INVESTIGATIONS OF JUVENILE WHITE STURGEON ABUNDANCE AND HABITAT USE IN THE LOWER GRAVEL REACH OF THE LOWER FRASER RIVER, 2009-2010

Prepared for

Fraser River Sturgeon Conservation Society

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Executive Summary

Investigations of juvenile white sturgeon (*Acipenser transmontanus*) abundance and habitat use in the lower gravel reach of the lower Fraser River were conducted at various intervals during August 2009 to April 2010. Sampling was carried out with the use of small mesh tangle nets and a modified bottom trawl. A total of 135 sites were sampled by tangle netting and 140 sites by trawling, with similar habitat types sampled by each method. Sturgeon catches were low by either method, although more so by trawling. In total, five sturgeon were caught by trawling, ranging from 140 to 356 mm fork length, and 30 sturgeon by tangle netting, ranging from 209 to 592 mm fork length. Although not aged, it is believed that two sturgeon 140 mm and 153 mm FL, caught by trawling in the Matsqui Channel in late November were probably age-0^+ on the basis of their length and external features (confirmed age-1^+ sturgeon, captured during previous years in autumn, were 210 mm or greater in length). More than 50% of the sturgeon captured by either gear type was in side channels, although sampling effort was biased in favour of side channels. Water depth at the sites at which sturgeon were captured ranged from 1.4 to 6.5 m, with an average 3.2 m for tangle netting, and from 3.5 to 10.5 m, with an average 5.2 m for trawling.

Cyprinids constituted the bulk of the non-sturgeon native fish catch for both gear types (54% and 96% for trawling and tangle netting, respectively); others consisted of sculpins, flounders, suckers, sticklebacks and salmonids. However, in contrast to the size distribution of fish caught by tangle netting, a high proportion of the catch by trawling consisted of small fish ranging from 25 to 35 mm in length. The predominance of small bottom fish types in the catch by trawling suggests the trawl is the more appropriate method to use in future sampling to determine habitat use of age-0 sturgeon in the lower Fraser River.

1. Introduction

Juvenile white sturgeon in the lower Fraser River (from the mouth of the Fraser to the vicinity of the Harrison River confluence) were sampled with the use of small mesh tangle nets in various habitat types in 2007 and 2008. The objectives of those studies were to collect baseline information on distribution and habitat use of the younger sector of the sturgeon population in the lower Fraser River watershed. During this two-year period, a total of 755 sites was sampled and 463 sturgeon were caught ranging in size from 140-1500 mm fork length (FL), with approximately 50% of them being <300 mm long. (Glova et al. 2008, 2009). In both years, very few fish <220 mm in length were caught. From an analysis of fin ray samples collected from a total of 21 sturgeon ranging from 165-250 mm FL, all were found to be age-1^{+} by an experienced fish-ageing analyst; the smallest fish (140 mm FL) caught during the 2007-2008 period may have been age-0^{+}, but unfortunately it was not aged. The lack of age-0 sturgeon caught in the wide range of habitat types sampled during this two-year period suggests they 1) are not susceptible to capture by tangle netting, 2) occupy different habitats/reaches of the river than those sampled to date, or 3) are present in relatively low numbers in the lower Fraser River.

In an attempt to help fill the gap on habitat use of age-0 sturgeon, the approach during the 2009/2010 study period was to 1) sample primarily upstream of those areas sampled in the lower gravel reach in 2007 and 2008, and 2) in addition to the use of tangle nets, to conduct trials using modified bottom trawls from the US Fish & Wildlife Service in Missouri, which were designed to sample small bottom-dwelling fish in large rivers in the southern states. The distribution of sampling in the present study extended from the vicinity of Mission to the Herrling Island area (Figure 1). Overall, a variety of habitat types was sampled, but with an emphasis in side channels - as these are areas in which sturgeon are known, or likely to spawn (e.g., Perrin et al. 2003) - to increase our chances of capturing age-0 sturgeon.

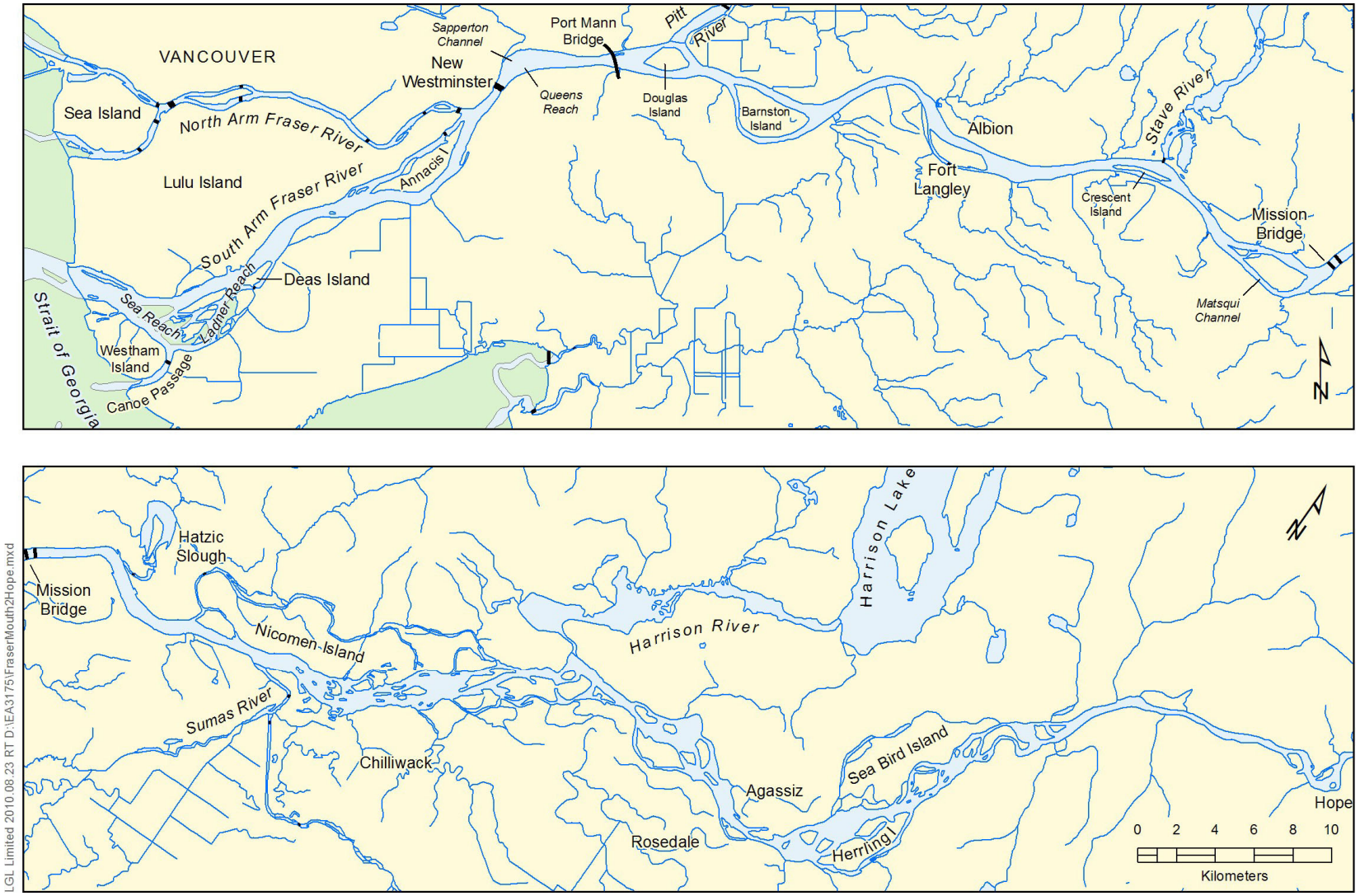

Figure 1: Map of lower Fraser River (from the river mouth to Hope)

The study objectives were to:

- Conduct a literature search on bottom trawl samplers and contact researchers (nationally and internationally) for advice on use/availability of trawls for sampling small bottom fish in gravel-bedded rivers;
- Design and construct a prototype trawl for field testing, or seek to obtain suitable sampling gear on loan from fisheries research organizations nationally or internationally;
- Conduct field trials with a trawl built to design and specifications or with trawls on loan from a fisheries research organization, to test the effectiveness of the gear in capturing small, bottom fish in the lower Fraser River and make modifications as necessary to improve capture efficiency;
- Make arrangements with net manufacturers or research organizations for nets/trawls to sample age-0 sturgeon in the lower gravel reach of the lower Fraser River;
- Conduct tangle netting and trawl surveys in various habitat types from the vicinity of Mission to the Herrling Island area during late summer 2009 to early spring 2010 to sample age-0 sturgeon and identify their habitat preferences;
- Enter the data into an *Access* database, process/analyze the data, and prepare a descriptive report including GIS-based mapping products and *Excel* tables and charts describing the results of this study.

