



Taku Region

Sustainability Plan for Aquatic Watershed-based Needs



A report prepared by the Taku Fish Sustainability Working Group

2002 /2003



326232

LIBRARY
FISHERIES AND OCEANS CANADA
200-401 BURRARD ST.
VANCOUVER, B.C. V6C 3S4
604-666-3851

Taku Region
Sustainability Plan
for
Aquatic Watershed-based Needs

DRAFT COPY- for review

A report prepared by
the Taku Fish Sustainability Working Group

2002 /2003

326232

Acknowledgements

The following groups and agencies are acknowledged for their contributions to the Taku Sustainability Plan for Aquatic Watershed-based Needs: the Taku River Tlingit First Nation; the Department of Fisheries and Oceans Canada; the community of Atlin, B.C.; the Douglas Indian Association; Tahltan Fisheries; the Alaska Department of Fish and Game; the National Marine Fisheries Service; Douglas Island Pink and Chum; and the BC Watershed Stewardship Alliance. All participated to some extent in the Planning Workshops. Others individuals not specifically mentioned are thanked for their willingness to provide technical information and knowledge that helped make the project a success.

Funding agents that provided financial support to the process included DFO / AFS, Fisheries Renewal BC, and DFO / HEB. Our gratitude is extended to Gord Zealand (DFO-Yukon/Transboundary Region) and John D. Ward (TRTFN- Spokesperson) for their support and recognition of this important initiative. Appreciation is given to Mark Connor (TRTFN – Habitat Steward) for his diligent work on the Biophysical Profile Report. Also, to Gaye Hanson and Bob Lorimer who acted as workshop facilitators in 2002. Photos were provided by Mark Connor and Doug Milek.

The following report was written and compiled by Richard Erhardt on behalf of the Taku SPAWN Working Group with content based upon planning workshops and related submissions as noted within.

Taku SPAWN Working Group:

Project Manager: Richard Erhardt

Technical Committee:

Mark Connor (Taku River Tlingit First Nation)

Ian Boyce (DFO-Stock assessment)

Eero Karanka (DFO-Habitat)

Planning Committee:

Harold Frank (Douglas Indian Association)

Cheri Frocklage (Tahltan Fisheries)

Richard Erhardt (Taku River Tlingit First Nation)

Mark Connor (Taku River Tlingit First Nation)

Ian Boyce (DFO-Stock assessment)

Eero Karanka (DFO-Habitat)

Mary Ellen Jarvis (DFO-Aboriginal Fisheries Strategy)

Table of Contents

INTRODUCTION	1
DESCRIPTION OF THE PROCESS	1
<i>Overview</i>	1
<i>Objectives</i>	1
METHODOLOGY	2
<i>Framework Protocol</i>	2
<i>Use of the WFSP Guidebook</i>	2
<i>Process Outline</i>	3
<i>Planning Process Details</i>	4
STAGE 1 – REGIONAL DATA:	6
REGIONAL PROFILE	6
<i>Environmental Overview</i>	6
<i>Biophysical Profile - Discussion</i>	9
<i>Regional Data Gaps</i>	13
<i>Regional Action Strategies</i>	14
<i>Conservation Matrix</i>	15
STRATEGIC OVERVIEW	17
<i>Management Structure & Activities</i>	17
<i>Legislation and Policy</i>	22
<i>First Nation Priorities</i>	25
<i>Community Ecological Concerns</i>	26
STAGE 2 - PLANNING PRIORITIES:	27
SELECTION OF PLANNING PRIORITIES	27
STOCK-SPECIFIC PLANNING	28
<i>Profile / Overview</i>	28
<i>Factors of Uncertainty and Risk:</i>	35
LOWER TAKU WATERSHED	36
<i>Profile / Overview</i>	36
<i>Potential threats to fish sustainability in the Lower Taku Watershed Unit:</i>	40
WILD CHUM SALMON	41
<i>Profile / Overview</i>	41
<i>Analysis of some potential factors affecting Taku Chum:</i>	44
STAGE 3- ACTION STRATEGIES:	47
STOCK-SPECIFIC PLANNING	47
<i>Goals, Objectives, Strategies</i>	48
LOWER TAKU WATERSHED	49
<i>Goals, Objectives, Strategies</i>	51
WILD CHUM SALMON	52
<i>Goals, Objectives, Strategies</i>	54
DISCUSSION	55
REFERENCES:	56

Note: Some figures do not follow proper numerical order having been taken from the Biophysical profile document.

INTRODUCTION

Description of the Process

Overview

The Taku Sustainability Plan for Aquatic Watershed-based Needs (S.P.A.W.N) was implemented based on the "Watershed-based Fish Sustainability Planning Guidebook for Participants" (herein after referred to as the "guidebook") developed jointly between Fisheries and Oceans Canada and British Columbia Fisheries agencies. The ultimate goal of the process is to ensure long-term conservation of fish and fish habitat by involving all agencies and interests in a strategic planning exercise.

With the possibility that Land Use Planning will be initiated for the Taku Region in the foreseeable future there is clear need to protect fisheries resources. Without consolidated information regarding how Taku salmonids and other species utilize the watershed, it will be more difficult to implement measures that will afford habitat protection and promote the sustainable health of fish populations.

The Taku Region covers an extensive drainage area and encompasses a broad diversity of freshwater and anadromous fish species and habitats. This area provides a unique opportunity for proactive fish and fish habitat conservation that could be used as a model in other regions. The basis of the planning process was therefore in developing a broader focus within the management regime, one that would recognize ecosystem processes and help to reduce the risk of future decline of fish populations or loss of fish habitat.

The SPAWN Project started in September of 2001 with the sponsoring agency being the Taku River Tlingit First Nation (TRTFN) who initiated and managed the process. Regional DFO staff has been very supportive, playing a vital role as partners in the project. The Taku SPAWN was focused upon engaging fisheries agencies and interests in an

inclusive, community-driven, four part strategic process which is science-based and respectfully incorporates Traditional Ecological Knowledge.

The success of this initiative can be largely attributed to finding common ground upon which to develop practical tools for risk management. Much like any other region, there are always differences of opinion in how to approach stewardship and what is necessary for conservation. However, by looking deeper and discussing basic principles of the various parties, we end up finding some universal values upon which to build a framework for sustainability. The resulting partnerships of what could be termed a "living plan", create a new framework for cooperation and promote long-term conservation.

The task of selecting several planning priorities has helped to formulate a new approach for salmon sustainability, one that is based upon the calculated foresight of proactive management and the valued recognition of ecosystem processes. The uniqueness of this approach is also demonstrated by the transformation of applied aquatic research into practical instruments of management. It is this type of adaptive management style that seems to be a necessary precursor for sustaining wild salmon ecosystems like the Taku.

Objectives

Simply stated, the objectives of the project were as follows:

1. To provide a forum that will facilitate a strategic, holistic and inclusive approach to fish sustainability planning.
2. To develop effective working relationships and establish ongoing partnerships between parties with a common interest in fish conservation.
3. To complete the necessary stages in creation of a strategic Watershed-based Fish Sustainability Plan, thereby allowing implementation to begin.

Methodology

Framework Protocol

Undertaking a project such as this requires cooperation between the different interests involved. Participants need to have a common understanding of the process principles and resulting roles and responsibilities. To facilitate this, a framework protocol was developed to outline how participants would work together. Some key points from this document are summarized below.

Working Group Structure

Those participating at the working group level were designated as either technical team and / or planning team members. This was done in order to assist in the assignment of specific tasks. It also allowed for break out exercises, although given the moderate size of the group this option was rarely exercised. Decision making was accomplished through consensus of the working group members.

Definition of Sustainability

For the purpose of simplicity, the working group decided to adopt a definition of fish sustainability similar to that located in the glossary of the guidebook. Whereas, "sustainability means an ability of the natural productive capacity of habitats to produce genetically diverse, stable and self-sustaining fish populations, and the management of fish populations in a way that takes full advantage of this ability."

Principles

The Working Group agreed to carry out the Project according to the following guiding principles as stated in the framework protocol:

1. The Project will be undertaken with a focus on the sustainability of wild fish stocks, and with attention to both anadromous and non-anadromous

species, genetic diversity, and commercial and non-commercial species;

2. The Project will maintain a focus on watersheds, including their processes and their interconnections, and including those in stream, in the uplands and in the ocean;
3. The Project will be carried out using a "fish first" approach; that is, with an emphasis on the needs of fish;
4. The Project will identify priorities for the protection and restoration of fish stocks and habitat;
5. The Project will build on existing initiatives;
6. The Project will use the best information currently available, including scientific data, traditional ecological knowledge, land and resource development trends, and community values;
7. The Project will identify data gaps and will provide recommendations on priorities and means of filling those gaps;
8. The Project will use "adaptive management"; that is, an approach that incorporates ongoing monitoring and assessment to create a living plan that has no defined completion point; and
9. The Project will be carried out using an inclusive and consensus-based process that openly involves members of the community, including residents, commercial and non-commercial users of the watershed and its resources, and responsible agencies.

Note: The above principles were based upon the guidebook, with the exception of #9 which was added upon discussion by the working group.

Use of the WFSP Guidebook

The WFSP Guidebook was used as the basis of this exercise in planning and accordingly the process structure was followed quite stringently. The project manager and facilitators agreed to stay as close as possible to the process laid out in the guidebook

recognizing that the project was funded as a "pilot", which necessitated "testing" of the model

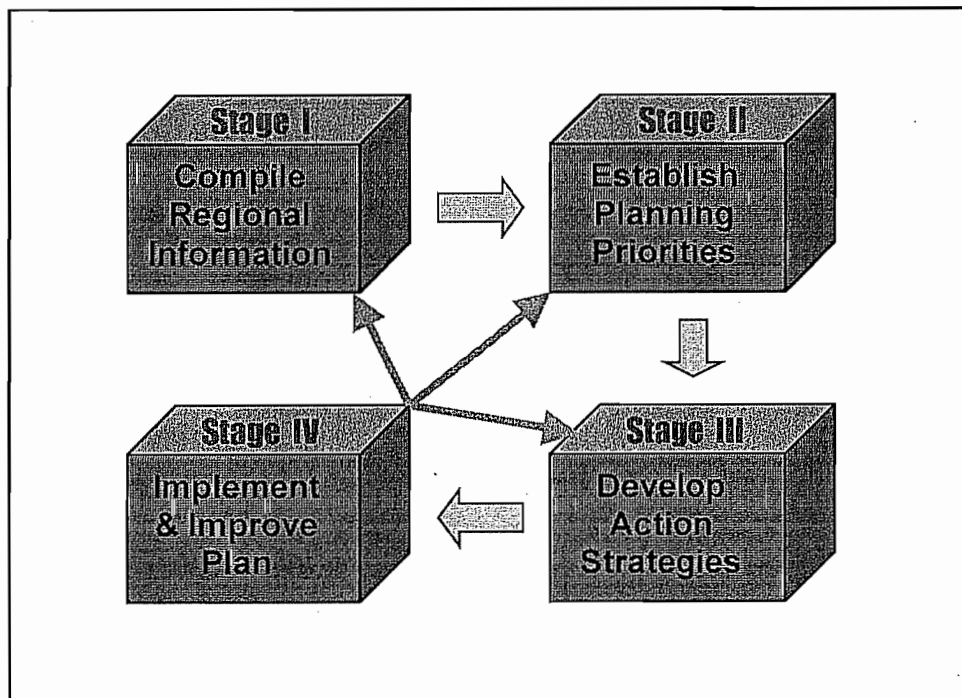
The general assessment from participants was that the guidebook was perhaps designed for watershed areas that are smaller and more impacted by development than the Taku Region. For the most part, a focus on restoration and reclamation was not relevant in the Taku. Therefore, a few minor deviations were made from the guidebook in order to better suit the region to which it was being applied and to clarify process terminology. For example, when selecting "watershed planning units" the working group did not restrict itself to a specific geographic area. Instead it was decided that Stage II planning could potentially include things such as a specific fish population or a management concept / approach. These were subsequently termed "planning priorities" instead of "watershed planning units". Other changes to the guidebook process will be outlined where appropriate in the body of this report.

Process Outline

The basic planning stages (see Fig. 1 a) and resulting activities undertaken can be summarized by the following:

- Existing data was collected and organized to provide a biological profile of the ecosystem.
- Overview documents were prepared that included information relating to Government Legislation and Policies, First Nation values and principles, and community interests.
- Profiling and overview documents were reviewed from an ecological perspective, in order to select several planning priorities (or projects) and further pursue these initiatives.
- Goals, objectives and general strategies were established for the three planning priorities.
- Action plans were developed that defined in more details the necessary steps and project details.
- Outreach was undertaken in order to promote self-sufficiency for the process and to facilitate project implementation.

Figure 1 (a):
Stages of strategic planning



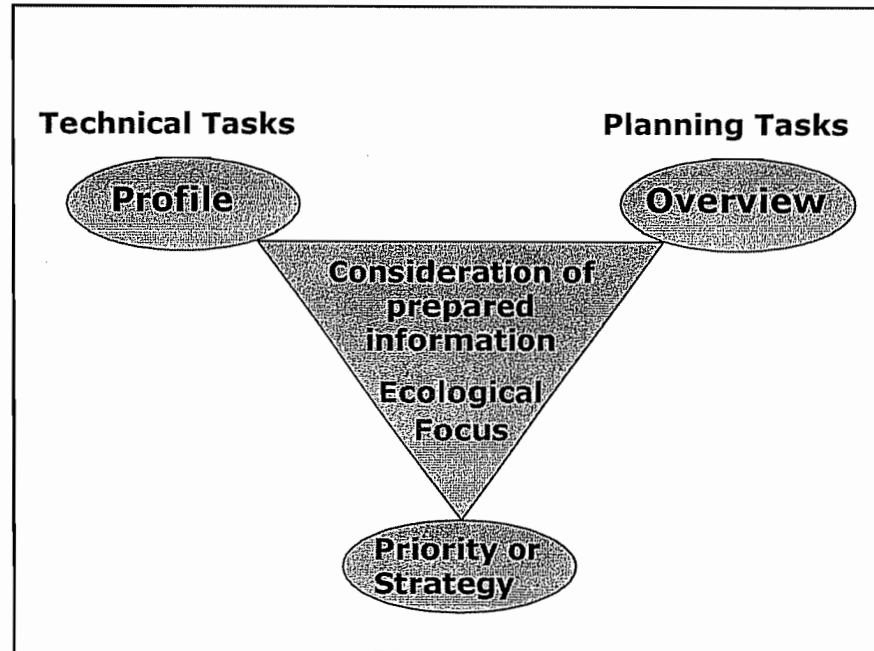


Figure 1 (b):
Conceptual approach to
planning, adopted for this
process.

Use of Traditional Ecological Knowledge, Technical Data and Community Input

During the SPAWN process we endeavored to utilize Traditional Ecological Knowledge (TEK), scientific methods and community input to facilitate the creation of an effective and inclusive management model. Our success in bridging the gap between these very different stewardship approaches is reflected throughout the document. This incorporation of information sources took two general forms:

- > A thorough comparison was conducted between Government Legislation / Policy and First Nation Principles and community values to reveal common conservation principles. Planning priorities were then selected based upon an overlap of interests from these sources.
- > Spatial data was collected from First Nation members, scientific reports and local individuals. It was then mapped in a GIS format that visually displayed the combined information relating to fish distribution.

Planning Process Details

The steps involved in the process were as follows:

1. *Project Initiation:*

This step involved meetings between the Project Manager and the project consultants to further develop the work plan, complete the planning for the first workshop and develop a list of participants to be invited into the process. The TRTFN sent out background and scheduling information to the potential participants once dates had been finalized for all three workshops. On the Canadian side invitations were extended to the TRTFN, DFO, Tahltan Fisheries and the Province of BC (Fisheries and Policy agencies). All of the fore mentioned groups participated with the exception of the Province of BC. Due the transboundary nature of the Taku River, Alaskan interests were invited into the process including the Alaska Department of Fish and Game (ADF&G) and the Douglas Indian Association (DIA). The DIA participated throughout the process and ADF&G sent a representative to a portion of the first meeting, after which

communication continued between TRTFN and State of Alaska officials. The initial January through March process was geared to completing stages one and two of the four stage WFSP planning process.

2. First Planning Session: (January, 2002)

The first planning session was three days in length and included an overview of successful planning strategies elsewhere, lessons learned and methods of building cooperation. Mr. Mike Romaine from the B.C. Watershed Alliance was an invited guest for the session and provided valuable information and advice. During the workshop, work began on the review of the principles relevant to WFSP, including those found in policy / legislation and Traditional Knowledge. Templates were developed following the workshop, and further research carried out and compiled. The participants engaged in a review of the requirements of the WFSP and completed a more detailed design of the process. A Framework Protocol development process was initiated and a first draft completed. A work plan to identify and assign specific tasks was also completed in first draft. Work was begun on the compiling of an inventory of existing reports, data sets and information inclusive of current projects and initiatives. A template was developed following the planning session and the information collected during the workshop was compiled and reported using this template.

In addition, a first Community-based meeting was held in the evening during the planning session of the working group. The public forum was designed to familiarize community members with the process and outline the resulting framework.

3. Stage I: Compiling Regional Information (February, 2002)

Initially planned as a two day workshop, the timeframe was extended with recognition of an abundance of tasks to complete. During this Stage 1 workshop, a review of the first draft biophysical profile document was completed, including maps

produced to date. The profile included relevant scientific information (including fish population and habitat status, Traditional ecological and local knowledge, land and resources development trends and broader social, cultural, political and economic values) to provide a basis for the planning process. Work was begun on a strategic overview, a regional action strategy and the process for the selection of watershed planning priorities. This type of methodology was used throughout the process. A second community meeting was held in of the evening during this workshop as well. Maps were provided for local residents to discuss, validate and add their knowledge regarding the Taku.

4. Stage II Establishing Planning Priorities (March, 2002)

The final three day workshop provided an opportunity for the review of a second draft of the biophysical profile and the establishment of planning priorities. Selection of the priorities was based upon consideration of the information collected in profile and overview documents (see Fig. 1 b). Subsequently, the working group developed goals, objectives, strategies and monitoring criteria for each selected watershed planning priority.

5. Stage III: Developing Action Strategies (February, 2003)

In this stage, more details needed to be established around each of the selected planning priorities. A two day workshop was arranged to develop strategy and direction around how goals and objectives best be pursued. With limited direct involvement from representatives on the Alaska side and a community interest in pursuing such involvement, these workshops were held in Juneau, Alaska.

During these sessions, the priorities were examined while seeking opportunities for specific commitments or partnerships from federal, provincial and First Nation government agencies, stakeholders and other parties with respect to implementation, research and monitoring.

Stage 1 – Regional Data:

Note: The following chapter is a summary of the type of ecological profiling information that was collected. Full details can be found in the "Taku River Aquatic Biophysical Profile", which was produced as a separate document.

The Taku River Aquatic Biophysical Profile was initiated in 2002 as part of the Taku SPAWN process. This report provides a broad summary of the current information regarding fisheries resources of the Taku River based on current knowledge and opinion. It builds on past efforts to assess fish and fish habitat within the drainage. The report draws heavily on information provided by Canadian federal, provincial and First Nation governments, as well as U.S. federal and Alaskan agencies. It also incorporates existing information from Traditional and local knowledge including historical accounts, and informed opinion.

Based on the available information the report presents:

- > An overview of the ecological setting
- > A description of fish species assemblages and spatial distributions (including GIS maps)
- > A delineation and description of the major sub-watersheds within the greater Taku drainage
- > A discussion of stream habitat classification
- > A summary of data gaps in the existing fisheries information

This initiative was the first to systematically map salmon spawning areas in the Taku drainage in a digital format. It was also the first to map known distribution of non-anadromous fish species in the region.

The Taku River drainage is a relatively pristine region. Being a vast and remote district it consequently creates numerous information gaps and in some cases conflicting information regarding the fisheries resources in the area. The biophysical profile should therefore be considered a work in progress and is intended also to be a "living document" that will evolve as more information

comes to light. Furthermore it should be noted that the biophysical profile focuses on the Canadian portion of the Taku River drainage.

