

Salmonid Habitat Evaluation, Restoration and Education for the Shediac Bay Watersheds

2019



Report produced for the Atlantic Salmon Conservation Foundation and the New Brunswick Wildlife Trust Fund

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Table of Content

1	Introduction	2
2	Habitat Evaluation.....	4
2.1	Water Temperature Monitoring.....	4
2.1.1	Temperature monitoring Shediac River	5
2.1.2	Water Temperature Monitoring Site - T-ShdE.....	8
2.1.3	Temperature monitoring Scoudouc River	10
2.2	Redd Count Survey and Stream Habitat Assessment .	Erreur ! Signet non défini.
2.3	Fisheries Management Plan	12
3	Restoration	13
3.1	Edna’s Pond Restoration Site	14
3.2	Culvert Restoration – Scotch Settlement.....	17
3.3	Fish Ladder Maintenance	19
4	Education and Stewardship	20
4.1	Adopt-A-River Program.....	21
4.2	Fish Friends program.....	23
4.3	ATV Club Engagement	Erreur ! Signet non défini.
5	Conclusion.....	25
	Annex 1 – <i>Newsletter</i>.....	Erreur ! Signet non défini.

The Shediac Bay Watershed Association is working to monitor, restore and educate on fish habitat in partnership with three funders: the Atlantic Salmon Conservation Foundation, the New Brunswick Wildlife Trust Fund and the New Brunswick Environmental Trust Fund. Funding was also received by the Habitat Stewardship Program for Species at risk to restore habitat for a freshwater mussel species of Special Concern, the Brook Floater (*Alasmidonta varicosa*). Funding for this freshwater mussel species benefits fish habitat due to their shared habitat needs.

In 2019, we continued our partnerships with the local ATV clubs to maintain the lines of communications for the betterment of the environment while sustaining responsible uses of recreational vehicle activity in the watershed. The *United ATV Club* and *ATV Country Wheelers* have both partnered with SBWA in 2018 and 2019 to provide help and resources to diminish ATV use in the rivers.

Many partners also help with knowledge sharing and data collection. A partnership between the Shediac Bay Watershed Association and its neighboring watershed groups, *Petitcodiac Watershed Alliance* and *Vision H2O*, allows for some staff support for culvert assessment and culvert restoration, and past electrofishing surveys. Another valuable partnership is with *INRS-ETE Québec* since 2016. This partnership contributes to additional temperature monitoring, using borrowed temperature data loggers in addition to our own equipment. This partnership has also helped with data management and interpretation.



Scoudouc River

Finally, the work could not be completed without the landowners who have given permission to the SBWA to access and conduct restoration work in various rivers and streams.

2 Habitat Evaluation

The main threats to fish habitat in the Shediac Bay Watershed are fish passage issues, water temperatures and sedimentation caused by human activities. The Shediac Bay Watershed Association has been evaluating these threats for several years, to help detect and prioritize areas needing future restoration work. In 2019, only temperature monitoring using pendant loggers was continued under the habitat evaluation portion of the overall salmon conservation program.

2.1 Water Temperature Monitoring

This part of the project is done in partnership with the “*Institut national de la recherche scientifique*” (INRS-ETE) in the province of Quebec. This partnership began in 2016, where INRS-ETE provided the SBWA with 3 temperature loggers, and an additional 4 loggers were purchased by the SBWA (HOBO light pendants). Having a total of 7 loggers, the strategy is to monitor temperatures fluctuations in strategic locations. Areas of interest are those determined to be high risk for thermal stress in juvenile salmonids and other cold water species. Other areas of interest are those determined to be colder zones suitable for thermal refugia, i.e. habitats containing colder water that provides a refuge for fish from high water temperatures.

Table 1: Thermograph monitoring Sites information, SBWA 2019

Site ID	Watercourse Name	Latitude	Longitude	Installation date	Date of retrieval
T-ShdA	Shediac River	N46° 11' 36.7"	W64° 48' 56.0"	05/31/2019	Lost
T-ShdE	Shediac River	N46° 14' 41.5"	W64° 39' 56.3"	05/31/2019	10/01/2019
T-ShdE-2A	Weisner Brook	N46° 14' 24.1"	W64° 39' 46.0"	06/11/2019	10/01/2019
T-ShdM	Weisner Brook	N46° 12' 27.1"	W64° 40' 21.0"	06/11/2019	10/01/2019
T-ShdB	McQuade Brook	N46° 13' 54.9"	W64° 44' 31.9"	05/31/2019	10/01/2019
T-ScdD	Scoudouc River	N46° 11' 2.3"	W64° 30' 39.8"	06/11/2019	Lost
T-ScdB	Scoudouc River	N46° 08' 39.2"	W64° 33' 36.6"	05/31/2019	10/01/2019

The temperature loggers were installed on May 31st and June 11th, and retrieved on October 1st. See Table 1 for site placement details. In 2019, two temperature loggers were unfortunately lost, one in each watershed. There were many heavy rain storm events that happened this year that could have taken out the loggers.



Figure 2: Installation of a water temperature logger in-stream

The following section of this report shows the thermograph data (daily maximum temperatures) recorded. The recommended temperature limits indicate the threshold for thermal stress beginning at 22.5°C for juvenile Atlantic salmon, and lethal limit of 25°C or greater (Crisp 1999).

2.1.1 Temperature monitoring Shediac River

Five sites are monitored in the Shediac River and its tributaries. The temperature logger “T-ShdA” was lost this year (no data).

