

**Nicola River Watershed:
Fisheries Resource Issues and the
Involvement of DFO, MELP and
First Nations**

John Millar, Matthew Child and Nick Page

Department of Fisheries and Oceans
Fraser River Action Plan
555 West Hastings Street
Vancouver, B.C. V6B 5G3


1997

**Canadian Manuscript Report of
Fisheries and Aquatic Sciences No. 2401**

SH
223
F55
no. 2401

Fisheries and Oceans
Canada

Pêches et Océans
Canada

Canada 

Canadian Manuscript Report of
Fisheries and Aquatic Sciences 2401

1997

NICOLA RIVER WATERSHED: FISHERIES RESOURCE ISSUES
AND THE INVOLVEMENT OF DFO, MELP AND FIRST NATIONS

by

John Millar , Matthew Child and Nick Page ¹

Fraser River Action Plan
Department of Fisheries & Oceans
555 West Hastings Street
Vancouver, B.C. V6B 5G3

¹ Coast River Environmental Services Ltd.
628 West 22nd Avenue
Vancouver, B.C. V5Z 1Z6

© Minister of Supply and Services Canada 1997

Cat. No. Fs 97-4/2401E

ISSN 0706-6473

Correct citation for this publication:

Millar, John, Matthew Child and Nick Page. 1997. Nicola River Watershed: Fisheries Resource Issues and the Involvement of DFO, MELP and First Nations. Can. Manusc. Rep. Fish. Aquat. Sci. 2401: 31 pp.

TABLE OF CONTENTS

	Page
Table of Contents	iii
List of Figures	iv
List of Tables	iv
1.0 Introduction	1
2.0 The Nicola River Watershed	2
3.0 Overview of Fisheries Resource Issues Until the 1980s	8
3.1 The State of the Nicola River Watershed's Fishery in the 1980s	8
3.2 Fishery Resource Issues in the Nicola River Watershed in the 1980s	9
3.3 Fishery Related Projects and Initiatives in the Nicola River Watershed in the 1980s	11
4.0 Nicola River Watershed's Fishery Today	11
4.1 Fishery Resource Issues in the Nicola River Watershed Today	12
4.2 Current Fisheries Related Projects and Initiatives in the Nicola River Watershed	13
4.3 Recently Completed Studies in the Nicola River Watershed	18
5.0 Conclusions and Recommendations	20
6.0 References	24
Appendix List of Contacts	

LIST OF FIGURES

	Page
Figure 1: Nicola River and its Tributaries	4

LIST OF TABLES

	Page
Table 1 Characteristics of SISS Watercourses in Nicola Watershed	5
Table 2: Species of Fish Documented in the Nicola River	7
Table 3: DFO Activities in Nicola River Watershed	14
Table 4: First Nations Activities in the Nicola River Watershed	15
Table 5: MELP Activities in the Nicola River Watershed	16
Table 6: Environment Canada Activities in the Nicola River Watershed	16
Table 7: Ministry of Forests Activities in the Nicola River Watershed	17
Table 8: Others' Activities in the Nicola River Watershed	17

ABSTRACT

The purpose of this study is to provide an overview of fisheries and aquatic resource issues and current initiatives underway within the Nicola River watershed. Additional objectives are to identify other resource issues and questions which may facilitate or conflict with achieving success in these initiatives and to present information in a format which can be integrated with other resource sectors and interest groups (forestry, agriculture, wildlife, First Nations, industry, water-management and recreation/tourism).

Recommendations include preservation and restoration of riparian areas by educating riparian users, restricting cattle access to watercourses and riparian clearing. It is suggested that a river hydraulic and channel stability study for the Nicola Valley floodplain be undertaken in order to formulate a floodplain management strategy. Continuing assessment and more in-depth study is necessary in order to evaluate the effects of increased Nicola Lake drawdown and the effects of ginseng agriculture on fisheries resources.

RÉSUMÉ

Cette étude a pour objet de fournir un aperçu des questions reliées à la pêche et aux ressources aquatiques ainsi que des initiatives actuellement en cours dans le bassin hydrographique de la rivière Nicola. Elle a aussi comme objectif, en ce qui concerne les ressources, d'identifier d'autres problèmes et questions qui peuvent contribuer ou nuire au succès de ces initiatives et de présenter l'information sous une forme qui peut être intégrée avec d'autres secteurs de ressources et groupes d'intérêt (foresterie, agriculture, faune, Premières Nations, secteur privé, gestion de l'eau et tourisme/loisirs).

Les recommandations consistent à protéger et à restaurer les zones riveraines en éduquant les usagers, en empêchant le bétail d'avoir accès aux cours d'eau et en limitant le déboisement des rives. Il est suggéré qu'une étude hydraulique de la rivière et de la stabilité des chenaux soit entreprise pour la plaine inondable de la vallée de la Nicola afin de formuler une stratégie de gestion de la plaine inondable. Une évaluation permanente et une étude plus approfondie est nécessaire pour évaluer les effets de l'augmentation du rabattement du lac Nicola et les effets de la culture du ginseng sur les ressources halieutiques.

1.0 Introduction

The Nicola River is a productive Fraser River Basin watershed that provides important habitat for fish, wildlife and waterfowl as well as aquatic plants and invertebrates. In addition, Nicola watershed residents depend heavily on the river's water resource to irrigate crops, maintain livestock herds, and provide for domestic, industrial and recreational requirements. As a result, there has been a tremendous investment of both human and financial resources by government agencies, First Nations and private sector interest groups to develop, protect and sustain this watershed.

The variety of water-based resource values throughout the watershed, coupled with high demands for water withdrawal has created a need for information sharing, education and cooperative decision making among the large number of user groups along the river. The process of integrated watershed decision-making is strongly supported by the Fraser Basin Management Program which has identified the Nicola as one of six British Columbia demonstration project areas. The Fraser River Action Plan (under the Green Plan) is an active participant in the Nicola Demonstration Project which is fostering the growing partnership between concerned citizens, business and community groups, First Nations and all levels of government agencies and resource users.

The large variety of natural resource issues and the number of projects currently underway on the Nicola River are not readily available in any summary form. However, a basic knowledge of these issues along with an understanding of the programs that are underway to address them, and an awareness of the possible impacts of these programs on other watershed resources or user groups is fundamental to managing any watershed on a sustainable basis. A valuable step toward sustainable resource use on a watershed basis is to begin to bring this information to light.

This paper attempts to provide an overview of fisheries and aquatic resource issues within the Nicola River watershed. Although it has been necessary for us to focus our efforts primarily on fisheries issues and aquatic habitat programs, it is our hope that other resource sectors and interest groups including forestry, agriculture, wildlife, First Nations, industry, water-management, recreation/tourism and others will identify other issues and initiatives within the watershed.

The objectives of this study are to:

- provide an overview of fish habitat issues and current initiatives underway or proposed by DFO, MELP, and First Nations in the Nicola River Watershed;
- identify other resource issues and questions which may facilitate or conflict with achieving success in these programs; and,
- present the above information in a format which can be integrated with other resource sectors.

This report consists of four sections. The first describes the physical characteristics of the watershed. This sets the stage for the second section which discusses fisheries issues and characteristics in the watershed as they existed in the 1980s. The third section provides a comprehensive account of the current status of fisheries projects and initiatives currently underway or proposed by DFO, MELP, and First Nations and presents the resource issues which impact on these projects. Two accompanying map sheets present this information geographically. The final section presents our conclusions and recommendations.

