North Coast LRMP

Background Report

Freshwater and Anadromous Fish and Fish Habitat in the North Coast

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BRITISH COLUMBIA

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Executive Summary

This report was compiled by Gordon and Associates Ltd. in the spring of 2003 in support of the North Coast Land and Resource Management Planning process. Information about fish and fish habitat in the North Coast is housed with a number of provincial and federal agencies, as well as First Nations and community level organizations. The intent of the report is to bring together available information about the various types of fish and fish habitat in the North Coast plan area and summarize information about current management.

The report provides a summary of the life histories of the fish species known to inhabit the area. Escapement data for Pacific salmon is summarized as is distribution and information about other freshwater fish.

Trends in salmon escapement over the period of record (1950-2001) were identified using DFO data on salmon escapement for streams in the plan area. A total of 543 individual stocks have been documented in the area. Data analysis indicates that salmon escapement across the landbase is in substantial decline. Specifically:

- 75% of known chinook stocks appear to be "Potentially threatened" or "Of Some Concern"
- 69% of known chum stocks appear to be "Potentially threatened" or "Of Some Concern"
- 72% of known coho stocks appear to be "Potentially threatened" or "Of Some Concern"
- 31% of known pink stocks appear to be "Potentially threatened" or "Of Some Concern"
- 45% of known sockeye stocks appear to be "Potentially threatened" or "Of Some Concern"

Of the 167 known salmon streams, only 26 do not have salmon stocks identified as "Potentially Threatened" or "Of Some Concern". This analysis of escapement data is preliminary. Further analysis of the data, including referral to local people familiar with the area is recommended to confirm whether the DFO escapement data are reflecting actual escapements. All escapement data have been summarized in a database, portions of which are printed out as Appendix I. The complete database has been provided to MSRM as a project deliverable.

The cause of this decline has not been identified in this report. However, it can be speculated that land use practices do not appear to be the leading cause as many of the watersheds where stock decline is apparent have not been subject to resource development activities.

Existing data on freshwater resident species was also reviewed, and incorporated into a database. Such information was often limited to presence/absence and local knowledge. Watershed scale inventory information is extremely limited. Dolly Varden char and cutthroat trout appear to be the most widely distributed fish species in the plan area. 263 streams are listed in the database of which 117 (44.5%) are known to have cutthroat trout, and 172 (57%) are known to have Dolly Varden.

The Community Fisheries Development Centre was sub-contracted through this work to summarize 4 years of coho rearing data that was collected through their organization. Local fisheries specialist Bart Proctor wrote the summary report, and provided an Overall Index of Rearing Productivity for the 79 streams assessed. The top three areas for rearing coho were identified as the lower Skeena, Grenville and Kincolith. Streams in the lower Skeena area include Kwinitsa, Antigonish, Aberdeen, Marigonish, Inver, Basalt, Stapledon, and Valley (Khyex). Proctor hypothesizes that streams in the lower Skeena serve as a temporary refuge area for out-migrating coho juveniles prior to them entering the ocean. The Grenville area also includes streams near the mouth of the Skeena River and the Kincolith area includes streams near the mouth of the Nass River. Proctor's report has been previously submitted to the GTT for circulation to the table.

The report also includes a summary of existing legislation that is intended to provide protection to fish and riparian areas (with respect to fish habitat). A brief overview of current forestry practices being used to protect fish and fish habitat is provided, as well as reference to the MoF/MoE Resource Management Plan initiated in 2000 that identifies priority watersheds for restoration, and notes the stage of completion attained for restoration activities. The report does not provide a summary or review of non fish riparian values (ie, tailed frog, wildlife, biodiversity, etc.).

This report was extensively reviewed by MSRM and LRMP staff, and was provided to the Government Technical Team and DFO for review. A summary of review comments and how or whether they were integrated into the report is also provided.

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1.0 Introduction

Gordon and Associates Ltd. was contracted by the Ministry of Sustainable Resource Management to provide expertise towards the development of General Management Direction (GMD) for fish and associated riparian values for the North Coast LRMP.

This report provides a summary and review of the existing fisheries and riparian information used in the preparation of the (GMD). Specifically, it provides:

- A summary of fish values (Pacific salmon and other species) in the plan area.
- A review and analysis of DFO escapement data for the plan area.
- A summary of coho rearing data collected by North Coast communities, and as analysed by Bart Proctor through the Community Fisheries Development Centre (2003).
- Identification of watersheds with fish values that may be considered as potentially unique, or vulnerable, or that have recreational fishing significance.
- A summary of existing legislation and guidelines that currently provide protection or management direction to fish and/or riparian values in the plan area.
- A summary of current management practices used by industry to protect fish and/or riparian habitat.
- A summary of existing identified priorities for watershed restoration.

2.0 Methods

Streams in the North Coast LRMP area were examined for salmon escapement trends, presence of resident fish species, as well as potential uniqueness, recreation (fishing) and vulnerability of their fish stocks. The stream analysis included data compiled from a number of sources including:

- A DFO Salmon Escapement Database providing escapements from 1950-2001 for chinook, chum, coho, pink and sockeye salmon
- Identification (by local experts, and Sarma Liepins, MSRM) of fish stocks that could be potentially unique or vulnerable, or have recreation potential
- Resident fish information included in the Fisheries Inventory Summary System (FISS) database
- Resident fish information gathered from other sources (ie. FISS update contract, relevant lake and stream inventories, local knowledge)
- Resident fish information and juvenile coho information provided by Bart Proctor resulting from the North Coast Stream Inventory Program (1998-2001), the Oona River Stream Inventory Program (1998) and the Fisheries Charter Vessels Survey Program (1998-2001).

The compilation of data has resulted in two databases that are provided in Appendix I (DFO Escapement Data) and Appendix II (Resident Fish Data). Electronic versions of these databases have been provided to MSRM.

2.1 Analysis of DFO Salmon Escapement Data

DFO escapement data are collected by a wide range of personnel including volunteers, fisheries guardians and officers, fisheries technicians, and fisheries biologists. Typically, streams are walked from their mouth upstream and personnel count adult fish. Occasionally, counts are completed from aircraft (helicopters or float planes) or enumeration fences are installed in streams. Streams may be assessed for spawners once or many times throughout the season, depending on the species of fish present, availability of access to the stream and funding. Some streams may not be assessed every year. The data recorded for escapement cannot be considered to be precise, as techniques for enumerating salmon are imprecise. A variety of factors influence salmon enumeration, including; experience of the person counting, clarity of the water, length of stream to be enumerated, and spawning period of the fish. Counts for coho are especially difficult, as they spawn over a protracted period, travel far upstream into small tributaries, and may be difficult to see in coastal streams. Due to budget constraints, DFO based efforts to enumerate salmon have declined in recent years. Actual escapement are likely greater than reported for many species and stocks.

Although numerous flaws in the data may exist, the data do provide a practical gauge to general abundance and potential trends. Potential trends in escapement for each species can be identified by examining the annual counts over the 52 years of record (1950-2001). Escapement data were collated and analysed for each of the 5 species of Pacific salmon for every stream on record (n=167). A summary of the data base is in Appendix 1. This database shows:

- Historical maximum for each species and each stream,
- Mean escapement for each decade (1950's, 60's, 70's, 80's, 1990-2001),
- Mean escapement for the period of record (1950-2001),
- Historical mean escapement (1950-1989),
- Calculated % of recent mean escapement (1990-2001) to historical mean escapement (1950-1989).

It is not practical to identify what a stream's optimum escapement may be. This may vary from year to year depending on the habitat conditions present each year and the fish species present. The historical maximum escapement is a number of interest as it *may* represent the productive capacity of the stream (*ie,* its optimum escapement). However, it can be impractical for stream enumerators to accurately count thousands (or hundreds of thousands) of fish, and as such these peak numbers may not be accurate and need to viewed with caution. As well, over escapement can result in super imposition of redds (fish spawning on top of previously spawned areas) which may reduce the survival rate of incubating eggs. The historical maximum escapement was not used in the analysis, but is presented for information purposes only. We chose to compare recent mean escapements (12 year average, 1990 to 2001) to historical mean escapements (40 year average, 1950 to 1989). Historical mean escapement may not be the best measure of a stream's escapement potential as stock decline may be masked if the decline occurred during this 40 year historical period, however it is a practical and relatively robust way of gauging how well a stream has produced over time, and for most streams, it is the only measure available.

The calculations listed above were used to identify potential trends in escapement following the methodology of Morrell (2000). The intent of these analyses is to identify stocks that *may* be in decline, and as such may require further investigation as to their status. Watersheds where such stocks are confirmed to be in decline may be candidates for precautionary land use practices such

that further stresses upon the stock are minimized. As well, these data have been summarized to provide an information source to guide land use managers in assessing risk to salmonid populations from land use activities.

Following is a detailed account of the methodology developed by Morrell (2000) that was used to identify stock status of Pacific salmon populations on the North Coast.

2.1.1 Morrell (2000) Ranking of Streams to indicate Stock Status

Mike Morrell (2000) analysed stock status in the Skeena River system using a combination of the trend of escapement records since 1950 and the average number of spawners observed since 1990. This analysis was applied in this report to streams in the North Coast LRMP Area, and provided a means to determine potential stock status. For the purposes of this analysis, each species in each stream was considered to be a separate stock or breeding population.

Prior to classifying stocks, streams were screened to determine if they had enough records to draw a reliable conclusion regarding their stock status. Stocks from streams that did not have enough records were divided into two categories:

U-P: *Status unknown*—the record does not support that this was ever an established, persisting stock. Fewer than 4 annual records of 50 or more spawners (sockeye and pink) or 25 or more spawners (chinook, coho, chum) were identified for that stream. These stocks were identified as "Questionable".

NRR: *No recent records*—more than 4 annual records above the criterion level outlined for U-P, but no recorded escapement since 1990. This category may include stocks that have gone extinct since 1950. It may also include healthy stocks that have not been monitored in the 1990s due to geographical isolation, DFO budget constraints or other reasons.

Once streams were screened for appropriate records, stock status was designated using a calculation of escapement trend (ET). The escapement trend was calculated as the ratio of the average (mean) of all the records from 1990-2001 to the average of 1950-1989 records. (ie. ET = mean escapement (1990-2001) divided by mean escapement (1950-1989)). If ET was 1.0 or larger, then recent escapement estimates are at least as large as historical records from 1950-1989. ET classes were categorized as:

Stock Increasing	$ET>1.5$
Stock Stable	$0.5\leq ET\leq 1.5$
Stock in Decline	$ET<0.5$
Stock in Precipitous Decline	$ET<0.2$

These categories were further divided based on the mean escapement in the 1990s. For example:

Population Stable or Increasing

L: Low risk of extinction—Mean escapement 1990-2001 (M_{90s}) 200 or more.
S-1: Special concern, historically small stock, now apparently stable—M_{90s} less than 200.
S-4: Special concern, apparently stable, maintained by enhancement.

Stock in Decline

M: Potentially moderate risk of extinction— M_{90s} less than or equal to 1000. (Stocks in this ET range with M_{90s} below 50 (sockeye and pink) or 25 (chinook, coho, chum) were classed as H, High risk of extinction.)
S-3: Special concern—historically large stock, now depleted—M_{90s} more than 1000.

Stocks in precipitous decline

H: Potentially high risk of extinction— M_{90s} less than 200.
M: Potentially moderate risk of extinction— M_{90s} between 200 and 1000.
S-3: Potential special concern, historically large stock, now depleted— M_{90s} more than 1000.

After each stock was categorized to this level, the database was summarized for each species into five intuitive groups; Unthreatened, Of Some Concern, Potentially Threatened, Unknown Status or Questionable. A summary of these groups is shown in Table 1.

Table 1. Summary of Stock Status Classes for salmon in the North Coast LRMP area.

Category	Code	Description
Unthreatened	L	Low risk of extinction
Of some concern	S-1 S-3	Small stock—apparently stable Historically large population—now depleted. Apparently not at immediate risk of extinction
Potentially Threatened	H M	***Potentially*** at high risk of extinction ***Potentially*** at moderate risk of extinction
Status unknown	U-N NRR	Insufficient data to determine status. No evidence of depletion. No recent records—may be extinct.
Questionable	U-P	May not correspond to distinct spawning stock

2.1.2 Cautionary Notes on Data Interpretation

It is important to note that the quality of the DFO escapement data may lead to false interpretation of what is actually occurring on the ground. Reduced effort in salmon spawner enumeration is likely to result in lower spawning counts than may actually exist. Due to the uncertainty regarding the actual status of these stocks, we have deliberately used the modifier "potentially" when describing stocks at risk.

