3.0 The Fisheries Resource

3.1 Introduction

The most important fish species present in the Coldwater River are chinook salmon (Oncorhynchus tshawytscha), coho salmon (Oncorhychus kisutch), steelhead trout (Salmo gairdneri), Dolly Varden char (Salvelinus malma), and mountain whitefish (Prosopium williamsoni). Of these, the most valuable are the chinook salmon, coho salmon and steelhead trout. The general life history patterns of the chinook and coho appear to be well documented, whereas only in the past several years has any work been done on describing the life history of steelhead in this drainage.

The Coldwater supports 10% of the chinook run and 40% of the coho run entering the Nicola River. Further, the Nicola contains 20% of the chinook run and 16% of the coho run found in the Thompson River system. These figures are especially significant considering that the Nicola system contains only 3 of 53 salmon spawning streams in the Thompson system (Brown, Musgrave, Marshall, 1979).

Salmon spawn within the mainstream of Coldwater River, and, depending on flow conditions, may also spawn in Midday, Voght and Juliet Creek. Young chinook and coho rear in all of the above areas. Some salmon rearing also occurs occasionally in the Bottletop Creek and perhaps Brook Creek, as well as in many of the major ponds, sloughs and backwaters located within the valley flat of Coldwater River.

The steelhead run in the Coldwater is part of the Thompson River run. Thompson River steelhead average from 5 to 7 kg (12 to 16 lbs.) and have been caught up to 14 kg (30 lbs.). These fish migrate into the Thompson starting in early September remaining there for the winter, and then migrate up in the spring to spawn in a number of tributaries including the Coldwater. The steelhead fishery takes place only in the Thompson itself with the largest proportion of the angling occurring below the Nicola junction. The Thompson is one of the most heavily fished steelhead rivers in the Province, and is ususally one of top fish producers. The fishery attracts anglers from all over the Pacific Northwest and has become one of the best known steelhead streams on the Pacific Coast. The actual size of the Thompson steelhead run cannot be accurately counted but is estimated to range between 1,000 to 2,000 fish. It is believed that at least 20% of the run spawns in the Nicola System, and it could easily be a much higher proportion (Pers. Comm. D. Sebastion).

There is also a run of pink salmon which spawn in the Nicola drainage on odd numbered years. The population is estimated to range in size between 200 to 4,000 spawners (Brown, Musgrave, and Marshall, 1979). However, pink salmon have not been recorded in the Coldwater River itself, and thus highway construction will have little impact on this species.

3.2 Life History of Important Species

3.2.1 Chinook Salmon

As can be seen from the following table the population size of the chinook spawning run has varied considerably over the period of record.

1947 - 750	1953 - 770	1959 - 200	1965 - 200	1971 - 400	1977 - 600
48 - 400	54 - 1500	60 - 200	66 - 200	72 - 200	78 - 750
49 - 200	55 - 1500	61 - 200	67 - 200	73 - 750	
50 - 200	56 - --	62 - 200	68 - 200	74 - 200	
51 - 750	57 - 400	63 - 200	69 - 200	75 - 1500	
52 - 1500	58 - 200	64 - 160	70 - 750	76 - 400	

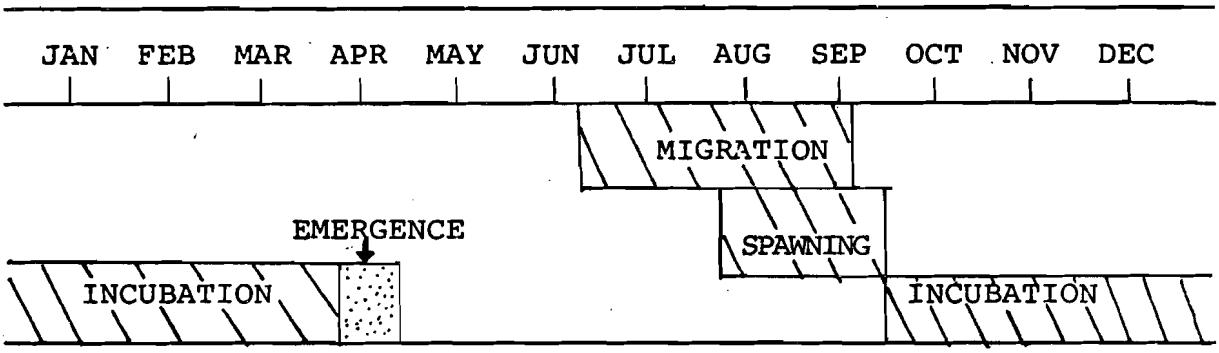
(from Brown, Musgrave, and Marshall, 1979)

This variation in escapement can be partly explained by the influence of environmental factors controlling the success of spawning and rearing. However, most of the variation is due to commercial and indian fisheries in the Fraser River and the difficulty in maintaining a consistent fish counting procedure.

