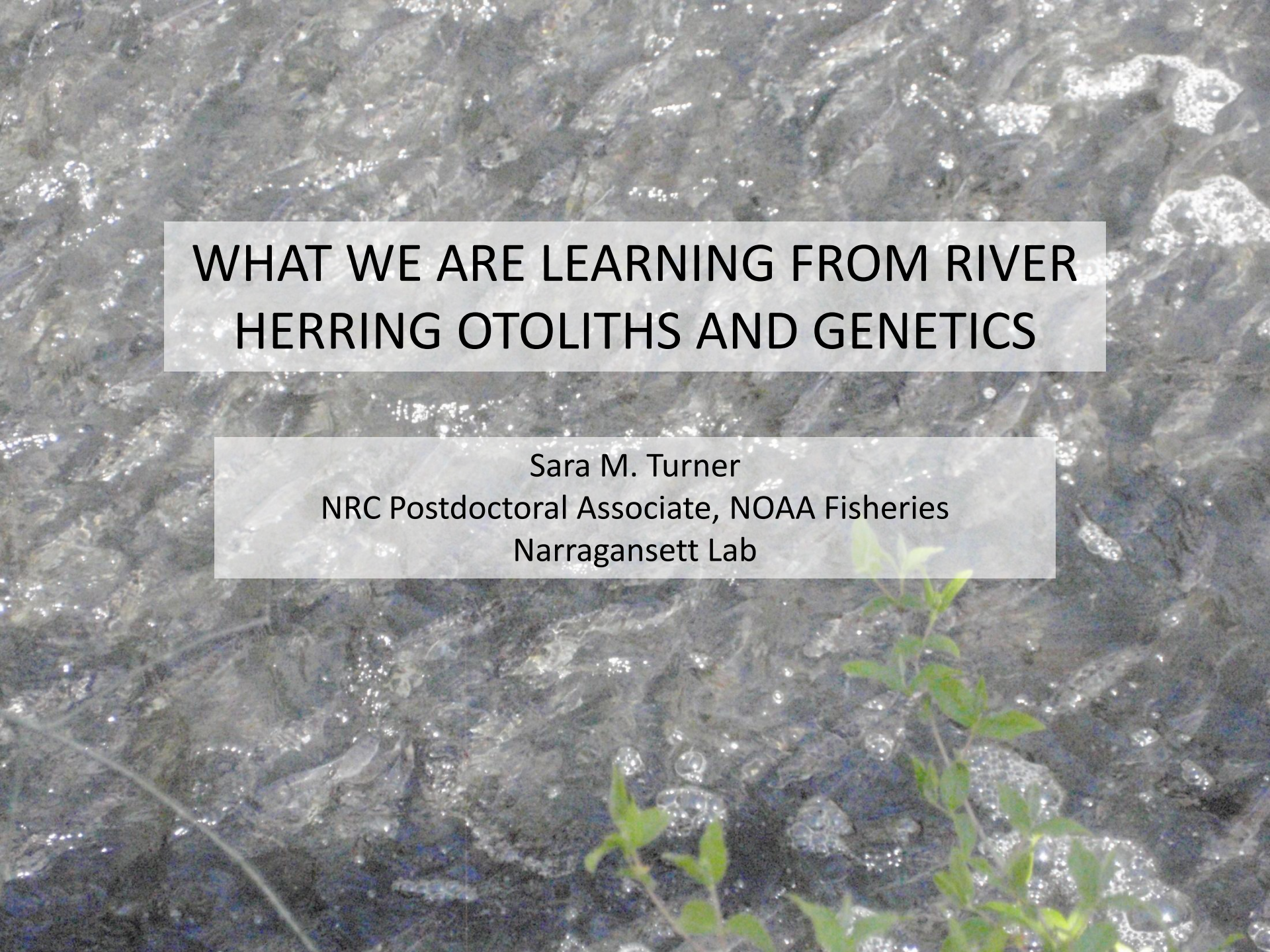

WHAT WE ARE LEARNING FROM RIVER HERRING OTOLITHS AND GENETICS

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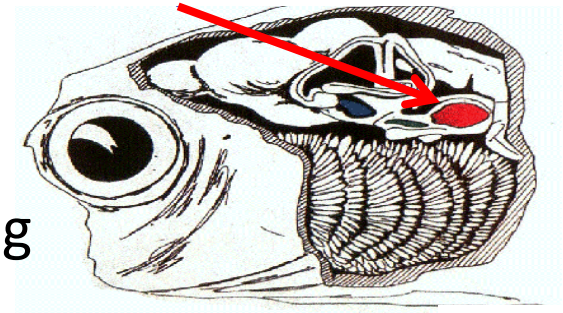
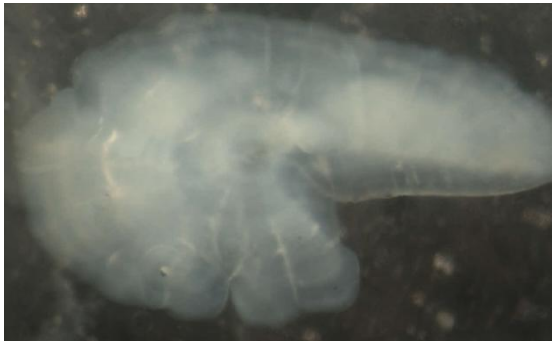
Narragansett Lab

What is an otolith?

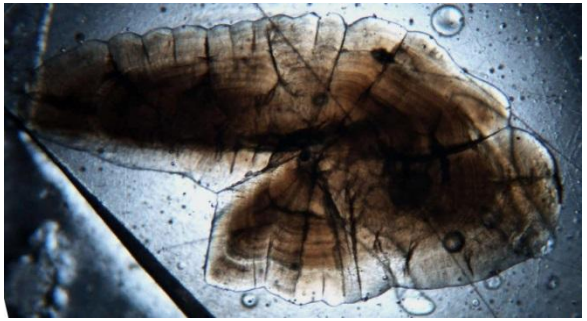
Otolith



- “Ear-stone”
- Functionally: Part of balance and hearing system (analogous to our inner ear)
- 3 pairs, one used for studies of most species



