FRASER, PORT MANN BRIDGE-DOUGLAS ISLAND EULACHON STUDY, 2008-2009

INTERIM REPORT

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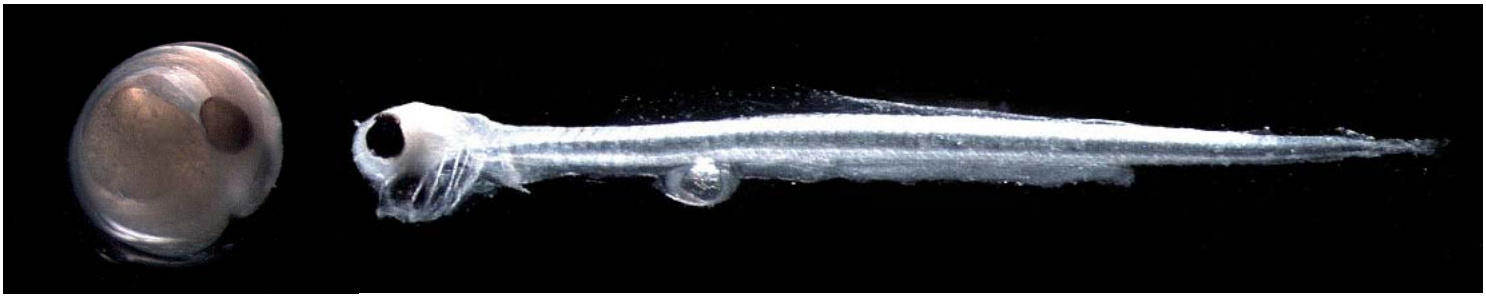

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1. British Columbia Eulachon Background

Within British Columbia, 33 rivers are documented to have spawning eulachon populations of which 15 are consistently used while others seem to be used for spawning only in years of large eulachon abundance. All rivers experience high glacial or snow pack run-off in spring following the eulachon larvae outmigration. The main British Coumbia eulachon producers are Nass, Fraser, Skeena and Klinaklini rivers. While the large-scale traditional First Nations harvest of eulachon for oil or smoking has disappeared in many areas, it is still common practice in the lower Nass River.

Eulachon enter the lower reaches of their natal river from late February to April. A single female lays about 30,000 adhesive eggs in sand and pebble areas, and the small larvae hatch dependent on ambient water temperature (usually between 3 and10 °C) in three to five weeks. Hatched larvae display a short freshwater residence time and are readily flushed out to estuarine or marine areas. Following a three-year stay in the ocean, eulachon return to their natal streams to spawn at lengths of 15 to 20 cm and weights of 40-60 grams. While the details of the eulachon's ocean migration route are largely unknown, they are regularly captured by groundfish and shrimp trawlers and in DFO shrimp surveys in offshore areas around Dixon Entrance, Hecate Strait, Queen Charlotte Sound, and the West Coast of Vancouver Island at depths of 80 to 200 m. Fraser River eulachon spawn mainly from March to May and have been captured on the southern West Coast of Vancouver Island mixing with Columbia River eulachon stocks (all eulachon life cycle information from: Hay & McCarter 2000; DFO 2008) .

2. Fraser River Eulachon Stock Status

The abundance of the Fraser River eulachon populations is currently being assessed by three methods (DFO 2007). These include 1) the assessment of egg and larval density (

Figure), 2) catches from a test fishery that was discontinued in 2005 (Figure , left panel), and 3) the assessment of commercial catches in the Columbia and Fraser Rivers (Figure , right panel). All three assessment methods paint the same picture; the Fraser River eulachon population has declined severely since 2004 (

Figure and Figure). A similar but less severe abundance decline was also observed in 1997, followed by a quick recovery until 2002. Long-term trends for the population are impossible to assess since even the farthest reaching data series starts in 1973. Anecdotally, it is known that the Fraser River eulachon were harvested in large numbers by First Nations along the river and that typical eulachon predators such as glaucous and Bonaparte sea gulls, bald eagles and California sea lions used to migrate into the river in large numbers following the spawning migration. Recently, the increase in number of eulachon predators is hardly detectable when the fish are spawning (Glen Joe, Kwikwetlem Fisheries Manager, pers. comm.).

