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Data Summary for Sockeye Salmon Spawning in the Canadian Portion of the Stikine River Basin (data through 2020)

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October 2024

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Data Summary for Sockeye Salmon Spawning in the Canadian Portion of the Stikine River Basin (data through 2020)

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ABSTRACT

Available run reconstruction data for sockeye salmon spawning in the Canadian portion of the Stikine River basin were compiled and verified through a bilateral Canada-U.S. technical process as part of an escapement goal review required for implementing Chapter 1 of the Pacific Salmon Treaty. Estimates of annual spawner abundance, harvest by fishery type and area, and age composition were developed for wild Tahltan-origin fish, enhanced Tahltan-origin fish, and Stikine Mainstem spawners. Spawner-recruit estimates were then generated for two stocks: (1) *Tahltan – Natural*, which links natural-origin (i.e., without hatchery marks) adult recruits to the total number of fish spawning naturally (i.e., sum of natural-origin spawners and enhanced-origin spawners). (2) *Mainstem*, which includes all spawners and returns not identified as Tahltan-origin fish. Spawner-recruit estimates are available for Tahltan – Natural since 1959 and for Mainstem since 1979.

ACKNOWLEDGEMENTS

The Stikine River Sockeye Salmon Working Group members were an integral part of the assimilation of historical data and the stock assessment review throughout the escapement goal process. The working group consisted of:

- Jody Mackenzie-Grieve – Fisheries and Oceans Canada (DFO) (Co-chair) - Senior Aquatic Science Biologist & Transboundary Technical Committee (TTC) member
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- Ed Jones – ADF&G – Fish & Game Coordinator & TTC co-chair
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1 INTRODUCTION

1.1 Escapement Goal Review (EGR) of Stikine River Sockeye Salmon: Tahltan and Mainstem stocks

In 2020, pursuant to Chapter 1 (1)(a) of the Pacific Salmon Treaty (PST), and consistent with the recommendations of the Transboundary Panel Strategic Plan, the Pacific Salmon Commission (PSC) Transboundary Panel directed the Transboundary Technical Committee (TTC) to complete a review of current spawning objectives for Tahltan Lake and Stikine River Mainstem sockeye salmon stocks. As an initial step of this bilateral project, the TTC established a Stikine Sockeye Working Group to direct and complete the spawning objectives review. Members included Department of Fisheries and Oceans Canada (DFO) staff, Alaska Department of Fish and Game staff (ADF&G), Tahltan Central Government (TCG) staff, as well an external consultant. The purpose of the working group was to gather and share relevant data, gather and prepare supporting documents, develop and conduct bilaterally agreed upon analysis, and develop science-based recommendations on maximum sustainable yield (MSY) spawning objectives and MSY-based ranges for both stocks. The recommended spawning objectives and MSY-based ranges were presented to members of the Transboundary Panel for their consideration (Miller et al., *in prep*).

1.2 Purpose of This Report

Early in the project, the Stikine Sockeye Working Group (WG) identified the need for agreed-upon, reproducible data set for the escapement goal review. The WG undertook an in-depth data review with two main components: (1) a detailed review of the source data and how they were collected, (2) migration of key steps in the data processing workflow from Excel to R, with version control on GitLab.

This report describes DFO's approach to Stikine River sockeye salmon stock assessment over the duration of the program by providing an overview of stock assessment projects, data collection, data review, analysis, and use in the Escapement Goal Review (EGR) process. The report is not required to undergo external review and is intended to support the Escapement Goal Review document by providing more detailed documentation for the data used in the EGR and establish a publicly available record of Canadian program changes over time.

Although data collected in the U.S. Stikine River sockeye salmon stock assessment program (through ADF&G) is a critical component of Stikine River sockeye salmon monitoring and assessment, it is not discussed here as the report focusses on the review, verification, and application of Canadian-origin data. We do, however, describe how U.S. stock assessment data are incorporated in the run reconstruction and brood table calculations.

2 METHODS

2.1 Stikine Sockeye Salmon

2.1.1 Stikine River watershed

The Stikine River is the largest of the northern transboundary rivers which drain from Canada through Southeast Alaska to the Pacific Ocean. It originates in the Stikine Plateau and Skeena and Cassiar Mountain ranges of northwestern British Columbia and drains an area of approximately 52,000 km^2. It flows in a southwesterly direction for approximately 640 km to the Pacific Ocean, terminating about 20 km north of the town of Wrangell, Alaska. Roughly 98% of the drainage area is in Canada (Wood and Johnson, 1990).

The Stikine River and its tributaries are major producers of transboundary Chinook (*Oncorhynchus tshawytscha*), sockeye (*Oncorhynchus nerka*), and coho (*Oncorhynchus kisutch*) salmon, and steelhead (*Oncorhynchus mykiss*). Due to numerous hydraulic velocity barriers, such as the 'Grand Canyon' of the Stikine located upstream of Telegraph Creek, and Forrest Kerr Canyon on the Iskut River (the largest tributary of the Stikine), salmon access is limited to approximately one quarter of the drainage basin (Wood and Johnson, 1990) and consequently several of the headwater lakes and tributaries do not currently produce salmon. Tahltan Lake, however, supports the largest single population of sockeye salmon in the Stikine River watershed (Wood et al., 1993).

There are 2 main fishing areas in the Canadian portion of the Stikine River including the lower river commercial fishery (upper and lower zones) just upstream of the Canada-U.S. border, and the upper river commercial and FSC fishery (includes First Nation fishery) between the Chutine River confluence and the Tahltan River confluence (Figure 1).

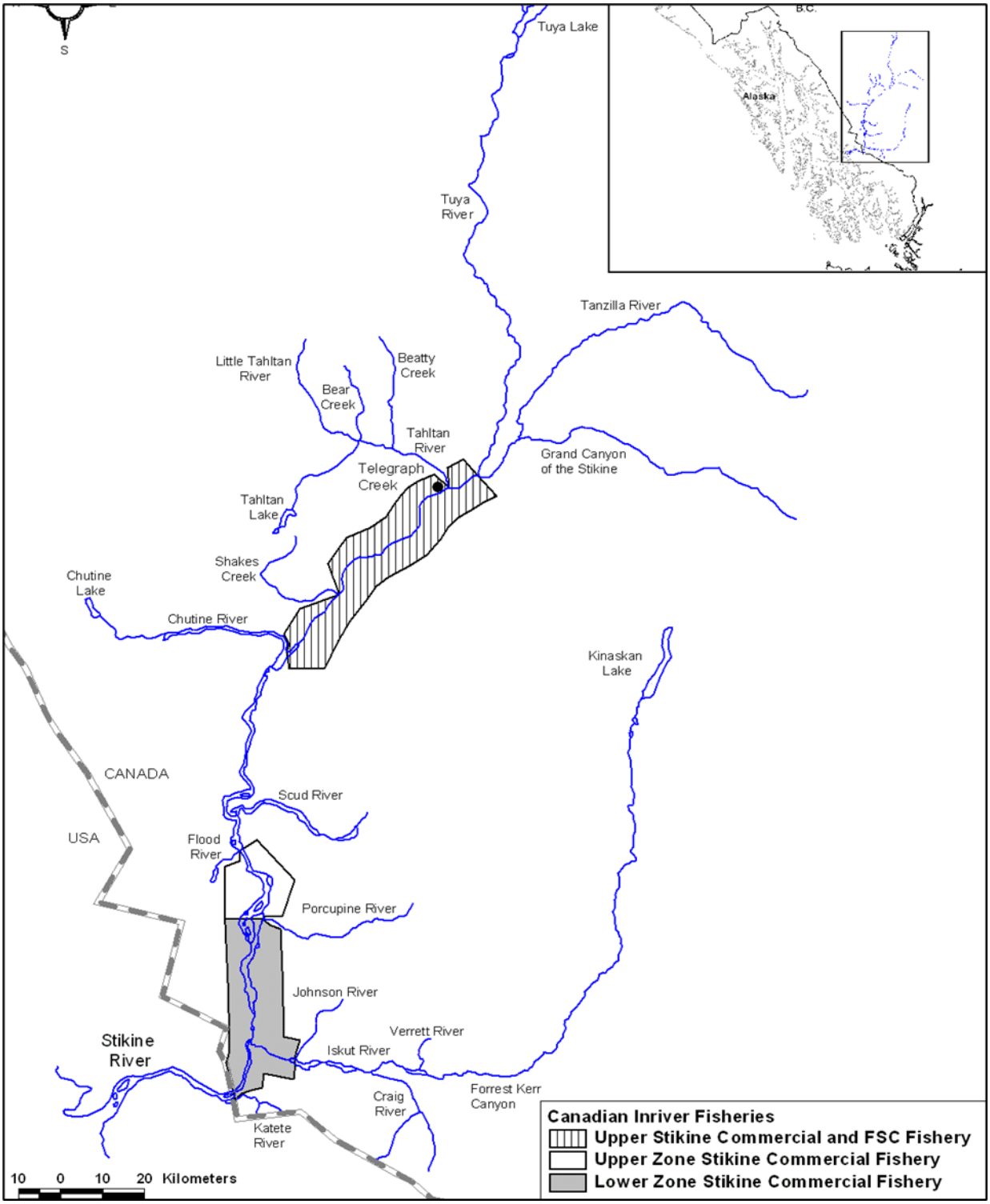

Figure 1. The Stikine River and Canadian fishing areas. Map shows the Upper Commercial and Food, Social, and Ceremonial (FSC) fishing zone, and the Upper and Lower zones of the Stikine Commercial Fishery in the lower river. The Lower Zone is the core Canadian Commercial fishing zone which has been expanded to include the Upper Zone in past years of abundant sockeye salmon returns.

2.1.2 Stikine River Sockeye Salmon Stocks

For management purposes, sockeye salmon stocks in the Stikine River are allocated to either the Tahltan stock or the Mainstem (non-Tahltan) stock which includes all other stocks. This stock structure has been maintained despite past investigations of stock identification using a variety of methods (otoliths/scales, various parasites, electrophoresis (Wood et al., 1987), genetics (TTC, 2022a) or egg diameter (Craig, 1985; TTC, 2022a).

Tahltan sockeye salmon are lake spawners and spawn only in Tahltan Lake. Tahltan sockeye salmon display identifiable differences in scale patterns, egg diameter (Craig, 1985; TTC, 2021), genetic characteristics (refer to TTC, 2021 for further discussion), and prevalence of the brain parasite *Myxobolus neurobius* (Wood et al., 1987) when compared to mainstem sockeye salmon. Tahltan sockeye salmon generally return earlier (between statistical week (SW) 26 and 29 in the Canadian portion of the lower river) than mainstem sockeye salmon. In the lower river, Tahltan fish have small eggs < 37 mm (10 eggs lined up in a row and measured; Craig, 1985; TTC, 2021) and this has been the primary method of stock identification to date. U.S. harvest samples utilize scale pattern analysis (SPA) (1982-2011) and genetic analysis (2012-present) to identify Tahltan stock. Tahltan sockeye salmon escapement is assessed by means of a weir at the mouth of Tahltan Lake. Previous assessment of the Tahltan stock suggests that it is spawning habitat limited rather than rearing habitat limited (Wood et al., 1993). The majority of smolts emigrate from Tahltan Lake as 1.0 (1+) aged fish. The majority of Tahltan sockeye salmon return as 1.3 (5 year olds) and 1.2 (4 year olds) aged fish. About 70% are age 5. In the past 10-yrs the average of contribution of age 4 has increased from about 15% to about 30%.

Mainstem (non-Tahltan) sockeye salmon are a stock aggregate that includes all sockeye salmon that spawn in areas of the Stikine watershed other than Tahltan Lake, including several major tributaries to the Stikine (e.g., Scud, Verrett, Porcupine, Chutine Rivers), and some lake spawners (e.g., Christina and Chutine Lakes). Generally, mainstem sockeye salmon return to the river later than Tahltan sockeye salmon, between SW 30 and 34 in the Canadian portion of the lower river. In the lower river, Mainstem sockeye salmon have large eggs ≥ 37 mm (10 eggs lined up in a row and measured; Craig, 1985; TTC, 2022a) and this has been the primary method of stock identification to date. U.S. harvest samples utilize SPA (1982-2011) and genetic analysis (2012-present) to identify the Mainstem stock. Generally, 1.3 aged sockeye salmon (5 year olds) are the dominant age class, but a relatively larger proportion of 4 year olds (0.3 and 1.2 aged fish) were observed in 2018 and 2019.

2.1.3 Tahltan stock enhancement program

Enhancement of the Tahltan stock commenced in 1989 (first egg take) under a PST joint Canada-U.S. enhancement program (TTC, 1991), with the first fry back-planted into Tahltan Lake in 1990. The program continues to present day. Eggs collected at Tahltan Lake are incubated and thermally marked at the Snettisham central

incubation facility near Juneau, Alaska, before being back-planted into Tahltan Lake as fry. Thermal marking induces a unique pattern of bands on the otoliths through incubating sockeye salmon embryos in varying water temperatures (TTC, 1991) such that enhanced sockeye salmon can be identified by brood year and release location (refer to TTC, 2022a; ADF&G - Mark, Tag and Age Laboratory (alaska.gov)).

Further, a Tuya Lake sockeye salmon enhancement program was introduced in 1991 (first egg take) using brood stock from Tahltan Lake. At one time, the PST stipulated that when the sockeye salmon escapement through the Tahltan Lake weir was greater than 15,000 or an agreed to alternate threshold, the fry would be distributed to Tahltan and Tuya Lakes in a manner that maximizes harvestable production, but when Tahltan Lake escapements are of less than 15,000 sockeye salmon or an agreed to alternate threshold, all fry would be returned to Tahltan Lake (PSC, 2004). All Tuya-bound enhanced sockeye salmon were given a different thermal mark than Tahltan Lake-bound sockeye salmon at the hatchery to allow for stock identification. Except for 2000 and 2001, Tuya Lake enhancement occurred annually through 2014 (last year of Tuya Lake fry releases).

As a result of the enhancement programs, between 1996 and 2018, Stikine River sockeye salmon were assigned to one of 4 stocks:

- *Wild Tahltan stock*: fish originating from naturally spawning sockeye salmon in Tahltan Lake;
- *Enhanced Tahltan stock:* fish originating from broodstock collected at Tahltan Lake and subsequently back-planted as fry into Tahltan Lake;
- *Tuya stock:* fish originating from broodstock collected at Tahltan Lake and subsequently planted as fry into Tuya Lake *(Last year of returns 2018)*; and
- *Mainstem stock*: all other natural sockeye salmon populations in the Stikine River

For management purposes, collective wild and enhanced Tahltan Lake stocks are referred to as “total Tahltan stock”, or just “Tahltan stock” (TTC, 2018). As a result of barriers in the lower portion of the Tuya River, the Tuya stock has no access to Tuya lake for spawning, has a spawning escapement of zero (TTC, 2000), and was not managed under an escapement goal target. Due to comingling and similar migratory timing as Tahltan stock, however, the harvest rate on Tuya fish was managed in the commercial fisheries to not exceed that which can be sustained by the Tahltan fish, so as to not overharvest the Tahltan stock (TTC, 2000). Tuya sockeye salmon were monitored annually for stock contribution, harvest, and surplus escapement. No enhancement of mainstem-origin sockeye salmon has occurred to date.

2.2 Canadian Stock Assessment Overview

Canadian stock assessment projects include harvest monitoring of various fisheries and spawner surveys. Typical fisheries include Upper River fisheries, specifically the First Nation (FSC) fishery and commercial fishery, and Lower River fisheries,

including assessment (test) and commercial fisheries (Figure 2). Occasionally, assessment (test) and Excess to Salmon to Spawning Requirements (ESSR) fisheries have operated in the Upper Stikine river near the confluence with the Tuya River (Assessment and ESSR) and at Tahltan Lake (ESSR).

Spawner surveys include Tahltan Lake escapement monitoring by means of a weir located near the outlet of Tahltan Lake. A portion of Mainstem sockeye salmon are counted at index sites with aerial surveys (e.g., Scud, Porcupine, and Verret Rivers). Initially the goal was to use aerial surveys of index sites as an alternative means to estimate abundance of mainstem spawners. These surveys are currently used as a line-of-evidence to gauge mainstem spawner abundance and to monitor spawning habitat changes over time. For management purposes, spawner abundance estimates (i.e., escapement estimates) for the Mainstem stock are estimated as the difference between known components of the overall Stikine sockeye salmon run.

In addition, a smolt outmigration project by means of a trap located near the outlet of Tahltan Lake has assessed abundance and biological characteristics of outmigrating smolts.

The next five sections describe the main components of the Canadian assessment program.

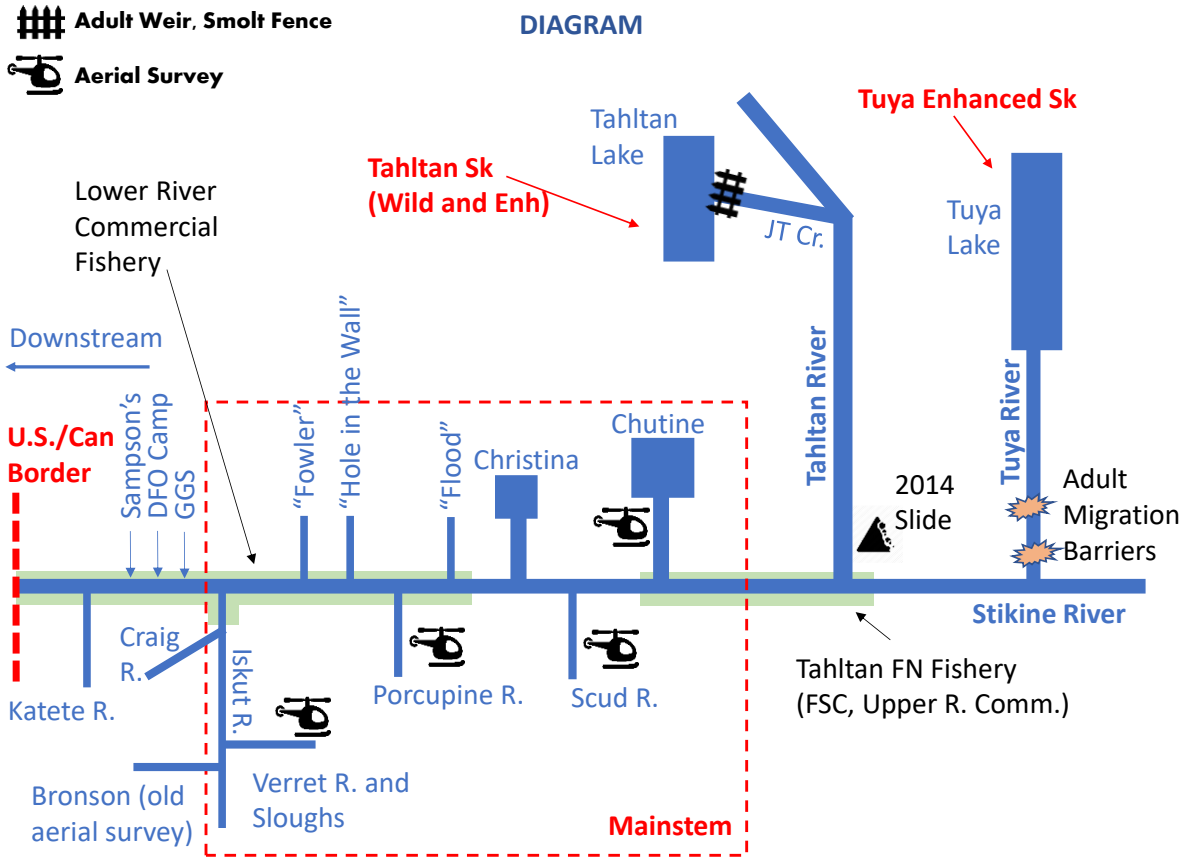

Figure 2. Schematic Overview of Stikine Sockeye Salmon Surveys. The diagram focuses on highlighting the spatial relationship between the watersheds and assessment program components, so the distances and angles are not to scale. Plot design adapted from a collaboration with Pete Nicklin (Tˆsilhqot'in Fisheries). Sampson's and Great Glacier Salmon (GGS) are commercial landing stations that are operated and maintained by commercial fishers. "Fowler" and "Hole-in-the-Wall" are local names for sites of historical significance to the commercial fishery and are adjacent to Great Glacier. "Flood" refers to the Flood River which discharges the glacial lake at the toe of the Flood Glacier. "JT Cr" refers to Johnny Tashoots Creek downstream of the weir.

2.3 Canadian Fisheries and Harvest Monitoring – Lower River

2.3.1 Lower River Fisheries

Availability of a brine barge to transport fish harvest, combined with improved marketing of the Lower River sockeye salmon quality, resulted in a shift of the fishery core from the Upper River to the Lower River in 1979. At this time, up to 25 licenses were participating in the Lower River fishery. For the purpose of providing additional samples and CPUE data at standardized intervals for in-season and post-season stock assessment, an assessment (test) fishery commenced in 1986 (Etherton, P. Working paper, 1991).

2.3.2 Lower River Commercial Fishery

The Canadian commercial fishery has been operating in the lower Stikine River since 1979, except for 1984 when no commercial fishery operated due to low anticipated returns. The fishery currently occurs between the U.S./Canada international border and the confluence the Porcupine River and includes the lower Iskut River approximately 1.5 km upstream of the water survey station (Pacific Fishery Regulations, 1993). In some years (usually high abundance years) the upper boundary was the confluence with the Flood River (1997 – 2000; 2004-2005 (post SW 23); 2006 (post SW 24); 2007 (post SW 23); 2009 (post SW 28)) approximately 25 km further upstream than the Porcupine River. Prior to 1997, the upstream fishing boundary was the confluence of the Stikine River and Porcupine River, and up until 2001, fishing on the Iskut River was permitted in the lower 1.5 km only.

All harvest in the commercial fishery is by set or drift gillnet. Typically, one gillnet (drift net or set net) up to 135 m in length has been permitted. Minimum and maximum mesh sizes has varied over the years, and in some years an additional gill net was permitted. Gillnet size restrictions are typically prescribed until about mid July to reduce Chinook salmon bycatch. Effort is managed through the duration of fishery openings and varies according to run strength, escapement targets, and allowable harvest. The directed sockeye salmon management period typically occurs between SW 26 (mid-June) and SW 34 (mid-August); the Tahltan stock management period is between SW 26 and 29, and the Mainstem stock management period is between SW 30 and the end of SW 34. On average, there were 32 commercial fishing days a year between 2011 and 2020 (range: 19.5 to 47) with an average harvest of 32,238 sockeye salmon (range: 6,153 to 75,739) (TTC, 2022b). There are two main landing stations on the Lower Stikine where fish harvest is landed (counted and documented), processed, and sampled: Great Glacier Salmon (GGS) and Sampson's. All sockeye salmon harvested are landed 'round' (whole fish intact) to meet biological sampling needs.

2.3.3 Lower River Commercial Fishery Sampling

The objective of the biological sampling program has been to provide in-season run timing, stock composition, and CPUE information for fishery management purposes, and post season information for run reconstruction and brood table development. Although biological sampling of commercial fishery harvest began in 1979, it has been modified depending on the stock assessment needs of the time (Appendix. B.1: Summary of Lower Stikine Commercial Fishery Sampling Objectives). Since 2016, the sampling goal has been 200 matched samples (random samples- includes males and females) per week which includes age, sex, length (ASL), egg diameter, and otoliths; an additional 200 female sockeye salmon per week (non-random) are sampled for length and egg diameter. Fork length (FL) has been consistently measured. Post orbital hypural (POH) length and mid eye fork (MEF) length has been largely calculated by regression from assessment fishery data from the same year (Appendix. B.2: Summary of Lower Stikine Commercial Fishery Length Measurements). A minimum of 100 egg diameters and 60 otoliths per week are required for weekly in-season estimates of stock composition, and the remaining samples are incorporated into post-season analyses. To estimate stock composition and biological characteristics of sockeye salmon 'in river', only biological data from harvest below the confluence with the Iskut River are utilized; this approach maximizes the representation of all stocks (a portion of sockeye salmon ascend the Iskut River to spawn and would not be represented in samples collected upstream of the Iskut River confluence). Since 2000, segregating harvest by location (i.e., above Iskut, below Iskut, in Iskut, above Porcupine) was a condition of the commercial license. Since 2018, additional scales have been collected (5 scales; previously 2 scales) for aging and for genetic stock identification (GSI).

2.3.4 Lower River Assessment Fishery

The Lower Stikine assessment (test) fishery occurs on the mainstem of the Stikine River in the vicinity of a location known as Boundary House. The area is located upstream of the Canada - U.S. border and below the confluence of the Stikine and Iskut Rivers. The assessment fishery operated almost annually between 1986 and 2020 (no assessment fishery in 2019 due to low anticipated returns). In most years the assessment fishery was completed by a lower river commercial fisher (selected by lottery) under contract to DFO. The fishery operated during the same seasonal timeframe as the commercial fishery (SW 26-34), but normally (except 1996 and 1997) did not occur on days when the commercial fishery operated. Generally, it followed a standardized approach using drift and set gillnets, measuring 100 feet (30.5 m) long, 30 mesh deep, 5 ½ inch (14 cm) stretched mesh at hang ratio of 2:1, light green color, 26 gauge, deployed in consistent locations. The number of drifts and duration of the sets, however, varied depending on direction from DFO (Appendix. B.3: Summary of Lower Stikine Assessment Fishery Sampling Objectives), and adjustments were made depending on the duration of commercial openings, river conditions, biological sampling goals, and run strength.

2.3.5 Lower River Assessment Fishery Sampling

The objective of the assessment fishery was to collect catch-per-unit-effort (CPUE) and biological information in a standardized manner to assess run timing and stock composition for fisheries management in season, and for run reconstruction and brood table development post-season. It was intended to supplement information from the lower river commercial fishery. Biological sampling commenced in 1986 and has typically included all harvest (or up to 400 samples per week) for matched (i.e., individual) ASL, egg diameter (from all females) and otolith samples. Measurements of FL have been consistently recorded and POH and MEF lengths have been a combination of field and calculated (regression) measurements (Appendix B.4: Summary of Lower Stikine Assessment Fishery Length Measurements). The 10-year average assessment fishery harvest (2011-2020) was 2,460 sockeye salmon (TTC, 2022b).

2.4 Canadian Fisheries and Harvest Monitoring – Upper River

First Nation and commercial fisheries occur in the upper Stikine River and are centered around the village of Telegraph Creek, B.C. In some years, assessment (test) fisheries and ESSR (Excess Salmon to Spawning Requirements) were also conducted. Each of these fisheries has unique characteristics and harvest monitoring.

