

Downstream Fish Passage at Hanover Pond Dam through the use of an Archimedes Screw Generator

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Archimedes Screw Generator is installed at an angle of 30 degrees. ASG has three blades with a runner diameter of 139.75 inches. The intake is hydraulically controlled by a sluice-gate to ensure a run-of-river flow design.

Introduction

The Archimedes Screw Generator (ASG) is largely described as 'fish friendly'. Yet, there is not adequate literature to support these claims. CT DEEP, USFWS, and Kleinschmidt Associates designed a fish movement study to evaluate downstream fish passage at Hanover Pond Dam.

Methods

The radio telemetry study included 3 fixed monitoring stations; T01 - Upstream of the Dam, T02 - Within the Intake, and T03 - Downstream of the Dam. 20 American Shad were implanted with radio tags and released 0.5 mile upstream of the Dam. The default tag setting was 2-second burst rate with an 11-second mortality burst rate activated after a 15 minute stationary period. Kleinschmidt implemented the following protocol to analyze telemetry data; (1) Identify and remove false positive detections; (2) Reduce any potential overlap between detection zones; (3) Assess movement with time-to-event analysis using a competing risks framework.

Objectives

The specific objectives were to determine;

- If downstream passage occurs through the ASG.
- The proportion of shad that pass downstream of the Dam through each of the passage routes.
- Passage survival through each of the passage routes.

Results

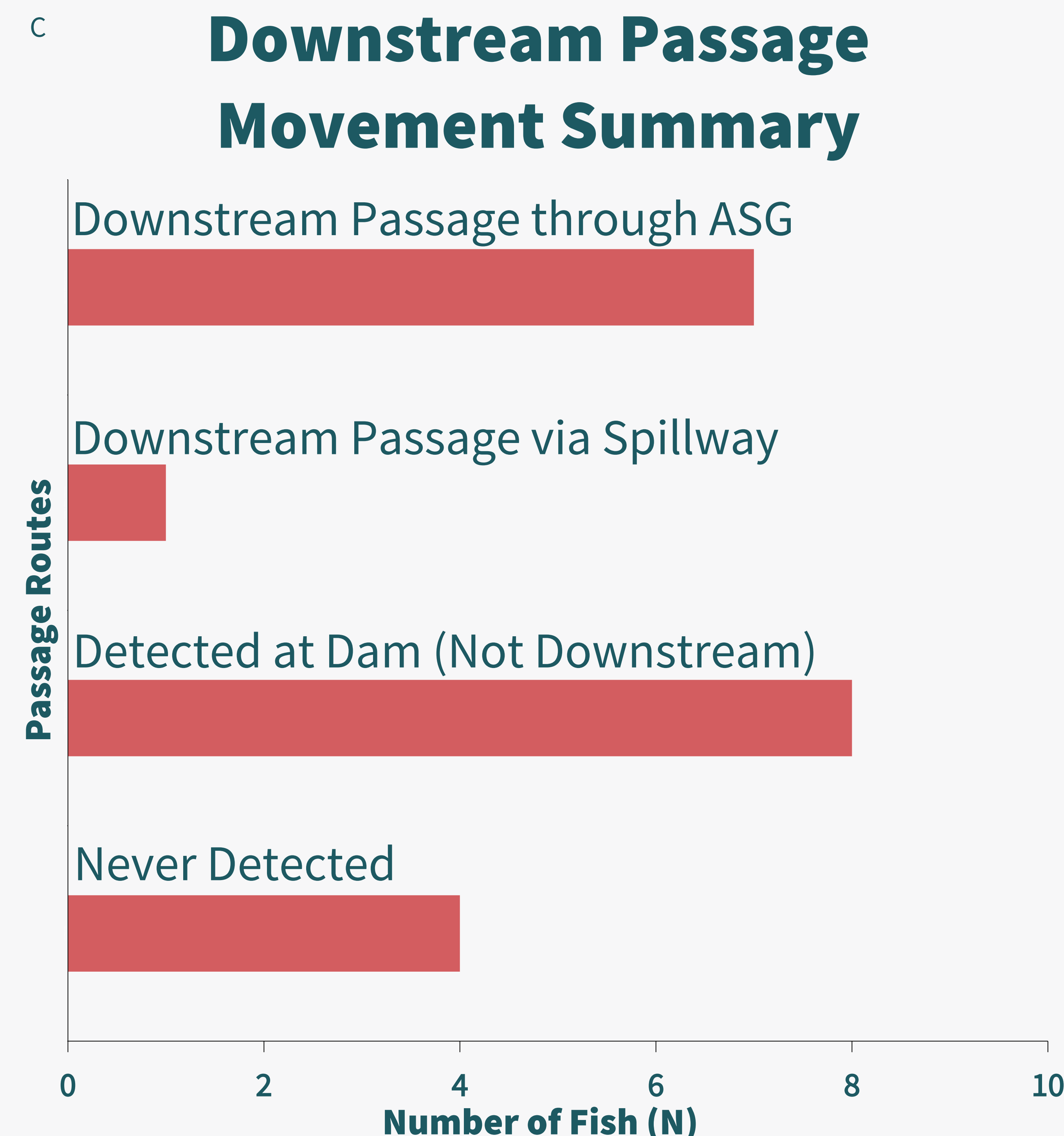
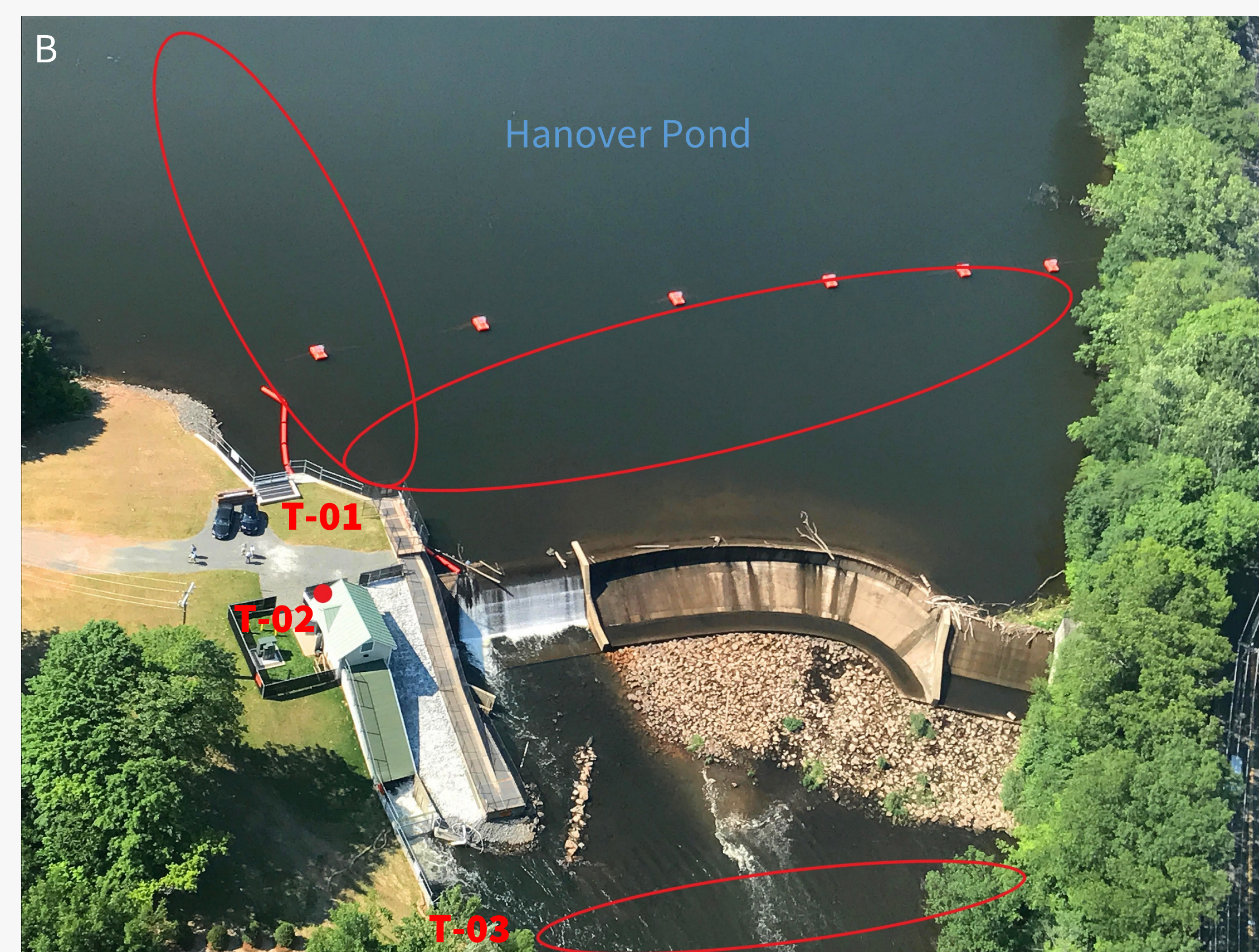
In total, 16 tagged shad were detected at Station T01. 8 of these 16 fish (50%), passed downstream and were detected at Station T03. 7 of these 8 fish (87.5%), utilized the intake (T02) and passed through the ASG before being detected at Station T03. 1 of these 8 fish (12.5%) passed downstream via the spillway or notch, as evidenced by lack of detections at Station T02.