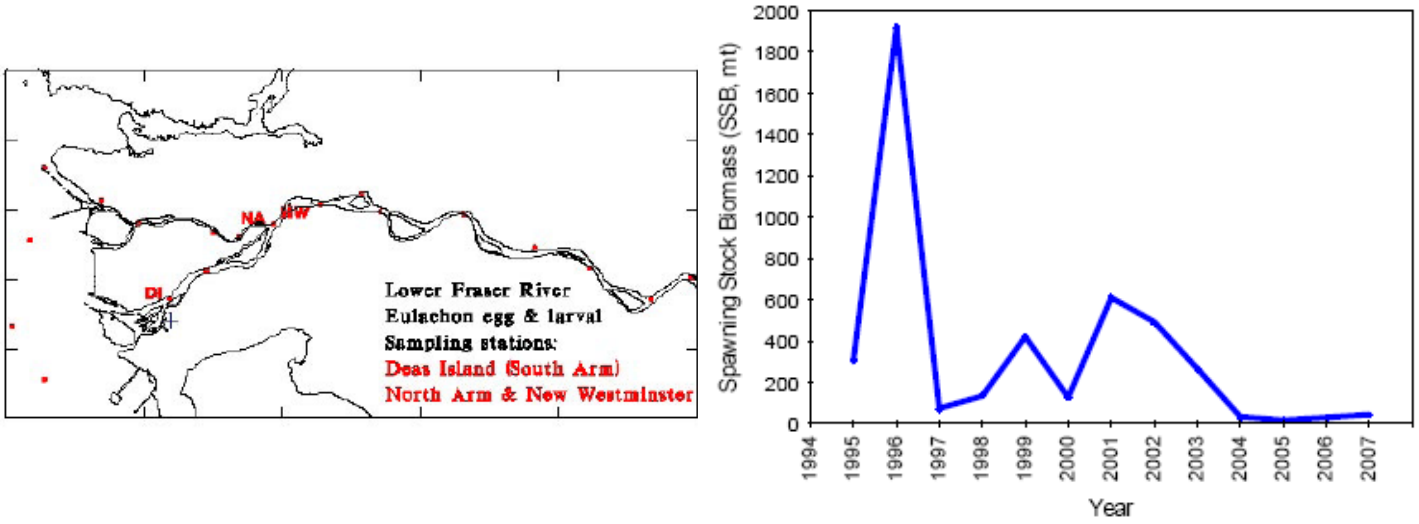

Figure : Fraser eulachon spawning stock biomass from 1995 to 2007 (right panel) estimated by egg and larval survey at Fraser sampling locations shown in left panel (from: DFO 2007)

