Pennsylvania Fish & Boat Commission Biologist Report

Delaware River

Monroe County

American Shad Monitoring, 2024

American Shad is collaboratively managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the Delaware River Basin Fish and Wildlife Management Cooperative (Co-op), which Pennsylvania Fish and Boat Commission (PFBC) is a member of both entities. A suite of long-term, time-series data sets with associated management benchmarks are outlined within the 2022 American Shad Sustainable Fisheries Management Plan (SFMP). The American Shad population is judged sustainable if indices of stock condition remain within the defined benchmarks. Each of these time-series are annually updated and evaluated relative to defined benchmark criteria. The SFMP itself is revised on a five-year cycle, with the 2022 SFMP tenure effective from 2022 to 2026.

Non-tidal Juvenile Annual Production Index (JAI)

This index follows the relative abundance of young-of-the-year (YOY) American Shad in the non-tidal main stem reaches of the Delaware River, Phillipsburg, NJ to Milford, PA. The non-tidal JAI is standardized with respect to environmental covariates using generalized linear model (GLM) methodology. Sampling was suspended, from 2008 to 2011, 2018 (extreme high flows) and 2020 (COVID-19). Higher values are indicative of sustainability with the objective being non-tidal JAI values higher than 188 (i.e., the 50th percentile of historical data) during three of the five most recent surveys.

A total of 24,944 YOY American Shad were collected during the 2024 season resulting in a standardized total catch of 575.2 YOY American Shad; the highest of the 31-year time-series (Figure 1). With respect to the management benchmark, the last three non-tidal JAI values were greater than the benchmark, indicative of sustainable juvenile production.

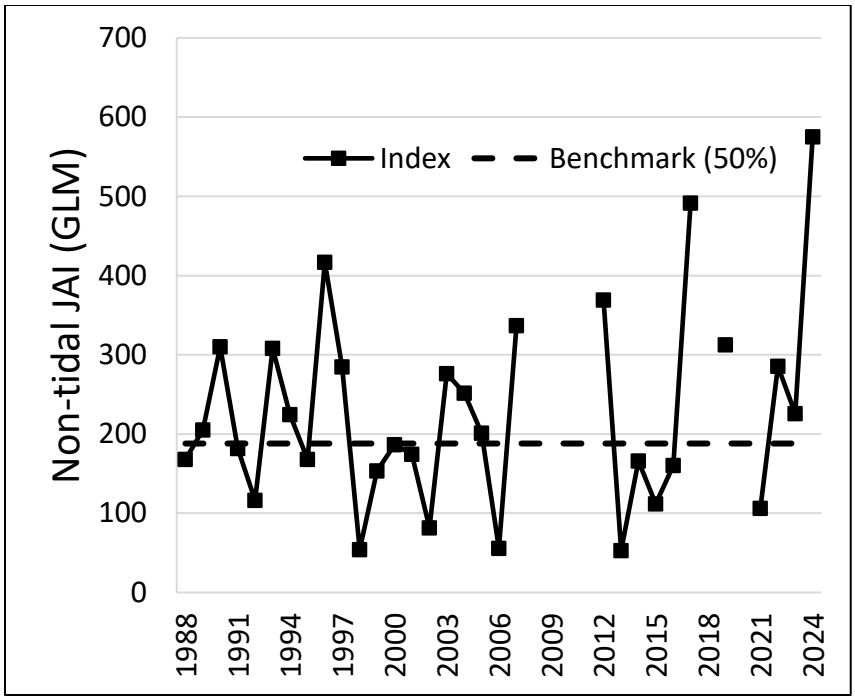

Figure 1. Standardized (GLM) annual YOY American Shad total catch within the Delaware River, 1988 to 2024.

Tidal Juvenile Annual Production Index (JAI)

This index utilizes YOY relative abundance within the tidal reaches of the upper Delaware Estuary between Newbold Island and the Delaware Memorial Bridge. The tidal JAI index is represented as the annual geometric mean (GM) of the catch data. As with the non-tidal JAI, higher values are indicative of sustainability with the objective being tidal JAI values higher than 5.81 (i.e., the 50th percentile of historical data) during three of the five most recent surveys.

The 2024 estimate of the tidal JAI was 7.8, ranking 16th in the 38-year time-series (Figure 2). Within the most recent five years (2020-2024), the tidal JAI exceeded the benchmark three of the four years (2021, 2022, and 2024; Figure 2) indicating sustainable juvenile production factoring in the exclusion of the 2020 year when no surveys were conducted.

