Assessment of the 2011 Gold River

Atlantic salmon smolt migration

Photo: Sarah Crnec

Bluenose Coastal Action Foundation

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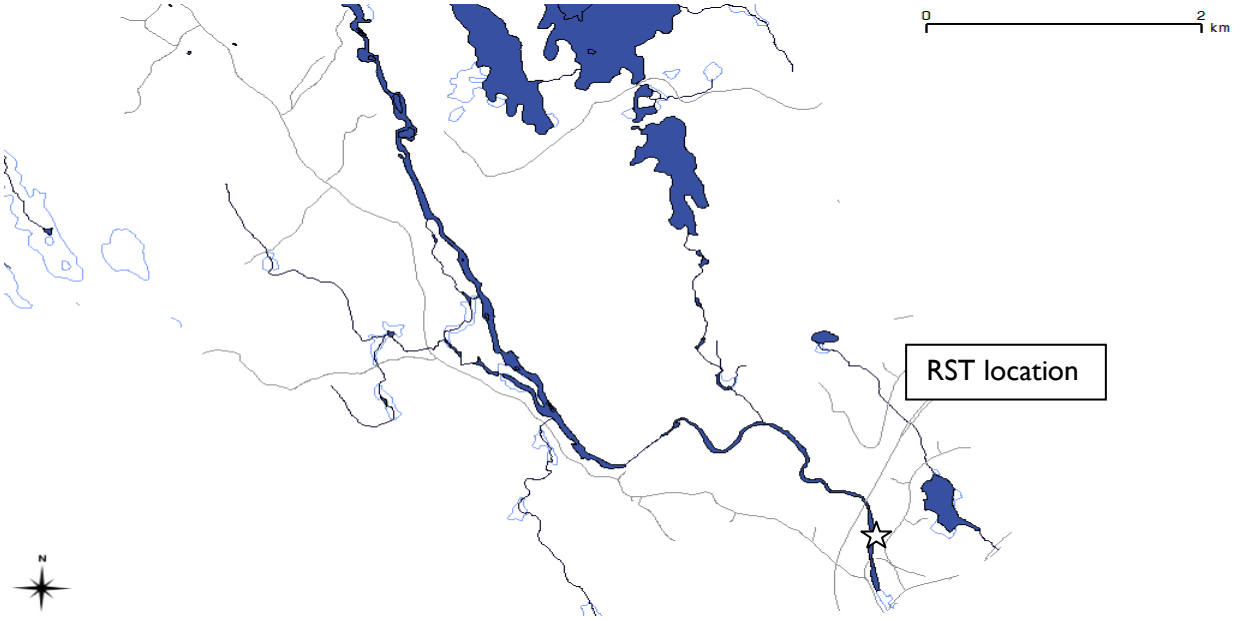
Introduction

The Gold River was once a productive salmon river on the south shore of Nova Scotia; however, it has been greatly affected by acid rain precipitation since the 1950's. The Gold River watershed is the second largest watershed in Lunenburg County (370 km^2). The headwaters are located around the Gold River Lake in the northern part of the county. The river flows for 40 km, through the community of New Ross flowing south, before empting into Mahone Bay.

The river historically supported a healthy population of Atlantic salmon, but due to the negative impacts of acid rain and habitat degradation, salmon numbers have been on the decline. Since the 1990's, the salmon population has dramatically declined to a level that in 1998 the river was closed to recreational salmon fishing.

Several projects have been conducted by the Bluenose Coastal Action Foundation (BCAF) over the last three years supported by generous funding from the Donner Canadian Foundation, NSLC Adopt-A-Stream Program, and Environment Canada's Atlantic Ecosystem Initiative. In an attempt to improve the productivity of the Gold River, BCAF and its partners intend to implement a terrestrial liming project in the Gold River headwaters. This project is slated for the Fall 2011. The 2011 Gold River Smolt Wheel Project was conceived as an opportunity to obtain baseline data regarding the population status of Atlantic salmon smolts in this watershed before the commencement of any liming projects.

