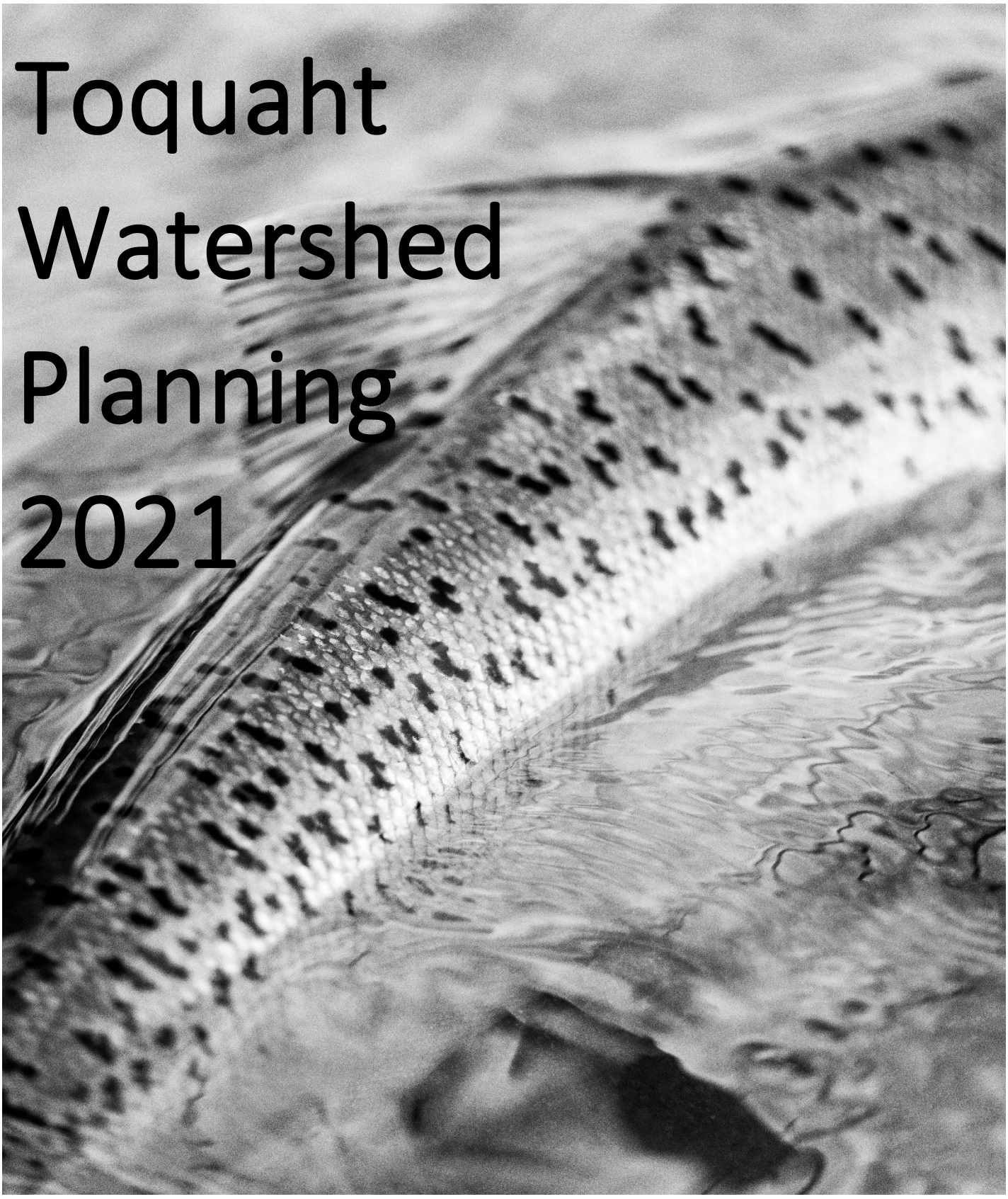
Toquaht Watershed Planning 2021



Contents

Background

The Toquaht river once supported healthy returns of coho, chum and Chinook salmon along with steelhead, rainbow trout, cutthroat trout and Dolly Varden and a unique population of summer Coho. The abundant fish populations have been a highly valuable food source for the Toquaht people since time immemorial.

Overview Methods

Existing Reports and Assessments

Title	Author	Date	Description
Spawning Gravel Placement in Sproat, Toquaht and Stewart Lake Outlets on Vancouver Island (2002), for Steelhead Habitat Enhancement	B.C. Conservation Foundation	March, 2003	A summary report of spawning gravel placements designed to increase Steelhead and Chinook spawning gravels
Toquaht River Fish Habitat Overview and Level 1 field assessment	Streamline	2005	A detailed overview and FHAP assessment of the Toquaht Watershed
Toquaht Watershed Assessment	Coulson/Chapman Geoscience	2001	Assessment of slope stability and forestry impacts
Toquaht Local Resource Use Planning Backgrounder	BC Ministry of Forests	1993	
A Reconnaissance Survey of Toquaht Lake	Ministry of Environment, Lands and Parks.	1990	
Toquaht Watershed Biophysical Stream Survey	DFO	1973	

Other Relevant Sources used in this document:

Dave Hurwitz- Thornton Creek Hatchery Manager and Toquaht River Escapement Survey Lead

Mike McCulloch-Anadromous Fisheries Specialist, Ministry of Forest Lands Natural Resources

David Johnson- Lands Manager, Toquaht Nation

Dennis Hetu- Lands Administrator, Toquaht Nation

Erica Blake- West Coast Community Advisor- SEP, DFO

Daryl Keeble- Lands and Resources- YG

Toquaht Watershed Overview

Watershed Description

The Toquaht River is a 4th order stream, located in northeastern Barkley Sound, on the west coast of Vancouver Island (10 327793, 5433916). The watershed is approximately 103km3 in area, draining from the Mackenzie mountains (1557m asl) south into the Pacific Ocean at Toquaht bay, north-eastern Barkley Sound (Ebell and Fleenor, 2005). The Toquaht river is ~22km in length with an average gradient of 4%, divided into upper and lower sections by Toquaht Lake. The lake is located ~8.7 km upstream from the estuary and is 118 ha in size (Duncan and Grant, 1990).