- Grow in proportion to fish
- Daily/ annual increments



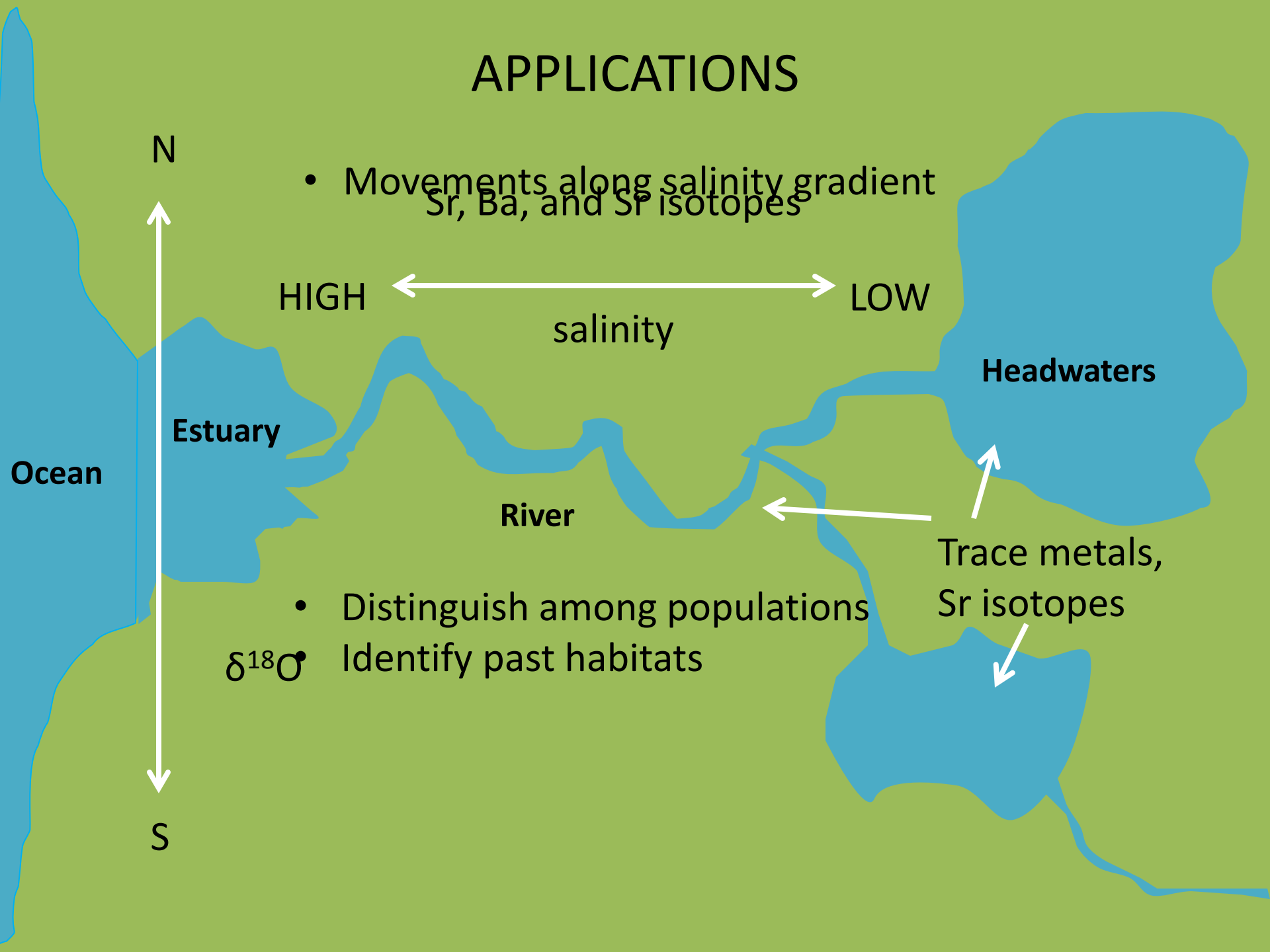
Otolith chemistry

Take up some elements/ isotopes in proportion to ambient availability

- Underlying bedrock – different geology, different weathering/ concentrations
- Human inputs/ sources
- Temperature/ salinity/ precipitation

