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CERTIFICATION UNIT PROFILE:
FRASER RIVER PINK SALMON

by

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ABSTRACT

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

RÉSUMÉ

To be included

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 Fraser River 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>.

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1 INTRODUCTION

1.1 Stocks covered in this document

This profile covers all pink salmon spawning in statistical Area 29, which includes the Fraser River mainstem and Fraser River tributaries. Only odd year runs produce significant returns in the Fraser River; even-year runs are very small, and therefore are not assessed or managed. Most pink production (~70%) occurs in the Lower Fraser from the Fraser Canyon downstream to the outlet, with major populations originating from the Harrison River, the Vedder-Chilliwack watershed, the Fraser Canyon, the Seton-Anderson watershed, the Thompson River, the Upper Fraser mainstem, and the Lower Fraser mainstem.

Pink salmon runs originating in the Fraser approach areas (Area 28) are covered in the *2009 Profile for Inner South Coast Pink Salmon (excluding Fraser)*. These include persistent populations observed in Squamish-Howe Sound, Burrard Inlet-Indian Arm, and Boundary Bay/Georgia Strait.

1.2 Fisheries covered in this document

This profile covers commercial, First Nations and recreational fisheries harvesting odd-year pink salmon in the Lower Fraser and approach areas.

Fraser River stocks are fall-run stocks that migrate in from September to December. Fraser pink are intercepted in commercial fisheries that occur in the Fraser River Panel Area (Areas 121-124 Troll, Area 20 Net, Areas 17-18 and 29 Troll and Area 29 Net) and non-Panel Areas (Areas 1-10 Troll and Net, Areas 11-16 Troll and Net, Areas 124-127 Troll) and Fraser River (Below the Mission Bridge).

First Nations harvest local pink stocks in marine areas (Areas 12 to 20 and 121 to 126; Area 29-1-7) and throughout the Fraser River and its tributaries in food, social and ceremonial (FSC) fisheries and in economic opportunity fisheries. Long-term harvest patterns depend on the local abundance of all salmon species. 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 Fraser River watershed. For odd-year runs, pink salmon retention is generally allowed on the Fraser River downstream of the Alexandra Bridge, on the Stave River, Harrison River downstream of Highway No. 7 Bridge, and the Chilliwack River. Effort is concentrated on the Fraser mainstem and the Chilliwack River.

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

Pink salmon are also caught in test fisheries in Areas 123-127, 16, 20, 29.

This profile covers fisheries on the Fraser and in approach areas in detail. The mixed-stock fisheries in Johnstone Strait and in the Strait of Georgia are covered in the profile for Inner South Coast pink salmon (excluding Fraser).

2 BACKGROUND AND STOCK OBJECTIVES

2.1 Life history

2.1.1 Stock units

2.1.1.1 Definition of stock units for Fraser River 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.

Fraser pink salmon (*Oncorhynchus gorbuscha*) follow a strict 2 year life cycle, such that even-year runs and odd-year runs are functionally distinct. In odd years, the Fraser River supports the largest run of pink salmon in British Columbia, with total escapement averaging 5.8 million (1959-2007), and a peak escapement of 23 million in 2003. Pink salmon production and returns in even years are negligible.

Pink salmon spawn in over 100 streams in the Fraser watershed. Spawning is concentrated in the lower river, from the Fraser Canyon downstream to the Fraser River outlet, but populations are established in the Upper Fraser as well.

Fraser River pink salmon are managed as a single aggregate, with some difference in migration timing for component populations. The early run group includes stocks that spawn in the Fraser River mainstem between Hope and Chilliwack, Fraser Canyon tributaries, Thompson River, Seton Creek and upper Fraser mainstem and tributaries. The late run group includes stocks that spawn primarily in Fraser River tributaries below Hope, with the Harrison and Chilliwack rivers supporting the largest populations in this group (Table 1).

Pink salmon also spawn in other watersheds in the Fraser approach areas, with persistent populations observed in the following systems:

- *Squamish-Howe Sound*: Spawning populations are observed in the Cheakamus River, Elaho River, Mamquam River, Stawamus River, and Squamish River, with the escapements of 100,000 or more historically recorded in the Cheakamus, Mamquam, and Squamish rivers.
- *Burrard Inlet-Indian Arm*: Tributaries that support pink salmon include Lynn Creek, MacKay Creek, Seymour River, Capilano River (Brothers Creek), and Indian River. Most of these populations are persistent at low abundance levels (<1000), except for the Indian River with a relatively large productive potential and a recent upward trend in escapement.

- *Boundary Bay/Georgia Strait*: The Campbell River and Nicomekl River support small but persistent populations of pink salmon.

Non-Fraser pink salmon contribute 1% or less to pink salmon harvests in Area 29. These non-Fraser stocks are covered in detail in the *2008 Profile for Inner South Coast Pink Salmon (excluding Fraser)*, including trends in escapement, exploitation rate, and survey coverage.

Fraser pink salmon are first intercepted in the mixed-stock fisheries that occur in Johnstone Strait, Strait of Georgia and Juan de Fuca Strait as they migrate back to their spawning grounds. All pink salmon that migrate through these waters are managed passively due to the significant conservation measures in place to protect co-migrating stocks of concern (Late run sockeye, Cultus sockeye, Interior Fraser coho, and Interior Fraser steelhead).

When pink salmon reach the Fraser River they are intercepted by commercial, First Nations and recreational fisheries in the approach areas and in the Fraser River. In this area, the management unit is the Fraser aggregate, with a total escapement target of 6 million. Pink fisheries on the Fraser are based on in-season run sizes estimated by several test fisheries in approach areas and on the Fraser River (i.e. Whonnock and Cottonwood), as well as the Mission hydroacoustic system. Statistical areas and sub-areas are designated to fine-tune the implementation of fisheries (e.g. area closures to reduce incidental harvest of weak stocks).

2.1.1.2 Conservation units for Fraser River 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 *2009 Pink and Chum Management Summary* summarizes the intent, development, and regional implementation of the *Wild Salmon Policy*, including the development of status benchmarks for each CU. Formal evaluations of CU status have not been completed, but there have been regular status assessments of Fraser River pink salmon (Section 5.1).

Holtby and Ciruna (2007) developed a comprehensive approach for identifying conservation units of anadromous Pacific salmon, based on a combination of the ecological context, the life history of each population, and genetic populations 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) grouped Fraser pink salmon into a single conservation unit based on their evolutionary lineage, life history, productivity, and ocean migrations. Table 1 lists the corresponding management areas and spawning sites. A complete and up-to-date list of sites for each conservation unit is available at http://www-comm.pac.dfo-mpo.gc.ca/pages/consultations/wsp/CUs_e.htm.

Non-Fraser pink salmon in the approach area are grouped with the *East Howe Sound – Burrard Inlet* CU (Squamish, Howe Sound, Burrard Inlet, Indian Arm) or the *Georgia Strait CU* (Boundary Bay/Georgia Strait).

Pink salmon escapements are evaluated at the level of management aggregates and CUs to assess population trends. For Fraser pink salmon these two groupings coincide. Populations within a CU are assumed to experience similar survival conditions. Fishery management actions are taken to address conservation of the entire CU, with the objective of ensuring spawner abundance is distributed across populations within the area.

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 5 (p. 127) shows locations with records of odd-year pink salmon.
- Table 2 (p. 128) summarizes pink salmon presence in each of the *Joint Adaptive Zones*.
- 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

Indicator stocks are not used for pink salmon in the Fraser watershed.

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, and some have been published in peer-reviewed journals:

- 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 southern regional group of odd-year pink salmon which includes the Fraser and Thompson Rivers, Northeast Vancouver Island and the south coast to Loughborough Inlet.
- 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 pink 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

The Fraser River supports the largest run of pink salmon in British Columbia, with total production increasing from an average 5.5 Million in the 1960s to an average of 14 Million in the 1990s.

Average total escapement since 1959 is 5.8 million, with a peak of 23 million in 2003. Escapements since 2001 have exceeded 8 Million (Table 2, Figure 1).

Fraser River pink salmon abundance follows pronounced 2-year cycles with large abundances in odd-numbered years. Pink abundance is negligible in even-numbered years, and is therefore not assessed or managed.

Pink salmon tend to spawn closer to the ocean than most other Pacific salmon species. They generally are not capable of passing waterfalls, cascades, or high-velocity barriers.

