Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2880

2009

CERTIFICATION UNIT PROFILE:
NORTH COAST AND CENTRAL COAST PINK SALMON

by

B. Spilsted and G. Pestal[1]

Fisheries & Aquaculture Management Branch
Department of Fisheries and Oceans
200 - 401 Burrard St
Vancouver, BC
V6C 3S4

[1]SOLV Consulting Ltd., Vancouver, BC V6H 4B9

Fisheries and Oceans Canada Pêches et Océans Canada

Canada

Cat. No. Fs 97-4/2880E-PDFISSN 1488-5387

Correct citation for this publication:

Spilsted, S. and G. Pestal. 2009. Certification Unit Profile: North Coast and Central Coast Pink Salmon. Can. Man. Rep. Fish. Aquat. Sci. 2880: viii + 72 p.

Table of Contents

List of Tables

List of Figures

ABSTRACT

Spilsted, B. and G. Pestal. 2009. Certification Unit Profile: North Coast and Central Coast Chum Salmon. Can. Man. Rep. Fish. Aquat. Sci. 2880: viii + 72 p.

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

RÉSUMÉ

Spilsted, B. and G. Pestal. 2009. Certification Unit Profile: North Coast and Central Coast Chum Salmon. Can. Man. Rep. Fish. Aquat. Sci. 2880: viii + 72 p.

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 pink 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.

Acknowledgments

Preparation of this report was mainly funded by the *Canadian Pacific Sustainable Fisheries Society* in support of the MSC Certification of BC Pink & Chum Fisheries. *Fisheries and Oceans Canada* contributed most of the information as well as a substantial amount of staff time, and supplementary funding. Overall, almost a hundred DFO staff contributed data, text, clarifications, and revisions to the full series of documents.

1 INTRODUCTION

1.1 Stocks covered in this document

This profile covers all pink salmon (*Oncorhynchus gorbuscha*) 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 pink systems, with estimated escapements larger than 20,000 more than once since 1990, are:

- *Queen Charlotte Islands:* Browns Cabin Creek, Copper River, Datlamen Creek, Davidson Creek, Deena River, Honna River, Kaisun Creek, Kano Inlet Creek, Lignite Creek, Mamin River, Mathers Creek, Naden River, Pallant Creek, Sachs Creek, Salmon River, Security Inlet Creek, Skedans Creek, Windy Bay Creek, and Yakoun River.
- *North Coast:* Alpha Creek, Babine River, Bish Creek, Brim River, Borrowman Creek, Captain Cove Creek, Chambers Creek, Dala River, Dogfish Bay Creek, Eagle Bay Creek, Ecstall River, Ensheshese River, Evelyn Creek, Foch Creek, Gil Creek, Gilttoyees Creek, Green River, Hankin Creek, Head Creek, Iknouk River, Kasiks River, Kemano River, Khutze River, Khutzeymateen River, Khyex River, Kildala River, Kincolith River, Kitimat River, Kitkatla Creek, Kitkiata Creek, Kumealon Creek, Kwinamass River, La Hou Creek, Lachmach River, Lakelse River, Limestone Creek, Moore Cove Creek, Oona River, Pa-aat River, Quaal River, Sandy Bay Creek, Shaw Creek, Silver Creek, Skeena River, Stagoo Creek, Stumaun Creek, Toon River, Turn Creek, and Turtle Creek.
- *Central Coast:* Bella Coola River, Carter River, Chuckwalla River, Clatse Creek, Clyak, Young & Neil Creeks, Cooper Inlet Creeks, Dean River, Elcho Creek, Frenchman Creek, James Bay Creek, Johnston Creek, Kainet Creek, Kilbella River, Kimsquit River, Koeye River, Korich Creek, Kwatna River, Mussel River, Necleetsconnay River, Neekas Creek, Nekite River, and Nooseseck River.

1.2 Fisheries covered in this document

This profile covers fisheries harvesting pink 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 pink 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:* Mixed-stock commercial fisheries harvest pink salmon, mainly with seine gear, in Area 3 (Nass), Area 4 (Skeena), and Areas 5 and 6 (Hecate Strait). Fisheries in the Dundas Island area and inside to Portland Inlet target returns to the Nass watershed, the Skeena watershed, and Alaska. Fisheries in the Chatham Sound area and at the entrance to the Skeena River target returns to the Skeena watershed. Fisheries in Ogden Channel target local stocks in Area 5.
- *Central Coast:* Terminal commercial net fisheries may target pink 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. 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 pink 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 pink 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 STOCK OBJECTIVES

2.1 Life history

2.1.1 Stock units

2.1.1.1 Definition of stock units for North Coast and Central Coast pink 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.

Pink salmon (*Oncorhynchus gorbuscha*) are common to many streams in the North Coast management area (DFO 2008a). Since 1950, at least 1 year of pink escapement has been recorded in 183 streams of the Queen Charlotte Islands (Areas 1 and 2), in 384 streams of the North Coast (Areas 3 to 6), and in 122 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 pink salmon originate in the following systems, with estimated escapements larger than 20,000 more than once since 1990:

- *Queen Charlotte Islands*
  - Datlamen Creek, Mamin River, and Yakoun River (Masset Inlet, Area 1)
  - Davidson Creek, Lignite Creek, and Naden River (Naden, 1)
  - Copper River (Copper, 2E)
  - Mathers Creek, Pallant Creek, and Skedans Creek (Cumshewa Inlet, 2E)
  - Salmon River (Darwin, 2E)
  - Windy Bay Creek (Juan Perez , 2E)
  - Kaisun Creek and Security Inlet Creek (Englefield Bay, 2W)
  - Kano Inlet Creek (Rennel Sound, 2W)
  - Browns Cabin Creek, Deena River, Honna River, and Sachs Creek (Skidegate Inlet, 2)
- *North Coast*
  - Dogfish Bay Creek (Portland Canal, 3)
  - Stagoo Creek (Obervatory Inlet, 3)
  - Chambers Creek, Iknouk River, and Kincolith River (Nass River, 3)
  - Khutzeymateen River and Kwinamass River (Portland Inlet, 3)

- Ensheshese River, Lachmach River, and Toon River (Work Channel, 3)
- Sandy Bay Creek and Stumaun Creek (Coastal, 3)
- Ecstall River, Khyex R., La Hou Crk, Moore Cove Crk, Oona River, and Silver Creek (Coastal, 4)
- Lakelse River (Lakelse, 4)
- Kasiks River and Skeena River - West (Lower Skeena, 4)
- Babine River (Babine, 4)
- Hankin Creek (Upper Principe / Browning Entrance, 5)
- Shaw Creek (Petrel Channel / Ala Pass, 5)
- Kumealon Creek and Pa-aat River (Upper Grenville Channel, 5)
- Alpha Creek, Captain Cove Creek, and Kitkatla Creek (Ogden Channel / Kitkatla Inlet, 5)
- Head Creek (Porcher Inlet, 5)
- Gil Creek, Limestone Creek, Turn Creek, and Turtle Crk (Laredo Channel/Campania Sound, 6)
- Borrowman Creek (Aristazabal Island, 6)
- Green River and Khutze River (Fraser Graham, 6)
- Brim River and Kemano River (Gardner Channel, 6)
- Bish Creek, Dala River, Eagle Bay Creek, Kildala River, and Kitimat River (Kitimat Arm, 6)
- Evelyn Creek, Foch Creek, Gilttoyees Creek, Kitkiata Creek, and Quaal River (Area 6)

- *Central Coast*
  - James Bay Creek (Mathieson Channel, 7)
  - Carter River, Korich Creek, and Mussel River (Finlayson-Mussel Channel, 7)
  - Kainet Creek (Kynoch Inlet, 7)
  - Neekas Creek (Spiller Inlet, 7)
  - Clatse Creek (Roscoe Inlet, 7)
  - Cooper Inlet Creeks (Cooper Inlet, 7)
  - Kwatna River (Burke Channel, 8)
  - Elcho Creek and Frenchman Creek (Dean Channel, 8)
  - Dean River and Kimsquit River (Upper Dean Channel, 8)
  - Koeye River (Fisher – Fitz Hugh, 8)
  - Bella Coola River, Necleetsconnay River, and Nooseseck River (North Bentinck, 8)
  - Chuckwalla River, Clyak, Young & Neil Creeks, Johnston Creek, and Kilbella River (Area 9)
  - Nekite River (Area 10)

Table 1 summarizes the population structure of North Coast & Central Coast pink salmon by grouping individual spawning sites according to management area, statistical area, and conservation unit. Note that Table 1 only lists spawning sites with more 5 observations since 1990. Sites with estimated pink escapements larger than 20,000 more than once since 1990 are highlighted in **bold font**. 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 Coast and Central Coast pink 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 *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 pink salmon (Chapter 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 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 19 conservation units of pink salmon in the Queen Charlotte Islands, the North Coast, and the Central Coast based on their evolutionary lineage, life history, productivity, and ocean migrations:

- *Even-year pink* salmon*:* Hecate Lowlands, Hecate Strait-Fjords, Nass-Skeena Estuary, Middle-Upper Skeena, North Queen Charlotte Islands, East Queen Charlotte Islands, West Queen Charlotte Islands, and Upper Nass.

- *Odd-year pink salmon*: Homathko-Klinaklini-Rivers-Smith-Bella Coola Dean, East Queen Charlotte Islands, North Queen Charlotte Islands, West Queen Charlotte Islands, Hecate Strait-Lowlands, Hecate Strait-Fjords, Nass-Skeena Estuary, Lower Skeena River, Middle & Upper Skeena River, Nass-Portland-Observatory, and Upper Nass.

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 each Conservation Unit (CU) is available at http://www-comm.pac.dfo-mpo.gc.ca/pages/consultations/wsp/CUs_e.htm.

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

- Chapter 5 summarizes the distribution, life history, ecotypes, and genetic population structure of pink salmon.
- Figure 4 (p 124) shows locations with records of even-year pink salmon, and Figure 5 (p 127) shows locations with records of odd-year pink salmon.
- Table 8 (p.151) summarizes classification criteria for even-year pink salmon CUs, shown in Figure 15 (p.153), and Table 9 (p 152) summarizes classification criteria for odd-year pink salmon CUs, shown in Figure 16 (p.154).
- 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 pink salmon generally rely on indicator stocks to locally identify surplus 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 pink salmon spawning streams. English et al. (2006) list the indicator stocks and survey methods. A number of these streams will likely never have a directed fishery, but are important as indicators of streams with similar run size, timing, and productivity. Intensive monitoring with counting fences occurs on the Tlell River and Copper River (Area 2 East), the Kincolith River in Area 3, as well as the Babine River and Kitwanga River in Area 4. A Counting Tower has been in used on the Atnarko (Area 8) since 1971. 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 fairly stable set of index streams and a variable set of additional streams. Section 4.1 summarizes assessment coverage for North and Central Coast pink 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 pink salmon. The analyses were peer-reviewed and accepted through the PSARC process, which includes scientists from outside the management agency:

- Beacham et al. (1985), Beacham et al. (1988), and other genetic studies since then have confirmed the reproductive isolation of odd-year and even-year broodlines.
- Beacham et al. (1988) identified a northern regional group of odd-year pink salmon.
- Riddell (2004) describes spawning populations of pink salmon on the North and Central Coast.

- 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

Annual abundance of adult pink salmon spawners on the North Coast and Central Coast has averaged about 5 Million since 1960, ranging from a low of about 1 Million in 1967 to a high of about 10 Million in 1986 (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.

Pink salmon are distributed widely in the north Pacific, with BC populations mostly found north of 50°N latitude and east of 150°W longitude (Heard 1991).

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

- *"The majority of pink salmon production occurs in only a few large populations, but their wide distribution also makes them an important ecological keystone species in the coastal watersheds."*
- *"The number of streams in the north is substantially greater than in the central region but the total number of pink spawners is not, on average, proportionately greater. Pink returns in central region are concentrated in the Bella Coola and Atnarko rivers, but there is no equivalent dominant system in the north. There are a few larger rivers with larger populations, but pink production in the north comes from many moderate sized rivers."*
- *"As in the Central Coast, northern pink salmon escapements in Even-year line have been greater than in the Odd-year line, but the lines are more similar in size in the past decade. The number of streams involved was typically greater in the Even-year line."*
- *"The Nass River and the Queen Charlotte Islands are not typically large producers of pink salmon. They have much lower levels of pink salmon returns than the other sub-areas. Even-year returns to the Yakoun River, Queen Charlotte Islands, are the significant exception."*

Hyatt et al. (2007) describe the distribution of pink salmon throughout the North Coast and Central Coast at different stages in their life history. 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

Pink salmon have a distinct life history characterized by smaller adult size, single age at maturity, and minimal time in freshwater (Holtby and Ciruna 2007, Hyatt et al. 2007).

Pink salmon return to spawn in natal streams after two summers at sea and all adults return to spawn as two-year olds (Heard 1991). Using the Gilbert-Rich age designation system, North and Central Coast pink salmon are designated 2_0.

Pink are the smallest of the five Pacific salmon species (Heard, 1991).

Size data for pink 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).

The egg to fry survival of North Coast and Central Coast pink salmon 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 from the North Coast and Central Coast. The majority of pink salmon return to coastal rivers during July and August, spawning in late August and September. Fry emerge from March to April and migrate to sea right away. Pink salmon fry occupy near-shore waters of estuaries and coastal inlets for several weeks to months of time, feeding on zooplankton and epibenthic organisms derived from estuarine and detritus-based food webs. Following their adaptation to marine waters, they rapidly migrate northwest the Gulf of Alaska.

Pink and sockeye tagging studies were conducted in Northern B.C. and Southeast Alaska from 1924 to 1958 (Canada-US Report, 1965), in Dixon Entrance and Hecate Strait from 1966 to 1968 (DFO 1968, Hollett 1970), and throughout the North Coast from 1982 to 1985 (Pella et al. 1993).

Central Coast pink salmon tagging studies occurred in 1976, 1978 and 1979. Results from these studies suggest highly variable stock composition, migration patterns and timing (Aquatic Resources Ltd. 1982, Leavens and Birch 1984).

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), and summarizes coast-wide pink and chum enhancement activities.

- Section 2.4.2 describes the regional approach to monitoring and assessing BC pink and chum salmon, including enhanced fish.
- Section 2.5.2 describes the regional approach to salmon harvest and explains conservation measures implemented in fisheries that target enhanced chum (e.g. cap on total exploitation rate, terminal fisheries).

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

Annual production targets for each salmon species and enhancement facility are publicly reviewed as part of the *Integrated Fisheries Management Plan*, which also includes a review of enhancement activities in the previous year.

2.2.2 North & Central Coast pink salmon enhancement facilities

There is currently no active hatchery production of pink salmon on the North Coast and Central Coast, but spawning channels are operated on the Atnarko River and the Nekite River.

2.3 Fisheries intercepting North & Central Coast pink 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.

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

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

- Section 1.3.2 summarizes allocation principles and their implementation.

- Section 2.2.3 provides a brief overview of fisheries targeting BC pink and chum salmon.
- Section 2.5 summarizes the planning and implementation of pink and chum fisheries, including access controls and compliance measures.

2.3.2 First Nations

First Nations target local salmon stocks for 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. Pink 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 pink salmon catches generally small.

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 1% of the long-term average escapement into each region (i.e. Queen Charlotte Islands, North Coast, Central Coast, see Table 4). 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 – Noprth 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 pink salmon is open year round. There are area closures, listed in the Tidal Water Sport Fishing Guide, in effect for various inlets and off river mouths to protect salmon 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 pink 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 pink salmon for Areas 1 to 10 is less than 15,000 annually (i.e. recorded catch available at www.pac.dfo-mpo.gc.ca/sci/sa/Recreational/default_e.htm), compared to a long-term average escapement of about 5 Million (Table 4).

2.3.4 Commercial

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

Terminal commercial net fisheries may target pink 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. Terminal net fisheries may occur in:

- Copper Bay (targeting mainly Copper River pinks)
- Cumshewa Inlet (Mathers Creek, Pallant Creek, Skedans Creek)
- Darwin Sound (Salmon River)
- Englefield Bay (Kaisun Creek, Security Inlet Creek)
- Juan Perez Sound (Windy Bay Creek)
- Masset Inlet (Datlamen Creek, Mamin River, and Yakoun River)
- Naden Harbour (Davidson Creek, Lignite Creek, and Naden River)
- Rennel Sound (Kano Inlet Creek)
- Skidegate Inlet (Browns Cabin Creek, Deena River, Honna River, and Sachs Creek)

There is currently an opportunity for a directed pink fishery in Area 1 by trollers, but there has been no troll effort directed at pinks over the last decade.

2.3.4.2 North Coast mixed-stock and terminal pink fisheries (Areas 3 to 6)

Mixed-stock commercial fisheries harvest pink salmon, mainly with seine gear, in Area 3 (Nass), Area 4 (Skeena), and Areas 5 and 6 (Hecate Strait). Fisheries in the Dundas Island area and inside to Portland Inlet target returns to the Nass watershed, the Skeena watershed, and Alaska. Fisheries in the Chatham Sound area and at the entrance to the Skeena River target returns to the Skeena watershed. Fisheries in Ogden Channel target local stocks in Area 5.

2.3.4.3 Central Coast terminal pink fisheries (Areas 7 to 10)

Terminal commercial net fisheries may target pink 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.

In recent years, directed pink salmon fisheries have occurred regularly in Area 8 and occasionally in Area 7. 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 (Targeting pink salmon returning to James Bay Creek, Kainet Creek)
- Finlayson Channel (Carter River, Korich Creek, and Mussel River)
- Sheep Passage (Mussel River)
- Spiller Inlet (Neekas Creek)

- Roscoe Inlet (Clatse Creek)
- Burke Channel (Kwatna River)
- Dean Channel (Dean River and Kimsquit River)
- Fisher – Fitz Hugh (Koeye River and Atnarko River)
- North Bentinck Arm (Bella Coola River, Necleetsconnay River, and Nooseseck River)

2.4 Stock objectives

2.4.1 Regional objectives

Pacific salmon are managed under a comprehensive umbrella of laws, treaties, and policies. Particularly relevant for the year-to-year management of 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 pink 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 pink salmon, these fundamental objectives translate into a cautionary approach to fisheries management, with a focus on identifying fishing opportunities in terminal areas based on in-season abundance estimates and observed escapements into the natal streams.

2.4.3 Management objectives for North & Central Coast pink 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 pink 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 pink stocks. However, operational

Management Escapement Goals (MEG) have been identified for each of the streams with regular observations of spawning pink salmon (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 aggregate MEG for Areas 1 to 10 (Note: these are simply the sum of all MEG identified for an area). Table 6 lists individual MEGs for major pink 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.
- 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 *2009 Pink & Chum Management Summary* for details):

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

3 MANAGEMENT FRAMEWORK

3.1 Regional approach to salmon harvest

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

- 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 Pink Salmon

Pink 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 pink 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 Early Indicators

Management of all pink salmon fisheries on the North Coast and Central Coast relies on several early indicators. For example, no directed or reduced time & area pink fisheries were planned for Area 3 due to low observed catch-per-effort in SE Alaska, early commercial fisheries, and in recreational fisheries.

3.3.2 Queen Charlotte Islands Terminal Pink Salmon Fisheries (Areas 1 & 2)

3.3.2.1 Harvest Objectives

Surplus pink salmon opportunities on the QCI occur only during even years; odd year returns are either minimal or non-existent in most streams. In the past, terminal pink salmon opportunities have occurred in a variety of locations:

- Masset Inlet (major systems: Yakoun River, Mamin River, and Datlamen River)
- Naden Inlet (Davidson Creek, Lignite Creek, Naden River)
- Cumshewa Inlet (wild chum from Mathers Creek and enhanced chum from Pallant Creek)
- Darwin Sound (Salmon River)
- Skidegate Inlet (Deena River, Browns Cabin Creek),
- Athlo-Otard (Mace Creek)
- Englefield Bay (Security Inlet Creek)

There have been few commercial pink salmon fisheries in recent years, the last one in 2006 in Darwin Sound.