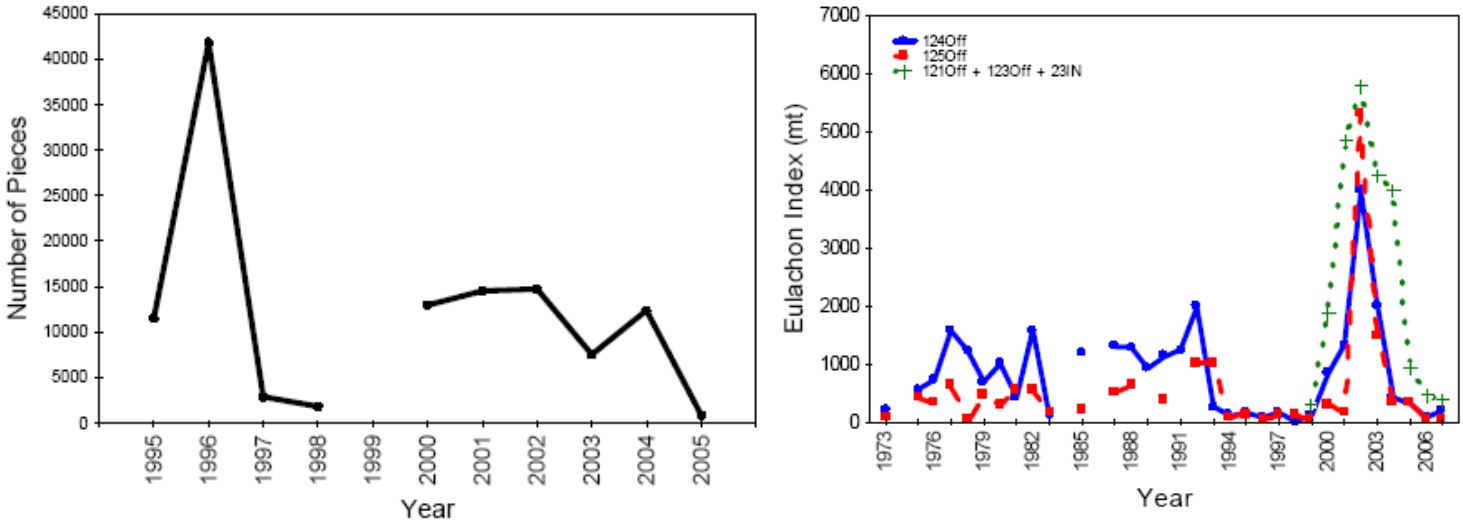

Figure : Left Panel: Catches from Fraser River eulachon test fishery (1995-2005); Right Panel: Commercial eulachon catches from the Columbia and Fraser rivers (1973-2007) (both from: DFO 2007)

3. Potential Areas of Concern for Fraser River Eulachon and their Habitat

In 2007, DFO conducted an eulachon workshop to bring together experts in the field and determine research priorities to address the sharp decline in Fraser River eulachon and other stocks (Pickard & Marmorek 2007). As a result of the workshop the following potential main impacts and research priorities for Fraser River eulachon stocks were identified:

Potential Impacts:

- Impact 1: Shoreline construction that reduces the quantity and quality of eulachon spawning habitat;

- Impact 2: Dredging activities that degrade eulachon spawning habitat and increase water velocity resulting in eulachon spawners not migrating upstream as far as they did historically (to the Mission area) and more rapid wash-out of larvae;

- Impact 3: Changes in ocean conditions that indirectly impact juvenile and adult eulachon survival through reduced food availability and increased predation;

Research Priorities:

- Priority 1: Use egg and larval surveys to monitor eulachon abundance over time;

- Priority 2: Monitor predator distribution and abundance, and temperature and food availability;

- Priority 3: Define, map and protect critical freshwater and estuarine eulachon habitat for spawning and rearing

4. Study Design to Monitor Potential Impacts in the Pre, During, and Post-Construction periods of the 10-Lane Port Mann Bridge

The construction of the latest concept of a new 10-lane Port Mann Bridge represents a major addition to shoreline and in-river construction on the lower Fraser River and has the potential to significantly impact the quantity and quality of eulachon spawning habitat within the vicinity of the new bridge footprint (as pointed out in the eulachon workshop, Pickard & Mamorek 2007). Important eulachon spawning habitat has been identified by members of the Kwikwetlem First Nations on the west end of the Port Mann Bridge near Douglas Island (Figure) and the shores of Tree Island (Figure). In line with the most important eulachon research priorities described in the 2007 eulachon workshop (Pickard & Mamorek 2007), and specific to the Port Mann Bridge construction site and claimed Kwikwetlem territories, we completed the following of a larger planned eulachon study:

1. A desk top background study on eulachon in BC and specifically in the Fraser watershed.
2. A sub-bottom profiling and sonar survey of the river bottom with ground truthing using sampling equipment to identify water depth, river substrate morphology and type (Shipek Grab Sampler), substrate stability (seismic profiling boomer) as well as water depth and current speed in the Douglas and Tree Islands vicinity.

This initial draft report summarizes our findings to-date. In the spring of 2009, during the Fraser River eulachon spawning migration we are preparing to conduct further field studies that will link the information gathered so far to the preferred eulachon spawning habitat. Kwikwetlem First Nations members will inform us about the start of the eulachon spawning migration by daily visual observations of the Fraser River and the anticipated increase of predators such as Bonaparte gulls and sea lions. Eulachon in the Fraser River generally start to enter the river during the last week of March and spawn throughout April and into May (DFO, New Westminster Test Fishery 1995-2005).

During nine days of field work we will concentrate on locating spawning eulachon through side scanning sonar surveys and net catches to verify our sonar observations. The biological and physical characteristics of the spawning habitat will be described in the greatest detail possible. As the result, we are expecting to locate, describe and map all eulachon spawning areas in the vicinity of the Port Mann Bridge and summarize our results visually on a map.

