Diadromous Fish Assemblage Assessment in the Saco River Estuary, ME

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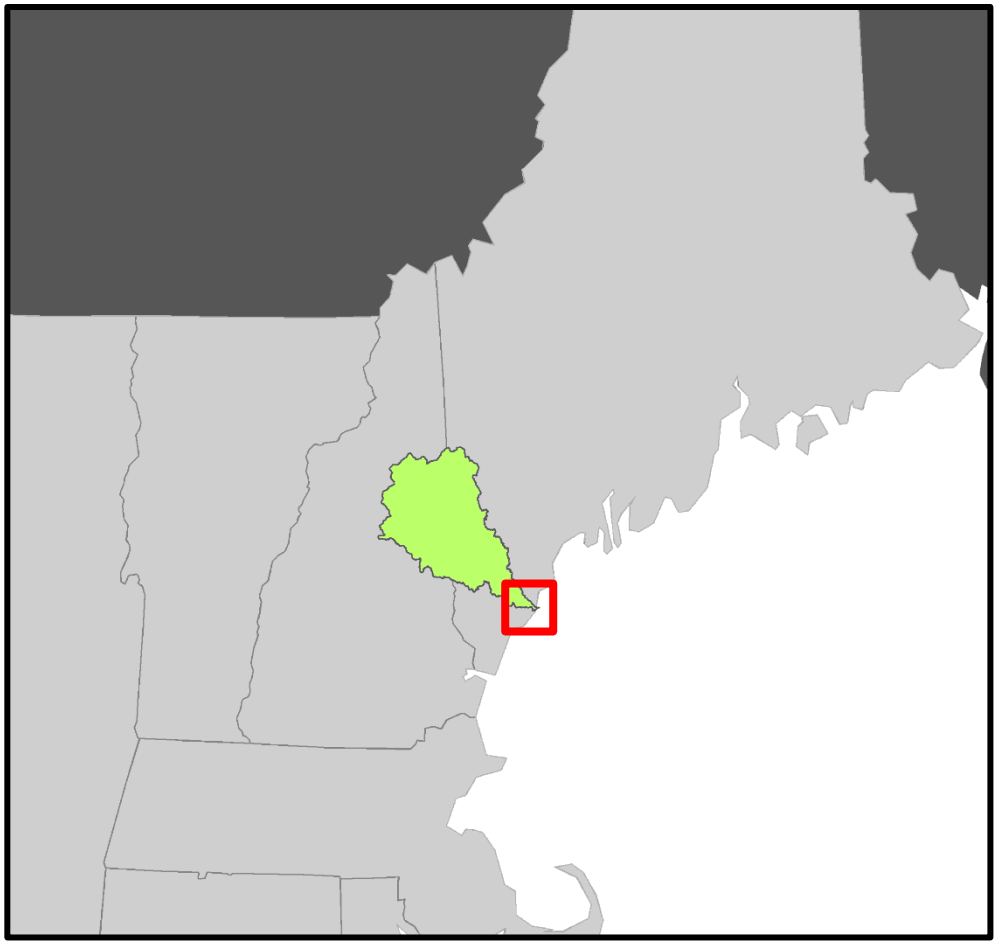
Saco River Estuary

- Nursery ground
- Foraging stop-over site for **migratory fishes**
- 60 marine, diadromous and freshwater species observed since 2007
  (J. A. Sulikowski, unpubl. data)



Previous Research

- Reynolds and Casterlin, 1985, *Hydrobiologia*
  - n = 18
- Furey and Sulikowski, 2011, *Northeastern Naturalist*
  - n = 24
- Little et al. 2013, *Journal of Applied Ichthyology*

Gear types used include:

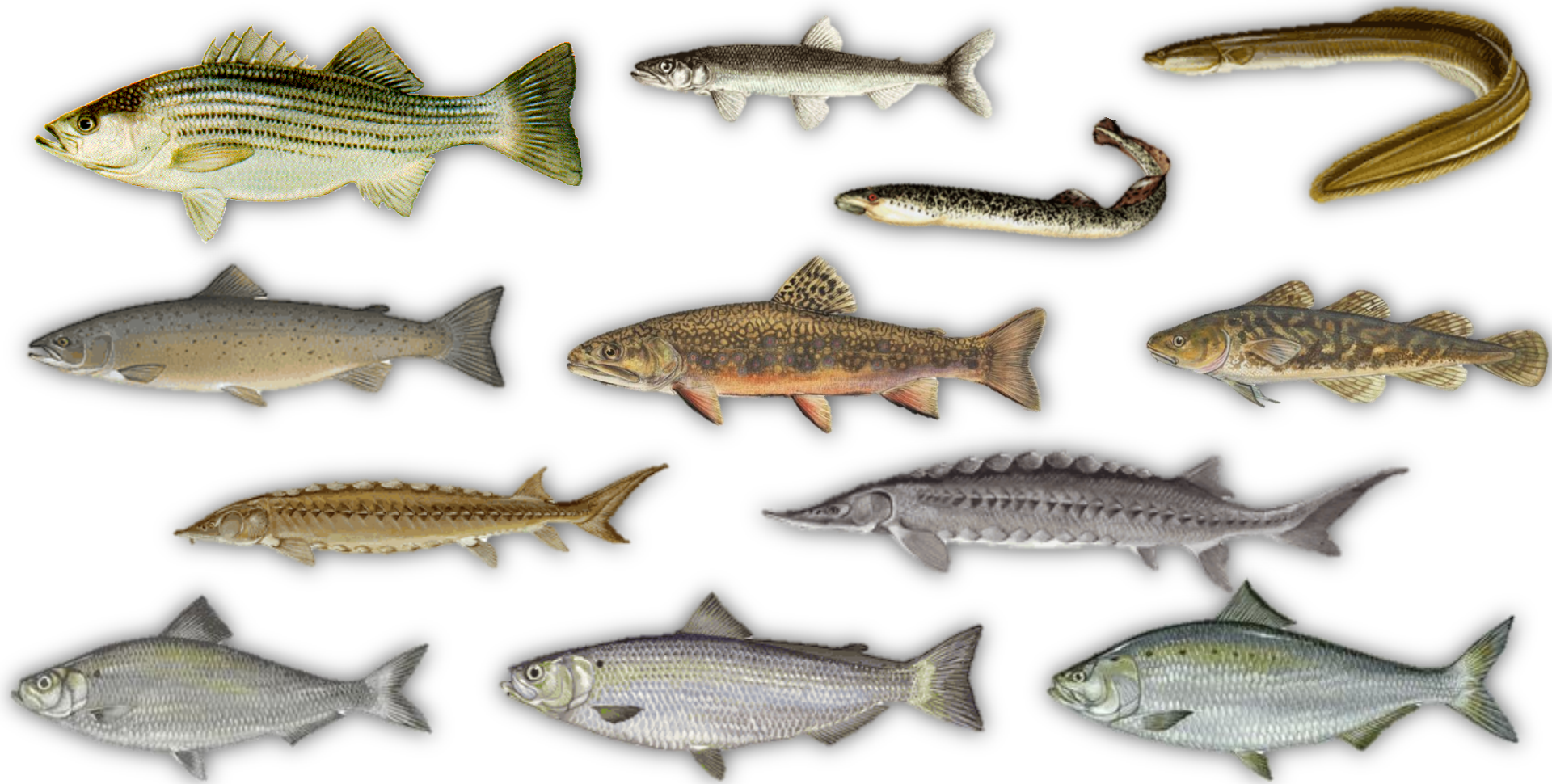
Hook and line
Plankton tows
Light and modified lobster traps
Beam and otter trawl
Seine, D-frame and gill netting
Settlement collectors
Long line

