American Eel Study in East River, Chester

Fall 2014

Danielle Pernette

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Summary

Fall 2014 marked the beginning of the first Coastal Action silver eel study on the East River, Chester (ER-C). The primary focus of the study was initially to conduct a mark and recapture study, but was later refocused to study biological characteristics of the run.

After examining potential trap sites, it was determined that a flume trap would be used upstream as a 'mark' site, and a fyke net would be used downstream as a 'recapture' site. Due to the size of the river the traps would only be fishing one particular section. The aim was not to capture all the eel, but rather a representative fraction of the eel. The idea was to mark eel at the upper site, and examine the ratio of recaptures and new eel at the lower site. As this was the projects first year, a number of logistical issues had to be worked out, as well as trap styles and locations had to be reconsidered several times. For this reason, trap styles, locations, and catches will be described in terms of upstream sites and downstream sites.

Background

Bluenose Coastal Action Foundation, in partnership with Fisheries and Oceans Canada (DFO) and the Scotia-Fundy Elver Advisory Committee, has been studying elver recruitment on the ER-C since 2008. The 2014 field season marked the highest elver recruitment since the study began, capturing 1, 733, 452 elver. In addition to studying elver recruitment in 2014, a survey of adult silver eel seaward migration was initiated.

Study Area

The East River, Chester drains into Mahone Bay, with its watershed located in the Municipality of the District of Chester. The watershed includes several lakes, marshes, and brooks and has a total drainage area of 134 km^2. The headwaters of the watershed are Connaught and Timber Lakes, which are also the largest bodies of water in the system. American eel are known to be the predominant species in the river system.

Materials, Locations, and Catches

Upstream

After examination of several areas of the river, the 'mark' site was determined to be about one kilometer up from the bridge on Highway 3. This section was chosen based on flow volume and practicality of setting a flume a trap. The area was just below a steep decline, where about half of the river is deflected into two flows that join back up with the main branch further down. Due to the size of the ER-C watershed, and therefore a predicted large eel population, this site would catch a reasonable fraction of eel migrating downstream.

A flume trap was designed and built for the site. The trap consisted of a funnel shaped plywood ramp with sides, and a polygon shaped holding box (Figures 1 and 2). The holding box was set in a couple feet of water below the drop, where the current (at the time) was not too forceful.

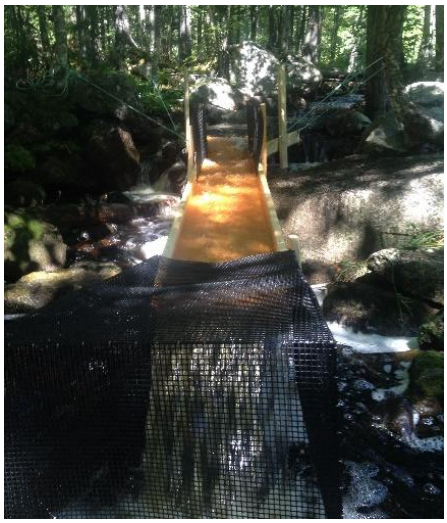

Figure 1: ER-C flume trap 2014 (upstream view).

Figure 2: ER-C flume trap 2014 (downstream view).

The flume trap was put in place September 6 and removed September 22, after being washed out by heavy rains. The trap was checked seven days a week, fishing eel out with a long handled fish net. Any eel captured were weighed, measured for length, vertical and horizontal eye diameter, head length, and pectoral fin length. Butterfly, or streamer tags, were placed about 2cm in at the base of the dorsal fin. Due to the toughness of the eel's skin, and fragile needle to insert the butterfly tag, a larger needle was used to first create a hole to then push the streamer tag through. Ovadine was used to clean eel skin before injecting the needle. A total of 141 eel were marked. In the case that the fin of the eel was torn upon inserting a tag, the eel was released with no tag.

Catches began low, and varied up until September 21 (daily catch range was 0-47 individuals). Overnight on September 21, heavy rains of more than 100mm resulted in a significant rise in water levels. The ER-C came up more than one meter, as measured at the Louisiana-Pacific pump house. As this was the first heavy rain of the season, many eel were signaled to migrate. Unfortunately, the flume trap was unprepared for such an event, and mortalities resulted due to overcrowding in the trap and turbulent waters. On September 22, an estimated 1452 eel were captured in the flume trap. No measurements were taken this day as the focus was to remove eel from the trap as quickly as possible. All eel appeared to be silver, and nearly 200 dead eel were collected and frozen to be sampled over the winter. The trap was removed immediately as it had been damaged by the turbulent waters.