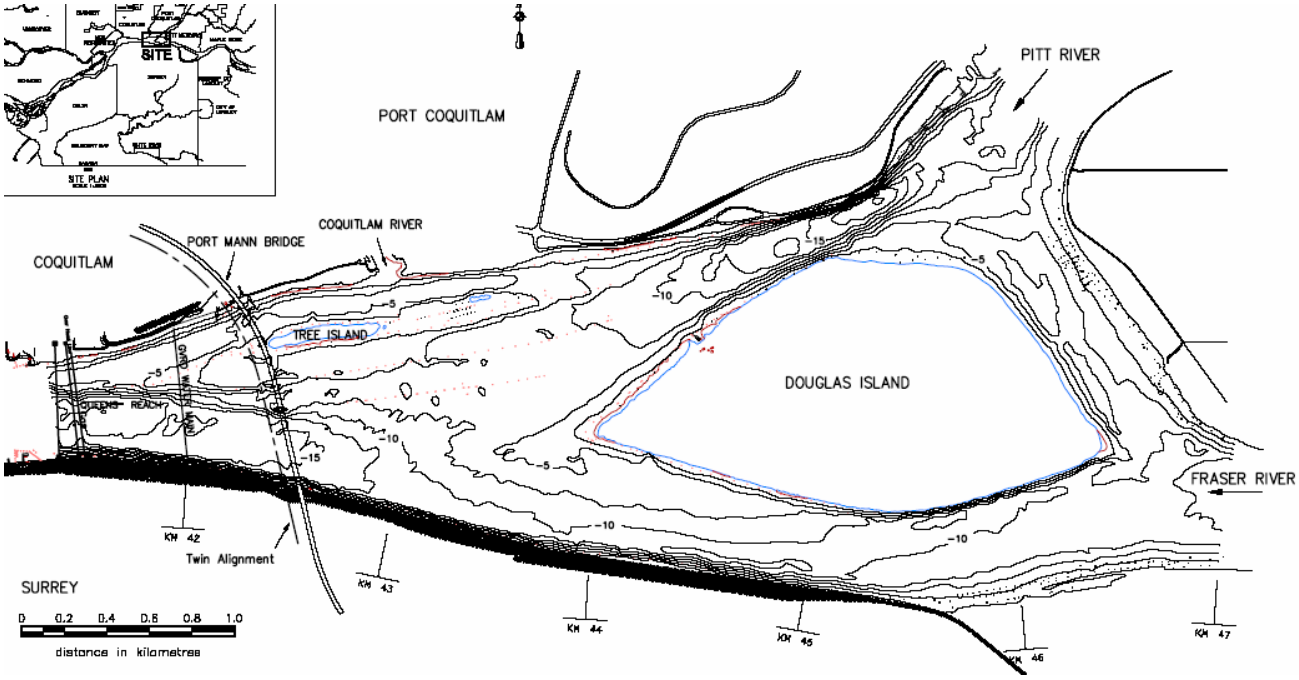

Figure : Map of Port Mann Bridge construction site in relation to Douglas Island and the Fraser River (from: northwest hydraulic consultants 2004)

5. Results from 2008 Sub-Bottom Profiling, Bathymetric Studies and Substrate Sampling

5.1. Seismic Profiling and Bathymetric Data Collection Results

All sub-bottom profiling through a seismic profiling boomer was carried out by Terra Remote Sensing Incorporated between October 14th and October 17th, 2008. Generally, the field work was carried out from a 26 foot research vessel (Figure) and data was recorded in hard copy on paper role (Figure) and in digital format. Seismic profiling transects were chosen to represent all river morphology types found in the area. Additional transects were chosen in areas of former eulachon spawning around Tree Island and the western end of Douglas Island (Figure).

Figure : Terra Remote Sensing Inc. research vessel that is used as the operating platform for seismic profiling docked on the left photograph and operating the boomer system (center bottom of picture) on the right photograph.