Spawning Run Relative Abundance Index

The relative abundance of the adult springtime spawning run is monitored at Smithfield Beach (RM 218) within the Delaware River main stem. This index is represented as the annual geometric mean of female American Shad catch per unit of effort (CPUE; shad/net-ft-h). Sustainability is defined as the occurrence of three-out-of-five years where index values are above 0.52 shad/net-ft-h (i.e., the 50th percentile of the historical data). Lower values are indicative of unsustainable levels of production in this index.

A total of 361 American Shad (276 females, 85 males) were captured during the 2024 season. Lengths varied from 16 - 23inches for females and 17- 21inches total length for males.

Unfortunately, the last four annual values were less than the benchmark and deemed unsustainable due to failure to reach the benchmark four of the last five years. The 2024 sample ranked 25th in the 29-year time-series (Figure 3).

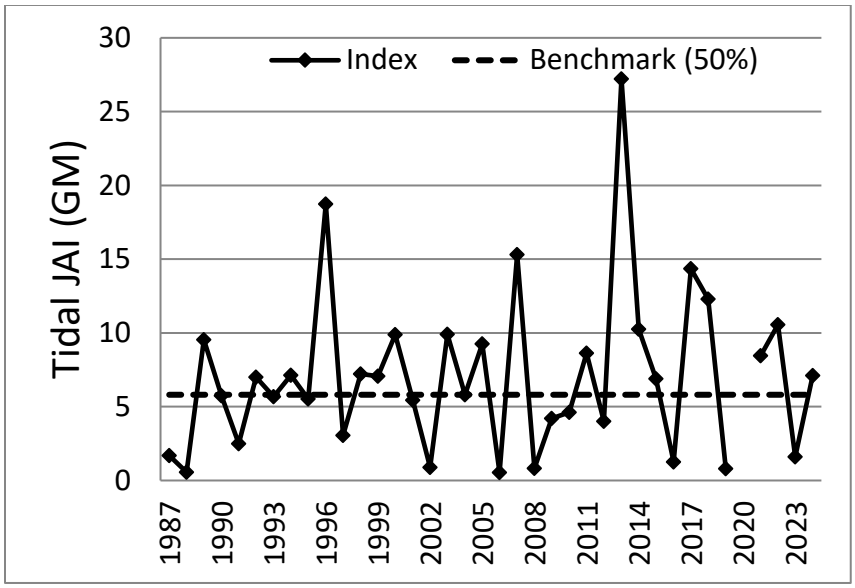

Figure 2. Geometric means (GM) of annual YOY American Shad total catch within the Delaware Estuary, 1987 to 2024.

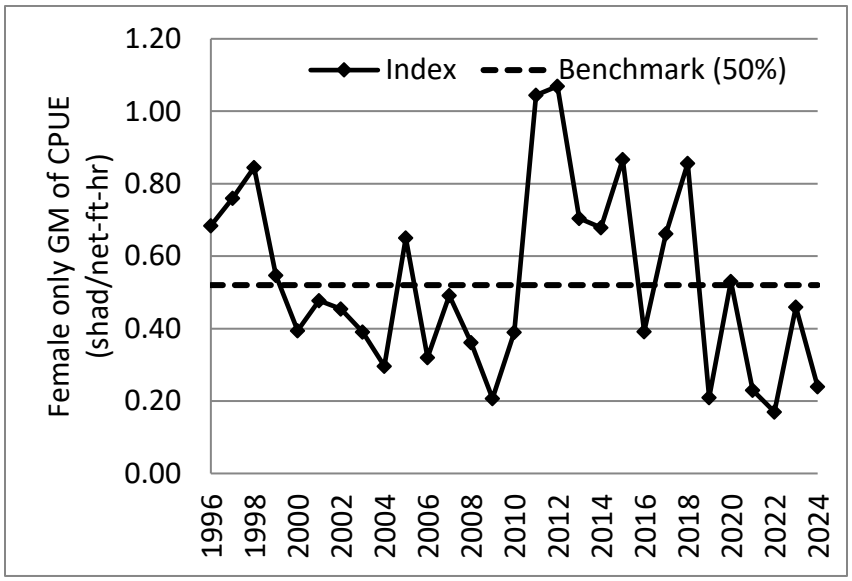

Figure 3. Annual geometric means of catch-per-unit-of-effort for adult female American Shad spawning run at Smithfield Beach (RM 218), Delaware River main stem, 1996 to 2024.

Total Mortality

This index represents the loss of females from the adult spawning population. It is calculated as the adult female total mortality (i.e., $Z_{40\%}$) based on the spawning population age distribution interpreted from otoliths. The total mortality index is updated every five years with the SFMP revision. Lower total mortality values indicate sustainability for this index with a three-year rolling value of 1.07 ($Z_{40\%}$) as the threshold.

