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# American (Silver) Eel in East River, Chester

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Fall 2015

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## Summary

Fall 2015 marked the second year of the East River, Chester silver eel study. Similar to the first year of the study in 2014, the primary focus was to conduct a mark and recapture study. Secondly, a length stratified sample of the run was to be collected throughout the season.

After experiencing some problems in 2014, such as poor trap site locations and trap efficiencies, several sites were examined for potential new locations in 2015. Two tagging sites were chosen high within the East River, Chester watershed; one on each of the Canaan Branch and East Branch, at the outflow of Connaught and Officer Camp Lakes, respectively. An additional tagging site was chosen low in the East Branch of the watershed, at the outflow of Little Whitford Lake. A recapture net was placed in the same channel of the Main Branch as in 2014. The fall run of silver eel experienced a slow start, with the first large numbers of eel appearing on October 1. Over 1300 eel were captured within the East River, including 294 tagged and five recaptures. Due to the number of traps and long travel times between sites, data collected at each site had to be reduced during runs to ensure field staff had adequate time to check all traps. A total of 75 eel were sacrificed and collected for biological sampling purposes.

## Background

### Bluenose Coastal Action Foundation

Bluenose Coastal Action Foundation, in partnership with Fisheries and Oceans Canada (DFO) and the Scotia-Fundy Elver Advisory Committee, has been studying annual elver recruitment on the East River, Chester since 2008. In addition to studying elver recruitment, a survey of adult silver eel seaward migration was initiated on the East River, Chester in 2014. Coastal Action has been monitoring silver eel migration on Oakland Lake since 2009; however, 2014 was the first year to study silver eel migration on the East River. Both Oakland Lake and East River silver eel projects were continued in 2015.

### Study Area

East River, Chester (ER-C) drains into Mahone Bay, with its watershed located within the Municipality of the District of Chester. The watershed includes several lakes, marshes, and brooks and has a total drainage area of 134 km<sup>2</sup>. The headwaters of the watershed are Connaught and Timber Lakes, which are also the largest bodies of water in the system. The Canaan Branch is acidified. American eel are known to be the predominant species in the river system. The East River was historically used by the Bowater-Mersey Co. Ltd for driving logs and has had many dams and sluiceways removed over the years, although some structures and remnants still remain.

## Materials, Locations, and Catches

A total of three tagging locations were placed within the watershed; a rotary screw trap (RST) at the outflow of Connaught Lake, a trapnet at the outflow of Officer Camp Lake into Indian Run and Timber Lake, and a wire trap at the outflow of Little Whitford Lake. Data loggers were placed at both the Connaught and Officer Camp locations to record temperature.

A recapture net was installed in a small channel of the Main Branch of the river, below the confluences of the tagging sites. Due to the size of the ER-C watershed, and the predicted large eel population size, this site was assumed to be able to catch a reasonable fraction of the eel migrating downstream.

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The trap sites were mapped and the approximate distances between each trap site and the recapture site were estimated using ArcGIS (Graphic Information Systems) (Table 1, Figure 1).

*Table 1. Approximate distances between tagging sites and recapture site, as estimated using GIS.*

Tagging site	Approx. distance to recapture site
Connaught Lake	8.43 km
Little Whitford Lake	4.22 km
Officer Camp Lake	18.81 km



Figure 1. Map of East River, Chester watershed showing 2015 trap locations.

### Connaught Lake

A Rotary Screw Trap (RST) was operational in the outflow of Connaught Lake from September 1 until November 6. Due to low water levels at the beginning of the season, the RST only began fishing on September 30, when water levels were high enough to rotate the drum.

The RST (Figures 2 and 3) was assembled and installed by four Coastal Action staff and tied securely to the shore in such a way so it would catch most of the current flowing from Connaught Lake. A walking plank was placed from the shore to the working platform, so the trap could be accessed safely. A padlock was used on the holding tank to ensure no poaching of fish and signs were put up describing the project.

