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The Taku River Tlingit (TRT) Fisheries Department is preparing for our 2023 field season. We wanted to update everyone on the Fisheries Program and provide information on the status of the Taku salmon runs. You may notice that some of the articles in this Newsletter are repeats from our previous newsletters (including “Some Background in How Salmon are Managed in the Taku”). This is because this article provides important background information that does not change year-to-year.

Any feedback on what you would like to see covered in our next newsletter would be most welcome!

We hope you enjoy the newsletter !

Fisheries Department Program Summary:

The core funding for TRT Fisheries Department comes from the Aboriginal Fisheries Strategy (AFS). This is Federal funding to support TRT involvement in salmon management on the Taku River.

The TRTFN Fisheries Department Collaborates with other departments on various projects, in particular the Land Guardian and Mining departments.

2023 TRTFN Fisheries Projects Overview

The TRT will be running its AFS (Aboriginal Fisheries Strategy) program again this summer with sockeye weirs at King Salmon and Kuthai Lakes as well as a Chinook carcass weir on the Nakina River. The Fisheries Department now uses underwater motion-activated video equipment on all our fish weirs. The advantage of using this equipment is that : 1.) it gives us a permanent record of fish moving through the weir that can be double-checked 2.) it allows the fish to pass through the weir at any time (fish are never being held up, and don't need to be handled) and 3.) reduces bear problems at weir as fish are not held in pens.

As of the 2022 field season the TRTFN Fisheries Department now has internet at all camps with the exception of the Nakina weir, where the camp is located in a steep valley and internet connection is not possible due to the proximity of cliffs.

For 2023 we intend to run all our long term projects including : King Salmon and Kuthai sockeye live weirs, Nakina chinook carcass weir, Canyon Island fishwheel participation and Tatsatua chinook sampling. Other projects we are doing or trying to pull together for 2023 include: support for Inklin food fish camp, Canoe Landing food fish monitoring and pilot project getting food fish from King Salmon Lake.

The TRTFN Fisheries program will also continue with the Salmon Resiliency Project that focuses on climate change impacts to salmon in the Taku.

More on these projects in the following pages.

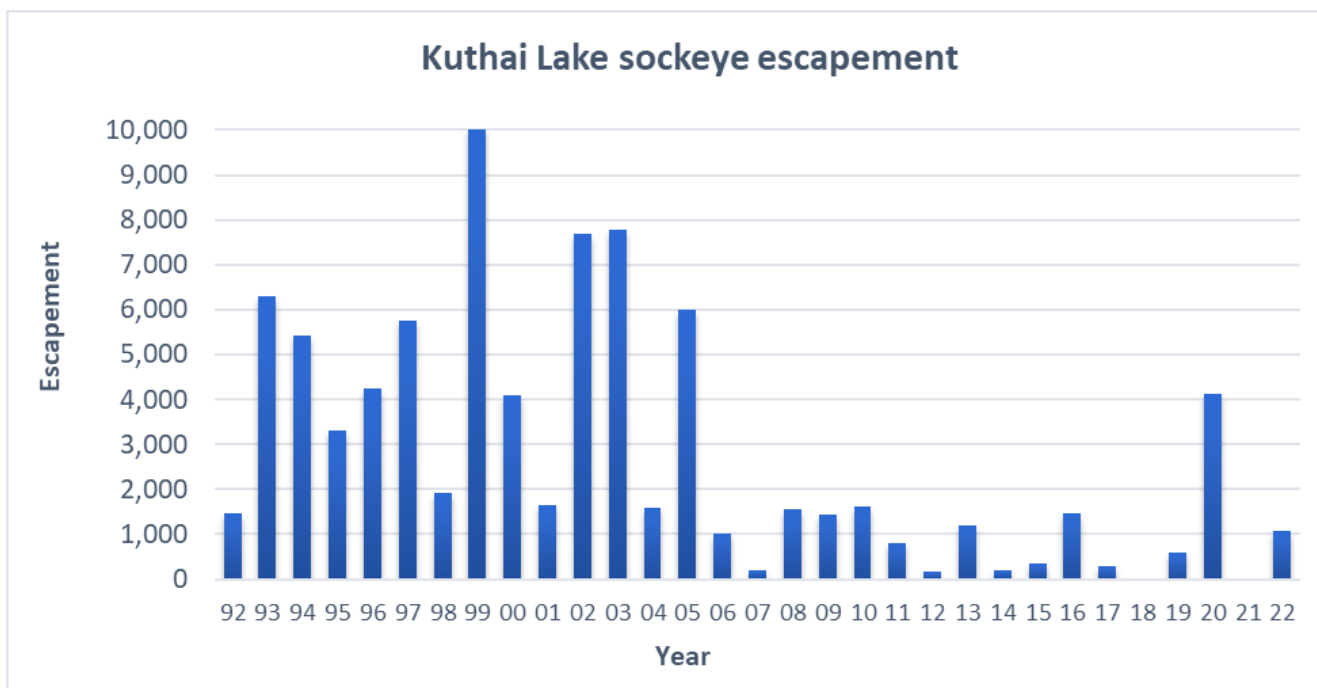


Kuthai Lake Weir

This project erects a weir at the outlet of Kuthai Lake to record sockeye salmon entering the lake to spawn. The project starts on July 4th and runs until Sept 3rd. Kuthai Weir employs 2 TRTFN Fisheries Technicians. The TRTFN has been running this weir since 1992.