Table 6 lists the operational escapement goals for major pink systems in each area.

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.

3.3.2.2 Pre-season Planning

Pre-season predictions of pink salmon surpluses are not reliable and for the most part harvest opportunities are normally provided only when surpluses are identified in-season.

3.3.2.3 In-season Implementation

Initial openings are based on fish observed to be schooling in front of the various systems. If a poor run is predicted, such that only enough salmon are expected to return to stock the creek, 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 stock abundance with subsequent openings as appropriate. The size of the return is estimated by the observed catch-per-effort during the first few openings.

3.3.2.4 Conservation Measures

Location and timing of these fisheries results in very limited encounters of non-target species, and selective fishing measures are in place. For example:

- 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.
- Coho release may be required for pink seine fisheries.
- Chinook release is a condition for pink fisheries in Masset Inlet to protect Yakoun chinook.

3.3.3 North Coast Mixed-Stock and Terminal Pink Salmon Fisheries (Areas 3 to 5)

3.3.3.1 Harvest Objectives

Ocean fisheries that encounter North Coast pink salmon in Statistical Areas 3, 4 and 5 are managed as mixed-stock fisheries harvesting broad geographic aggregates:

- *Nass River* (Area 3): The major pink stocks return to Kwinamass River, Khutzeymateen River and the Iknouk River in odd years. Most Area 3 pink stocks arrive in the fishing area at approximately the same time, mid-July. The outer coastal stocks are an exception, arriving in August and early September. Returns are harvested by seine fishery starting mid-July, usually in a targeted sockeye and pink fishery with restrictions such as time, area and gear restrictions in place to pass more chums through to the spawning grounds.
- *Skeena River* (Area 4)*:* Returns are harvested in Areas 4 and 5 and upper Chatham Sound in Area 3. For sockeye and pink salmon fisheries, there is little opportunity to isolate component stocks spatially in these ocean fisheries. In the Skeena River, pinks have returned well in odd years, but even years have shown lower levels and limited fishing opportunities. 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.

Table 6 lists the operational escapement goals for major pink systems in each area.

3.3.3.2 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.

3.3.3.3 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 consider 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 consider escapement information in the Tyee test fishery (Section 4.2.2.1) along with fish counts on individual streams.

Fishing times and locations are adjusted based on expected and observed abundances of the various systems (e.g. if Skeena pink run is stronger, seine fisheries are moved to the outer parts of Areas 3 and 4, but if the Nass run is stronger, seine fisheries move closer to the coast)

3.3.3.4 Conservation Measures

The Skeena River (Area 4) 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 the other 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
- Timing closures.
- 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 has been 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 net fish harvesters are required to release all live chum to the water with the least possible harm.

3.3.4 Area 6 Pink Salmon Fishery (Kitimat, Kemano, Quaal)

3.3.4.1 Harvest Objectives

In recent years Area 6 has experienced strong pink returns on odd years with only very modest returns on even years. Historically, chum fisheries have been managed along with more abundant pink returns. In recent years, the only directed chum fishery has been on enhanced stocks returning to the Kitimat Hatchery. Table 6 lists the operational escapement goals for major pink systems in each area.

Fisheries in this area do not focus on a single major stock, but a mixture of many local stocks with variations in migration timing. Fisheries are managed towards stream-specific targets (Table 6) and a good distribution across streams (e.g. by adjusting time and area to harvest earlier or later components, depending on abundance).

3.3.4.2 Pre-season Planning

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

3.3.4.3 In-season Implementation

Gill net fisheries are announced in-season based on catch and escapement information. Further fishing opportunities are based on the assessments of the fishery, with good catches indicating a strong return. As the season progresses the focus changes increasingly to an assessment of escapements to determine further fishing opportunities

Weekly fishery openings are adjusted based on historic catch averages for each week, as well as early indications of escapement into the spawning streams.

3.3.4.4 Conservation Measures

Location and timing of these fisheries results in very limited encounters of non-target species, and selective fishing measures are in place. For example:

- Gill nets have a mesh restrictions to reduce interceptions of non-target salmon species.
- Gill net fisheries restricted to Douglas Channel.
- Non-retention steelhead in all fisheries.
- Commercial net fishing is limited to daylight hours to reduce by-catch.

- Mandatory brailing for all seine sets and non-retention of chinook, steelhead, coho and chum by the commercial seine fleet.
- Non-retention of a species could change in-season depending on abundance and allocation across fleets.

3.3.5 Area 8 Pink Fishery

3.3.5.1 Harvest objectives

Fisheries in Area 8 target mainly pink salmon from the Bella Coola/Atnarko system, but there is a component of Kwatna River and Koeye River pinks that are fished. The pink fishery on Kwatna stocks occurs at the same time as the Atnarko fishery, while Koeye pinks are harvested during the later part of August.

Gil net fisheries in North Bentinck Arm, Dean Channel and Burke Channel target chum and retain pink salmon, while targeted pink fisheries take place in Fisher Channel and Fitz Hugh Sound, mostly with seine gear.

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

3.3.5.2 Pre-season Planning

In November/December during the pre-season planning process, opportunities are evaluated for two-day gill net fisheries in the first two weeks of July, targeting chum with pink salmon retention. The evaluation is mainly based on brood year escapements. This fishery is implemented to get an early assessment of chum run strength.

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.

The information collected during these assessment fisheries is then used to shape subsequent gill net openings, and also serves as an early indicator of pink salmon abundance for targeted pink salmon fisheries by seine in Fisher Channel and Fitz Hugh Sound. Catch and effort data from these directed pink fisheries is then used to shape subsequent pink salmon openings, in combination with early indications of escapement.

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.

- If the in-season estimate of the Atnarko River pink salmon stock exceeds two million fish, a portion of Sub area 8-13 south of a line from Kelpa Point due west to a boundary sign on King Island may be opened for seines. This would only be done after consultation with central coast advisors.

3.3.5.4 Conservation Measures

Location and timing of these fisheries results in very limited encounters of non-target species, and selective fishing measures are in place. For example:

- Conservation measures to protect Rivers Inlet and local sockeye stocks have been put in place in recent years. Most importantly, complete commercial fishery closures have been implemented in those areas since the 1990s (e.g. Figure 11). Sockeye non-retention is in place for recreational fisheries within Rivers Inlet.
- Gill nets have a 149mm minimum and 165mm maximum mesh restriction. This restriction is in place so that chum is targeted selectively and other non-target species such as sockeye and chinook are not impacted.
- Non-retention of steelhead in all fisheries.
- Daylight-only fisheries reduce the amount of coho encountered by gillnets and seines.
- Commercial net fishing is limited to daylight hours to reduce by-catch.
- Non-retention of a species could change in-season depending on abundance and allocation across fleets.
- In Areas 7 and 8, 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, 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 with 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.
- Coho in the North and Central Coast are being managed to an exploitation rate ceiling. Coho will be actively managed during all net fisheries in 2008 with coho retention initially not allowed in gillnet and seine fisheries. Fishery managers monitor the encounter rates on a weekly basis and allow retention of coho if abundances warrant.
- 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.

3.3.6 Northern troll fisheries

Northern troll fisheries are planned each year in accordance to the Pacific Salmon Treaty. For example, the *2008 Integrated Fisheries Management for Salmon – North Coast* states: *"Canada will manage the Area 1 troll fishery to achieve an annual catch share of 2.57 percent of the annual allowable harvest (AAH) of a portion of south-east Alaska, as agreed to in the Pacific Salmon Treaty (PST). The methodology for AAH calculations is provided in the PST. Canada can carry forward from year to year annual deviations from the*

prescribed catch. To increase the pink catch, the northern section of Dixon Entrance will open to pink salmon fishing on July 1st. During this fishery, coho and sockeye retention will also be allowed. Pink salmon opportunities will begin on July 1 in the northern portions of Dixon Entrance, and are anticipated to remain available throughout the coho fishery. The allowable pink harvest under the provisions of the PST is such that it is very unlikely that the troll fleet will be restricted."

3.3.7 Summary: Annual timeline for commercial pink fisheries

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

- *Areas 3 to 5:* Start mid July and continue until the end of August
- *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 mid July and continue until the end of August
- *Areas 9 and 10:* Have not fished for pink for many years.

4 ASSESSMENT FRAMEWORK

4.1 Overview

Catch and escapement of North and Central Coast pink salmon are assessed annually, as documented in the North Coast's *Core Stock Assessment Plan*, which is summarized below. Estimates of aggregate escapement to each statistical area are based on a surveys of key streams identified in a comprehensive assessment framework.

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 pink salmon.

Riddell (2004) reviewed the assessment history of Central Coast pink salmon (p. 48 to 54) and North Coast pink salmon (p. 54 to 59) 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:

- *"Spawning records for pink salmon have been maintained since the early 1950s, but the streams monitored have varied over time, methods of enumeration have changed, and the effects of fisheries and habitat alterations have undoubtedly affected streams to varying degrees. The vast majority of spawning escapement data for pink salmon is based on visual observations by fishery guardians who conduct walks of streams and/or over-flights at peak spawning times. These data are not likely to be highly accurate on a stream-by-stream basis, but efforts are made to conduct annual surveys in a consistent manner so that the trends over time are representative of changes over time and areas.*"[Comment by North Coast DFO: The observed escapement is considered a reliable index of trends in abundance, because the survey methodology has remained relatively consistent. Section 4.3.3 describes how the observed escapements are expanded to estimate total escapement].
- *"Between the 1950s and 1990s, over three-quarters (75%) of the streams in central BC have been surveyed three or more times in every five years. This is a particularly good record of survey effort given the remoteness of most rivers and the area covered."*
- *"The frequency of spawner surveys in northern pink salmon streams is a strength, as was noted in the central region. The accuracy of the number of spawners is likely low because the vast majority of the surveys are based on visual methods and streams could have been inspected once or several times within a year. However, with a high frequency of streams inspected each year, Fisheries and Oceans Canada is able to monitor the distribution of pink salmon, the trends in relative population sizes between streams within a year and within a stream between years. These visual surveys can also be an important check on the habitat conditions, water levels etc."*
- *"Pink salmon production in the Skeena is significant, but the frequency of spawning surveys has decreased substantially since the early 1990s."*[Comment by North Coast DFO: The Tyee test fishery is

now relied upon as a weekly index of abundance, which is considered in the weekly decision process. Refer to Section 4.2.2.1]

- *"Since there is very little quantitative data on pink salmon in central and northern BC, these historical spawning escapement surveys are the heart of our information on pink salmon. Changes in the relative size of spawning populations between streams, and within a stream but between years, are the best available indicators of pink salmon status. This is especially true now due to major reductions in fisheries and fishery related data."*
- *"The quality of data needed for an assessment is related to the fishing intensity (or other impacts) that may impact the pink salmon populations. If harvest rates are expected to be high, then more quantitative data should be collected. But if the harvest rates are expected to be low to moderate (possibly in the 20% to 40% range) then more qualitative methods for escapement monitoring may be adequate, depending on the confidence that can be placed on the escapement surveys. In recent years, commercial fisheries on pink salmon have been limited by efforts to reduce by-catch in mixed-stock fisheries and by reduced salmon prices."*
- *The PFRCC recommends, therefore, the establishment of an explicit assessment framework for pink salmon populations in the central and northern regions. Efforts should be directed to ensuring consistency of methods over time, and quantifying the accuracy and precision of surveys adopted in the assessment 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 *"In general, the index streams for pink salmon streams represent a substantial portion of the streams where pink salmon spawners have been observed for each statistical area. The notable exceptions are QCI streams in odd years and Area 10 in all years. As indicated for chum, most QCI and Central coast fisheries are located in terminal areas. Unlike chum salmon, management biologists are less concerned about that assumption of equal harvest rates for Area 3-5 stocks, thus these estimates of relative abundance and trends for pink salmon are more comparable between areas."* (p. 7). Their Tables 7 and 8 include a detailed summary of escapement survey coverage by statistical 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.

4.2 Annual Monitoring

4.2.1 Escapement

North and Central Coast pink salmon 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.

Pink salmon 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.

Tables 7 and 8 of English et al. (2006) include a detailed summary of escapement survey coverage by statistical area. Specifically, they recommend that "*As indicated above, annual surveys are recommended for all pink index streams because of the need to track even and odd cycles separately. Visual surveys conducted 3-4 times per year and AUC estimation procedures are recommended for all pink salmon index streams. In total, 26 index streams are monitored using aerial survey techniques (19 by fixed-wing and 7 by helicopter), 126 index streams in even years and 102 in odd years should be assessed using ground-based surveys.*"

Implementation of the stock assessment framework has been consistent since 2004 (Table 8). Almost 2,500 stream inspections for pink salmon escapement were conducted over a 4 year period, with a total of 424 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 when a local surplus abundance of pink salmon is expected (e.g. Masset Inlet or Cumshewa Inlet on the Queen Charlotte Islands, Section 3.3.2.3).

4.2.2.3 Intensive enumeration programs

Salmon counting fences are used throughout the North and Central Coast. The following fence enumeration facilities currently collect pink salmon data in odd and even years:

- *Pallant Creek fence* (Area 2E)
- *Tlell River fence* (Area 2E)
- *Copper River* (Area 2 East)
- *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.
- *Babine River fence* (Area 4): Established in 1946, this counting fence provides an accurate escapement count of sockeye and other species of salmon entering Babine Lake about 360 km upstream from mouth of the Skeena River, where up to 90% of the Skeena River sockeye are produced in any given year. More information, including daily in-season salmon counts since 1990, is available at http://www.pac.dfo-mpo.gc.ca/northcoast/counts/babine/babine.htm.
- *Bulkley/Morice fishway* (Area 4)
- *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.
- *Atnarko Counting Tower:* Visual count from a tower as fish swim past, operational since 1971. Daily counts are extrapolated based on full 24-hour counts several times a year. Riddell (2004) describes the details.

The Yakoun River fence (Area 1) is operated only in even years due to the strong two year pattern of abundance observed for pink salmon in Masset Inlet (Table 2).

The fences at Pallant Creek, Copper River, and Yakoun River are operated the Haida Fisheries Program supported by funding through DFO's *Aboriginal Fisheries Strategy* (AFS). The Atnarko Tower has been managed by the Nuxalk First Nation since 2001, in cooperation with DFO. Section 1.2.4 of the *2009 Management Summary for BC Pink and Chum Fisheries* summarizes AFS and links to other programs that are part of the on-going development of Aboriginal and Treaty Rights in BC.

4.2.2.4 Nisga'a

- Fishwheel Program conducted at test-fishing sites near Gitwinksihlkw on the Nass River.

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.
- On-ground charter patrol hails are used for real-time management of most fisheries (e.g. Area 6 hails are received at 2pm. Based on this information, an additional day of fishing may or may not be implemented).

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.

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 pink removals from larger stock groupings (i.e. by statistical area). Aggregate catch estimates for pink salmon have been previously summarized by English et al. (2006). 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 pink stocks due to the high variability in migration routes, run timing, and abundance of individual populations. However,

the harvest strategy for North & Central Coast pink salmon limits the risk associated with this uncertainty through two main strategies:

- Terminal fisheries on local abundances identified in-season (Section 3).
- Non-retention of pink salmon in fisheries intercepting pink salmon originating from areas with persistent low abundances. For example, pink non-retention is implemented in Queen Charlotte Strait troll fisheries to protect passing Mainland Inlet pink returns.

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."* [Note: This applies to Queen Charlotte Islands and North Coast as well].

A standardized monitoring plan for charter patrol has been in place since the early 1980s. The details of weekly data collection and resulting management actions are documents in the *Records of Management Strategies,* which are compiled annually for statistical areas 1 to 10.

4.2.3.2 Recreational

Pink salmon are generally not targeted by recreational harvesters and harvests are typically small, with total recreational catch of pink 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."* [Note: A charter patrol survey on the Bella Coola River is now in place as well].

Creel surveys continue to be implemented periodically as before. For example, a creel survey in Areas 3 and 4 was completed in 2008.

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."*

The accuracy of catch monitoring data for FSC fisheries has been improving through collaborative initiatives with local First Nations. For example, a standardized reporting format and database has been developed for Oweekeno FSC fisheries (Area 9).

4.3 Analysis

4.3.1 Stock Composition

Stock composition of North Coast and Central Coast pink salmon is not monitored as intensively as for chum salmon, or for South Coast pink salmon.

Genetic Stock Identification (GSI) programs for pink salmon are being implemented on the South Coast where mixed-stock fisheries in Johnstone Strait and the Strait of Georgia target Fraser River pink salmon. In those areas, pink salmon catches can be divided into Fraser, non-Fraser (Areas 11 to 19), and US stocks. Section 4.3 of the *2009 Fraser River Pink Salmon Profile* describes the details.

GSI programs for pink salmon on the North Coast ran from 1988 to 1997, but were discontinued for four reasons:

- Fisheries have generally shifted to more terminal areas, where passing pink salmon stocks are not encountered, and openings in a statistical area are designed to predominantly harvest pink salmon bound for that area (i.e. mostly stream-specific terminal fisheries).
- The population structure of pink salmon tends to be more geographically dispersed (i.e. more straying, larger conservation units), as described in Section 2.1.1.2. As a result, GSI within a more localized area is less informative.
- Very low catches of Fraser pinks north of Cape Caution
- Cost of processing and analyzing the samples.

There is no active hatchery supplementation of North Coast and Central Coast pink salmon (Section 2.2), so there is no stock composition data available from mark-recovery programs.

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 pink salmon are relatively inaccurate compared to forecasts for other salmon species, caused by high variation in freshwater and marine survival rates. Due to the high uncertainty, and recent changes in the management approach (i.e. shift to terminal fishing locations with cautious early openings, and subsequent openings based on observed in-season abundance), only rough forecasts are routinely provided to the public to guide early pre-season planning.

4.3.3 Trend Summaries

This section describes the time series shown in Figure 2 to Figure 20.

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 5 on the North Coast.

Estimates of Canadian commercial harvest rate, shown in Figure 2 to Figure 20, are adjusted as follows:

- *Areas 1 and 2W*: English et al. (2006) include only catches after August 15th.
- *Areas 3 to 5*: English et al. (2006) calculate an aggregate harvest rate for Areas 3 to 5 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 2 to Figure 20, 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).
- *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 2 to Figure 20 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 Pavg 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 2 to Figure 20 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 pink 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*. 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 pink salmon include:

- DFO (1999) *Central Coast Pink Salmon*. DFO Science Stock Status Report D6-03. Available at http://www.pac.dfo-mpo.gc.ca/sci/psarc/SSRs/Salmon/d6-03-99.pdf
- 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.
- 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 pink salmon incorporates conservation measures to promote long-term survival of pink stocks which originate from a wide range of stream sizes and productivity found within each statistical area.

Currently, North & Central Coast pink salmon populations are healthy enough not to warrant a legislated level of protection and the overall persistence of North Coast and Central Coast pink salmon 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.

Riddell (2004) includes the following comments regarding the status of North Coast and Central Coast pink salmon:

- *"The central and northern region continues to support a diversity of pink salmon populations, both in numerous small coastal rivers and a few larger rivers."*
- *"Escapements of pink salmon in central BC have been quite stable on a decadal average in both even and odd years (Table 3.1), but are much more variable on an annual basis."*
- There have been some changes in stream diversity. *"In both the Even and Odd-year lines, two or three of the larger populations during the 1950s have declined in size, but others have increased substantially."*
- *"[…] the number of northern streams with pink salmon reported during 2001 and 2002 are much lower than in previous years. The reported total escapement, however, were comparable with the past decade and suggest a substantial increase in pink salmon production."*

Based on these analyses, the *Pacific Fisheries Resource Conservation Council* (PFRCC) concluded that *"Pink salmon in central BC (Areas 7-11) and in northern BC (Areas 1-6) remain a diverse resource with evidence of increasing spawning population sizes recently. The PFRCC also noted the extensive effort to monitor this resource in the past, but our primary concern now is about the questionable ability of Fisheries and Oceans Canada to assess these resources reliably in the future. The historical information for assessments includes spawning escapement trends and reported catch, but the availability of sufficient information has been compromised by reductions in monitoring of spawning populations and reductions of fisheries over the past several years."* (Riddell 2004). Section 4.1 outlines how a comprehensive assessment framework was developed to build on and implement the recommendations from the PFRCC.