Regional Profile

Environmental Overview

The Taku River is the fifth largest river, in both area and discharge, to empty into the Pacific Ocean from a primarily British Columbia source area. Located in the north-western corner of the province, the Taku is a transboundary river, with a mouth at the head of Taku Inlet about 30 km north-east of Juneau, in the Alaska Panhandle. Ninety percent of the basin area of 18,800 km² is within British Columbia. The basin covers 5 Ecosections and includes 7 biogeoclimatic zones in two major climate types.

A total of five watershed units were delineated within the greater Taku River drainage basin: the Lower Taku, the Nakina, the Inklin, the Sheslay and the Nahlin watershed units (see Figure 2). These five Watershed Units were based on the BC Watershed Atlas with a modification that separated the Lower Taku Watershed Unit (downstream of the Inklin/Nakina junction) from the Inklin drainage. This modification was made in recognition of the distinctive nature of the Lower Taku relative to the rest of the Inklin Watershed Unit.

The 16,900 km² of the Taku Basin that is within British Columbia encompasses a considerable variety of environmental conditions, biological characteristics, fish habitat types and species presence (see Figure 3). The Taku River main-stem is 75 km long, being so named only below the junction of the Nakina and Inklin Rivers. The main-stem continues as the Inklin River for 70 km to the junction of the Nahlin and Sheslay Rivers and then as the Sheslay River for another 110 km to the source. The Taku River drainage remains one of the largest (virtually) road-less wilderness areas in the Canadian Pacific, and indeed the world. Its wilderness qualities are valued by many.

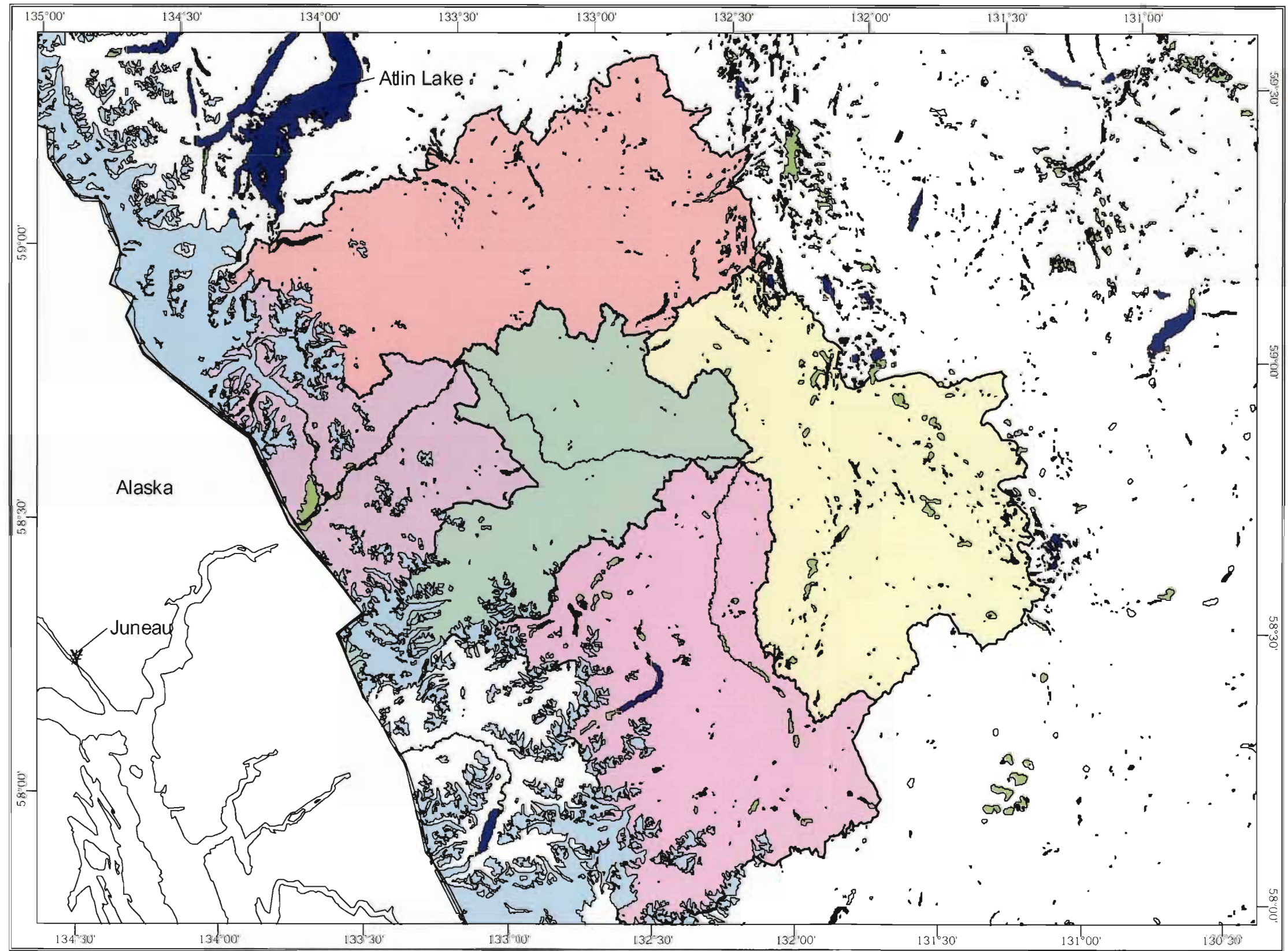
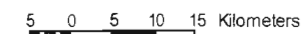







Figure 2. Watershed Units within the Taku River drainage

Scale 1:900,000

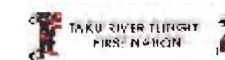


BC Albers Equal Area projection (standard parallels: 50 0'N & 58 30'N)

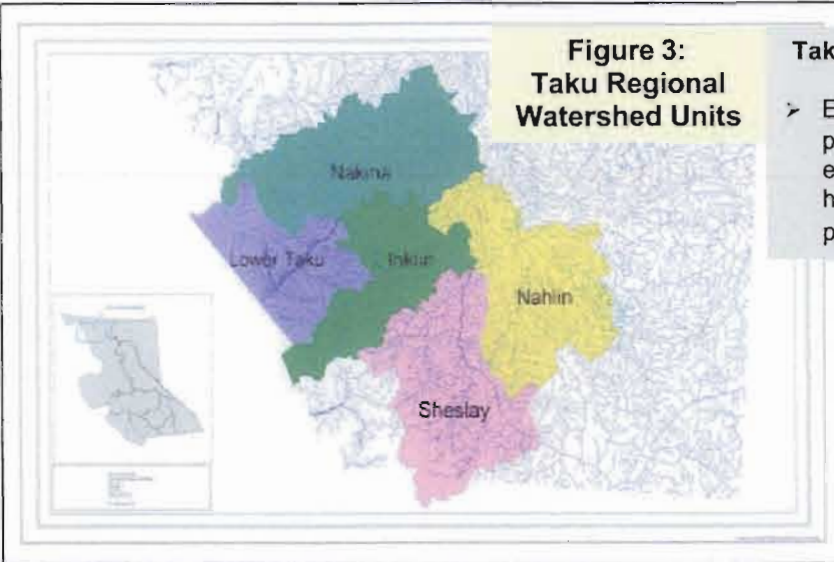
-  Nahlin Watershed Unit
-  Inklin Watershed Unit
-  Nakina Watershed Unit
-  Lower Taku Watershed Unit
-  Sheslay Watershed Unit

Map Compiled By:
 Mark Connor
 Box 132
 Atlin BC
 V0W 1A0
 (250) 651-7615

26 June 2002



**Figure 3:
Taku Regional
Watershed Units**



Taku Region:

- Each of the five defined watersheds possesses a unique variety of ecological characteristics, fish habitat types and species presence.



Lower Taku:

- A highly productive watershed with the greatest diversity of fish species.
- Very dynamic system, influenced by glacial processes and containing a complex mosaic of fish habitats.



Nakina:

- Contains important spawning areas for several species.
- Includes a large area of canyon lands with an upper barrier.



Nahlin:

- Interior plateau, clear water, no glaciers, many lakes and wetlands.
- Relatively high proportion of arctic interior species.



Sheslay:

- Includes several of the largest sockeye salmon lake systems.
- Gradient of river increases as you move down the main-stem.



Inklin:

- Transitional between coastal and interior zones.
- A major migration corridor.

Biophysical Profile - Discussion

Due to the general scarcity of habitat information for much of the Taku drainage, the determination of critical habitats including spawning, rearing and over-wintering areas is incomplete. However, relatively high fisheries values are confirmed in the main-stem and lake-buffered rivers for anadromous fish, and in the non-glacial streams for anadromous fish. Included in the relatively high fisheries value category are the following: Taku, lower Nakina, Inklin, Sheslay, Nahlin, Sloko, Silver Salmon, King Salmon, Yeth, Kowatua, Tatsatua, Hackett, Dudidontu, Kakuchuya, Tseta, Seguthooth, and Kawdy rivers. The emphasis on the above higher valued fish streams should not be interpreted as a downplaying of the glacial, coastal headwater, and arctic streams. Locally, the latter have high fisheries values, particularly in the clear side channels and tributaries of glacial systems, and where the coastal headwater and arctic streams support populations of fish in lakes. Highly glacial streams include the Sittakanay, Wilms, Tulsequah, Shazah, Stuhini, Nakonake, Sutlahine, and Samotua. All support salmon populations that should receive the same degree of protection as the higher valued lake-buffered and main-stem streams. Most of the information available for the Taku concerns the larger watercourses and lakes, the importance of smaller tributaries including non-nadal streams has not been assessed. Several lakes offer highly valuable fish habitat including the larger sockeye lakes: Tatsamenie, Little Trapper, King Salmon and Kuthai.

The Lower Taku Watershed Unit stands out as a particularly important portion of the overall Taku River drainage. The side channel systems of the Taku and lower Nakina Rivers are valuable for their sockeye, coho, and chum salmon spawning and holding areas. Specific areas of note include Flannigan Slough, Bull Slough, Yellow Bluff and King Salmon Flats Slough. The Lower Taku Watershed Unit is also the area within the Taku that appears most likely to see development impacts that could effect fish sustainability.

The Taku drainage contains a wide variety of fish species. Through our research it is estimated that approximately 27 different species may be present in the various watersheds (see Figure 4). Some questions remain about particular fish species. The presence of Yukon/Interior species in the Taku Basin is well established. However, the extent of the distribution of many of these species is not known. Lake trout, grayling and pike are spotty in distribution. Round whitefish, slimy sculpin and longnose sucker appear fairly widely distributed. Notable questions concerning estuarine species in the Taku include the distribution, habitats and life history of cutthroat, stickleback and white sturgeon in the drainage. Some doubt exists as to whether, or to what extent white sturgeon is found in the Taku drainage.

As part of the SPAWN process, spawning and distribution of GIS maps were created utilizing collected information from both technical and Traditional Knowledge sources. One example is taken from the biophysical profile is displayed as Figure 9 on page 12.

Coastal anadromous species are certainly the most ubiquitous fish in the Taku Basin. Although the general distributions of the coastal salmonids are now fairly well known, some specific distribution questions remain. Notable questions are the upstream extent of rainbow trout and chinook salmon in the Nakina River, chum and pink salmon distribution in the Inklin River, the relative distribution of the bull trout / dolly varden complex, the spawning locations for coho salmon in much of the upper drainage and steelhead life history / spawning areas. At the time this report was being prepared a steelhead telemetry study was underway in the Taku drainage. This study will undoubtedly shed more light in this regard.

Lake surveys will provide some of the most interesting new information about the distributions of the Arctic/Interior species within the Taku Basin, and the distributions of rainbow trout and dolly varden charr in the upper Nakina and Nahlin Rivers. Some of the priority lakes for limnological survey are: Trapper (upper), Hatchau/Kennecott, Ketchum, Hatin, Tedideech, Granite, Sloko (in Atlin Provincial

Park), Tawina, Nakina, Bell, and a number of unnamed lakes in the Nakina and Nahlin drainages.

The jökulhlaupe on the Tulsequah River are a spectacular, relatively well known phenomena. The role of smaller jökulhlaupe in determining the characteristics of other glacial outwash flood plain channels in the Taku is strongly supported. In particular, Sloko River above Sloko Lake, a branch of the Nakonake River, Sittakanay River, Sutlahine River, and Samotua River have specific evidence of glacial drainage conditions that result in jökulhlaupe. The streams affected by jökulhlaupe probably support dolly varden all the way to the lakes at the snouts of the glaciers. The most productive habitats in such systems, however, are in the clear water side channels, tributaries, and beaver ponds along the margins of the outwash gravel flats.

While the Alaskan portion of the Taku makes up less than 10% of the overall Taku drainage, it incorporates a biologically and ecologically critical area including the estuary and other important salmonid rearing habitats. A comprehensive biophysical profile of the Taku River requires the inclusion of the Alaskan segment of this drainage. It is the intention of the Planning Group to collect and incorporate Alaska data for inclusion in the *Taku River Aquatic Biophysical Report* as it becomes available. A list of some of the specific information that could be included in this effort is presented in the Data Gaps section of this report.

While efforts are being made to augment sockeye salmon production through fry implants at Tatsamenie Lake, to date the success of these activities has been very limited. The result is that Taku River salmon populations remain virtually all genetically 'wild' stock. Recently the importance of preserving wild salmon stocks has been recognised in the DFO Wild Salmon Policy and the Alaskan Sustainable Salmon Fisheries Policy.

There is some difference in opinion regarding the status of salmon stocks in the Taku. Managers report that salmon populations in the Taku (with the exception of chum) appear to be relatively stable. Many of the anecdotal sources however, offer the opinion that salmon numbers are not 'what used to

be'. In particular, main-stem spawning sockeye and fall chum are reported to have declined. The cause of this differing opinion may lie in temporal fluctuations in fish stocks or the relatively short duration managers have been scientifically measuring fish populations.

The decline in the fall chum on the Taku River has effects both for the fish and for species dependant upon them. Potential reasons for this decline includes climate change, habitat shifts, ocean productivity, coho predation, over fishing and enhancement activities. The plight of the chum salmon on the Taku and an analysis of possible reasons for their decline are examined in Tobbler et al, 2001. This issue is being addressed through other aspects of the Taku SPAWN Process and so will not be discussed in detail here.

Due to the dynamic nature of the lower Taku River, the available base maps for the GIS program (including the 1:20,000 TRIM data) are no longer very accurate in terms of the river line work. This has made accurate mapping of spawning areas and other habitats difficult, particularly in the Lower Taku Watershed Unit. The Taku River Tlingit First Nation currently has a project underway to geo-reference a series of recent air photos of the lower Taku River for inclusion in their GIS database. Once these photos have been geo-referenced, a far more accurate mapping of specific habitats in the Lower Taku Watershed Unit will be possible. Developing a habitat model that would describe fish habitats and habitat utilization would allow for a landscape analysis approach and help monitor and predict temporal fluctuations in habitats. Such information is important in determining important conservation areas within the temporally and spatially dynamic system that is the lower Taku River.

Figure 4: Fish Species Assemblage

Approximately 27 fish species may be found in the Taku River basin. These can be subdivided into an estuarine group restricted to the lower Taku River, a coastal anadromous group, and an Interior/Arctic group. The table below lists fish species believed present in the greater Taku drainage and their presence/absence by watershed unit. Due to limited distribution information, predictions had to be made as to distribution within each watershed unit in some cases.

Species Group and Species	Watershed Unit				
	Lower Taku	Nakina	Inklin	Nahlin	Sheslay
Estuarine Species					
Green sturgeon (<i>Acipenser medirostris</i>)	?	A	A	A	A
White sturgeon (<i>Acipenser transmontanus</i>)	?	A?	A?	A	A
Shad (<i>Alosa sapidissima</i>)	?	A	A	A	A
Threespine stickleback (<i>Gasterosteus aculeatus</i>)	P	?	A?	A?	A?
River lamprey (<i>Lampetra ayresi</i>)	P	?	?	?	?
Longfin smelt (<i>Spirinchus thaleichthys</i>)	P	A	A	A	A
Eulachon (<i>Thaleichthys pacificus</i>)	?	A	A	A	A
Coastal Anadromous Species					
Coastrange sculpin (<i>Cottus aleuticus</i>)	P	P	P?	P	P?
Pacific lamprey	P	?	?	?	?
Prickly sculpin (<i>Cottus asper</i>)	?	?	A?	A?	A?
Pink salmon (<i>Oncorhynchus gorbuscha</i>)	P	P	P	P	A?
Coho salmon (<i>Oncorhynchus kisutch</i>)	P	P	P	P	P
Sockeye salmon (<i>Oncorhynchus nerka</i>)	P	P	P	P	P
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)	P	P	P	P	P
Chum salmon (<i>Oncorhynchus keta</i>)	P	P	P?	A	A
Rainbow trout (<i>Oncorhynchus mykiss</i>)	P	P	P	P	P
Steelhead trout (<i>Oncorhynchus mykiss</i>)	P	P	P	P	P
Cutthroat trout (<i>Salmo clarki clarki</i>)	P	P	P?	P	A?
Dolly Varden (<i>Salvelinus malma</i>)	P	P	P?	P?	P?
Yukon/Interior Species					
Longnose sucker (<i>Catostomus catostomus</i>)	P	P?	P?	P	?
Slimy sculpin (<i>Cottus cognatus</i>)	P	P	P	P	P
Lake chub (<i>Couesius plumbeus</i>)	A	A	A	P	A
Round whitefish (<i>Prosopium cylindraceum</i>)	P	P?	P?	P?	P
Northern pike (<i>Esox lucius</i>)	A	P	A	P	A?
Lake trout (<i>Salvelinus namaycush</i>)	A	P	A	?	P
Bull trout (<i>Salvelinus confluentus</i>)	P	P	P	P	P
Burbot (<i>Lota lota</i>)	?	P	?	P	?
Arctic grayling (<i>Thymallus arcticus</i>)	A?	P	A?	P	A?

P= Present
A= Absent or assumed absent
? = Unknown
P? = Assumed present
A? = Assumed absent

Examples of some fish species found in the Taku Drainage:



Bull Trout



Rainbow Trout



Sockeye Salmon



Coho Salmon

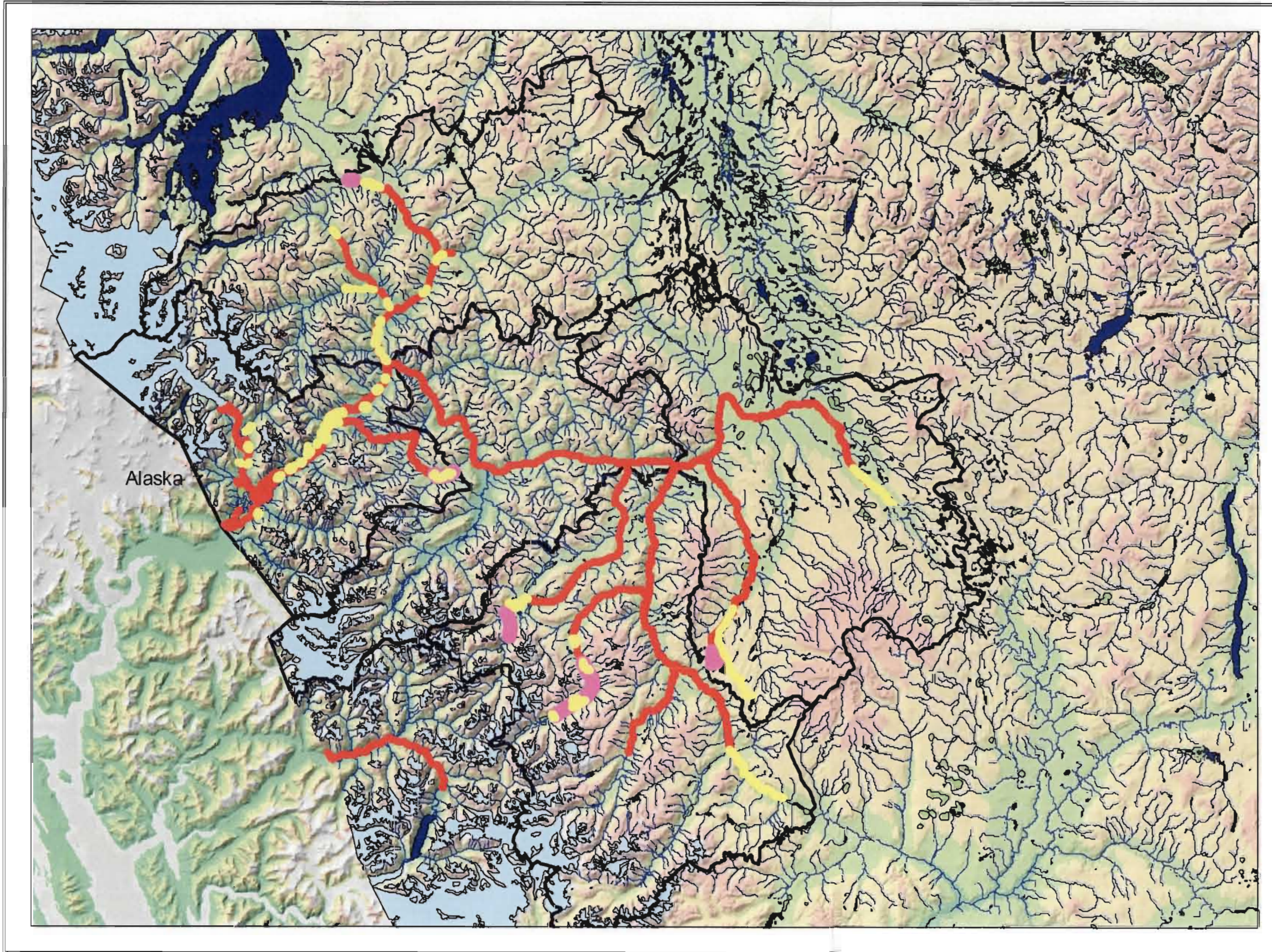


Lake Trout



Chinook Salmon

Figure 9. Sockeye and kokanee salmon spawning and distribution in the Taku River drainage




Scale 1:900,000
 0 5 10 15 Kilometers
 BC Albers Equal Area projection (standard parallels 51°N and 58°N)

- Sockeye salmon spawning and distribution**
- Sockeye spawning area
 - Sockeye salmon distribution
 - Kokanee distribution
- Water Features**
- River/Stream
 - Lake
 - wetland
 - Icefield
 - Watershed Unit boundary



Map Compiled By:
 Mark Connor
 Box 132
 Atlin BC
 V0W 1A0
 (250) 651-7615
 02 April 2002



Regional Data Gaps

The following is a summary of some of the data gaps evident from this project (*in no order of priority*). It is recommended that ongoing work should strive to address this missing information.