DFO has expressed concerns that the terminology used in this report may be confused with the terms used under Species at Risk legislation. The categories defined above are **not** linked to categories used by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Species at Risk Act (SARA). Following is a brief summary of the relevant COSEWIC definitions and criteria:

COSEWIC provides scientific advice to governments regarding the status of species potentially at risk, and has developed the following definitions (COSEWIC 2003):

Extinct:	No longer occurring anywhere.
Extirpated:	A species no longer existing in the wild in Canada, but exists elsewhere in the world.
Endangered:	A species facing imminent extirpation or extinction.
Threatened:	A species likely to become endangered if nothing is done to reverse the factors leading to extirpation or extinction.
Special Concern:	Those species that are particularly sensitive to human activities or natural events but are not endangered or threatened species.

COSEWIC also provides quantitative criteria and guidelines for the status assessment of species. The most relevant criteria for fish populations on the North Coast occurs under the criteria of "Declining Total Population" where:

> "*population size reduction that is observed, estimated, inferred or suspected over the last 10 years or 3 generations, whichever is longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any combination of a-e below.*
> *a) direct observation*
> *b) an index of abundance appropriate for the taxon*
> *c) a decline in area of occupancy, extent of occurrence and/or quality of habitat*
> *d) actual or potential levels of exploitation*
> *e) the effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites"*

Where this population decrease is $\geq$70% the population may be considered "Endangered" and where the population decrease is $\geq$ 30% the population may be considered "Threatened".

It would be premature to link the analysis in this report to any potential status under COSEWIC. Further analysis of other factors that may affect the data, and improved ground truthing of actual escapement numbers is recommended.

2.2 Analysis of Resident Fish Information

Appendix II contains the resident fish species (non Pacific salmon) data, compiled from FISS, resident fish information supplied by Bart Proctor, knowledge from local experts, a FISS update report (Zimmerling et al. 2001) and various lake inventory reports (Mason 1998, Mason and Adams 1997, Mason and Williams 1998, Mason et al. 1997). Little quantitative information exists on resident fish in the plan area. As such, the database is generally limited to presence/absence information. The uniqueness, recreation potential and vulnerability of fish stocks in these streams has also been included with a column for explanation. This qualitative information has been gathered from Watersheds BC (WBC-based on FISS data), North Coast Stream Inventory Program (NCSI), Ministry of Water, Land and Air Protection (WLAP) through a rich ecosystem analysis (Sarma Liepins), and input by local experts (LK). Descriptions of the categories are as follows:

Uniqueness: These streams have fish stocks that may be in some way distinct or uncommon, such as summer run steelhead, anadromous cutthroat, anadromous Dolly Varden or eulachon.

Recreation Potential: These streams are highly valued for recreational fishing or other pursuits related to the presence of fish such as viewing of wildlife during eulachon or salmon runs, viewing salmon migrating past waterfalls or viewing based on abundance.

Vulnerability: These streams may be at risk of over exploitation or are dependent on habitats which are considered sensitive to disturbance. Fish stocks that are at risk of over-harvesting based on angling guide management system reports and fish harvest and escapement data are included in this category.

3.0 Results

This section provides an overview of the fish species on the North Coast and their general life histories. Information about particularly abundant runs of each species of Pacific salmon is provided as well as information about recent trends in escapement. To keep the report succinct, only select salmon runs have been identified in the text (ie., the largest runs, or those runs in substantial decline). While these runs are likely to be of the most interest to table members and stakeholders in the plan area, it is not inferred here that smaller runs of salmon are of less significance, or may be managed to a low standard. The continued health of all salmon runs is a key objective of LRMP table members. A complete list of all streams and salmon populations is included in Appendix 1.

This section also provides summaries of:

- Existing information on resident fish (non Pacific salmon) species,
- Information about potentially unique or vulnerable watersheds, and those that have been identified as having high recreational fishing value (Liepins, undated).
- Coho rearing assessments completed by North Coast communities through the Community Fisheries Development Centre.
- Existing Legislation, Policy and Guidebooks
- Current Forestry Management Practices adjacent to streams and riparian areas

3.1 Fish species in the North Coast LRMP Area

The North Coast LRMP area is known to support at least 36 species of fish (Table 2). Pacific salmon are the fish of greatest concern, given their well documented ecological, economic and cultural values. DFO has documented salmon spawning in 167 streams in the North Coast LRMP area.

Table 2: List of fish species and number of documented stocks in the North Coast LRMP Area.

Fish Species	Latin Name
chinook salmon	*Oncorhynchus tshawytscha*
coho salmon	*O. kisutch*
chum salmon	*O. keta*

Fish Species	Latin Name
pink salmon	*O. gorbuscha*
sockeye salmon	*O. nerka*
cutthroat trout	*O. clarki*
anadromous cutthroat trout	*O. clarki*
kokanee	*O. nerka*
rainbow trout	*O. mykiss*
steelhead	*O. mykiss*
Atlantic salmon	*Salmo salar*
eulachon	*Thaleichthys pacificus*
bull trout	*Salvelinus confluentus*
Dolly Varden	*S. malma*
anadromous Dolly Varden	*S. malma*
mountain whitefish	*Prosopium williamsoni*
three-spine stickleback	*Gasterosteus aculeatus*
coastrange sculpin	*Cottus aleuticus*
slimy sculpin	*C. cognatus*
prickly sculpin	*C. asper*
river lamprey	*Lampetra ayresi*
pacific lamprey	*Entosphenus tridentatus*
western brook lamprey	*Lampetra richardsoni*
green sturgeon	*Acipenser medirostris*
shad (introduced)	*Alosa sapidissima*
peamouth chub	*Mylocheilus caurinus*
northern pikeminnow	*Ptochocheilus oregonensis*
longnose dace	*Rhinichthys cataractae*
redside shiner	*Richardsonius balteatus*
longnose sucker	*Catostomus catostomus*
largescale sucker	*Catostomus macrocheilus*
rainbow smelt	*Osmerus mordax*
longfin smelt	*Spirinchus thaleichthys*
Pacific staghorn sculpin	*Leptocottus armatus*
starry flounder (estuary)	*Platichthys stellatus*
burbot	*Lota lota*
northern redbelly dace	*Chrosomus eos*
pygmy whitefish	*Prosopium coulteri*

3.1.1 Pacific Salmon

Chinook Salmon

Description

Chinook salmon are the largest Pacific salmon on the North Coast, occasionally growing up to 58 inches (147 cm) and sometimes weighing over a hundred pounds.

Life Cycle
Chinook salmon are usually between 2 and 9 years of age when they return to freshwater to spawn. Adults may migrate up rivers at all times of the year, however, on the North Coast, migration usually occurs in the last half of June through August, and spawning generally occurs between August and October. Redds are usually composed of larger gravel and located in deeper areas than other Pacific salmon. Incubation happens over the winter, and eggs hatch in the spring. Most fry remain in fresh water for up to a year before smolting and migrating to the ocean. Adults die after spawning, and contribute significant marine derived biomass to the freshwater and terrestrial ecosystems.

Escapement Data
Of the 167 salmon bearing streams on the North Coast, 20 have runs of chinook salmon. Of these, 4 are identified as questionable stocks (fewer than 4 annual records of 25 or more spawners). A complete list of all chinook streams is included in Appendix I and escapement trends are presented in Section 3.2.1. Chinook salmon counts are potentially the most reliable counts, as the fish are readily visible and spawning occurs at a predictable time each year.

Table 3 lists those streams that have average escapements >500 fish (the threshold of 500 is arbitrary). Historically, some streams have had substantially large escapements including:

- Johnston Creek, 7,500 in 1969
- Kwinamass River, 5,000 in 1968
- Khutzeymateen River, 5,000 in 1968
- Ecstall River, 3,800 in 1988

Table 3. Max and Mean escapement data (1950-2001) for chinook streams in the NC LRMP area that have average escapements >500 fish.

Stream Name	Max	Mean
Ecstall River	3800	1476
Johnston Creek	7500	1424
Kwinamass River	5000	851
Khutzeymateen River	5000	511

Chum Salmon

Description
Chum salmon average 7 to 10 pounds (3.5 to 4.5 kg) and can be more than 100 cm in length at maturity.

Life Cycle
Chum salmon are usually between 3 and 4 years of age when they return to freshwater to spawn. Adults migrate up rivers between July and September on the North Coast, and spawning generally occurs in August and September, but may occur as early as the last half of July or as late as October. Spawning occurs in freshwater, but usually takes place close to estuaries and adults rarely attempt to migrate upstream past obstructions. Incubation happens over the winter, and eggs hatch from late December until late February. Chum fry spend very little time in freshwater, and migrate to the ocean in late April or early May, immediately after they emerge from the gravel. Adults die after

spawning and contribute significant marine derived biomass to the freshwater and terrestrial ecosystems.

Escapement Data

Of the 167 salmon bearing streams on the North Coast, 137 have supported runs of chum salmon. Of these, 27 are identified as questionable stocks (fewer than 4 records >25 spawners). A complete list of all chum streams is included in Appendix I and escapement trends are presented in Section 3.2.2. Table 4 lists those streams that have average escapements >2000 fish. Historically, some streams have had substantially large escapements including:

- Ecstall River, 75,000 in 1988
- Stagoo Creek, 70,000 in 1974
- Quall River, 65,000 in 1988
- Kshwan River, 50,000 in 1993

Table 4. Max and Mean escapement data (1950-2001) for chum streams in the NC LRMP area that have average escapements >2000 fish.

Stream	Max	Mean
Stagoo Creek	70,000	9,825
Ecstall River	75,000	9,370
Kshwan River	50,000	8,381
Quaal River	65,000	7,423
Khutzeymateen River	35,000	6,623
Toon River	40,000	6,294
Kiltuish River	35,000	5,777
Kitsault River	15,000	4,865
Illiance River	22,000	3,721
Kingkown Inlet System	13,000	2,796
Turn Creek	35,000	2,690
Eagle Creek	15,000	2,647
Kwinamass River	12,000	2,203
Kdelmashan Creek	7,500	2,007

Coho Salmon

Description

Coho salmon grow in length to approximately 38 inches (98 cm) and weigh up to 31 pounds (14 kg), however, mature adults are usually between 6 and 12 pounds (2.7-5.4 kg).

Life Cycle

Mature adults are usually between the ages of 3 and 5 and migrate to freshwater streams to spawn in the fall, between August and October. Spawning areas are usually small, gravelly streams and are often tributaries of a larger river. The spawning event usually takes place between August and December on the North Coast. Eggs incubate in the gravel over winter and hatch around April. Juvenile coho may spend up to two years rearing in freshwater tributary streams prior to smolting.

The young can often be found around large boulders or log jams, and feed actively during the summer. Adults die after spawning and contribute significant marine derived biomass to the freshwater and terrestrial ecosystems.

Escapement data
Of the 167 salmon bearing streams on the North Coast, 151 have supported runs of coho salmon. Of these, 22 are identified as questionable stocks (fewer than 4 records >25 spawners). A complete list of all coho streams is included in Appendix I and escapement trends are presented in Section 3.2.3. Table 5 lists those streams that have average escapements >1500 fish. Historically, some streams have had substantially large escapements including:

- Quaal River, 25,000 in 1966
- Kwinamass River, 20,000 in 1966
- Kingkown Inlet System, 15,000 in 1957
- Lowe Inlet System, 15,000 in 1966
- Quitonsta Creek, 15,000 in 1961

Table 5. Max and Mean escapement data (1950-2001) for coho streams in the NC LRMP area that have average escapements >1500 fish.

Stream Name	Max	Mean
Quaal River	25,000	4,608
Kwinamass River	20,000	3,833
Kingkown Inlet System	15,000	3,330
Lowe Inlet System	15,000	2,996
Quitonsta Creek	15,000	2,837
Khutzeymateen River	10,000	2,214
Eagle Creek	9,000	2,209
Ecstall River	10,000	1,871
Clifford Creek	7,500	1,765
End Hill Creek	7,500	1,736
Salmon Creek	7,500	1,724
Stannard Creek	7,500	1,672

Pink Salmon

Description
This is the smallest of the Pacific salmon on the North Coast, with adults usually growing up to 30 inches long and weighing between 3 and 5 pounds (1.4-2.3 kg).

Life Cycle
Adults usually migrate from the ocean to freshwater to spawn between August and September. Pink salmon are almost always two years old at maturity which often isolates even and odd year runs. Even year runs predominate in the North Coast. Pink salmon are not known to be strong swimmers, are rarely found above barriers in freshwater, and usually spawn in the lower reaches of main systems. Eggs incubate over the winter, and fry migrate immediately to the ocean after emergence, often using habitat in the intertidal areas adjacent to freshwater during their first summer in

saltwater. Adults die after spawning and contribute significant marine derived biomass to the freshwater and terrestrial ecosystems.