2.0 The Nicola River Watershed

The Nicola River arises approximately 20 km northwest of Kelowna, B.C. on the Thompson Plateau and flows north and west through Douglas and Nicola Lakes into the Thompson River near Spences Bridge (Figure 1). The Nicola River mainstem is approximately 213 km in length and its watershed is approximately 7227 km² (SISS, 1992). Figure 1.0 shows the location of reach breaks along the Nicola system as established by Sebastian (1981, 1982a, 1982b, 1984).

As discussed by Coast River in earlier reports (CRES, 1994a, 1994b) there are 11 significant tributaries along the Nicola, including four important salmon producing streams (Spius Creek, Maka Creek, Coldwater River, and Spahomin Creek). General characteristics of these watercourses are summarized in Table 1. Other tributaries with important fisheries values include Clapperton, Guichon, Shakan, and Skuhun Creeks.

Sebastian (1982b) identified 12 reaches on the Nicola River (see Figure 1) and described their fisheries values as presented below in extracts from his report:

"Glide and pool habitats near Merritt (Reach 3) are the most productive areas for rearing juvenile chinook salmon, while riffles and rapids downstream of Spius Creek (Reaches 1 and 2) are more typical of steelhead habitat. Reach 2 has an abundance of flood channels which provide suitable areas for steelhead spawning during spring flows. The majority of habitat suitable for chinook spawning is found between Spius Creek and Merritt (Reach 3)."

Reaches 4, 5, and 6 lie between Merritt and Nicola Lake. Fisheries values in this area were reported to be marginal by Sebastian (1982b). Reach 5 comprises the longest portion of this section and was reported to have possibly the poorest water quality (temperature and dissolved oxygen) and generally the poorest salmonid habitat values in the Nicola system.

"A low gradient section of stream immediately upstream of Nicola Lake has substrates and velocities ideal for kokanee spawning (Reach 7), while the majority of habitats upstream to Douglas Lake (Reach 8) have a higher degree of complexity and are useful for rainbow and chinook spawning and rearing. A

similar sequence of increasing gradient (and habitat complexity) occurs upstream of Douglas Lake in Reaches 9, 10 and 11. Little is known of Reach 12 as access is very limited."

A list of fish species documented in the Nicola River is provided in Table 2. At least four anadromous species were known to spawn in the Nicola system in the mid-1980s including chinook, coho, steelhead and pink salmon. Although sockeye and possibly white sturgeon may have historically been present in the system, none have been reported recently. Nicola, Douglas, and Stump Lakes all support sport fisheries (CRES, 1994b).

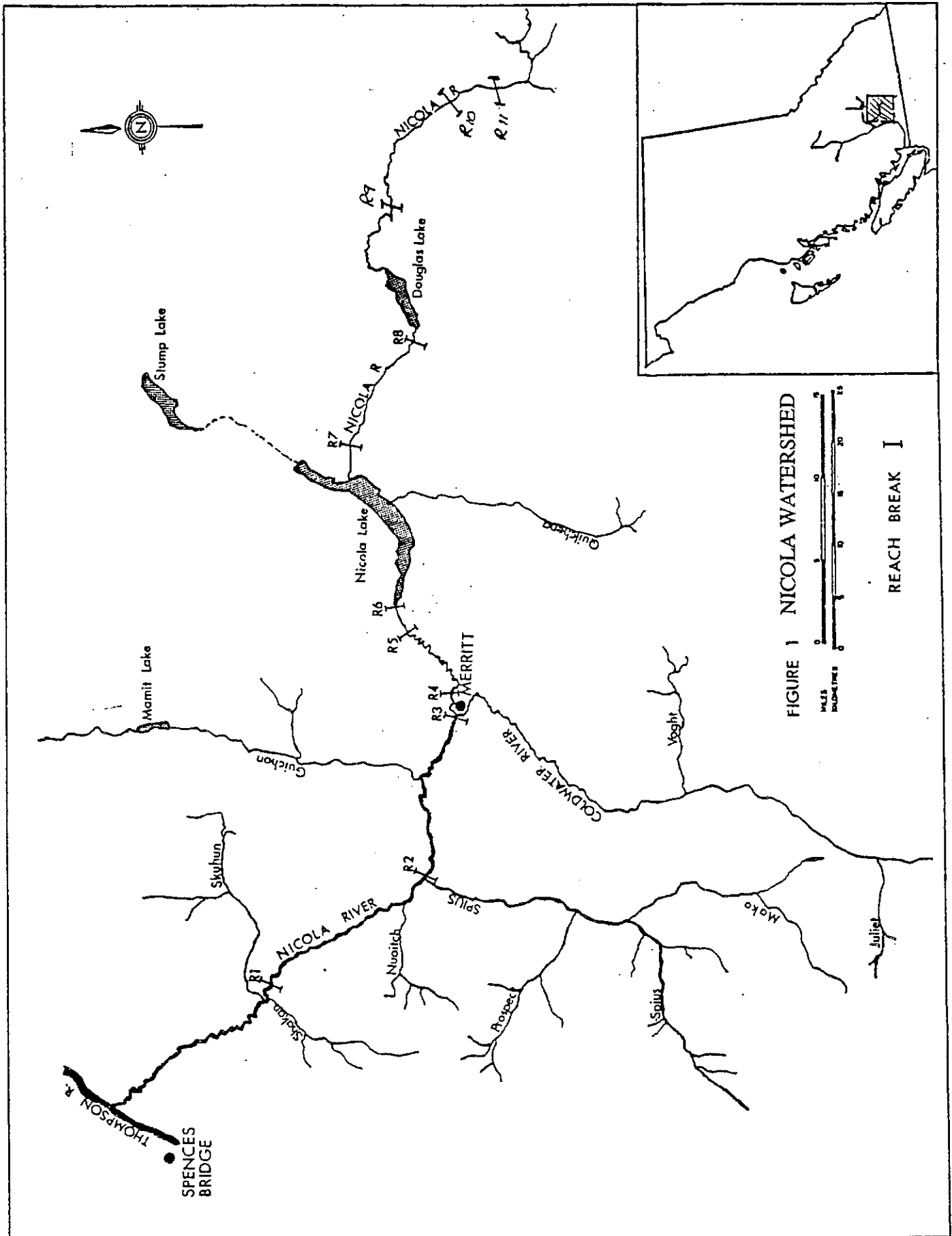


FIGURE 1 Nicola River and tributaries. (Source: Sebastian, 1981)

Table 1: Characteristics of SISS Watercourses in the Nicola River Watershed

Characteristic	Nicola River	Spius Creek	Maka Creek	Coldwater River	Spahomin Creek
watershed area (km ²)	7227.2	780.2	217	915	237
channel width (m)	30-40	15-25	10-20	15-25	<10
bank erosion potential	moderate to high	moderate to high	moderate to high	moderate to high	moderate to high
stream order	4	3	2	3	2
% non-forested area	24.1	4.5	3	5	35
% watershed recently logged	10.1	17.8	25	5	5
% watershed older logging	16.3	12.2	5	30	5
% forest remaining	49.5	65.6	67	60	55
% improved farmland	0.84	0.18	0	1.04	1.86
animal units (per km ²)	2.41	0.51	0	2.97	5.35
water use	high	medium	low	low	low
mean annual flow (m ³ /s)	26.7	10.2	2.84	8.4	0.6
mean 7 day low flow (m ³ /s)	2.28	0.55	n/a	0.31	0.018

Table 1 (continued)

Characteristic	Nicola River	Spilus Creek	Maka Creek	Coldwater River	Spahomin Creek
urban presence (km ²)	31	0	0	6	0
developed mines (and commodity)	1 (Cu)	0	0	0	0
abandoned mines (and commodity)	23 (Cu, Ag, Mo)	0	0	0	0
10 year mean salmonid escapement (1980-1989)	chinook 3762 (79%) Pink 925 (19%) coho 98 (2%)	chinook 227 (60%) coho 149 (40%)	n/a	coho 886 (51%) chinook 882 (49%)	n/a

Source: Sigma Engineering, 1991b
SISS, 1992

Table 2: Species of fish documented in the Nicola River (phylogeny after Scott and Crossman, 1973).

