Lower Fraser Gravel Reach Assessment of Past and Proposed Gravel Bar Mining Locations — December 17, 2010 Site Visit

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Preamble

This document is provided to the *Cohen Commission on the Decline of the Fraser River Sockeye Salmon* as a summary of observations that took place on December 17, 2010 relating to the large-scale destruction of Fraser River habitat via gravel removal and a FRGSC field observation trip of the impacts of this effort. This material is based on the Otto Langer report of the same trip and largely directly abstracts material, both written (in some cases word for word) and figures (*Langer, O.E. 2011. Inspection of Gravel Bars in the Lower Fraser Gravel Reach and Commentary on Recent Past Mining Impacts - December 17, 2010 Fraser River Gravel Stewardship Committee (FRGSC)*). Otto Langer gave me permission to utilize his material as such. Regardless, the opinions and many observations in this report are mine. Again, the format and much of the content of this report is from Langer, but I take full responsibility for any statements or observations therein.

Background

The gravel reach of the Fraser River has been extensively mined over the last decade and particularly since 2004. As a result, large-scale habitat destruction of one of the most bio-diverse aquatic ecosystems in British Columbia has taken place without any measurable mitigation or compensation.

In response to these past gravel bar mining operations undertaken in the Chilliwack gravel reach of the Lower Fraser River since 2004 (e.g. Hamilton, Gill and Spring Bars), and the mining application submitted by Emergency Management BC for 2011 Tranmer Bar, the FRGSC arranged for an inspection of several gravel mining sites/gravel bars in that section of the river on Dec 17. Bob's Adventures Unlimited (owner and pilot - Bob St. Germaine) made an air boat available for the inspection and this included Frank Kwak, Marvin Rosenau and Otto Langer. DFO was invited to be part of the inspection but their representative could not make the trip.

The trip's goal was to conduct a visual inspection of several mining sites and do selective beach seining at sites of concern relating to the protection of fish habitat. The inspection trip began at 09:00h at the Island 22 boat launch and proceeded upstream through the river's islands and gravel bars for a distance of 30km up to Spring Bar.

The key finding relating to the *Cohen Commission on the Decline of the Fraser River Sockeye Salmon* was that this species uses these gravel reach habitats significantly more than Fisheries

and Oceans Canada (DFO) has hitherto recognized, and the failure is due to a lack of appropriate sampling effort. This phenomenon is particularly poignant in regards to the observations by the BCIT FWR studies over the last three years assessing sockeye juvenile rearing within the gravel reach (Morrison et al. 2011). Most importantly, from a 2011 perspective, the Tranmer Bar site (slated for large-scale gravel removal) is one of the locations that consistently have rearing juvenile sockeye salmon, probably because of its particular groundwater features.

Finally, while the focus of the trip was towards fish and fish habitat, other observations in respect to this exceptional aquatic ecosystem were also made. The initial 20km of the river included significant observations of bald eagles, waterfowl and blue herons. Hundreds of ducks— especially fish eating ducks (e.g., common mergansers)—were evident. The Gill Bar area (the site of large-scale gravel mining, including 2010) was covered with a large flock of swans and many eagles and blue herons. Most of this bird life could be seen to be resting or foraging on or adjacent to most of the gravel bars from Island 22 to Tranmer Bar.

For the fish sampling, the specimens were caught using a 30m and a small pole seine. All fish were returned to the river alive, except for the juvenile sockeye salmon samples. Considering the small size of many of the fish, positive identifications to the species level, and occasionally at the family level, of very young fish were not possible for the cyprinids/catostomids. Given the large catches of juvenile suckers/minnows (catostomids/cyprinids), they were not fully enumerated or fork lengths taken, but rough estimates were made of numbers and sub-samples measured. All salmonids were identified, counted and measured for length.

In respect to the survey, this report provides comments on the various-assessed areas of the river from Island 22 launch in an upstream direction to Spring Bar. Appendix 1 provides a map of all of the sites examined.

Peg Leg Bar

Peg Leg Bar (Fig. 1), also referred to as Webster Bar, and which is located just upstream of Harrison Bar, was visually observed in an upstream direction. The morphology of Peg Leg Bar at its upper end (low in elevation, not reaching far out into the main channel) indicates that it has still not recovered its historical sediment volume after it was mined in 1995. Despite intensive surveys monitoring whether or not it recovered throughout the 1990's and early 2000's, there is no indication that the agencies are continuing this important assessment work. Large amounts of habitat were lost as a function of this gravel mining.

Figure 1. Peg Leg Bar showing location of large-scale losses of gravel and fish habitat resulting from the 1995 gravel-removal.