Escapement Data

Of the 167 salmon bearing streams on the North Coast, 164 have runs of pink salmon. Of these, 9 are identified as questionable stocks (fewer than 4 annual records of 50 or more spawners). A complete list of all pink streams is included in Appendix I and escapement trends are presented in Section 3.2.4. Table 6 lists those streams that have average escapements >10,000 fish. Historically, some streams have had substantially large escapements including:

- Quaal River, 1,500,000 in 1962
- Kitkiata Creek, 275,000 in 1963
- Kwinamass River, 250,000 in 1984
- Khutzeymateen River, 230,000 in 2001
- Khyex River, 220,000 in 1989
- Moore Cove Creek, 150,000 in 1999

Table 6. Max and Mean escapement data (1950-2001) for pink streams in the NC LRMP area that have average escapements >10000 fish.

Stream Name	Max	Mean
Quaal River	1,500,000	157,192
Kwinamass River	250,000	72,815
Moore Cove Creek	150,000	40,112
Kitkiata Creek	275,000	38,817
Kumealon Creek	120,000	35,048
Khutzeymateen River	230,000	34,070
Khyex River	220,000	22,143
Dogfish Bay Creek	60,000	13,516
Turn Creek	60,000	13,098
Kiskosh Creek	75,000	13,067
La Hou Creek	70,000	12,749
Gil Creek	60,000	12,159
Turtle Creek	43,000	10,424
Ecstall River	100,000	10,347
Oona River	50,000	10,266

Sockeye Salmon

Description

Sockeye adults are usually 4 to 5 years old, range from approximately 3.0 to 5.5 kg and may grow in length to 33 inches (84 cm).

Life Cycle

Sockeye spawn in rivers that feed into lakes, or in the outlets and spring-fed beaches of lakes. On the North Coast, sockeye migrate into freshwater between June and September to spawn between September and October. After fry emerge from the gravel in the spring, they migrate to a nursery lake (usually downstream) and spend 1-2 years in lakes prior to smolting in May or June. Adults die

after spawning and contribute significant marine derived biomass to the freshwater and terrestrial ecosystems.

Escapement Data
Of the 167 salmon bearing streams on the North Coast, 71 have runs of sockeye salmon. Of these, 23 are identified as questionable stocks (fewer than 4 annual records of 50 or more spawners). A complete list of all sockeye streams is included in Appendix I and escapement trends are presented in Section 3.2.5. Table 7 lists those streams that have average escapements >1500 fish. Historically, some streams have had substantially large escapements including:

- Lowe Inlet System, 35,000 in 1975
- Curtis Inlet System, 35,000 in 1963
- Quitonsta Creek, 15,000 in 1971
- Kooryet Creek, 15,000 in 1963
- Keecha Creek, 15,000 in 1959
- Devon Lake System, 15,000 in 1966

Table 7. Max and Mean escapement data (1950-2001) for sockeye streams in the NC LRMP area that have average escapements >1500 fish.

Stream Name	Max	Mean
Curtis Inlet Creek	35,000	5,339
Lowe Inlet System	35,000	5,139
Quitonsta Creek	15,000	4,047
Devon Lake System	15,000	3,641
Kingkown Inlet System	15,000	3,258
Diana Creek	10,000	2,664
Keecha Creek	15,000	2,602
Mikado Lake System	5,500	2,380
Kooryet Creek	15,000	2,290
Shawatlan Creek	6,000	2,204
Tsimtack Lake System	10,000	2,072
Kitkiata Creek	5,800	1,847
End Hill Creek	7,500	1,703
Johnston Lake	8,000	1,703

3.1.2 Salmonids other than Pacific Salmon

Cutthroat Trout

Description
Cutthroat adults can either adopt a resident freshwater form or an anadromous form that migrates to the ocean. Resident cutthroat trout can reach up to 76 cm in length and approximately 17 pounds. Anadromous "sea-run" cutthroat trout can be as large as 3.2 kg (Beere, pers. comm.).

Life Cycle
Cutthroat trout typically migrate in late autumn and early winter to spawn between February and May. They may be repeat spawners (Behnke 1992). Spawning takes place in the gravel of small

streams and fry generally emerge around April in coastal populations. Anadromous migration usually occurs in the spring and may coincide with that of Pacific salmon. Sea-run cutthroat trout attain a maximum age of about 10 years (Behnke 1992), usually remain in the estuaries within the influence of the river, and may move in and out of freshwater in spring to feed on migrating salmon smolts.

Status
On the North Coast, cutthroat trout are known to inhabit 120 different streams. They have recreational fishing potential and have been documented in 14 different lakes in the NC LRMP area. Sizes recorded from lake sampling ranged from 266 mm to 470 mm in fork length. The largest cutthroat recorded was found in Triumph Lake and weighed 1090 g (Mason 1998). Nine streams (Captain Cove Creek, Denise Creek, Ecstall River, Khutzeymateen River, Lachmach River, McNichol Creek, Pa-aat River, Quitonsta Creek and Silver Creek) are known to have anadromous cutthroat, however, little data have been recorded about these fish. These populations have been designated as potentially unique (Appendix V)

Cutthroat trout are blue listed in BC through the Conservation Data Centre, which means they are vulnerable.

Rainbow Trout or Steelhead

Description
Similar to cutthroat trout, rainbow trout also have a resident freshwater form and an anadromous form called steelhead. Rainbows typically become mature around age 3-5. Steelhead usually return to spawn in freshwater after spending 1 to 4 years in the ocean. They may spawn repeatedly in freshwater and have multiple ocean migrations. Steelhead may live up to 8 years, reach lengths over 100 cm and weigh up to 19 kg (Scott and Crossman 1973).

Life Cycle
Both resident rainbow trout and steelhead spawn in the spring, from mid April to late June. Steelhead are often divided into "summer run" and "winter run" depending on the time they spend in freshwater. Summer-run steelhead usually migrate to freshwater in the summer, approximately 9-12 months prior to spawning, whereas winter-run steelhead migrate in the late fall to winter, approximately 3-4 months prior to spawning. Steelhead spawn in mainstem rivers or tributaries, whereas lake dwelling resident rainbow trout spawn in inlet and outlet streams of their lakes. Emergence of fry usually occurs in mid-June to mid-August, and juveniles may spend up to three years in streams prior to smolting if they become steelhead, or migrating to a lake if they become lake residents. Other rainbow trout may inhabit the stream for their entire lives.

Status
On the North Coast, rainbow trout have been identified in 79 streams and steelhead are known to inhabit 69 different streams. Both of these fish have recreational fishing potential. In particular, a population of rainbow trout exists in Union Lake that grows to weights of 1.8 kg (Mason and Lewis 1997) and a population in Khtada Lake that grows up to weights of 6 kg (FISS 2003). Streams with steelhead are of great importance for recreational fishing, and in particular, summer-run steelhead are of importance to fishers.

A number of North Coast stocks are likely quite small and would potentially be vulnerable to overfishing.

Dolly Varden

Description
Dolly Varden may also adopt a freshwater (resident) or anadromous form. On the North Coast, resident Dolly Varden can grow up to 330 mm and weigh up to 450 grams.

Life Cycle
Both anadromous and resident forms spawn in freshwater streams in the fall, between September and early November, and may repeat spawn in multiple years (Scott and Crossman 1973). Mature adults are usually 3-6 years old, and spawn in rivers of moderate current with a bottom of medium to large gravel. Eggs hatch in March or April and emerge in late April to mid May. Anadromous forms migrate to the ocean in late May to early June and generally spend time near the river mouths in tidal water. Resident forms disperse but remain in their spawning streams.

Status
On the North Coast, Dolly Varden char are widespread and are known to inhabit 172 different streams. Although they also adopt an anadromous form, there is only record of this form in the Lachmach River. Dolly Varden have recreational fishing potential and have been documented in at least 17 different lakes in the NC LRMP area (Mason 1998, Mason and Lewis 1997, Mason et al. 1997, Mason and Williams 1998), although they are likely present in many more lakes. Recorded sizes range from 177 to 337 mm in fork length in these lakes. The largest Dolly Varden recorded was captured in Lowe Lake and weighed 458 g.

Dolly Varden are blue listed in BC through the Conservation Data Centre, which means they are vulnerable.

Bull Trout

Description
Bull trout have a similar life cycle to Dolly Varden, and are suspected to have both anadromous and freshwater forms. On the North Coast, bull trout presence is not documented, however they can grow up to 755 mm and weigh 3.8 kg in the Morice River watershed (Bahr, 2002).

Life Cycle
Bull trout usually mature between the ages of 4 and 7 and spawn in the fall, often in mid September. They begin migrations to the spawning grounds as early as June and as late as early September. Bull trout spawn in cold water in the upper headwaters of tributary systems, and often navigate barriers to get to their spawning locations. Eggs incubate over the winter, and emerge in the spring. Juvenile fish spend the first 1-2 years in their natal streams, but may then migrate to a larger mainstem. Other forms may remain in their natal streams for their entire lives, or migrate to the ocean if they adopt an anadromous life history strategy.

Status
There are no records of bull trout in streams within the NC LRMP area, however they are easily misidentified as Dolly Varden. The lack of recorded data is likely the result of low sampling effort and probably does not reflect the species distribution in the area.

Bull trout are blue listed in BC through the Conservation Data Centre, which means they are vulnerable. Bull trout are also an Identified Wildlife under the Forest Practices Code (now the

Forest and Range Practices Act). This means that their habitat may require special management attention during forest and range operational planning or higher level planning.

3.1.3 Eulachon

Description

Eulachon adults typically grow to about 203 mm (8 inches), weigh 40-60 grams and generally spawn after their third year of life. Eulachon are a species of concern in British Columbia and are blue listed. On the North Coast, eulachon are found in the Nass, Skeena, Ecstall, Khyex, Kasiks and Gitnadoix rivers, as well as Scotia and Khtada Creeks (Stoffels, 2001). They may have also occurred in the Quaal River (Chris Picard, Pers.Com.).

Life cycle

Eulachon are anadromous fish that spawn in freshwater and spend the remainder of their life in the ocean. Adults broadcast spawn in coastal rivers between mid-March and mid-May and the eggs stick to sand grains in the river bottom. They hatch in 2 to 8 weeks and larvae immediately drift passively downstream to the ocean. It is not known whether eulachon die after spawning.

Status

Little is recorded about the status of eulachon on the North Coast. Eulachon are found in the lower Skeena and its tributaries, the Ecstall, Khyex, Scotia and Khtada, as well as the lower Nass River (Stoffels 2001). The oil from eulachon is used to make grease and is of cultural importance to First Nations people. In recent years, eulachon have declined throughout their range (Lewis 2001), and a sharp decline occurred in 1994. Rivers also had decreased eulachon runs in 1999 and 2000. The declines are unclear and speculative, but possible explanations affecting populations include directed fisheries, bycatch in marine trawling, marine mammal or forage fish predation, contamination by industry, debris from log handling, shoreline construction or dikes, changes in ocean temperature and changes in the volume and discharge patterns of rivers draining forested areas. Historically there has been no active management of eulachon in BC (DFO 1999, 2000a) and few scientific and technical studies have been conducted. However, the Eulachon Research Council is an ad hoc group that has been meeting since 1995 to address the research needs related to eulachon (Stoffels 2001).

Eulachon are a blue listed species in BC through the Conservation Data Centre, which means they are vulnerable.

3.1.4 Sticklebacks

Description

The most common stickleback on the North Coast is the Threespine Stickleback. There are both marine and freshwater forms of sticklebacks. Sticklebacks can grow up to 4 inches in length, but are usually 35-55 mm after their third year (Scott and Crossman 1973).

Life Cycle

Sexual maturity is attained in the first year of life and spawning takes place in the summer, generally in June and July. Sticklebacks build barrel shaped, hollow nests composed of small twigs and plant debris that have circular openings at each end for the deposition of eggs. The freshwater form of the

threespine stickleback (*G. aculeatus leiurus*) prefers to build its nest on a sandy bottom in shallow water. Eggs hatch in approximately 7 days and are guarded by the male until the new fish become independent. The marine form (*G. aculeatus trachurus*) commonly schools in the eelgrass around harbours where the water is brackish, but is also found in the open ocean. It is also known to breed in salt water.

Status
Threespine sticklebacks are found in at least 54 streams within the North Coast LRMP area, and are likely widespread. They have been recorded up to 95 mm in length with weights of 4.6 grams (Mason 1998).

3.1.5 Sculpins

Description
The most common sculpins on the North Coast are the coastrange sculpin, the prickly sculpin and the slimy sculpin. They grow up to 7 inches, but are typically around 4 to 5 inches in length.