Site Selection



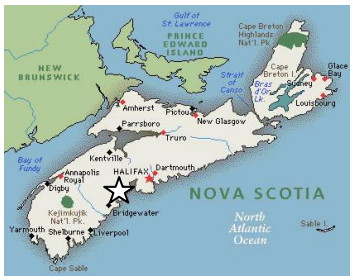


Figure 1. Rotary Screw Trap (RST) location directly underneath "Old Railway Bridge".

Initially several sites were considered to determine their suitability for the project. These sites were assessed for: ease of access, likelihood of vandalism, landowner support, suitable water depth and flow rate, and distance from the estuary.

Methodology

A 5 foot diameter Rotary Screw Trap (RST) was purchased from E.G. Solutions (Oregon) in September 2009. All approvals to place the RST in the Gold River were finally received by BCAF by the end of March 2011. The RST was installed over a two day period and began actively fishing the Gold River on the April 27th, 2011. The site selected for the RST deployment was directly below the old railway bridge approximately 300 meters from the Gold River Estuary.

Daily Monitoring

Every morning, BCAF staff checked the live holding box and measured the following parameters: water depth, temperature, and wheel Revolutions Per Minute (RPM). All fish captured over the previous 24 hours were removed and taken to the sampling area, where they were identified and counted; any new captures were marked and taken 200 meters upstream and released into the river. All previously marked fish, and non-target species fish, were released downstream from the RST. The trap was checked every day between April 28th and May 21st, except for periods of high water on the river May 10th -11th and May 17th-18th.

The smolts were marked with an anal fin clip (Figure 2). The clipped tissue was then preserved in alcohol for possible future DNA analysis.

Figure 2. Example of an anal fin clip used for the mark-recapture study. Photo: Sarah Crnec.

Results

A total of 325 salmon smolt were captured in the RST; of these, 241 were marked and released 200 meters upstream from the trap. A total of 29 were recaptured, thus allowing for a determination of trap efficiency and a total smolt population estimate. Of the 325 smolt, 84 fish (25.8%) were caught on May 7th, 2011 and over 90% were caught before May 9th, 2011. Furthermore, a total of 196 non-target fish species were caught: 184 American Eel, 6 Brook Trout, 4 Gaspereau, and 2 Salmon parr.

Smolt Length

Of the smolts captured, 296 were measured for fork length. The mean fork length was 173 mm. The smallest smolt was 142 mm and the largest was 235 mm.

Salmon Smolt Yield Estimate

The statistical design adopted for this study was that of simple stratified design, implementing a Chapman-modified Petersen (Ricker 1975, Carlson et al. 1998, Volkhardt et al. 2007).

The 2011 estimate of smolts for the Gold River is 2544 with a 95% confidence interval (1632, 3456).

The flood that occurred during May 10-11th, 2011 marked an obvious break-point to stratify the data into two time periods (prior and post flood); however, a lack of recaptures (n=0) post flood did not facilitate an estimate for this period.

The data were thus stratified based on a) the entire time frame minus the 2 days of flood (i.e., the sum of all data on either side of the flood) and b) the 2 day flood period.

Using the smolt mark recapture data, information can be arranged so that;

h = Stratum index
L = Number of strata
Uh = Smolt population estimate for strata h
Mh = Number of smolts marked and released in strata h
mh = Number of marked smolts recaptured in strata h
uh = Number of unmarked smolts captured in strata h
N = Smolt estimate for entire study period
These variables are then plugged into the following equations;

