# Juvenile American Shad Monitoring in the Connecticut River

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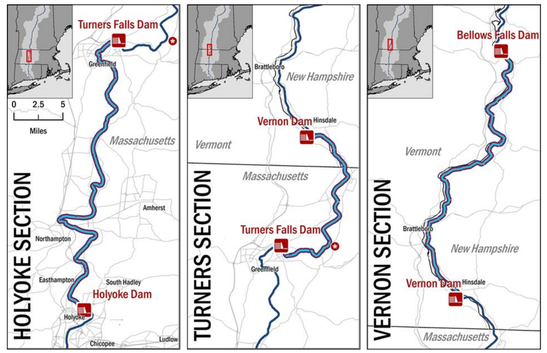
## Introduction

**American Shad** support commercial and recreational fishing and are vital for linking marine and freshwater ecosystems via nutrient pathways. Shad populations have substantially decreased compared to historical abundances due to overfishing and habitat degradation, particularly dam construction. Four main-stem dams were constructed on the Connecticut River beginning in 1798 within the historical range of shad and are significant barriers to spawning migrations and population recovery.

Passage rates at main-stem dams have improved somewhat in recent decades, but remain below restoration targets, particularly for Turners Dam.




Dam impacts on adult shad are monitored through adult fish passage counts, yet little is known about the impacts of main-stem dams on juvenile shad growth, productivity, condition, and habitat preference/use.

### Adult Fish Passage Counts

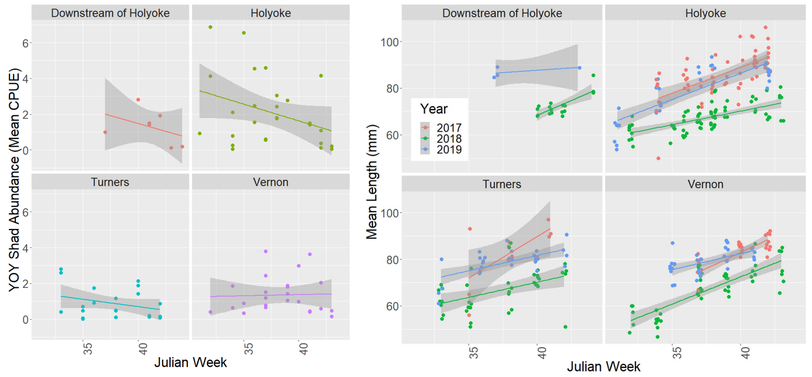
| Dam Section | 2017 | % Passage* | 2018 | % Passage* | 2019 | % Passage* |
|---|---|---|---|---|---|---|
| Holyoke | 536,670 | - | 275,232 | - | 314,361 | - |
| Turners | 48,727 | 9% | 43,146 | 16% | 22,649 | 7% |
| Vernon | 28,682 | 59% | 31,725 | 74% | 12,872 | 57% |
| Bellows Falls | 0 | 0% | 733 | 2% | 3 | <0.1% |

* % passage rates are relative to the number of fish passed at the next downstream dam

## Methods

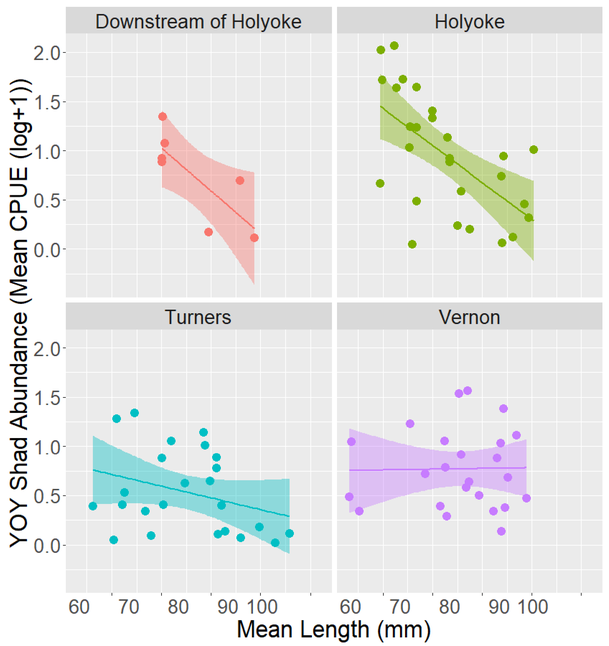
We conducted random stratified boat electrofishing surveys at night in fall 2017-2019 (n=497), within three main-stem dam sections upstream of Holyoke Dam **(Holyoke-Turners, Turners-Vernon, and Vernon-Bellows).** Dam sections were further stratified by **"impoundment zones"** (lower, middle, upper), which consisted of ~ 5 randomly selected zig-zag electrofishing runs per night per, with the goal of sampling each impoundment zone every ~2-3 weeks.

## Shad Length and Abundance Over Time




**Juvenile shad CPUE** decreased over time for the Holyoke section, while CPUE in the Vernon section remained constant throughout the fall. Shad length increased over time for all sections.

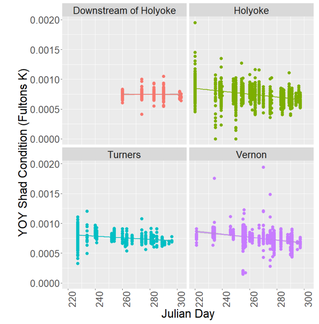
**Density-dependent growth** appears to dominate the Holyoke section **(Holyoke Dam-Turners Dam),** while shad growth (length over time) in the Turners and Vernon sections does not appear to be limited by density.




This is likely a direct result of poor adult passage at Turners Falls, and suggests that Turners and Vernon sections could support higher abundances of juvenile shad without growth being limited by density.

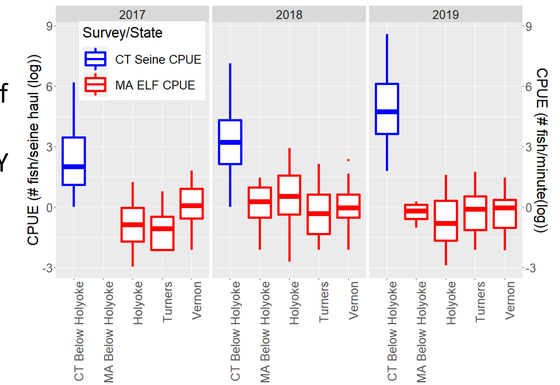
## Shad Condition Over Time

Fulton's condition factor (K) was calculated for YOY shad (n=6,377) and averaged for each electrofishing run. A subtle decline in condition occurred throughout the fall (all years). Rates of decline appear similar across dam sections, but this was not specifically tested.




## CT Seine Survey Compared to MA Electrofishing Survey

**CT DEEP** conducts beach seine surveys for YOY shad, producing an index of juvenile abundance (JAI) which tracks YOY shad year class strength, with some spatial (below the Holyoke Dam) and statistical (fixed stations) limitations.




Although **abundance metrics** differ between surveys, trends can be compared to assess direction, magnitude, and utility. MA electrofishing surveys were also conducted below Holyoke Dam as a proxy for "paired " survey comparisons. Shad CPUE trends similarly between surveys in 2017-2018, but appears to diverge slightly in 2019.

## Management Implications

**Improved upstream and downstream adult passage**, particularly at **Turner's Dam Fishway**, is needed, with suitable passage/protection of juvenile shad passing by/through all hydropower facilities. Increasing adult and juvenile shad abundances has significant implications for bottom-up food web effects (forage) for sportfish species such as striped bass. Dams are clearly impacting both adult and juvenile populations, with broad population and ecological implications that are not yet fully understood.