1.1 Study Rationale

A prototype of a trawl for sampling small, bottom-dwelling fish was designed (Figure 2), but was not built. Instead, field trials were conducted with existing trawls provided by the US Fish & Wildlife Service to assess the performance of the trawls in the lower Fraser River. It was found that with minor modifications, the trawls performed satisfactorily. As a result, the prototype trawl design was not pursued, and the juvenile sturgeon sampling program during 2009-2010 consisted of a combination of tangle netting and trawling.

During 2007 and 2008, only 2" mesh tangle nets were used to sample juvenile sturgeon in the lower Fraser River (Glova et al. 2008, 2009). In the present study, in addition to 2" mesh nets, 1" mesh nets were also used during the latter period of sampling (April 2010) to provide catch information to compare capture efficiency with 2" mesh nets.

At the beginning of the study in 2009, pilot tows were conducted with the trawl to assess its performance in various habitat types in the lower Fraser River. A few minor modifications were made to the trawls: 1) a heavy 'tickler' chain was dragged along the bottom between the otter boards to disturb the gravels and cobbles to increase capture of fish hiding in the substrate, 2) the lines between each of the otter boards and the trawl, and a short length of line mid-length in the 'tickler chain', were of 2 mm diameter cord to serve as 'breaking points' when badly snagged to avoid losing gear, and 3) a buoy on a long rope was tied to the cod end of the trawl so that the trawl could be readily retrieved if it broke free from the otter boards when snagged.

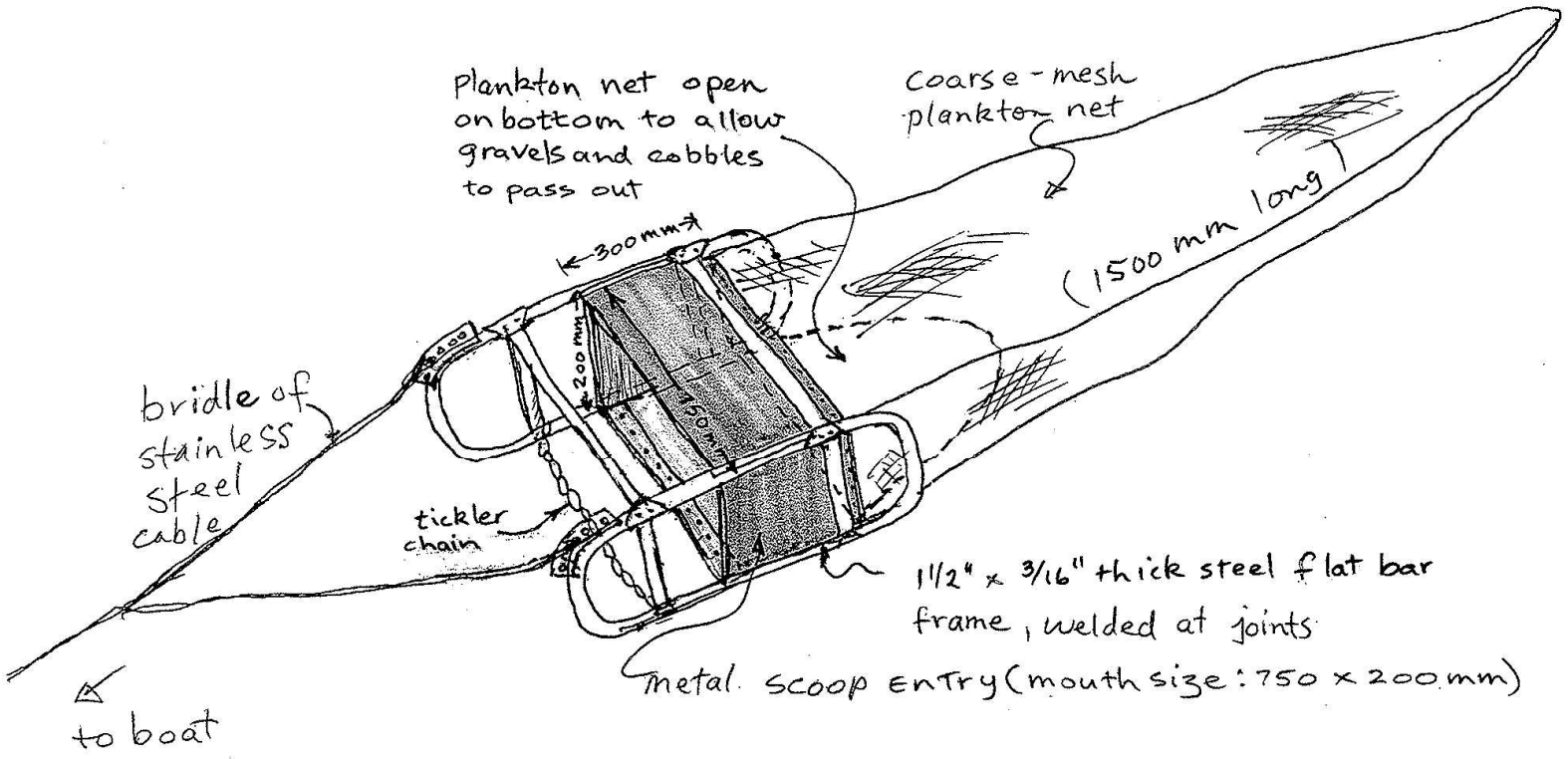

Figure 2: Conceptual design of a bottom trawl for sampling small fish in the lower Fraser River.

2. Methods

2.1 Tangle Netting

Sampling with 2" mesh tangle nets was conducted in a variety of habitat types (e.g., pools, sidepools, backwaters, side channels, high-top bars) from the vicinity of the Harrison River confluence to the Herrling Island area from 18 August to 4 September 2009.

The tangle nets used were the same as those used in the previous two years of study (Glova et al. 2008, 2009). They were made from soft, multi-strand, braided 2-inch mesh webbing purchased from Memphis Net & Twine in Oregon, with the dimensions of each net being 50 ft (15.2 m) long x 8 ft (2.4 m) deep. This size was appropriate for sampling a variety of habitats and provided site-specific information on catch of juvenile sturgeon in the lower Fraser River. In instances where longer nets were necessary, two nets were joined together. The First Nations crew used, consisting of a crew leader and a technician, was the same as that used to sample upstream of Mission in the 2007 and 2008 studies. Both crew members are very familiar with the river, navigational and boat safety skills, and fish netting procedures.