2.1.2.2 Age / size / fecundity

All Fraser River pink salmon remain in the ocean for one winter and return to spawn as two year olds (Heard 1991). This life history is identified as 2₀ in the Gilbert-Rich age designation system.

Fraser pink salmon are relatively small, with mean observed fork lengths ranging from 52.5 cm to 57.6 cm for males, and 50.3 cm to 53.7 cm for females. Size and weight of Fraser pink salmon have decreased as average run size and escapement increased (Table 3).

Mean fecundity of Fraser pink salmon has ranged from about 1,500 to 1,900 eggs per female, with a slight decrease as average run size and escapement increased (Table 3).

2.1.2.3 Migration timing

Fraser River pink fry emerge from the gravel as early as February and migrate downstream from February through June with peak migration generally occurring from mid-April to early May. Similar to other species of Pacific Salmon, pink salmon migrate out of the Strait of Georgia over a relatively short time period, although there is evidence some populations may remain in the Strait until September (Sweeting, personal communication). The majority of juvenile pink salmon tend to exit the Strait of Georgia through Johnstone Strait en-route to offshore waters and the Gulf of Alaska. In their first year in the North Pacific, pink are primarily located along the coast of North America and into the Gulf of Alaska (Heard, 1991).

Adult return migrations are of considerable distance and most Fraser pink salmon migrate through the Johnstone Strait and to a lesser extent through Juan de Fuca Strait.

Adults return to the Strait of Georgia from August through September and migrate directly into the Fraser River en-route to natal spawning areas where the peak of spawning occurs in mid October.

There are three geographically-based run timing components within the Fraser River. The mean spawning date of the earliest group of populations (Lillooet) is Sept. 27th (early Fall). The mean spawning date of the latest group of populations (Lower Fraser) is October 22nd (late fall). The remaining populations within the Fraser spawn on average around Oct 11th (mid-Fall).

2.2 Stock enhancement activities

2.2.1 Enhancement approach

DFO leads or supports enhancement activities to:

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

In addition, some enhancement activities provide stock assessment information.

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

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

- Section 3.2.5 describes the regional approach to salmon enhancement, reviews the history of the *Salmon Enhancement Program* (SEP), summarizes coast-wide pink and chum enhancement activities, and briefly discusses enhancement in the context of the *Wild Salmon Policy*.
- Section 2.4.2 describes the regional approach to monitoring and assessing BC pink and chum salmon, including estimation of enhanced contributions to chum harvest and escapement.
- Section 2.5.2 describes the regional approach to salmon harvest and explains conservation measures implemented in fisheries that target enhanced chum (e.g. cap on total exploitation rate, terminal fisheries).

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

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.

Currently, Fraser pink salmon populations do not have significant fishing pressures due to conservation measures implemented to protect co-migrating salmon stocks of concern (i.e Late run sockeye and Cultus sockeye, Interior Fraser coho and Interior Fraser steelhead) during the pink migration periods. Pink populations in the Fraser watershed are abundant and do not require any significant enhancement to maintain population abundance for conservation, ecosystem function, habitat capacity, or harvesting.

Enhancement activities focus on supplementation, and contribute less than 5% of the total Fraser River production.

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

2.2.2 Fraser River pink enhancement facilities

Recent pink salmon enhancement activities on the Fraser include:

- artificial spawning channel on Weaver Creek
- some hatchery enhancement of Chehalis River

Transplants of Indian River or Mamquam River stock to river systems run by community groups, including: Alouette River and Coquitlam River in the past (have enough returns to each river now); Kanaka Creek and Brunette River.

2.3 Fisheries intercepting Fraser River 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.

Historically, Fraser River pink salmon have been harvested primarily by purse seine vessels operating in Areas 12-13, 16 and 20 (up to 8.5 million in 1983). In addition, a troll fleet operated in Area 121-127 and to a lesser extent in Areas 11-13, 16 and 29 (as high as 3 million in 1981). Smaller quantities of pink salmon were harvested by gillnet vessels in Areas 11-13, 16, 20 and 29 (<700,000 in 1971). Fraser River pinks have also been harvested in the United States Panel Area Waters (Washington State Management Areas 4B, 5, 6, 6C, 7 and 7A) consistent with the Pacific Salmon Treaty and managed by the Fraser River Panel.

Figure 2 summarizes catch trends for these fisheries since 1989.

2.3.2 First Nations

First Nations target local salmon stocks for food, social and ceremonial (FSC) purposes throughout the Fraser River. 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 Fraser First Nations. Fisheries are concentrated in the lower river mainstem, using drift nets from the river mouth to Mission, and beach seines from the Mission to the Chilliwack confluence. Fishing opportunities are structured as a combination of FSC fisheries and Economic Opportunity fisheries, depending on in-season estimates of abundance and coordinated with commercial openings.

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.

Section 6.3 of the *2008 Integrated Fisheries Management Plan for Salmon – South Coast* identifies communal licence harvest targets of 125,000 pink salmon for Lower Fraser First Nations, and 500 pink salmon for Middle and Upper Fraser First Nations. Note that actual numbers of fish on some communal licences are still in negotiation, and therefore these numbers 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.

Lower Fraser First Nations also target sockeye, pink and chum salmon in Economic Opportunity (EO) fisheries. These fisheries only occur when a commercial Total Allowable Catch has been identified, and are triggered by commercial openings. EO fisheries can take place in all of the Lower Fraser area, from the mouth to Sawmill Creek, using beach seines, dip nets, drift nets, or set nets. All EO fisheries have a mandatory landing program for monitoring of catches. Weekly fishery reports for Fraser River First Nations back to 2004 are available at http://www.pac.dfo-mpo.gc.ca/fraseriver/firstnations/firstnationsLF_e.htm. These reports document openings, gear types, and catches.

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](http://www.ops2.pac.dfo-mpo.gc.ca/xnet/content/fns/index.cfm?pg=fishery_search&lang=en&ID=recreational).

Retention of pink salmon in recreational fisheries on the Fraser River is generally permitted in the following waters, subject to annual conservation measures:

- Fraser River downstream of the Alexandra Bridge;
- Stave River;
- Harrison River downstream of Highway No. 7 Bridge; and
- Chilliwack River.

The initial daily limit for pink retention is two per day, which is reviewed and potentially amended as in-season run size estimates become available.

Detailed assessment reports for recreational fisheries in the Fraser watershed are available at http://www.pac.dfo-mpo.gc.ca/fraserriver/recreational/recfisherystudies_e.htm.

2.3.4 Commercial

Fraser pink are intercepted in commercial fisheries that occur in the Fraser River Panel Area (Areas 121-124 Troll, Area 20 Net, Areas 17-18 and 29 Troll and Area 29 Net) and non-Panel Areas (Areas 1-10 Troll and Net, Areas 11-16 Troll and Net, Areas 124-127 Troll) and on the Fraser River (below the Mission Bridge).

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

Fraser pink salmon are also caught in test fisheries in Areas 12 and 13 (Johnstone Strait), 16 (Texada Island), 20 (Juan de Fuca), and 29 (Whonnock and Cottonwood).

This profile covers fisheries on the Fraser in detail. The mixed-stock fisheries in Johnstone Strait and in the Strait of Georgia are covered in the profile for *Inner South Coast pink salmon (excluding Fraser)*.

The Area 29 commercial fishery takes place on the Fraser River downstream of Mission, the Fraser estuary, and adjacent waters of Georgia Strait. Section 3.3.1 describes the management approach.

2.4 Objectives

2.4.1 Regional objectives

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

The provisions of these laws, treaties, and policies form the basis for long-term objectives that shape the management of North Coast and Central Coast chum and the fisheries that harvest them.

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

- Chapter 1 summarizes the legal and policy context for the management of Pacific salmon, with a section for each of the acts and policies listed above.
- Section 2.3 reviews long-term objectives and explains the use of management reference points for BC pink salmon.
- 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 *South Coast Integrated Fisheries Management Plan for Salmon*, which are available at <http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/MPLANS/MPlans.htm>. Draft versions are publicly available each spring through the Salmon Consultation Website at http://www-ops2.pac.dfo-mpo.gc.ca/xnet/content/consultations/salmon/sapdefault_e.htm.