1. Barriers:

- Types and how they affect fish distribution.
- Need to identify gradient barriers on the GIS system.
- Determining the exact location and nature of the barrier on the Nakina River and the extent of upstream distribution of anadromous species including rainbow trout and chinook salmon.

2. Base mapping for the Alaskan side:

- What types of coverage are available? (i.e. Biogeoclimatic zones, Forest/wetlands, Geology, Soils)
- Delineate watershed units on the Alaskan side. Probably extend the Lower Taku unit to the estuary and then add a new unit for the estuary.
- Expanding this profile to include the Alaska portion of the Taku will involve: obtaining and incorporating base maps from the Alaska side with those on the Canadian side; obtaining coverages; such as biogeoclimatic zones, spawning, rearing, and over-wintering areas; and completing the delineation of the Alaskan portion of the Lower Taku Watershed Unit. It may be desirable to designate a separate watershed unit for the Taku River estuary. Worthwhile discussions would include dynamics of the estuary including past and future influence of glacial activities on the Taku and estuary, fluctuations in the size and location of the estuary, important rearing areas for all species and the presence of estuarine species that may not extend into the Canadian portion of the drainage.

3. Fry rearing distribution in the estuary:

- Delineate estuary.
- Identify critical habitats.

4. Location of spawning areas especially for coho salmon in the upper reaches of many tributaries:

Determining or clarifying the location of salmon spawning areas. In many cases distribution information implies more spawning areas than are currently documented. Clarification is necessary for:

- Coho in the Nakina (Silver Salmon), Sutlahine, Samotua, Nahlin, Dudidontu, Segthooth, and Kawdy drainages.
- Chinook spawning areas in the upper Sheslay, King Salmon and Samotua rivers
- Sockeye spawning areas on the Dudidontu and Samotua.

5. A general lack of comprehensive habitat data, including rearing areas (for all species), spawning areas (for non-salmon species) and especially over-wintering areas.

- Information on spawning areas for non-salmon species is virtually non-existent. Furthermore, basic distribution information for most if not all, species is incomplete. Most of the lakes in the upper drainage have not been inventoried.
- Specific information on rearing and over-wintering areas for all species is lacking. This is particularly true for the upper portions of the drainage.
- The relative importance of smaller watercourses in the Taku drainage is not known. Spawning and distribution information tends to focus on the larger rivers.

6. Extent of steelhead populations and trends, life history, distribution, spawning, over-wintering

and rearing areas. (Also true for other non-salmon species).

7. Abundance information and exploitation rates for pink, chum and steelhead.

8. The identification of Conservation Units within the Taku as outlined in the Wild salmon Policy.

Other information not readily available:

Water quality and quantity.

Some recent information has been collected for the Lower Taku. An overview summary of such water quality data on the Taku basin is yet to be incorporated into this report.

Cutthroat populations and trends

Information on cutthroat trout populations, life history, distribution, spawning, over-wintering, rearing is incomplete. The extent to which Taku cutthroat are anadromous has not been determined.

Bull Trout/Dolly Varden

The relative distribution of the Dolly Varden / Bulltrout complex is basically unknown. Specific information on spawning, over-wintering and rearing areas is incomplete. The extent to which these species are anadromous or hybridise in the Taku is not known.

Extent of lake trout distribution in the Taku.

Many lakes have not been assessed.

White Sturgeon data

There are some records in the FISS data but apparently no locals including a Tlingit elder (on the

Canadian side have ever seen or heard of them in the Taku.

Index Chinook aerial counts done by ADF&G.

Summaries of existing management activities within each watershed unit.

Index Chum salmon data.

Soils and geology base maps.

Information on geology and soils including base maps for the GIS project has yet to be incorporated into this report.

Historic/post glacial distribution patterns of fish in the Taku

(e.g. why are there lake trout in some lakes but not others, Dolly Varden above barriers, etc.? What refugium did fish recolonize from, etc.?)

Conservation concerns for estuarine species (have not been included in the Conservation Matrix).

Regional Action Strategies

Note: Upon consideration the working group decided not to devote much time on this topic since the scope of watershed planning priorities was expanded. It was also thought that duplication or overlap would cause some confusion around terminology.

The group identified the following priority Regional Action Strategies:

- Collect habitat information (especially rearing and over-wintering areas for all species).
- Develop model of habitat use (especially for the Lower Taku).
- Identify locations of spawning areas (especially for Coho).
- Fill data gaps for species of concern.

Conservation Matrix

Conservation status for selected fish in the greater Taku River drainage

Species	Presence/ absence	Estimated escapement /population (range)	Population trends	Conservation Concerns (population)	Comments
Chinook	present	(10 K – 115 K) / (12 K – 126 K)	Recovering since 1970's	Sensitivity to future harvest	Escapement goals met (in 6 of 10 years from 1980-89s and 11 of past 12 years from 1990 – 2001)
Sockeye	present	(71 K – 144 K) / (146 K – 405 K)	stable	No	Escapement goals met
Coho	present	(40 K – 128 K) / (51 K – 158 K)	stable	No	Escapement goals met
Chum (fall)	present	unknown	Depressed since 1992	Yes	Fixed site catch data provides inter-annual comparison No program to determine system – wide escapement
Pink	present	unknown	High fluctuations in numbers	No	Fixed site catch data provides inter-annual comparison No program to determine system – wide escapement
Steelhead	present	unknown	unknown	Lack of information on populations, trends and habitats (i.e. spawning areas)	Fixed site catch data provides inter-annual comparison No program to determine system – wide escapement

Cutthroat trout	present	unknown	unknown	Declining harvests and a decrease in trophy sized fish noted in some areas of Alaska A blue listed species (considered vulnerable) in BC	No program to determine system – wide escapement. Breakdown in anadromous vs. resident populations is unknown Extent of distribution unknown
Rainbow trout	present	unknown	unknown	unknown	Widely distributed in the Taku drainage
Dolly Varden	present	unknown	unknown	A blue listed species (considered vulnerable) in BC	No program to determine system – wide escapement. Relative distribution of bull trout vs. Dolly Varden in the drainage not fully determined
Bull trout	present	unknown	unknown	A blue listed species (considered vulnerable) in BC	Relative distribution of bull trout vs. Dolly Varden in the drainage not fully determined
Lake trout	present	unknown	unknown	Apparently limited distribution in the Taku drainage	Confirmed only in Tatsamenie, Tatsatua, Little Trapper, Paddy and Ruth Lakes
Arctic grayling	present	unknown	unknown	Apparently limited distribution in the Taku drainage	Confirmed only in Nakina and Nahlin Watershed Units
Northern pike	present	unknown	unknown	Apparently limited distribution in the Taku drainage	Confirmed only in Kuthai Lake, Paddy Lake, Bell Lake and Nahlin River
White Sturgeon	Present?	unknown	unknown	unknown	Some documentation in the lower Taku, but no local or traditional knowledge of this species

Strategic Overview

Management Structure & Activities

The Taku in being an international / transboundary region, salmon management activities are jointly undertaken by Alaskan, Canadian and First Nation Government's. Under the Pacific Salmon Treaty there is a Transboundary Panel and Transboundary Technical Committee within which the various agencies and interests are involved.

Summary of salmon management

(Provided by DFO/Stock Assessment – Whitehorse)

Stock Assessment and Research Processes:

The assessment processes for sockeye, coho and chinook salmon are being developed along similar lines. The process generally involves assessing the total in river run size through mark-recapture programs, monitoring of in river catches for use in conjunction with in river abundance estimates to obtain total escapement estimates, sampling of catches and escapements to determine age, size and sex composition and information on the contribution of enhanced stocks, and stock specific escapement studies.

Sockeye Salmon

The assessment program for Taku sockeye salmon includes the following components:

- a) A mark-recapture program in the lower Taku River to determine in-season forecasts and post-season estimates of total in-river run size and escapement, major stock timing, and overall age and size distribution.
- b) Sampling in Canadian and U.S. gill net fisheries to determine age and size distribution of catches and contributions of enhanced stocks. Sampling is also conducted for stock identification.

c) Stock-specific escapement enumeration and sampling at weirs located at Little Trapper, Tatsamenie and Kuthai lakes.

d) A number of assessment projects to facilitate the joint Canada/U.S. sockeye enhancement program on Taku sockeye including: hydroacoustic and limnological surveys; fry outplant and smolt emigration studies; otolith sampling and analyses in catches, escapements and juvenile samples to determine enhanced and wild contributions; and preliminary surveys of other potential enhancement opportunities.

Coho Salmon

The assessment program for Taku coho salmon includes the following components:

- A mark-recapture program in the lower Taku River to determine in-season forecasts and post-season estimates of total in river run size and escapement, major stock timing, and overall age and size distribution.
- A Canadian test fishery which will operate to recapture tagged adult fish in the event the commercial fishery is closed.
- Sampling in Canadian and U.S. gill net fisheries to determine age and size distribution of catches and contributions of enhanced stocks (U.S. fisheries only) and to recover coded wire tags (CWT's).
- A coded-wire tagging program to provide smolt production estimates associated with brood year escapement estimates, ocean survival, harvest rates, and stock identification and contributions within the marine fisheries.

Chinook Salmon

The assessment program for Taku chinook salmon includes the following components:

- A mark-recapture program in the lower Taku River to determine in-season forecasts and post-season estimates of total in-river run size and escapement, major stock timing, and overall age and size distribution.

- A Canadian test fishery which will operate to recapture tagged adult fish.
- Sampling in Canadian and U.S. gill net fisheries to determine age and size distribution of incidental catches and contributions of enhanced stocks (in U.S. fisheries only) and to recover CWTs.
- A coded-wire tagging program to provide smolt production estimates associated with escapement estimates, ocean survival, harvest rates, and stock identification and contributions within the marine fisheries
- Aerial surveys of select escapement index streams.

Pink, Chum and Steelhead Salmon

The assessment program for Taku pink, chum and steelhead primarily involves monitoring catches and effort in the Canyon Island fishwheels and gillnets (i.e. the fishwheels / nets used for the chinook, sockeye and coho mark-recapture programs).

Spawning Escapement Requirements:

Chinook

Following a number of reviews which culminated with the Transboundary Technical Committee (TTC) escapement goal evaluation in 1998 and 1999, and an evaluation conducted by the Chinook Technical Committee of the Pacific Salmon Commission, the recommended goal range for escapement of large chinook salmon has been set between 30,000 and 55,000. The TTC has accepted this goal for the 1999–2003 period. These numbers translate into a combined aerial survey index of 6,000 to 11,000 thousand chinook salmon.

Sockeye

The interim¹ escapement goal range for Taku sockeye is between 71,000 and 80,000 fish. Escapement estimates, derived from tagging studies conducted since the PST took effect in 1985, indicate that the yearly numbers fall within or

exceed this range. As spawner–recruitment data accumulates over time, these escapement targets will be re-examined by the TTC.

Coho

The interim escapement goal for Taku coho is 27,500 to 35,000 fish.

Pink

The interim escapement goal for Taku pink salmon is between 150,000 and 200,000 fish.

Chum

The interim escapement goal for Taku chum salmon is between 50,000 and 80,000 fish.

Fishing Activity

Note: The summary below is focused upon fishing activity in Canada and does not identify the details of such practices and regulations in Alaska.

Participants:

There are three groups of fishers that utilize the Canadian portion of the Taku river salmon run: First Nation, commercial and recreational fishers.

First Nations Fishery

The First Nation that fishes the Taku River drainage is the Taku River Tlingit First Nation (TRTFN) with primary offices located in Atlin, B.C. Fishing gear consists primarily of set and drift gill nets. One fishwheel has also been used in recent years. After conservation needs are met, priority in terms of allocation is to fulfil the Section 35 constitutional priority of the First Nations fishery. This priority has been re-affirmed by a series of Supreme Court rulings, (i.e. Sparrow, NTC Smokehouse, Delgamuukw, Nikal). All other fisheries, therefore, are managed to accommodate the fundamental priorities of conservation and First Nations fishery requirements.

Commercial Fishery

The Canadian commercial fishery on the Taku system was established in 1979. Currently there are sixteen licences available to fish commercially, including 8 First Nation licences (2 of which are held

¹ Interim escapement goals are subject to adjustment as more stock-recruitment data becomes available.

under an Aboriginal Fisheries Strategy (AFS) agreement.) Gear consists of drift and set gill nets.

Recreational Fishery

Due to its relative inaccessibility, the Taku drainage has not yet been subject to heavy recreational fishing activity. Commercial guiding operations are located on the Nakina and Tatsatua rivers. In 1999 there were eight guiding licences issued by the province for the Taku drainage.

Locations of the Fisheries:

The Taku River commercial fishing area extends from fishery boundary signs located approximately 50 meters upstream of the international border, upstream to boundary signs located near a geological feature locally known as Yellow Bluff, approximately 18 kilometres upstream from the international border. The area does not include Flannigan's Slough and South Fork Lake and outlet channel, which are marked with fishing boundary signs. Most of the subsistence fishing by the TRTFN also occurs in the commercial fishing area. A smaller amount occurs on tributaries such as the Nakina River and lakes such as Kuthai Lake. The recreational fishery is distributed throughout the headwater tributaries. Notable areas include the Nakina River, Tatsamenie Lake and outlet stream, Nahlin and Sheslay rivers.

Time Frame for Fishing Seasons:

The commercial fishery usually commences the second or third week of June and continues through the first week of October. First Nations fishing takes place primarily during the commercial fishery season as outlined above, but may also occur in May or early June, and into October as there is no specific time regulations.

The recreational fishery is open year round, with the exception of dates that are published in the B.C. Freshwater Salmon Supplement at:

www-comm.pac.dfo-mpo.gc.ca/english/freshwater/

The supplement is available free of charge from licence vendors as well. Closed times include:

- December 01 to June 30 and August 20 to September 15 from Tatsamenie Lake outlet downstream to Tatsatua Creek;
- December 01 to June 30 and August 20 to September 15 in Kowatua Creek;
- July 20 to August 15 in the Nakina River.

Most sport fishing for salmon occurs in early to mid-July and mid- to late September.

Allocations:

The following International arrangements will apply to the Taku River for the 1999 to 2008 period as outlined in the Transboundary Annex of Pacific Salmon Treaty that was re-negotiated in 1999.

Sockeye Salmon

- a) Except as noted below, Canada shall harvest no more than 18% of the Total Allowable Catch (TAC) of the wild sockeye salmon originating in the Canadian portion of the Taku River each year.
- b) If the projected in river escapement is greater than 100,000 sockeye, Canada may, in addition, harvest 20% of the projected in river escapement above 100,000 sockeye.
- c) The Parties agree to manage the returns of Taku River sockeye to ensure that each country obtains catches in their existing fisheries equivalent to each country's share of wild sockeye and a 50% share of enhanced sockeye.
- d) The Parties agree to continue the existing joint Taku enhancement program designed to produce annually 100,000 returning sockeye salmon.

Coho Salmon

- a) The Parties agree to develop and implement an abundance-based approach to managing coho salmon on the Taku River no later than May 1, 2004. The Parties commit to developing a revised MSY escapement goal to be implemented no later than May 1, 2004.

b) Until a new abundance-based approach is developed, the management intent of the United States is to ensure a minimum above-border in river run of 38,000 coho salmon, and the following arrangements will apply:

- i) No numerical limit on the Taku River coho catch will apply in Canada during the directed sockeye salmon fishery (through statistical week 33).
- ii) If in-season projections of above-border run size are less than 50,000 coho salmon, a directed Canadian harvest of up to 3,000 coho salmon is allowed for assessment purposes as part of the joint Canada/US Taku River mark-recapture program.
- iii) If in-season projections of above-border run size exceed 50,000 coho salmon, a directed Canadian harvest of 5,000 coho salmon is allowed.
- iv) If in-season projections of above-border run size exceed 60,000 coho salmon, a directed Canadian harvest of 7,500 coho salmon is allowed.
- v) If in-season projections of above border run size exceed 75,000 coho salmon, a directed Canadian harvest of 10,000 coho is allowed.

Chinook Salmon

- a) Both Parties shall take the appropriate management action to ensure that the necessary escapement goals for chinook salmon bound for the Canadian portions of the Taku River are achieved.
- b) The Parties agree that new fisheries on Taku River chinook salmon will not be developed without the consent of both Parties. Management of new directed fisheries will be abundance-based through an approach to be developed by the Committee no later than May 01, 2004. The Parties agree to implement assessment programs in support of the development of an abundance-based management regime.
- c) The Parties shall review an appropriate MSY escapement goal for Taku River chinook by May

1999 and thereafter establish a new goal as soon as practicable.

First Nations

Under terms of the of an Aboriginal Fisheries Strategy agreement between the Taku River Tlingit First Nation and the Department, First Nations catches of two thousand sockeye, five hundred chinook and seven hundred and fifty coho salmon are currently managed for. These "quotas" can be renegotiated if they fail to meet the food, social and ceremonial needs of the First Nation. (Catch allocations are typically reviewed by the First Nation and DFO on an annual basis.)

Commercial

Allocations to the commercial fishery are based on the projections of total run strength and TAC; the TAC for the commercial fishery will have escapement goals and First Nations fishery requirements already accounted for. With abundance-based management, pre-season estimates of potential harvest are estimates only; in-season estimates of allowable catch will vary weekly based on in-season indicators.

Recreational

Allocations to the recreational fishery on the Taku River are generally not actively set in-season. Rather, recreational fishing catch is limited by daily and possession limits set out in the B.C. Freshwater Salmon Supplement available on line at:

www-comm.pac.dfo-mpo.gc.ca/english/freshwater/

On the Taku River, recreational fishing catch limits include:

- > 4 chinook salmon per day of which only 2 may be over 65 cm in length (from tip of nose to fork of tail).
- > 4 coho salmon per day of which only two may be over 50 cm in length.

