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# Evidence of River Herring Life History Variation in Penobscot River Estuary, Maine USA

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Duffy

March 14, 2016

# Background



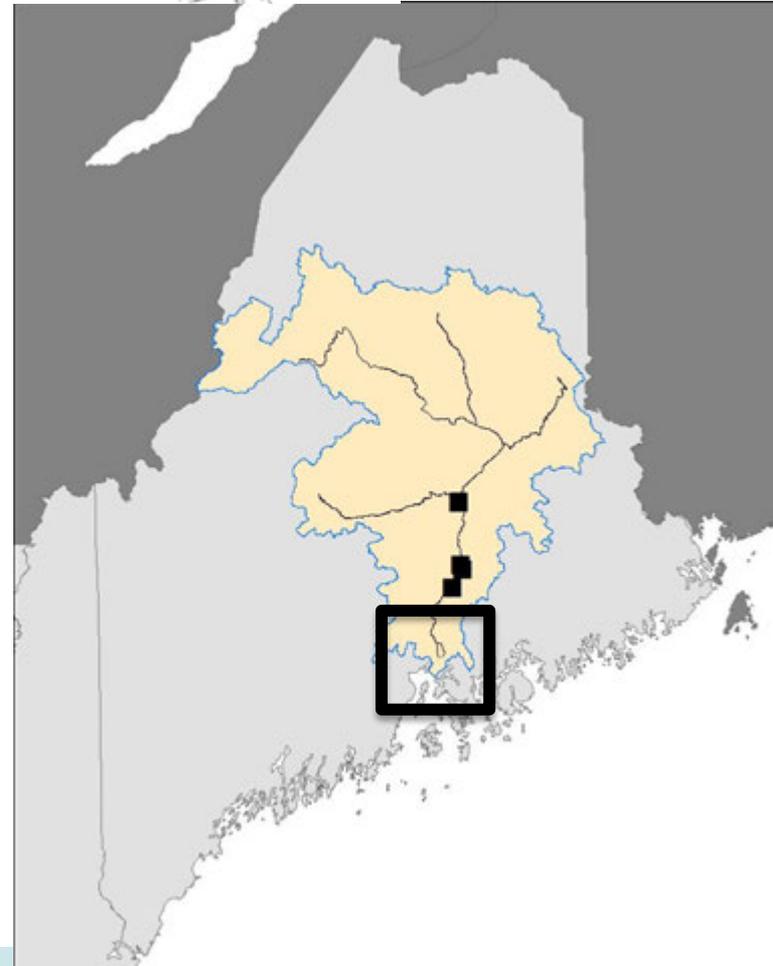
- Penobscot River
- Site of active restoration
  - Dam removal
  - Inter-basin stocking
- NMFS survey 2010-present



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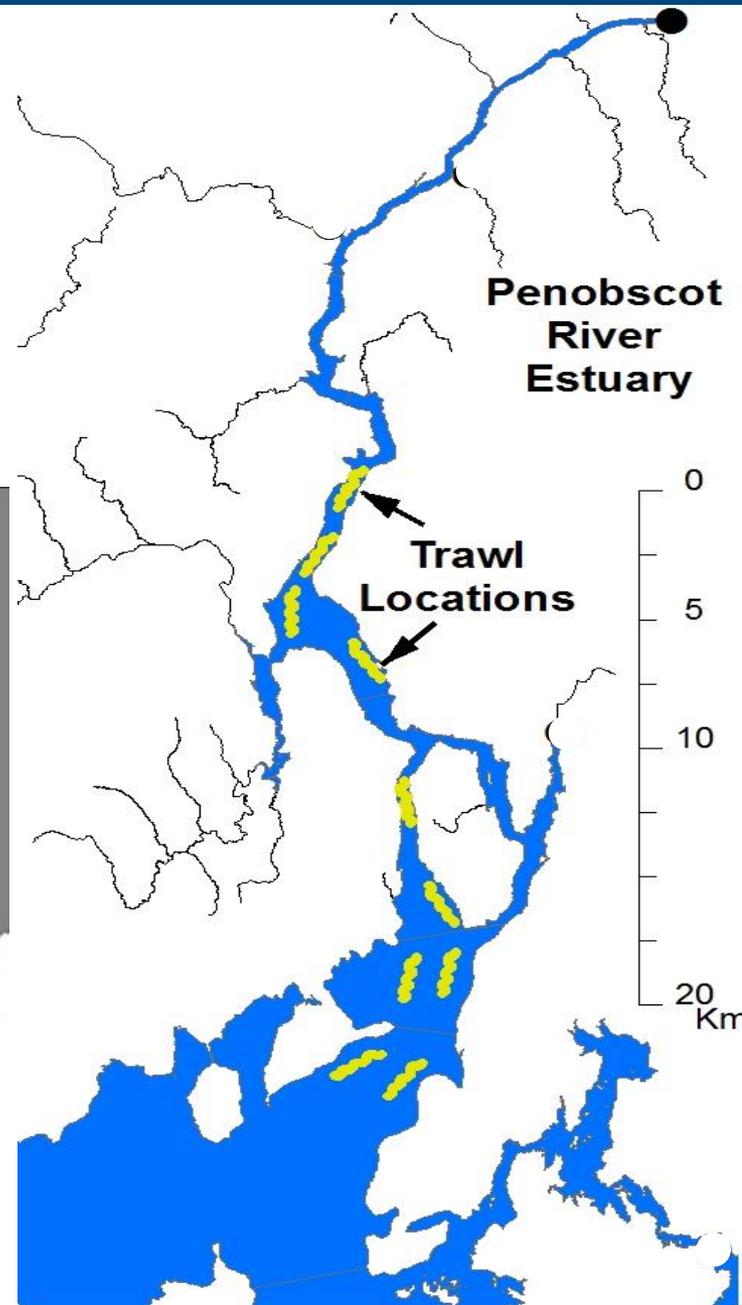


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# Study Area

- Penobscot River Estuary
- 10 trawl stations
- 0-28 ppT
- Turbidity max.