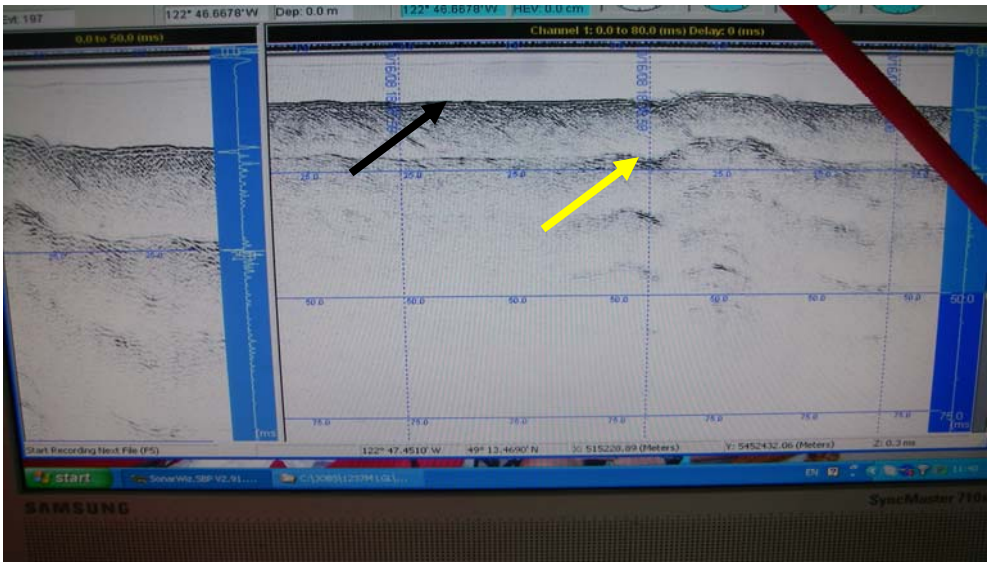

Figure : Typical printout and hardcopy back–up from seismic sub-bottom profiling showing river bottom (black arrow) and the first layer of substrate with different physical features (yellow arrow). The soft layer

between the black and yellow arrow is likely unstable and will change in thickness with different scouring and deposition rates during lower and higher or freshet flows.

