NEWSS salmon recovery projects

eDNA research

Submitted by Dr. Brent Murray and Barry Booth

UNBC Ecosystem and Science Management

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Methodology

Hiring summer field crew

We worked with Casey Litton, Nechako Valley Secondary School (NVSS) and Darren Carpenter of School District 91(SD 91) to have our job posting for summer positions posted in May of 2023. We interviewed 5 students. All interviews took place at NVSS. Barry Booth joined the meetings via Teams and Rebecca Morin and Eldon Kochel were present at NVSS. We interviewed 5 students on June 21, 2023. Based on these interviews we selected 3 candidates, all grade 11 students on June 22, 2023. Rebecca Morin assisted each student in completing all the required employment paperwork. Our first set of sampling/training took place at NVSS on June 29th with Dr. Brent Murray, Barry Booth (UNBC), and Eldon

Kochel (NVSS). Dr. Murray went over the details of filtering with the students in the NVSS lab. From that point on we worked in concert with Eldon Kochel and Casey Litton, NVSS staff to execute field season which included gaining access to SD 91 equipment and lab space. Further training of the students was effectively on 'the job training' whereby students were continually exposed to new facets of the job (e.g., how to place minnow traps, handle fish, record field data) as the summer progressed.

Site selection

Our work with eDNA in the Nechako watershed began in 2020 and has continued each year since then. In 2023, we took water/eDNA samples from 39 different creeks/water bodies (Table 1). In keeping with our on-going sampling program, we sampled 11 creeks that have been sampled regularly since 2020. In addition to continuing our work on sampling our core sites, we greatly expanded our sampling creeks and locations on creeks. We also continued our examination of how salmon are utilizing a developing beaver dam complex on the bottom 1 km section of Murray Creek. This was the third year of sampling of this beaver dam complex[1].

The selection of additional creeks within the Nechako watershed was facilitated by conversations with project partners. Chelton van Geloven, the then source water hydrologist for the BC Ministry of the Environment, suggested sampling 6 new creeks within the Chilako watershed. We also worked with Mr. van Geloven on sampling of 17 creeks from river boat at/near the confluence of these creeks with the mainstem of the Nechako from Prince George all the way to the Upper Nechako (~20 km downstream of the Kenney Dam). Mr. van Geloven conducted two of these surveys with another team member and Barry Booth accompanied him on a third.

We also worked with Jeff Beardsal, contractor for the Carrier Sekani Tribal Council (CSTC), to determine sampling within the reaches of the Endako River where the Endako River chinook salmon are known to spawn. We traveled with Mr. Beardsall and two CSTC fisheries technicians on our first sampling trip along the Endako River and Shovel Creek. Mr. Beardsall also accompanied us on our second trip to the Endako, as well, where sampling was abandoned because we encountered and did not want to disturb spawning chinook salmon. We also sampled numerous locations on the Endako River both upstream and downstream of Shovel Creek, including Tchesinkut Creek.

As per our commitment to NEWSS, we added sampling locations to coincide with planned restoration projects. This included adding new sampling locations along Murray Creek and a new site on Eden Creek (a tributary of Clear Creek). We are also able to sample the mainstem of the Nechako both above and below the confluence with the Cheslatta River in November due to reports of potential spawning of coho salmon in this region.

Sauls Creek, in Burns Lake, was not sampled prior to or after the restoration work on this creek due to extremely low water levels throughout the summer.

[1] Maps of figures are provided as a KMZ file. One set of locations is provided in Appendix 1.

Results

Minnow trapping results

Minnow trapping was conducted on a sub-sample of the eDNA survey sites. Results of this component of our project are presented in Appendix 2.

eDNA results

Our eDNA samples have been processed and are now being interpreted. We expect to have the final results available for review in early June of 2024. We will be producing data output like the one below (Figure 1) that shows the results of the 2021 eDNA and minnow trapping survey, as well as interactive summary maps generated by the Nechako Watershed Portal (see below).