# Trawl - Methods

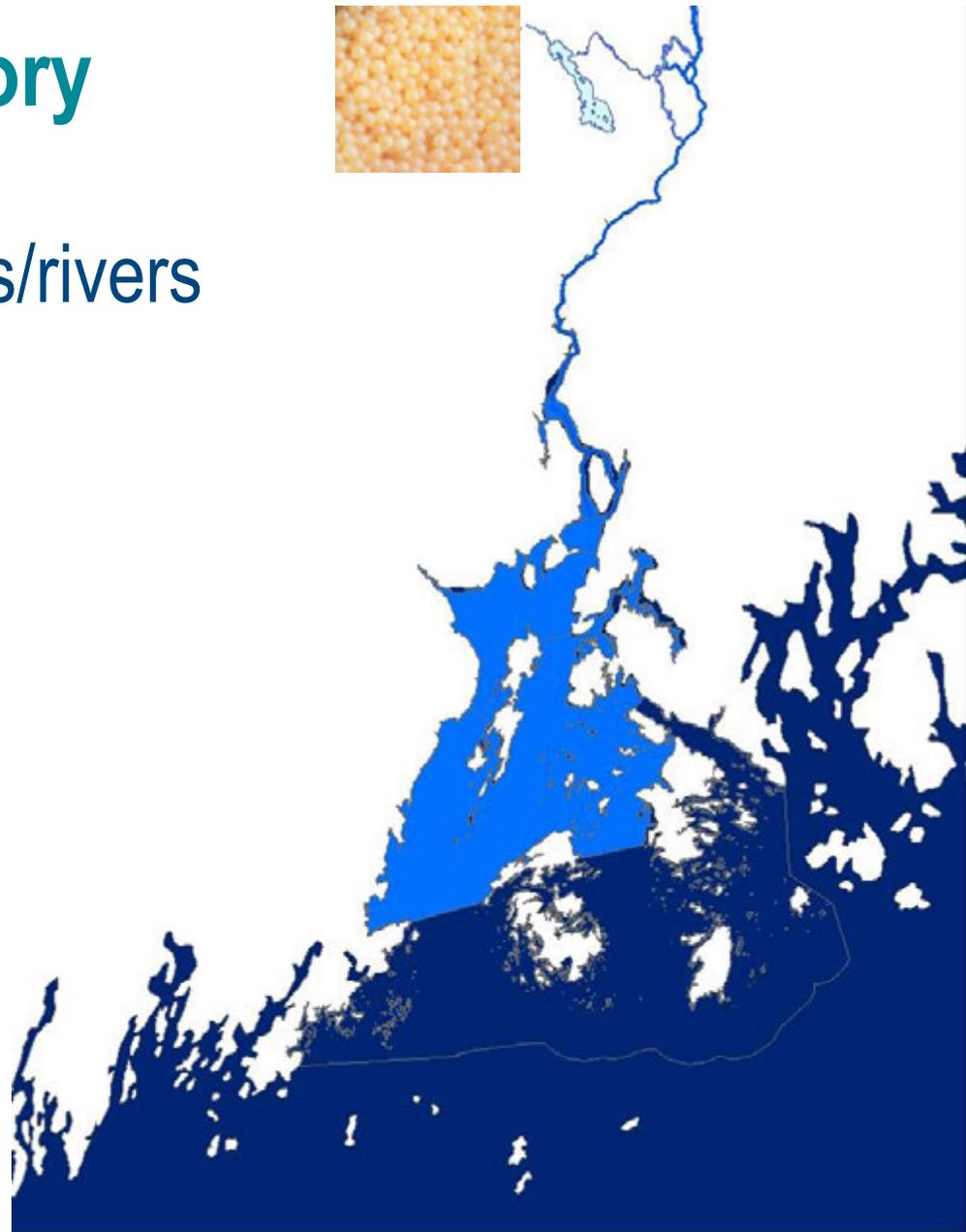
- 10m x 4m surface trawl
- 20 min. tows
- Weekly (spring) to monthly (summer and fall), 2012-13



- Catch ID and counts
- Length, weight, age (otoliths) from subsample
- Water temp., DO, salinity