Diadromous fishes

- Provide important links between coastal watersheds and the Atlantic Ocean
- Economic and cultural value

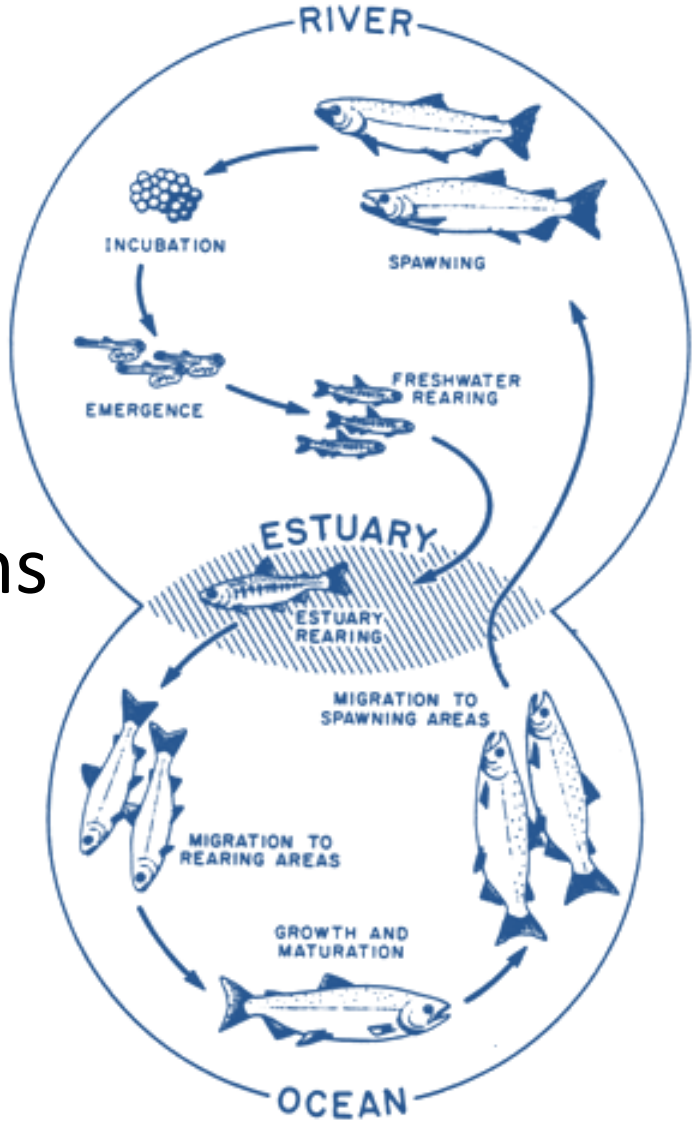
Diadromous fishes in the Gulf of Maine

12 species



Status in the Gulf of Maine

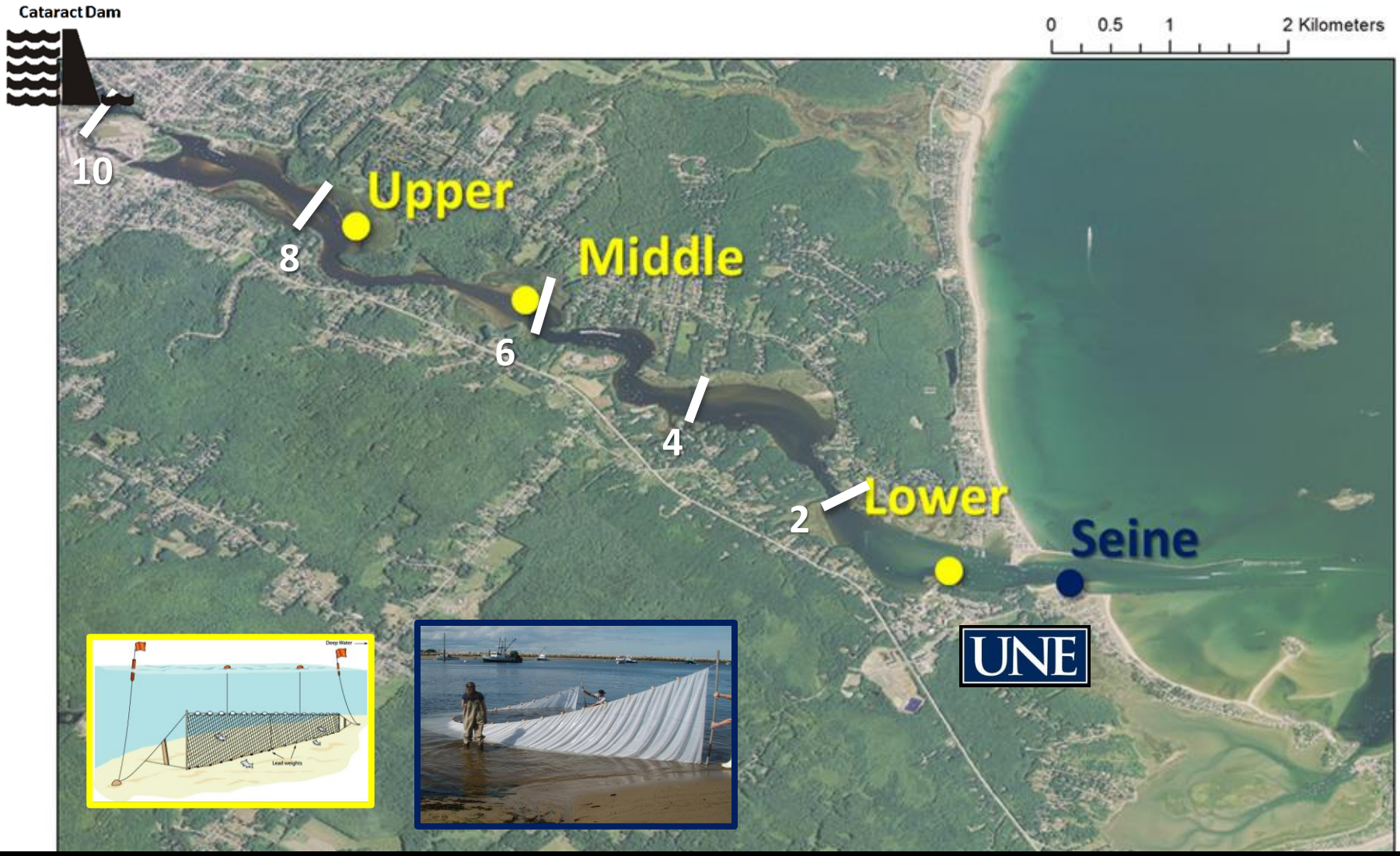
- Complicated life history
- Severe population declines
- Lost connections = impaired ecosystems
- **Need**: better define interactions and linkages between species