Equation 1 - Single strata estimator

$$Uh=Nh-Mh=\underline{Uh(Mh+1)}/mh+1$$

Discussion

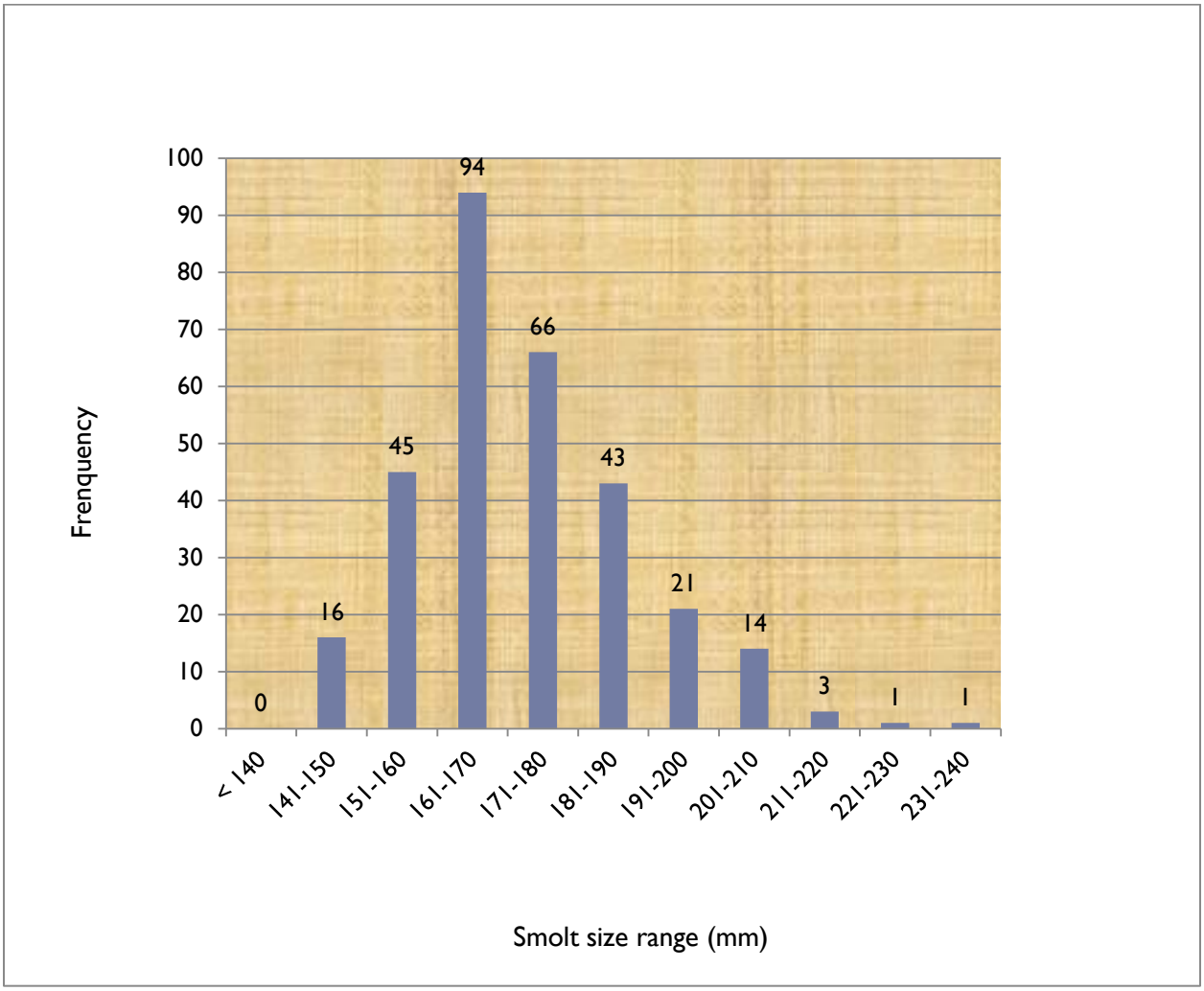
Given the difficulties involved with the application process to allow for the installation of the smolt wheel on the Gold River, BCAF was extremely pleased with the field work phase of this project. The weather was inclement most days; however, field staff were fortunate that rainfall amounts remained low. Under different circumstances, this location could prove significantly more hazardous in future years during high rainfall events. The smolt wheel operated as expected throughout the duration of the project and experienced no mechanical problems, although for future use, it is recommended to ensure that the drum cleaning mechanism functions throughout the project. BCAF field staff were pleased with the mark recapture study and obtained a significant amount of recaptures to produce a wheel efficiency and a total smolt estimate. The wheel was situated in the only deep channel in this section of the river and fished extremely well, especially in water levels >0.65m (see Appendix Graph 3). During higher flows, the wheel's catch rate would probably improve if it was relocated 30m upstream, as the deeper channel is more defined in this area.