Timing

Chinook salmon enter the Coldwater from late June to mid-September, with spawning occuring from approximately mid-August to late September. The eggs remain in the gravel until approximately late April when all the fish should have emerged. The peak of emergence is about the 26th of April.

Chinook Timing Summary



As indicated by the proceeding summary table, the eggs are in the gravel for about 7 to 8 months. After hatching, the young fry remain in the stream for the summer and winter and then the next spring as 1 year olds, they smolt and migrate to the sea. These fish then spend 1½ to 2½ years in the ocean, returning to the river as a 2½ to 3½ year old adults.

Stream Habitat Preferences

Chinook fry prefer low velocity areas (.15 m/sec), and are thus usually found along the stream margins and within backwater areas. This habitat is normally associated with sand or silt sized bed material. Some fry prefer faster velocity habitat (.6 m/sec) but densities are usually lower (Everest and Chapman, 1972). As the fry increase in size they utilize deeper and faster areas in the main river. In the Coldwater this shift in habitat preference takes place in mid-August when the fish are 55 to 66 mm in length (Pers. Com. - J.C. Wightman).

Chinook juveniles have been recorded to overwinter amongst boulders on the stream bottom (Everest and Chapman, 1972). In the Coldwater overwintering habitat has not yet been well defined but chinook most likely overwinter in debris jams and amongst large boulders.

Spawning

Spawning areas are not well defined due to yearly variations in discharge and temperature conditions, as well as the variation in the number of spawners. Spawning may take place throughout the length of the river, with known areas of concentrated use being in the lower river near the Nicola junction, and at Kingsvale and Brodie (Brown, Musgrave and Marshall, 1978).

3.2.2 Coho Salmon

As shown in the following table, the size of the coho salmon run, has varied greatly over the period of record. This variation has occured for the same reasons as was explained in Section 3.2.1.

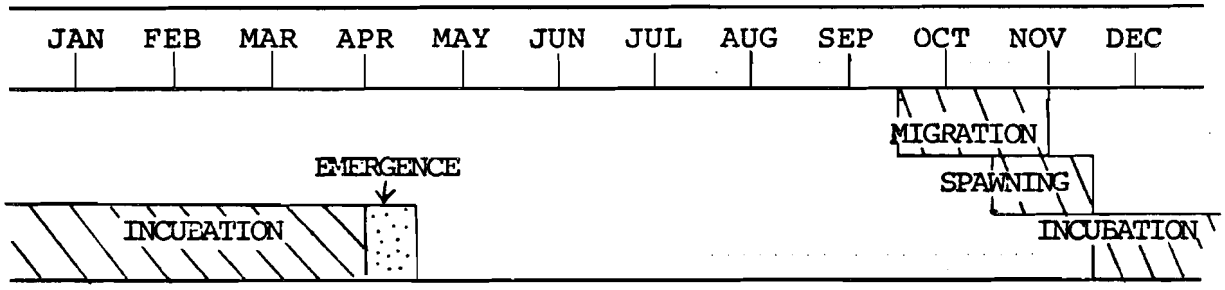
1948 - 750	1955 - 7500	1963 - 75	1969 - 3500	1974 - 750
49 - 400	57 - 750	65 - 750	70 - 750	75 - 200
51 - 3500	60 - 400	66 - 3500	71 - 400	76 - 200
52 - 1500	61 - 400	67 - 75	72 - 200	77 - 300
54 - 750	62 - 75	68 - 750	73 - 1500	78 - 1500

(from Brown, Musgrave, and Marshall, 1979)

Timing

Coho salmon enter the Coldwater from approximately October 1st to mid November. Spawning occurs during November, with the peak of spawning occurring about the 15th. The young fish emerge from the gravel in early May, usually peaking by the second week of May.

