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Ministry of Water, Land and Resource Stewardship
and
Fisheries and Oceans Canada

Re: Scientific Fish Collection Permit Application

Please note that permitting to Fisheries and Oceans Canada is requested for inventory purposes only. PIT tagging is NOT proposed for salmon species. PIT tagging is proposed to the Provincial Ministry of Water, Land and Resource Stewardship (WLRS) for provincial jurisdiction species only to monitor fish movement and growth over multiple years.

A summary of sites proposed for assessment, including historic fish presence records from FISS, is provided in Tables 2 to 3. Fish species known to occur within each watershed are summarized in Table 4. An overview map showing potential sample locations is presented in Figure 1. A KML file (google earth) and GPX file (for garmin gps devices) of all sites is attached to the application with latest versions downloadable here or here. The KML includes detailed site-specific information accessible by clicking on each location in google earth, with brief summaries of background reports where available.

Brief description of project/activities

This work is a multi-year collaboration of many groups and an initiative of the Society for Ecosystem Restoration Northern BC. Funding for the project is through the Habitat Conservation Trust Foundation, Society for Ecosystem Restoration Northern BC, and the Ministry of Transportation and Infrastructure (MoTI). Al Irvine, R.P.Bio from New Graph Environment Ltd. is leading the fieldwork with field and office collaboration with teams from throughout the study area. Previous reports are provided below:

- https://www.newgraphenvironment.com/fish_passage_fraser_2023_reporting/
- https://www.newgraphenvironment.com/fish_passage_moti_2022_reporting/

Rationale for sampling

Rationale for sampling is to inform fish presence/absence, species composition/density, abundance estimates, movement, growth, and survival as part of habitat confirmations and effectiveness monitoring related to fish passage restoration at barrier culverts. Habitat confirmation methodology information can be referenced in the above reports which builds on the Fish Passage Technical Working Group Phase 2 protocol. Presence/absence of fish, species composition/abundance, distribution limits and fish movement can be useful for prioritizing which crossings are a best fit for fish passage restoration and inform baseline as well as follow up effectiveness monitoring.

Methodologies

Sampling methodologies will be dependent on the site, fish species suspected, type of habitat encountered, risks to aquatic organisms potentially present (Table 1) and ongoing communications. Sampling methods may include minnowtrapping, electrofishing, and dip netting upstream and downstream of current and past barrier culvert locations.

Sampling is proposed at streams included in Tables 2 - 3 where we will be performing habitat confirmation assessments and follow up site visits related to past habitat confirmations/fish passage remediations.

PIT Tagging

As part of this permit application we are proposing tagging for provincial jurisdiction species only. PIT tagging is not proposed for salmon species. When time allows and tagging is expected to improve knowledge of a system, our study plan is to electrofish small sites both upstream and downstream of priority culvert “barrier” sites and implant Biomark APT12 PIT tags in the abdominal cavity of select fish over 60mm in fork length. To anesthetize fish prior to PIT tagging, we use a clove oil solution at 0.1mL/L (1:10,000), which provides effective sedation with minimal residual effects (Fernandes et al. 2017). The solution is prepared by dissolving clove oil in ethyl alcohol at a 1:9 ratio before mixing into water (Fernandes et al. 2017). Site location (UTM), fish length and weight will also be collected. In addition to providing information on abundance upstream and downstream of potential culvert restoration sites, the study will also provide information for

monitoring programs to document fish movement, growth and survival at sites over multi-year time frames. Main objectives are to:

1. Determine if fish are moving into restored areas
2. Determine if before any remediation is conducted - fish are moving through sites where stream crossing structures (culverts) likely cause connectivity issues
3. Evaluate if productivity of the systems are increasing following bridge installation and/or if fish are moving upstream/downstream of where replaced/removed structures are located

Dependent on how relevant tracking information would be to inform restoration actions, we may wish to tag select fish over 60mm in each site sampled. We would like to apply for a permit allowing a maximum of 600 fish tagged with a maximum of 150 fish/stream. Although we are requesting a maximum of 150 fish/stream, we have listed 150 fish of each species per stream because we will not know the species composition of the sites until the sampling occurs. In general, only salmonid and burbot species will be tagged with likely species present being rainbow trout, bull trout, and burbot. Based on past assessments in the same and similiar systems in the region, the number of fish tagged per stream are very likely to be much less than 150, however we are requesting the maximum number of fish to be tagged to facilitate permit application procedures and allow for flexibility in the field based on actual sampling results.

