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CERTIFICATION UNIT PROFILE:
NORTH COAST AND CENTRAL COAST CHUM SALMON

by

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ABSTRACT

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This profile includes information about stock status, management reference points, management approach for fisheries in the area, assessment programs, and specific conservation measures.

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 North Coast & Central 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), and 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>.

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1 INTRODUCTION

1.1 Stocks covered in this document

This profile covers all chum salmon spawning in watersheds in Areas 1 and 2 (Queen Charlotte Islands), Areas 3 to 6 (North Coast), and Areas 7 to 10 (Central Coast). The major chum systems are:

- *Queen Charlotte Islands:* Ain River, Awun River, Botany Inlet, Browns Cabin Creek, Deena River, Lagins Creek, Lagoon Creek, Mace Creek, Pallant Creek (enhanced), Salmon River, Security Inlet Creek, and Slatechuck Creek.
- *North Coast:* Ecstall River, Foch Creek, Kemano River, Khutzeymateen River, Kitimat River (enhanced), Kshwan River, Quaal River, Stagoo Creek, and Toon River.
- *Central Coast:* Bella Coola River (enhanced), Chuckwalla River, Clatse Creek, Clyak, Cooper Inlet Creeks, Draney Creek, Elcho Creek, Kainet Creek, Kimsquit River, Kwakusdis River, Kwatna River, Lockhart-Gordon Creek, Mussel River, Neekas Creek, Nekite River, Nekite spawning channel, Quartcha Creek, and Roscoe Creek.

1.2 Fisheries covered in this document

This profile covers fisheries harvesting chum salmon in the Queen Charlotte Islands, the North Coast, and the Central Coast (Statistical areas 1 to 10). Harvesters include First Nations (FSC fisheries), recreational, and commercial (seine, gill net and troll). Major commercial fisheries are:

- *Queen Charlotte Islands:* Terminal commercial net fisheries may target chum salmon when a surplus abundance has been identified in-season. Generally the required escapement is secured within the streams or behind boundaries near the estuary location before fisheries are allowed to proceed, and fishing locations are usually channels or inlets adjacent to the natal stream of the target stocks.
- *North Coast:* Terminal commercial fisheries may target salmon in Area 3 (Nass), Area 4 (Skeena), and Areas 5 and 6 (Hecate Strait), but there have been no targeted harvests of wild chum for at least a decade due to low abundance concerns. Hatchery returns to Kitimat River are harvested terminally, in Kitimat Arm adjacent to the natal stream, when surplus hatchery stocks are identified. Measures are in place to conserve chum in fisheries targeting other salmon species, including frequent non-retention requirements for commercial seines, and frequent non-retention for gillnets combined with requirements for short nets and short sets to facilitate the release of non-target species. Possession of revival boxes for release of non-retention species is mandatory for all commercial gear. Chum non-retention is mandatory for trollers throughout the whole season.
- *Central Coast:* Mixed-stock commercial fisheries may harvest chum in Fisher-Fitz Hugh Channel, but the majority of fishing effort in Areas 7 and 8 has been shifted towards terminal fisheries. There have been no targeted commercial salmon harvests in Area 9 (Rivers Inlet) or Area 10 (Smith Inlet) since the mid-1990s to protect local salmon populations.

First Nations target local salmon stocks for food, social and ceremonial (FSC) purposes throughout the North and Central Coast, and in the Nisga'a treaty fisheries (Nass River, Area 3). Long-term harvest patterns depend on the local abundance of all salmon species, with effort concentrated in the Nass, Skeena, Kitimat, and Bella Coola systems. 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 North & Central coast, but harvest relatively few chum salmon. Marine angler effort is concentrated in Area 1, coastal outside parts of Areas 3 and 4, the Kitimat Arm/Douglas Channel parts of Area 6, outside part of Areas 7 and 8, and Area 9. Freshwater recreational fisheries focus on the Skeena River, the lower Kitimat River, and the Bella Coola River.

2 BACKGROUND AND OBJECTIVES

2.1 Life history

2.1.1 Stock units

2.1.1.1 Definition of stock units for North & Central Coast chum salmon

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. for setting 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 the North Coast management area (DFO 2008a). Since 1950, at least 1 year of chum escapement has been recorded in 205 streams of the Queen Charlotte Islands (Areas 1 and 2), in 278 streams of the North Coast (Areas 3 to 6), and in 119 streams of the Central Coast (Areas 7 to 10). Streams are identified according to the standardized stream naming and numbering system used by DFO and the Province of BC (DFO 2008b). Major runs of chum salmon originate in the following systems:

- *Queen Charlotte Islands*
 - Ain River and Awun River (Masset Sub-Area, Area 1)
 - Pallant Creek (Cumshewa, 2E) - enhanced
 - Lagoon Creek (Selwyn, 2E)
 - Salmon River (Darwin, 2E)
 - Deena River, Lagins Creek, and Slatechuck Creek (Skidegate, 2E)
 - Browns Cabin Creek (West Skidegate, 2W)
 - Mace Creek (Athlo-Otard, 2W)
 - Security Inlet Creek (Englefield Bay, 2W)
 - Botany Inlet (Tasu, 2W)
- *North Coast*
 - Kshwan River and Stagoo Creek (Observatory Inlet, 3)
 - Khutzeymateen River (Portland Inlet, 3)
 - Toon River (Work Channel, 3)
 - Ecstall River (Coastal, 4)

- Kemano River (Gardner Channel, 6)
- Kitimat River (Kitimat Arm, 6) - enhanced
- Foch Creek and Quaah River (Douglas, Ursula, and Devastation Channels, 6)
- *Central Coast:*
 - Mussel River (Finlayson-Mussel Channel, 7)
 - Kainet Creek (Kynock, 7)
 - Kwakusdis River, Kwatna River, Neekas Creek, Roscoe Creek, and Cooper Inlet Creeks (Spiller - Fitz Hugh - Burke, 7 & 8)
 - Kimsquit River, Elcho Creek (Dean Channel, 8)
 - Bella Coola River (North Bentinck, 8) - enhanced
 - Chuckwalla, Clyak Creek, Draney Creek, Lockhart-Gordon Creek, Nekite River, and Nekite spawning channel (9 and 10).

Table 1 summarizes the population structure of North Coast & Central Coast chum by grouping individual spawning sites according to management area, statistical area, and conservation unit. Note that Table 1 only lists spawning sites with more than 5 observations since 1990. Sites with estimated chum escapements larger than 10,000 more than once since 1990 are clearly identified, as are systems with active hatchery enhancement. Complete records of escapement data and detailed maps for each statistical area are available through the North Coast DFO office in Prince Rupert (DFO 2008a).

2.1.1.2 Conservation units for North & Central Coast chum salmon

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 4 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 Conservation Units 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 North Coast and Central Coast chum salmon (Section 5.1).

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.

Holtby and Ciruna (2007) identify 21 conservation units of chum salmon in the Queen Charlotte Islands, the North Coast, and the Central Coast based on their evolutionary lineage, life history, productivity, and ocean migrations:

- *Queen Charlotte Islands (Areas 1 and 2)*: North QCI, North QCI – Stanley Creek, East QCI, West QCI, Skidegate
- *North Coast (Areas 3-6)*: Portland Canal-Observatory, Lower Nass, Portland Inlet, Upper Skeena, Middle Skeena, Lower Skeena, Skeena Estuary, Hecate Lowlands, Mussel-Kynoch, Douglas-Gardner
- *Central Coast (Areas 7-10)*: Bella Coola - Dean Rivers, Bella Coola River – Late (i.e. Fall run), Spiller-Fitz Hugh-Burke, Wannock, Rivers Inlet, Smith 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. Note that two groups of early-migrating chum are captured in distinct CUs:

- Bella Coola and Dean River chum include enhanced early-migrating chum from Snootli Creek hatchery on the Bella Coola River, which are identified as distinct from later migrating chum.
- Early-migrating Stanley Creek chum were identified as distinct from other chum populations on the North Coast of the Queen Charlotte Islands.

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

Commercial fisheries targeting North and Central coast chum salmon generally rely on indicator stocks to identify local abundance in-season. Indicator stocks tend to be more intensively surveyed, and provide more accurate estimates of local abundance than the visual surveys used for the majority of chum salmon spawning streams. English et al. (2006) list the indicator stocks and survey methods. Intensive chum monitoring with counting fences occurs on Pallant Creek and Mathers Creek in Area 2E, the Kincolith River in Area 3, and the Kitwanga River in Area 4. Section 4.2.2.3 describes each of these counting facilities and links to annual data summaries.

In addition to intensive surveys in these indicator systems, escapement estimates in each statistical area are compiled for a fairly stable set of index streams and a variable set of additional streams. Section 4.1 summarizes assessment coverage for North and Central Coast chum salmon. Section 4.3 briefly describes how observed escapements are adjusted to reconstruct run size and calculate harvest rates.

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:

- Riddell (2004) describes spawning populations of chum salmon on the North and Central Coast.
- 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 Abundance and distribution

Observed abundance of adult chum spawners on the North Coast and Central Coast has averaged about 1 Million since 1960, ranging from a low of 470,000 in 1975 to a high of 2.2 Million in 1998 (Table 2). Note that survey coverage fluctuates across years, and comparisons of annual estimates must be approached with caution. Section 4.3 briefly describes how observed escapements are adjusted to reconstruct run size and calculate harvest rates.

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).

Riddell (2004) summarizes chum salmon resources on the North and Central Coast:

- *“Chum salmon in the northern and central BC regions may be classified as Summer chums or Fall chums depending on their adult migration timing back to their natal stream and spawning time. Summer chums are larger and older chum salmon, and are typically finished spawning before the Fall chums return to the streams. The largest known summer chum population is the Bella Coola River Summer chums. However, a good description of the distribution of Summer chums is apparently not available. The only spawning records in the regions comparing Summer and Fall chum in the same river system have been kept for the Bella Coola River.”*
- *The distribution of spawning population sizes for chum salmon is a combination of a few large populations and a much wider variety of moderate to small populations. For central region chum salmon, very few of the streams are reported to have, on average, more than 10,000 chum spawners.”*

Hyatt (2007) describes the distribution of chum salmon throughout the North Coast and Central Coast at different stages in their life history. Chum salmon spawn in the lower reaches, side channels and tributaries of gravel-bed rivers. Juveniles of all salmon species aggregate in near-shore inlets and estuaries during their first spring and summer near their points of sea entry (e.g. Skeena, Nass, Bella Coola). By October, juvenile salmon of all species move further offshore to pelagic surface waters over the continental shelf.

2.1.2.2 Age / size / fecundity

Chum return to spawn in natal streams after two to five winters at sea at sea, and most return to spawn as four-year olds (Salo 1991). Using the Gilbert-Rich age designation system, North and Central 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 are the second largest Pacific salmon species, with an average fork length of about 70 cm and average weight roughly 5 kg (Salo, 1991).

Age and size data for chum salmon is not consistently collected each year from catch in Canadian ocean fisheries or from spawning streams in the North and Central Coast, but extensive records have been compiled over the years across statistical areas. Table 3 summarizes size data currently available in the biological traits database maintained by DFO - North Coast (DFO 2008c).

Chum eggs are large relative to other Pacific salmon, with fecundities of 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 North and Central 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

Hyatt et al. (2007) describe the migration times of salmon originating from the North Coast and Central Coast. The majority of chum salmon return to coastal rivers from July to September, with spawning concentrated in late September to early November. Fry emerge from March to April and migrate to sea right away. Chum salmon fry occupy near-shore waters of estuaries and coastal inlets for several weeks to months

of time, feeding on a diet dominated by amphipods and benthic copepods. Following their adaptation to marine waters, they rapidly migrate northwest to the Gulf of Alaska.

Two groups of chum exhibit distinct migration timing:

- Chum stocks located on the Queen Charlotte Islands (QCI, Statistical Areas 1, 2 East and 2 West) have the latest spawner arrival timing (mid-September to early October) of North Coast chum. QCI chums also have a later timing than North Coast sockeye, pink and chinook salmon.
- The enhanced Kitimat River chum stock in Area 6 has an earlier run timing (July to mid August) than other Area 6 chum populations (August to September), and fisheries targeting these enhanced chum are generally separated both temporally and spatially from the migration peak of other Area 6 chum populations. (See next section, and Section 3.3.3)

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 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.

Production planning meetings are held annually within DFO to discuss changes in targets or in release strategies. Annual production targets for each salmon species and enhancement facility, except the smaller Public Involvement programs, are then publicly reviewed as part of the *Integrated Fisheries Management Plan*, which also includes a review of enhancement activities in the previous year.

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

2.2.2 North & Central Coast chum enhancement facilities

Large-scale chum enhancement in the North and Central Coast occurs in Pallant Creek (Area 2 East), Kitimat River (Area 6), Kitasu Creek (Area 7), McLaughlin Bay Creek (Area 7), and the Bella Coola River (Area 8). In addition to these large hatchery programs, chum are also enhanced through several small-scale programs managed by local groups.

Detailed information about chum enhancement in the North and Central Coast is publicly available, and evaluated regularly:

- Section 3.7.3 of the 2008 North Coast Salmon IMFP lists brood production targets for chum salmon for 2008, and Section 8.7.3 reviews hatchery activities from 2007.
- Riddell (2004) briefly reviews the history of chum enhancement in the North and Central Coast.
- Spilsted (2004) summarizes fry releases for all North Coast and Central Coast chum enhancement operations, including small projects.

Commercial fisheries harvest enhanced chum from Pallant Creek in Cumsheewa Inlet (Area 2 East), from Kitimat River in Kitimat Arm (Area 6), from Kitasu Creek in Trout Bay and McLaughlin Bay (Area 7) and from the Bella Coola River in the Bella Coola Gillnet Area (Area 8). Section 3 explains how the regional approach to the harvest and assessment of enhanced chum is implemented in the North Coast management area.

2.3 Fisheries intercepting North & Central Coast chum salmon

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. There are no ESSR fisheries on chum in the North and Central Coast.

Priority of access for these different fisheries depends on the salmon species, as set out in the *Allocation Policy*.

The *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 food, social and ceremonial (FSC) purposes throughout the North and Central Coast, and in the Nisga'a treaty fisheries. 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 North Coast and Central Coast First Nations. Long-term harvest patterns depend on the local abundance of all salmon species, with catches concentrated in the Nass, Skeena, Kitimat, and Bella Coola systems.

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.

Table 7 summarizes communal harvest targets for FSC fisheries in Areas 1 to 10, which amount to less than 5 % of long-term average escapement into each region (i.e. Queen Charlotte Islands, North Coast, Central Coast). Note that actual numbers of fish on some communal licences are still in negotiation, and are therefore subject to change. Also note that these are long-term targets, and actual catches in any given year will depend on, among other factors, in-season assessments of actual stock strength, management measures taken to ensure conservation of individual stocks, abundance of other species, and targeted fishing effort.

The Nisga'a Final Agreement defines the catch allocations and fisheries management structures related to Nisga'a fisheries and salmon stocks originating from the Nass area. Nisga'a Lisims Government is responsible for the internal allocation of catch opportunities among Nisga'a harvesters and the day-to-day operation of the Nisga'a fishery. The Nisga'a have distributed their salmon catches between three types of fisheries: domestic fisheries for food, social and ceremonial purposes; communal sale fisheries where proceeds are used to support fisheries management programs; and individual sale fisheries that provide commercial catch opportunities and income for Nisga'a harvesters.

The Nisga'a Annual Fishing Plan (NAFP) is developed by the Fisheries Program of the Nisga'a Lisims Government and governed by the terms of the Nisga'a Final Agreement and the Nisga'a Harvest Agreement. The Nisga'a Harvest Agreement does not form part of the Nisga'a Final Agreement, and includes Nisga'a fish allocations expressed as a percentage of the adjusted total allowable catch of sockeye and pink salmon. The NAFP is developed in accordance with Chapter 8 of the Nisga'a Final Agreement. Once approved by

the Minister, the Annual Fishing Plan remains in effect until replaced the following year. The fishing plan applies to persons who harvest fish, other than steelhead, in Nisga'a fisheries.

Notwithstanding that Nisga'a fish entitlements are treaty rights, a Nisga'a fish allocation of sockeye and pink salmon, as defined in the Nisga'a Harvest agreement, is set out as a percentage of the Canadian Total Allowable Catch for salmon stocks in the Nass area. Nisga'a commercial fisheries for these or other salmon species have the same priority in fisheries management decisions as other commercial and recreational fisheries that target Nass Area salmon stocks.

The NAFP defines the escapement goals required to guide management decisions for Nass salmon stocks, calculates Nisga'a allocations for each salmon species and provides the general regulatory requirements for catches of each salmon species. The NAFP is reviewed by the Joint Fisheries Management Committee (JFMC) prior to being submitted to the Minister for approval.

2008 Pre-season estimates for the Nisga'a salmon allocation are:

- 54,000 pink of a total return to Canada of 569,000 based on the 5-year average return of even-year pink (no underage or overage are accrued).
- 7,000 chum of a total return to Canada of 90,000 based on the 5-year average return or dominant brood year return. Actual entitlement that may be targeted could be greater, depending on run strength to account for underages accrued between 2000 and 2003, and from 2007.

The Pacific Integrated Commercial Fishing Initiative (PICFI) seeks to transfer commercial salmon shares to First Nations. The Aboriginal Transfer Program (ATP), where commercial licences are purchased out of the fleet and transferred to First Nation communities, is one means by which First Nations communities may gain further access to economic benefits from the fishery. The Skeena Inland Demonstration Fishery is once again being planned for 2008 (Appendix 8 of the 2008 *Integrated Fisheries Management Plan for Salmon – North Coast*). This would involve the transfer of the salmon allocation of some commercial licences inland to be fished by the First Nations of the Skeena.

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 North & Central coast, but harvest relatively few chum salmon. Marine angler effort is concentrated in Area 1, coastal outside parts of Areas 3 and 4, the Kitimat Arm/Douglas Channel parts of Area 6, outside part of Areas 7 and 8, and Area 9.

Freshwater recreational fisheries focus on the Skeena River, the lower Kitimat River, and the Bella Coola River.

Total recreational catch of chum salmon for Areas 1 to 10 is less than 5,000 annually (i.e. recorded catch in regional database at http://www.pac.dfo-mpo.gc.ca/sci/sa/Recreational/default_e.htm).

2.3.4 Commercial

2.3.4.1 Queen Charlotte Islands terminal chum fisheries (Areas 1 & 2)

Terminal commercial net fisheries may target chum salmon when an abundance surplus to a stream's escapement goal has been identified in-season. Generally the required escapement is secured within the streams or behind boundaries near the estuary location before fisheries are allowed to proceed, and fishing locations are usually channels or inlets adjacent to the natal stream of the target stocks.

