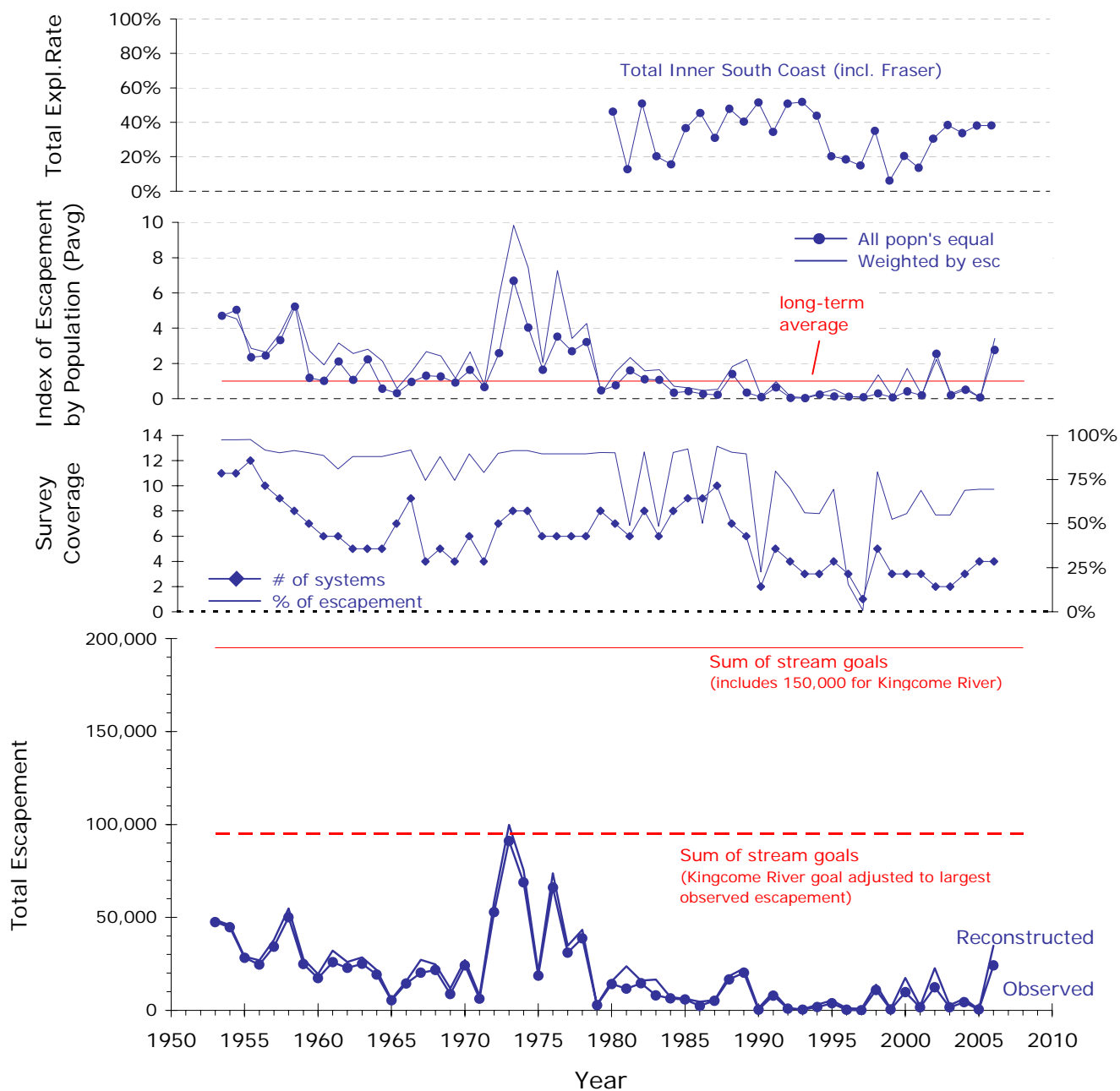


Figure 7. Trend summary for Inner South Coast chum salmon – Kingcome

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