- Retention of sockeye (except Kokanee), pink and chum salmon is not permitted.
- 10 Kokanee per day (none from streams); and 2 steelhead of which 1 may be over 50 cm in length and none may be less than 30 cm in length.
- The aggregate daily limit for all species of Pacific salmon (other than Kokanee) is four fish.
- Generally, subject to monthly and annual catch limits, possession limits are equal to twice the daily quota. Monthly catch quotas include 2 steelhead and there are annual catch quotas of 10 steelhead, and 10 chinook salmon greater than 50 cm in length.

Schedules and Conditions:

Commercial Fisheries

The Canadian fishery typically opens for an initial 48-hour period to target early sockeye runs. Weekly TAC projections for sockeye salmon, are used to guide the management of the commercial fishery. Seasonal TAC projections for the commercial fishery will have allowances built in for escapement and First Nations fishing requirements. Run timing is used to provide weekly guideline harvests in the fishery and the weekly fishing periods will be adjusted accordingly. Extensive in-season consultations between fishery managers of the two countries occur to co-ordinate management as best as possible.

For coho salmon, the commercial fishery is managed on the basis of in river run strength within the overall Canadian harvest levels. Commercial catch guidelines also include allowances for escapement and First Nations fishing requirements.

While participating in the fishery, commercial fishers are required to land catches at a registered landing station within each 24-hour period, or portion thereof, commencing from opening time. All fish caught within a 24-hour period must be landed at a registered landing station no later than 1:30 pm. Hail information

collected throughout the openings will be used to justify extensions to fishing times. Tag recovery information must be segregated by gear-type, i.e. gill net or fishwheel, and delivered to DFO personnel no later than 1:30 pm after each 24-hour fishing period. Catches are made available for sampling by DFO staff and/or samplers designated by DFO.

One of the following combinations of gear may be used:

- a) one anchored gill net and 1 drift gill net;
- b) two anchored gill nets;
- c) one fishwheel and one drift gill net;
- d) one fishwheel and one anchored gill net; or,
- e) two fishwheels.

Gill nets (set or drift) may be up to 30.5 meters (100 feet) in length and must meet the following web specifications:

- a) Have 30 or more filaments in each twine of the web, with all filaments in the web of equal diameter. This is the web which has been typically fished on the Taku River in the past; or,
- b) Have 6 or more filaments in each twine of the web, with all filaments in the web a minimum of 0.20 mm in diameter. This web is otherwise known as "Alaska twist";
- c) In order to minimise the incidental catch of chinook salmon, a maximum mesh size restriction of 150 mm (approximately 5.9 inches) will be in effect through 12:00 noon July 15.

Set nets must be identified with an orange coloured buoy that is not less than 125 cm in circumference (16 inch diameter) with the fisher's name clearly marked on it. The buoy must be attached to the end of the net that is furthest from shore. All drift nets will have the last float of the float line orange in colour with the fisher's name clearly marked on it. All gear must be checked at least every 12 hours and any fish caught must be removed. Any gear left for more than the time specified on the conditions of licence will be deemed to be unattended.

As noted in item (c) above, mesh size restrictions are in effect through mid July to reduce the

incidental harvest of chinook salmon. To address conservation concerns and poor market conditions for Taku chum salmon, all chum salmon caught in the commercial fishery must be released. Commercial fishers are also encouraged to release all steelhead which are alive, not bleeding and appear likely to survive. This is a management action designed to minimise the impact of the commercial fishery on steelhead.

First Nations

Fishing times in the First Nations fishery are only restricted if there is a conservation concern and only after actions have been taken in other fisheries to conserve stocks of concern. Normally the fishery is open 7 days a week from April 1 to March 31. The main guiding factor in the First Nations fishery will be the allocations as specified in the Communal Fishing Licence of the Taku River Tlingits.

Recreational Fisheries

Fishing restrictions for the recreational fishery are described in the B.C. Freshwater Salmon Supplement. Gear is limited to single barbless hooks for fishing in all streams and sloughs.

Control and Monitoring of the Fisheries:

The Canadian commercial fishery is monitored by DFO staff who collect catch and tag recovery data from fishers and sample portions of the catch for age, size, sex and stock composition determinations. Catch and tag recovery data will be collected daily and will be recorded for each licence by species and hours fished. Conservation and Protection staff monitor and enforce compliance in the fishery.

Catch monitoring in the First Nations fishery is conducted by the TRTFN in conjunction with Fisheries and Oceans Canada. In consultation with TRTFN, Conservation and Enforcement staff may assist TRTFN in monitoring and enforcement in the First Nations fishery if and when required.

Monitoring in the recreational fishery has been done primarily through a creel census program undertaken by DFO and TRTFN. As well, fishing guides must report catches to the province of B.C. Compliance monitoring and enforcement will be undertaken by enforcement personnel with the province of B.C. and/or Fisheries and Oceans Canada.

Legislation and Policy

As part of the overall process, a search was conducted within current Government Legislation and Policy for principles that would be applicable to the Taku SPAWN process. The chart on page 24 was created for reference purposes during the selection of planning priorities. General principles were summarized in order to facilitate planning which supports current political direction.

Other relevant policy and legislation sources are also listed in Appendix 1 of the WFSP Guidebook.

Taku Fisheries Management projects anticipated in 2002 (From Transboundary Technical Committee)

Project/Dates	Function	Agency	Involvement
Canyon Island Marking Program			
mid April	Set up camp, build and place fishwheels.	ADF&G/ DFO/ TRTFN	All aspects
4/22 - 10/5	Fishwheel/ gillnet operation; Mark all chinook, sockeye, coho, and (pending analysis) chum captured with spaghetti tags. Sample for age-sex-length information: 260 sockeye/week throughout sockeye run, 634 coho for the entire season, all chinook. Scan all adipose-clipped chinook and coho caught for CWTs. Sacrifice sub-set (number to be identified).	ADF&G DFO/ TRTFN	3 staff 2 staff / 1 staff
Smolt Tagging			
4/7-6/27	Tagging (CWT) 35,000 to 50,000 chinook and 20,000 to 40,000 coho smolt.	ADF&G/ DFO	All aspects /2-3 staff
Canadian Aboriginal Fishery Sampling			
5/1-9/30	Collect and record AFS catch information including spaghetti tags.	TRTFN	All aspects
9/1-10/15	Capture 500-750 coho and sample for spaghetti- and coded-wire tags.		
Nahlin Sampling			
7/20-8/15	Sample 200 sockeye and up to 600 chinook in Nahlin River for age-sex-length, spaghetti- and coded-wire tags.	TRTFN/ DFO/ ADF&G	All aspects
Dudidontu Sampling			
8/20-8/30	Sample sockeye (opportunistically) and up to 400 chinook in Dudidontu River, for age-sex-length, spaghetti- and coded-wire tags.	TRTFN/ DFO/ ADF&G	
Canadian Commercial Fishery Sampling			
6/15-10/16	Collect and record commercial catch information; Catch information shall be sent to DFO Whitehorse; whose staff will provide/relay catch information to management staff, ADF&G (Juneau); Sample commercial chinook, sockeye and coho salmon for age-sex-length and tag loss; 200 samples per week for sockeye; 520 per season for coho; 300 scale samples per season for chinook.; Collect 96 sockeye otolith samples per week to estimate contribution of enhanced fish; send otolith samples to ADF&G for processing.; Collect and record all spaghetti tags caught in commercial fisheries, pay fishers for tag recoveries.	DFO	All aspects
Canadian Chinook Test Fishery			
4/28-6/16	Capture and examine a minimum of 1400 large (>660mm MEF) chinook for spaghetti tags and adipose-clips. Release all healthy unclipped females.; Sample all fish retained for age-size-sex, spaghetti- and coded-wire tags as well as spaghetti tag loss.	DFO	All aspects
Canadian Coho Test Fishery			
commercial fishery end to 10/12	Capture and sample approximately 400 coho per week for spaghetti- and coded-wire tags. Sample 100 coho per week for age-size-sex, spaghetti- and coded-wire tags as well as spaghetti tag loss.	DFO	All aspects
District 111 Fishery Sampling			
6/21 - 9/30	Sample a minimum of 20% of chinook and coho catches for CWTs; all species except pinks for age-sex-length, as well as chinook for maturity (goals are 800 per week for sockeye and 600 per season for chinook, chum, and coho). Collect 600 matched brain-parasite/scale/otolith samples per week from sockeye with sub-district specific goals	ADF&G	All aspects
Kuthai Sockeye Sampling			
7/2-8/30	Maintain adult sockeye salmon weir at Kuthai Lake; enumerate and sample for age-sex-length (600 samples) and recover spaghetti tags.	TRTFN	All aspects
mid-Sept.	Conduct an aerial survey in Kuthai Lake to enumerate sockeye and compare with weir count.		
Little Trapper Sampling			
7/16- 9/12	Maintain adult sockeye salmon weir at Little Trapper Lake; enumerate and sample for age-sex-length (750 samples) and recover spaghetti tags. Sample chinook salmon for age-length-sex, tags, secondary marks and adipose-clips, collect CWT heads.	DFO	All aspects
Aerial chinook surveys			
7/25- 8/25	Aerial surveys of spawning chinook salmon in index tributaries of Nakina, Nahlin, Dudidontu, Tatsatua, Kowatua, and Tseta rivers.	ADF&G	All aspects
Nakina Chinook Escapement Estimation			
8/1-8/28	Maintain chinook carcass weir enumerate chinook. Sample every fourth (minimum 600) chinook for age-sex-length and all other chinook for sex-length and tags. Examine all chinook salmon for tags, secondary marks and adipose clips; collect CWT heads.	TRTFN	All aspects
Tatsamenie Sampling			
5/15 - 6/24	Conduct sockeye smolt mark-recapture study to estimate abundance of wild and enhanced smolt; Sample for age, size and stock (wild vs enh'd).	DFO	All aspects
8/5- 9/30	Maintain adult sockeye salmon weir. Enumerate sockeye, sample for age-sex-length (750 samples) and recover spaghetti tags. Collect otoliths from sockeye broodstock taken at weir.	DFO	All aspects
9/1-10/1	Examine 100-200 chinook salmon for CWTs, size, tags and tag loss.		
8/23- 9/7	Chinook salmon carcass weir at Lower Tatsamenie. Sample for age-sex-size and examine for CWTs, tags and secondary marks on all chinook salmon recovered.	ADF&G/ DFO	All aspects
Kowatua Sampling			
9/1-10/1	Examine a minimum of 200 chinook for CWTs, size, tags and tag loss.	DFO	
Mainstem Escapement Sampling			
9/5- 9/25	Sample sockeye escapement in mainstem areas for age-sex-length (600 samples) and recovery of spaghetti tags. Examine all chum encountered for tags and tag loss subject to marking.	ADF&G/ DFO	All aspects
Tatsamenie Lake Enhancement Project			
5/10 - 6/4	Sample smolt outmigration from Tatsamenie (Taku River, in Canada) and conduct mark-recapture program on smolt from Tatsamenie Lake.	DFO	All aspects
5/22 - 7/15	Conduct feeding experiments with subsample of planted fry.	DFO	All aspects
5/15 - 5/30	Backplant sockeye fry from Lake Snettisham Hatchery into Tatsamenie Lake.	DIPAC/ ADF&G	All aspects
6/1 - 9/30	Collect plankton samples from Tatsamenie and King Salmon Lakes; conduct hydroacoustic and limnological surveys in Tatsamenie and King Salmon Lakes to evaluate the success or potential success of fry outplants.	DFO	All aspects
8/15 - 10/15	Collect up to 5.0 million sockeye eggs from Tatsamenie Lake and transport to Snettisham Hatchery in Alaska.	DFO	Egg-take and transport
Fall-winter	Test passive flow incubator in Tatsamenie Lake	DFO	All aspects
Aug - Sep	Conduct barrier assessments of Trapper Lake outlet and Nakina Lake access.	DFO	All aspects
9/6 - 10/8	• Sample 400 adult sockeye from Tatsamenie Lake egg-take for otolith samples.	DFO	All aspects
Salmon Egg Incubation			
9/97-6/98	• Incubation and thermal marking of juvenile sockeye (eggs & alevins) collected from Tatsamenie Lake at the Snettisham Incubation Facility in Alaska.	DIPAC/ ADF&G	All aspects

Legislation and Policy

A (Agreement)	P (Policy)
L (Legislation)	PDP (Policy Discussion Paper)
O (Other)	T (Treaty)

Name(of document)	Type/ Date	Gov't	Purpose (of the document)	Principles (in the document)
1. Pacific Salmon Treaty	T 1999	Canada U.S.A.	To facilitate the common interest in conservation and rational management of Pacific salmon stocks.	<ul style="list-style-type: none"> ➤ Prevent over fishing and provide for optimum production. ➤ Cooperate in management, research and enhancement ("enhancement" means man-made improvements to natural habitats or application of artificial fish culture technology that will lead to the increase of salmon stocks). ➤ Maintain a joint Transboundary Technical Committee that shall: <ul style="list-style-type: none"> (a) assemble and refine available information on migratory patterns, extent of exploitation and spawning escapement requirements of the stocks; (b) examine past and current management regimes and recommend how they may be better suited to achieving preliminary escapement goals; (c) identify enhancement opportunities ➤ Improve procedures for coordinated or cooperative management of the fisheries on transboundary river stocks.....intent to develop and implement abundance-based management regimes for transboundary chinook, sockeye and coho salmon no later than May 1, 2004. ➤ To use their best efforts, consistent with applicable law, to: <ul style="list-style-type: none"> (a) protect and restore habitat so as to promote safe passage of adult and juvenile salmon and achieve high levels of natural production, (b) maintain and, as needed, improve safe passage of salmon to and from their natal streams, and (c) maintain adequate water quality and quantity.
2. Fisheries Act	L	Canada (DFO)	Legislative authority for the management and regulation of fisheries and protection of fish.	<ul style="list-style-type: none"> ➤ Primary responsibility for protecting fish habitat. Proposed alterations to habitat require authorization by DFO.
3. Wild Salmon Policy	PDP 2000	Canada (DFO)	Conserving genetic diversity of wild Pacific salmon populations and protecting their habitat, while recognizing the importance of sustainable use of the resource.	<ul style="list-style-type: none"> ➤ An emphasis on maintaining the diversity of local wild salmon populations and their habitats. ➤ The aggregation of closely related local wild salmon populations into conservation units for the purposes of management and conservation ➤ The determination of specific minimum and target levels of abundance for each conservation unit. ➤ The management of each conservation unit to optimize long-term sustainable benefits or productive capacity. ➤ The strategic use of salmon cultivation techniques where their use can preserve populations of wild salmon at greatest risk of extinction. ➤ An emphasis on the conservation of wild salmon populations over other production objectives involving cultivated salmon, when genetic diversity and long-term viability are at risk.
4. Policy for the Management of Fish Habitat	P 1986	Canada (DFO)	To protect, restore and improve fish habitat.	<ul style="list-style-type: none"> ➤ No net loss – to ensure that the productive capacity of fish habitat is not reduced through urban / industrial development. ➤ Net gain – achieved through the restoration, improvement or creation of fish habitat.
5. A New Direction for Canada's Pacific Salmon Fisheries	PDP 1998	Canada (DFO)	Broad policy directions that will guide management for conservation, sustainable use and improved decision making.	<ul style="list-style-type: none"> ➤ The establishment of conservation as the primary objective in the management of Pacific salmon populations. ➤ The continued emphasis on a precautionary approach to fisheries management that takes into account uncertainties in predicting fish population and survival levels. ➤ A continued emphasis on a net gain in productive capacity in order to ensure that natural salmon habitat is maintained to support naturally reproducing populations of salmon. ➤ An ecosystem approach that recognizes the complex interactions between different species and moves away from single species management. ➤ An emphasis on the long-term sustainability of the resource, based on the best available science, and a commitment to avoid compromising long-term goals for short-term gain.
6. Fish Protection Act	L 1997	B.C.	Provides legislative authority for water managers to consider impacts on fish and fish habitat before approving new licences, amendments to licences or issuing approvals for work in or near streams.	<ul style="list-style-type: none"> ➤ Ensuring sufficient water for fish. ➤ Protecting and restoring fish habitat. ➤ Improved riparian protection and enhancement. ➤ Stronger local government powers in environmental planning.
7. International Convention on Biological Diversity	O 1993	Canada (175 countries)	Commitment to the sustainable use of biological resources and to minimizing adverse impacts on biological diversity.	<ul style="list-style-type: none"> ➤ Requires governments to develop legislation and policies that will protect ecosystems and natural habitats and maintain viable species populations.

First Nation Priorities

Taku River Tlingit (TRT)

Policy Directions for Fish and Fish Habitat:

1. Sustain populations of all native fish species within historic ranges of abundance.
2. Sustain the natural productive capacity of fish habitats.
3. Sustain the cultural and subsistence benefits of fish and fisheries for TRT people.
4. Provide sustainable economic opportunities in fishing for TRT people and others.

Ecological Management Issues:

1. Declining stocks

This seems to be the primary issue identified especially from elders and other members that remember historic abundance levels. (A related concern is the risk of over harvest.) Escapement goals are created for commercial species, system wide, leaving the conservation of individual stocks and their genetic diversity a strategic issue. Current escapement goals are calculated using the dated theory of maximum sustainable yield, which works well for achieving short-term species conservation and economic gain but has performed poorly in maintaining the long-term conservation of individual stocks. The current TRT Joint Clan meeting mandate is to "promote management styles that are based-upon the concepts of "stock-by-stock" and "ecosystem-based" management.

2. Integration of TRT values and principles into fisheries management and planning

Given the historical importance of salmon to our people, involvement in fisheries management and protection remains a cultural and social necessity. Due to its Transboundary nature, the need for multi-agency coordination and management of the Taku watershed is readily apparent. Developing a broader focus within the management regime that

recognizes ecosystem processes and TEK will help to reduce the risk of future decline of fish populations and loss of habitat.

3. Enhancement

The elders in particular have been concerned about the ethics and influences of hatchery enhancement. The current TRT Joint Clan meeting mandate is to "Not support hatchery-related salmon enhancement activities at this time. However, to investigate the potential for habitat-related enhancement as an alternative and possibly implement such projects."

4. Proactive habitat protection

The current focus of fisheries work in the Taku Watershed is stock assessment by species. Projects have been developed to estimate system-wide escapement, run strength and productivity of commercially important salmon species. However, less attention has been devoted to documenting the diversity within Taku fish populations, the variety of habitat areas they utilize and the related ecosystem functions. Industrial interests within the Taku Watershed are becoming increasingly evident and in the near future it is likely that a Land Use Planning process may be initiated for the region. Without consolidated information regarding fish habitat utilization it will be more difficult to implement measures that will afford habitat protection and promote the sustainable health of fish populations.

Tahltan Fisheries (TF)

Policy Directions for Fish and Fish Habitat:

1. Sustain populations of all native fish species within historic levels of abundance.
2. Sustain the natural productive capacity of fish habitats.
3. Sustain the cultural and subsistence benefits of the fisheries resource and fisheries activities for Tahltan people.
4. Provide sustainable economic opportunities in fisheries for Tahltan people.

Ecological Management Issues:

1. Declining stocks:

This has been identified as the primary concern of almost all people who were interviewed or participated in discussions, was the decline of populations from historical recollection and review of archival information.

This may be related to concerns of over harvesting in the commercial sector, however the opinions of Tahltan members that participated and contributed information to the Taku WFSP are that heavy beaver activity within this area has restricted access to many of the historical spawning grounds and suggest that this has played a major role in the decline of fish stocks.

TF like the TRT, also promotes management styles that are based on the concept of "stock-by-stock" management that are crucial in maintaining and conserving individual stocks within the system.

2. Integration of Tahltan values and principles into fisheries management and planning:

Given the historical importance of the salmon resource to the Tahltan people, involvement in fisheries management and protection remains a cultural and social necessity. TF also agrees that the need for multi-agency coordination and management of the Taku Watershed is apparent, and that a management regime that recognizes ecosystem processes and Traditional Ecological Knowledge will help to reduce the risk of future decline of fish populations and loss of habitat.

Community Ecological Concerns

(As recorded from 1st Community Workshop, Jan. 23, 2002)

Input from community members was collected by asking several general questions. Responses were be categorized into ecological, social / cultural, economic and political types. Although all responses are considered important, given the scope and purpose of the process (i.e. "fish first approach"), only those of an ecological nature are subsequently displayed. (In this manner, it is much

the same as having the First Nation submissions focus on ecological management issues).