Historically, terminal net fisheries have been implemented in:

- Masset Inlet (major systems: Ain and Awun Rivers)
- Cumsheewa Inlet (wild chum from Mathers Creek and enhanced chum from Pallant Creek)
- Darwin Sound (Salmon River)
- Skidegate Inlet (Deena River, Lagins Creek, Slatechuck Creek, and Browns Cabin Creek),
- Athlo-Otard (Mace Creek)
- Englefield Bay (Security Inlet Creek)
- Tasu Sound (Botany Inlet Creek)

2.3.4.2 North Coast incidental harvests and terminal chum fisheries (Areas 3 to 6)

Terminal commercial fisheries target salmon in Area 3 (Nass), Area 4 (Skeena), and Areas 5 and 6 (Hecate Strait). There have been no targeted chum fisheries in Areas 3 to 5 for at least a decade due to low abundance concerns. Commercial fisheries targeting other salmon species in Areas 3 to 5 generally operate under chum non-retention provisions, with some variations:

- Seines have non-retention / non-possession regulations for most of the year, except for a few days with very high abundance of sockeye or pink salmon, due to practical constraints on catch sorting.
- Gill-nets have higher release mortality, so the conservation strategy is to reduce encounters by area closures around Whale Island and Pierce Island (Area 3), releasing live chum, and retaining dead chum.
- Area 3 fisheries have high encounter rates of enhanced chum from Alaska. These fisheries retain wild chum, but minimize encounters of local Area 3 chum through ribbon boundaries and area closures.

The only targeted chum fishery on the North Coast occurs in Area 6 and targets enhanced Kitimat River chum. This fishery has moved from the Gil Island area to more terminal harvests of the enhanced stock in Kitimat Arm and inner Douglas Channel to more selectively harvest enhanced chum. The terminal fishery encounters very few non-enhanced chum, because stocks are separated by timing (i.e. Kitimat chums return earlier) and location.

2.3.4.3 Central Coast mixed-stock and terminal fisheries (Areas 7 to 10)

Mixed-stock commercial fisheries may harvest chum in Fisher-Fitz Hugh Channel and Seaforth Channel, but the majority of fishing effort in Areas 7 and 8 has been shifted towards terminal fisheries. There have been

no targeted commercial salmon harvests in Area 9 (Rivers Inlet) or Area 10 (Smith Inlet) since the mid-1990s to protect local salmon populations.

Terminal net fisheries may occur in:

- Mathieson Channel
- Finlayson Channel and Sheep Passage (targeting mainly Mussel River chum)
- Spiller Inlet (Neekas Creek)
- Roscoe Inlet and Johnson Channel (Roscoe and Quartcha systems)
- Burke Channel (Bella Coola River)
- Dean Channel (Kimsquit River)
- Klemtu Pass and Lara Pass (enhanced chum from McLoughlin Bay and Kitasoo Creek)

The area 8 net fishery which targets enhanced Bella Coola chum salmon occurs in the Bella Coola Gillnet Area (Burke Channel) for gillnets and Fisher Channel - Fitz Hugh Sound area for seines and gillnets. Some of the net fishery area occurs as a mixed stock chum fishery; however commercial fishery guidelines attempt to limit impacts on non-target species. Gillnet mesh restrictions, time and area restrictions and seine brailing, sorting and release guidelines attempt to limit impacts on sockeye, coho, chinook and steelhead stocks. Chum management plans for net harvest of enhanced chum incorporate time, area and gear restrictions as strategies to address potential weak chum stocks of concern.

2.4 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 Fraser River chum salmon 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 North Coast and Central Coast chum and the fisheries that harvest them.

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

- Chapter 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.
- Chapter 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 *North 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 North & Central 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 North Coast and Central Coast chum salmon, these fundamental objectives translate into a cautionary approach to fisheries management, with a focus of identifying fishing opportunities in terminal areas based on in-season abundance estimates and observed escapements into the natal streams.

While Central Coast and Kitimat hatchery chum salmon stocks are reasonably healthy, other North Coast chum stocks have been either declining or in a depressed, but stable, state in recent years.

The overall conservation objective for wild chum salmon in Areas 3 to 6 is to minimize fishery impacts to the greatest degree possible while still maintaining fisheries targeting other species.

2.4.3 Management objectives for North & Central Coast chum salmon 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 through restricting the length 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, methods used). Identified surplus stocks are harvested by nets terminally, adjacent to natal stream 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. Section 3 describes the specific management objectives for each area.

Examples include:

- Time and area net restrictions to limit encounters of non-target stocks and species to minimize fishery impacts.
- Gillnet mesh restrictions to limit encounters of non-target species and minimize impacts on species of concern.
- Geographic separation of harvests of identified surpluses of enhanced chum returns from weaker wild stocks by locating fisheries terminally, adjacent to natal stream to minimize impacts on stocks and species of concern.

- Non-retention of non-target chum and steelhead stocks to minimize impacts on stocks of concern.
- Daylight only to reduce coho encounters and minimize fishery impacts.
- Mandatory seine brailing and sorting and gillnet short sets and use of revival boxes when specified by Public Notice 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.

2.4.4 Performance measures

Performance measures for North and Central Coast chum salmon generally relate back to estimates of escapement:

- Annual escapement is the main performance measure for statistical areas, and for the index streams within each area (Section 2.1.1.3). Formal Limit Reference Points (LRP) or Target Reference Points (TRP) have not yet been developed for North and Central Coast chum stocks. However, operational *Management Escapement Goals* (MEG) have been identified for each of the over 500 streams with regular observations of spawning chum (Table 1), and aggregated for statistical areas. 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. The MEG represent 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). Table 5 lists high-level MEG for Areas 1 to 10, and Table 6 lists individual MEGs for major chum systems.
- Performance relative to genetic diversity objectives is measured in terms of the distribution across spawning sites in the CU, as well as the proportion of returns from wild and enhanced populations.
- For hatcheries, performance is measured in terms of broodstock targets and releases, which are reported in the annual *Integrated Fisheries Management Plans*, 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 *Integrated Fisheries Management Plans*. Detailed post-season review materials for last year are available at <http://www.pac.dfo-mpo.gc.ca/northcoast/post-seasonreview/default.htm>.

Several regional policy and conservation initiatives are establishing formal performance measures (refer to the listed section in the *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:

- Detailed management guidelines have been developed for statistical areas 1 through 10. These *Operational Frameworks* outline expected management responses to various in-season stock scenarios. The Operational Framework documents were written up by field management and stock assessment staff with many years of experience.
- Pre-season planning centers on the development and broad public review of *Integrated Fisheries Management Plans* (IFMP). 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.
- Detailed *Records of Management Strategies* (RMS) are compiled annually for statistical areas 1 through 10, which document in-season management decisions and post-season evaluations.

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 North & Central Coast chum salmon

Chum salmon in Areas 1 to 10 are managed relative to escapement goals (Table 5 and Table 6). These operational Management Escapement Goals (MEG) are used in all three phases of the planning cycle:

- *Pre-season planning:* MEGs are used to identify potential net fisheries based on expected abundance. Where escapement is expected to fall short of the MEG, potential net fisheries are reduced or eliminated.
- *In-season implementation:* MEGs are used as benchmarks for tracking cumulative escapements into each watershed, and to identify local harvest opportunities. The weekly in-season decision process for management of salmon fisheries in the North and Central Coast is fully documented in the annual *Record of Management Strategies* maintained for each statistical area by the responsible manager.
- *Post-season evaluation:* Actual escapements relative to the MEGs for each watershed are the main performance measure used to review each season and identify long-term conservation priorities.

The primary management tool for limiting exploitation rate or meeting escapement targets for North and Central Coast chum salmon is to control fishing effort through restricting the length 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, methods used).

The sections below summarize the management approach for commercial fisheries in the North Coast management area.

3.3 Decision guidelines for commercial fisheries

3.3.1 Queen Charlotte Islands terminal chum fisheries (Areas 1 & 2)

3.3.1.1 Harvest Objectives

Chum stocks located on the Queen Charlotte Islands (QCI, Statistical Areas 1, 2 East and 2 West) have the latest spawner arrival timing (mid-September to early October) of North Coast chum. QCI chums also have a later timing than North Coast sockeye, pink and chinook salmon. The QCI stocks are therefore separated both temporally and spatially from directed pink and sockeye fisheries occurring on the coastal mainland of northern BC.

In the past, terminal chum salmon opportunities have occurred in a variety of locations:

- Masset Inlet (major systems: Ain and Awun Rivers)
- Cumshewa Inlet (wild chum from Mathers Creek and enhanced chum from Pallant Creek)
- Darwin Sound (Salmon River)
- Skidegate Inlet (Deena River, Lagins Creek, Slatechuck Creek, and Browns Cabin Creek),
- Athlo-Otard (Mace Creek)
- Englefield Bay (Security Inlet Creek)
- Tasu Sound (Botany Inlet Creek)

Terminal harvest opportunities each year are only considered on identified local surpluses. Generally the required escapement is secured within the streams or behind boundaries near the estuary location before fisheries are allowed to proceed, and fishing locations are usually channels or inlets adjacent to the natal stream of the target stocks.

In recent years chum returns have declined to levels where surpluses have frequently not been observed.

Recent commercial chum fisheries have focused on Cumshewa Inlet (Area 2E). Chum stocks harvested within Cumshewa Inlet are enhanced stocks from Pallant Creek, and fisheries are managed to target Pallant Creek surpluses. The overall escapement goals for chum are 30,000 to Pallant Creek and 25,000 for hatchery brood stock; and 20,000 to Mathers Creek.

Pallant Creek coho are also enhanced to allow for a recreational fishery, retention of coho in commercial fisheries directed at enhanced chum, and directed harvest by troll.

If available, modest levels of commercial harvests target chum returning to the Ain River, with a management escapement goal of 25,000, and the Awun River, with an escapement goal of 15,000. Management escapement goals for other systems are listed in Table 6.

3.3.1.2 Pre-season Planning

If a poor run is predicted, such that only enough salmon are expected to return to stock the spawning streams, then no fishing will occur unless an actual surplus is identified in-season. Conversely, if a surplus is forecast, an initial opening may be held to confirm returning abundance with subsequent openings as appropriate. The size of the return will be estimated by the CPUE of the first few openings, in combination with in-season escapement estimates (local and coastwide).

3.3.1.3 In-season Implementation

Initial openings, with an emphasis on stock assessment, are based on the number of spawners that have entered the stream, the relative abundance of target chums observed schooling in tidal waters adjacent to the natal stream, and the estimated run size and timing in relation to historic data for that system.

Subsequent opportunities are then determined based on observed catch and catch-per-effort in the initial openings:

- *Masset Inlet*: When surplus stocks are indicated, in-season assessment gillnet fisheries in the western portion of McIntyre Bay (outside Masset Sound) are generally a reliable indicator of run size.
- *Cumshewa Inlet*: Due to the poor returns observed in Cumshewa in recent years, fisheries are managed similarly to wild chum systems, with openings only on identified surpluses:
 - Boundaries are determined depending on fish holding behaviour and the status of Pallant Creek hatchery brood stock collection. When fish are abundant, fisheries have been conducted with inner boundaries from Beattie Anchorage to the easternmost point of Oliver Island, thence from the westernmost point of Oliver Island to a boundary sign on the Moresby Island shore, or from Barge Point to a boundary sign on the opposite shore.
 - Cumshewa Inlet opportunities will only be considered if there is reasonable evidence that escapement and hatchery brood stock objectives are at least 75 percent secure behind the inner boundary. The percentage of secured escapement and hatchery brood stock increases as the season progresses, such that fisheries considered late in the season (second week of October) require the full complement of escapement and brood stock either in-stream, harvested at the fence, protected behind the proposed inner boundary, or a combination of such preferred circumstances.

- Alternate seine and gill net opportunities may be considered if the gill net fleet size is greater than 30 vessels. Gill net fleet size will generally be estimated from the size of the fleet during the previous opening.
- All net fisheries are managed so that catch may be delivered within two days, as requested by the commercial industry.

3.3.1.4 Conservation Measures

Coho by-catch may be a concern in some areas, and so brailing by seines and the use of revival tanks by both gill nets and seines are usually, but not always, required. All fisheries are during daylight hours, generally 11 or 12 hour days during September reducing to 10 or 11 hour days in October. Daylight-only fisheries reduce the amount of coho encountered by gillnets and seines.

3.3.2 North Coast incidental chum harvests (Areas 3 to 5)

3.3.2.1 Harvest Objectives

Ocean fisheries that encounter North Coast chum in Statistical Areas 3, 4 and 5 are managed as mixed-stock fisheries harvesting broad geographic aggregates. There are very few directed chum fisheries in these areas and only on identified surpluses. For sockeye and pink salmon fisheries, there is little opportunity to isolate component stocks spatially in these ocean fisheries. Non-retention of returning chum salmon (July to early September) encountered in commercial fisheries directed on surplus sockeye and pink salmon and fish handling and revival guidelines are used as a conservation measure to protect less abundant chum stocks.

- *Area 3:* There is no single major chum producer in Area 3, but significant stocks return to the Kshwan River (management escapement goal = 15,000), Stagoo River (MEG = 15,000), and the Khutzeymateen River (MEG = 20,000).
- *Area 4:* The Skeena River is the second largest producer of sockeye in B.C. Co-migrating with these strong sockeye stocks are weaker runs of wild sockeye, as well as stocks of all the northern Pacific salmon species. Measures have been taken to reduce the impact of the fishery on Skeena River coho, chum, steelhead, and some sockeye stocks. These measures include non-retention of weak stocks such as Skeena chum, gear and fishing modifications, use of revival boxes for non-target species, and specific timing closures. Skeena River returns are harvested in Areas 4 and 5 and upper Chatham Sound in Area 3.
- *Area 5:* No major chum runs originate here. Skeena sockeye and pink salmon, as well a local pink salmon are harvested here. As in Area 4, pink and sockeye harvests are adapted to reduce impacts on local chum salmon when they are present.

3.3.2.2 Pre-season Planning

If a poor run is predicted, such that only enough salmon are expected to return to stock the spawning streams, then either no fishing will occur or a low impact assessment fishery may be held to confirm if the preseason forecast was accurate. If a surplus is forecast, an initial opening is usually held to confirm returning stock abundance with subsequent openings as appropriate. The size of the return is estimated based on observed catch-per-effort in the first few openings.

- *Area 3:* Terminal chum fisheries could occur in some restricted terminal areas once a surplus has been identified from spawning ground escapement inspections.

- *Area 4 and 5:* Chum fisheries are never considered. Area 4 has never been a large producer of chum and pre-season planning is always centered around reducing the impacts of fisheries targeting other species.

3.3.2.3 In-season Implementation

A daily in-season management model for ocean fisheries (Cox-Rogers 1994) is used to develop fishing plans, to manage the Area 3/4/5 fishery in-season, and for post-season assessments. This model provides multi-species, stock-specific harvest impact evaluations for Canadian ocean fisheries (Cox-Rogers 2003). The ocean model is being expanded to include stock and fishery evaluations for Skeena in-river fisheries (Gazey 2001).

- *Area 3:* Weekly decisions for are made from run size predictions based on:
 - Catch and effort data from Area 3 and Alaskan Tree Point commercial net fisheries,
 - Escapement information from the Nisga'a Fishwheel Program conducted at test-fishing sites near Gitwinksihlkw on the Nass River and fish counts at the Meziadin fishway, and later from individual stream inspections for chum and pink.
- *Area 4 and 5:* Weekly decisions for are made from escapement information in the Tyee test fishery (Section 4.2.2.1) along with fish counts on individual streams.

3.3.2.4 Conservation Measures

Commercial salmon fisheries in Areas 3 to 5 include the following conservation measures:

- Fishing is limited to daylight hours to reduce the incidental catch of coho, except during directed chinook gill net fisheries when mesh size and run timing are used to target chinook only.
- Non-retention of steelhead is mandatory in all fisheries.
- Brailing and sorting, with the mandatory release of chinook, chum and coho will be in place for the seine fishery. Changes to the non-retention species are possible depending on in-season estimation of run strengths or identified surpluses.
- Non-retention of coho for both seine and gill net will be in place initially, but may be modified depending on stock abundances and fishing effort.
- Gill nets have a 137 mm maximum mesh restriction. This restriction is in place so that sockeye is targeted selectively and larger non-target species such as chum and chinook are impacted to a lesser degree.
- Gill netters are required to release all live chum to the water with the least possible harm.
- Additional time and area closures are implemented as required.
- Use of revival boxes to revive non-target and non-retention species prior to release is a condition of license for gillnet and seine vessels.
- 1.2 meter minimum weedline.
- Short nets and short sets: half-length nets with 20 minutes soak time prior to retrieving.

3.3.3 Area 6 terminal chum fishery (Kitimat)

3.3.3.1 Harvest Objectives

Historically, chum fisheries in Area 6 were managed along with more abundant pink returns. In recent years, however, the only directed chum fishery terminally targets returning enhanced chum from Kitimat Hatchery in upper Douglas Channel and Kitimat Arm, separated both temporally and spatially from other Area 6 chum populations. Any terminal harvest opportunities on wild chum are only considered on identified local surpluses.

3.3.3.2 Pre-season Planning

- Opportunities for a gill net fishery are evaluated during the pre-season planning process based on Kitimat Hatchery chum production and wild chum stock assessments. Wild chum stocks have declined in recent years. Terminal wild stock chum fisheries may be considered based on in-stream escapement assessments.
- Seine fishing opportunities are usually evaluated pre-season for a start in mid-July. The anticipated opening date is determined from brood year escapements, run timing, and concurrent openings in other areas.
- Note that returns to Kitimat Hatchery have been highly variable and forecasts unreliable.
- Where possible, openings in Areas 3, 4, 5, 6, 7 and 8 are coordinated to spread fishing effort over a broader area.

3.3.3.3 In-season Implementation

- Given recent escapement trends, assessment fisheries have been confined to determining hatchery stock strength. Terminal wild stock chum fisheries may be considered based on in-stream escapement assessments.

3.3.3.4 Conservation Measures

- Gill nets have a 149mm minimum and 165mm maximum mesh restriction to target hatchery chum selectively and reduce by-catch of sockeye and chinook.
- Gill net and seine fisheries have been restricted to a terminal harvest of enhanced Kitimat chums located in Kitimat Arm and upper Douglas Channel to avoid encounters of weaker stocks.
- Non-retention of steelhead in all fisheries.
- Commercial net fishing is limited to daylight hours to reduce by-catch.
- Use of revival boxes to revive non-target and non-retention species prior to release is a condition of license for gillnet and seine vessels.
- Other conservation measures are also in effect, including mandatory brailing for all seine sets and non-retention of chinook, steelhead, and usually chum by the commercial seine fleet.
- Non-retention of a species could change in-season depending on abundance and allocation across fleets.

3.3.4 Area 7 terminal chum fisheries (Mussel, Kainet, Neekas, Quartcha and Roscoe)

3.3.4.1 Harvest Objectives

Major chum systems actively managed in Area 7 are the Mussel River (management escapement goal = 40,000), Kainet Creek (MEG=50,000), Neekas Creek (MEG= 30,000), Quartcha Creek (MEG = 5,000), and Roscoe Creek (MEG = 50,000), as well as community hatchery stocks at Kitasu Creek and McLaughlin Bay Creek. These fisheries occur in terminal areas or the approach areas where timings of these stocks are known.

Pink salmon migrate during a similar time period as chum but are not actively targeted and are caught incidentally. Fisheries for Mussel and Kainet chum generally occur in August. Early returns of Roscoe and McLaughlin chum occur in Seaforth Channel in August, while the main return occurs in September. Gill net and seine fleets are normally small for these fisheries with generally no more than two days per week fishing during good returns and one day per week during an average return.

When possible, openings are coordinated to spread fishing effort over a broader area.

3.3.4.2 Pre-season Planning

Opportunities for one-day gill net and seine assessment fisheries on the last week of July or first week of August are determined pre-season based on recent trends in brood year escapement. If recent escapement estimates indicate an increasing or stable run, the assessment fisheries will very likely go ahead, regardless of other information. Since it occurs early in the run, this fishery has little impact on the overall escapement, and still provides an improved indication of run strength. One-day assessment fisheries for 2008 were under consideration for lower Finlayson, lower Mathieson, and Sheep Pass.