# Generalized Life History

- Spring – Spawn in lakes/rivers
- Summer
- Fall



# Generalized Life History

- Spring
- Summer –freshwater nursery
- Fall



# Generalized Life History

- Spring
- Summer
- Fall – migration to marine rearing for 3+ years

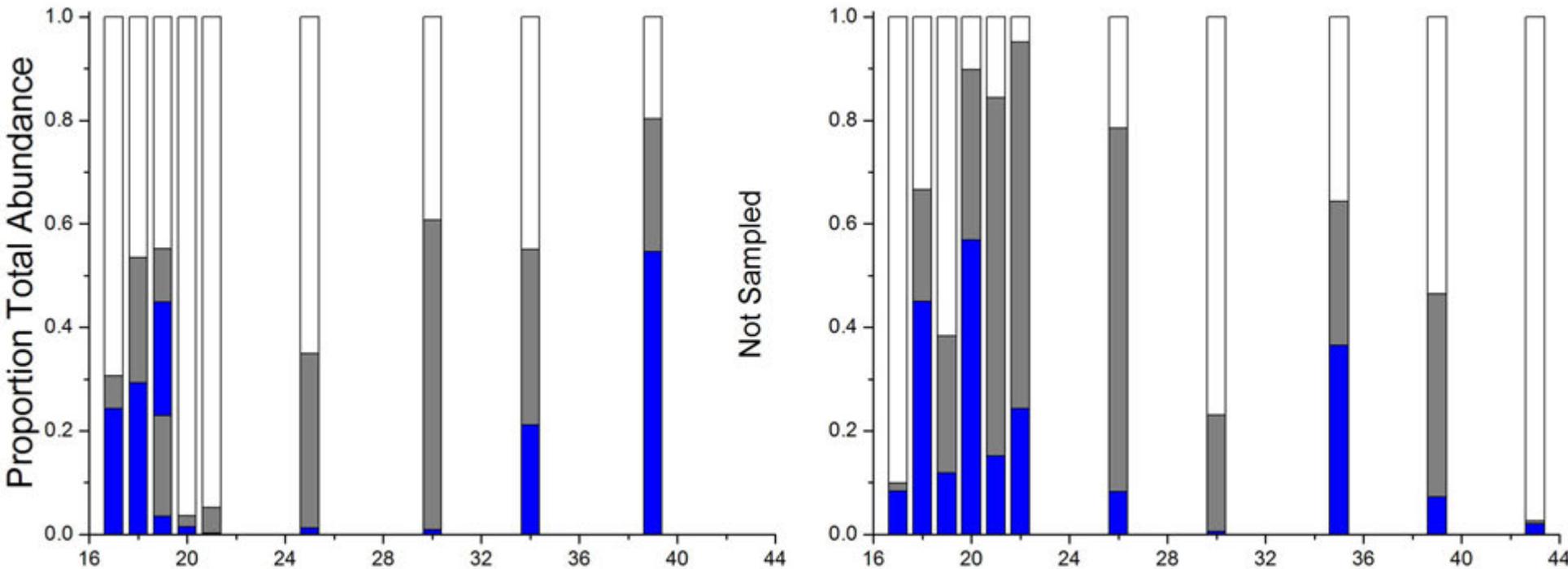


# Results

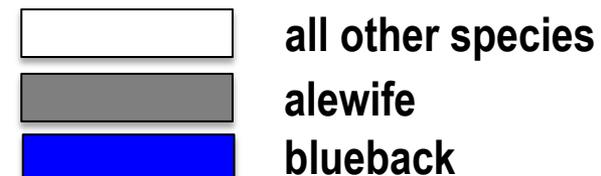
# Results: Species Composition - Abundance