  * Can vary over relatively short time/ space

APPLICATIONS

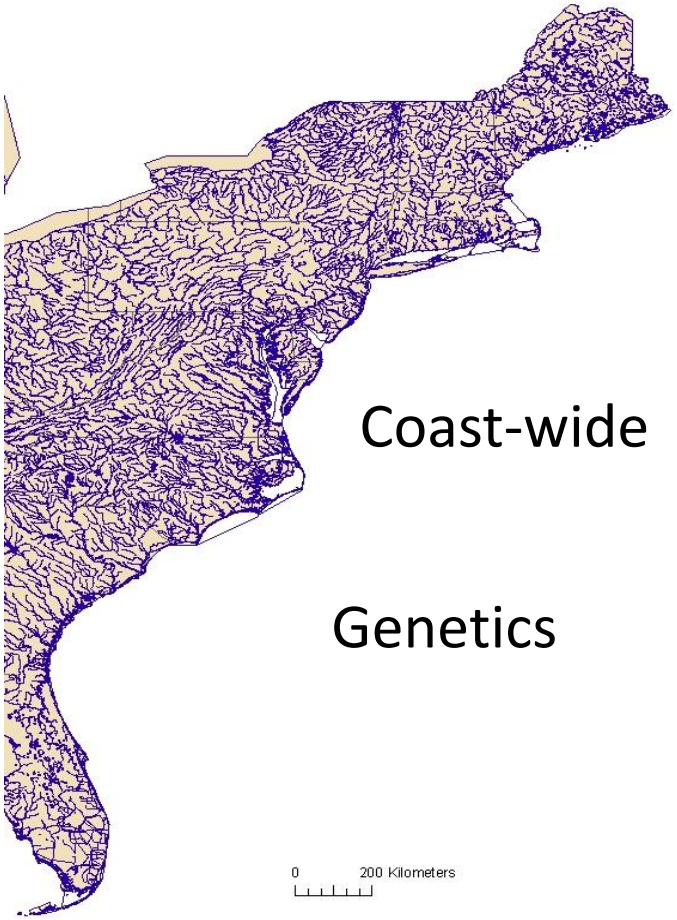


- Movements along salinity gradient
  - Sr, Ba, and Sr isotopes
- Distinguish among populations
  - $\delta^{18}O$
- Identify past habitats

Can otolith chemistry be used to distinguish among groups of fish reared in different areas?

Spatial scales

Statistical model with "leave-one-out" test



Coast-wide

cal

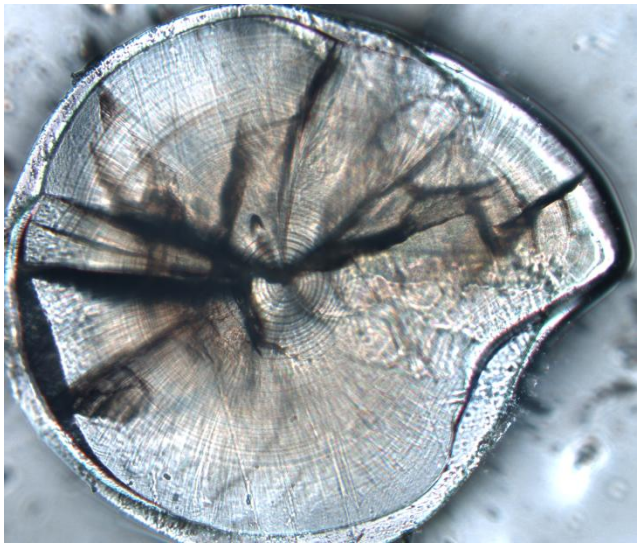
ds

Genetics


HUDSON RIVER WATERSHED
• One of largest East coast watersheds
• estuary > 250 km (> 155 mi)
• > 79 tributaries
LONG ISLAND ESTUARIES
nasa.gov

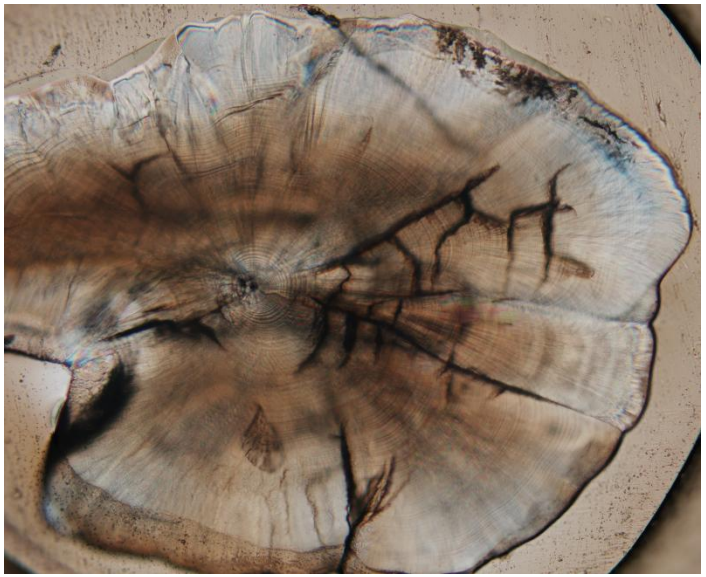
How well did it work? – Regional differences (w/ “Outgroups”)