Life Cycle
All three sculpin species have similar reproductive strategies. Mature adults spawn in spring, anytime after mid March. They spawn in freshwater but can tolerate brackish water. Eggs are deposited in a mass on the ceiling of a nest usually underneath a rock. Eggs hatch within approximately 15-16 days, and the young live in the water column for the first 30-35 days after hatching, prior to metamorphosing and remaining on the bottom.

Status
Prickly sculpin has been recorded in 27 different streams on the North Coast. Slimy sculpin has been recorded in 3 streams, and coastrange sculpin has been recorded in 6 streams. These fish are not important for recreational fishing.

3.1.6 Mountain Whitefish

Description
Mountain whitefish adults remain in freshwater for their entire lives, can grow up to 570 mm and can weigh up to four pounds.

Life Cycle
Mountain whitefish reach sexual maturity at age 3 or 4, however, they can live to be up to 17 years old. Broadcast spawning occurs in the late fall or early winter over gravel and eggs hatch in early spring. These fish inhabit lakes and larger rivers, are primarily bottom feeders, but will feed on midwater plankton and surface insects if necessary.

Status
Very little is known about mountain whitefish on the North Coast, and they are only recorded in the Ecstall River (FISS 2003).

3.1.7 Lamprey

Description
The Pacific lamprey and the river lamprey can be found on the North Coast. The Pacific lamprey grows to approximately 680 mm whereas the river lamprey is much smaller, growing to 311 mm. They are both parasitic and anadromous.

Life Cycle
Very little is known about the river lamprey, except that they spawn in freshwater and may make long migrations to do so. Pacific lampreys migrate to freshwater to spawn between July and September, and spend the winter months until the following March becoming sexually mature. They spawn from April to July in sandy gravel and usually die between 1 and 14 days after spawning.

Status
Few streams have recorded data on lamprey in the North Coast, however the river lamprey has been recorded in Kitkiata Creek and the Pacific lamprey can be found in Kitkiata Creek, and both the Goat and Lachmach rivers.

3.2 Escapement Trends of Pacific Salmon based on DFO Escapement data

The following section provides the analysis of escapement trends of Pacific salmon in the LRMP study area. As noted previously in this report, this is a preliminary analysis based solely on the available data and is not intended to be a comprehensive assessment of escapement trends.

3.2.1 Chinook Salmon

A summary of chinook salmon stock status is presented in Table 8 and escapement data are included in Appendix I. Of the 16 known chinook stocks, 18.8% (n= 3) are identified as of some concern and 75 % (n=12) are identified as potentially threatened. Streams with abundant escapement appear to have declined less than streams with sparse escapement. Each of the top 4 chinook streams (based on historical average escapement) are potentially threatened (Ecstall River, Johnston River, Kwinamass River, Khutzeymateen River) and these streams all have current escapements less than 40% of their historical means. In addition to these, other notable chinook stocks in apparent decline include:

- Georgie River, at 0% of its historical escapement
- Chambers Creek, at 1% of its historical escapement
- Kitsault River, at 14% of its historical escapement
- Kloiya River, at 51% of its historical escapement

Table 8. Summary of escapement data for chinook salmon from 1950-2001.

Chinook Salmon		
Stock Status	**Total**	**% of Total Stocks**
Unthreatened[1]	0	0.0%
Of Some Concern[2]	3	18.8%
Small stock--apparently stable (S-1)	3	18.8%
Historically large popn--now depleted. (S-3)	0	0.0%
Potentially Threatened	12	75.0%
Potential High Risk of Extinction (H)	9	56.3%
Potential Moderate Risk of Extinction (M)	3	18.8%
No Recent Records[3]	1	6.3%
Total Known Chinook Stocks	**16**	
Questionable stocks[4]	4	
Total Chinook Streams	**20**	

[1]Unthreatened stocks are at low risk of extinction

[2]Of Some Concern are not at immediate risk of extinction

[3]No Recent Records: No records from 1990-2001

[4]Questionable stocks have fewer than 4 annual records of 25 or more spawners

3.2.2 Chum Salmon

A summary of chum salmon stock status is presented in Table 9 and escapement data are included in Appendix I. Of the 110 known chum stocks, 14.5% (n= 16) are identified as unthreatened, 10.9 % (n=12) are identified as of some concern and 74.5% (n=82) are identified as potentially threatened. Streams with abundant escapement appear to have declined less than streams with sparse escapement. Of the top 10 chum stocks (based on historical average escapement), 6 are identified as unthreatened (Ecstall River, Stagoo Creek, Kshwan River, Khutzeymateen River, Kitsault River, and Illiance River). 52 of the 104 stocks identified as threatened have average escapements of less than 500 spawners. Some of the notable chum stocks in apparent decline include:

- Kiltuish River, at 15% of its historical average escapement
- Turn Creek, at 8% of its historical average escapement
- Kingkown Inlet System, at 2% of its historical average escapement
- Kwinamass River, at 3% of its historical average escapement
- Stannard Creek, at 11% of its historical average escapement
- Georgie River, at 9% of its historical average escapement

Table 9. Summary of escapement data for chum salmon from 1950-2001.

Chum Salmon		
Stock Status	**Total**	**% of Total Stocks**
Unthreatened[1]	16	14.5%
Of Some Concern[2]	12	10.9%
Small stock--apparently stable (S-1)	9	8.2%
Historically large popn--now depleted. (S-3)	3	2.7%
Potentially Threatened	82	74.5%
Potential High Risk of Extinction (H)	62	56.4%
Potential Moderate Risk of Extinction (M)	20	18.2%
No Recent Records[3]	0	0.0%
Total Known Chum Stocks	**110**	
Questionable stocks[4]	27	
Total Chum Streams	**137**	

[1]Unthreatened stocks are at low risk of extinction

[2]Of Some Concern are not at immediate risk of extinction

[3]No Recent Records: No records from 1990-2001

[4]Questionable stocks have fewer than 4 annual records of 25 or more spawners

3.2.3 Coho Salmon

A summary of coho salmon stock status is presented in Table 10 and escapement data are included in Appendix I. Of the 129 known coho stocks, 10.1% (n=13) are identified as unthreatened, 8.5% (n=11) are identified as of some concern and 76 % (n=98) are identified as potentially threatened. Eight of the top 11 coho producing streams (based on historical average escapement) are threatened (Kingkown Inlet System, Lowe Inlet System, Quitonsta Creek, Eagle Creek, End Hill Creek, Clifford Creek, Salmon Creek and Stannard Creek) and these streams all have current escapements less than 16% of their historical means. On the other hand, both the Khutzeymateen and Ecstall rivers are unthreatened and mean escapements in the 1990s were 265% and 401% of the historical mean escapement. Even so, some of the notable coho stocks are in apparent decline and include:

- Clifford Creek, at 0% of its historical mean escapement
- Salmon Creek, at 0% of its historical mean escapement
- Georgie River, at 0% of its historical mean escapement
- Eagle Creek, at 1% of its historical mean escapement
- Kingkown Inlet System, at 3% of its historical mean escapement
- Stannard Creek, at 7% of its historical mean escapement
- End Hill Creek, at 9% of its historical mean escapement

Table 10. Summary of escapement data for coho salmon from 1950-2001.

Coho Salmon		
Stock Status	**Total**	**% of Total Stocks**
Unthreatened[1]	13	10.1%
Of Some Concern[2]	11	8.5%
Small stock--apparently stable (S-1)	10	7.8%
Historically large popn--now depleted. (S-3)	1	0.8%
Potentially Threatened	98	76.0%
Potential High Risk of Extinction (H)	86	66.7%
Potential Moderate Risk of Extinction (M)	12	9.3%
No Recent Records[3]	7	5.4%
Total Known Coho Stocks	**129**	
Questionable stocks[4]	22	
Total Coho Streams	**151**	

[1]Unthreatened stocks are at low risk of extinction

[2]Of Some Concern are not at immediate risk of extinction

[3]No Recent Records: No records from 1990-2001

[4]Questionable stocks have fewer than 4 annual records of 25 or more spawners

3.2.4 Pink Salmon

A summary of pink salmon stock status is presented in Table 11 and escapement data are included in Appendix I. Of the 154 known pink stocks, 66.9% (n=103) are identified as unthreatened, 5.8% (n=9) are identified as of some concern and 27.3 % (n=42) are identified as threatened. Fourteen of the top 15 pink producing streams (based on historical average escapement) are unthreatened (Quaal, Kwinamass, Khutzeymateen, Oona, Ensheshese and Khyex rivers, Moore Cove, Kitkiata, Kumealon, Dogfish Bay, La Hou, Turn, Borrowman and Head Creeks), and 10 of these systems have means in the 1990s greater than 100% of their historical means (1950-1989). Many pink stocks have abundant escapements and of all the pink stocks, 79 (48%) have means in the 1990s greater than 100% of their historical means. Although most pink streams are unthreatened, there are some notable streams that have been declining and are of some concern, including:

- Kiltuish River at 22% of its historical mean escapement
- Kiskosh Creek, at 46% of its historical mean escapement
- Kdelmashan Creek, at 16% of its historical mean escapement
- Scotia River, at 18% of its historical mean escapement
- Kingkown Inlet System, at 1% of its historical mean escapement

Table 11. Summary of escapement data for pink salmon from 1950-2001.

Pink Salmon		
Stock Status	**Total**	**% of Total Stocks**
Unthreatened[1]	103	66.9%
Of Some Concern[2]	9	5.8%
Small stock--apparently stable (S-1)	4	2.6%
Historically large popn--now depleted. (S-3)	5	3.2%
Potentially Threatened	42	27.3%
Potential High Risk of Extinction (H)	26	16.9%
Potential Moderate Risk of Extinction (M)	16	10.4%
No Recent Records[3]	0	0.0%
Total Known Pink Stocks	**154**	
Questionable stocks[4]	10	
Total Pink Streams	**164**	

[1]Unthreatened stocks are at low risk of extinction

[2]Of Some Concern are not at immediate risk of extinction

[3]No Recent Records: No records from 1990-2001

[4]Questionable stocks have fewer than 4 annual records of 25 or more spawners

3.2.5 Sockeye Salmon

A summary of sockeye salmon stock status is presented in Table 12 and escapement data are included in Appendix I. Of the 48 known sockeye stocks, 29.2% (n=14) are identified as unthreatened, 4.2% (n=2) are identified as of some concern and 62.5% (n=30) are identified as potentially threatened. Eight of the top 10 sockeye producing streams (based on historical average escapement) are unthreatened (Devon Lake System, Mikado Lake System, Kingkown Inlet System, and Diana, Keecha, Shawatlan, Kooryet and Curtis Inlet creeks). As well, three runs of sockeye have increased in the 1990s; the Mikado Lake System at 114% of historical mean, Tsimtack Creek at 124% of historical mean and Johnston Lake at 324% of its historical mean. However, there are some notable streams that have been declining and are of concern or threatened, including:

- Lowe Inlet System, at 42% of its historical mean escapement
- Quitonsta Creek, at 39% of its historical mean escapement
- Kitkiata Creek, at 43% of its historical mean escapement
- End Hill Creek, at 4% of its historical mean escapement
- Cridge Inlet Creek, at 0% of its historical mean escapement

Table 12. Summary of escapement data for sockeye salmon from 1950-2001.

Sockeye Salmon		
Stock Status	**Total**	**% of Total Stocks**
Unthreatened[1]	14	29.2%
Of Some Concern[2]	2	4.2%
Small stock--apparently stable (S-1)	0	0.0%
Historically large popn--now depleted. (S-3)	2	4.2%
Potentially Threatened	30	62.5%
Potential High Risk of Extinction (H)	27	56.3%
Potential Moderate Risk of Extinction (M)	3	6.3%
No Recent Records[3]	2	4.2%
Total Known Sockeye Stocks	**48**	
Questionable stocks[4]	23	
Total Sockeye Streams	**71**	

[1]Unthreatened stocks are at low risk of extinction

[2]Of Some Concern are not at immediate risk of extinction

[3]No Recent Records: No records from 1990-2001

[4]Questionable stocks have fewer than 4 annual records of 25 or more spawners

3.2.6 Summary of Escapement Trends for Pacific Salmon

DFO's salmon escapement data have documented 543 individual stocks of salmon in the North Coast LRMP area (Table 13). Although a number of concerns exist about consistency of data collection for each of these stocks, it is apparent that spawning populations of all species are in decline. Nearly 50% of these stocks are classified as potentially threatened (High or Moderate risk) while only 26.9% of stocks are classified as Unthreatened.

Table 13: Summary of Escapement Trends for Salmon in the NC LRMP Area.