Total mortality was demonstrated to be unsustainable within the Delaware Basin in the ASMFC 2020 stock assessment (Figure 4). In response, Co-op members implemented restrictions of both commercial landings and recreational harvest of 33% beginning with the 2023 season. Specifically, within Pennsylvania, the Delaware River daily creel limit was reduced to two shad per day. The Lehigh and Schuylkill rivers remain catch-and-release only.

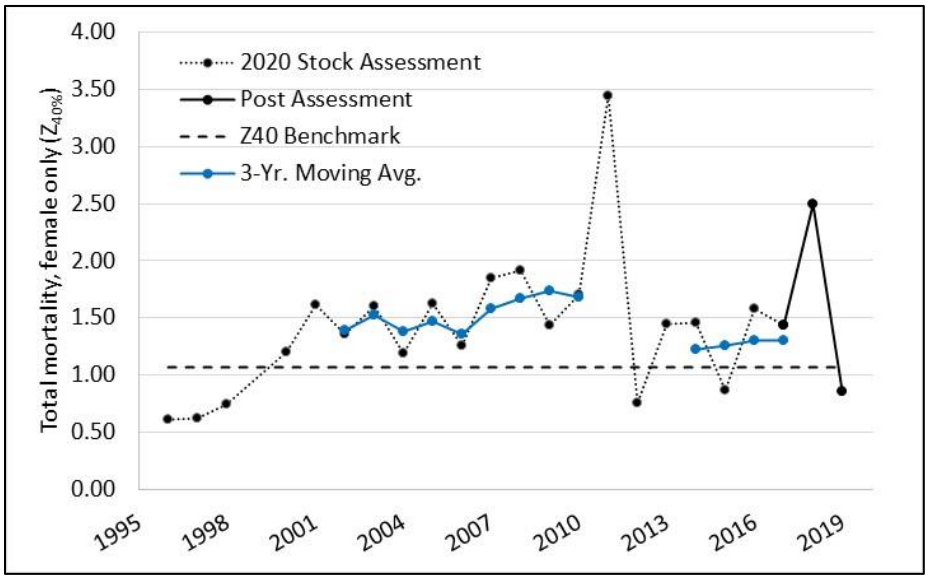

Figure 4. Total adult female mortality for American Shad captured at Smithfield Beach, Delaware River, 1996 to 2019.

Ratio Commercial Harvest to Spawning Run Relative Abundance

Commercial fisheries exist within the Delaware Bay that harvest adult American Shad during the springtime as they return to their natal waters. The intent of the this index is to address the relative loss of shad from the Delaware River population, based on surviors after the commerical fisheries. It is expressed as the ratio of total combined pounds of adult shad reported landed to the states of New Jersey and Delaware relative to the adult female-only spawning run relative abundance as characterized by the Smithfield Beach index, divided by 100. Lower ratio values indicate sustainability for this index with the objective being three out of five years with a ratio below 799 (i.e., the 50th percentile of historical data)

A combined total of 98 pounds of shad were reported being landed for the 2024 season to the states of New Jersey and Delaware. Half (i.e., 50%) of the total landings (i.e., 49-pounds) are attributed as represenative of the Delaware River stock. The 2024 estimate was 2.04, ranking the 2nd lowest in the 29-year time-series (Figure 5). Within the most recent five years (i.e., 2020 to 2024), index values for all years has remained well below the benchmark and met the sustainability threshold.

