

Efficacy of fish passage over the Brunswick-Topsham hydroelectric dam by American shad (*Alosa sapidissima*)

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The Brunswick-Topsham hydroelectric dam has obstructed passage of anadromous fish species migrating upriver to preferred spawning habitat in the Androscoggin River since the early 19th century. The American shad is a key anadromous fish species that historically migrated as far as Lewiston, Maine to spawn each year. However, dam construction, overfishing, and water pollution decimated the shad population along with several other anadromous fish species over the last three centuries. Shad are an important component of Maine's river ecosystems. Their young-of-year consume and export excess nutrients out of the riverine ecosystem and after migrating out to sea, they serve as a prey base for several piscivorous fish species in the Gulf of Maine.

In 1982, a volitional fish ladder was constructed at Brunswick-Topsham to facilitate fish passage at the dam. However, the fish ladder has not been effective for American shad. To quantify shad attempting to migrate upriver at Brunswick-Topsham, I used an ARIS Sonar instrument to count fish moving past a point below the bridge connecting Brunswick and Topsham on the Brunswick side of the river. This acoustic technology provides video-like recordings of fishing passing through an approximately 8 x 20-m footprint (Figure 1). Over six sample days lasting 5-6 hours each, I recorded an average of 3495 migrating shad between June 21 and July 18 moving upriver past the sonar footprint. The peak of the migration was on July 10 in which 4791 shad were observed. At the top of the fish ladder, an employee of the Department of Marine Resources or a volunteer counts the number of fish that successfully make it to the top of the ladder. Only a single shad made it to the top of the ladder indicating that there are many more shad attempting to scale the ladder than actually succeed. Although I was able to get clear video imaging of the river ecosystem, the sonar footprint only reached halfway across the river channel below the tail race of the dam (Figure 2). Thus, my counts were at best minimal estimates of the number of shad present.

The Brunswick-Topsham hydroelectric is not up for FERC relicensing for several years. The sonar count data should be useful as evidence of the inefficiency of this dam for passage of American shad. Improvements in fish passage would likely benefit other anadromous species as well and provide miles of historical spawning habitat between Brunswick and Lewiston.

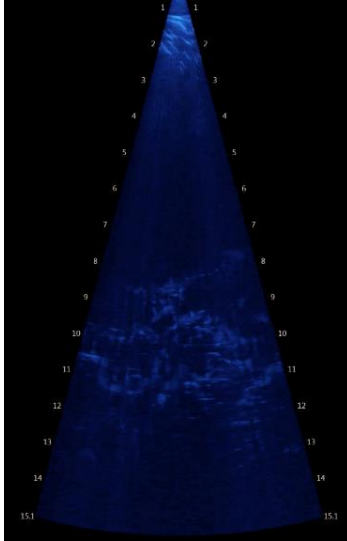


Figure 1. Under-water image from the ARIS Sonar. The light blue fish at the top are American shad. We can tell this because of their size, about half a meter, and behavior, they migrate in schools.

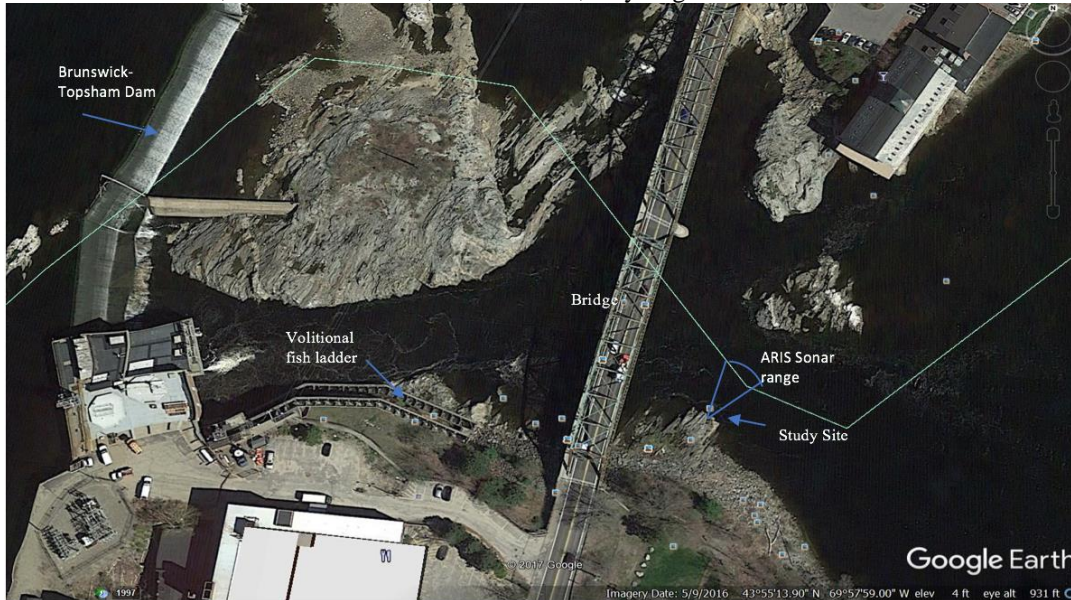


Figure 2. Aerial view of the Brunswick-Topsham dam, fish ladder, bridge, our study site, and the range of the ARIS Sonar.

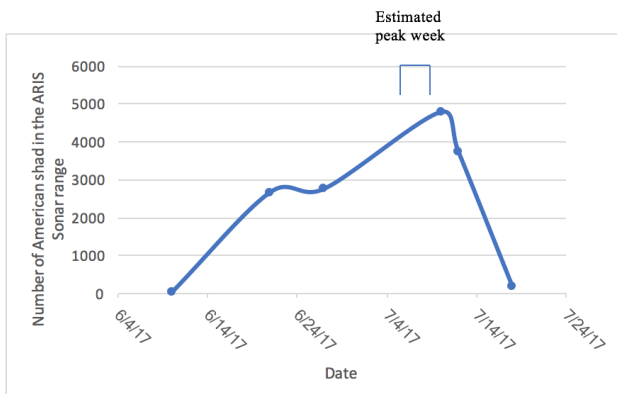


Figure 3. Number of American shad counted for 5 days over the 7 week period of the migration run. The estimated peak week of the run is July 3- July 9.