		Of Some Concern		**Potentially Threatened**				
Species	**Unthreatened**	**S-1** (small stock, apparently stable)	**S-3** (historically large population, now depleted)	**High Risk**	**Moderate Risk**	**No Recent Records**	**Questionable Stock**	**Total**
Chinook	0	3	0	9	3	1	4	**20**
Chum	16	9	3	62	20	0	27	**137**
Coho	13	10	1	86	12	7	22	**151**
Pink	103	4	5	26	16	1	9	**164**
Sockeye	14	0	2	27	3	2	23	**71**
Total	**146**	**26**	**11**	**210**	**54**	**11**	**85**	**543**
% of all stocks	**26.9%**	**4.8%**	**2.0%**	**38.7%**	**9.9%**	**2.0%**	**15.7%**	

Stock decline appears to be consistent across the study area. Only 26 of the 167 identified salmon producing streams do not have any salmon stocks identified as "Potentially Threatened" or "Of Some Concern". Most of these 26 streams sustain small populations. These streams are listed separately in Appendix IV. Conversely, 141 of the 167 salmon producing streams have stocks that are identified as "Threatened" or "Of Some Concern".

No ready explanation of why such a large number of stocks are in decline is available at this time. While impacts from historical land use practices may have contributed to some stock decline, many of the watersheds that have stocks in decline have minimal or no development. A more detailed analysis of what may be leading to this stock decline is recommended.

Slaney *et al* (1996) undertook a comprehensive assessment of anadromous salmon and trout escapement for all stocks in BC and the Yukon (n= 9,662). Stocks were identified in categories similar to Morrel as outlined in the following table:

Table 14: Comparison of Escapement Evaluation Methods between Slaney (1996) and Morrel (2000).

Category	Slaney *et al (*1996)	Morrel (2000)
Extinct	Referral to local experts	Not included
High Risk	Mean population in the current decade was less than 20% of the long term mean **and** less than 200 fish.	Mean population in the current decade was less than 20% of the long term mean **and** less than 200 fish. Or, Mean population in the current decade was less than 50% of the long term mean, and less than 50 fish (pink, sockeye) or 25 fish (chinook, coho, chum)
Moderate Risk	Large populations exhibiting declines to 200-1000 fish from a long term mean of more than 5000 fish or, Small populations reduced to less than 20% of a long term mean of 1,000 to 5,000 fish.	Mean population in the current decade is between 20% and 50% of the long term mean and less than or equal to 1000 fish or Mean population in the current decade is less than 20% of the long term mean and between 200 and 1000 fish.
Special Concern	Stocks could be threatened by relatively minor disturbances, especially where a pending threat is known or, Have insufficient information on population trends, but available information suggests depletion or, May interbreed with introduced, non native fish, or Are not currently at risk but require attention because of unique characterisitics	Historically small stock, mean escapement in the current decade is less than 200 fish and >50% of the long term mean. Historically large stock, depleted to <20% of long term average and mean escapement in the current decade is >1000 fish
Unthreatened	Stocks averaging more than 1,000 fish or greater than 20% of their long term mean abundance.	Mean escapement in the current decade is 200 or more fish and >50% of the long term mean.
Unknown	Not defined	Insufficient data to determine status. No evidence of depletion. No recent records, - may be extinct. May not correspond to distinct stock.

The above table notes that the methods used in this report are similar in identifying stocks at moderate to high risk, but use different criteria for stocks that may be unthreatened or of some concern. Also, the criteria for Slaney *et al* (1996) unknown stocks is not defined, and as outlined below, this category accounted for almost half of their identified stocks in the North Coast.

Slaney *et al* (1996) identified 584 stocks on the North Coast (the geographic boundaries are not clearly defined and may be slightly different than the LRMP boundaries), compared to the 543 stocks included in this report. The following table compares the results of the Slaney *et al* (1996) stock evaluation to the evaluation in this report:

Table 15: Comparison of Stock Assessment Results with Slaney *et al* (1996).

	Extinct	**High Risk**	**Moderate Risk**	**Special Concern**	**Unthreatened**	**Unknown**	**Total**
Slaney *et al (1996)*	0 0%	41 7.0%	5 0.9%	0 0%	267 45.7%	271 46.4%	584
Gordon and Bahr (2003)	n/a	210 38.7%	54 9.9%	37 6.8%	146 24.6%	96 17.7%	543

The different criteria used for Unthreatened and Unknown stocks makes comparison of the 2 studies difficult at this time. The large number of unknown stocks in the Slaney *et al* report appear to be turning up as stocks that are at High Risk, Moderate Risk or Of Special Concern in this analysis. Further analysis of the original data sets (to compare stream by stream results) would be required to clearly identify how the escapement trend on the North Coast have evolved in the years between these assessments.

The apparent sharp decline in stocks over the past decade is an issue that requires further assessment to confirm whether the data reflects actual conditions in the streams.

3.3 Summary of Freshwater (non Pacific salmon) Information, and watersheds with unique or vulnerable fish values.

The information on freshwater species in the North Coast LRMP area comes from a wide variety of sources, and has been compiled to note fish presence in a stream. The information in the database reflects available information about freshwater fish, and absence of data does not necessarily reflect a lack of fish presence, but rather a lack of knowledge about the presence of that fish.

Dolly Varden char, and cutthroat trout are the most widely distributed species on the North Coast. 263 streams are listed in the database of which 117 (44.5%) are known to have cutthroat trout, and 172 (57%) are known to have Dolly Varden. Number of stocks documented for other species in the North Coast LRMP area is given in Table 14. Although cutthroat trout and Dolly Varden appear to be widespread in streams on the North Coast, we have less knowledge about anadromous forms

of these two species, and have no record of bull trout. This lack of information probably reflects a small amount of sampling effort and not the abundance of the species in this area.

Table 16. List of freshwater fish species and their presence in North Coast streams.

Fish Species	# documented stocks
cutthroat trout	117
anadromous cutthroat trout	9
Dolly Varden	150
anadromous Dolly Varden	1
rainbow trout	68
steelhead	61
kokanee	19
eulachon	3
mountain whitefish	1
threespine stickleback	42
prickly sculpin	24
coastrange sculpin	5
slimy sculpin	3
sculpin (General)	40
river lamprey	1
Pacific lamprey	3
lamprey (General)	3
stickleback (General)	19
western brook lamprey	0
green sturgeon	0
shad (introduced)	0
peamouth chub	0
northern pikeminnow	0
longnose dace	0
redside shiner	0
longnose sucker	0
largescale sucker	0
rainbow smelt	0
longfin smelt	0
Pacific staghorn sculpin	0
starry flounder (estuary)	0
Atlantic salmon	0
burbot	0
northern redbelly dace	0
pygmy whitefish	0

The freshwater database also includes information about a stream or fish stocks' recreational value, its potential vulnerability and its potential uniqueness. Most of this information came from stakeholder input and from MELP's Rich Ecosystem Analysis (Liepins, undated), and not from inventories or scientific studies. The criteria for determining recreational value, vulnerability and

uniqueness are not scientifically defined. Further studies for site specific development issues may be needed to determine actual or relative recreational value, vulnerability and uniqueness.

Some freshwater fish species such as rainbow and cutthroat trout, and steelhead have been identified as important for recreational angling. In particular, steelhead were regarded as very important for recreational fishing and streams known to contain them have been identified as potentially unique. Some steelhead streams were also identified as potentially vulnerable, mainly due to their easy access – small populations are vulnerable to over fishing. Other potentially vulnerable streams include those with karst topography that may be sensitive to ground disturbance. Eulachon were also identified as unique because of their cultural significance to native people. Other streams have recreation potential for fish viewing or guiding. Of the data available, 64 streams are identified as potentially unique, 14 are potentially important for recreation and 5 are potentially vulnerable. A list of these streams identified as unique, vulnerable or having recreation potential is given in Appendix V.

Some lakes within the North Coast area are also suspected to have unique populations of freshwater fish. Khtada Lake appears to have a unique population of rainbow trout that have been reported up to weights of 6 kg (FISS 2003). There is a genetic study underway on rainbow trout in Khtada Lake, however it is still incomplete at this time (Heath, pers. comm.). Union Lake also has large rainbow trout, reported to have weights up to 1.9 kg (Mason and Lewis 1997). Lowe Lake has populations of cutthroat trout that weigh up to 690 g and Dolly Varden that weigh up to 458 g that may be of interest to recreational anglers (Mason and Williams 1998). Similar fish values may exist in other lakes, but have not yet been identified.

3.4 Review of Community Collected Rearing Data (Proctor, 2003)

The North Coast LRMP Fish and Wildlife sector requested that community collected coho rearing data be included in this background report. As such, local resident Bart Proctor, through the North Coast Community Fisheries Centre, completed a report on juvenile coho utilization of streams within the LRMP area. A complete copy of this report entitled *The Ranking of North Coast Coho Stream for Rearing Productivity and Biodiversity: A supplementary Fisheries Report for the North Coast LRMP* has been circulated previously by the GTT. This report was meant to supplement the fisheries data being used to evaluate productive streams in the plan area, particularly for coho salmon as enumeration of coho stocks is often confounded by weather and field conditions. Proctor's report included data from juvenile coho synoptic programs from 1998-2001 for 79 streams. These data were collected through contracts managed by the Community Fisheries Development Centre during the North Coast Stream Inventory Program, as well as the Oona River Stream Inventory Program and the Fisheries Charter Vessels Survey Program. Proctor evaluated coho productivity in streams with an Overall Index of Rearing Productivity from 1-3 (low=1, medium=2 or high=3) based on catch per unit effort and density of juvenile fish in selected sampling sites. Streams were then grouped geographically and their productivity indexes averaged to indicate the areas with the highest productivity.

The top three areas for rearing coho salmon were identified as the lower Skeena, Grenville and Kincolith. Streams in the lower Skeena area include Kwinitsa, Antigonish, Aberdeen, Marigonish, Inver, Basalt, Stapledon, and Valley (Khyex). Proctor hypothesizes that streams in the lower Skeena serve as a temporary refuge area for out-migrating coho juveniles prior to them entering the

ocean. The Grenville area also includes streams near the mouth of the Skeena River and the Kincolith area includes streams near the mouth of the Nass River.

3.5 Summary of Existing Legislation, Policy and Guidebooks

Fisheries Act

The *Fisheries Act* is administered by the federal Minister of Fisheries and Oceans Canada (DFO). Habitat management staff in the department have responsibility for protecting fish and fish habitat under the habitat provisions of the *Fisheries Act*. The *Act* contains definitions of terms including: *fish, deleterious substance, deposit, fish habitat*, etc.. The portion of the act most applicable to land and resource management are sections 34 to 43 which govern Fish Habitat Protection and Pollution Prevention. Key provisions of these sections include:

- S. 35(1): No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.
- S. 35(2): The minister may authorize harmful alteration, disruption or destruction of fish habitat (*sic*).
- S. 36(3): No person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish. (*note: this includes sediment*)
- S. 37(1): Requires the proponent of an activity that may harmfully alter, disrupt or destroy fish habitat to undertake appropriate studies to assess for and mitigate potential impacts. (*ie., proponent pays*)
- S. 37(2): Allows the minister to require plan modifications, and/or restrict the operation of the undertaking.
- S. 40: Prescribes fines up to $1,000,000 and/or up to 3 years in jail for offences committed under the act.

While the *Fisheries Act* provides specific legislation to protect fish habitat, a number of DFO papers have been published that provide direction to the public and to DFO's habitat staff on how to interpret the *Act*. The most important of these is The Department of Fisheries and Oceans Policy for the Management of Fish Habitat (DFO, 1986). This document sets out the Department's policy objective of a *Net Gain of Habitat*, and the guiding principle of *No Net Loss of the Productive Capacity of Habitats*. To clarify aspects of this Policy, DFO published the Habitat Conservation and Protection Guidelines (2nd Edition, 1998). This document provides direction to DFO Habitat staff and proponents on the processes by which projects may meet the guiding principle of No Net Loss.

In recent years, DFO Habitat staff have taken a precautionary approach in their review of projects that could affect fish habitat. Projects that have the potential to harmfully affect fish habitat are generally subject to a review process whereby DFO requires the proponent to relocate and/or redesign their project and develop mitigation strategies to avoid impacts to fish habitat. Where unavoidable losses may still occur, DFO may choose not to authorize the alterations to fish habitat, or to authorize them with specific conditions such as the creation of compensation habitat, and the monitoring of project impacts and the effects of compensation. Proponents do not require DFO authorizations to harmfully affect fish habitat, however they are at risk to prosecution under the *Fisheries Act* if fish habitat is harmfully affected without receiving an authorization in advance.