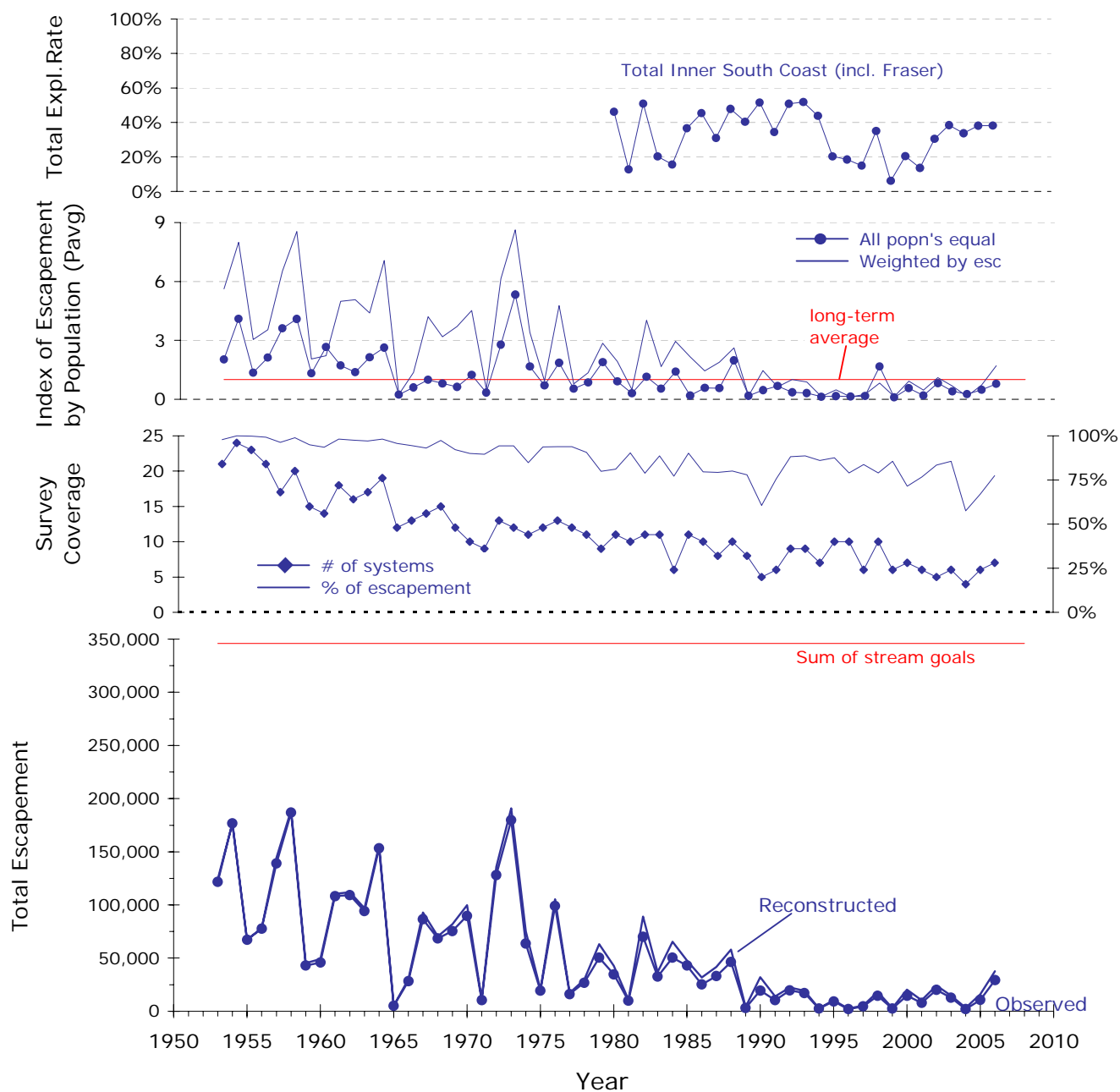


Figure 8. Trend summary for Inner South Coast chum salmon – Bond to Knight

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