2.4.1 First Nation Fishery

Conducted by Tahltan Central Government members (i.e., members of the Tahltan First Nation and members of the Iskut First Nation), the First Nation fishery is for food, social, and ceremonial purposes (sometimes called the FSC fishery). The commercial fishery occurs in the same general area as First Nation fisheries, but fishers are licenced as such. Although First Nation harvesting of salmon from the area has occurred for millennia, harvest from the Upper Stikine River First Nation fishery has been recorded since 1972 (TTC, 2022b). Fishing for sockeye salmon occurs from mid-June through early August with most fishing activity completed by late August.

The fishery is centered around the community of Telegraph Creek, and fishing generally takes place along the Stikine River between the confluence with Chutine River and the Tahltan River (Figure 1, Figure 2). Gear primarily involves set gillnets approximately 30 to 50 feet in length (10-15 m) with an average mesh of $5^{1/4}$ to 6 inches (13.3 to 15.2 cm). Most gillnets are secured to, and serviced from, shore by boom poles. Sport fishing gear is also used in tributaries such as the Tahltan River (Fisheries and Oceans Canada, 2021). Average annual harvest of sockeye salmon in the First Nation fishery was 5,165 fish from 1972 to 2020 (TTC, 2022a).

2.4.2 Upper River Commercial Fishery

The upper Stikine River commercial fishing area occurs from the confluence with the

Chutine River, upstream to the confluence with the Tuya River (Figure 1, Figure 2). Harvest in this fishery has been recorded since 1975 (TTC, 2022b). The fishery was initiated at the request of local residents to serve local markets in the communities of Telegraph Creek, Dease Lake, Cassiar, and Watson Lake (Wood and Johnson, 1990). This gill net fishery is small scale in comparison to the lower river, with six commercial licenses designated for upper river commercial fisheries and only one active commercial fishing license currently operating (B. Waugh, Transboundary Rivers Operations Manager, pers. comm). Fishery openings are generally based on the lower Stikine commercial fishery openings, lagged by one week. Average (1985-2020) annual sockeye salmon harvest in the upper river commercial fishery was 841 fish (TTC, 2022b).

2.4.3 Upper River Assessment and ESSR fisheries – Tahltan and Tuya River

Additional harvests and lethal biological samples were taken annually in the Tuya river area from 1996 to 2014, with the aim of harvesting excess enhanced Tuya sockeye salmon and obtaining Tuya-specific biological data. All Tuya sockeye salmon that avoid the lower and upper Stikine River fisheries are considered to be excess, as they are blocked from accessing potential spawning grounds of Tuya Lake by natural barriers located in the lower reaches of Tuya River.

An ESSR fishery was conducted on the Tuya River, below the first barrier, from 1996 to 2004. The minimum harvest recorded was 216 sockeye salmon in 1996, and maximum harvest recorded was 7,031 sockeye salmon in 2003 (TTC, 2022b). The fishing area was challenging to access and waters were turbid and hard to work in, making fishing and marketing difficult. In 2005 an experimental floating fish ladder and trap designed to help address some of the difficulties in fish capture in the area was tested and harvest (148 sockeye salmon) was sampled and used in marketing assessments only (TTC, 2008). A rockslide at the fishing site in early 2006 rendered the fishing location unsafe and unusable for fishing and created an additional migration barrier. Blasting efforts in the area continued for two years to improve salmon passage and safety of the fishing site, and annual assessment of fish passage was conducted until 2013. During these years, a small number of sockeye salmon were captured in gillnets and lethally sampled for biological data such as otoliths (TTC, 2022b). To continue harvesting excess Tuya sockeye salmon, a lethal assessment fishery was conducted between 2008 and 2014 on the mainstem Stikine at the confluences of the Tahltan and Tuya Rivers. Average harvest was 2,157 sockeye salmon (range: 883 to 2,878) (TTC, 2022b). The fishery closed in 2014 due to excessive operational challenges (e.g., access, market value).

An ESSR fishery was also introduced at Tahltan Lake from 1993 to 1996, as returns exceeded the upper end of the spawning escapement goal range. Average harvest during this period was 8,421 sockeye salmon (range: 1,752 to 14,339) (TTC, 2022b). No ESSR harvest was taken during additional years where returns exceeded spawning goal requirements.

2.4.4 Upper River Fishery Sampling

Although harvest from First Nation and upper river commercial fisheries are separately recorded, biological samples from the upper river fishing areas are combined. With the establishment of enhancement programs in the early 1990s and subsequent back-planting of Tahltan fry into Tahltan Lake in 1990 and fry planting into Tuya Lake in 1992, a sampling program was formalized in 1996 to assess stock composition of the upper river harvest, obtain stock-specific biological information, and monitor the run timing of stocks (Fisheries and Oceans, 1996). Biological data collected annually have included matched (i.e., by individual) ASL (including FL, POH length , MEF length), egg diameter (until 2018: refer to Appendix A.4), and otoliths. Egg diameters were intended for Tahltan-Mainstem stock identification and otoliths were used to identify enhanced fish through thermal marks (wild :no mark; enhanced: marked as Tahltan enhanced or Tuya enhanced). Measurements of FL and POH length have been consistently recorded, MEF length has been sporadically recorded, and in some years regression analyses were used to estimate missing lengths (Appendix B.5: Upper Stikine Commercial and First Nation (FSC) Fishery Length Measurements). Samples have been consistently collected from fish camps in the Telegraph Creek area and assigned to 1 of 7 general locations. Sampling occurs annually 3 to 5 days per week from mid to late June until mid to late August. In most years, sampling targets have been 600 sockeye salmon per season apportioned to approximate run timing although some variation in sample type and quantity have occurred over time (Appendix B.6: Summary of Upper Stikine Commercial and First Nation (FSC) Fishery Sampling Objectives).

2.5 Spawner Surveys: Tahltan stock

Data from the Tahltan weir enumeration and sampling project are used to assess the number of adult returns, and the stock (wild and enhanced) and age composition for run reconstruction, brood table development, and pre-season forecasting.

2.5.1 Tahltan Escapement Enumeration

Since 1959, a weir and counting chamber have been installed near the outlet of Tahltan Lake upstream of a water control structure from mid-July to late September to monitor escapement to the lake and collect biological samples. The enumeration and sampling program was operated by ADF&G between 1959 and 1976, and by DFO and TCG from 1977 to present. To minimize impact to upstream migration, water levels are managed at the water control structure to help facilitate passage. The counting chamber is opened hourly between the hours of 7:00 and 00:00 and salmon are visually enumerated as they exit the counting chamber into the lake. A subsample of sockeye salmon is selected for biological sampling which typically, at least in recent years, includes live and lethal samples. Since the enhancement program was initiated in 1989, a subsample of the brood stock taken has also been sampled as

they are removed from holding pens within the lake for spawning. ypically, peak immigration to Tahltan Lake occurs in late July, and 90% of the run is complete by mid-August. Average annual escapement to the lake (1959 to 2020) was 25,077 sockeye salmon (TTC, 2022b).

2.5.2 Tahltan Escapement Sampling

Prior to initiation of the enhancement program, only live (random) sampling was completed (age (scales), sex, length (FL, POHL)), however since the return of enhanced fish, a subsample of sockeye salmon has been randomly selected from the counting chamber prior to release to the lake for live and lethal sampling (Table 1; Appendix B.7: Summary of Tahltan Lake Escapement Sample Types Collected and Application to Age and Stock Composition). Lethal sampling allows evaluation of stock composition through otoliths (wild: no mark; enhanced: thermally marked otolith). Generally, FL and POH have been field measured, however in recent years, some POH and MEF lengths have been calculated via regression (refer to Appendix B.9). Weekly sampling targets of live and lethal samples are proportioned through the run based on 5-year average run timing (Fisheries and Oceans Canada, 2020a). Since 2018, lethal samples have been from males only. As analyses suggested that there was no difference in age composition of males and females, the “males-only” approach was taken to allow the stock to be assessed (through marked otoliths) even in years of low returns when lethally sampling females was undesirable. Since 1996, a random subsample (between 100 and 125 fish per day) have been sexed prior to release into the lake to increase the sample size used to estimate male-female proportions. Since 1995, a subsample of the broodstock taken has also been sampled for various metrics (Table 1). Over the years, samples from carcass, food fish, and electrophoretic and electrofishing projects have been taken, but samples have been infrequent and few (see Table 2).

Table 1: General sampling strategy for Tahltan Lake escapement through live and lethal sampling and Broodstock collection (FL = fork length, POHL = post-orbital hypural length).

Sample Group	Sample Number	Sample Type	Years
Live	600-800	age (scales), sex, length (FL, POHL)	1977-2020
Lethal	400	age (scales), sex, length (FL, POHL), otoliths	1995 - 2009
		otoliths, sex, length	2010-2016
		male only: otoliths, length	2017-2020
Broodstock	400	age (scales), sex, length (FL, POHL), otoliths	1995-2001
		otoliths only or otoliths, sex, length	2002-2020

2.6 Spawner Surveys: Mainstem stock

2.6.1 Mainstem Escapement Estimation

Mainstem spawning escapement is calculated as the difference between Mainstem above border estimate and the Mainstem removals. The Mainstem above border estimate is calculated from the difference between Tahltan and Tuya above border estimates to the Stikine River above border estimate. Age distributions are calculated from Mainstem escapement but where age proportions are assumed to be equivalent to the Canadian harvest (Miller et al, *in prep*).

2.6.2 Mainstem Escapement Sampling

Aerial surveys of key, known mainstem spawning locations commenced in 1984 and have occurred annually since that time (with the exception of 2011 when no survey was conducted due to budget constraints) (TTC, 2022b). The aerial surveys were intended to provide an index of mainstem escapement. Surveys initially included the Chutine River, Scud River, Porcupine Slough, Christina Creek, Craig River and Verrett River, and in 1989 surveys were expanded to include Bronson Slough (which is no longer surveyed as a result of a change in the river) and Verrett Slough. Although these surveys have been completed annually and provide an index of escapement, the relationship between the index and the estimated mainstem escapement is weak and as a result, these data were not used in analyses for the escapement goal review.

Sampling of mainstem escapement, in combination with aerial surveys, has occurred occasionally since 2000. Although the intent of the mainstem sampling was to assess biological characteristics of spawners for the Mainstem stock (rather than using lower river harvest as a proxy), it has been challenging to obtain an adequate number of samples from a representative number of locations. As a result, those age compositions have not been used in brood table development although there is significant utility for comparative purposes.

2.7 Tahltan Lake Smolt Outmigration Assessment

2.7.1 Tahltan Lake Smolt Enumeration

Enumeration and biological sampling of out-migrating sockeye salmon smolts from Tahltan Lake (Figure 2) has been conducted annually since 1984 by DFO and/or TCG staff. The project occurs from early May to mid/late June, with the majority of smolts emigrating by the end of May. Out-migrating smolts are retained by a weir and two Wolf traps located approximately 30 m downstream of Tahltan Lake outlet. Smolts are either individually counted when densities are low or numbers are estimated via volumetric displacement. A random daily subsample (n = 30) is live sampled to estimate average fork length and subsequently estimate the number of

smolts required to displace the predetermined volume of water (previous calibration has determined the number of smolts of a given average fork length required to displace the predetermined volume of water), thus providing an estimate of smolt numbers. Water levels are managed to facilitate downstream movement and water temperatures are monitored daily. The recent 10-year average (2011-2020) estimate of out-migrating smolts was 1,628,324 (range 639,473 to 2,461,675) which excludes lethal (otoliths for wild-enhanced proportions) samples (TTC, 2022a)

2.7.2 Tahltan Lake Smolt Sampling

Biological sampling is conducted annually from a random subset of the daily outmigrants. Annual sampling targets have ranged from 600-800 samples per year, apportioned to the 5 year average run timing. Smolts are sampled for matched age (scales), size (fork length and weight), and since 1991 a subset of the daily samples is lethally sampled for otoliths to assess origin (wild or enhanced). Approximately 400 smolts are lethally sampled annually. On average (2011-2020), 47% of smolt out-migrants have been of wild origin, and 53% have been of enhanced origin, however enhanced outmigrants have outnumbered wild outmigrants since 2015 (TTC, 2022b).

Although Tahltan Lake smolt outmigration assessment is a core annual project, data were not used in the escapement goal review; analyses for the escapement goal review focussed on adult data.

2.8 Data Review and Streamlined Data Management

2.8.1 The Need for an Agreed-Upon Data Set

Recurring debates regarding data and data treatment choices can be a serious challenge to large-scale, collaborative projects with a formal peer-review component, such as escapement goal reviews for northern transboundary salmon stocks. The Stikine River Sockeye Salmon Working Group members therefore dedicated a significant component of project effort to:

1. thoroughly reviewing data sources,
2. documenting the complex sequence of steps required to get from disparate raw data to usable estimates, and
3. streamlining the data processing steps for a faster and more easily reproducible workflow.

Raw data sets and metadata were saved to a PSC SharePoint site as a reference source for members of the TTC ((https://psconline.sharepoint.com/sites/ttc_365). The following sections of the report provide a brief overview. Details are documented in *Appendix A: Data Processing Details*. The Stikine River Sockeye Salmon Working Group members consider the details in the appendix to be essential information for properly understanding the strengths and limitations of the available data and ensuring that they are used appropriately.

2.8.2 Review of Canadian ASL Data

Annual ASL data sets from Canadian harvest, assessment, and escapement projects were scrutinized prior to compilation and additional diagnostic analyses (e.g., pivot tables, many alternative types of diagnostic plots) were completed to identify any additional errors or inconsistencies in the data sets, add any missing data, and ensure formatting was suitable for reading into the R statistical package. Data were verified against internal raw paper records and electronic data and project files, ageing records from DFO's Sclerochronology Lab (Nanaimo, B.C.), marking records from ADF&G's Mark, Tag, Age (MTA) lab (Juneau, Alaska: commercial and assessment fisheries), and DFO's Whitehorse lab (escapement, upper river commercial, and First Nation fisheries) files. Significant effort was invested in this element of the work since the intent was to rebuild Canadian brood tables following a thorough review of the data used to create them.

Occasionally, mismatches were observed in the data sets (i.e., rows of data were not matched to the same individual fish; may have resulted from a 'bad sort' of the data at some point). In these cases, the raw data were reviewed and, if possible, data sets were adjusted to correct row alignment. If the source of the error was not identifiable, the year was excluded from subsequent analyses.

Occasionally, differences were observed between scale age (through reading of annuli on scale samples) and brood year age (through identification of thermal marks applied at hatchery). In years when the mismatch between scale-derived age composition and otolith-derived age composition (through brood year mark) was greater than 5%, individual records were investigated. In the early years of the marking program, thermal mark types were on a two-year cycle (refer to TTC, 2022a) which may have led to incorrect brood year assignment (i.e., a 4-year old and 6-year old fish may have the same mark and both are common age classes). In these cases, scale age, in combination with supporting data, was used to assign the most likely brood year.

2.8.3 Review of Other Data

The TTC prepares annual production, harvest, and escapement reports (i.e., C&E reports) documenting annual stock specific harvest and effort in the various fisheries. These data are bilaterally reviewed and eventually finalized. Generally, these data were taken 'as is' as they had been previously reviewed and accepted by the TTC prior to publication in the annual reports.

Data sets from U.S. fisheries for harvest and age composition were provided as results from annual mixed-stock separation analysis.

2.8.4 Streamlined Spawner Estimates

Spawner estimates for Stikine sockeye salmon stocks are derived from Tahltan Lake weir counts (Figure 3). All spawners in Tahltan Lake are combined as the Tahltan Natural stock but comprised of wild and enhanced fish (both wild and enhanced fish comingle and spawn naturally). Biological and broodstock sampling at the weir is

used to estimate the proportion of hatchery-marked fish as well as age composition. Broodstock for Tahltan and Tuya enhancement programs is also collected. Brood stock, lethal samples (fish used for otolith sampling), and ESSR harvests are included in the weir counts but deducted from natural spawner estimates. Spawner estimates for Mainstem sockeye salmon are calculated based on the weir count and the observed stock composition in the lower river. For example, if the lower river estimate (through harvest sampling) is 50% Tahltan, and Tahltan weir count is 30,000 sockeye salmon, then Mainstem stock spawners are also 30,000, for a total escapement of 60,000).

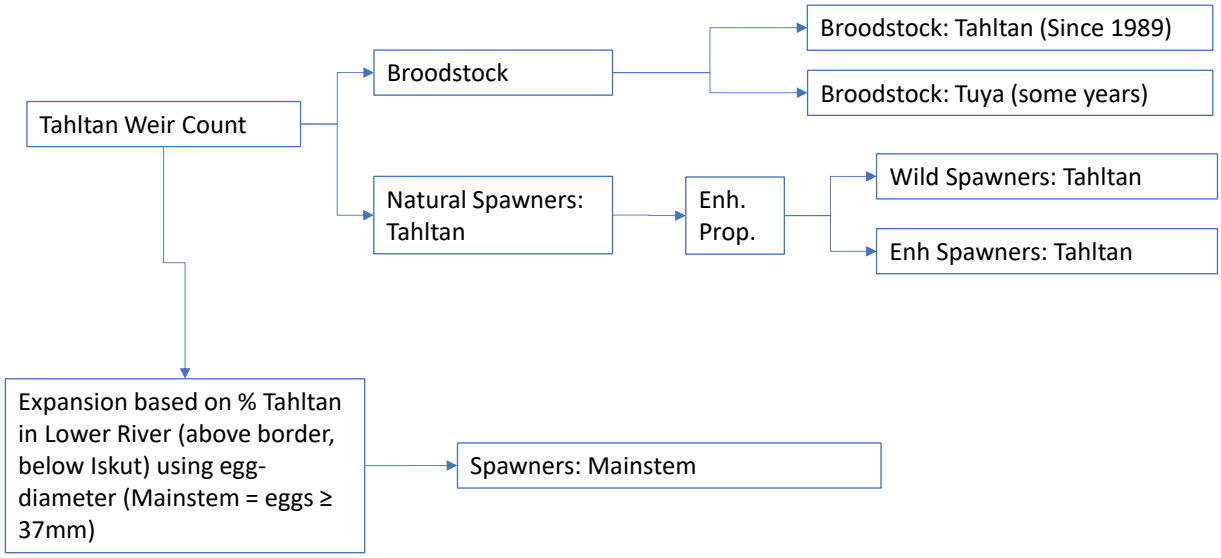

Figure 3. Overview of escapement calculations.

2.8.5 Streamlined Run Reconstructions

Run reconstructions combine spawner estimates, harvest estimates, and age composition estimates (Figure 4). These are done the same way for three stocks (Tahltan Natural, Mainstem, Tuya Enhanced): Total U.S. harvest, Canadian harvest, and spawning escapement (including broodstock take) are combined into an estimate of terminal run, then split across brood years based on estimated age composition. Each step in the run reconstruction is described in detail in *Appendix A: Data Processing Details.*

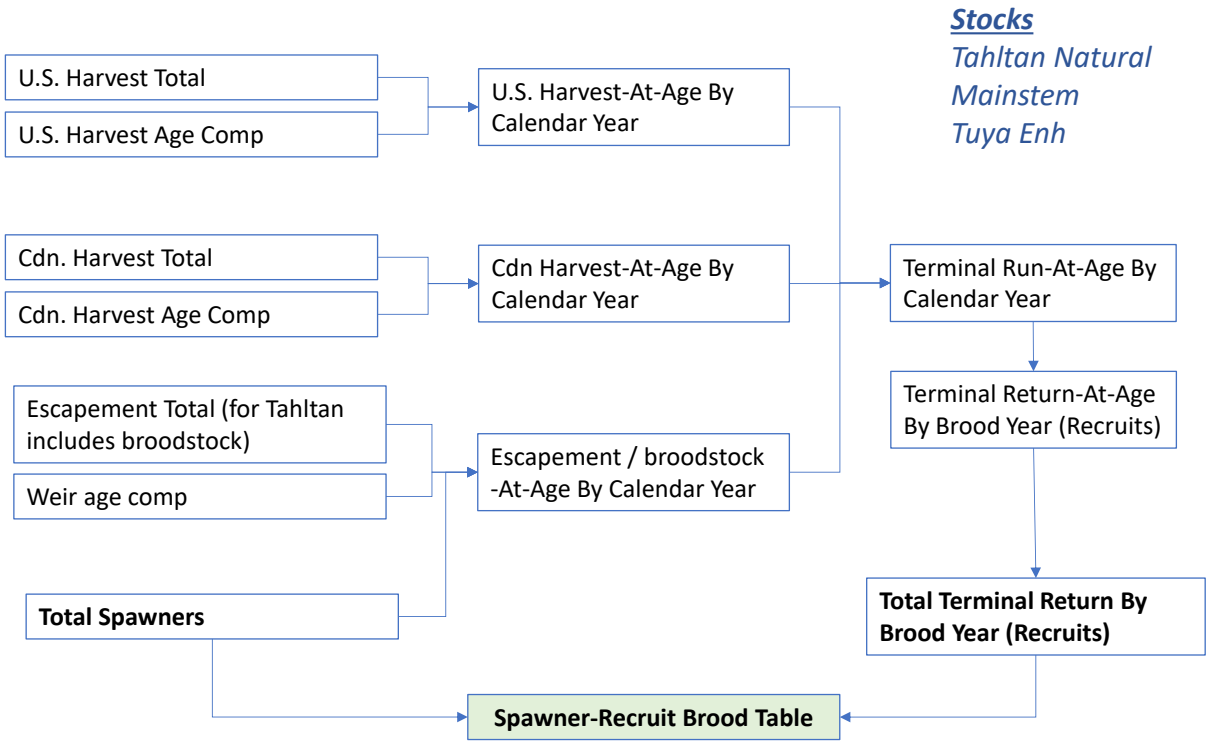

Figure 4. Final steps completed for each stock (i.e., Tahltan natural, Mainstem, Tuya Enhanced) in the Stikine sockeye salmon brood table calculations after mixed-stock analysis is completed for the fisheries.

3 RESULTS

3.1 Available Biological Samples and Aerial Surveys

3.1.1 Available Escapement Biological Samples: Tahltan Stock

Escapement sampling for the Tahltan stock has been completed at the weir and from within the lake (from fish held in net pens within the lake as Broodstock) (Figure 5, Table 2). Two types of biological samples have been collected at the Tahltan weir

- *'live'* samples: random subsample of fish handled at the weir is measured, sexed, and sampled for scales and DNA.
- *'lethal' samples*: random subsample of fish handled at the weir is measured, sexed, sampled for scales, and sampled for otoliths

Live samples have been collected annually since 1987, and lethal samples and broodstock samples have been collected most years since 1995 (Figure 5). In select recent years (2013, 2015, 2017, 2020), lethal sampling did not occur because in-season indicators suggested that the lower end of the escapement goal range may not be met.

Until 2010, matched data were collected from lethal samples (Figure 6); since then, age estimates have been derived from live samples and enhanced-wild proportions have been derived from lethal samples (i.e., samples were not "matched"). Although the approach reduces the sample size required to obtain reliable estimates of wild-enhanced proportions (thus reducing the number of lethal samples), it is not possible to estimate the age composition of wild spawners and the age composition of enhanced spawners discretely.

Additional samples have also been collected from fish held in net pens within the lake and used as Broodstock (Figure 5, Figure 6; Table 1). These fish have been randomly sampled during artificial spawning for ASL and otoliths. In some years various other types of sampling were completed including carcass sampling, electrophoretic sampling (GSI), electrofishing, and food fish sampling (Table 1).

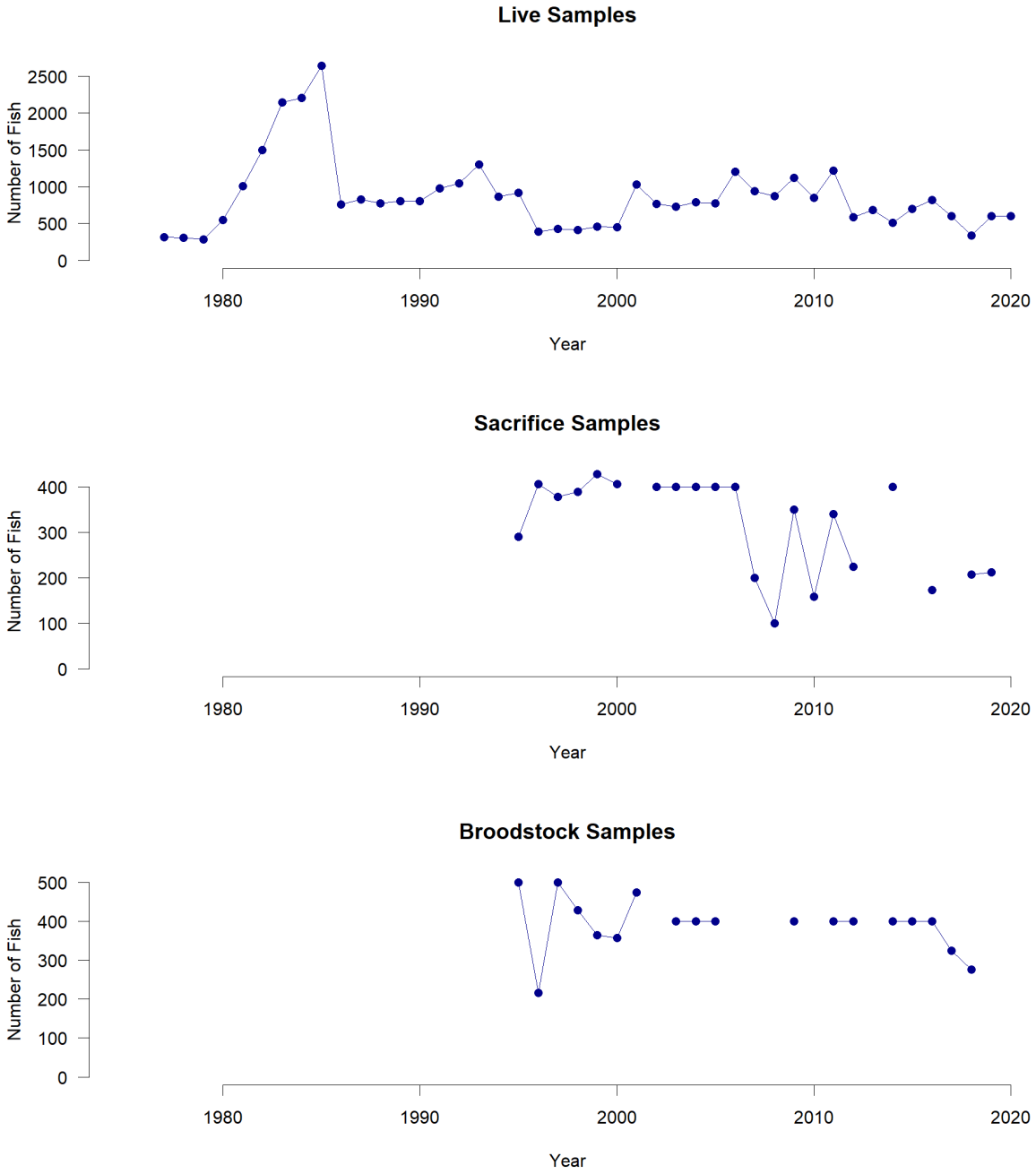

Figure 5. Number of adult fish sampled at the Tahltan Lake weir (live and lethal samples) and from holding pens within the lake prior to artificial spawning (Broodstock samples) across years. Although escapement has been monitored since 1959, live sampling has been completed since 1977. Lethal and Broodstock sampling was initiated to support enhancement monitoring. Table 2 lists the annual sample sizes.