As you can see by the graph below, sockeye returns to Kuthai have been depressed since 2006. The average run size (escapement) into the lake from 1992-2005 was 4,806 fish. The average escapement into Kuthai since 2006 is 953 fish. Investigations by the TRTFN Fisheries Department have determined that a significant cause for this reduced escapement is the result of access issues in the lower Silver Salmon River. We have been working to rectify these issues (see page 14) and have had some success.

A total of 1084 sockeye made it into Kuthai in 2022. The first salmon arrived at the weir on July 18 and the last salmon recorded at the weir was September 2.

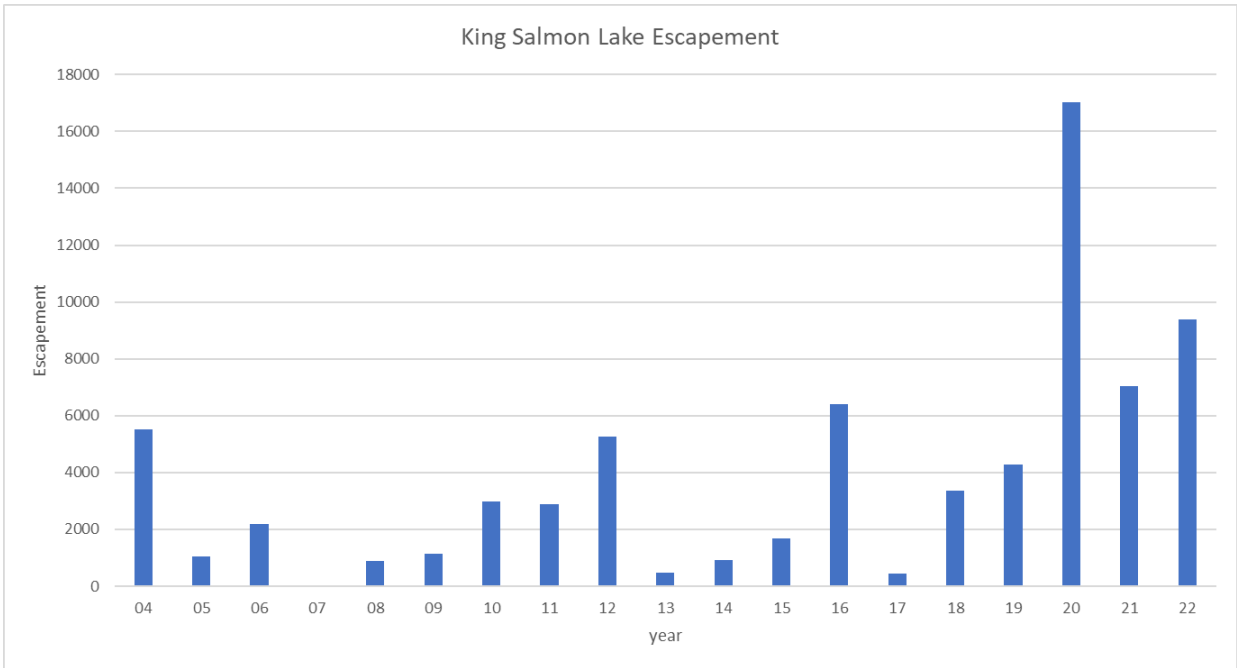


King Salmon Lake Weir

This project erects a weir at the outlet of King Salmon Lake to record sockeye salmon entering the lake to spawn. The project starts on July 5th and runs until Sept 4th. King Salmon Weir employs 2 TRTFN Fisheries Technicians.

Sockeye escapements into King Salmon Lake have been consistently good since 2018 (see graph below) even though there is a migration obstruction in the lower river (see page 15)

The average escapement into the lake since the weir started operating in 2004 has been 3,811 salmon. The first fish into King Salmon in 2022 was on July 26 and the last salmon through the weir was recorded on August 29th. The migration challenge (a log jam) delayed the sockeye return into the lake. Once the obstruction was removed the first salmon came through the weir in a surge. On July 28 (shortly after the obstruction removal) the weir counted 2,725 fish in one day! A total of 9,385 sockeye made it into King Salmon Lake to spawn in 2022.



Nakina Carcass Weir

This project erects a weir across the Nakina River to try to sample 1000 chinook salmon carcasses for age (scales), length, sex and tags. The project started July 22th and ended August 28th and employed 2 TRTFN Fisheries personnel.

