

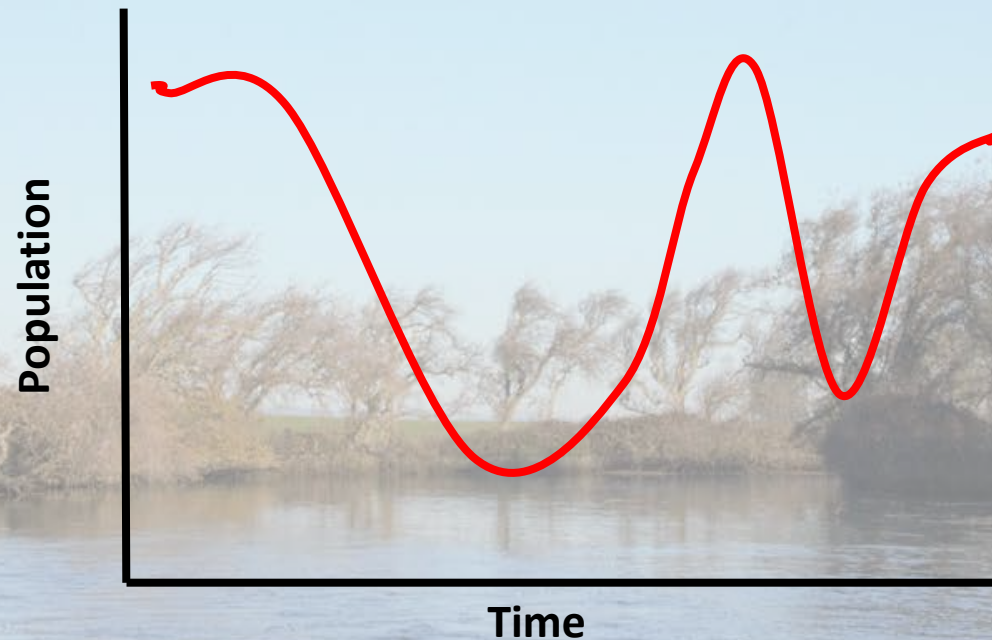
Does Life History Diversity Provide Population Resilience in Delta Smelt?

Eva Bush and Jim Hobbs
Wildlife Fish and Conservation, UC Davis
eebush@ucdavis.edu