Does fish species diversity, richness and abundance vary along a river gradient in the Saco River estuary?

Is there interannual variability in the fish community?

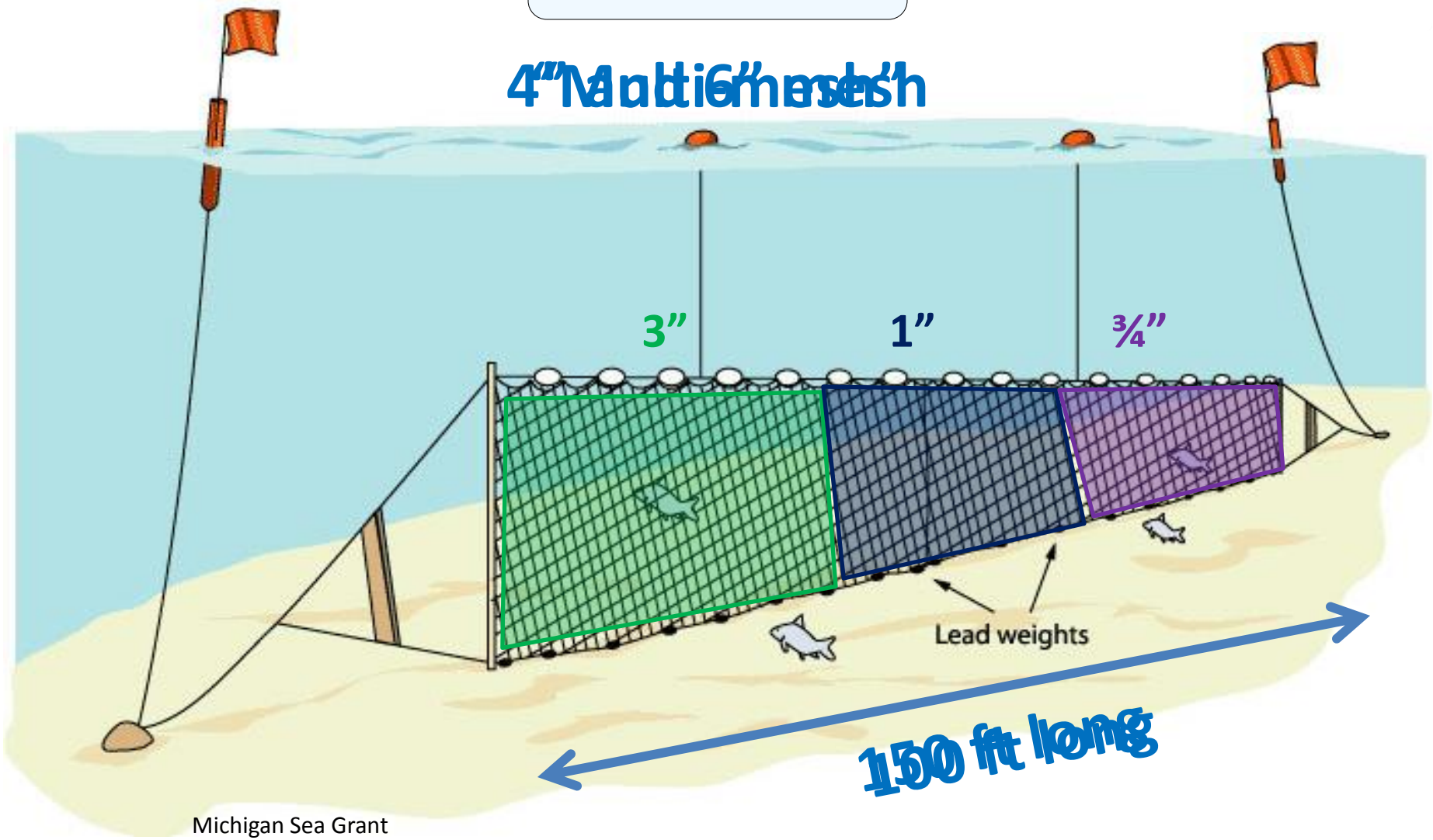
River Channel Sampling



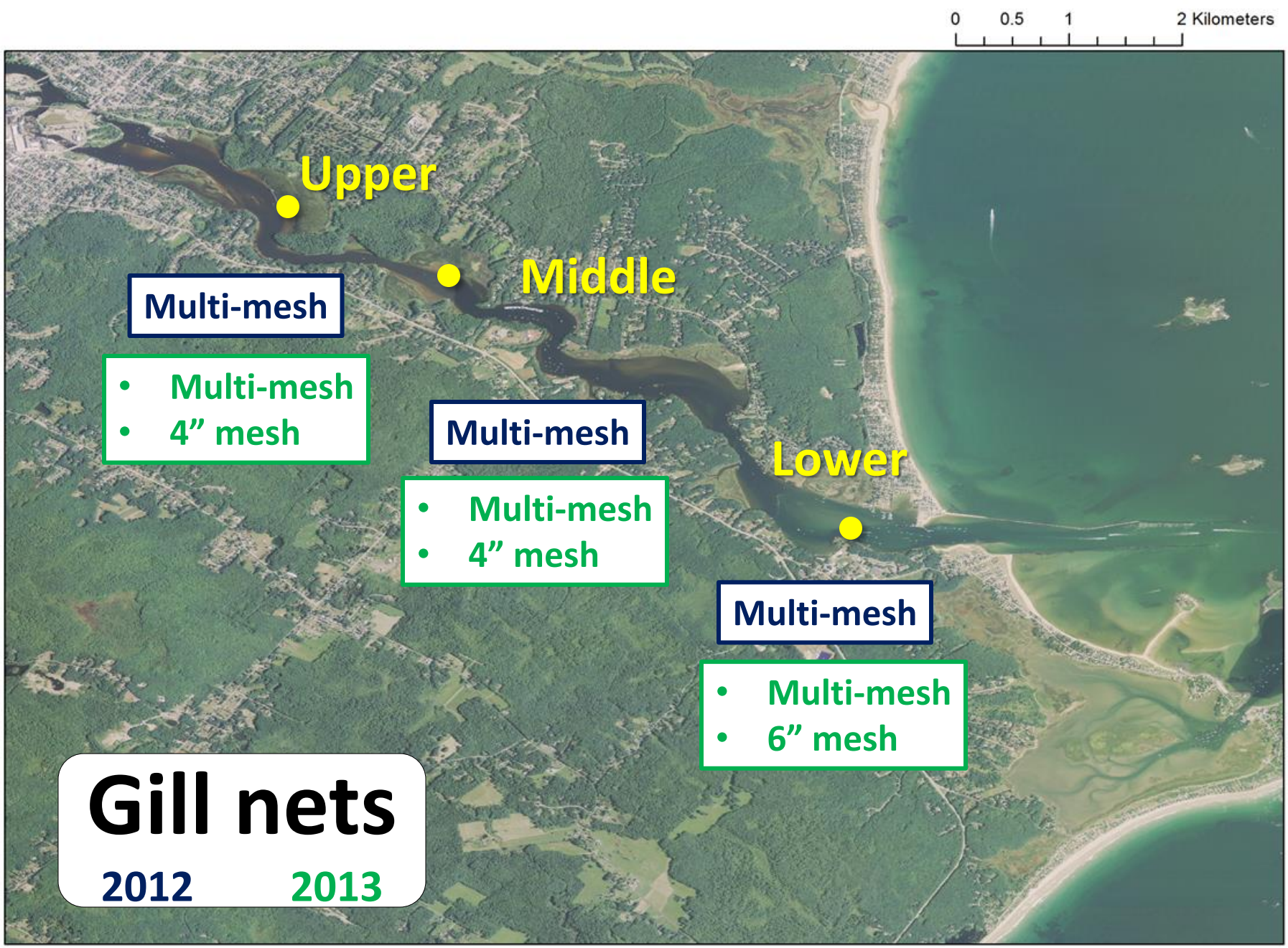
Gill nets

Channel

Marsh



Michigan Sea Grant


0 0.5 1 2 Kilometers
Upper
Middle
Lower
Multi-mesh
• Multi-mesh
• 4” mesh
Multi-mesh
• Multi-mesh
• 4” mesh
Multi-mesh
• Multi-mesh
• 6” mesh
Gill nets
2012 2013

Sampling Methods – Gill nets

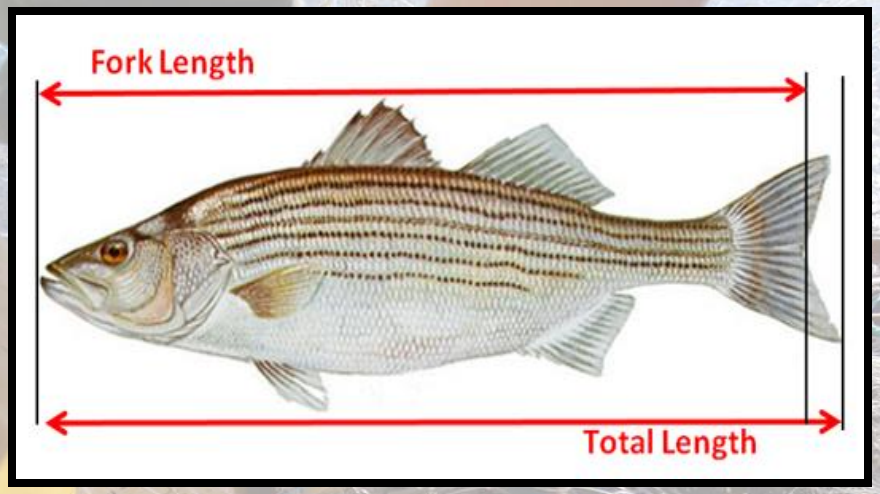
- Set between 2 and 4 a.m.