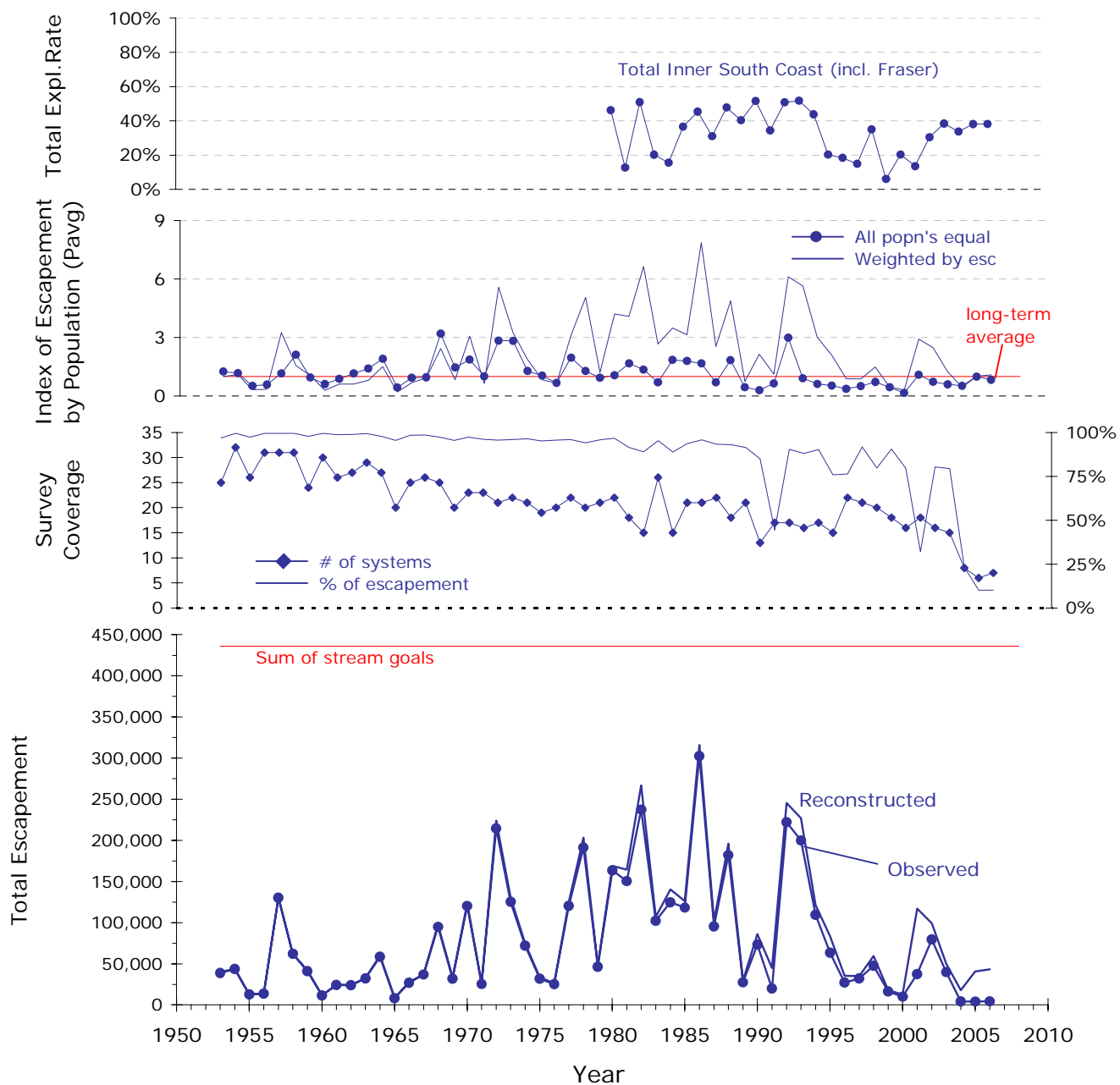


Figure 9. Trend summary for Inner South Coast chum salmon – Loughborough to Bute
 Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