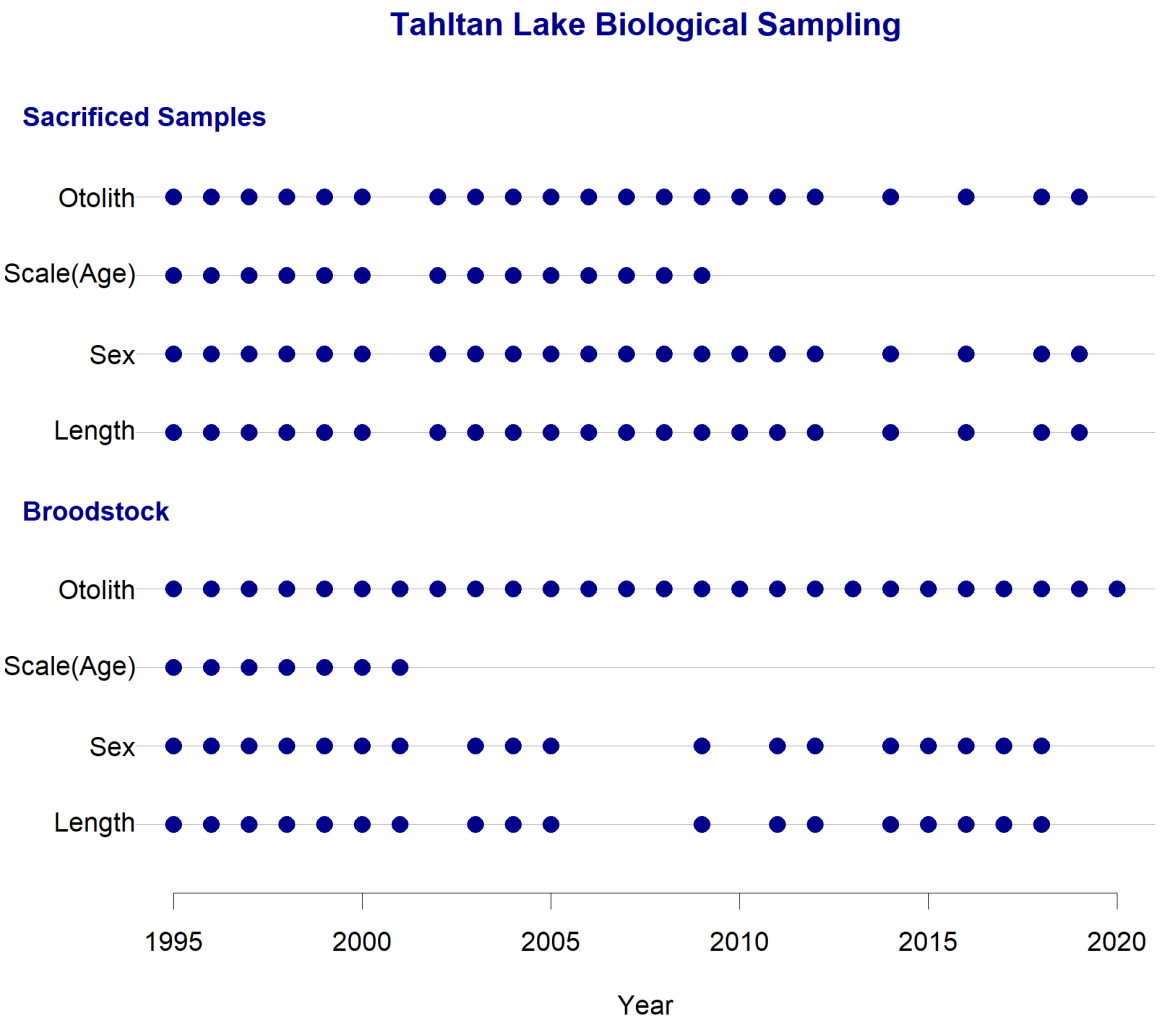

Figure 6. Timeline of Tahltan Lake broodstock and lethal (sacrifice) sample data collection. Broodstock sampling was completed on fish held within net pens within the lake and lethal sampling was completed on a random subset of sockeye salmon at the Tahltan Lake weir. Points mark years where samples were collected. Broodstock scale collection ceased due to poor condition of scales and lack of representation of the run. Lethal scale collection ceased due to the potential negative influence of holding fish at the weir prior to sampling. For years where only otoliths were collected from broodstock (i.e., no associated age, sex, or length data), otolith data is not in the ASL data compilation file.

Table 2: Number of fish sampled for Age-Sex-Length (ASL) data at Tahltan Lake by year and sample type. Live, lethal, and electrophoretic samples were taken through weir sampling. Food fishing and related sampling was completed near the weir. Carcass and electrofishing sampling was conducted in Johnny Tashoots Creek downstream from the weir. Broodstock sampling was completed on fish retained in net pens within the lake.

Year	Live	Lethal	Broodstock	Carcass	Electro-fishing	Electro-phoretic	Food Fish
1977	312						
1978	308						
1979	280						
1980	548						
1981	1011						
1982	1500						
1983	2150						
1984	2210						
1985	2647				100	100	
1986	761						
1987	830				100	100	
1988	774						
1989	800						
1990	800						
1991	975						
1992	1048						
1993	1305						
1994	865						
1995	915	290	500				
1996	391	407	216				
1997	430	378	500				
1998	415	390	428				
1999	458	429	364				
2000	446	406	357				
2001	1032		474				
2002	763	400					
2003	725	400	400	38			
2004	790	400	400				20
2005	770	400	400	60			
2006	1200	400		25			
2007	936	200		1			

Table 2 continued…

Year	Live	Lethal	Broodstock	Carcass	Electro-fishing	Electro-phoretic	Food Fish
2008	871	100					
2009	1122	350	400				
2010	848	158					
2011	1217	340	400				
2012	586	224	400	3			
2013	685			6			
2014	510	400	400				
2015	700		400	7			
2016	820	173	400				
2017	600		324				
2018	335	207	276				
2019	600	212					
2020	600						

3.1.2 Available Escapement Biological Samples and Aerials Surveys: Mainstem stock

Regular aerial surveys of mainstem spawning sites have been conducted since the mid- to late 1980s and have generally included six core locations including: the Scud River, the Verrett River, the Verrett Sloughs, the Porcupine River, the Chutine River, and the Bronson Slough. In 2016/17 however, the mainstem of the Iskut River changed making Bronson Slough unsuitable for sockeye salmon spawning and therefore unproductive. In some years, biological sampling has also occurred at some of these core index sites (Figure 7). In the earlier years of the aerial surveys, the Craig (tributary to Iskut River) and Christina Rivers (tributary to Stikine River) were also surveyed (Figure 7), but these two systems were eventually excluded as visibility during the time of year of sockeye salmon surveys is generally poor because of glacial run-off. Although aerial surveys have been used to provide an index of Mainstem spawner abundance, the relationship between aerial survey estimates and Mainstem escapement calculated as a proportion of Stikine sockeye salmon based on the relationship between Tahltan Lake escapement and Tahltan stock harvest, is weak. Surveys do, however, allow regular monitoring of available spawning habitat and any landscape-induced changes to it.

Even though Mainstem escapement sampling has not been completed in recent years, it has been completed in the past, generally in combination with the aerial (index) surveys (Figure 7). Although mainstem escapement sampling at spawning sites may provide a better estimate of age composition than assuming that it is the same as the Mainstem stock harvest age composition, sampling is often challenging at spawning sites, sample sizes are generally low, and the cost-benefit of the work can be difficult to justify, particularly given the low Mainstem stock abundance in recent years.

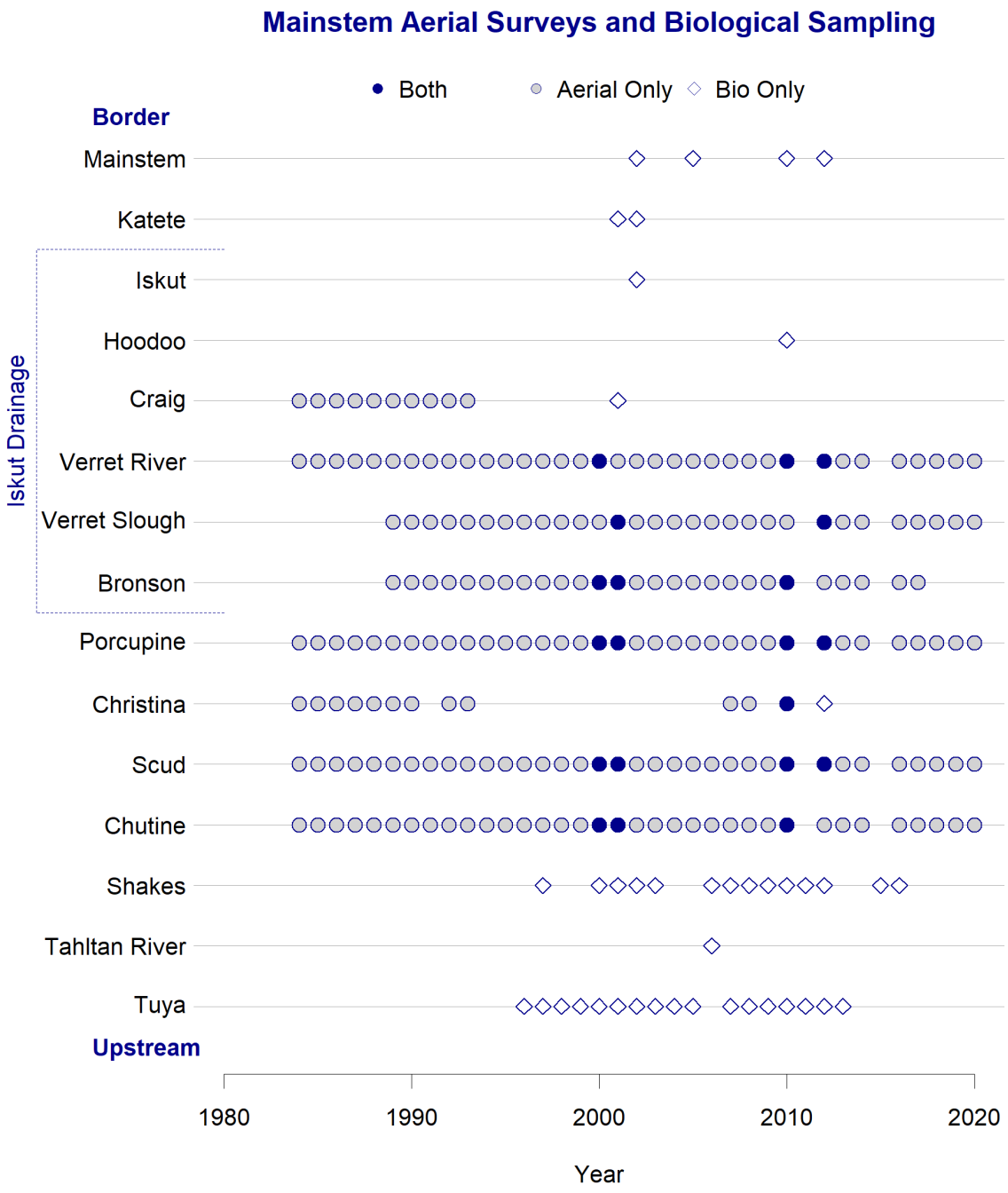

Figure 7. Timeline of Mainstem aerial surveys and biological (bio) sampling. Points mark years where aerial surveys were flown and/or samples were collected. Figure 1 and **Figure 2** show the main sampling locations. No surveys were flown in 2011 due to operational constraints. No estimates are available for 2015 because all spawning areas had turbid high waters.

3.2 Available Spawner Estimates

3.2.1 Tahltan

Estimates of wild Tahltan spawners are available for all years since 1959, with decadal averages increasing from the 1960s to the 1990s, then persistently decreasing over the last three decades (Figure 8) as enhanced Tahltan sockeye salmon contributed to Tahltan estimates. Year-to-year variation in wild spawners is very large, with the highest and lowest spawner abundance both in the 1980s.

Broodstock collection started in the late 1980s and has ranged from roughly 2,000 to 5,000 adults (Figure 9). Hatchery-reared fry have been released in Tahltan Lake starting with the offspring from the 1989 brood year, and over the years a variable share of the fry were released in Tuya Lake. Tahltan Lake fry releases were fairly stable at 1-2 million in the 1990s and 2000s but increased to 2-3.5 million since 2010.

Although the enhanced (hatchery-marked) fish likely started contributing to the natural spawning population in Tahltan Lake in 1993, the sampling project to monitor their contribution was not initiated until 1995. Since then, the decadal average has sharply increased (Figure 10).

The total natural spawner abundance (i.e., wild and enhanced sockeye salmon) in Tahltan Lake has been fairly stable since the 1970s, as the hatchery-origin natural spawners increased, and wild spawners decreased (Figure 11). Enhanced contribution to natural spawners has increased sharply since 1990s, and hatchery-marked fish have accounted for about two thirds of the natural spawners in recent years.

3.2.2 Mainstem

Estimates of Mainstem spawners are available for all years since 1979, with decadal averages persistently decreasing since then (Figure 12). The running average of spawner abundance has dropped below the 25th percentile in recent years (i.e., recent average falls in the lower quarter of all available estimates).

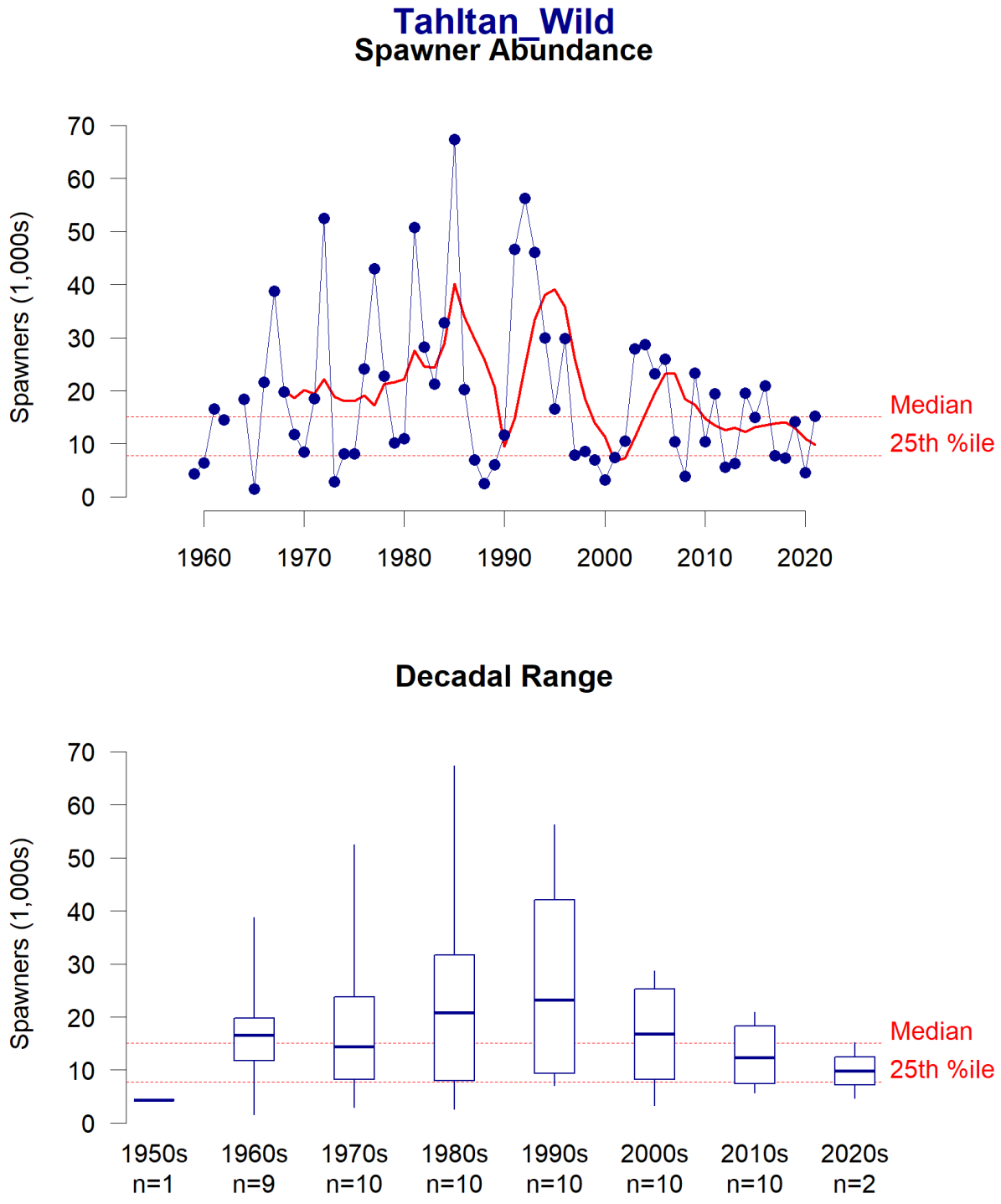

Figure 8. Available estimates for wild Tahltan spawners. This includes all unmarked fish reaching Tahltan Lake to spawn. Top panel shows annual estimates (points) and 4-yr running average (red line) as well as overall median and lower quartile (i.e., 25th percentile, 1 out of four estimates falls below the lower quartile). Bottom panel shows distribution by decade, with each boxplot marking median, lower and upper quartile, and whiskers showing the lowest and highest estimate in each decade. *n* is the number of annual estimates available for each decade.

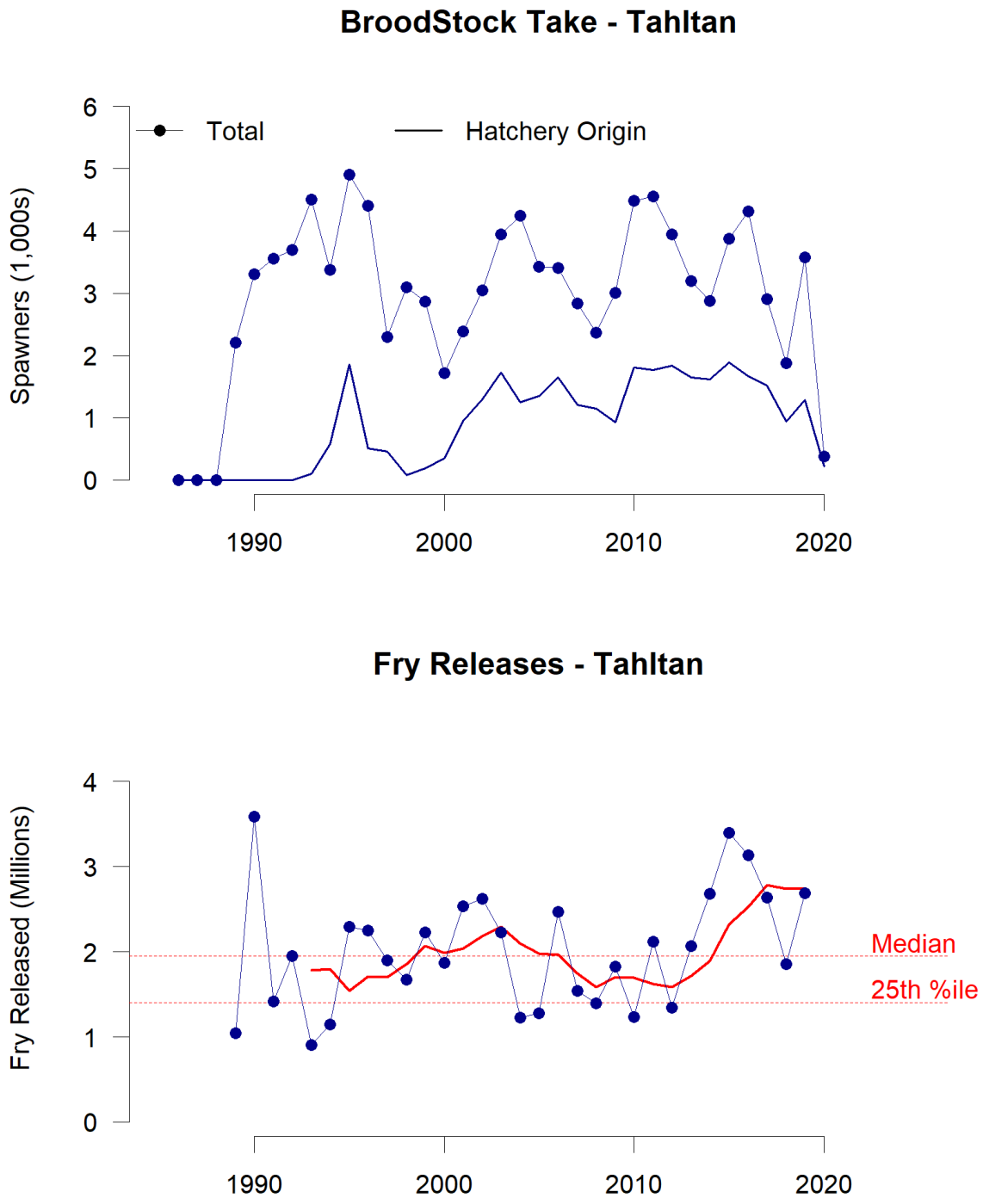

Figure 9. Available estimates of Tahltan broodstock take and fry releases. Top panel shows total annual broodstock (line with points) take and the component of broodstock from hatchery-origin (i.e., marked) fish. Bottom panel shows the annual fry releases (points), aligned to brood year, and 4-yr running average (red line) as well as overall median and lower quartile (i.e., 25th percentile, 1 out of four annual estimates falls below the lower quartile).

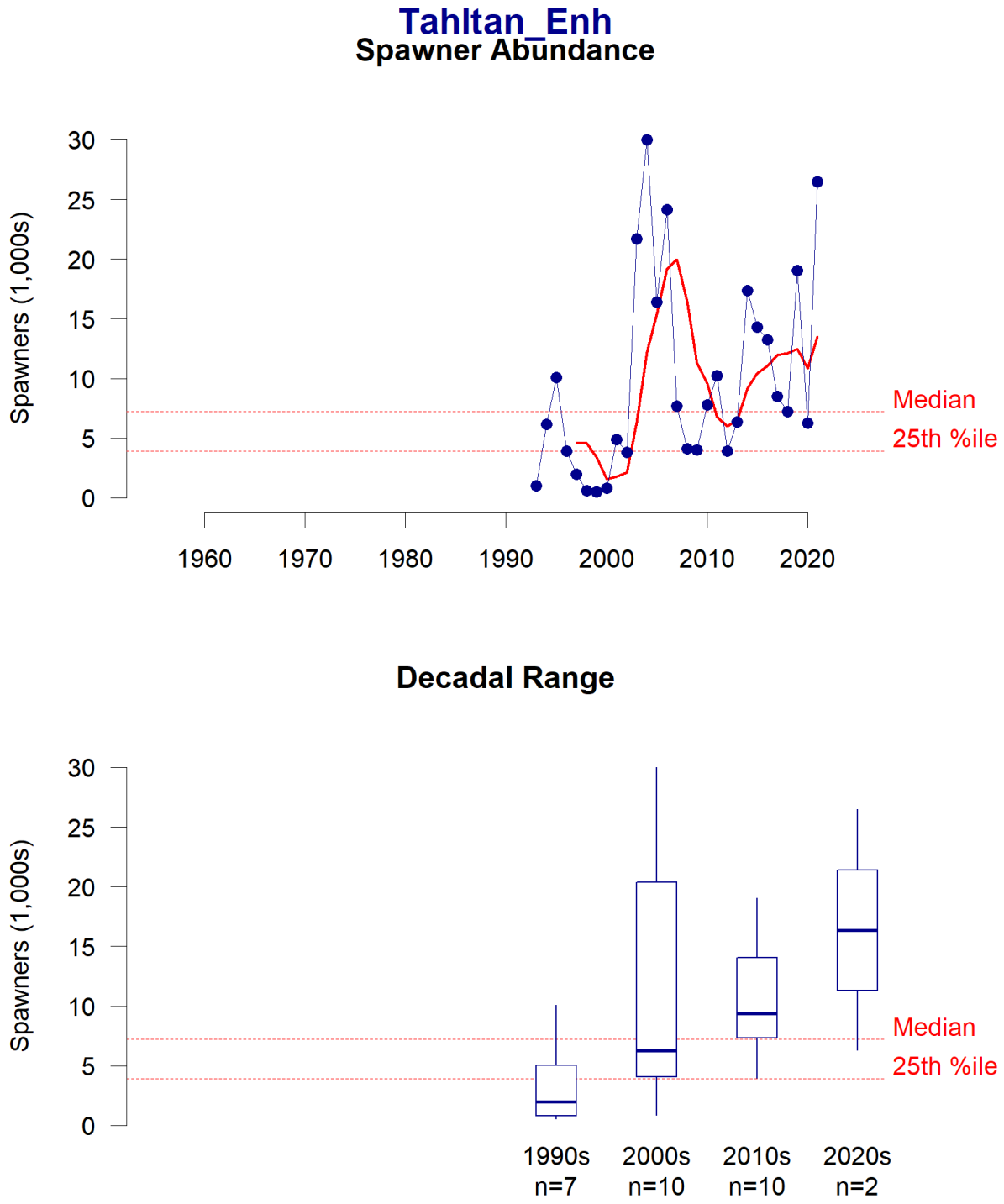

Figure 10. Available estimates for enhanced Tahltan spawners. This includes all hatchery-marked fish reaching Tahltan Lake to spawn. Top panel shows annual estimates (points) and 4-yr running average (red line) as well as overall median and lower quartile (i.e., 25th percentile, 1 out of four estimates falls below the lower quartile). Bottom panel shows distribution by decade, with each boxplot marking median, lower and upper quartile, and whiskers showing the lowest and highest estimate in each decade. *n* is the number of annual estimates available for each decade.