- Pick-up between 6 and 8 a.m.

- Temperature
- Salinity
- Dissolved oxygen

Beach Seining

2010-13

Fish Metrics and Abundance



Catch-per-unit-effort (CPUE)

$$CPUE = N/t/l_n/h_n$$

N = Number of fish caught
t = Time of net in water
l_n = Length of net
h_n = Height of net mesh area

Biodiversity Indices

Shannon - Wiener Diversity Index

$$H' = -\sum_{i=1}^{s} pi \ln pi$$

H’ = diversity index,
S = total number of species
pi = proportion of S represented by the ith species

Simpsons diversity index

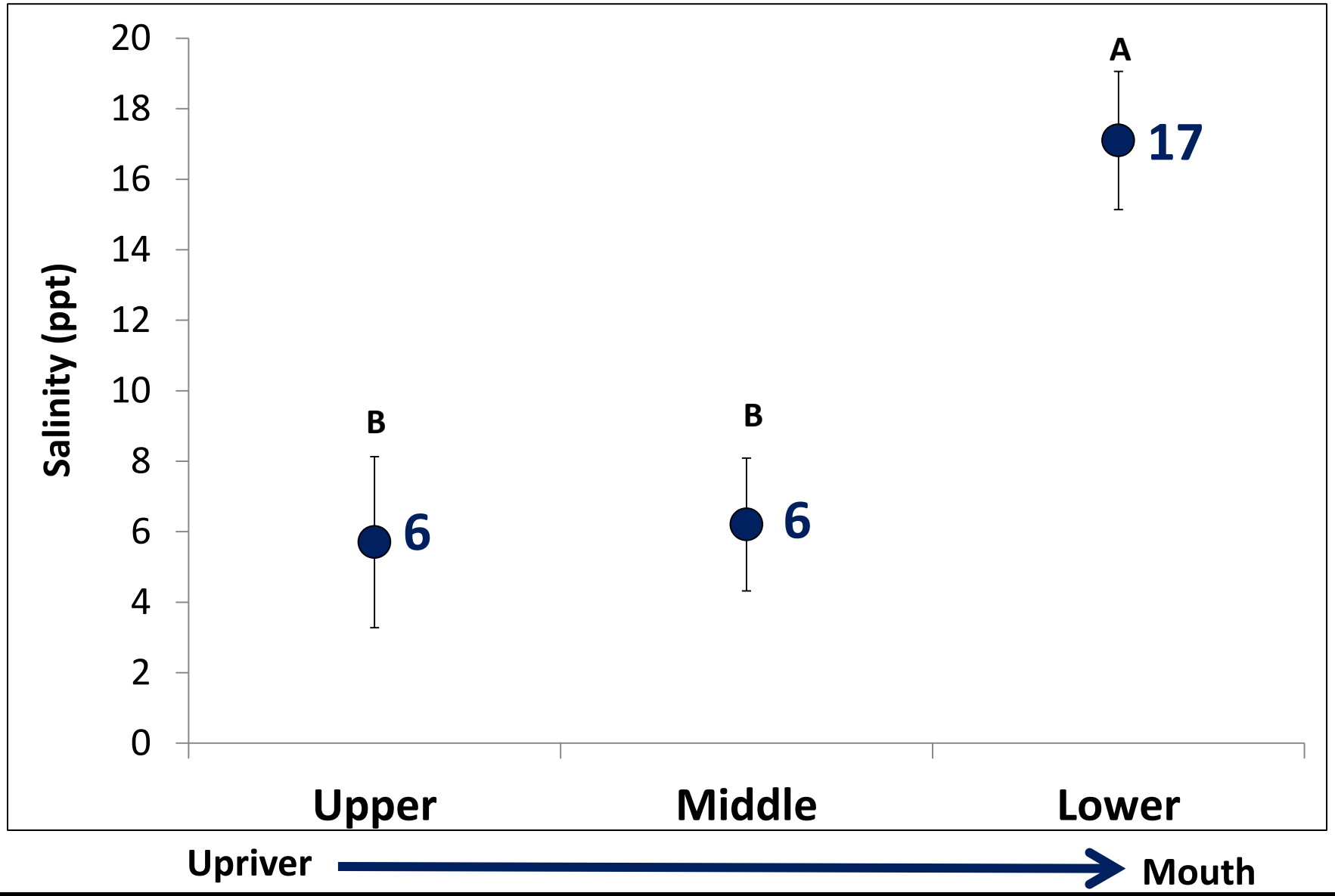
$$D = 1 - \frac{\sum \mathrm{n}(n-1)}{\mathrm{N}\,(N-1)}$$