3.3.4.3 In-season Implementation

Fisheries for Mussel and Kainet chum generally occur in August. Fisheries for Neekas, Roscoe and McLoughlin chum can occur in Seaforth Channel in August, while the main fishery occurs more terminally in inlets approach areas during September. Gill net and seine fleets are normally small for these fisheries with generally no more than two days per week fishing during good returns and one day per week during an average return.

Openings targeting Kitasoo Creek Hatchery stocks and surplus chum in terminal areas are only considered after August 22 and follow the pattern of gill nets fishing first and seines second.

The decision timeline for these fisheries follows an annual schedule:

- *First Week of August:* One additional day of fishing during daylight hours is considered if the run appears strong on the afternoon of the one-day assessment fisheries. The assessment of run strength and expected escapement is based on a review of hauled catches after 14:00 hours on the fishing day to estimate CPUE, salmon escapements to the Mussel and Kainet Rivers to-date, and total catch of chum salmon to-date. A large increase in fleet size could adversely affect smaller stocks in the area, so extra fishing time may depend on openings in other areas in the North Coast.
- *Second Week of August until Mid-October:* The results of the past week's fisheries and their implications for the status of target stocks and incidental stocks are reviewed at the in-season advisory meeting with central coast advisors. Recommendations on future fishing opportunities are discussed at this meeting. If stock strength permits, fishing opportunities are considered each week until mid-October. Announcements for the next week's opportunities are made on the Thursday or Friday of the week preceding the proposed fishery. Salmon escapements to the Mussel and Kainet Rivers will be monitored

in conjunction with CPUE and total catch of chum salmon to estimate the run strength and the resulting escapement. A large increase in fleet size could adversely affect smaller stocks in the area, so extra fishing time may depend on openings in other areas in the North Coast.

- Subject to in-season discussions with central coast advisors, Lama Pass (McLoughlin Bay) may be opened in mid-August, depending on observed chum abundance. Gill nets and seines alternate their fishing each week.
- Subject to in-season discussions with central coast advisors, portions of Spiller Channel may be opened to seines and gill nets in late August. Openings in that area depend on chum escapements to the Neekas River.
- Subject to in-season discussions with central coast advisors, portions of Johnson Channel and Roscoe Inlet may be opened to seines and gill nets in late August. Openings in that area depend on chum escapements to the Roscoe, Quartcha and Clatse Rivers.
- Subject to conservation concerns and First Nations food, social and ceremonial fisheries, the Klemtu Pass area may be opened to harvest surplus chum returning to the Kitasoo Creek Hatchery.

3.3.4.4 Conservation Measures

- Pink salmon migrate during a similar time period as chum but are not actively targeted and are caught incidentally. During periods of high pink salmon catches in Areas 7 or 8, fisheries will be managed so that there is a maximum of two consecutive days of fishing. This action has been recommended by fishers and processors to maximize the value of the pink salmon caught.
- The half-mile radius boundary around Mary's Cove Creek is in effect year-round to conserve Mary's Cove and Lagoon Creek sockeye.
- Gill nets subject to 149mm mesh restriction all season to protect sockeye stocks in some of the Central Coast systems.
- Seines are required to brail and release sockeye, chinook and steelhead to the water with the least possible harm all season.
- Fishing is limited to daylight hours to reduce coho by-catch.

3.3.5 Area 8 Terminal Chum Fisheries (Kimsquit, Bella Coola)

3.3.5.1 Harvest Objectives

Chum fisheries in Area 8 target mainly Kimsquit River and summer run Bella Coola River stocks. Fisheries also occur on returns to Lower Dean streams (Elcho, Cascade and Jenny) but to a lesser extent. The summer run timing component from the Bella Coola system is enhanced, while the Kimsquit River is not.

Fisheries in North Bentinck Arm, Dean Channel and Burke Channel are gill net only while fisheries in Fisher Channel and Fitz Hugh Sound are open for gill net as well as seine.

Note that chum fisheries in Area 8 are closely coordinated with pink salmon harvests, as described below and in the profile for North & Central coast pink salmon.

3.3.5.2 Pre-season Planning

Opportunities for two-day gill net assessment fisheries in the first two weeks of July are evaluated based on trends in brood year escapement, and reviewed through the pre-season planning process in November and December. This fishery is implemented to get an early assessment of run strength. It has very little impact on the stocks because it occurs early in the run and the benefits of the stock status information provided by this fishery outweigh the small risks associated with its limited impact. Two weeks of data are required to obtain sufficient information for an updated run-size estimate. The final decision is made the previous week.

3.3.5.3 In-season Implementation

- The assessment openings may be extended for a third day that week if the runs appear strong based on a review of catches to-date.
- Opportunities for a gill net and seine opening on subsequent weeks are considered, based on the results of the assessment fisheries and:
 - If Atnarko pink stocks are weak but Bella Coola and Kimsquit chum stocks are strong, Sub areas 8-3 and a portion of Sub area 8-4 south of a line from Walker Point to Hergest Point will be closed.
 - If Kimsquit and Lower Dean chum are weak but Bella Coola chum are strong, Sub area 8-5 will be closed.
 - If Kimsquit and lower Dean chum are very weak but Bella Coola chum are strong, Sub areas 8-5 and 8-4 north of Walker Point will be closed.
- Fisheries can continue every week for one to three days until early September depending on stock strength.

3.3.5.4 Conservation Measures

- During periods of high pink salmon catches in Areas 7 or 8, fisheries will be managed so that there is a maximum of two consecutive days of fishing. This action has been recommended by fishers and processors to maximize the value of the pink salmon by-catch.
- Where possible, openings in Areas 6 through 10 will be concurrent to spread out effort.
- Gill nets are under a 158mm mesh restriction until the beginning of August to protect sockeye stocks in some of the central coast systems. Gill nets will be allowed to use nets with 149mm for the remainder of the season.
- Fishing is limited to daylight hours to reduce the by-catch of coho.
- Seines are required to brail and release sockeye, chinook and steelhead to the water all season.
- Between July 10 and August 14 weed lines are required for gill nets in Sub areas 8-5 north of Bold Point and 8-8 for steelhead conservation.
- There are important by-catch issues in Area 8, particularly for sockeye and steelhead. Sockeye impacts are limited by time and area restrictions, as well as mandatory release for seines. Steelhead impacts in Dean Channel are very important and this fishery is carefully managed to reduce by-catch by using more selective gear, and there may be mandatory release of steelhead, coho and sockeye.

3.3.6 Area 10 Terminal chum fishery experiment (Nekite)

Since 1985, all gill net fishing has occurred inside Smith Inlet with the last fishery occurring in 1996. Total sockeye returns to the tributaries of Long Lake have remained relatively poor since the 1996 fishing closure. An expanded mark-recapture experiment will be conducted for Nekite chum in 2008 to determine whether escapements may support a terminal fishery in future years. Given poor marine survivals from the 2004 brood, a precautionary approach will be taken regarding any Nekite chum fishery.

If a terminal fishery is initiated for Nekite chum salmon, catch and escapement data will be used to make decisions on any further fisheries. Because of the lack of data on this system, caution will be used regarding any harvest opportunities.

If a fishery takes place, a maximum mesh restriction of 150mm will be in place to protect Docee River chinook stocks. Boundaries will be restrictive to protect non-targeted stocks. No coho retention unless abundance warrants.

3.3.7 Summary: Annual timeline for commercial chum fisheries

Based on the decision guidelines outlined in the previous section, commercial fisheries follow the same rough timeline each year, depending on stock strength.

- *Area 6:* Start mid July and continue until the end of August
- *Area 7:* Start near the end of July and continue until early October
- *Area 8:* Start end of June and continue until the end of August
- *Area 10:* Have not fished for chum for many years. Recent assessment of returns to the Nekite River suggest that a harvestable surplus may develop in the near future. This fishery would likely take place during September.

4 ASSESSMENT FRAMEWORK

4.1 Overview

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 regional approach is implemented for North Coast and Central Coast chum salmon.

Catch and escapement of North and Central Coast chum salmon are assessed annually, as documented in the North Coast's *Core Stock Assessment Plan*, which is summarized below. Catch in commercial fisheries areas is sampled in order to determine stock composition (i.e. hatchery versus wild origin) and age composition. Estimates of aggregate escapement to each statistical area are based on a surveys of key streams identified in a comprehensive assessment framework.

Riddell (2004) reviewed the assessment history of Central Coast chum salmon (p. 62 to 67) and North Coast chum salmon (p. 67 to 73) in a report to the *Pacific Fisheries and Resource Conservation Council* (PFRCC), which is an independent advisory body (Refer to Section 4.3.5 of the *2009 Pink and Chum Management Summary* for a description of the PFRCC and other external advisory groups). The main conclusions by the author and subsequent council discussion are:

- “[...] a strength for the chum salmon in central BC has been the consistency of the escapement monitoring in the 140 chum streams. During the 53 years of recorded escapements, over half of these streams have been enumerated in 40 or more years, and only 23 streams have been inspected fewer than 10 times. Given the remoteness of some of the rivers and the local climates, this record of escapement monitoring for central BC chum salmon is exceptional.”
- “While the frequency of escapement surveys does not address concerns about the accuracy of these data, the consistent effort over a long period and large set of streams does add confidence to the relative measures of change in central BC chum salmon.”
- “The coverage of escapement surveys between streams and years in northern BC is not as thorough as in central BC. However, given the number of streams involved (470 different streams reported with chum spawning), it may simply be impractical to maintain the coverage given the large number of streams. Using the same comparative standards as those used for the central region, 149 streams (32% of the total) have been surveyed in over 40 of the 53 years, and 111 streams have been surveyed equal to or less than 10 times (24% of the total). The number of streams with high frequency of surveys (i.e. the 149 streams) could still, however, provide an adequate sampling basis for monitoring of northern BC chum. One immediate concern in the north is the increased variability in escapement sampling between sub-areas and the reduction in number of streams monitored. Survey frequency for those chum salmon declined further during 2001 and 2002.”
- “Given how few major chum populations (i.e., over 10,000 spawners on average) are estimated in both central and northern BC, the real basis of the chum salmon resource is the diversity and status of the medium to smaller systems.”

- “While there has been extensive effort by Fisheries and Oceans Canada personnel to maintain escapement records for chum salmon in the central and northern BC, the Council again recommends the establishment of an explicit assessment framework that focuses these efforts in an efficient and informative monitoring program. In both regions, the high frequency of monitoring in a significant number of chum spawning streams provides an important basis for development of this framework”

English et al. (2006) built on the recommendations in Riddell (2004), reviewed assessment history in more detail, and developed a comprehensive salmon assessment framework for the North Coast and Central Coast. They conclude that “the methods proposed to monitor chum escapements to North and Central coast streams include counting fences and visual surveys of adult abundance. There are only 4 streams where counting fences provide annual data on chum escapement (Pallant and Mathers creeks in Area 2E, the Kincolith River in Area 3 and Kitwanga River in Area 4). [Update: Mathers Creek fence is currently not operational. West Arm Creek fence located in Area 6 focuses on coho, but provides chum and pink escapement counts.] Visual surveys are the most common and efficient technique for obtaining escapement estimates for chum salmon. In most areas, annual surveys are recommended because these surveys provide counts for both pink and chum salmon. In all Areas, reliable estimates can be obtained from visual surveys conducted 3-4 times per year and AUC estimation procedures. In Areas 1-6, ground-based surveys are effective for counting chum and pink salmon in spawning areas. In Areas 7-10, both ground and aerial surveys are effective for escapement monitoring. In total, 23 index streams are proposed to be monitored using aerial survey techniques, 148 index streams should be assessed using ground-based surveys, and 44 index streams in Area 2E and 2W were suitable for periodic monitoring because of pink salmon returns are relatively small in odd numbered years.” Their Table 6 includes a detailed summary of recommended survey coverage by stat area.

DFO develops *Annual Field Assessment Plans* for North Coast and Central Coast salmon based on the recommendations in English et al. (2006), and tracks annual performance relative to the recommended coverage in *Annual Stream Inspection Logs*. Actual survey coverage each year is influenced by local conditions and regional budget priorities. For example, stream inspections in 2007 were affected by high water levels and poor visibility. *Annual Field Assessment Plans* and *Stream Inspection Logs* are available upon request from the North Coast DFO office in Prince Rupert.

Walters et al. (2008) reviewed the implementation of the core assessment framework, and outlined 4 options for salmon monitoring on the Skeena. These recommendations are currently being reviewed by DFO.

An annual chum sampling program has begun in 2008, collecting scales as well as recording sex and length. Activities in 2008 include:

- *Queen Charlotte Islands*: Pallant Creek (enhanced)
- *North Coast*: Kincolith and Lachmach Rivers in Area 3, Kitwanga River (Skeena) and Kumealon River (coastal) in Area 4, Kitimat River (enhanced) and West Arm Creek (wild) in Area 6
- *Central Coast*: Bella Coola River (enhanced) and possibly Klemtu Creek (enhanced) in Area 8. Other wild stocks will be added in the future, however low returns in 2008 precluded much chum sampling.

4.2 Annual monitoring

4.2.1 Escapement

North and Central Coast chum escapement is monitored in-season by charter patrol boats and by stream walks in representative streams (English et al. 2006). Stream inspections are conducted annually by DFO staff, contracted charter patrols, First Nations assessment staff, and various non-governmental community groups.

Information for a small number of streams is obtained from either over-flights or fence programs. Daily inspection data from escapement surveys is recorded in a database program used by field staff. The annual estimates of total returns to streams are calculated using an 'area-under-the-curve' calculation. All assumptions within this calculation are documented within the database. Escapement data are fully documented and publicly available (DFO 2008a)

Key streams for salmon monitoring were chosen using the following criteria (English et al. 2006):

- High potential to obtain reliable stream counts (e.g. water clarity, accessibility, flow rates)
- Similarity to other streams in terms of geographic area, genetics, migration timing, and similar vulnerability to fishing effort.
- Equal coverage of large, medium or small-size streams.
- Sufficient coverage identified as important to commercial and First Nation interests.

Chum assessment information for large river systems is recorded using a tributary stream hierarchy system which follows the BC Provincial stream naming and numbering system. Large river systems may have several orders of tributary levels found within a watershed. Large rivers with tributary stream data include the Nass (Area 3), Khutzeymateen (Area 3), Kitsault (Area 3), Skeena (Area 4), Kitimat (Area 6), Kemano (Area 6) and Bella Coola (Area 8) watersheds.

Implementation of the stock assessment framework has been consistent since 2004 (Table 8). Over 3,500 stream inspections for chum salmon escapement were conducted over a 4 year period, with a total of 432 streams surveyed at least once, and key streams surveyed multiple times each year.

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.

The Tyee Test Fishery (Skeena River, Area 4) is the main in-season stock assessment tool for estimating an abundance index of Skeena River salmon and steelhead through the use of a multi-panel gill net with varying mesh sizes (Cox-Rogers and Jantz 1993). In addition, daily in-season escapements and total run size are estimated for sockeye. Estimates are subject to error as the catchability of salmon by the test fishery net varies from year to year due to varying environmental conditions (including water level, clarity and temperature, weather conditions and tide). More information about the test fishery, including daily in-season salmon indices, is available at <http://www.pac.dfo-mpo.gc.ca/northcoast/skeena/tyeetest.htm>.

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:

- *Area 1:* Catches in early assessment fisheries for gill nets in the western portion of McIntyre Bay, outside Masset Sound, are generally a reliable indicator of run size.

- *Area 6*: Terminal assessment fisheries in Kitimat Arm only, to determine hatchery returns.
- *Area 7*: One-day assessment fisheries for 2008 are under consideration for lower Finlayson, lower Mathieson, Sheep Pass and the eastern portion of Seaforth Channel.

4.2.2.3 Counting fences

Salmon counting fences are used throughout the North and Central Coast. The following fence enumeration facilities currently collect chum data:

- *Pallant Creek fence* (Area 2E)
- *Kincolith River fence* (Area 3): Video-counting facility is jointly operated by Nisga'a and DFO.
- *Kitwanga River fence* (Area 4): This facility is jointly operated by the Gitanyow Fisheries Authority, DFO, and the BC Ministry of Water, Land and Air Protection. More information, including weekly in-season counts, is available at www.pac.dfo-mpo.gc.ca/northcoast/counts/kitwanga/kitwanga.htm.
- *West Arm Creek fence* (Area 6): The primary focus of this fence operated by DFO is to assess coho, but it counts chum and pink as well.

4.2.2.4 Nisga'a

- Fishwheel Program conducted at test-fishing sites near Gitwinksihlkw on the Nass River.
- Radio telemetry study on Kincolith River chums was initiated in 2008.

4.2.3 Catch Monitoring

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 and age composition of the catch, either directly from boats in the fishery or from combined catch at processing plants.

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

- Daily harvest logs documenting date, location, species encounters, species kept, and species released are completed by each fishery participant. This data is collated and accessible at the regional level. Appendix 9 of the 2008 *Integrated Fisheries Management Plan for Salmon* includes sample logbook pages for each licence area.
- Weekly phone-in of in-season harvest information by all fishery participants is collated and accessed at the regional level.
- Daily inspections by enforcement patrol staff surveying harvest information and monitoring compliance to all fishery restrictions and management guidelines (e.g. use of revival boxes when mandatory). This data is recorded in the fishery managers *Record of Management Strategies* (RMS).
- 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 hail-in data are verified occasionally by on-water inspections of catch by Fishery Officers, dock-side monitoring and auditing of sales slip data. Nearly all commercial harvesters submit catch

information to DFO. Catch in directed chum fisheries is usually sampled for hatchery marks (otolith) and age (scales) at either landing sites or processing plants, although occasionally observers sample on board fishing vessels. Pallant and Kitimat hatcheries have not marked chum releases in recent years.

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 North Coast and Central Coast is sufficient for estimating chum removals from larger stock groupings (i.e. by statistical area). Aggregate catch estimates have been previously summarized by Spilsted (2004). Trends in catch and harvest rate are discussed in Section 5.2.2.

Removal estimates at a finer level of detail are highly uncertain for North and Central Coast chum stocks due to the high variability in migration routes, run timing, and abundance of individual populations. However, the harvest strategy for North & Central Coast chum limits the risk associated with this uncertainty through terminal fisheries on local abundances identified in-season and non-retention of chum in areas with persistently low returns (e.g. Areas 3 to 5, Area 9)

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 steelhead 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.

English et al. (2006) summarize commercial catch monitoring in the North and Central Coast: “*Mandatory reporting systems provide annual estimates for total catch and landed value by statistical area. In-season data from aerial counts and charter patrols are used to monitor fisheries, assess returning abundance for some stocks (e.g. Area 6-10 pink and chum) and provide finer spatial and temporal resolution for catch estimates (e.g. Area 3-4 sockeye). Dockside monitoring is required to obtain information on the size, age and stocks harvested for specific species and fisheries. The relative importance of these data collection programs for stock assessment varies by area and species. For example: reliable information from each of these programs is required for the detail run reconstruction analyses to determine the annual abundance and harvests of Nass and Skeena sockeye required to implement the PST and Nisga’a Final Agreement [...]. In contrast, most of the harvest information required for management and stock assessment related to Central coast pink and chum fisheries has been obtained through the charter patrol “hail” survey efforts.*”

4.2.3.2 Recreational

Chum are generally not targeted by recreational harvesters and harvests are typically small, with total recreational catch of chum salmon for Areas 1 to 10 less than 5,000 annually (i.e. recorded catch in regional database at http://www.pac.dfo-mpo.gc.ca/sci/sa/Recreational/default_e.htm).