Common Name	Scientific Name
Pacific lamprey	<i>Entosphenus tridentatus</i> (Gairdner)
river lamprey	<i>Lamproetra ayresi</i> (Gunther)
western brook lamprey	<i>Lamproetra richardsoni</i> (Vladykov and Follett)
pink salmon	<i>Oncorhynchus gorbuscha</i> (Walbaum)
coho salmon	<i>Oncorhynchus kisutch</i> (Walbaum)
kokanee	<i>Oncorhynchus nerka</i> (Walbaum)
chinook salmon	<i>Oncorhynchus tshawytscha</i> (Walbaum)
steelhead (rainbow) trout	<i>Oncorhynchus mykiss</i>
Dolly Varden char/ bull trout	<i>Salvelinus malma</i> (Walbaum)
lake whitefish	<i>Salvelinus confluentus</i> (?)
mountain whitefish	<i>Coregonus clupeaformis</i> (Mitchill)
longnose dace	<i>Prosopium williamsoni</i> (Girard)
leopard dace	<i>Rhinichthys cataractae</i> (Valenciennes)
speckled dace	<i>Rhinichthys falcatus</i> (Eigenmann and Eigenmann)
redside shiner	<i>Rhinichthys osculus</i> (Girard)
longnose sucker	<i>Richardsonius balteatus</i> (Richardson)
bridgelip sucker	<i>Catostomus catostomus</i> (Forster)
white sucker	<i>Catostomus columbianus</i> (Eigenmann and Eigenmann)
prickly sculpin	<i>Catostomus commersoni</i> (Lacepede)
slimy sculpin	<i>Cottus asper</i> (Richardson)
peamouth chub	<i>Cottus cognatus</i> (Richardson)
chiselmouth	<i>Mylocheilus caurinus</i> (Richardson)
northern squawfish	<i>Acrocheilus alutaceus</i> (Agassiz and Pickering)
	<i>Ptychocheilus oregonensis</i> (Richardson)

Sources: Scott et. al. (1985), SISS (1992) and Sebastian (1982b).

3.0 Overview of Fisheries Resource Issues Until the 1980s

The Nicola River and its tributaries have never directly supported commercial on-river fisheries, although it continues to support important Aboriginal and sport fisheries. Because the Nicola River system supports productive wild and enhanced salmon stocks it is a significant contributor to ocean-based and lower Fraser River commercial fisheries. Concerns over habitat degradation and the status of the Nicola stocks drew the attention of DFO and MELP in the late 1970s and early 1980s. Several studies were conducted to document the biophysical characteristics of the river and to identify potential enhancement opportunities to maximize fish production (Sebastian, 1984).

3.1 The State of the Nicola River Watershed's Fishery in the 1980s

As of the mid-1980s fish presence in the Nicola River watershed was documented as follows (after Sebastian, 1981, 1984):

- Most anadromous production occurred in the lower 75 km of the Nicola mainstem, downstream of Merritt.
- Merritt downstream to the outlet of Spius Creek contained glide and pool habitats which provided good spawning and rearing habitat for chinook.
- Spius Creek downstream to the outlet of the Nicola River at Spences Bridge contained habitat which was typical of steelhead, although chinook also reared there as well. Approximately 75% of rainbow stocks were anadromous (i.e., steelhead).
- The most important contributors to total steelhead biomass (fry and smolt populations), in descending order of importance, included:

Nicola River (68.3% of total biomass);
Coldwater River (13.2%);
Spius and Maka Creeks (13.0%);
Skuhun Creek (<5.0%);
Nuaitch Creek (<5.0%);
Guichon Creek (<5.0%); and,
Shakan Creek (<5.0%).

In 1984 Sebastian stated that steelhead production appeared to be limited by parr habitat in the Nicola River and lower Spius Creek, by fry recruitment in the upper reaches of the Spius and Coldwater systems, and by low summer flows and barriers to fish migration in smaller tributaries to the mainstem Nicola.

- The most important contributors to chinook biomass (fry population) included the lower reaches of the Nicola River (68% of biomass) and the lower reaches of Spius and Maka Creeks (32% of biomass).
- Coho populations in the Nicola River watershed were very low in the mid-1980s, and were found exclusively in Maka and Spius Creeks, and the Coldwater River. No significant coho populations were found in the Nicola River during an intensive sampling period from 1980-1984.
- A small number (700-3000) of pink salmon spawned in the lower 25 km of the mainstem Nicola.
- Small tributaries to the Nicola River supported anadromous production only in their extreme lower reaches, and were primarily important as nursery streams for relatively small numbers of steelhead.
- Enhancement potential for each of the watershed's main fish species in the 1980s were as follows:
 - Steelhead: Coldwater River was considered to be underrecruited; steelhead production was estimated at 70% of potential.
 - Chinook: chinook production was thought to be limited more by rearing area than by spawning area; rearing area for juvenile chinook may have decreased in the Nicola River during the late 1970s and early 1980s as channelization activities reduced the areas available for refuge habitat.
 - Coho: best opportunities for enhancement were thought to be realized through fry outplanting to increase habitat utilization; protection and restoration of rearing and refuge areas (sidechannels, backchannels, and oxbows) was thought to be required.

It is important to note that in the 10 years preceding the 1980's studies cited in this section that a significant decline in chinook, coho and steelhead populations in the Nicola River watershed had occurred (Sebastian 1982a, 1982b, 1984). Declines in coho populations appeared to be more serious than for chinook and steelhead.

3.2 Fishery Resource Issues in the Nicola River Watershed in the 1980s

Several fisheries issues were identified in the Nicola River watershed during the 1980s which were believed to bear on declining salmonid production throughout the watershed. Although some of these issues were addressed throughout the 1980s, the persistence of some of these resource issues has forced renewed efforts which have been made more effective through the cooperation of MOE, landowners, and interest groups. The early work undertaken on the Nicola was primarily concerned with water quality/quantity and instream habitat. It was during the mid-1980s that some of the specific restoration and enhancement prescriptions recommended in the

earlier reports began to be implemented. A summary of the salmonid enhancement projects undertaken in the Nicola River watershed are listed in DFO's Stream Information Summary System (SISS) (1992).

Fishery resource issues of concern in the watershed during the 1980s may be generalized as follows:

1. Ranching and Agriculture

Cattle ranching in the upper, middle, and lower Nicola contributed to several water quality problems which impacted on salmon spawning and rearing habitat and was believed to have directly affected fish survival. These water quality problems included:

- irrigation withdrawals were high, particularly for Nicola River and Spius Creek. Nicola River flows decreased below fisheries maintenance levels several times during the early-1980s (Sebastian, 1982a). This led to fish mortalities and decreased production through entrapment, reductions in available spawning habitat, and increased water temperatures;
- loss of riparian vegetation as a result of land clearing or animal grazing led to bank erosion and siltation, increased nutrient levels, increased temperature and reduced food sources and rearing habitat; and,
- excessive irrigation in some areas may have increased sedimentation by increasing surface water runoff or groundwater flow (silt boils).