Gill Bar

Heading in an upstream direction, Gill Bar was the feature that we next observed. Large-scale changes to the topography of the Fraser River in this sub-reach have now occurred subsequent to the extensive mining that has occurred over the last several years. There is now a semi-isolated 4km Gill Oxbow on the upstream side of Gill Bar (Photos 1a to 1c). What was an area of a significant channel and flow a few years ago is now, more or less, a still water lagoon characterized by significant fine-sediment deposits in the bottom gravels (Photo 1b). This site now only flows at medium and medium-high Fraser River discharges in that vertical erosion of sediments at the upstream junction of Gill Bar directed flows in a more southerly direction. This isolation of the large oxbow is probably due to recent gravel mining in the river (i.e., the south-channel avulsion, likely exacerbated by the extensive gravel mining in this channel, ended up creating a fast flowing mid-river main channel to the south). If so, the changes to the habitat capacity relating to gravel mining, at Gill Bar, have been massive.

Figure 1a. Channel/lagoon at upstream end of Gill Oxbow. This recently-active channel is now a still-water area at medium to low-winter flows and large amounts of fine sediments can be found in the gravels.

Figure 1b. Looking upstream to extensive sand and silt sediment deposits in the newly created Gill Oxbow. Such habitats are probably not extensively used as salmonid over-wintering habitat, but need more inventory and assessment to confirm.

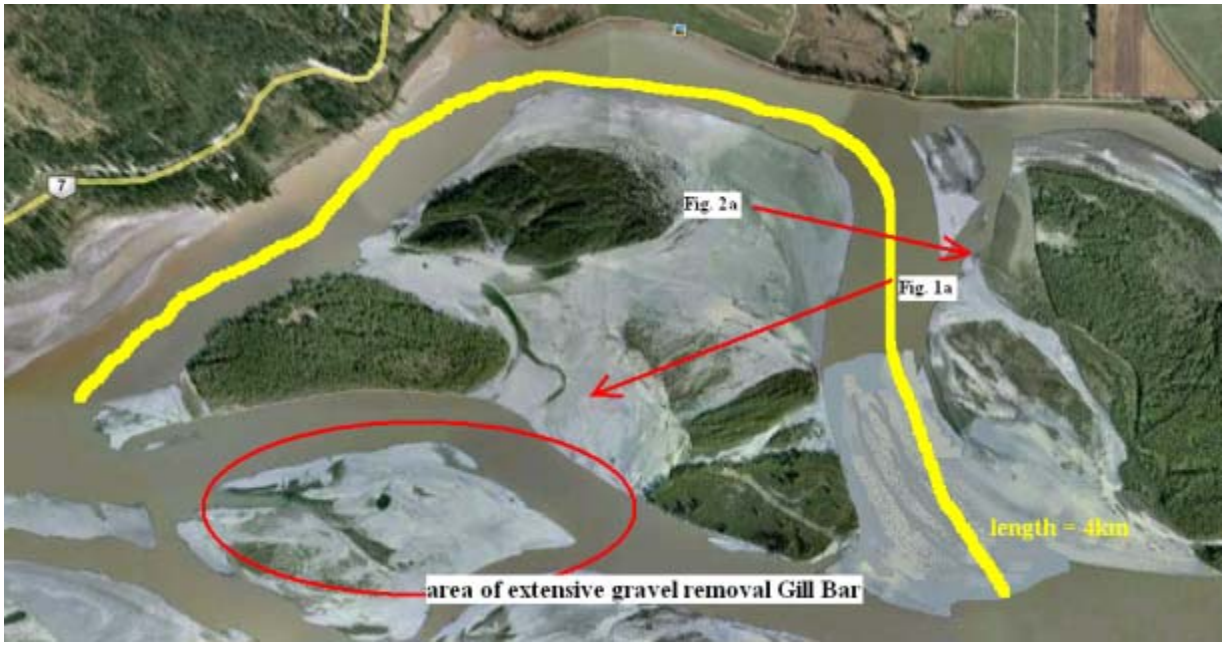

Figure 1c. This aerial photo shows the new Gill Oxbow area. Figures 1a and 1b taken in the northern part of that newly created low flow lagoon or backwater. The yellow line indicates the extent of the isolation due to the avulsion at the junction of the two channels.

Hamilton Bar

We then inspected the Hamilton Bar site which was located upstream to the Gill Bar site. This location was mined in early 2010 and it was obvious that little naturalized bar recovery (sediment recruitment) had taken place. Although the 2010 freshet occurred after mining, there was very little (if any) new gravel mobilized in to the mined site.

Also problematic was the design of the mining in 2010 has resulted in a shallow water entrapment area for fish (Figure 2).