The holding box (Figure 4) was emptied with a dip net, and any fish other than eel that were caught were recorded in the field notes and released immediately. Any eel captured were marked with a streamer tag, each consisting of an individual number, making the eel identifiable (Figure 5). The streamer tags were placed in the base of the dorsal fin, about two centimetres from the front. A series of measurements such as length, eye diameter, as well as fin and head lengths were taken and recorded. Due to time restraints only some of the eel were tagged, leaving the rest to be counted and released. Length, being the most important measurement this season, was taken on as many eel as possible. A temperature logger was suspended off the side of the RST to continuously monitor water temperature throughout the field season.



Figure 2. RST at the outflow of Connaught Lake (view from back).



Figure 3. RST at the outflow of Connaught Lake (view from front).



Figure 4. RST holding box with eel visible.



Figure 5. Streamer tag inserted into the base of the dorsal fin.

## Little Whitford

A wire trap was placed in the outflow of Little Whitford Lake on September 3, and removed on November 4. The wire trap (Figure 6) consisted of a large rectangular frame with a ramp and extended funnel to catch and retain eel in the holding area. The funnel was 6" x 6", and extended into the holding area, to make it harder for eel to find their way out. In addition, a sock was added to the funnel to decrease the chances of eel escaping. The stream had a slow flow, even during significant rainfall events. A wing was installed on either side of the funnel in an attempt to capture more eel. A dip net was used to fish eel from the trap, and daily efforts were made to clear any debris build up from the entrance.

American eel captured at this location underwent similar procedures as at the other marking sites. Depending on allowable time at this site, eel were tagged and measured for length, eye diameter, as well as head and fin lengths.



Figure 6. Wire trap at outflow of Little Whitford Lake.

#### Officer Camp

A trapnet was placed in the outflow of Officer Camp Lake into Indian Run and Timber Lake on September 3, and set to fish on September 8. The trapnet (Figure 7) consisted of two small wings, an apron to keep fish from swimming under, and an adjustable entrance to which a cloth funnel was later added. Ropes were used to create a pulley system, allowing the net to be lifted and lowered, essentially allowing fish to be pushed into one area of the net for emptying. Small rebar (5/8") and 2"x2" boards were used to hold the trap in place. Due to low catches, an additional wire trap (Figure 8) identical to the Little Whitford trap, was placed directly below the bridge (in front of the trapnet) on October 8, to ensure the trapnet was not missing fish. Wings were added and any gaps were filled with rock and moss. Both traps remained in place until November 4. A temperature logger was also suspended from the trapnet to monitor temperature throughout the season.



*Figure 7. Trapnet at Officer Camp Lake outflow.*



*Figure 8. Wire trap installed in front of trapnet at Officer Camp Lake outflow. Trapnet visible behind.*

### Main Branch Recapture

The recapture trapnet was set up in the same location as in 2014, in a side branch of the main river below the confluence of the East and Canaan Branches. The trap was in place from September 2 to November 9, but only fished until October 31. The recapture trapnet was a larger version of the trapnet at Officer Camp, with an L-shaped holding area allowing a larger number of eel to be held safely in less turbulent water out of the main flow. The wings were long, stretching to either side of the channel, and the opening to the holding area was tied to an approximate 5" width opening. The trap was held in place with 1" rebar and 2"X2" boards. To make it easier to fish and set the trap, durable rope was used to create a pulley system, allowing the bottom of the net to be lifted and lowered (Figures 9 and 10).

American eel captured at this location were examined for tag presence, or evidence of having had a tag (such as a hole in the base of the dorsal fin), as well as measured for length, eye diameter, and head and fin lengths.



*Figure 9. Trapnet at recapture site in the Main Branch. Note that trap is pulled up and not fishing.*



Figure 10. Trapnet at recapture site in the Main Branch. Note that trap is set and fishing.

#### Biological Sampling

A length stratified sample was to be sacrificed; collecting three eel per each one centimetre interval between 20 cm and 100 cm. The eels collected were euthanized on ice, and frozen in water until early February, when they were thawed for sampling. In addition to the fresh length taken before the eel were sacrificed, once thawed, length was taken once again along with weight, eye diameter, and head and fin lengths. Gonads were extracted and weighed, and each eel was sexed as male, female, or undifferentiated if gonads were underdeveloped. Otoliths were collected and stored in vials with a corresponding identifying number and swim bladders were examined for parasite presence.