However, all recreational catch is monitored through the regional creel surveys. Creel surveyors gather catch-per-unit-effort data and take biological samples from boat landing sites. 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.

English et al. (2006) provide the following recommendations: *“The primary tools for monitoring North and Central coast recreational fisheries are creel surveys and lodge logbooks. Annual creel surveys are required for the recreational fisheries in Area 1-2 because these fisheries catch and release large numbers of salmon. Periodic creel surveys should be adequate to track harvest trends for the other significant marine fisheries (Area 3, 4, 6) and freshwater fisheries (Nass and Skeena). The bulk of the recreational harvests in Area 7-9 are based out of lodges so the most effective means of obtaining harvest data is through annual logbook programs. As these recreational fisheries increase in size over time, the frequencies of creel surveys should be revisited.”*

4.2.3.3 First Nations

English et al. (2006) provide the following recommendations: *“The procedures recommended for monitoring annual harvests for First Nation fisheries vary with the size and intensity of the fishery. Monitoring programs within the Nass and Skeena watersheds provide the most reliable and timely harvest data by combining catch per effort from fishermen interviews with effort estimates from net counts and fishermen logs (Bocking and English 1996). First Nation terminal harvests of Copper River and Yakoun River sockeye in the Queen Charlotte Islands are also considered reliable. The catch estimates are much more uncertain for First Nation harvests in marine areas. These estimates could be substantially improved ensuring that each First Nation has the technical support required to design and implement more rigorous catch monitoring programs including direct sampling through interview, logbook programs and telephone surveys.”*

4.3 Analysis

4.3.1 Stock Composition

4.3.1.1 Methods

Estimates of stock composition are required to distinguish harvests of wild chum and enhanced chum, and to identify the presence of weaker stocks in a fishing area.

Stock composition is determined by two methods:

- Coastwide Mark-Recovery Program (MRP).
- Genetic Stock Identification (GSI) analysis.

4.3.1.2 Mark-Recovery Program (MRP)

Chum released from hatcheries are marked to allow determination of hatchery contribution to returns and, when suitable, estimation of survival, exploitation and distribution parameters.

Adipose or ventral fin clips are the primary marking method for chum in the North and Central Coast. Snootli Creek hatchery marked two or more stocks for many years and continues to mark Snootli Creek chum (in the Bella Coola River system) as the Central Coast chum indicator stock. Pallant and Kitimat hatcheries have not marked chum releases in recent years.

The Area 8 commercial fisheries are consistently sampled for marks along with the Snootli Creek escapement. In addition, scales are collected from catch, escapement and broodstock for age determination.

This sampling allows determination of survival rates, exploitation rates and enhanced contribution to catch and escapement.

4.3.1.3 Genetic Stock Identification (GSI)

A comprehensive research project started in 2004 to explore whether genetic baseline data could be used to identify chum stocks passing through an area. Experimental testing has focused primarily on weekly sampling of Area 3 commercial fisheries. Results from this study are currently being assessed in terms of stock identification of weekly chum by-catch and stock migration timing through Area 3 Commercial fisheries. Current work is focusing on whether differentiation of Alaskan chum (strong stock) and Canadian chum (weak stock) can be achieved for use as a management tool. However, in-season stock identification remains a substantial challenge, and the management approach has been adapted by shifting fisheries to more terminal, stock-specific locations (Section 3.2).

4.3.2 Forecasts

Annual salmon stock outlooks provide qualitative expectations for the upcoming season (<http://www.pac.dfo-mpo.gc.ca/fm-gp/species-especes/salmon-saumon/index-eng.htm>).

Quantitative forecasts for North and Central Coast chum salmon are relatively inaccurate compared to forecasts for other salmon species. Spilsted (2004) describes chum forecasting models for Areas 1-6 based on log-transformed running averages using 4-year, 5-year, and all-year intervals. However, due to the high uncertainty, and recent changes in the management approach (i.e. shift to terminal fishing locations with openings based on observed in-season abundance), forecasts are not routinely provided to the public.

4.3.3 Trend Summaries

This section describes the time series shown in Figure 1 to Figure 11.

4.3.3.1 Escapement and survey coverage

Observed escapements were extracted from the escapement database maintained by DFO - North Coast (DFO 2008a), which includes all of the data collected through the various components of the escapement monitoring program. Section 4.2.1 summarizes the development and recent implementation of the framework.

Survey coverage fluctuates across years, and comparisons of annual estimates must be approached with caution. Table 8 summarizes recent survey coverage.

A key element of the assessment framework for chum salmon are *index streams*, designated as unenhanced systems with escapement data for 10 or more years over the period 1950 to 2004. Time series of survey coverage for each statistical area plot the number of index systems surveyed, and the % of long-term index escapement covered by those systems.

Escapement reconstructions account for the fluctuation in survey coverage. Reconstruction methods are described in Gazey and English (1999), and applied to North and Central Coast chum in English et al. (2006), as documented in their Appendix B. 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. Table 5 lists the range of annual expansion factors used for each statistical area.

4.3.3.2 Catch and harvest rate

Canadian commercial catch records by statistical area were extracted from the regional catch data base. Section 4.2.3 describes the catch monitoring program. Note that the catch by statistical area in Table 4 includes all catches reported from a statistical area, which may contain salmon originating from a different statistical area, and that fisheries have shifted towards more terminal, locally selective fishing locations in recent years. This is particularly pronounced for Areas 1 and 2W on the Queen Charlotte Islands and Areas 3 to 6 on the North Coast.

Estimates of Canadian commercial harvest rate, shown in Figure 1 to Figure 11, are adjusted as follows:

- *Areas 1 and 2W*: English et al. (2006) include only catches after August 15th.
- *Areas 3 to 6*: English et al. (2006) calculate an aggregate harvest rate for Areas 3 to 6 because catch reported for a statistical area may contain salmon originating from a different statistical area.

In addition, fisheries have shifted towards more terminal, locally selective fishing locations in recent years, but these shifts are not reflected in Figure 1 to Figure 11, which show the aggregate harvest rates. Specifically :

- *Queen Charlotte Islands*: Fisheries shifted to the Cumshewa Inlet management sub-area of statistical area 2E to target enhanced returns from Pallant Creek hatchery.
- *North Coast*: Fisheries shifted from Gil Island into the Kitimat Arm management sub-area of statistical area 6 to target enhanced returns from the Kitimat River hatchery). As a result, recent harvest rates on chum originating from Areas 3, 4, and 5 are assumed to be substantially lower than the aggregate harvest rate for Areas 3 to 6 shown in Figure 1 to Figure 11.
- *Central Coast*: Note that there have been no targeted fisheries in Areas 9 or 10 since the 1990s.

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

In addition to aggregate trends in observed and reconstructed escapement (bottom panel), Figure 1 to Figure 11 also show an index of escapement by population (P_{avg}), calculated as follows:

- Use index streams only. This removes any potential biases associated with enhanced systems and highly uncertain estimates from systems that are rarely surveyed.
- Calculate the long-term average escapement for each index 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 index streams with a numerical escapement record in a given year.

Figure 1 to Figure 11 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 North and Central 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 *Integrated Fisheries Management Plans*, as well as the annual reports of the Pacific Salmon Commission and its Joint Chum Technical Committee, available at www.psc.org. Detailed post-season review materials for last year are available at <http://www.pac.dfo-mpo.gc.ca/northcoast/post-seasonreview/default.htm>.

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 North and Central Coast chum include:

- Riddell (2004) *Pacific Salmon Resources in Central and North Coast British Columbia*. Pacific Fisheries Resource Conservation Council. Available at http://www.fish.bc.ca/files/SalmonResources-North_2004_0_Complete.pdf.
- 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.
- Spilsted (2004) *Trends in abundance for Northern British Columbia chum salmon*. Canadian Science Advisory Secretariat Research Document - 2004/013, available at http://www.dfo-mpo.gc.ca/csas/Csas/DocREC/2004/RES2004_013_E.pdf.
- English et al. (2006) *North and Central Coast Core Stock Assessment Program for Salmon*. Pacific Salmon Foundation and DFO.
- Walters et al. (2008) *Report of the Skeena Independent Science Review Panel*. Available at <http://www.skeenawild.org/resources/archive/report-of-the-skeena-independent-science-review-panel/index.html>.

The remainder of this section summarizes the conclusions from these status evaluations and provides updated information on key trend indicators.

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

5.2 Current status

5.2.1 Conservation priorities

Management of North and Central Coast chum salmon incorporates conservation measures to promote long-term survival of chum stocks which originate from a wide range of stream sizes and productivity found within each statistical area.

Currently, North & Central Coast chum populations are healthy enough not to warrant a legislated level of protection and the overall persistence of North Coast and Central Coast chum populations is not immediately

threatened. However, if any of the conservation units declined to a point where their persistence was threatened, Canada's Species at Risk Act (SARA) provides a legislative and policy framework for recovery. Conservation priorities have been identified for each region.

5.2.1.1 Queen Charlotte Islands (Areas 1 and 2)

There are 7 chum streams with consistent escapement records for Area 1, 122 for Area 2 East, and 71 for Area 2 West. Spilsted (2004) reviewed escapement data from 1950 to 2002 and concluded that chum escapements have been variable but stable for most of the management sub-areas, except for a moderate decline in area 2E. In recent years, chum escapements in Areas 1 and 2 have been generally below Management Escapement Goals (Section 2.4.4) and below the long term average. In 2007 there was a very low abundance of returning spawners throughout Area 2 East, including Pallant Creek which receives significant releases hatchery fry. This suggests that recent abundance has been strongly affected during the marine stage of the lifecycle.

Conservation priorities include assessing core streams as identified in the North Coast's Core Stock Assessment Plan (Section 4.1), and minimizing encounters of non-target chum stocks by establishing discrete terminal fisheries when surplus chum stocks have been identified. In recent years collection and analysis of genetic samples from streams throughout Areas 1 and 2 have provided information for delineating distinct of stock groupings (Section 2.1.1.2). Chum stocks are generally managed at the watershed level within each Statistical Area.

5.2.1.2 North Coast (Areas 3 to 6)

North Coast chum salmon stocks can exhibit highly variable annual return rates. Riddell (2004) summarized the analytical challenges and observations: *"The number of streams involved in chum surveys has varied from only 235 streams in 1950 to 404 streams during the 1980s. Over this period the total estimate of chum spawning escapements has declined from a range of 800,000 to one million to possibly one-half of that range, but the variation in numbers of streams surveyed makes simple comparisons of total escapement of limited value [...]. The status of northern BC chum salmon is much more difficult to summarize than for their central BC counterparts. The status of northern chum is more variable between sub-areas with reductions in escapement numbers and stream diversity likely in the Nass River, Skeena River, and areas of the Queen Charlotte Islands. Analyses by Spilsted (2004) suggest that these changes are related to stream size with changes most evident in chum populations that were typically 5,000 spawners or less."*

Specifically, Spilsted (2004) found that:

- North Coast aggregate escapements show a declining trend over time for streams with average escapements less than 5,000 fish per year; larger stocks did not show this trend.
- Escapements to Area 3 (Portland Inlet and the Nass River) *"appear to be generally lower than returns in the 1950s and 1960s"*
- Escapement to Area 4 (Skeena River and outer coast) *"does not show a clear trend"*.
- The declining trends and current low escapements for Areas 5 and Area 6 are of particular concern.

Medium to smaller systems were consistently highlighted as particular conservation priorities. Riddell (2004) evaluated diversity plots and found *"substantial changes in the distribution of spawning population sizes in the different decadal periods. The total number of spawners has declined, but a few streams involved with major hatcheries now contribute a large proportion of the total, and the number of medium to small populations contributing has declined in numerical importance."*

These conclusions were supported by the *Pacific Resource Conservation Council* (Riddell 2004), and confirmed by English et al (2006).

Section 3 describes how salmon fisheries have been adapted in response to these observed trends. Most notably, there are no targeted chum fisheries in Areas 3 to 5. Other salmon fisheries generally operate under chum non-retention regulations, and are subject to time and area closures designed to reduce chum encounters.

5.2.1.3 Central Coast (Areas 7-10)

Riddell (2004) summarizes: “A recent detailed examination of time trends in spawning escapements for these statistical areas demonstrated the high variability in annual escapements, but did not indicate any strong time trends over the years, with the possible exception of chums in Area 11 (Seymour Inlet) and very recent declines in Area 10 (Smith Inlet). These data were presented to the Pacific Scientific Advice Review Committee by Godbout et al. (2003) at the May 2003 meetings [Note: now archived as Godbout et al. 2004]. Returns during 2001 and 2002, though, have increased significantly (note that the increased total [...] for these two years involved only 84 streams). A portion of this increase may be associated with enhancement programs at Snootli Hatchery (Bella Coola River) and the Nekite River spawning channel. However, the increase in escapements was much broader than just those two locations and was more likely a reflection of improved marine survival for chum salmon and recent reductions in many chum fisheries.”

Overall, Riddell (2004) concludes: “Given the recent increases in spawning escapements and little change in measures of diversity between streams, chum salmon in the central region appear to have maintained their status over this period (1950 to 2003).”

5.2.2 Trends

5.2.2.1 Abundance

Estimates of total abundance for North and Central Coast chum salmon are based on run reconstructions that extrapolate from escapement to index streams and catches within each statistical area (Section 4.3).

Appendix Figure C4 of English *et al.* (2004) plots reconstructed Total Returns To Canada (TRTC) from 1980 to 2002. The following general trends emerge:

- *Queen Charlotte Islands*: Chum escapements have been generally below Management Escapement Goals (Section 2.4.4) and below the long term average. Areas 1 and 2E showed declines in TRTC since the late 1990s, while 2W had some improved TRTC after a depressed period in the 1990s.
- *North Coast*: TRTC for Area 3 has steadily, but not drastically declined since the 1980s, with 2 large spikes in abundance (1993, 1998). TRTC for Areas 3 and 4 have been at low, but stable, levels since the late 1980s. TRTC for Area 5 was at a low level for most of the 1990s, but showed some increase over 1998 to 2002. TRTC for Area 6 increased steadily throughout the 1990s, dipped over 1998 to 2001, and picked up again in 2002.
- *Central Coast*: TRTC for Areas 7 and 8 was stable, but variable, for the period 1980 to 2002. Areas 9 and 10 both showed substantial increases in TRTC after conservation measures were implemented in the mid-1990s.

5.2.2.2 Escapement

Table 2 summarizes observed escapement for statistical areas 1 to 10 since 1960. 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 in these figures table are adjusted to reconstruct

run size and calculate harvest rates. Gazey and English (1999) and English et al. (2006) describe the methods in more detail.

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 in these figures table are adjusted to reconstruct run size and calculate harvest rates. Gazey and English (1999) and English et al. (2006) describe the methods in more detail.

Figure 1 to Figure 11 show trends in total observed escapement for each statistical area. The following trends emerge:

- *Queen Charlotte Islands*: Escapement in 1 and 2E has generally declined since the 1980s, with a more pronounced drop in Area 1. Escapement in Area 2W increased steadily throughout the 1990s (even years), but dropped sharply for 2004 and 2006, illustrating the pronounced variability in escapements.
- *North Coast* (Areas 3 to 6): Escapement in Area 3 has been highly variable, but with an overall increasing trend since the late 1990s. Escapement in Areas 4 and 5 has decreased steadily since the late 1980s. Escapement in Area 6 increased over the 1980s and 1990s, but had some years of low spawner abundances in recent years.
- *Central Coast*: Escapements in Areas 7 and 8 increased steadily since the 1990s, but show a decline in recent years. Escapements in Areas 9 and 10 dropped substantially in the late 1980s, spiked over 2002 to 2004, and recently dropped again, even though there have been no targeted salmon fisheries since the mid-1990s.

5.2.2.3 Catch

Table 4 summarizes commercial chum catches by statistical area since 1980. Total catch has declined steadily since the late 1980s, with catch reductions especially pronounced in areas with low escapements or conservation measures for other salmon stocks (i.e. 2E, 3 to 6, 9, and 10).

5.2.2.4 Canadian commercial harvest rate

Figure 1 to Figure 11 show trends in Canadian commercial harvest rate (CCHR) for each statistical area. CCHR has dropped substantially in all areas as conservation measures have been implemented. Note that aggregate CCHR by statistical area does not reflect the additional reduction in harvest on local stocks of concern due to shifting fisheries into terminal, more selective, locations.

The harvest reduction is most pronounced for Areas 9 and 10, where CCHR dropped from 30 to 40% in the early 1990s to 0% since 1998.

CCHR for all areas is now about 30% or less, except in terminal fisheries harvesting enhanced chum near the hatchery stream.

5.2.2.5 Survey coverage

Survey coverage is extensive (Section 4.2.1), but has generally declined since the 1950s. Typically, assessments have focused on more abundant systems, so that the proportion of index escapement covered by surveys has declined less than the number of systems surveyed. Escapement surveys still capture about 50% or more of the long-term index escapement in 6 of the 10 areas. These overall declines in survey coverage concurred with changing harvest strategies and substantially reduced catches. Survey coverage has dropped the most in those areas with the lowest catches (e.g. areas 1 and 9).

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

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. The most notable example is Area 6, where abundant stocks (i.e. Khutze River, Kemano River, Foch Creek) have performed much better than small stocks in recent years.

5.2.2.7 Survival

Chum marine survival estimates are not routinely calculated, as they are for other species using coded wire tags or other mark recoveries. In the past, when release-specific fin clips applied to all hatchery produced chum were recovered in fisheries and brood collections, such calculations were made; but since 1999, hatchery marks consist only of otolith thermal marks. Processing of otolith thermal marks has been sporadic for chum due to funding constraints. Current estimates of marine survival from otolith marks are in preparation. For North and Central Coast salmonid populations, trends in marine survival rate tend to be correlated. Therefore, for forecasting and planning purposes, major fluctuations in the marine survival rate of chum broods are somewhat anticipated.

Freshwater and marine environmental conditions are assumed to have had a negative impact on chum stocks over the last few generations.

5.2.2.8 Size

Size data for chum salmon is not consistently collected in the North and Central Coast. Table 3 summarizes size data currently available in the biological traits database (DFO 2008c), which is insufficient for evaluating trends in the size of chum salmon.

6 CONSERVATION MEASURES IN NORTH & CENTRAL 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 industry and First Nations representatives. Fisheries commence each year using the established pre-season plan. As in-season catch and escapement data becomes available through the season, fishing plans are adjusted on a daily or weekly basis to reflect this '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 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. Conservation requirements such as the use of revival boxes and mandatory brailing are monitored and enforced.
- 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 examples of local conservation measures in North and Central Coast chum fisheries. The fisheries descriptions in Section 3 of this report document the details.

6.2 Chum conservation measures

Concerns for the status of North Coast chum salmon have precipitated very clear and significant management actions. By-catch of non-target chum in net fisheries is not permitted. Identified surplus chum stocks are harvested terminally, adjacent to the natal stream using selective fishing practices:

- Geographic separation of harvests of identified surpluses of enhanced chum returns from weaker wild stocks by locating fisheries terminally, adjacent to natal stream to minimize impacts on stocks and species of concern (e.g. Area 6 fishery on returning enhanced Kitimat River chum, as described in Section 3.3.3).
- Time, area and gear restrictions to address potential chum stocks of concern.
- Non-retention of chum in areas where concerns have been identified.
- Pink and chum return migrations to the Skeena system overlap, but the peak of chum migration into the Skeena is later than the timing of directed pink fisheries on the Skeena. Thus, the encounters of chums are thought to be minimized, and non-retention is implemented.
- Mandatory seine brailing and sorting and gillnet short sets and use of revival boxes when specified by Public Notice to minimize impacts on encountered non-target species.