2. Logging

Logging, which occurred mainly in the headwater areas of some of the Nicola's tributaries (particularly Spius Creek and Coldwater River) had altered flow regimes and increased silt and nutrient loadings to downstream areas and also caused direct habitat degradation at stream crossings etc.

3. Industrial Activities and Effluent Loadings

There were at least two ready-mix concrete companies operating in the Nicola River watershed. Gravel washing operations by these companies introduced fines directly in to the Nicola River (under Waste Discharge Permits). In addition, communities throughout the watershed discharged various levels of treated effluent into the Nicola or its tributaries (some under Waste Discharge Permit).

4. Mining

Copper and molybdenum was mined by Highland Valley Copper near Logan Lake. Their activities coincided with increased copper and molybdenum levels in the headwaters of Guichon Creek (Sigma Engineering, 1991).

5. Obstructions to Fish Passage

Many human made obstructions to fish passage existed in the Nicola River and its tributaries in the mid-1980s. The Nicola Lake dam formed an upstream migration barrier to anadromous fish, while numerous irrigation weirs and dams throughout the watershed caused fluctuating water levels and resulted in fish strandings. Starr (1976) in Sebastian (1982a) identified 13 major irrigation diversions along the mainstem Nicola River.

3.3 Fishery Related Projects and Initiatives in the Nicola River Watershed in the 1980s

Sebastian (1981, 1982a, 1982b, 1984) and others (Scott and Olmstead, 1985) identified various enhancement and fish stocking opportunities in their reports, most of which focused on habitat protection, habitat restoration, fry stocking, and continuing assessment. Although some of these recommendations were addressed in the 1980's many of the issues remain unchanged today.

1. Continuing Stock Assessment

Studies and data collection by agencies, First Nations, and public interest groups have been ongoing in the Nicola River watershed since the early 1980s. Activities over this same period include fish and fish habitat sampling through foot surveys and counting fences (SISS, 1992).

2. Habitat Enhancement

Two major enhancement efforts were undertaken in the 1980s:

- upgrading of the Nicola Lake dam to improve the structure and increase storage capacity. Construction also included installation of a fishway at the dam and gravel spawning beds immediately downstream; and,
- irrigation ditch improvement measures such as the installation of numerous Finnegan screens to prevent fish from entering irrigation diversions.

3. Fish Stocking

Spilus Creek Hatchery was put into operation in 1984 as part of the Salmonid Enhancement Program (SEP). Annual hatchery releases approach 350,000 Chinook smolts, 150,000 Coho smolts, and 200,000 Steelhead smolts (Lauzier, pers. comm.).

4.0 Nicola River Watershed's Fishery Today

In an effort to determine the state of the watershed's fisheries resource today and the fisheries activities of government agencies and First Nations, information was gathered from government libraries and the personal collections of government personnel. We also contacted several individuals by phone and visited the Kamloops and Merritt areas to meet in person with several

agency representatives and members of the Nicola Watershed Community Roundtable and Nicola Watershed Stewardship and Fisheries Authority (NWSFA). A list of the individuals contacted and their affiliation is included as an Appendix to this report.

As a point of departure, it is important to note that a review of existing research indicates that wild fish stocks in the Nicola River watershed have been in general decline since the early 1980s (e.g., SISS, 1992). This trend is likely due to a combination of stock management and habitat degradation issues.

4.1 Fishery Resource Issues in the Nicola River Watershed Today

Although there have been successful fisheries enhancement and stocking projects over the past 15 years (see section 3.3 above), water and land use pressures in the watershed are still high. Indeed, many of the resource issues present in the watershed in the 1980s are still present today. Although these activities include mining and industrial effluent loadings, the most severe impacts are a result of agricultural and forestry activities.

Perhaps the largest difference between the overriding issues of the past 2 decades and the present lies in the approach to resolve them. While past initiatives have focused on rehabilitating instream fish habitat and increasing salmon production, present opinion and activity is drawing on a larger picture of land use and resource management (on a watershed level) that recognises the conflicts and common ground shared by all resource users.

It is not meaningful to address salmon stock management (i.e., harvest or escapement targets) at the Nicola watershed level because so much of this activity is governed by events which occur outside of the Nicola. For example, factors such as varying ocean survival conditions, mixed stock fisheries, bi-catch harvests in combination with commercial, sport and aboriginal fisheries or hatchery production can dramatically affect fish stock dynamics independently from in-river habitat conditions. Rather, it is more useful to present a discussion of the factors which limit the Nicola's fish production capability because this is something which communities in the watershed can control.

Our literature review and discussions with knowledgeable individuals and fisheries workers on the Nicola have identified three primary biophysical factors in the watershed which currently limit fish production:

1. High water temperatures due to riparian clearing, the loss of cold water inflows or the increase in warm water sources

Riparian clearing for development, cattle access, crop production or forestry has exposed large areas of shallow water to direct sunlight causing water temperatures to increase. Summer water temperatures have been reported to exceed critical levels (25°C or higher) in the summer months. In addition to high temperatures directly limiting fish production, lowered dissolved oxygen levels

which accompany increased temperatures or increased biological activities also affect fish populations. The problem of low oxygen levels due to biological oxygen demand is exacerbated by high nutrient levels which can accompany fertilizer or sewage effluent sources. Irrigation water withdrawal directly from cool water infeeders along the Nicola is also expected to be contributing to increasing water temperatures in the system.

2. Bank instability and siltation due to forestry and agricultural activities

Excessive bank instability and erosion occurs throughout the Nicola River watershed. A variety of factors are likely responsible for the degree of streambank erosion along the Nicola. These may include: logging in unstable upland areas or inside stream protection buffers; livestock access down streambanks along the agricultural areas of the valley; excessive clearing of natural streamside vegetation for crop land; and, increasing clearing for developments and service alignments. In general, the Nicola River has been entrained and confined throughout its valley in an effort to maximise usable land and minimise land loss through erosion at specific sites. As a result of entraining the river at specific points and clearing its margins of vegetation, the problem of erosion has likely been increased. Certainly, our direct field observations indicate that the most serious sedimentation problems are occurring where riparian areas have been cleared and where cattle access the Nicola River mainstem or its tributaries for watering.

Logging in the headwaters of many of the Nicola's tributaries is ongoing and this activity may be increasing sediment inputs to the watershed's streams. A recent study by Northwest Hydraulic Consultants (1992) indicates that logging in the Maka and Spius Creek watersheds is affecting the sediment regime of these streams. A separate study by Sigma Engineering (1991) found that forestry impacts on the Nicola and Coldwater Rivers are increasing sediment inputs.

3. Water supply concerns (low flows due to irrigation and agricultural withdrawals)

Irrigation demands for the mainstem Nicola, Coldwater River, and Spahomin Creek are considerable (i.e., between 1/3 and 1/2 of total streamflow volume). In addition, the percentage of baseflow in the Coldwater River and Spius and Maka Creeks which could potentially be required to meet irrigation demand is high (Northwest Hydraulic Consultants, 1992).

4.2 Current Fisheries Related Projects and Initiatives in the Nicola River Watershed

The information obtained during our interviews and telephone conversations is included below in table format and is intended to provide an 'inventory' of fisheries related projects or initiatives underway or proposed in the Nicola River watershed. This information is also presented geographically on the map sheet accompanying this report.