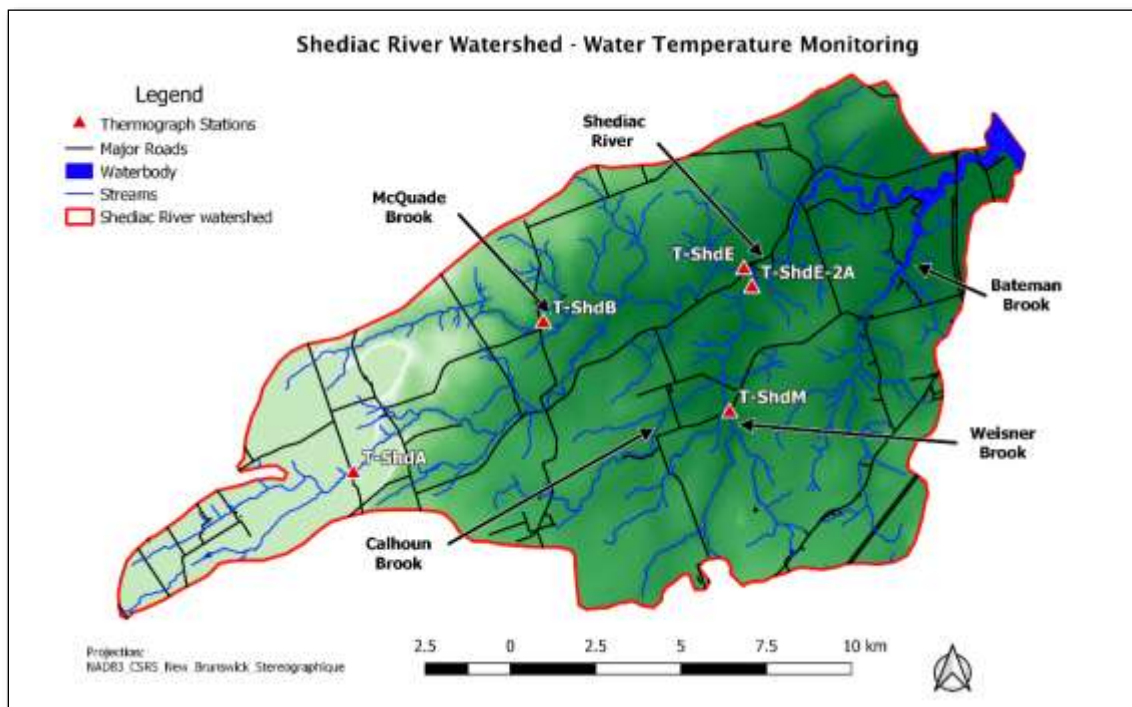


Figure 3: Map of temperature logger placement in the Shediac River

2.1.1.1 Water Temperature Monitoring Site - T-ShdB

This temperature logger was installed in the McQuade Brook, approximately 35 metres downstream of the fish ladder and upstream of the electrofishing site EShdB-02.

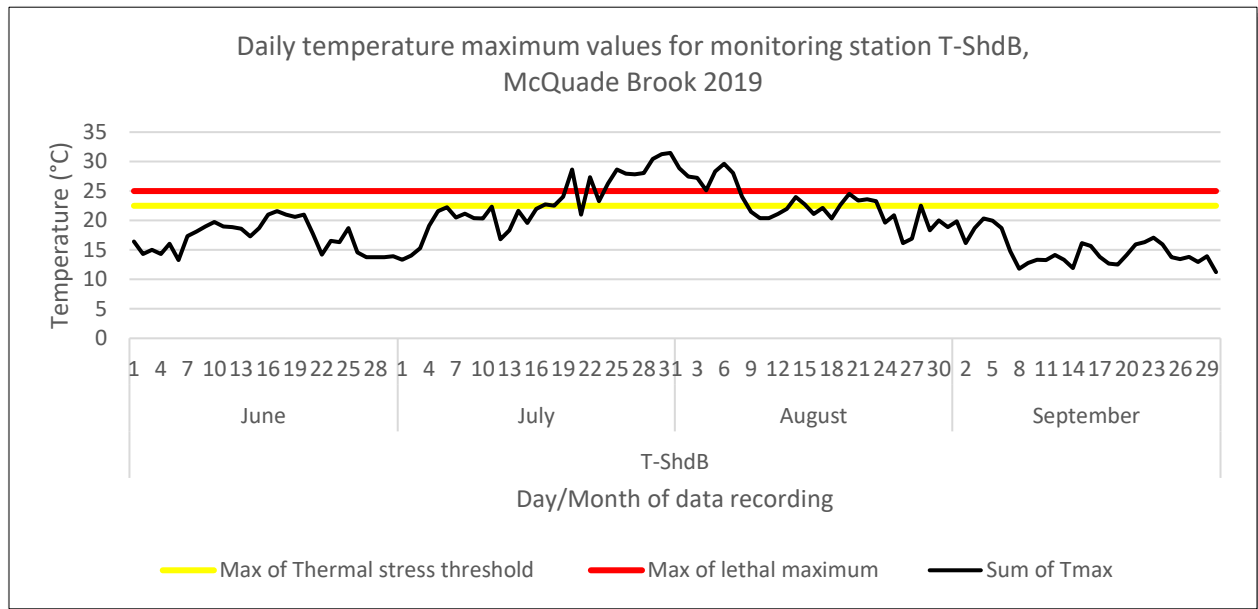


Figure 4: Thermograph data chart for monitoring station ID T-ShdB, McQuade Brook 2019

The thermograph shows the maximum daily temperature between June 1st and September 30th (Fig.4). The maximum temperatures exceeded the thermal stress threshold on 30 occasions during the peak of the summer months. During these 30 days, the maximum temperatures exceeded the lethal limit on 17 occasions. The lethal maximum temperature was exceeded for 15 consecutive days (July 24 to August 7). The highest maximum temperature recorded at this station was 31°C, and lasted for 2 consecutive days (on July 30 and July 31). The highest average daily temperature was 23.35°C.