- 1st tested years separately (2 years)
  - > 95% correctly re-classified to location within Hudson and Long Island
- Pooling years
  - High for alewife (93%), lower for blueback herring (67%)
  - Most mis-classifications within Hudson/ Long Island
- Pooling years, excluding oxygen isotope (difficult to sample for adults)
  - Both decreased substantially (76% alewife, 65% blueback)



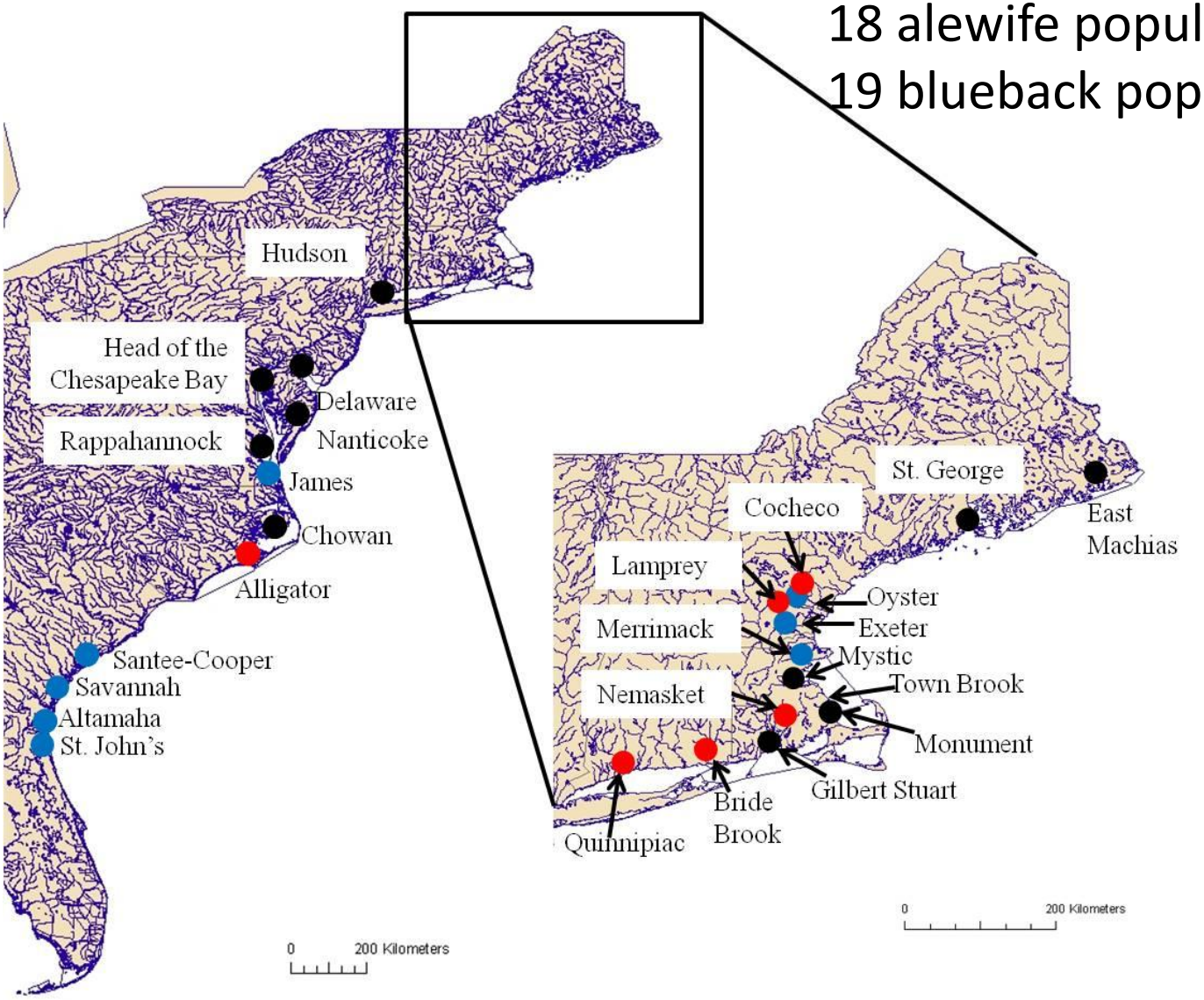
<- 28 mm fish (1.1 in.)