n = total number of individuals of a single species
N = total number of individuals caught

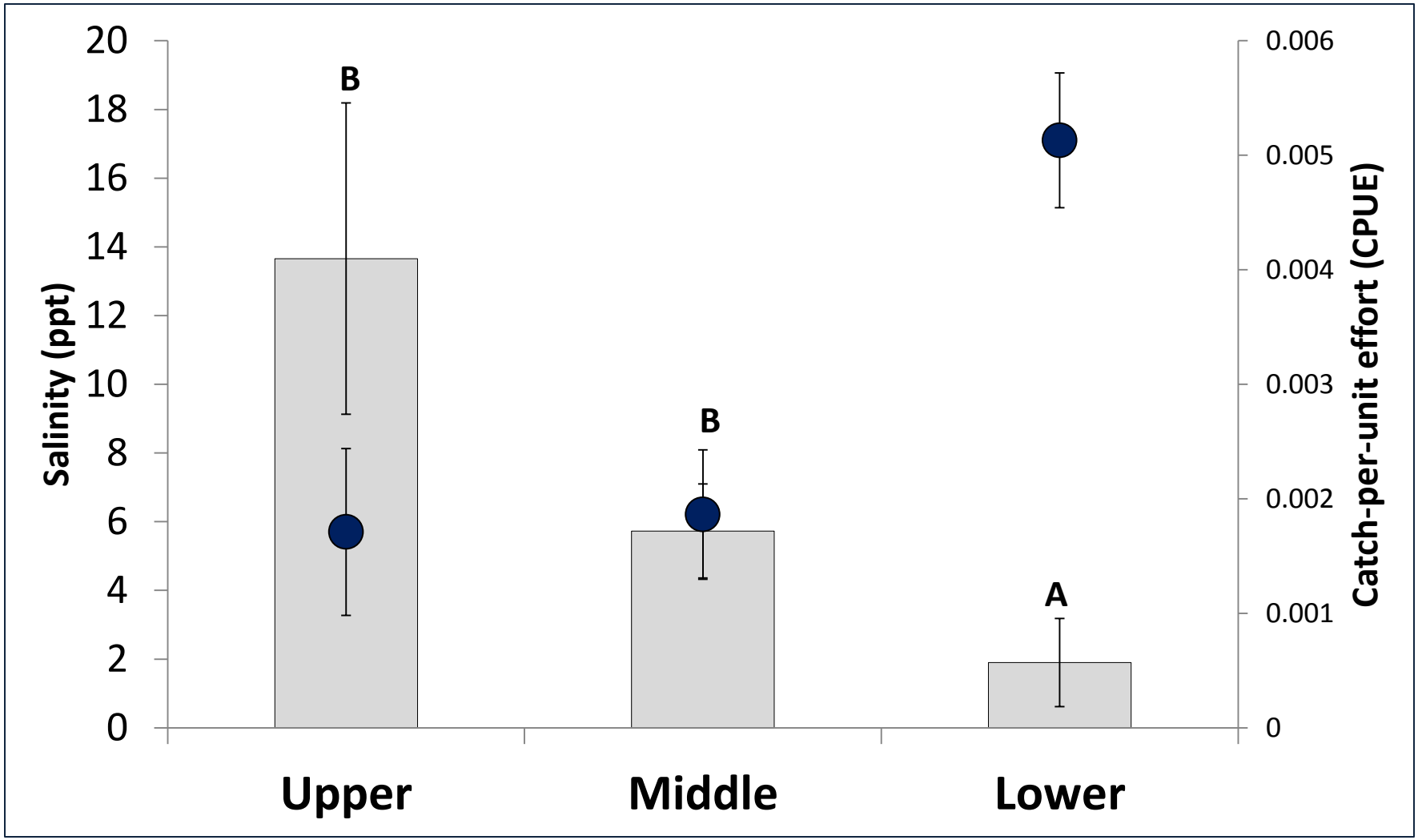
Preliminary Results – Gill nets

- **17 trips June through September**
  - 2012 (5)
  - 2013 (12)
- **230 hours fished**
  - Average soak of 3.7 hours
- **353 fish caught**
  - 13 species, juveniles and adults
  - 89 % diadromous fish