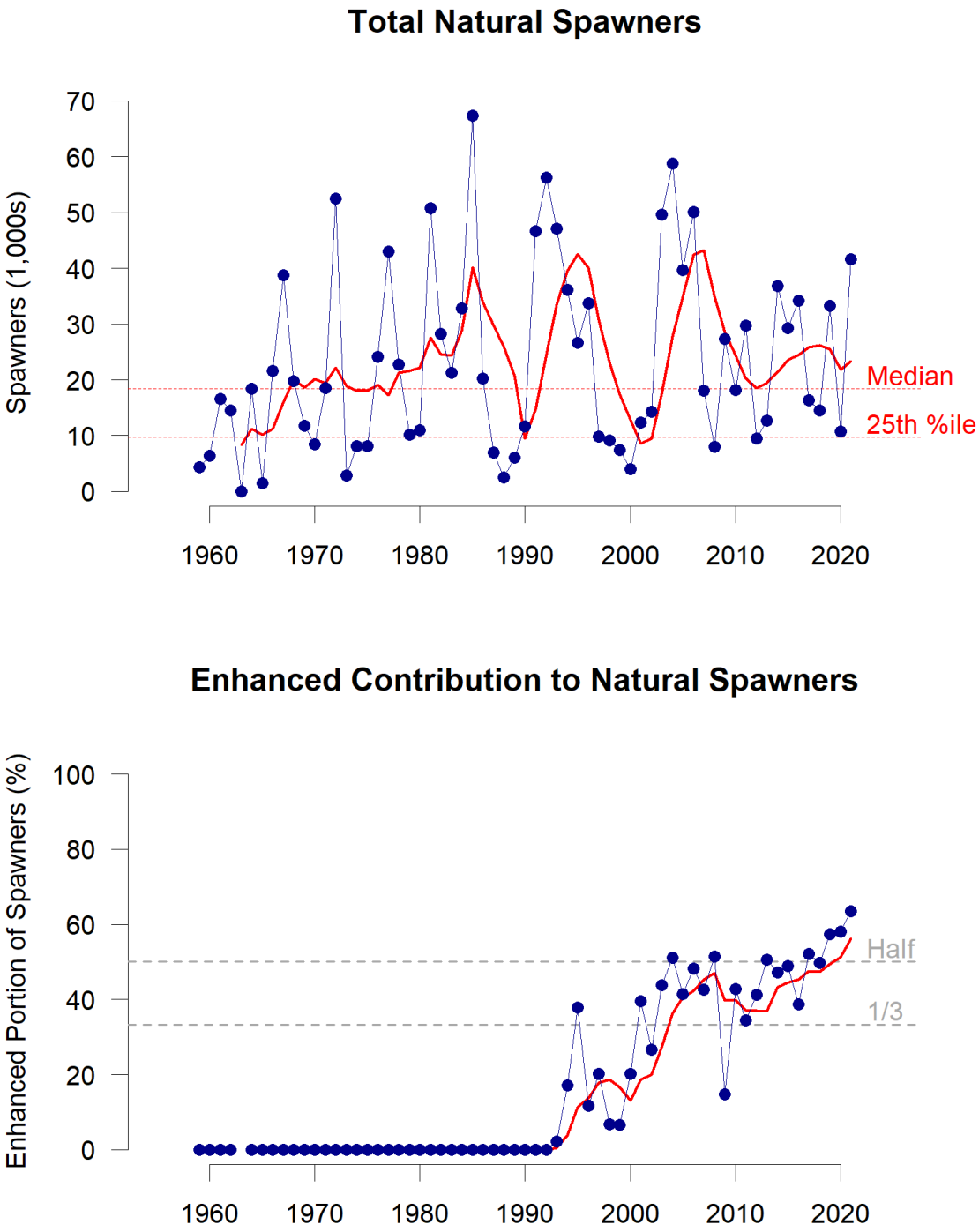

Figure 11. Available estimates for natural Tahltan spawners. This includes all unmarked and hatchery-marked fish reaching Tahltan Lake to spawn (i.e., sum of the spawner estimates in Figure 8 and Figure 10). Top panel shows annual estimates (points) and 4-yr running average (red line) as well as overall median and lower quartile (i.e., 25th percentile, 1 out of four estimates falls below the lower quartile). The bottom panel shows the enhanced contribution (%) to annual estimates of natural spawner abundance.

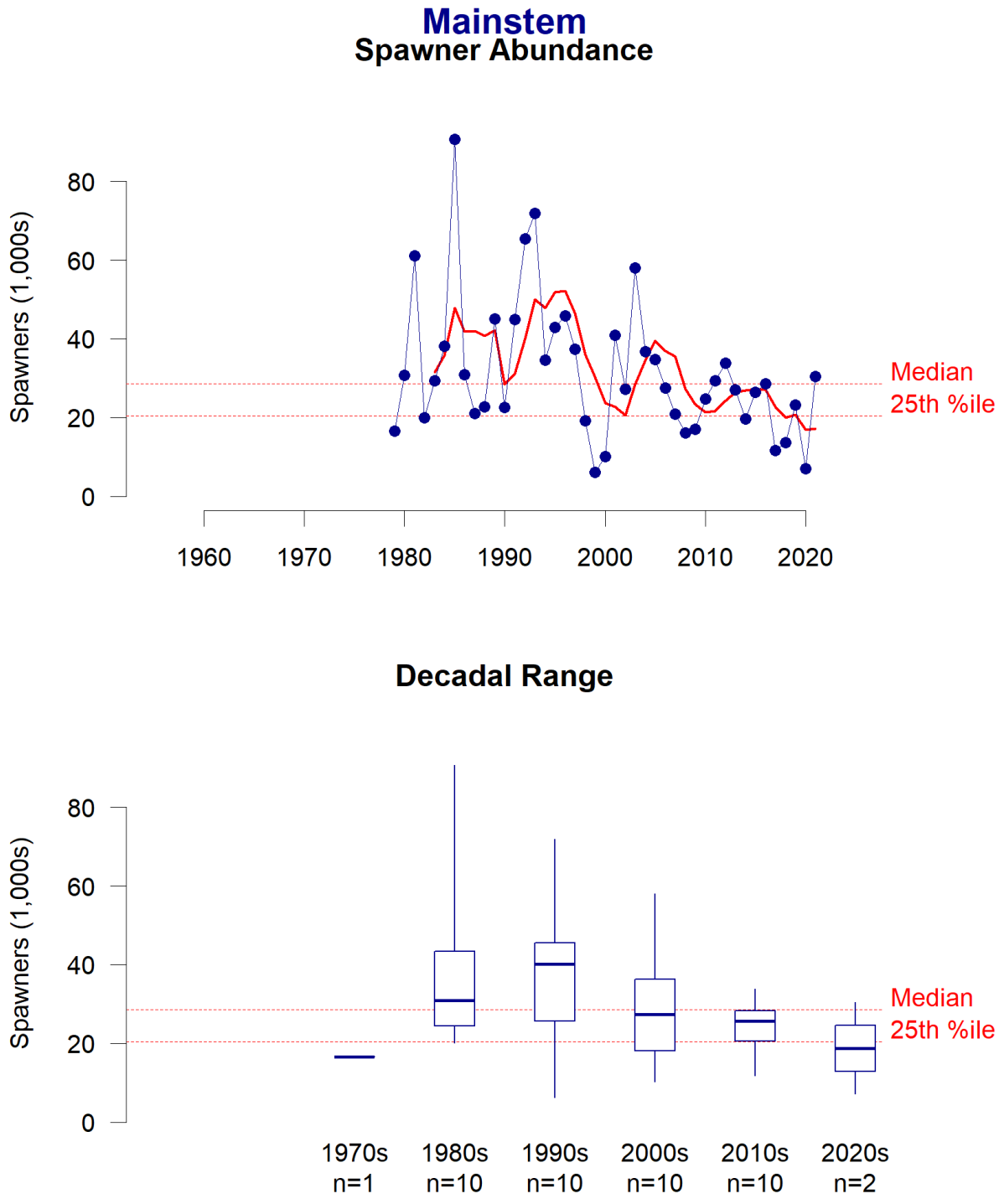

Figure 12. Available estimates for Mainstem spawners. This includes all non-Tahltan (Mainstem) fish. Top panel shows annual estimates (points) and 4-yr running average (red line) as well as overall median and lower quartile (i.e., 25th percentile, 1 out of four estimates falls below the lower quartile). Bottom panel shows distribution by decade, with each boxplot marking median, lower and upper quartile, and whiskers showing the lowest and highest estimate in each decade. *n* is the number of annual estimates available for each decade.

3.3 Available Harvest Estimates

Annual estimates of U.S. and Canadian harvest of wild (unmarked) Tahltan sockeye salmon are available since the 1980s for seven types of fisheries (Figure 13). Not all fisheries operated in all years, but total harvest estimates by country are available for all years. The Canadian portion of the total harvest of wild Tahltan is variable but averages around 60% quite consistently.

Annual estimates of U.S. and Canadian harvest of enhanced (hatchery-marked) Tahltan sockeye salmon are available since 1993 for seven types of fisheries (Figure 14). Not all fisheries operated in all years, but total harvest estimates by country are available for all years. The Canadian portion of the total harvest of enhanced Tahltan has increased steadily, from about 30% in the late 1990s to over 60% in recent years.

Annual estimates of U.S. and Canadian harvest of Mainstem sockeye salmon are available since the 1980s for seven types of fisheries (Figure 15). Not all fisheries operated in all years, but total harvest estimates by country are available for all years. The Canadian portion of the total harvest of Mainstem sockeye salmon has been highly variable between years, and the running average has ranged from about 40-60%.

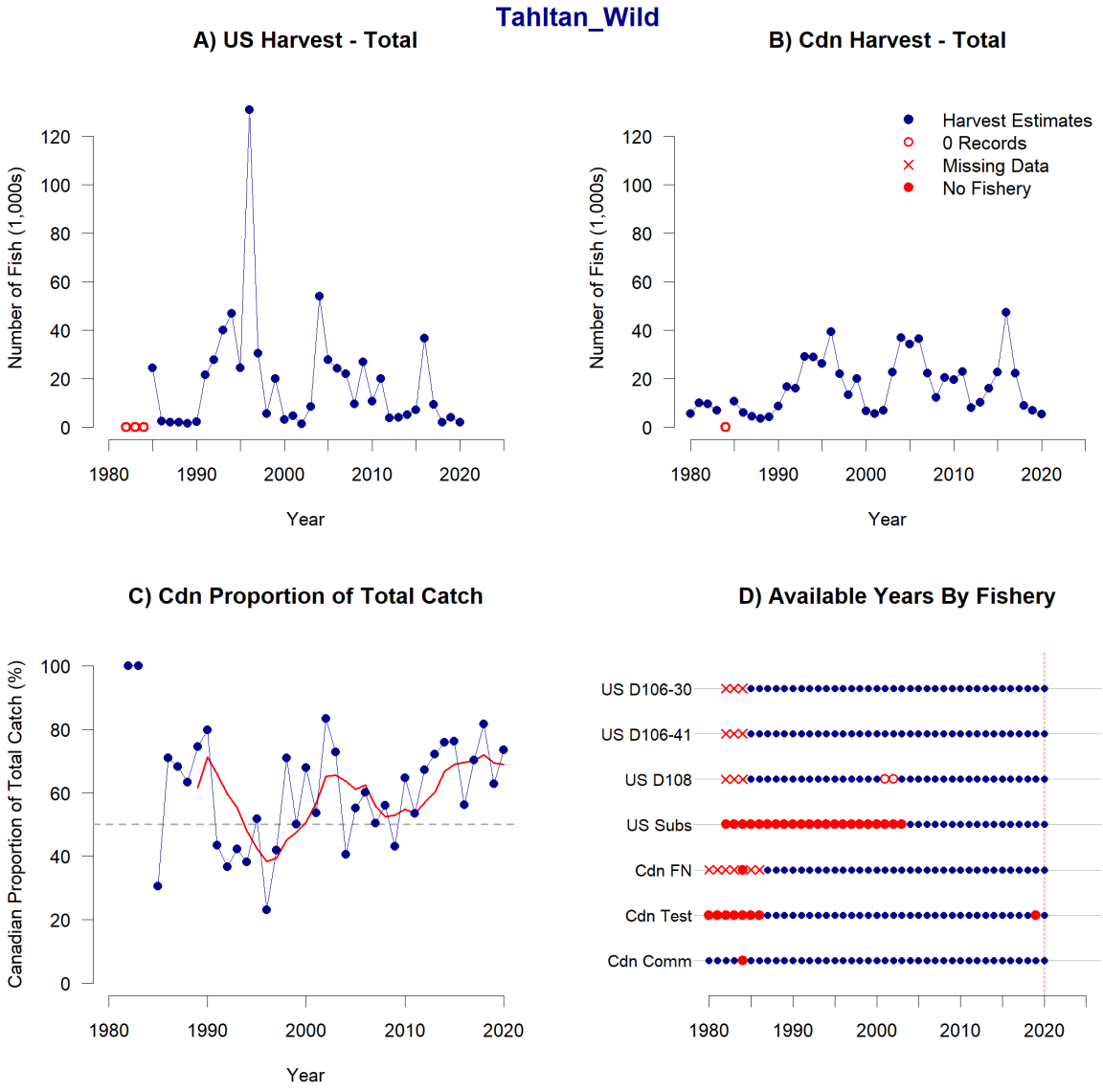

Figure 13. Available estimates for wild Tahltan harvests. This includes all unmarked fish assigned to Tahltan based on stock ID. Panels A, B show the total harvest by country. Panel C shows Canadian portion (%) of the total harvest (points) and running 5-yr average (red line). Panel D shows a timeline of available estimates for each fishery type. In all panels a red x marks missing estimates, and open red circle marks estimates of 0 harvest (i.e., a true zero, not a missing value), and a filled red circle marks years where the fishery was not open. The data set is trimmed to 1980-2020. The data review could not fully reconcile some of the component estimates from the early 1980s. Note that *Cdn Comm* in Panel D includes both the lower river commercial fishery and the upper river commercial fishery, if it occurred.

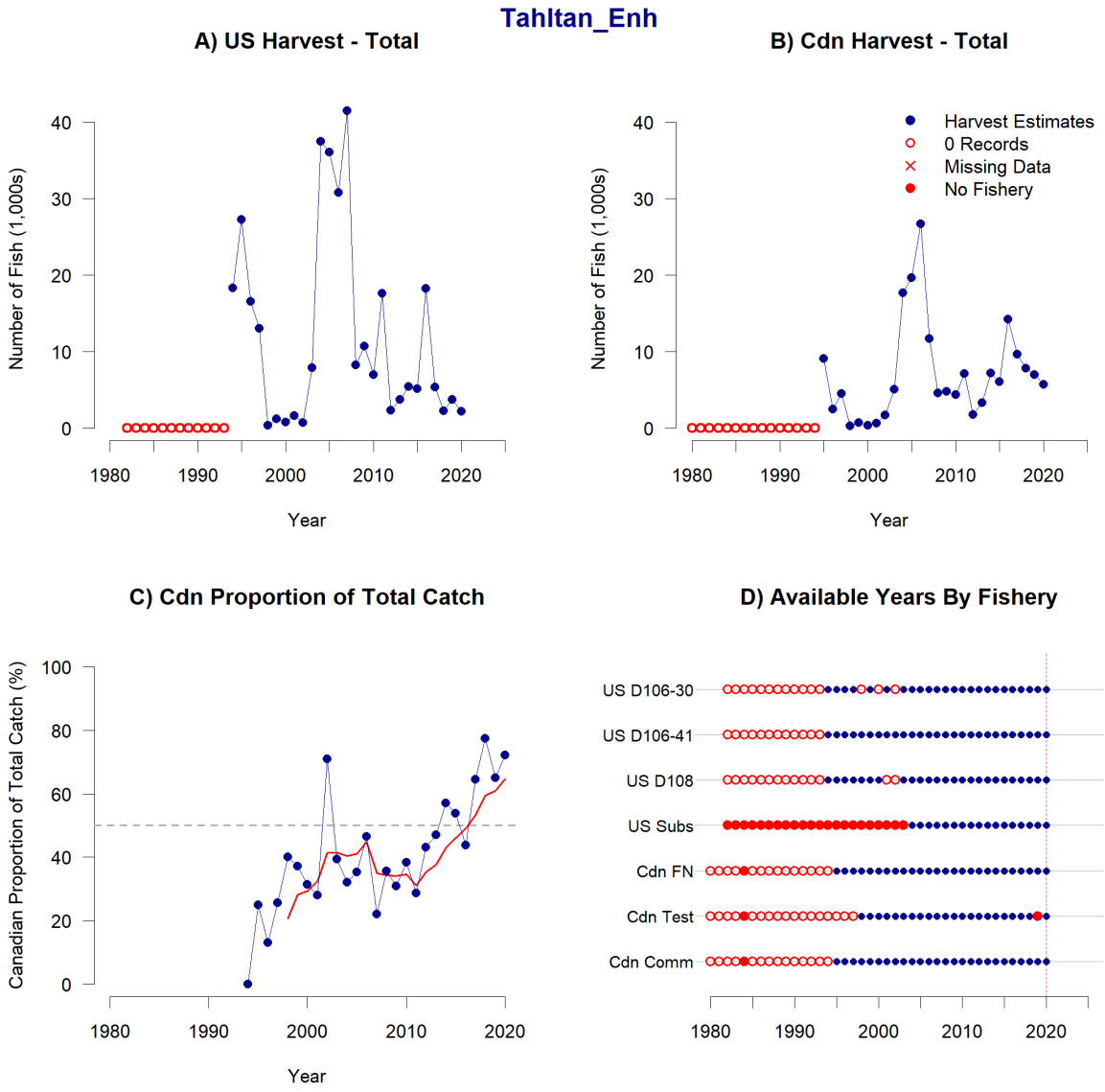

Figure 14. Available estimates for enhanced Tahltan harvests. This includes all hatchery-marked fish assigned to Tahltan based on stock ID. Panels A, B show the total harvest by country. Panel C shows Canadian portion (%) of the total harvest (points) and running 5-yr average (red line). Panel D shows a timeline of available estimates for each fishery type. In all panels a red **x** marks confirmed 0 observations (i.e., a true zero, not a missing value). In all panels a red x marks missing estimates, and open red circle marks estimates of 0 harvest (i.e., a true zero, not a missing value), and a filled red circle marks years where the fishery was not open. The data set is trimmed to 1980-2020. The data review could not fully reconcile some of the component estimates from the early 1980s. Note that *Cdn Comm* in Panel D includes both the lower river commercial fishery and the upper river commercial fishery, if it occurred.

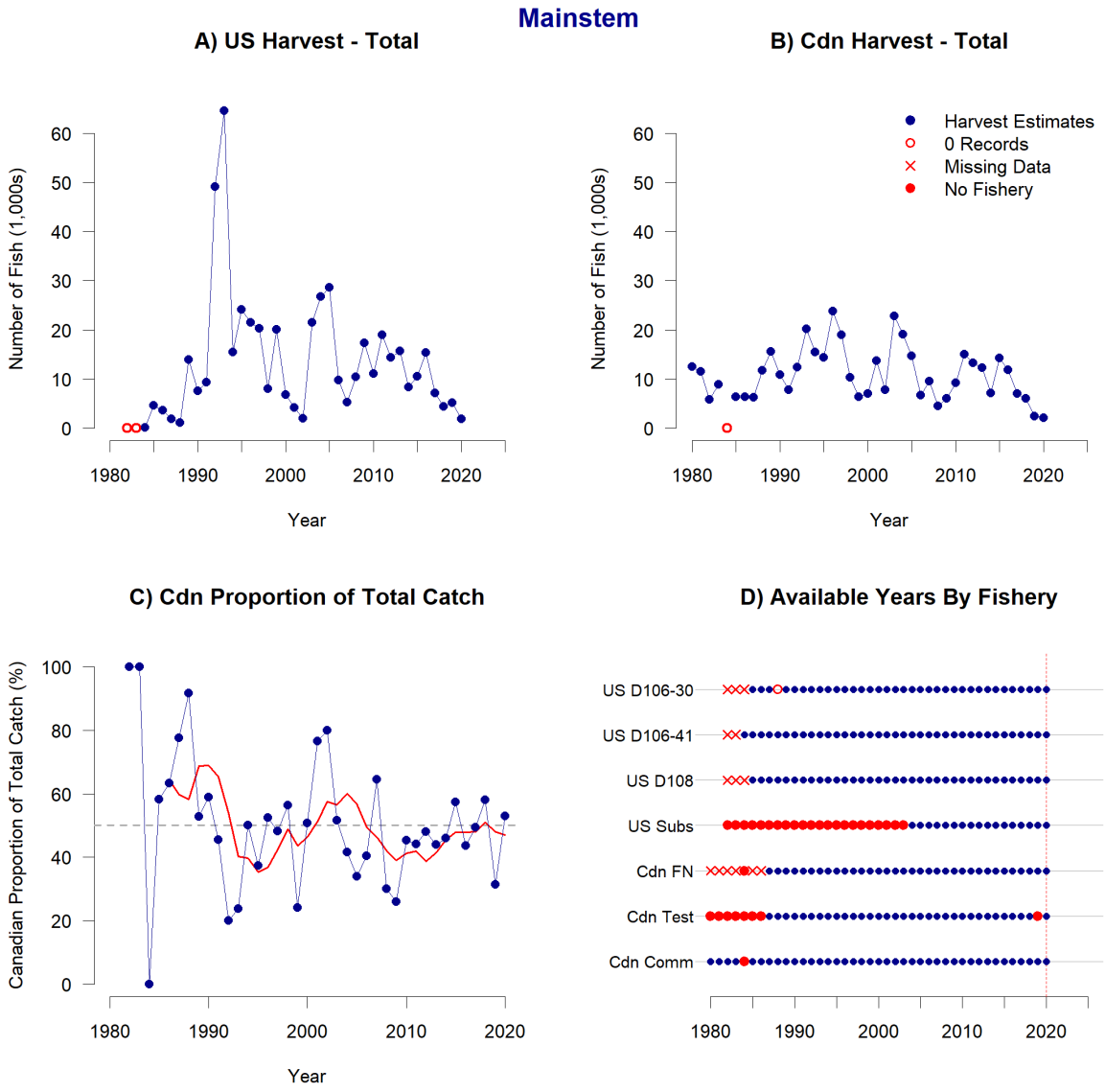

Figure 15. Available estimates for Mainstem harvests. This includes all fish assigned to Mainstem based on stock ID. Panels A, B show the total harvest by country. Panel C shows Canadian portion (%) of the total harvest (points) and running 5-yr average (red line). Panel D shows a timeline of available estimates for each fishery type. In all panels a red x marks missing estimates, and open red circle marks estimates of 0 harvest (i.e., a true zero, not a missing value), and a filled red circle marks years where the fishery was not open. The data set is trimmed to 1980-2020. The data review could not fully reconcile some of the component estimates from the early 1980s. Note that *Cdn Comm* in Panel D includes both the lower river commercial fishery and the upper river commercial fishery, if it occurred.

3.4 Available Spawner-Recruit (SR) Estimates

Spawner and recruit estimates for the Tahltan Natural (wild and enhanced sockeye salmon) stock are currently available for the 1983 to 2014 brood years (Figure 16, top left panel). Observed productivity has been highly variable over these three decades, with about 1/3 of the brood years having less than 1 R/S (i.e., total offspring including harvest, broodstock, and escapement was less than the parent spawners) (Figure 16, top right panel). The observed changes in productivity are partly explained by density-dependence, because years with low abundance generally had high productivity (Figure 16, bottom panel). However, the relationship between spawners and productivity is very noisy: years with spawner abundance around 20,000 had the same range of productivities as years with spawner abundances of 50,000. This noise in the data introduces uncertainty in SR model fits and resulting estimates of biological benchmarks are potentially sensitive to alternative assumptions (e.g., prior distributions, model forms). The capacity parameter (i.e., the slope of a linear regression fit to the scatterplot in the bottom panel) in particular will be highly uncertain.

Spawner and recruit estimates for the Mainstem stock are currently available for the 1983 to 2014 brood years (Figure 17, top left panel). Observed productivity has been highly variable over these three decades, with almost 1/3 of the brood years having less than 1 R/S (Figure 17, top right panel). The observed changes in productivity are strongly explained by density-dependence because years with low abundance generally had high productivity and productivity generally declined with abundance (Figure 17, bottom panel). In the context of Pacific salmon, this is a highly informative SR data set.

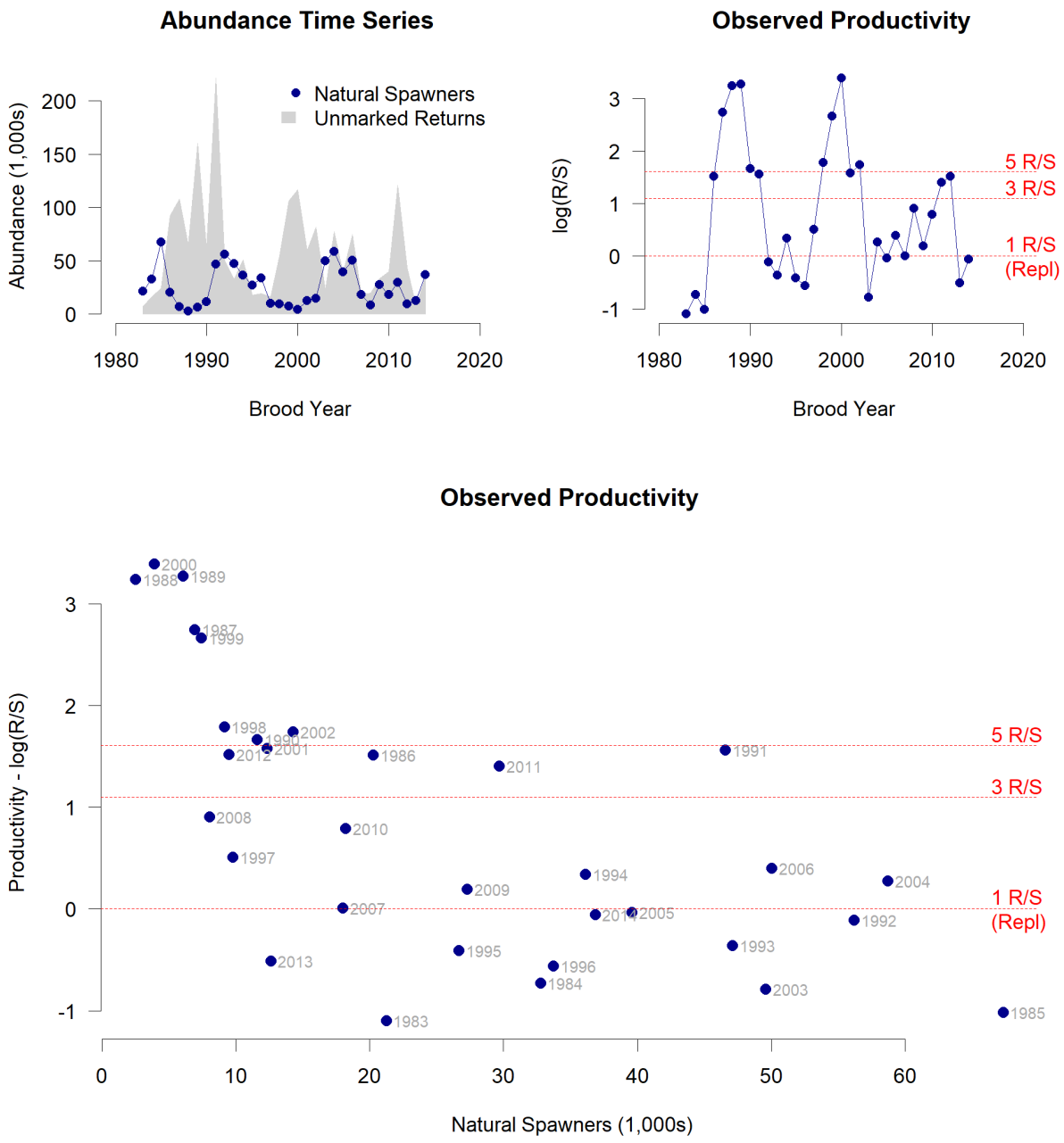

Figure 16. Brood table diagnostics for natural Tahltan spawners. This includes all fish spawning in Tahltan Lake (i.e., unmarked and marked) and their offspring (all unmarked). Top left panel shows the spawner time series and corresponding returns. Top right panel shows "raw" productivity in terms of log(recruits/spawner), without accounting for density dependence (i.e., these are not Ricker residuals, just observed values). Bottom panel shows a scatterplot of log(R/S) vs. spawners. The Ricker model fits a straight line through these data points.

