Penobscot Estuarine Fish Community Survey

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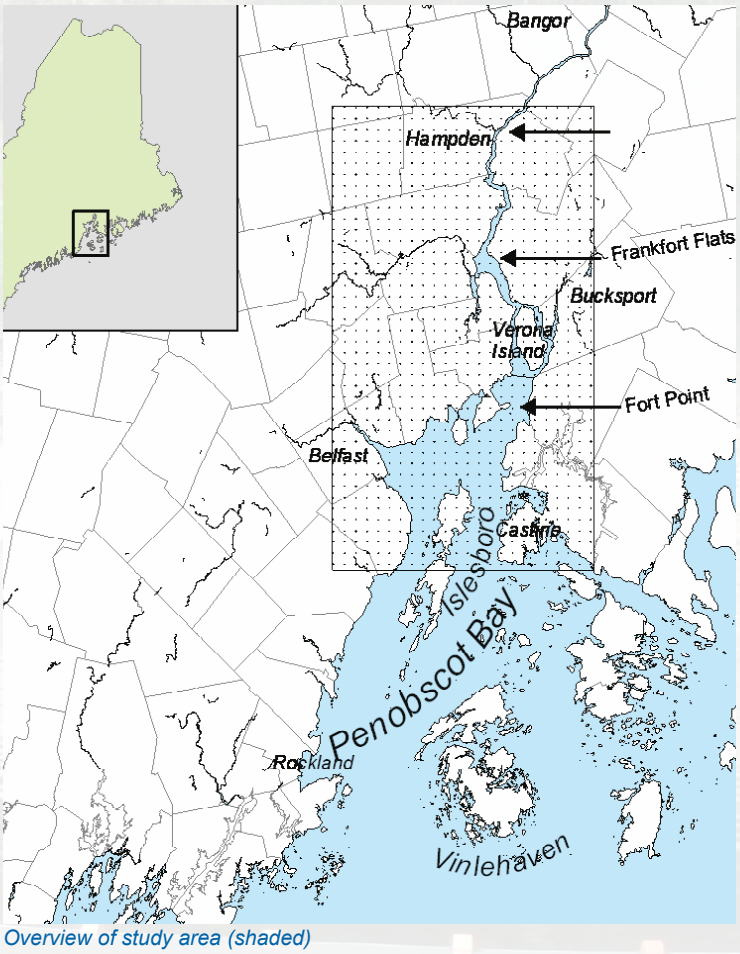
Background

Many diadromous fish populations across the North Atlantic are at, or near, all time lows (Limburg and Waldman 2009). Reasons for the historic declines are many, with dams, overfishing, and pollution being major concerns (Moring 2005). Many of the perturbations that caused the declines of diadromous populations have been or are in the process of being ameliorated. However, diadromous fish remain at very low levels throughout the eastern United States. Advances in our understanding of inter-specific linkages have pointed toward the estuary and near shore environments as critical to shaping population dynamics of many fish species. For example, Atlantic salmon smolts have recently been shown to experience relatively high mortality rates as they migrate through estuaries and transition to life at sea (LaCroix *et al*. 2005; Kocik *et al*. 2009). A recent hypothesis postulates that reduced abundance levels of other diadromous species results in elevated levels of predation on salmon smolts (Saunders et al. 2006). Greater understanding of the diadromous fish community is necessary to improve the status of all fish communities inhabiting and migrating through the Penobscot Estuary.



Overview of study area (shaded)

Objectives

- A thorough multi-gear feasibility study is planned over the period 2010 to 2011
- Spatial and temporal distribution of estuarine fish will be quantified, with a particular emphasis on diadromous fish
- Sampling sites are being selected for suitability
- Fish capture methods trialed initially include; beach seining, fyke netting and mid-water trawling
- Sampling stations will be established for continuous monitoring of environmental parameters (Salinity, temperature, turbidity, dissolved oxygen and chlorophyll)
- A database of the Penobscot estuarine fish community and environmental parameters is being created and will form the basis of vital research in the future.

Previous work on diadromous fish behavior within estuarine systems will guide the project initially and on-going analysis of the data will determine its overall direction eventually. Year 1 of the proposed work will focus on feasibility/refinement of gear, sampling techniques and selection of sample sites. The results from this work will guide the intensity of sampling in Spring/Summer 2011 and onwards. The study design is being developed in collaboration with the Maine Department of Marine Resources, partly to mirror the 20+ year effort on the Kennebec.

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Methods (2010 to 2011)

- Beach seines are sampling shallow, intertidal and sub-tidal areas. Sites will be sampled weekly in the estuary (Hampden to Sandy Point)
- 3ft and 6ft fyke nets are being deployed and tested weekly to sample sub-tidal areas
- Investigative mid-water/pelagic trawling will be carried out in Spring/Summer 2011 to target surface/pelagic fish
- Fish are identified to species, enumerated and total length (TL) measured
- Environmental data (temperature, salinity, dissolved oxygen) is taken at each sampling event, as well as habitat type, site conditions, tide etc.
- Sites for continuous environmental monitoring are being selected.

Fyke net (3ft) assemblage example at low tide

Beach seine - August 2010

Results (November 2010)

- Site selection for beach seining is difficult owing to the nature of the shoreline, but 11 suitable sites have been identified so far
- Beach seine efforts have been successful in obtaining fish samples and it is hoped that results could be used to compare with other estuaries in the future (e.g. Kennebec)
- Fyke netting sites have been selected and testing of the gear and its suitability is on-going
- Fish species encountered to date:

American shad (*Alosa sapidissima*), alewife (*Alosa pseudoharengus*), Atlantic silverside (*Menidia menidia*), Atlantic tomcod (*Microgadus tomcod*), banded killifish (*Fundulus diaphanus*), blueback herring (*Alosa aestevalis*), bluefish (*Pomatomus saltatrix*), common shiner (*Luxilus cornutus*), eel (*Anguilla rostrata*), fallfish (*Semotilus corporalis*), grubby sculpin (*Myoxocephalus aenaeus*), largemouth bass (*Micropterus salmoides*), mummichog (*Fundulus heteroclitus*), northern pipefish (*Syngnathus fuscus*), pumpkinseed sunfish (*Lepomis gibbosus*), rainbow smelt (*Osmerus mordax*), rock gunnel (*Pholis gunnellus*), rough scad (*Trachurus lathami*), sand flounder (*Lophopsetta maculata*), sand launce (*Ammodytes americanus*), small-mouth bass (*Micropterus dolomieu*), white perch (*Morone americana*), white sucker (*Catostomus commersonii*), windowpane flounder (*Scophthalmus aquosus*), winter flounder (*Pleuronectes americanus*), 3-spined stickleback (*Gasterosteus aculeatus*), 9-spined stickleback (*Pungitius pungitius*).

Conclusions

- Sampling methods are expected to go through a period of transition as the project develops to allow for increasing experience and greater understanding of the fish communities and the estuary
- Beach seining, fyke netting and pelagic trawling were the selected methods for preliminary sampling, as they can sample different habitats of the estuarine ecosystem. Depending on results, it may be necessary to evaluate other sampling methods in the future, for instance, hydro-acoustics
- Continuous monitoring stations to measure environmental parameters (Salinity, temperature, turbidity, dissolved oxygen and chlorophyll) would give useful data on abiotic fluctuations in the estuary and add to the data collected at each sampling event
- Sampling needs to be thorough, both spatially and temporally, to capture a true representation of the fish communities and environmental variability within the Penobscot estuary.

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