There are a total of 43 tributaries to the Toquaht River and lakes (Hatfield, 1997); the majority of these tributaries are high gradient, drainages in the upper watershed (Figure 1).
The most significant tributary is Little Toquaht River, which has a sub-basin area of 17 km2. Little Toquaht River joins the lower mainstem ~600 m upstream Toquaht estuary. Little Toquaht Lake is located 2.5 km up Little Toquaht River (Duncan and Grant, 1990), the lake is 59 ha in size and lies at the end of the mainstem and is fed by low gradient tributaries extending approximately 4 km upstream of Little Toquaht Lake (Figure 1)(Ebell and Fleenor, 2005).

The watershed lies withing the territory of the Toquaht Nation, and is fully managed by the Nation who is now the primary user after procuring the Forest License A19234 from Colsoun Forest Products in 2014 (ref)

Area	102km2
Land Cover	Coniferous Forest (81%); Snow,Ice &Exposed Land (11%); Herb Grassland & Shrub (5%)
Land Use	Forestry, water, fish, wildlife, domestic use plans and non-timber forest products, medicinal plants and migratory birds.
Land Title	Toquaht Nation; Provincial Crown Land
Significance to Toquaht Nation	The watershed has always beenimportant for harvest of fisheries, wildlife and plant resources for domestic use. The mouth of the river had been used as a village site.
Forestry Tenures	BC Timber Sales, Arrowsmith Timber Supply Area, W1903 In 2016 in the Toquaht Nation acquired 100% ownership of Fores Licence A19234
Fish Usage	Chinook, Chum, , Coho, Cutthroat Trout, Dolly Varden, Rainbow Trout,Sockeye, Steelhead,Coastrange Sculpin
Artificial Fish Enhancement	1929-1941: Sockeye egg implantation XXXX-XXXX hatchery Coho stocking (Thornton Creek)
Key Tributaries	Side (Paradise) Creek, Draw Creek
Pressure drivers	High total land disturbance High-risk road crossing density High-risk occurrence of roads near streams High-risk density of roads on steep slopes

	High-risk riparian disturbance
Existing Restoration	1939- Maggie fish ladder construction (rebuilt 1972), no recent maintenance
Unique Features	Fisheries & Oceans Canada (DFO) Salmon Conservation Units: Maggie Lake Sockeye; Southwest Vancouver Island Chinook; Southwest Vancouver Island Chum; West Vancouver Island Coho; West Vancouver Island River Sockeye BC Ministry of Environment Intrinsic Seasonal Flow: Summer Low Flow Sensitive BC Designated Water Resource Maggie River estuary is considered of importance class 2 for marine birds as rated within past Pacific Estuary Conservation Program (PECP) surveys (1 = highest relative value, 5 = lowest relative value) (Ryder et al. 2007)

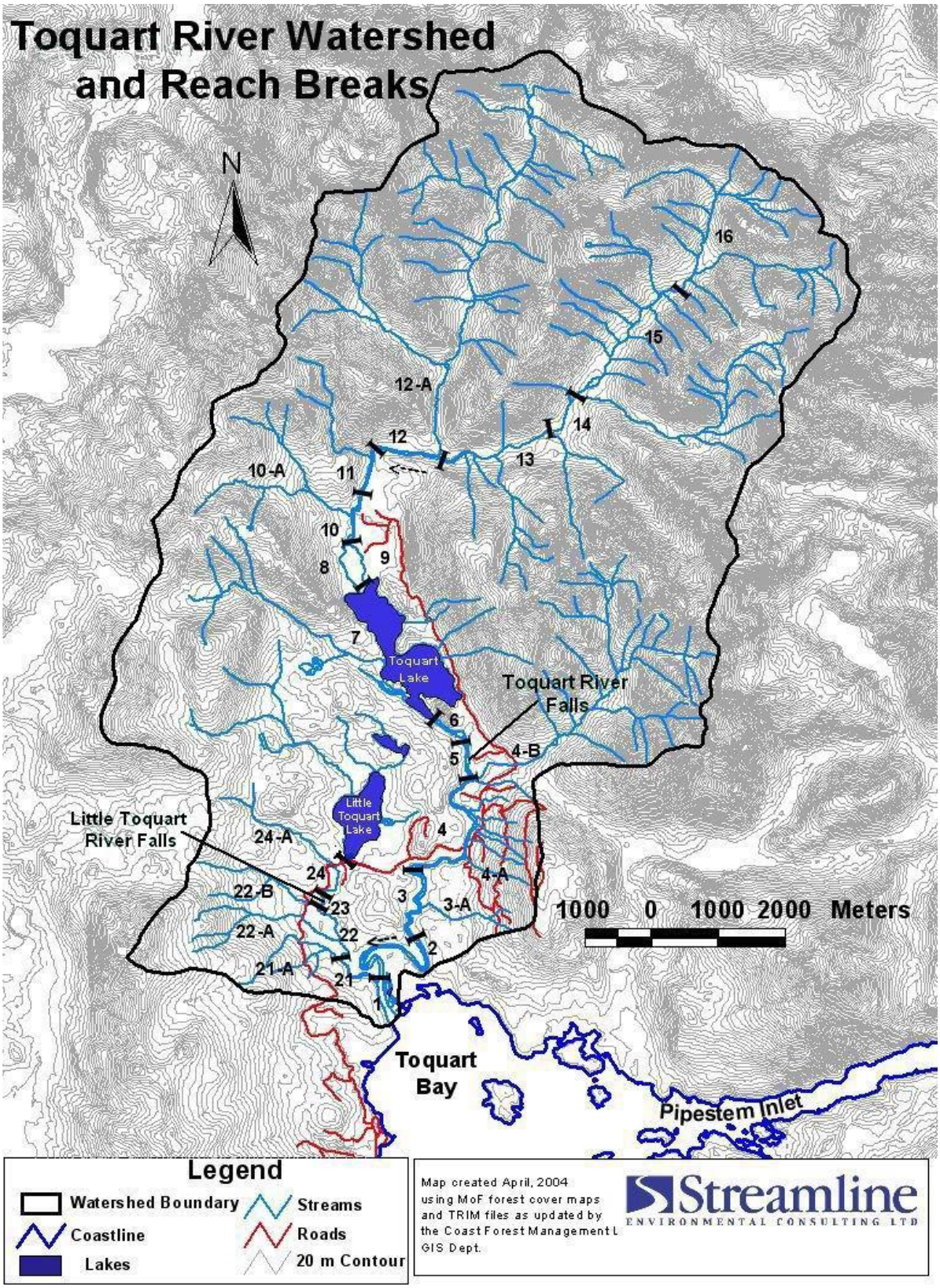


Figure 1: Toquaht Watershed Reach Map as created by Streamline Environmental in 2004