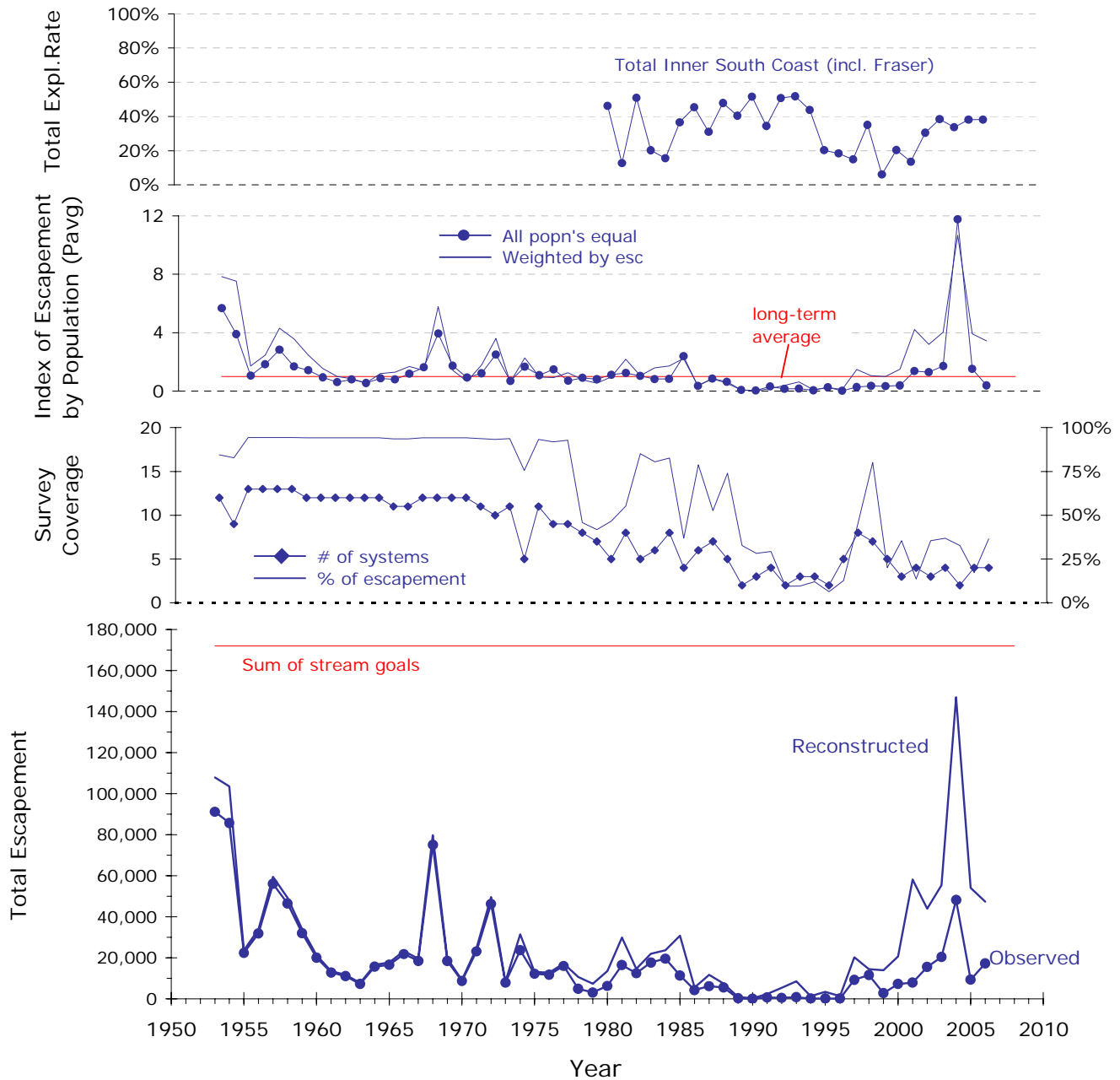


Figure 10. Trend summary for Inner South Coast chum salmon – Toba Inlet

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