2.1.1.2 Water Temperature Monitoring Site - T-ShdM

This temperature logger was installed in the Weisner Brook, a tributary of the Shediac River. This logger was predicted to show cooler temperatures, as the brook is recognized as a summer resting area for mature brook trout by the *Department of Natural Resources and Energy Development*, due to its colder characteristics. This stream has an excellent tree coverage; undeveloped forested lands along the majority of the brook. It also has a lot of input of cold water from natural underground springs. These conditions of shade from the forest and cold water springs are great to keep the water temperatures cool.

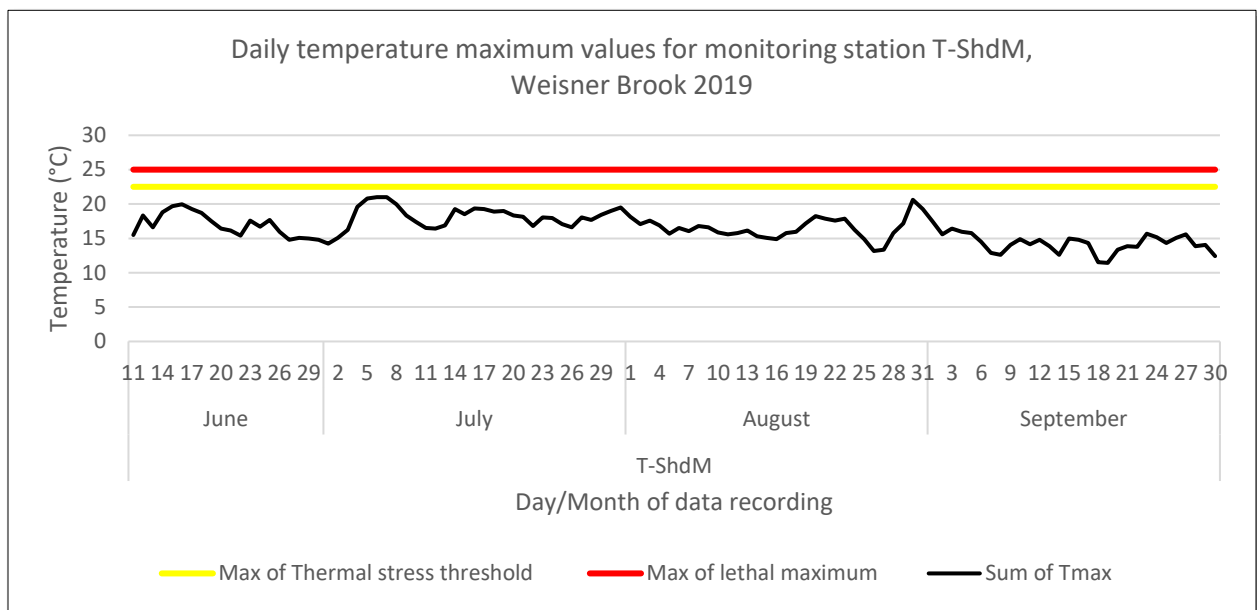


Figure 5: Thermograph data chart for monitoring station ID T-ShdM, Weisner Brook 2019

The thermograph shows the maximum daily temperatures between June 11th and September 30th (Fig.5). The logger was installed on June 1st but it did not start recording until the 11th, the cause of the glitch is unknown. The maximum temperatures did not exceed the lethal limit or the thermal stress threshold. The highest temperature recorded was 21°C on July 6 and July 7. The highest daily average temperature for this site was 19.22 °C.

2.1.2 Water Temperature Monitoring Site - T-ShdE

This temperature logger is located in the mid to lower reaches of the main branch of the Shediac River, near the covered bridge. This area was predicted to have warmer waters due to the lack of canopy coverage, and its wide and shallow channel.