## Outcomes & Discussion

Due to the extent of activities and distance between locations of activities, the 2015 field season activities have been summarized in Table 2.

*Table 2. Summary of trap locations and activities in the East River, Chester watershed, 2015.*

Trap Location	CR	MR	RcMR	RcR	SR	RcSc	SSc	Grand Total
Connaught	17	212	3	5	6		6	249
Little Whitford	32	63			4			99
Officer Camp		16						16
Recapture	579			2	337	3	66	987
<b>Grand Total</b>	<b>628</b>	<b>291</b>	<b>3</b>	<b>7</b>	<b>347</b>	<b>3</b>	<b>72</b>	<b>1351</b>

### Key:

**CR** = Count and Release

**SR** = Sample and Release

**MR** = Mark and Release

**RcSc** = Recapture, Sacrifice

**RcMR** = Recapture, Mark, and Release

**SSc** = Sample, Sacrifice

**RcR** = Recapture and Release

### Connaught

Aside from the recapture net, Connaught caught and tagged the most eel. It was noted after the first run that upon raising the drum to push fish back into the holding tank, a gap was created where fish would escape. Following that realization, fish were scooped out with a dip net. However, during the first run, it is estimated that half of the eel escaped, thus reducing the number of eel counted. The largest eel recorded was also captured at Connaught, measuring 980 mm in length (Figure 11). On several occasions, eel that were captured and tagged a day or two before, were recaptured, and were then either released or marked again, if the tag fell out, and then released indicating that they remained in the area for a bit before continuing their migration. As expected, most of the eel captured were silver, with seven yellow eel caught, most of which were in the 200-300 mm length range.

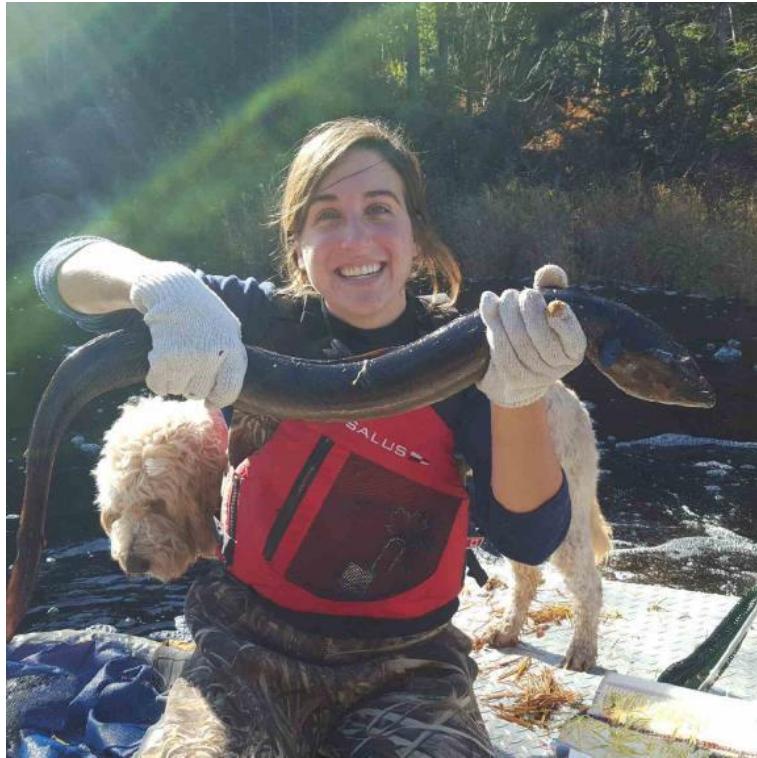


Figure 11. American eel caught and tagged at the Connaught Lake outflow measuring 980 mm in length.

#### Little Whitford

Little Whitford caught a fairly large number of eel after the first rainfall, but quickly tapered off and caught very few throughout the remainder of the season. A total of 63 eel were tagged at this location, out of a total 99 captures. All of the eel captured were silver, with the exception of one yellow eel.