2.4.2 Conservation objectives for Fraser River 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 Fraser pink salmon, these fundamental objectives translate into a cautionary approach to fisheries management, with a focus on identifying coordinated fishing opportunities across all salmon species based on in-season abundance estimates and conservation measures that limit encounters of non-target species and minimize impacts on species of concern.

Specific conservation objectives in Fraser pink fisheries include:

- Time and area net restrictions to limit encounters of non-target stocks and species to minimize fishery impacts.
- 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.

Fisheries on the Fraser and in approach areas are managed each year to achieve a management escapement goal of 6 Million, subject to harvest constraints due co-migrating salmon stocks of concern. Management reference points have been implemented to formalize the annual planning and implementation process. Table 5 lists the reference points and Section 3.2 describes implementation guidelines.

2.4.3 Management objectives for Fraser River 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). Time and area closures, as well as selective fishing techniques, are used to protect specific non-target populations or species of concern.

2.4.4 Performance measures

Performance measures for Fraser River pink salmon generally relate to escapement and terminal harvests:

- Annual escapement is the main performance measure for Fraser River pink salmon. Formal Limit Reference Points (LRP) or Target Reference Points (TRP) have not yet been developed. However, an operational *Management Escapement Goal* (MEG) of 6 Million pink salmon has been identified.
- Performance relative to genetic diversity objectives is measured in terms of the distribution across spawning sites in the CU, as well as the proportion of returns from wild and enhanced populations.
- For hatcheries, performance is measured in terms of broodstock targets and releases, which are reported in the annual *Integrated Fisheries Management Plans*, for all but smaller Public Involvement projects.
- Post-season performance reviews are compiled annually. These reviews report catch and escapement statistics and describe whether or not the fishery met objectives. Post-season reviews are included in the annual *Integrated Fisheries Management Plans*. Detailed post-season reviews from the PSC Fraser River Panel are available at http://www.psc.org/publications_annual_fraserreport.htm.

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

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

3 MANAGEMENT FRAMEWORK

3.1 Regional approach to salmon harvest

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

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

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

- Section 2.4 outlines monitoring and assessment programs.
- Section 2.5 describes planning and implementation of Pacific salmon fisheries, including long-term decision guidelines, access controls, and conservation measures.
- Section 2.6 compares the three types of compliance mechanisms in place for Pacific salmon fisheries: incentives, education, and enforcement.
- Section 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 Fraser River pink salmon

The primary management tool for limiting exploitation rate or meeting escapement targets for Fraser 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 Pacific Salmon Treaty, signed in 1985 by Canada and the United States, established the Pacific Salmon Commission (PSC), its Panels, and the framework for managing Fraser River pink salmon in an integrated international system. The PSC, guided by the principles and provisions of the Treaty, establishes general fishery management regimes for international conservation and harvest sharing of

Fraser River pink salmon in the Fraser Panel Area. The PSC's Fraser River Panel, consisting of Canadian and American representatives, is responsible for developing pre-season fishing plans and implementing in-season management of the Fraser River pink salmon to meet the following objectives: 1) spawning escapement goals, and 2) agreed international and domestic catch allocations to Canada and the United States.

Note: This document covers only pink salmon fisheries in the Fraser and in approach waters. Fisheries harvesting Fraser pink salmon in Johnstone Strait and Strait of Georgia are described in the profile for *Inner South Coast Pink salmon (excluding Fraser)*. There are no directed commercial fisheries for Fraser River pink salmon in the north (i.e. Licence Areas A, C and F).

3.3 Decision Guidelines for Commercial Fisheries

3.3.1 Decision Guidelines for Area 29 pink salmon fisheries

3.3.1.1 Harvest objectives

Fraser River pink salmon fisheries are managed to address conservation objectives for the conservation unit by achieving a minimum escapement of 6 Million. Fisheries are also modified due to conservation measures for co-migrating salmon stocks of concern.

3.3.1.2 Planning and implementation

A formal harvest strategy for Fraser River pink salmon has been developed (Table 5), but they have been managed passively in recent years due to their increasing abundance (Table 3) and the substantial constraints imposed by conservation measures for co-migrating stocks of concern (e.g. Cultus sockeye, Interior Fraser coho, and Interior Fraser steelhead). Total exploitation rate has been reduced from an average 64% before 1997 to less than 10% since then (Figure 1).

Fraser pink salmon management draws on the following information sources:

- *Pre-season planning:* Forecasts using juvenile abundance and survival rates estimated from salinity and juvenile-to-adult survival data.
- *In-season implementation:* Test fisheries and harvest data, and escapement data.

3.3.1.3 Conservation measures

No conservation measures are required for pink salmon. Fisheries on pink salmon are limited due to conservation constraints for stocks of concern such as Late run and Cultus sockeye, Interior Fraser coho and Interior Fraser steelhead.

Comprehensive conservation measures are in place for Fraser pink salmon fisheries:

- Revival tanks are mandatory to maximize survival of released non-targeted species; particularly species of concern such as Interior Fraser coho and steelhead.
- Non-retention of all steelhead and coho by-catch is mandatory.
- Commercial harvests are spread over broad time periods to avoid disproportional fishing mortality on specific component populations.
- Area E license conditions include: fish slips, observers, logbooks, hails, and mandatory revival tanks

- Conservation of Thompson River coho became a major issue in 1997 and will likely remain so for the foreseeable future. Fishing restrictions between August 29 and October 15 in Area 29 can be anticipated each year in the main stem of the river from the mouth to Mission.
- Conservation of Thompson and Chilcotin River steelhead results in fishing restrictions in later October and possibly early November. The B.C. Ministry of Water, Lands and Air Protection (MWLAP) has used Albion test fishing data to estimate abundance of Interior Fraser steelhead. Fishing-related mortality is estimated with a steelhead harvest model the MWLAP also developed. Conservation measures during in-river fisheries are discussed with DFO. Commercial fisheries are not allowed before late October to protect Interior Fraser steelhead. Exact timing of commercial and First Nations net fisheries are finalized following discussions with provincial staff.
- Potential low returns of Harrison River Chinook are also a consideration if earlier fisheries are proposed.

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

3.3.2 Summary: Annual timeline for commercial pink fisheries

Based on the decision guidelines outlined in the previous section, commercial fisheries follow the same rough timeline for each odd-year dominant cycle. Coast-wide harvests of Fraser pink salmon have been substantially reduced due to conservation measures (e.g. Interior Fraser coho, Cultus Lake sockeye, Interior Fraser River steelhead, Sakinaw sockeye, and Mainland Inlet pink salmon):

- Area 20 opportunities directed at Fraser River pink not available in recent years due to conservation measures.
- Area 11 to 13 opportunities targeting Fraser River pink salmon are generally available, subject to abundance levels and conservation measures.
- Area 14 to 19 opportunities targeting Fraser River pink not available in recent years due to conservation measures.
- Troll fishery opportunities targeting Fraser River pink generally available in Area 123 to 127 on the West Coast of Vancouver Island, and possibly Areas 11, 111, and the upper portion of Area 12. Small fleet assessment fisheries may be required in advance of regular fisheries to confirm fishing opportunities that may be available.
- Area H troll (Inner South Coast) are generally permitted to retain pink salmon by-catch in Fraser River sockeye fisheries occurring in Areas 12, 13, 18, and 29 with the possible exception of the waters of Queen Charlotte Strait north of Lewis Point where pink non-retention may be required to protect migrating Mainland Inlet pink. Consideration may be given to a stepped opening and closing strategy to allow the earliest possible opening time (e.g. open northern Area 12 first before southern Area 12 followed by Area 13). Area H is exploring options to optimize pink fishing opportunities. Pre-season meetings shape the final fishing plan for Fraser River pink.

4 ASSESSMENT FRAMEWORK

4.1 Overview

Fraser pink salmon catches are assessed every other year when odd-year runs return to the Fraser River. Escapement is not currently monitored, but a system-wide fry program is in place to assess the relative pink salmon production in the Fraser. Abundance of Fraser pink salmon is then estimated based on in-season catch-per-unit-effort estimated from in-river test fisheries and their relationship to the past escapement time series. This assessment approach is commensurate with recent large abundances and the extremely limited fisheries due to conservation measures for co-migrating stocks (Late run sockeye, Cultus sockeye, Interior Fraser coho, and Interior Fraser steelhead). In-season assessment for Fraser pink salmon is linked to Fraser sockeye assessment and coordinated through the Pacific Salmon Commission (e.g. test fisheries).