Returns and escapements have been highly variable, and annual management responds to observed abundance. No persistent conservation concerns have been identified. One potential emerging concern, however, are the recent low returns on the Kitimat River. The proposed strategy is non-retention in the recreational fishery on the Kitimat, accompanied by a commercial fishing closure for 2010, when the current brood returns.

5.2.2 Trends

5.2.2.1 Abundance

Estimates of total abundance for North and Central Coast pink salmon are based on run reconstructions that extrapolate from escapement to index streams and catches within each statistical area (Section 4.3). Appendix Figures C5 and C6 of English *et al.* (2004) plot reconstructed Total Returns To Canada (TRTC) from 1980 to 2002. The following general trends emerge:

- *Queen Charlotte Islands*: Even-year returns are highly variable in Areas 1 and 2W, but fairly stable in Area 2E. 1998 to 2002 was a period of high abundance for Area 2W and a period of low abundance for Area 1. Odd-year returns have historically been very small, and run reconstructions were not completed.
- *North Coast*: Even-year returns are highly variable in Areas 3 to 5, with low abundance in 1994 and 1998, a peak year in 1996, and strong increases from 1998 to 2002. Odd-year returns were stable in Area 3, low in 1990s relative to the 1980s in Area 4, and high in Area 5 for 199 to 2001. Returns in Area 6 have been low throughout the 1990s for both even and odd-year runs, but picked up substantially for odd-year stocks in 2001.
- *Central Coast*: Even and odd-year pink salmon abundance increased in Areas 7 and 8 since 2000, after a period of low abundance in the 1990s, followed by a recent period of declining abundance, despite

reductions in fishing effort. Even and odd-year pink salmon abundance increased initially in Areas 9 and 10 since fisheries were closed to protect local salmon stocks of concern, but declined in recent years despite a continuation of the fishing closure.

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.

Most of the areas show increased average escapement since 1990 compared to the earlier period, while a few show decreases of about 20-30% (Areas 4 to 7 in even years and Area 10 in odd years). Observed odd-year escapements in Areas 1, 2E, and 2W show strong declines that are partly an artifact of reduced survey coverage.

Figure 1 summarizes recent escapement for statistical areas 1 to 10 relative to the operational targets listed in Table 5. Note that these targets are intended as long-term benchmarks reflecting highly productive stocks. Even-year escapements are near or above the target (>70% of long-term target) except for Area 4 (48%) and Area 10 (59%). Odd-year escapements are near or above the target except for Area 10 (33%).

Figure 2 to Figure 20 show trends in total observed escapement for each statistical area. The following trends emerge:

- *Queen Charlotte Islands* (Areas 1 and 2)*:* Even-year escapements are highly variable in Areas 1, 2E, and 2W, with recent observed declines from peaks in the 1990s. Odd-year escapement have been persistently several orders of magnitude smaller than even-year escapements, but also were low since the early 1970s in comparison to the 1960s. An apparent large increase in Area 2E odd-year escapement in 2005 illustrates the high variability introduced by changes in survey coverage and pink salmon population dynamics (Table 2).
- *North Coast and Central Coast* (Areas 3 to 6): Even and odd-year escapements are highly variable in Areas 3 to 5, with recent peaks for Area 3 and 5, but lower escapements in Area 4 after peaks in the early 1990s. Odd-year escapements in Areas 6 show a recent increase after a low period in the early 1990s, but even-year escapements show a roughly opposite pattern.
- *Central Coast* (Areas 7 to 10): Odd-year escapements in Areas 7 and 8 show a recent increase after a low period in the early 1990s, but even-year escapements show a roughly opposite pattern. Even and odd-year escapements in Areas 9 and 10 spiked between 1998 and 2004, after salmon fisheries were closed to protect local stocks of concern, but have decreased again since 2004.

5.2.2.3 Catch

Table 4 summarizes commercial chum catches by statistical area since 1980. Total catch across all areas has declined substantially compared to the 1980s and early 1990s, with catch reductions especially pronounced in areas with low abundances and low escapements (i.e. 1, 2E, 2W, 9,10).

5.2.2.4 Canadian commercial harvest rate

Figure 1 to Figure 20 show 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. The harvest reduction is most pronounced for Areas 1, 2E, 2W, 9 and 10, where CCHR dropped to less 5% since

2000. 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.

CCHR for all areas is now less than 40% or less, except for even years in Areas 3-5 and in terminal fisheries harvesting locally-observed surpluses near the natal 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 75% or more of the long-term index escapement in most of the systems, with the exception of Areas 5 and 9 in even years, and Area 5 in odd years. In these three cases, survey coverage has been about 50% of long-term index escapement.

These overall declines in survey coverage concurred with changing harvest strategies and substantially reduced catches.

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. For example, the observed peak escapement of even-year pinks in Area 1 was mainly due to a large escapement in the Yakoun system, reaching 10 times the long-term average. Similar aggregate peaks driven by a few abundant component systems occurred in Area 6 – Even and Area 9- Odd in 2000. The opposite scenario also occurred in a few cases, with escapement on typically abundant systems being poor while smaller systems returned around their long-term average: Area 4 – Odd and Area 8 – Odd in recent years.

5.2.2.7 Survival

Pink salmon marine survival estimates are not routinely calculated, as they are for other species using coded wire tags or other mark recoveries. 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 pink broods are somewhat anticipated.

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

5.2.2.8 Size

Size data for pink 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 pink salmon.

6 CONSERVATION MEASURES IN NORTH AND CENTRAL COAST PINK SALMON 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 some 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 Pink salmon conservation measures

Returns and escapements have been highly variable, and annual management responds to observed abundance. No persistent conservation concerns have been identified. One potential emerging concern, however, are the recent low returns on the Kitimat River. The proposed strategy for 2010, when the current brood returns, is non-retention in the recreational fishery on the Kitimat, accompanied by a commercial fishing closure.

6.3 Measures to reduce incidental harvest and by-catch in pink 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 11, Figure 12, Figure 19, and Figure 20).
- 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.

REFERENCES

Aquatic Resources Ltd. 1982. Central Coast Salmon Tagging Report for 1976, 1978 and 1979. Prepared for the Department of Fisheries and Oceans.

Beacham, T.D., Withler, R.E., Murray, C.B., and Barner, L.W. 1988. Variation in body size, morphology, egg size, and biochemical genetics of pink salmon in British Columbia. Trans. Am. Fish. Soc. 117: 109-126.

Canada/US Report. 1965. Report of the Committee on Problems of Mutual Concern related to the Conservation and Management of Salmon Stocks in Southeast Alaska and Northern British Columbia.

Cox-Rogers, S. 1994. Description of a Daily Simulation Model for the Area 4 (Skeena) Commercial Gillnet Fishery. Canadian Manuscript Report of Fisheries and Aquatic Sciences, No. 2256.

Cox-Rogers, S., J.M.B. Hume and K.S. Shortreed. 2003. Stock status and lake-based production relationships of wild Skeena River sockeye stocks. PSARC working paper S2003-09, DFO, Nanaimo. 62p.

DFO. 1968. A summary of the 1966 and 1967 results of the Dixon Entrance Salmon Investigations. Canada Dept. of Fish., Vancouver. Typescript 14 p.

DFO (1999) Central Coast Pink Salmon. DFO Science Stock Status Report D6-03. Available at http://www.pac.dfo-mpo.gc.ca/sci/psarc/SSRs/Salmon/d6-03-99.pdf

DFO (2008a) Escapement database – Areas 1 to 10. Available from Brian Spilsted (DFO – Prince Rupert spilstedb@dfo-mpo.gc.ca)

DFO (2008b) Stream name dataset – North Coast. Available from Barb Spencer (DFO – Prince Rupert, spencerb@dfo-mpo.gc.ca)

DFO (2008c) Morphometric chum dataset – North Coast. Available from Barb Spencer (DFO – Prince Rupert, spencerb@dfo-mpo.gc.ca)

English K., D. Peacock and B. Spilsted (2006) North and Central Coast Core Stock Assessment Program for Salmon. Prepared by LGL Ltd. for Pacific Salmon Foundation and Fisheries and Oceans Canada.

Heard, W.R. (1991). Life History of Pink Salmon. In Pacific Salmon Life Histories (eds C. Groot & L. Margolis), p. 119-230. UBC Press, Vancouver, BC.

Hollett, E.L. 1970. Summary of Salmon Tagging in Dixon Entrance and Hecate Strait in 1968. Can. Tech. Report No. 1970 - 13.

Holtby, B and K Ciruna (2007) Conservation Units for Pacific Salmon under the Wild Salmon Policy. CSAS Research Document 2007/070 (http://www.dfo-mpo.gc.ca/CSAS/Csas/Publications/ResDocs-DocRech/2007/2007_070_e.htm).

Holtby, B., B. Finnegan, D. Chen and D. Peacock. 1999. Biological Assessment of Skeena River coho salmon. PSARC Working Paper S1999-09. Fisheries and Oceans Canada, Nanaimo, BC

Hyatt, K., Johannes, M.S., and Stockwell, M. 2007. Appendix I: Pacific Salmon. In Ecosystem overview: Pacific North Coast Integrated Management Area (PNCIMA). Edited by Lucas, B.G., Verrin, S., and Brown, R. Can. Tech. Rep. Fish. Aquat. Sci. 2667: vi + 55 p.

Leavens, K. A., G.J. Birch. 1984. Analysis of Migrational Timing Data from the Central Coast Tagging Report. Prepared for the Department of Fisheries and Oceans. Aquatic Resources Ltd. Van. B.C.

Pella, J., M. Hoffman, M. Hoffman, S. Hoffman, M. Masuda, S. Nelson and L. Tally. 1993. Adult sockeye and pink salmon tagging experiments for separating stocks in Northern British Columbia and Southeast Alaska, 1982-1985. NOAA Technical Memorandum NMFS-AFSC-18.

Riddell, B. 2004. Pacific Salmon Resources in Central and North Coast British Columbia. Pacific Fisheries Resource Conservation Council. Available on-line at http://www.fish.bc.ca/files/SalmonResources-North_2004_0_Complete.pdf.

Sprout, P.E., and R.K. Kadowaki. 1987. Managing the Skeena River sockeye salmon (Oncorhynchus nerka) fishery – the process and the problems. pp. 385-395 in H.D. Smith, L. Margolis, and C.C. Wood (ed.) Sockeye salmon (Oncorhynchus nerka) population biology and future management. Can. Spec. Publ. Fish. Aquat. Sci. 96. Pages 386 to 389.

Tautz, A.F., B.R. Ward, and R.A. Ptolemy. 1992. Steelhead trout productivity and stream carrying capacity for rivers of the Skeena drainage. PSARC Working Paper S1992-6. Fisheries and Oceans Canada, Nanaimo, BC

TABLES

Table 1. Population structure of North and Central Coast pink salmon

Spawning sites are listed if there are 5 or more observations of pink presence since 1990. This includes quantitative estimates, records of adult presence ("A/P"), and "UNK" records indicating that the inspected stream was frequented by pink, but information was not adequate to estimate total escapement. **Bold font** indicates systems with estimated escapements larger than 20,000 more than once since 1990. 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). Note that pink salmon CUs distinguish between even-year returns and odd-year returns.

Stat Area	Conservation Unit	Management Sub-Area	Spawning Sites
1	North Queen Charlotte Islands (Even, Odd)	Masset	Ain River, Awun River, **Datlamen Creek,** Dinan Creek, **Mamin River,** Mc Clinton Creek, **Yakoun River**
		Naden	Davidson Creek, Lignite Creek, Naden River, Stanley Creek
		Outside Waters	Hiellen River, Jalun River, Sangan River
2 East	East Queen Charlotte Islands (Even, Odd)	Tlell	Tlell River
		Copper	**Copper River**, Macintyre Creek
		Cumshewa	Aero Creek, Braverman Creek, Carmichael Creek, Chadsey Creek, **Mathers Creek**, **Pallant Creek, Skedans Creek**
		Selwyn	Big Goose Creek, Breaker Bay Creek, Dana Creek 1 and 3, Lagoon Creek, Little Goose Creek, Pacofi Creek, Sewell Inlet Creek (Head, L/H 1, L/H 3), Sewell Point Creek, Thurston Harbour Creek, Waterfall Creek
		Darwin	Anna Inlet Creek, Crescent Inlet Creek, Echo Harbour Creek, **Salmon River**
		Juan Perez	Gate Creek, Hutton Head Creek, Marshall Creeks (3), Matheson R/H Creek, Matheson L/H Creek, Sedgwick Creeks (3), **Windy Bay Creek**
		Skincuttle & South	Bag Harbour Creek, George Bay Creek, Sedmond Creek
		Skidegate	Cameron Creek, **Deena River**, East Narrows Creek, Haans Creek, **Honna River**, Indian Cabin Creek, Lagins Creek, Macmillan Creek, Outlook Creek, **Sachs Creek**, Saltspring Creek, Saltspring Bay L/H Creek, Slatechuck Creek, South Bay Culvert Creek, Tarundl Creek, Two Torrent Creek
2 West	West Queen Charlotte Islands (Even, Odd)	West Skidegate	**Browns Cabin Creek**, Buck Channel Creek #3 and 8, , Canoe Pass Creek, Dawson Harbour Creek, Dawson Inlet Creek, North Arm Creek (Head, R/H), West Narrows Creek
		Athlo-Otard	Celestial River, Mace Creek, Mercer Creek, Otard Creek, Steel Creek
		Rennel Sound	Bonanza Creek, Gregory Creek, **Kano Inlet Creek** (Head, Outer), Mountain Creek, Riley Creek, Seal Inlet Creek, Tartu Inlet Creek (Head, Outer), Yakoun Trail Creek
		Englefied Bay	Boomchain Bay Creek, Gold Harbour Creek, Inskip Creek, **Kaisun Creek**, Kootenay Inlet Creek (North, South), Peel Inlet Creek (Head, L/H#2), **Security Inlet Creek** (L/H, R/H)
		Tasu	Fairfax Inlet Creek, Flat Creek, Lomgon Creek, Tasu Creek
		South End	Louscoone Inlet Creek
3	Nass - Skeena Estuary (Even, Odd) / Nass – Portland –	Portland Canal	Belle Bay Creek, **Dogfish Bay Creek,** Donahue Creek, Georgie River
		Observatory Inlet	Illiance River, Kitsault River, Kshwan River, Salmon CoverCreek, **Stagoo Creek**, Wilauks Creek

Stat Area	Conservation Unit	Management Sub-Area	Spawning Sites
3	Observatory (Odd)	Nass River	Burton Creek, **Chambers Creek**, Flewin Creek, **Iknouk River**, Ishkheenickh River, **Kincolith River**, Meziadin River & Lake, Nass Mainstem, Welda Creek
		Portland Inlet	Cedar Creek, Crag Creek, Crow Lagoon Creek, **Khutzeymateen River**, **Kwinamass River**, Larch Creek, Lizard Creek, Manzanita Cove Creek, Mouse Creek, Pirate Cover Creek, Tsamspanaknok Bay Creek
		Work Channel	Ensheshese River, Lachmach River, Toon River
		Coastal	American Bay Creek, Boat Harbour Creek, Brundige Creek, Brundige Creek West, **Sandy Bay Creek**, **Stumaun Creek**, Tracy Creek, Tracy Bay #2 Creek, Whitley Point Creek
4	Nass - Skeena Estuary (Even, Odd) / Lower Skeena River (Odd) / Middle – Upper Skeena (Even, Odd)	Coastal	Big Useless Creek, Chismore Creek, Diana Creek, **Ecstall River**, Humpback Creek, **Khyex River,** Kloiya River, **La Hou Creek,** Little Useless Creek, McNichol Creek, **Moore Cove Creek, Oona River,** Prudhomme Creek, Shawatlan Creek, **Silver Creek,** Spiller River
		Lakelse	**Lakelse River**, Schulbuckhand Creek
		Lower Skeena	Andesite Creek, Dog-Tag Creek, Erlandsen Creek, Exchamsiks River, Exstew River, Gitnadoix River, **Kasiks River**, Middle Creek, **Skeena River – West**, Zymogotitz River
		Kispiox	Cullon Creek, Kispiox River, Nangeese River
		Bulkley – Morice	Morice River
		Middle Skeena	Comeau Creek, Kitwanga River, Kleanza Creek, Shegunia River, Singlehurst Creek
		Babine	**Babine River (Section 4**, Boucher Creek, Fulton River, Pinkut Creek, Tsezakawa Creek
5	Hecate Lowlands (Even, Odd) / Nass - Skeena Estuary (Even, Odd) / Hecate Strait – Fjords (Even, Odd)	Upper Principe / Browning Entrance	End Hill Creek, **Hankin Creek**, Keswar Creek, Sencer Creek
		Lower Principe	Bolton Creek, Curtis Inlet Creek, Deer Lake Creek, Devon Lake System, Keecha Creek, Kooryet Creek, Mikado Lake System, Port Stephens Creek
		Petrel Channel / Ala Pass	Hevenor Inlet Creek, Markle Inlet Creek, Newcombe Harbour Creek, Ryan Creek, **Shaw Creek**, Wilson Creek
		Upper Grenville Channel	False Stewart Creek, Klewnuggit Inlet Creek, **Kumealon Creek**, Kxngeal Creek, Northness Creek, North Kumealon 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, Kitkatla Creek, Phoenix Creek
		Porcher Inlet	**Head Creek**, Porcher Creek, Salt Lagoon Creek, West Creek, Wolf Creek
6	Hecate Lowlands (Even, Odd) / Hecate Strait – Fjords (Even, Odd)	Laredo Channel - Campania Sound	Barnard Creek, Blackrock Creek, Crane Bay Creek, Douglas Creek, East Arm Creek, Fury Creek, **Gil Creek**, **Limestone Creek**, Roland Creek, Talamoosa Creek, **Turn Creek**, **Turtle Creek**, Wale Creek, West Arm Creek, Whalen Lake Creek
		Aristazabal Island	**Borrowman Creek**, Duffey Creek, Eagle Creek, Flux Creek, Kdelmashan Creek, Stannard Creek
		Laredo Sound	Arnoup Creek, Blee Creek, Bloomfield Creek, Dallain Creek, Dally Creek, Fifer Cove Creek, Kwakwa Creek, Nias Creek, Packe Creek, Powles Creek, Price Creek, Pyne Creek, Quigley Creek, Ronald Creek, Steep Creek, Trahey Creek, Tyler Creek
		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 Ck, **Kemano River**, Kiltuish River. Kitlope River, Kowesas River, Paril River, Wahoo R.