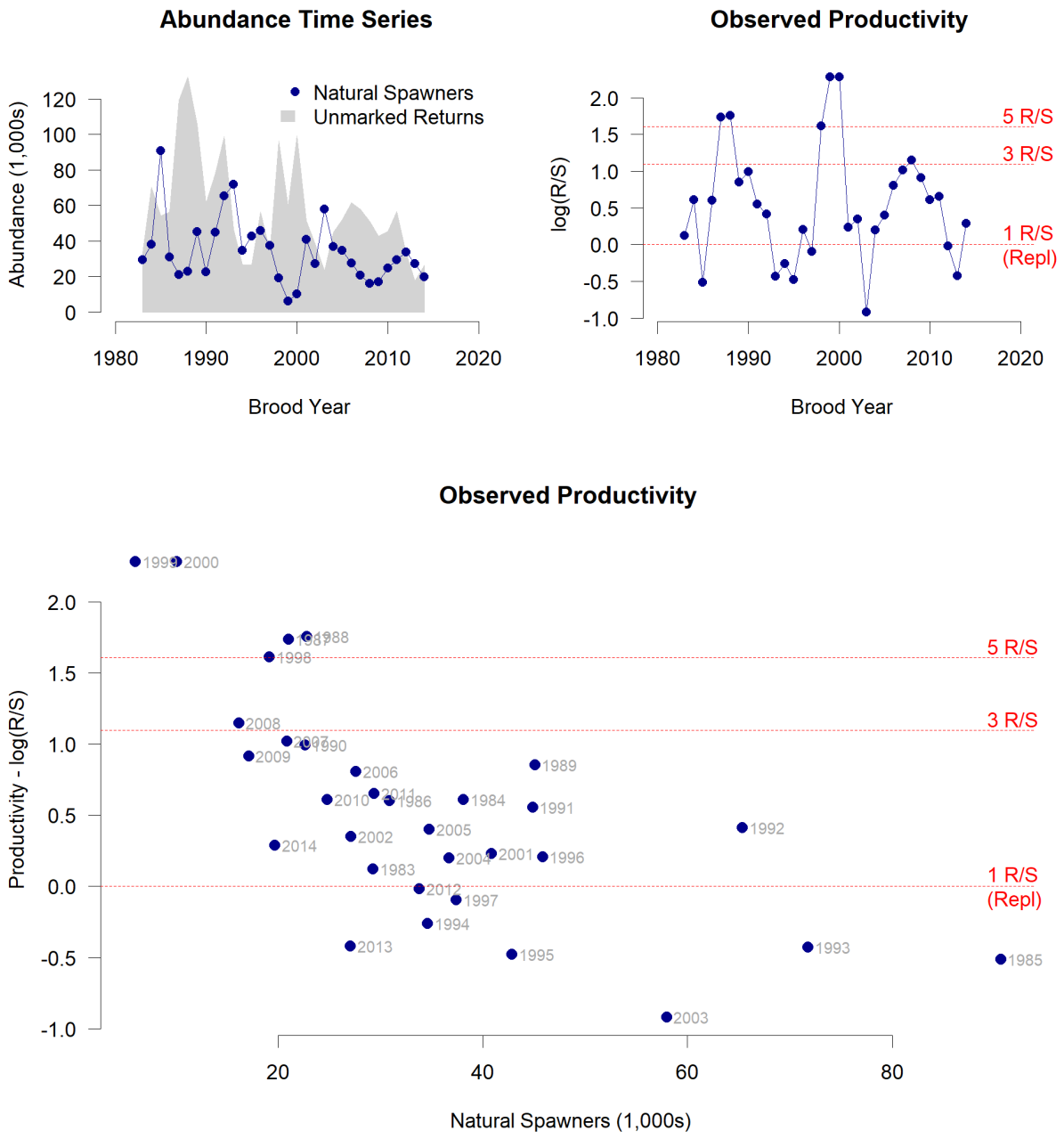

Figure 17. Brood table diagnostics for Mainstem spawners. This includes all fish spawning in the Mainstem and their offspring. Top left panel shows the spawner time series and corresponding returns. Top right panel shows "raw" productivity in terms of log(recruits/spawner), without accounting for density dependence (i.e., these are not Ricker residuals, just observed values). Bottom panel shows a scatterplot of log(R/S) vs. spawners. The Ricker model fits a straight line through these data points.

3.5 Data Review Outcomes

The detailed review of source data coordinated by the Working Group led to many changes of individual records (e.g., individual ASL records, harvest estimates for some fisheries in some years).

A specific example best illustrates the scale of the challenge undertaken by the Working Group: To enable stock-specific analyses, Canadian data relies heavily on egg diameter to assign a record (i.e., fish) to a stock (i.e., Tahltan or Mainstem; see the Lower River Commercial Fishery in the Methods section). As a result, a significant number of records were excluded from the analysis. For example, about 71% (77,000 of 108,300) of the records from the Lower River Commercial Fishery were excluded because data were not 'matched' (i.e., records did not have age (scales), sex (egg diameter), stock, otoliths, and/or statistical week).

In this case, the data review did not change the estimates of spawner abundance (top panels of Figure 18 and Figure 19). Changes in estimates of total terminal run-at-age by return year were very small, but updates to the age composition data and calculation approach resulted in some of the returns being shifted to other brood years (bottom panel of Figure 18 and Figure 19). Overall, these data updates had very little effect on preliminary SR parameter estimates. Preliminary estimates were much more sensitive to choices regarding model form (e.g., basic Ricker vs. Ricker with lag-1 autocorrelation correction) and estimation approach (e.g., Bayesian vs. non-Bayesian).

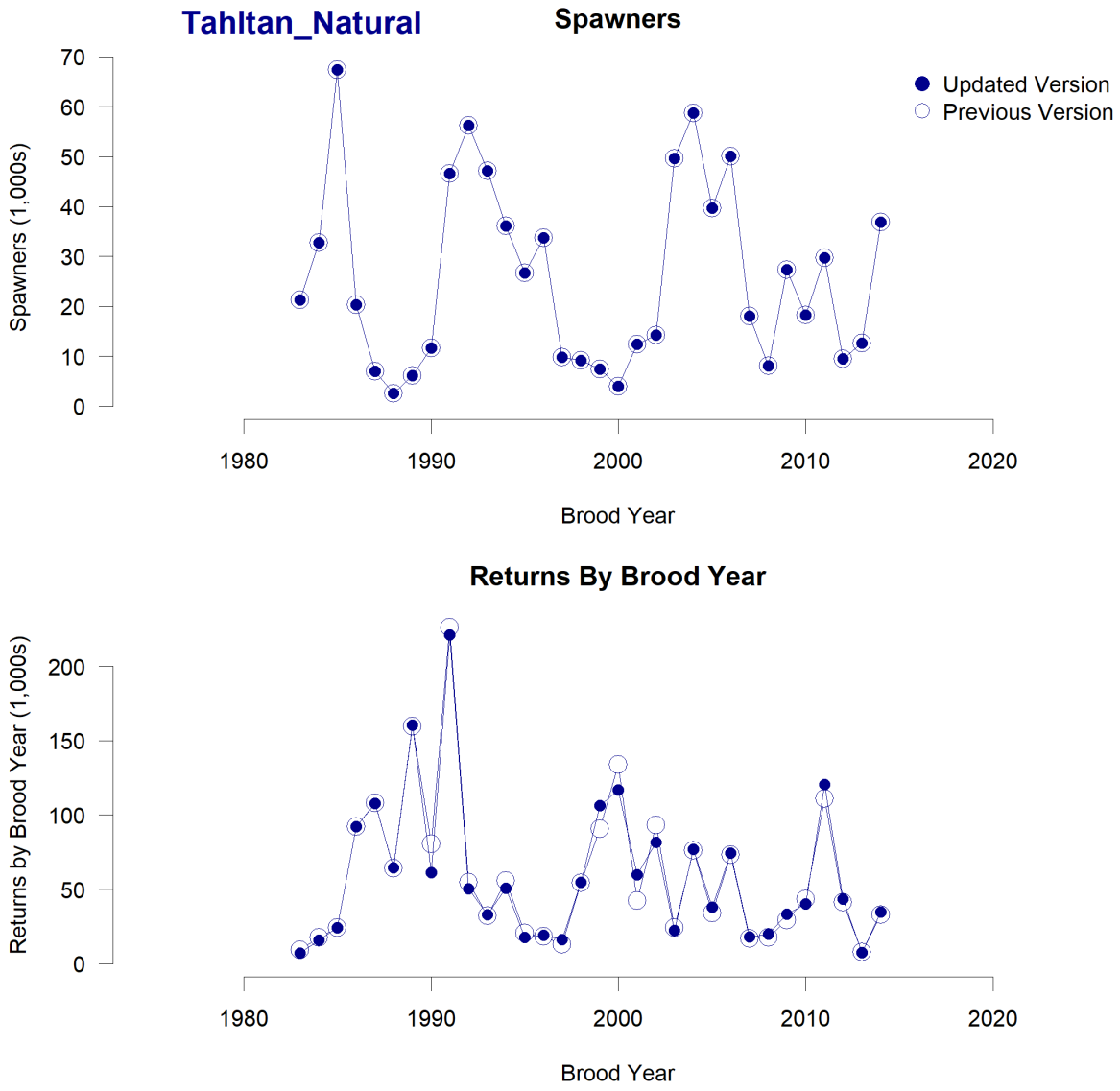

Figure 18. Effect of data review on Spawner-Recruit data for the Tahltan Natural stock. Panels compare the updated time series of spawners (top) and returns (bottom) to the previous version used by the TTC before the data review.

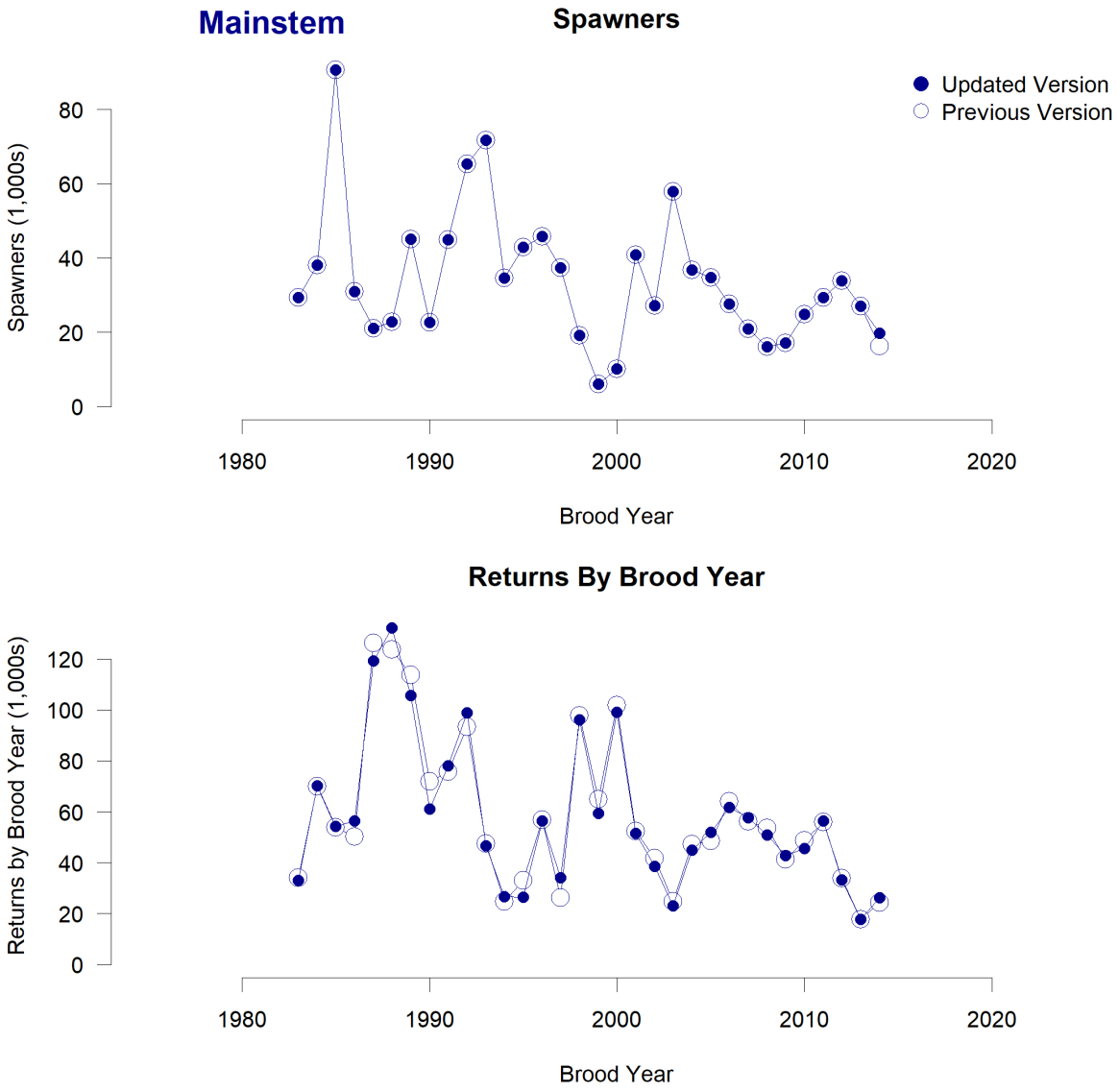

Figure 19. Effect of data review on Spawner-Recruit data for the Mainstem stock. Panels compare the updated time series of spawners (top) and returns (bottom) to the previous version used by the TTC before the data review.

4 DISCUSSION

4.1 Benefits of the Detailed Data Review

A key component of the escapement goal review process was an in-depth review and update of the available Canadian and U.S. data, leading to this stand-alone data report that provides the foundation for subsequent analytical work. Similar bilateral data reviews have recently been completed for Taku Sockeye salmon (Pestal et al. 2020) and Yukon River Chinook salmon (Pestal et al. 2022).

Available data and associated metadata were reviewed within the Working Group as were operational/sampling plans and analysis methods. Through this review, data sources (i.e., survey projects, years available) and related data quality concerns (i.e., data gaps, missing data, other data quality concerns) were documented, summarized, and addressed if possible. For example, much effort went into reviewing fishery-specific harvest data, sorting out the difference between missing values, true records of 0 harvest in a fishery, and years when a fishery was closed (Figure 13 to Figure 15).

Even though this data review had very little effect on the SR data used for the analyses in Miller et al. (in prep), as shown in Figure 18 and Figure 19, this effort was nevertheless a crucial part of the overall escapement goal review process. Participants gained a common understanding of the available information and built trust in the overall WG process. While intangible, these process-related benefits persist and accrue long after the specific project wraps up.

Although evaluation and updating of data sets for brood table calculations occurs regularly, this project has compelled a critical review of the data sets and related assumptions made over time. Data sets have been updated according to a series of detailed rules based on evaluation of the data set as a whole (and the variability within it) to provide increased consistency and a clearer understanding of the data requirements of brood table development/maintenance and spawner-recruit analysis using contemporary analytical tools related to biological characteristics (e.g., GSI) and data analysis packages (e.g., ‘R’ analysis package).

4.2 Available Data

Original escapement goals, established in 1987 by the Transboundary Technical Committee (TTC), for the Stikine River Tahltan and the Mainstem sockeye salmon stocks were largely based on professional judgment regarding stock productivity, the ability of existing systems to manage to them, precision and accuracy of estimates of stock assessment abundance estimates, and the degree of risk considered acceptable (TTC 1987; TTC 1993). At the time, the Tahltan stock escapement goal range was 20,000 to 40,000 sockeye salmon with a management objective of 30,000

fish (unpublished Wood et al. 1993 report). The goal was later revised to 18,000 to 30,000 sockeye salmon with a management objective of 24,000 fish, using data collected as part of the enhancement program evaluation, to account for 20,000 naturally spawning fish and up to 4,000 fish needed for broodstock to meet the objectives of the Canada/U.S. Stikine River enhancement program (TTC 1993; unpublished Wood et al. 1993 report). The Mainstem stock escapement goal range was 20,000 to 40,000 with a management objective of 30,000 fish (TTC 1987; unpublished Wood and Johnston 1990 report) and has remained in place until the current revision.

Although the Canadian stock assessment program for the Stikine River has evolved over time, many more years of data are now available, providing a much better basis for estimating biological parameters and associated escapement goals.

Stikine sockeye salmon are currently modeled as two stocks for escapement goal analyses (Tahltan Natural, Mainstem). There are 32 years of continuous SR data, covering the 1983 to 2014 brood years, available for both stocks. This is a good-sized data set for SR modelling, consistent with other escapement goal analyses for northern transboundary salmon stocks. For example:

- Alsek Chinook salmon EG analysis in 2011 was based on 32 brood years (Fisheries and Oceans Canada 2011a)
- Alsek Sockeye salmon EG analysis in 2011 was based on 33 brood years (Fisheries and Oceans Canada 2011b)
- Taku Chinook salmon EG analysis in 2011 was based on 19 brood years (Fisheries and Oceans Canada 2011c)
- Taku Coho salmon EG analysis in 2015 was based on 23 brood years (Fisheries and Oceans Canada 2015)
- Taku Sockeye salmon EG analysis in 2020 was based on 32 brood years (Fisheries and Oceans Canada 2020b)

Contrast in both spawner abundance and productivity is good for both stocks. Within the 32 brood years with paired spawner and recruit estimates, the observed ranges are:

- *Mainstem*: Smallest spawner abundance was 6,071 in 1999 and largest was 90,617 in 1985, for a contrast of 15 (Max/Min). This is well above the minimum contrast of 4 recommended by Clark *et al.* (2014). Available spawner estimates without a paired recruitment estimate all fall within the range of spawner abundances in the SR data set (i.e., SR data set captures full range of available spawner estimates). Three of the four brood years with the largest spawner abundances (Spn > 50,000) had productivity below replacement (< 1 R/S), indicating that the available SR data set has information for estimating capacity parameters (Smax, Seq).
- *Tahltan Natural*: Smallest spawner abundance was 2,536 in 1988 and largest was 67,326 in 1985, for a contrast of 26.5 (Max/Min). This is well above the minimum contrast of 4 recommended by Clark *et al.* (2014). There is one earlier spawner estimate with lower spawner abundance (1,417 in 1965) but the SR data set captures the largest available spawner estimate. Six of the

seven brood years with the largest spawner abundances (Spn > 45,000) had productivity near or below replacement (< 1.5 R/S), indicating that the available SR data set has information for estimating capacity parameters (Smax, Seq).

4.3 Future Data Requirements

To continue to update data sets for the brood table and for future SR analyses, existing stock assessment programs should continue to collect and assess harvest and escapement data from Stikine River sockeye salmon stocks. Specifically, the Working Group recommends that the following data continue to be collected:

U.S. Data

- U.S. Subsistence fishery (harvest)
- District 106 commercial fishery data (ASL data, harvest, weekly stock proportions, enhanced contribution)
- District 108 commercial fishery data (ASL data, harvest, weekly stock proportions, enhanced contribution)

Canadian Data

- The lower Stikine River assessment project is no longer a lethal fishery (as of 2021), but age, sex, and length data are collected; data collected informs run timing for in-season fishery management, postseason run reconstruction, and age composition of the run, but does not currently contribute to brood table calculations or spawner recruit analyses.
- Lower Stikine River commercial fishery sample data (ASL data, weekly stock proportions, harvest, enhanced contribution)
- Upper Stikine River commercial fisheries (ASL data, weekly stock proportions, harvest, enhanced contribution)
- Canadian First Nation fishery sample data (ASL, harvest)
- Tahltan Lake weir data (ASL data, weir counts, broodstock, natural spawners, enhanced contribution)

In addition, we recommend evaluating and updating Canadian fishery sampling projects to include the use of genetic stock identification rather than egg diameter to assist in stock identification; this change may increase the number of matched records available for future spawner recruit analysis.

4.4 Future Directions for the Stock Assessment Program

Although the Canadian stock assessment program on the Stikine River is relatively well established, it will continue to evolve over time to meet management and monitoring needs of the day.

For example, low anticipated forecasts for 2021, and resulting temporary closures of commercial fisheries and cancellation of assessment (test) fisheries, prompted the development and implementation of a Canadian non-lethal assessment project to replace the lower river assessment (test) fishery. The non-lethal project duplicated methods used in the lethal assessment (test) fishery to the extent possible but shifted toward the use of genetic stock identification (GSI) to identify stock (i.e., Tahltan or Mainstem) rather than the use of egg diameters which require lethal sampling. Continuing to collect biological and CPUE data in the non-lethal lower river assessment project provides a tool with which to gauge abundance and manage fisheries and allows calculation of run timing and run reconstruction including ASL, CPUE, stock composition (including run timing and run reconstruction).

Similarly, the use of GSI for stock identification of Stikine River sockeye salmon continues to be implemented and evaluated. GSI will allow a re-evaluation of current assumptions related to stock identification. For example, the proportion of Tahltan and Mainstem (non-Tahltan) stocks harvested in upper river fisheries has been assumed using professional judgement in past years. Since 2019, for example, it has been assumed that harvest is 2% Mainstem and 98% Tahltan. As stock identification using lower river benchmarks are likely not suitable for use for upper river sockeye salmon, the use of GSI has the potential to provide year-specific estimates of stock composition.

In addition, although management of Stikine River sockeye salmon currently focuses only on two stocks, Tahltan and Mainstem (i.e., non-Tahltan), the use of GSI allows exploration of population structure within the Mainstem (i.e., non- Tahltan) stock. For example, based on current information, the non-Tahltan stock is comprised, usually to a minor extent, of non-Tahltan-origin stocks (i.e., strays) from other watersheds (e.g., Alsek, Taku, Skeena, Nass, Babine, etc..). Although this information may have little influence on current sockeye salmon management decisions, it may allow evaluation and monitoring of straying rates which may assist in informing future management decisions.

4.5 Stocks vs. CUs

Current stock assessment and management of Stikine sockeye salmon does not fully align with the currently identified conservation units (CU) under Canada's Wild Salmon Policy (WSP). The regional escapement database nuSEDS (Fisheries and Oceans Canada 2022) identifies three CUs for lake-type sockeye salmon in the Stikine (Tahltan, Christina, and Chutine) and a large river-type CU, called Northern Transboundary Fjords River-Type, which encompasses observed spawning sites assigned to river-type sockeye salmon in the Stikine and Taku basins, as well as any river-type sockeye salmon spawning in the Unuk and Whiting basins, for which there are currently no records.

The Tahltan Natural stock matches up exactly with the Tahltan CU, allowing for status assessment under the WSP. However, the Mainstem stock combines two lake-type CUs (Christina, Chutine) with part of the large river-type CU. Separate spawner

estimates for these components of the Mainstem stock are currently not available, so status assessments under the WSP are not possible for these 3 CUs. Resolving the sub-stock population structure of Mainstem sockeye to either confirm or update the current CU list is a high priority for WSP implementation.

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APPENDIX A: DATA PROCESSING DETAILS

A.1 Streamlined Data Processing

As part of the data review, we fully automated key steps of the data processing, including record cleaning of the raw data and estimation case-specific estimation steps. Calculations for each data set are compiled into distinct R functions. This appendix shows flowcharts for each of the functions, together with a summary of key steps.

A.2 U.S. Harvest Data Processing

Estimates of Stikine sockeye salmon harvest amounts and age composition by stock for U.S. fisheries were taken 'as-is' for the Stikine sockeye salmon escapement goal review (See section 2.8). Harvest estimates are derived for four distinct fisheries (Figure 20), three marine commercial fisheries (Districts 108, 106-30, and 106-42) and the in-river subsistence fishery. Fishery-specific age composition estimates for the marine commercial fisheries are estimated based on time-stratified samples (by statistical week), but for the subsistence fishery the age composition from the Canadian lower river commercial fishery, which is geographically close (Figure 1), is used. Harvest-at-age is calculated for each of the four fisheries, then combined into an overall estimate of age composition for the U.S. harvest.