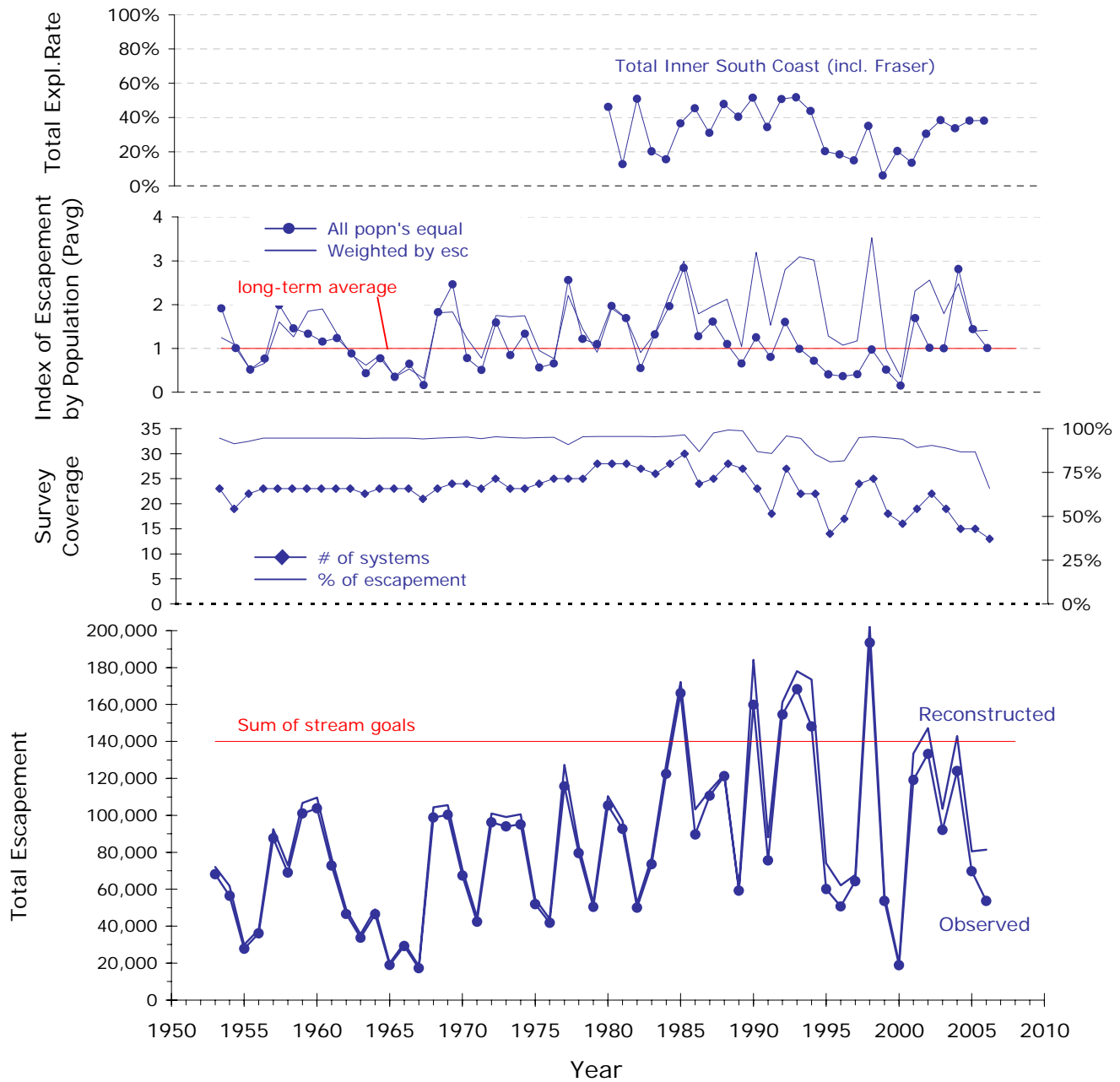


Figure 11. Trend summary for Inner South Coast chum salmon – Jervis Inlet

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