70 mm fish (2.75 in.) ->



Coast-wide Rivers

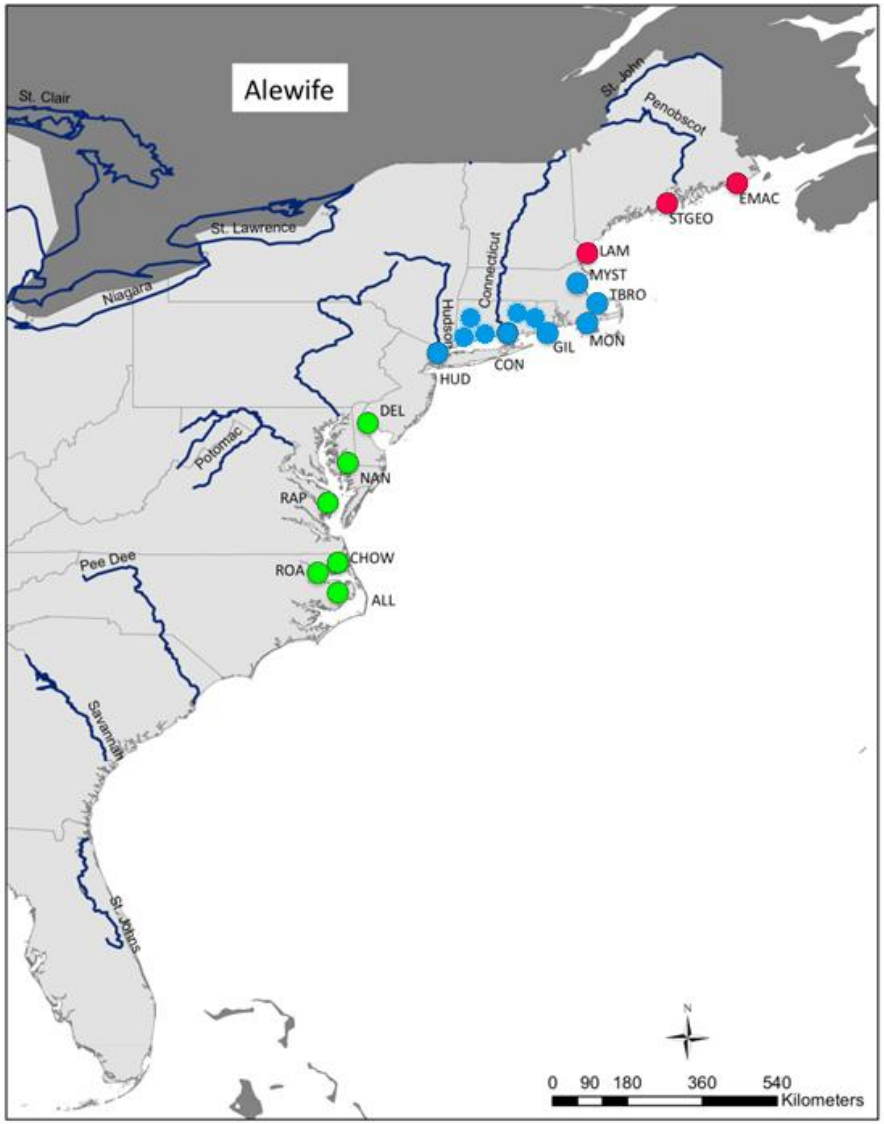
18 alewife populations
19 blueback populations