Stat Area	Conservation Unit	Management Sub-Area	Spawning Sites
6		Kitimat Arm	Anderson Creek, **Bish Creek**, **Dala River**, **Eagle Bay Creek**, Emsley Creek, **Kildala River**, **Kitimat River** (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, Hugh Creek, Kihess Creek, Kiskosh Creek, **Kitkiata Creek**, Little Tillhorn River, Missed Creek, Pike Creek, **Quaal River**, Riordan Creek, Verney Passage Creek, Weewanie Crk.
7	Hecate Lowlands (Even, Odd) / Hecate Strait – Fjords (Even, Odd)	Mathieson Channel	Bulley Bay Creek, Canyon Creek, Hird Point Creek, **James Bay Creek**, Nameless Creeks, Salmon Bay Creek, Tom Bay Crk
		Finlayson-Mussel Channel	Bolin Bay Creek, Bottleneck Creek, **Carter Rive**r, Duthie Creek, Gorilla Creek, Kitasu Creek, **Korich Creek**, Lagoon Creek, Mary Cove Creek, **Mussel River,** Poison Cove Creek, Watson Bay Creek, Windy Bay Creek
		Kynock	Big Creek, Desbrisay Creek, **Kainet Creek,** Lard Creek
		Gunboat/Seaforth/ Return	Bullock Channel Creek, Deer Pass Creek, Goat Bushu Creek, Kakushdish Creek, Kunsoot River, Kwakusdis River, Sally Creek, Scribner Creek, Walker Lake Creek
		Spiller	Cheenis Creek, **Neekas Creek**, Pine River, Tankeeah River
		Roscoe Inlet	**Clatse Creek**, Lee Creek, Quartcha Creek, Rainbow Creek, Roscoe Creek
		Southern Group / Hunter Island	**Cooper Inlet Creeks**, McLaughlin Bay Creek
8	Hecate Strait – Fjords (Even, Odd) / Homathko-Klinaklini-Rivers-Smith-Bella Coola Dean (Odd)	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
		U. Dean Channel	**Dean River**, Deep Bay Creek, Kimsquit Bay, **Kimsquit River,** Skowquiltz River
		Fisher – Fitz Hugh	De Cosmos Lagoon Ck, Evans Inlet Cks, Four Lakes Ck, Hook Nose Ck, Kiltik Cove Ck, **Koeye River**, Namu River, Sagar Ck
		North Bentinck	Atnarko Spawning Channel, Bella Coola River, Necleetsconnay River, Nieumiamus Creek, Nooseseck River
		South Bentinck	Asseek River, Larso Bay Creek, Taleomey River
9	Hecate Strait –Fjords (Even) / Homathko-Klinaklini-Rivers-Smith-Bella Coola Dean (Odd)	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, Nicknaqueet River, Wannock River & Flats, Washwash Creek, Others
10		N/A	**Nekite River**, Nekite Spawning Channel, Walkum Creek

Table 2. Escapement summary for North & Central Coast pink 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.

EVEN

Total	Year	Total Escapement	Statistical Area 1	2E	2W	3	4	5	6	7	8	9	10
	1960	3,352,841	98,575	370,695	148,230	48,300	251,376	174,400	568,175	112,375	1,571,365	5,850	3,500
	1962	9,801,338	175,675	677,450	97,850	218,325	997,100	442,900	2,822,725	302,300	3,910,088	121,925	35,000
	1964	5,160,270	441,825	138,795	54,625	232,450	1,379,000	217,225	1,509,225	353,650	763,125	68,850	1,500
	1966	5,788,198	1,071,925	509,375	214,875	297,210	644,313	295,350	1,139,500	549,650	939,850	118,650	7,500
	1968	8,408,413	1,335,900	769,343	148,770	214,525	1,702,475	271,700	1,182,300	562,325	2,095,000	111,050	15,025
	1970	4,869,375	432,650	808,360	324,625	224,750	971,800	139,850	753,700	323,365	731,100	144,175	15,000
	1972	6,921,854	329,900	766,950	380,800	244,250	1,765,154	280,725	1,023,900	269,150	1,356,100	502,400	2,525
	1974	3,811,241	201,400	423,171	148,975	84,915	367,605	337,075	400,925	153,425	1,469,900	214,850	9,000
	1976	5,098,924	285,050	615,100	49,371	158,175	693,850	348,450	1,021,288	263,740	1,382,200	259,600	22,100
	1978	5,859,880	217,500	528,385	159,413	401,445	724,597	264,850	853,855	287,710	2,293,475	109,650	19,000
	1980	4,105,969	290,795	305,172	172,078	130,777	745,367	225,825	740,109	229,821	1,127,725	135,800	2,500
	1982	2,756,663	362,000	164,203	113,317	427,135	739,247	70,300	403,265	172,575	195,590	100,000	9,031
	1984	5,122,353	1,213,900	191,850	67,469	531,035	1,037,698	162,450	638,903	170,220	967,210	138,102	3,516
	1986	10,025,070	838,500	703,761	264,502	375,245	2,323,944	313,900	1,433,010	184,288	3,271,535	289,815	26,570
	1988	9,667,848	566,100	572,303	168,203	185,065	828,090	162,000	1,448,818	272,440	5,204,570	242,146	18,113
	1990	9,803,054	1,389,560	876,177	192,840	154,968	2,611,520	202,244	954,619	363,031	2,759,835	257,195	41,065
	1992	8,552,823	994,800	654,261	100,766	196,808	821,950	41,161	700,798	267,194	4,614,400	158,585	2,100
	1994	2,589,654	647,000	501,810	100,159	155,356	242,285	44,725	237,024	193,925	367,790	97,550	2,030
	1996	9,708,002	2,924,000	603,753	156,180	344,860	2,025,648	270,100	974,145	225,371	1,844,345	333,200	6,400
	1998	3,608,677	747,200	524,364	216,127	151,940	272,871	161,250	585,595	166,985	626,245	155,500	600
	2000	5,968,390	465,000	281,755	311,062	322,990	260,481	278,150	1,902,650	189,900	1,621,450	316,455	18,497
	2002	6,881,122	939,003	409,199	269,440	598,264	232,451	409,810	685,400	366,850	2,002,805	866,900	101,000
	2004	3,491,724	177,500	214,965	22,780	542,500	653,350	88,330	662,619	240,580	744,600	144,500	UNK
	2006	1,299,915	250,250	186,218	15,610	129,050	116,367	31,880	253,330	38,680	239,795	38,385	350

Table 2 continued…

ODD

Total	Year	Total Escapement	Statistical Area 1	2E	2W	3	4	5	6	7	8	9	10
	1961	3,942,823	20,000	42,325	8,050	209,375	1,135,994	244,675	670,475	332,975	1,249,004	22,450	7,500
	1963	3,850,875	18,575	115,400	3,700	172,625	987,375	175,275	1,329,750	275,475	748,425	16,775	7,500
	1965	2,703,089	33,950	45,700	35,475	277,100	1,326,629	115,075	509,150	111,535	222,100	18,875	7,500
	1967	1,073,441	150	71,950	6,000	64,865	592,686	22,175	95,525	150,180	66,310	100	3,500
	1969	1,480,449	200	120,425	6,000	45,725	889,474	17,775	105,415	234,585	59,925	525	400
	1971	2,502,122	6,050	26,700	UNK	136,525	1,173,381	80,761	366,450	416,900	257,150	34,205	4,000
	1973	2,022,932	4,000	34,225	UNK	70,786	1,260,186	56,375	233,040	182,650	166,875	9,765	5,030
	1975	2,754,161	3,950	20,365	327	141,758	1,767,907	170,375	309,079	101,850	150,100	87,150	1,300
	1977	2,267,312	4,900	8,580	75	229,155	976,527	110,275	142,690	292,720	434,690	47,600	20,100
	1979	2,768,740	3,250	21,788	601	50,625	515,563	43,000	489,720	441,268	1,123,325	49,350	30,250
	1981	3,090,702	3,650	9,246	434	204,425	1,187,835	121,850	377,395	290,420	737,360	93,050	65,037
	1983	5,805,443	2,130	13,244	516	738,205	2,610,074	81,025	476,817	293,616	1,420,270	124,275	45,271
	1985	7,235,330	1,875	19,985	921	508,855	2,042,150	177,075	1,050,407	328,142	2,793,620	276,700	35,600
	1987	4,943,627	4,500	35,565	42	371,866	3,180,414	127,950	673,643	83,171	383,056	65,187	18,233
	1989	6,959,671	1,300	23,264	77	641,270	4,675,527	178,500	579,398	284,076	522,529	25,624	28,106
	1991	8,547,862	600	14,071	435	388,100	4,797,937	70,160	611,916	245,179	2,399,345	4,986	15,133
	1993	2,797,679	350	18,141	221	314,102	663,888	39,475	277,786	275,828	1,184,713	13,100	10,075
	1995	3,501,746	1,000	3,844	93	349,017	1,641,489	90,900	593,594	148,185	629,099	18,000	26,525
	1997	2,873,538	UNK	3,295	40	216,527	484,476	68,750	298,265	191,675	1,454,210	154,800	1,500
	1999	3,756,316	2,700	2,588	395	464,775	1,095,352	313,450	639,156	182,020	937,230	118,550	100
	2001	7,811,710	1	6,872	59	826,632	1,017,612	395,650	1,611,225	427,460	2,267,100	1,257,640	1,459
	2003	6,708,732	UNK	153	18	841,856	1,517,355	233,825	1,995,375	353,900	1,069,300	646,950	50,000
	2005	5,693,679	UNK	70,064	30	944,415	1,213,770	277,400	1,358,975	222,675	998,550	602,550	5,250

Table 2 continued…

Summary (Rounded)

	Total Escapement	Statistical Area 1	2E	2W	3	4	5	6	7	8	9	10
Before 1990 - Even Years												
Min	2,757,000	99,000	139,000	49,000	48,000	251,000	70,000	401,000	112,000	196,000	6,000	2,000
Avg	**6,050,000**	**524,000**	**503,000**	**168,000**	**252,000**	**1,011,000**	**247,000**	**1,063,000**	**280,000**	**1,819,000**	**171,000**	**13,000**
Max	10,025,000	1,336,000	808,000	381,000	531,000	2,324,000	443,000	2,823,000	562,000	5,205,000	502,000	35,000
Since 1990 - Even Years												
Min	1,300,000	178,000	186,000	16,000	129,000	116,000	32,000	237,000	39,000	240,000	38,000	350
Avg	**5,767,000**	**948,000**	**473,000**	**154,000**	**289,000**	**804,000**	**170,000**	**773,000**	**228,000**	**1,647,000**	**263,000**	**22,000**
Max	9,803,000	2,924,000	876,000	311,000	598,000	2,612,000	410,000	1,903,000	367,000	4,614,000	867,000	101,000
Before 1990 - Odd Years												
Min	1,073,000	150	9,000	40	46,000	516,000	18,000	96,000	83,000	60,000	100	400
Avg	**3,560,000**	**7,000**	**41,000**	**5,000**	**258,000**	**1,621,000**	**115,000**	**494,000**	**255,000**	**689,000**	**58,000**	**19,000**
Max	7,235,000	34,000	120,000	35,000	738,000	4,676,000	245,000	1,330,000	441,000	2,794,000	277,000	65,000
Since 1990 - Odd Years												
Min	2,798,000	0	150	20	217,000	484,000	39,000	278,000	148,000	629,000	5,000	100
Avg	**5,211,000**	**930**	**15,000**	**160**	**543,000**	**1,554,000**	**186,000**	**923,000**	**256,000**	**1,367,000**	**352,000**	**14,000**
Max	8,548,000	3,000	70,000	440	944,000	4,798,000	396,000	1,995,000	427,000	2,399,000	1,258,000	50,000
Change (Average Before/After 1990) - Even Years												
Even	-4.7%	80.9%	-6.0%	-8.3%	14.7%	-20.5%	**-31.2%**	-27.3%	-18.6%	-9.5%	53.8%	69.2%
Odd	46.4%	**-86.7%**	**-63.4%**	**-96.8%**	110.5%	-4.1%	61.7%	86.8%	0.4%	98.4%	506.9%	-26.3%

Note: Observed odd-year declines in Areas 1, 2E, and 2W are strongly driven by changes in survey coverage (e.g. Copper River in Area 2E contributed almost the entire observed escapement in 2005, but was not surveyed for pink abundance in 2003). Escapement monitoring for odd-year pink salmon on the Queen Charlotte Islands has been reduced in recent years as catches declined to less than 7% of the catch level in the 1980s (Table 4).

Table 3. Size summary for North & Central Coast pink 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.

Fork Length (cm)

Area	1974 to 1989 Min	**Avg**	Max	Obs	1990 to 2007 Min	**Avg**	Max	Obs	Avg. Change	Source
1										
2										
3	39	**53**	68	*596*	35	**52**	69	*1,925*	-1.9%	Nass River, Canyon City (1996-2003), Upper Nass escapement surveys (1974,1988,1989)
4	34	**50**	69	*8,468*	22	**50**	84	*17,846*	0.0%	Area 4 escapement surveys (82,88,89,93), Babine Fence (1988-90,1993,1995-98, 2005, 2007), Tyee Skeena Test Fishery (16 years over the period 1974 to 2000)
5					47	**55**	63	*100*		Area 5 ecapement surveys - Kumaleon Creek (1989)
6	44	**55**	67	*196*						Area 6 escapement surveys - Kitimat and Quaal Rivers (1989)
7										
8	46	**55**	69	*99*						Area 8 escapement surveys - Dean River (1984) and Salloomt River (1989)
9										
10										
	Total obs.			9,359	Total obs.			19,871		

Weight (kg)

Area	1974 to 1989 Min	**Avg**	Max	Obs	1990 to 2007 Min	**Avg**	Max	Obs	Change	
1										
2										
3										
4	1.4	2.4	6.4	*15*						Tyee Skeena Test Fishery (1975, 1978)
5										
6										
7										
8										
9										
10										
	Total obs.			15	Total obs.			0		

Table 4. Commercial catch summary for North & Central Coast pink 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, 2E, and 2W listed here includes troll harvests, which are excluded in the calculation of Canadian Harvest Rate shown in the corresponding trend summaries, because the majority of fish are assumed to be passing stocks. ** Total catch for Area 3 is included here, but for calculating Canadian Harvest Rate in the corresponding trend summaries only half of the catch is assumed to be pink salmon originating in Area 3.

			Catch by Statistical Area										
Total Catch	Year	**Total Catch**	1*	2E*	2W*	3**	4	5	6	7	8	9	10
Even Years													
	1980	**6,942,817**	854,739	34,309	124,077	953,592	190,503	485,534	2,897,980	467,678	909,408	22,698	2,299
	1982	**2,422,971**	74,347	18,627	23,120	1,076,681	332,153	86,901	585,836	177,917	40,462	2,830	4,097
	1984	**7,185,651**	1,858,549	62,224	145,329	2,453,921	1,075,866	579,222	616,969	131,544	174,604	82,732	4,691
	1986	**17,204,640**	1,282,284	392,470	137,523	3,465,400	1,427,987	1,503,650	4,653,859	716,912	3,431,948	153,366	39,241
	1988	**21,620,700**	2,231,159	185,564	135,314	716,709	635,257	352,181	7,942,444	421,007	8,713,572	224,596	62,897
	1990	**12,794,268**	2,534,724	360,608	574,977	1,199,002	1,047,215	760,114	1,943,105	383,364	3,652,546	177,180	161,433
	1992	**8,936,625**	1,211,604	42,548	142,728	1,836,751	1,856,595	230,655	566,419	64,949	2,710,927	199,254	74,195
	1994	**1,968,983**	296,802	87,525	76,318	505,337	230,848	48,260	117,840	12,157	562,902	19,840	11,154
	1996	**5,824,214**	1,242,329	26,481	11	1,676,068	1,653,244	299,514	502,701	20,431	402,698	0	737
	1998	**2,325,883**	66,751	150,026	504,013	474,714	18,437	1,414	582,179	7,414	520,935	0	0
	2000	**3,106,971**	66,894	14,741	504,267	506,547	356,391	34,298	1,554,047	2,441	67,344	0	0
	2002	**5,195,529**	25,049	20,935	21,740	2,505,207	505,930	471,981	515,887	95,529	1,033,271	0	0
	2004	**2,238,911**	22,308	44,787	376	1,316,877	177,896	158,347	67,708	122,154	328,458		
	2006	**721,572**	29,901	32,258	41	240,215	327,676	15,823	9,294	4,383	61,981		
Odd Years													
	1981	**6,643,787**	542,157	39,846	122,152	659,131	1,149,772	40,773	1,274,790	980,709	1,658,999	123,146	52,312
	1983	**13,490,721**	327,835	32,367	299,119	7,504,732	669,430	137,022	3,587,990	82,322	811,378	20,540	17,986
	1985	**9,661,701**	924,545	46,925	127,844	2,680,532	1,728,243	313,426	1,522,252	918,449	1,248,817	124,539	26,129
	1987	**10,252,540**	1,643,419	70,108	742,576	3,836,950	1,843,680	396,128	943,233	227,968	412,188	113,771	22,519
	1989	**7,894,889**	1,527,909	50,543	610,994	4,105,633	995,710	334,790	54,352	38,174	161,443	5,213	10,128
	1991	**17,137,945**	1,888,339	17,200	533,561	11,485,325	1,889,986	501,507	535,835	157,687	115,566	2,054	10,885
	1993	**4,860,758**	1,020,005	9,958	536,288	2,365,417	587,340	38,677	10,505	19,319	257,896	2,488	12,865
	1995	**7,983,731**	1,468,539	28,532	344,403	3,990,037	1,576,003	258,850	35,947	38,235	237,292	4,263	1,630
	1997	**2,385,239**	638,821	2,329	45,063	585,020	491,623	28,043	134,858	27,651	427,111	1	4,719
	1999	**5,885,698**	24,608	0	0	5,339,063	312,658	15,657	18,236	50,174	125,302	0	0
	2001	**5,488,948**	132,709	29	246	1,240,248	1,166,335	236,943	1,662,847	244,697	804,894	0	0
	2003	**9,303,004**	70,936	677	2,646	2,486,509	1,299,522	310,875	4,442,994	71,008	617,837		
	2005	**6,807,530**	27,768	482		2,183,329	1,761	187,403	3,905,106	33,301	468,380		

Table 5. Operational Management Escapement Goals (MEG) for North & Central Coast pink 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 2 to Figure 20. Aggregate MEG calculated as the sum of all stream-specific MEG. Stream-specific MEG for major systems are listed in Table 6. 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). * Pink salmon in Areas 1 and 2 follow a pronounced 2-year pattern in abundance, with even year returns several orders of magnitude larger than odd year return. Abundance patterns in the other areas are more variable and less pronounced. Figure 1 plots adjusted escapements relative to the aggregate MEG. Note that pink salmon abundance is 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).

		Operational Management Escapement Goals (MEG) by Statistical Area										
		1*	2E*	2W*	3	4	5	6	7	8	9	10
Aggregate MEG		1,152,000	740,000	327,000	385,000	1,919,000	255,000	1,447,000	444,720	1,520,400	342,450	65,600
Adj. escapement estimate												
Even Years	High	1,375,738	560,670	252,857	614,589	967,709	352,136	1,391,137	313,359	1,769,810	478,077	38,831
	Low	1,375,738	555,064	250,303	544,168	890,292	319,464	1,265,935	307,092	1,769,810	468,419	38,438
Odd Years	High				979,361	2,420,158	425,918	1,727,816	405,828	1,876,400	716,093	22,325
	Low				938,975	1,742,514	370,961	1,640,553	385,332	1,838,872	699,623	21,641
Avg. observed escapement												
Even (1996-2006)		917,159	370,042	165,200	348,267	593,528	206,587	843,957	204,728	1,179,873	309,157	25,369
Odd (1995-2005)					607,204	1,161,676	229,996	1,082,765	254,319	1,225,915	466,415	14,139
Expansion Factors												
Even Years	High	1.50	1.52	1.53	1.76	1.63	1.70	1.65	1.53	1.50	1.55	1.53
	Low	1.50	1.50	1.52	1.56	1.50	1.55	1.50	1.50	1.50	1.52	1.52
Odd Years	High				1.61	2.08	1.85	1.60	1.60	1.53	1.54	1.58
	Low				1.55	1.50	1.61	1.52	1.52	1.50	1.50	1.53

Table 6. Operational Management Escapement Goals (MEG) for North and Central Coast pink 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 2 to Figure 20. MEGs are available for all of the streams listed in Table 1, but only major systems with MEG ≥ 25,000 are included below.