Geology and Slope Stability

The watershed is underlain mostly by fine-grained volcanics of the Karmutzen Group. The bedrock is irregular in character and this controls the surface shape of much of the watershed. Surface materials are dominated by glacial till along the lower and mid slopes, and locally derived colluvium on the steeper slopes. Fluvial deposits are limited to the narrow intermittent bands along the mainstem channel of the river. The largest area of fluvial sediments is the large floodplain located immediately upstream of Toquaht Lake. (Chapman 2001) The watershed contains substantial areas of unstable and potentially unstable terrain. Greater than 50% of the of the watershed has been mapped as terrain stability class *IV* or V. Very large portions of the watershed area upstream of Toquaht Lake are noted to be naturally unstable. (Chapman 2001)

Sediment Sources

Many natural and active slides are evident within the headwaters of the watershed. These events contribute to the natural sediment load within the system. The braided channel within Reach 15 and the dynamic alluvial reaches of 8, 9 and 10 are evidence of this ongoing process. The 2001 CWAP mapped and evaluated landslides and other sediment sources that have affected the watershed in recent, post-harvest times. A total of 27 sediment sources were noted; all of these were landslides. Of the 27 landslides, twelve (44%) are of natural rock fall and debris fall on steep slopes and fifteen (56%) are related by proximity to past forestry activity. Of the forestry-related sediment sources, three are channeled debris flows; three are debris slides in logged blocks; six are debris slides associated with logging roads, and one is an area of active bed scour in Tributary 4-B (Chapman, 2001).

Forestry related slides are mostly concentrated within tributaries of Reach 4 of the lower river and tributaries of Reach 12 of the upper river. In the lower river slides appear to have contributed some course sediment into the mainstem anadromous waters. There appears to be no effects on channel morphology in the lower river as the sediment input is naturally low due to the lake headwater. In fact, gravel inputs from the torrented channel Tributary 4-B are currently providing a valued chinook salmon spawning site in the mainstem channel (Richard Smith Pers. Comm.). Within the upper river, debris slides are road related and small. These slides do not appear to have contributed significant amounts of sediment to the mainstem. The roads associated with *Toquaht River Overview / L1* Streamline Environmental Consulting File 2094 17 most of these slides have been deactivated over the past decade through extensive pullback and slope reconstruction. All forestry-related landslides occurred prior to implementation of the Forest Practices Code (FPC). No landslides associated with post – FPC forestry activity were noted in the CWAP (Chapman, 2001).

Logging

Equivalent Clearcut Area

Chapman (2001) concluded that forest regeneration on logged areas in the watershed is generally good. As a result, the Equivalent Clearcut Area (ECA) of the watershed was 10% of the total watershed area. ECA levels within the sub-basins range from a low of 0% for the Upper West sub-basin to a high of 15% for the Little Toquaht River. (Chapman, 2001). Recent harvesting since the 2001 CWAP has been limited to 221.6 ha all of which were small blocks within the Little Toquaht system that will have minimal impact to the ECA scenario outlined by Chapman.

Road Density

The 2001 CWAP identified a total of 80 km of forest road constructed in the Toquaht River watershed. Of this road, 17 km have been permanently deactivated, leaving 63km of active road in the watershed. The current road density is approximately 0.6 km/km$_2$ and is considered low (Chapman, 2001). Many of the older roads that were determined to be terrain stability concerns have
been deactivated over the past decade with extensive fill-slope pullback works. Chapman (2001) notes that the deactivation was aggressive and will likely be successful in mitigating erosion concerns.

Riparian Logging

Riparian logging has occurred along 4800 m of the Toquaht River mainstem channel. This accounts for 36% of the channel length (Chapman, 2001). In all cases logging has occurred along only one bank. In many cases a “picket fence” of trees was maintained along the logged bank.