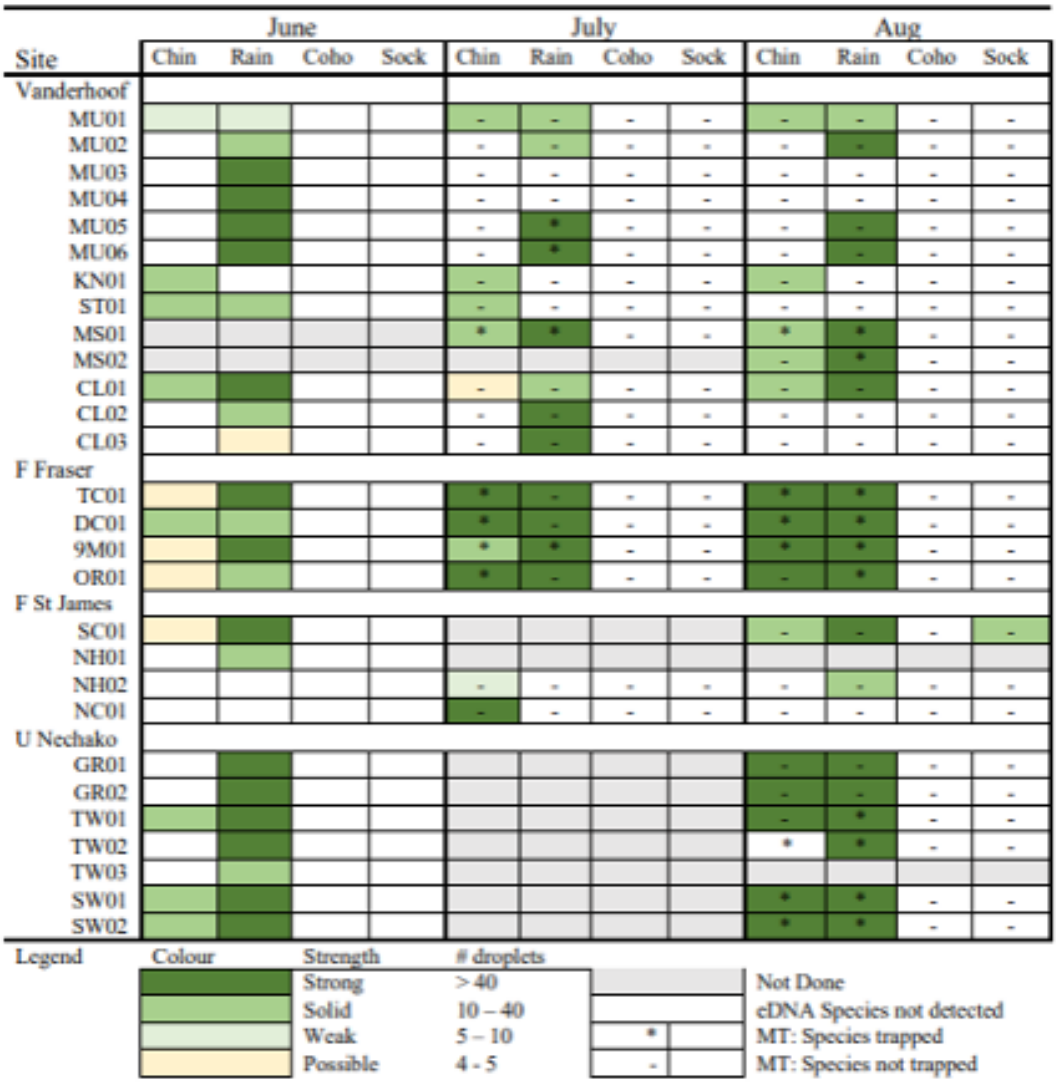

Figure 1. eDNA data from 2021

Extension of results

We are worked with Scott Emmons, Geoborealis, on incorporating our results into the Nechako Watershed Portal (https://www.leaph.org/branch/nechako-watershed-portal). This portal is one of several similar geo-spatial tools being using the same Opensource web-based software. These portals have been created, expanded, and maintained by computer developers, First Nations, researchers, and other watershed groups since 2007. Mr. Emmons has created the tools for incorporation of our site data, minnow trapping and eDNA results. Once vetted and incorporated, the portal will enable us to develop detailed maps that illustrate the location and strength of the eDNA signal that we have detected for each of the target species. It is also designed to be expandable to include the expected metabarcoding eDNA results that will be associated with each restoration site.