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 Fraser pink salmon.

4.2 Annual Monitoring

4.2.1 Escapement

4.2.1.1 Overview

Early observations of pink escapement were conducted for much of the last century by enforcement officers (Farwell et al. 1987). Adult tributary escapement estimates, using mark-recapture surveys, were compiled for the odd-year run from 1957 to 1991. A streamlined approach was implemented from 1993 to 2001, using a mark-recapture sampling in the lower river to develop an escapement estimate for the entire Fraser system. A fry enumeration program at Mission has been conducted from 1962 to present. These changes in survey coverage are reflected in the escapement summary in Table 2, and are consistent with the increasing abundance and changing harvest patterns over the same period.

Assessment programs in Squamish and Burrard Inlet are led by local First Nations, with a focus on estimating run size and monitoring FSC catches.

4.2.1.2 Tributary surveys (1957-1992)

The International Pacific Salmon Fisheries Commission (IPSFC) developed a framework for assessing Fraser River pink salmon using intensive stock-specific enumeration programs involving a combination of mark-recapture and visual survey methods. The enumeration method used for each individual stock was based on the numbers of spawners that were expected to return. Stocks with large expected escapements (>25,000) were enumerated using intensive methods involving either counting fences or mark-recapture studies. Stocks with smaller expected escapements (<25,000) were enumerated using a variety of stock specific visual estimation methods involving live and dead counting methods. The

major tributary populations (Chilliwack, Harrison, Seton, and Thompson) were estimated using individual tributary mark-recapture studies and the Fraser mainstem population was estimated using a system mark-recapture study, with fish tagged in the lower Fraser River and carcasses recovered throughout the watershed. The Fraser mainstem population was calculated by subtracting the sum of the tributary estimates from the system estimate, as derived from the Lower Fraser tag application and total recoveries. (Ward 1959; Vernon et al 1964). The majority of the smaller tributary populations throughout the watershed were systematically assessed using a variety of stock-specific visual estimation methods. This escapement estimation system was used by the IPSFC from 1957 to 1985 and adopted by the Department of Fisheries and Oceans (DFO) in 1987 when the responsibility for conducting spawning ground assessments was transferred to DFO.

4.2.1.3 System-wide survey (1993 - 2001)

In 1993, concerns regarding reduced project funding, a forecast record escapement, and the optimal allocation of sampling effort across salmon species prompted the first major review of the Fraser River pink escapement estimation system in over 30 years (Cass and Whitehouse 1993). This review resulted in two fundamental changes to the Fraser River pink escapement estimation system:

- the termination of all stock-specific tributary mark-recapture studies; and
- the implementation of a system capture-live recapture program in the lower Fraser River with the objective of estimating system-wide escapement with 95% confidence limits of +/- 25%.

These changes were implemented starting in 1993, and the system-wide survey was further modified in 1995 as documented in Schubert, Whitehouse and Cass (1997). Fraser pink salmon were captured at Duncan Bar near Mission, tagged and released. Tagging started as pinks first enter the river and continued daily (8 hrs/day) for the duration of the run. A second capture site was located 22 km upstream from Mission at Strawberry Island where samples of pink salmon were captured, assessed for marks, and released alive. Sampling at Strawberry Island was conducted over a 24 hour period, starting on the same date and extending several days past the last day of tagging at Duncan Bar. Both capture sites are below spawning areas and above the major commercial net fisheries. The system-wide survey was discontinued in 2001 given large returns, heavily curtailed fisheries, and the balance of assessment priorities on the Fraser across all salmon species.

4.2.1.4 Outmigrating fry survey (1962 - present)

In 1961 personnel from the DFO and the PSC developed a field program to capture seaward-migrating Pacific salmon fry in the Fraser River at Mission, B.C. The purpose of the program was to yield an annual index of migrating chum and pink salmon fry in the Fraser River. The sampling location is approximately 1,400 feet upstream from the C.P. Railway bridge at Mission, B.C. Sampling occurs from early March to late May (depending on catch and spring freshet). Sampling gear includes two traps attached to either side of a 33 foot gill net boat; a mobile trap (4-foot by 4-foot inclined plane trap which samples the surface 40 inches of the water column) and a vertical trap (consists of a surface trap (similar to the mobile) and a movable vertical section (fyke net) which can be positioned to any depth to 12 feet). Sampling occurs every second day, with the sampling period alternating between 8 and 24 hours. Traps are set for a 15 minute sampling period with the vertical trap operating sequentially at 6, 9 and 12 foot depths. The boat is maneuvered to sample sequentially at three stations across the width of the river. The catch for each set is identified, counted and released. Twenty-five pink fry are sampled and preserved in formalin every 8 hour shift. Catches are stratified by depth, gear type and sample period. Average catches are generated and scaled by time and discharge to calculate daily (24 hour)

abundance estimates. Estimates are calculated for each sampling day and interpolated for non-sampling days.

4.2.1.5 On-going developments

Pink salmon returns have been large in recent years, well above the long-term average of about 4 Million, and fisheries have been extremely limited due to co-migrating stocks of concern such as Late run sockeye and Cultus sockeye, Interior Fraser coho, and Interior Fraser steelhead) (Figure 1). Current levels of assessment, as described in the previous sections, are adequate to manage fisheries and track changes in relative abundances between cycle years.

The Pacific Salmon Commission is exploring pink salmon DNA baselines to assign returns to different stocks and develop a cost effective method to apportion historical returns-by-system in the Fraser watershed.

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 stock composition.

Fraser River pink salmon are caught in purse seine test fisheries in Areas 12 and 13 (Johnstone Strait), 20 (Juan de Fuca), and in gillnet test fisheries in areas 29-14 (Cottonwood) and 29-16 (Whonnock) . Methods and results are documented in the annual reports of the Fraser River Panel, available at http://www.psc.org/publications_annual_fraserreport.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. There are no assessment fisheries for Fraser pink in Area 29.

4.2.3 Catch

4.2.3.1 Overview

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. Figure 3 summarizes catch monitoring programs in Lower Fraser pink salmon fisheries. Table 4 summarizes catch of Fraser pink salmon by area and sector.

4.2.3.2 Commercial

Commercial 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 patrol staff surveying harvest information and monitoring compliance to all fishery restrictions and management guidelines.
- Sales slip data encompassing information such as catch by species, statistical area of catch, date of catch, and gear type is generated as each fishery participant lands catch. The data is available at the regional level through database queries.

Commercial haul-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.

Independent observers from environmental organizations have recently begun monitoring by-catch in some salmon fisheries as part of collaborative initiatives. A sample report from the Fraser River chum fishery is available at <http://www.watershed-watch.org/news/item.html?nid=157>.

The *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 Fraser River is sufficient for estimating pink removals from larger stock groupings. Trends in catch and harvest rate are discussed in Section 5.3.

Removal estimates at a finer level of detail are highly uncertain for Fraser pink stocks due to the high variability in run timing and abundance of individual populations. However, the harvest strategy for Fraser River pink salmon limits the risk associated with this uncertainty through an aggregate escapement target and abundance-based decision guidelines (Section 3.3).

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.

4.2.3.3 Recreational

Recreational catch is monitored with creel surveys that have been consistently conducted on the Fraser mainstem (May through November), the Chilliwack River (September through November), and the Nicomen (October through November) since the 1980s. Access point or bus-route surveys conducted by creel surveyors are used to obtain angler interviews to collect information on catch rates (catch-per-unit effort (CPUE) and release-per-unit-effort (RPUE). Total angler effort information is obtained from overflight or vehicle rod counts of the entire survey area combined with hourly rod count information collected by creel surveyors. Catch rate and total effort data are compiled and analyzed to produce catch and effort statistics by area and species (see Schubert 1992). Detailed final reports since 2001,

including study design and results, are available for the Fraser watershed at www.pac.dfo-mpo.gc.ca/fraserriver/recreational/recfisherystudies_e.htm. Reports prior to 2001 have been published in previous *Canadian Technical Report of Fisheries and Aquatic Sciences*. The largest assessed recreational catches of pink salmon occur in the Fraser mainstem and the Chilliwack River.

Assessment of recreational fisheries in the Fraser watershed is prioritized based on the size of the fishery (i.e. areas with large angler effort are an assessment priority), local conservation concerns, and wild indicator stocks for assessment purposes.