Frequency & Code	Route of Passage	Date & Hour of Passage	Project Discharge at Passage (cfs)	Flow Through ASG at Passage (cfs)	Spill/Notch Flow at Passage (cfs)
149.440 21	ASG	6/8/2019 2100	142.5	50.8	91.7
149.440 28	ASG	6/13/2019 0700	163.3	71.1	92.2
149.440 31	ASG	6/4/2019 0400	176.5	79.9	96.6
149.440 33	ASG	6/7/2019 2000	150.5	55	95.5
149.440 36	ASG	6/5/2019 0300	165.5	68.7	97.7
149.440 38	ASG	6/3/2019 2100	183.5	91.4	92.1
149.440 39	ASG	6/3/2019 2200	182.5	89.1	93.4
149.440 35	Spill or Notch	6/2/2019 2100	195	108.4	86.6

Date, Time, Route of passage, and discharge (cfs) during downstream passage for eight tagged Shad. 7 out of 8 fish passed downstream through the Archimedes Screw Generator. ASG discharge (cfs) was greater than Spillway/Notch discharge when fish 149.440 35 passed downstream over the spillway.

Discussion

Demonstration of downstream passage through the ASG was successful for this study, and passage survival for all routes was 100%. The fate of these 8 fish that were not detected remains unknown. They potentially may have remained in the pond, shed their tags, or more unlikely passed downstream without being detected at Stations T02 or T03.



(A) Hanover Dam (Meriden, CT), looking upstream showing the spillway, fish ladder and enclosed Archimedes Screw Generator. (B) Locations of the three fixed radio telemetry sites. The red circles illustrate the area covered by the Yagi antennas. The red dot shows the location of the Dipole antenna. (C) Bar chart displays overall outcome of movement in the 20 radio-tagged Shad. There were four unique scenarios for a tagged Shad; downstream Passage through the Archimedes Screw Generator (T01 > T02 > T03), downstream passage via Spillway (T01 > T03), only detected at Dam (T01), and never detected.