Since 2008, part of the duties of Fisheries crew at the Nakina weir has been monitoring the obstruction (several waterfalls) on the lower Silver Salmon River that has been restricting sockeye access into Kuthai Lake (see page 14).

Due to high water in 2022 the Nakina weir was not able to be completed. Instead 2 partial weirs were constructed on opposite sides of the river to collect carcasses. This reduced the efficiency of the weir and only 132 samples of a target of 1000 could be collected.

The Nakina weir site is located in the proximity of an historic Tlingit village (*Tatlen'ixhoo*). In 2022 the Nakina crew took some time out to work with Ben Louter (TRTFN Heritage Department) and Maria Vigneron to hike and locate portions of the traditional trail from the Nakina weir site towards Kuthai Lake.



Photo left:

View of *Sinwaa yadi* from the Nakina weir cabin

Photo right: Bears are regular visitors to the Nakina weir



Canyon Island:

The TRT Fisheries Department provides one staff to support the Canyon Island fish wheels located just across the border in Alaska. This TRT staff person supports the Alaska Department of Fish and Game in tagging salmon for the mark-recapture program that is used to estimate salmon abundance on the Taku. More about mark-recapture to follow in this newsletter.

Photo (right): Fish wheel at Canyon Island



Tatsatua River Chinook Sampling:

This project collects age, sex and length data from Chinook on the Tatsatua River using rod and reel. Chinook are caught and measurements and scales taken. The project hires 2 TRTFN Fisheries technicians and ran from August 15 to September 6th.

The crew sampled a total of 300 chinook salmon. They also recovered 9 spaghetti tags, 3 radio tags and 9 coded wire tags.



Photo (left) A calm evening at Tatsatua

Photo (right) You call this work?



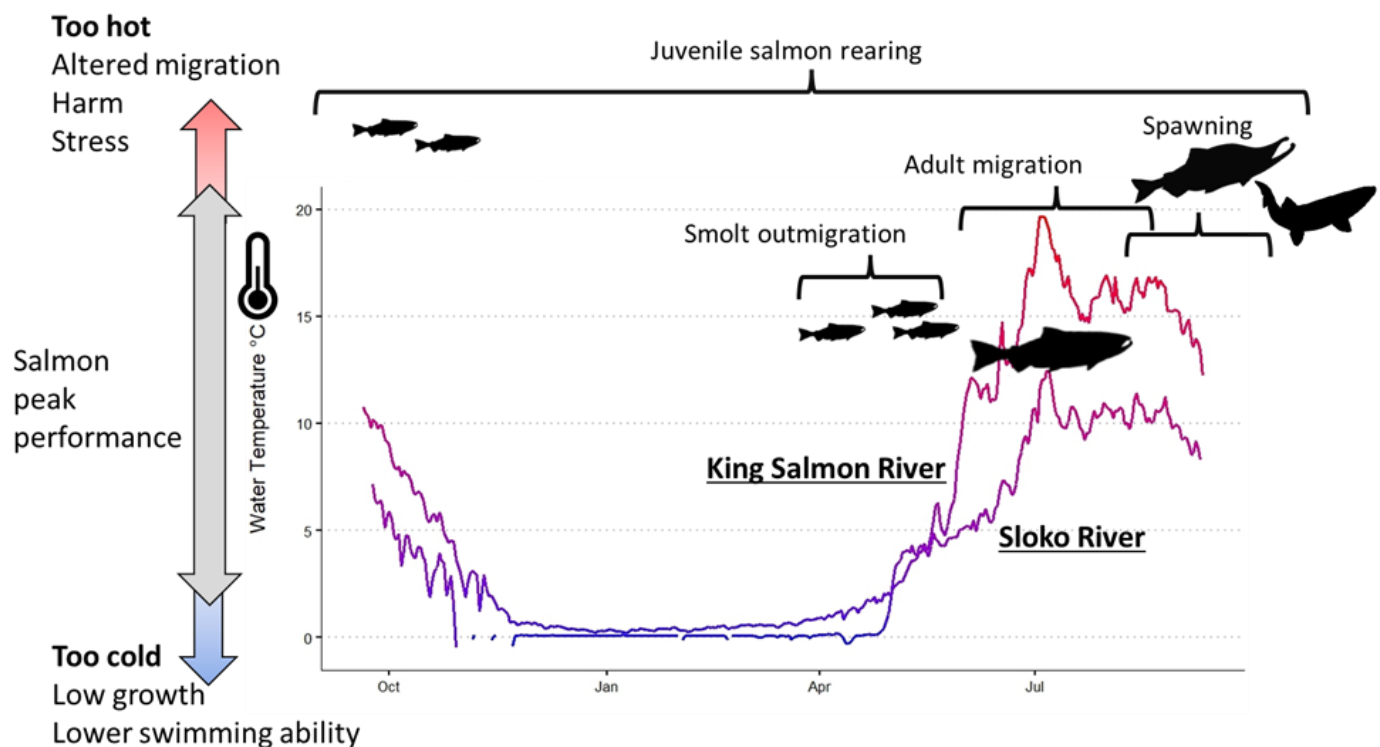
Salmon Resiliency Project

The Salmon Resiliency initiative was started in 2021 and is a collaborative project between the TRTFN, Simon Fraser University and the University of Montana. The overarching objective of the program is to ensure the long term health of Taku salmon in the face of climate change.