1. How do you see the future of the Taku?

- Not be overused
- Can stand improvements – the priorities are in getting the fish back – not just the high value commercial species
- Seeing the 20 year history of the river – fish stocks are definitely down – need them to come back
- Would like to see more fish as there is a worry that there are less fish and it is continuing to decline
- Should be more monitoring of animals and insects that cause erosion of land – need to prevent infestations
- Should be monitoring of beaver dams
- Should be more fish for bears

2. What do you value about the fish resource and its home (habitat) on the Taku River?

- Return it to what it was, or at least not let it decline further
- Predators
- Should return to activity seen 20 years ago

3. What do you see as important things to think about in fish planning for the Taku?

- What are the real population numbers by species? There should be information back to the 50s. How much of a problem is there?
- Need to look at long term impacts and proper management of commercial fishery – address impacts on species that are not prime or optimum for markets (i.e. by-catch)
- Is the decline due to hatcheries in Alaska? There is an interconnection between hatchery and wild stocks.

Stage 2 - Planning Priorities:

Selection of Planning Priorities

Note: After discussion and to avoid confusion, the group decided to use the term "Planning Priorities" rather than "Planning Units" which was used in the beginning to delineate the different watersheds.

Based upon review and consideration of the profile and overview information the group established the following Planning Priorities:

- | | | |
|----|---------------------------------------|---------------------------------|
| 1. | Stock Specific Planning | (high priority – do now) |
| 2. | Lower Taku Watershed | (high priority – do now) |
| 3. | Wild Chum Salmon | (high priority – do now) |
| 4. | Steelhead and Pink Salmon | (medium priority – do later) |
| 5. | Bull Trout and Dolly Varden | (lower priority – do later) |
| 6. | Fish Distribution in the Upper Nahlin | (lower priority – do later) |

The Planning Priorities were screened against the following classification filters:

Category of Classification Filter	Result
1. Risk of decline, loss or impact is relatively high. (Urgency level is high)	Yes or No
2. Is there a likelihood of significant /measurable benefit with a reasonable level of resources?	Yes or No
3. Scope of planning unit being addressed would be large enough to facilitate/assist in sustainability planning or projects for other areas, populations, etc.	Yes or No Description
4. Identified as data / information gap in the WFSP profile.	Yes or No Priority gap?
5. Identified as an ecological principle in government legislation, policies, priorities etc.	Yes or No List Reference
6. Identified as a First Nation ecological issue.	Yes or No Which FN('s)
7. Identified as a community or stakeholder ecological concern / value.	Yes or No Forum
7. Other (barriers to addressing the issue?, active area of interest?, timing?)	Identify

Having completed the screening process, the group noted that it had some discomfort with prioritizing the six Planning Priority candidates. It was noted that there was a need to decide how many should/could be tackled at the beginning, subsequently it was decided to address the first three.

It was agreed that the priorities should be defined in terms of goals and objectives in order to track progress. A discussion about timelines for the planning horizon concluded that there was a general range of 2 to 10 years, depending upon the specific species of concern. Based on this, the group somewhat arbitrarily decided to use a 5-year planning target.

Stock-specific Planning

Profile / Overview

Background:

In approaching the stock specific planning concept, an underlying goal of reducing the risk of future decline becomes readily apparent. This requires first looking at the current stock assessment and harvest management activities at a broad scale. For this purpose, an overview and evaluation of current management processes and biological information has been depicted below.

Taku Salmon Synopsis:

(Provided by DFO/Stock Assessment – Whitehorse)

Sockeye

In the Pacific coastal drainages of North America, primary spawning grounds of sockeye salmon extend from the Columbia River, Washington to the Kuskokwim River in Alaska. Sockeye have also been observed infrequently further north off the Arctic coast as far east as Banks and Victoria islands, Northwest Territories. Sockeye salmon also occur along the Asian coast of the Pacific Ocean with major spawning populations located on the Kamchatka Peninsula (in: Groot and Margolis, 1991).

The Taku River drainage contains significant populations of spawning and rearing sockeye salmon. Spawning occurs in lakes throughout the

drainage (e.g. Little Trapper, Tatsamenie, Kuthai lakes), as well as in the mainstem of the river and side-channels.

Most adult spawners enter the Taku River between mid-June through August. Taku River sockeye exhibit a diverse age structure. The average (1983-1997) age composition of returning adults is approximately 50.0% age 1.3², 22.3% age 1.2, 8.9% age 0.3, 5.3% age 2.2, 5.0% age 0.2, 4.6% age 2.3, 3.2% age 1.1 and < 1% for each of ages 0.1, 2.1, 0.4, 1.4, 3.2, 2.4, 3.3. Spawning occurs from late July through October. The eggs hatch the following spring. The length of time that juveniles spend in freshwater varies from a few weeks (for the majority of the mainstem fish) to three years (for portions of some lake-rearing populations). However, freshwater residence is usually one or two years. Smoltification and seaward migration normally occurs in the spring with peak downstream migration in late May and June. Taku River sockeye salmon spend from one to four years in the ocean before they return as adults to spawn.

Utilization of Taku River sockeye salmon occurs in the U.S. commercial gill net fisheries located near the mouth of the Taku River (District 111), and in an in-river personal use fishery. Commercial fisheries located in marine waters outside of District 111 also harvest Taku River sockeye at an assumed interception rate of 5%. In the Canadian portion of the drainage, harvest of sockeye occurs in commercial and First Nations fisheries near the international border.

The current Taku River sockeye in river stock assessment program includes: the joint Canada/U.S. mark-recapture project, which involves tag application at Canyon Island just downstream of the border, and tag recovery in the commercial fishery; enumeration weirs at Little Trapper Lake, Tatsamenie Lake, and Kuthai Lake; age-length-sex-

² The decimal point separates the number of winters spent in freshwater as a juvenile (first digit) from the number of winters spent in the ocean. Therefore, an age 1.3 fish migrated seaward after rearing for one winter in freshwater as a fry or pre-smolt and returned to spawn after spending 3 years in the ocean. The total age of the fish is the sum of the two numbers plus one additional year to account for the incubation period.

otolith sampling at various sites; and enhancement assessment at Little Trapper and Tatsamenie lakes.

Run sizes of sizes of sockeye have averaged about 227,000 since 1984, ranging from 146,000 (1998) to about 405,000 (2001). In 2000 and 2001, the preliminary average run size is 349,000 fish.

The interim sockeye salmon escapement goal for the drainage is 71,000 to 80,000 fish. Escapement estimates since 1984, have either fallen within or exceeded this target range (estimates range from 71,000 in 1997 to 144,000 in 2001).

A declining trend in return per spawner was noted over the brood years 1988 to 1994 (3.9, 2.9, 2.3, 2.3, 1.9, 1.8, 1.6, respectively), with a slight improvement for the 1995 brood year (1.8). However, a dramatic improvement has been observed for the 1996 brood year (4.5 returns per spawner). The return of age-4 fish from the 1997 brood year was also promising. This appears to be a reflection of improved environmental conditions.

Chinook

Chinook salmon are found from central California to the northern Pacific coast of Alaska and infrequently along the Arctic coast as far east as the Mackenzie River and perhaps the Coppermine River, N.W.T. Spawning stocks along the Asian coast extend from northern Japan to the Amadyr River, which enters into the northern portion of the Bering Sea (in: Groot and Margolis, 1991).

Of the Canadian transboundary and U.S. river systems that drain into southeast Alaska, the Taku River produces the most chinook salmon.

Spawning populations of chinook salmon in the Taku River drainage are considered to be "spring" run. Most adult spawners enter the Taku River between early May and early July. The average (1988-90, 1995-97) age composition of returning adult chinook salmon in the lower Taku River is as follows: 37.1% age 1.2, 33.2% age 1.3, 16.9% age 1.4, 8.1% age 1.1, 1.9% age 2.2, 1.4% age 2.3 and <1% for each of ages 2.1, 1.5, 2.4, and 0.2 (Kelly and Milligan, 1999). Spawning occurs from late July through September in a number of tributaries (e.g.

Nakina, Nahlin, Tatsatua, Kowatua). Juveniles emerge the following spring and almost all rear in river for one year (a few migrate to the ocean after emerging while others spend an additional year in freshwater) before smolting and migrating to the ocean. Fry are known to migrate from natal streams to non-natal streams/ rivers to rear. Out-migration of smolts generally occurs from late April through June. Taku River chinook salmon spend from one to five years in the ocean before they return as adults to spawn. Fish maturing after one or two years in the ocean are mostly males, while on average, 50% of the older fish are females.

Prior to the mid-1970s Taku River chinook salmon were exploited in commercial and recreational fisheries in the U.S., with annual commercial harvests of greater than 15,000 fish. As part of a program to rebuild southeast Alaskan and Canadian stocks, various restrictions were placed on all U.S. intercepting fisheries (troll, gill net and recreational) beginning in 1976. This rebuilding effort was combined with a coast wide rebuilding effort for chinook salmon in conjunction with the Pacific Salmon Treaty and an agreement not to implement new directed fisheries for Taku River chinook salmon.

At present, migrating chinook salmon from the Taku River are caught incidentally in a commercial gill net fishery in U.S. waters near the river and in an in river Canadian gill net fishery. Chinook salmon from the Taku River also constitute a large component of the spring catch in the recreational fishery in marine waters near Juneau and are also caught in low numbers in recreational fisheries in Canadian reaches of the drainage.

Since 1975, chinook spawning escapements to the Taku River have been assessed by helicopter aerial counts in six clear water tributaries. Only large chinook salmon, typically those who have spent three or more winters in the ocean, are counted during these surveys because of the difficulty of distinguishing smaller fish from other species. Counts are expanded to obtain drainage-wide population estimates. Expansions are based on limited data associated with mark-recapture

estimates of system-wide escapement coupled with corresponding peak annual aerial index counts.

In 1988 a study demonstrated that it was possible to mark and recapture sufficient large chinook in the Taku River to estimate escapement (McGregor and Clark, 1989). This method was used in 1989, 1990 and from 1995 through 1999. Additional mark-recapture studies have provided smolt abundance data and marine harvest rates.

Run sizes of large chinook have averaged about 49,000 since 1979, ranging from 12,000 (1983) to about 126,000 (1996). From 1979 to 1989, run sizes averaged 37,000 fish; from 1990 to 2001, they averaged about 60,000 fish. In 2000 and 2001, the preliminary average run size is 42,500 fish.

Annual run sizes are most often dependent upon survival of a particular brood year. For example, the 1991 brood year had good survival and over 9% of the smolt survived at sea to return as adults. The record runs seen in 1996 and 1997 included the five- and six-year old fish returning from the 1991 brood.

The estimated escapements of large chinook spawners have ranged from about 10,000 in 1983 to 115,000 in 1997; this is over a ten-fold difference. Escapement averaged about 19,500, 33,000 and 55,000 spawners in the 1970's, 1980's and 1990's respectively. The lower end of the escapement goal range of 30,000 to 55,000 was exceeded in six of ten years in the 1980's, nine of ten years in the 1990's, as well as in 2000 and 2001 (McPherson et al 2002, in prep).

Coho

Coho salmon are found in the North Pacific Ocean with a range extending from California to Korea. The centre of abundance is between the state of Washington and Southeast Alaska (in: Groot and Margolis, 1991). Coho generally spawn and rear in freshwater, and migrate to the ocean after one or two years.

Taku River coho are known to spawn and rear throughout the watershed, from the Taku estuary to small headwater tributaries. The aggregate Taku

coho stock is composed of many separate components, or sub-stocks³, of varying size and diverse habitat usage. The adult spawning migration begins in mid-July and extends through November and possibly longer. Spawning is known to occur from mid-August through to December. Emergence timing is dependent on both incubation water temperature and the time of year egg deposition occurs. It is probable that fry emergence occurs from mid-April to mid-June. Offshore migration routes and behaviour of Taku River coho are largely unknown. The main migration route of returning adults is through S.E. Alaska waters via Cross Sound, Icy Strait, and Lynn Canal (Mcpherson et al. 1998).

The average Taku coho egg production (fecundity), is not known but is likely comparable to other northern coho stocks which range from 2,500 to 5,000 eggs per female, depending on fish size (Hart 1973). The average length (mid-eye to fork of tail), of adults sampled at Canyon Island near the Canada/U.S. border during the 1987 - 1996 period was 58.5 cm (DFO Whitehorse, unpublished data). The age composition of adult coho salmon sampled in the lower Taku River at Canyon Island over the 1983 to 1997 period averaged: 52.8% age 1.1, 46.9% age 2.1, and <1% for each of ages 3.1, 2.0, 1.0, 4.0 (Kelly and Milligan, 1999).

Juvenile Taku coho spend a variable amount of time rearing in fresh water, ranging from a few months up to three years. The age composition of adult coho sampled at Canyon Island near the Canada/U.S. border from 1983 - 1997 indicates that on average, approximately 55% of Taku coho rear for 2 years in fresh water (Mcpherson et al. 1998). Taku coho smolts migrate from the end of April to the latter part of June, with the peak migration occurring during May 15 through May 30. Estimated Taku River coho salmon above-border spawning escapements from 1987 to 2001 have averaged 71,872 (range 32,441 - 127,484), well above the interim goals set by U.S. (27,500), and Canadian (35,000) members of the Transboundary

³ For the purposes of this paper, the term "sub-stock" is used to define a localised spawning population that possesses some degree of genetic uniqueness through adaptation to local environmental conditions and/or reproductive isolation.

Technical Committee (TTC). Stock-recruitment data available for the 1991-1998 period suggests there is a density dependent relationship between escapement and smolt production. The data indicates that optimum smolt production occurs at an escapement of approximately 52,000 (95% confidence interval 45,000 - 59,000). This escapement results in the production of approximately 1,180,000 smolts. Although higher than current escapement goals, this level has been met or exceeded in all but 3 years since 1987. The stock-recruitment predictions should be viewed cautiously as they encompass a relatively small data set with a short time series that involved an interval of fluctuating marine survival. However, the stock-recruitment relationship indicates that current escapement goals may warrant revision with the inclusion of future data. Such revision will be conducted by the Transboundary Technical Committee prior to May 01, 2004, as stipulated in the Transboundary Annex of the PST, i.e. Annex IV, Chapter 1.

Although the data set is small, the smolt-to-adult survival from 1991 through 1997 exhibits a significant relationship to adult production. Over the same period, adult production is inversely proportional to escapement, however it is not likely a causal relationship. This is evidenced by the absence of a significant relationship between smolt production and adult production. The principal determinant of the variable adult production during the 1991-1998 period therefore appears to be marine survival. The recent lower returns experienced during 1996 and 1997 are likely a function of lower marine survival. During this interval, estimated catches and harvest rates also declined, indicating lower returns were due to a decrease in production rather than increased exploitation.

The estimated marine survival of Taku coho based on CWT data from 1991 to 2001 reflects variable smolt to adult survival, from a high of 23.0% in 1994, to lows of 6.7% in 1997 and 6.8% in 2000 (Yanusz et al, 1999, and ADF&G files; the 2001 figure is preliminary). Marine survival of 11 other Southeast Alaska stocks averaged 6.5% during the

period 1979 - 1983 (Shaul et al. 1991), suggesting that recent lower Taku coho survivals may not be atypical. Using the U.S. Taku inlet coho catches from 1960 to 1998 as an index of coho production, it is apparent the above average production during the period 1989 through 1995 is an anomaly if considered within the context of the previous 38 year average. The 1996-2001 Taku coho production decline could perhaps be interpreted as a return to representative levels.

Run sizes of coho have averaged about 158,000 since 1992, ranging from 51,000 (1997) to about 340,000 (1994). In 2000 and 2001, the preliminary average run size is 141,500 fish.

The estimated escapements of coho spawners have ranged from about 40,000 in 1988 to 127,000 in 1991. Escapement averaged about 75,000 spawners in the 1990's, and 93,000 (preliminary) in 2000 and 2001. The upper end of the escapement goal range of 27,500 to 35,000 has been exceeded in all years except one since 1987.

Pink Salmon

Pink salmon are the most abundant species of Pacific salmon. Spawning populations are found from central California, north and east to near the Mackenzie River system. In Asia, pink salmon distribution extends from Korea, north along the Pacific coast and into the Arctic as far west as the Lena River in northern Russia (in: Groot and Margolis, 1991).

The Taku River frequently supports large numbers of spawners. Mature fish enter the Taku River from late June through August, with the bulk of the migration occurring in July. Spawning occurs from August to November and fry emerge the following spring. As with chum salmon, smoltification and seaward migration occur shortly afterward; the species is not known to overwinter in freshwater. After only eighteen months in the ocean they return as adults to spawn.

There is no program in place to estimate drainage-wide pink salmon escapement. However, since 1984 fixed-site CPUE data from fishwheels at

Canyon Island, has provided some indication of interannual variation. This is somewhat imprecise because catch rates can be affected by water levels. Due in part to the two-year life cycle, pink salmon run sizes are often cyclical. Prior to 1994, odd-year escapements (based on Canyon Island fishwheel counts) appeared to be dominant. However, in 1994, the even-year became dominant due to a near-complete failure of the odd-year return the preceding year. Things evened out in 1998 and 1999 when Canyon Island fishwheel counts were almost identical (approximately 23,000 pink salmon). Likewise, fishwheel counts in 2000 and 2001 were closely matched. In general up to 2000, even-year counts showed an increasing trend since the mid-1980's. Odd-year counts were strong until they crashed in 1993. They have been recovering since then.

Chum Salmon

Chum salmon have the widest natural geographic distribution of all Pacific salmon species. In North America they are found from the San Lorenzo River in Monterey, California to as far north and east to the Mackenzie River system. In Asia, they occur in Japan, along the Okhotsk and Kamchatka coasts into the Arctic and westward to the Laptev Sea, northern Russia (in: Groot and Margolis, 1991).

Two sub-species of chum have been identified, summer chum and fall chum. Fall chum can be distinguished by a number of factors: later entrance into spawning streams, less developed reproductive systems at the time of entry into these streams, later spawning period, larger size, and greater fecundity. Significant numbers of enhanced summer chum from Alaska hatchery programs are found in marine waters adjacent to the mouth of the Taku River. Although summer chum do not ascend the Taku River, natural populations of fall chum are found in the drainage. Spawning occurs in groundwater fed areas throughout (Groot and Margolis, 1991).

Adult spawners enter the Taku River from August through September. Spawning occurs from mid-September through November (and possibly later) and fry emerge the following spring. Smoltification and seaward migration occur shortly afterward; Taku River chum are not known to overwinter in freshwater. They spend from two to five years in the ocean before they return as adults to spawn. However, the vast majority return after three or four years in the ocean.

As with pink and steelhead salmon, there is no program in place to estimate drainage-wide chum salmon escapement. However, since 1984 fixed-site catch data from fishwheels and gillnetting at Canyon Island has provided some indication of interannual variation. This is somewhat imprecise because catch rates can be affected by water levels. Catches from in the 1980's, and 1990's averaged about 840 and 415 fish. In 2000 and 2001 (preliminary), the average catch was 205 chum salmon. These averages are influenced by major fluctuations; catches have ranged from 80 fish in 1986 to 1,600 in 1987. With the exception of 1986, counts from 1985 to 1991 were relatively high.

Related Government Policies/Priorities:

DFO – Wild Salmon Policy / Discussion Paper

- An emphasis on maintaining the diversity of local wild salmon populations and their habitats.
- The aggregation of closely related local wild salmon populations into conservation units for the purposes of management and conservation
- The determination of specific minimum and target levels of abundance for each conservation unit.
- The management of each conservation unit to optimize long-term sustainable benefits or productive capacity.

Sustainable Salmon Fisheries Policy for the State of Alaska - ADF&G / ABF - 2000

- "Escapement goal ranges should allow for uncertainty associated with measurement techniques, observed variability in the stock measured, changes in climatic and oceanographic conditions, and varying abundance within related populations of the stock measured."
- "Escapement should be managed in a manner to maintain genetic and phenotypic characteristics of the stock, by assuring appropriate geographic and temporal distribution of spawners as well as consideration of size range, sex ratio, and other population attributes."
- "The role of salmon in ecosystem functioning should be evaluated and considered in harvest management decisions and in setting of escapement goals."