Fisheries Values

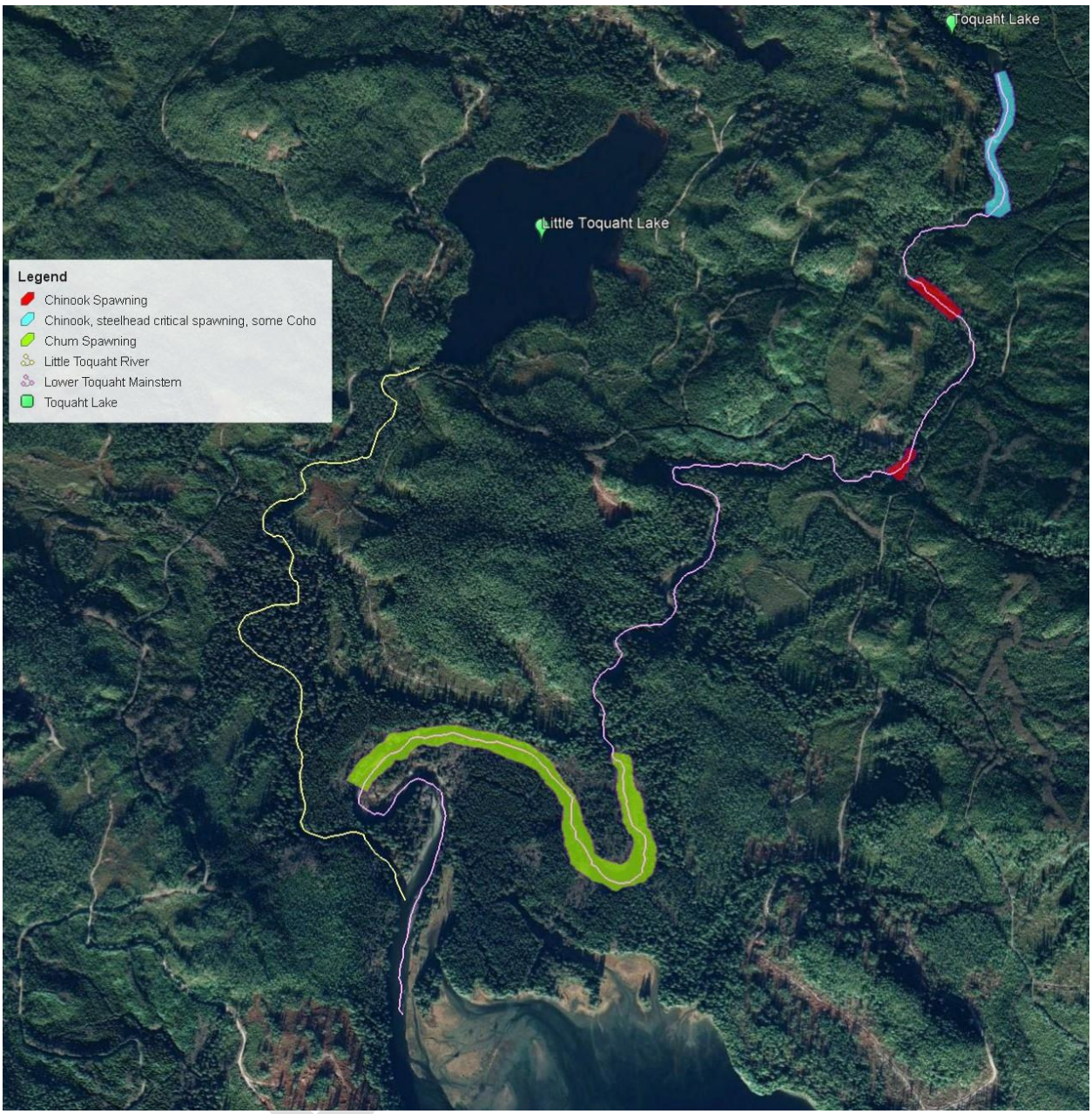


Figure 2: Known spawning locations in the lower Toquaht River

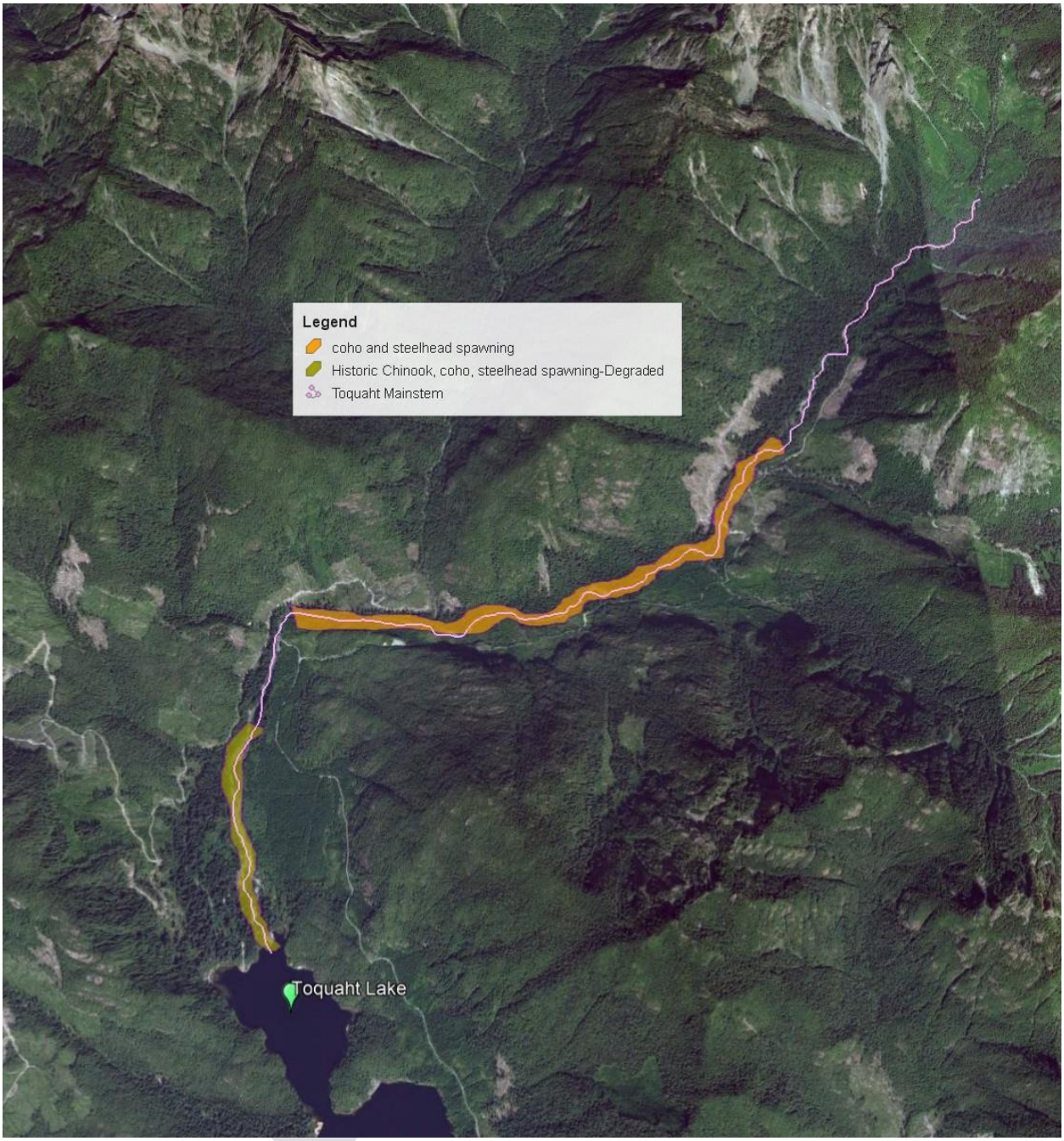


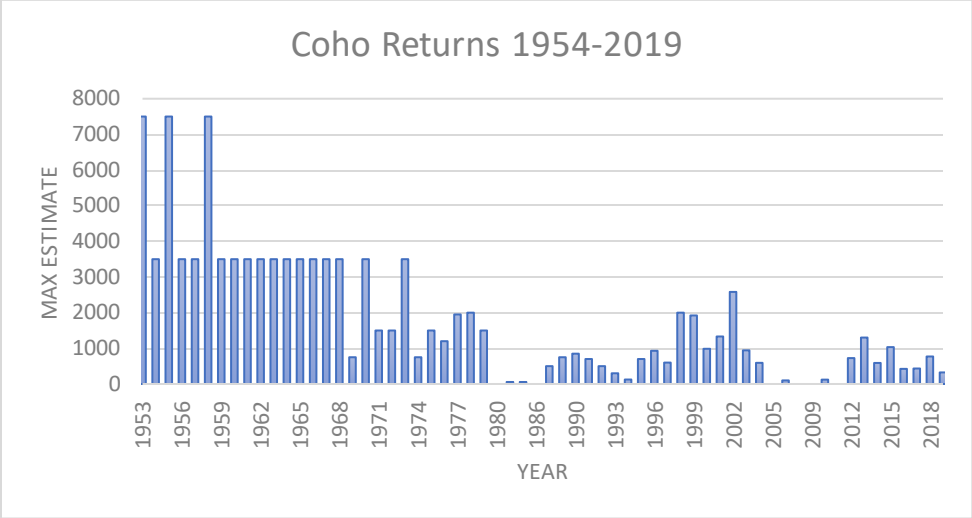
Figure 3: Known spawning locations in upper Toquaht River

