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Exploring the effects of dam removals on zooplankton in Penobscot Estuary

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Background

Penobscot Estuary
- One of the largest river restoration efforts in the United States
- Recent dam removals have increased spawning habitats for sea-run fish
- Increased habitat and stocking efforts have dramatically increased the abundance of returning alewives

Role of Zooplankton
- Zooplankton are the primary food source for anadromous fish
- The increase of returning alewives caused an initial six-fold decline in zooplankton abundances

How has zooplankton species diversity and composition been impacted by restoration efforts in the Penobscot Estuary?

Methods

Zooplankton Sampling
- Targeted mesh tows
- Collected at four stations throughout estuary (Fig. 1)
- Immediately preserved

Lab Identification
- Zooplankton identified to lowest possible taxa

Fig. 1. Sampling sites and salinity gradient throughout the Penobscot Estuary, midcoast, Maine.

Fig. 2. Dominant species throughout the Penobscot Estuary. Left: Acartia. Right: Eurytemora.

Fig. 3. Zooplankton density in the Penobscot Estuary. Samples were collected across four sites within the estuarine transition zone and then pooled.

Fig. 4. Change in zooplankton composition across all stations. Upper and lower estuary species composition with decreasing diversity from 2013 to 2016.

Fig. 5. Seasonal variation of zooplankton composition illustrating increasing abundance of Acartia and decreasing abundance of Eurytemora and Pseudocalanus.

Preliminary Results and Next Steps

After an initial decline, zooplankton populations in May were dominated by Eurytemora and Pseudocalanus (Fig. 4). However, both species decrease in abundance from May to July and again from July to August (Fig. 5). Meanwhile, Acartia abundances increased from May to September (Fig. 5).

Three years after the dam removal, zooplankton populations in May were dominated by Eurytemora and Pseudocalanus (Fig. 4). However, both species decrease in abundance from May to July and again from July to August (Fig. 5). Meanwhile, Acartia abundances increased from May to September (Fig. 5).

Since the dam removals and reintroduction of anadromous fish species we have observed a decrease in diversity and evenness of zooplankton. We are currently exploring the relationship between fish predation and other environmental drivers on zooplankton diversity to gain a mechanistic understanding of the patterns we have observed.

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