Current management projects and existing information:

The assessment processes for sockeye, coho and chinook salmon are being developed along similar lines. The process generally involves assessing the total in river run size through mark-recapture programs, monitoring of in river catches for use in conjunction with in river abundance estimates to obtain total escapement estimates, sampling of catches and escapements to determine age, size and sex composition and information on the contribution of enhanced stocks, and stock specific escapement studies. (See table of Taku Fisheries Projects on page 23).

Other related information collected during transboundary projects includes run timing for various species and scale pattern analysis / genetic sampling (for age composition and identification of Taku stocks).

Management Approach:

(From Taku Integrated Fisheries Management Plan- 2002)

In-season management protocols are, where possible, set in advance of the impending season either in discussions of the Transboundary Technical Committee or the Transboundary Panel. The Technical Committee usually meets three times annually and the Transboundary Panel is tentatively scheduled to meet at least on a biannual basis (generally in conjunction with Pacific Salmon Commission meetings) to examine stock status and review other information relevant to the Transboundary rivers.

The cornerstone of the fishing arrangements negotiated in 1999 under the Pacific Salmon Treaty is abundance-based management. This approach means resource conservation is paramount and harvesting will fluctuate according to actual abundance rather than to pre-set levels. On the Taku River an abundance-based management regime for sockeye salmon has been in place since 1984. Similar regimes are being developed for both coho and chinook salmon.

As an example, sockeye salmon in-season management relies on weekly forecasts of the total run size based on estimates of cumulative in river abundance, provided from the joint Canada/U.S. mark-recapture program at Canyon Island, added to marine catches lagged by one week to allow for the time it takes the fish to migrate from the marine fisheries into the river. This sum is then apportioned by historical in river run timing data to provide a seasonal forecast of run strength. The seasonal total allowable catch (TAC) is then calculated by subtracting the escapement target from the projected total run size. The TAC is apportioned by the allocations set out in the PST to give a forecast of the Canadian allowable harvest for the season. Historical timing data from the Canadian fishery is applied to provide weekly guideline harvest levels for management.

➤ Overview of current methods for escapement goal calculation (to be inserted)

Identified Data Gaps:

- Consolidation of existing stock-specific data.
- Definition of conservation units
- Limit reference points (under development).
- Risk assessment regarding current management methods.

General review of the current management process by the Working Group, took the form of a simplified table which delineated certain factors of uncertainty and risk. This is displayed in the table on the subsequent page and includes various options for approach.

Factors of Uncertainty and Risk:

Category	Description	Options Analysis
MSY and stock-recruitment functions	<ul style="list-style-type: none"> ➤ Various stock-recruitment functions share several limitations: <ul style="list-style-type: none"> - The estimation of biological production functions in a highly variable natural environment. (The function reflects estimated production under past environmental conditions.) - Differences between stocks and change over time within stocks. - The necessity for accurate and detailed information. (CPMPNAS, 1996) ➤ The only true method to determine MSY is to harvest to the point of over-exploitation. ➤ Technical improvements in the analyses have led to overconfidence in its abilities to compensate for uncertainties. (CPMPNAS, 1996) 	<ul style="list-style-type: none"> ➤ Given that you cannot definitively predict MSY without exceeding it, risks of each possible management action must be weighed against potential benefits. ➤ Transparent discussions regarding uncertainties should occur, leading to the development of a risk assessment framework. The biological consequences of different actions should be displayed in decision tables with management alternatives. ➤ Effort should be placed on retaining flexibility to reduce fishing effort when the need is determined. (Hilborn et al, 1992) ➤ The creation of limit reference points by species.
Stock specific	<ul style="list-style-type: none"> ➤ Long-term survival depends not only on abundance but on genetic diversity within and between local breeding populations. (CPMNAS, 1996) 	<ul style="list-style-type: none"> ➤ Pursuing a stock-by-stock management approach is a complicated technical exercise. A detailed work plan, staged over time may be necessary. ➤ Assistance / guidance from experts already pursuing this approach would be beneficial. ➤ Establishing conservation units. Interim units based on biological characteristics, genetic analysis and productivity level. ➤ Some stock-specific sampling / analysis could begin through current transboundary projects.
Ecosystem-based	<ul style="list-style-type: none"> ➤ The contribution of salmon spawners to ecosystem processes and the recycling of nutrients are documented in current research. ➤ Other species are often viewed simply as predators instead of considering their broader role in the ecosystem. 	<ul style="list-style-type: none"> ➤ Expanding the scope of fisheries management to incorporate an ecosystem approach.
Enhancement	<ul style="list-style-type: none"> ➤ Artificial propagation should be considered in terms of competition to wild stocks instead of strictly as enhancement. 	<ul style="list-style-type: none"> ➤ Risk assessments and decision tables (as mentioned above) should include the potential effects of enhancement on wild stocks and other effects upon ecosystem components and processes.

Lower Taku Watershed

Profile / Overview

The lower Taku River is the single, largest and most bio-diverse sub-watershed in the entire Taku River basin (see Figure 17 on next page). In terms of area alone, the lower Taku includes about 1/3 of the entire wetted channel area surveyed in 1988, yet is contained within only 4% of the total channel length surveyed in 1988. The Canadian portion of this watershed unit covers an area of approximately 238,682 hectares extending along the Taku main-stem and its tributaries from the international border to the junction of the Inklin and Nakina Rivers. Here the Taku River cuts through the Boundary Range in a deep valley surrounded by high mountains with extensive glaciers giving this the highest glaciation & steepplands of all the watershed units. Major sub-drainages within this watershed unit include the Tulsequah River, King Salmon Creek, Sittakanay Creek and Stuhini Creek. Most of these larger tributaries are of glacial origin (Tulsequah River, Sittakanay Creek and Stuhini Creek) with the exception of King Salmon Creek. The Sittakanay and Stuhini have narrow valleys and are heavily influenced by glaciers. Their greatest biodiversity is on the fans within the lower Taku River valley. Wilms and Shazah creeks provide pockets of high quality aquatic habitat because of the adjoining wetlands in their lowest reaches. Many of the smaller tributaries flow from the steep mountainsides in V shaped valleys with little or no floodplain development. These smaller tributaries may offer fish habitat near their mouths, which tend to be fans, but steep gradients restricts upstream access. The Tulsequah River has several large jokulhlaupe annually, making it the most extreme environment for aquatic life in the surveyed portions of the Taku watershed. Still, fish are present wherever there is standing or flowing water, a statement about the resiliency of life. Gradient barriers exist on Shazah, Chasm, Shustahini, Zohini and Sinwa creeks as well as many smaller creeks. The Taku River main stem is a highly braided, aggrading and dynamic channel. This creates a

complex mosaic of channels and off channel areas in the Taku valley that offers extensive and complex fish habitat.

King Salmon Creek is a clear-water tributary buffered by King Salmon Lake. The King Salmon has few glaciers and is the only lake-influenced stream in this group. As a result, it has a relatively stable channel with the most channel complexity and likely aquatic biodiversity of any of the sub-watersheds. King Salmon Flats, a widening of the Taku valley at the confluence of the Taku River and King Salmon Creek, is known as a complex and productive habitat area, even by Taku standards.

Five biogeoclimactic zones occur within this watershed unit. Glaciers are numerous throughout the Lower Taku Watershed with alpine tundra (AT) dominating higher non-glaciated areas. Forested areas in the western portion of this watershed unit are coastal, with the Coastal Western Hemlock Biogeoclimactic Zone (CWH) covering lower elevations and the Mountain Hemlock (MH) zone extending to tree line. This is the only portion of the Taku drainage in which the CWH zone is found. Moving upstream, the coastal forests give way to the transitional forests of the Engelmann Spruce-Subalpine Fir (ESSF) and Sub-boreal Spruce (SBS) Biogeoclimactic Zones.

Relatively few large lakes are located in this watershed unit, the exceptions being King Salmon and Tulsequah Lakes. King Salmon Lake, located at the headwaters of King salmon Creek is a productive lake that supports spawning sockeye, kokanee and is known for its rainbow trout. Reports from Atlin residents suggest this lake was heavily fished and stocks depleted during the mid-1950's by fishermen flying in from Juneau, AK. A beaver dam located at the lake outlet may impede fish migration during low water levels. Tulsequah Lake is a glacier lake created by the damming of the Tulsequah Glacier. The lake is isolated from the Tulsequah River by the Tulsequah Glacier and is unlikely to support fish. Tulsequah Lake is subject to rapid draining during "jökulhlaupe", or sudden flood surges caused by the sub-glacial draining of lakes impounded by glaciers. These catastrophic events

usually occur twice a summer on the Tulsequah River corresponding to the releases of Tulsequah Lake and an unnamed lake (Noname Lake) adjacent the glacier. These floods tend to reconfigure the Tulsequah River channels making it a very dynamic system. The influence of jökulhlaufe on fish distribution in the Tulsequah River appear to be mitigated by refugium that exist where bedrock spurs extend into the floodplain creating areas protected from the flood surge (Karanka pers comm.).

Wetlands are relatively numerous in this watershed unit, the largest being located near the international boundary at Flannigan Slough and vicinity, near Yellow Bluff, Eriksen Slough and the outlet of Shazah Creek in the Tulsequah valley. Localized wetlands are often located at the bottoms of avalanche tracks along the edge of the floodplain. Wetland areas often serve as important habitat for a number of fish species including rearing sockeye, coho, cutthroat and three spine stickleback.

Flannigan Slough is a large (2,066 ha) wetland located on the west side of the Tulsequah/ Taku confluence adjacent to the international boundary. Wilms Creek, a coho and pink salmon spawning creek, flows into the north end of the slough. Flannigans Slough is within the zone of influence of the Tulsequah Jokalhaulps. The slough is comprised of a mosaic of emergent vegetation, channels and ponds of both clear and turbid waters. Clear water habitats are more common on the west side of the slough at the base of Mount Strong. These clear water habitats have been noted as good cutthroat rearing areas. This slough is also important habitat for coho, chum and sockeye as well as cutthroat trout, bull trout/Dolly Varden and stickleback. In 1976 the Alaska Dept of Fish and Game estimated 10,000 spawning chum utilising Flannigans slough (Hancock et al 1984). Coho and sockeye salmon have also been observed utilising the slough. The area serves as important habitat for beaver, waterfowl and moose. Several local sources have expressed concerns regarding poachers originating from Alaska in Flannigans Slough.

Chum salmon distribution appears to be concentrated in the Lower Taku Watershed Unit. The majority of documented chum salmon spawning sites are located in this watershed unit, in various side channels, tributaries and wetlands including King Salmon Flats, Yellow Bluff and Flannigan Slough.

Sockeye and coho spawning habitat is distributed over much of the watershed, primarily along the main-stem and side channels and in the King Salmon drainage. Sockeye, chum and coho spawning are documented in the Tulsequah watershed and adjacent Flannigan Slough. Coho spawning has also been recorded in the Sittakanay and Stuhini watersheds. Documented chinook spawning areas in this watershed unit are limited to King Salmon Creek. A telemetry study in 1991 indicated the Taku main-stem in the King Salmon Flats area as a possible chinook spawning area. Pink salmon have been documented as spawning in Wilms Creek, which flows into the north end of Flannigans Slough. The Canadian distribution of cutthroat trout within the Taku is concentrated in this watershed unit. Estuarine species that extend into the Canadian portion of the Taku are likely limited to, or at least concentrated in this watershed unit.

Some documentation exists indicating white sturgeon are found in the Lower Taku River. However informed locals including a Tlingit elder have never encountered or heard of, this species in the Taku River.

South Fork Lake used to support up to 3,000 spawning sockeye salmon. Some years ago one of the branches of the Stuhini River changed course and began flowing into the lake. The river is of glacial origin and carries a high sediment load. Over time the lake filled with these sediments, significantly reducing salmon spawning and rearing.

Several dormant mines exist in the vicinity of the Tulsequah River including the Tulsequah Chief, Polaris Taku and Big Bull mines (Figure 16). Acid Rock Drainage has been leaching from several sources associated with these mine sites.

Related Government Policies/Priorities:

See summary table on page 24.

Management activities:

Much of the salmon management for salmon species drainage-wide is concentrated in the lower Taku River Watershed. However, management directed specifically towards salmon that spawn/rear in this area is somewhat limited. Care is taken not to overharvest the later part of the sockeye run, which is comprised primarily of lower Taku River stocks. Interannual variations in abundance of chum salmon, which spawn primarily in this area, are tracked at the Canyon Island fishwheels/gillnets. Commercial fishers are required to release captured chum. Aerial surveys of chum salmon and sockeye salmon have been conducted sporadically in the area between Erickson Slough and the Inklin/Nakina confluence. Sockeye in this area are also sampled annually for age, size, sex, and parasites. This information is used primarily for identifying mainstem sockeye in U.S. catches. Recently investigation of habitat utilisation by all species of fish has increased, primarily in the Tulsequah River.

All commercial fishing on the Canadian side is located in this watershed unit and tends to be concentrated near the international border, as is the TRTFN food fishery.

Potential threats to fish sustainability in the Lower Taku Watershed Unit

Category	Description of Risk	Analysis	Feasibility of Mitigation
Land Planning Issues			
1. Mineral Development	<ul style="list-style-type: none"> Acid Rock Drainage Direct loss of habitat as a result of mine facilities (tailings ponds, etc) Increased access for fishers Road construction and maintenance issues 	<ul style="list-style-type: none"> A proposal to develop the Tulsequah Chief Mine property currently exists. Road access as a result could open the way for further developments in the area. Other potential mines exist in the lower Taku 	<ul style="list-style-type: none"> Level of effective mitigation may depend on available affordable technology, political will, etc Some negative impacts to fish would be virtually certain
2. Forestry Development	<ul style="list-style-type: none"> Loss of riparian habitat and associated impacts such as slope stability and sedimentation Road construction and maintenance issues Increased access to fishers 	<ul style="list-style-type: none"> Old growth (presumably valuable) exists in the watershed unit. No current proposal for forest development in this watershed unit and the area is not in the Operable Forest base Numerous logistic issues, including access 	<ul style="list-style-type: none"> Level of effective mitigation may depend on political will, etc Some negative impacts to fish would be virtually certain
3. Hydro-electric Development	<ul style="list-style-type: none"> Alteration of downstream water flow May restrict or impede fish passage May harm/kill downstream migrating smolts 	<ul style="list-style-type: none"> A proposal did exist to build a series of dams in the Taku and Yukon drainages. There is no current proposal for a dam in the Taku drainage The BC fish Protection Act prohibits building a dam on the Taku main stem, but leaves the door open for dams on its tributaries 	<ul style="list-style-type: none"> If a dam were to be built on any of the larger tributaries of the Taku River, significant impacts to fish would be virtually assured. PST requires maintenance of transportation corridors and spawning habitat. Would require Canadian Environmental Assessment Act approval
Ecological Issues			
4. Water Quality	<ul style="list-style-type: none"> Acid Rock Drainage (ARD) results in heavy metals contamination 	<ul style="list-style-type: none"> Ongoing ARD exists at several old mine sites in the Tulsequah Valley including Tulsequah Chief and Big Bull and the vicinity of Polaris Taku Lime bed treatment (passive) is in place, some questions as to its effectiveness Active treatment for ARD is expensive and long term 	<ul style="list-style-type: none"> Development of Tulsequah Chief Mine may address ongoing ARD at the Tulsequah Chief mine site. If this project does not go through, the likelihood of ongoing ARD being addressed is uncertain Ongoing water monitoring could be coordinated and analyzed Options to address ARD in the Tulsequah (if the TC mine does not proceed) could be investigated, including various 'passive' mitigation
5. Climate Trends	<ul style="list-style-type: none"> Warming trends may influence freshwater flow regimes Decrease in fitness including possible increase in parasites Changes in glacier movements could impact fish habitat Possible decrease in ocean survival due to changes in food and predator abundance/distribution 	<ul style="list-style-type: none"> Taku glacier has advanced into the mouth of the Taku River in historic times Increased forest fires may result in increased sedimentation 	<ul style="list-style-type: none"> Mapping habitats would help allow for monitoring and possibly predicting changes over time. This may allow implementation of actions that could mitigate negative changes
6. Natural Processes	<ul style="list-style-type: none"> Landslides can increase sedimentation and block fish passage Channel changes can increase sedimentation and change flow patterns Beaver activity can have localized effects 	<ul style="list-style-type: none"> South Fork Lake an example of impacts due to channel change Beaver activity has impeded upstream migration of adult salmon in some areas 	<ul style="list-style-type: none"> Mapping habitats would help allow for monitoring and possibly predicting changes over time. This may allow implementation of actions that could mitigate negative changes
7. Harvest	<ul style="list-style-type: none"> Potential for over-fishing System wide escapement approach may allow individual stocks to be impacted Lack of enforcement in some areas/times By-catch may harm non-target species 	<ul style="list-style-type: none"> Overall salmon population/escapement not delineated into separate stocks Local concerns about poaching in King Salmon Lake in the past that resulted in depleted fish stocks Recent reduction in presence of Atlin Conservation Officer will make enforcement more difficult Level of by-catch for species such as steelhead unknown 	<ul style="list-style-type: none"> Abundance based management should help reduce the risks of commercial over-harvest Wild salmon Policy -Conservation units are necessary to address individual stock concerns Increased surveillance and enforcement presence
8. Fish Farming in BC	<ul style="list-style-type: none"> Atlantic salmon escapement from fish farms may compete or displace local species Risk of disease spreading from farmed fish to wild stocks 	<ul style="list-style-type: none"> Atlantic salmon have been captured in the Stikine system, but not recorded in the Taku A recent lifting of the BC moratorium on fish farms may result in greater risk of farmed fish reaching the Taku 	<ul style="list-style-type: none"> Encourage local fisherman to co-operate in DFO's Atlantic Salmon Watch Program Lobby BC government to address concerns with fish farming
9. Lack of Information	<ul style="list-style-type: none"> A lack of information for some species makes effective management and monitoring difficult A general deficiency of habitat information 	<ul style="list-style-type: none"> Steelhead, cutthroat trout, bull trout/ Dolly Varden and sturgeon are examples of species for which information is lacking Important spawning/rearing areas are incomplete for all species 	<ul style="list-style-type: none"> Determine priority species and develop programs to collect relevant information Collect and map habitat information
10. Stock Enhancement /augmentation	<ul style="list-style-type: none"> Loss of genetic diversity Risk of disease Mixed stock fishing may impact wild stocks Increased competition for food and space for wild stocks Interferes with natural selection 	<ul style="list-style-type: none"> In other jurisdictions enhancement activities have caused wild salmon stocks to suffer Enhancement may have contributed to the decline in fall churn on the Taku Current target exists to produce 100,000 enhanced sockeye from the Tatsamenie Lake program. To date this program has not been successful 	<ul style="list-style-type: none"> DFO's Wild Salmon Policy and Sustainable Salmon Fisheries Policy for the State of Alaska may help address these concerns

Wild Chum Salmon

Profile / Overview

Species Synopsis:

Chum salmon have the widest natural geographic distribution of all Pacific salmon species. In North America they are found from the San Lorenzo River in Monterey, California to as far north and east into the Mackenzie River system. In Asia, they occur in Japan, along the Okhotsk and Kamchatka coasts into the Arctic and westward to the Laptev Sea, northern Russia (Groot and Margolis, 1991).

Two sub-species of chum have been identified, summer chum and fall chum. Fall chum can be distinguished by a number of factors: later entrance into spawning streams less developed reproductive systems at the time of entry into these streams, later spawning period, larger size, and greater fecundity. Significant numbers of enhanced summer chum from Alaska hatchery programs are found in marine waters adjacent to the mouth of the Taku River. Although summer chum do not ascend the Taku River, natural populations of fall chum are found in the drainage. Spawning occurs in groundwater fed areas throughout (Groot and Margolis, 1991).

Chum salmon distribution seems focused within the lower Taku watershed, although local sources describe historical presence in the Nakina and Inklin watersheds (see Figure 13 on page 46). Adult spawners enter the Taku River from August through September. Spawning occurs from mid-September through November (and possibly later) with fry emerging the following spring. Smoltification and seaward migration occur shortly afterward; Taku River chum are not known to over winter in freshwater. They spend from two to five years in the ocean before they return as adults to spawn. However, the vast majority return after three or four years in the ocean. (TakuFMP)

Brief description of Taku fall chum life history, ecology etc. and summer chum enhancement.