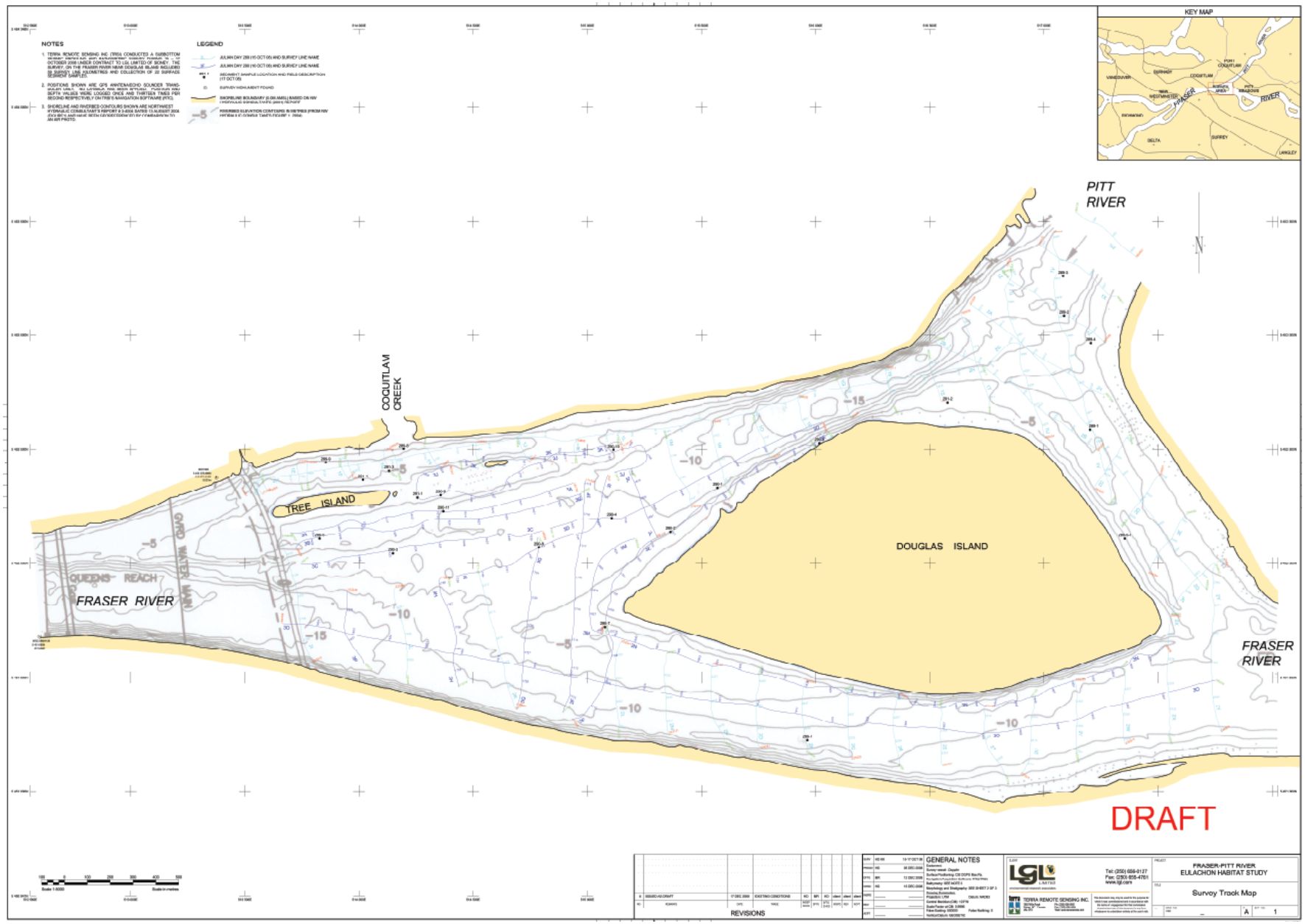

Figure : Map tracking all of the seismic profiling transects carried out between October 14th and October 17th, 2008 (a more detailed map in PDF format has been submitted along with this map and a hard copy has also been printed and submitted for more detail)