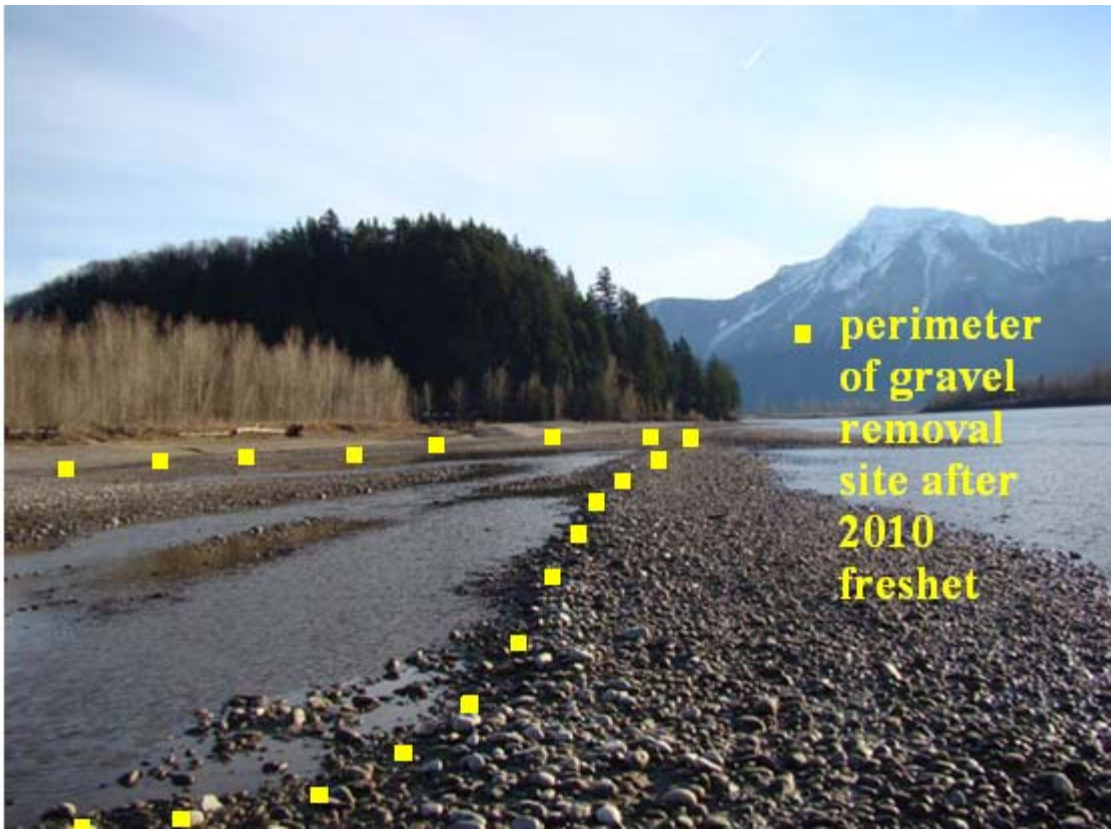

Figure 2. Hamilton Bar looking upstream. Note the lack of natural bar deposits and the development of a ponded area (on the left) that acted as a fish trap. The contractors failed to provide proper access to the main river so as fish can escape as the water levels subside after spring freshet.

Little Big Bar

A detailed visual inspection was then made of Little Big Bar located upstream of Hamilton Bar. In addition to visual observations, two seine sets (30m seine) were taken in the isolated lagoon created by the mining project earlier in 2010 (Fig. 3).