Risks associated with project/activities and associated mitigation

Table 1: Risks and mitigation

Impact	Mitigation
High Voltage Injuries	Use the minimum effective voltage. Avoid contacting fish with the anode. Avoid electrofishing directly adjacent to metal culverts.
Disruption of Spawning	Avoid electrofishing during highest risk periods in likely spawning habitat.
Physical Stress on Fish	Quick/gentle handling and release of captured fish. Use of clove oil to anesthetize fish.
Injury from PIT Tagging Surgeries	Shallow insertion of tags and use of fresh sterile syringes every approximately 10 surgeries
Mortality in traps due to predation and starvation	Ensure all traps set are retrieved within 24 hours.

Please note that the sampling will be completed before October 31 (end of August till early October) however the end-date of the sampling period is listed as Dec 31 on the application to allow time

outside of the busy field season for the data to be processed, QA'd and organized so that required reporting can be as informative as possible when submitted. An example of how we have been presenting results and methodologies from past assessments can be referenced in reports above.

Please do not hesitate to contact me if you need more information or have any questions or concerns.

Al Irvine, R.P.Bio

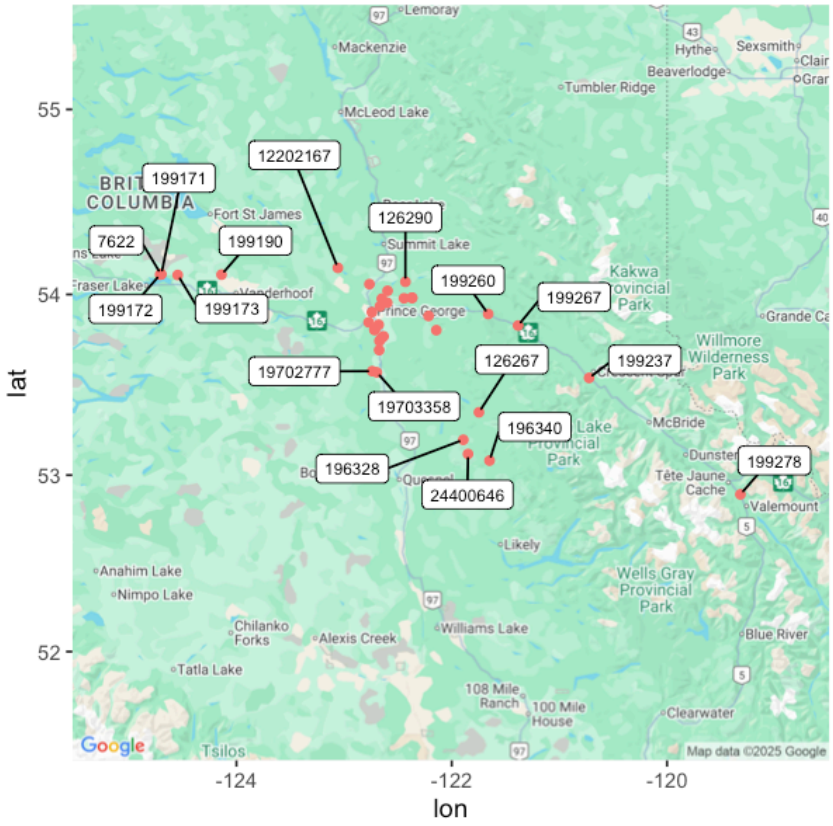

Figure 1: Location of potential sample sites.

Table 2: Potential sampling locations.