Recreational effort is concentrated in the Fraser River non-tidal mainstem and the Chilliwack River and intercepts all five species of Pacific Salmon (Chinook, coho, sockeye, pink, chum). These fisheries represent the most significant angler effort in the Fraser River watershed with the Fraser mainstem being among the largest occurring freshwater recreational fisheries in British Columbia. Stocks of concern also migrate through the area during recreational openings. Given the magnitude of effort, recreational fisheries in these areas are the most consistently assessed (Fraser River mainstem since 1980, Chilliwack River since 1985):

- The Fraser River mainstem creel project generally runs from May to October with the greatest effort occurring in July and August, particularly during sockeye retention fisheries which have lasted one to five weeks. Average annual effort has been 400,000 angler hours on the Fraser River mainstem since 1980.
- The Chilliwack River is generally assessed from September to November when the most significant angler effort occurs. Average effort has been 200,000 angler hours (1985 to present). Very little angler effort occurs in the summer or after November, so this period is not assessed. The Chilliwack River is also assessed because it is an indicator system for Fraser Chinook and estimates of catch and recovery of coded wire tags in the recreational fishery are required. Pink salmon are incidentally assessed in this sport fishery.
- The Nicomen Slough/Norrish Creek system has also been consistently assessed starting in 2001, because Inch Creek, which flows into Nicomen Slough, is an indicator system for Fraser coho salmon and estimates of catch and CWT recovery are required. Effort is not significant for this fishery relative to the Chilliwack and Fraser River fisheries (average total effort: 14,000 angler hours) and pink salmon are only incidentally assessed.
- Smaller systems have been opportunistically assessed, mainly for coho and chinook catch, such as the Stave River (average total effort: 21,000 angler hours), the Chehalis River (average total effort: 50,000 angler hours), and the Harrison River (average total effort: 44,000 angler hours). These systems, however, are not a priority since angler effort is relatively low, they have large hatchery components (Stave & Chehalis) and they are not used as indicator systems for any stocks.

4.2.3.4 First Nations

Catch monitoring programs are in place for all communal FSC fisheries and economic opportunity fisheries:

- *Communal FSC*: There are generally no explicitly specified limits on the number of fish or fishers. Rather, catch and effort are controlled through the duration of fishery openings. These fisheries are actively monitored, generally by individual First Nations, but there is also one larger society that monitors for many of the First Nations in the upper portion of the Lower Fraser Area. Drift nets are monitored by census, while set nets are surveyed and results sent to DFO for analysis.

- *Economic Opportunity* (EO): EO fisheries are monitored using a mandatory landing program. All landings take place at specific sites or on-board specified packers. All designated sites and packers have a monitor who counts the catch as it is unloaded and provides a landing slip to verify that the fish was caught during a commercial opening.

In addition, specific ceremonial licences may be issued to designated individual fishers for a specified small number of fish and for a short durations. These fisheries are not actively monitored, but DFO requests catch data after the licence expires.

4.3 Analysis

4.3.1 Stock Composition

Estimates of stock composition are required to identify the presence of weaker stocks in a fishing area.

Genetic Stock Identification (GSI) is the method used for analyzing tissue samples collected from pink salmon caught in mixed-stock fisheries to estimate the contribution of Fraser River pink salmon (White 1996). Canada South Coast (non-Fraser) and Washinton pink salmon stocks are also often present in the stock contribution estimates, although generally in lower proportions than Fraser stocks. GSI sampling is conducted in odd-year Canadian (south of Cape Caution) and Washington pink salmon fisheries. From 1989 to 2005 protein electrophoretic analysis of allozymes was employed and starting in 2007 microsatellite DNA analysis has been conducted.

GSI estimates indicate that the contribution of Fraser River pink salmon to fisheries occurring in Johnstone Strait, the west coast of Vancouver Island, Salmon Banks and Point Roberts (U.S. Areas 7 and 7A respectively) often exceeds 80% during the peak marine migration of Fraser pinks from mid-August to early September.

4.3.2 Harvest / Exploitation Rate Analysis

Since 1991, four factors have contributed to a reduced harvest of Fraser River Pink salmon:

- Conservation concerns on co-migrating salmon stocks of concern (e.g. Fraser River Late-run sockeye, Interior Fraser coho, Lower Georgia Strait chinook) restricted South Coast salmon fishing opportunities.
- Area Licensing, introduced in Canada in 1995 has restricted the number of vessels of all gear types permitted to fish in areas south of Cape Caution.
- The overall number of commercial fishing licences has been reduced due to a series of buy-backs since 1995.
- Market conditions for pink salmon restricted the economic viability of the fishery: profit margins for fresh, frozen and canned pink salmon deteriorated to the point that fish processing companies lowered prices (<\$0.20/kg) and imposed restrictions on the quantity of pinks they were prepared to purchase from fishermen. Consequently the frequency of fishing openings was reduced as well as fishing effort during available openings.
- Considerable reduction in fishing time and effort has also occurred in United States Panel Area Waters.

As a result of all of the above, exploitation rates on Fraser River pink salmon have declined each decade since the 1970's: from an average of 74% (1971-1979) to 64% (1981-1989) to 38% (1991-

1999) to 6% (2001-2007). Due to this reduction in regular commercial fisheries, the traditional estimation models for run-size of Fraser River pink, which relied on historical commercial catch and catch-per-unit-effort (CPUE). As a consequence, in-season estimates of run-size then depended on catch-per-effort and historical catchability in purse seine test fisheries in Areas 12, and 20 (i.e. cumulative Fraser River pink CPUE divided by average historical catchability for Areas 12 and 20 separately). Because of the very low unit harvest rates (catchability) in these test fisheries, uncertainty in the derived daily estimates of abundance undoubtedly increased. Through 2001, the final estimate of total run of Fraser River pink salmon was based on the sum of total catch and total spawning escapement. However with the discontinuation of spawning escapement estimation programs on Fraser River pink salmon, the in-season estimates by default became the final estimates of total return. Since 2003, spawning escapement is estimated as total run minus total catch.

Exploitation rates by area or by sector are calculated as catch / total run.

4.3.3 Forecasts

Forecasts are produced for pink salmon for the odd-year run. Recent escapements, averaging 16 million since 2001, have been well above the escapement goal of 6 million, but pink fisheries continue to be very limited due to co-migrating stocks of concern (Late run sockeye and Cultus sockeye, Interior Fraser coho, and Interior Fraser steelhead). Forecasts are therefore used to guide pre-season fisheries expectations for these limited fisheries.

Forecasts are based on fry abundance estimated at Mission during the downstream migration and average Sea Surface Salinity (SSS) from July to August measured at Amphitrite Point and at Race Rocks (DFO 2007).

In addition, brood year return and freshwater and ocean survival conditions are evaluated to provide a qualitative estimate of expected returns to the Fraser River. The annual *Pacific Salmon Outlook* is available at <http://www.pac.dfo-mpo.gc.ca/fm-gp/species-especes/salmon-saumon/index-eng.htm>.

5 STOCK STATUS

5.1 Regular status evaluations

DFO evaluates the status of Fraser 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 reviews from the PSC Fraser River Panel are available at http://www.psc.org/publications_annual_fraserreport.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.

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

Currently, Fraser pink populations are healthy enough not to warrant a legislated level of protection. Fraser pink returns have almost quadrupled from historical average (Table 3). Fraser pink populations have remained strong in recent years despite the low marine productivity that has affected other species and populations of Pacific salmon. If the conservation unit in the Fraser watershed did decline to a point where its persistence was threatened, the Canada Species at Risk Act (SARA) provides a legislative and policy framework for recovery.

5.2.2 Production

Productivity of the Fraser pink conservation unit has been below average in recent years (2001 to 2007), evidence for a downturn in productivity that most other Pacific Salmon stocks have experienced. Productivity on average has decreased from 3.7 recruits/spawner (1959-1999) to 0.99 recruits/spawner (2001-2005). Marine conditions were particularly poor in 2005 resulting in relatively poor survivals for other species and populations of salmon that migrated to the ocean in 2005. Productivity should improve in future return years given improving ocean conditions observed in 2007.

5.3 Trends

5.3.1 Abundance

Annual returns of Fraser pink are summarized in Table 3. Average total estimated return for the period 1995 to 2007 is 13 Million pink salmon (range: 3 million to 26 million).