We continued and expanded our work in 2022 and provided opportunities for some Tlingit citizens assist get out on land and visit some of our remote sample sites in the Taku.

Water Temperature Monitoring in the Taku

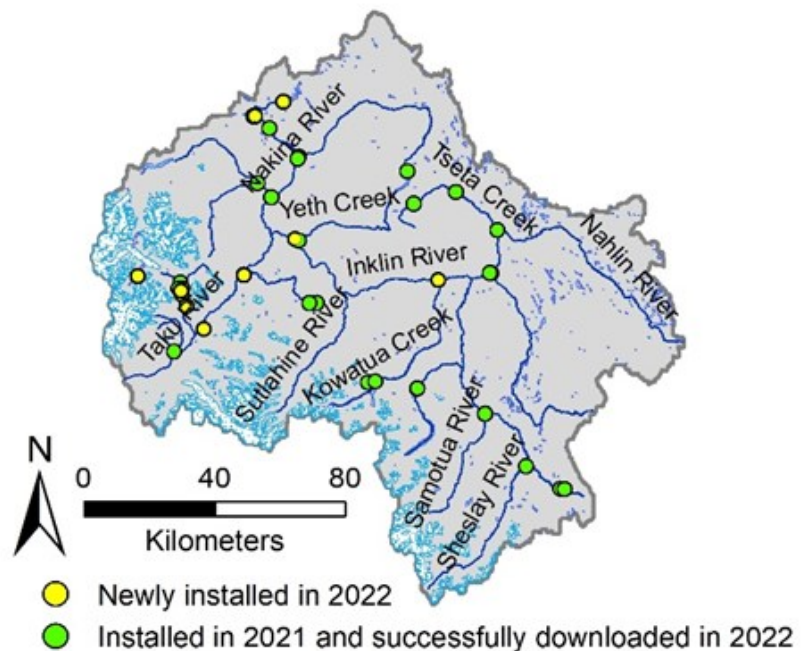
One of the important ways that climate change is impacting rivers like the Taku is by warming water temperatures. Water temperature is critically important for sensitive fish such as salmon. If water temperatures are too hot (e.g., $>20^{\circ}\text{C}$), adult and juvenile salmon may be stressed or even killed. If water temperatures are exceedingly cold (e.g., $<4^{\circ}\text{C}$), juvenile salmon may not be able to grow. The seasonal patterns of water temperatures also influence the timing of salmon runs, spawning, and egg emergence. Thus, salmon can be strongly influenced by water temperatures and its warming. However, the impacts of climate warming will be felt differently in different locations. The Taku Watershed is incredibly diverse, with regions draining wetlands, plateaus, steep canyons, glacier-fed rivers, or shallow lakes. These different habitats will respond differently to climate warming.



In order understand which parts of the Taku may be particularly vulnerable to climate warming, we launched an extensive project to monitor water temperatures throughout the watershed, with a particular focus on salmon habitat (see Map). In September 2021, we deployed 37 sensors that were attached underwater and recorded water temperatures every hour, with a battery life of 5 years. In September 2022, we visited these locations with Taku River Tlingit First Nation (TRTFN) community members to download the data and redeploy the sensors. Here we report on the results from Year 1 of this ongoing water temperature research in the Taku Watershed. This project was a collaboration among the Taku River Tlingit First Nation Fisheries Program (TRTFN), Simon Fraser University (SFU), and University of Montana Flathead Lake Bio Station (FLBS), and is a component of the **Salmon Resilience Project**. [Funding for this project was primarily through FLBS and SFU](#), as well as from grants through TRT Fisheries.



Team members in the background are downloading water temperature data, with a sockeye salmon in the foreground, battered from its hard migration up the King Salmon canyon.



Initial findings

The Taku River watershed has an enormous diversity of water temperatures. This diversity means that ongoing climate warming will pose not only local challenges, but also likely local opportunities, for sensitive species like salmon. Stewardship and protection of these diverse habitats will help enable salmon the space and time to adapt to and maintain the overall resilience of the system.

Currently in the Taku, many productive salmon watersheds that were lake-fed have water temperatures that reached warm temperatures during the summer. These water temperatures reached warm-enough levels that, depending on the sensitivity and run-timing of the salmon populations, could pose stress to salmon. An example of this system is King Salmon river, which flows out of King Salmon Lake. These sites warrant further attention as they may be vulnerable to future climate warming or heat waves.