#### Officer Camp

Officer Camp caught the fewest eel of all the traps during the season. A total of 16 eel were captured, 3 of them being yellow. All of the eel caught here, including the yellow eel, were tagged and released; however, none were recaptured in any trap. The trapnet did, however, capture a number of decent sized brook trout (~15 cm) and shiners. Muskrat proved to be a problem on two occasions, as it is suspected that holes found in the net were chewed by muskrat. Only three eel (two yellow and one silver) were caught after the wire trap was put in place, along with the occasional killifish and white sucker.

There is an old flow control structure (Figures 12 and 13) blocking passage into Timber Lake and onto Officer Camp Lake, as many white suckers and brook trout were observed on multiple occasions pooled at the base of the structure. Although eels have superior ability to bypass such structures, it could potentially lower the number of eel getting into the upper reaches of the watershed. In addition, fish density may decrease with distance upstream, so seemingly there may be less eel in the headwaters of the watershed, which consequently would result in catching lower numbers at the headwaters. These reasons could possibly contribute to the low catch of eel at Officer Camp, but it is difficult to make any

assumptions, given that upon speaking with locals there is known to be both numerous and large eel in both Timber and Officer Camp Lakes.



*Figure 12. Flow control structure at the outflow of Timber Lake. View from below.*



*Figure 13. Flow control structure at the outflow of Timber Lake (view from above).*

## Recapture

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The recapture site caught a total of 987 eel, with only five recaptures. One of the recaptures was identified as being from Little Whitford, tagged nine days before. Another recaptured eel was tagged at Connaught only two days before. The other three recaptures did not retain their tags; however, the hole from the tag was evident. Unfortunately, their origin is unknown. Of all 987 eel captured in the recapture net, four were yellow.

The largest number of eel to come through was overnight on October 1, when 652 eel were caught. The net safely held all of the eel, with no mortalities. However, due to the large number of eel, not only in the recapture net, but in the other traps as well, most of these eel had to be counted and released. It was noted that most of the eel in this run would be classified as males, based on size.

During at least two visits to the recapture net, several eel were observed swimming upstream and out of the trap opening. It is likely that a number of eel were lost this way; however, exact numbers of lost eel remain unknown.

Towards the end of the season, leaves quickly became a problem; more so in the recapture net than the other traps. The fast current, along with heavy rains and cool temperatures, made it impossible for staff to keep up with clearing the net. This resulted in the destruction of the frame from the water pressure and overflow of water along with the eels. On one occasion the net was cleared and reset, only to be overflowing again within an hour. An attempt was made to create a leaf catcher upstream above the trapnet, which although was successful in capturing many leaves, did not alleviate the leaf build up in the trapnet. As a result, unfortunately no eel were recorded during what was likely the last run of the season.

## Biological Sampling

A total of 75 eel were collected and sacrificed from East River, Chester. Due to difficulties collecting length stratified samples for each size category, any eel caught towards the end of the season were collected regardless of the size. Six of these eel were collected from the RST at Connaught, while the others from the recapture site in the Main Branch.

More than half of the sacrificed eel were female; 44 were female, while the other 31 were male. None of the eel were found to be undifferentiated, expectedly so as they were all silver eel migrating to spawning grounds, and therefore had very developed gonads. Figures 14 and 15 show female and male gonads from eels caught at ER-C.



Figure 14. Female American eel, gonads visible "frilled" appearance.



Figure 15. Male American eel, gonads visible "beaded" appearance.

The exotic swim bladder parasite, *Anguillicoloides crassus*, was found in seven of the sacrificed eel. All but one of the eel were female. Four of the infected eel were collected from the Canaan Branch, while the other three were collected from the recapture net but were not tagged so origins could not be determined. The most parasites found in one eel were at least 10 or more. In another eel, nine parasites were counted (Figure 16). The remaining eels contained less than five parasites. To the best of our knowledge, this is the first time the presence of *A. crassus* has been identified in this river, although it is known to be present in other watersheds throughout the province.



Figure 16. Swim bladder parasite (*A. crassus*) found inside one swim bladder of an eel from East River, Chester.