Coho Timing Summary



Once emerged, the young fish spend the remainder of the summer and the following winter in the stream. Next spring, as 1 year old smolts, the coho then migrate to the ocean where they spend 1½ years, returning as 2½ year old adults.

Stream Habitat Preferences

Coho fry prefer low velocity areas either on the stream margins or more often in small side channels, and ponds, as illustrated by Plate 3.2.1. Unlike chinook salmon, they maintain this preference for low velocity areas during their stream residence.

Plate
3.2.1

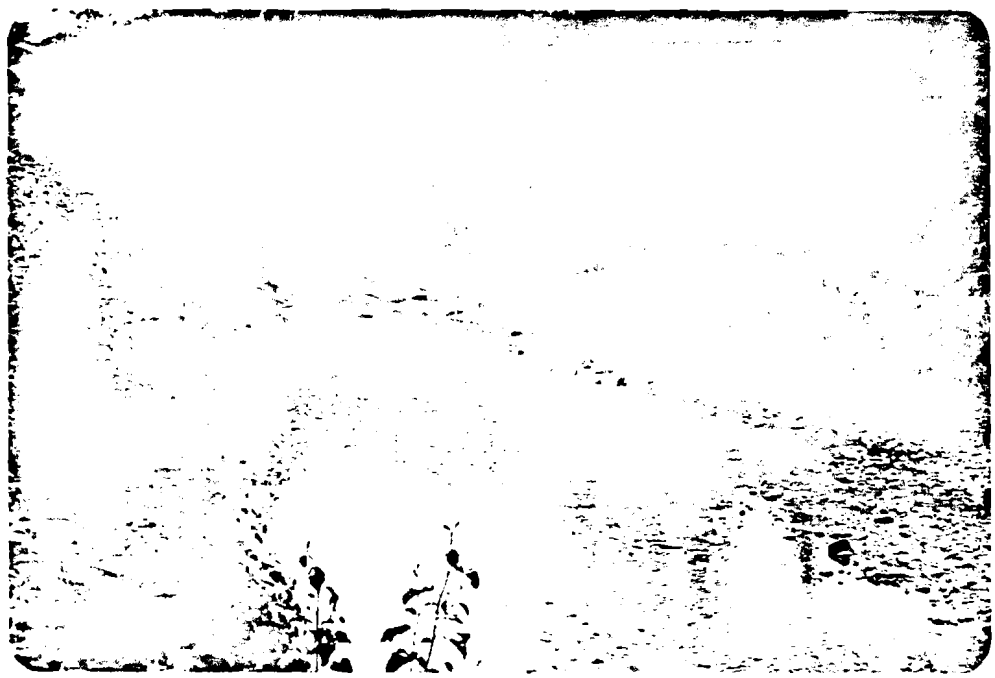


Plate 3.2.1 Back water channel utilized by coho for rearing near Station ____.

Overwintering areas are located in ponds or swamps as well as in low velocity areas consisting of debris piles, logs, root-wads and undercut banks. This type of habitat is found throughout the Coldwater.

Spawning

Coho spawn throughout the Coldwater River system, including well into the headwaters regions. There are no preferred spawning areas although some of the larger holding pools will contain concentrations of adult coho before spawning begins.