Once water levels had dropped, a new site was determined about 300 meters below the flume trap, where the side channel branches back into the main channel. The site was a shallow man-made channel, historically used to generate power. The upstream fyke (Figure 3) was set on October 7,

missing about two weeks of fishing time between the flume being dismantled and the fyke net being set.

Figure 3: Upstream fyke net, East River, Chester 2014.

The fyke net was set to capture everything travelling down this small side channel. Catches peaked between October 17 and 18. As October 18 was expected to be the second peak of the run, staff stayed overnight on site watching the sites to ensure no mortality occurred. However, the second run was much smaller in size than the first, catching only 156 at the peak as opposed to 1452. Total catch throughout the duration in the upper fyke net was 346 eel. Total catch, including both upstream sites, was 1977 eel including 13 yellow eel.

Downstream

Initially, a slow water site was chosen as the recapture site, based on water depth, accessibility, and safety precautions. A square-framed fyke net was set from September 6 to October 9, perpendicular to the water flow, with the left leader stretching about one-third across the river and right leader at a 45

degree angle back towards the bank (Figures 4 and 5). An additional leader was added across the river to account for two-thirds the width of the river.

Figure 4: Slow-water fyke net, East River, Chester 2014.

Figure 5: Checking the slow-water fyke net and setting additional leader, East River, Chester September 18, 2014.

The location of the slow-water fyke net, although safe, was not ideal. Due to the deeper water in the middle of the channel, and the slow velocity of the water, many eel were thought to be getting past the net. Based on the low numbers being captured, two smaller fyke nets on loan from a fisherman were placed directly below the Highway 3 bridge to observe the number of eel getting past the other fyke net.

The two bridge fyke nets were set on September 20, and later removed (washed out) September 22. On September 21, the slow-water fyke caught only two fish, and the bridge fyke caught 34, confirming that a large number of eel were being missed. Although the aim was not to catch all the fish, but rather a fraction, the catch in the slow-water fyke was not catching as many as hoped.

When water levels increased overnight September 21 and into September 22, the bridge fyke nets had to be cut loose due to safety concerns. Unfortunately, there is no estimate of how many eel, let alone recaptures, were in the two nets that were let go.

The slow-water fyke was kept in place until October 9, at which date it was removed due to low to no catch. It was reset below the bridge in tidal waters on October 10, with an additional leader added as a wing to deflect eel in the current towards the net. This location was more effective in catching eel; however, on account of it being set in a tidal area, staff were only able to check the net during low tide. The tidal fyke net captured 268 eel total; including a few yellow eel as well as some very large eel. On several occasions eel were found to be scratched up, likely from the mink that is frequently seen in the area. Two eel were found dead with chew marks, once again thought to be mink related.

Table 1 and Figure 6 provide a summary of traps, dates active, and eel captured, as well as a visual of trap location on the East River, Chester system. Figures 7 and 8 show the sizes of eel captured, both upstream and downstream.

Table 1: Summary of trap catches on East River, Chester, September and October 2014. (*Note - Bridge fyke was full of eel on September 22; however, was impossible to check due to water levels and therefore not included in the total).

Site	Dates Active	Yellow	Silver	Total Catch	Total Upstream	Mortalities
Upstream Flume	Sept 6-22	5	1626	1631	1977	high
Upstream Fyke	Oct 7-28	8	338	346		none
Slow-water Fyke	Sept 6-Oct 9	10	165	175	**Total Downstream**	none
Bridge Fyke	Sept 20-22	5	29	34*	477	unknown
Tidal Fyke	Oct 10-27	19	249	268		2 (mink)