Some watersheds are very cold throughout the year. Their suitability for salmon is likely limited to some degree by excessively cold water, and some climate warming will likely increase their productivity for salmon. An example of a cold system is the Tulsequah River that is fed by a glacial lake.

Looking forward

These data will inform a Taku River salmon climate vulnerability assessment.

Temperature loggers will continue to be downloaded and redeployed every year with community members to understand how water temperature vary across years with different weather conditions (e.g., high vs. low snowpack).

Summary

- 33 out of 37 temperature loggers successfully downloaded and redeployed.
- 7 new temperature loggers installed.
- Over 275,000 data points on temperatures from 2021-2022.



Sept. 2021 - Sept. 2022

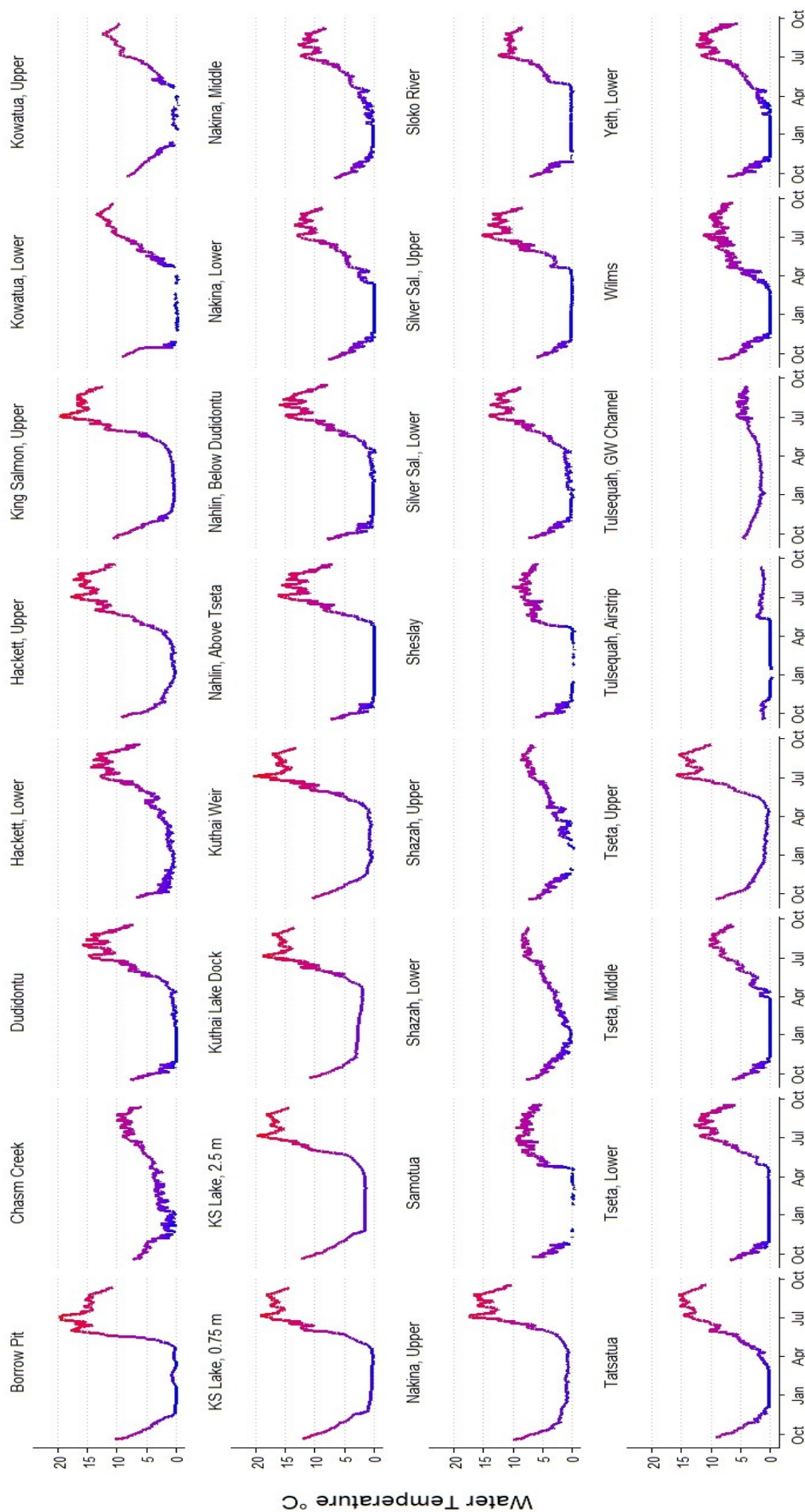
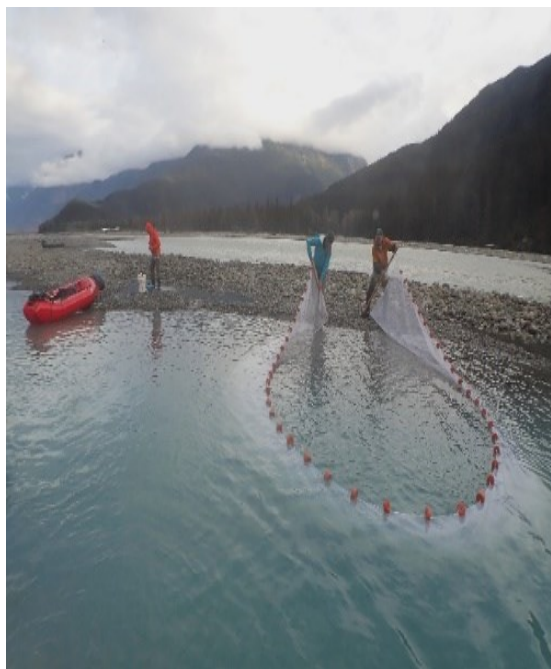