Escapement

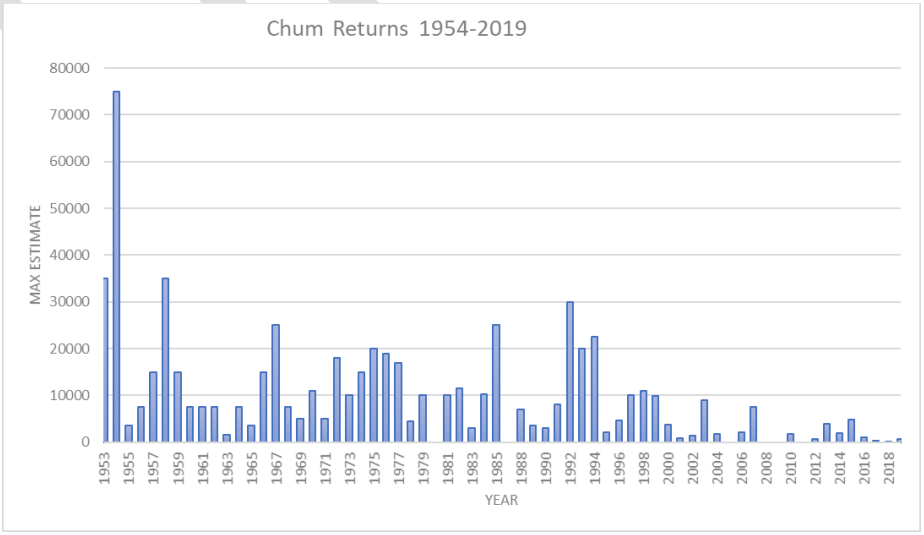
Toquaht is a highly valued salmon producing system. From 1954-59, the river was one of ten streams in southern BC with the largest escapement of Coho and Chum (Walters & Cahoon 1985). General declines in Toquaht fish production are reported by Ebell and Fleenor (2005), who also indicate that Coho populations may have declined much more than what was portrayed in Fisheries & Oceans Canada (DFO) escapement records. Increased fishing pressure and logging in certain areas of the Toquaht watershed are thought to have contributed to the decline (Ebell & Fleenor 2005).

Salmon escapement in the Toquaht River has been carried out by DFO since the 1950's however counts were based on stream bank observations in limited locations due to the difficult access to much of the river. In the mid-1990's thorough snorkel surveys began in the watershed providing a much more accurate count of returning salmon populations.

Coho

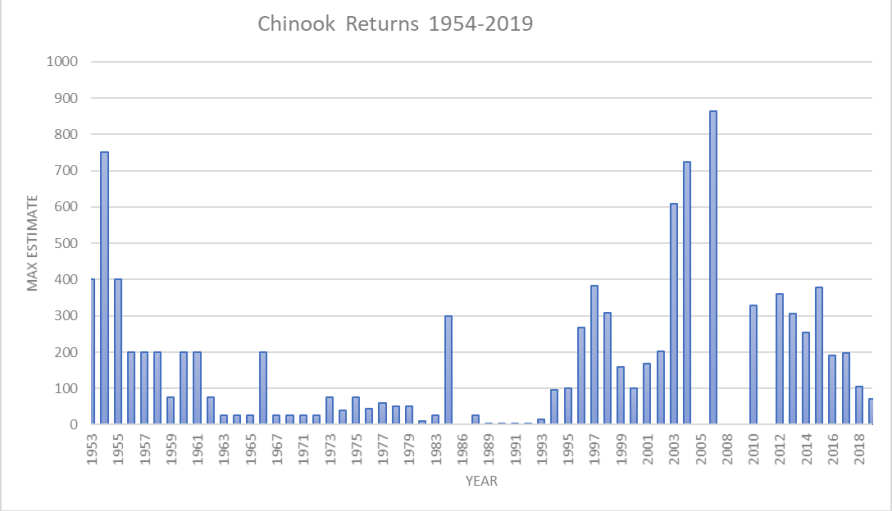


The escapement records suggest that the substantial coho population remained stable for two decades after counts began. The period between 1988 – 1997 saw a collapse in choh numbers; from 3-7000 yearly to a mean of 595 during this period. The numbers suggest a slight rebound since 1998 as returns have varied from 930 – 2,400 fish annually. Coho have been observed to favor the mainstem and tributary habitat upstream of Toquaht Lake for spawning. These areas also offer valuable rearing habitat, as does Toquaht Lake (Ebell and Fleenor, 2005).



The most abundant salmon species in Toquaht appears to be chum salmon with peak densities of 35,000 recorded in the 1950s. Chum salmon have commonly achieved densities of 7,500 – 20,000 in the Toquaht River, however escapement numbers appear to have declined over the past decade with observations ranging from 1,000 to 10,000 fish in this period. Average chum escapement over the past decade is 8,634 fish. Chum production is limited primarily to Reach 2 in the Toquaht River mainstem and Reaches 21 and 22 in Little Toquaht River. Chum salmon habitat has been buffered from watershed impacts by the stable non-alluvial channel character within the lower river as well as the stabilizing effects of the lake headwaters. The advantages of this habitat stability are reflected in stable and relatively robust chum escapement in both the Toquaht River and in Little Toquaht Creek. Recent declines in the past decade are likely the result of poor ocean survival rates observed in most pacific salmon stocks throughout the coast. (Ebell and Fleenor, 2005)

Chinook



A moderate run of Chinook salmon populates the Toquaht River. Again, historic enumeration efforts likely missed the majority of the chinook escapement in the river as their preferred spawning habitat is known to lie within bedrock constricted reaches 4 and 5, which are difficult to access without snorkeling. Trends in population densities suggested by the DFO records show that peak numbers of 400 fish in the 1950s dwindled to residual densities of 25 fish by the early 1960s. These numbers remained very low throughout the 1960s. A very small increase in numbers is reported in the 1970s before plummeting to near-extinction levels in the 1980s until 1994 when the first results of the stock enhancement program begin to emerge. From this year forward, densities rebound to between 95 and 463 chinook recorded annually through to 2003. (Ebell and Fleenor, 2005)

There have also been returns of both sockeye and pink salmon at very low and variable numbers. Pink salmon densities were estimated at numbers of up to 200 fish in the 1950s. Few pink salmon were noted during the 1960 through to the mid-1990s at which point more diligent snorkel surveys started recording low numbers of adult fish.