Lessons learned

Efficacy of using river boat for sampling

We were grateful to be able to partner with Chelton van Geloven this past field season. Sampling from the river boat provided exceptional access to many creeks, near their confluence with the Nechako, that have up until now been inaccessible. With the use of the river boat our sampling of creeks along the Nechako now extends from ~35 km upstream from Prince George to within ~ 20 km of the Kenney Dam.

Drought and its impacts

While there are always unanticipated challenges with any field season, the drought of 2023 had significant impacts. As the season progressed most if not all creeks were 0-30% of their regular flow. Numerous proposed sampling creeks were running subsurface, resulting in the severing of the connection between the confluence and upper sections of the creek (add figure). This happened in some of the creeks that we regularly sample (e.g., Swanson, Twin, and Knight. Creeks) and creeks that we hoped to sample either by river boat (Targe Creek) or by foot (Beaverly Creek). In other creeks, sections of the creek were running subsurface (e.g., sections of Murray and Knight Creek).

Challenges with access.

Being able to use riverboat greatly enhanced our ability to access many previously unsampled creeks. In addition, working with CSTC biologists also enabled us to sample selected locations along the Endako River in proximity to documented Chinook spawning locations. We did, however, still struggle with access to some small creeks especially along the Endako River. There are numerous small creeks (e.g., Cheskwa, Sam Ross, Four Mile, Tatin) where access is difficult, in part due to the vegetation (dense deciduous shrubs) associated with this low gradient and sinuous river and in part due to challenges with the intimate association with the CN railway. We will work with our community partners to determine if there is a need/desire to sample some of these smaller creeks and devise possible sampling efforts in 2024.

Draft sampling plan for 2024-25

Our draft sampling plan will build on results from 2023-4 season. In general sampling will include the following:

- Sampling at NEWSS restoration sites
    - Saul's Creek
    - Clear/Eden Creek
    - Murray/McIntosh Creeks (J. Johnson, D. Stephen, A. Marten properties)
- Continue to sample core streams
    - Twin, Greer, Swanson, Ormond, Tatsutani, Nine Mile, Dog/Unnamed, Moss, Clear, Murray, Knight
- Based on feedback from partners, expand the number of sampling sites on selected creeks
    - Swanson Creek
    - Greer Creek
- Potentially expand sampling in the Vanderhoof area in areas that are being considered for restoration projects
    - Chilco Creek
    - Tritt Creek
- Work with CSTC to explore further sampling in the Endako River watershed.
- Re-sample beaver dam complex and consider minnow trapping this portion of Murray Creek
- Repeat sampling of creeks from river boat along the mainstem of the Nechako
- Sample within Chikao watershed.

Table 1. eDNA sample locations and dates.