References

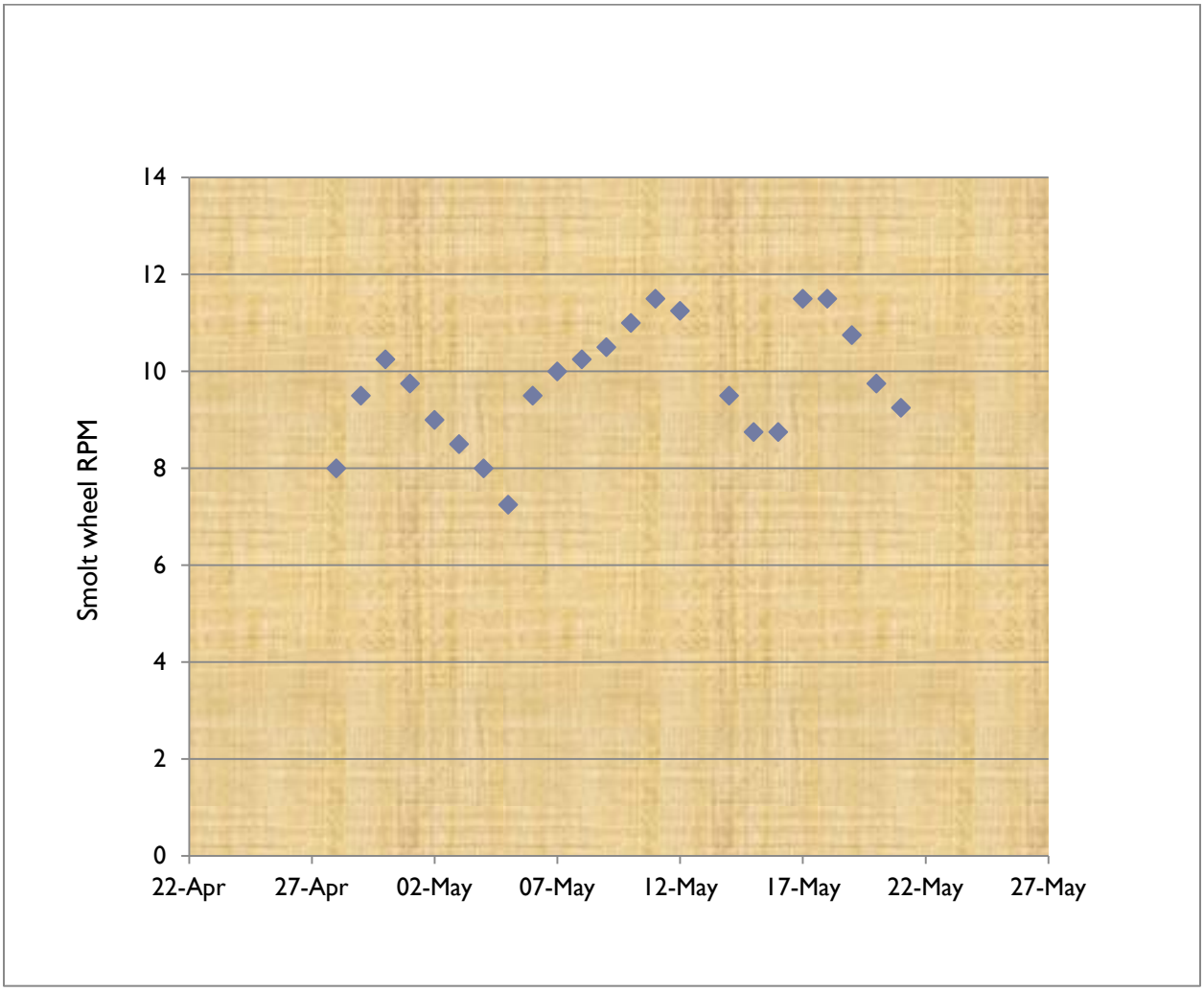
Halfyard, E.A. and J.P. Hastey. 2008. Assessment of the 2008 West River, Sheet Harbour Atlantic salmon smolt migration. Report of the Nova Scotia Salmon Association. P.O. Box 396, Chester, Nova Scotia, B0J 1J0.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Brd. Can. 191: 382 p.