- There have been no targeted fisheries on Skeena chum in Areas 3, 4 and 5 for many years.

For example, the 2007 season unfolded as follows:

- Troll fisheries had a small by-catch of chum in the Alaskan Boundary pink salmon fishery.
- Seine fisheries were mostly non-possession of chum.
- Chum retention was allowed occasionally in Area 3 due to mortality concerns of sorting during times of high chum abundance.
- Gill net fisheries in Area 3 had voluntary release of chum.
- Areas 4 & 5 had mandatory release all year.
- Area 3 had a 0.5 nautical mile ribbon boundary along the shorelines of Pearce and Wales Island to reduce the chum catch.
- In Area 6 the Gil Island area is closed to gillnet fishing to conserve wild chum.

In 2008, chum non-retention was implemented for trollers all season.

An independent science panel recently reviewed the status and management of Skeena salmon (Walters et al. 2008), and concluded that Skeena chum “*appear to be severely depressed and should be protected by avoiding late-season ocean fishery openings and targeted fisheries of any kind.*” DFO is reviewing the recommendations by the science panel.

The management approach for chum fisheries in the Queen Charlotte Islands (Section 3.3.1) ensures that a large proportion of the escapement goal for a stream has been identified in-stream before a terminal harvest off river mouth is scheduled. Chum fisheries are only located terminally, and adjacent to mouth of natal stream to minimize encounters of other chum stocks..

Small scale chum supplementation to North Coast streams identified as having low returns over many cycles have occurred for Kumealon Creek (Area 5, Upper Grenville Channel) by the Oona River community hatchery. Evaluation of results of marked releases by examining returning spawners will commence in 2009. Small scale chum enhancement is planned to commence at the Oldfield hatchery for Silver Creek (Prince Rupert basin) in 2009. Discussions have taken place with Nisga’a and local N/C enhancement staff for future small scale chum enhancement at the Kincolith (Area 3) hatchery.

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

Commercial fishery guidelines attempt to limit impacts on non-target species. Gillnet mesh restrictions, time and area restrictions and seine brailing, sorting and release guidelines attempt to limit impacts on sockeye, coho, chinook and steelhead stocks.

- Fishing closures in areas with persistent conservation concerns (e.g. Areas 9 and 10, as shown in Figure 10 and Figure 11).
- Time and area net restrictions to limit encounters of non-target stocks and species to minimize fishery impacts.
- Gillnet mesh restrictions to limit encounters of non-target species and minimize impacts on species of concern. In addition, there have been short sets (time in water), short nets, mandatory use of revival boxes initiated.
- Non-retention of steelhead stocks.

- Mandatory seine brailing and sorting and gillnet short sets and use of revival boxes when specified by Public Notice to minimize impacts on encountered non-target species.
- Daylight only fisheries to reduce coho encounters and minimize fishery impacts.
- Coho in the North and Central Coast are being managed to an exploitation rate ceiling. Coho are actively managed during all net fisheries, with coho retention initially not allowed in gillnet and seine fisheries. Fishery managers monitor the encounter rates on a weekly basis and will allow retention of coho only if abundances warrant.

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TABLES

Table 1. Population structure of North & Central Coast chum salmon.

Spawning sites are listed if there are 5 or more observations of chum presence since 1990. This includes quantitative estimates and qualitative records of adult presence (i.e. “A/P” and “UNK” indicating that the inspected stream was frequented by chum, but information was not adequate to estimate total escapement). **Bold font** indicates systems with estimated escapements larger than 10,000 more than once since 1990. Underlined italic font with an asterisk* marks systems with active hatchery enhancement. 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. Methods for identifying CUs are documented in Holtby and Ciruna (2007).

Stat Area	Conservation Unit	Management Sub-Area	Spawning Sites
1	North QCI / North QCI – Stanley Creek	Masset Naden	Ain River, Awun River Lignite Creek, Naden River, Stanley Creek
2 East	East QCI	Cumshewa Selwyn Atli Darwin Juan Perez Burnaby Strait Skincuttle & South S/A	Aero Creek, Carmichael Creek, Chadsey Creek, Mathers Creek , <u>Pallant Creek</u> * Big Goose Creek, Dana Creek 1 to 3, <u>Dass Creek</u> *, Lagoon Creek , Little Goose Creek, Pacofi Creek, Sewell Inlet Creek (Head, L/H 1, L/H 2, L/H 3), Sewell Point Creek, Talunkwan Creek, Thurston Harbour Creek, Traynor Creek, Waterfall Crk. Beljay Bay Creeks (2), Moore Creek, Powrivco Creek, Richardson Creek, Sandy Creek, Takelley, Cover Creek Anna Inlet Creek, Crescent Inlet Creek, Echo Harbour Creek, Koston Creek, Lockeport Creek, Salmon River Arrow Creek, Hutton Head creek, Hutton L/H Creek, Kogangas Creek, Marshall Creeks (3), Matheson R/H Creek, Matheson L/H Creek, Sedgwick Creeks (3) Alder Island Creek, Burnaby Narrows 2 R/H Creek, Burnaby Straits Creek, Forgotten Creek, Haida Creek, Island Bay R/H Creeks (2), Island Bay L/H Creeks (4), Marker Creek, Section Cove Cree (3), Skaat Harbour Head Creek, Skaat Skaat Harbour R/H Creek (2), Skaat Harbour L/H Creeks (2) Bag Harbour Creek, Balcom Inlet Creek, Carpenter Bay Creeks (4), Collision Bay Creeks (2), George Bay Creek, Harriet Creek, Heater Creek, Huston Inlet Creeks (3), Ikeda Creek, Jedway Creek, Kendrick Point Creeks (2), Koya Creek, Luxana Creek, Poole Inlet Creeks (4), Scudder Point Creek, Sedmond Creek, Slim Inlet Creek, South Cove Creeks (2), Surprise Creeks (3), Tangle Cove Creek
	Skidegate	Skidegate	Cameron Creek, Charlie Hartie Creek, Crabapple Brook, <u>Deena River</u> *, East Narrows Creek, East Narrows Can Bouy Creek, East Narrows Dolphin Creek, Gore Brook Creek, Haans Creek, Honna River, Indian Cabin Creek, Indian Cabin Creek R/H, Lagins Creek , Lagins Creek R/H, Macmillan Creek, Mud Bay Creek, Outlook Creek, Sachs Creek, Saltspring Creek, Saltspring Bay L/H Creek, Slatechuck Creek , Slatechuck R/H Creek, Sleeping Beauty Creek, South Bay Creek, South Bay Culvert Creek, Tarundl Creek, Two Torrent Creek
2 West	Skidegate	West Skidegate	Browns Cabin Creek , Buck Channel Creek #One To Eight, Canoe Pass Creek, Dawson Harbour Creek, Dawson Inlet Creek, North Arm Creek. – Head, North Arm Creek. – R/H, West Narrows Creek
	West QCI	Athlo-Otard Rennel Sound	Celestial River, Coates Creek, Hobbs Creek, Mace Creek , Mercer Creek, Nesto Inlet Creek – Inner, Port Louis Creek.- Outer, Steel Creek Clapp Basin Creek, Indian Bay Creek, Kano Inlet Creek – Head, Kano Inlet Creek – Outer, Mountain Creek, Rennell Creek, Rockrun Creek, Seal Inlet Creek, Shields Creek, Tartu Inlet Creek – Head, Tartu Inlet Creek – Outer, Yakoun Trail Creek
2 West		Englefied Bay	Boomchain Bay Creek, Bottle Inlet Creek, Douglas Inlet Creek- Head, Douglas Inlet Creek - R/H, Gold Harbour Creek, Inskip Creek, Kaisun Creek, Kootenay Inlet Creek -North., Kootenay Inlet Creek -South., Moresby Lake Creek, Mudge Creeks (3), Peel Inlet Creek – Head, Peel Inlet Creek - L/H#1, Peel Inlet Creek - L/H#2, Security Inlet Creek- L/H , Security Inlet Creek - R/H

Stat Area	Conservation Unit	Management Sub-Area	Spawning Sites
2 West		Tasu	Botany Inlet Creek – Head, Botany Inlet Creek - Outer , Fairfax Inlet Creek, Fairfax Inlet Creek – Outer, Flat Creek, Lomgon Creek, Tasu Creek, Wilson Bay Creek
		South End	Flamingo Inlet Creek, Goski Bay Creek, Louscoone Inlet Creek, Louscoone Inlet Creek-Outer, Staki Creek, Yakulanas Ck
3	Portland Canal - Observatory	Portland Canal	Dogfish Bay Creek, Donahue Creek
		Observatory Inlet	Illiance River, Kitsault River, Kshwan River , Perry Bay Creek, Stagoo Creek , Wilauks Creek
	Lower Nass	Nass River	Chambers Creek, Kincolith River, Nass Mainstem
	Portland Inlet	Portland Inlet	Khutzymateen River , Kwinamass River, Larch Creek, Lizard Creek, Mouse Creek, Tsamspanaknok Bay Creek
		Work Channel	Ensheshese River, Lachmach River, Toon River
	Skeena Estuary	Coastal	Brundige Creek, Sandy Bay Creek, Stumaun Creek
4	Lower Skeena	Coastal	Eestall River , Khyex River
		Lower Skeena	Andesite Creek, Dog-Tag Creek, Erlandsen Creek, Gitnadoix River, Kasiks River, Middle Creek
	Middle Skeena	Kispiox	Date Creek, Kispiox River, Nangeese River
		Middle Skeena	Kitwanga River, Kleanza Creek
5	Hecate Lowlands	Lower Principe	Curtis Inlet Creek, Kooryet Creek
		Petrel Channel / Ala Pass	Hevenor Inlet Creek, Markle Inlet Creek, Newcombe Harbour Creek, Shaw Creek, Wilson Creek
		Upper Grenville Channel	False Stewart Creek, <u>Kumealon Creek*</u> , Kxngeal Creek, Northness Creek, Pa-aat River
		Lower Grenville Channel	Belowe Creek, Lagoon Creek, Stewart Creek, Three Mile Creek, Tsimtack Lake System,
		Ogden Channel/ Kitkatla Inlet	Alpha Creek, Billy Creek, Captain Cove Creek
6	Hecate Lowlands	Laredo Channel/ Campania Sound	Barnard Creek, Blackrock Creek, Crane Bay Creek, East Arm Creek, Fury Creek, Gil Creek, Limestone Creek, Mcmicking Creek, Turn Creek, Turtle Creek, West Arm Creek, Whalen Lake Creek
		Laredo Sound	Arnoup Creek, Blee Creek, Bloomfield Creek, Dally Creek, Fifer Cove Creek, Kwakwa Creek, Nias Creek, Osment Creek, Packe Creek, Powles Creek, Price Creek, Pyne Creek, Quigley Creek, Ronald Creek, Trahey Creek, Tyler Creek
		Aristazabal Island	Borrowman Creek, Clifford Creek, Duffey Creek, Eagle Creek, Flux Creek, Kdelmashan Creek, Linnea Creek, Noble Creek, Stannard Creek
6	Hecate Lowlands/ Douglas–Gardner	Fraser-Graham Reach	Aaltanash River, Canoona Creek, Dome Creek, Green River, Khutze River, Klekane Creek, McKay Creek, Marmot Cove Creek, Marshall Creek, Meyers Pass Creek, Scow Bay Creek, Soda Creek, Taylor Creek
		Gardner Channel	Brim River, Crab River, Hotspring Creek, Kemano River , Kiltuish River. Kitlope River, Kowesas River, Paril River, Tsaytis River, Wahoo River
		Kitimat Arm	Bish Creek, Dala River, Eagle Bay Creek, Kildala River, <u>Kitimat River*</u> (Includes Kitimat mainstem, side channels and all its main and minor tributaries), Wathl Creek
		Douglas, Ursula, and Devastation Channels	Angler Cover Creek, Big Tillhorn River, Evelyn Creek, Fishtrap Bay Creek, Foch Creek , Gilttoyees Creek, Goat River, Gribbell Island Creek, Hartley Bay Creek, Hawksbury Island Creek, Heysham Creek, Hugh Creek, Kiskosh Creek, Kitkiata Creek, Little Tillhorn River, Missed Creek, Pike Creek, Quaal River , Riordan Creek, Verney Passage Creek. Weewanie Creek

Stat Area	Conservation Unit	Management Sub-Area	Spawning Sites
7	Hecate Lowlands	Mathieson Channel	Bulley Bay Creek, Canyon Creek, Hird Point Creek, James Bay Creek, Nameless Creeks, Robinson Creeks, Salmon Bay Creek, Tom Bay Creek, Windfall Creek
	Hecate Lowlands and Mussel–Kynoch	Finlayson-Mussel Channel	Bolin Bay Creek, Bottleneck Creek, Carter River, Duthie Creek, Geish Creek, Gorilla Creek, <i>Kitasu Creek</i> *, Korich Creek, Lagoon Creek, Mary Cove Creek, Mussel River , Poison Cove Creek, Watson Bay Creek, Windy Bay Creek
	Mussel– Kynoch	Kynoch	Big Creek, Desbrisay Creek, Kainet Creek , Lard Creek
	Spiller- Fitz Hugh - Burke	Gunboat/Seaforth/Return	Bullock Channel Creek, Deer Pass Creek, Deer Pass Lagoon, Goat Bushu Creek, Kakushdish Creek, Kunsoot River, Kwakusdis River , Sally Creek, Scribner Creek, Walker Lake Creek, Yaaklele Lagoon
		Spiller	Cheenis Creek, Neekas Creek , Pine River, Spiller Lagoon Creek, Tankeeah River
Roscoe Inlet		Clatse Creek, Lee Creek, Quartcha Creek. Rainbow Creek, Roscoe Creek	
	Southern Group / Hunter Island	Cooper Inlet Creeks , <i>McLaughlin Bay Creek</i> *, Ship Point Creek	
8	Spiller- Fitz Hugh - Burke	Burke Channel	Kwatna River , Nootum River, Quatlena River
		Dean Channel	Cascade River , Elcho Creek , Eucott Bay Creek, Frenchman Creek, Green River, Jenny Bay Creeks, Martin River (Fall run)
		Fisher – Fitz Hugh	De Cosmos Lagoon Creek, Evans Inlet Creeks, Four Lakes Creek, Hook Nose Creek, Kiltik Cove Creek, Koeve River, Namu River, Sagar Creek
	Bella Coola River / Dean River / Bella Coola River Late	Upper Dean Channel	Dean River, Deep Bay Creek, Kimsquit Bay, Kimsquit River , Skowquiltz River
		North Bentinck	<i>Bella Coola River</i> *, Bella Coola Fall Chum, Necleetsconnay River, Nieumiamus Creek, Nooseseck River
		South Bentinck	Asseek River, Taleomey River
9	Smith Inlet / Rivers Inlet / Wannock	N/A	Allard Creek, Amback Creek, Ashlulm Creek, Beaver Creek, Chuckwalla River, Clyak, Young & Neil Creeks, Dallery Creek, Draney Creek , Genesee Creek, Johnston Creek, Kilbella River , Lockhart-Gordon Creek , MacNair Creek, Milton River, Neechanz River, Nicknaquet River, Wannock River & Flats , Washwash Creek
10	Smith Inlet	N/A	Nekite River , Nekite Spawning Channel , Takush River, Walkum Creek

Table 2. Escapement summary for North & Central Coast chum salmon

Data were extracted in March 2008 from the escapement database maintained by DFO - North Coast (DFO 2008a). 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 in this table are adjusted to reconstruct run size and calculate harvest rates. Gazey and English (1999) and English et al. (2006) describe the methods in more detail.

Total	Year	Total	1	2E	2W	3	4	5	6	7	8	9	10
	1960	806,016	15,125	184,118	148,230	32,550	1,131	12,050	172,775	117,975	93,187	16,375	12,500
	1961	651,177	26,025	188,325	8,050	100,250	38,462	21,400	74,575	78,250	92,965	17,125	5,750
	1962	1,276,598	14,575	295,625	97,850	43,800	8,298	27,675	333,150	235,825	150,725	25,075	44,000
	1963	982,433	10,700	286,533	3,700	66,775	4,850	20,725	124,450	167,725	236,650	44,575	15,750
	1964	1,479,855	95,025	428,380	54,625	85,050	6,800	17,850	282,750	218,675	209,225	66,075	15,400
	1965	707,258	161,600	231,300	35,475	30,225	9,103	17,800	119,650	85,980	13,600	925	1,600
	1966	1,759,637	93,950	376,350	214,875	35,350	19,445	16,775	372,225	448,917	135,325	42,500	3,925
	1967	1,035,590	31,575	274,550	6,000	39,900	13,775	13,000	342,850	193,290	90,500	14,925	15,225
	1968	1,660,172	37,500	316,700	148,770	58,125	10,700	10,450	407,452	333,275	284,250	41,875	11,075
	1969	688,382	45,000	196,900	6,000	28,050	10,634	3,375	78,063	222,785	84,600	10,325	2,650
	1970	1,421,640	24,800	198,975	324,625	35,400	10,890	12,250	105,650	372,550	275,400	38,600	22,500
	1971	775,237	44,500	222,350	UNK	28,825	5,232	25,625	90,300	238,675	82,875	11,855	25,000
	1972	1,540,756	8,600	185,780	380,800	81,125	36,920	17,725	271,600	266,000	221,375	27,581	43,250
	1973	1,443,426	50,000	225,350	UNK	66,025	25,476	18,975	278,750	405,150	277,775	24,425	71,500
	1974	1,231,017	41,800	146,440	148,975	121,570	14,102	34,025	258,640	228,090	146,800	62,075	28,500
	1975	469,853	53,050	72,562	327	30,550	10,375	10,075	79,296	105,940	83,575	16,603	7,500
	1976	644,557	53,500	143,420	49,371	64,650	11,071	19,625	67,340	95,735	125,000	6,345	8,500
	1977	739,182	60,300	161,075	75	57,775	10,927	32,170	85,810	155,810	122,950	9,790	42,500
	1978	1,126,270	56,200	213,519	159,413	75,970	8,153	13,775	185,255	267,750	49,135	61,100	36,000
	1979	527,797	32,450	43,523	601	42,313	5,705	13,950	87,805	169,665	99,485	18,550	13,750
	1980	825,992	14,768	165,416	172,078	54,794	25,007	9,350	82,862	97,567	123,475	23,675	57,000
	1981	642,048	26,100	164,924	434	16,508	9,385	3,120	93,410	142,927	107,090	12,650	65,500
	1982	1,066,157	70,800	202,343	113,317	29,476	4,626	7,370	135,783	200,882	129,380	102,180	70,000
	1983	635,751	35,225	156,082	516	45,115	1,667	4,596	44,080	114,449	155,045	34,976	44,000
	1984	939,024	52,775	277,596	67,469	67,425	29,764	6,830	119,254	144,762	132,260	26,689	14,200
	1985	1,124,217	63,800	302,505	921	48,971	12,198	11,765	239,201	169,338	220,865	28,653	26,000
	1986	1,647,449	82,500	279,928	264,502	34,900	12,780	16,450	264,685	150,662	266,222	201,220	73,600
	1987	907,755	51,100	315,766	42	31,387	7,652	10,175	114,671	113,369	138,170	87,923	37,500
	1988	1,590,389	29,950	259,102	168,203	47,050	108,921	12,750	460,518	216,935	201,537	44,423	41,000
	1989	960,538	18,975	296,627	77	33,770	20,331	4,750	272,988	159,868	121,789	10,363	21,000

Table 2 continued...