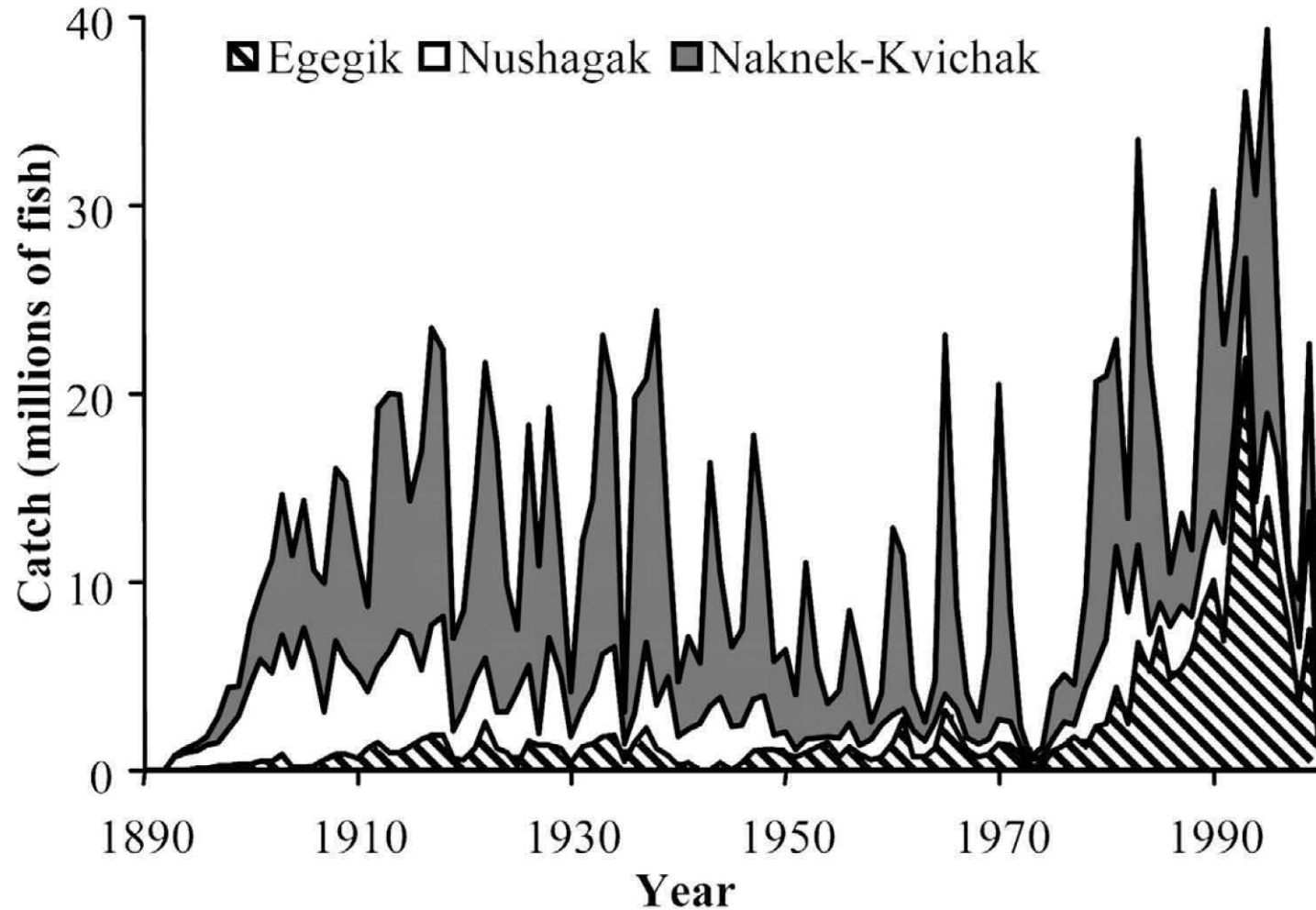


Resilience

The ability of a population to reach previous population abundance when conditions are favorable after a major decline

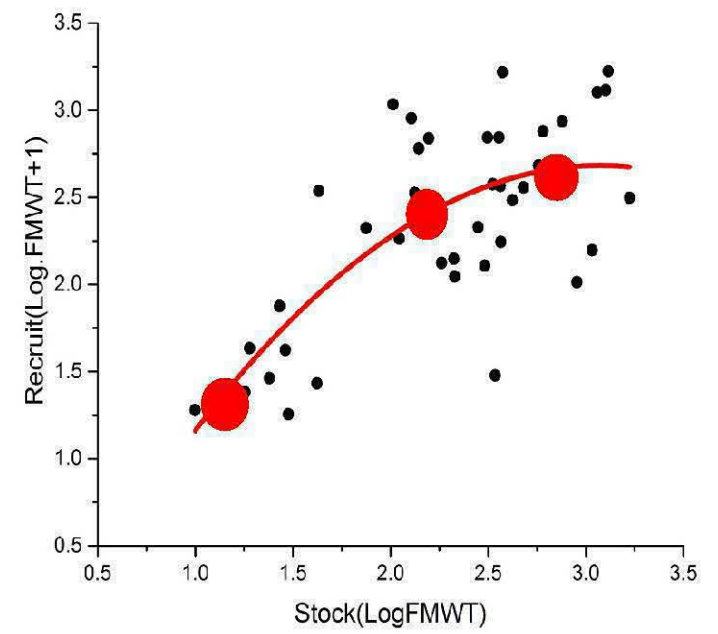
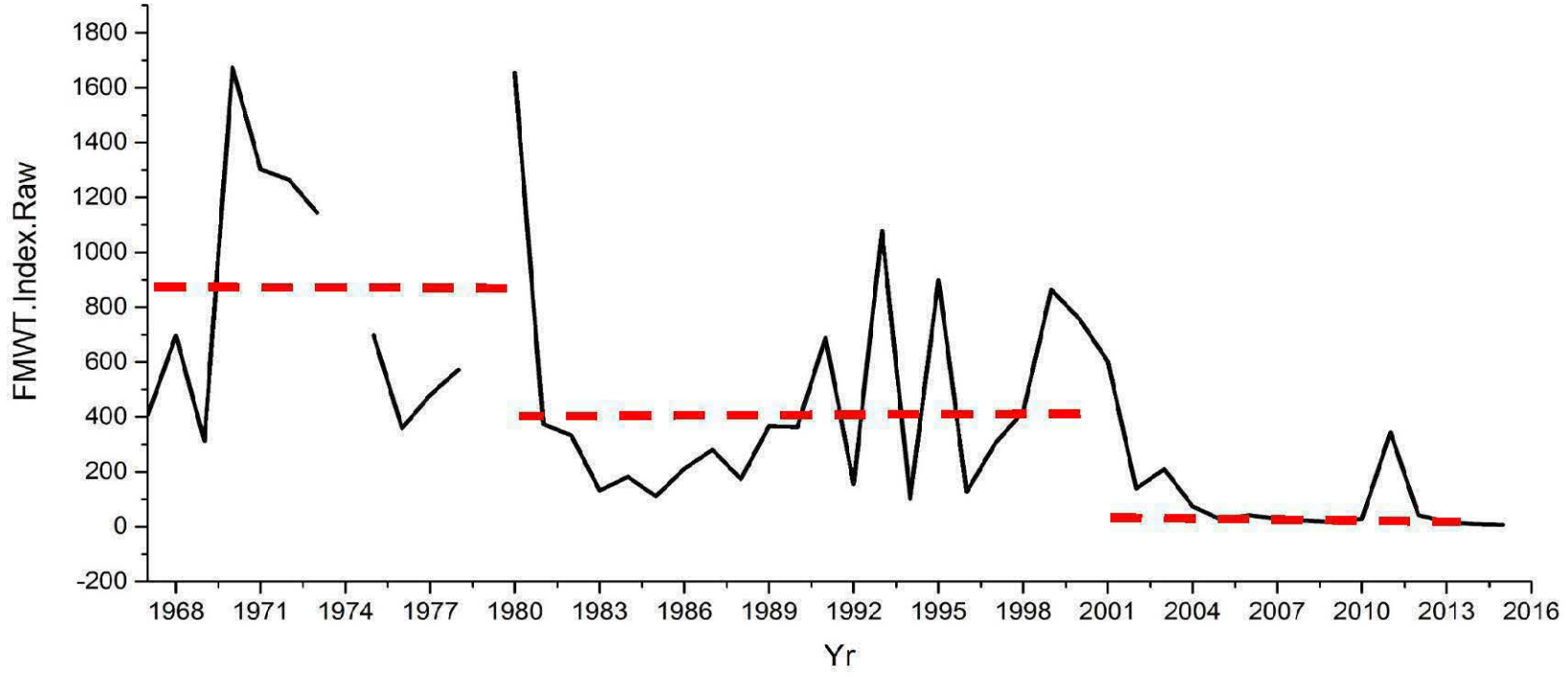