Table 3: DFO Activities in Nicola River Watershed*

Project	Location	Description	Objective
Stock Assessment Projects			
Nicola Lake Dam Fishway Enumeration Study I	outlet of Nicola Lake	fish counting structure	assess effectiveness of fish ladder
Nicola Lake Dam Fishway Enumeration Study II	outlet of Nicola Lake	fish counting structure	assess effectiveness of fish ladder
Fish Enumeration Projects	Nicola and Coldwater Rivers, Spius Creek	stream walks and helicopter enumeration	annual spawner counts
Biorecognition Project			
Temperature Monitoring Program	six sites (see map)	installation and monitoring of thermographs	understanding of Nicola River's thermal regime
Stock Enhancement Projects			
Spius Creek Hatchery	Spius Creek at Nicola River	fish hatchery	augment natural stocks in Nicola system
Habitat Restoration and Enhancement Projects			
Eaton Channel	Coldwater River at Midday Creek	groundwater channel	fish refuge/rearing
Sherman Channel	Sunshine Valley section of Nicola mainstem	groundwater channel	fish refuge/rearing
Juliet Channel	Coldwater River at Juliet Creek	side channel	fish refuge/rearing
Latta Channel	4km downstream of Merritt	groundwater channel	fish refuge/rearing
Guichon Irrigation Project (Native Component)	Guichon Creek at Nicola River	irrigation system improvements	elimination of fish strandings and water conservation
Guichon Irrigation Project (Rancher Component)	Guichon Creek at Nicola River	irrigation system improvements	elimination of fish strandings and water conservation
Mamit Lake Fishway	Mamit Lake dam on Guichon Creek	fishway	facilitate salmonid movement upstream
Interior Wetlands Project	Nicola River Between Nicola Lake and Merritt	variety of projects focusing on bank stabilization, riparian planting, livestock fencing, groundwater channels	habitat complexing, silt control, summer water temperature modification
Planning Projects			
Nicola Watershed Community Roundtable	Merritt	hiring of part-time coordinator and office space	effective coordination of Nicola Valley Roundtable activities

* Although DFO has contributed funds for the projects listed in this table MELP has contributed to most of them in kind. MELP during project formulation and implementation, while DFO has tended to contribute funding and engineering expertise. Projects separately in Table 5.

** Salmonid Enhancement Program

*** Fraser River Action Plan

Funding	Source	Duration	Status	Contact	Remarks
\$10 000	\$5K DFO (SEP)** \$5K MELP	April/May 1994	complete	DFO: Ed Woo MELP: Ian MacGregor	
\$10 000	DFO (SEP)	August 1994	current	Ed Woo Wayne Peterson	with First Nations (NWSFA)
n/a		annually	current	Barry Rosenberger	with Spius Creek Hatchery and First Nations (NWSFA)
\$17 000	DFO (FRAP)***	July 1994-present	current	Jennifer Nener Ray Lauzier	additional groundwater temperature station installed below Nicola Lake dam
approx. \$450 000 per year	DFO (SEP)	1984-present	current	Keith Sandercock Barry Rosenberger	produces coho, chinook, steelhead stocks; some funding by MELP
\$6 500	DFO (SEP)	July-August 1994	current	Mel Sheng	study with expansion potential
\$45 000	DFO (SEP)	1992-present	current	Mel Sheng	
\$30 000 to \$90 000	DFO (SEP) MELP Transmountain Pipeline	1993-present	current	Mel Sheng	compensation project; cost estimate varies between contributors
\$25 000	\$20K DFO (SEP) \$5K landowner	1992	complete	Mel Sheng	
\$400 000	\$330K DFO (FRAP) \$70K MELP	fall 1994?	proposed	DFO: Mel Sheng DFO: Ed Woo MELP: Ian MacGregor	
\$200 000	DFO (FRAP)	1995?	proposed	Ed Woo	
n/a	DFO (FRAP)		proposed	Ed Woo	component of the Guichon Irrigation Project; review of dam operation must be completed first
\$230 000	\$200K Environment Canada \$30K DFO	1994-present	current	Mike Crowe	in cooperation with Canadian Wildlife Service, Ducks Unlimited, and landowners
\$25 000	DFO (FRAP)	July 1994-present	current	Mike Romaine	

MELP contributions have included staffing to provide conceptual inputs
 projects which have included direct funding from MELP are included

Table 4: First Nations Activities in the Nicola River Watershed*

Project	Location
Stock Assessment Projects**	
Guichon Creek Counting Fence	mouth of Guichon Creek
Upper Nicola Counting Fence	lower reach of Nicola River
Nooaitch Creek Counting Fence	lower reach of Nooaitch Creek
Spawner Enumeration-Coldwater River, Clapperton and Spius Creeks	length of streams
Nicola River Spawner Enumeration	length of Nicola River
Nicola and Coldwater Rivers Carcass Recovery Project	Nicola and Coldwater Rivers
Spahomin Creek Spawner Enumeration	Spahomin Creek
Nicola Lake Dam Fishway Enumeration	outlet of Nicola Lake
Coded Wire Tagging Project	Spius Creek Hatchery
Biorecognition Projects	
various Biorecognition Projects	Skulhun, Shackan, Klokowuck Creeks
Stock Enhancement Projects	
Coldwater Smolt Acclimation Pond Project	Coldwater River near Midday Creek
Spahomin Creek Smolt Acclimation Pond Project	Spahomin Creek near Spahomin Lake
Habitat Restoration and Enhancement Projects	
Lower Nicola Bank Stabilization Study and enhancement works	Nicola River at Lower Nicola Indian Band and Shulus Cattle Company
Upper Nicola Bank Stabilization Study	Nicola River at Quilchena
Shackan Reserve-Site 10	Nicola River at Shackan Reserve
Nooaitch Reserve-Site 3	side channel of Nicola mainstem at Nooaitch Reserve
Coldwater Rip-rap Project	Coldwater River

- * First Nations fisheries work in the Nicola River watershed is done mainly through the Nicola five are in the Nicola River watershed. The NWSFA signed the Nicola Watershed Stewardship Agreement with the Nicola River watershed.
- ** The NWSFA received \$300 000 from DFO's Aboriginal Fisheries Strategy (AFS) for the fiscal year 2000-2001. Expenditures are anticipated to be \$375 000. AFS is the source of all funding and is based on a cooperative arrangement with DFO. The NWSFA considered the contact for project work conducted by the NWSFA.

** in cooperation with DFO, Habitat Management

Description	Objective	Funding	Status
counting fence	enumeration of adult Coho stocks	1993/94: \$5 700	complete
counting fence	enumeration of spawning Chinook and Coho stocks	1993/94: \$7 000 1994/95: \$10 000	current
counting fence	enumeration	1994/95: \$10 000	proposed
stream walk	Chinook spawner enumeration	1993/94: n/a 1994/95: \$10 000	current
helicopter/aerial survey method	Chinook spawner enumeration	1993/94: \$21 600 1994/95: \$20 000	current
deadpich program	assessment of Spius Creek Hatchery outplant strategies	1993/94: n/a	complete
stream walk	spawner enumeration	1994/95: \$2 000	proposed
fish counting structure	assess effectiveness of fish ladder	1994/95: \$30 000	proposed (with DFO, MELP)
CWT of chinook and coho psemolts	evaluation of survival and success of imprinting	1993/94: n/a	complete
on-site visit to assess habitat features, fish incidence and relative fish abundance	derive baseline data to design to prioritize future enhancement strategies	1993/94: \$16 000	complete
construction and operations of imprinting pond	improve imprinting of smolts to reduce incidence of straying by returning adult stocks	1993/94: \$27 500 1994/95: \$20 000	current
construction and operations of imprinting pond	improve imprinting of smolts to reduce incidence of straying by returning adult stocks	1993/94: \$35 600 1994/95: \$20 000	current
identification of sites experiencing serious erosion problems and implementation of bank stabilization measures	baseline information and bank stability	1993/94: n/a 1994/95: \$35 000	current
bank stabilization work, livestock fencing, irrigation screen installation	reduce erosion and habitat enhancement	1993/94: \$9 500 1994/95: \$11 000	current
investigation of flow control in spring fed pond and flow enhancement	assessment of site for future habitat enhancement	1993/94: n/a 1994/95: \$25 000	current
fluvial geomorphology study by contractor and implementation of monitoring program	assessment of vulnerability of the site to flooding and erosion	1993/94: n/a 1994/95: \$25 000	current
rip-rap placement and other shore protection measures (fencing)	reduce erosion	1993/94: \$10 200 1994/95: \$30 000	current

a Watershed Stewardship and Fisheries Authority (NWSFA), which represents seven Bands, of which Watershed Fisheries Agreement with the Department of Fisheries and Oceans in April 1993.