Site ID	Stream Name	Watershed Code	UTM Zone	UTM Easting	UTM Northing	Watershed Group Code
12200024	–	100-593800-03100-20600-0000-0000-000-000-000-000-000-000	10	515409	5989806	LSAL
12202167	–	100-593800-25800-29500-0000-0000-000-000-000-000-000-000	10	496209	5999657	LSAL
126267	Stephanie Cr.	100-596500-54900-00000-0000-0000-000-000-000-000-000-000	10	583374	5911978	WILL
126290	Hay Creek	100-596500-03300-00000-0000-0000-000-000-000-000-000-000	10	537250	5991350	WILL
126316	Wansa Creek	100-596500-15700-00000-0000-0000-000-000-000-000-000-000	10	551588	5970657	WILL
196051	Unnamed	100-574400-00000-00000-0000-0000-000-000-000-000-000-000	10	526285	5978523	TABR
196072	Cale Creek	100-553400-00000-00000-0000-0000-000-000-000-000-000-000	10	522679	5956610	TABR
196085	Tabor Creek	100-559300-00000-00000-0000-0000-000-000-000-000-000-000	10	518502	5962002	TABR
196151	Cale Creek	100-553400-00000-00000-0000-0000-000-000-000-000-000-000	10	524160	5957999	TABR
196201	Haggith Creek	100-560100-00000-00000-0000-0000-000-000-000-000-000-000	10	521127	5965112	TABR
196207	Hudson Bay Slough	100-567900-00000-00000-0000-0000-000-000-000-000-000-000	10	516996	5972733	TABR
196264	Parkridge Creek	100-562800-00000-00000-0000-0000-000-000-000-000-000-000	10	515025	5966533	TABR
196328	Archer Creek	100-596500-82000-00000-0000-0000-000-000-000-000-000-000	10	573972	5894796	WILL
196340	Slough Creek	100-596500-90900-00000-0000-0000-000-000-000-000-000-000	10	590481	5882133	WILL
19702777	–	100-535900-08600-00000-0000-0000-000-000-000-000-000-000	10	517279	5936628	TABR
19703257	Tabor Creek	100-559300-00000-00000-0000-0000-000-000-000-000-000-000	10	518845	5961982	TABR
19703286	Bittner Creek	100-572700-00000-00000-0000-0000-000-000-000-000-000-000	10	521864	5976392	TABR

Site ID	Stream Name	Watershed Code	UTM Zone	UTM Easting	UTM Northing	Watershed Group Code
19703295	–	100-587900-00000-00000-0000-0000-000-000-000-000-000-000	10	526448	5985791	TABR
19703303	Bertschi Creek	100-580500-00000-00000-0000-0000-000-000-000-000-000-000	10	522978	5980978	TABR
19703358	Trapping Creek	100-536400-00000-00000-0000-0000-000-000-000-000-000-000	10	520105	5935908	TABR
199171	Tributary To Fraser Lake	180-374000-33800-00000-0000-0000-000-000-000-000-000-000	10	388945	5997015	FRAN
199172	Scotch Creek	180-374000-36600-00000-0000-0000-000-000-000-000-000-000	10	388276	5996951	FRAN
199173	Tributary To Nechako River	180-364700-00000-00000-0000-0000-000-000-000-000-000-000	10	398947	5996427	NECR
199190	Clear Creek	180-296000-00000-00000-0000-0000-000-000-000-000-000-000	10	425559	5996140	NECR
199237	Snowshoe Creek	100-770300-00000-00000-0000-0000-000-000-000-000-000-000	10	650784	5934858	MORK
199260	Tributary To Sugarbowl Creek	100-683800-01900-12800-0000-0000-000-000-000-000-000-000	10	587921	5972449	MORK
199267	Driscoll Creek	100-698700-00000-00000-0000-0000-000-000-000-000-000-000	10	606373	5965784	MORK
199278	Teepee Creek	100-907400-42800-00000-0000-0000-000-000-000-000-000-000	11	344022	5862734	UFRA
24400646	Rucheon Creek	100-596500-84300-21000-0000-0000-000-000-000-000-000-000	10	577020	5886032	WILL
24401504	Tsadestsa Creek	100-596500-10600-00000-0000-0000-000-000-000-000-000-000	10	536470	5981315	WILL
24401692	–	100-596500-11200-00000-0000-0000-000-000-000-000-000-000	10	541465	5981577	WILL
24402183	–	100-596500-11100-00000-0000-0000-000-000-000-000-000-000	10	541358	5981709	WILL
24723694	Cale Creek	100-553400-00000-00000-0000-0000-000-000-000-000-000-000	10	521645	5955176	TABR
24723695	Red Rock Creek	100-545900-00000-00000-0000-0000-000-000-000-000-000-000	10	521513	5949553	TABR

Site ID	Stream Name	Watershed Code	UTM Zone	UTM Easting	UTM Northing	Watershed Group Code
24727190	Wansa Creek	100-596500-15700-00000-0000-0000-000-000-000-000-000-000	10	556416	5962053	WILL
7622	Unn Flows Into Fraser Lake	180-374000-33800-00000-0000-0000-000-000-000-000-000-000	10	388738	5997154	FRAN