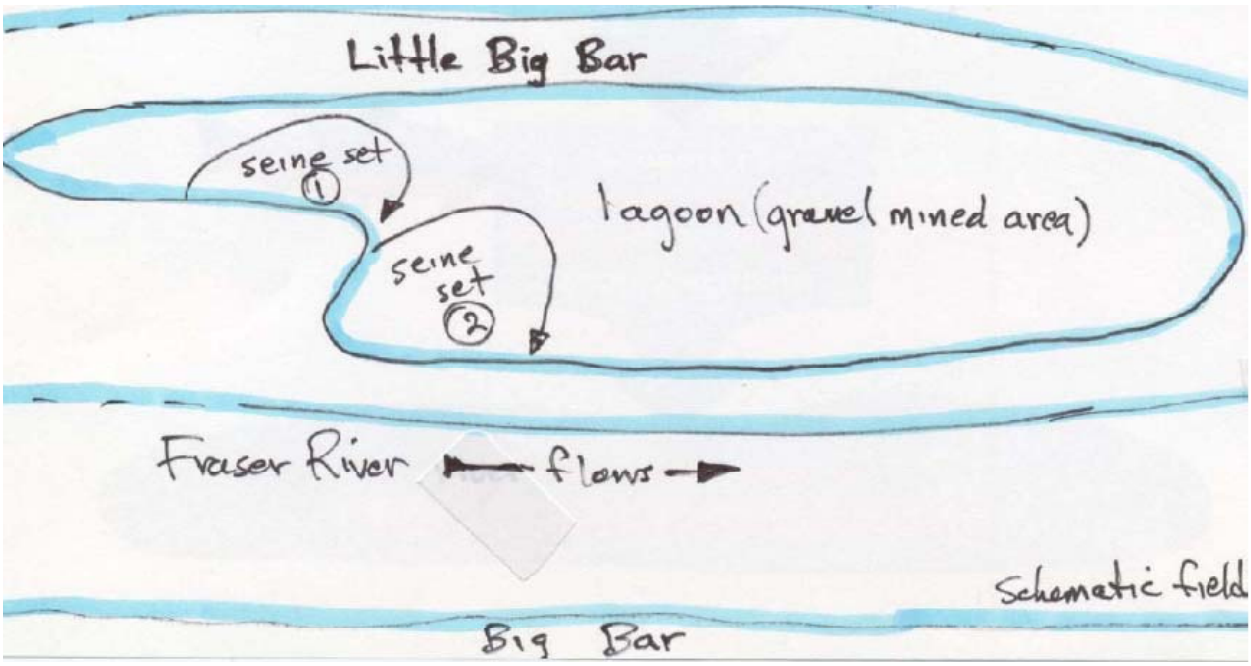

Figure 3. A field drawing of the middle part of the Little Big Bar gravel area. The lagoon was created by gravel mining in early 2010. The sites of the two 30m seine sets are shown. The direction south is towards the top of the drawing.

When this location was being mined in 2010, DFO was advised on-site, and later in writing, that this type of mining would create a "bathtub effect" (Fig. 4) and trap fish in the resulting lagoon if an egress channel, for fish passage, was not incorporated into the design. The design that was ultimately used for this mining project created a large hole in the gravel bar, but with contiguous edges, and this retained water during the spring-summer freshet season and had no way for fish to exit; with receding flows in the late summer and fall, the hole formed a fish-entrapment lagoon.

By fall/winter, the Little Big Bar lagoon was about 2ha in area and was shallow (i.e., was no deeper than 20cm). This lagoon was ideally situated to provide opportunities for avail predation of fish life had been trapped therein. The largest number of blue herons that we saw during our 17 December field day was noted at this site. As we approached the site, the air boat frightened off a flock of 23 great blue herons from the site area. The still water shallow lagoon afforded them a man-made opportunity to more-easily accomplish predation of the fish therein. Given the size of the lagoon, it was surprising that we did not catch more fish in our seine hauls thus giving credence to the thesis that avian predation was probably significant over the period of its existence.

Figure 4. Large shallow lagoon created by the mining of Little Big Bar in early 2010 (looking downstream). This lagoon, after the freshet, was ideal to serve as a fish trap and allow predation of those fish by birds.

The upstream end of the lagoon had minor sub-gravel flows entering the ponded area and the upstream portion had significant growths of filamentous algae growing in it. Two seine sets were made in the lagoon (Fig. 5). The depth of the water in the middle of the lagoon where the seine sites took place was about 20cm. The bottom of the lagoon was covered with a large amount of fine sediment (i.e., silt and sand). High quality salmon spawning gravel was evident outside of the lagoon area (i.e., between the lagoon and the Fraser River flow channel). However, no obvious salmon spawning redds were evident. This area contained many redds when inspected in early 2010 (i.e., from the spawning of pink and chum in the fall of 2009) but it is not clear whether they would have interfered with the construction of an egress channel. (There probably would not have been any problems constructing an exit channel based on our observations in 2006.)

This bar was also the very site of a major fish kill in the spring of 2006 due to access construction for gravel mining on an adjacent bar.

Catch Data: (air temperature was 6.5 and the lagoon water temperature was 2.5o C).

Seine Haul 1 (Depth 0-20cm / 25X50m haul).
-8 catastomids or cyprinids (lengths - 25, 28, 29, 35, 47, 47, 48, 48mm)
-1 stickleback - 55mm

Seine Haul 2. (Dept 0-20cm / 25X70m haul)
-2 suckers (38 and 43mm)

On Dec. 23, 2010 the FRGSC was notified that a backhoe was doing working on Little Big Bar and excavating material (Fig. 6). This activity was undertaken to connect the pond to the flowing channel. This activity was largely a wasted effort because was too late in the year to remediate the problem in a timely and effective manner. Most fish caught in the lagoon would long-ago have been eaten by wildlife/birds by that date. Any such work could have been undertaken by a Spider excavator much earlier in the hydrological year. This equipment is capable of working on a 100% slope or a 1:1 slope ratio and in 5 feet of water without any assistance. (It was also ironic that this effort took place only five days after the FRGSC field trip.)

Figure 5. Set number 2 of the 30m seine hauls in the large isolated lagoon on Little Big Bar (looking downstream). The lagoon was caused by gravel mining on the bar in early 2010.

Figure 6a. Excavation of a channel from the main-flowing sidestream of the Fraser River to the Little Big Bar lagoon. Photograph taken by Nick Basok on the morning of December 23, 2010. Remedial work on the bar lagoon at this time of the year would accomplish little for most fish originally trapped in the lagoon and already eaten by avian predators. Note that this channel should have been excavated at least five months earlier, and this could have been done using a Spider excavator, for example.

Figure 6b. Spider excavator.

Tranmer Bar

In that Tranmar Bar was under application for mining in 2011 (Fig. 7), we walked much of the area to be excavated. A large portion of the downstream section of the bar, flagged for excavation was very flat and clearly had been stable for some time; it was not more than 30-60cm above observed river flows. The upper end of the bar (north and west) did have a higher elevation and included considerable amount of cobble, which is prime juvenile Chinook rearing habitat. If much of the flagged area is to be mined to a depth of 100cm or more, it would be below the wetted elevation of the river as observed on December 17, 2010. This would, again, constitute an issue of creating fish entrapment lagoons and would be a concern.