al year 1993-94 and this was used to fund the projects listed above. At the time of this writeup 1994/95 on an April 1-March 31 cycle. Arnie Narcisse is the Project Manager at the NWSFA and should be

Table 5: MELP Activities in the Nicola River Watershed*

Project	Location	Description	Objective
Habitat Restoration and Enhancement Projects			
Guichon Irrigation Project (part of Nicola Valley Enhancement and Education Project**)	Guichon Creek	irrigation system improvements	elimination of fish strandings
Clapperton Creek Irrigation Diversion	Clapperton Creek	diversion of irrigation intakes	water conservation and open Creek to fish use
Stock Assessment Projects			
Nicola Lake Dam Fishway Enumeration Study	outlet of Nicola Lake	fish counting structure	assess effectiveness of fish ladder

* MELP contributes in Kind (staffing and expertise, etc.) to many DFO initiatives

** Nicola Valley Enhancement and Education Project has been ongoing for seven years and focuses on education and water conservation of irrigation intakes and upgrading of irrigation systems). It is estimated that \$250 000 has been spent in the watershed since Habitat Conservation Fund (HCF).

Table 6: Environment Canada Activities in the Nicola River Watershed

Project	Location	Description	Objective
Biorreconnaissance Projects			
Spring Runoff Study	Thompson Basin including Nicola watershed	aerial survey and runoff samples collected in ranch areas	identify nutrient and coliform inputs to Nicola River
SFU Post Doctorate Study	throughout Nicola mainstem	scientific study of aquatic communities	investigate invertebrate and vertebrate community structure
Habitat Restoration and Enhancement Project.			
Interior Wetlands Project	Nicola River between Nicola Lake and Merritt	variety of projects focusing on bank stabilization, riparian planting, livestock fencing, groundwater channels	habitat complexing, silt control, summer water temperature modification

* Canadian Wildlife Service

Funding	Source	Duration	Status	Contact
\$400 000	\$330K DFO (FRAP) \$70K MELP (HCF)	Fall 1994?	proposed	Ian MacGregor
n/a	n/a		proposed	Ian MacGregor
\$10 000	\$5 000 MELP \$5 000 DFO	April/May 1994	complete	Ian MacGregor

conservation awareness, as well as enhancement measures (diversion
e the project's inception. All funding has been provided through the

Funding	Source	Duration	Status	Contact	Remarks
\$30 000	Green Plan	1994-present	current	Environment Canada: George Dirkson DFO: Jennifer Nener	in cooperation with DFO and MELP; coop student has been hired to continue work with B.C. Federation of Agriculture
\$50 000	Green Plan	1994-present	current	Bob Vadas, CWS*	
\$230 000	\$200K CWS* (FRAP) \$30K DFO (FRAP)	1994-present	current	Ed Henan	in cooperation with CWS, Ducks Unlimited, and landowners

Table 7: Ministry of Forests Activities in the Nicola River Watershed*

Project	Location	Description
Planning Projects		
5 Year Development Plan	Merritt Forest District	major harvesters detail planned activities for 5 year period
Brook Creek Community Watershed LRUP**	Brook Creek near Brookmere	focuses on the management of unique features
Lakes LRUP	Merritt Forest District	classifying lakes based on sensitivities to logging
Highways LRUP	Merritt Forest District	visual impact management
Habitat Restoration and Enhancement Projects		
Helmer Lake Access Strategy	Helmer Lake at Coquihalla Highway	installed gate at road entrance
Cattle Management Strategy	Merritt Forest District	installation of cattle guards, fencing, etc.

* Alisa Dorion is the contact for all MOF projects in the Nicola River watershed

** Local Resource Use Plan

Table 8: Others' Activities in the Nicola River Watershed

Project	Agency	Location	Description
Planning Projects			
Best Agricultural Waste Management Plans	Ministry of Agriculture, Fish and Food	throughout B.C.	identify and mitigate against farm runoff etc.
Land and Resource Management Plan	Interagency Management Committee	Merritt and Lillooet Forest Districts	preparation of LRMP

Objective	Funding	Source	Status
monitor planned activities of licenses	\$100 000	\$50K MOF \$50K licenses	current
forest management in watershed	\$85 000 to date	\$75K MOF \$10K Tolko	current
management of lakes given existing logging pressures	\$30 000 to date	MOF	current (with MELP expertise)
minimize visual impact of cut blocks	\$10 000 to date	MOF	current
limit access to reduce visits	n/a	MOF	complete
prevent cattle entrance onto logging roads, etc.	\$10 000 per year	MOF	complete

Objective	Funding	Duration	Status	Contacts
elimination of contaminated runoff	n/a	1991-present	current	Lance Brown
effective coordination of land use activities at a regional scale	n/a		proposed	Terry MacDonald

4.3 Recently Completed Studies in the Nicola River Watershed

In addition to the projects listed above there have been several studies completed on the Nicola River watershed in recent years which are available in report form. These include:

Beniston, R.J. and D.B. Lister, 1992. Effects of highway construction on juvenile salmonid rearing habitat in the Coldwater River, B.C.: Results of post-construction monitoring, 1986-1990. Prepared for Ministry of Transportation and Highways, Victoria, by R.J. Beniston and Associates, Port Coquitlam, B.C.

Coast River Environmental Services, 1994a. Proposed Floodplain Works, Nicola River Corridor, Interior Wetlands Program and Fraser River Action Plan. Prepared for Fraser River Action Plan, April 26, 1994.

Coast River Environmental Services, 1994b. Nicola River Demonstration Project Area Aquatic Habitat Overview. Prepared for Fraser River Action Plan, May 10, 1994.

Costerton, R.W., 1993. Nicola Lake inflow forecasting model review. Regional Water Management, B.C. Environment, Kamloops, B.C. 42pp.

Doyle, P.F., Kosakoski, G.T. and R.W. Costerton, 1993. Negative effects of freeze-up and breakup of fish in the Nicola River. B.C. Environment and DFO, Kamloops, B.C. 16 pp.

Hickey, D.G. and J.A. Trask, 1994. Inventory and rating of salmonid habitat in the vicinity of Kamloops, B.C. Prepared for the Fraser River Action Plan by Envirowest Consultants Ltd. (in preparation).

Lauzier, R. and G. Taylor, 1989. Juvenile chinook salmon and rainbow trout in the Nicola River Watershed, B.C. Can. MS Rep. Fish Aquat. Sci.

Michel, B. and T. Tom, 1992. Salmon counting fence, kokanee sampling, incline fry trapping for Nicola River and Spahomin Creek. Prepared for DFO.

Miles, M. and Associates Ltd., 1992. Coquihalla Highway: Stability assessment of Coldwater River fisheries mitigation structures. Prepared for Highway Environment Branch, B.C. Ministry of Highways, Victoria.