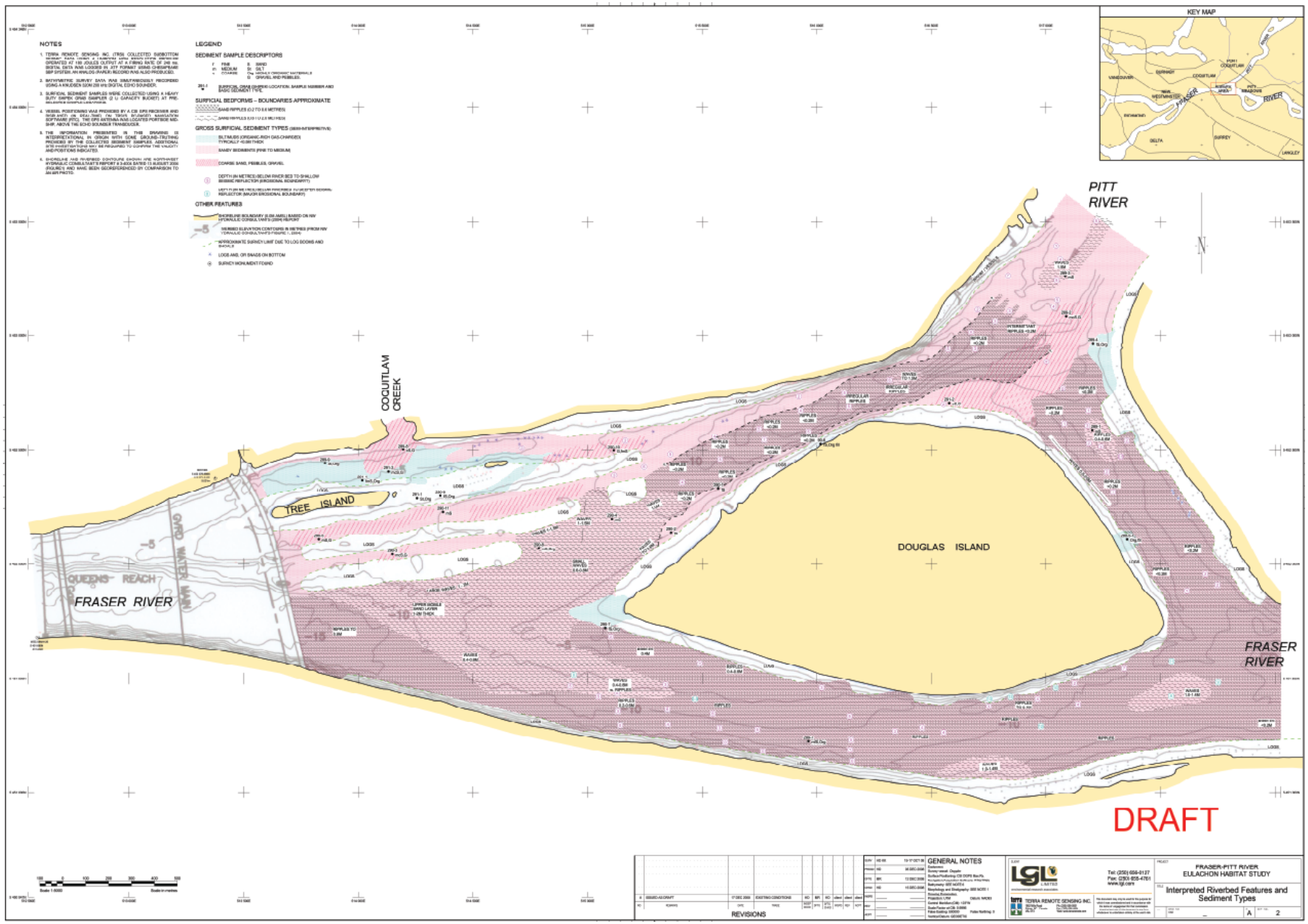

Figure : Map of interpreted morphological and sub-bottom river bed features and sediments. Coarse sand and pebbles and sandy sediments, the most likely eulachon spawning substrates in combination with low current speeds (no sand ripples) were mainly found on the south and the east side of Tree Island, the north and the north-east side of Douglas Island, the initial 300m of the Pitt River and on the Kwikwetlem Shore of the Fraser River north of Douglas Island (a more detailed map in PDF format has been submitted along with this map and a hard copy has also been printed and submitted for more detail).

All of the suitable eulachon habitat determined by sub-bottom profiling and the detection of substrate surface features is overlapping with traditionally known areas of eulachon spawning (Glen Joe, Kwikwetlem Fisheries Manager, personnel communication). The areas south and south-east of Tree Island, north and north-east of Douglas Island, the intial 300m of the Pitt River and the Fraser River shore along the Kwikwetlem lands north of Douglas Island feature medium and coarse sands and occasionally pebbles and slow currents speeds. A part of the traditionally known eulachon spawning areas in the shallow water directly around Tree and Douglas Islands is now covered by log booms and could thus not be investigated. Most bottom samples taken from location close to log booms featured organic-rich gas charged silts and mud. In later studies it should be investigated whether the organic debris and their gas producing deterioration processes from log booming affect eulachon spawning habitat in the lower Fraser River.

5.2 Substrate Sampling

To verify the interpreted seismic profiling assumptions shown in Figure , we sampled substrate with a Shipek Grab Sampler (Figure) lowered to the bottom and triggered to close on impact (a more detailed description of the methodology will be provided in a later version of this report).

The river bottom north of Tree Island extending into the mouth of the Coquitlam River is covered with a relatively stable layer of substrate composed of coarse sand and small rounded pebbles, ideal eulachon spawning substrate (Figure). In contrast, the river bottom in between the log booms east of Tree Island is covered with fine sand interlaced with mud clasts and releases organic-rich gases. This kind of substrate is unlikely to support eulachon spawning and may due to the release of Sulphur Dioxide as a bacterial waste product of organic breakdown be toxic for eulachon eggs (Figure).

Figure : Shipek Grab sampler

Eulachon spawning friendly substrate types were also found south of Tree Island (Figure) and north of Douglas Island in the mouth of the Pitt River (Figure).

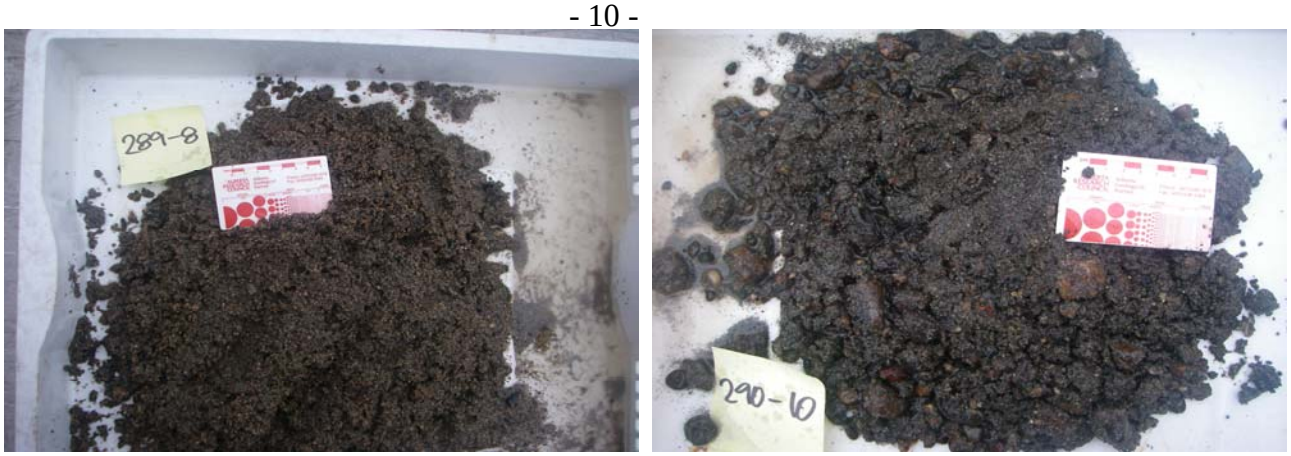

Figure : Coarse sand and pebble sediments sampled from the area north of Tree Island and in the mouth of the Coquitlam River. These sediments are considered to be suitable for eulachon spawning.