Greater resiliency with greater diversity in a population



Hillborn et al. PNAS 2003

Resilience in Delta Smelt



Can Life History Diversity Provide Population Resilience in Delta Smelt?

Migration

- Life history strategies available to use

Resilience

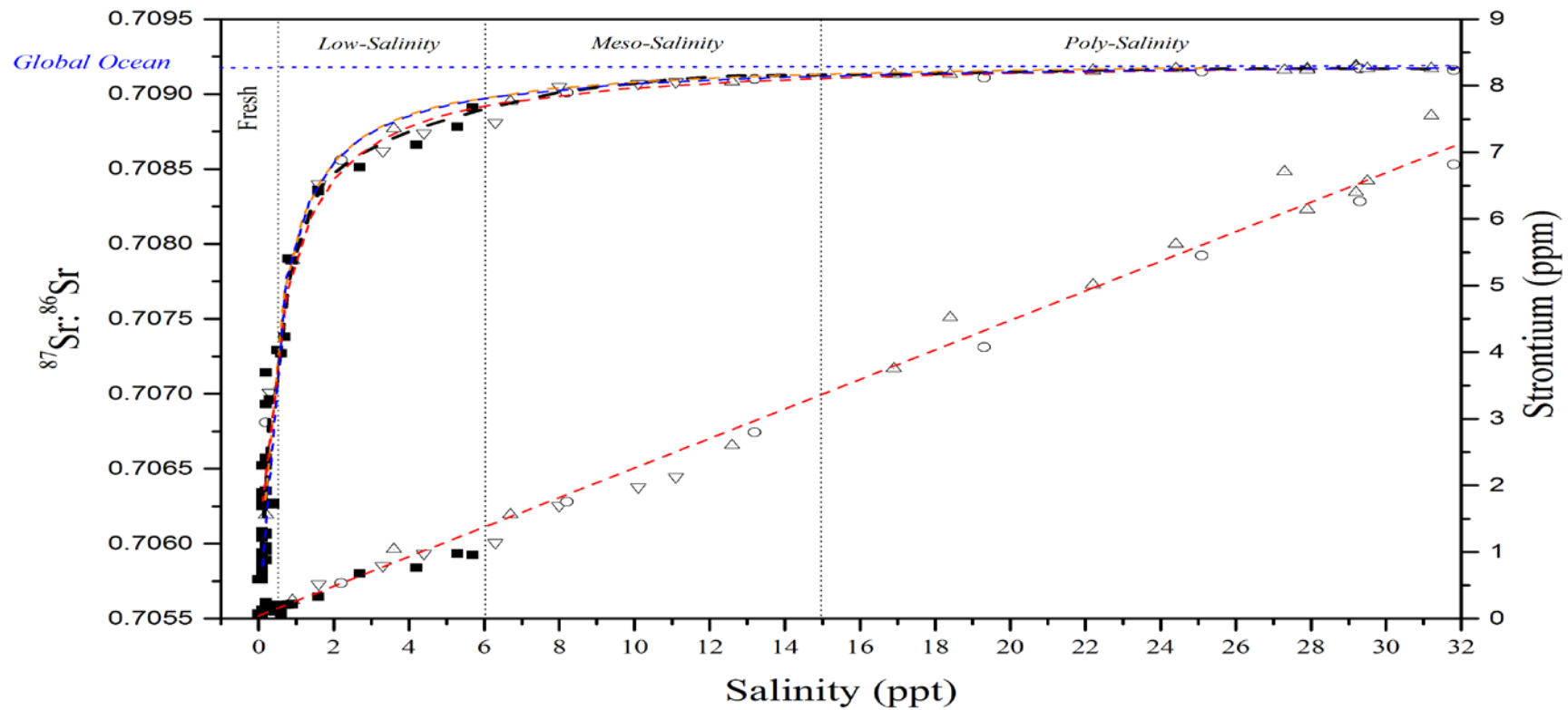
- Variations in life history strategies used