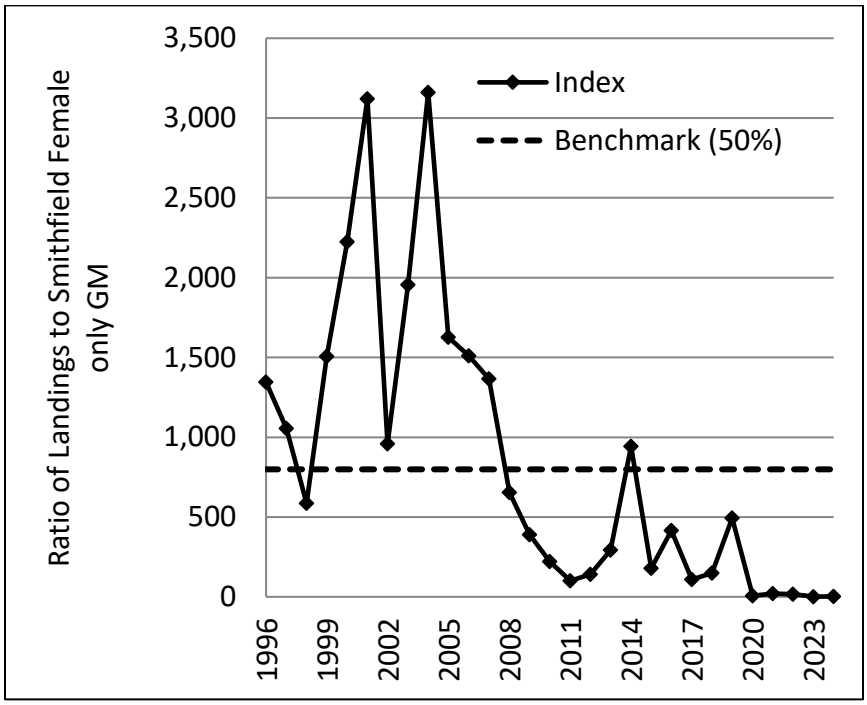

Figure 5. Ratio of combined commercial landings from the Delaware Bay and lower Delaware Estuary to Smithfield Beach index, 1996 to 2024.

Mixed Stock Landings

American Shad occurring in the Delaware Basin are represented by fish originating from Delaware River as well as fish from multiple other coastal river stocks. The commercial fisheries operating within the Delaware Bay and Delaware Estuary land shad from these mixed stocks in addition to the Delaware River stock. Half of all commercial landings reported to the states of New Jersey and Delaware are attributed as representative of the mixed stock component, based on updated genetic findings. Lower ratio values indicate sustainability for this index with the objective being two consecutive years with values below 18,505 lbs (i.e., the 25th percentile of historical data).

A combined total of 98-pounds of shad were landed from the Delaware Bay and Delaware Estuary, with 49-pounds considered as the mixed stock during 2024 (Figure 6). Within the most recent last two years, both the 2023 (78 pounds) and the 2024 (49 pounds) landings were well below the benchmark.

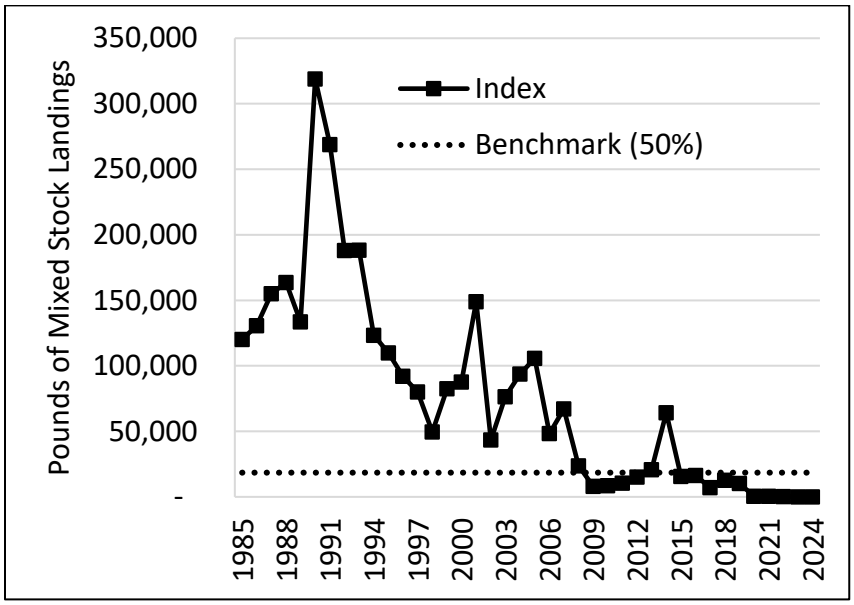

Figure 6. Commercial landings of American Shad mixed stock from the Delaware Bay and Delaware Estuary, 1996 to 2024.

Assessment of Delaware River American Shad Sustainability

Amendment 3 to the *Interstate Fishery Management Plan for Shad and River Herring* defines a sustainable fishery as one that will not diminish potential future stock reproduction and recruitment. Indices of female total mortality and female spawning run relative abundance failed to meet their associated benchmarks while the other four benchmarks were met. Corrective management action was enacted for the 2023 season by Co-op members in response to the failed female total mortality index. Given the newness of that response, coupled with the successful juvenile production, and the perception of low harvest from both the recreational and commercial fisheries, Co-op members will not pursue further management action. Monitoring will continue for the 2025 season, with Co-op members reconvening during winter 2025/2026 to reassess sustainability indices performance.

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