2012 – 49,000 fish

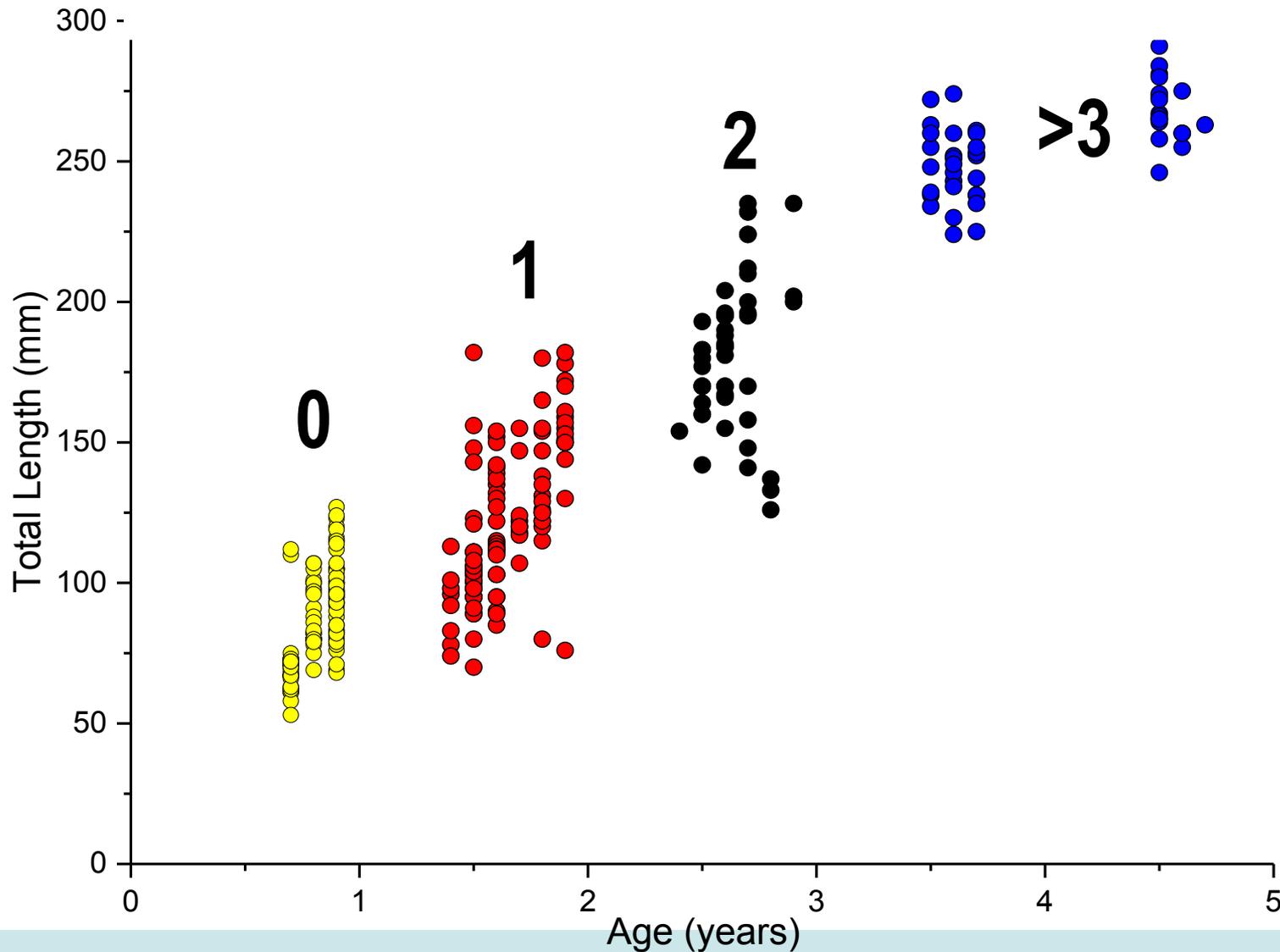
2013 – 40,000 fish



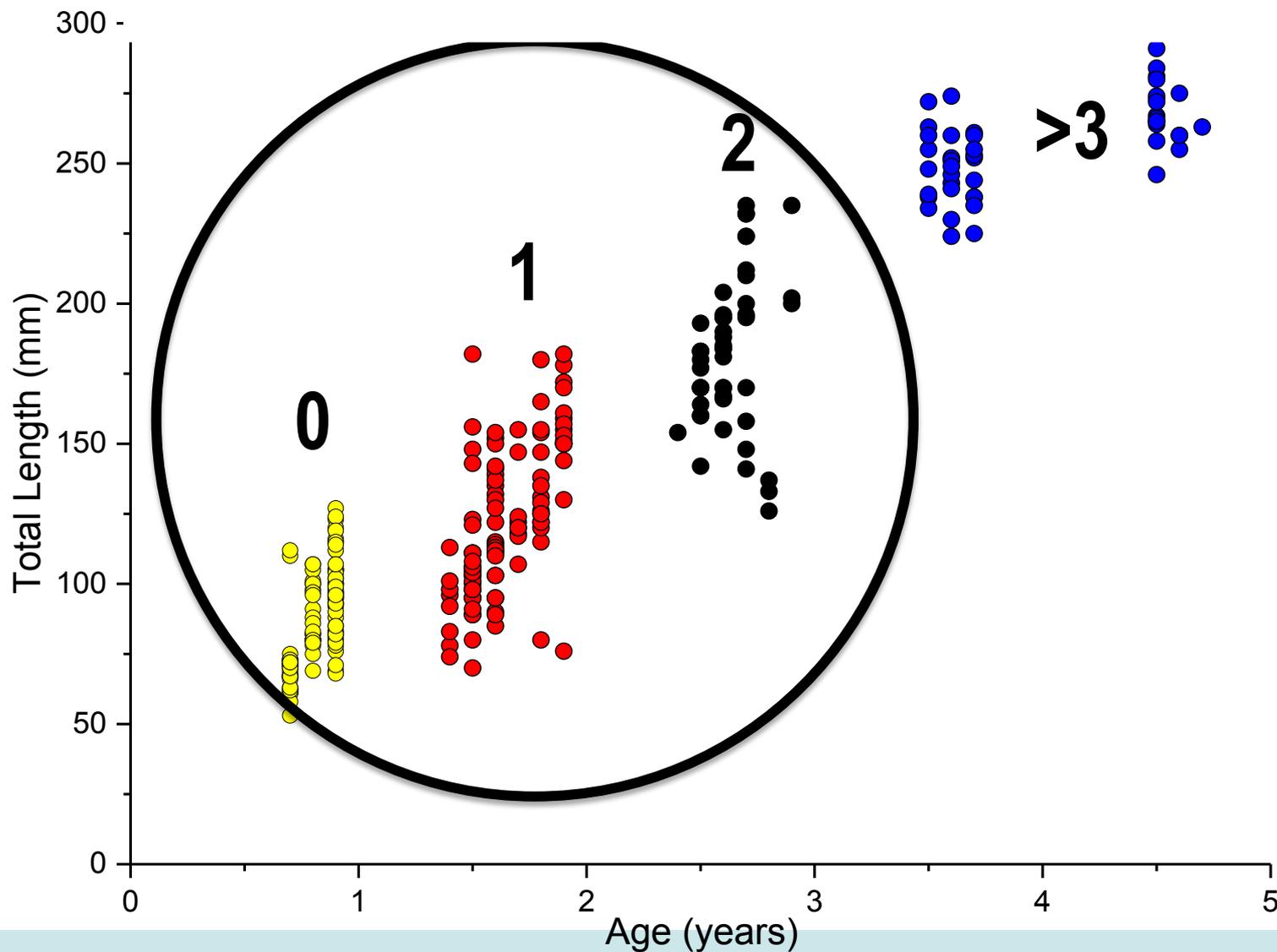
Standard Week



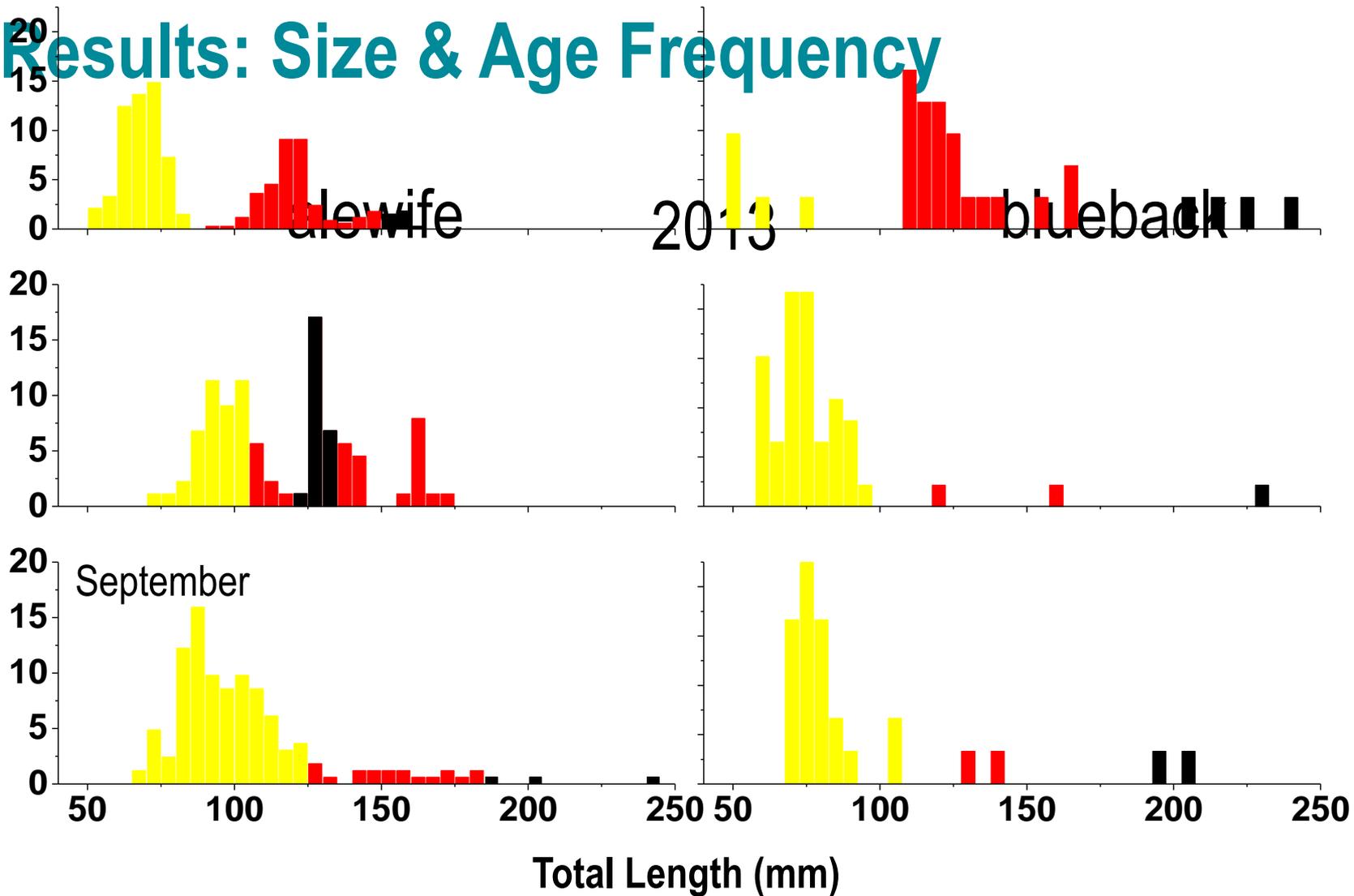