The boat used was a 5-m long aluminum craft powered by a 60 hp outboard jet suitable for use in relatively shallow water areas (<1.5 m). Up to eight nets were set/d (on the bottom), with the nets set in late afternoon (~1700 h onward) and retrieved the following morning. The location of each of the sets was recorded with the GPS unit onboard the boat. The fish caught were removed as the net was brought up, and any sturgeon present were removed immediately and placed into a large, plastic container with fresh water. Other native fish species captured were identified to species, counted and released. Any non-native fish present in the catch were identified to species, measured, and disposed of as stipulated by the MoE permit. For all sturgeon captured, fork length and girth were recorded; fish of taggable size (≥ 200 mm FL) were scanned for presence of a PIT tag and any untagged fish were tagged as per standard PIT-tagging procedures of the ongoing Lower Fraser River White sturgeon Monitoring and Assessment Program (Nelson et al. 2008). The condition code of individual sturgeon at time of release was recorded as to one of five categories: 1 = vigorous, no bleeding; 2 = vigorous, but bleeding; 3 = lethargic; 4 = lethargic and bleeding; 5 = dead. Sturgeon mortality was zero during tangle net sampling.

For each of the sites sampled, the fish and habitat (habitat type, location coordinates, water depth, water temperature near the bottom, Secchi depth, and dominant substrate type) data were recorded on waterproof standardized data forms. The completed original data forms were mailed to LGL Limited, with back-ups (photocopies) made before sending. Upon receiving the data forms in the office, they were checked for completeness and in instances where information was missing, the field crew leader was contacted in an effort to complete the information record.

Tangle nets were also set during the trawl surveys conducted from 22-24 April 2010, during which both 1" and 2" mesh nets were used; the sampling procedure was the same as that described above for the August-September period.

2.2 Trawling

Four trawls (one 6-ft and three 8-ft wide at the mouth) and one pair of otter boards (two feet long) were shipped to us via airfreight from the US Fish & Wildlife Service, Missouri, in early September 2009. In this study, only the eight-ft wide trawls (Plate 1) were used as we were interested in maximizing the area sampled since most of the channels were quite wide (>20 m).

A buoy on a 5-m line was attached to the cod end of the trawl, and a long bridle of 10 mm diameter poly rope was attached to the otter boards for towing with a jetboat: during the September tows, a 22 ft long boat with a 350 hp inboard motor was used; for all other surveys, a 23 ft boat with a 450 hp inboard motor was used. The trawl was tapered in shape, made of tough, coarse-mesh webbing at the mouth end, with a finer mesh net attached on the inside, and a minnow mesh at the cod end. The mouth opening was approximately 8 feet wide x 2 feet high, with a heavy chain and lead line secured along the bottom and cork floats along the top.

Plate 1: **Front view of trawl with otter boards and 'tickler' chain, and buoy tied to the cod end. The 'breaking points', to break when badly snagged, were of 2 mm diameter nylon cord, with one of them located in the middle of the 'tickler chain' and the others as the lines between each of the otter boards and the trawl.**

Trawling was conducted during three time periods: 18-24 September; 2 November to 10 December 2009; and 22-24 April 2010, with sampling overall extending from the vicinity of the Stave River confluence to the Herrling Island area. The September sampling period consisted mainly of trial tows in various habitat types in the lower gravel reach of the lower Fraser River from the vicinity of the Harrison River confluence to the Herrling Island area to assess the performance of the trawl and make minor modifications as necessary to increase capture efficiency. These trial tows were usually short (~300 m long). The trawl performed reasonably well, and on recommendation from the US Fish & Wildlife Service, a heavy 'tickler' chain was fastened between the otter boards to drag along the bottom in front of the trawl to disturb the cobbles and facilitate capture of small fish hiding in the substrate. Unfortunately, the otter boards were lost when the trawl became badly snagged while conducting a tow in the main river on 24 September; the trawl net was salvaged, but badly damaged at the mouth end. In due course, an additional two pairs of otter boards were sent to us from the US Fish & Wildlife Service. To minimize the loss of gear when snagged, it was recommended by the US Fish & Wildlife Service that 'breaking points' be installed in the lines between the trawls and the otter boards, and mid-length in the 'tickler chain'. This was done, and in all subsequent tows no gear was lost.

The surveys conducted during November/December 2009 and April 2010 were an effort to determine juvenile sturgeon abundance and habitat use by trawling in the reach from the Harrison River to Herrling Island area, as well as downstream to the vicinity of the Stave River area. Sampling at all sites was post-dusk to around midnight, based on the assumption that catches would be greater at night when fish are known to be more active. The boat was equipped with floodlights fore and aft, as well as onboard, that could be switched on and off as needed. All tows were made in the direction of the current, at a speed slightly faster than that of the river current to facilitate fish capture. At the end of a tow, the trawling gear was lifted onboard and the contents in the cod end were emptied into a bucket with water (Plate 2) for sorting, identification, and counting of the catch; some samples had large amounts of debris to sort through in the process of looking for fish (Plate 3). A few samples of very small fish were preserved in 95% ethanol in whirl-paks for positive identification under a microscope in the laboratory. During the September trawling, a large proportion of the catch was measured to determine fish size distribution; during all other trawling periods, relatively few fish were measured to save time. The fish caught by trawling were processed in the same manner as those sampled by tangle netting described in Section 2.1. The start and end of each of the trawling transects were recorded on the GPS unit onboard the boat, and for additional reference the approximate location of each transect was marked on 1:30,000 base maps from Google. The approximate distance of each tow was computed by multiplying the jetboat speed by the duration of the tow.

For each of the trawl sites sampled, the habitat variables for which data were recorded and data handling procedures were the same as those described for tangle netting (see Section 2.1).

Plate 2: The catch of small fish from a single tow in a side channel, November 2009.

Plate 3: Sorting through debris looking for fish from a tow in a side channel with sluggish flow.

3. Results

3.1 Tangle Netting

Tangle-netting was performed at a total of 135 sites in various habitat types of the lower Fraser River from the vicinity of the Harrison River mouth to the Herrling Island area from August 2009 through April 2010 (Figure 3). The habitat types sampled included side channels (57%), sidepools (15%), backwaters (14%), mainstem pools (7%), high-top bars (4%), and sloughs (1%); for two of the sites (2%), habitat type was not recorded (forgotten). Water depth at the sites sampled ranged from 0.85 to 7.5 m, and Secchi depth ranged from 0.3 to 3.5 m. Surface water temperature during the period of sampling ranged from 6 to 18 ºC. Of the 135 sites sampled, 126 sites were sampled with 2" mesh nets (August-September) and nine were sampled with the use of both 1" and 2" mesh nets (April) to provide a comparison of the catch by mesh size.

The distribution of sturgeon captured by tangle netting during the August to April (2010) surveys is shown in Figure 4. Sturgeon were captured at 21 (16%) of the sites sampled, a total of 30 individuals in all. For 84% of the nets set, no sturgeon were caught; the catches ranged from 1-5 fish, with a single fish being the most frequent result and the maximum of 5 only once. The condition of all sturgeon was vigorous, with no bleeding. Of the total catch, 53%, 27%, 10%, 7%, and 3% were taken in side channels, backwaters, mainstem pools, sidepools, and high-top bars, respectively. Water depth at the sites at which sturgeon was caught ranged from 1.4 to 6.5 m, with an average of 3.2 m.

The sturgeon captured by tangle netting ranged from 209 to 592 mm FL, with the mean being 298 mm. The mean FL and range for all other fish groups captured by tangle netting are shown in Table 1. There were insufficient numbers of sturgeon caught (n = 5) with the 1" mesh nets to compare catch efficiency with that of the 2" mesh nets.