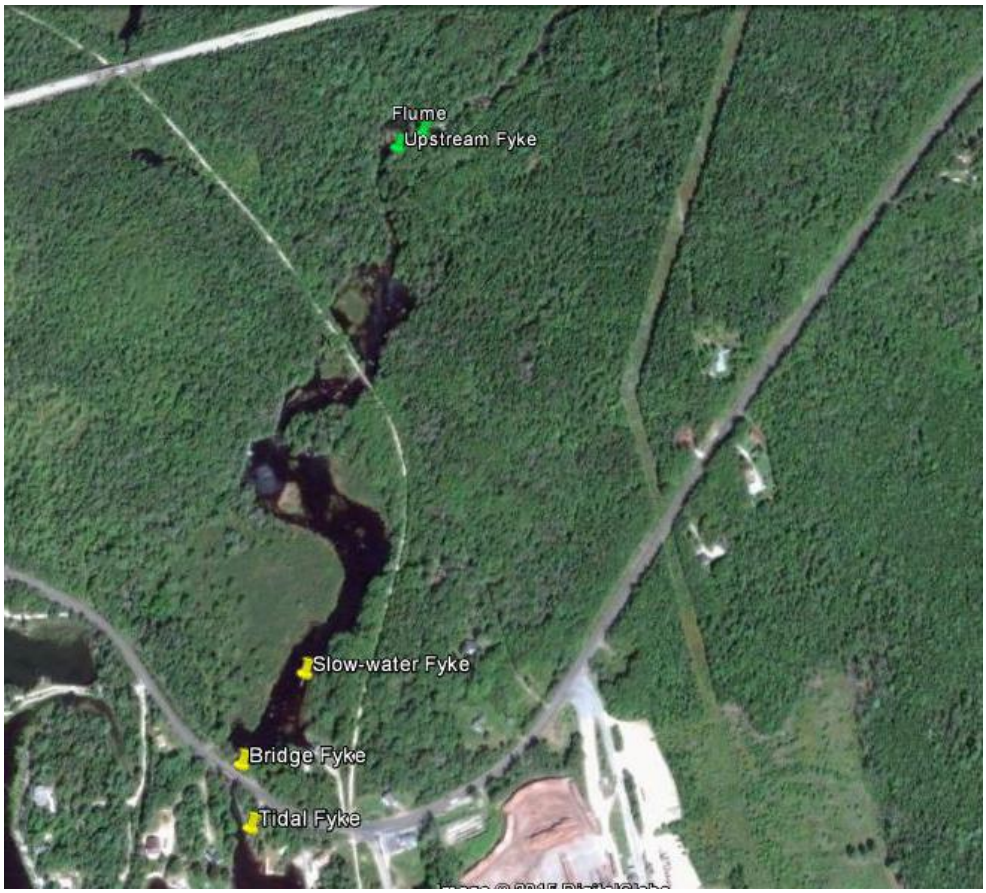

Figure 6: East River, Chester approximate upstream (green) and downstream (yellow) trap sites 2014. Highway 103 above, and East River Basin below.

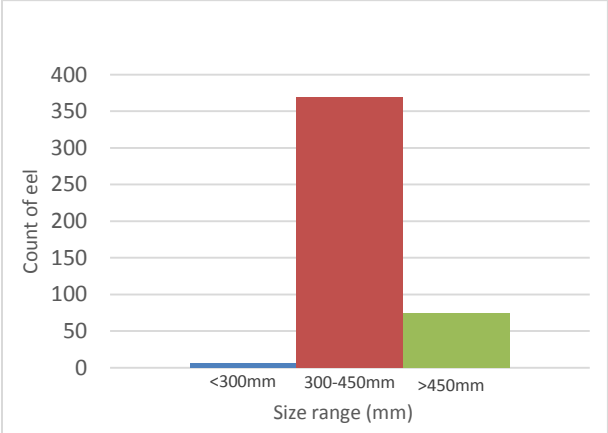

Figure 7: Silver eel size range, upstream, East River, Chester. (Note that not all eel were measured, therefore, some eel are not included in this chart).

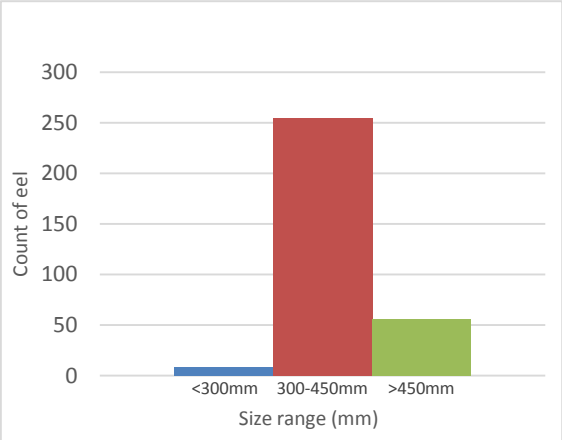

Figure 8: Silver eel size range, downstream, East River, Chester. (Note that not all eel were measured, therefore, some eel are not included in this chart).