# Results: Age distribution - alewife



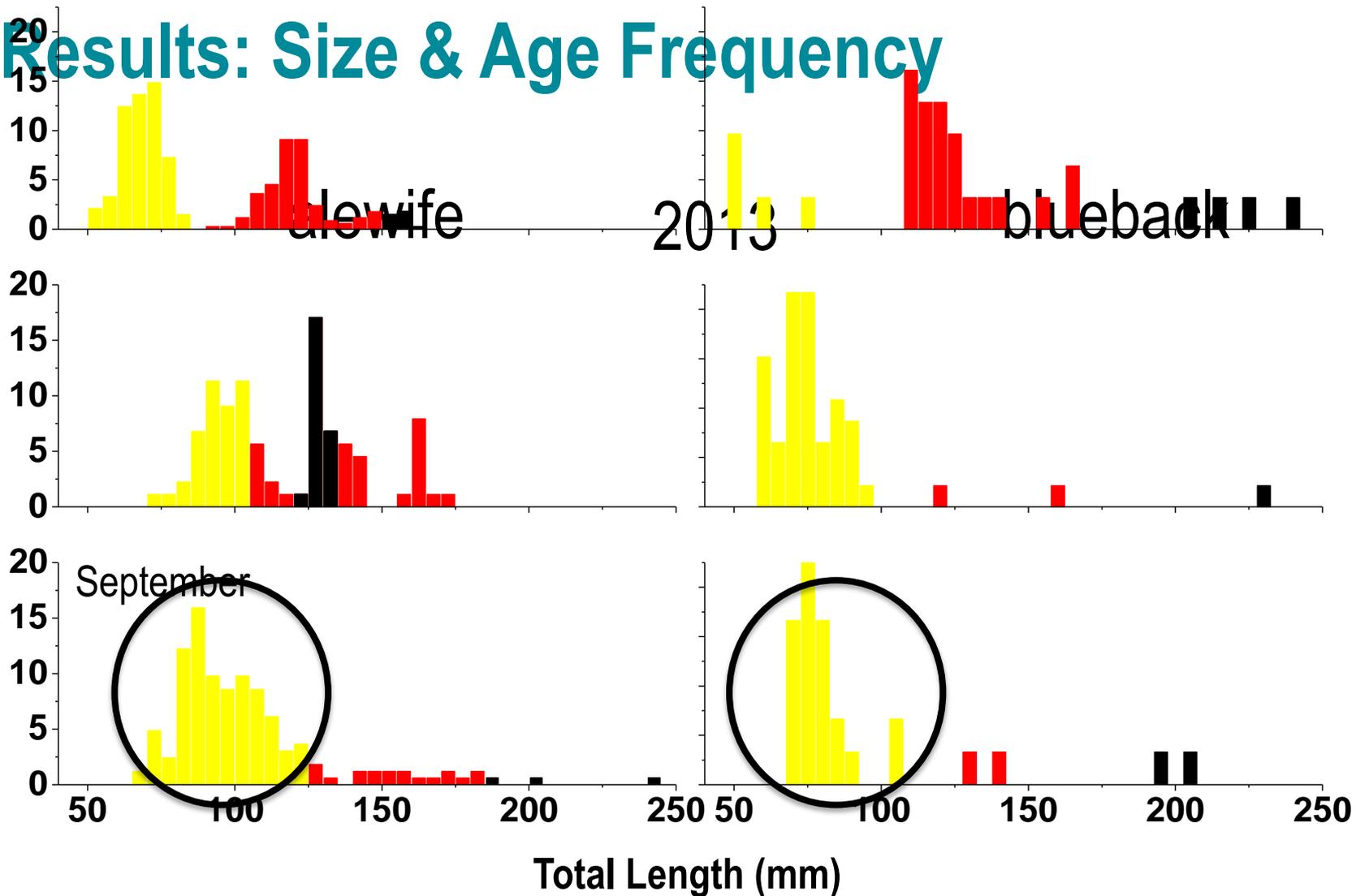
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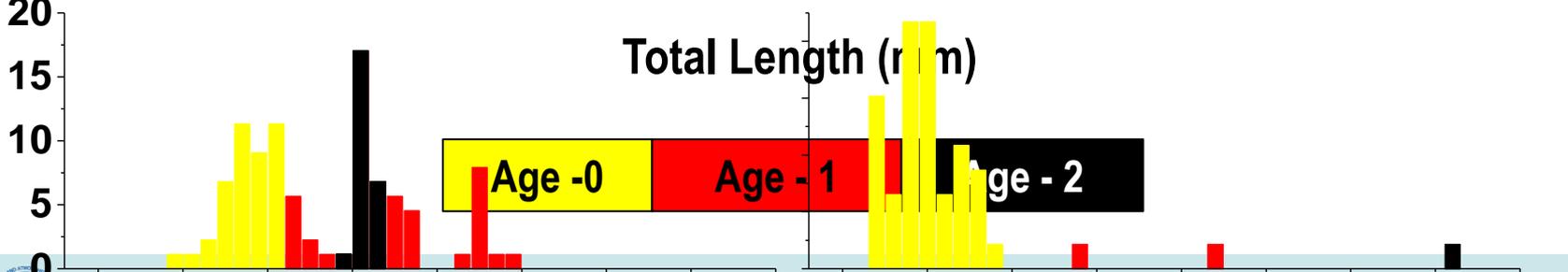