The substantial fines and potential jail time associated with the *Fisheries Act* is a powerful motivator for land developers to seek advice from DFO Habitat staff prior to proceeding with projects that could affect fish habitat.

Projects identified as potentially causing a harmful alteration, disruption or disturbance of fish habitat are required to undergo a review under the Canadian Environmental Assessment Act.

Canadian Environmental Assessment Act (CEAA)

The CEAA establishes a process for conducting environmental assessments of projects that involve the federal government, and ensures that environmental effects are considered in the planning stage, including cumulative effects. Projects that may affect fish habitat trigger a CEAA assessment. Projects with relatively minor effects typically receive a CEAA screening review, while projects with potentially more significant effects may require a much more detailed review. Both types of reviews require referral to other federal agencies (Canadian Wildlife Service, Coast Guard), stakeholders and First Nations, and provide opportunities for public input.

Species at Risk Legislation

Both federal and provincial government manage the status of species at risk. At the federal level, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses and designates which wild species are in some danger of disappearing from Canada. Under the National Accord for the Protection of Species at Risk, federal, provincial and territorial governments have agreed to recognise COSEWIC as a source of independent advice on the national status of species at risk and have agreed to work together to protect these species. COSEWIC designations are also accepted under the federal Species at Risk Act (SARA) which was passed into law on December 12, 2002 and came into effect in July 2003. SARA is designed to prevent Canadian indigenous species, subspecies and distinct populations of wildlife from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to encourage the management of other species to prevent them from becoming at risk. Both SARA and the National Accord for the Protection of Species at Risk are components of the federal government's Strategy for the Protection of Species at Risk.

At the provincial level, British Columbia is committed to the National Accord policy and also maintains a provincial "red" and "blue" list of species grouped according to their conservation risk. Red listed species are species or subspecies that have, or are candidates for Extirpated, Endangered or Threatened status in British Columbia. Blue listed species are vulnerable taxa of special concern because of characteristics that make them particularly sensitive to human activities or natural events. They are at risk, but are not Extirpated, Endangered or Threatened. The provincial status given to a species is dependent on the ranking assigned to it on a subnational (provincial or territorial) level by an independent, non-profit organization called NatureServe. NatureServe scientists rank each species on a Global and Subnational scale based on scientific research and expertise of their members. The Conservation Data Centre manages all of these designations and reports them for four fish species at risk on the North Coast, as found below in Table 1. COSEWIC has not applied designations to any of these fish species at the present time, therefore they are not protected by SARA.

Table 17. Fish species at risk on the North Coast with their NatureServe and BC Status designations. Explanations of the rankings are given below the table.

		NatureServe		
Scientific Name	English Name	G Rank	Subnational	BC Status
Oncorhynchus clarki clarki	Cutthroat Trout, *clarki* subspecies	G4T4	S3S4SE	BLUE
Salvelinus confluentus	Bull Trout	G3	S3	BLUE
Salvelinus malma	Dolly Varden	G5	S3S4	BLUE
Thaleichthys pacificus	Eulachon	G5	S2S3	BLUE

G: Global--Applies to a species over its entire range; **T: Infraspecific Taxon**--The status of infraspecific taxa (subspecies or varieties) **S: Subnational**--Applies to species conservation status in British Columbia
SE: Exotic--An exotic established in the nation or subnation; may be native in nearby regions
1 = critically imperilled**; 2** = imperiled; **3** = vulnerable to extirpation or extinction; **4** = apparently secure; **5** = demonstrably widespread, abundant, and secure.

The blue list is designed to emphasize species that require special attention, therefore assisting in prioritization of research, inventory, and management which will facilitate conservation and appropriate land-use decisions. For example, bull trout have been selected as part of the Identified Wildlife list which receives further attention in the Identified Wildlife Management Strategy, a component of the Forest Practices Code.

Through this initiative, areas of limiting habitat called wildlife habitat areas (WHAs) can be mapped and approved by the Chief Forester and Deputy Minister of Water, Land and Air Protection (WLAP). WHAs are managed according to general wildlife measures (GWMs) specific to the habitat requirements of the species. In the case of bull trout, WHAs are intended to retain functioning riparian areas around critical habitats, maintain stream channel integrity, groundwater flow and natural temperature regimes. Although the infrastructure is in place, there are no WHAs for bull trout at the present time in the North Coast. Cutthroat trout, Dolly Varden and eulachon are not part of the Identified Wildlife list, therefore their presence on the blue list allows them to be considered for more formal designation as Endangered or Threatened either under the British Columbia Wildlife Act or COSEWIC.

Forest Practices Code

Legislation governing forestry practices is currently in transition from the *Forest Practices Code Act* to the *Forest and Range Practice Act (FRPA)*. The *Forests Statutes Amendment Act (No. 2) 2002* (FSAA) was given Royal Assent on November 26, 2002 and makes amendments to the existing Forest Practices Code. These amendments came into force on December 17, 2002 and were intended to provide some immediate efficiencies and streamlining in planning and practices.

The *Forest and Range Practices Act (FRPA)*--expected to come into force in April 2003--replaces the *Forest Practices Code of BC Act* and enacts a new forest and range management planning and practices framework. Associated regulations will be developed to support this legislation, and will come into force at the same time.

Legislation associated with fish habitat and riparian protection remains unchanged in the new act. Many aspects of this legislation are specifically designed to protect fish and fish habitat, but are too numerous to repeat in this document. Some of the most important regulations include:

1. The Operational and Site Planning Regulations:
    - Defines terms such as: *fish stream, stream, wetland, lake, riparian reserve zone, stream reach, fisheries and marine sensitive zones* etc.
    - Part 8 – Riparian Management Areas:
        - Division 1 – Streams, Division 2 – Wetlands, Division 3 – Lakes: Defines riparian classes and associated riparian reserve and management zones.
2. Timber Harvesting and Silviculture Practices Regulation
    - Part 3, Division 1: Harvesting on potentially unstable terrain.
    - Part 3, Division 2: Protection of Streams and Riparian Areas.
3. Forest Road Regulation
    - Part 3, Construction and Modification: Ensures timing windows and fish passage for construction and deactivation of crossings in fish streams

Perhaps the most important aspect of stream and riparian protection are the legislated requirements for riparian reserve and management zones around streams, lakes and wetlands. The designation of a reserve zone (no harvesting) maintains streamside timber and vegetation, vital for stabilizing banks, filtering sediments, providing shade and cover for fish and contributing litterfall and downed wood into channels. Current legislated reserve and management zones are shown in the following table:

Table 18: Stream, Wetland and Lake Reserve and Management Zones

Stream Reserve and Management Zones				
Riparian Class	**Riparian Reserve Zone (m)**	**Riparian Management Zone* (m)**	**Riparian Management Area (m)**	**Notes**
S1	50	20	70	Fish bearing, >20m wide
S2	30	20	50	Fish bearing, >5, <20m wide
S3	20	20	40	Fish bearing, >1.5, <5m wide
S4	0	30	30	Fish bearing, <1.5m wide
S5	0	30	30	Non-fish bearing, >3m wide
S6	0	20	20	Non-fish bearing, <3m wide
Large Streams	0	100	100	Channel width and active floodplain >100m wide
				* RMZ extends to the edge of any active floodplain
Wetland Reserve and Management Zones				
W1	10	40	50	>5 ha
W2*	10	20	30	>1, <5 ha, and in CWH very dry maritime, dry maritime or dry sub-maritime BGCZ
W3	0	30	30	>1, <5 ha, and in BGCZ other than above.
W4*	0	30	30	>0.5 ha, <1 ha, and in CWH very dry maritime, dry maritime or dry sub-maritime BGCZ
W5	10	40	50	2 or more wetlands with overlapping riparian management areas that are >5ha.

Lake Reserve and Management Zones				
Riparian Class	**Riparian Reserve Zone (m)**	**Riparian Management Zone* (m)**	**Riparian Management Area (m)**	**Notes**
L1	10	Established by district manager		>5ha in size*
L2*	10	20	30	>1, <5 ha, and in CWH very dry maritime, dry maritime or dry sub-maritime BGCZ
L3	0	30	30	>1, <5 ha, and in BGCZ other than above.
L4*	0	30	30	>0.5 ha, <1 ha, and in CWH very dry maritime, dry maritime or dry sub-maritime BGCZ
*Lakes >1000 ha have no reserve zone				

* note: the BGC Zones for these classifications do not occur in the plan area.

Fish Stream Crossing Guidebook

Forest Practices Code guidebooks have been developed to support the regulations, but are not part of the legislation. The recommendations in guidebooks are not mandatory requirements, but once a recommended practice is included in a plan or prescription, it becomes legally enforceable.

The Fish Stream Crossing Guidebook (March 2002) was prepared under the direction of a multi-agency steering committee consisting of federal and provincial agency representatives and the forest industry representatives. It provides users with technical, statutory reference and process guidance for selecting and designing fish-stream crossings on forest, and mineral and petroleum access roads that should void harming fish habitat and provide fish passage at stream crossing sites.

This guidebook provides specific direction on:

- The provincial and federal review and approval process for crossing structures on fish streams,
- Design and installation methods of various crossing structures,
- Fish stream protection methods during installation and maintenance, and
- Practices for deactivation of crossing structures.

The detailed content of the guidebook and the collaborative nature of its creation has made it an effective and well supported tool.

Fish Stream Identification Guidebook

The Fish Stream Identification Guidebook (2nd edition) provides specific details and examples of how streams, wetlands, lakes, and fisheries and marine sensitive zones are to be identified and classified in the field, and to be shown on planning maps. It also restates the specific regulations and definitions that govern stream identification.

Riparian Management Area Guidebook

The Riparian Management Area Guidebook was provided to assist foresters in compliance with the Forest Practices Code of British Columbia Act and to set and achieve the management objectives for riparian management areas (RMA) specified in operational plans. The recommendations in the guidebooks are not mandatory, but once a recommended practice is included in a plan, prescription or contract, it becomes legally enforceable. In the absence of permits and plans, the guidelines outlined in the guidebook are used by government to assess riparian classification, management and mapping.

RMAs consist of a riparian management zone and a reserve zone if required. The widths of these zones are determined by attributes of streams, wetlands or lakes and adjacent terrestrial ecosystems. A summary of the riparian requirements for streams classified from S1-S6 under the Forest Practices Code can be found in Appendix III (Zielke and Bancroft, 2001).

Land Development Guidelines

The Land Development Guidelines for the Protection of Aquatic Habitat were produced in 1992 by the Habitat Management Division of the Department of Fisheries and Oceans and the Integrated Management Branch of the Ministry of Environment, Lands and Parks (now Ministry of Water, Land and Air Protection). The purpose of these guidelines is to protect fish populations and their habitat from the damaging effects of land development activities. As per the guidebook, each land development project is subject to the following objectives:

- Provision and protection of leave strips adjacent to watercourses
- Control of soil erosion and sediment in runoff water
- Control of rates of water runoff to minimize impacts on watercourses
- Control of instream work, construction and diversions on watercourses
- Maintenance of fish passage in watercourses for all salmonid life stages
- Prevention of the discharge of deleterious substances to watercourses

All new developments and expansions or re-developments of existing areas are considered land development projects and are subject to these guidelines unless they do not have fish habitat onsite or do not have any potential impact to fish habitat through construction activities, land use or stormwater discharges. Projects are referred to DFO and MWLAP for assessment of any proposed impact to the productive capacity of fish habitat. If an impact exists, options are examined to meet the no net loss criteria prior to project approval. Once approved, the project must follow the guidebook objectives and guidelines for construction in the following areas:

- Leave strips (typically 15 m from the high water mark on each side of the watercourse)
- Erosion, sediment control and site development practices
- Stormwater Management
- Instream Work
- Fish Passage and Culverts
- Operating windows for fisheries sensitive zones

Water Act

The *Water Act* is provincial legislation that regulates and licenses water use in BC. Of particular importance to land development are the requirements under Part 7 - Changes in and about a Stream. Proponents are required to seek and attain approval, licence or order for most types of changes in and about a stream. Exceptions include any changes made under the *Forest Practices Code*, or exceptions as listed in the *Act*.

Other Legislative Acts

There are a number of other legislative acts that may govern activities in and around streams under a variety of circumstances. These include:

Navigable Waters Protection Act: An act that regulates any activity in, around, under and over navigable waters (culverts, bridges, dredging, riprap placement)

Waste Management Act: An act that regulates discharge of all wastes into the environment.

Fish Protection Act: An act that protects fish habitat, particularly in urban areas where new or redeveloped industrial, commercial or residential developments take place beside streams.

Canadian Environmental Protection Act: An act designed to prevent pollution, to protect the environment and human health in order to contribute to sustainable development. It regulates the production and control of toxic substances.