Northwest Hydraulic Consultants Ltd., 1992. Hydrology and Water Use for Salmon Streams in the Thompson River Watershed, British Columbia. Prepared for the Fraser River Environmentally Sustainable Development Task Force, Department of Fisheries and Oceans.

Sigma Engineering Ltd., 1991. Assessment of Resource Uses in the Thompson-Nicola Habitat Management Area, Volumes I and II. Prepared for the Fraser River Environmentally Sustainable Development Task Force, Department of Fisheries and Oceans.

5.0 Conclusions and Recommendations

Resource issues in the Nicola River watershed have not changed substantially since the 1980s. High water temperatures and bank instability/sedimentation associated with forestry and agricultural activities are still present in the watershed, and water allocation remains a management concern. It is important to note that the issue of declining fish stocks in the Nicola relates in part to problems which lie outside of the watershed including ocean survival and harvest rates.

Although the Nicola River was studied in some detail in the late 1970s and early 1980s and some stock and habitat enhancement work was done, the last half of the 1980s was a less active period. At present, a number of positive initiatives are underway through DFO's Green Plan, the Aboriginal Fisheries Strategy, MELP, Environment Canada, MAFF, MOF and Ducks Unlimited. The focus of these initiatives include fry entrapment, fish passage, riparian management, bank stability, water quality, and waterfowl habitat enhancement.

A number of these persistent resource issues will require ongoing information exchange and interaction between the agencies, First Nations, the Nicola Watershed Community Roundtable and other community interest groups in the watershed. It is becoming increasingly evident that fisheries issues are in nearly all cases closely tied to other resource sectors such as forestry, agriculture and water management. We feel strongly that many fish habitat restoration and protection works will require input and support from other resource sectors and communities throughout the watershed in order to achieve their objectives.

1. Water Resource Allocation

Salmon production, crop production, livestock farming, and domestic water supply are all dependent on the water resource of the Nicola River and its tributaries. Therefore, water supply is a critical issue for DFO, MELP (Fish and Wildlife and Water Management Branches), First Nations, ranchers and valley residents alike.

The Nicola Lake Dam was constructed to provide adequate lake water storage to address water allocation issues and control flooding. Furthermore, the Nicola Lake Dam project was divided into two phases which included dam construction and the lowering of dam and irrigation intake channels. Although the dam was upgraded and a fishway installed in 1986, the second phase of lowering of the intakes was not completed. Because the dam has not been completed as was originally intended, it is important that the fate of the project be resolved through community and interagency discussions.

2. Preservation and Restoration of Riparian Areas

Riparian clearing and uncontrolled livestock access through riparian areas continues to contribute to increased water temperatures and bank erosion throughout the Nicola River system. We recommend that efforts be made to preserve and restore riparian areas using these mechanisms:

- continue efforts to educate riparian users and raise sensitivities to riparian values;
- use existing water license provisions to control direct cattle access to watercourses;
- restrict riparian clearing using existing guidelines e.g., DFO/MELP's "Land Development Guidelines for the Protection of Aquatic Habitat"; and,
- encourage the installation of livestock exclusion fencing programs throughout the watershed and restore riparian areas where bank erosion is most acute.

3. Flood Plain Management

We recommend that a river hydraulic and channel stability study for the Nicola Valley floodplain be completed to provide background information to be used in formulating a floodplain management strategy. We feel this is important because our involvement on this assignment indicates that there are several approaches being taken by agency and First Nations groups in the Nicola River watershed to mitigate bank instability problems. While we recognize that bank treatment efforts for persistent erosion problems have to be carefully considered for each situation, we recommend that biological stabilization techniques be used wherever feasible, including riparian management, live crib walls, brush layers, brush mattresses, spiling, wadding, facines, live staking, seeding, etc. Long term mechanical erosion control such as rock armour should be limited to those situation where there is an imminent risk to property or infrastructure. In many cases, a combination of mechanical and biological measures can be used to stabilize banks. Bank stabilization can often be achieved by using rock armour at the lower portion of the bank in combination with appropriate biological measures at the higher bank areas.

4. Education

A diverse range of interest groups in the Nicola River watershed are already interacting well through the Nicola Watershed Demonstration Program. This program, which is promoting education and awareness within the Nicola's communities, should continue to be an important focus of agency efforts in the watershed. Specifically, we recommend that the awareness of agriculture, ranching and First Nations groups to sensitivities of aquatic and fisheries habitat as they relate to land use activities and the importance/benefits of riparian management and water conservation measures be reinforced by preparing information packages and workshops directed at these groups. This activity would require the cooperation of intermediaries (Band offices, B.C. Cattlemen's Association, etc.).

5. Maintaining Community Level Involvement

It is important that community based groups continue to participate in efforts to improve their watershed. Specifically:

- the Nicola Valley Institute of Technology (NVIT) can be an important technical resource in the Valley both directly through their involvement in projects and indirectly through their student training program;

- the Nicola Watershed Community Roundtable plans to establish a resource centre to house available literature on the watershed. This can be used by local residents, students, teachers, NWSFA and Roundtable members alike for background information and to help inform the direction of future efforts; and,
- MELP has established an ongoing Nicola Valley Enhancement and Education Project which can be a good source of information and education for watershed communities.

In addition, joint programs for groups with shared interests should be encouraged. For example, riparian planting and bank stabilization works could become a shared and interactive project involving ranching, tree planters, First Nations, community volunteers, and government agency workers. A tree planting program organized by the City of Prince George has been successfully implemented over the past few years using this approach whereby trees which have been donated by industry are planted by several community groups working side by side over a two day period. A community picnic at the conclusion of the program has also provided an opportunity for the many interest groups to interact.

6. Coordinating Native and non-Native Efforts

We recommend that the NWSFA and the Nicola Watershed Community Roundtable be encouraged to establish a discourse as First Nations and non-Native groups are becoming increasingly involved in projects and initiatives around the watershed which address similar issues.

7. Continuing Assessment

There have been several studies addressing the Nicola River system which have contributed important understandings to planning and management activities. Some areas which appear to require further study include:

(i) Effects of increased Nicola Lake drawdown

Increased drawdown of Nicola Lake will likely impact recreation uses, fisheries values, mosquito production, etc. Prior to beginning any activities geared towards completing the dam, it is therefore important that the impacts of altering the Nicola Lake storage and release regime be better understood. Of particular concern is the effect of lowering irrigation intakes on downstream water temperatures during summer low flow conditions.

(ii) Effects of ginseng agriculture on fisheries resources

Ginseng is an important and growing industry in the Nicola River watershed. Although much is understood about the crop we are not aware of any studies which document the impacts of ginseng agriculture on fish resources in the Nicola watershed or any other B.C. Interior systems. Because ginseng cultivation relies on the use of herbicides, fungicides, etc., which impact water quality, it is important that a study be completed which includes:

- background documentation of what is already understood about ginseng farming and its impact on water quality, particularly in the B.C. Interior;
- design and implementation of a water quality monitoring program; and,
- presentation of findings as a report which includes opportunities for impact mitigation.

(iii) Bank stabilization and erosion control

DFO, MELP (Fish and Wildlife and Water Management Branches), First Nations, and the Nicola Watershed Community Roundtable should develop a protocol to direct bank stabilization efforts in the watershed. This may require that a thorough review of appropriate bank stabilization techniques be undertaken which can then be applied within an overall floodplain management program.