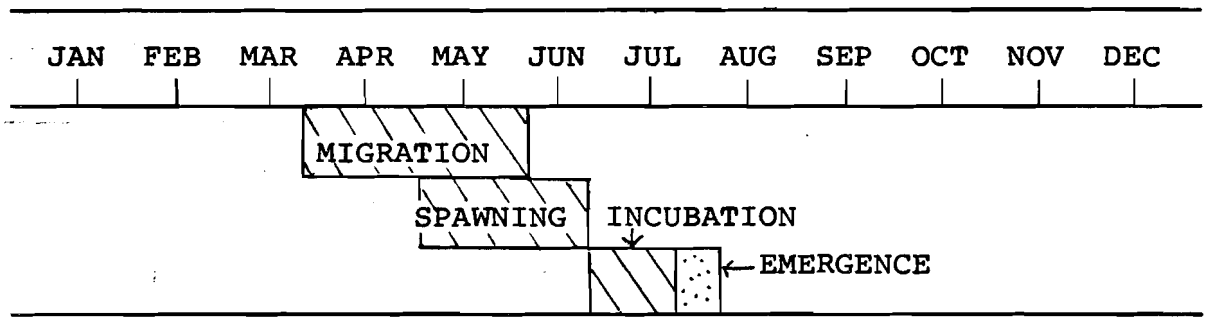
3.2.3 Steelhead Trout

The Coldwater is one of five known steelhead spawning streams in the Nicola system including Spius, Nuaitch, Shakan, Skuhun Creeks and, historically, Guichon Creek. The number of Thompson River steelhead spawning in the Coldwater has not been determined as it is impossible to count the spawning fish due to turbid water conditions. Calculations based on potential smolt yield estimates indicate that there could be an average of 200 spawners in the Coldwater System (Wightman, 1979). Alternate estimates based on escapement counts from the other steelhead streams in the region indicate that an excess of 100 spawning fish could easily be expected.

Timing

Steelhead enter the Coldwater over the period between April and early June. They probably spawn from early May to mid June, and the eggs remain in the gravel until mid to late July when the fry emerge.

Steelhead Timing



The eggs are in the gravel for a period of 2-3 months. The young fish then will remain in the stream for up to 3 years before smolting and migrating to the ocean. The period of time spent in the ocean is another 2 to 3 years, with the adult fish returning to spawn at an age of 5 to 6 years. Unlike salmon, steelhead do not die after they spawn but return to the ocean and can spawn several more times.

Steelhead Habitat Preferences

Young steelhead (both fry and parr) are found in areas of higher velocity than those preferred by chinook and coho. Coho and chinook juveniles usually prefer average velocities of .15 m/sec (Bovee, 1978). Steelhead juveniles

also prefer bouldery areas as well as the head ends of pools, undercut banks and debris jams are utilized when preferred habitats are not present. There is only a limited amount of steelhead habitat available on the Coldwater due to the small size of the bed material and the long sections of low gradient hence low velocity channel. Highest densities of steelhead fry are found downstream of the Kingsvale area. Above Brodie rainbow or steelhead fry are only found in very low densities, although historically the odd steelhead has been observed in this area.

Spawning

Specific steelhead spawning areas have not been located in the Coldwater River. However, the location of newly emerged fry provide an indicator of spawning concentration, on the basis of this data, most spawning appears to occur downstream of the Kingsvale area and definitely not above Brodie.

3.2.4 Dolly Varden Char

The life history and population structure of Dolly Varden Char is not well defined for the Coldwater system. Dolly Varden appear to spawn throughout August and September and the young fish hatch the following spring, probably during April. No attempt has yet been made to estimate the size of the spawning population, however, densities of 1 to 5 adult

fish have been observed in some pools in the Brodie area. The young char spend from one to three years in the Coldwater, however after that period little is known. The adults could remain in the Coldwater but most likely they move downstream into the Nicola, Thompson or perhaps even the Fraser. This is still speculation since migratory movements have not been documented.

Because of the similarity in timing and life history for Dolly Varden and salmon, protection of the Dolly Varden stocks is assured by the protection of the salmon stocks.

3.2.5 Mountain Whitefish

Mountain whitefish appear abundant but population structure and life history patterns have not been documented for Coldwater River. As with the salmon species and Dolly Varden, they spawn in the fall of the year and the eggs hatch in the spring.

Economically, they have no great value, and in this region they are not sought after as a sport fish. However, in some areas, such as in northern British Columbia, they are a popular sports species. It is thus likely that there, local importance will increase in the future.

3.3 River Dynamics and Fish Habitat

A river system is created by a combination of terrain and runoff characteristics to which fish and biota must adapt. As previously discussed in Section 2.4.1, the Coldwater River is an occasionally confined, irregularly meandering channel. Scour holes located where the river impinges upon the valley walls form holding habitat for adult and juvenile fish.

The high rates of channel migration provide the conditions for creation of most fish habitat in the Coldwater. For instance, undercut banks, providing cover for fish, are a direct result of channel migration. Bank vegetation deposited by erosion, form debris jams used for rearing and holding for all species. Meander cutoffs provide back water areas, frequently impounded by beaver dams, which are utilized as rearing areas by coho and some chinook salmon fry. Finally, channel migration is also responsible for the movement of bed materials which serves to wash out accumulated fine material making the gravel better suited for spawning.

Overbank flooding of low-lying areas is important as it ensures a supply of water and nutrients to wet land areas and aids in the movement of juvenile fish to and from these rearing sites.