3.6 Summary of Current Forestry Management Practices Adjacent to Streams and Riparian Areas

Forest harvest practices have changed substantially with the introduction of the Forest Practices Code, and the forest industry's growing concern to be seen as good environmental stewards. Changes that affected streams and riparian areas included:

- Legislated reserve and management zones adjacent to streams.
- Professional assessment of unstable terrain and gullies to minimize potential of mass wasting into streams and fish habitat.
- Deactivation of road networks after harvesting activities have been completed.
- Restoration of streams and riparian areas from historical logging activities.

Generally, the forestry companies operating on the North Coast are striving for continual improvement of forest harvesting activities around streams. Recently Interfor, Triumph Timber and Interpac contracted Triton Environmental Consultants Ltd. to assess impacts to stream channels in harvested areas and identify potential downstream affects (Triton 2003, in press). Management of harvesting activities to maintain a low risk to streams and fish habitat is a primary driver in how harvesting plans are developed and implemented. Typically, stream values and risks are identified in advance, and blocks are laid out to protect stream values. Areas that have the potential to lead to stream or fish habitat problems are usually left out of blocks entirely, or managed through

prescriptions developed by registered professionals (Foresters usually, geoscientists and biologists also). However, conflicts between fisheries and forestry values do exist and include:

- Logging up to the banks of S4 streams
- Logging up to the banks of S5 and S6 (non fish bearing) streams.
- Logging related slope failures that contribute excess sediments into fish habitat.
- Chronic sedimentation from forestry roads.
- Log dumps and load outs in lakes, rivers and marine areas contribute excessive amounts of woody debris that accumulate on the bottom.
- Machine disturbance of small (S6) stream channels.
- Disturbance of stream channels in karst topography that affects downstream fish habitat.
- Failure to recognize fisheries sensitive areas.
- Increased vulnerability to blowdown of riparian reserve zones.

The General Management Direction (GMD) outlined later in this document is designed to address these and other development conflicts with fish and riparian ecosystems.

Some forest companies are implementing environmental protection strategies that are incremental to those required under the FPC. These include:

- Leaving S4 streams out of the block entirely. Typically, potential cutblocks are laid out in the field along the mountain side adjacent to a mainstem river. Many of the small streams that feed into the mainstem are classified as S4 from the mainstem up to the break in slope along the mountain side, where stream gradient increases and classification changes from S4 to S6. While the cutblock could extend out to the edge of the reserve zone adjacent to the mainstem, and include portions of these S4 streams (which could be clearcut), the final boundary is often laid out where these streams change from S4 to S6. Harvesting of S4 streams does occur, but on a limited basis. Recent statistics provided on the canadianrainforests.org website [1] that 85% of fish bearing streams are logged are somewhat misleading. It may be true that 85% of fish streams in blocks are logged, however the vast majority of fish streams are not in blocks and have not been logged and are protected under existing legislated reserve zones (all S1 to S3 streams).

- Special management (or no harvesting) where stream stability may be an issue. Throughout the office planning and field layout process, streams with potential stability issues are identified. Where the scope of developing and implementing special management around these streams exceeds the potential value of the timber, or doesn't sufficiently reduce the potential risk, no harvest zones are implemented. Where timber values are high, and risk appears to be manageable, a registered professional (typically a P. Geo.) undertakes an assessment and recommends mitigation strategies to ensure the stream and downstream values are managed to a low risk. All streams in or near blocks are typically assessed in the field to identify potential stability problems that may occur due to logging. These are nearly always non-fish bearing streams, as fish bearing streams are typically not in cutblocks (and all fish bearing streams >1.5m wide have reserve zones). These assessments address a stream's potential to transport sediment and debris, its dependence on downed wood to

[1] http://www.canadianrainforests.org/report_findings/streams

maintain channel morphology, and the stability of its banks. Silviculture prescriptions are then prepared that detail harvest and silviculture activities in the stream's management zone which might include fall away, yard away, selective harvest, and windthrow management. The management zone of streams with low transport potential, stable banks and little to no dependence on downed wood are usually clearcut.

The above review is not intended to be a thorough description of all activities undertaken to protect streams and fish habitats, but rather a highlight of key areas.

4.0 Summary of Existing Watershed Restoration Priorities

Forest Renewal BC, through the Watershed Restoration Program (WRP) initiated a number of projects in the North Coast Forest District to identify watersheds degraded by historical logging practices and develop and implement restoration plans. Overview assessments of several of the watersheds in the Forest District were completed by Jyrkannen Environmental Consulting (1997). Detailed assessments of high priority watersheds were completed by Triton (1998a and b). Major instream works were designed and completed by Triton in Kumealon (Triton 1999), and in Silver Creek (Triton 2002). Extensive road deactivation projects were also implemented, and some riparian assessments were also completed. .

In 2000, the Ministries of Forests and Environment and industry stakeholders, with the support of Forest Renewal B.C, established working groups throughout the Prince Rupert Forest region. Part of their mandate was to prioritize watersheds for restoration works and identify the progress made towards completion of watershed restoration for these watersheds. This work is summarized in the Resource Management Plan, chapter 3, Enhancing Environmental Values[2] and is available on the internet (see web site address in footnote below). The following table is taken from that report, and summarizes the status of restoration work in priority watersheds in the North Coast Forest District.

Table 19: Summary of WRP status in priority watersheds in the North Coast.

Watershed Unit	Priority Key	Targeted	Overview Assessment			Restoration Plans		Prescriptions			Major Works			Routine Effectiveness Evaluation		
			Up-slope	Riparian	In-Stream	In-terim	Full	Up-slope	Riparian	In-Stream	Up-slope	Riparian	In-Stream	Up-slope	Riparian	In-Stream
Kumealon	Y	Yes	C	C	C	C	C	C	C	C	NR	P	C	NR	P	C
Quottoon	Y	Yes	C	C	C	C	C	NR	P	P	NR	P	P	NR	P	P
Tuck	Y	Yes	C	C	C	C	C	C	P	C	NR	P	C	NR	P	P
Union	Y	Yes	C	C	C	C	C	P	P	NR	P	P	NR	P	P	NR
Kaien	Y	No	P													
Kitkiata	Y	No	C	C	C			C			C			P		
Kwinamass	Y	No	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Porcher	Y	No	C					C			C			P		
Scotia	Y	No	C	C	C			C			C			P		
Skeena Is.	Y	No														

P=Planned (Scheduled/not underway). O= Ongoing (commenced/not complete). C= Complete (no further work scheduled). NR= Not required (restorative work not required for this component)

[2] http://www.for.gov.bc.ca/ftp/hcp/external/!publish/Resource_Management_Planning/RMP_2002_2003/RMPs/prince_rupert/

No one document exists that summarizes the complete slate of upslope, instream and riparian assessments, prescriptions and implementation projects that have been completed since the inception of FRBC and the Watershed Restoration Program in the mid 1990's. Although such a document may be of interest, its value as a practical document is diminished in the short term due to a lack of funding to advance planning and implementation of restoration projects. The above table should provide sufficient direction towards which watersheds further restoration work should be directed.

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Appendix I. DFO Salmon Escapement Database

Appendix II. Resident Fish Species Database

Appendix III. Abbreviated summary of BC Riparian Guidebook Approach to Riparian Management for streams

S1	**Large streams (> 20 m wide) with fish or in a community watershed**
	Reserve Zone (RRZ): 50 m (100 m RRZ on "Large Rivers"[4]); no harvesting except for "dangerous trees" as per WCB regulations **Management Zone (RMZ):** 20 m; harvesting allowed. Best management practices recommended for this zone. **Retention in RMZ:** • The FPC specifies a 50% maximum retention (not to be exceeded at a forest development plan level. • Dead, "non-dangerous trees" should be left as per guidebook. • Wildlife trees should be considered for retention. • Manage windthrow hazard consistent with guidebook options. **When on an active floodplain (further criteria provided for hardwood management along rivers):** • 70% to 100% retention of timber with harvesting using singletree, group selection or small patch cuts to maintain riparian structure. • Retain most non-merch. conifers, and understory vegetation. • Feather or top and limb the outer edge of the RMZ to reduce windthrow risk. **When a Large River (100 m wide or more with wide (100m+) floodplain):** • RMZs set on back channels, side channels and sloughs as well. • 50% retention – dominant trees with large branches and open crowns (with reforestation plan to replace most for next harvest).
S2	**Medium sized streams (> 5 m and ≤ 20 m wide) with fish or in a community watershed**
	RRZ: 30 m **RMZ**: 20 m **Retention in RMZ:** • The FPC specifies a 50% maximum retention for S2's (not to be exceeded at a forest development plan level). • Manage windthrow hazard consistent with guidebook options. • Dead, "non-dangerous trees" should be left as per guidebook. • Wildlife trees should be considered for retention.
S3	**Small streams (1.5 to 5 m wide) with fish or in a community watershed**

	RRZ: 20 m **RMZ:** 20 m **Retention in RMZ:** • The FPC specifies a 50% maximum retention for S3's (not to be exceeded at a forest development plan level). • Manage windthrow hazard consistent with guidebook options. • Dead, "non-dangerous trees" should be left as per guidebook. • Wildlife trees should be considered for retention.
S4	**Very small streams (< 1.5 m) with fish or in a community watershed**
	RRZ: None **RMZ 30 m:** **Retention in RMZ:** • The FPC specifies a 25% maximum retention for S4's (not to be exceeded at a forest development plan level). • Remove dominant conifers and retain **50% of the remaining stems within 10 m of the channel**, while harvesting to maintain stand structure. • Retain all windfirm trees with roots embedded in the bank. • Fall and yard away and remove slash and debris providing the removal poses a greater threat to stream integrity and without damaging channel or bank. • Retain non-merch. conifers, and understory vegetation within 5 m of the channel as much as possible. • Wildlife trees should be considered for retention. • **ALSO -** WHERE WINDTHROW HAZARD IS HIGH and high tree retention within 10 m of channel cannot be achieved – consider the following: • Harvest windthrow prone trees and maintain as many of the windfirm trees as possible. • In streams dependant on woody debris – Retain all conifers > 30 cm dbh.
S5	**Larger streams (> 3 m wide) without fish and outside of a comm. watershed**
	RRZ: None **RMZ 30 m:** **Retention in RMZ:** • The FPC specifies a 25% maximum retention for S5's (not to be exceeded at a forest development plan level). • Retain nonmerch conifer trees and other vegetation within 10 m of channel as much as possible. • Wildlife trees should be considered for retention. • Fall and yard away and remove slash and debris. *ALSO FOR COASTAL Valley bottom streams*: Retain 50% of dominant and codominant windfirm stems. *ALSO FOR COASTAL Non-valley bottom streams dependant on woody debris or*

	streamside trees for channel / bank stability: Retain conifers < 30 cm dbh plus understory and deciduous trees within 5 m of channel and retain all leaners within 10 m of channel.
S6	**Smaller streams (≤3 m wide) without fish and outside of a comm. watershed**
	RRZ: None **RMZ 20 m:** **Retention in RMZ:** • The FPC specifies a 5% maximum retention for S6's (not to be exceeded at a forest development plan level). • Retain nonmerch conifer trees and other vegetation within 5 m of channel as much as possible. • Fall and yard away and remove slash and debris. • Wildlife trees should be considered for retention. **Coast streams dependant on woody debris or streamside trees to maintain channel and bank stability and temperature sensitive streams:** • Retain 10 sph (< 30 cm dbh) per 100 m of streambank.

Appendix IV. Table of 26 streams that are Unthreatened in the North Coast LRMP area.