Figure. Seasonal patterns of daily average water temperatures from Sept 2021– Sept 2022. Site names are shown above the data. Warmer water temperatures are shown in red colours, cooler water temperatures are more blue/purple. Note that data are preliminary, and have not been error checked for if, for example, water temperature sensors were temporarily out of the water.

Climate change is rapidly altering the Taku Watershed, posing challenges but also local opportunities for salmon. One hotspot of change is the Tulsequah River, where glacier retreat is leading to rapid ecosystem evolution. Over the next 100 years or so, the retreat of the Tulsequah Glacier will likely increase the amount of downstream river and lake habitat available for salmon. By studying and observing oncoming changes, this information can increase understanding and support TRTFN leadership in the proactive stewardship of the watershed and its salmon into the future.

Here we report on the results of a Sept 2022 initial research study on fish and their habitats across the Tulsequah River. This project was a component of the **Salmon Resilience Project**, a collaboration among the Taku River Tlingit First Nation Fisheries Program (TRTFN), Simon Fraser University (SFU), and University of Montana Flathead Lake Bio Station (FLBS).



Members of the Salmon Resilience team setting a seine net to sample fish in the Tulsequah River. The fish are identified, counted, measured, and released unharmed. We sampled 18 sites in this initial study.



The Tulsequah River has a complex floodplain. The main channel of the Tulsequah River is extremely cold and turbid, but the off-channel habitats are fed by groundwater and can be warmer and clearer which is good for young fish.

Table. Summary of data on Tulsequah River fish and water conditions. Values shown are averages.

	LOWER RIVER		UPPER RIVER	
	Off-channel	Main-stem	Off-channel	Main-stem
Turbidity (NTU)	6.0	77.2	8.9	91.4
Temperature (C)	11.6	4.3	5.7	2.1
Young salmon (fish/seine)	1.3	1.4	3.7	0

Summary of key findings. The Tulsequah River floodplain is complex and very dynamic, including the mainstem river and groundwater-fed off-channel habitats. These river habitats have different water temperatures and water clarities. Water temperatures were generally warmer in off-channel habitats, as well as lower downstream in the river. In the lower river, young salmon were found in both mainstem and off-channel habitats. In the upper river, near the glacier, young salmon were restricted to groundwater habitats. It is often assumed that rivers downstream of glaciers are too cold and turbid to support important fish; however, our data reveal that the complexity of this river allows it to support important fish stocks, including coho salmon and river-type sockeye salmon. These initial results are promising for salmon productivity in the Tulsequah, indicating that as climate change occurs here, these habitats will likely become even more productive for salmon.



Greta Thorlakson with young Dolly Varden and Sockeye Salmon.

Fish species observed

Sockeye Salmon (juveniles)
 Coho Salmon (juveniles)
 Dolly Varden
 Round Whitefish
 Sculpin
 Three-spined Stickleback

Food Fishing at Inklin Camp

Last summer, TRTFN Land Guardians and Fisheries staff hosted a food fishing camp on the Inklin River. The goal of the camp was to provide opportunities for Tlingit community members to connect with the territory, while fishing and processing salmon, sharing visions for conservation and land stewardship, and spending quality time on-the-land. The camp ran for two weeks and hosted two groups of participants. For many community members, this camp was their first time visiting the Inklin River. Fish from the camp has been provided at community events and used for processing workshops at Five Mile. We are currently planning this summer's Inklin Camp and are looking forward to extending opportunities for greater community involvement. Stay tuned!



Chinook Stocks: finally some room for optimism in 2023?

Information and studies are showing that the downturn in Taku Chinook production is not likely related to any freshwater issues, but rather marine / ocean survivals. In particular, early marine survival is suspected as a key problem. Indications from some research suggests that juvenile Taku Chinook (in the near shore marine environment) are "hanging out" on their own and therefore more prone to predation. Whereas juvenile coho are "hanging out" with an abundance of pink and chum, which provides them with a predation buffer. To note, other ocean conditions are likely to be contributing factors further along in the Chinook life cycle (i.e. warming ocean temperatures, food web, competition, predation of adults etc.) Unfortunately, there is very little / nothing obvious we can do to help Chinook at this specific life stage. What we can and have been doing is limiting harvest of Chinook salmon in the commercial and sport fishery.