Total	Year	Total	1	2E	2W	3	4	5	6	7	8	9	10
	1990	1,234,425	4,700	303,826	192,840	30,980	6,343	3,607	196,086	151,348	285,515	14,830	44,350
	1991	636,805	1,000	204,360	435	23,835	4,680	4,113	105,896	170,197	84,607	7,182	30,500
	1992	625,800	6,300	138,668	100,766	15,684	11,290	731	152,379	57,335	112,447	16,450	13,750
	1993	714,967	50,060	170,494	221	79,951	10,052	1,795	119,877	120,769	133,188	9,960	18,600
	1994	991,794	32,150	176,768	100,159	33,199	7,967	870	249,671	112,748	244,997	15,465	17,800
	1995	1,083,079	19,855	160,529	93	40,451	7,928	3,880	351,653	214,065	204,550	39,345	40,730
	1996	1,044,246	6,725	208,076	156,180	22,990	8,404	3,200	149,017	230,765	219,339	16,400	23,150
	1997	866,178	31,050	145,305	40	20,302	22,250	2,260	235,056	199,955	196,375	8,985	4,600
	1998	2,203,305	32,100	216,348	216,127	138,490	14,664	9,250	864,896	322,330	331,335	47,450	10,315
	1999	835,924	33,000	189,206	395	33,467	2,650	900	161,336	198,290	188,800	18,780	9,100
	2000	943,952	13,520	137,613	311,062	20,718	4,650	1,070	61,289	169,820	181,875	42,135	200
	2001	740,673	3,804	140,983	59	30,472	8,620	3,080	103,785	233,902	175,200	35,730	5,038
	2002	1,322,043	7,000	90,433	269,440	17,813	3,060	4,965	331,132	218,680	232,220	98,300	49,000
	2003	1,448,360	34,081	110,961	18	40,002	1,782	4,110	413,706	292,100	380,100	118,500	53,000
	2004	1,039,092	4,000	117,200	22,780	54,033	2,020	2,670	91,973	299,366	312,850	77,400	54,800
	2005	603,068	1,650	103,389	30	30,855	2,335	2,600	42,037	199,322	142,300	61,850	16,700
	2006	663,581	18,300	101,579	15,610	43,975	685	2,575	89,609	156,208	176,610	33,100	25,330
	2007												

Summary (Rounded)**All Years**

Min	470,000	1,000	44,000	20	16,000	690	730	42,000	57,000	14,000	930	200
Avg	1,028,000	36,000	203,000	88,000	47,000	13,000	11,000	199,000	197,000	172,000	38,000	28,000
Max	2,203,000	162,000	428,000	381,000	138,000	109,000	34,000	865,000	449,000	380,000	201,000	74,000

Before 1990

Min	470,000	9,000	44,000	40	17,000	1,000	3,000	44,000	78,000	14,000	930	2,000
Avg	1,044,000	47,000	227,000	92,000	51,000	16,000	15,000	188,000	197,000	149,000	38,000	29,000
Max	1,760,000	162,000	428,000	381,000	122,000	109,000	34,000	461,000	449,000	284,000	201,000	74,000

Since 1990

Min	603,000	1,000	90,000	20	16,000	690	730	42,000	57,000	85,000	7,000	200
Avg	1,000,000	18,000	160,000	82,000	40,000	7,000	3,000	219,000	197,000	212,000	39,000	25,000
Max	2,203,000	50,000	304,000	311,000	138,000	22,000	9,000	865,000	322,000	380,000	119,000	55,000

Change (Before/After 1990)	-4.2%	-61.7%	-29.5%	-10.9%	-21.6%	-56.3%	-80.0%	16.5%	0.0%	42.3%	2.6%	-13.8%
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Table 3. Size summary for North & Central Coast chum salmon

Size data was extracted on July 31, 2008, from the biological traits database maintained by DFO - North Coast (DFO 2008c). This summary table reflects electronic records entered to date, but additional information is available in archived documents such as field sampling sheets and technical reports.

Area	Fork Length (cm)								Avg. Change	Source
	1974 to 1989				1990 to 2007					
	Min	Avg	Max	Obs	Min	Avg	Max	Obs		
1										
2	53	68	85	963						QCI escapement survey (1989, 1990)
3	50	76	98	510	44	76	103	1,221	0.0%	Nass test fishery / Area 3 escapement survey (1983,1988-90, 1998-2007)
4	55	79	99	950	55	79	100	823	0.0%	Skeena test fishery / Area 4 escapement surveys (1974-83, 1987-97,2005, 2007)
5					53	76	90	107		Area 5 escapement surveys (2007)
6	62	75	88	192	58	71	87	99	-5.3%	Area 6 escapement surveys (1988-89, 2007)
7										
8	48	76	94	101						Area 8 escapement surveys (1989)
9										
10										
	Total obs. 2,716				Total obs. 2,250					

Area	Weight (kg)								Change
	1974 to 1989				1990 to 2007				
	Min	Avg	Max	Obs	Min	Avg	Max	Obs	
1									
2	2.6	4.1	6.2	34					1982 Pallant Creek
3									
4	2.6	5.5	10	119					Skeena test fishery (1975-76, 1983, 1988)
5									
6									
7									
8									
9									
10									
	Total obs.			153	Total obs.			0	

Table 4. Commercial catch summary for North & Central Coast chum salmon

Catch information is based on fish slips, which are mandatory receipts for all commercially sold salmon. Note that catch reported for a statistical area may contain salmon originating from a different statistical area, and that fisheries have shifted towards more terminal, locally selective fishing locations in recent years. Section 4.3 briefly describes run reconstruction techniques used to estimate chum harvest rates for each area. Catch data up to 2002 are taken from run reconstructions for North and Central Coast chum presented in English et al. (2006). Catch data for 2003 to 2006 were retrieved from http://www-sci.pac.dfo-mpo.gc.ca/sa/Commercial/AnnSumm_e.htm. * Catch for Areas 1 and 2W includes only harvests on or after August 15th in the run reconstruction data, because the majority of earlier fish are assumed to be passing stocks.

		Catch by Statistical Area											
Total Catch	Year	Total Catch	1*	2E	2W*	3	4	5	6	7	8	9	10
	1980	1,584,978	1,127	123,217	42,656	314,622	74,103	40,626	201,486	412,701	343,122	11,001	20,317
	1981	763,084	3,541	37,499	1,346	44,513	43,232	9,056	96,521	205,052	303,752	7,371	11,201
	1982	845,820	0	29,427	46,952	71,936	63,162	20,562	142,743	256,303	182,418	11,683	20,634
	1983	680,660	531	885	247	186,021	25,149	20,228	82,877	22,855	331,478	4,965	5,424
	1984	1,192,092	1,409	281,750	88,771	322,300	130,109	28,227	31,757	220,964	70,876	11,753	4,176
	1985	2,040,451	45,656	651,722	77,423	134,723	115,200	18,947	167,622	249,574	536,992	19,917	22,675
	1986	2,911,398	88,822	223,856	18,822	191,874	61,004	40,322	231,752	337,312	1,516,253	165,420	35,961
	1987	1,291,084	3,098	194,030	13,324	127,176	30,830	19,096	116,628	212,986	521,523	36,818	15,575
	1988	2,781,519	3,741	394,844	4,146	178,319	230,839	40,876	717,856	313,883	846,088	41,457	9,470
	1989	781,426	641	136,601	6,656	180,910	64,995	21,231	15,147	99,193	237,269	9,981	8,802
	1990	1,535,350	2,933	298,484	46,120	50,669	36,210	19,868	154,219	214,373	688,027	18,886	5,561
	1991	1,013,941	367	270,841	45,711	165,372	54,018	26,346	51,541	140,014	235,164	5,961	18,606
	1992	685,828	1,439	136,573	4,942	146,762	93,101	12,947	43,458	50,102	155,939	22,058	18,507
	1993	1,166,766	10,734	117,307	35,768	474,548	197,614	16,871	11,738	99,298	186,621	3,500	12,767
	1994	1,431,970	2,817	135,172	12,847	295,596	164,109	28,026	75,494	191,751	494,459	11,014	20,685
	1995	1,659,516	2,507	28,700	13,161	419,796	192,250	32,495	29,889	202,384	711,193	18,818	8,323
	1996	908,392	955	122,887	1,063	245,705	144,023	21,145	30,294	65,130	275,858	0	1,332
	1997	544,653	86	50,389	1,498	119,633	62,199	6,784	12,015	56,130	234,808	5	1,106
	1998	1,557,528	1,413	90,922	16,483	248,772	19,071	1,630	437,529	99,985	641,723	0	0
	1999	601,602	1,149	133,111	35,841	140,326	418	0	28,988	83,511	178,258	0	0
	2000	315,541	0	78,905	32,402	72,217	29,363	5,863	15,560	33,935	47,296	0	0
	2001	611,740	0	37,998	53	35,576	22,369	5,472	56,430	149,453	304,388	0	0
	2002	886,546	16	35,495	1,523	54,915	15,617	1,532	202,779	189,180	385,489	0	0
	2003	1,425,842		5,945		64,259	10,519	1,286	388,427	265,771	689,635	0	0
	2004	1,571,932		62,585		94,574	11,411	3,587	165,515	346,209	888,051	0	0
	2005	658,969		11,940		82,033	1	0	234,033	67,506	263,456	0	0
	2006	555,887		16,656		101,171	7,842	1,448	46,960	22,612	359,198	0	0
	2007												

Table 5. Operational Management Escapement Goals (MEG) for North & Central Coast chum salmon – Statistical Areas.

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). Fisheries are adjusted in areas where escapement consistently falls short of the operational goals, as illustrated by the harvest rate trends in Figure 1 to Figure 10. MEG for Areas 1 to 6 are calculated as the average annual sum of stream-specific targets (Spilsted 2004). Index streams are those with escapement estimates for about 3 out every 4 years from 1980 to 2002. Expansion factors below cover the range of adjustments applied in the run reconstruction analyses by English et al. (2006), as outlined in Section 4.3. 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).

Operational Management Escapement Goals (MEG) by Statistical Area												
		1	2E	2W	3	4	5	6	7	8	9	10
MEG for index streams		61,000	223,000	137,000	72,000	37,000	22,000	134,000				
MEG for all streams		61,000	384,000	138,000	89,000	38,000	23,000	197,000				
Observed escapement (1990-2006 Avg)		18,000	160,000	82,000	40,000	7,000	3,000	219,000	197,000	208,000	39,000	24,000
Adj. escapement estimate	High	31,000	247,000	135,000	72,000	20,000	8,000	369,000	305,000	339,000	60,000	43,000
	Low	28,000	245,000	131,000	61,000	11,000	6,000	332,000	298,000	322,000	59,000	39,000
Expansion Factors	High	1.72	1.55	1.65	1.81	2.83	2.83	1.69	1.55	1.63	1.53	1.79
	Low	1.53	1.53	1.60	1.52	1.52	1.90	1.52	1.52	1.55	1.52	1.63

Table 6. Operational Management Escapement Goals (MEG) for North & Central Coast chum salmon – Major Systems.

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, as illustrated by the harvest rate trends in Figure 1 to Figure 11. MEGs are available for all of the streams listed in Table 1, but only major systems are included below. Note that aggregate MEGs for each statistical area in Table 5 are not simply the sum of stream-specific MEGs because annual chum returns are variable across systems within a statistical 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).

Stat			Stat			Stat			
Area	System	MEG	Area	System	MEG	Area	System	MEG	
1	Ain River	25,000	4	Ecstall River	20,000	9	Wannock River & Flats	40,000	
	Awun River	15,000			Draney Creek		10,000		
2E	Deena River	30,000	6	Kitimat River	137,500		Lockhart-Gordon Creek	10,000	
	Pallant Creek	30,000			Kemano River	75,000		Kilbella River	5,000
	Lagins Creek	25,000			Quaal River	25,000	10	Nekite River	60,000
	Lagoon Creek	25,000			Foch Creek	10,000			Nekite Spawning Channel
	Salmon River	25,000	7	Kainet Creek	50,000				
	Mathers Creek	20,000			Roscoe Creek	50,000			
	Slatechuck Creek	18,000			Mussel River	40,000			
2W				Neekas Creek	30,000				
	Browns Cabin Creek	7,500		Kwakusdis River	20,000				
	Mace Creek	5,000		Cooper Inlet Creeks	15,000				
	Botany In. Cr. - Head	5,000	8	Bella Coola River	60,000				
	Botany In. Cr.- Outer	3,000			Kimsquit River	60,000			
3	Khutzymateen River	20,000			Kwatna River	25,000			
	Kshwan River	15,000			Elcho Creek	20,000			
	Stagoo Creek	15,000		Cascade River	12,000				
	Toon River	7,000							

Table 7. Communal licence harvest targets for North & Central Coast chum salmon.

Targets taken from Section 5.3 of the 2008 *Integrated Fisheries Management Plan for Salmon – North Coast*. Note that actual numbers of fish on some communal licences are still in negotiation, and therefore the numbers listed below are subject to change. Also note that these are long-term targets, and actual catches in any given year will depend on, among other factors, in-season assessments of actual stock strength, management measures taken to ensure conservation of individual stocks, abundance of other species, and targeted fishing effort.

Region	Area	First Nation	Fishing Location	Chum Salmon Harvest Target
Queen Charlotte Islands	1 & 2	Haida		2,500
			<i>Total</i>	<u>2,500</u>
North Coast	3	Gitanyow	Nass River	25
	4	Yekooche	Babine Area	
	4	Lake Babine	Babine Lake and Area	
		Gitksan &	Skeena River & Bulkley	500
	4	Wet'suwet'en	River	
	4	Kitselas	Skeena River	200
	4	Kitsumkalum	Skeena River	500
	3 & 4	Lax Kw'alaams		700
	4	Metlakatla		100
	5	Kitkatla		750
	6	Gitga'at		200
	6	Haisla		2,000
	6 & 7	Kitasoo		3,000
			<i>Total</i>	<u>7,975</u>
Central Coast	7 & 8	Heiltsuk		6,000
	8	Ulkatcho	Bella Coola & Atnarko	50
	8	Nuxalk	Bella Coola & Atnarko	3,000
	9	Wui'kinuxv		400
	10	Gwa'sala- 'Nakwaxda'xw		70
			<i>Total</i>	<u>9,520</u>

Nisga'a treaty fisheries are planned and implemented in addition to these communal FSC fisheries, as described in Section 2.3.2.

Table 8. Survey coverage for chum salmon escapement.

	Stat Area	Streams*	Number of stream inspections**				Avg Inspections/ Stream
			2004	2005	2006	2007	
Queen Charl. Isl.	1	6	4	4	8	3	1.0
	2	126	136	172	154	190	1.2
North Coast	3	40	73	70	81	49	1.7
	4	25	58	14	29	23	1.2
	5	16	28	36	41	28	2.1
	6	82	179	197	203	187	2.3
Central Coast	7	65	200	190	231	194	3.1
	8	50	160	137	173	152	3.1
	9	17	15	13	27	16	1.0
	10	5	8	9	12	6	1.8
Total		432	861	842	959	848	2.0

* Streams that have been surveyed at least once over the period 2004 to 2007.

** Key streams are inspected multiple times for more accurate estimates, and not all streams are surveyed each year (see Section 4.2.1).