Stat Area	System	MEG
1	Yakoun River	650,000
	Davidson Creek	100,000
	Naden River	100,000
	Jalun River	50,000
	Lignite Creek	50,000
	Mamin River	50,000
	Datlamen Creek	30,000
	McClinton Creek	30,000
	Ain River	25,000
2E	Deena River	100,000
	Copper River	75,000
	Mathers Creek	75,000
	Skedans Creek	75,000
	Windy Bay Creek	70,000
	Pallant Creek	45,000
	Matheson L/H Creek	30,000
	Honna River	25,000
	Salmon River	25,000
	Tlell River	25,000
2W	Security Inlet Creek L/H	40,000
	Browns Cabin Creek	36,000
	Kaisun Creek	30,000
	Riley Creek	30,000
	Bonanza Creek	25,000
	Gregory Creek	25,000
3	Kwinamass River	100,000
	Iknouk River	60,000
	Khutzeymateen River	40,000
	Ishkheenickh River	30,000
4	Lakelse River	500,000
	Kitwanga River	250,000
	Skeena River - West	250,000
	Babine River	200,000
	Kispiox River	200,000
	Lower Kitsumkalum River	100,000
	Moore Cove Creek	75,000
	Morice River	50,000
	Oona River	30,000
	La Hou Creek	25,000
5	Kumaleon Creek	50,000
	Pa-aat River	30,000
6	Kitimat River	220,000
	Quaal River	200,000
	Kemano River	150,000
	Khutze River	70,000
	Kitkiata Creek	50,000
	Dala River	40,000
	Turn Creek	40,000
	Arnoup Creek	35,000
6	Bish Creek	30,000
	Canoona Creek	25,000
	Gil Creek	25,000
	Green River	25,000
	Soda Creek	25,000
7	Kainet Creek	75,000
	Mussel River	50,000
	Neekas Creek	35,000
	Clatse Creek	30,000
8	Bella Coola River	1,000,000
	Koeye River	100,000
	Kwatna River	100,000
	Dean River	35,000
	Kimsquit River	25,000
9	Chuckwalla River	100,000
	Johnston Creek	90,000
	Clyak, Young & Neil Creeks	50,000
	Kilbella River	50,000
10	Nekite River	65,000

Table 7. Communal Licence Harvest Targets for pink salmon in 2008 IFMP.
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	Pink Salmon Harvest Target
Queen Charlotte Islands	1 & 2	Haida		2,500
			Total	2,500
North Coast	3	Gitanyow	Nass River	185
	4	Yekooche	Babine Area	0
	4	Lake Babine	Babine Lake and Area	1,000
	4	Gitksan & Wet'suwet'en	Skeena River & Bulkley River	25,000
	4	Kitselas	Skeena River	2,000
	4	Kitsumkalum	Skeena River	1,000
	3 & 4	Lax Kw'alaams		1,000
	4	Metlakatla		500
	5	Kitkatla		600
	6	Gitga'at		140
	6	Haisla		1,000
	6 & 7	Kitasoo		1,500
			Total	33,925
Central Coast	7 & 8	Heiltsuk		6,000
	8	Ulkatcho	Bella Coola & Atnarko	350
	8	Nuxalk	Bella Coola & Atnarko	5,000
	9	Wui'kinuxv		400
	10	Gwa'sala-'Nakwaxda'xw		20
			Total	11,770

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 pink salmon escapement.

	Stat Area	Streams*	Number of stream inspections** 2004	2005	2006	2007	Avg Inspections/ Stream
Queen Charl. Isl.	1	10	6		14		1.0
	2	66	68		95		1.2
North Coast	3	43	155	126	97	78	2.7
	4	44	73	49	33	52	1.2
	5	32	77	66	59	50	2.0
	6	92	81	80	71	74	0.8
Central Coast	7	64	180	48	206	191	2.4
	8	50	99	37	73	106	1.6
	9	20	14	18	34	12	1.0
	10	3	2	2	4	5	1.1
	Total	**424**	**755**	**426**	**686**	**568**	**1.4**

* 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

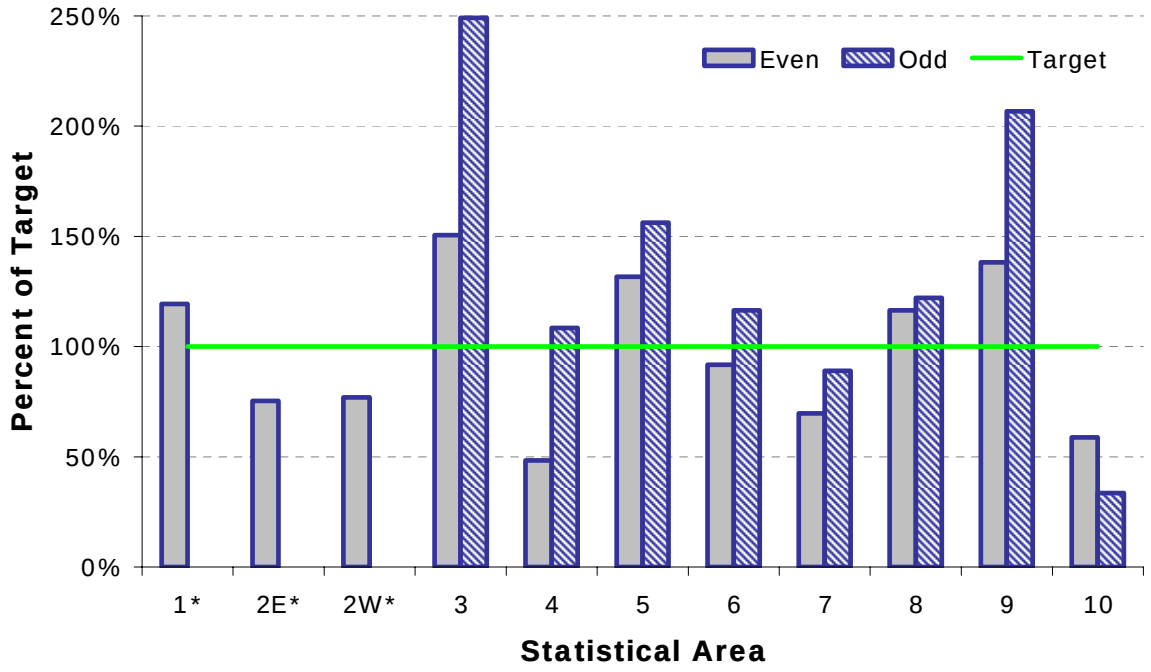

Figure 1. Recent escapement compared to Operational Management Escapement Goals (MEG). Adjusted escapements by statistical area (10-year average) are plotted as a proportion of the Aggregate MEG (Table 5), which are simply the sum of stream-specific MEG (Table 6). Note that stream-specific MEG are intended as long-term benchmarks reflecting highly productive stocks (i.e. high sustainable yields) and that pink salmon abundance is 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). Section 4.3 briefly describes how observed escapements are adjusted to account for observer efficiency and variations in survey coverage.

* Pink salmon in Areas 1 and 2 follow a pronounced 2-year pattern in abundance, with even year returns several orders of magnitude larger than odd year return.

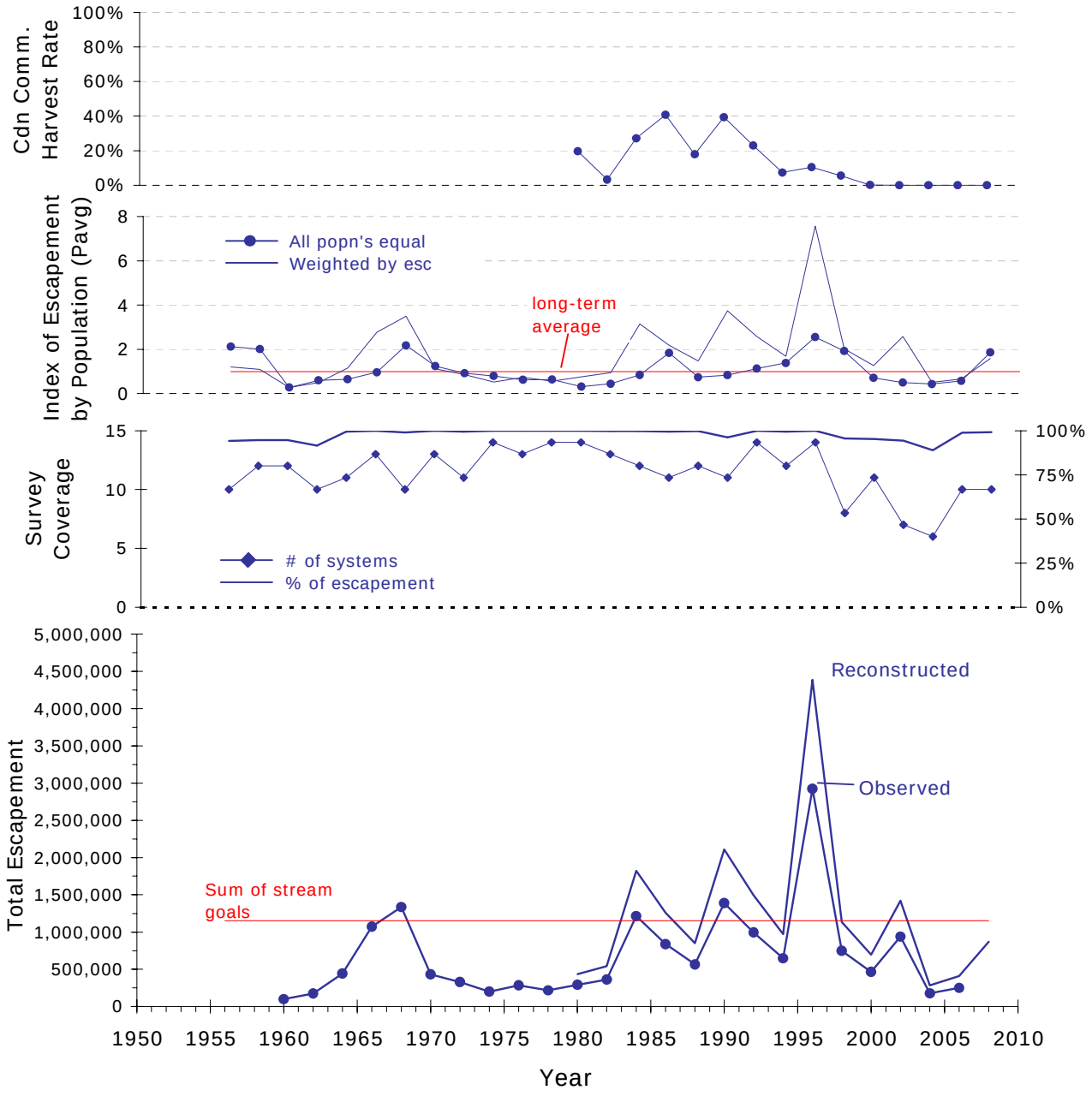

Figure 2. Trend summary for North & Central Coast pink salmon - Area 1 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

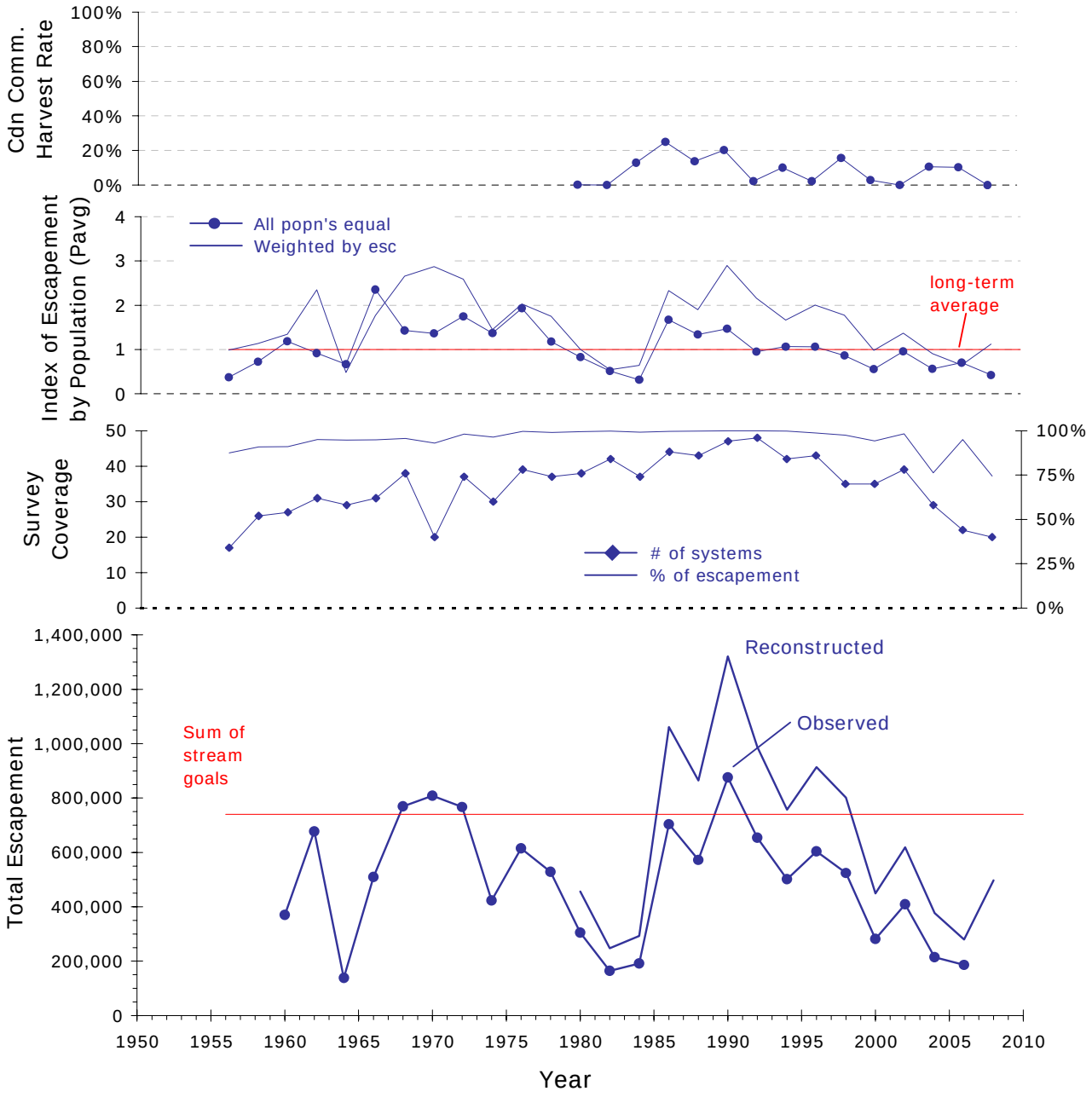

Figure 3. Trend summary for North & Central Coast pink salmon - Area 2E Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

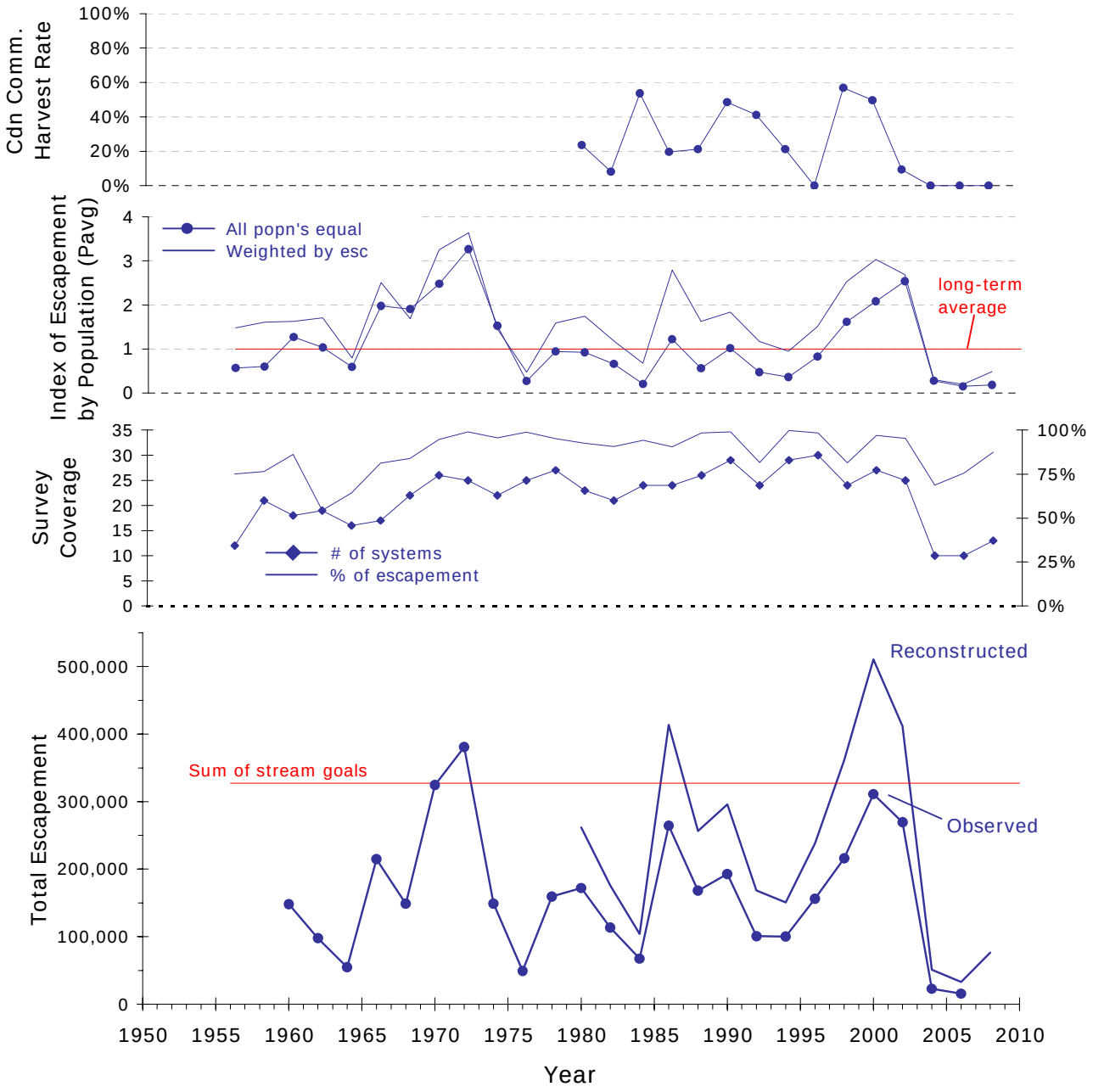

Figure 4. Trend summary for North & Central Coast pink salmon - Area 2W Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

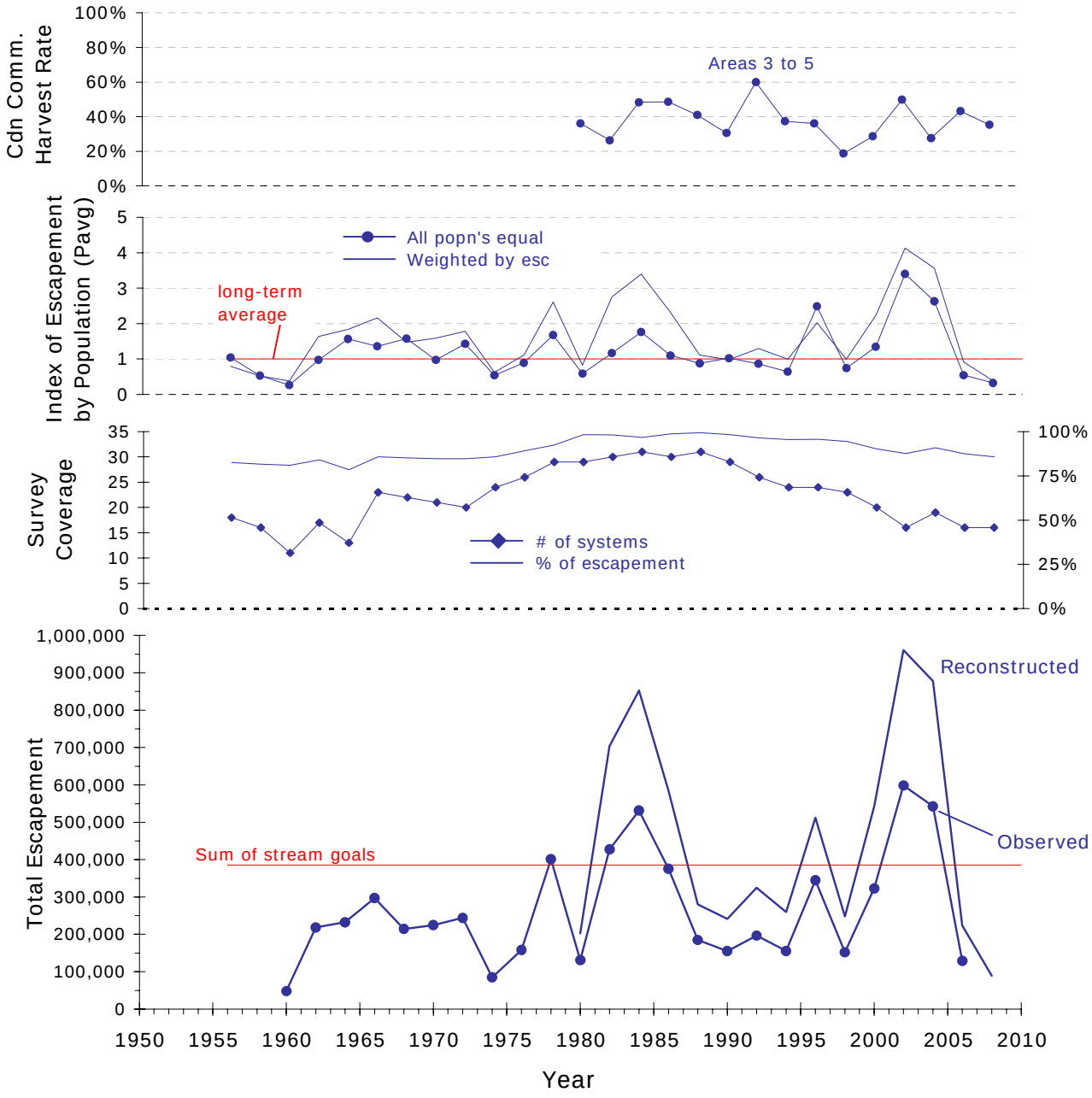

Figure 5. Trend summary for North & Central Coast pink salmon - Area 3 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