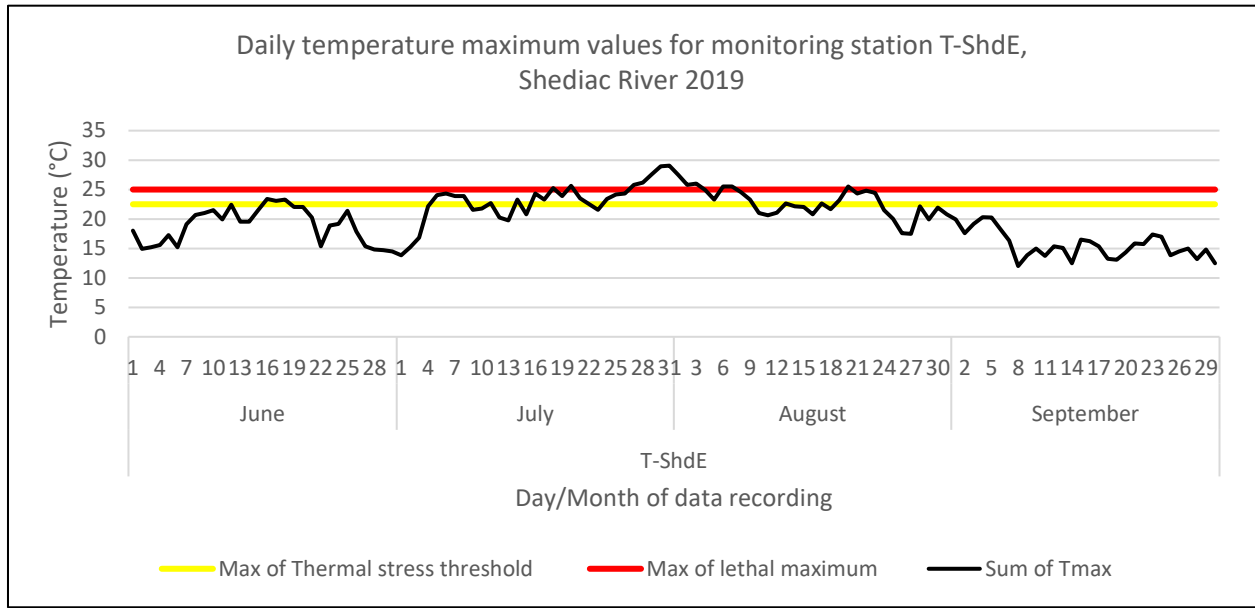


Figure 6: Thermograph data chart for monitoring station ID T-ShdE, Shediac River 2019

The thermograph shows the maximum daily temperature between June 1st and September 30th (Fig.6). The maximum temperatures exceeded the thermal stress threshold on 40 occasions during the peak of the summer months. Of those 40 days, the maximum temperatures exceeded the lethal limit on 13 occasions. The lethal maximum temperature was exceeded for 8 consecutive days (July 27 to August 3). The highest maximum temperature recorded at this station was 29.05°C on August 31st and the highest average daily temperature was 25.27°C.

2.1.2.1 Water Temperature Monitoring Site - T-ShdE 2A

This temperature logger was installed in the Weisner Brook, approximately 300 metres upstream from its convergence with the Shediac River. This site is used to compare with the station of the covered bridge (T-ShdE), as it is the closest source of cold water for migrating fish looking for thermal refuge during high temperatures. This site is located approximately 5 km downstream from the second logger in the Weisner Brook; T-ShdM. Just like the other site in this brook (T-ShdM), the surrounding canopy coverage of the forested land and the input of cold water from natural springs contributes to the overall colder water temperatures.

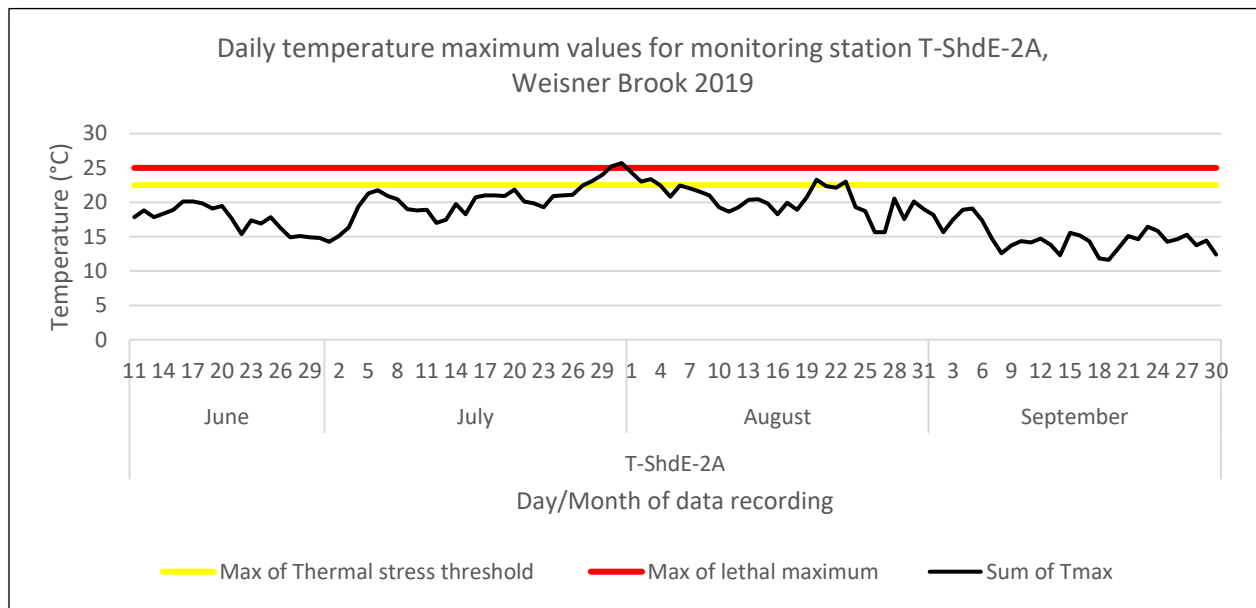


Figure 7: Thermograph data chart for monitoring station ID T-ShdE-2A, Weisner Brook 2019

The thermograph shows the maximum daily temperatures between June 11th and September 30th (Fig.17). The temperature was installed on June 1st but it did not start recording until the 11th, the cause of the glitch is unknown. The maximum temperatures exceeded the thermal stress threshold on 9 occasions during the peak of the summer months. Of those 9 days, the maximum temperatures exceeded the lethal limit on only 2 occasions (July 30 and July 31). The highest maximum temperature recorded at this station was 25.71°C on July 31 and the highest average daily temperature was 21.91°C.

2.1.3 Temperature monitoring Scoudouc River

Two sites are monitored for water temperature in the Scoudouc River. The temperature logger “T-ScdD” was lost this year (no data).