FIGURES

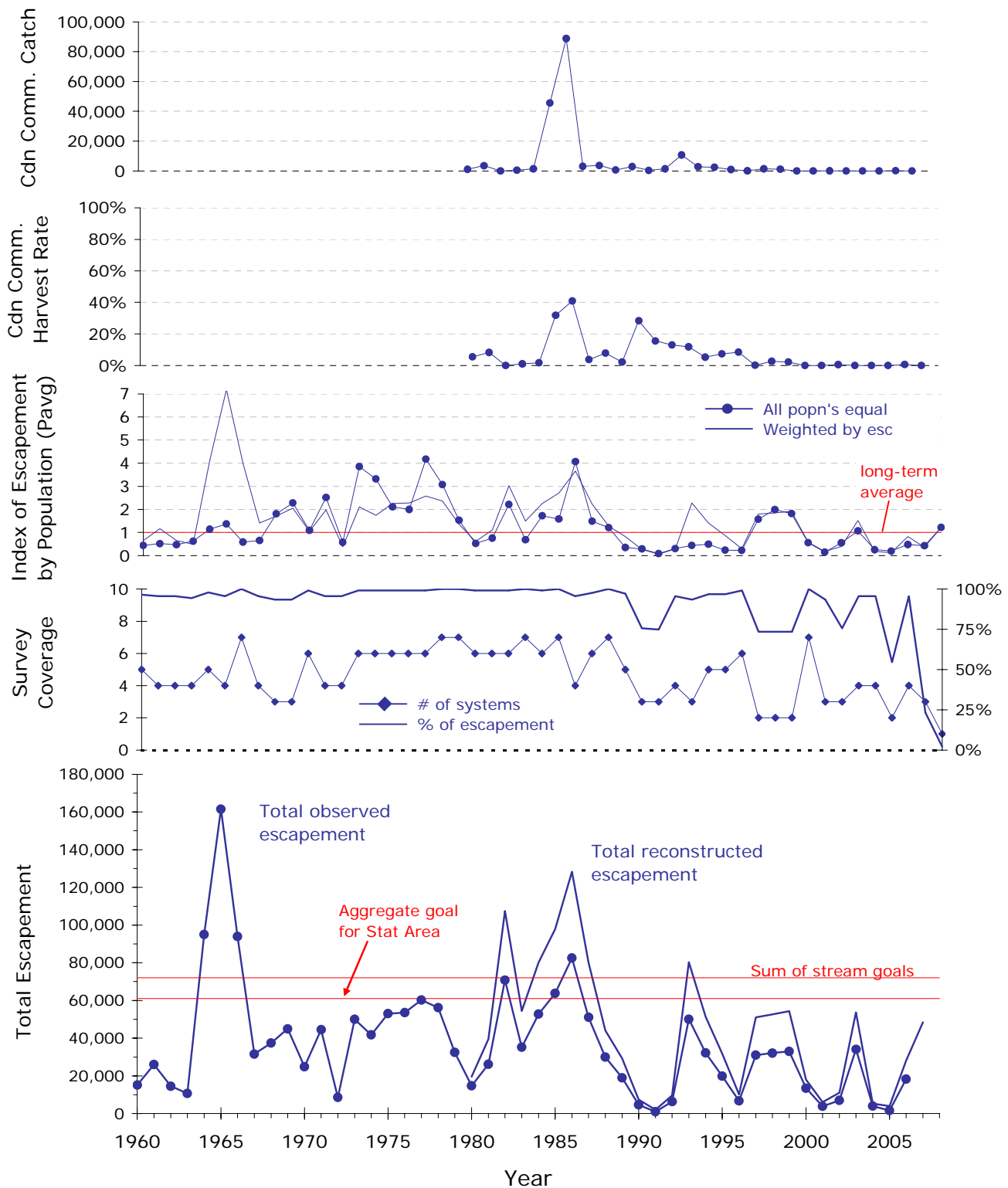


Figure 1. Trend summary for North & Central Coast chum salmon - Area 1

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

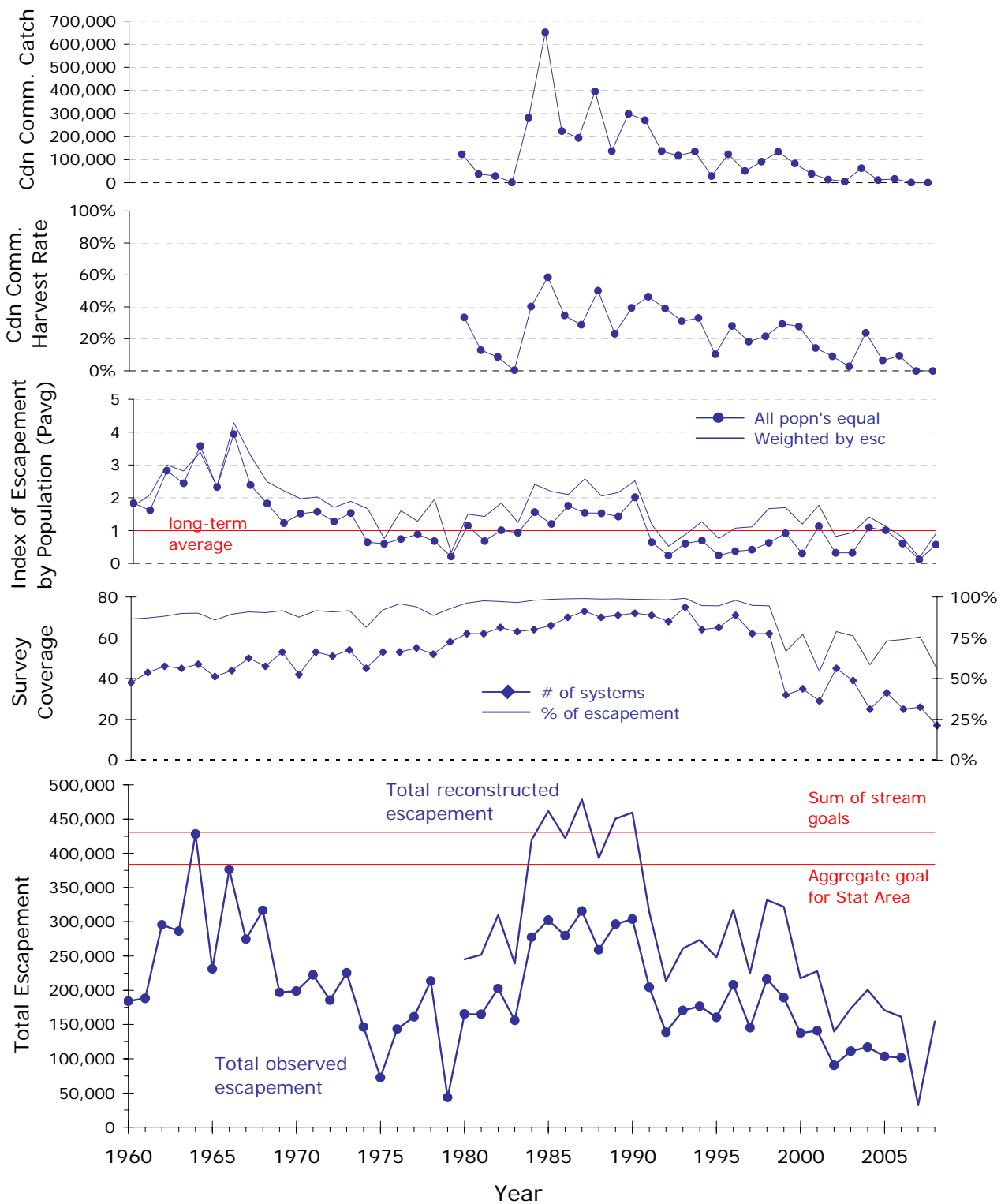


Figure 2. Trend summary for North & Central Coast chum salmon - Area 2E

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

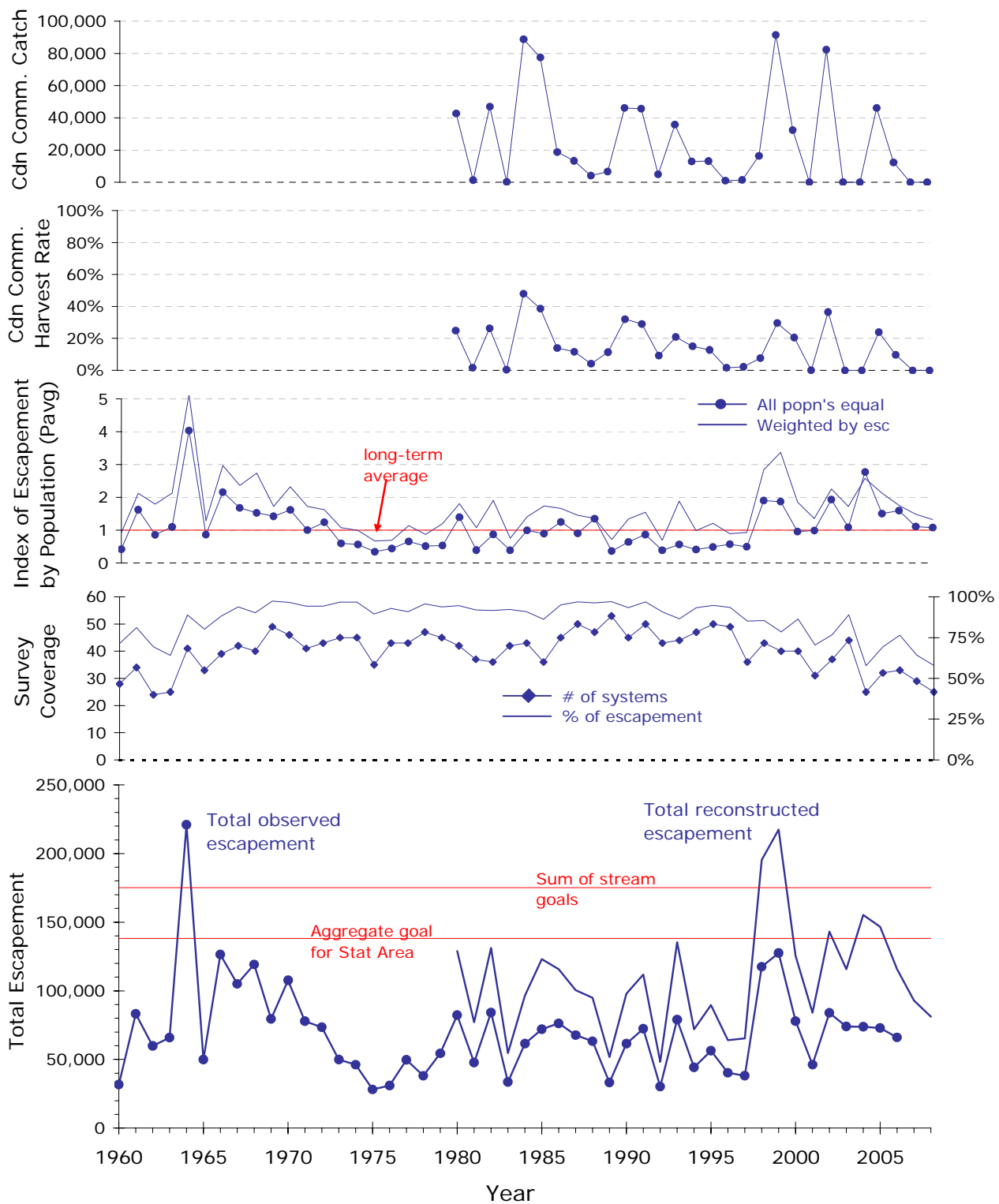


Figure 3. Trend summary for North & Central Coast chum salmon - Area 2W
 Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