Table 1 Numbers and sizes of fish sampled by tangle netting in the lower Fraser River, August 2009 to April 2010

		Length (mm)		
Species/Group	Number	Mean	Minimum	Maximum
White Sturgeon	30	298	209	592
Cyprinids	1622	121	40	330
Salmonids	34	385	240	659
Suckers	20	201	105	350
Sculpins	9	115	94	150
Exotics	19	116	98	128
Crayfish	9	-	-	-

A major proportion of the catch (94%, 1622 fish) during the August to April (2010) tangle netting surveys consisted of cyprinids (mainly northern pike minnow, peamouth chub and redside shiner); other non-sturgeon native fishes (salmonids, suckers and sculpins) comprised <4%, and exotics (smallmouth bass, largemouth bass and black crappie) about 1% of the catch (Figure 5).

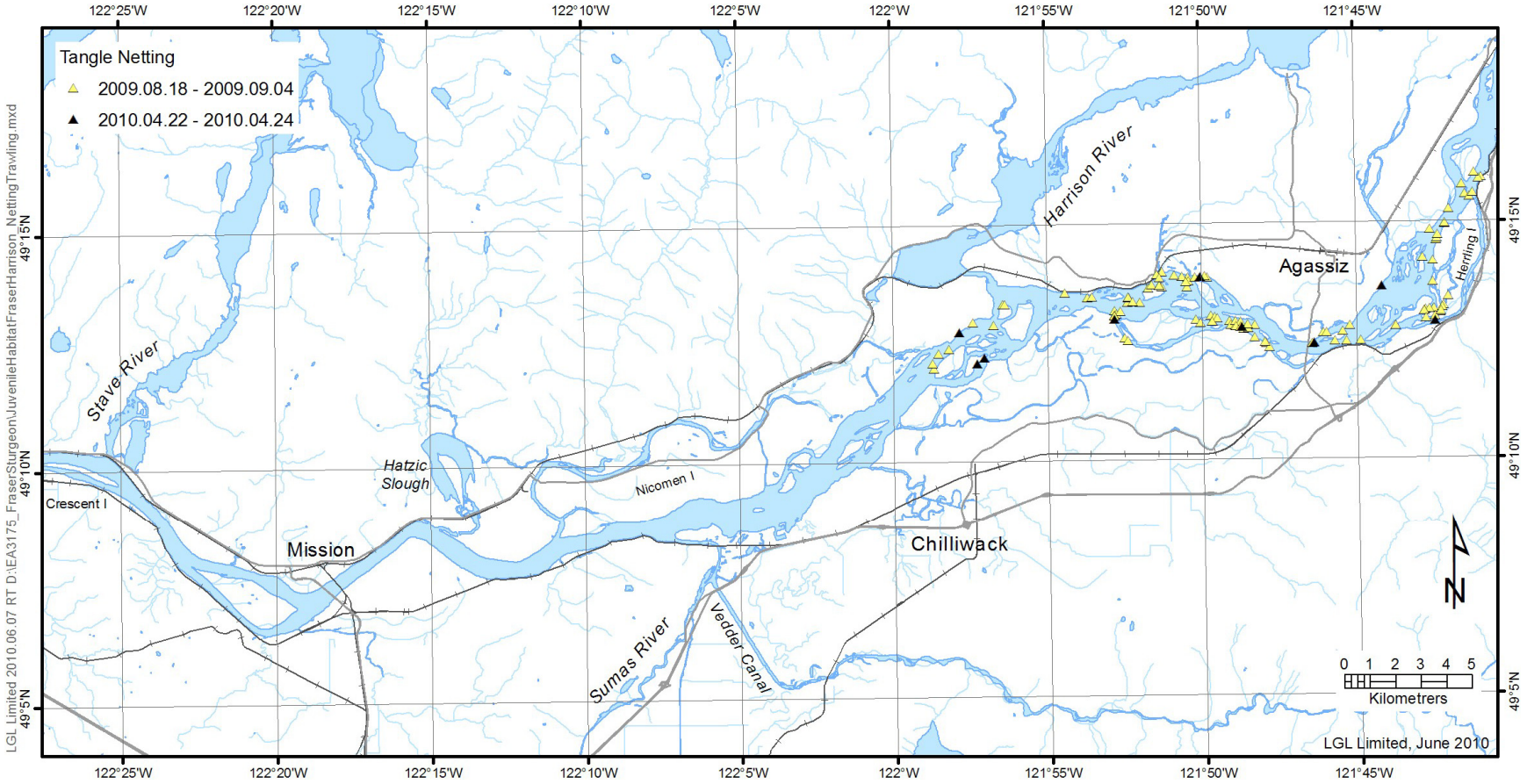

Figure 3: **Sites sampled by tangle netting in the lower gravel reach of the lower Fraser River during two time periods: 18 August to 4 September 2009; 22 to 24 April 2010 (Due to superimposition of sites, not all sites can be seen).**

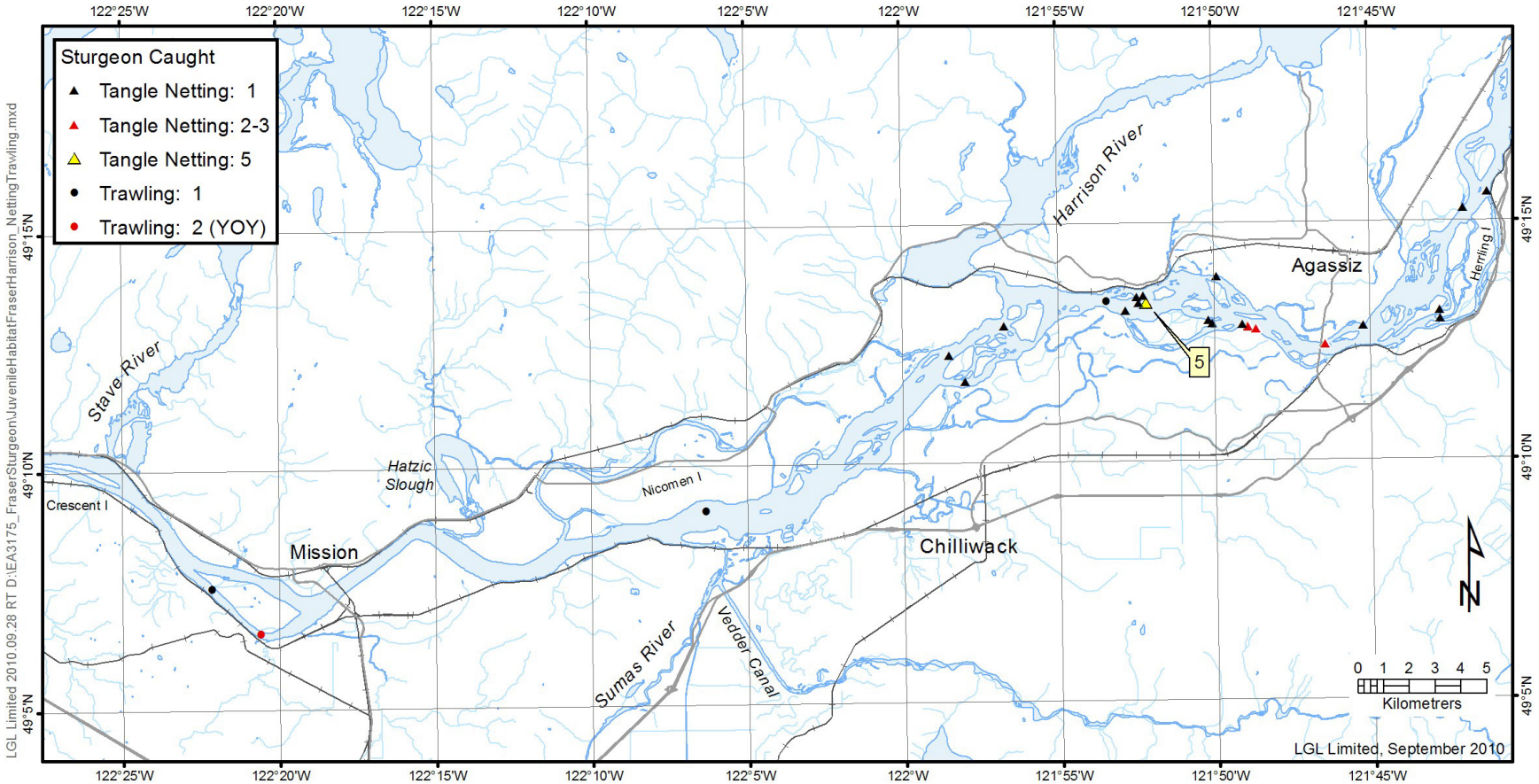

Figure 4: Juvenile white sturgeon sampled by tangle netting and trawling in the lower gravel reach of the lower Fraser River, 2009-2010; the site at which 5 sturgeon were captured by tangle netting is noted.