The Taku Chinook forecasted run size for 2023 is better than it has been for a decade, so this is great news. However the projection is still below the management target and so there will once again be no directed commercial fisheries for Canada or the U.S. during the 2023 season. There will also be no retention of any Chinook in the sport fishery.

Kuthai Lake Access Issues

The purpose of this project is to address the decline of sockeye salmon in Kuthai Lake since 2006. Field assessments revealed that the decline in Kuthai sockeye is the result of access problems in the lower Silver Salmon River canyon. Since the fall of 2018, a TRTFN Fisheries crew has been working in the canyon to improve passage for sockeye to Kuthai Lake. Prior to 2021, access issues had been due only to low water conditions.

In 2021 the Silver salmon experienced very high water levels. Monitoring found that sockeye were not making it past the falls. This was puzzling because previously, high water had not caused problems in the canyon. Review of past video showed that a rock had shifted and blocked a high water by-pass channel that had allowed for fish passage previously.

The TRTFN Fisheries Department accessed the site in April 2022 and removed the problematic boulder with support from DFO. We also continued widening the waterfall that is the main obstacle for salmon passage up the river to Kuthai Lake. For spring of 2023 the TRT Fisheries Department will send in a crew to continue work to improve salmon access into the Kuthai Lake. This is a very challenging place to work and requires the crew to lower themselves 90 feet into a canyon and work above a waterfall (see photo below).

Although Kuthai Lake has had some low returns in recent years, it is a very productive lake and our expectation is that once we have addressed the access issues the salmon numbers will rebound.



Photo (left) looking down into the Silver Salmon Canyon to the main fish obstacle (waterfall). Look carefully to see the crew at work in the canyon

King Salmon Lake Access Issues

Although sockeye salmon returns into King Salmon Lake have been good in recent years (see page 6), radio telemetry and field assessments in 2021 found that fish were being slowed down at a log jamb combined with a small waterfall (about 1.7 m high) located on the lower reaches of the King Salmon River.

In 2023 fish were delayed in accessing King Salmon Lake to spawn due to the obstruction (see photo below). In collaboration with DFO, the TRT Fisheries Department sent in a crew to remove materials from the obstruction to allow for fish passage. This work was successful and the sockeye came thru the weir in a wave, with over 2700 coming through in the initial push upriver.

The TRTFN Fisheries Department in collaboration with DFO will be sending a crew into the site in early summer 2023 to monitor and address any potential access issues.

With climate change we are seeing more variation in water flows (high water years and low water years) and this can result in challenges for fish access into spawning areas. The TRT Fisheries Department is responding to these challenges as they arise and are building monitoring plans and expertise to address them in the future as they may arise.

Photo below: The obstruction on the lower King Salmon River prior to removal



Some Background on How Salmon are Managed in the Taku

Salmon from the Taku River drainage are caught by US and Canadian fishers. Sockeye are the primary commercial species. The number of fish each country is allowed to catch is set out in the international Pacific Salmon Treaty. Right now Canada gets about 20% of Taku sockeye and Alaska gets 80%.

Commercial salmon fishing in the Taku is managed by determining how many salmon above the 'escapement' can be harvested. Escapement refers to the number of salmon that 'escape' to make it back to the spawning areas. The 'escapement goal' refers to the number of salmon that are needed to return to the spawning areas to ensure the salmon population is sustained.

The amount of commercial fishing allowed is determined based on an estimate of how many salmon are returning to the river. One of the major ways biologists use to determine how many fish are returning is with the 'mark/recapture' method.

Mark/recapture:

Salmon are captured in a 'fish wheel' located just across the Canadian border in Alaska. The current of the river turns the wheel and salmon are captured in the baskets. Salmon are tagged, measured and sexed. The fish are then released back into the river to continue their upstream migration to the spawning areas. The number of tags recaptured in the commercial fishery and weirs is used to calculate the salmon run size.

In simple terms, the mark recapture method uses the proportion of tags collected relative to the number of tags put on salmon to determine the population of salmon. For example, let's say the fish wheel puts out 100 tags and the commercial fishery captures 200 fish total, 50 of which have tags. So this means the fishery has caught half the tags ($100 \text{ tags put out}, 50 \text{ recovered} = 1/2$). Therefore we estimate the fishery has captured half the fish in the river. Since the total number of fish caught by the commercial fishery was 200, we estimate that the total run size during that time was 400 fish ($200 \times 2 = 400$). This is a simplistic presentation, in reality things like drop-out rate (number of fish who die after being tagged) needs to be factored in. This estimate is done every week during the commercial fishery and is used to determine how much fishing can be done. The amount of fishing is regulated by the length of 'Openings'. An Opening is a period of time a fisher is allowed to fish. So a 2 day Opening means you can fish for 2 days.