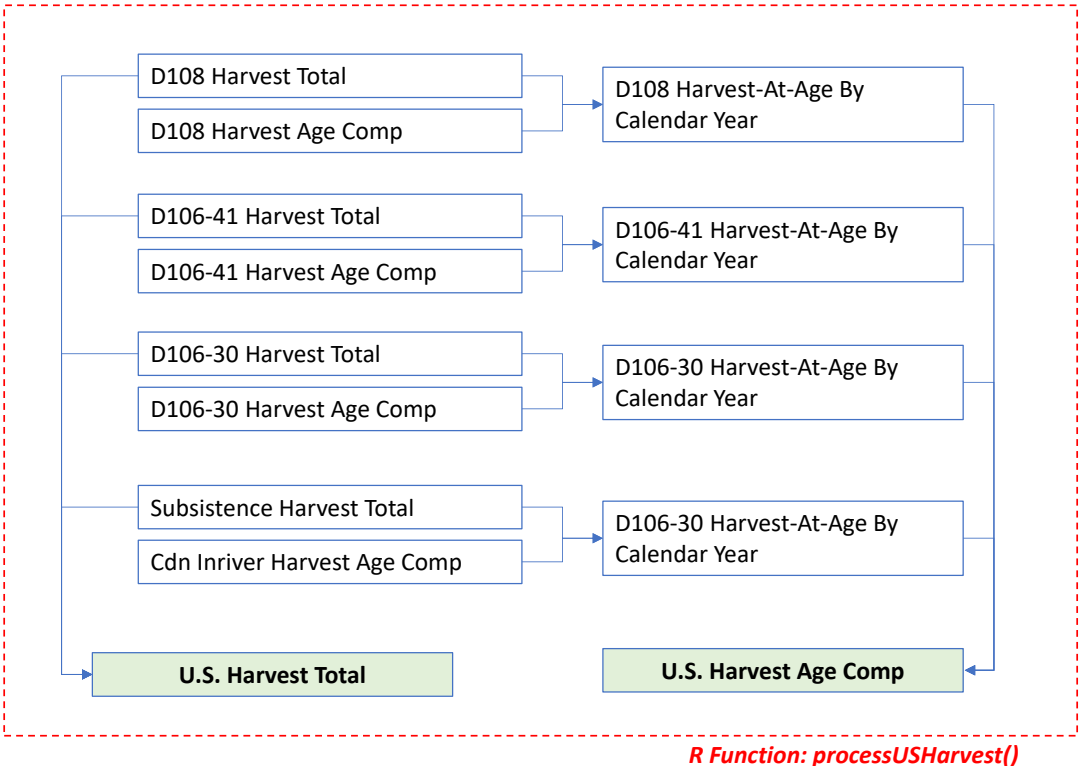

Figure 20. Data processing steps for U.S. harvest estimates.

A.3 Canadian Commercial and Test Fishery ASL Data

Estimates of stock composition, sex ratio, and age composition for the Canadian commercial and test fishery harvests in the lower river focus on *matched* records, which have a complete set of valid entries for age, sex, and statistical week, as well as a thermal mark check from 1995 onward (Figure 21). Although Upper River commercial sampling is completed in concert with Upper River FSC sampling, Upper River commercial data are combined with Lower River commercial data to derive an overall Canadian commercial data set for analysis.

Marked Samples

Samples with a thermal mark are first-generation hatchery releases and are tracked as enhanced (Enh) fish. These are split by origin into Tahltan_Enh, Tuya_Enh or strays. Tahltan and Tuya samples are then used to calculate % contribution of Tahltan_Enh and Tuya_Enh to the harvest, as well as sex ratio and age composition for the enhanced harvest.

Unmarked Samples

Samples without thermal marks are assigned to stocks based on egg diameter. Several alternate approaches were historically investigated (refer to Appendix B.1), but egg diameters since have been used consistently since 1992. To estimate egg diameter, 10 eggs are lined up and measured to the nearest mm.

Samples with egg diameter <37 mm are assigned to the Tahltan_Wild stock and samples with egg diameter ≥37 mm are assigned to the Mainstem stock (refer to Craig, 1985; TTC, 2022c).

In some cases, field measurements of egg diameter were not completed and samples were assigned to a stock based on visual interpretation of egg diameter. In most cases, it is obvious if samples have large eggs (Mainstem) or small eggs (Tahltan).

The assigned samples represent most of the sampled females and are then used to calculate % contribution of Tahltan_Wild and Mainstem to the harvest as well as age composition for each stock. Key assumptions are made in this step. Specifically, stock composition for harvested males is assumed to be the same as for harvested females (put another way: 50:50 sex ratio), and age composition calculated from the female samples is assumed to be applicable to the male samples.

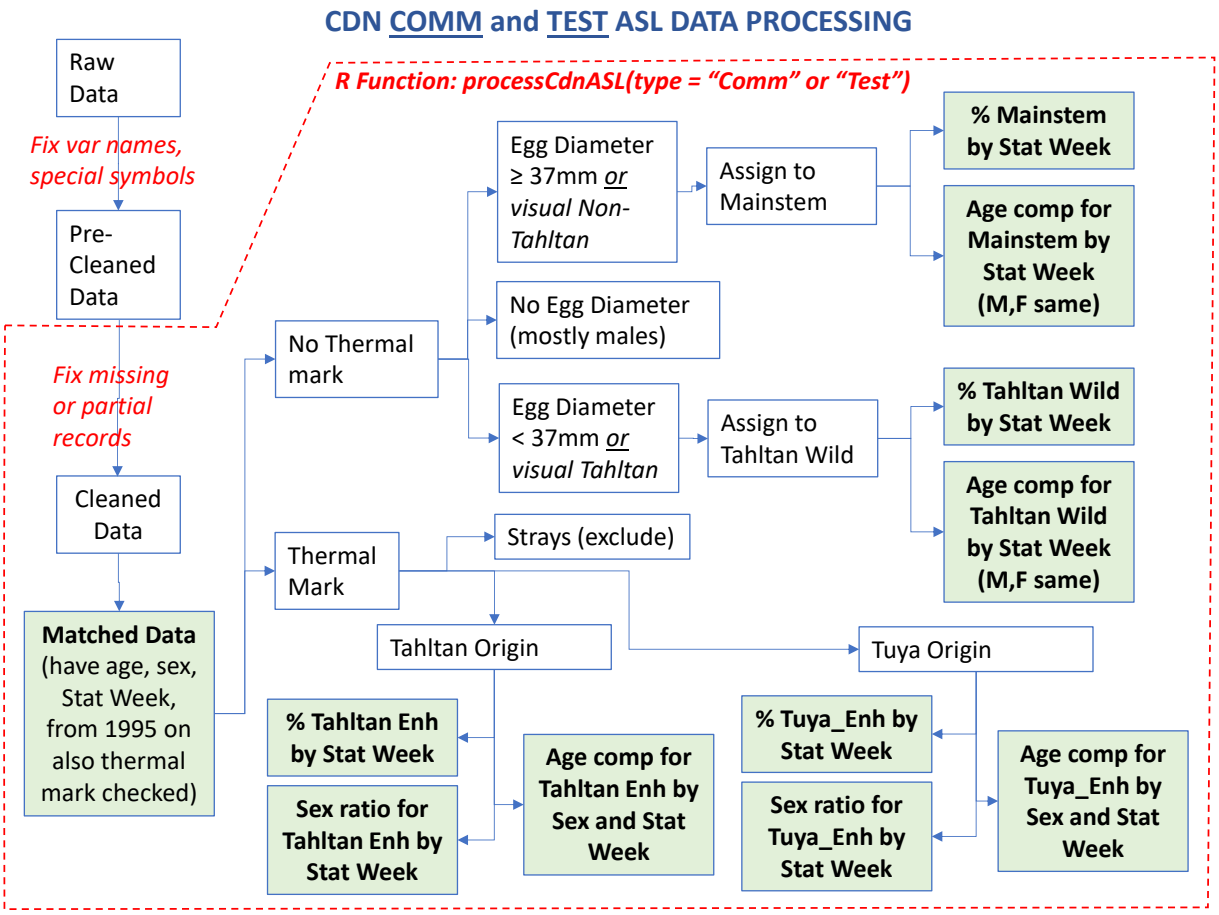

Figure 21. Data processing steps for Canadian commercial and test fishery ASL data.

A.4 Canadian First Nation Fishery ASL Data

Estimates of stock composition, sex ratio, and age composition for the Canadian First Nation fishery harvests in the upper river focus on *matched* records, which have a complete set of valid entries for age, sex, and statistical week, as well as a thermal mark check from 1995 onward (Figure 22).

A fixed proportion of 2% of the harvest is currently assigned to Mainstem. The fixed proportion is based on professional judgement as there are few mainstem spawning sites in the vicinity of First Nation fishing sites. Stock and age composition in upper river fisheries have not been consistently derived. For example, prior to 1996, the age composition of the upper river harvest was derived from Tahltan Lake escapement sampling, and it was assumed that 90% of the sockeye salmon run in the Upper River was of Tahltan origin (Wood et al., 1987). Until 2017, stock composition (Tahltan vs. Mainstem) was based on egg diameter and the same criteria used in the lower river were applied to upper river data (i.e., egg diameters ≥ 37mm were Mainstem fish). In 2018, the approach to upper river stock composition shifted again such that it was assumed that 2% of the harvest was Mainstem stock and 98% was Tahltan stock. The shift was made because egg diameter criteria were developed using egg diameters in the lower river and as eggs continue to grow as they mature and as fish move upstream, size criteria are not likely to be the same as they are in the lower river.

Marked Samples

Samples with a thermal mark are first-generation hatchery releases and are tracked as enhanced fish. These are split by origin into Tahltan_Enh, Tuya,_Enh or strays. Tahltan and Tuya samples are then used to calculate % contribution of Tahltan_Enh and Tuya_Enh to the harvest, as well as sex ratio and age composition for the enhanced harvest.

Unmarked Samples

Samples without thermal marks are assigned to Tahltan_Wild to calculate sex ratio and separate age compositions for males and females by stat week. The same estimates are then applied to the 2% Mainstem harvest.

Gap Filling

The resulting data set does not span all required years and statistical weeks, so the following rules were used for gap filling:

- Stock composition for 1994 and earlier: set any missing records as 0% Tahltan_Enh, 98% Tahltan_Wild, 2% Mainstem, 0 % Tuya
- Stock compositions for 1995 and later: set any missing stock prop as 2% Mainstem, mean % Tuya for that year, and mean % Tahltan_Enh enhanced for that year, then calculate % wild as 100% - Mainstem – Tuya – Tahltan_Enh
- Proportion of enhanced: 1995 has no records in the raw or cleaned data. 1997 and 2015 have records in the raw data, but no *matched* samples (missing otolith data). These three years are gap filled from a lookup file with estimates of enhanced proportion used at the time (i.e., gap filled with historical data rather than recalculated from reviewed data)
- Sex ratio: If have less than 5 samples for a stat week, then set % Female for wild harvest to 50%

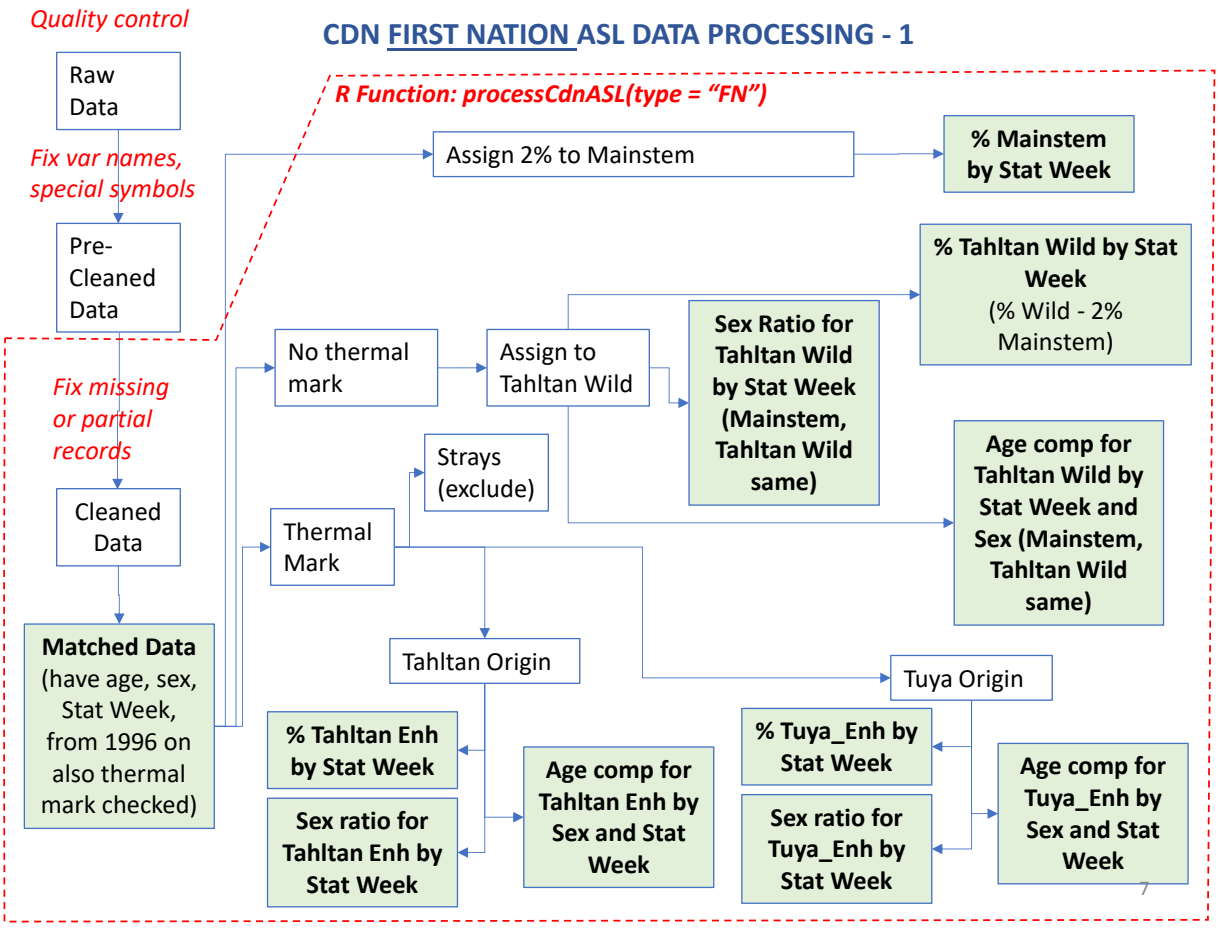

Figure 22. Data processing steps for Canadian First Nation ASL data.

A.5 Tahltan Lake Weir ASL Data

Estimates of stock composition, sex ratio, and age composition for the Tahltan Weir are derived differently for 4 different time periods, due to changes in the sampling program (Figure 23).

1977 to 1994 – Prior to enhancement

Use all random live samples to calculate age composition and sex ratio, assuming that all samples are Tahltan fish, and that age composition is the same for males and females. Age composition was calculated from scale samples taken (proportionally) throughout the run from randomly selected live sockeye salmon. Weekly age composition was expanded by the weekly weir escapement to construct the age composition of the return.

1995 to 2009 (excluding 2001)

Assessment of wild and enhanced sockeye salmon returns commenced in 1995 based on otolith thermal marks. Fully matched (i.e., otoliths, scales-based age, sex, length) records by statistical week from lethal samples were used to calculate stock composition (i.e., wild vs. enhanced), sex ratio, and age composition by stock and sex. Weekly estimates of stock-specific age composition were expanded by weekly estimates of lake escapement and summed to derive an estimate of the stock-specific age composition of the lake escapement.

2001 (No matched records in the lethal samples)

Fully matched records from broodstock samples (age, sex, statistical week, thermal mark check) were used to calculate stock composition (i.e., wild vs. enhanced), sex ratio, and age composition by stock and sex.

Starting 2010 (no matched data)

Since 2010, the samples have either an age (live sampling) or a thermal mark check (lethal sampling), but not both. Age composition estimates by sex and statistical week are based on age from live random samples. Stock composition is estimated from a combination of lethal samples and broodstock samples with thermal mark checks. The ratio of wild to enhanced fish is applied to the overall estimate of lake escapement and the annual age composition (proportions) are applied to the estimate of wild and enhanced returns to derive an estimate of the age composition of wild escapement and enhanced escapement. In 2013, 2015, and 2017 lethal sampling did not occur and wild to enhanced proportions were derived from the brood stock samples (thought to be sampled in proportion to the return). In 2020, lethal sampling did not occur however wild to enhanced proportions were derived from the Upper River fishery data since it was thought that the brood stock was not sampled in proportion to escapement.

Since 2010, matched data have not been collected: scale samples were obtained from live-sampled fish and otoliths (but not scales) were obtained from lethal samples. As a result, the age composition of wild and enhanced fish cannot be discretely assessed and therefore is assumed to be equivalent. Moreover, since

2018, lethal samples have included only male fish. In years when Tahltan Lake escapement was either anticipated to be, or appeared to be, below escapement, there was significant discomfort with lethally sampling female fish. As data analyses suggested that there was no discernable difference between male and female age composition (from live samples) (Fisheries and Oceans Canada, *unpublished data*), a male-only lethal sample approach was taken to reduce uncertainty in completing lethal samples to obtain accurate wild versus enhanced escapement proportions.

Gap Filling

The resulting data set does not span all required years and statistical weeks, so the following rules were used for gap filling:

- Annual % enhanced: 2013 and 2020 have no records with thermal mark checks, so can't get estimate of % enhanced. The previous year's estimate is used for each missing year using 2012 for 2013 and 2019 for 2020
- Weekly stock comp - 1994 and earlier: set any missing stock proportions as 0% enhanced, 0% Mainstem, 0% Tuya
- Weekly stock comp - 1995 and later: set any missing stock proportions as 0% Mainstem, 0% Tuya, and mean % enhanced for that year
- Percent Female: If have less than 5 samples for a stat week, then set % Female for wild to 50%

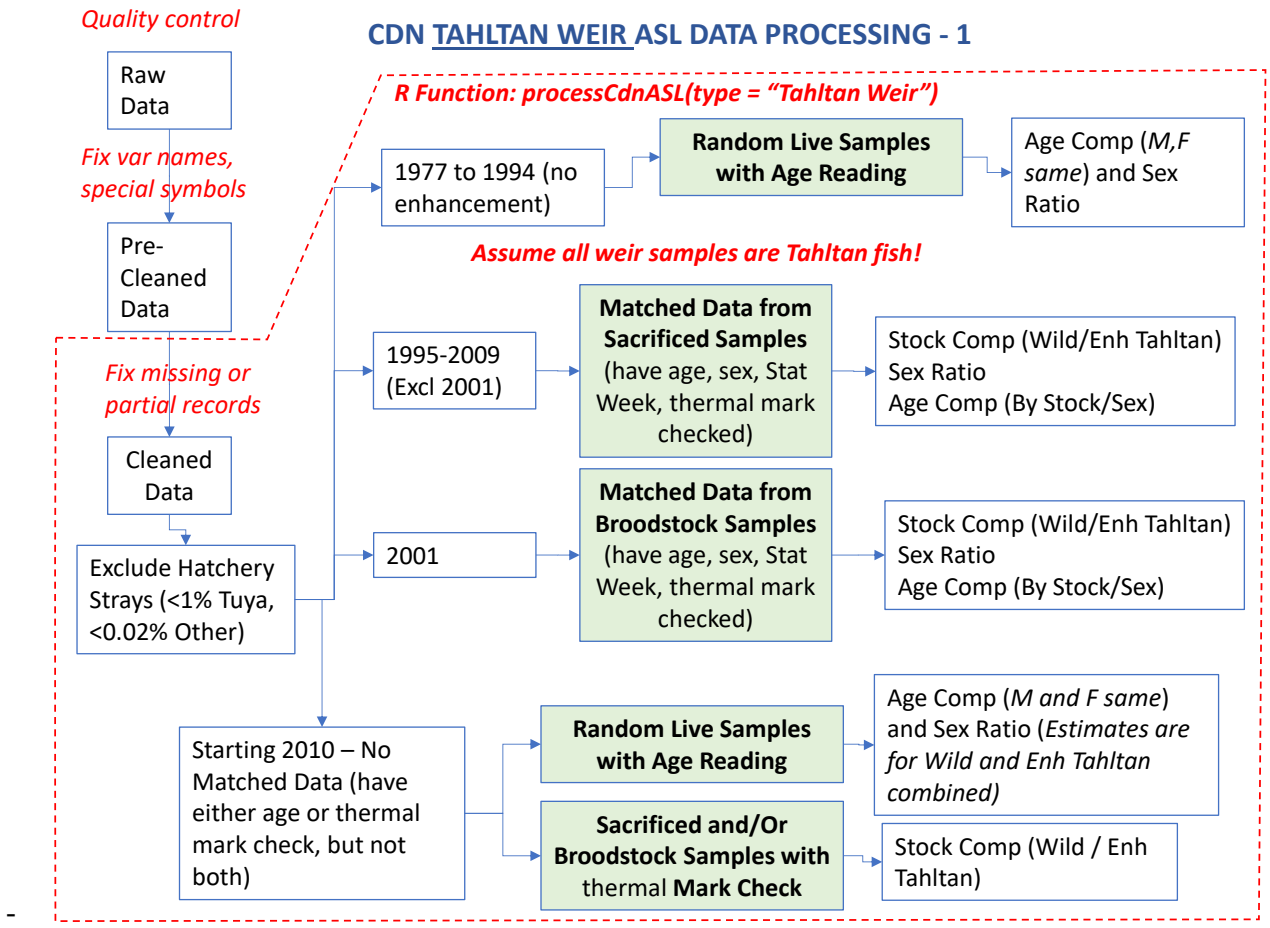

Figure 23. Data processing steps for Tahltan Weir ASL data.

A.6 Age Composition Estimates for Canadian Stock-Specific Harvest and Escapement

Age composition of the annual stock-specific harvest is derived annually by expanding the age composition of stock-specific samples to stock specific harvest within each statistical week (i.e., weighting by the harvest in each statistical week), and the summing the expanded stock-specific age composition across statistical weeks. The annual, weighted, stock specific age composition is utilized in brood table development. Since egg diameter has historically been the only way to distinguish between wild Tahltan and Mainstem sockeye salmon, only females are used in the analysis (it is assumed that the male age composition is equivalent). Since enhanced Tahltan fish are marked, male and female fish can be used in the analysis. Typically, in most years, age compositions of the commercial and assessment (test) fisheries were combined for the purposes of the brood table. In some years, however, either the age composition of the assessment fishery or the commercial fishery was used for brood table development as the information available at the time suggested one or the other better represented average age composition of returning sockeye salmon.

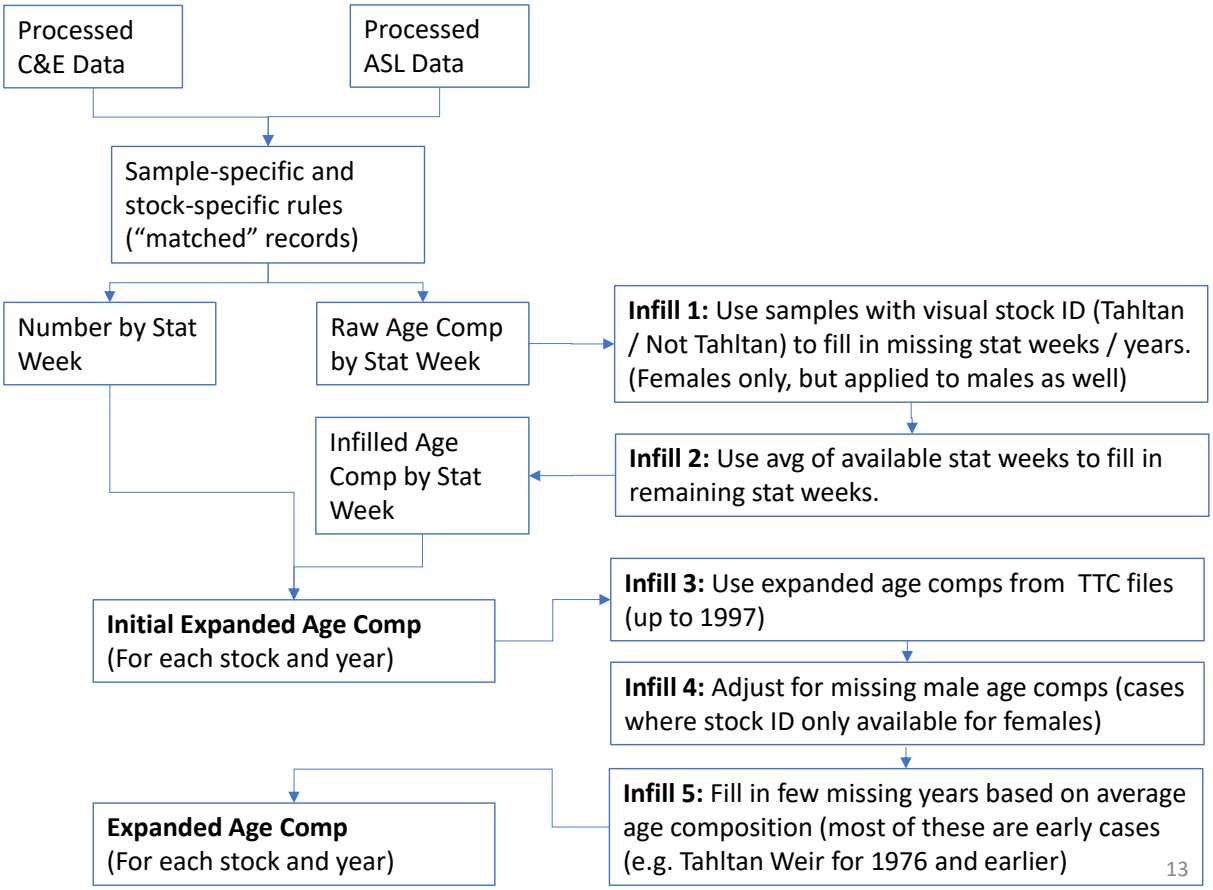

Figure 24. Age composition calculations. Age composition estimates by statistical week are expanded based on weekly run size to calculate overall age composition for the run year.

Stock-specific harvest within each statistical week is derived by estimating the proportions of Tahltan and Mainstem fish within each statistical week (i.e., run timing). The following are the steps in the analysis:

1. Final stock-specific statistical week proportions are determined postseason by analyzing the sampling data paired with assigned ages and thermal marks.
2. Once the ASL and otolith results are combined with the sampling data, the data is checked for individual fish errors corresponding to the assigned age from a scale and assigned brood year from otolith thermal marks, then the data is refined through several steps.
3. The female samples that are sampled for large and small egg and assigned an age, are summed by statistical week into the large or small egg totals by age class.
4. Those results are then used in a “smoothing” analysis using a logistic regression to predict the stock proportions by statistical week for each age class.
5. Since egg diameters (female samples only) are used to predict the stock (Tahltan or Mainstem) the smoothing results are then used to proportion out the stock-specific harvest by estimating the proportion of female and male harvest by age by statistical week.
6. The thermal marked results are used to determine the estimate of stock-specific enhanced harvest by statistical week.
7. The results of stock-specific sex by ages by statistical week are then used to determine weekly proportions of stock-specific harvest used with statistical week CPUE to determine stock-specific migratory timing.

These results provide the overall proportions of wild and enhanced fish for brood table calculations (in TTC 2020, refer to Appendix A 12 for the assessment (test) fisheries and Appendix A 10 for the commercial fisheries).

Historically, for the purposes of the brood table, the age composition of the lower river fisheries (assessment + commercial) has generally been applied to the entire Canadian harvest (including upper river fisheries). The historical approach has, however, been revised as part of the data analysis for the escapement goal review such that the stock-specific age composition of the harvest from each discrete fishery was developed initially, and then combined to represent the entire Canadian harvest.