Location/Area	Site #	Sample 1	Sample 2	Sample 3
Vanderhoof SD91				
Murray	MU 01	29-Jun	26-Jul	30-Aug
	MU 02	29-Jun	26-Jul	30-Aug
	MU 03	29-Jun	26-Jul	30-Aug
	MU 04	29-Jun	26-Jul	30-Aug
	MU 04.1		26-Jul	30-Aug
	MU 05	29-Jun	27-Jul	31-Aug
	MU 06	29-Jun	27-Jul	31-Aug
	MU 07		27-Jul	31-Aug
	MU 08		No water	No water
	MU 09		27-Jul	30-Aug
Beaver Dam Survey on Murray Creek	Stn1			21-Oct
	BD 03			21-Oct
	BD 04			21-Oct
	BD 05			21-Oct
	BD 06			21-Oct
	BD 07			21-Oct
	BD 08			21-Oct
	BD 09			21-Oct
	BD 11			21-Oct
	BD 12			21-Oct
Knight	KN 01	05-Jul	No flow	No flow
Moss	MS 01	05-Jul	26-Jul	28-Aug
Clear	CL 01	05-Jul	26-Jul	28-Aug
	CL 02	05-Jul	26-Jul	28-Aug
	CL 03	05-Jul	26-Jul	28-Aug
	CL 04	05-Jul	26-Jul	28-Aug
Eden	EN 01	05-Jul	26-Jul	28-Aug
Ft Fraser				
Dog	DC 01	04-Jul	25-Jul	31-Aug
Tatsutani	TC 01	04-Jul	25-Jul	31-Aug
9 Mile	9M 01	04-Jul	25-Jul	31-Aug
Ormond	OR 01	04-Jul	25-Jul	31-Aug

Table 1. eDNA sample locations and dates, continued

	Site #	Sample 1	Sample 2	Sample 3
Upper Nechako				
Twin	TW 01	12-Jul	10-Aug	No flow
	TW 02	12-Jul	10-Aug	09-Sep
Swanson	SW 01	12-Jul	10-Aug	09-Sep
	SW 02	12-Jul	10-Aug	09-Sep
Greer	GR 01	12-Jul	10-Aug	09-Sep
	GR 03	12-Jul	10-Aug	09-Sep
Nechako coho sampling				
	Nechako Canyon 1			10-Nov
	Nechako Canyon 2			10-Nov
	Nechako @ Twin			10-Nov
	Nechako @ Cutoff			10-Nov
	Nechako @ Greer			10-Nov
	GR 01			10-Nov
Endako/Shovel with CSTC and SD 91				
Shovel	SH 01	06-Jul	*	
	SH 02	06-Jul	*	
Endako	ED 54	06-Jul	*	
	ED 56	06-Jul	*	
	ED 57	06-Jul	*	
Endako Mainstem	ED 13		15-Aug	
	ED 18		15-Aug	
	ED 22		15-Aug	
	ED 26		15-Aug	
	ED 66		15-Aug	
	ED 66.1		15-Aug	
Tchesinkut	TH 01		15-Aug	
Chilako Watershed				
Beaverly	BE 02		17-Aug	
Butcherflats	BU 01		17-Aug	
Chehischic	CH 08		17-Aug	
Dahl	DH01		17-Aug	
Gregg	GG 01		17-Aug	
Unnamed Chilako Trib1	CK UN1		17-Aug	
Unnamed Chilako Trib2	CK UN2		17-Aug	

* we made a trip to these sites on Aug 19, but did not sample because of the presence of spawning chinook

Table 1. eDNA sample locations and dates, continued

Creeks near confluence of Neckako main stem by river boat

	Site #	Sample 1	Sample 2	Sample 3
Breeze	BZ 01	12-Jul		21-Aug
Chilako	CK 01	12-Jul		21-Aug
Clucuuz	CZ 01	12-Jul		21-Aug
Cuttoff	CO 01			24-Aug
Cuttoff	CO 02			24-Aug
Engen	EG 01	13-Jul		
Halsey	HY 01			22-Aug
Hullat	HL 01			21-Aug
Hutchinson	HN 01	12-Jul		21-Aug
Kluk	KK 01	13-Jul		22-Aug
Nine Mile	9M 00	13-Jul		22-Aug
Sinkut	SU 01	12-Jul		21-Aug
Smith	SM 01	13-Jul		
Sweden	SN 01	12-Jul		21-Aug
Tahultzu	TU 01	13-Jul		22-Aug
Targe	TE 01	13-Jul	16-Aug	
Tatentelichick	TK 01	12-Jul		21-Aug
Tatsunai	TC 00			22-Aug
Zelkwas	ZK 01	12-Jul		21-Aug