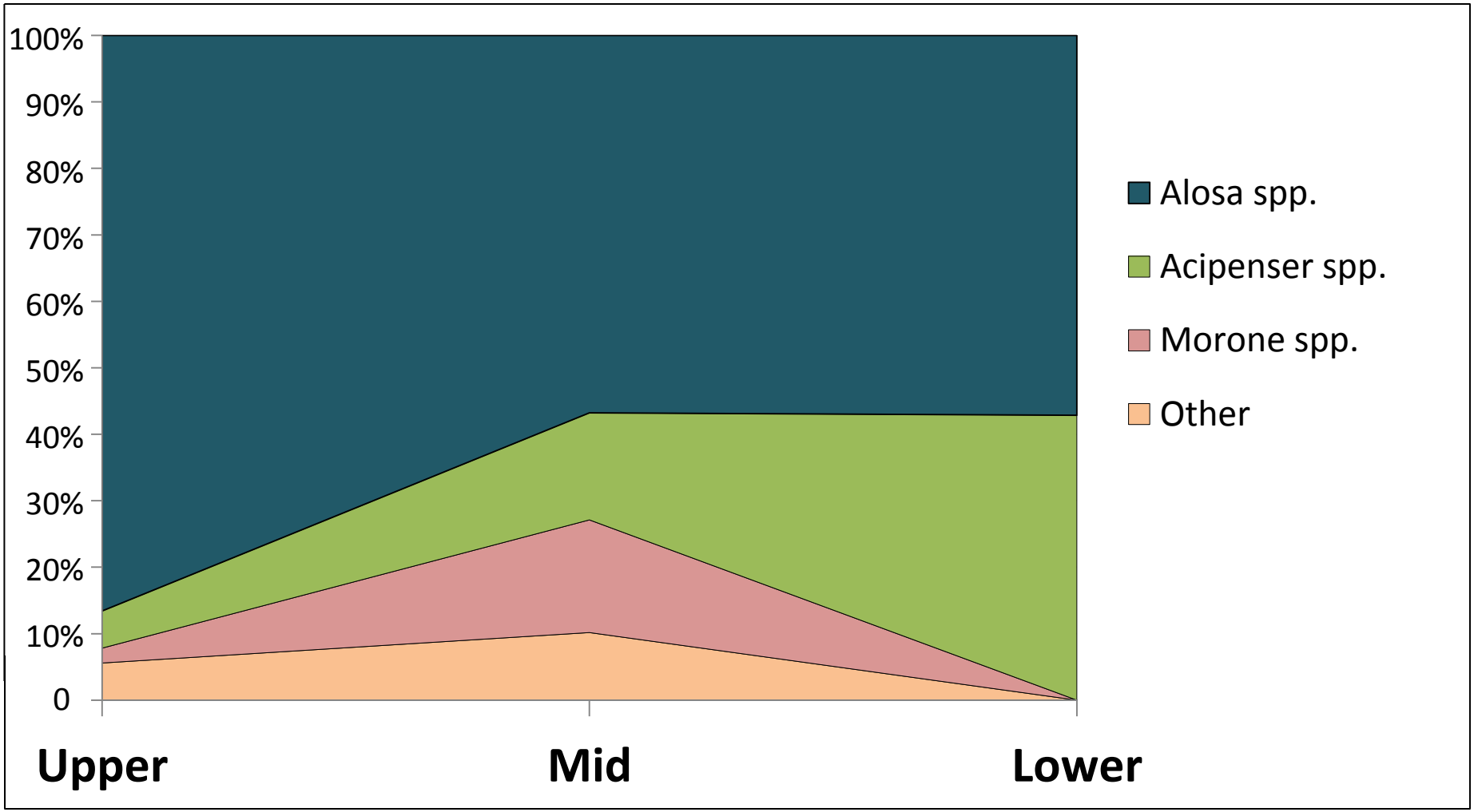
Salinity Gradient



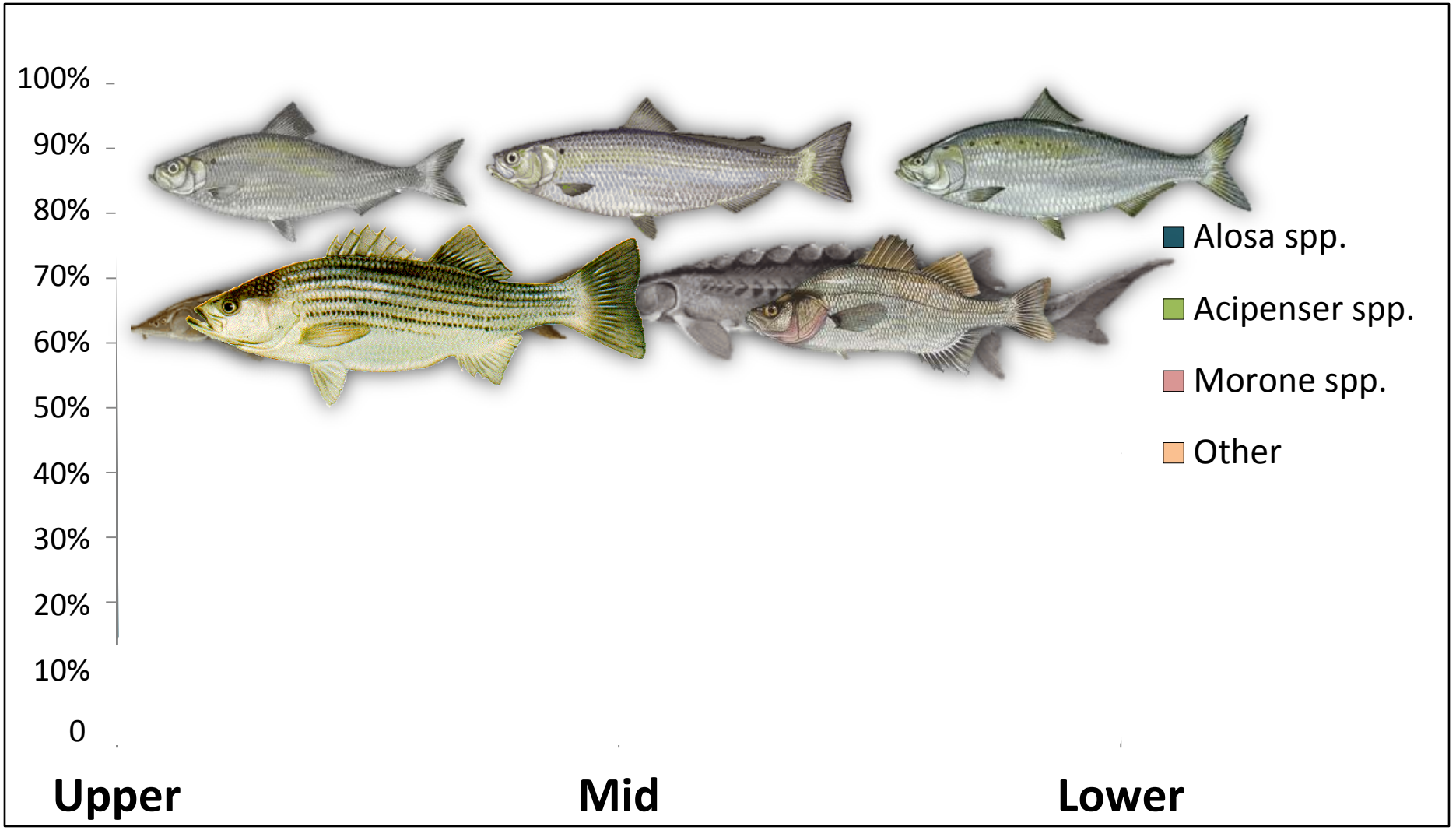
Fish Abundance



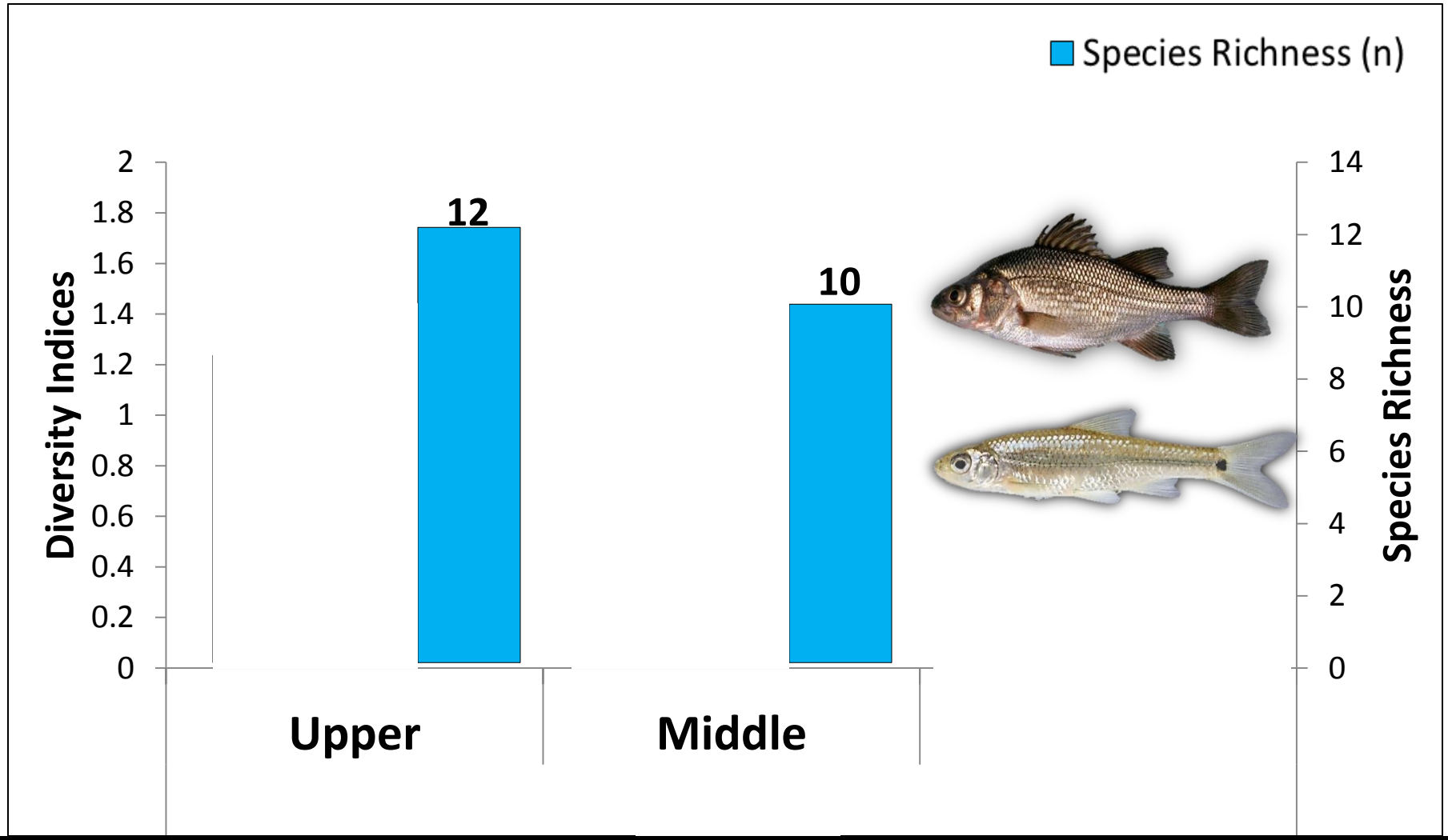
Fish Abundance