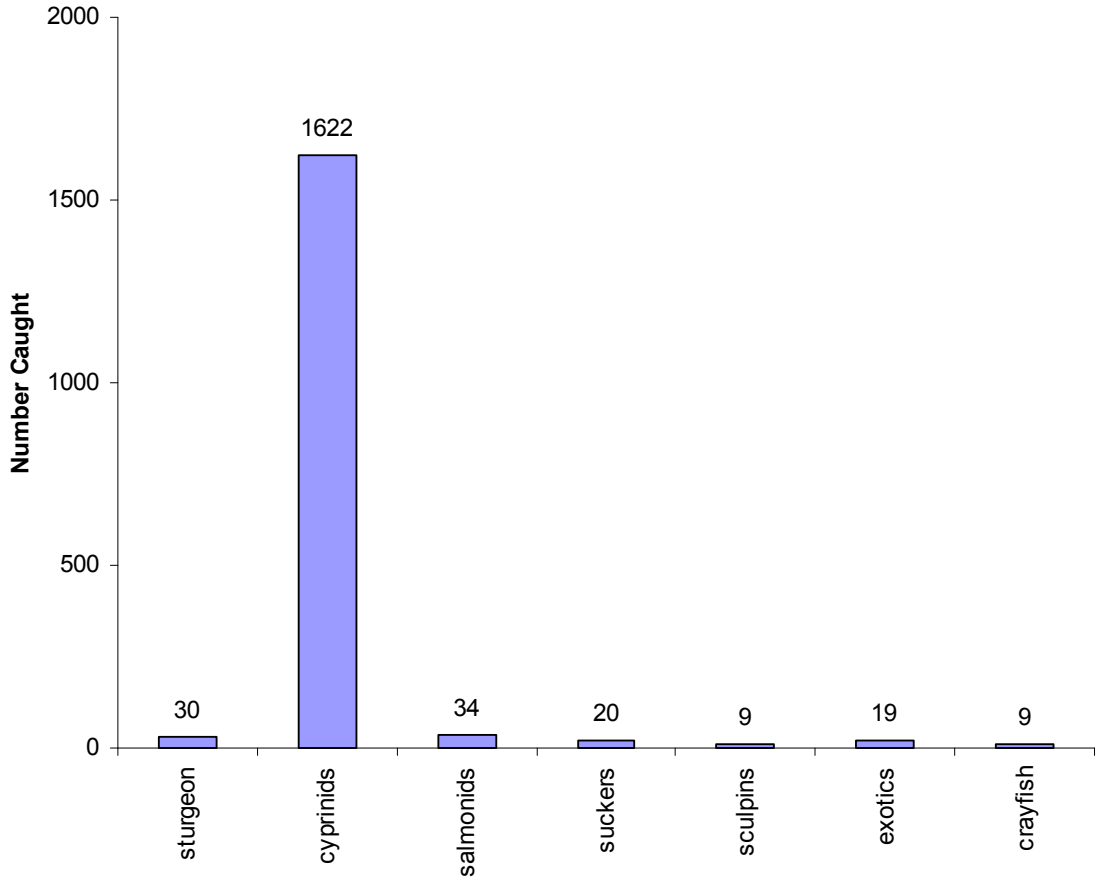

Figure 5: Catch of fish and crayfish sampled by tangle netting, lower Fraser River, 2009-2010.

3.2 Trawling

Trawling was carried out at a total of 140 sites in the lower Fraser River from the vicinity of the Stave River confluence to the Herrling Island area at various intervals from September 2009 through April 2010 (Figure 6). In both the September and April periods, trawling was mainly in the reach between Harrison and Herrling Island, whereas during the November/December period trawling was more widespread, including sites from the vicinity of the Stave River to Nicomen Island and the Harrison to Herrling Island. Overall, the trawling tows ranged from 0.3 to 3.5 km, and on average were 1.3 km long. The habitat types sampled for all three sampling periods combined included side channels (49%), mainstem runs (20%), high-top bars (14%), mainstem pools (6%), sloughs (5%), and sidepools (1%); for seven sites (5%), recording of habitat type was forgotten. Water depth at the sites sampled ranged from 0.6 to 22.5 m, and Secchi depth ranged from 0.3 to 1.0 m. Surface water temperature during the period of sampling ranged from 2.4 to 10.6 ºC.

During trawling in September to April (2010), sturgeon were captured at 4 of the 140 (3%) sites sampled, a total of 5 individuals in all (see Figure 4). Of the sturgeon caught, three were taken in side channels, and two in high-top bar areas. Water depth at the sites of capture ranged from 3.5 to 10.5 m, with an average of 5.2 m. The condition of all sturgeon sampled was vigorous, with no bleeding.

During the trial tows in September, a single sturgeon, 356 mm FL, was captured. The overall catch during the trial tows consisted mainly of small cyprinids, suckers and sculpins (see examples Plate 4), with a high proportion (48% of the total catch) consisting of fish between 35 and 45 mm long and another less prominent mode (38%) for fish between 55 and 95 mm long (Figure 7). The high proportion of small bottom fish in the catch suggested that trawling was an appropriate method for sampling juvenile sturgeon in the lower Fraser River. Accordingly, further trawling was continued in subsequent months.

The number of fish and non-fish specimens caught by trawling during the overall sampling period September through April 2010 is shown in Figure 8). The catch was dominated by cyprinids, suckers and sculpins, with others (sticklebacks, sturgeon, flounders, salmonids, etc.) constituting a minor proportion of the catch. Overall, the size of fish caught by trawling ranged from 15 to 205 mm in length, bimodally distributed, with a prominent peak for fish 25 to 35 mm long and a secondary peak for fish between 55 and 85 mm long (Figure 9).

The mean length and range for all species or groups of specimens captured by trawling during September through April 2010 are shown in Table 2. The five sturgeon captured ranged from 140 to 356 mm FL, with a mean 214 mm FL. From the length ranges shown in Table 2, it is likely that the prominent peak in the catch of fish 25 to 35 mm in length in Figure 9 consisted mainly of young cyprinids, suckers and sculpins.

Two YOY sturgeon (140 and 152 mm FL) were caught in the Matsqui Channel in late November. Both of these fish were taken in the same trawl set, and were in an area of dense leaf litter (mainly alder leaves) that also had an abundance of small (2-3 mm long) mysids. The leaves may have provided a food source for the mysids and other sturgeon prey, as well as some cover for young sturgeon.

Two of the total of three sturgeon caught in the Matsqui Channel in late 2009 are shown in Plate 5 and Plate 6, to convey differences in their external appearance that may be age related: the smaller fish, 140 mm FL, assumed to be age-0^+, had a predominance of melanin pigment over the entire body, its fins and rostrum were quite transparent, and the scutes and head area were not hardened. The larger fish, 210 mm FL, almost certainly age-1^+ based on our findings of length at age from samples aged in 2008 (Glova et al. 2009), had grey pigmentation overall, its fins and rostrum were opague, and the scutes and head area were hardened.