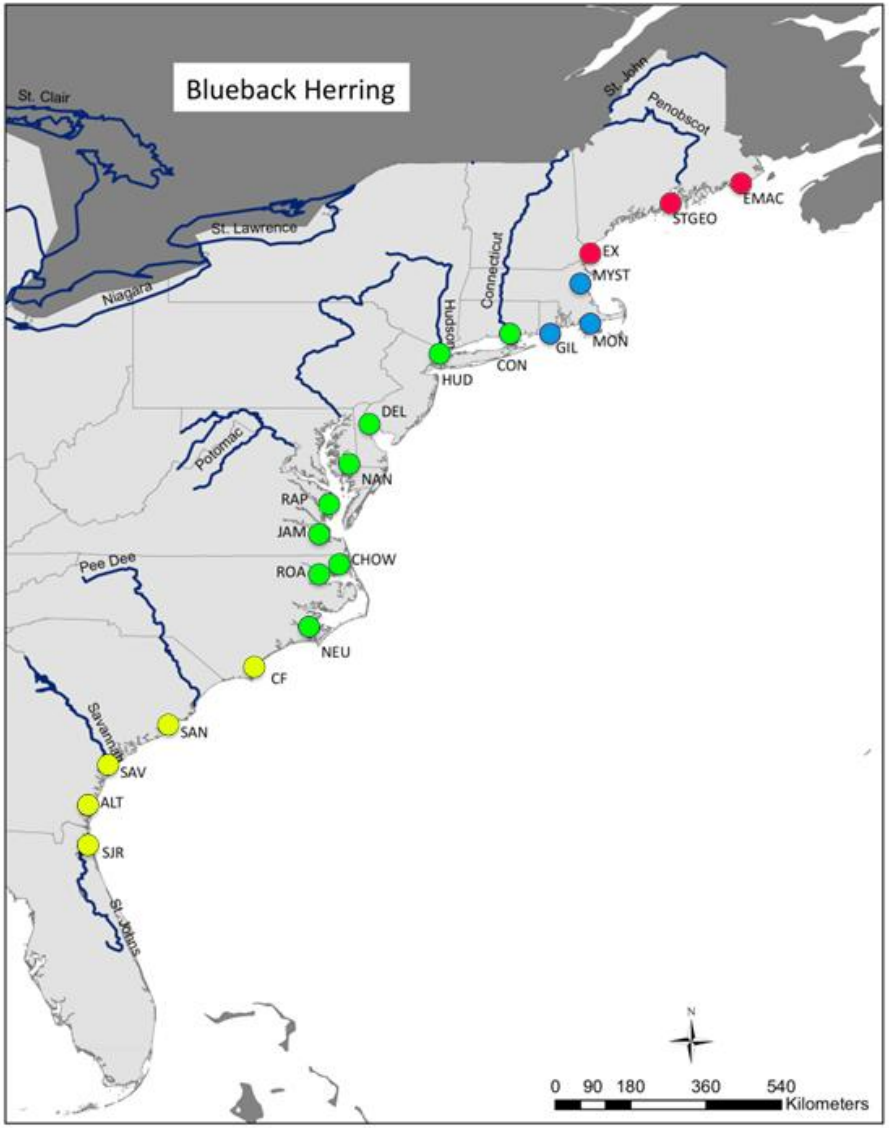


Genetics

Microsatellite markers – “neutral” DNA sequences in between those coding for traits (in ALL tissue – some easier to work with)

- Stable over generational scales
- Change relatively quickly IF no “straying”, different markers in populations