Fish Abundance



Biodiversity Indices

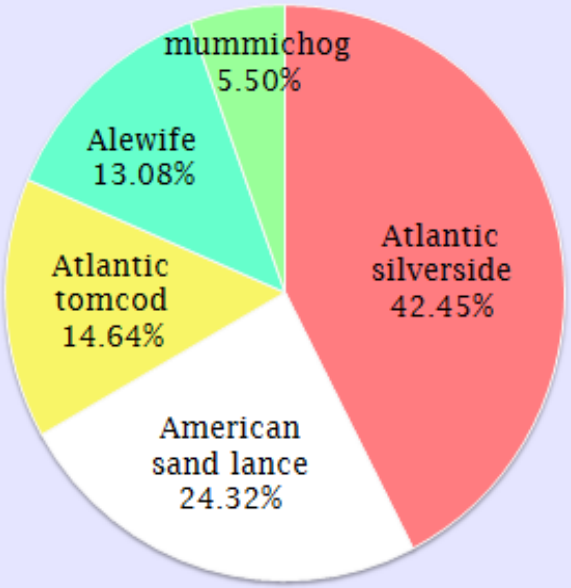


Results – Beach Seining

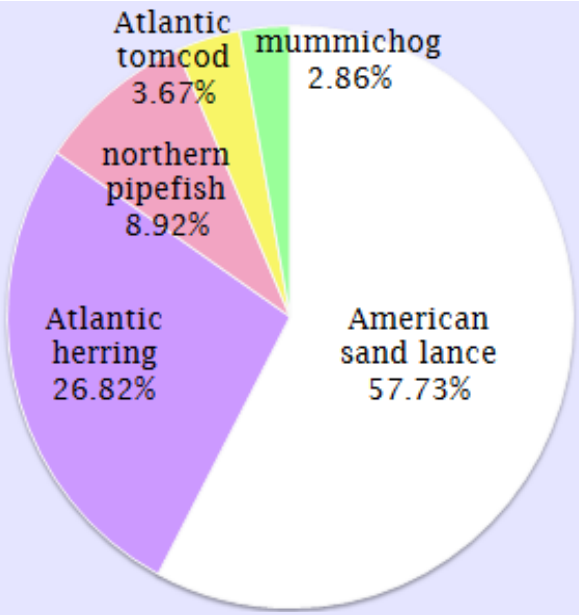
227 seines **11,544 fish** **4% Diadromous**