Table 2 **Numbers and sizes of fish and non-fish specimens sampled by trawling in the lower Fraser River, September 2009 to April 2010.**

		Length (mm)		
Species/Group	Number	Mean	Minimum	Maximum
White Sturgeon	5	214	140	356
Cyprinids	1610	48	15	140
Salmonids	2	55	40	70
Suckers	727	49	21	160
Sculpins	592	72	15	200
Flounders	19	142	80	170
Sticklebacks	61	42	14	85
Exotics	1	150	-	-
Crayfish	11	64	25	130
Tadpoles	6	70	60	80

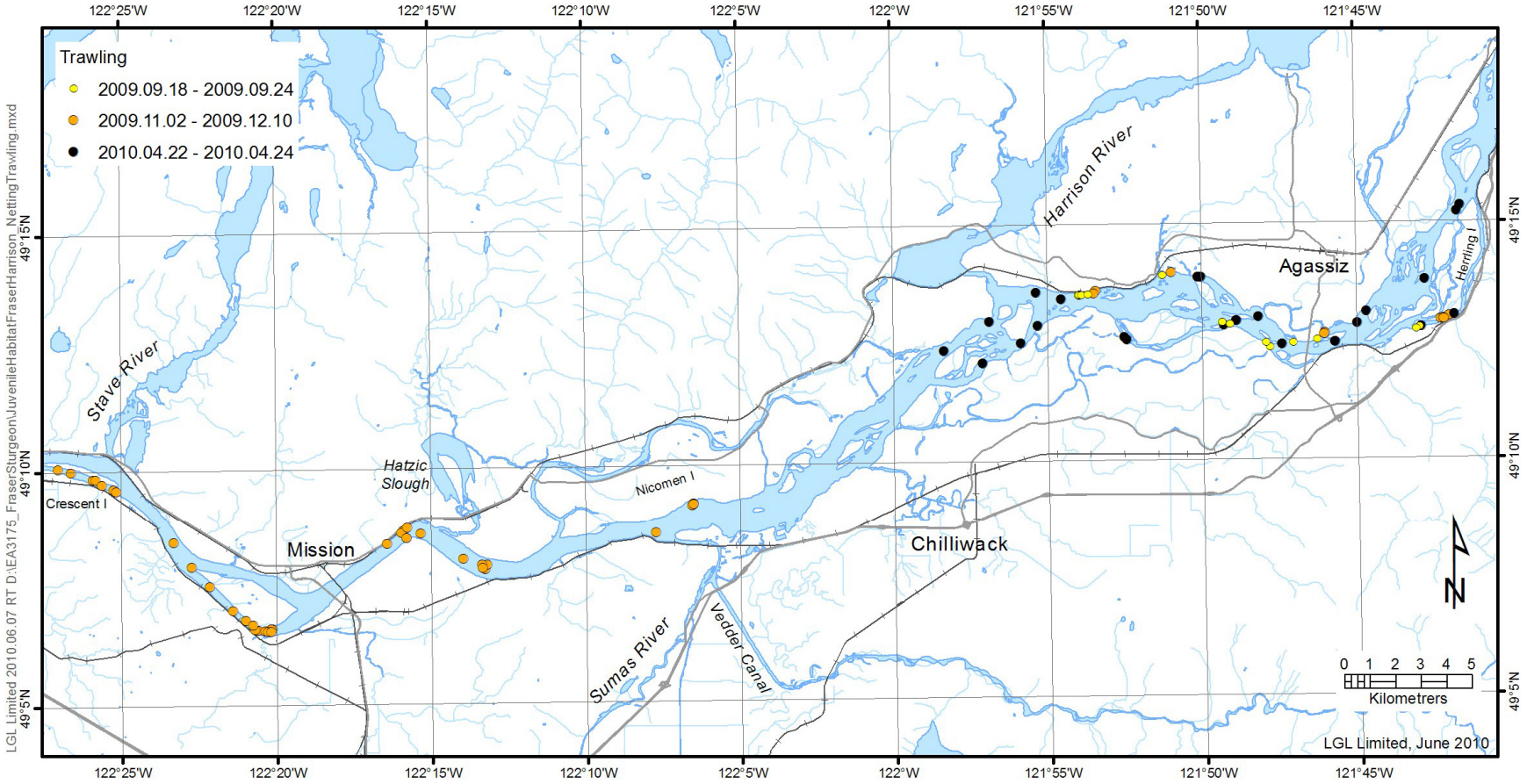

Figure 6: **Sites sampled by trawling in the lower gravel reach of the lower Fraser River during three time periods: 18 to 24 September 2009; 2 November to 10 December 2009; and 22 to 24 April 2010. (Due to superimposition of sites, not all sites can be seen).**

Plate 4: **Examples of small fish caught by trawling in the lower Fraser River: top to bottom - longnose dace, leopard dace and largescale sucker.**

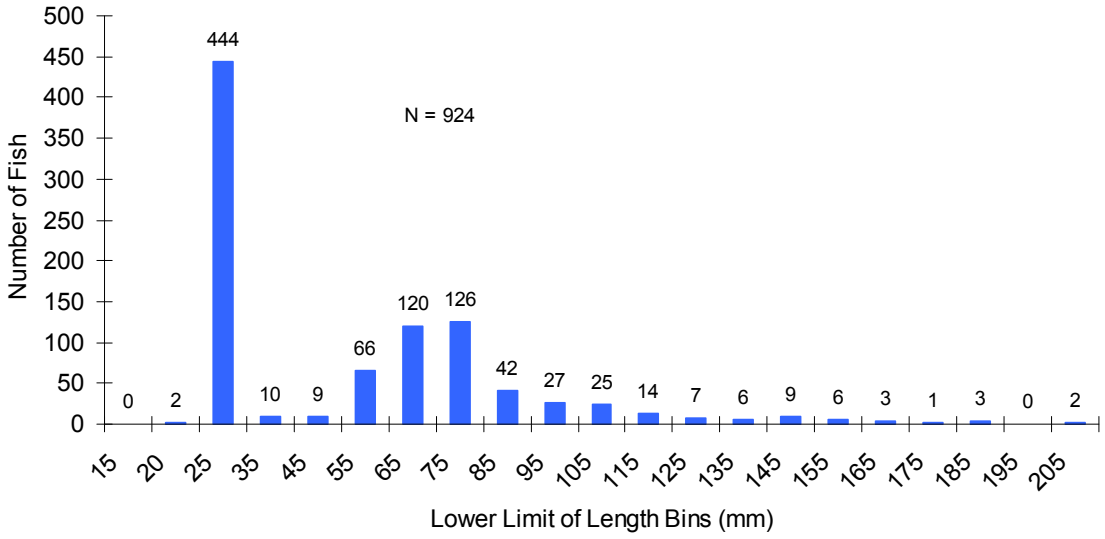

Figure 7: **Size distribution of fish (sturgeon not included) sampled by trawling during the trial tows in September 2009.**