5.3.2 Escapement

Escapement has been estimated in recent years based on the relationship catch-per-unit effort estimated from test fisheries in the Fraser River and past escapements. Average total estimated escapement for the period 1995 to 2007 is 11 Million pink salmon (range: 3 million to 23 million).

The escapement target has been 6 million pink salmon. Since 1985, this escapement target has been exceeded for 8 out of 11 odd-year returns.

5.3.3 Catch

Figure 2 shows catches of Fraser River pink salmon by fishery and area. Throughout the 1990s, the major harvests occurred in mixed-stock fisheries (Inner South Coast including Johnstone Strait and Strait of Georgia, Juan de Fuca, and West Coast Vancouver Island, US). These were significantly reduced after 1997 due to coast-wide conservation measures for salmon stocks of concern (i.e. Interior Fraser coho, Late-run Fraser sockeye, Lower Georgia Strait chinook) and other changes in BC salmon fisheries (as discussed in Section 4.3.2). South Coast recreational harvest and in-river commercial harvest (Area 29) also dropped after 1997. First Nations harvests increased after 2001 as part of collaborative initiatives aimed at improving First Nations' access to fishing opportunities and creating economic opportunities (Section 2.3.1).

Total exploitation rate has been reduced from an average of 63% over the period 1959 to 1997 (range: 37-86%) to less than 10% since 1999 (5-10%). This drastic reduction in catch produced a substantial increase in escapement, despite a prolonged decline in survival rates (Figure 1) and a resulting period of low productivity (Table 3).

5.3.4 Exploitation Rate

Exploitation rate has decreased significantly from the historical average of 63.5% (1959-1997) to 7.6% (1999-2007). This significant decrease is attributed to a combination of increased return sizes and decreased catch as a result of fishery restrictions due to co-migrating stocks of concern.

5.3.5 Survival Rates

The egg to fry survival of Fraser 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).

Only in the years from 1962, when a Fraser juvenile assessment program commenced until 2001, the final year of a Fraser adult assessment program, is marine and freshwater survival available for Fraser River pink salmon. Marine survival declined starting in the late 1970s and freshwater survival has remained relatively constant from 1962-2001 with an increase in the final year of assessment (Figure 1).

5.3.6 Size

Average pink weights have decreased from historical average of 2.28 kg (1959-1997) to 1.93 kg (1999-2007) possible due to density-dependent effects attributed to recent significant increases in pink abundance.

6 CONSERVATION MEASURES IN FRASER RIVER PINK FISHERIES

6.1 Coast-wide conservation strategy

The *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.
- 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.

The decision guidelines in Section 3.3.1 list specific conservation measures in the Area 29 commercial pink fishery. This section highlights some local conservation measures in Fraser pink salmon fisheries.

6.2 Pink salmon conservation measures

Fraser River pink fisheries are managed to address conservation objectives for the conservation units by achieving a minimum escapement of 6,000,000 for the entire management aggregate, with fisheries structured to avoid disproportionate impacts on individual components of the extended return migration.

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

Time and area closures as well as selective fishing techniques are used to protect specific non-target populations or species of concern. For example, constraints on the in-river fisheries for Fraser River pink salmon include conservation measures for Interior Fraser coho and steelhead:

- Window closures on the Fraser mainstem have been in place since 1998 to prevent by-catch of Interior Fraser coho during their upstream migration.
- To reduce exploitation rates on steelhead, measures have been taken in commercial marine pink fisheries (e.g. weed lines, changing fishing boundaries) and commercial in-river Fraser pink fisheries (e.g. short sets, short nets, revival boxes and restrictions on times/areas) to reduce encounters and mortality.

As a result of these measures, pink salmon exploitation rate has been substantially reduced despite large abundance.

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TABLES

Table 1. Population structure of odd-year Fraser pink salmon

Systems with current hatchery enhancement are identified in underlined italic font with an asterisk*. 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).

Conservation Unit	Geographic Area	Spawning Sites
FRASER RIVER	Fraser Canyon	American Creek, Anderson River, Coquihalla River, Emory Creek, Hunter Creek, Kawkawa Creek, Kawkawa Lake, Nahatlach River, Ruby Creek, Sawmill Creek, Silverhope Creek, Spuzzum Creek, Stoyoma Creek, Yale Creek
	Lower Fraser	Alouette River, Big Silver Creek, Birkenhead River, Borden Creek, <u>Brunette River*</u> , <u>Chehalis River*</u> , Chilliwack Creek, Chilliwack River-Upper, Chilliwack/Vedder River, Coquitlam River, Cultus Lake, Depot Creek, Douglas Creek, Floods Creek, Foley Creek, Fraser River, Giesbrecht Spawning Channel, Harrison River, Hope Slough, Hopedale Slough, Johnson Slough, <u>Kanaka Creek*</u> , Lillooet River-Lower, Liumchen Creek, Lorenzetta Creek, Mahood Creek, Maria Slough, Nesakwatch Creek, Norrish Creek, North Alouette River, Paleface Creek, Peach Creek, Pitt River-Upper, Ryder Creek, Silverdale Creek, Slesse Creek, Sloquet Creek, Squawkum Creek, Stave River, Steelhead Creek, Sweltzer River, Tamihi Creek, Trout Lake Creek, Wahleach Creek, <u>Weaver Channel*</u> , Whonnock Creek, Widegeon Creek
	Mid Fraser	Baker Creek, Bridge River, Cayoosh Creek, Chilcotin River – Lower, Churn Creek, Gates Creek, Hawks Creek, Narcosli Creek, Nechako River, Portage Creek, Quesnel River, Seton And Cayoosh Creeks, Seton River, Stein River, Texas Creek, Upper & Lower Seton Channels, Watson Bar Creek, Williams Lake River, Yalakom River
	Thompson	Adams River, Bonaparte River, Deadman River, Eagle River, Hiuihill Creek, Lemieux Creek, Little River, Little Shuswap Lake, Lower Shuswap River, Nicoamen River, Nicola River, Nikwikaia Creek, North Thompson River, Scotch Creek, Shuswap Lake, Shuswap River-Lower, South Thompson River, Thompson River, Sucker Creek

Table 2. Fraser River pink salmon escapement summary

Adult tributary escapement estimates, using mark- recapture surveys, were compiled for the odd-year run from 1957 to 1991. A streamlined approach was implemented from 1993 to 2001, using a mark-recapture sampling in the lower river to develop an escapement estimate for the entire Fraser system. A fry enumeration program at Mission has been conducted from 1962 to present. These changes in survey coverage and are consistent with the increasing abundance and changing harvest patterns over the same period. Section 4.2.1 describes escapement estimation in detail.

Year	Total Escapement	Early Run				Late Run			
		Lower Fraser	Fraser Canyon	Upper Fraser	Seton - Anderson	Thompson	Lower Fraser	Harrison	Vedder - Chilliwack
1957	2,242,867	1,073,904	12,660	263	60,820	269,332	8,061	595,480	222,347
1959	1,078,000	733,933	28,862	62	16,153	87,224	1,526	117,127	93,113
1961	1,092,561	547,850	15,290	83	62,175	69,411	4,383	198,597	194,772
1963	1,954,038	516,831	21,832	723	136,562	285,243	1,319	658,563	332,965
1965	1,194,099	543,757	7,798	3,180	125,248	233,100	268	77,396	203,352
1967	1,831,219	785,797	7,942	3,015	239,720	450,487	284	70,831	273,143
1969	1,530,913	848,532	4,894		212,980	248,900		104,462	111,145
1971	1,804,952	928,046	22,549	5,346	308,241	258,203		107,494	175,073
1973	1,751,261	766,053	18,237		249,058	283,504		211,345	226,064
1975	1,367,089	315,049	9,516	36	280,860	480,350		184,020	97,258
1977	2,387,811	775,016	9,276	3,444	435,341	978,325		132,755	53,654
1979	3,560,655	1,523,458	25,610	1,846	712,840	891,191		272,779	132,930
1981	4,488,335	2,255,753	43,234	5,532	626,402	1,166,348		316,998	74,069
1983	4,631,620	3,310,999	46,456	1,721	501,475	512,398	100	149,792	108,780
1985	6,460,614	5,254,163	164,437	530	274,120	193,448	16,273	447,377	110,602
1987	3,223,521	1,066,032	11,736	496	743,286	253,109	1,359	1,035,626	111,877
1989	7,189,186	4,781,051	40,697	6,838	1,059,491	281,640	1,111	687,586	331,310
1991	12,949,318	9,287,834	121,763	2,309	1,618,828	769,800	6,929	964,108	170,964
1993	10,768,335								
1995	7,174,584								
1997	2,842,108								
1999	3,422,194								
2001	19,725,820								
2003	23,931,030								
2005	8,939,601								
2007	10,131,474								