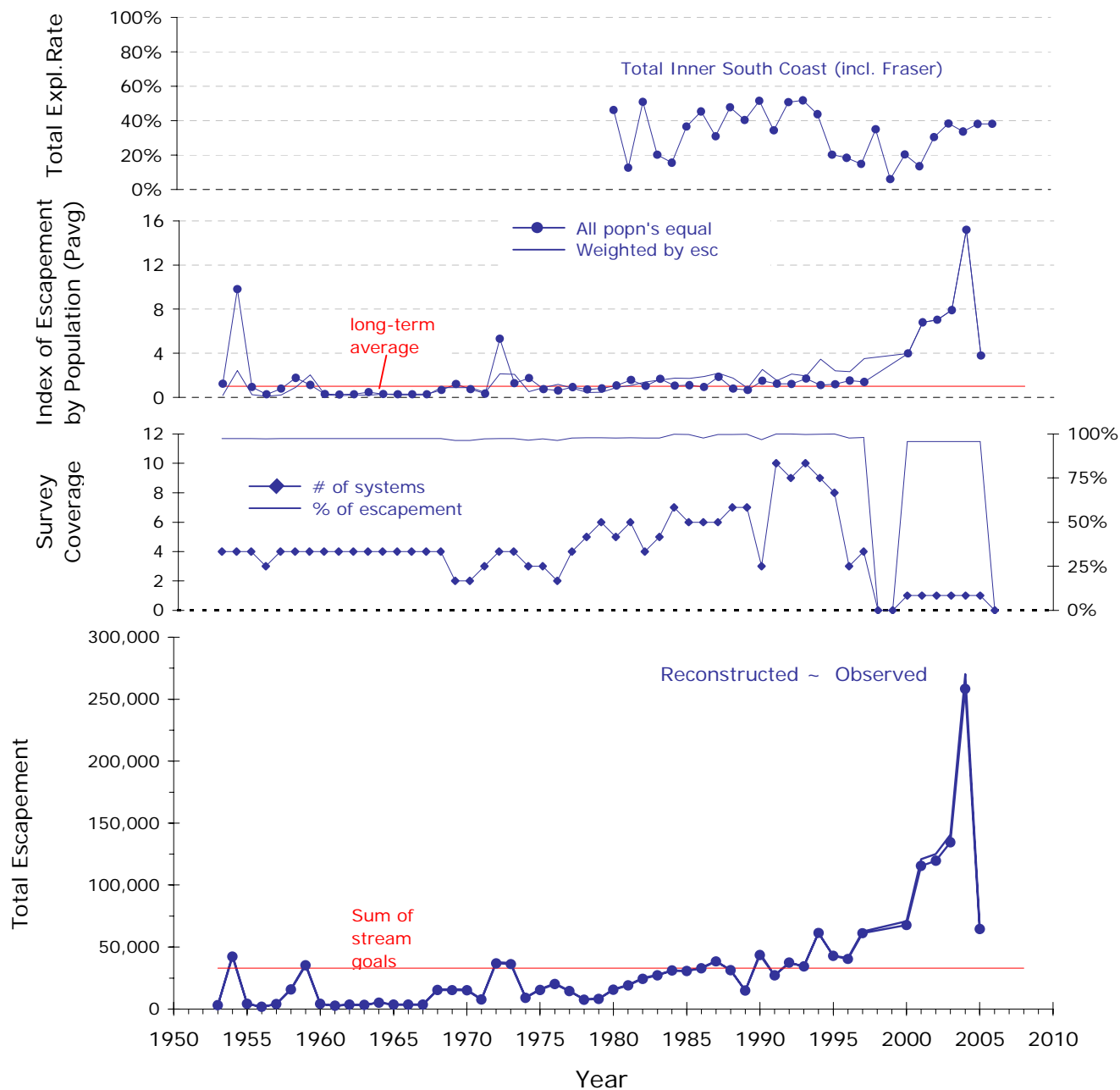


Figure 12. Trend summary for Inner South Coast chum salmon – Burrard Inlet

Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