Stream Name	Species	DFO Adult Mean Escapement Data Summary					Max	Mean (50-01)	Historical Mean (50-89)	% Hist. Mean[2]	Stock Status
		1950-1959	1960-1969	1970-1979	1980-1989	1990-2001					
Belle Bay Creek	COHO	0	0	0	11	0	100	2	3	0%	Questionable
Belle Bay Creek	PINK	0	0	358	3715	1992	10000	1090	876	227%	Unthreatened
Chismore Creek	PINK	0	0	0	935	920	4100	371	234	394%	Unthreatened
Cliff Creek	PINK	0	0	0	50	0	500	11	13	0%	Questionable
Fishtrap Bay Creek	CHUM	0	0	0	5	9	50	2	1	905%	Questionable
Fishtrap Bay Creek	COHO	0	0	0	6	0	25	1	1	0%	Questionable
Fishtrap Bay Creek	PINK	0	0	0	1600	573	3200	435	400	143%	Unthreatened
Flewin Creek	PINK	229	1207	131	885	1709	10000	884	608	281%	Unthreatened
Gil Creek	CHUM	543	300	56	290	468	1800	369	338	138%	Unthreatened
Gil Creek	COHO	213	390	55	163		1500	202	202		No Recent Records
Gil Creek	PINK	915	738	6463	24150	23927	60000	12159	8563	279%	Unthreatened
Gil Creek	SOCKEYE	0	0	0	0	0	1	0	0	557%	Questionable
Hunts Creek	COHO	0	0	0	2	0	20	0	1	0%	Questionable
Hunts Creek	PINK	0	0	0	680	213	2765	174	170	125%	Unthreatened
Illiance River	CHUM	7088	3840	3650	1775	2496	22000	3721	4088	61%	Unthreatened
Illiance River	COHO	1422	150	165	550	400	3500	536	550	73%	Unthreatened
Illiance River	PINK	250	0	778	1222	2488	6000	1007	539	461%	Unthreatened
Larch Creek	CHUM					1	2	1			Questionable
Larch Creek	PINK	0	0	0	250	812	2500	200	63	1300%	Unthreatened
Lizard Creek	CHUM	0	0	0	1	94	500	15	0	36771%	Questionable
Lizard Creek	COHO	0	0	0	0	0	0	0	0		Questionable
Lizard Creek	PINK	0	0	856	1894	5550	14000	1672	651	852%	Unthreatened
Manzanita Cove Creek	COHO	0	0	29	0	0	200	5	6	0%	Questionable
Manzanita Cove Creek	PINK	0	0	3600	2178	1121	20000	1214	1244	90%	Unthreatened
Moore Cove Creek	CHUM					250	500	250			Questionable
Moore Cove Creek	COHO	160	3067	690	9		7500	978	978		No Recent Records
Moore Cove Creek	PINK	46000	47750	26570	28250	50909	150000	40112	37143	137%	Unthreatened
Mouse Creek	CHUM					21	40	21			Questionable

Stream Name	Species	DFO Adult Mean Escapement Data Summary					Max	Mean (50-01)	Historical Mean (50-89)	% Hist. Mean[2]	Stock Status
		1950-1959	1960-1969	1970-1979	1980-1989	1990-2001					
Mouse Creek	PINK	0	0	0	450	5564	17000	1288	113	4945%	Unthreatened
Oona River	COHO	267	767	510	178	563	3500	445	432	130%	Unthreatened
Oona River	PINK	10225	4295	11270	12496	12583	50000	10266	9571	131%	Unthreatened
Pearse Canal Creek	PINK	0	0	600	0	0	6000	133	150	0%	Questionable
Perry Bay Creek	CHUM	0	0	250	61	259	2500	107	79	330%	Unthreatened
Perry Bay Creek	PINK	0	0	0	6	0	25	1	1	0%	Questionable
Prudhomme Creek	COHO	0	0	0	19	670	2000	54	4	18363%	Unthreatened
Prudhomme Creek	SOCKEYE	0	0	0	253	1182	2500	307	53	2218%	Unthreatened
Salmon Cove Creek	COHO	0	0	0	21	0	100	4	4	0%	Questionable
Salmon Cove Creek	PINK	0	0	944	3944	1188	9000	1163	1158	103%	Unthreatened
Shawatlan Creek	CHINOOK	0	26		11	0	200	11	12	0%	Questionable
Shawatlan Creek	CHUM	200			0	3	200	30	67	4%	Questionable
Shawatlan Creek	COHO	13	1300	400	300	863	3500	495	438	197%	Unthreatened
Shawatlan Creek	PINK	700	238		393	280	2000	429	487	58%	Unthreatened
Shawatlan Creek	SOCKEYE	3270	2950	845	2586	1542	6000	2204	2408	64%	Unthreatened
Spiller River	COHO	0	185	0	0		1500	64	64		No Recent Records
Spiller River	PINK	8350	3150	3165	2980	4785	40000	4486	4411	108%	Unthreatened
Stumaun Creek	CHUM	0	5	0	0	0	50	1	1	0%	Questionable
Stumaun Creek	COHO	0	75	0	3	0	750	20	21	0%	Questionable
Stumaun Creek	PINK	833	1585	5056	7833	5642	15000	4226	3766	150%	Unthreatened
Tracy Creek	CHUM	50	0	0	0	0	200	6	6	0%	Questionable
Tracy Creek	COHO	75	0	0	0	0	75	4	5	0%	Questionable
Tracy Creek	PINK	156	463	3855	1228	1632	10000	1311	1190	137%	Unthreatened
Trail Bay Creek	PINK	0	0	0	11	0	100	2	3	0%	Questionable
Tsampanaknok Bay Creek	COHO	0	0	0	2	0	20	0	1	0%	Questionable
Tsampanaknok Bay Creek	PINK	0	0	89	52	1209	4500	338	29	4146%	Unthreatened
Welda Creek	PINK	0	0	0	2235	615	10000	569	559	110%	Unthreatened
Whitley Point Creek	PINK	0	0	222	1701	2978	10000	966	422	706%	Unthreatened
Wolf Creek	COHO	0	0	3	4	0	34	1	2	0%	Questionable
Wolf Creek	PINK	6050	9060	6041	6900	4233	30000	6371	7013	60%	Unthreatened

Appendix V. Streams in the North Coast LRMP area that may have potentially unique or vulnerable fish stocks, or that have identified recreation potential.

Stream or Lake Name	U	R	V	Explanation
Aaltanash River		Y		Guiding
Antigonish Creek	Y			Steelhead (WBC, LK)
Barnard Creek		Y		Wildlife viewing
Big Bay Creek	Y			Steelhead (NCSI)
Canoona Creek	Y			Summer run steelhead. Wildlife viewing related to salmon runs.
Chambers Creek	Y		Y	Steelhead (NCSI, WBC, LK) - summer run. Marine blue clays, limited offchannel habitat on floodplain, steelhead vulnerable to overfishing (WLAP)
Chapple Creek			Y	Karst geologies, open systems vulnerable to ground disturbance, sensitive hydrology
Denise Creek			Y	
Diana Creek	Y	Y		Steelhead (NCSI, WBC, LK) Recreational fishing
Douglas Creek			Y	Karst geologies, open systems vulnerable to ground disturbance, sensitive hydrology
Ecstall River	Y	Y	Y	Eulachon; Spring run steelhead (WBC). Recreational fishing and viewing. Large river system. Class II water
Ensheshese River	Y	Y		Steelhead (WBC, LK). Guiding
Iknouk River		Y		Winter steelhead and recreational fishing.
Inver Creek	Y			Steelhead (NCSI)
Johnston Creek	Y	Y		Steelhead (WBC); Recreational fishing
Keesil Creek	Y			Steelhead (NCSI)
Khtada Creek	Y	Y		Steelhead (WBC, LK); Shoreline-spawning kokanee ; Khtada Lake: Blue ribbon fishery for Rainbow trout, 300,000+ shoreline spawning kokanoo, research site, surrounded by unstable terrains.
Khtada Lake	Y	Y		Shoreline-spawning kokanee ; Khtada Lake: Blue ribbon fishery for Rainbow trout, 300,000+ shoreline spawning kokanoo, research site, surrounded by unstable terrains.
Khutze River		Y		Wildlife viewing related to salmon runs. Displacement potential and increased mortality risk to Grizzly as a consequence of human use.
Khutzeymateen River	Y	Y		Steelhead (WBC, LK); Wildlife viewing related to salmon runs. Displacement potential and increased mortality risk to Grizzly as a consequence of human use.
Khyex River	Y	Y		Eulachon run, steelhead (WBC, LK)
Kincolith River		Y	Y	Winter run steelhead/suspected summer run steelhead. Displacement and increased mortality risk to Grizzly as a consequence of human use.
Kiskosh Creek	Y			Steelhead (NCSI, LK)
Kitkiata Creek	Y			Steelhead (NCSI)
Kitsault River	Y	Y		Steelhead (NCSI) Recreational fishing and wildlife viewing. Displacement potential and increased mortality risk to Grizzly as a consequence of human use.

Stream or Lake Name	U	R	V	Explanation
Kloiya River	Y	Y	Y	Largest steelhead fishery in the NC (WLAP, WBC, LK); Recreational fishing; Steelhead vulnerable to over-fishing due to easy access (WLAP)
Kumealon Creek			Y	Karst geologies, potentially open systems with vulnerable to ground disturbance
Kwinamass River	Y	Y		Spring run steelhead (WBC, LK); Recreational fishing, guiding; Class II water; spring run steelhead. Displacement potential and increased mortality risk to Grizzly as a consequence of human use.
Kwinitsa River	Y			Steelhead (WBC)
Lachmach River	Y			Steelhead (WBC, LK); Important assessment stream for DFO and MELP; the only enumeration stream for steelhead in NC
Lockerby Creek	Y			Steelhead (WBC)
Lost Creek	Y			Steelhead (NCSI)
Lowe Inlet System		Y		Viewing of salmon ascending falls at inlet
McNeil River	Y			Steelhead (NCSI)
McNichol Creek	Y			Steelhead (NCSI)
Moore Cove Creek	Y			Steelhead (NCSI)
Pa-Aat River	Y			Sea-run cutthroat (WLAP, LK); sea run cutthroat reported by M. Lambyorksi
Prudhomme Creek		Y		Recreational fishing
Quaal River	Y			Steelhead (NCSI, LK); Exceptional eagle concentrations during salmon runs (WLAP)
Roland Creek			Y	Karst geologies, potentially open systems with vulnerable to ground disturbance
Stagoo Creek	Y			Steelhead (NCSI)
Toon River	Y			Steelhead (WBC)
Triumph Creek	Y		Y	Summer-run steelhead (WLAP, WBC); Vulnerable to over-fishing (WLAP)
Union Creek		Y		Union Lake recreational fishing

NCSI=North Coast Stream Inventory; WLAP=Water, Land and Air Protection;
WBC=Watersheds BC (FISS); LK=Local Knowledge

Appendix VI: Documentation of Comments by GTT and DFO reviewers.

October 9, 2003

MSRM has requested that a summary of review comments be completed with that outlines whether, why and how the various review comments were dealt with in producing the final version. This appendix provides this summary.

Draft 1 of this report was submitted by Gordon and Associates Ltd. to Sarma Liepins (MSRM) on May 26, 2003 and was distributed to the DFO and WLAP by Sarma the same day. No review comments were received from WLAP. Review comments from MSRM and Hannah Horn were received June 3, 2003 and were integrated into the 2nd draft. On July 8, 2003, a 2nd draft of the background report was provided by Gordon and Associates Ltd. to Sarma Liepins (MSRM) and Hannah Horn. This was distributed to the GTT and DFO on July 25, 2003. Review comments from Hannah Horn and Sarma Liepins were received by Gordon and Associates Ltd. on July 24, 2003 and September 24, 2003 respectively. DFO comments on both the 1st and 2nd drafts were provided by email from Dale Guerit to Sarma Liepins. The key concerns were:

- DFO did not support the analysis methodology in evaluating salmon escapement trends.
- The results seriously exaggerate the state of the problem.
- Report terminology (Threatened, and Of Some Concern) was not defined.
- Designation of species at risk is the responsibility of COSEWIC.
- The process of describe fish stocks should emulate that completed by Dave Bustard for the Morice WFSP.

In response to DFO's concerns regarding the analysis of escapement data, emphasis has been added in the report that the results indicate "potentially" threatened stocks and that further data analysis and ground truthing is required to identify whether the data actually reflect what is occurring in the streams.

DFO contends that the terms "threatened" and "of some concern" are not defined. However, pages 7 and 8 of this report provide explicit definitions of these terms which are based on quantitative analysis of the data.

To avoid confusion between the terminology in this report and the terminology used by COSEWIC to identify "threatened" or "endangered" species, I have provided a summary of the COSEWIC process and definitions. It should be noted that the threshold for a "threatened" species as defined by COSEWIC is lower than defined in this report. As well, I have clarified that no connection exists between COSEWIC designations and the designations in this report.

DFO has suggested that the Morice WFSP process for describing fish stocks be used. I have reviewed the document by Dave Bustard (Bustard, 2002) and agree that it is an excellent review. However, the WFSP report only required the summary of escapement of 5 anadromous salmon stocks (including steelhead), compared to 543 in this report. Bustard also used DFO data to describe escapement trends, but did not categorize the trends of recent escapements as was done in this report.

Only one other review was received on the 2nd draft. This was from Chris Picard who requested that the escapement analysis completed in the report be compared to a published paper by Slaney *et al* (1996). This comparison was integrated into the final report.

All editorial and technical review comments by Hannah Horn and Sarma Liepins (MSRM) were integrated into the final report.

Dave Gordon, R.P.Bio.