Biological Sampling

In addition to monitoring eel numbers in the ER-C, and to make use of the mortalities that occurred on September 22, some of the eel were kept for biological sampling. There were 183 eel collected and frozen in water, in addition to 14 from Oakland Stream. Over the winter, the eel were thawed and a series of morphometric measurements were taken; such as length, weight, horizontal and vertical eye diameter, pectoral fin, and head length. Once cut open, eel were first photo documented and then gonads were extracted, weighed, and looked at under a microscope to determine gender. Otoliths were extracted from all eel and stored in vials. Swim bladders were also extracted and examined for presence or evidence of swim bladder parasite. There was no evidence of parasites in either ER-C or Oakland eel. The majority of the eel were male, as expected, as most of the eel were under 450mm in length. Several eel were undifferentiated between male or female. Only 10 of the eel samples from ER-C were female.

Habitat Surveys

Due to the severity of the winter season and amount of snow that the winter brought to Nova Scotia during January to March 2015, conducting the proposed habitat surveys in the field was not an option. Instead, habitat surveys were initiated over the winter using computer-based mapping tools.

Using data in Geographic Information Systems (GIS), a map was created of the ER-C watershed, showing all lakes and waterways. Roads were overlaid on the map so road-waterway crossings would be visible. Examining road crossings is considered very important for eel, as well as other fish species, to ensure they are able to access certain reaches of the watershed. Using information and a template similar to *A Guide to Surveying Culverts for Fish Passage* (Taylor, 2011) and *Broken Brooks* (CARP, 2011) culverts were given priority based on proximity to the main branch of the river, and potential habitat gained; i.e.,

potential barriers near the main branch will have the highest negative impact on aquatic connectivity and therefore fish migration and are considered high priority, whereas stream crossings near the headwaters of the system will provide less habitat gain and are therefore lower priority. At least six of the total road crossings sites have been identified as needing further assessment in the field. See map of crossings as shown in Figure 9 below.