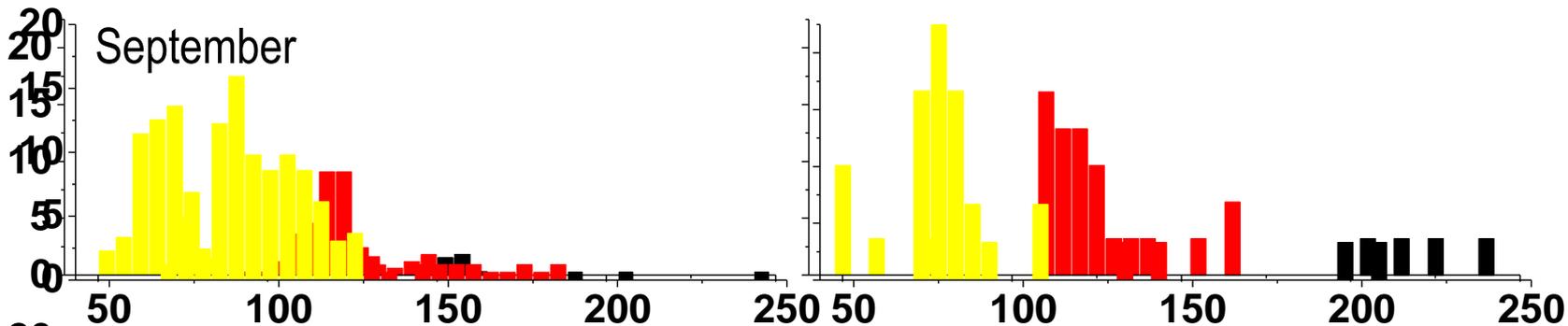
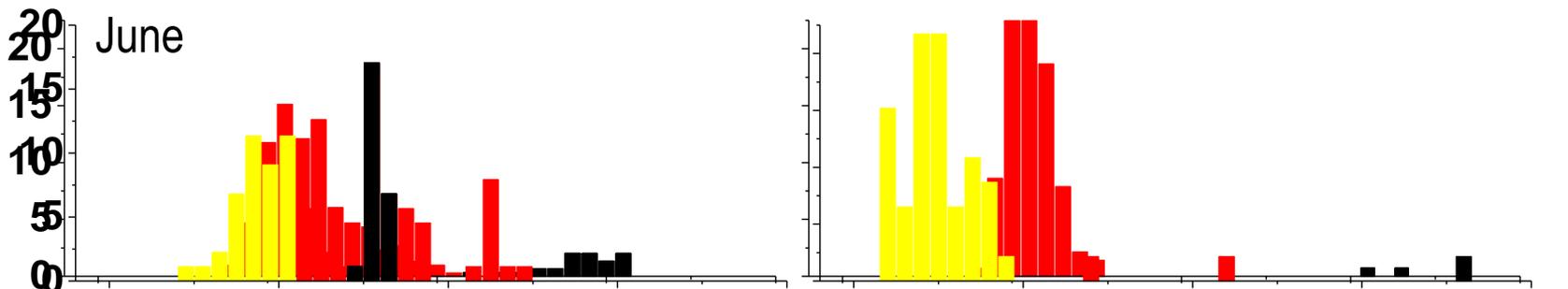
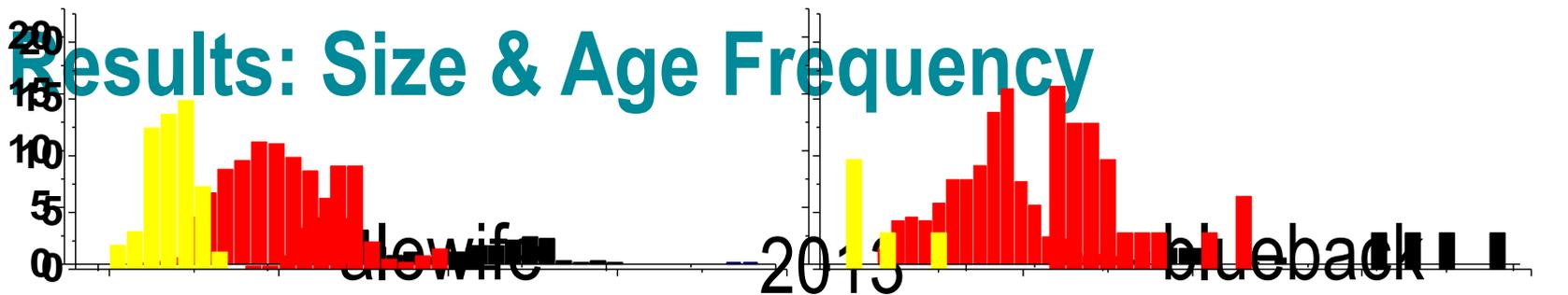
# Results: Size & Age Frequency