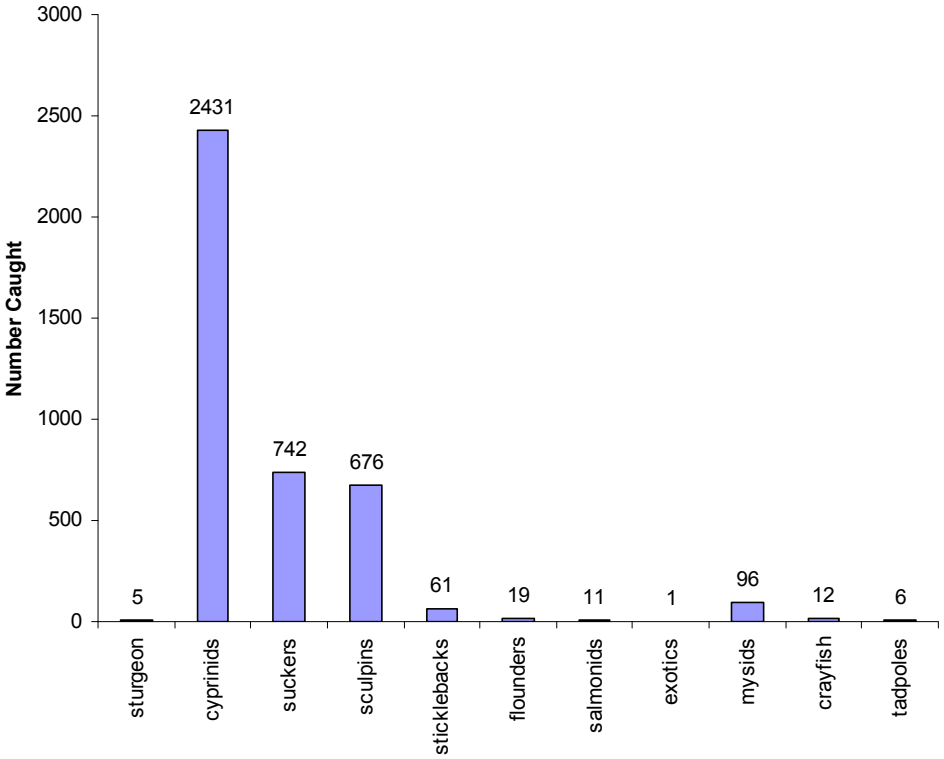

Figure 8: **Catch of fish and non-fish specimens caught by trawling, lower Fraser River, September 2009 to April 2010**

Plate 5: **Sturgeon 140 mm FL caught by trawling, Matsqui Channel, 30 November 2009**

Plate 6: **Sturgeon 210 mm FL caught by trawling, Matsqui Channel, 8 December 2009**

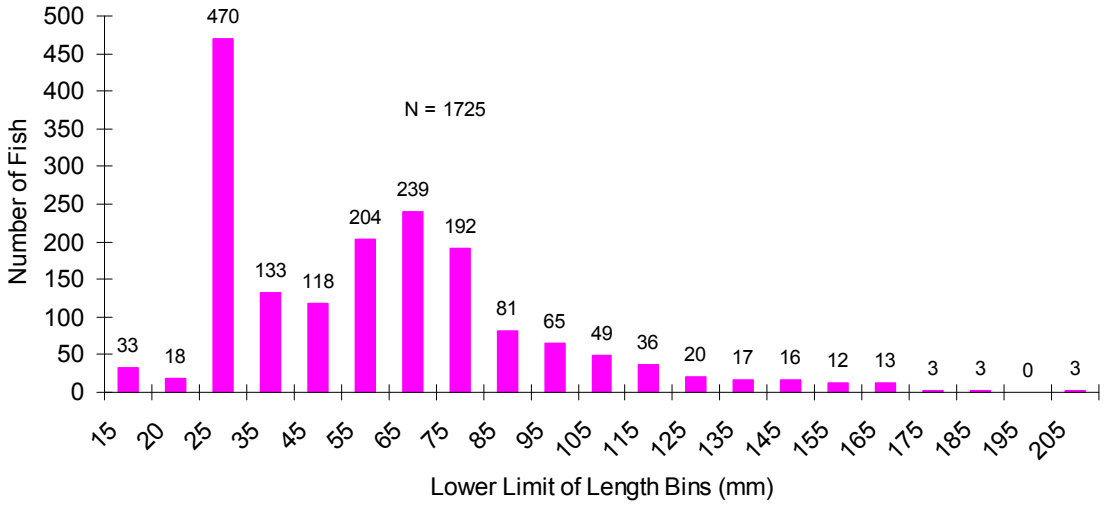

Figure 9: **Size distribution of fish caught by trawling, lower Fraser River, September 2009 to April 2010 (not all fish were measured)**

3.3 Comparisons of Catch by Habitat Type

A comparison of sturgeon catch by habitat type and gear type is shown in Figure 10, although the low numbers of fish caught and fewer habitat types sampled by trawling limit the scope of the comparison. Backwaters and sidepools were virtually avoided by trawling because of potential snags. For both gear types, the relative frequency of the catch was greatest in side channels, but this was also the habitat type in which sampling effort was greatest. Tangle netting caught sturgeon in all habitat types sampled, approximately in proportion to sampling effort.

The relative frequency of non-sturgeon fish caught in side channels was similar for both gear types (Figure 11). Although sampling was biased in favour of side channels, these fishes were probably more abundant in side channels than in other habitat types. The relative frequency of the catch of these fishes in high-top bars was low for both gear types. Although it is not evident from the results presented in Figure 11, trawling generally caught a considerably smaller size spectrum of fish than did tangle netting (compare the mean lengths and ranges of fish sampled by tangle netting and trawling in Tables 1 and 2, respectively).

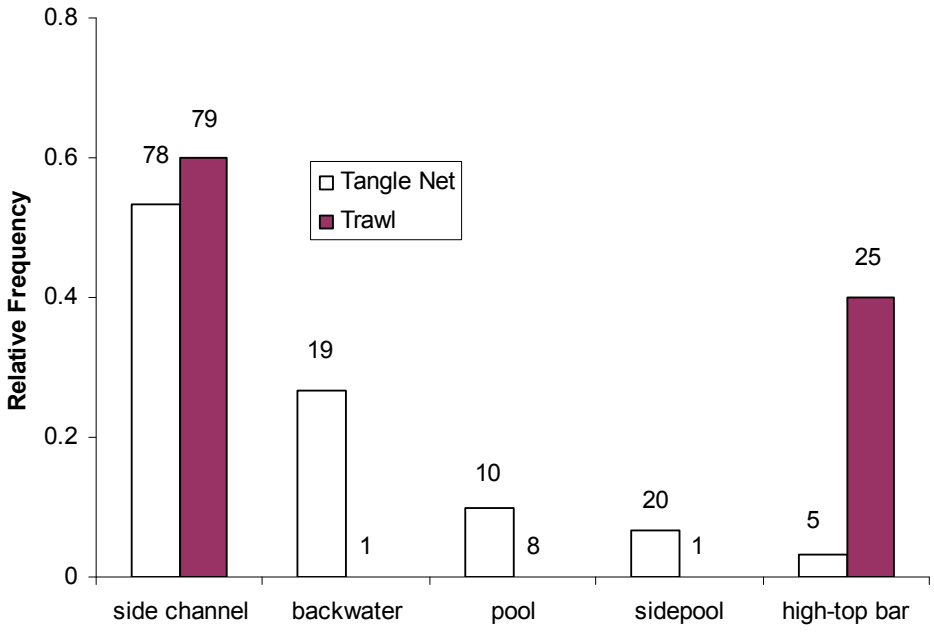

Figure 10: Catch of sturgeon by tangle netting and trawling by habitat type, lower Fraser River, 2009-2010 (the number of sites sampled by each gear type is shown).