Overall escapement age composition is estimated by determining the age composition of escapement samples within each statistical week expanded by the total escapement within each statistical week. The weighted age compositions within each statistical week are summed to derive an annual, weighted estimate of escapement age composition (proportions). These proportions (equivalent for wild and enhanced fish) are further applied to the overall estimate of wild and enhanced escapement to the lake derived from otolith (marked) proportions applied to the overall lake escapement. As a general rule, lethal samples were used to estimate the proportion of wild to enhanced escapement, however in years when lethal sampling did not occur, either the wild to enhanced proportions from the brood stock (when sampling was representative of the run) or the upper river fishery were used.

APPENDIX B: SAMPLING PROGRAM DETAILS

B.1: Summary of Lower Stikine Commercial Fishery Sampling Objectives

DFO Operational Plans and/or Transboundary Technical Committee Management Plans (Transboundary - Pacific Salmon Commission (psc.org)) were consulted to derive sampling objectives in each year of the program. Relevant comments and changes to the program over time are also noted.

Year	Sampling Objective	Program or Sampling notes/changes
1986 (1987 post season PSC report)	To estimate Stikine River sockeye salmon in fisheries: Matched scale, genetic, and parasite data from in-river and marine harvest areas; No specific data collection breakdown found (no management plan or operational plan located)	
1987 (Management Plan)	Lower commercial fishery: 400 scales /week; 100 Egg Diameters (EDs) (for inseason use) Iskut (at Verrett): *samples per season* 100 EDs 100 for parasite *(Philonema oncorhynchi and Myxobolus neurobius)* 100 for GSI	All scales to ADF&G on a weekly basis; weekly age summaries in-season Post-season stock assessment using SPA (Scale pattern analysis) and PGA (parasite-genetic-age analysis)
1988 (Management	400 fish/week (scales, sex, length) 100 EDs/week (for inseason use)	Scale samples to ADF&G ongoing in-season for age comp summaries through to

Year	Sampling Objective	Program or Sampling notes/changes
Plan)		Aug 4 Post-season stock assessment using SPA (Scale pattern analysis) and PGA (parasite-genetic-age analysis)
1989 (Management Plan)	700 fish/season (scales, sex, length) 100 EDs/week	Program note: Reduction in assessment programs due to budget cuts within each party New: First year to use ED for stock identification in-season AND post-season for Canadian data (previously, stock compositions were estimated post-season with SPA and PGA)
1990 (Management Plan)	350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females	Scales with matched data sent to ADF&G weekly Genetic stock identification sampling eliminated due to budget cuts (previously liver samples taken in the 1980's – test fishery and some comm samples) Program note: *Important to match EDs and scales in order to be able to develop post season scale pattern standards (for U.S. stock analysis) and stock specific age composition estimates
1991	350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females	Program note: *Important to match egg diameters and scales in order to be able to

Year	Sampling Objective	Program or Sampling notes/changes
(Operational Plan)		develop post season scale pattern standards (for U.S. stock analysis) and stock specific age composition estimates
1992 (Operational Plan)	350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females	
1993 (Operational Plan)	350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females	First year that a portion of the Tahltan run (return) consists of enhanced sockeye salmon (released into Tahltan Lake as unfed fry in 1990) – *no biological assessment of enhanced proportions yet*
1994	350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females	*FIRST YEAR OF OTOLITH COLLECTION AND ANALYSIS (*Otoliths collected in US fishery and Upper River but no data to suggest otoliths were collected in the Lower River commercial or test fisheries) Introduction of additional fishing net permitted: For the first 48 hours of each week, each fisher was allowed the use of one gillnet, after which 2 nets were permitted (one of which could be drift) – *due to increased fishing effort as a result of above average run*
1995 (Operational Plan)	Sockeye salmon harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: 350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females and matched otoliths, EDs and ASL from 150 females	New: consideration of enhanced sockeye salmon contribution - First year of otolith collection to estimate enhanced contribution to Tahltan stock

Year	Sampling Objective	Program or Sampling notes/changes
	Sockeye salmon samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	New net regulations: 2 gillnets permitted for entirety of fishery openings (one of which can be drift) Note: it is imperative that weekly stock comp sample data originates from sites below the confluence of the Stikine and Iskut. ****To be an annual procedure moving forward****
1996 (Operational Plan)	Sockeye salmon harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: 350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females and matched otoliths, EDs and ASL from 200 females from 50 males Sockeye salmon samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
1997 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: 350 fish/week: scales (1), sex, length (FL); includes matched EDs from 100 females and matched otoliths, EDs and ASL from 200 females from 50 males Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	Fishery boundary change: upper limit extended from Stikine confluence with Porcupine River, 25 km upstream to confluence with Flood River
1998	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers:	Program note: Otoliths and matched ED data delivered to ADF&G weekly (Tues or

Year	Sampling Objective	Program or Sampling notes/changes
(Management Plan)	350 fish/week: scales, sex, length (FL); includes matched EDs and otoliths from 150 females and matched otoliths from 50 males Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	Wed) for inseason analysis; Min of **60/wk** for stock comp analysis; remaining (up to 200) samples delivered the following week (continued until 2020)
1999 (Operational Plan/Management Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: 350 fish/week: scales, sex, length (FL); includes matched EDs and otoliths from 150 females and matched otoliths from 50 males Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
2000 (Operational Plan/Management Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: 350 fish/week: scales, sex, length (FL); includes matched EDs and otoliths from 150 females and matched otoliths from 50 males Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	Commercial License change: Landed fish must be segregated by gear type and specified on landing slip: AI, BI, II; SN, DN (Above Iskut, Below Iskut, In Iskut; Set Net, Drift Net) New: Mark-recapture (M/R) program introduced to explore the feasibility of developing an alternate abundance-based management regime for Stikine sockeye salmon stocks; event 1 tagging at Rock Island, event 2 retrieval in lower Stikine

Year	Sampling Objective	Program or Sampling notes/changes
		commercial and test fisheries and other Mainstem or upper river sampling programs; all samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage
2001 (Management Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: 350 fish/week: scales, sex, length (FL); includes matched EDs and otoliths from 150 females and matched otoliths from 50 males 100 DNA samples matched with EDs and otoliths Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	Fishing boundary change: extended from 1.5 km up Iskut to 10 km up Iskut Net regulation change: back to 1 gillnet only (drift or set) M/R program: All samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage
2002 (Operational Plan/ management plan)	-not clear	M/R program: All samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage
2003 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (1), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (1), sex, and	M/R program: All samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage

Year	Sampling Objective	Program or Sampling notes/changes
	length (FL); 100 to include matched ED Sockeye samples from above the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
2004 (Operational Plan)	Sockeye harvested from below the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (1), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (1), sex, and length (FL); 100 to include matched ED Sockeye samples from above the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	M/R program: All samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage
2005 (Operational Plan)	Sockeye harvested from below the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) Sockeye samples from above the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	Net regulation change: One net only (drift or set); changed to two nets (one can be drift) during the fishing season M/R program: All samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage

Year	Sampling Objective	Program or Sampling notes/changes
2006 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (1), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (1), sex, and length (FL) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	Estimated below average Tuya return *(no Tuya enhancement in 2000 or 2001)* Net regulation change: 2 gillnets permitted for entirety of fishery openings (one of which can be drift) M/R program (LAST YEAR): All samples must be checked for spaghetti and tag loss as indicated by left lower opercular hole punch and absence of left axillary appendage
2007 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: sampling initiated Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	*Up to 350 random samples are required for age and size analysis*
2008 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL),	*Up to 350 random samples are required for age and size analysis*

Year	Sampling Objective	Program or Sampling notes/changes
	otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
2009 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	*Up to 350 random samples are required for age and size analysis*
2010 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and	*Up to 350 random samples are required for age and size analysis*

Year	Sampling Objective	Program or Sampling notes/changes
	50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
2011 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	*Net regulation change: One net only (set or drift) *Up to 350 random samples are required for age and size analysis*
2012 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males)	New: *Scale books need not be sent with the otolith samples as per past year's practices. This may change inseason and notification will be provided.*

Year	Sampling Objective	Program or Sampling notes/changes
	b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from above the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	*Up to 350 random samples are required for age and size analysis*
2013 (Operational Plan)	Sockeye harvested from below the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from above the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	*Up to 350 random samples are required for age and size analysis*
2014 (Operational Plan)	Sockeye harvested from below the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL), otoliths, and ED (150 EDs required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (2), sex, and	*Up to 350 random samples are required for age and size analysis*

Year	Sampling Objective	Program or Sampling notes/changes
	length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
2015 (Operational Plan)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (1), sex, length (FL), otoliths, and egg diameter (150 egg diameters required; sample 150 females and 50 males) b) 350 fish/week (random) with matched scales (1), sex, and length (FL) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from <u>above</u> the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	*Up to 350 random samples are required for age and size analysis*
2016 (Operational Plan)	200 fish/week (random) with scales (1), FL 200 fish/week with scales (1), FL, otoliths 150 fish/week – ED (may be from same fish as otoliths) DNA: 200/week	
2017 (Operational plan -draft version)	Sockeye harvested from <u>below</u> the confluence of the Stikine and Iskut Rivers: a) 200 fish/week with matched scales (2), sex, length (FL,	**FL is the main length for all – alternate every 10 fish between POHL and MEF for a second length*

Year	Sampling Objective	Program or Sampling notes/changes
	POHL, MEF), otoliths, and egg diameter (150 egg diameters required; sample 150 females and 50 males) b) 200 fish/week (random) with matched scales, sex, and length (FL, POHL, MEF) c) DNA: 200 axillary appendages/week (composite; 1 bottle/SW) Sockeye samples from above the confluence of the Stikine and Iskut Rivers *(low priority)*: Up to 200 samples	
2018 (sampling directive)	1st priority: 200 fish/week (random) with matched ED, otoliths, scales (5), sex, length (FL, MEF, POHL) 2nd priority: 200 fish/week (random) with matched sex, FL, ED Samples from harvest below confluence of Stikine and Iskut Rivers *random = no selection of male and female*	***Sampling directives change*** *Scales used for aging AND GSI*
2019 (Operational plan)	1st priority: 200 fish/week (random) with matched ED, otoliths, scales (5), sex, length (FL, MEF, POHL) 2nd priority: 200 fish/week (random) with matched sex, FL, ED Samples from harvest below confluence of Stikine and Iskut	*Scales used for aging AND GSI*

Year	Sampling Objective	Program or Sampling notes/changes
	Rivers *random = no selection of male and female*	
2020 (Operational Plan)	1st priority: 200 fish/week (random) with matched ED, otoliths, scales (5), sex, length (FL, MEF, POHL) 2nd priority: 200 fish/week (random) with matched sex, FL, ED Samples from harvest below confluence of Stikine and Iskut Rivers *random = no selection of male and female*	*Scales used for aging and GSI* Otoliths not shipped to Wrangell on a weekly basis (office closure) COVID-19 Pandemic

B.2: Summary of Lower Stikine Commercial Fishery Length Measurements

Within the Lower Stikine Commercial Fishery sampling program, a variety of length measurements have either been measured or calculated across years. Generally, fork length (FL) has been measured from all fish sampled, however mid eye fork length (MEF) and post-orbital hypural length (POH) has often been calculated through regression using test fishery data from the same year. NA indicates no data. Specific approaches in each year are summarized.

Year	**Fork Length (FL)**	**Mid-eye Fork Length (MEF)**	**Post-orbital Hypural Length (POH)**
1985	Measured	N/A	Measured
1986	Calculated (regression of HL; by sex)	N/A	Measured
1987	Measured	N/A	Measured
1988	No data found. Length data not noted in sampling objectives this year		
1989	Measured	N/A	Measured
1990	Measured *(note: all are from Iskut River)*	N/A	Measured *(note: for both Iskut and comm fishery samples)*
1991	Measured	N/A	N/A
1992	Measured	N/A	N/A
1993	Measured	N/A	Calculated (regression of 1993 test fishery FL & POH; for males and for females)
1994	Measured	N/A	Calculated (regression of 1994 test fishery FL & POH; for males and for females)
1995	Measured	N/A	Calculated (regression of 1995 test fishery FL & POH; for males and for females)
1996	Measured	N/A	Calculated (regression of 1996 test fishery FL & POH; for males and for females)
1997	Measured	N/A	Calculated (regression of 1997 test fishery FL & POH; for males and for females)
1998	Measured	N/A	Calculated (regression of 1998? test fishery? FL & POH; for males and for females
1999	Measured	N/A	Calculated (regression of 1999? test fishery? FL & POH; for males and for females
2000	Measured	N/A	'Otolith' samples: Calculated (regression; data source not clear)

			'No Otolith' samples: N/A
2001	Measured	'Otolith' samples: Calculated (regression of 2001 tagging site POHL & MEF) 'No otolith' samples: Calculated (regression of 2001 tagging site POHL & MEF)	'Otolith' samples: Calculated (regression of 2001 test fishery POH & FL) 'No otolith' samples: Calculated (regression of 2001 tagging site POH & FL)
2002	Measured	Calculated (regression; irreparable error in data)	'Otolith' samples: Calculated (regression, data source not clear) 'No Otolith' samples: N/A
2003	Measured	Calculated (regression; data source not clear)	Calculated (regression of 2003 test fishery FL & POH)
2004	Measured	Calculated (regression of 2004 test fishery FL & MEF)	Calculated (regression of 2004 test fishery FL & POH)
2005	Measured	Calculated (regression of 2005 test fishery FL & MEF)	Calculated (regression of 2005 test fishery FL & POH)
2006	Measured	Calculated (regression of 2006 test fishery FL & MEF oto data)	Calculated (regression of 2006 test fishery oto FL & POH)
2007	Measured	Calculated (regression of 2007 test fishery FL & MEF)	Calculated (regression of 2007 test fishery FL & POH)
2008	Measured	Calculated (regression of 2008 test fishery FL & MEF)	Calculated (regression of 2008 test fishery FL & POH)
2009	Measured	Calculated (regression of 2009 test fishery FL & MEF)	Calculated (regression of 2009 test fishery FL & POH)
2010	Measured	Calculated (regression of 2010 test fishery FL & MEF)	Calculated (regression of 2010 test fishery FL & POH)
2011	Measured	Calculated (regression of 2011 test fishery FL & MEF)	Calculated (regression of 2011 test fishery FL & POH)
2012	Measured	Calculated (regression of 2012 test fishery FL & MEF)	Calculated (regression of 2012? test fishery? FL & POH)
2013	Measured	Calculated (regression of 2013 test fishery FL & MEF)	Calculated (regression of 2013 test fishery FL & POH)

2014	Measured	Calculated (regression of 2014 test fishery FL & MEF)	Calculated (regression of 2014? test fishery? FL & POH)
2015	Measured	N/A	N/A
2016	Measured	Calculated (regression of 2016 test fishery FL & MEF)	Calculated (regression of 2016 test fishery FL & POH)
2017	Measured	'otolith' samples: ½ measured (alternate with POHL), ½ calculated (regression of 2017 test fishery FL & MEF) 'No otolith' samples: Calculated (regression of 2017 test fishery FL & MEF)	'otolith' samples: ½ measured (alternate with MEF), ½ calculated (regression of 2017 test fishery FL & POH) 'No otolith' samples: Calculated (regression of 2017 test fishery FL & POH)
2018	Measured	Calculated (regression of 2018 test fishery FL & MEF)	Calculated (regression of 2018 test fishery FL & POH)
2019	Measured	Calculated (regression of 2018 test fishery FL & MEF)	Calculated (regression of 2018 test fishery FL & POH)
2020	Measured	'otolith' samples: Measured 'No otolith' samples: Calculated (regression of 2020 comm oto FL & MEF)	'otolith' samples: Measured 'No otolith' samples: Calculated (regression of 2020 comm oto FL & POH)

B.3: Summary of Lower Stikine Assessment Fishery Sampling Objectives

DFO Operational Plans and/or Transboundary Technical Committee Management Plans (Transboundary - Pacific Salmon Commission (psc.org)) were consulted to derive sampling objectives in each year of the program. Relevant changes and comments associated with the program are noted.

Year	Sampling Objective	Program or Sampling notes/changes

1986 (1987 post season PSC report)	To estimate Stikine River sockeye in fisheries: Matched scale, genetic, and parasite data from in-river and marine harvest areas; No specific data collection breakdown found (no management plan or operational plan located)	GILLNET USE: drift only (1)
1987 (Management Plan)	All sampled for scale, sex, length ½ the catch/week sampled for brain, liver (GSI) and parasites (*Philonema oncorhynchi* and *Myxobolus neurobius*) – overall target is 800 samples throughout the run	GILLNET USE: drift and set (1 each) In-season: ED used for stock composition Post-season stock composition to be computed using SPA (Scale pattern analysis) and PGA (parasite-genetic-age analysis))
1988 (Management Plan)	Sampled for scale, sex and length *(no specifics)* 50 fish/week for brain, liver and nematode parasites	GILLNET USE: drift and set (1 each) Scales to be aged post-season, unless no commercial samples are available during a particular week Post-season stock composition will be computed using SPA (Scale pattern analysis) and PGA (parasite-genetic-age analysis)
1989 (Management Plan)	Sampled for scale, sex and length *(no specifics)* 200 fish/week for brain, liver and scales for electrophoretic analysis	GILLNET USE: drift and set (1 each) In-Season: EDs used to estimate T/NT Post-season: stock analysis with PGA (Post-Genetic Analysis)
1990 (Management Plan)	All fish: matched scales, sex, length; matched with EDs for all females	GILLNET USE: drift and set (1 each) Scales sent to ADF&G for aging

		ED used for stock composition in-season and post-season
1991 (Operational Plan)	All fish for matched scales (3), sex, length (FL, POHL), weight; matched with EDs for all females; samples separated by location (*1: boundary house; 2: boat hole or across boundary house (ABH); 3: am drift; 4: pm drift*) Weight: minimum 100 females & 100 males	GILLNET USE: drift and set (1 each) Scale impressions to be available to ADF&G In-season stock composition: ED; Post-season stock composition: may use ED or may use SPA to estimate age specific stock compositions for both males and females if biometric review indicates this method increases accuracy and precision of estimates
1992 (Operational Plan)	All fish for matched scales (3), sex, length (FL, POHL), weight; matched with EDs for all females; samples separated by location (*1: boundary house; 2: boat hole or across boundary house (ABH); 3: am drift; 4: pm drift*) Weight: minimum 100 females & 100 males	GILLNET USE: drift and set (1 each) + additional drifts Scale impressions to be available to ADF&G ED for stock composition in-season and post-season ***(use this method in future)***
1993 (Operational Plan)	All fish for matched scales (2), sex, length (FL, POHL), weight; matched with EDs for all females; samples separated by location (*1: boundary house; 2: boat hole or across boundary house (ABH); 3: am drift; 4: pm drift*) Weight: minimum 100 females & 100 males	GILLNET USE: drift and set (1 each) + additional drifts Scale impressions to be available to ADF&G
1994 (no Operational	All fish for matched scales (2), sex, length (FL, POHL), weight; matched with EDs for all females; samples separated by location (*1: boundary house; 2: boat hole or across boundary house (ABH); 3: am drift; 4: pm*	*FIRST YEAR OF OTOLITH COLLECTION AND ANALYSIS (does not appear otoliths collected in the lower river)*

or Management Plans available)	*drift*) Weight: minimum 100 females & 100 males	
1995 (Operational Plan and Management Plan)	All fish for matched scales (2), sex, length (FL, POHL), weight; matched with EDs and otoliths for all females (up to 150/week); samples separated by location (*1: boundary house; 2: boat hole or across boundary house (ABH); 3: am drift; 4: pm drift*) Weight: minimum 100 females & 100 males	GILLNET USE: drift and set (1 each) + additional drifts FISHING PLAN: *Whenever the fishing time in a particular week is extended to more than four days, the section of river from Boundary House to the Canada/U.S. border will be closed from 8:00 am to 11 :00 am on days five (Friday), six (Saturday) and seven (Sunday) of that week. This closure is required to allow the test fishery to operate to obtain essential data for management and stock assessment.* Scale impressions to be available to ADF&G
1996 (Operational Plan)	All fish for matched scales (2), sex, length (FL, POHL), weight; matched with EDs and otoliths for all females (up to 200/week); sample location and time (AM or PM) recorded Weight: minimum 100 females & 100 males	GILLNET USE: drift and set (1 each) + additional drifts FISHING PLAN: *Much fewer samples than most years - Comm fishery was open almost continuously due to large run. Comm closed for 3 hours on days 5,6 and 7 each week, at the drift site near the Canada/US border, to allow for drift net test fishery – some overlap occurred with commercial fishery*
1997 (Operational	All fish for matched scales (2), sex, length (FL, POHL), weight; matched with EDs and otoliths for all females (up to 200/week)	GILLNET USE: drift only (1)

Plan)	Weight: minimum 100 females & 100 males	FISHING PLAN: *No bid submitted for 1997 test and much fewer samples than most years - Comm fishery was open almost continuously due to large run. Comm closed for 3 hours on days 5,6 and 7 each week, at the drift site near the Canada/US border, to allow for drift net test fishery– some overlap occurred with commercial fishery*
1998 (Operational Plan)	All fish for matched scales (2), sex, length (FL, POHL), weight; matched with EDs and otoliths for all females (up to 200/week) Weight: minimum 100 females & 100 males *Otoliths sent to ADF&G with egg diameter, sex and length data weekly (60 minimum, remaining sent the next week) – ANNUAL OCCURANCE moving forward*	GILLNET USE: drift only (1) FISHING PLAN: *Abbreviated version of test Fishery by DFO* *(large run - no bid for 1998 test); 5 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, commencing the morning after the fishery closure, and ceasing the afternoon preceding the fishery opening.* *Much fewer samples than most years -*
1999 (Operational Plan)	All fish for matched otoliths (up to 200/week), scales (2), sex, length (FL, POHL), weight, EDs for females Weight: minimum 100 females & 100 males *Note: Sampling not required from 'additional drifts'*	GILLNET USE: drift and set (1 each) + additional drifts FISHING PLAN: *5 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *There will be NO overlap between commercial and assessment fisheries* *Set net details not noted*
2000	All fish for matched otoliths (up to 200/week), scales	GILLNET USE: drift and set (1 each) + additional drifts

(Operational Plan)	(2), sex, length (FL, POHL), weight, EDs for females Weight: minimum 100 females & 100 males *Note: Sampling not required from 'additional drifts'* Collect spaghetti tags and check for lost tags (Mark-Recapture)	FISHING PLAN: *5 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *There will be NO overlap between commercial and assessment fisheries* *Set net details not noted*
2001 (Operational Plan)	All fish for matched otoliths (up to 200/week), scales (2), sex, length (FL, POHL), weight, EDs for females Weight: minimum 100 females & 100 males DNA: 100 opercular flap samples matched with ED, scales, otoliths (females only; individual vials) Collect spaghetti tags and check for lost tags (Mark-Recapture)	GILLNET USE: Drift only (1) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *There will be NO overlap between commercial and assessment fisheries*
2002 (Operational Plan; some uncertainty)	All fish for matched otoliths (up to 200/week), scales (2), sex, length (FL, POHL), weight, EDs for females Weight: minimum 100 females & 100 males DNA: 100 opercular flap samples matched with ED,	GILLNET USE: Drift only (1) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of*

	scales, otoliths (females only; individual vials) Collect spaghetti tags and check for lost tags (Mark-Recapture)	*the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *There will be NO overlap between commercial and assessment fisheries*
2003 (Operational Plan)	All fish (or up to 400/week) for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken DNA: 100 opercular flap samples matched with ED, scales, otoliths (females only; individual vials) Collect spaghetti tags and check for lost tags (Mark-Recapture)	GILLNET USE: 1 drift and 2 set FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *2 set nets (Boundary House eddy and Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2004 (Operational Plan)	All fish (or up to 400/week) for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken DNA: 100 opercular flap samples matched with ED, scales, otoliths (females only; individual vials)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and*

	Collect spaghetti tags and check for lost tags (Mark-Recapture)	*assessment fisheries*
2005 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken Collect spaghetti tags and check for lost tags (Mark-Recapture)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2006 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken Collect spaghetti tags and check for lost tags (final year of Mark-Recapture)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2007 (Operational	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females	GILLNET USE: drift and set (1 each)

Plan)	Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 200 axillary appendages/week (composite; 1 bottle/SW); can be mixed with commercial DNA samples from same SW	FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2008 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 200 axillary appendages/week (composite; 1 bottle/SW); 120 axillary appendages matched with EDs and scales (for DFO North Coast)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2009 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and*

	and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 200 axillary appendages/week (composite; 1 bottle/SW); 120 axillary appendages matched with EDs and scales (for DFO North Coast)	*1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2010 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 200 axillary appendages/week (composite; 1 bottle/SW); 120 axillary appendages matched with EDs and scales (for DFO North Coast)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2011 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of*

	DNA: 200 axillary appendages/week (composite; 1 bottle/SW); 120 axillary appendages matched with EDs and scales (for DFO North Coast)	*the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2012 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 200 axillary appendages/week (composite; 1 bottle/SW)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries* NOTE: *New*: No longer sending scalebooks with otolith data – just egg diameter, size and sex data
2013 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of*

	DNA: 200 axillary appendages/week (composite; 1 bottle/SW)	*the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2014 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 400 axillary appendages/week (composite; 1 bottle/SW)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*
2015 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken If numbers are very high, aim to sample half of the catch DNA: 400 axillary appendages/week (composite; 1 bottle/SW)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries*

2016 (Operational Plan)	All fish for matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – second length can alternate between POHL and MEF, but always 2 lengths taken DNA: 200/week (composite; 1 bottle/SW)	
2017 (Operational Plan)	400 fish/week (random): matched otoliths, scales (2), sex, length (FL, POHL, MEF), weight, EDs for females Weight: minimum 100 females & 100 males FL for all – alternate every 10 fish between POHL and MEF for a second length DNA: 200 axillary appendages/week (composite; 1 bottle/SW)	GILLNET USE: drift and set (1 each) FISHING PLAN: *7 timed drifts at 'Dream Eddy' between 800-1100hrs and 1400-1700 hrs daily, immediately following the closure of the commercial fishery – The weekly test fishery shall end on the afternoon immediately preceding the opening of the commercial fishery* *1 set net (Boundary House eddy or Across Boundary House (ABH))* *There will be NO overlap between commercial and assessment fisheries* SCHEDULE: 2 days a week SW 25-29 and 35; set net one day only SW 26-29 (2 days SW 25), drift both days 3 days a week SW 30-34, set net two days only each SW, drift all three days each SW, except only 2 days SW35 *Start fishing the day after commercial closure (or afternoon if fishery closes at noon after a 4+ day opening). *Days contingent on commercial openings and*

		staying in maximum catch allowance of 1,800 sockeye for 2017
2018 (Operational Plan)	400 fish/week (random): matched otoliths, scales (5), sex, length (FL, POHL, MEF), EDs for females sockeye per week: FL for all – alternate every 10 fish between POHL and MEF for a second length	*Increase # scales taken to for GSI & aging* GILLNET USE: drift and set (1 each) SCHEDULE: 2 days a week SW 25 and 31-35; set net one day only in SW25, two days remaining SWs, drift both days 3 days a week SW 27-30; set net two days only, drift all three days *Start fishing the day after commercial closure (or afternoon if fishery closes at noon after a 4+ day opening).
2019	No data collection	NO TEST FISHERY
2020 (Operational Plan)	200 fish/week (random): matched otoliths, scales (5), sex, length (FL, POHL, MEF), EDs for females 200 fish/week: ED, and length (FL)	*Scales used for aging and GSI* GILLNET USE: drift and set (1 each) SCHEDULE: 2 days a week SW 26 and 34; set net one day only, drift both days 3 days a week SW 27-33, set net two days only, drift all three days *Start fishing the day after commercial closure (or afternoon if fishery closes at noon after a 4+ day opening). D*ays are contingent on commercial openings*

		and staying in maximum catch allowance of 1,800 sockeye for 2020

B.4: Summary of Lower Stikine Assessment Fishery Length Measurements

Within the Lower Stikine Assessment (Test) Fishery sampling program, a variety of length measurements have either been measured or calculated across years. Generally, fork length (FL) has been measured from all fish sampled, however mid eye fork length (MEF) and post-orbital hypural length (POH) have been alternately measured (NA indicates no data). Specific approaches in each year are summarized.