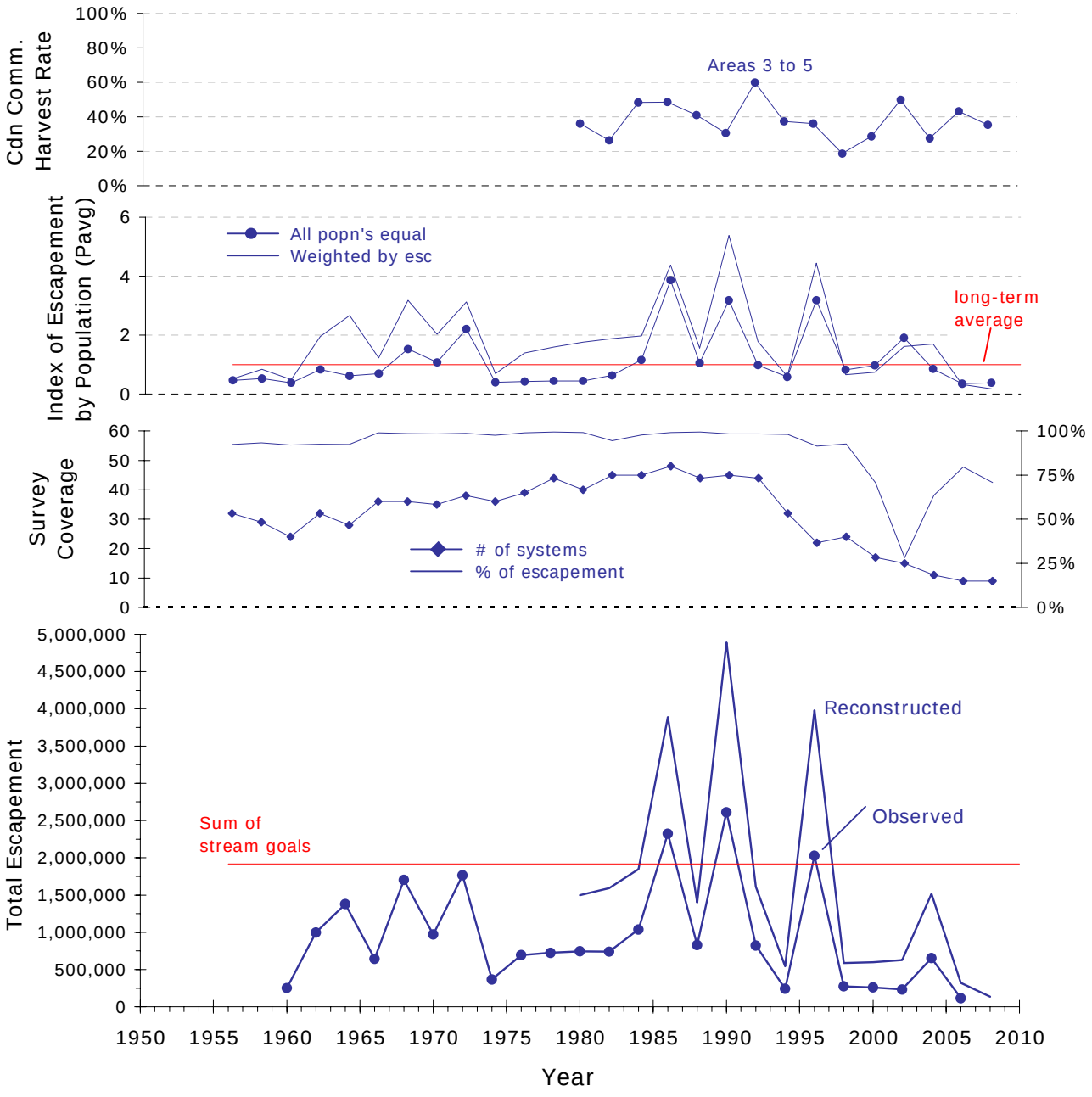

Figure 6. Trend summary for North & Central Coast pink salmon - Area 4 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

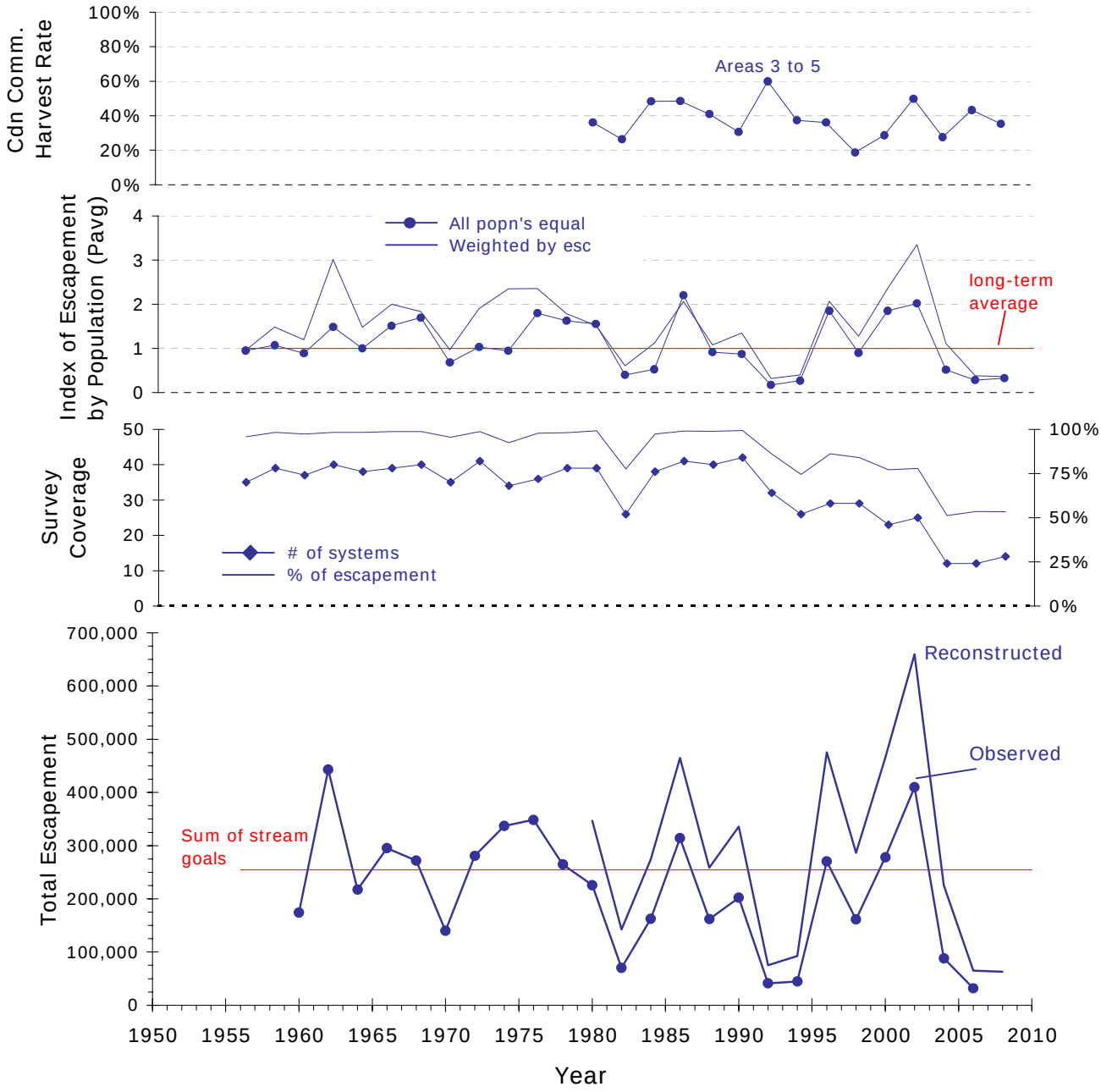

Figure 7. Trend summary for North & Central Coast pink salmon - Area 5 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

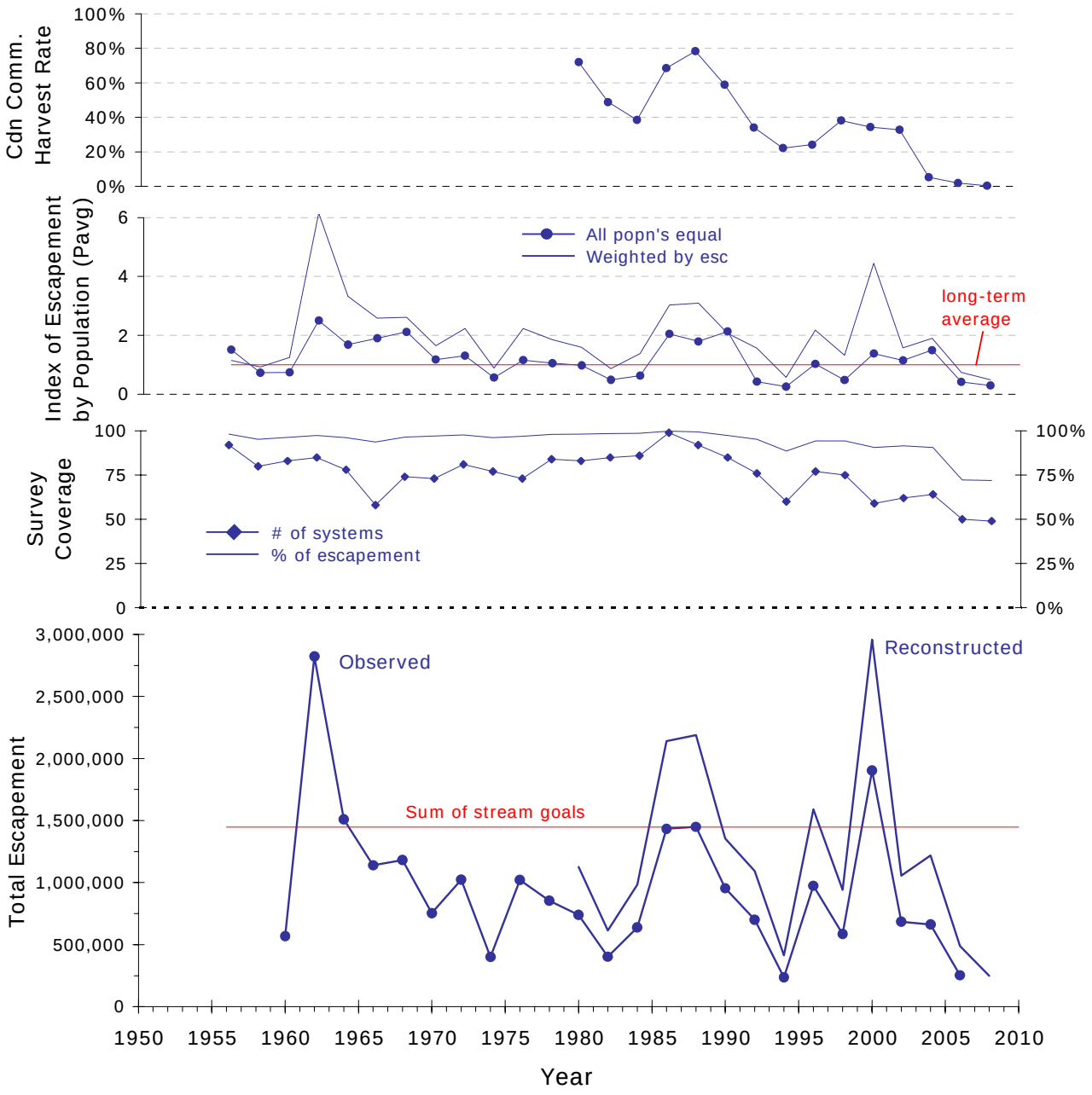

Figure 8. Trend summary for North & Central Coast pink salmon - Area 6 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

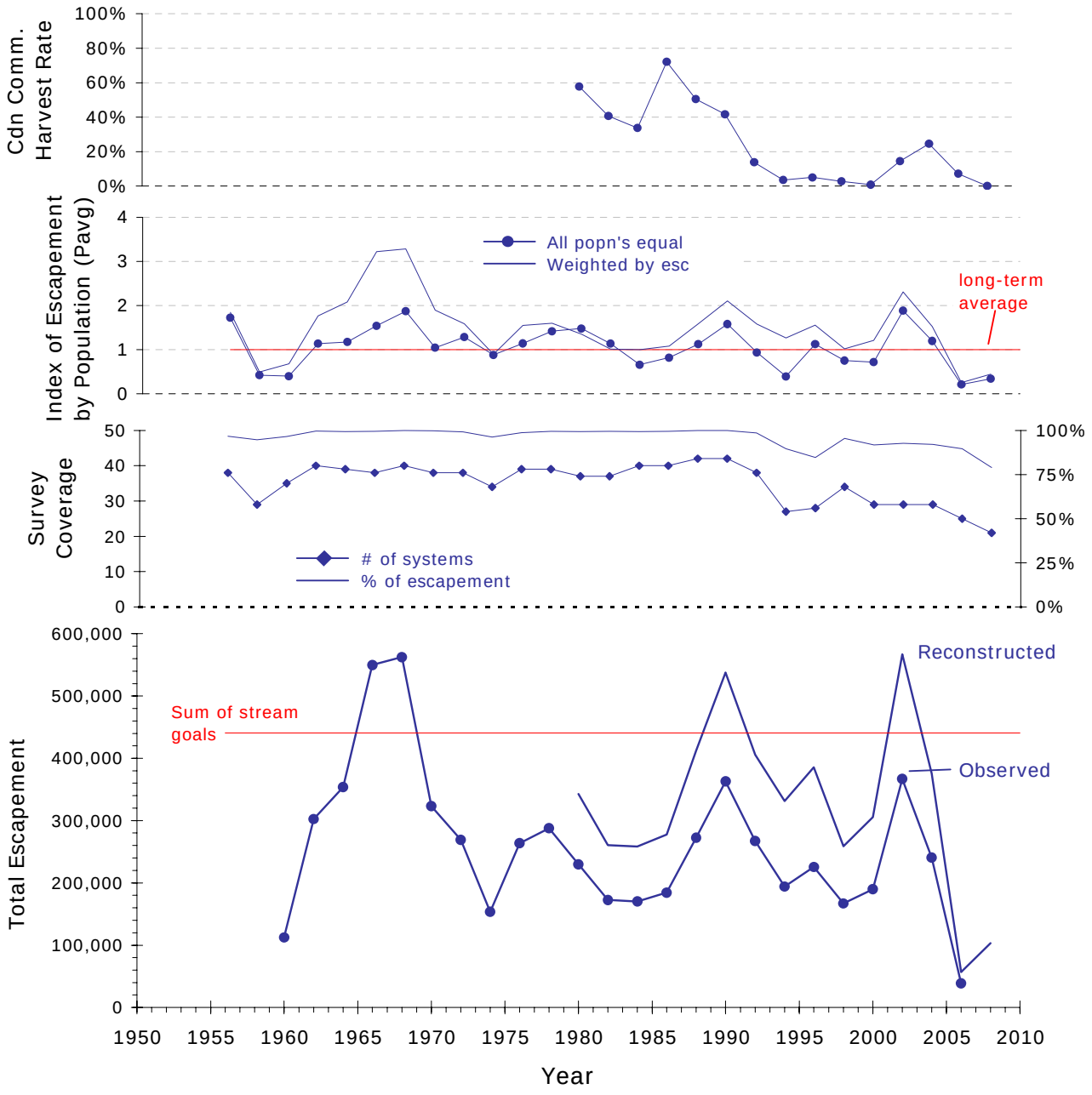

Figure 9. Trend summary for North & Central Coast pink salmon - Area 7 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

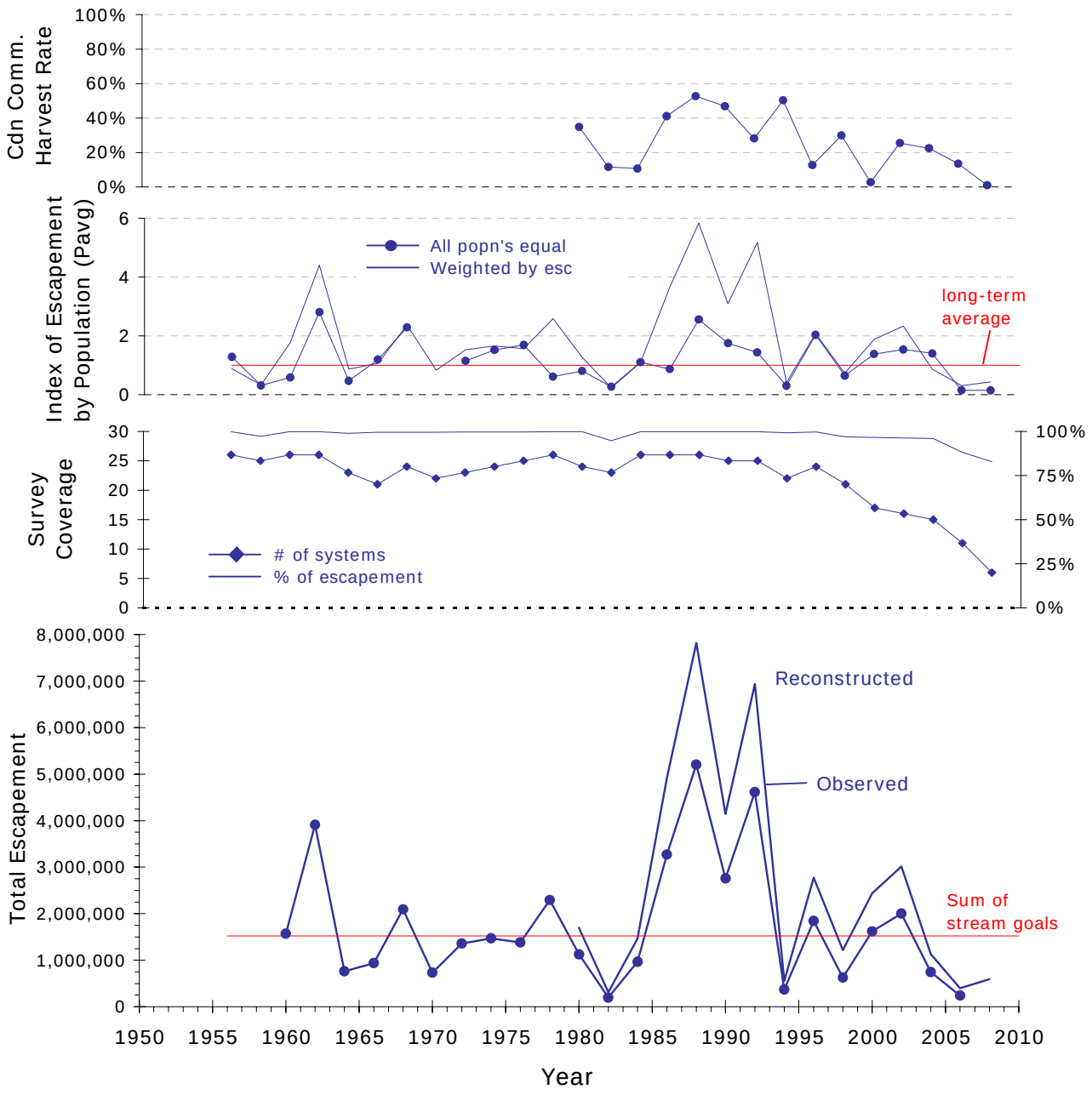

Figure 10. Trend summary for North & Central Coast pink salmon - Area 8 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