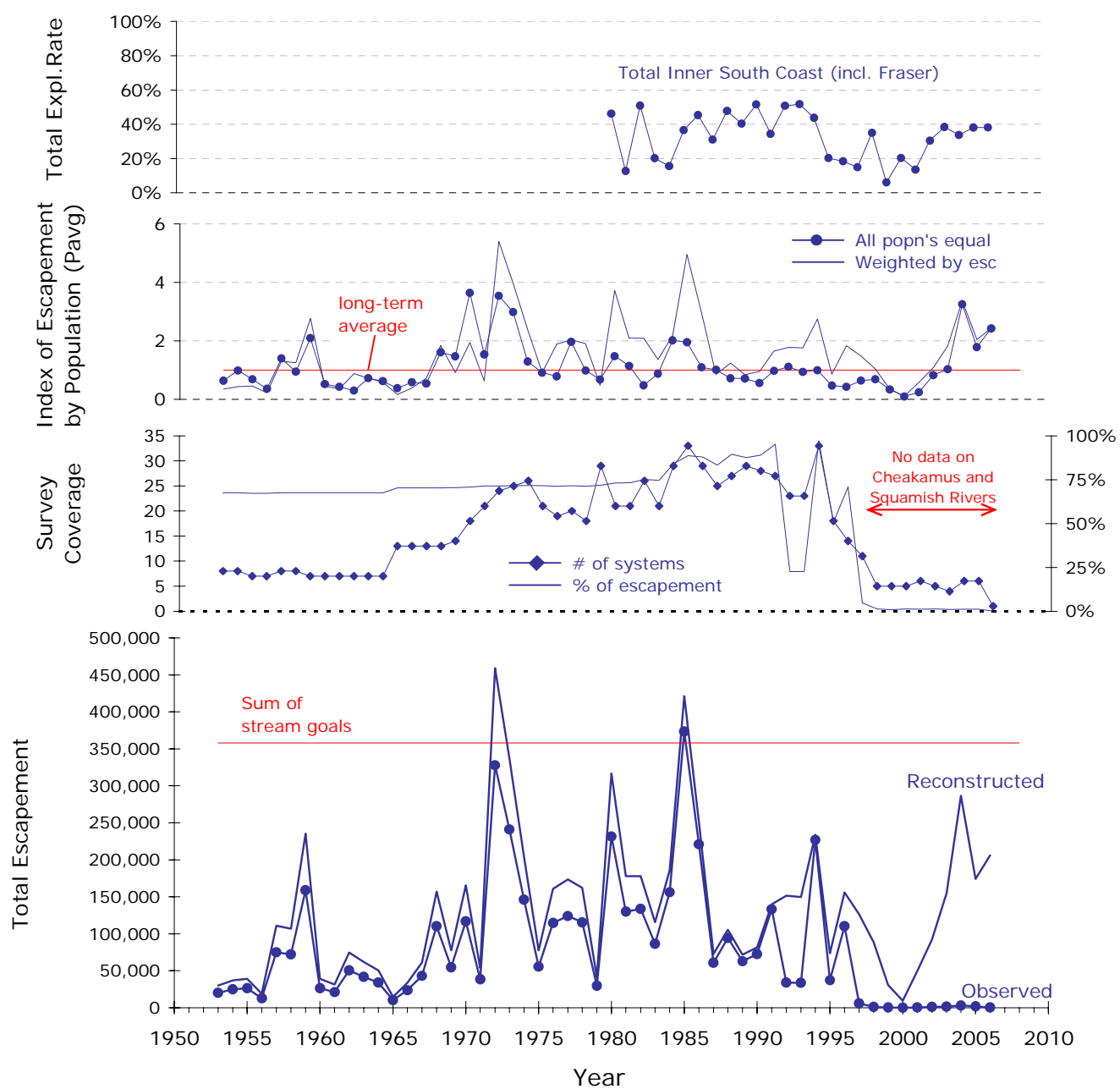


Figure 13. Trend summary for Inner South Coast chum salmon – Howe Sound / Sunshine Coast
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.