Thus, the fisheries capabality of Coldwater River can be seen to be directly related to the dynamic nature of the system.

Hence, construction of dykes, rip-rap and bridge abutments results in permanent loss of habitat and of the opportunity for the natural creation of new habitat.

3.4 Factors Limiting Fish Production

At present a major factor limiting the size of spawning populations of steelhead and salmon is over expoitation by commercial, sport, and Indian fisheries. Until the science of catch management is refined this will continue to be the biggest concern. However, in the Nicola Valley there are also a variety of other man made impacts which are having considerable effect on fish numbers.

Irrigation is a major problem caused by water withdrawal reducing available rearing area, and by diverting and stranding fish in irrigation ditches.

Another significant factor is bank protection and channel modification to protect farmland, roads, and pipelines. In the upper Coldwater, protection of the pipelines has had a major impact on fish habitat. As indicated in Section 2.4.1, the pipeline companies have modified extensive sections of the Coldwater River to protect the buried pipe from river scour. A conservative estimate of damage indicates that at least 10% to 20% of available rearing habitat above Brodie was eliminated by pipeline construction.

Natural Factors

As for natural limiting factors the main one is the level and perhaps the length of the low discharge period. The water levels in the swamps and sidechannels (where a large

portion of the young salmon rear) is directly dependent on the water level of the main river. In a year when discharge is below average, then a large proportion of the swamps and channels dry up, stranding and eventually killing the fish. However, in an above average flow year a higher percentage of these channels remain wetted throughout the year, increasing the survival of young fish. Another concern is the quality of the spawning gravels. Much of the coarser bed material is embedded with fine gravels and sands, rendering it not suitable for spawning. This problem has been noted throughout the Nicola drainage and has been attributed to increased soil disturbance from logging, road, and pipeline construction, as well as to the limited bedload transport capacity of the river. In some areas of the Nicola fines have been removed from the gravel by actually ripping the riverbed with a catapiller tractor. In one case during the spawning period immediately following this treatment, fish were once again spawning in the treated area (Pers. Com. - S.J. MacDonald).

Water tempertures, see Figure 2.3.18, in the Coldwater are somewhat colder than those in the Nicola or other Thompson Plateau streams. The water temperature does not rise above 10^{o}C until early July, whereas in the Nicola water is above 10^{o}C by early June. This certainly limits the summer period of maximum fish growth and development.

Nutrient levels as reflected by dissolved solids, see Figure 2.4.3, are relatively high, and should actually be a positive factor promoting fish production. Suspended sediment concentrations, see Figures 2.4.7 to 2.4.10, are of concern during runoff in May and June, and during peak rainfall periods throughout the year. Recorded levels of 400 to 700 mg/liter during the peak runoff period could have some effect on egg and fry survival but on the whole levels are low enough to not have major impacts. However, surficial materials, see section 2.1.2, are of such a unstable nature that in many areas the potential exists for much greater and more damaging suspended sediment loading.

The other natural impact, probably compounded by road and logging development, is the accumulation of fine grain material in the bed of the main channel. This is in fact a major problem since it appears that the capability of the channel to move material is restricted, see section , resulting in a reduction in the quality and quantity of spawning gravel.

3.5 Management History and Present Objectives

In the past, management of salmon in the Coldwater was undertaken by regulation of the fishery at the mouth of the Fraser and by closures to sport fishing for salmon in the Nicola system. Steelhead have been managed in a somewhat similar way with restrictions on catch limits and reductions of fishing season. Generally these regulations have become more and more restrictive as stocks decreased and the number of anglers increased. Due to the Salmonid Enhancement Program, there has been a major increase in investigative work in the Nicola and Coldwater systems. The Fish and Wildlife Branch has been involved in a major steelhead program which is attempting to document movements and population structures throughout the Nicola system. Federal fisheries are also involved in similar projects, looking at coho and chinook salmon. Of perhaps greater significance is the Nicola Basin Planning Group, being coordinated by the Ministry of Environment's Planning Branch, which is attempting to initiate planning on a basin level. The Nicola Valley is to be the first test or example of this type of basin level planning.

The key to basin planning in the Nicola drainage, for the fisheries resource, is proper water management. This includes better predictive capability for yearly and seasonal water needs, more storage capability and much more efficient use of water for irrigation.