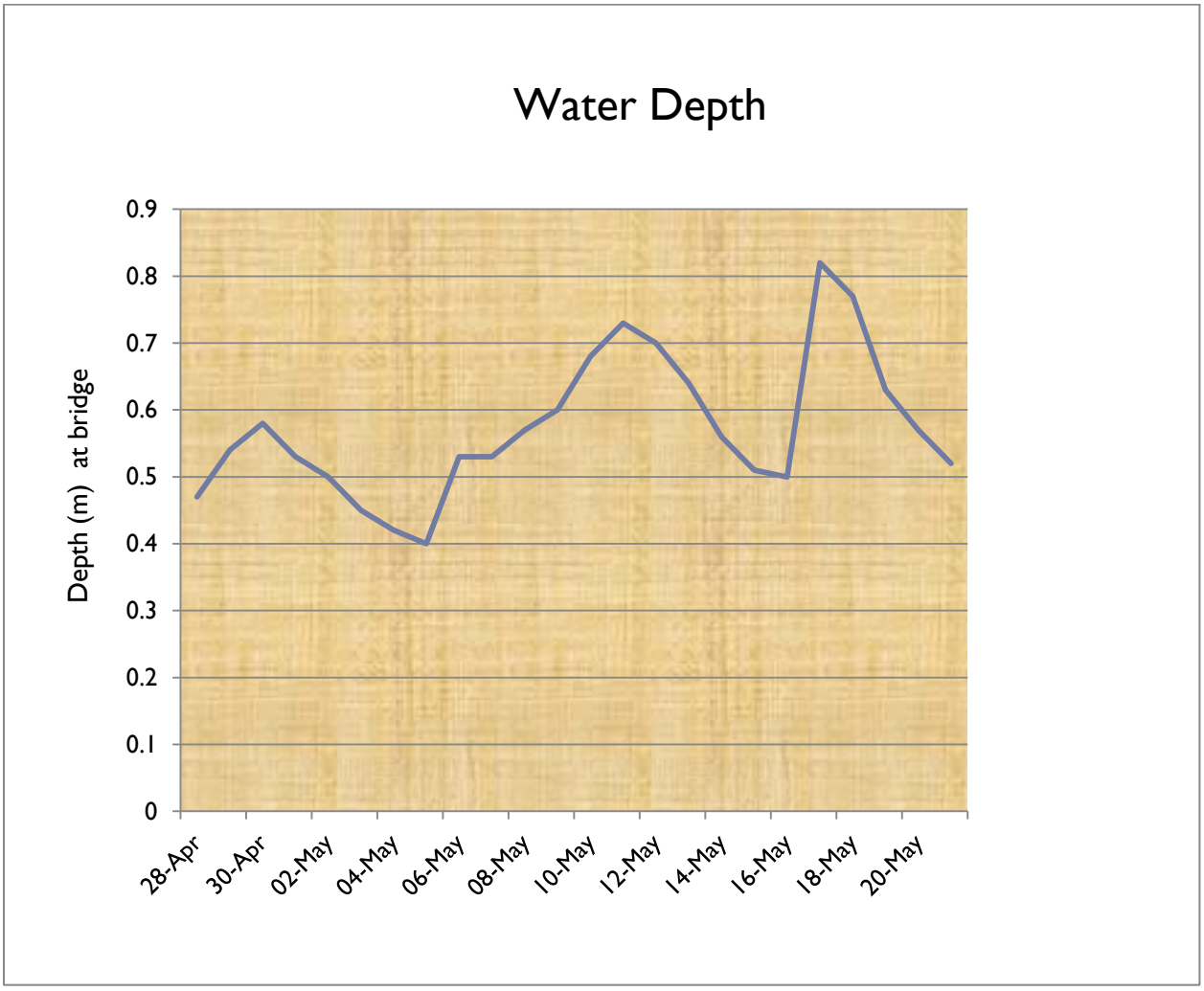
Appendix