This in-season adjustment to the catch (openings) is why we want to know every week from our camps how many tags have been recovered at the weirs.



In many regions sockeye salmon spawn only in lakes. However, in the Taku we have some sockeye that spawn in lakes and other populations that spawn in rivers (mainstem spawners). There are 4 main sockeye spawning lakes in the Taku drainage (Tatsamine, Little Trapper, Kuthai and King Salmon). All the 4 sockeye lakes have weirs. The purpose of these weirs is to:

- Collect precise information on the number of returning salmon
- Count the number of tags in the returning population of salmon (part of the mark/recapture work)
- Sample some of the returning salmon for sex and length
- Collect scales for aging the fish sampled
- Use this information to get a picture of (reconstruct) the run characteristics (ages, sex ratio, numbers)

Fish scales are collected for aging the salmon. Salmon grow at different rates during the year (slower in winter) and this shows up on their scales as rings (Annuli). You can count the annuli and age the fish much like you can age trees by counting their rings. The reason we want to know the age of fish is to determine the age composition of the run because this helps us predict what future run sizes will be.

Salmon return to spawn at different ages, but the proportion of the run that returns in any year stays about the same. Therefore if you know what the age composition of the run is in any year it helps you predict what future run sizes will be.

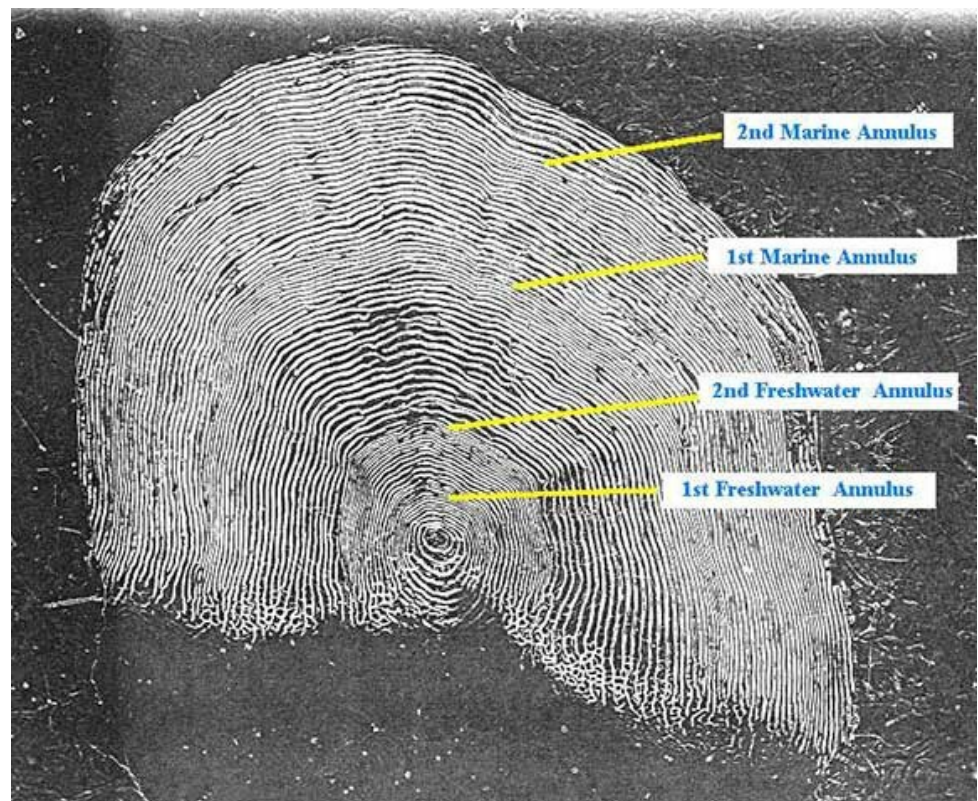


Photo (right) Example showing annuli of a fish scale

Summary of 2022 Taku River Salmon Run:

The following tables summarize last season's 2022 Taku River salmon run :

2022 Taku salmon escapement* :

	Chinook	Sockeye	Coho
Escapement estimate	12,722	121,046	73,830
Management target	25,500	58,000	70,000

* The escapement is the number of fish that 'escape' to make it back to the spawning grounds

Taku River Salmon Run Forecasts 2023

Below are the forecasts for the 2023 Taku River salmon terminal runs.

Species	Preseason run Forecast	Average run size (10 year)	Escapement Goal (range)
Chinook	23,000	15,000	19,000 - 36,000
Sockeye (wild)	169,000	150,000	40,000 - 75,000
Sockeye (enhanced)	9,000	n/a	n/a
Coho	102,000	98,000	50,000 - 98,000

Gunalchéesh !

Thanks for taking the time to read up on what the TRT Fisheries Department is up to these days. If you have any questions, concerns or information you would like to see presented in our next newsletter please don't hesitate to contact us:

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