Table 3. Size, fecundity, and production of Fraser River pink salmon

Brood Year	Total		Mean fork length (cm)		Mean Fecundity (eggs/female)	Mean Weight (kg)	Fry Abundance (Millions)	Returns per Spawner
	Escapement	Total Returns	Male	Female				
1957	2,242,867							
1959	1,078,000	6,460,055				2.4		2.9
1961	1,092,561	1,889,246				3.0	144	1.8
1963	1,954,038	5,482,350				2.4	284	5.0
1965	1,194,099	2,319,887				2.8	274	1.2
1967	1,831,219	12,962,791				2.5	238	10.9
1969	1,530,913	3,931,461				2.7	196	2.1
1971	1,804,952	9,763,328				2.4	245	6.4
1973	1,751,261	6,800,984				2.5	292	3.8
1975	1,367,089	4,893,955				2.8	279	2.8
1977	2,387,811	8,209,485				2.7	473	6.0
1979	3,560,655	14,404,121			1,824	2.3	341	6.0
1981	4,488,335	18,684,688			1,881	2.2	545	5.2
1983	4,631,620	15,345,996			1,604	2.0	555	3.4
1985	6,460,614	19,037,688	57.6	53.7	1,657	2.4	256	4.1
1987	3,223,521	7,171,773	55.6	52.6	1,881	2.1	407	1.1
1989	7,189,186	16,484,260			1,646	2.1	361	5.1
1991	12,949,318	22,180,122	54.0	51.9	1,552	1.8	697	3.1
1993	10,768,335	16,983,498	53.8	51.5	1,426	1.7	439	1.3
1995	7,174,584	12,903,708	54.0	50.7	1,576	1.7	272	1.2
1997	2,842,108	8,175,964	55.2	52.5	1,647	1.8	253	1.1
1999	3,422,194	3,585,477	52.5	50.3	1,435	1.8	223	1.3
2001	19,725,820	21,173,974	54.4	52.2	1,707	2.0	681	6.2
2003	23,931,030	26,000,000				2.0	419	1.3
2005	8,939,601	10,000,000				1.9	615	0.4
2007	10,131,474	11,000,000				2		1.2

Table 4. Catch summary for Fraser River pink salmon.

Brood Year	Catch										Total Catch	Total Expl. Rate	
	Area 29 GN	Inner SC Comm	Juan de Fuca	WCVI Troll	Test Fishing	SC Marine FN	Fraser FN*	SC Rec	NC Total**	US Total			
1957													
1959											5,364,360	83.0%	
1961											766,630	40.6%	
1963											3,493,562	63.7%	
1965											1,096,557	47.3%	
1967											11,107,228	85.7%	
1969											2,374,948	60.4%	
1971											7,930,654	81.2%	
1973											4,995,151	73.4%	
1975											3,529,609	72.1%	
1977											5,956,402	72.6%	
1979											10,873,394	75.5%	
1981											14,172,356	75.9%	
1983											10,644,726	69.4%	
1985											12,512,075	65.7%	
1987											3,920,059	54.7%	
1989	216,754	3,606,732	1,389,528	1,304,889	39,099	0	72,443	83,416	403,633	2,178,580	9,295,074	56.4%	
1991	82,010	3,399,242	984,471	1,105,298	44,231	0	103,692	197,300	563,525	2,751,036	9,230,804	41.6%	
1993	131,069	3,371,571	26,191	365,846	30,026	0	17,022	146,564	347,546	1,779,328	6,215,163	36.6%	
1995	36,116	1,605,878	702,306	573,598	89,189	6,667	154,494	164,081	367,945	2,028,851	5,729,124	44.4%	
1997	163,584	3,025,598	303,604	12,129	32,205	10,970	28,345	118,580	76,662	1,562,180	5,333,856	65.2%	
1999	0	5,703	57	1,385	15,230	56,693	10,737	57,155		16,324	163,283	4.6%	
2001	0	742,288	8,542	8,125	37,293	16,040	117,153	74,119		444,463	1,448,023	6.8%	
2003	18,136	806,071	8,582	627	42,348	0	296,098	86,370		810,739	2,068,971	8.0%	
2005	1,080	124,214	0	0	84,602	182,506	265,194	64,387		338,365	1,060,348	10.6%	
2007	0	1,488	0	0	33,225	5,858	342,890	77,506		407,559	868,526	7.9%	

Note: GN = Gillnet, SC = South Coast, Comm = Commercial, WCVI = West Coast Vancouver Island, FN = First Nation, NC = North Coast

* Fraser First Nations catch includes Food, Social, and Ceremonial (FSC) harvest and Economic Opportunity (EO) harvest (Section 2.3.1).

** Genetic Stock Identification (GSI) programs for pink salmon were discontinued north of Cape Caution after 1997 because fisheries shifted to more terminal areas predominantly harvesting local stocks. The *2008 North Coast and Central Coast Pink Salmon Profile* describes the details.

Table 5. Harvest Strategy for Fraser pink salmon

RUN SIZE*	EXPLOITATION RATE GUIDELINES**	ESCAPEMEN T TARGET
0 to 7.06 Million	0 – 15%	6 Million
7 Million to 17.14 Million	15 – 65%	6 Million
17.14 Million to 20 Million	65 – 70%	6 Million
Over 20 Million		7.8 Million

* Estimates of run size based on pre-season forecasts and in-season catch data (test fisheries, commercial fisheries).

** Exploitation rate guideline for targeted fisheries, subject to constraints imposed by co-migrating salmon stocks of concern.

Table 6. Recreational catch summary for Fraser River pink salmon.

Year	Creel Survey				Pink Salmon			
	Survey Period	Inter-views	Over-flights	Est. Angler Effort	Total Returns	Released	Retained	
1985	Sep-Nov	5,718	22	485,931	6,460,614	6,293	319	
1987	March-Dec	16,858	64	794,658	3,223,521	852	18	
1989	Jun-Jul	1,855	16	90,678	7,189,186	0	0	
1991					12,949,318			
1993					10,768,335			
1995	Jun-Sep	6,171	32	374,510	7,174,584	73,160	22,888	
1997	Jul-Aug	5,275	17	260,874	2,842,108	63	484	
1999	Jul-Aug	603	5	21,765	3,422,194	0	0	
2001	Jul-Nov	7,768	27	253,818	19,725,820	686	304	
2003	May-Nov	6,882	48	659,025	23,931,030	8,344	9,405	
2005	May-Sep	6,823	39	439,876	8,939,601	38,522	17,390	
2007	May-Nov	6,175	56	258,161	10,131,474	55,578	18,028	