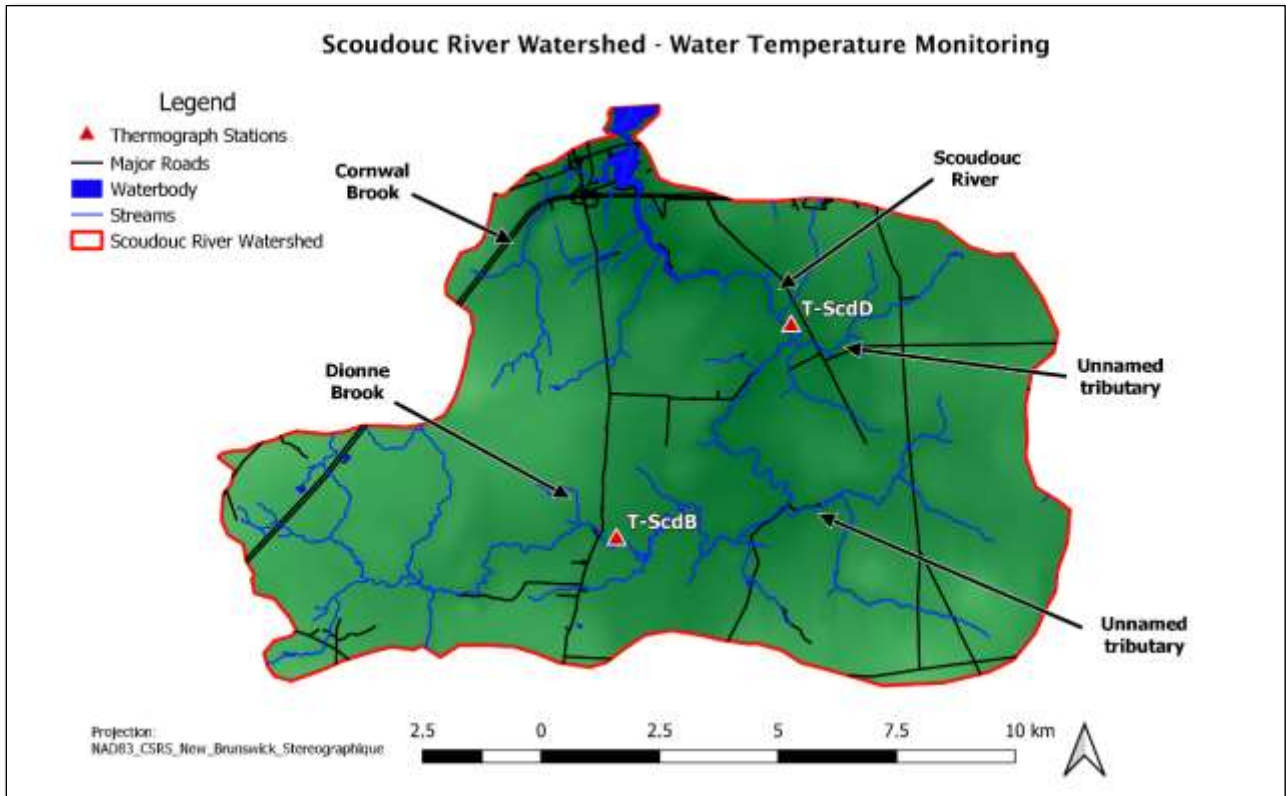


Figure 8: Map of temperature logger placement in the Scoudouc River

2.1.3.1 Water Temperature Monitoring Site - T-ScdB

This temperature logger was installed in the main branch of the Scoudouc River, next to the *Greater Shediac Sewage Commission's* treatment lagoons in Scoudouc.

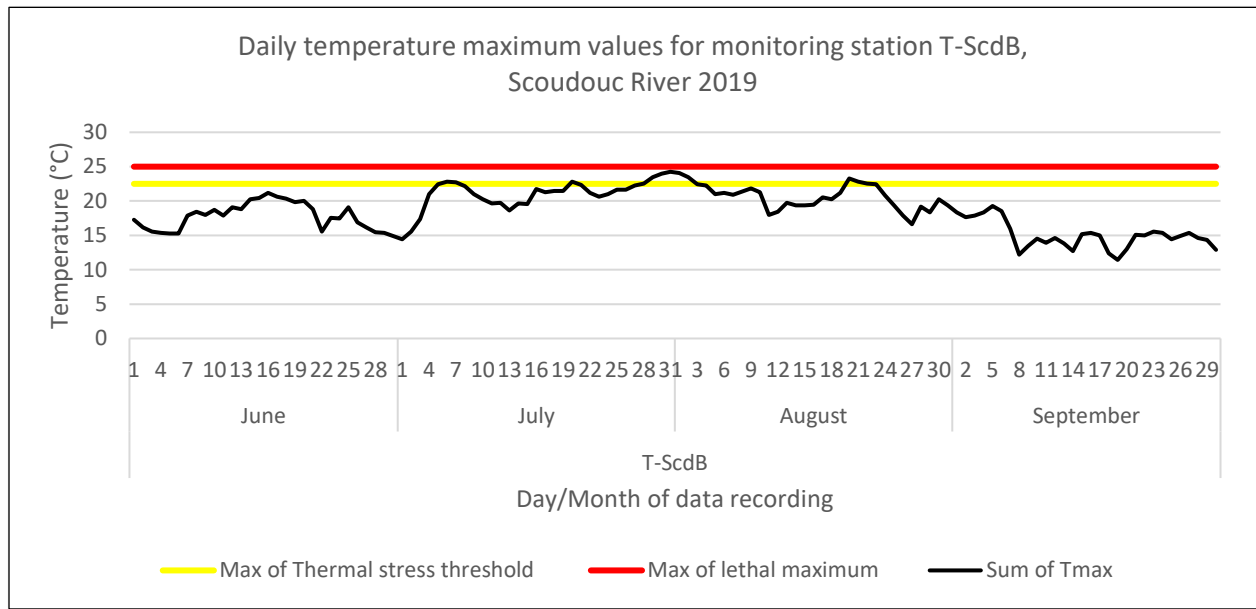


Figure 9: Thermograph data chart for monitoring station ID T-ScdB, Scoudouc River 2019

The thermograph shows the maximum daily temperatures between June 1st and September 30th (Fig.9). The maximum temperatures exceeded the thermal stress threshold on 12 occasions during the peak of the summer months. The maximum temperatures at this site did not exceed the lethal limit. The highest temperature recorded during this time period was 24.26°C on July 31. The highest average temperature daily temperature for this site was 23.05°C.