Population Status:

Current enumeration of wild Taku River fall chum run allows for the monitoring of yearly fluctuations and relative abundance. However, it does not provide for definitive population estimates. A number of data sources provide indication that a population decline may have occurred. Seasonal catches of fall chum in the Canyon Island fish wheel and CPUE in the Alaskan gillnet fishery both display a downward trend that begins in the late 1980's / early 1990's (see figure on page 43). Since that period of time there does not seem to be any signs representative of population increase.

The interim escapement goal for Taku chum is between 50,000-80,000 fish. It is unlikely that this has been met in years and is unknown at this point if that goal was ever achieved. It could not be determined upon what basis this interim goal was established and it may be somewhat arbitrary due to lack of available information. The continued trend of low spawning escapement suggests that run outlooks in the near future are likely to be poor.

Current management projects and existing information:

- Canyon Island Fishwheel
- Harvest information
- General documentation of known spawning areas
- Environmental Dynamics Ltd. Report
- Aerial Surveys

Related Government Policies/Priorities:

- Wild Salmon Policy Discussion Paper Draft), DFO – 2000.

Sustainable Salmon Fisheries Policy for the State of Alaska - ADF&G / ABF - 2000

"Effects and interactions of introduced or enhanced stocks on wild stocks should be assessed; wild stocks and fisheries on them should be protected

from adverse impacts from artificial propagation and enhancement efforts."

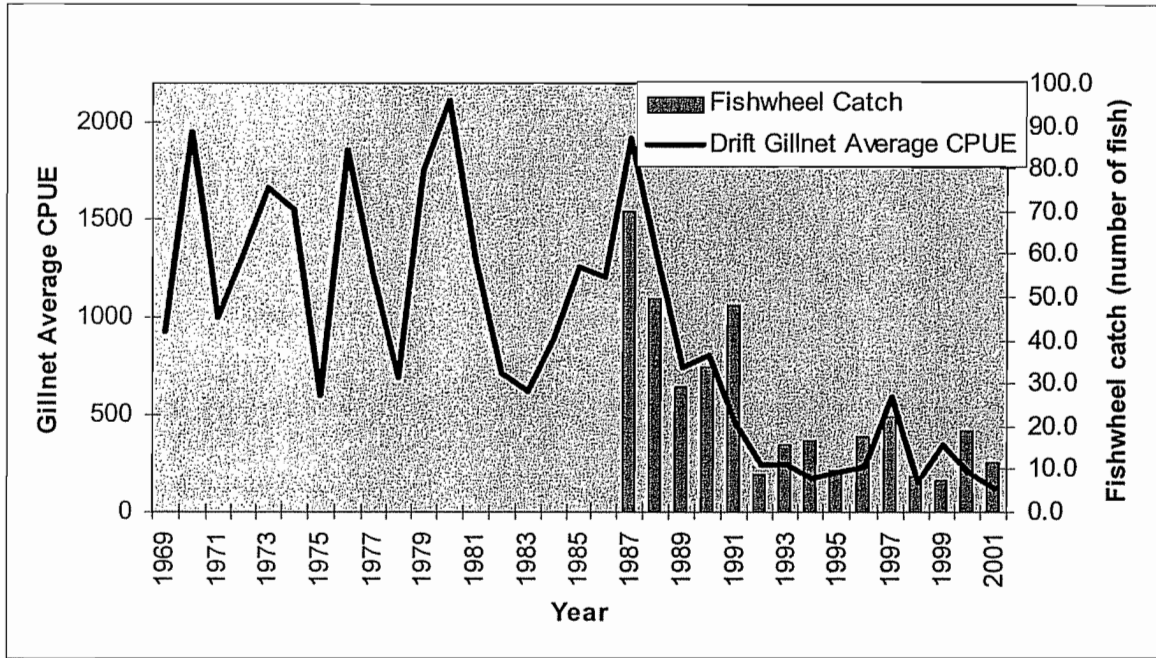
"Depleted stocks should be allowed to recover or, where appropriate, shall be actively restored. Diversity should be maintained to the maximum extent possible, at the genetic, population, species, and ecosystem levels."

First Nations - Concerns

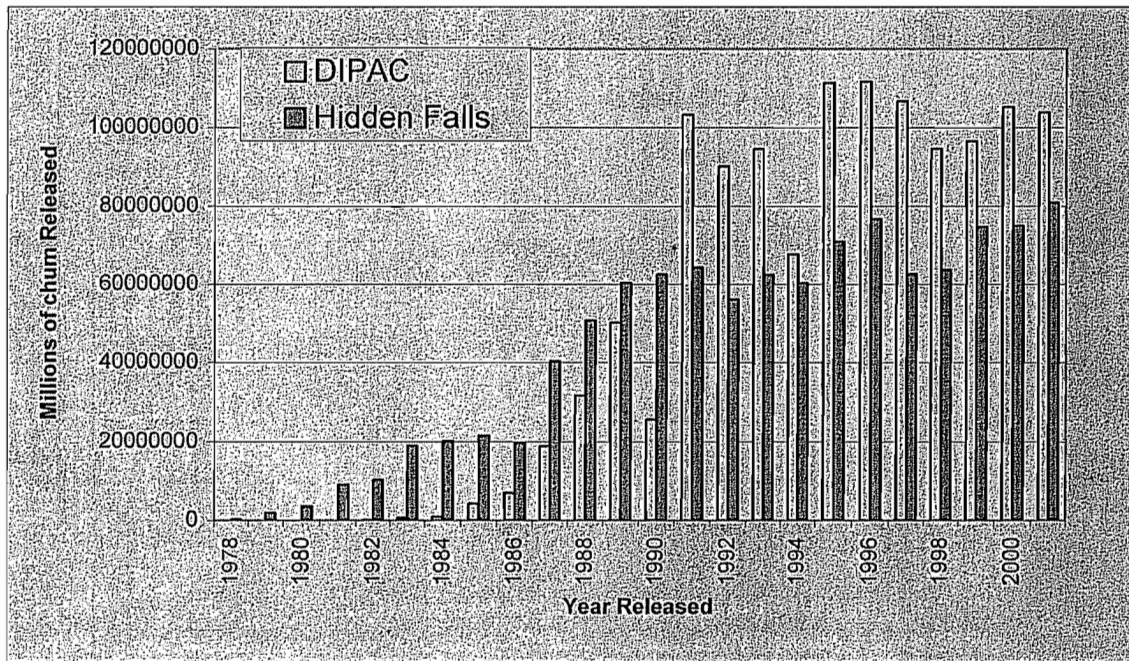
TRT, TF, & DIA - The decline of wild stocks from their historical abundance is a high priority strategic issue. The potential effects of hatchery related enhancement activities remain a concern which needs to be addressed

Identified Data Gaps :

- Actual cause(s) of apparent decline
- Population abundance estimates (total run size and escapement)
- Exact spawning locations and extent of temporal changes in habitat
- Migration patterns / run timing (especially regarding end of season).
- Habitat use in the estuary, nearshore and marine environments.
- Potential interactions between native and hatchery stocks in the estuary and nearshore environment. As well as, food source availability in these areas.
- Stock-specific U.S. catches (i.e. percentage of historical harvest)



Cumulative catch-per-boat-day (CPUE) of chum during the fall Taku-Snettisham drift gillnet fishery compared with the total season catch of chum in the Canyon Island fish wheel (data provided by Alaska Department of Fish and Game 2002a). Note: Not adjusted for different yearly project start / end dates.



Hatchery releases of chum fry from DIPAC and Hidden Falls Hatcheries. (DIPAC 2002a and NSRAA 2002).

Analysis of some potential factors affecting Taku Chum:

* The following table and associated figures is a summary of information based upon the report: Investigating the decline of the Taku River Chum Salmon: An evaluation of existing information / prepared by Environmental Dynamics Inc. Presented as originally created by the working group i.e does not attempt to incorporate information from the subsequent Juneau workshop. Feasibility of mitigation was considered from both a financial and technical / operational standpoint.

NATURAL FACTORS				
Category	Description	Analysis	Degree of influence (minor, moderate or major)	Feasibility of Mitigation (low, medium or high)
1. Climate change influencing egg to fry survival	<ul style="list-style-type: none"> ➤ Warming trends may influence freshwater flow regimes. ➤ Severe low flows can limit adult access to spawning areas or result in the dewatering / freezing of eggs. ➤ High winter flows can increase incubation mortality through streambed scouring and siltation. 	<ul style="list-style-type: none"> ➤ Lowest flows for the Taku River are typically in Feb. and March, therefore, not likely to influence spawning access. ➤ No apparent pattern of extreme low flows (Fig. 2) or of high flows (Fig. 3) that would drastically reduce egg to fry survival. 	➤ Minor	➤ Low
2. Changes to spawning habitat	<ul style="list-style-type: none"> ➤ Fall chum spawning locations are often associated with groundwater sources. Such particular spawning requirements may be affected by habitat and hydrology changes. ➤ The suggestion has been raised that a habitat shift may have occurred in the King Salmon Flats area. ➤ In 1980, documented siltation of gravel bars in this area occurred as a result of a landslide near the Inklin River. 	<ul style="list-style-type: none"> ➤ (See aerial photos of King Salmon Flats (1974 and 2000). ➤ Thus far, land-use activities have played a relatively minor role in any habitat disruption. The lower Taku is a very active system and naturally undergoes continuous changes in which the chums have historically persisted. ➤ The timing of the 1980 event does not correlate with the decline in native chum stocks. Spawning main-stem sockeye have been documented as utilizing the same areas and type of habitat. ➤ Chum salmon spawning areas have been identified in numerous other main-stem Taku areas (other than King Salmon Flats). ➤ An apparent, coinciding decline of fall chum in the Chilkat River suggests the main factor for decline is likely one that affected both rivers. (Fig. 4) 	➤ Minor	➤ Low
3. Ocean survival / productivity (due to climate change)	<ul style="list-style-type: none"> ➤ Changes in climate and ocean conditions have had an influence upon ocean productivity. ➤ In various North Pacific salmon stocks, a decrease in the size of returning adults has been noted. Body size is positively related to reproductive success in some stocks. 	<ul style="list-style-type: none"> ➤ Mean lengths of native chum in the mid to late 80's appears to be stable. (Fig. 5) ➤ North Pacific fall chum population declines seem to be restricted to the Taku and Chilkat systems. ➤ Similar decline is not evident in other Taku species. ➤ Question as to whether there has been changes in prey abundance / availability. 	➤ Minor	➤ Low

<p>4. Increased Coho abundance (predation or competition)</p>	<ul style="list-style-type: none"> ➤ Taku coho abundance increased in the early 1990's. (Fig. ?) ➤ A number of studies have shown that coho, during their estuarine and early marine life stages, are important predators on chum and pink salmon fry. 	<ul style="list-style-type: none"> ➤ With the exception of the 1990's the coho numbers do not appear to have impacted fall chum levels. (Fig. 6 - Weak significant to insignificant correlation). ➤ Increases in coho during this period are likely attributable to increased ocean survival not an increase in juveniles. ➤ Native pink stocks were not dramatically affected by the coho increase and sources indicate that coho have a stronger preference for targeting pink fry. 	<ul style="list-style-type: none"> ➤ Probably Minor (requires further investigation) 	<ul style="list-style-type: none"> ➤ Low
<p>ANTHROPOGENIC FACTORS</p>				
<p>5. Commercial Harvest</p>	<ul style="list-style-type: none"> ➤ Fall chum used to be part of the Canadian in-river commercial fishery. (Fig. ?) ➤ U.S. catches of fall chum occur(ed) within the Alaskan District 111, the Taku-Snettisham and Taku Inlet gillnet fishery located in Stephens Passage. (Fig. 7) 	<ul style="list-style-type: none"> ➤ The timing of Canadian harvests does not seem to coincide with chum decline as the fishery shifted away from chum in the 1980's. (1980 - 18,516 / 1982-89 ave. - 943) ➤ Start of the decline does not appear to be influenced by U.S. harvest effort, which was consistent to previous years. However, during the decline period, increased/continued effort may have affected recovery. (Fig. 8) 	<ul style="list-style-type: none"> ➤ Moderate 	<ul style="list-style-type: none"> ➤ Medium
<p>6. Hatchery production of summer chum</p> <ul style="list-style-type: none"> ➤ Increased predation ➤ Competition from hatchery released chum and/or pink salmon 	<ul style="list-style-type: none"> ➤ The potential impacts of hatcheries upon wild stocks continue to be debated among fisheries professionals. ➤ The release of summer chum fry from Alaskan hatcheries has increased substantially in the past few decades and releases of pink salmon into Gastineau Channel started in 1988. (Other international enhancement not known i.e. Russia / Japan). ➤ Predation is normally the primary cause of mortality in the estuary environment. ➤ Carrying capacity limitations may exist for juvenile chum in estuaries and nearshore areas. ➤ Interactions between native fall chum and hatchery released fish are not well known. However, research conducted elsewhere indicates the possibility of competition occurring. 	<ul style="list-style-type: none"> ➤ Significant regressions between a number of hatchery release locations and the returning native chum appear to display a relationship. (Fig. 11, 12) ➤ The addition of hatchery released fry could attract more predators as well as helping to sustain a larger predatory population. ➤ Based on existing data, it appears that hatchery-released chum would (on average) be approximately double the weight of the native fall chum in May (when they both arrive in nearshore areas). ➤ The large numbers of hatchery fish released (chum and pink) within the vicinity of the Taku River could potentially impact food availability for native fall chum; forcing them to migrate away from the nearshore earlier and at a smaller size; making them more susceptible to predation and reducing feeding efficiency (larger prey). 	<ul style="list-style-type: none"> ➤ Major 	<ul style="list-style-type: none"> ➤ Medium to High

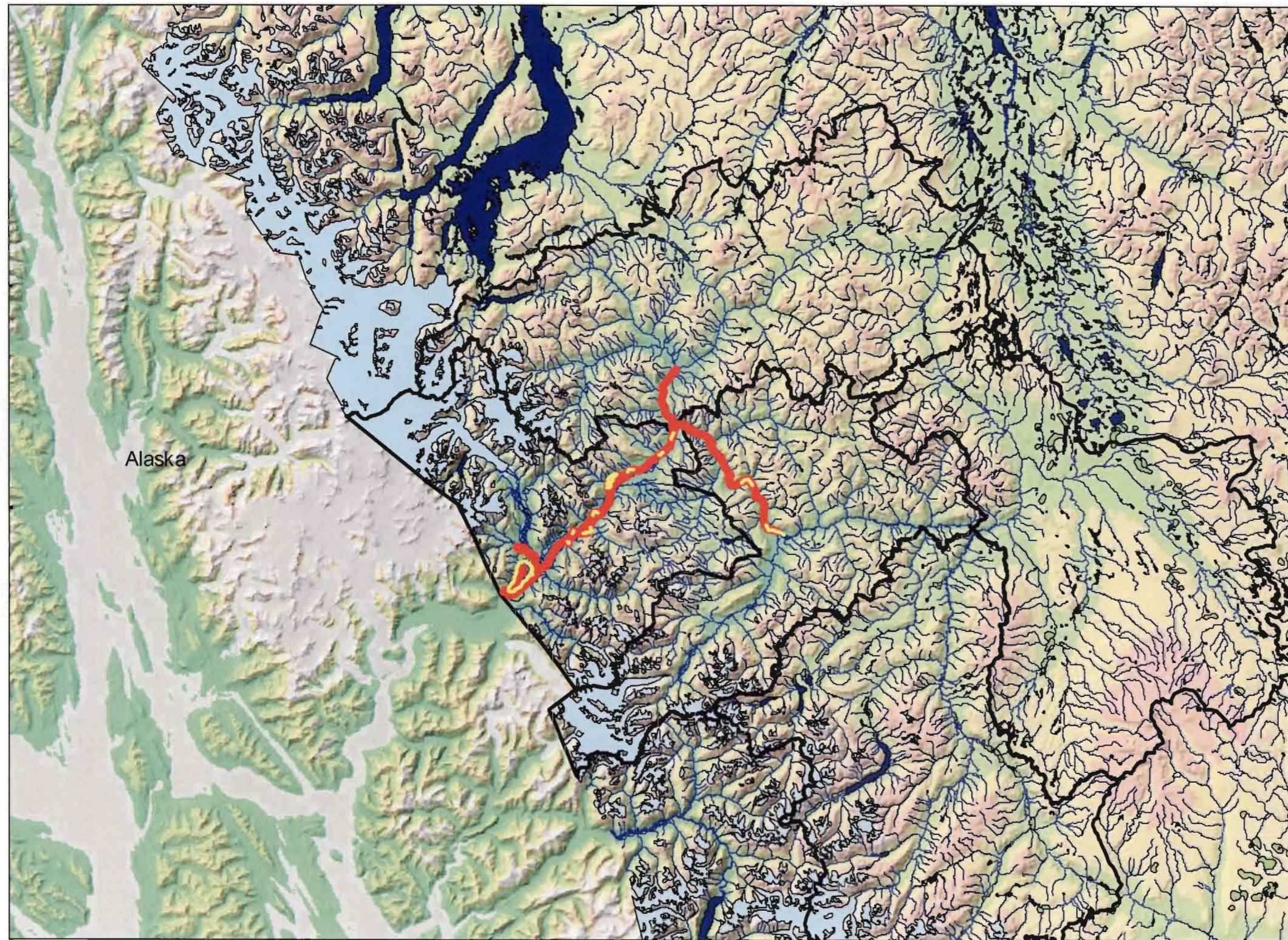


Figure 13. Chum salmon spawning and distribution in the Taku River drainage

Scale 1:900,000
 5 0 5 10 15 Kilometers
 BC Albers Equal Area projection (standard parallels: 50°0'0"N & 58°30'N)

Chum salmon spawning and distribution
 Chum spawning area
 Chum salmon distribution

Water Features
 River/Stream
 Lake
 wetland
 Icefield
 Watershed Unit boundary



Map Compiled By:
 Mark Connor
 Box 132
 Atlin BC
 V0W 1A0
 (250) 651-7615
 02 April 2002
 TAKU RIVER TRIBE
 FIRST NATION

Stage 3- Action Strategies:

Stock-specific planning

Although it was hoped a workshop devoted to this priority would take place, due to scheduling difficulties this was not possible. However, the incorporation of stock-specific planning is becoming more recognized within the management regime. In order to help facilitate this concept, the TRTFN has submitted the following draft work plan for such a project they plan to start in 2004.

Preliminary data collection for salmon stock delineation and the qualification of stock-specific conservation units

Genetic diversity within salmon populations, often represented as various stocks or demes, provides the ability for populations to adapt in dynamic environmental conditions. Reluctance to pursue a stock-specific approach is often qualified by the complexity and difficulties of defining Evolutionary Significant Units (ESU's) based on genetic analysis including determining the scale of variance and types of genetic variations that are evolutionarily. Even if these scientific obstacles can be resolved it may remain problematic to effectively implement related programs at an operational level.

Rather than fuel the ESU debate, we will take an approach that focuses on maintaining the range of current variation within Taku River populations and maintaining the associated ecosystem processes. We will initially collate existing information on measurable ecological (e.g., run timing, body size, spawning habitat) indexes of evolutionary potential to develop a template for establishing stock-specific conservation units. Consolidation of historical data will require consultation with other Transboundary fisheries agencies, and initial analyses may be limited by the availability and functionality of existing data. Key information gaps will be identified and will be the focus of field data collection efforts. Limited

stock data is available from ongoing mark-recapture projects, and spatial data for spawning areas has been collated and mapped through the Taku SPAWN process and the TRTFN Conservation Areas Design (CAD).

To search for biological distinctiveness within populations, available phenotypic characteristics will be reviewed including body length, sex ratio, life history (run timing, freshwater residency periods and age structure), type of spawning habitat and geographic distribution. Existing genetic data may also be evaluated (e.g., allozyme frequencies), although it is expected that such information will be limited. Based on existing data for the Taku River, and within the context of regional populations across the Pacific Northwest, we will select a suite of ecological characteristics which best provide indexes of evolutionarily-relevant variation. Focal species will be sockeye and possibly chinook salmon, as they are of the greatest commercial interest and therefore more at risk of diversity degradation. As well, better data exists for these species in terms of developing a template for stock-specific management.