Records of sockeye salmon densities are provided since 1989. These numbers are very low and variable ranging from 2 to 100 fish. Sockeye are primarily observed within the lower river however the occasional adult has been seen in the lake and upper river (Richard Smith, Pers. Comm.) (Ebell and Fleenor, 2005)

Steelhead

Both summer and winter runs of steelhead are found in the Toquaht River; only winter runs of steelhead inhabit the Little Toquaht River system. Within the Toquaht River mainstem, steelhead have been observed to access the river to 9.2 km upstream of Toquaht Lake to the top of Reach 15 (MOF, 1996). Steelhead use Little Toquaht River, and (possibly) Little Toquaht Lake, the major tributaries to the northwest of Little Toquaht Lake and two western tributaries to Little Toquaht River BC (Ministry of Forests, 1996). Both summer and winter runs of steelhead are found in the Toquaht River; only winter runs of steelhead inhabit the Little Toquaht River system. Within the Toquaht River mainstem, steelhead have been observed to access the river to 9.2 km upstream of Toquaht Lake to the top of Reach 15 (MOF, 1996). Steelhead use Little Toquaht River, and (possibly) Little Toquaht Lake, the major tributaries to the northwest of Little Toquaht Lake and two western tributaries to Little Toquaht River BC (Ministry of Forests, 1996).
(Ebell and Fleenor, 2005)

Poaching

The relatively small populations size of fish in the Toquaht River makes these populations highly susceptible to the impacts of illegal harvest and/or fishing techniques, particularly in steelhead and chinook, whose populations are lowest and while being highly prized food/game fish.

Anecdotal reports of steelhead poaching in the Toquaht River have been recorded since the access road to the upper river was built in the late 1980's (Dave Hurwitz, TCSES Manager, perrs comms, June 21th, 2021). Poaching reports peaked in the early 2000's and provincial conservation officers responded with increased enforcement efforts and successfully caught both poachers using illegal fishing equipment, as well as evidence of steelhead harvest (Mike McCulloch, pers comms, June 24th 2021).

Anecdotal stories do persist about poaching of steelhead and Chinook do persist and should be monitored as current populations are at critical low numbers, even small amounts of poaching can have substantial impacts on fish populations.

Anecdotal stories of ungulate and black bear poaching in the Toquaht Watershed also persist and should be followed up on (Daryl Keeble, Pers comms,)

Hatchery Enhancement

The Toquaht River Chinook enhancement program began in 1988 with a release of ~10,000 hatchery-reared Chinook salmon bred from wild Toquaht Chinook salmon stock. In 1990, over 350,000 Chinook salmon fry were transplanted from the Nitinat hatchery brood stock into the Toquaht River. The transplant program continued until 2002, transplanting over 3.69 million Chinook salmon fry into the Toquaht River. During the transplant period, Toquaht origin Chinook salmon were also being collected

for brood stock and 777,592 fry from Toquaht collected brood stock were also released (Dave Hurwitz, TCSES Manager, perrs comms, Dec 15th, 2020).

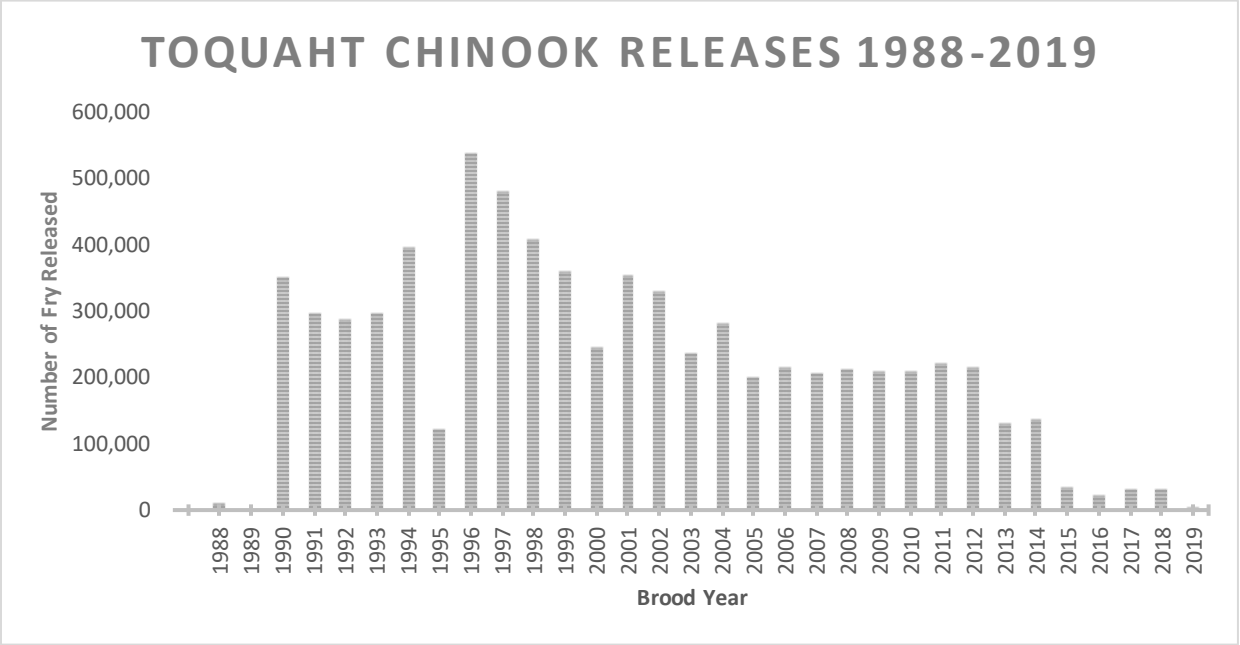


Figure 4: Number of Chinook salmon fry released into the Toquaht River since the transplant and enhancement program began in 1988. NItnat hatchery transplanted program stopped in 2002, after which all brood stock was collected from the Toquaht river returns

Post-2002 all brood stock was collected exclusively from Chinook salmon returning to the Toquaht River. In the 32 years that Thornton Creek Enhancement Society has been artificially enhancing the Toquaht Chinook salmon stock, over 7 million hatchery-reared fry have been released into the Toquaht River (Dave Hurwitz, TCSES Manager, Pers comms, Dec 15th, 2020). Despite the high level of input, current adult returns remain a 4-year average of 110 returning adults and 8-year average of 170 (**Error! Reference source not found.**) (DFO, 2020).