The lower part of the bar is comprised of highly diverse features including exceptional-habitat back channels; these channels are watered by sub-gravel flows into three significant streams (Figs. 8, 9, 10). Most of these channel areas had a fine sediment bottom intermixed with coarser material which tended to be of gravel-sized in diameter and less.

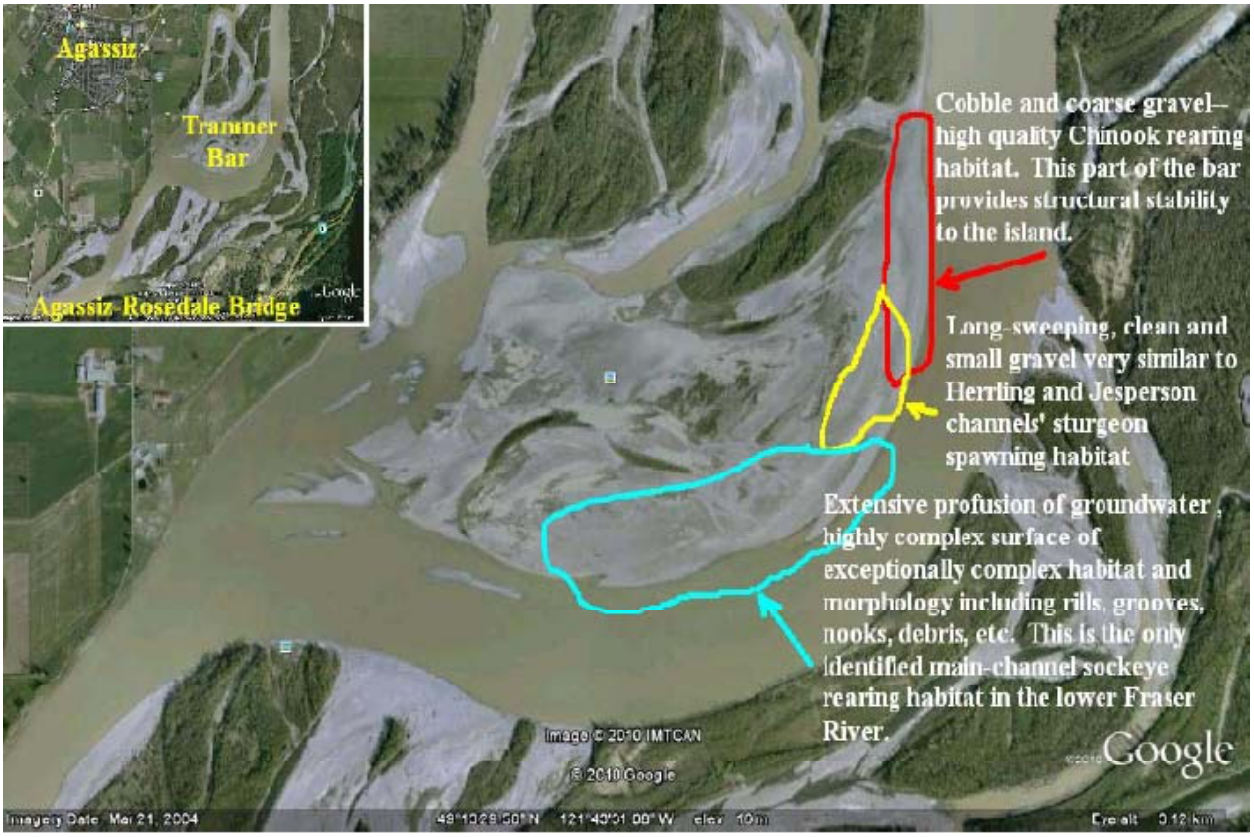

Figure 7. 2004 aerial photo of Tranmer Bar. Photo and notes on the photo are from M. Rosenau observations.

Figure 8. Downstream section of the south part of Tranmer Bar showing the very flat nature of that part of the bar. A groundwater channel can be just seen on the right edge of the photo. Photo taken looking east.

Figure 9. Looking upstream over a back channel habitat area that stretches across the flat part of Tranmar Bar into the area proposed for mining in 2011 (note survey stakes). The proposed mine area is the water supply for the very productive groundwater-fed channels where high fishery values and good whitefish and sockeye over-wintering habitat was documented on December 7, 2010. Mining would encroach into this area and disrupt the groundwater patterns.

The complex nature of the bar was also evident in a 1998 photo of Tranmar Bar that we examined onsite (Lower Fraser River Stream Inventory Atlas DFO-MELP 1999). The more

westerly part of the bar also exhibits this back-channel diversity of habitat (i.e., the area that is slated for an gravel-trucking corridor for the 2011 mining of Tranmer Bar).

