

Migratory Fish (SOOE Extended)

Methods and Data Sources

Measurements of abundance for three diadromous fish species were tracked for each year using data from the NH Fish and Game Department (NHFG). Abundance was measured by counts of fish passing through fish ladders or via visual counts in the spring.

NHFG also has tracked abundance of five other diadromous fish: Atlantic salmon, sea lamprey, American eel (young-of-year), brown trout, and striped bass. Very few Atlantic salmon have returned to rivers in the Piscataqua River in the past decade, making this species an insensitive indicator. Between 1992 and 2003, only 44 fish were recorded in fish ladders. NHFG discontinued the Atlantic salmon stocking and monitoring programs in 2003. The abundance of brown trout and striped bass were tracked by voluntary reports from anglers rather than designed surveys implemented by NHFG staff. (Note: NHFG discontinued the sea run brown trout program in 2015.) Therefore, the abundance results for these species were not included in this indicator. The number of rainbow smelt (*Osmerus mordax*) caught by fisherman (per year) has also been tracked by NHFG since 1978.

NH Fish and Game Anadromous Fish Monitoring Programs provided data for this indicator. Research on rainbow smelt by UNH was funded by New Hampshire Sea Grant and NHFG.

Additional Discussion

In 2021, a research partnership between NHFG and UNH began to investigate the migrations of rainbow smelt in Great Bay using acoustic telemetry. Acoustic telemetry tags emit unique signals at specific intervals, and these unique signals are heard and decoded by hydrophones or receivers placed throughout the Great Bay system. A total of 44 adult rainbow smelt captured in the Winnicut, Squamscott, Oyster, and Bellamy Rivers received acoustic telemetry tags and their movements recorded by 22 telemetry receivers placed in Great Bay, its tributaries, and the mouth to the coastal Gulf of Maine. This process was aided by NH Sea Grant's Coastal Research Volunteer (CRV) program. A total of 14,142 detections of rainbow smelt occurred between March 23 (first date of tagging) through mid-May, when the final tagged fish exited Great Bay via the Piscataqua River. Rainbow smelt spent longer in Great Bay than expected (on average for ~39 days among the tributaries and estuary, prior to exiting the system), and several fish used multiple tributaries. Survival from release to the Piscataqua River mainstem (enroute to exit) was estimated (via mark-recapture Cormack-Jolly-Seber models) to be 74%. Although movements among individual rainbow smelt were diverse and complex, in general, movements downstream in the system (towards the Gulf of Maine) occurred disproportionately during ebb tides, while upstream movements (towards tributaries) occurred disproportionately during flood tides, suggesting rainbow smelt may use tides to aid in larger-scale movements. More information on this project can be found at <https://storymaps.arcgis.com/stories/1ac83acd0f104e1781ab6cbc01d02276>.

UNH and NHFG continue to work together on rainbow smelt, with a new project initiated in 2022 and continuing in 2023 to better estimate interannual survival of the local rainbow smelt population. This project uses passive integrative transponder (PIT) tags, the same technology as microchips used in household pets. Rainbow smelt will be PIT-tagged each spring during the

NHFG fyke net surveys, and the number of recaptures identified each year will allow for estimating annual survival. In addition, the locations of tagging and any recaptures will provide further insight into what rivers rainbow smelt use during the spawning season.

Acknowledgements and Credit

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