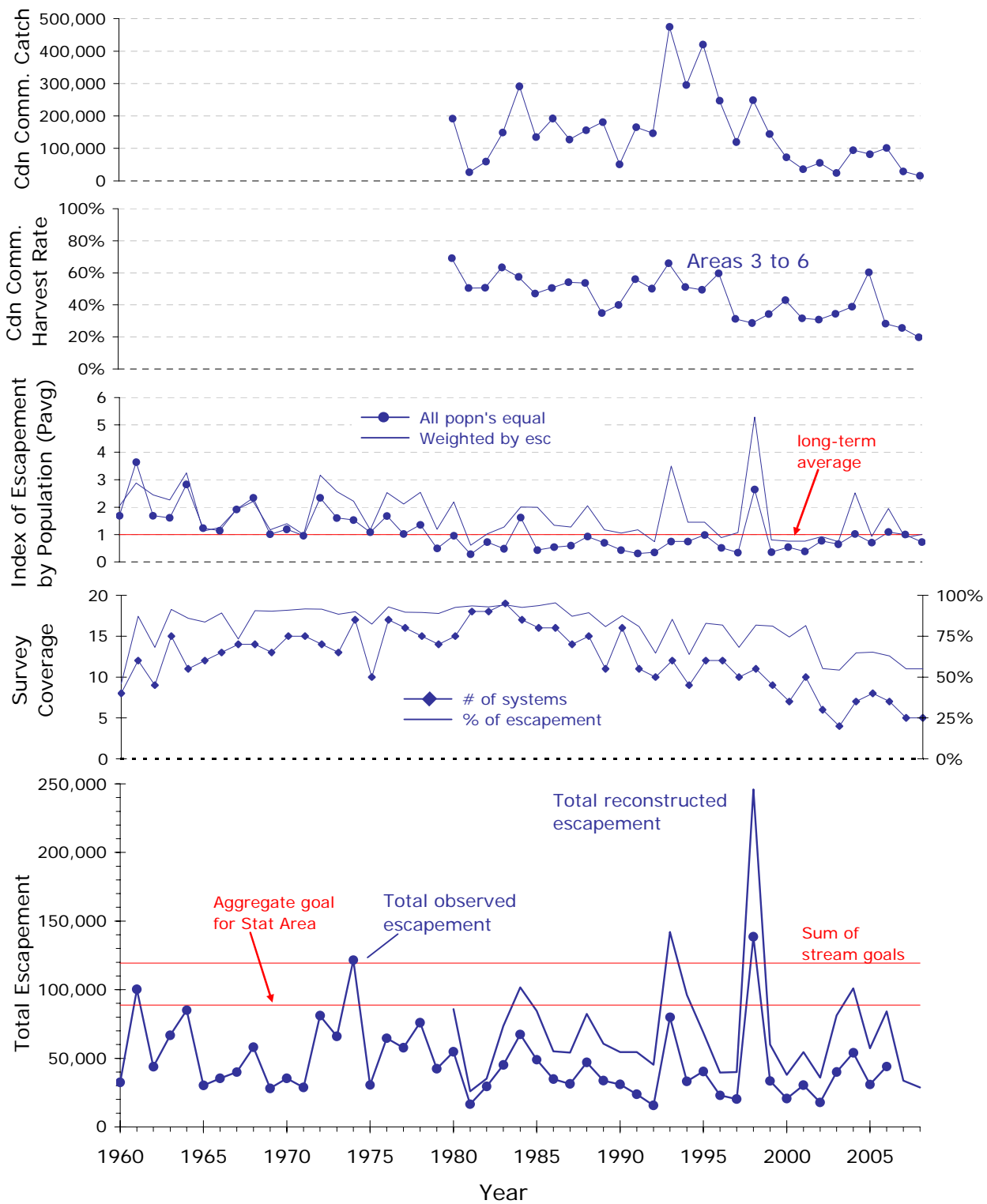


Figure 4. Trend summary for North & Central Coast chum salmon - Area 3

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

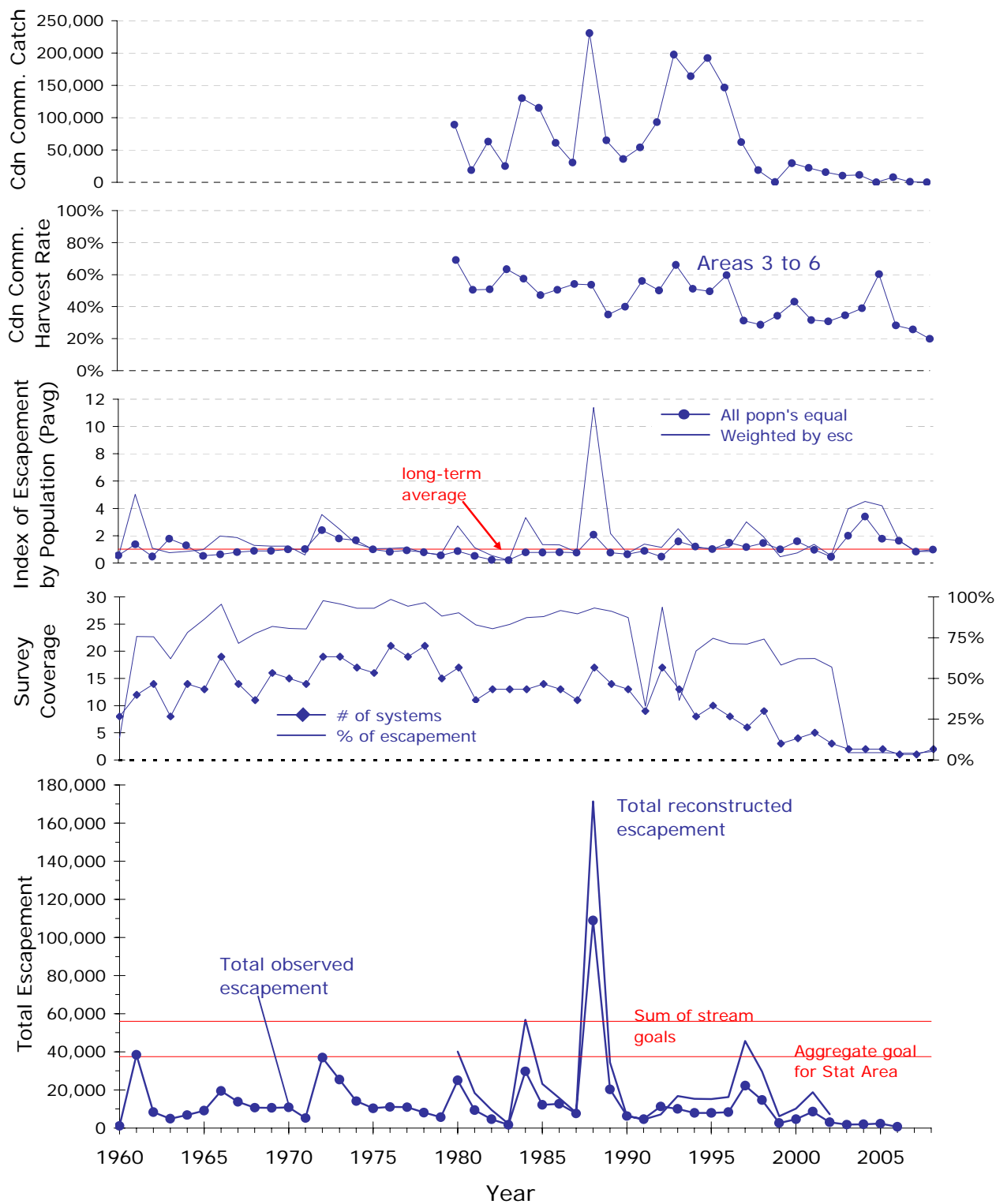


Figure 5. Trend summary for North & Central Coast chum salmon - Area 4

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

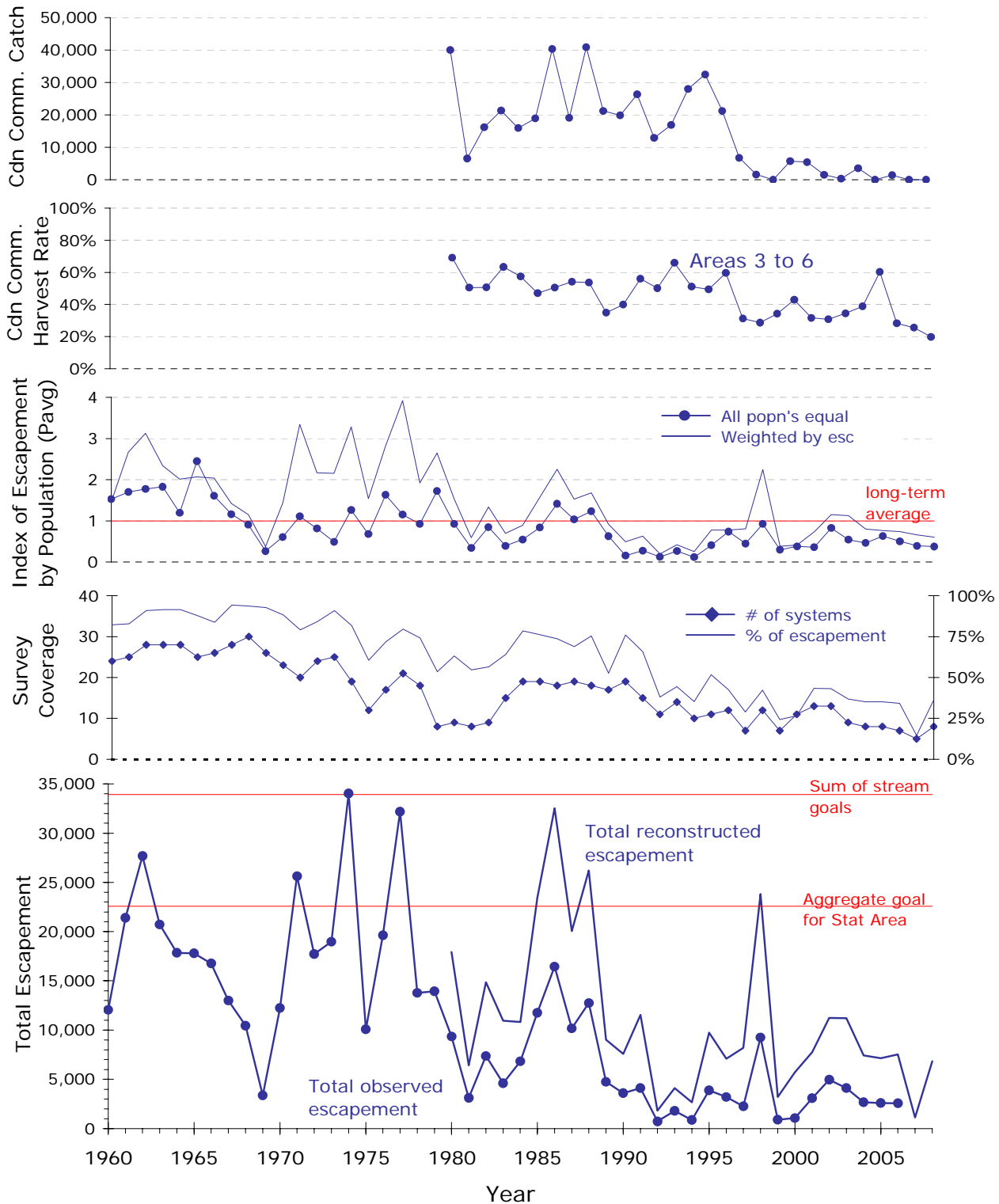


Figure 6. Trend summary for North & Central Coast chum salmon - Area 5

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

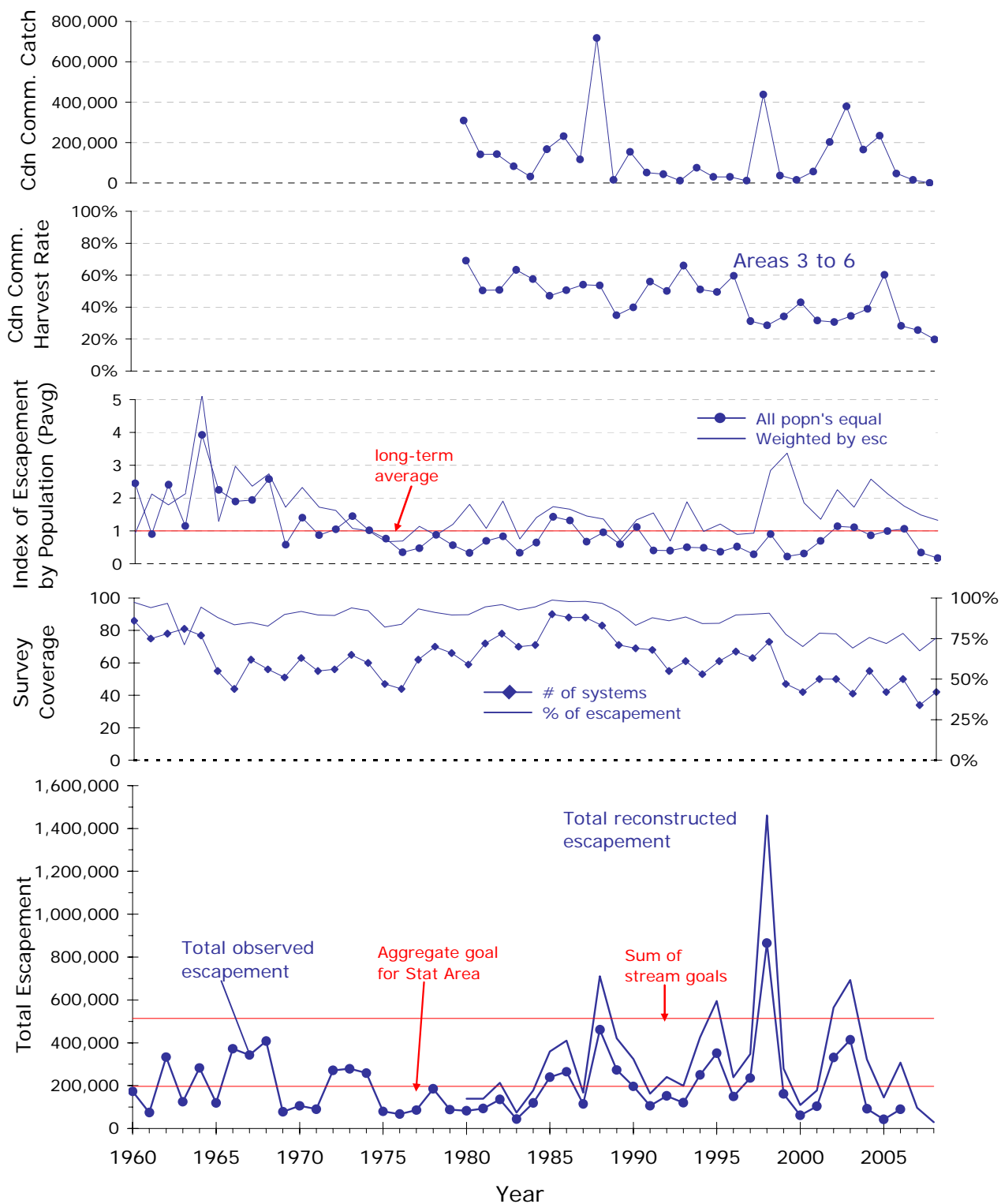


Figure 7. Trend summary for North & Central Coast chum salmon - Area 6

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

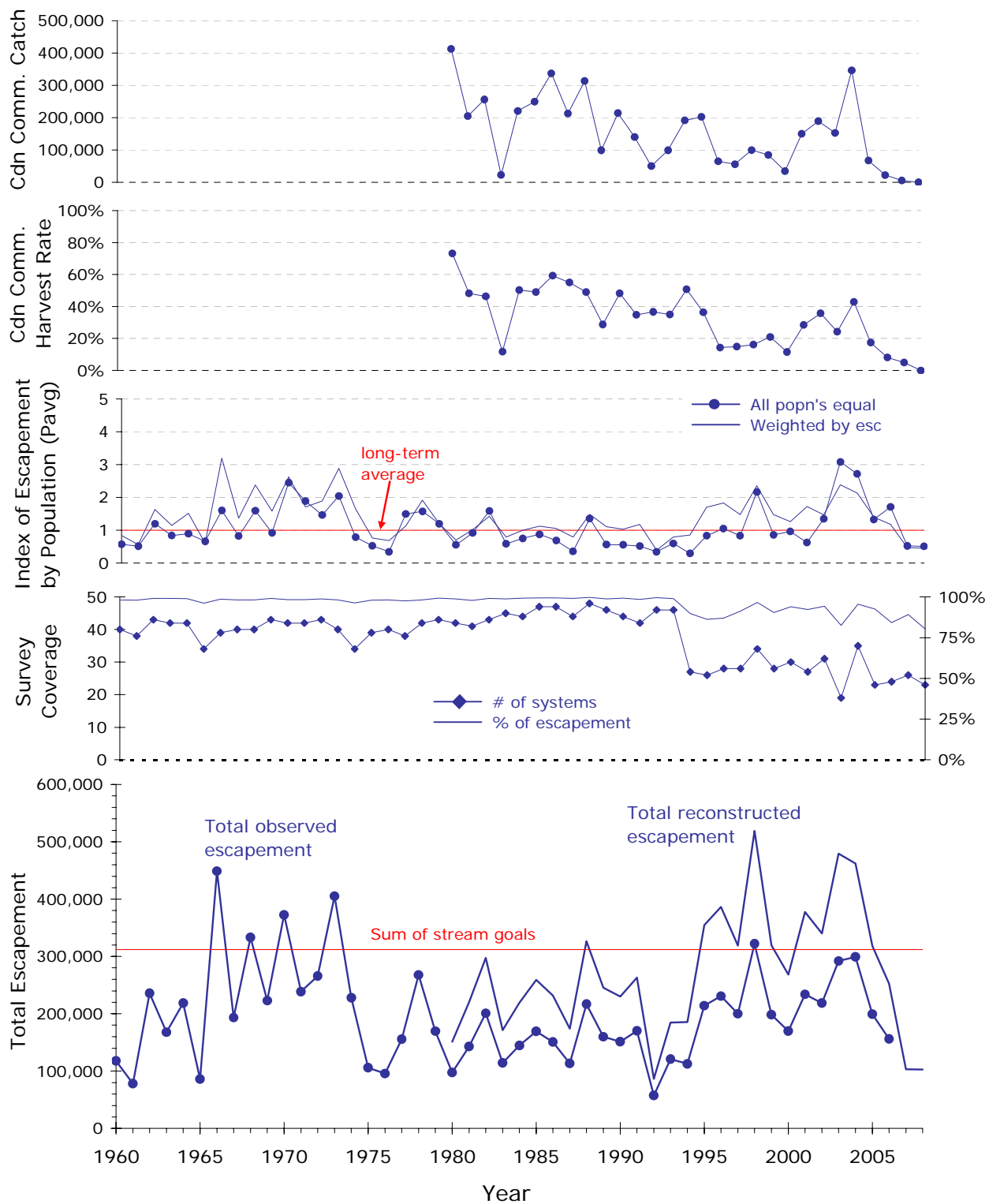


Figure 8. Trend summary for North & Central Coast chum salmon - Area 7

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

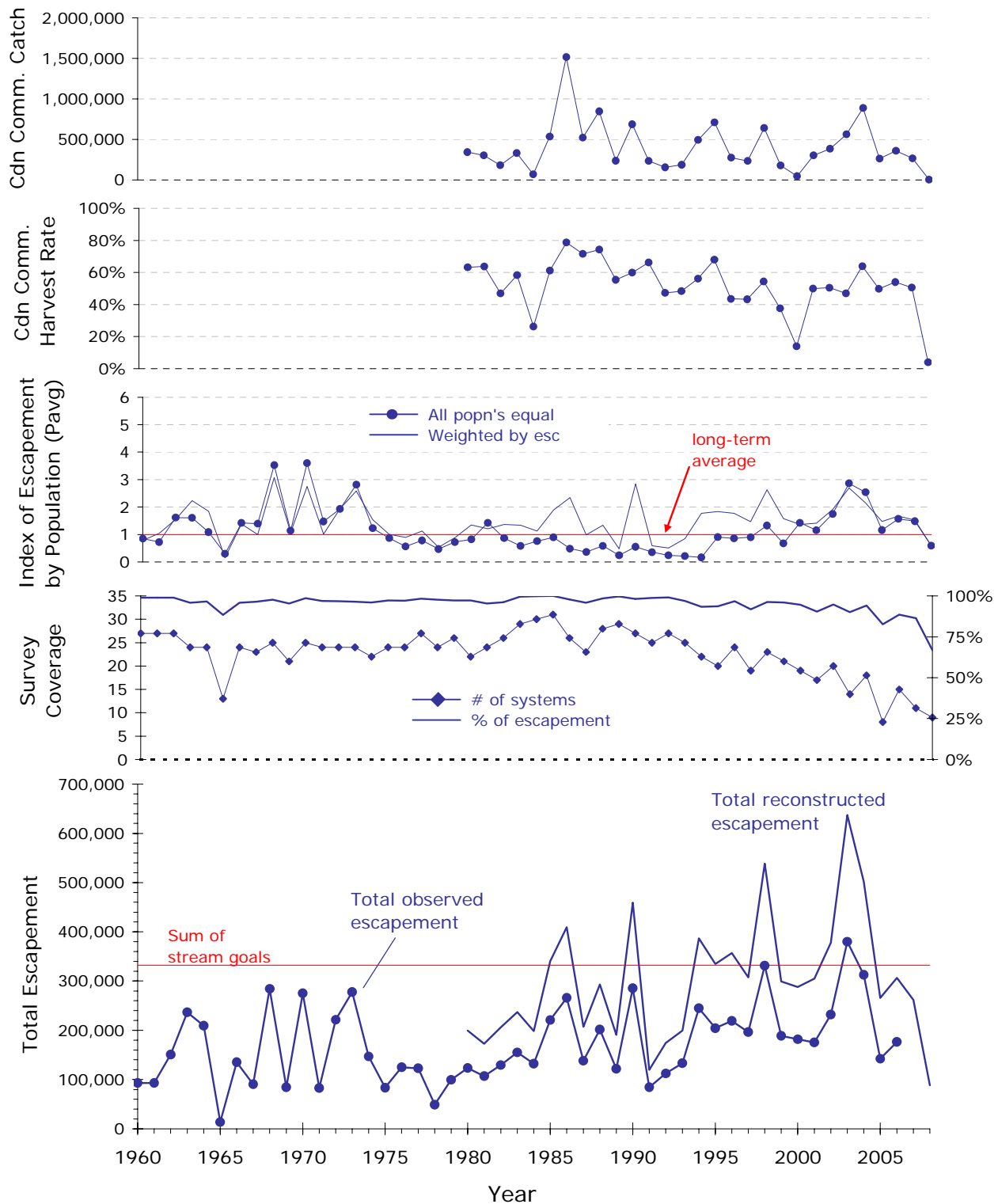


Figure 9. Trend summary for North & Central Coast chum salmon - Area 8

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

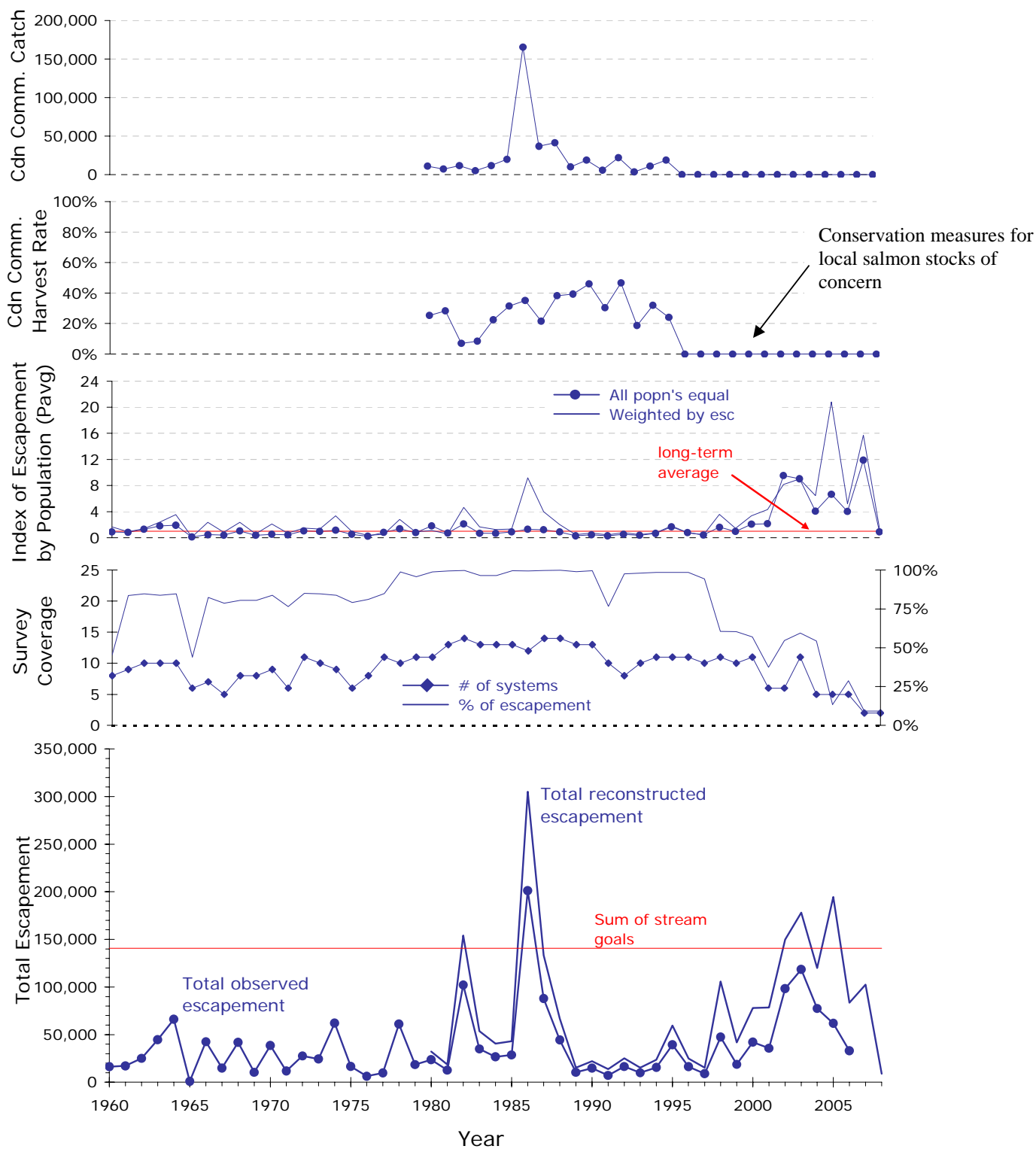


Figure 10. Trend summary for North & Central Coast chum salmon - Area 9
 Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

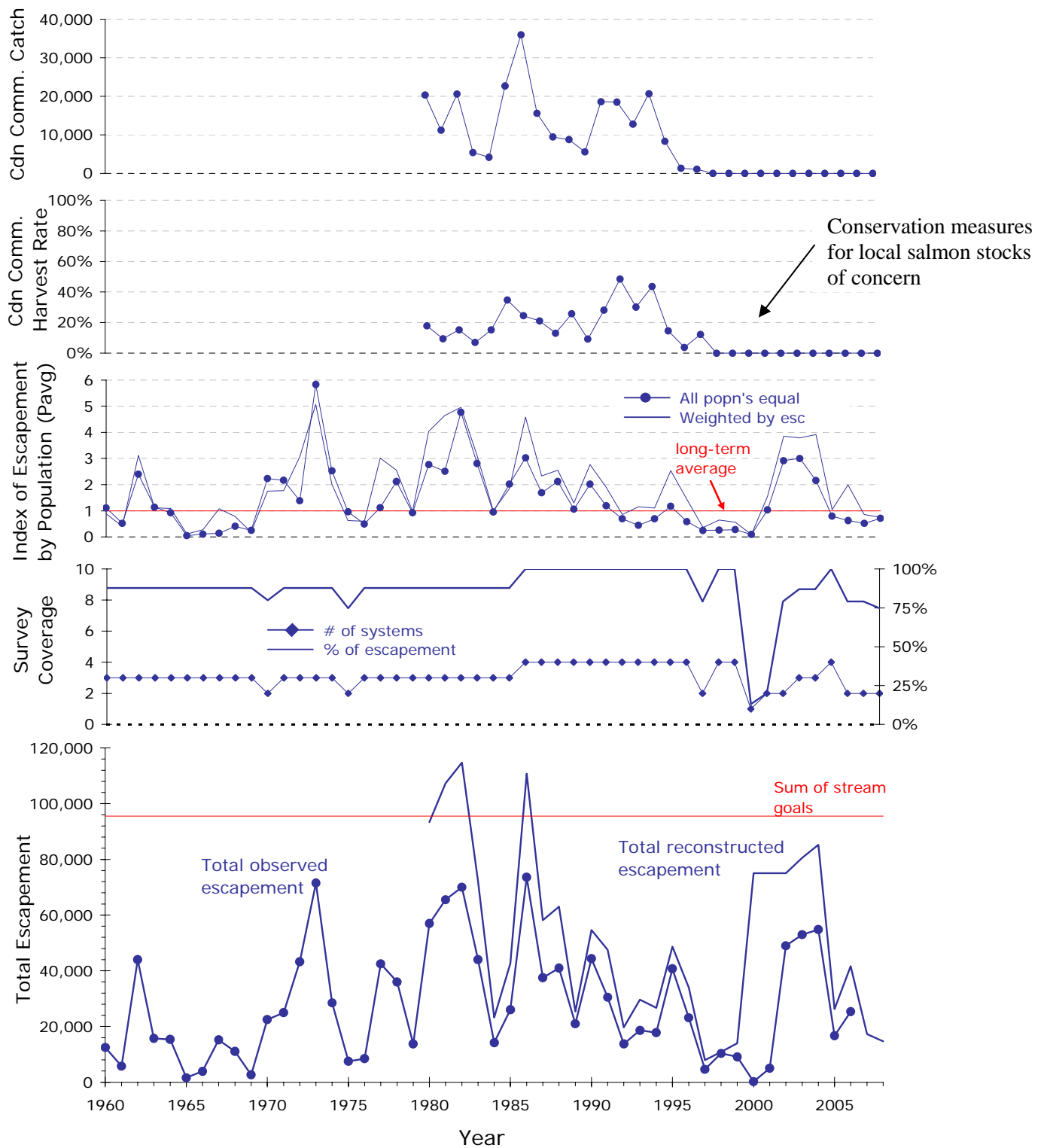


Figure 11. Trend summary for North & Central Coast chum salmon - Area 10
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.