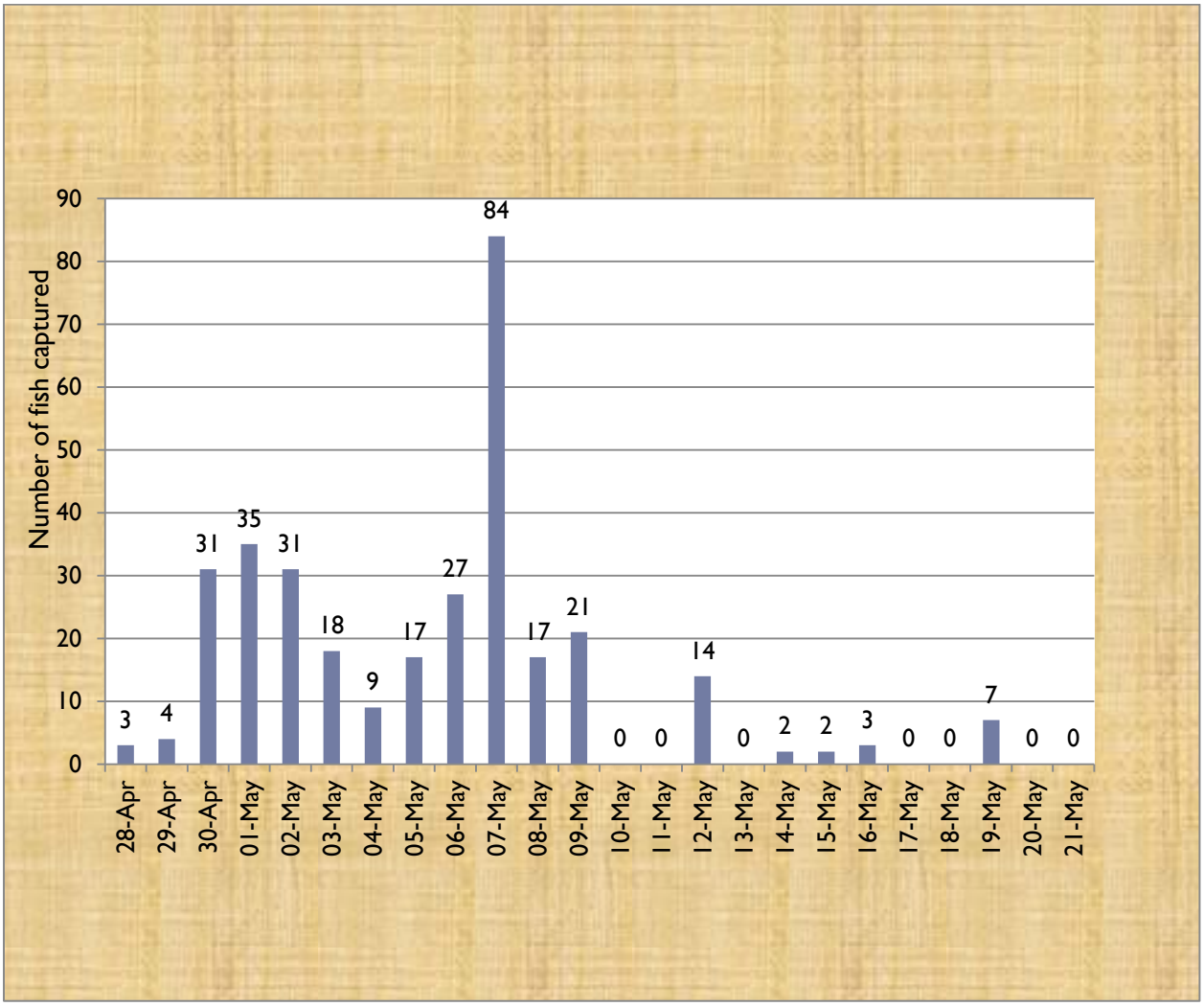
Graph 1. Fork Length Histogram.