To date, Tranmer Bar is the most consistent bar on the Fraser River that is frequented by river rearing sockeye (Fig. 11, 12) during the sampled fall and winter seasons (the juveniles of this species were also seen here in a similar sampling session in 2007, as well, at Spring Bar on that same trip).

Another key finding was the number of juvenile and sub-adult mountain whitefish that were caught at this location. Furthermore, in the back-water channel closest to the main river channel (southern most back channel in Fig. 13), a large number of small fish were evident. This channel had a larger proportion of gravel bottom composition and had large amounts of algal growth in it (Fig. 14—suggestive of the groundwater influence and the higher level of productivity). Due to time considerations it was determined that another seine set in this channel, although looking more productive than another of the other sites seen over the day, could not be sampled due to lack of time. In this channel, large numbers of fish could be seen freely swimming throughout the water column. This was not seen at any other habitat site.

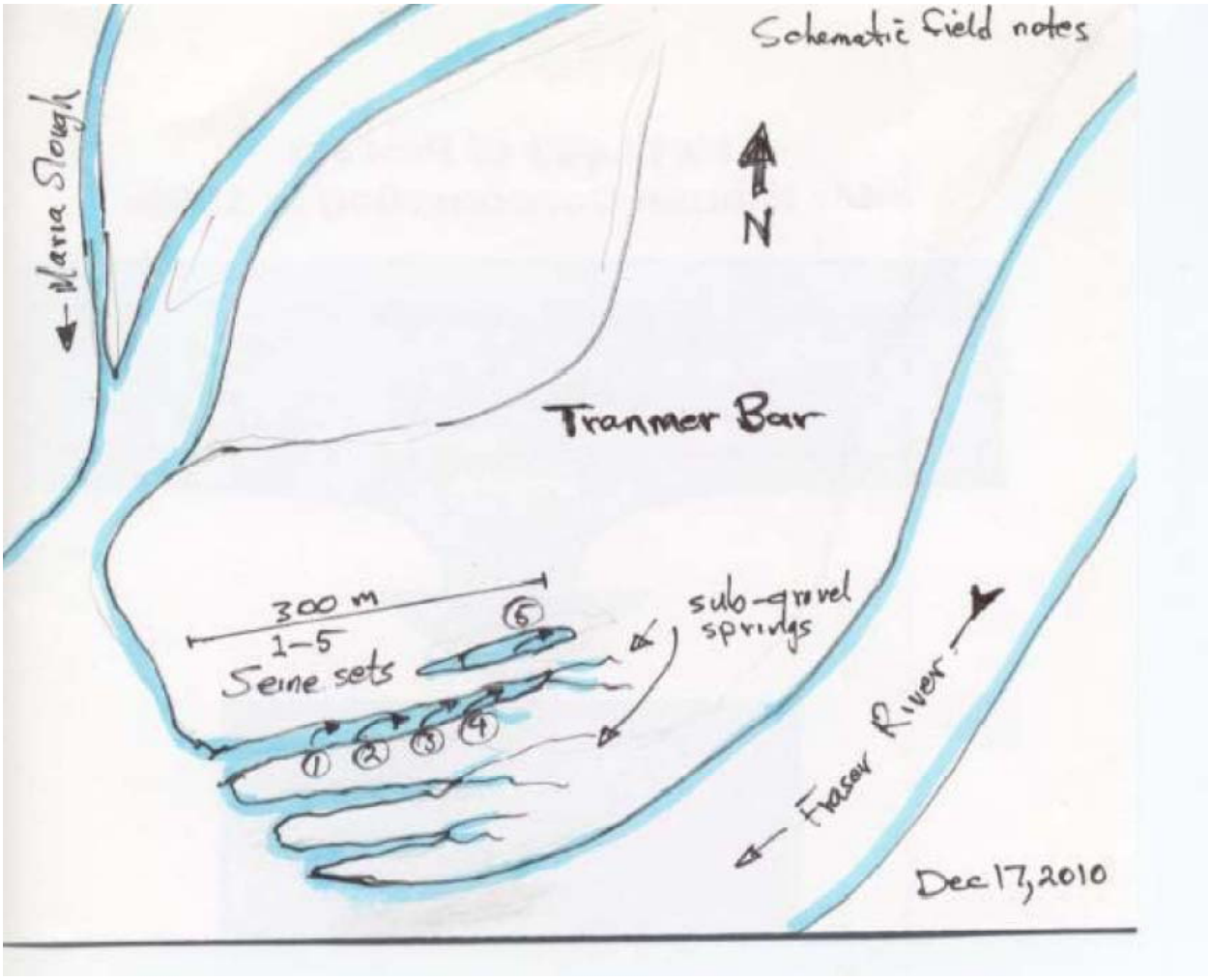

Figure 10. Schematic field notes drawing of the downstream south west part of Tranmar Bar. The drawing shows the sites of the five seine sets made on Dec. 17, 2010. The isolated lagoon is also shown in the diagram (Seine set 5).