Figure : Fine sand with mud clasts and releasing organic-rich gas sampled from the area east of Tree Island between log booms. This sediment type is considered too fine for eulachon spawning and will due to the release of organic-rich and likely egg toxic gases represent an environment that is unsuitable for eulachon egg deposition.

Figure : Medium and coarse sand interlaced with small 0.5cm to 1cm rounded gravel sampled in the area south of Tree Island. These sediments are considered to be suitable for eulachon spawning.

Figure : Coarse sand with rounded pebbles and 100% medium to coarse sand sampled from the area north of Douglas Island in the mouth of the Pitt River. These sediments are considered to be suitable for eulachon spawning.

Table shows the detailed bottom sampling results from all sampling locations in the vicinity of the Port Mann bridge and Douglas Island.

Table : Bottom sampling data sheet for the Fraser River in the vicinity of Douglas Island and directly adjacent to the Port Mann Bridge

SAMPLE #	TIME	NORTHING	EASTING	DEPTH (M)	CURRENT (m/s)	PICTURE	SUBSTRATE COMPOSITION & OTHER COMMENTS
289-9-1	161650	5452441	513862	3	0.513	no	Silt & mud
289-9-2	162204	5452460	513845	1.8	0.513	yes	Silt & mud and organics, trace clay (bubbles on impact). Second attempt.
291-4	194157	5452364	513947	6.3	0.1539	no	Mainly fine-medium sand with trace organics
290-5	172537	5452140	513813	5.9	0.2565	yes	70% medium sand, 30% gravel (1-2cm rounded)
290-3	174807	5452056	514146	5	0.2565	yes	90% medium-coarse sand, 10% gravel (0.5cm rounded)
290-11	171030	5452224	514347	7.5	0.2565	yes	100% medium sand
290-9	173251	5452293	514289	2	0.2565	yes	100% fine sand with mud clasts (bubbles on impact, organics) ,east end of Tree Is.
291-1	173957	5452294	514232	1.2	0	no	Organic sludge, no silt, second attempt, East end of Tree Is.
290-8	175406	5452059	514793	5.9	0.2565	yes	Mainly medium sand with trace organics
291-3	193753	5452397	514159	6.2	0.1539	yes	Mainly medium-coarse sand with a few pebbles (0.2-0.5cm rounded), trace of organics
289-8	162926	5452512	514182	2.9	0.1539	yes	Mouth of Coquitlam River, 80% coarse sand, 10% pebbles (1-3cm rounded), 10% organics, 1 lamprey ammocoetes larvae (11cm)
290-10	163827	5452522	515075	6.4	0.2565	yes	Also close to mouth of Coquitlam River, 40% gravel, (1-4cm rounded), 60% fine sand, gravel overlaying sand
290-4	170104	5452180	515078	7.3	0.7695	yes	100% medium sand
290-2	165455	5452181	515343	8	1.026	yes	100% fine compact sand
290-1	192131	5452309	515580	6	0.2565	yes	100% fine sand
290-6	191357	5452525	515987	3	0.2565	yes	100% muddy silk with mud clasts, 1 ammocoetes lamprey (7cm)
291-2	190350	5452693	516633	4.8	0.4104	yes	90% coarse sand, 10% pebbles (0.5-3cm rounded)
289-3	185434	5453256	517058	12.1	0.2565	yes	100% medium sand
289-2	184923	5452997	517104	7.8	0.7695	yes	Mainly medium-coarse sand with a few pebbles (0.5cm rounded)
289-4	184210	5452939	517257	3.4	0.513	yes	Mainly fine sand with trace organics
289-1	183523	5452538	517232	9.1	0.7695	no	100% medium sand
289-5-1	182541	5452108	517324	2.3	0	yes	50% mud and 50% organics (closer to shoreline). Second attempt.
289-7	180918	5451265	515962	11.5	0.2565	no	Mainly medium-fine sand with trace organics
290-7	175955	5451739	515097	3.8	0.2565	yes	Mainly fine sand with trace organics

6. Literature Cited

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