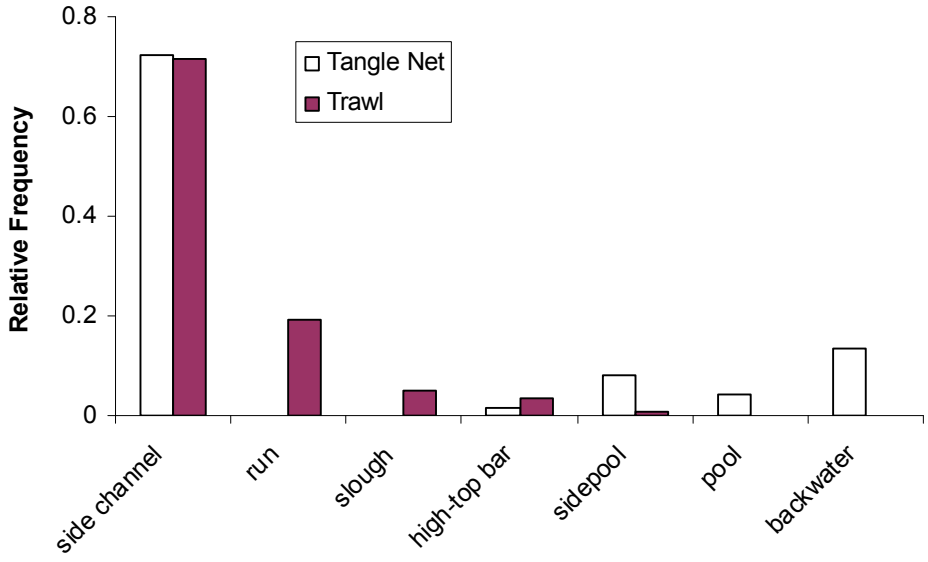

Figure 11: Catch of non-sturgeon native fish by tangle netting and trawling by habitat type, lower Fraser River, 2009-2010.

4. Discussion

The main emphasis in this study was to attempt to fill the information gap on habitat use of age-0 white sturgeon in the lower Fraser River. In this endeavour, in addition to the use of small mesh tangle nets which we had used previously (Glova et al. 2008, 2009), a new methodology (a small mesh bottom trawl) was applied to assess its suitability for sampling small bottom fish in habitats similar to those occupied by juvenile sturgeon. The results obtained from this study indicate the trawl is appropriate for use in a variety of habitat types and should be suitable for capturing young sturgeon. It is probable that the low catches of sturgeon with the use of the trawl, in spite of relatively high catches of other small bottom fishes, was due to the very low abundance of sturgeon present in the areas sampled. Although the microhabitat occupied by age-0 sturgeon in the lower Fraser River has yet to be described, presumably it is not greatly dissimilar from that occupied by young cyprinids, sculpins, and suckers of which an abundance of them was captured by trawling.

Relative to the rather large sampling effort expended during this study, the low numbers of sturgeon captured overall were unexpected, particularly as the area has been reported (Laidlaw and Rosenau 1998; Perrin et al. 2003) to be of importance for sturgeon spawning. The results obtained suggest the reach from the Harrison to Herrling Island was currently not heavily utilized by juvenile sturgeon, which may have been related to a low incidence of spawning in the area in the recently preceding years. At only one site, in the main channel approximately 5 km upstream of the Harrison confluence, was a maximum catch of 5 sturgeon obtained. Of the total 275 sites sampled by tangle netting and trawling combined, sturgeon were caught at only 25 (9%) of the sites, usually

comprising only a single fish. In contrast, during our 2007 and 2008 studies from the mouth of Fraser to the vicinity of the Harrrison in which 755 sites were sampled by tangle netting, a total of 463 sturgeon were captured ranging from 140 to 1500 mm FL (Glova et al. 2008, 2009). The marked differences in the catch between these two broad areas suggest the lower river from the Harrison to the vicinity of the mouth is the area of greater importance for juvenile sturgeon. This reach contains several sites (e.g., Matsqui Channel, Hatzic Eddy, Port Mann Bridge area, Annacis Island, and others) that have been identified as 'hot spots' for sturgeon rearing and other uses.

Despite the low numbers of sturgeon captured during the present study, they do nonetheless add to the habitat use database, providing novel information on the habitats occupied by sturgeon in the area. Water depth at the sites at which sturgeon were captured ranged from 1.4 to 6.5 m, with an average 3.2 m for tangle netting, and from 3.5 to 10.5 m, with an average 5.2 m for trawling. A wider range of water depths was found to be occupied by juvenile sturgeon in the lower river, although more commonly they were in areas less than 5 m deep with fine substrates in side channels, sidepools, backwaters, and nearshore areas in mainstem open channels (Glova et al. 2008, 2009). Although more than 50% of the sturgeon caught in the present study was in side channels, this may not be a meaningful indication of habitat use as sampling was biased in favour of side channels.

Overall, cyprinids made up a high proportion of the non-sturgeon native fish catch for both trawling (54%) and tangle netting (96%). Other native fish caught consisted of sculpins, flounders, suckers, sticklebacks and salmonids. An important difference in the catch between the two gear types, was in the size distribution of the fish caught. By trawling, a high proportion of the catch consisted of small fish ranging from 25 to 35 mm in length, mostly cyprynids and some sculpins and suckers. By tangle netting, no such small fish were caught and the range and mean size of fish were distinctly greater than those taken by trawling. The predominance of small bottom fish types in the catch by trawling suggests the trawl is the more appropriate method to use in future sampling to determine habitat use of age-0 sturgeon in the lower Fraser River.

5. Conclusion

Overall, despite the low catch of sturgeon during this study, the high proportion of small (<50 mm long) bottom fish caught by trawling compared with that by tangle netting suggests that sampling by trawling is more likely to provide habitat use information on age-0 sturgeon in the lower Fraser River. A trawl sampling program providing adequate coverage of potential sites at certain times of the year seems appropriate.

6. Recommendations

In Year 3, an attempt was made to fill the gap on age-0 sturgeon habitat use in the lower Fraser River. Unfortunately, the attempt was largely unsuccessful, but in all likelihood not because the sampling gear used was ineffective, but because very few age-0 sturgeon were present in the areas sampled. Nonetheless, the relatively large numbers of small

non-sturgeon bottom fish caught by trawling indicates the trawl is effective in sampling small bottom fish and would capture small sturgeon, if present.

It is recommended that sampling of age-0 sturgeon by trawling in the lower Fraser River be pursued further during the late summer to autumn period in 2011. The possibility that white sturgeon drift to the lower reaches of the river during early larval stages, as has been found to occur for green sturgeon in the Mississippi, should be investigated by trawling in specific areas of the lower river during late summer. The possible occurrence of larval movement downstream may account for the lack of success to date in capturing age-0 sturgeon in the vicinity downstream of areas where spawning is believed/known to occur.

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Appendix

FRASER RIVER STURGEON CONSERVATION SOCIETY To Tony Mochizuki: Fax: 250-655-4761 (phone: 250-656-0127)
JUVENILE WHITE STURGEON HABITAT SURVEY Page:_____ of _____

Name of Person that Recorded Data: _____ Weather: _____
Date (dd/mmm/yy)_____ Location:_____ River km:_____ Net mesh size: 1" or 2" or trawl
UTM:_____ _____ Latitude:_____ Longitude:_____ Tide direction: incoming outgoing flood ebb
Time net in:_____ Time net out:_____ Soak time:_____ Photo taken:_____

Habitat Information General description: _____
Habitat type (circle one): High-top bar mainstem pool sidepool backwater side channel slough other (specify) _____ LWD ☐ SWD ☐
Surface temp (C):_____ Bottom temp (C):_____ Depth (m):_____ Surface velocity (m/s):_____ Bottom velocity (m/s):_____
Substrate (circle): mud silt sand gravel cobbles boulders bedrock other (specify) _____ Bottom condition: soft / hard
Surface dissolved O_2 (mg/l):_____ Surface salinity (‰):_____ Surface conductivity (mS/cm):_____ Secchi (m):_____
Bottom dissolved O_2 (mg/l):_____ Bottom salinity (‰):_____ Bottom conductivity (mS/cm):_____ TDS (mg/l):_____

White Sturgeon					Native Fish			Non-native Fish[1]		Comment
No.	Fork Length (mm)	Girth (mm)	Condition at Release[2]	PIT TAG #	Species	Fork Length (mm)	Condition at Release	Species	Fork Length (mm)	

Comments:

[1] Largemouth bass, smallmouth bass, black crappie, brown catfish, carp, American shad
[2] 1=vigorous, no bleeding; 2=vigorous, bleeding; 3=lethargic, no bleeding; 4=lethargic, bleeding; 5=dead