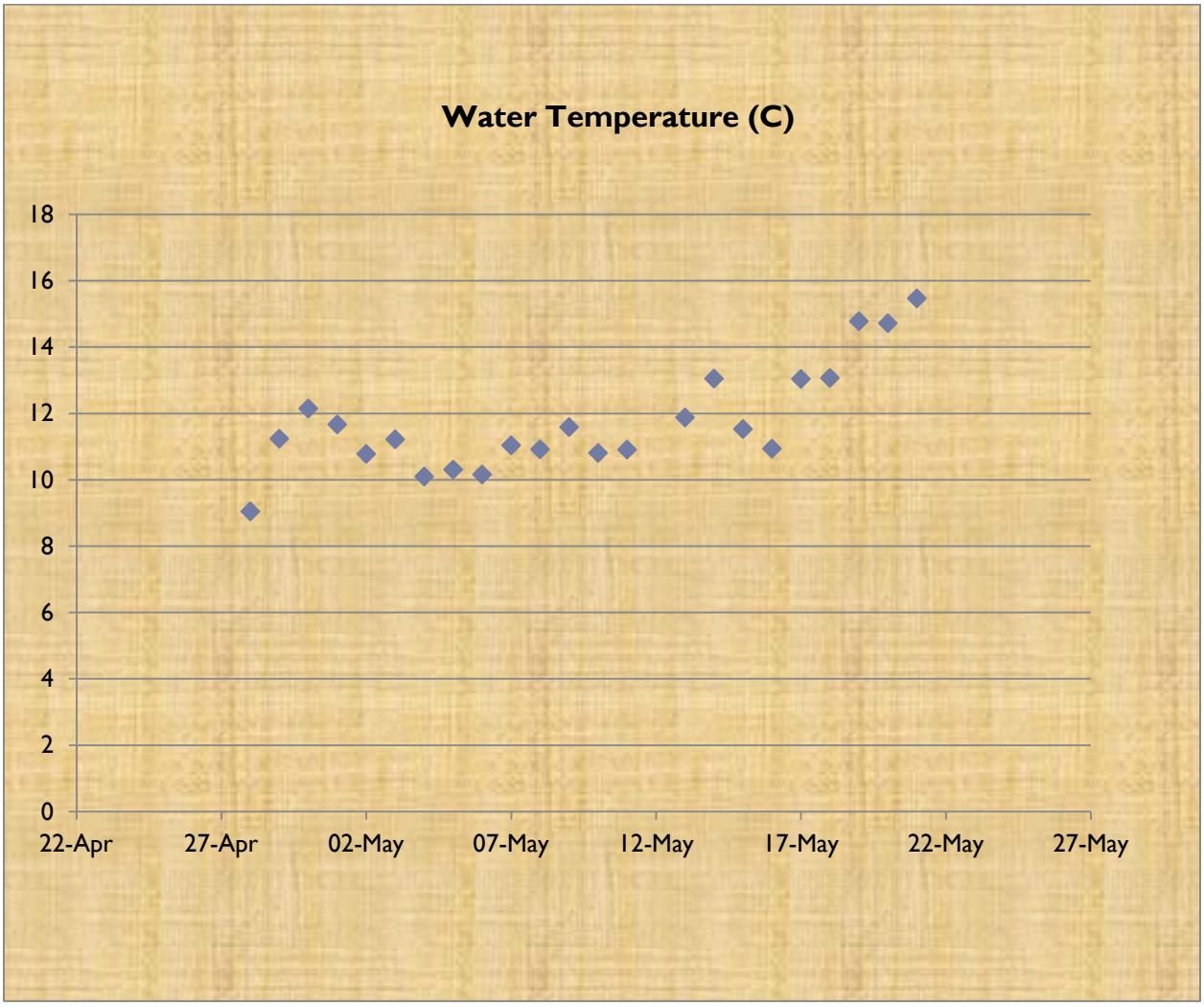
Graph 2. This graph shows the revolutions per minute of the smolt wheel.