Figure 11. Rich catch of salmonids from spring-fed backwaters on Tranmar Bar. The large fish are sockeye parr and mountain whitefish.

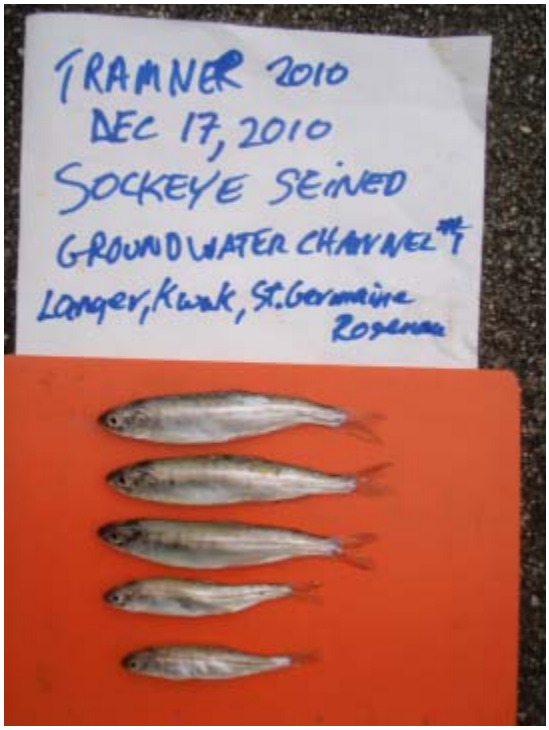

Figure 12. Tranmer Bar sockeye salmon sample.

Catch:
Seine Haul 1 (1230PM / Rubble bottom / Heavy green algal growth / Depth 0-50cm. / Haul area 25X40m) (haul greatly compromised by submerged tire and algal growth)
-17 suckers and or cyprinids (18, 18, 24, 25, 25, 27, 27, 30, 32, 34, 34, 36mm)
-1 sculpin (70mm)
-1 sockeye parr (74mm).
Seine Haul 2. (Rubble with fine sediment / Heavy green algal growth / Depth 0-70cm deep/ Haul area 25X65m) (haul effectiveness compromised by submerged tire and filamentous algae)
- about 50 cyprinids and suckers (under 35mm length).
-25 Mountain whitefish (132, 120, 118, 118, 124, 114, 150, 136, 110, 130, 127, 122, 120, 125, 123, 113, 122, 107, 121, 115, 110, 127, 112, 113, 115mm)
-4 sockeye parr (67, 75, 97, 98mm). Sockeye retained by Dr. Rosenau .
Seine Haul 3. (1330hrs / fine sediment and some gravel bottom / Heavy green algal growth / Depth 0-40cm /haul 25X63m – haul efficiency affected byy tree branch).
-54 cyprinids and /or suckers (all under 30mm long).
Seine Haul 4. (Heavy green algal growth / Fine sediment bottom / Depth 0-30cm / haul area 18X40m).
-30 cyprinids and suckers (lengths under 30mm).
Seine Haul 5 (Isolated shallow lagoon –muddy bottom – Depth 0-15cm / haul 25X100m).
-2 cyprinids/suckers <30mm in length).

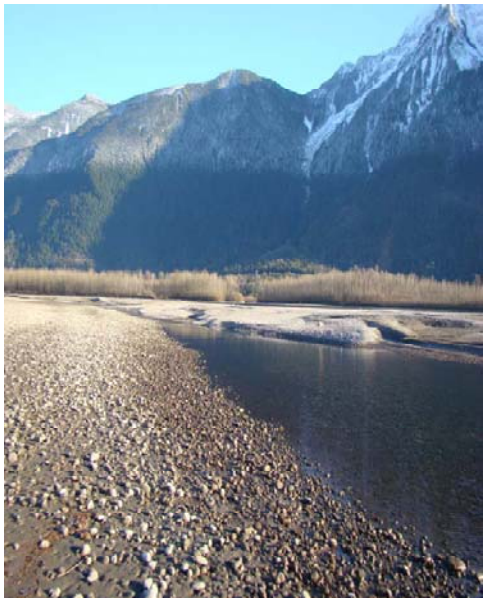

Figure 13. The middle back-water channel on Tranmar Bar (see Figure 10). Several small spring channels fed the larger backwater channels. The bar offered more complex habitat areas for rearing fish than most other inspected bars.

Figure 14. Picking the fish-catch out of seine net on larger Tranmer north backwater channel (see Fig. 10). Note large filamentous algal growth collected in the net indicating a highly productive habitat location.

Figure 15. Looking upstream to the series of dolphins across the navigation channel at Spring Bar. The downstream marker buoy can be seen adjacent to the third dolphin structure from the left.