Table 3: Potential sample site details

Site ID	Stream Name	Species Upstream	# Fish Tags
12200024	–	BB;C;EB;LKC;LNC;LSU;NSC;RB;RSC	150
12202167	–	–	150
126267	Stephanie Cr.	RB	150
126290	Hay Creek	BB;BMC;BT;CAS;CC;CH;CSU;DV;LDC;LKC;LSU;MW;NSC;PCC;RB;RSC;SP;SU;WSU	150
126316	Wansa Creek	CBC;CH;CT;DV;RB;RSC;SP;SU;WF	150
196051	Unnamed	–	150
196072	Cale Creek	CSU;EB;LNC;LSU;MW;NSC;PCC;RB;RSC	150
196085	Tabor Creek	BB;C;CSU;DV;EB;LKC;LSU;MW;NSC;PCC;RB;RSC;SB;SP;SU	150
196151	Cale Creek	CSU;EB;LSU;MW;NSC;PCC;RB;RSC	150
196201	Haggith Creek	–	150
196207	Hudson Bay Slough	LKC;RB	150
196264	Parkridge Creek	RB;SP	150
196328	Archer Creek	BT;RB	150
196340	Slough Creek	BB;CCG;LKC;RB;SP;WSU	150
19702777	–	–	150
19703257	Tabor Creek	BB;C;CSU;DV;EB;LKC;LSU;MW;NSC;PCC;RB;RSC;SB;SP;SU	150
19703286	Bittner Creek	CCG;CSU;LSU;RB;RSC;SU	150
19703295	–	–	150
19703303	Bertschi Creek	–	150
19703358	Trapping Creek	RB	150
199171	Tributary To Fraser Lake	–	150
199172	Scotch Creek	–	150
199173	Tributary To Nechako	SP	150

Site ID	Stream Name	Species Upstream	# Fish Tags
199237	Snowshoe Creek	EB;LKC;RB;RSC;ST	150
199260	Tributary To Sugarbowl Creek	–	150
199267	Driscoll Creek	CCG;RB	150
199278	Teepee Creek	SA	150
24400646	Rucheon Creek	RB	150
24401504	Tsadestsa Creek	–	150
24401692	–	–	150
24402183	–	–	150
24723694	Cale Creek	CSU;EB;LNC;LSU;MW;NSC;PCC;RB;RSC	150
24723695	Red Rock Creek	RSC	150
24727190	Wansa Creek	CBC;CH;CT;DV;RB;RSC;SP;SU;WF	150
7622	Unn Flows Into Fraser Lake	–	150

Table 4: Fish species recorded in the Fisheries Information Summary System within the freshwater atlas watershed group areas where the potential sample sites are located.

Scientific Name	Species Name	BC List	COSEWIC	Francois Lake	Lower Chilako	Lower Salmon	Morkill	Nechako	Tabor	Upper Fraser	Willow
Acipenser transmontanus	White Sturgeon	No Status	E/T (Nov 2012)	Yes	Yes	–	Yes	Yes	Yes	–	–
Carassius auratus	Goldfish	Exotic	–	–	Yes	–	–	–	–	–	–
Catostomus catostomus	Longnose Sucker	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Catostomus columbianus	Bridgelip Sucker	Yellow	–	Yes	–	Yes	–	Yes	Yes	–	–
Catostomus commersonii	White Sucker	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
Catostomus macrocheilus	Largescale Sucker	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
Catostomus platyrhynchus	Northern Mountain Sucker	Blue	SC (Nov 2010)	–	Yes	–	–	–	–	–	–