After ending the net-penning, fry were hatchery-reared to 5-7 grams at which point they were released into Toquaht Lake and, later on, released at a mid-river bridge 6.5km from tidewaters. Currently, both lake and bridge release sites are used, however, quantities of released fry have decreased significantly (Dave Hurwitz, TCSES Manager, perrs comms, Dec 15th, 2020).

Changes in hatchery management and DFO direction at TCES in recent years have shifted interest in release strategies away from bulk releases and towards producing smaller quantities of higher quality fish (Dave Hurwitz, TCSES Manager, perrs comms, Dec 15th, 2020).

Habitat Conditions

As described by

"The non-alluvial, bedrock-controlled character of much of the mainstem channel yields a high degree of habitat stability. Spawning gravels appear to be somewhat limited throughout many of the mainstem

reaches, particularly within the mainstem reaches downstream of the lake. Chapman (2001) noted that the mainstem channel below the lake is sediment "starved". Hatfield (1996) notes that the lower river is boulder and cobble dominated with smaller patches of gravel that provide some spawning habitat. As well, the lower river is noted in Erickson (1972) as being primarily a holding area with some spawning and rearing potential. Alluvial deposits of gravels and fines are noted in Reaches 1 and 2, close to the river mouth (Hatfield 1996).

Although much of the upper river is also classified as non-alluvial, intermittent sections of alluvial bar deposits exist within the channel (Chapman, 2001). The only alluvial reaches that are found within the watershed are Reaches 8, 9 and 10 immediately upstream of Toquaht Lake. These reaches offer abundant spawning gravel. Little Toquaht Creek provides good gravels and stable spawning opportunities within Reaches 21 and 23 (Hatfield, 1996). Short lengths of alluvial channels exist within the smaller unnamed tributaries throughout the system. Boulders are a dominant substrate component throughout much of the mainstem channel length. These boulders provide some stable mainstem rearing habitat for salmonids. As well, the extensive littoral zone in Toquaht Lake is densely complexed with woody debris and consequently provides highly productive rearing habitat. The upper river (Reaches 8-10) are noted as providing the good rearing habitat due to the lower gradient, less confined channel characteristics and the numerous tributaries and side channels in the area (Erickson, 1972; Hudson, 1994; Hatfield, 1997 and Chapman, 2001). It should be noted that a number of field reports suggest that stream nutrient productivity downstream of the lake is likely to be higher than that of the cool, clear waters inflowing from the upper river.

The presence of large woody debris is rarely mentioned in the studies and records reviewed. An aerial over flight of the Toquaht mainstem in May 2004 noted little LWD present within both the lower and upper river. The constricted non-alluvial nature of the channels likely limits the ability of LWD to remain anchored and functional within the lower river. Some sites of log jams are noted within the tributaries and Little Toquaht Creek.

Side channel habitat for juvenile rearing and high-water refuge are limited to Reaches 2 in the lower river, Reaches 8, 9 and 10 in the upper river, and within Reach 21 and 22 of Little Toquaht River (Hatfield, 1997). Reaches 8, 9 and 10 immediately upstream of the lake were particularly noted for their valuable side channel habitat by Erickson (1974) and the BC Forest Service (1974). An additional assessment of the upper river side channel area for DFO in 2001 noted historic off-channel areas have become infilled and remain dry in all but high-water events and therefore offer little rearing opportunity (Ebell, 2001). Holding habitat for adult salmon is noted to be abundant within the system due to the prevalence of deep canyon pools, boulder substrate, and lake habitat. While adult passage is widespread throughout the Toquaht River, it should be noted that the two small falls 2 m and 2.7 m in height in Reach 5 may cause some migration injuries and adult mortalities to coho and chinook during lower flow, warmer water summer months".

Habitat Restoration efforts

Gravel Placements

The only documented habitat enhancement work on the Toquaht River occurred in 2002, where the BC conservation foundation, funded by the Habitat Conservation trust placed spawning gravels at the lake outlet, with the goal of increasing spawning habitat for steelhead and Chinook (BCCF, 2003). This report incorrectly noted that Chinook and fall coho cannot access the lake outlet and upper reach of the lower

river. Snorkel surveys have confirmed that in fact this area is some of the most heavily utilized Chinook spawning in the entire river.

As of 2020 observations in appears much of this gravel has since washed downstream, given the limited availability of spawning gravel in the lower river, and the high value of this reach for spawning, replacing this gravel should be a priority.

Future of the Toquaht River-Watershed Planning

Watershed Conditions

Fisheries Restoration Opportunities

Lower River Gravel Replenishment

Chapman (2001) noted that the mainstem channel below the lake is sediment "starved", despite of this most of the Chinook spawning occurs in the upper reaches of the lower river (fig x). The 2002 gravel placements by BCCF helped boost the availability of spawning gravel in these critical reaches, but much of that gravel has been washed away. Replenishing this gravel would provide a straightforward habitat enhancement option to ensure sufficient gravel supply for future spawning fish.

Original gravel placement was done using a heavy-lift helicopter equipment with a gravel bucket moving gravel from stockpile at the boat launch. Gravel placements should focus on the lake outlet and the tail-out of "lake pool". Using a helicopter for placements allows for precision placements, but is costly. Boat-based placements may be an option for the lake outlet, and an excavator could potentially access the outlet of lake pool to provide a lower cost option.

Figure 5: Gravel Placement Map

Upper River Side Channel

The canyon confined nature of much of the Toquaht River have largely buffered habitat conditions for the impacts of logging and road building in the watershed. The alluvial reaches of the upper watershed, reaches 8, 9 and 10 immediately upstream of Toquaht Lake (fig 4), extensive harvest in the floodplain surrounding these reaches as well as upslope instability have resulted in extensive braiding, sedimentation, bank erosion, and sub-surface flows (fig 5). This was traditionally high-quality spawning and rearing habitat for coho, Chinook and steelhead, which has now been heavily degraded.