The identification of information data gaps across the selected suite of ecological characteristics will determine field sampling needs and priorities. Accessibility to remote regions presents certain field sampling limitations, so efforts will be coordinated with other projects herein, wherever possible. Data collection methods may include tag recovery, measurements of length, sex determination, scale and genetic sampling. Efforts will also be made to encourage the inclusion of sampling needs into existing transboundary salmon management projects.

Potential methodologies for designing salmon conservation units will be investigated and evaluated based upon both their scientific credibility and aptitude for practical application. A selection framework for determining conservation units will potentially take the form of a decision matrix which incorporates the relevant stock-specific characteristics. Other factors that will be considered for the selection of conservation units may include stock status (i.e. escapement or harvest levels),

competition and habitat parameters. Options for implementing a stock-specific approach at a harvest management level will be investigated and practical methods for incorporating ecological considerations into harvest strategies will be developed. Based on our initial evaluation, the most feasible method will likely be a harvest strategy based on run-timing to establish an escapement timeline or windows of escapement. Temporally-stepped escapement goals throughout the season may help ensure more effective spawning distributions of delineated stocks (i.e., conservation units) within the Taku River populations.

Lower Taku Watershed

The following is an overview and draft work plan submitted by TRTFN regarding their development of the Habitat Mapping Model for the Lower Taku.

The lower Taku River is the largest and most biodiverse watershed in the entire Taku Region. Covering an area of approximately 238,682 hectares, this watershed supports highly braided and complex mosaic of channel and off channel areas that provides an extensive variety of fish habitats and important productive capacity for salmonids and other fish species.

Pursuing a broader and more integrated understanding of the natural aquatic processes and habitat patterns in the Taku River corridor is considered a necessary prelude to effective long-term planning and future conservation activities. In order to facilitate and incorporate the concepts of "ecosystem-management", accurate and seamless habitat mapping for the transboundary Taku region is required. The previous lack of standardized habitat classification and mapping procedures between Transboundary fisheries agencies, along with the limited practicality of existing mapping standards, spurred the initiation of the Taku Fish Habitat mapping model. Central to the development of this habitat classification is for it to be based largely on mapable, geomorphic and habitat

features, with the goal of producing a visual picture of how fish utilize these aquatic habitats (i.e., a model of use).

The Taku Fish Habitat modeling effort began in 2000. A framework for the model has been developed through a pilot project focused within the King Salmon Flats area of the lower main-stem Taku River. Several weeks of field work were completed in the Fall of 2003. During this field season, random sampling of across a variety of habitat types collected baseline data on key characteristics, including water turbidity and flow, channel structure and substrates, and the presence and relative abundance of fish species. Based on this field data and consultation with other fisheries agencies, a draft habitat classification system has been developed and used to map the pilot study area. In 2004, we will integrate known fisheries values (e.g., relative abundance of different species, spawning habitat qualities, rearing habitat potential, over wintering habitat values, etc) with the habitat model through establishing a GIS database.

In order to develop a predictive habitat model, we will research the availability of pertinent spatial data (e.g., geomorphic data) across the Taku watershed. We expect readily available, uniform data to be limited, particularly due to the transboundary nature of the watershed and its remoteness. In addition to readily available data (e.g., government data sources), we will assess the feasibility of purchasing alternative data, such as may be available through a diversity of satellite products. We will use maximum likelihood techniques to search for key geomorphic and other habitat features captured within the obtained spatial data that may have power to predict fish habitat and fisheries values.

Based on these explorations, we will develop a preliminary spatially-explicit model that identifies potential key fish habitats within the lower Taku River.

During the summer and fall of 2004, we will sample predicted high and low quality habitats to validate the preliminary model, fill in information gaps identified through our data exploration effort, and increase baseline data. The field effort will expand

upon previous data collection efforts both spatially and temporally to include other seasons and the broader sampling area. Habitat assessments will be spatially stratified across the lower Taku based on habitat model prediction, with some limitations based on potential access restriction. Additionally, sampling will be conducted during the spring and summer season to obtain the necessary data reflecting habitat use during this time period. Sampling efforts will be coordinated with other projects herein, increasing the cost-effectiveness of conservation activities.

A stratified random sampling of habitat categories identified from our preliminary modeling will be conducted during field investigations. Habitat information will be collected in a manner consistent with BC Resources Inventory Committee (RIC) standards and recorded on a standardized site card specific to the Taku model. Concentration of effort will be placed upon collecting data that is known to influence fish distribution and use i.e. turbidity, water velocity, channel morphology etc. In-situ water quality information will be measured including temperature, conductivity, dissolved oxygen and pH. A hand-held GPS will be used to record site location and will be recorded and a photograph of the site taken. Habitat features such as barriers to fish passage, spawning sites, side channels, obvious ground water inflows, etc will be documented. Visual observations will be used to determine dominant cover, crown closure, riparian vegetation, disturbance indicators, stream morphology, dominant substrate and habitat quality (spawning, rearing and over-wintering). A variety of non-lethal fish sampling methods will be employed including minnow trapping, seine netting (20 meter and 4 meter 1/8 inch mesh), electro-fishing (using a Smith-Root 12A POW backpack unit), angling and snorkel surveys. All fish captured will be identified to species and a sub-sample measured for weight and fork length. Genetic samples will be taken from dolly varden/bull trout and rainbow/steelhead captured and archived for future genetic analysis.

Habitat and catch per unit effort information collected during field inventories will be input into a computer database which will be linked through the

GIS system to the aquatic habitat classification (i.e., the preliminary habitat model). The data will be used to validate and refine the habitat model parameters, and further spatial data requirements may be identified. Field data will be used to refine fisheries utilization descriptions as well as generalized habitat characterizations for each of the predicted habitat types. The habitat model and mapping when coupled with the point source information collected from field inventories will eventually result in a comprehensive habitat database that links spreadsheet and GIS information and will allow for analysis and characterization at both a regional and landscape scale.

Conventional habitat assessments done in this region can easily underestimate fisheries values or potential impacts if sampling is done with inappropriate methods or timing. This innovative fish habitat mapping model is designed to be a practical tool to prevent loss of fish habitat by visually displaying fisheries values and having habitat data in a practical format. It will also provide a framework for proactive protection of important fish habitat areas within a temporally and spatially dynamic ecosystem.

Lower Taku Watershed

Goals, Objectives, Strategies

GOALS	OBJECTIVES	STRATEGIES	EFFECTIVENESS INDICATORS	TARGET
<p>To maintain the productive capacity of the Lower Taku as one of the most productive areas in the watershed.</p>	<p>Develop and implement a strategy for addressing water quality concerns.</p> <p>Prepare for future land use planning by establishing fish values in the lower Taku.</p>	<p>Consolidate existing water quality information.</p> <p>Continue and possibly expand existing water quality and hydrology sampling and analysis.</p> <p>Carry out a specific assessment of water quality in the whole watershed and identify critical monitoring points</p> <p>Complete habitat model and data gaps for the Lower Taku.</p> <p>Identify areas where other land uses and fish values could occur (resource hot spots) (maybe a computer modelled risk assessment with guidelines/potential prescriptions)</p>	<p>Complete a consolidated report.</p> <p>CCME (or other) guidelines for protection of aquatic life.</p> <p>Have a coordinated and comprehensive water sampling program in place with buy in from various agencies (incl compatible sampling methods and standards).</p> <p>Completed habitat model with overlaid with critical areas including those in potential conflict.</p>	<p>2 years</p> <p>General compliance with guidelines or/cause of non-compliance identified.</p> <p>3-4 years</p> <p>2 years</p>
<p>To maintain the species and habitat diversity and complexity as the most diverse in the watershed.</p>	<p>To address data gaps, critical habitat (spawning, rearing and overwintering), life history info for various species, other species and stock specific info, exploitation rates (non-anadromous species) [both goals]</p> <p>Identify species and sub-species, sub-populations and stocks and sub-stocks of specific concern</p>	<p>Build further mechanisms for sharing digital land and water data.</p> <p>Continue GIS mapping of spawning, rearing and overwintering areas and including model of use, range of capacity, including linkages between physical habitat info and fish life history.</p>	<p>Amount and quality of shared data and range of organizations sharing.</p> <p>Completed model of use.</p> <p>Number of samples collected and analyzed.</p>	<p>3-4 years</p>

Wild Chum Salmon

On February 19th, 2003 a workshop regarding Taku Chum Salmon was held in Juneau, Alaska by the Working Group. The following is a preliminary summary of that meeting (which still needs to be reviewed by participants.)

Participants:

Jev Shelton – PSC; Mark Connor – TRTFN; Ian Boyce – DFO; Alex Wertheimer – NMFS; Richard Erhardt – TRTFN; Nicole Guy – DFO; Scott Sloane – ADFG; Rick Focht – DIPAC; Eero Karanka – DFO; Craig Farrington – ADFG; Eric Prestegard – DIPAC; Bill Smoker – UofA

Erhardt identified the 100k of Governors Fund \$ that ADF&G had applied for and received to conduct chum telemetry work.

Wertheimer and Sheldon saw this as a worthwhile follow up to the pilot study that had been conducted in 2002, the results of which were quite interesting (particularly in light of the above- and below-border break-out).

Boyce and others questioned the return on this type of investment in terms of new information that could be used to determine the cause for the depressed status of the chum run. It was felt that it would be necessary to conduct a four-year study to get anything more than a snapshot of the distribution. It was also felt that a large proportion of the spawning areas had already been identified.

Wertheimer gave an overview of the proposed University of Alaska project, funded by the state. He and Rick Focht were involved in the planning of the study. The objective is to examine temporal and spatial overlap of Taku and hatchery chum by conducting littoral, nearshore and pelagic sampling in the Taku estuary. It would involve beach seining and trawling at a variety of sites from late April into June. DIPAC will process otoliths. NMFS will look at condition and diet.

There is good potential for the project to begin this spring. It will take place over two seasons and there will be a year for write-up. Approximately 2,400 smolt per annum will be sacrificed for otoliths.

DIPAC has embarked upon a similar study (on hold last year), specifically an examination of the distribution and habitat utilisation of chum fry in Gastineau channel and Auke Bay. The primary goal of the study is to evaluate early and late fry release strategies. (DIPAC is testing holding fry two weeks longer, releasing them in mid-June, in an attempt to improve survival). A secondary goal of the study is to examine hatchery and wild chum interactions.

Wertheimer suggested that it would be worthwhile at some point to examine predation on chum juveniles, particularly by coho (but also by dolly varden). This would be a worthwhile companion to the University temporal/spatial study. Addition of one grad student could cover this off, but if the study were to be conducted upriver as well it would involve significantly more resources.

The potential for using hydroacoustics to study chum in the estuary was debated. It was suggested that hydroacoustics might be useful for learning more about the energetics of the multi-species fish population as a whole but it would not lend itself to learning more about chum specifically. Chum are quite surface-oriented and thus make poor hydroacoustic targets.

Data gaps were listed as follows:

- Pre 1969 chum CPUE in District 111.
Annual fishwheel CPUE corrected for operational period.
- > Habitat shifts – have there been some significant changes in chum spawning habitat?
 - > Coho predation / competition levels.
 - > Spatial/temporal/dietary overlap with hatchery chum.
 - > More distributional information.

It was suggested that it might be worthwhile to track copepod abundance in the estuary. Wertheimer indicated that one would have to look at both zooplankton and epibenthic organisms to assess the availability of food for chum smolts. He also indicated that at the few sites where NMFS did monitor plankton, the information could at best be considered an index - the sampling was very time sensitive and zooplankton levels could fluctuate dramatically over the course of a few days. The index sites were not near the Taku River, but in the Icy Straits area. It was felt that monitoring zooplankton in the estuary would just indicate that there was a lot there; it was unlikely that salmon would crop it down significantly (also the effect of herring would be a major confounding factor).

There was an enquiry regarding fisheries outside of D111; Sheldon noted that the only such fishery that would catch Taku chum would be the troll fishery and this would be at most trace amounts.

There was some discussion regarding streamside incubators. It was pointed out that apart from facilitating mass marking, they would likely be ineffective for stock recovery if the survival problem was in the estuary.

The question of migration corridors for returning adults was raised. Information on this is limited. It was suggested that it wouldn't be too difficult to determine this by the process of elimination - all hatchery fry are thermally marked (with the exception of those released in the vicinity of Kake, however these do not overlap spatially with Taku chum).

Climate change was brought up again. It was pointed out that recent warming trends have generally been favourable for Gulf of Alaska fish, and other wild chum stocks appear to be healthy (even the Chilkat stock which declined somewhat concurrently with the Taku stocks is now doing well). This emphasised the fact that what was happening locally with chum (estuarine ecological interactions, habitat shifts) has to be examined.

Hatchery releases will be status-quo this year.

It was proposed that the issue of a recovery plan be examined however this was felt to be premature in light of the uncertainty surrounding current levels of escapement relative to historic levels (Sheldon) and not knowing what was behind the apparent low run sizes in recent years.

The feasibility of conducting a m/r study was examined. It was pointed out (Boyce) that the current catch rates at Canyon Island (avg 300 fish per annum) did not lend themselves to a m/r study and that it would also be very difficult to recover tags without a directed commercial fishery (or one that is limited to 10,000 pieces) on the spawning grounds.

It was noted that a PBS scientist, Chuck Parkin, had recently made a presentation to the CTC on the relationship between habitat and production; his results could have some applicability to Taku chum.

The TTC was proposed as the best forum for continuing communication regarding fall chum although it was noted that this committee tended to focus more on other species.

There will be a pink and chum workshop in a couple years, most likely in Alaska and that topics such as wild Taku chum would be welcome.

Wild Chum Salmon

Goals, Objectives, Strategies

(Based upon meeting of Working Group in March of 2002)

GOALS	OBJECTIVES	STRATEGIES	EFFECTIVENESS INDICATORS	TARGET
Facilitate recovery of fall Chum on the Taku.	<p>To develop and implement a recovery plan which will:</p> <p>Identify and address causes of fall Chum decline.</p> <p>Identify and increase the population size/escapement of fall Chum.</p>	<p>Brief Alaska on the WFSP process and determine if hatchery (summer Chum) is a significant factor in fall Chum decline, incl. research and identification of options including interim measures to reduce impacts of hatchery stock.</p> <p>Put WFSP plan on the agenda of the Transboundary Panel and consolidate support for the fall Chum study (incl. US/Cdn/other scientists).</p> <p>Establish draft Terms of Reference for a study that reviews the hatchery issue and the effect on fall Chum, incl. cost estimates.</p> <p>Identify potential sources of funding.</p> <p>Implement and promote study.</p> <p>Identify major rearing areas.</p> <p>Establish an abundance estimate and monitoring program.</p>	<p>Project partnerships (Cdn/US/others) established.</p> <p>Study underway and completed.</p> <p>Determination of specific cause(s) of the decline and the causes are accepted.</p> <p>Policy change on hatchery program and/or change in management regime for fall Chum in Taku Inlet.</p> <p>Aerial surveys of returning chum in index areas in the watershed. Canyon Island catches. CPUE, District 111 CPUE.</p>	<p>Cdn and US panel members (ADF&G, NSRAA, BC, DFO, FNs). Jan 03.</p> <p>18 months</p> <p>5 years, with acceptance by ADF&G and NSRAA</p> <p>ADF&G, NSRAA, Pacific Biological Station, Conservation groups, Alaska commercial fleets, AF&WS, academics and others for technical expertise, money, profile, peer review.</p> <p>% increase in fall Chum escapement levels over 3 cycles (12 years) as measured by Canyon Island CPUE.</p>

Discussion

The key to Taku SPAWN successes have been a community-driven methodology, where decision making and methodologies are transparent, with information shared and consensus encouraged outcome from the process

Recognition of this important work is expanding rapidly and the TRTFN presented the Taku WFSP process to both the House of Commons and Senate Standing Committee on Fisheries and Oceans at Parliament Hill in Ottawa, May 28th, 2003.

Several recommendations were made to these forums:

- The success of this pilot initiative clearly reveals significant advantages towards its incorporation into the regular fisheries co-management regime.
- The WFSP model would serve well in other regions, especially Transboundary areas, through the encouragement of inclusive and community-driven strategic planning, which is science-based and respectfully incorporates Aboriginal Traditional Knowledge as a vital component in co-management.

The following are some selected comments that were received in response to the Ottawa meeting:

"I think it's important to see a synergy or merger between fisheries science and traditional knowledge. ... that's what I take out of this--a ray of hope, a nice example." Tom Wappell, Chair of the House Standing Committee on Fisheries and Oceans

"We wish you very well. I hope you become a model for other regions of Canada — not only for the West Coast, but also for all regions of Canada." Senator Gerald Comeau, Chair of the Standing Senate Committee on Fisheries and Oceans

Throughout the Taku SPAWN process (particularly in the early stages) presentations were made to variety of other agency and local audiences

including the Transboundary Technical Committee, Transboundary Panel and the WFSP Steering Committee and the community of Atlin.

The Taku River drainage is in an excellent position to benefit from this proactive planning approach due to its relatively undeveloped nature. The data collected and evaluated in the process will be a critical step in enabling informed land use decisions while at the same time creating a framework and focus for the partnerships in the longer term.

The opportunity also exists to use the Taku Region experience as a role model of how a new approach to effective and respectful fisheries planning can facilitate long-term conservation. The process has helped bring various segments of the fisheries community together in a constructive manner and continues to strengthen links between the various agencies and organizations associated with management. Promotion of the plan will serve to provide for its future self-sufficiency while also allowing the experience to be shared with others who might benefit from the knowledge of a successful planning process.

It is hoped that results thus far will facilitate further work and continuation of the process. The real intent of such an initiative is to form the framework of a "living plan" which continues to be developed over time. That is, it can assist in setting priorities for new research, designing projects, monitoring success and continuing partnerships.

The sustainability of healthy fish populations and habitat for future generations continues to be of the utmost importance as we strive to create new pathways for cooperative management, utilizing the calculated foresight of strategic planning.

References:

- ADF&G / ABF – 2000, *Sustainable Salmon Fisheries Policy for the State of Alaska*. Alaska Department of Fish and Game , Alaska Board of Fisheries. SF Policy Final 03-23-00.doc.
- BC MF, BC MELP, DFO. 2001. *Watershed-based Fish Sustainability Planning: Conserving BC Fish Populations and their Habitat: A Guidebook for Participants*. National Library of Canada.
- CPMPNAS, 1996. *Upstream: salmon and society in the Pacific Northwest*. Committee on Protection and Management of Pacific Northwest Anadromous Salmonids, Board on Environmental Studies and Toxicology, Commission on Life Sciences, 1996, National Academy Press, Washington.
- DFO, 2000. *Wild Salmon Policy / Discussion Paper*, Department of Fisheries and Oceans Canada
- Groot C. and L. Margolis (eds.). 1991. *Pacific Salmon Life Histories*. UBC (University of British Columbia) Press Vancouver.
- Hilborn, R., and Walters, C.J. 1992. *Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty*. Chapman & Hall. New York
- Kelley, M.S. and P.A. Milligan. 1999. *Mark-Recapture Studies of Taku River Adult Salmon Stocks in 1997*. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report IJ99-21, Juneau.
- McPherson, S.A., R.J. Yanusz, D.R. Bernard, and M.S. Kelley. 1998. *Production of coho salmon from the Taku River, 1996-1997*. Alaska Department of Fish and Game, Fishery Data Series No. 98-18, Anchorage.
- Shaul, L.D., J.F. Koener, and P.L. Gray. 1991. *Coded wire tag estimates of abundance, harvest, and survival rates of selected coho salmon stocks in Southeast Alaska, 1981-1986*. Alaska Department of Fish and Game Fishery Research Bulletin No. 91-05.
- Tobler, Patrick. 2002. *Investigating the decline of the Taku River Chum Salmon: An Evaluation of Current Knowledge*. Environmental Dynamics Inc. March 2002.
- Yanusz R.J., S.A. McPherson, D.R. Bernard, and M.S. Kelley. 1999. *Production of coho salmon from the Taku River, 1997-1998*. Alaska Department of Fish and Game, Fishery Data Series No. 99-34, Anchorage.