Scientific Name	Species Name	BC List	COSEWIC	Francois Lake	Lower Chilako	Lower Salmon	Morkill	Nechako	Tabor	Upper Fraser	Willow
Chrosomus neogaeus	Finescale Dace	Yellow	–	Yes	–	–	–	–	–	–	–
Coregonus clupeaformis	Lake Whitefish	Yellow	–	Yes	Yes	Yes	–	Yes	–	–	Yes
Cottus asper	Prickly Sculpin	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
Cottus cognatus	Slimy Sculpin	Yellow	–	Yes	Yes	–	Yes	Yes	Yes	Yes	Yes
Cottus ricei	Spoonhead Sculpin	Yellow	NAR (May 1989)	Yes	–	–	–	–	–	Yes	–
Couesius plumbeus	Lake Chub	Yellow	DD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cyprinus carpio	Carp	Exotic	–	Yes	–	–	–	–	–	–	–
Hybognathus hankinsoni	Brassy Minnow	No Status	–	Yes	Yes	Yes	–	Yes	Yes	–	Yes
Lota lota	Burbot	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Micropterus salmoides	Largemouth Bass	Exotic	–	–	–	–	–	Yes	–	–	–
Mylocheilus caurinus	Peamouth Chub	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
Oncorhynchus clarkii	Cutthroat Trout	No Status	–	Yes	–	–	–	–	–	–	Yes
Oncorhynchus gorbuscha	Pink Salmon	Yellow	–	–	Yes	Yes	–	–	–	–	Yes
Oncorhynchus kisutch	Coho Salmon	Yellow	–	Yes	Yes	–	–	Yes	–	–	Yes
Oncorhynchus mykiss	Rainbow Trout	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Oncorhynchus mykiss	Steelhead	Yellow	–	–	–	–	Yes	–	–	–	–
Oncorhynchus nerka	Kokanee	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Oncorhynchus nerka	Sockeye Salmon	Yellow	–	Yes	Yes	–	Yes	Yes	–	Yes	–

Scientific Name	Species Name	BC List	COSEWIC	Francois Lake	Lower Chilako	Lower Salmon	Morkill	Nechako	Tabor	Upper Fraser	Willow
Oncorhynchus tshawytscha	Chinook Salmon	Yellow	E/T/SC (Dec 2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prosopium coulterii	Pygmy Whitefish	Yellow	NAR (Nov 2016)	–	Yes	–	–	Yes	Yes	Yes	Yes
Prosopium cylindraceum	Round Whitefish	Yellow	–	–	–	–	Yes	–	–	–	–
Prosopium williamsoni	Mountain Whitefish	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ptychocheilus oregonensis	Northern Pikeminnow	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
Rhinichthys cataractae	Longnose Dace	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Rhinichthys falcatus	Leopard Dace	Yellow	NAR (May 1990)	Yes	Yes	Yes	–	Yes	Yes	–	Yes
Richardsonius balteatus	Redside Shiner	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
Salvelinus confluentus	Anadromous Bull Trout	Blue	SC (Nov 2012)	–	–	–	–	Yes	–	–	–
Salvelinus confluentus	Bull Trout	Blue	SC (Nov 2012)	Yes	Yes	–	Yes	Yes	Yes	Yes	Yes
Salvelinus fontinalis	Brook Trout	Exotic	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Salvelinus malma	Dolly Varden	Yellow	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Salvelinus namaycush	Lake Trout	Yellow	–	Yes	Yes	–	Yes	Yes	Yes	Yes	Yes
–	All Salmon	–	–	–	Yes	–	–	–	–	–	–
–	Arctic Char	–	–	–	–	–	–	–	–	–	Yes
–	Char, General	–	–	–	–	–	–	–	–	Yes	–
–	Chub (General)	–	–	Yes	Yes	Yes	–	Yes	–	–	Yes
–	Dace (General)	–	–	Yes	Yes	Yes	–	Yes	Yes	–	–

Scientific Name	Species Name	BC List	COSEWIC	Francois Lake	Lower Chilako	Lower Salmon	Morkill	Nechako	Tabor	Upper Fraser	Willow
–	Lamprey (General)	–	–	–	–	Yes	–	–	–	–	–
–	Minnow (General)	–	–	Yes	Yes	Yes	Yes	Yes	Yes	–	Yes
–	Northern Pearl Dace	–	–	Yes	–	–	–	–	–	–	–
–	Salmon (General)	–	–	–	Yes	–	Yes	–	–	Yes	Yes
–	Sculpin (General)	–	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
–	Stickleback (General)	–	–	–	–	–	–	–	Yes	–	–
–	Sucker (General)	–	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
–	Whitefish (General)	–	–	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

References

Fernandes, I. M., Y. F. Bastos, D. S. Barreto, L. S. Lourenço, and J. M. Penha. 2017. “The Efficacy of Clove Oil as an Anaesthetic and in Euthanasia Procedure for Small-Sized Tropical Fishes.”*Brazilian Journal of Biology = Revista Brasleira De Biologia* 77 (3): 444–50. https://doi.org/10.1590/1519-6984.15015.