Figure 6: Logging impacts in the upper river

A side channel in this location could provide high quality spawning and rearing habitat sheltered from the impacts of the mainstem. This channel was originally proposed by Ebell and Fleenor in 2005:

> "The construction of the upper Toquart River side channel in the alluvial flats to the east of Reaches 9, 10 and 11 offers a significant opportunity to boost salmonid production. This channel would help restore historic off-channel habitat that existed on the site prior to forest logging and that was noted to be of high fisheries value and an important feature to preserve (British Columbia Ministry of Forests, 1974). A stable, well complex side channel would help compensate for impacts in the unstable mainstem Reaches 10 and 11 by:
> a) creating large areas of stable spawning and rearing habitat;
> b) providing high water refuge, a habitat type that is limited throughout much of the Toquart system; and
> c) offering the opportunity to construct a bypass to Little Toquart Lake around the subsurface flows that have been known to occur in Reach 10" (Ebell and Fleenor, 2005).

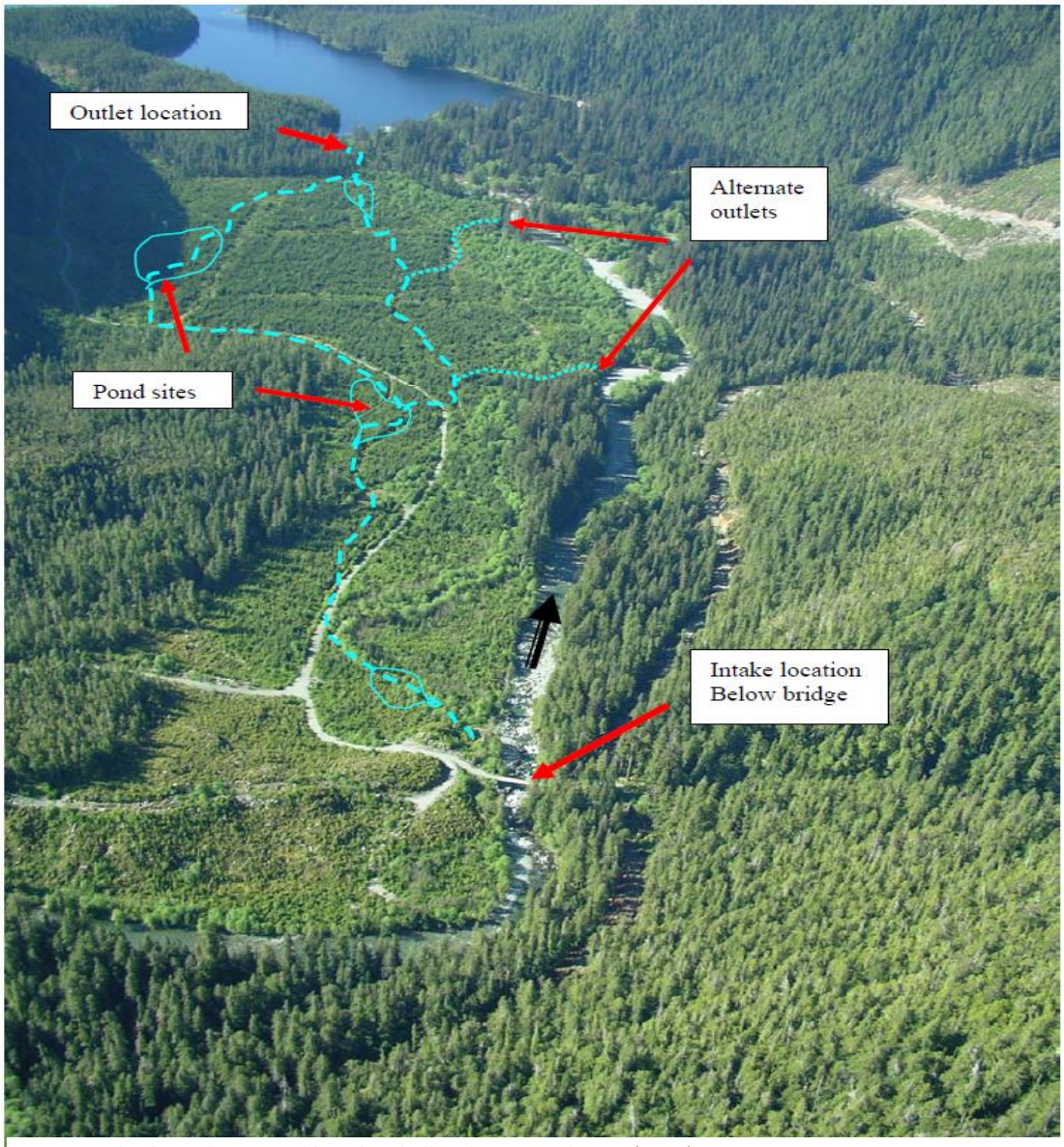


Figure 7: Side channel Proposed by John Ebell and Warren Fleenor (2005).

The feasibility of this project will need to be explored further before works could begin. Ground truthing the proposed routes and installing test pits to monitor water quality and availability should be the next steps.

Riparian Treatments

In conjunction with in-stream restoration efforts the upper river

Salmon Enhancement

Assessments

- Terrain Stability and road condition assessment
    - Understand current slope stability conditions and develop restoration and/or deactivation prescriptions
- Updated habitat conditions assessment in upper river
    - Purpose: Evaluate changes in the alluvial reaches of the upper river and explore restoration opportunities.
- Upper river side channel test pitting and feasibility study
    - Purpose: Follow up on the upper river side channel project proposed by Ebell and Fleenor. Including ground truthing the route and installing test pits.
- Historic Air photo analysis of changes in the upper river
    - Purpose: Evaluate how the upper river has changed thought time in response to logging.
- Summer Coho Enumeration
    - Purpose: June and July snorkel surveys to assess escapement of summer coho and begin to understand the population dynamics of this unique run
- Steelhead Enumeration
    - Purpose: spring and fall snorkel surveys to increase understanding of Toquaht Steelhead populations.

Resource Extraction

- Silviculture Treatments
- Updated Harvest Practices
- Future Harvest Plans for the Toquaht Watershed

Hatchery Enhancement

- Updated Enhancement Practices
    - Work with DFO and Thornton creek to establish how salmon enhancement is carried out in the Toquaht River and ensure goals and practices align with those of the Toquaht Nation.
    - Establish conservation targets, and acceptable PNI

Poaching Mitigations

- Guardians
- Cameras
- Education (Salmon Beach)

Recreation

- Boat launch
- Camping
- Guide/outfitter