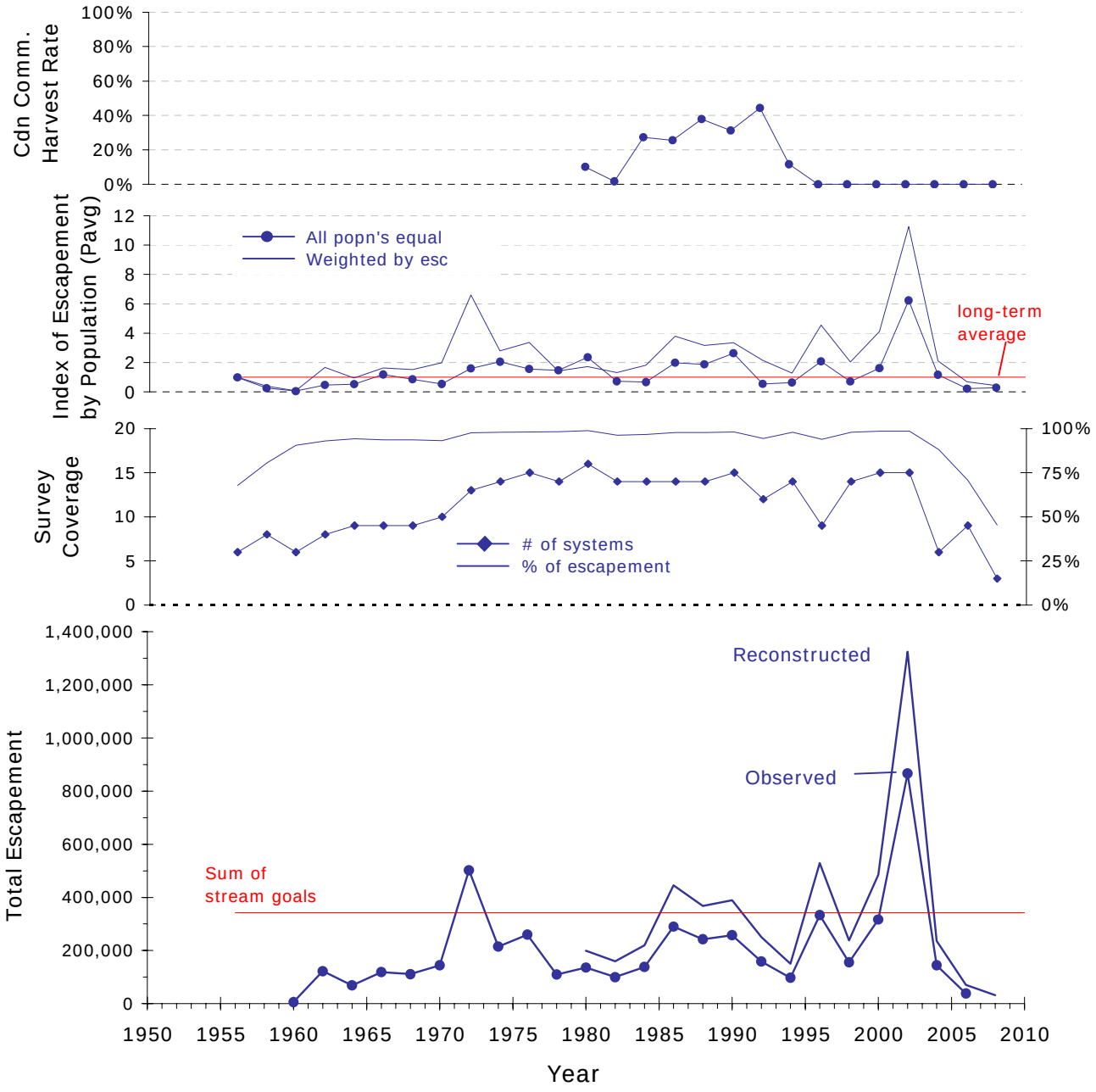

Figure 11. Trend summary for North & Central Coast pink salmon - Area 9 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

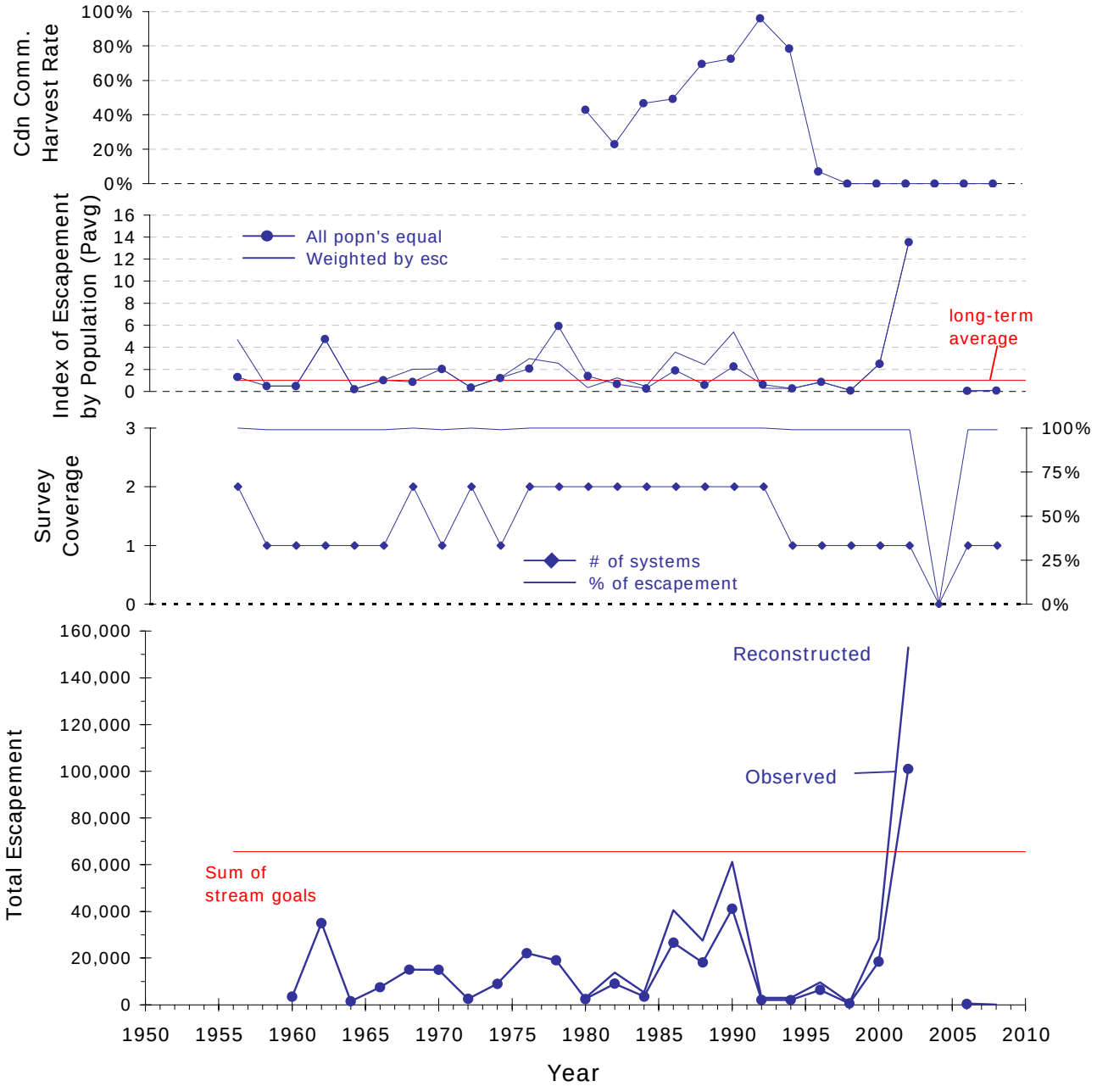

Figure 12. Trend summary for North & Central Coast pink salmon - Area 10 Even
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

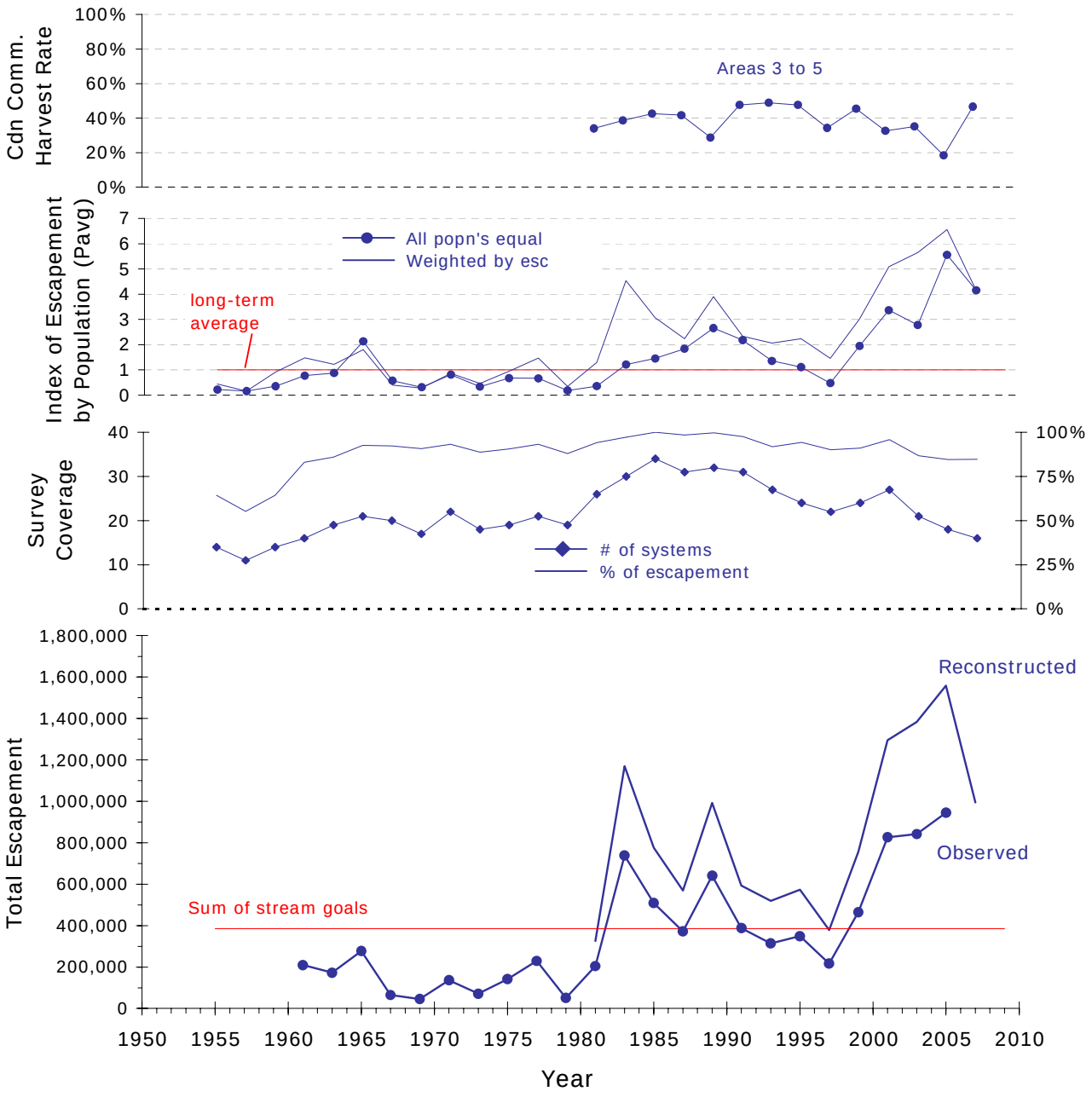

Figure 13. Trend summary for North & Central Coast pink salmon - Area 3 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

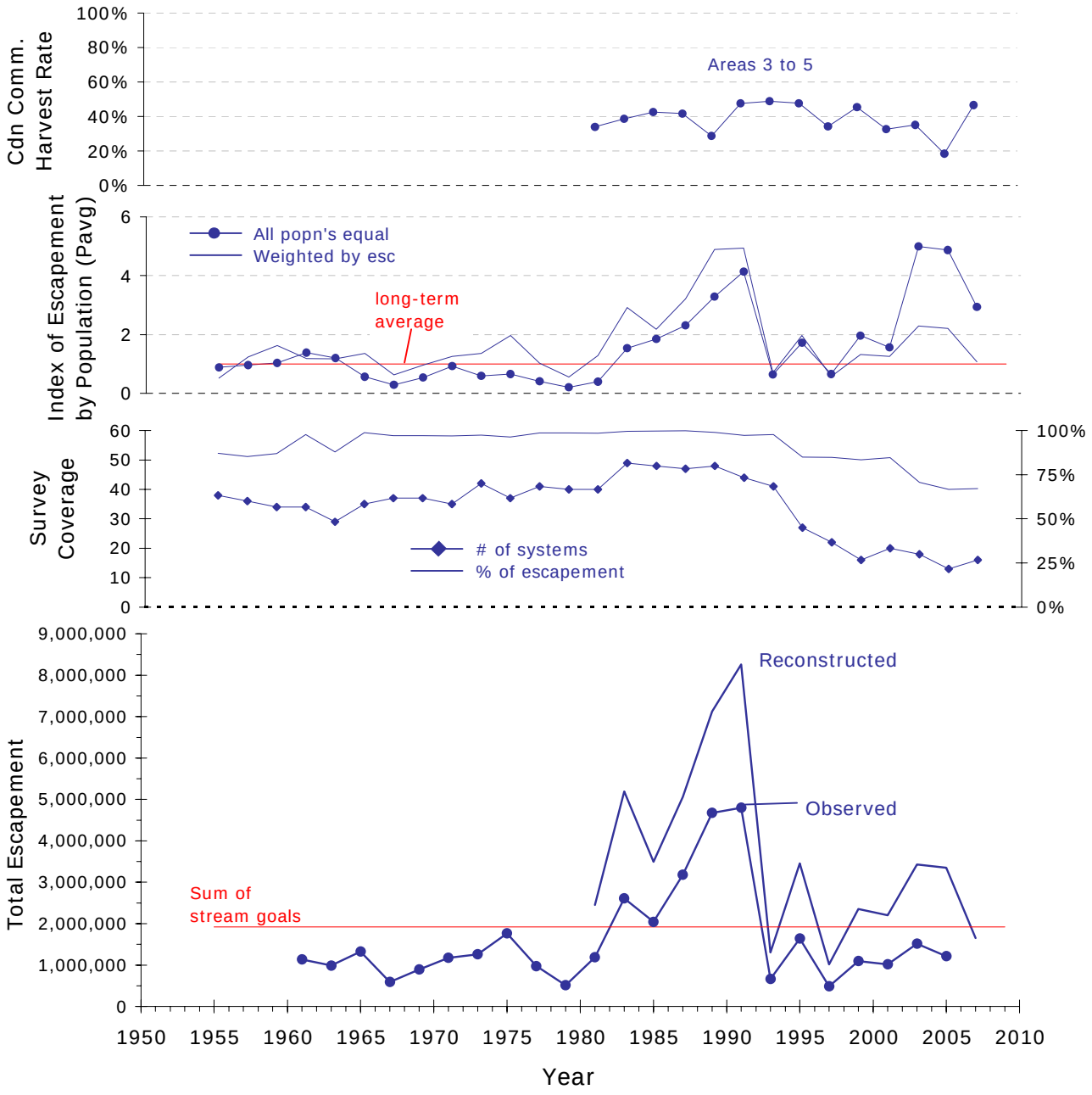

Figure 14. Trend summary for North & Central Coast pink salmon - Area 4 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

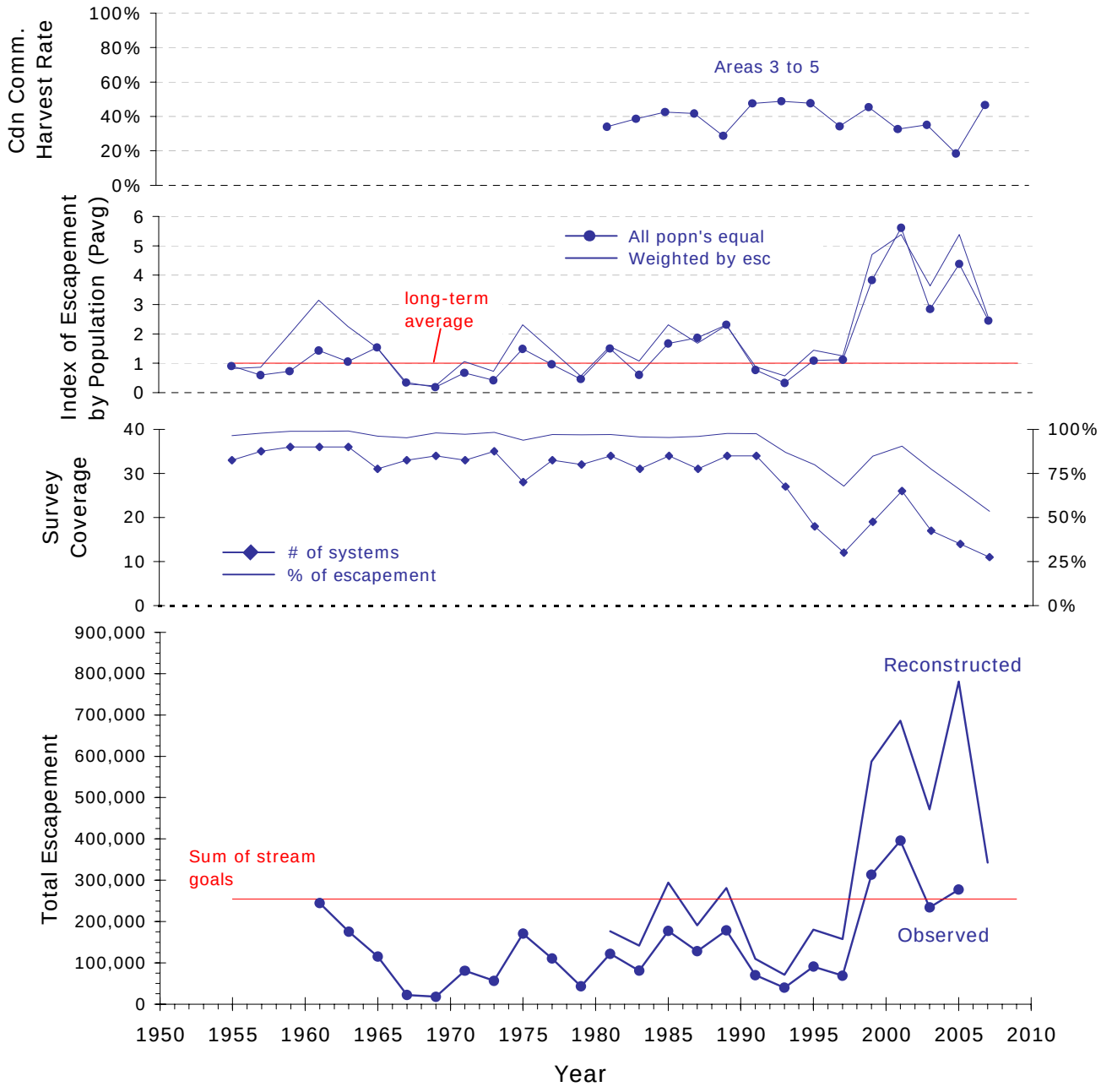

Figure 15. Trend summary for North & Central Coast pink salmon - Area 5 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