## Recommendations

When significant rainfall events occurred in 2014, upwards of 100 ml per event, this led to high mortality of eel. Although it was a catastrophic event at the time, it provided knowledge and preparedness for the 2015 season. Weather forecasts were monitored carefully, and on several occasions when heavy rainfall was expected, extra help was called in to ensure all traps could be emptied to prevent eel mortalities. Typically, this involved checking the traps before 11:00 PM (AST), where two teams of two visited each trap. Occasionally, the extra help and night checks were not necessary; however, being prepared nonetheless resulted in zero mortalities in 2015. It was recommended for future field seasons, that keeping a watchful eye on the weather and having extra help on standby, whether or not it is needed, would be essential to the project's success.

During several visits to the recapture net, eel were observed swimming upstream and out of the net. It is unknown how many eel escaped this way. A cloth funnel, or something similar, is recommended to be added next year, to aid in retaining eel in the net and preventing them from finding their way out.

Time restrictions were one of the season's biggest problems; as a team of two to check five traps (four at ER-C, and one at Oakland) left little time to handle and sample the eels, especially in the event of a run. Having fewer traps next season, and a larger holding area at Oakland, will allow staff ample time to handle and sample the captured eel. In addition, during times when a heavy eel run is expected, additional people will be on call in the event that help is needed.

Streamer tags, although cheap and supposedly efficient, were found to be highly ineffective with eel. In other fish, the tag is attached to a needle and is simply pushed through the skin of the fish and released. However, the tough skin of the eel prevented this from being a simple task. A stronger needle, one for sewing sails, was used to first create a hole in the eel's skin to allow for the weaker needle attached to the tag to go through. This worked fairly well; however, would occasionally result in tearing the eel's dorsal fin, in which case it was released with no tag. Additionally, the larger diameter of the sail needle permitted the streamer tag to slip through, resulting in several recaptures with no tag, just a hole. Alternative tagging methods were discussed, and although more expensive, PIT tags were chosen for next season as they are easy to implant in eel with a high retention rate.

Several ideas were discussed to deal with the buildup of leaves in the net including: setting the traps at night so they catch less leaves; installing a leaf catcher net(s) above the main net; changing the trap type; or moving the recapture trap location. No decisions were made, but will need to be further investigated.

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## Industry Engagement & Public Education / Outreach Efforts

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

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- Project information was drafted and posted on the newly designed and recently launched Coastal Action website [www.coastalaction.org](http://www.coastalaction.org). The new website was launched in June 2015, and has since received 8,710 visitors and over 34,000 visits. The American eel page has itself had 987 visits so far.
- Project staff met with project partners from both DFO and Scotia-Fundy Elver Advisory Committee twice over the duration of the project. Commercial elver fishers were involved in the set-up, construction and maintenance of field gear, and periodic checking of traps throughout the field season. In addition, commercial elver fishers provided extra hands when help was needed checking traps.
- A number of public events were attended where project information was highlighted including: World Oceans Day presentation at the Fisheries Museum of the Atlantic in partnership with Senator Wilfred Moore and the Sargasso Sea Commission; the American eel symposium *Future Directions for Science, Law, and Policy* in Portland, Maine; Fort Point Museum American eel presentation; Bayview Coomunity School's Camp Mushamush; Chester Race Week; Bridgewater Growing Green Festival; YMCA Healthy Kids Day; Michelin Health and Safety Fair; and the Bridgewater Children's Fair.
- Many people were involved in the project including local residents, students, and commercial eel fishers. At least 10 local residents volunteered their time to help with traps and learn about the American eel. 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.
- Social media posts about the project's field work reached a large number of people. The Bluenose Coastal Action Foundation Facebook page received well over 100,000 reaches and at least two people contacted Coastal Action about the swim bladder parasites found.

## Conclusion

Working in a watershed the size of East River, Chester, is expected to be challenging when heavy rains increase the water levels significantly, bringing thousands of eel down river. Important lessons were learned in 2014, making for a more successful 2015 silver eel season. No major challenges were encountered, no mortalities occurred, and lots of data was collected. The biggest issue was time restrictions, mainly during large runs, with two staff to check five traps. However, keeping a close eye on the forecast and having extra hands nearby to help, alleviated extra pressure on the field staff. Overall, the season was successful and very busy.