Fish Abundance

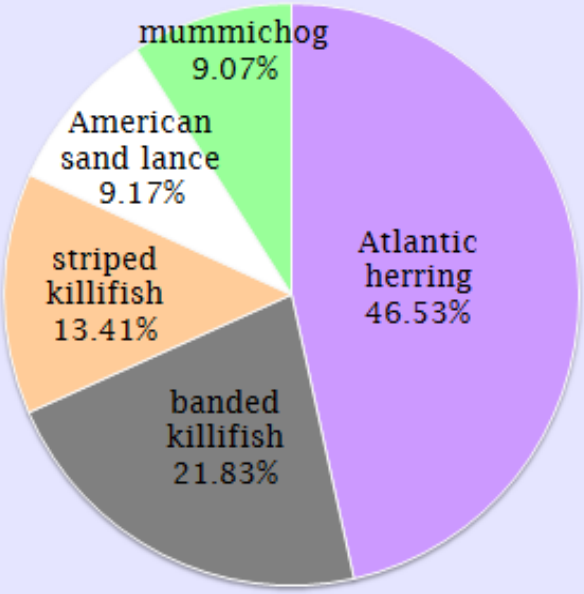
2010



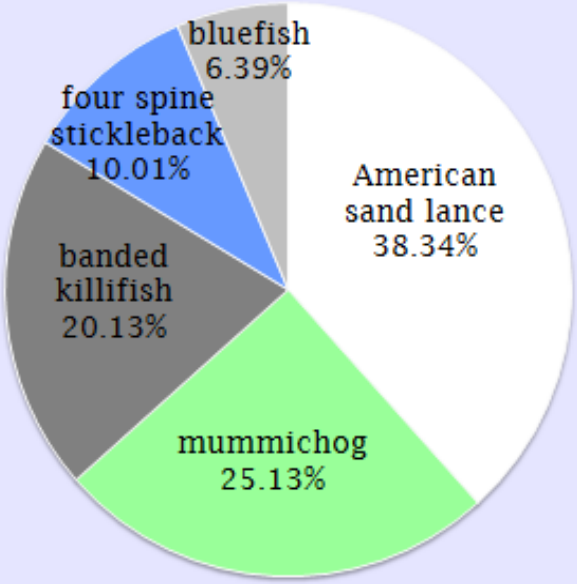
2011



2012



2013



Life History Groups

Water classifications from the EPA's Volunteer Estuary Modeling Manual. Fish species life history classifications categorized by Dionne et al. (1999) and FishBase v. 04/2014.

Summary

- **33 fishes and 4 crustacean species**
  - Gill nets (13), Beach seines (28)
- **5 federally-listed species**
  - **Endangered** (shortnose sturgeon)
  - **Threatened** (Atlantic sturgeon)
  - **Species of Concern** (blueback herring, alewife, and rainbow smelt)
- **4 species of recreational importance**
  - largemouth and striped bass, pumpkinseed, bluefish
- **3 species with commercial fisheries**
  - Atlantic herring, winter flounder, red hake

Summary

- **Fish abundance, richness and diversity**
  - Lowest in areas with significant salinity mixing
  - Greatest in areas with less tidal influence
- **Diadromous fish not observed**
  - brook trout, sea lamprey and Atlantic salmon*
- **Comparison to Wells Reserve sampling and Penobscot River (Kiraly et al.,2014)**

Comparison to other estuaries

- **Since 2007, (60) species have been observed in the SRE and Bay**
  - Little River **(33)**
  - Kennebec Point **(27)**
  - York River **(24)**
  - Wells Harbor **(24)**
  - Weskeag River **(10)**
  - Penobscot River **(35)**
  - Penobscot Bay **(22)**
  - Casco Bay **(25)**
  - Muscongus Bay **(24)**

(Orrniger et al. 2005; Lazzari et al. 1996; Dionne et al. 2006; Ayvazian et al. 1992; Kiraly et al 2014 Lazzari 2002; Lazzari and Tupper 2002; Lazzari et al. 2003)

Future Work

- **Continue to collect abundance data**
  - Correlation with freshwater discharge and time from peak high tide
- **Create a static food web model**
  - Mass-balance approach
  - Goal: Determine role of diadromous fish as predators and prey

Thank you!

- **Sulikowski Lab – Brenda Rudnicky, Julia Reynolds, Ashleigh Novak**
- **This research was conducted as part of the Sustainability Solutions Initiative, supported by National Science Foundation award EPS-0904155 to Maine EPSCoR at the University of Maine**

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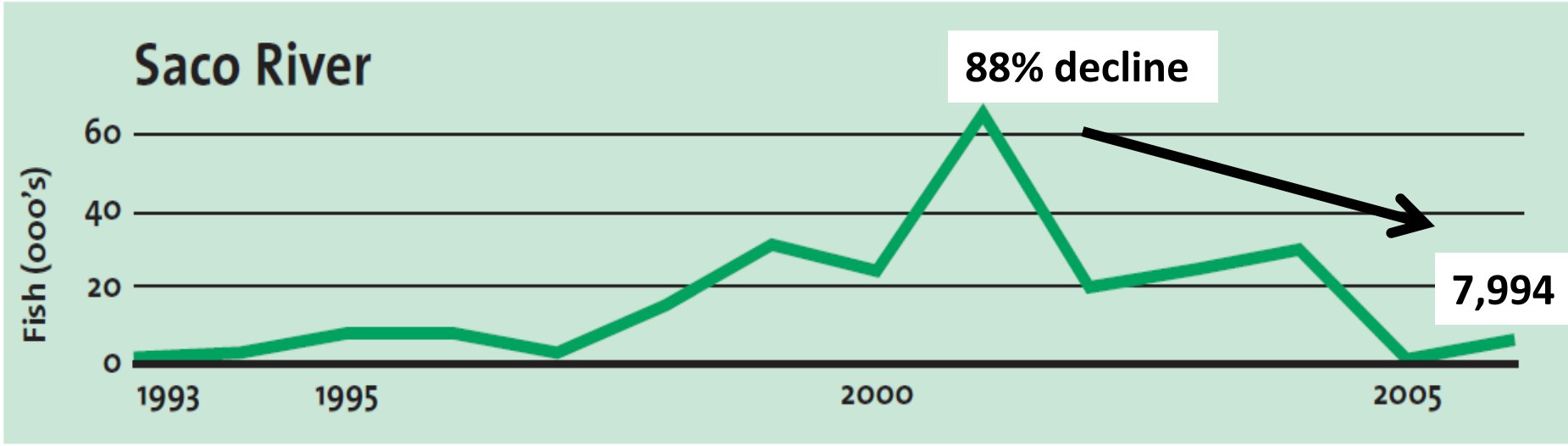
Questions?
Comments?
Suggestions?

River Herring Counts



Empty Rivers The Decline of River Herring - A Report of the Herring Alliance
Source: ASMFC River Herring Compliance Reports.