2.2 Fisheries Management Plan

The Shediac Bay Watershed Association has been collecting data and information on fish habitat for the past 20 years. Over the years, our project reports looked at threats to fish habitat, water quality and remediation work undertaken in the past year. Because of the nature of the year-by-year grants, there has been no summary of all the work that has been done since the beginning.

The format of this report is designed to report on all the data gathered and work done in each individual watercourse Shediac Bay watershed. The template for each watercourse is easily replicated and updatable. In addition to all the data gathering and mapping, a list of future recommendations for habitat enhancement is also drafted.

The compilation of all the data accumulated for the watershed over 20 years is a major undertaking. Therefore, due to limited annual funding, the Association decided to compile most of the data on the two main river systems (main branch of Shediac River and Scoudouc River) in 2018, the Phase 1 of the report. In 2019, the Phase II of the report now includes the McQuade Brook sub-watershed. The next phase will include another major sub-watershed, such as the Weisner Brook drainage system.

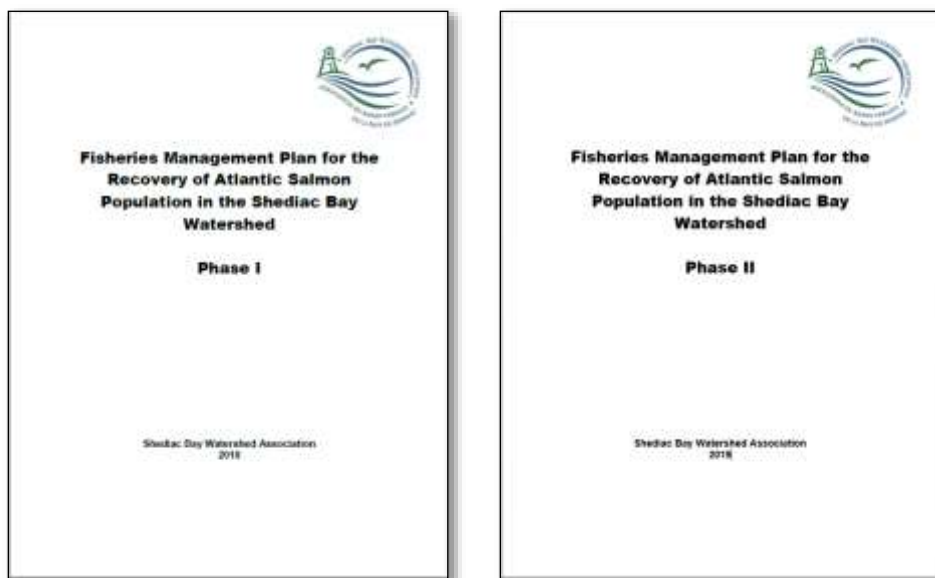


Figure 10: Fisheries Management Plan Phases I & II

3 Restoration

In 2019, two sites were selected for habitat enhancement. Work continued at the existing restoration site known as Edna's Pond, along the Scoudouc River. The second restoration site includes maintenance of a problematic culvert, clearing of woody debris along the stream, and buffer zone enhancement for riverbank stabilization.



3.1 Edna's Pond Restoration Site

In 2017, an area in the Scoudouc River surrounding a precious salmon habitat, was selected for major restoration efforts intended to reduce sediment runoff from a sloped ATV trail and to halt the river bank erosion. Ongoing efforts are being carried out every year to maintain the previous restoration work of the area.