FIGURES

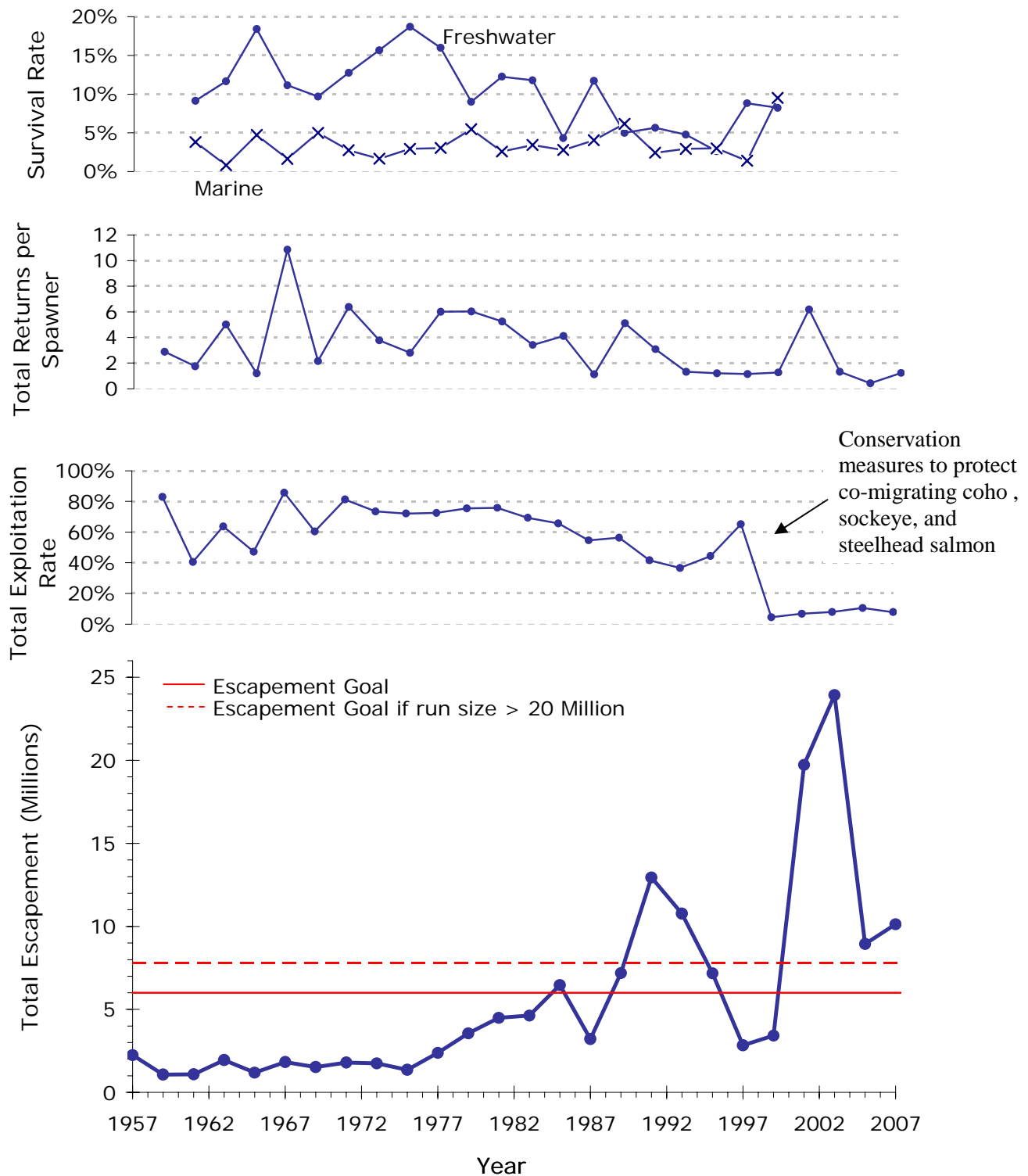


Figure 1. Trend summary for Fraser River pink salmon

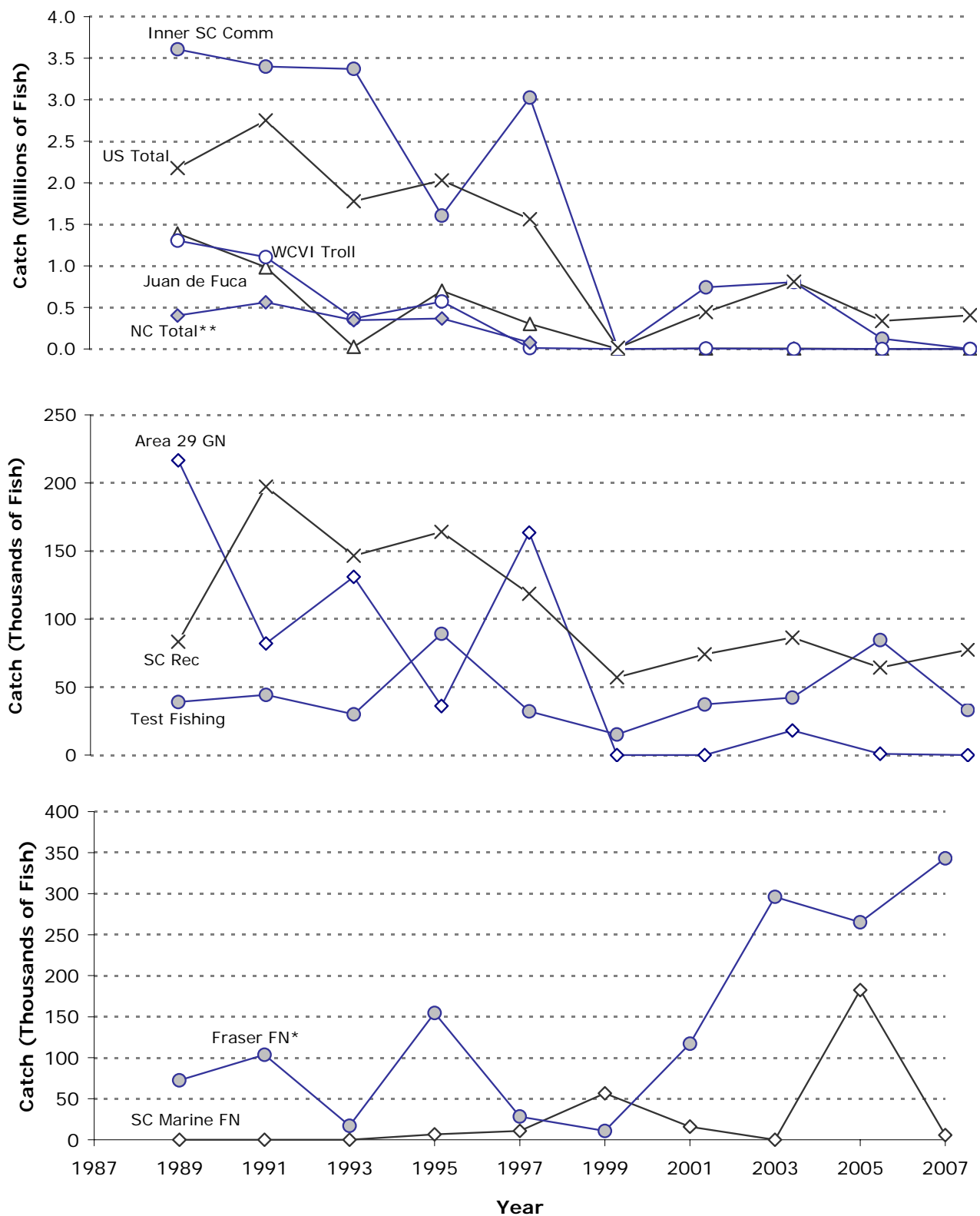
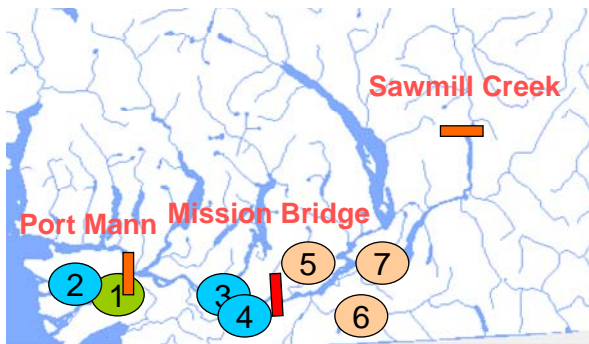


Figure 2. Catch trends for Fraser River pink salmon.

For data sources and explanatory notes refer to Table 4. Note: GN = Gillnet, SC = South Coast, Comm = Commercial, WCVI = West Coast Vancouver Island, FN = First Nation, NC = North Coast



Commercial (PFMA 29: upstream to Mission)

- | | |
|------------------|--|
| ① Area E gillnet | Logbooks, overflights, hails (DFO)
limited no. independent on-board observers |
|------------------|--|

First Nations

- | | |
|--------------------------------|-----------------------------|
| ② FSC below Port Mann | Hails (FN, DFO) |
| ③ FSC Port Mann to Sawmill Cr. | Creel/Hails (FN, DFO) |
| ④ Economic Opportunity | Mandatory Landing (FN, DFO) |

Recreational

- | | |
|---------------------------------------|-------------|
| ⑤ Nicomen | Creel (DFO) |
| ⑥ Chilliwack (Sumas R. to Slesse Cr.) | Creel (DFO) |
| ⑦ Fraser (Sumas R. to Coquihalla R) | Creel (DFO) |

Figure 3. Lower Fraser River catch monitoring program