6.0 References

- Coast River Environmental Services, 1994a. Proposed Floodplain Works, Nicola River Corridor, Interior Wetlands Program and Fraser River Action Plan. Prepared for Fraser River Action Plan, April 26, 1994.
- Coast River Environmental Services, 1994b. Nicola River Demonstration Project Area Aquatic Habitat Overview. Prepared for Fraser River Action Plan, May 10, 1994.
- Ducks Unlimited, 1994. Nicola River Corridor Proposed Work (report + three map sheets).
- Hickey, D.G. and J.A. Trask, 1994. Inventory and rating of salmonid habitat in the vicinity of Kamloops, B.C. Prepared for the Fraser River Action Plan by Envirowest Consultants Ltd. (in preparation).
- Lauzier, Ray. River Habitat Biologist, Salmon Habitat Section, West Vancouver Laboratory, DFO. Personal Communication.
- McGregor, Ian. Senior Fisheries Biologist, MELP. Personal Communication.
- Merritt Herald, 1994. Merritt History, in *Visitor's Guide to the Nicola Valley*.
- Northwest Hydraulic Consultants Ltd., 1992. Hydrology and Water Use for Salmon Streams in the Thompson River Watershed, British Columbia. Prepared for the Fraser River Environmentally Sustainable Development Task Force, Department of Fisheries and Oceans.
- Scott, K.J. and W.R. Olmstead, 1985. Migration of Juvenile Chinook and Coho Salmon and Steelhead Trout in the Nicola River Drainage, 1984. Volume 1-Technical Report. Prepared for Department of Fisheries and Oceans, SEP Operations, DSS Contract No. 03SB.FP576-3-5715.
- Scott W.B. and E.J. Crossman, 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada, Ottawa.
- Sebastian, D.C., 1981. Nicola Fisheries Enhancement Assessment - A Summary of 1980 Results and Preliminary Enhancement Opportunities, with Recommendations for Future Assessment Activities. Prepared for the Fisheries Improvement Unit, Fisheries Branch, British Columbia Ministry of the Environment.
- Sebastian, D.C., 1982a. Nicola Fisheries Assessment - Interim Enhancement Opportunities and Recommendations Based on 1980 and 1981 Investigations. Prepared for the Fisheries Improvement Unit, Fisheries Branch, British Columbia Ministry of the Environment.

Sebastian, D.C., 1982b. Nicola Fisheries Assessment - Preliminary Enhancement Opportunities and Recommendations Based on 1980 Investigations. Prepared for the Fisheries Improvement Unit, Fisheries Branch, British Columbia Ministry of the Environment.

Sebastian, D.C. and B.A. Yaworski, 1984. Summary of Nicola Fisheries Assessment, 1980-1983. Prepared for the Fisheries Improvement Unit, Fisheries Branch, British Columbia Ministry of the Environment.

Sigma Engineering Ltd., 1991. Assessment of Resource Uses in the Thompson-Nicola Habitat Management Area, Volumes I and II. Prepared for the Fraser River Environmentally Sustainable Development Task Force, Department of Fisheries and Oceans.

Stream Information Summary System (SISS), 1992. Fish Habitat Inventory and Information Program - Stream Summary Catalogue, Subdistrict #29F Lillooet. Nicola River Report.

Appendix

List of Contacts

DFO:

Michael Crowe
Habitat Biologist, Kamloops Area Office
Phone: 374-2329
Fax: 372-9771

Gordon Kosakoski
Head, Habitat Management Sector, Kamloops Area Office
Phone: 374-7247
Fax: 372-9771

Ray Lauzier
River Habitat Biologist, West Vancouver Laboratory
Phone: 666-7916
Fax: 666-3497

Don Lawrence
Habitat Technician, Lillooet Area Office
Phone: 256-4503
Fax: 256-4649

Doug Lofthouse
Support Biologist, Salmonid Enhancement Program
Fraser River Action Plan
Phone: 666-8646
Fax: 378-4615

Mike Romaine
Chief, Integrated Resource Management and Planning
Fraser River Action Plan
Phone: 666-3856
Fax: 666-0417

Lidia Jaremovic
Senior Program Biologist
Fraser River Action Plan
Phone: 666-0017
Fax: 666-0417

Jennifer Nener
Water Quality Biologist
Fraser River Action Plan
Phone: 666-0395
Fax: 666-0417

Barry Rosenberger
Manager, Fisheries Management Sector, Kamloops Area Office
Phone: 374-0929
Fax: 372-9771

Mel Shang
Biologist, Salmonid Enhancement Program
Fraser River Action Plan
Phone: 666-6578
Fax: 666-0292

Neil Todd
Manager, Spius Creek Hatchery
Phone: 378-2992
Fax: 378-4615

Cam West
Chief, Fraser River/NBC Operations Division, SEP
Fraser River Action Plan
Phone: 666-0197
Fax: 666-6894

Ed Woo
Senior Project Engineer, Salmonid Enhancement Program
Fraser River Action Plan
Phone: 666-2874
Fax: 666-8874

MELP: **Brian Chan**
Senior Fisheries Biologist, Kamloops Office
Phone: 371-6250
Fax: 828-4000

Bob Costerton
Hydrologist, Kamloops Office
Phone: 371-6282
Fax: 828-4000

Don Holmes
Environmental Section Head, Environmental Protection
Kamloops Office
Phone: 371-6237
Fax: 828-4000

Ramona Halota
Native Liaison Worker, Kamloops Office
Phone: 371-6274
Fax: 828-4000

Terry MacDonald
Secretariat, Interagency Management Committee
Regional Planner, Thompson-Okanagan Region
Phone: 828-4800

Steve Maricle
Fisheries Technician (Rivers), Kamloops Office
Phone: 371-6253
Fax: 828-4000

Ian McGregor
Fisheries Section Head, Fish and Wildlife, Kamloops Office
Phone: 371-6250
Fax: 828-4000

Ron Smith
Head, Allocation Section, Kamloops Office
Phone: 371-6206
Fax: 828-4000

Al Zackodnik
Regional Manager, Water Management, Kamloops Office
Phone: 371-6203
Fax: 828-4000

MAFF: Lance Brown
Engineering Technologist, Kamloops Office
Phone: 828-4552
Fax: 828-4979

Al Oliver
Provincial Ginseng Specialist, Kamloops Office
Phone: 828-4552
Fax: 828-4979

MOF: Alisa Dorion
District Planner, Integrated Resources
Merritt Forest District
Phone: 378-8470
Fax: 378-8481

Rich Hodson
Resource Officer, Integrated Resources,
Merritt Forest District
Phone: 378-8400
Fax: 378-8481

Tim Sheldon
District Manager
Merritt Forest District
Phone: 378-8470
Fax: 378-8481

Joyce Shield
Aboriginal Forest Advisor
Merritt Forest District
Phone: 378-8485
Fax: 378-8481

Aboriginal Fisheries Strategy
NWSFA (Nicola Watershed Stewardship and Fisheries Authority):

Amie Narcis, NWSFA
Phone: 378-4235
Fax: 378-9119

Ducks Ian Barnett
Unlimited: Manager, B.C. Southern Interior District
Phone: 374-8307
Fax: 374-6287

Fraser Basin Management Program:

Greg Mallette
Demonstration Projects Coordinator
Phone: 660-1177
Fax: 660-3600

Nicola Valley Roundtable:

**Laurie Guichon
Gerard Guichon Ranch
Phone: 378-4535
Fax: 378-5011**

**Mil Juricic
Phone: 387-6670**

**Elizabeth Salomon-de-Friedberg
Phone: 378-3924**

**Melody Norbain
Phone: 378-2284**