Year	**Fork Length (FL)**	**Mid-eye Fork Length (MEF)**	**Post-orbital Hypural Length (POH)**
1984	Measured	Measured	Measured
1985	No data located for 1985		
1986	Calculated (regression of 1989 commercial fishery HL & FL); by gender; all no otolith samples	N/A	Measured
1987	N/A	N/A	Measured
1988	Calculated (regression of 1989 commercial fishery HL & FL); by gender; all no otolith samples	N/A	Measured
1989	Calculated (regression of 1989 commercial fishery HL & FL); by gender; all no otolith samples	Measured	Measured
1990	Measured; all no otolith samples	N/A	Measured
1991	Measured; all no otolith samples	N/A	Measured
1992	Measured; all no otolith samples	N/A	Measured
1993	Test fishery occurred, but no data record available		
1994	Measured; all no otolith samples	N/A	Unclear if measured or calculated
1995	Measured; no otolith & otolith samples	N/A	Unclear if measured or calculated
1996	Measured; no otolith & otolith samples	N/A	Unclear if measured or calculated
1997	Measured; no otolith & otolith samples	N/A	Unclear if measured or calculated
1998	Measured; no otolith & otolith samples	N/A	Unclear if measured or calculated
1999	Measured; no otolith & otolith samples	N/A	Measured

2000	Measured; discrete no otolith & otolith data sets	N/A	Unclear if measured or calculated
2001	Measured; discrete no otolith & otolith data sets	N/A	Measured; no otolith & otolith samples
2002	Measured; discrete no otolith & otolith data sets		Measured; no otolith & otolith samples
2003	Measured; discrete no otolith & otolith data sets	Calculated; approach not clear	Measured; no otolith & otolith samples
2004	Measured; discrete no otolith & otolith data sets	Otolith samples: some measured, some calculated (regression of 'no oto' FL & MEF oto samples); Recorded sporadically in the 'No otolith' samples: some measured, some calculated (regression of raw 'oto' FL & MEF)	Otolith samples: some measured, some calculated (regression of 'no oto' FL & POH) 'No otolith' samples: measured
2005	Measured; discrete no otolith & otolith data sets	Otolith samples: some measured, some calculated (regression of measured subset of FL & MEF) 'No otolith' samples: calculated (regression of FL & MEF from subset of 'oto' data)	Otolith samples: some measured (150 samples), some calculated (regression of FL & POH from measured subset) 'No otolith' samples: calculated (regression of FL & POH from measured 'oto' subset)
2006	Measured; discrete no otolith & otolith datasets	Otolith samples: some measured, some calculated (regression of measured subset of FL & MEF) 'No otolith' samples: calculated (regression of FL & MEF from subset of 'oto' data)	Otolith samples: some measured, some calculated (regression of FL & POH from measured subset) 'No otolith' samples: calculated (regression of FL & POH from measured 'oto' subset)
2007	Measured; otolith samples	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)

2008	Measured; otolith samples (most) and no otolith samples (gaps)	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2009	Measured; otolith and no otolith samples	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2010	Measured; otolith samples (most) and no otolith samples (gaps)	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2011	Measured; otolith samples (most) and no otolith samples (gaps)	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2012	Measured; otolith samples (most) and no otolith samples (gaps)	Measured (alternating with POH)	Measured (alternating with MEF)
2013	Measured; otolith samples	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2014	Measured; otolith samples	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2015	Measured; otolith samples	Measured (alternating with POH)	Measured (alternating with MEF)
2016	Measured	Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2017		Measured (alternating with POH) and calculated (regression with measured FL & MEF)	Measured (alternating with MEF) and calculated (regression with measured FL & POH)
2018	Measured	Measured and calculated (regression with measured FL & MEF)	Measured and calculated (regression with measured FL & POH)
2019	No Test fishery – no data		
2020	Measured	Measured	Measured

B.5: Upper Stikine Commercial and First Nation (FSC) Fishery Length Measurements

Within the Upper Stikine Commercial and First Nation (FSC) Fishery sampling programs, a variety of length measurements have either been measured or calculated across years. Generally, fork length (FL) has been measured from all fish sampled, however mid eye fork length (MEF) and post-orbital hypural length (POH) have been both measured and calculated (usually with regression of measured data). Specific approaches in each year are summarized.

Year	**Fork Length (FL)**	**Mid-eye Fork Length (MEF)**	**Post-orbital Hypural Length (POH)**
1981	Measured	N/A	Measured
1984	Measured	N/A	Measured
1985	Measured	N/A	Measured
1996	Measured	N/A	Measured
1997	Measured	N/A	Measured
1998	Measured	N/A	Measured
1999	Measured	N/A	Measured
2000	*Unable to locate ASL data*		
2001	Measured	N/A	Measured
2002	Measured	N/A	Measured
2003	Measured	N/A	Measured
2004	Measured	N/A	Calculated (regression from Tahltan Lake FL & POH)
2005	Measured	N/A	Measured
2006	Measured	Calculated (regression of lower Stikine test fishery oto FL & MEF)	Measured
2007	Measured	N/A	Measured
2008	Measured	Measured (majority) and calculated (regression from raw FL & MEF)	Measured (majority) and calculated (regression from raw FL & POH)
2009	Measured	Measured	Measured
2010	Measured	Measured and calculated (regression from raw FL & MEF)	Measured and calculated (regression from raw FL & POH)
2011	*Calculated*	*Calculated*	*Calculated*

2012	Measured	Measured	Measured
2013	Measured	Measured	Measured
2014	Measured	Calculated (regression uncertain)	Calculated (regression uncertain)
2015	Measured	Measured (majority) and calculated (regression from raw FL & MEF)	Measured (majority) and calculated (regression from raw FL & POH)
2016	Measured	Measured (majority) and calculated (regression from raw FL & MEF)	Measured (majority) and calculated (regression from raw FL & POH)
2017	Measured	Measured (majority) and calculated (regression from test fishery FL & MEF)	Measured (majority) and calculated (regression from test fishery FL & POH)
2018	Measured	Calculated (regression from test fishery data)	Measured (majority) and calculated (regression from test fishery FL & POH)
2019	Measured	N/A	Measured (majority) and calculated (regression with measured FL & POH data)
2020	Measured	N/A	Measured (majority) and calculated (regression with measured FL & POH data)

B.6: Summary of Upper Stikine Commercial and First Nation (FSC) Fishery Sampling Objectives

DFO Operational Plans and/or Transboundary Technical Committee Management Plans (Transboundary - Pacific Salmon Commission (psc.org)) were consulted to derive sampling objectives in each year of the program. Samples from the Upper River Fisheries (including the First Nation and Commercial Fisheries) are pooled for analysis. Typically the number of samples from the First Nation fishery far exceed samples from the upper river commercial fishery.

Year	Sampling Objective	Program or Sampling notes/changes
1987 - 1995	No samples taken; age composition assumed to be equivalent to Tahltan Lake	Stock proportions were estimated to be 90% Tahltan, 10% Mainstem during these years 1995: The stock assessment program for the Stikine River run is under works in order to adapt to take into consideration the introduction of enhanced fish.
1996 (Operational Plan)	20 – 40 fish/day: matched lengths (FL,POH), weight, scales, sex, otoliths, liver (DNA), EDs (for females)	*Primary objective to assess relative contributions of: 1/ Wild Tahltan sockeye 2/ Enhanced Tahltan sockeye, 3/ Enhanced Tuya sockeye and 4/ Mainstem sockeye, as well as gathering data on their biological characteristics.* ED: used to assess Tahltan : Mainstem contributions
1997 (Operational Plan)	20 – 40 fish/day: matched lengths (FL,POH), weight, scales, sex, otoliths, liver (DNA), EDs (for females)	
1998 (Management Plan)	800 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
1999 (Management Plan)	800 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	

2000 (Management Plan)	800 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	*Sockeye mark-recapture year*
2001 (Management Plan)	800 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek; collect spaghetti tags	*Sockeye mark-recapture year*
2002 (uncertain)	800 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek; collect spaghetti tags	*Sockeye mark-recapture year*
2003 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek; collect spaghetti tags	*Sockeye mark-recapture year*
2004 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek; collect spaghetti tags	*Sockeye mark-recapture year*
2005 (uncertain)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek; collect spaghetti tags	*Sockeye mark-recapture year*
2006 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek; collect spaghetti tags	*Sockeye mark-recapture year*
2007 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	

2008 (uncertain)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2009 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2010 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2011 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2012 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2013 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2014 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2015 (Management Plan)	600 fish / season: scales, sex, size, EDs, otoliths in proportion to harvest from Aboriginal and commercial fishery at Telegraph Creek	
2016 (Operational Plan)	600 fish / season: matched scales (5), sex, length (FL,POH), weight, EDs, otoliths in proportion to run timing	

	(per week: min=1 max=197)	
2017 (Operational Plan)	600 fish / season: matched scales (5), sex, length (FL,POH), weight, otoliths in proportion to run timing (80/week for 1st 6 weeks, 40/week for last 3 weeks)	Note: No ED collection; stock determination based on lower river data
2018 (Operational Plan)	600 fish / season: matched scales (5), sex, length (FL,POH), weight, otoliths in proportion to run timing (80/week for 1st 6 weeks, 40/week for last 3 weeks)	
2019 (Operational Plan)	600 fish / season: matched scales (5), sex, length (FL,POH), weight, EDs, otoliths in proportion to run timing (80/week for 1st 6 weeks, 40/week for last 3 weeks)	
2020 (Operational Plan)	600 fish / season: matched scales (5), sex, length (FL,POH), weight, otoliths in proportion to run timing (80/week for 1st 6 weeks, 40/week for last 3 weeks)	

B.7: Summary of Tahltan Lake Escapement Sample Types Collected and Application to Age and Stock Composition

Sample types collected over the years of the Tahltan Lake escapement sampling program include live and lethal samples collected from the weir and broodstock samples collected from sockeye held in net pens within the lake. Prior to enhancement, only live sampling was completed. The information is relevant as it applies to development of the brood table for the Tahltan stock. "Matched" samples are those where otoliths, scales (age), sex, and length information is collected from the same individual. "Not matched" refers to collection of various samples from different sample types (e.g., scale, sex, length samples from live samples and otolith samples from lethal samples).

Year	Sample Types Collected	Sample Type for Age Composition (scales)	Samples Type (otoliths) for Wild/Enhanced Proportions
1977	Live	Live	N/A
1978	Live	Live	N/A
1979	Live	Live	N/A
1980	Live	Live	N/A
1981	Live	Live	N/A
1982	Live	Live	N/A
1983	Live	Live	N/A
1984	Live	Live	N/A
1985	Live	Live	N/A
1986	Live	Live	N/A
1987	Live	Live	N/A
1988	Live	Live	N/A
1989	Live	Live	N/A
1990	Live	Live	N/A
1991	Live	Live	N/A

1992	Live	Live	N/A
1993	Live	Live	N/A
1994	Live	Live	N/A
1995	Live Lethal (Matched) Broodstock (Matched)		Lethal *Data seems to actually be terminal fishery samples*
1996	Live Lethal (Matched) Broodstock (Matched)	Live and Lethal - combined	Sacrifice
1997	Live Lethal (Matched) Broodstock (Matched)	Live and Lethal - combined	Lethal
1998	Live Lethal (Matched) Broodstock (Matched)	Live and Lethal - combined	Lethal
1999	Live Lethal (Matched) Broodstock (Matched)	Live and Lethal - combined	Lethal
2000	Live Lethal (Matched) Broodstock (Matched)	Live and Lethal - combined	Lethal
2001	Live Broodstock (Matched)	Live	Broodstock – *No sacrifice taken*
2002	Live	Live and Lethal - combined	Lethal

	Lethal (Matched)		
2003	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal
2004	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal
2005	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal
2006	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal
2007	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal
2008	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal (only 100 samples)
2009	Live Lethal (Matched) Broodstock (NOT Matched)	Live and Lethal - combined	Lethal
2010	Live Lethal (NOT matched)	Live	Lethal and Broodstock – pooled

	Broodstock (NOT Matched)		
2011	Live Lethal (NOT matched) Broodstock (NOT Matched)	Live	Lethal
2012	Live Lethal (NOT matched) Broodstock (NOT Matched)	Live	Lethal
2013	Live Broodstock (NOT Matched)	Live	Broodstock – *No lethal taken*
2014	Live Lethal (NOT matched) Broodstock (NOT Matched)	Live	Lethal
2015	Live Broodstock (NOT Matched)	Live	Broodstock – *No lethal taken*
2016	Live Lethal (NOT matched) Broodstock (NOT Matched)	Live	Lethal
2017	Live Broodstock (NOT Matched)	Live	Broodstock – *No lethal taken*
2018	Live Lethal (NOT matched) Broodstock (NOT Matched)	Live	Lethal – *Males only*
2019	Live Lethal (NOT matched)	Live	Lethal – *Males only*

	Broodstock (NOT Matched)		
2020	Live Broodstock (NOT Matched)	Live	FSC – *No sacrifice taken. Broodstock samples not collected in proportion to the run*

B.8: Tahltan Lake Escapement Sampling Objectives

DFO Operational Plans and Transboundary Technical Committee Management Plans (Transboundary - Pacific Salmon Commission (psc.org)) were consulted to summarize annual sampling objectives for escapement sampling at Tahltan Lake. Sampling has generally occurred at a weir structure located at the lake outlet. The project has been operating since 1959 (project operated by ADF&G until 1977, then project operated by DFO/TCG), however neither DFO Operational Plans nor TTC Management Plans prior to 1988 are available. As a result, records from DFO archives were consulted for relevant information. Sample collection quantities listed are objectives and may not be representative of what was collected.

Year	Sampling Objective	Program or Sampling notes/changes
1959	Tahltan Lake weir project operated by ADF&G (1959-1976). Although live (random) sampling (scales, length) was completed, only weir count data is available.	Construction of the Tahltan Lake dam, (funds donated by the Petersburg Vessel Owners Association and the Wrangell Gillnetters Association) by residents of Telegraph Creek, BC to specifications drawn by the Department Engineering *(Stikine River Studies, 1975, DFO archives)*
1965		Tahltan River landslide and low flow over Decheeka Falls resulted in total migration blockages; 2 airlift attempts resulted in 1,471 sockeye counted at Tahltan Lake
1977		DFO and TCG take over Tahltan Lake weir monitoring and sampling from ADF&G
1985		Lake fertilization attempted. Objective: to increase primary production and subsequently transfer this production through the food chain to augment smolt size (link found between smolt size and marine survival)
1988 (Management Plan)	800 ASL samples /season	
1989 (Management Plan)	800 ASL samples /season	First egg take for Tahltan sockeye enhancement
1990	800 ASL samples /season	First enhanced sockeye fry release into Tahltan Lake (from 1989 broodstock)

(Management Plan)		
1991 (Operational Plan)	800 – 900 ASL samples / season apportioned to average run timing; live sampling: scales(3), length (FL, POHL) and sex	First egg take for Tuya enhancement (Tahltan Lake Broodstock)
1992 (Operational Plan)	800 – 900 ASL samples / season apportioned to average run timing; live sampling: scales(3), length (FL, POHL) and sex	First enhanced Tuya sockeye release into Tuya lake (from 1990 Tahltan Lake broodstock
1993 (Operational Plan)	800 – 900 ASL samples / season apportioned to average run timing; live sampling: scales(3), length (FL, POHL) and sex	Terminal ESSR fishery due to excess (above escapement) sockeye returns Spawning study (application of 500 spaghetti tags in proportion to the run)
1994 (Operational Plan)	800 – 900 ASL samples / season apportioned to average run timing; live sampling: scales(3), length (FL, POHL) and sex	Terminal ESSR fishery due to excess (above escapement) sockeye returns Spawning study (application of 500 spaghetti tags in proportion to the run)
1995 (Management Plan)	800 ASL samples /season; analyze otoliths for thermal marks *(No indication of quantity)*	Terminal ESSR fishery due to excess (above escapement) sockeye returns Introduction otolith collection for thermal mark identification in enhanced fish (from sacrificed fish at lake weir and broodstock)
1996 (Operational Plan)	800 ASL samples / season apportioned to average run timing; ½ will be live, and ½ will be lethal; scales(3), length (FL, POHL) and sex ; 400 EDs from lethal samples (random); 100 (200 during run peak) additional sockeye daily for EDs (sex ratio)	Terminal ESSR fishery due to excess (above escapement) sockeye returns Spawning study (application of 400 spaghetti tags in proportion to the run) Carcass sampling: scales (10), otoliths, FL, POHL Record water level and temperature throughout; multiple times/day. Clear beaver dams
1997 (Operational Plan)	800 ASL samples / season (random) apportioned to average run timing; ½ will be live, and ½ will be lethal (every 2nd one lethal); scales(3), length (FL, POHL) and sex ; 400 otoliths from lethal (matched to ASL); 400 EDs from lethal samples (random); 100 (200 during run peak) additional sockeye daily	Spawning study (application of 400 spaghetti tags in proportion to the run) Carcass sampling: scales (10), otoliths, FL, POHL Record water level and temperature throughout; multiple times/day.

	for EDs (sex ratio); 100 samples of DNA (liver tissue) from lethally sampled fish	Clear beaver dams
1998 (Operational Plan)	800 ASL samples / season (random) apportioned to average run timing; ½ will be live, and ½ will be lethal; scales(3), length (FL, POHL) and sex ; 400 otoliths from lethal (matched to ASL); 400 EDs from lethal samples (random); 100 (200 during run peak) additional sockeye daily for EDs (sex ratio)	Spawning study (application of 400 spaghetti tags in proportion to the run) Carcass sampling: scales (10), otoliths, FL, POHL Record water level and temperature throughout; multiple times/day. Clear beaver dams
1999 (Operational Plan)	800 ASL samples / season (random) apportioned to average run timing; ½ will be live, and ½ will be lethal; scales(3), length (FL, POHL) and sex ; 400 EDs and otoliths from lethal samples (random; matched to ASL); 100 (200 during run peak) additional sockeye daily for EDs (sex ratio) Broodstock: 400 otolith samples	Spawning study (application of 400 spaghetti tags in proportion to the run) Carcass sampling: scales (10), otoliths, FL, POHL Record water level and temperature throughout; multiple times/day. Clear beaver dams
2000 (Management Plan)	800 ASL samples / season (random) apportioned to average run timing; scales(3), length (FL, POHL) and sex ; 400 EDs and otoliths from lethal samples (random; matched to ASL); Broodstock: 400 otolith samples	No Tuya Enhancement *Sockeye mark-recapture year*
2001 (Management Plan)	800 ASL samples/season (live) apportioned to average run timing 400 lethal samples (otoliths & ED) if escapement goal achieved Broodstock: 400 otolith samples (matched) (potential for 400 additional spawning grounds and/or Broodstock samples if no lethal samples	No Tuya Enhancement Last year scale collection from broodstock samples (poor scale condition; not likely representative of run) No lethal samples due to low forecast escapement *Sockeye mark-recapture year*
2002	Uncertain	**Sampling regime based on years pre and post*

No Operational or Management plan located		*Sockeye mark-recapture year*
2003 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for tags and sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	*Sockeye mark-recapture year*
2004 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for tags and sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	*Sockeye mark-recapture year*
2005 No Operational or Management plan located	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for tags and sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	*Sockeye mark-recapture year*
2006 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for tags and sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	*Sockeye mark-recapture year*
2007 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	

2008 No Operational or Management plan located	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	
2009 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	Last year scales collected from lethal samples. Scale collection ceased due to difficulties on collection due to the weir set up. It was felt that the process was holding back fish and wanted to avoid doing that. No more 'matched' lethal sample data
2010 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	
2011 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	
2012 (Management Plan)	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	
2013 (Management Plan	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	Last year of egg take for Tuya enhancement No lethal samples due to low forecast escapement
2014	Live: 600 fish /season fish apportioned to average run timing for age, sex and size; 125 fish per day for sex.	Last (enhanced) fry release into Tuya Lake Tahltan River landslide- delayed upstream migration

(Management Plan – *internal draft version*)	Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	Endeavor to conduct terminal fishery at Tahltan Lake if escapement targets are likely to be exceeded
2015 (Management Plan	Live: 600 fish /season apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	No lethal samples due to low forecast escapement
2016 (Management Plan	Live: 600 fish /season apportioned to average run timing for age, sex and size; 125 fish per day for sex. Lethal: 400 fish/season otoliths & ED (subject to conservation concerns) Broodstock: 400 otolith samples	
2017 (Operational Plan)	Live: 1000 fish / season apportioned to run timing for sex, length (FL, POH), age (600 scales); 100 fish / day for sex ratio Lethal: 400 fish/season otoliths, ED, FL, POH, mass, sex (subject to conservation concerns); can be part of 1000 samples (live);	No lethal samples taken due to low forecasted escapement Carcass: collect sex, tag information, fork length and hypural length measurements from all carcasses Record water level and temperature throughout; multiple times/day. Clear beaver dams
2018 (Operational Plan)	Live: 600 fish / season apportioned to run timing for age, sex, length (FL, POH); 100 fish / day for sex ratio Lethal (male only): 400 fish/season otoliths, FL, POH (otoliths from Broodstock samples if conservation concerns)	Tahltan Lake wildfire: Evacuations resulted in fewer live random samples than most years, and incomplete adult weir counts; estimate was expanded by the 2015–2017 average of run timing. Lethal samples are male only (due to escapement concerns) Carcass: collect sex, tag information, fork length and hypural length measurements from all carcasses Record water level and temperature throughout; multiple times/day. Clear beaver dams
2019 (Operational Plan)	Live: 600 fish / season apportioned to run timing for age, sex, length (FL, POH); 100 fish / day for sex ratio Lethal (male only): 400 fish/season otoliths, FL, POH	Lethal samples are male only (due to escapement concerns) Carcass: collect sex, tag information, fork length and hypural length measurements from all carcasses

	(otoliths from Broodstock samples if conservation concerns)	Record water level and temperature throughout; multiple times/day. Clear beaver dams
2020 (Operational Plan)	Live: 600 fish / season apportioned to run timing for age, sex, length (FL, POH); 100 fish / day for sex ratio Lethal (male only): 400 fish/season otoliths, FL, POH (otoliths from Broodstock samples if conservation concerns)	No lethal samples taken due to low forecasted escapement Carcass: collect sex, tag information, fork length and hypural length measurements from all carcasses Record water level and temperature throughout; multiple times/day. Clear beaver dams

B.9: Summary of Tahltan Lake Escapement Length Measurements

An annual record of length data collection during the Tahltan Lake Adult Escapement sampling program. 'Measured' are measurements that have been measured in the field. If not noted otherwise, the data is considered to be 'Measured'. N/A's represents no length data as a result of either no data collected, or no data located in historical records. Any further information found as to why the length data is N/A is included in the chart.

Sample Type	Fork Length (FL)	Mid-eye Fork Length (MEF)	Post-orbital Hypural Length (POH)
1995			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	N/A	N/A	Measured
1996			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
1997			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
1998			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	N/A	Measured	Measured
1999			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
2000			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured

2001			
Live	Measured	N/A	Measured
Lethal	N/A	N/A	N/A
Broodstock	Measured	N/A	Measured
2002			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	N/A	N/A	N/A
2003			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	?	?	?
2004			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
2005			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
2006			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	N/A	N/A	N/A
2007			
Live	Measured	N/A	Measured; some calculated (regression of raw FL &POH)
Lethal	Measured	N/A	Measured; some calculated (regression of raw FL &POH)
Broodstock	N/A	N/A	N/A
2008			
Live	Measured	N/A	Measured

Lethal	Measured	N/A	Measured
Broodstock	N/A	N/A	N/A
2009			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
2010			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	N/A	N/A	N/A
2011			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
2012			
Live	N/A	N/A	Measured
Lethal	N/A	N/A	Measured
Broodstock	Measured	N/A	Measured
2013			
Live	Measured	N/A	Measured
Lethal	N/A	N/A	N/A
Broodstock	N/A	N/A	N/A
2014			
Live	Measured	N/A	Measured
Lethal	Measured	N/A	Measured
Broodstock	Measured	N/A	Measured
2015			
Live	Measured	N/A	Measured
Lethal	N/A	N/A	N/A
Broodstock	Measured	N/A	Measured
2016			

Live	Measured	N/A	Measured; some calculated (regression of raw FL &POH)
Lethal	Measured	N/A	Measured; some calculated (regression of raw FL &POH)
Broodstock	Measured	N/A	Measured; some calculated (regression of raw FL &POH)
2017			
Live	Measured	N/A	Measured; some calculated (regression of raw sex-specific FL &POH)
Lethal	N/A	N/A	N/A
Broodstock	Measured	Calculated	Measured; some calculated (regression of raw sex-specific FL &POH)
2018			
Live	Measured	Calculated	Measured; some calculated (regression of raw sex-specific FL &POH)
Lethal	Measured	Calculated	Measured; some calculated (regression of raw sex-specific FL &POH)
Broodstock	Measured	N/A	Measured Recorded measurements
2019			
Live	Measured	N/A	Measured; some calculated (regression of raw sex-specific FL &POH)
Lethal	Measured	N/A	Some measured; some calculated (regression of raw sex-specific FL &POH)
Broodstock	N/A	N/A	N/A
2020			
Live	Measured	Calculated	Some measured; some calculated (regression of raw sex-specific FL &POH)
Lethal	N/A	N/A	N/A
Broodstock	N/A	N/A	N/A