Spring Bar Gravel Excavation

The massive size and lack of habitat recovery was remarkable in regards to the current Spring Bar excavation site, despite the passing of three post-mining freshets. Indeed, visually, it appears that the excavation hole had gotten substantially larger since the mining occurred as subsequent erosion appears to have taken place here, and in a very large way (Figs. 16, 17). In respect to the habitat conditions that were affected, the DFO made very clear statements in 2008, and then again via the Auditor General of Canada (Fig. 18), that such mined sites would recover within two years, thus they did not need compensatory habitat to replace what the excavation had disrupted or harmed. Indeed, despite the fact that Spring Bar was "on the books" for several years prior to the 2008 mining, DFO could not be bothered to properly assess the fish utilization of this macro-habitat structure (Fig. 18). Indeed, sampling of Spring Bar by the FRGSC in November 2007, just prior to the excavation in winter 2008 showed a very rich community of fish, ***including juvenile sockeye salmon*** (Figure 19). Thus, the losses of fish habitat, at Spring Bar, due to gravel mining have been massive.

Of note, the 'temporary' bridge piling structures, that would normally have been removed after the 2008 mining season to mitigate habitat damage, was deemed a permanent structure and permitted to remain in place for another 50 years (as permitted by Transport Canada with an NWPA permit) to allow a more cost effective re-mining of the area once Spring Bar refilled in with newly recruited gravel (i.e., rehabilitated) within a few years. It is now evident that it will not happen.

Figure 16. Looking south across what was Spring Bar (prior to mining in 2008) and is now a small lake of over two meters in depth. The mining excavation has left a large pond which is almost totally cut off from the Fraser Rivers flows; this can and will act as a trap for any fish isolated in it.

Figure 17. Photo indicates that the bar mining in early 2008 had created a large hole (lake) in that part of Spring Bar that was clearly exacerbated by subsequent down-cutting erosion. The top of bar to the water level was about three meters in elevation difference, with the water being at least another two meters deep. Direction of photo is at top end of bar.

Q2 **There are concerns that more than 10 hectares of prime chinook habitat will be destroyed. Why did DFO not require any inventory and assessment to determine chinook salmon use of Spring Bar?**

A2 DFO believes any impact on chinook habitat will be minor and short-term. During periods of high water, juvenile chinook favour shallow water near gravel bars and there is a lot of that type of habitat in this area of the Fraser River. The gravel removed at Spring Bar will fill in over time as high water during the spring and summer brings in new gravel and restores the area to usable chinook habitat.

The provincial government tested the area around the gravel removal project and found few salmon eggs in the gravel. Pink salmon, but not chinook salmon, spawn in this area. An assessment of juvenile chinook in the area would normally be done in the summer, but exceptionally high water levels last summer made sampling impossible.

Figure 18. Excerpt from DFO response to Auditor General Petition on Spring Bar gravel removal 2008. Note that despite this project being "on the books" for several years in advance of the removal occurring, DFO did not require fish sampling at this macro-habitat site.

Figure 19. FRGSC sampling of Spring Bar, November 2007.

In regards to the loss of the bar habitat, very little of it appears to have been replaced. The large-scale cut, and a very deep pond, are what remains of a previously good habitat area (sampled by FRGSC in November 2007). The massive lagoon that had been created to an estimated two or more meters below the Fraser River flow elevation at time of mining in 2008 looks like a small lake. This lagoon is now almost completely isolated

The lagoon was cut off from the Fraser by a narrow berm of gravel at its upstream end and the lagoon's water level was more than one meter lower than the than the prevailing Fraser River

water levels at time of inspection at the upstream end of the lagoon. A few chum salmon redds were noted in the channel where flows did enter the lagoon at higher Fraser River flow levels. A flow connection was evident at the lower end of the lagoon but it could possibly be cut off at lower river flows causing a large fish trap that was once a large gravel bar.

The depth of water in the lagoon was not measured but wading out two feet from the shore (right side in Figure 18) indicated a water level that was up to chest deep and visually the lagoon appeared to be at least two meters deep. Most experts dealing with this extraction, including DFO consultants (Chillbeck et al), Dr. Church (UBC Geography emeritus) and the BC Ministry of Environment flood control/dyking engineer R. Henry, noted that mining this site would do nothing to alleviate flood risk or erosion concern along the north bank of the Fraser River at this site (i.e., to protect Seabird Island). One can only conclude that he mining of Spring Bar, the largest known in-river mining project in BC, did not have any legitimate scientific or engineering basis in that it was more or less an in river mine to provide commercial aggregate.

Conclusions

1. Large-scale losses of fish (including juvenile sockeye salmon) habitat have, and are continuing to occur as a result of the gravel mining of the gravel reach of the Fraser River.
2. The key agency, Fisheries and Oceans Canada (DFO), has consistently refused to require mitigation or compensation for large-scale losses of fish habitat as a result of this activity.
3. Despite the unequivocal evidence of habitat destruction, it DFO does not understand the intricate linkages between fish utilization and habitat.
4. Of the gravel-mining locations, Tranmer Bar (approved in 2011) comprised the most consistent location of identified juvenile sockeye salmon habitat.

Appendix 1. Map of Fraser River December 17, 2010 gravel bar field inspection trip.