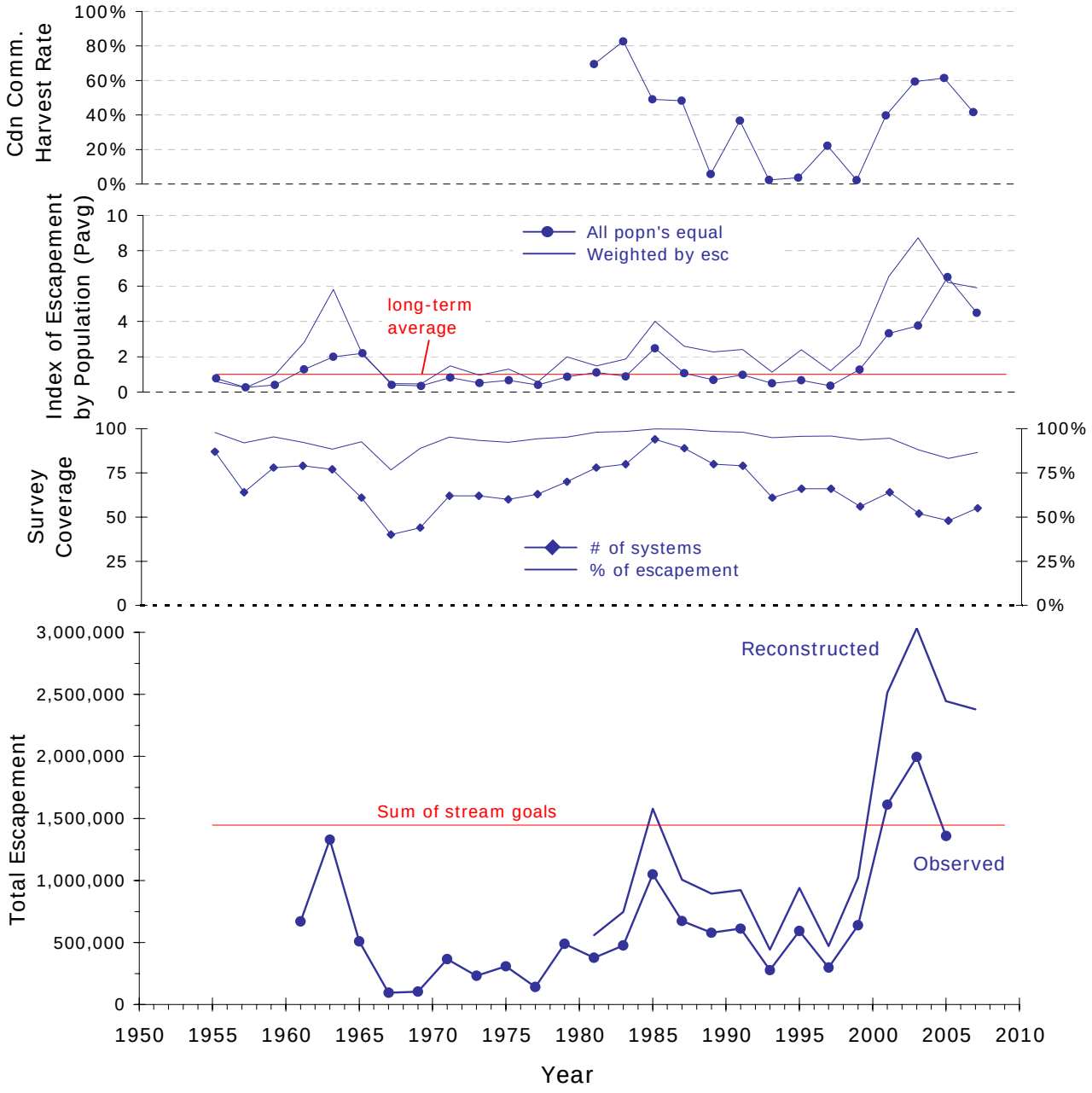

Figure 16. Trend summary for North & Central Coast pink salmon - Area 6 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

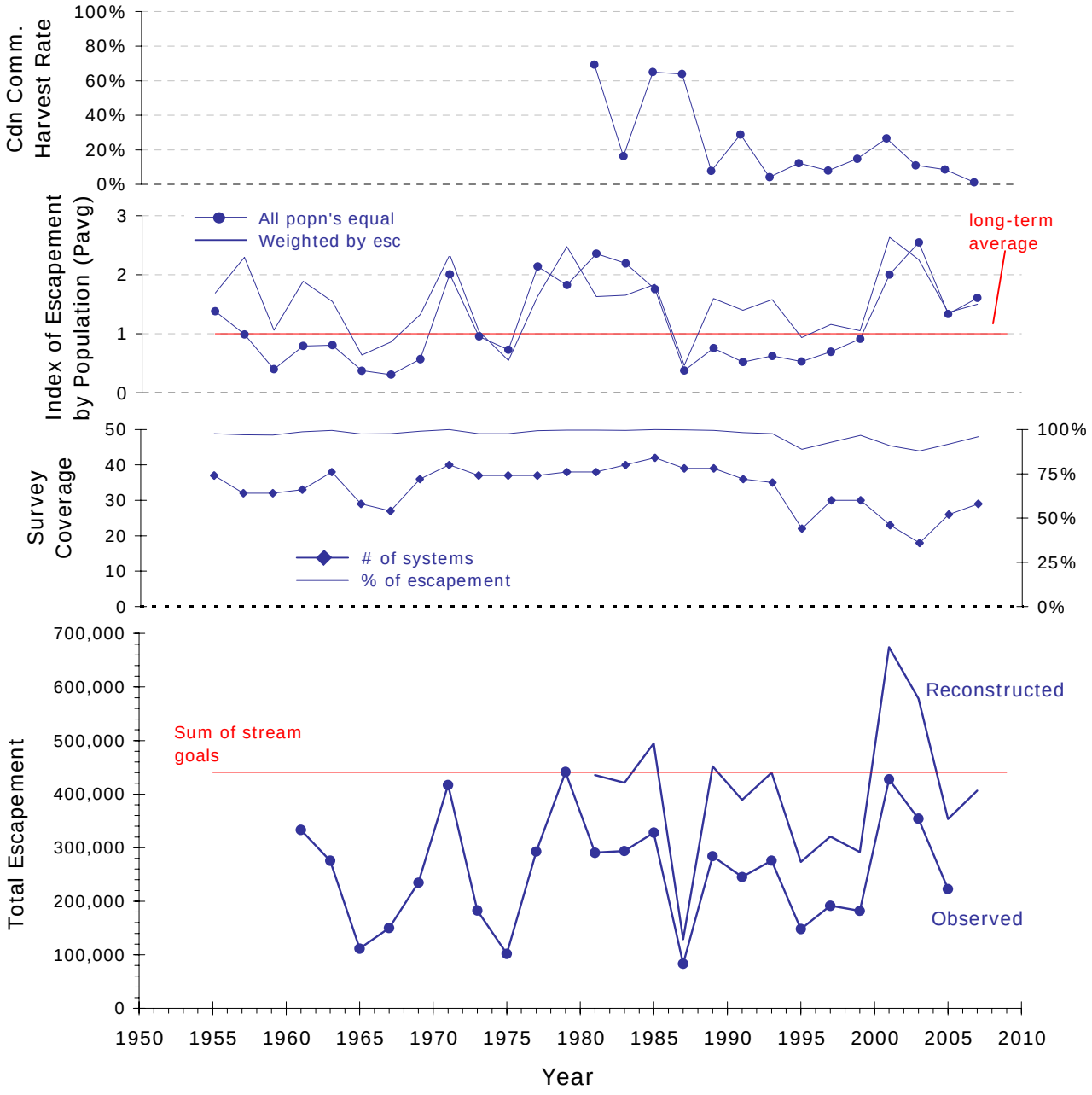

Figure 17. Trend summary for North & Central Coast pink salmon - Area 7 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

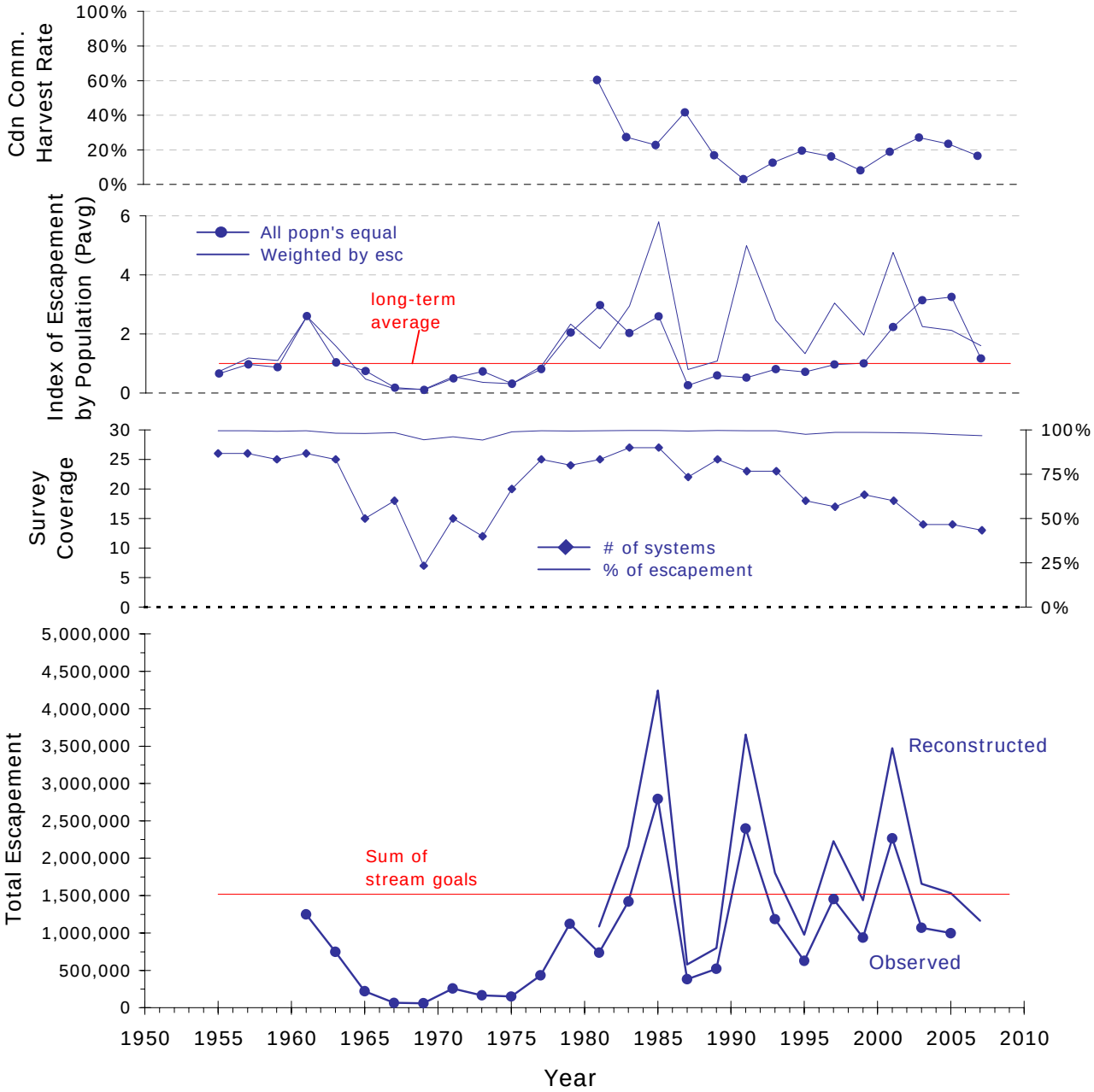

Figure 18. Trend summary for North & Central Coast pink salmon - Area 8 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

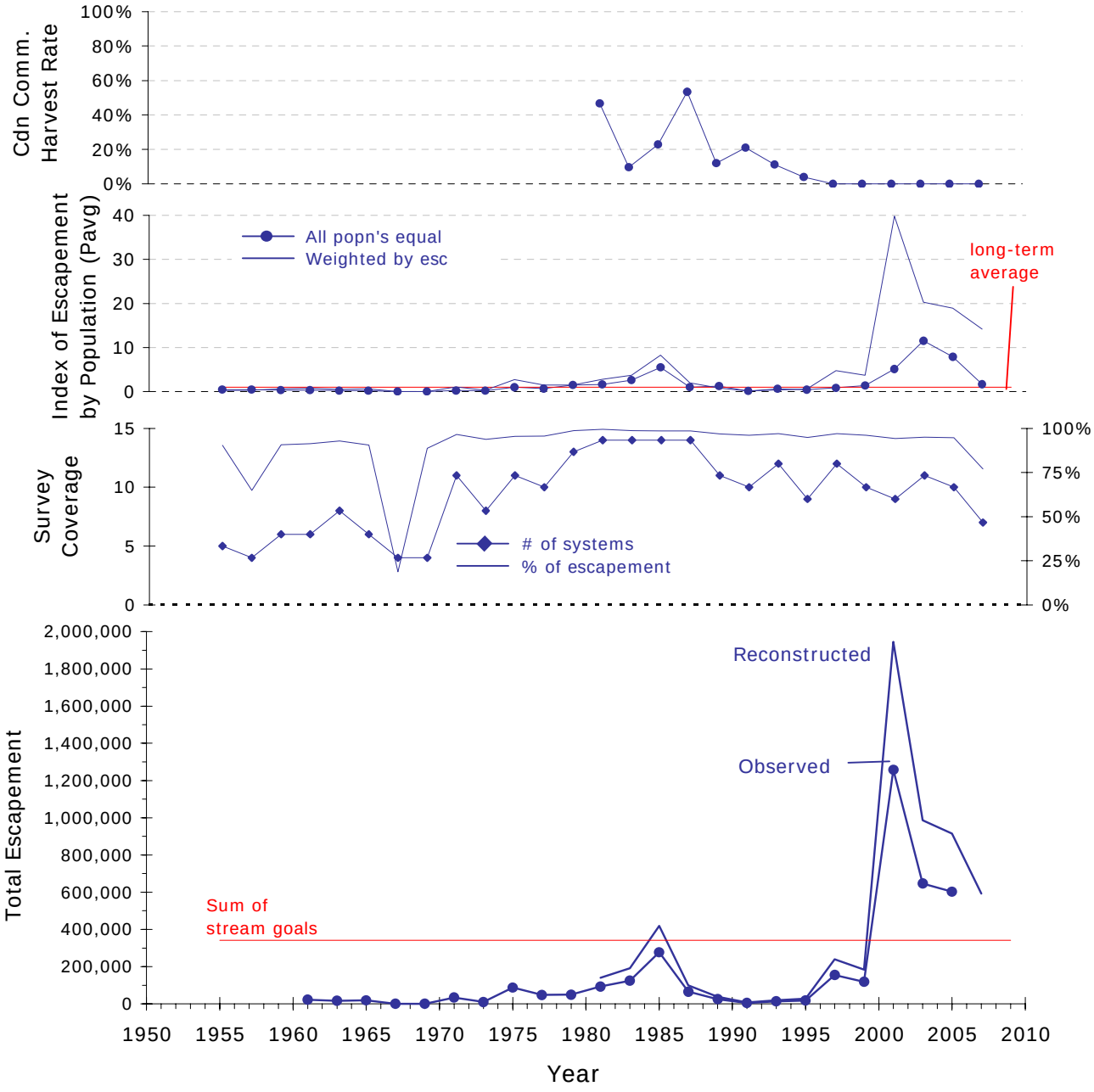

Figure 19. Trend summary for North & Central Coast pink salmon - Area 9 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.

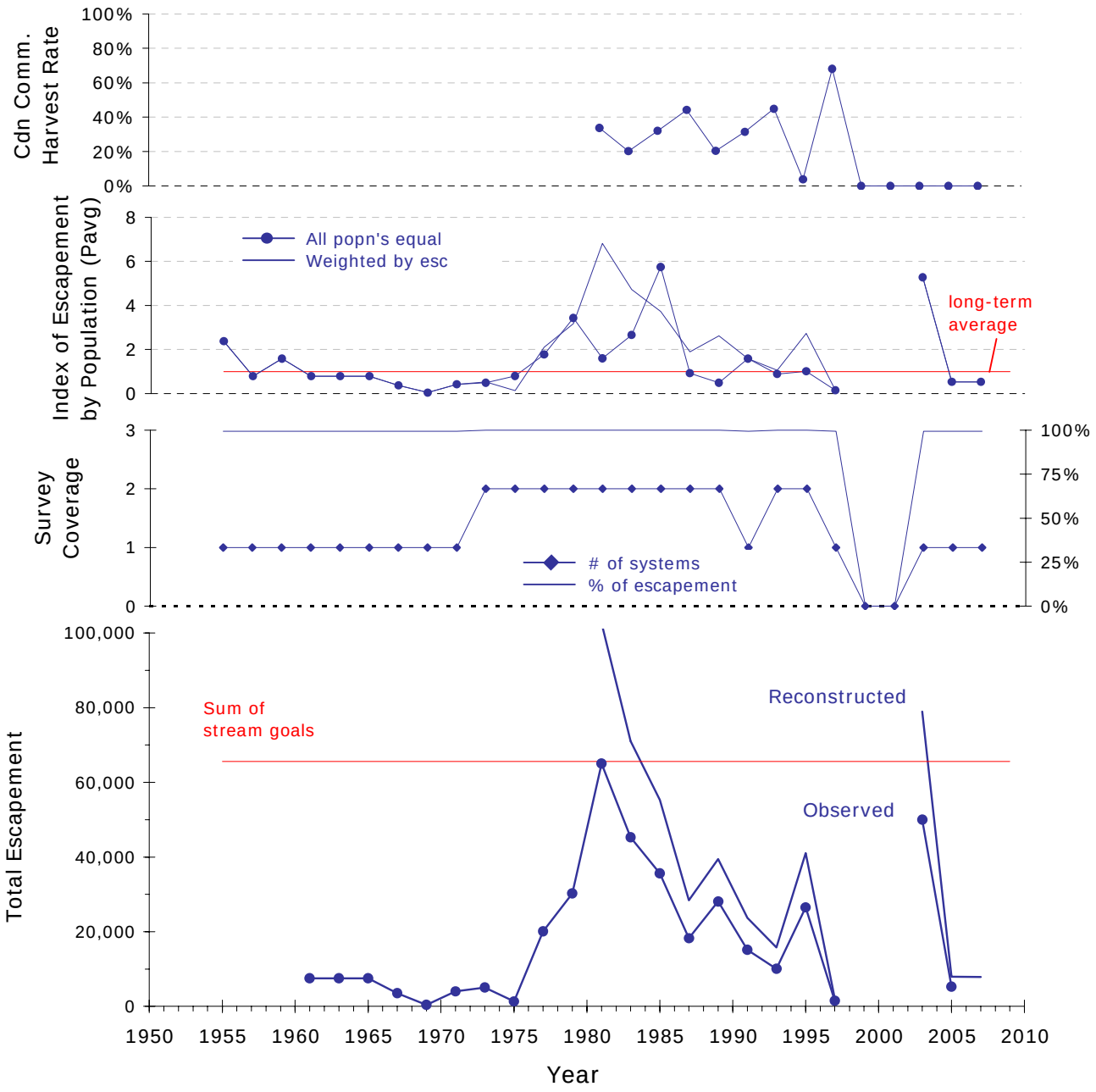

Figure 20. Trend summary for North & Central Coast pink salmon - Area 10 Odd
Data sources and assumptions for each of the time series are summarized in Section 4.3.3.