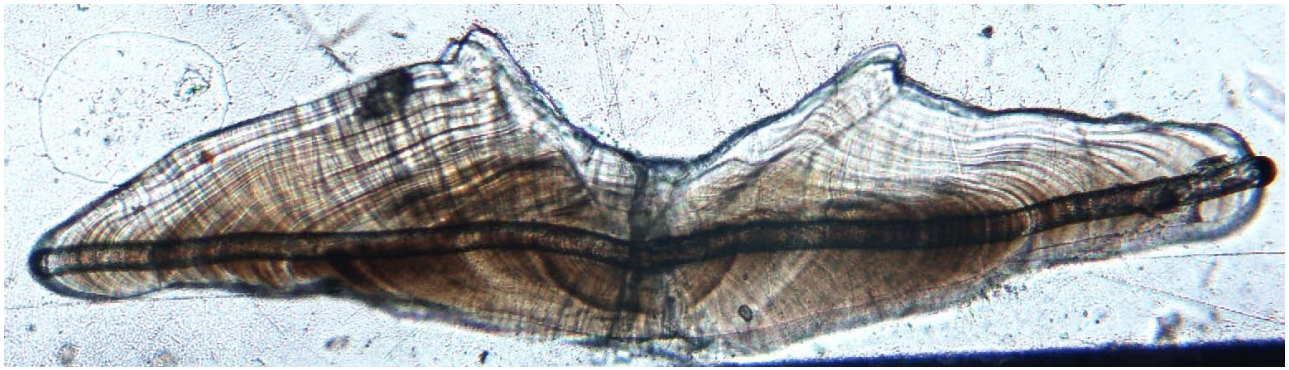

Alewife
St. Clair
St. Lawrence
Niagara
St. John
Penobscot
Connecticut
Hudson
Potomac
Pee Dee
Savannah
St. Johns
EMAC
STGEO
LAM
MYST
TBRO
MON
GIL
CON
HUD
DEL
NAN
RAP
CHOW
ROA
ALL
N
0 90 180 360 540
Kilometers


Blueback Herring
St. Clair
St. Lawrence
Niagara
St. John
Penobscot
Connecticut
Hudson
Potomac
Pee Dee
Savannah
St. Johns
EMAC
STGEO
EX
MYST
MON
GIL
CON
HUD
DEL
NAN
RAP
JAM
CHOW
ROA
NEU
CF
SAN
SAV
ALT
SJR
N
0 90 180 360 540
Kilometers

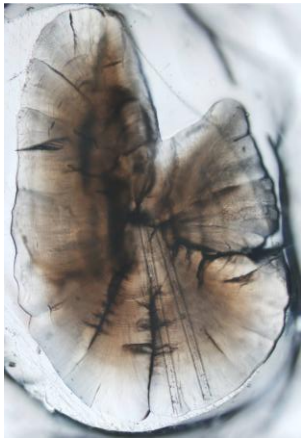
Coast-wide: What worked the best?

- Calculated % of fish classified to river of capture* by different marker combinations

	Otolith chemistry	Chemistry w/ Genetic "filter"	Chemistry w/ Oxygen	All markers
Overall % correct - alewife	70%	81%	93%	99%
Overall % correct - blueback	69%	80%	93%	94%



Nursery habitat use



- Freshwater only – bluebacks higher (~8%)
- Estuary only – both close
- Use of both – alewives higher (~10%)
- North of Boston Harbor – both used only fresh water
- Southern rivers – both used estuaries more
- No general differences between species – even in rivers with both

Nursery habitat to sea

- Size at emigration – no overall species difference
- Smaller in rivers with both (generally)
- Negatively related to:
  - Latitude – smaller in north, larger in south
  - Urbanization – percentage within watershed
- Positively related to:
  - Watershed area
  - Upstream access
  - Estuary area

} More habitat/ food?

What next?

Understanding marine population mixing and migration paths

Try to predict offshore distributions – temperature, salinity, depth

Avoid in commercial fisheries

ESF

NOAA FISHERIES SERVICE
Northeast Fisheries Science Center
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Funding:

NATIONAL FISH AND WILDLIFE FOUNDATION NFWF

HUDSON RIVER FOUNDATION
for Science & Environmental Research

This work was funded by a grant to E. Palkovacs and K. Limburg, "Determining the origins of river herring bycatch."