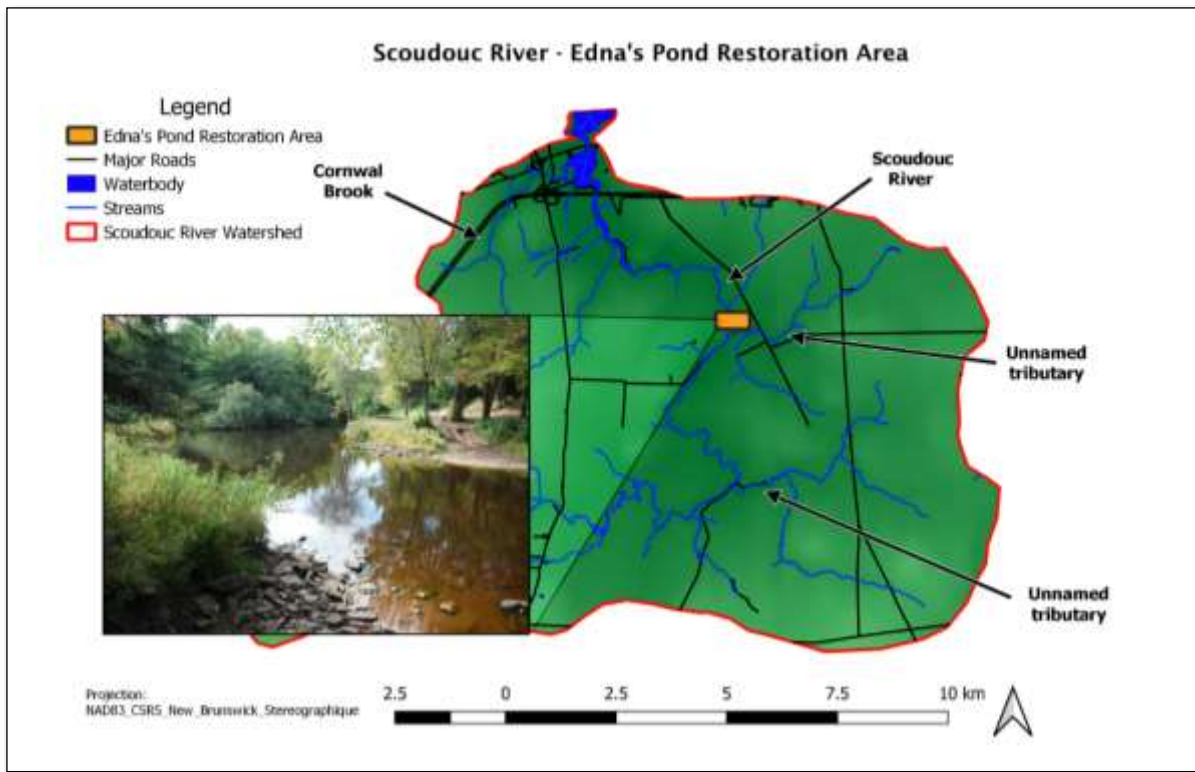


Figure 11: Map of Edna's pond restoration area

The five sediment deflectors in the area require constant maintenance every year. They capture sediments from runoff which causes a sediment buildup on the logs. In the spring of 2019, small trenches were dug by shovel to eliminate the sediment build up on the stabilizers and also to help direct the runoff towards the forested areas.

Actions have been taken this year to block two illegal river crossing access trails. Three large posts made out of a fallen birch tree was set deep in the middle of the two river

access trails and cement was poured in the holes to help secure them. Along with the posts, straw bales were set in the trails. This will hopefully discourage ATV from trying to use the river access trails and also will help capture sediment from runoff. These were installed with student volunteers from Shediac Cape School.

In addition, 7 native trees and grass seeds have been planted on the slope and around the river bank to further stabilize the soil of the area. The trees used were provided by the SBWA tree nurseries.

A sign was installed at the southernmost river access indicating the trail blockages and the negative implications of crossing the river with motor vehicles to this sensitive habitat.



Figure 12: Before and after photos of ATV access blockage and sediment control (hay-bale check dam)



Figure 13: ATV access blockage and sediment control (hay-bale check dam)



Figure 14: New signage designed for Edna's pond restoration site, 2019

3.2 Culvert Restoration – Scotch Settlement

Aquatic connectivity is very important for the biodiversity of a watershed. Culverts modify the morphology and the hydrology of a stream, and can sometimes hinder that connectivity by creating barriers. The presence of an outflow drop, steep culvert slopes, deteriorating culverts, and the presence of beaver dams or debris blockages within the culvert, can all negatively influence fish passage. Problematic culverts in terms of passage prevent fish to access upstream habitats. Other issues includes erosion of stream banks and road washouts caused by flooding and improperly sized culverts.

In 2018, the SBWA field team received training and conducted culvert assessments within the Shediac Bay watershed. The objective of these assessments was to target culverts located on Atlantic salmon and/or Brook Floater host fish bearing streams, then classify them as either passable, partial barrier or full barrier to fish passage.

In 2019, four problematic culverts were revisited. Two of these culverts had been replaced by the *Department of Transportation and Infrastructure* during the summer. The two other culverts were now free of the debris that classified them as partial or full barriers to fish passage. Other culverts deemed to be possible fish barriers were also revisited. While stopped at a culvert known to have issues in the Scotch Settlement area, a local resident confirmed that debris frequently blocks the culvert and leads to flooding during heavy rain events. The stream is a tributary of the McQuade Brook, an important branch of the Shediac River.

The issue was caused by shrub overgrowth directly upstream of the culvert, which causes debris to build up every spring. These blockages caused impediments to water flow, leading to flooding and fish passage issues. The area surrounding the culvert showed evidence of streambank erosion and sedimentation, due to a lack of a vegetative buffer zone, flooding and agriculture activities in the surrounding farmland.

The landowner was then contacted, and permission was granted to the SBWA to clear the obstructions at the mouth of the culvert, clean the excess of woody debris up the stream and plant native shrubs along the buffer zone to enhance fish habitat.



Figure 15: Map of the Scotch Settlement stream restoration, 2019

On September 12, the team trimmed the overgrowth at the culvert using manual tools. The stream was cleaned of excessive woody debris on a distance of approximately 235 meters upstream of the culvert. The native shrubs planted were Red Osier Dogwood, for its strong roots and its capacity to stabilize stream banks and prevent erosion. A total of 28 native shrubs were planted on a distance of approximately 60 meters. The farmer did not want reforestation beyond the planting of shrubs, but he may be willing to continue in future years if the project goes well.



Figure 16: Before and after photos of the shrub thinning upstream of the culvert

3.3 Fish Ladder Maintenance

In 2015, funding was received to mitigate a suspended culvert in a critical area of the McQuade Brook. A 10-foot heavy-duty aluminum fish ladder was installed on the elevated culvert, to bridge the gaps of this broken brook. The following year, water deflectors were added to increase efficiency of the structure. Ongoing maintenance of the structure is required, such as clearing of the occasional woody debris, removing and reinstalling the water deflectors in late fall and early spring, and repairing minor winter damages. The SBWA is committed to the ongoing maintenance of the fish passage structure.