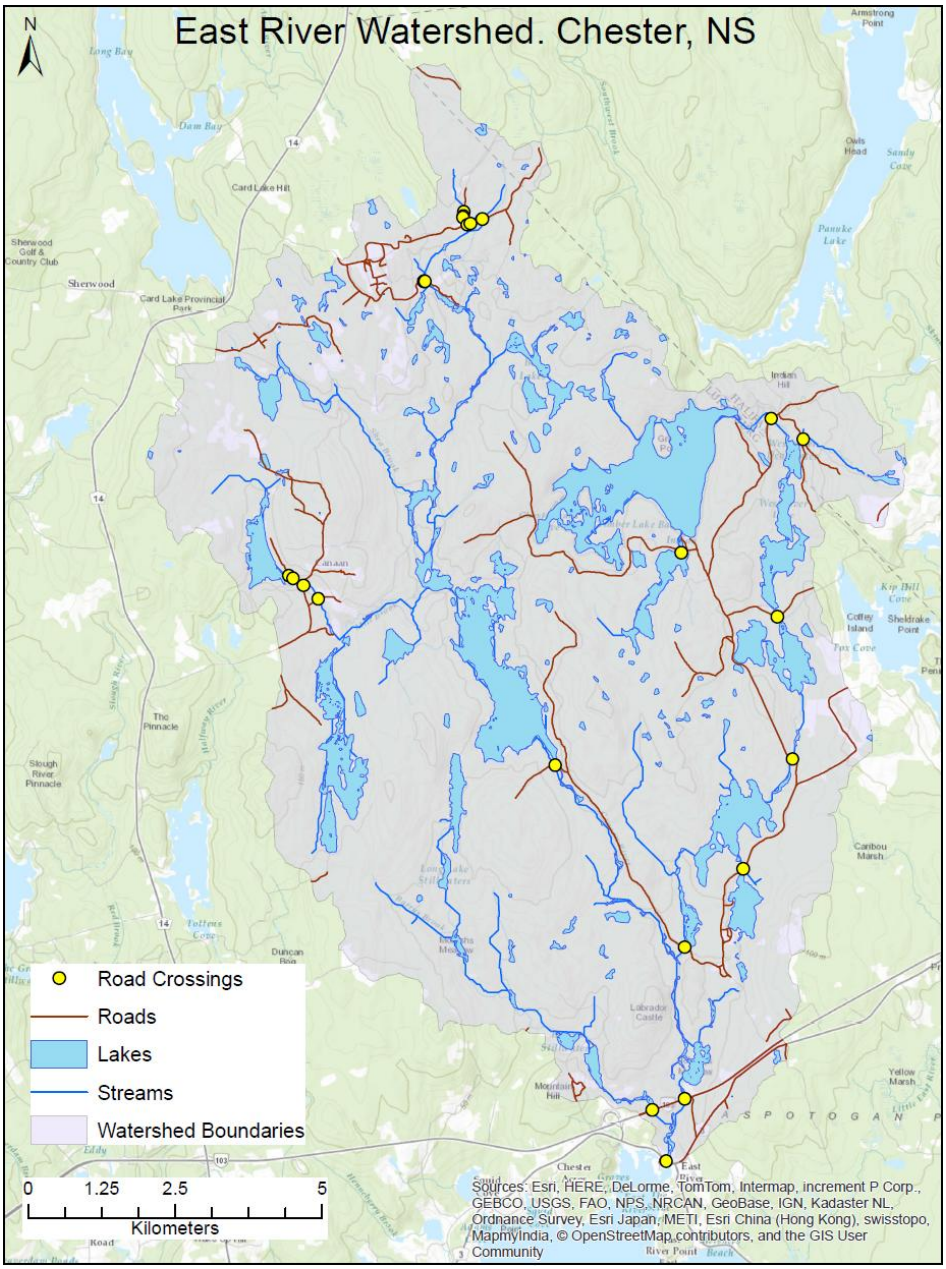

Figure 9: East River, Chester watershed area.

Industry Engagement & Public Education Efforts

The following communications / outreach activities took place as part of the project.

- Project information was drafted and posted on the newly designed and recently launched Bluenose Coastal Action Foundation website www.coastalaction.org. From November 2014 to March 2015, the Coastal Action website was visited 5970 times receiving a total of 248,476 hits.
- Project staff met with project partners from both DFO and Scotia-Fundy Elver Advisory Committee three times in total over the duration of the project; one meeting in the fall and two over the winter/spring months to discuss the project. Local resident, Earl Delong, was involved in data collection for the project and provided anecdotal traditional knowledge of the river and the area to project staff. Commercial elver fishers were involved in the set-up, construction and maintenance of field gear, and periodic checking of traps throughout the field season.
- Public events attended where project information was highlighted: NS Community College's Natural Resources and Environmental Technology Program class presentation, White Point Beach Resort March Break Programming Activities, NS Community College's Sustainability Expo, and Park View Education Centre's Knowledge Festival, and Coastal Action's Clean Water Symposium.
- A guided hike with the Municipality of the District of Chester's Parks and Recreation took place in early fall with about 12 people from the area participating. Coastal Action led the hike while informing attendees about the American eel and its lifecycle, as well as the importance of monitoring populations and protecting watersheds.
- Many people were involved in the project, including local residents, students, and commercial eel fishers. At least 15 local residents volunteered their time to learn and help with traps. Posters with information about Coastal Action and the lifecycle of the American eel were put up next to the traps to inform people passing through of the project taking place. At least two people were reached through the posters, as phone calls were received from citizens voicing concerns about gear washing away during the heavy rainfall events.

Problems / Recommendations

The fyke nets, although efficient in capturing eel, were more efficient in capturing leaves. This posed a difficult problem for staff, who spent 20-30 minutes cleaning leaves off daily, only to have them build up again in minutes causing a dam. A leaf catching net was attempted just above the fyke net to reduce the amount of leaves in the net; however, did not work well. One of the leaders of the upstream fyke had to be removed later in the season as it was causing too much of a dam. While leaf debris is unavoidable, other trap design possibilities should be considered.

If a flume trap was to be used again, the holding box would need to be placed in less turbulent waters and be manageable should water levels rise suddenly or unexpectedly.

Conclusion

Despite many obstacles that occurred throughout the 2014 field season on East River, Chester, valuable information was still collected. Measurements and biological information were taken from a large number of eel and trap locations as well as the feasibility of trap types was determined. The significant rainfall resulting in high eel mortality was an unfortunate event; however, it provided an opportunity to be better prepared for or avoid such an event in the future. The 2014 field season was very much a "learning" season and, while not going quite as planned, valuable lessons were learned and a large number of eel were captured.