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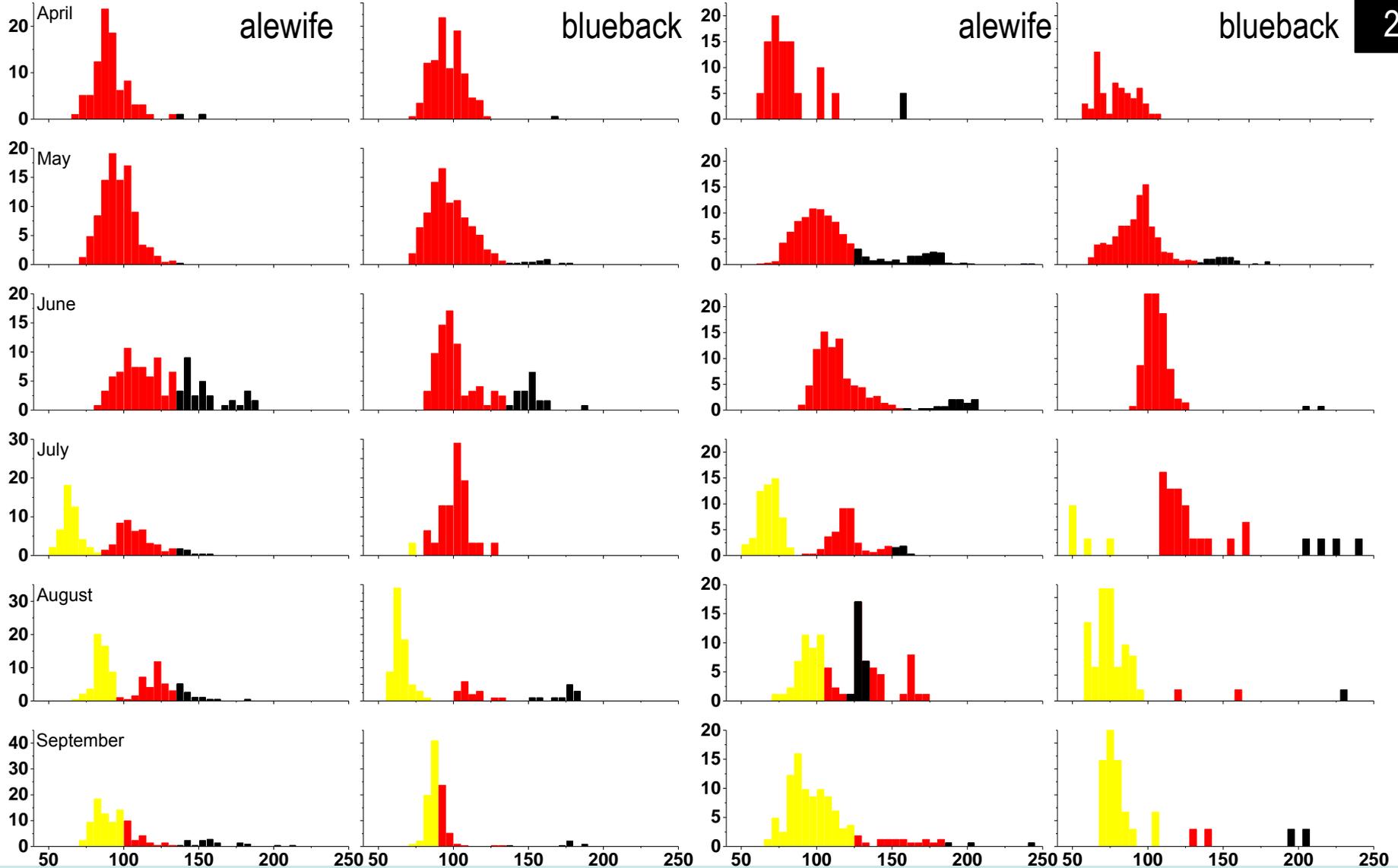