Figure 17: Fish ladder on the McQuade Brook



Figure 18: Up-close view and overhead view of the fish ladder with water deflectors

4 Education and Stewardship

The project was promoted through various activities, tools and channels. Our communications and outreach program targeted residents, local organizations like ATV clubs, anglers' associations and other stakeholders in communities located in the Shediac Bay watershed. The following material and activities are often used to raise awareness and enhance community stewardship:



Presentations to groups and stakeholders;

- Social media publications on our Facebook and Instagram page to show fish & watercourse and restoration efforts
- Methods placed at visible locations near restoration sites
- Project highlights and Atlantic Salmon was featured in the Association's annual newsletter;
- Restoration work, photos, communication material and project results featured in various sections of our website;
- Design and print of brochures, posters, infographics and fact sheets related to salmon habitat & life cycle, watercourse protection and restoration measures;
- Electronic versions of print material for online publications, website and social media;
- Educational videos used for public and school presentations and published on our website, YouTube page and social media;
- Banners, project sheets and other communication material adapted for our events and presentation kiosk.

4.1 Adopt-A-River Program

Adopt-A-River is a school-based program designed to teach the concept of biomonitoring of a river's ecosystem using macroinvertebrate sampling. It also teaches water chemistry using water quality analysis kits for various physicochemical parameters. The program is designed to be integrated into the school's science curriculum.

The SBWA project manager is a certified project coordinator for the "*G3E, Education and Water Monitoring Action Group*" in Quebec, the organization that created and manages the Adopt-A-River program. The science teachers for grades 6 to 8, English and French Immersion of the Shediac Cape School, have agreed to integrate the program within their normal curriculum in partnership with the SBWA since 2016.

A classroom presentation was given before the field trip on the concept of biomonitoring using macroinvertebrates. It was explained that looking at the composition of the community can provide information on water quality, changes in water quality or habitat over many years, and overall aquatic health monitoring. A description of the field trip activities was given, along with a demonstration of the sampling using the equipment in the classroom.

The field trips were organized on two separate days for the English and the French Immersion students. They were brought to Edna's pond on the Scoudouc River for its ease of access, safe water levels and habitat type rich in macroinvertebrates. The first group went on October 4, and the second group on October 5, 2019.

The groups were divided into teams, each with a specific task. There were multiple tasks designed to complete the macroinvertebrate sampling, sorting the invertebrates using a sampling protocol, taking site measurements, filling out data sheets, drawing a sketch of the site, and taking habitat observations. The science teachers are always amazed with the various components of the activity, stating that a great portion of the curriculum's objectives and outcomes are being attained in one day.



Figure 19: Field observations and discussion

After the lunch on the first day, several students volunteered to plant a few native trees (7 trees) at the active restoration site across the river. On the second day, the students observed the installation of a restoration sign and installation of hay bales for sediment control. Both groups received a presentation on the impacts of sediment runoff on fish habitat, a description of the ongoing restoration work, and the importance of responsible use of recreational vehicles.



Figure 20: In-stream collection of benthic macroinvertebrates and sorting for sample



Figure 21: Data collection (site measurements and flow speed)



Figure 22: Tree planting and installation of sign at Edna's Pond

4.2 Fish Friends program

The Fish Friends program is a wonderful tool for getting children excited about fish and aquatic ecosystems. The program usually includes an aquarium in the classroom, containing either salmon or trout eggs that the children will witness hatch and grow. The program includes several presentations on fish habitat, on the life cycle of salmonids, salmon migration, etc. The program normally ends with a field trip to release the fish into the wild.

In March of 2019, fish eggs were unfortunately not available from the Miramichi Salmon Conservation Centre. Therefore, there was no aquarium but the presentation were given in the classrooms and a field trip was organized at the end of the school year to see fish species in the Scoudouc River estuary using a beach seine. The program was taught in both French and English; the MFB School is Francophone, and Shediac Cape School is both Anglophone and French emersion.

The 3rd graders of MFB School (57 students) went to the Big Lobster for the activity on June 12th and the 3rd and 4th graders of the Shediac Cape School (41 students) went on June 13th. During the field trip, the kids observed SBWA staff perform a 30-meter beach seine sampling to catch small fish, shrimps and crabs. The catch was divided and transferred to clear containers, where the kids got to observe the specimens. The fish, shrimps and crabs were then transferred to mason jars, and the students got to release them back into the water.



Figure 23: Preparation of the activity and beach seine fish sampling



Figure 24: Observation of fish caught in beach seine and release of the fish by the students

5 Conclusion

The Shediac Bay Watershed Association continued its program to improve fish habitat in both major rivers that form the watershed. In the past years, the program has expanded as the capacity of the organization has increased. Our program looks at water and habitat quality in the watershed, and identifies threats and gaps in information that can be used to target restoration activities.

Many partners also help with data collection. More temperature monitoring has been done thanks to a partnership with the INRS-ETE in Quebec, provides three additional data loggers to our program as well as data management and interpretation support. In 2018, we expanded our partnership with the local ATV clubs to allow for some restoration work to occur on both main rivers. The United ATV club and ATV Country Wheelers both offered help and resources to diminish ATV use and impacts in the rivers.



Scoudouc River

Finally, the work could not be completed without the landowners that give permission to the SBWA to access and conduct the much needed work to enhance aquatic habitat in our watershed.