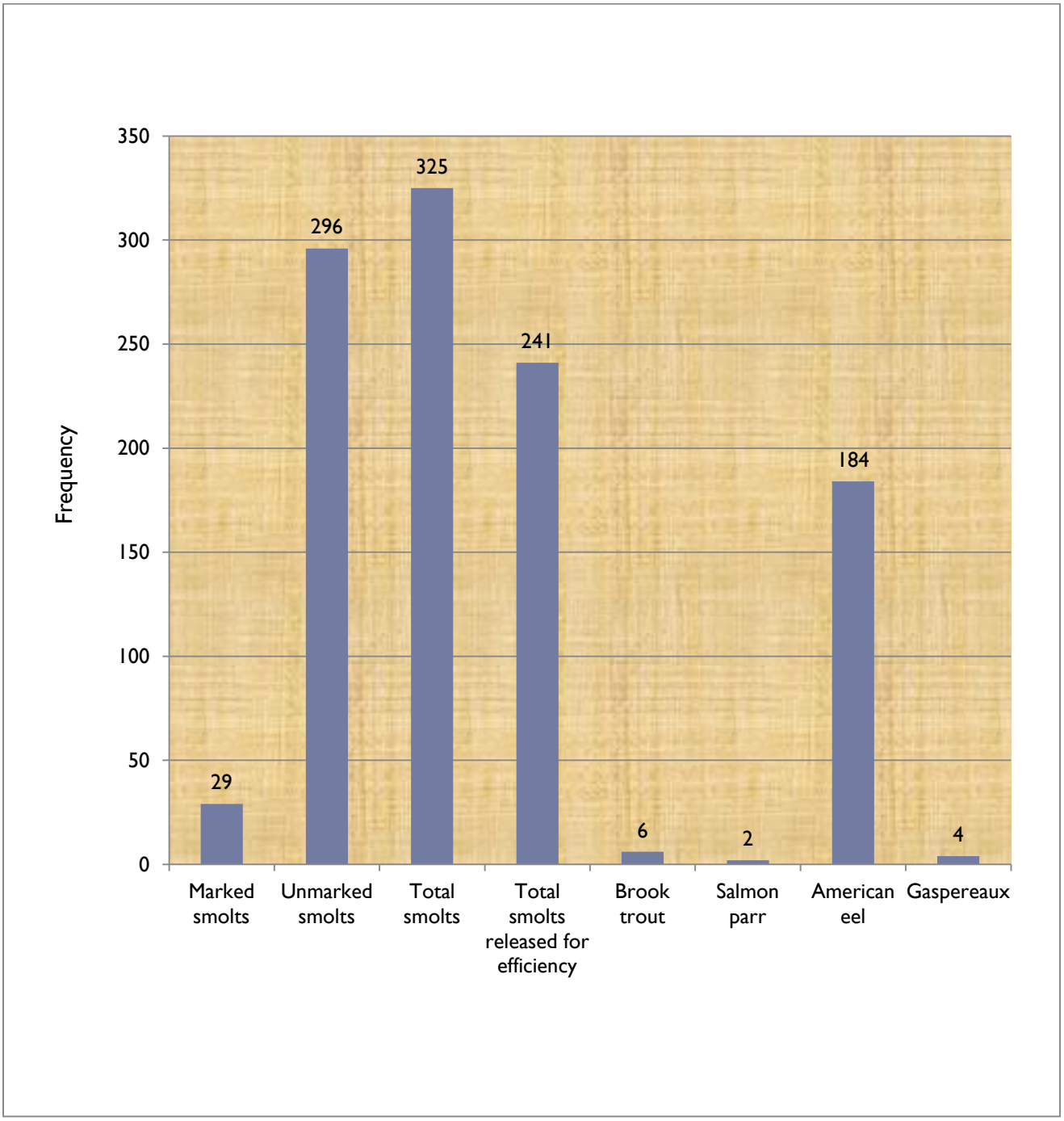
Graph 3. Water level was measured at the same site on each day. The smolt wheel was deemed inaccessible when the water level was greater than 0.7m at the datum site.



Graph 4. Smolt catch (#) each day.



Graph 5. Water Temperature (°C).



Graph 6. Total Captures (All Fish).

Figure 3. BCAF field staff (from left to right) Andrew Breen (foreground), Ian Manning, and Sarah Crnec.

Figure 4. Upstream warning sign. This instructs all kayakers or canoeists to exit the river immediately.

Figure 5. Volunteer, Tim Hiltz, and BCAF staff, Erika Cross, observe Andrew Breen and Ian Manning checking the smolt wheel's holding tank.