# Results: Size & Age Frequency

0
1
2

2012

2013



# Summary of Results:

- Juvenile river herring are persistent in pelagic estuary fish community
  - Age 0 – enter July – October as expected
  - Age 1 and 2 present April – October - unexpected

# Generalized Life History

- Spring
- Summer
- Fall – migration to marine rearing for 3+ years



# Alternate Life History

- Spring
- Summer
- Fall – migration to estuary and reside for 1+ years – **estuary rearing?**



# Conclusions: Implications

- **Species Resilience**
  - Life history diversity as solution to environmental stochasticity (i.e. Pacific Salmon)
  - See *Fisheries* March '16
  - Further evidence of life history diversity in *Alosa*
- **River Herring**
  - Important component of the estuary ecosystem

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# Future

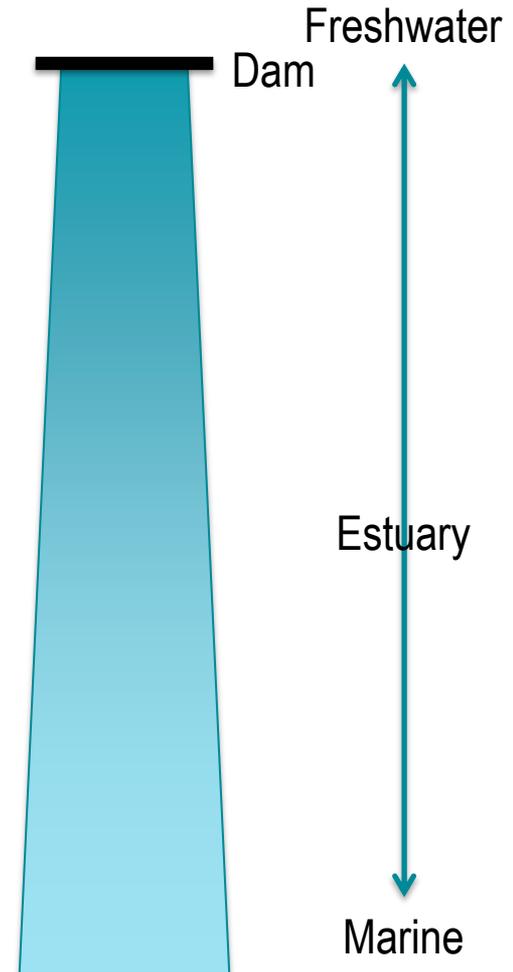
- **Given these habitat use patterns:**
  - Implications - What are growth & survival costs or benefits of marine rearing v. estuary rearing?
  - Mechanisms - Are patterns driven by habitat accessibility & suitability?

# Future - Implications

- More to come: Ongoing collaborations
  - Growth, microchemistry, etc.
- Archive of >2k otoliths – Juveniles & adults
- Collections through 2015

# Future - Mechanisms

- Limburg 1998
  - “Anomalous migrations”
- Gahagan et al. 2012
  - “Indirect migration...particularly in systems where movement between different habitats was **unrestricted**”
- Payne-Wynne et al. 2015
  - “...freshwater duration was positively correlated with the area of freshwater habitat **available**.”
- Limburg & Turner 2016
  - “non-textbook migrations...if estuarine habitats were **available**, these were commonly utilized after the fish spent some time in freshwater nurseries.”



# Thoughts & Questions?

- Acknowledgements
  - Capt. Josh Conover, F/V Odd Ball, Islesboro, Maine
  - Dr. Rachel Lasley-Rasher, UM Darling Marine Center
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  - Maine Field Station staff