Migration

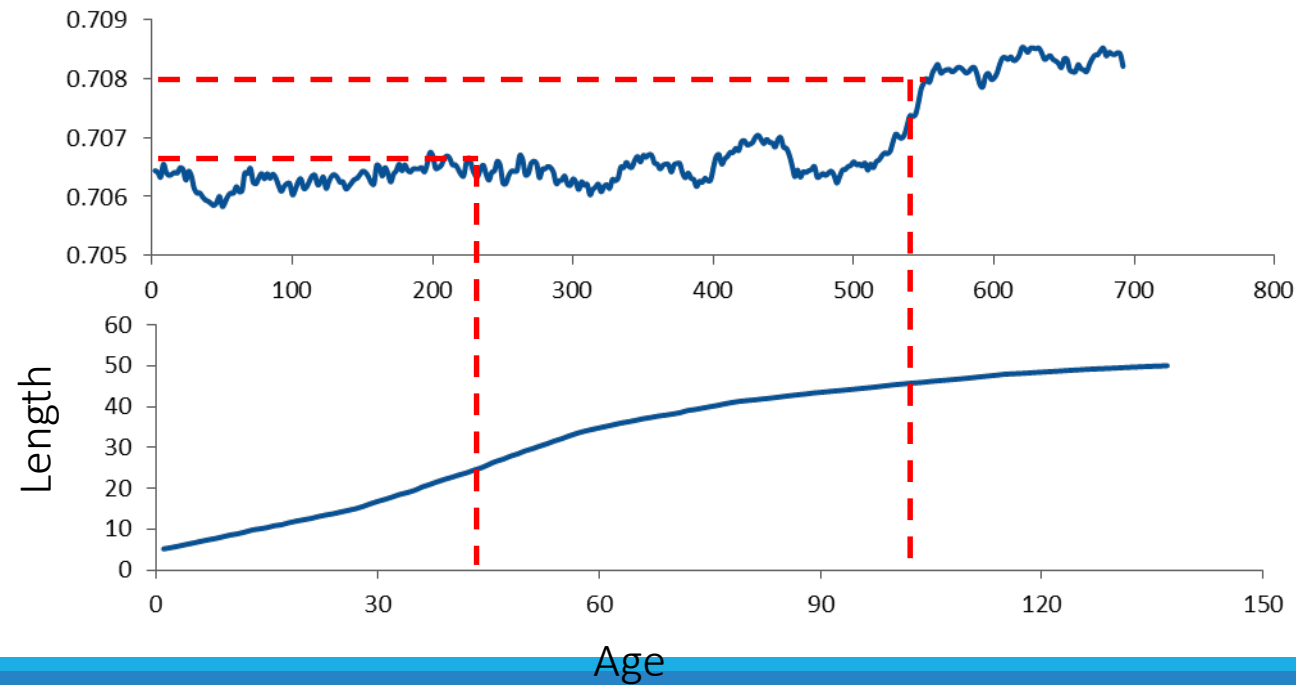
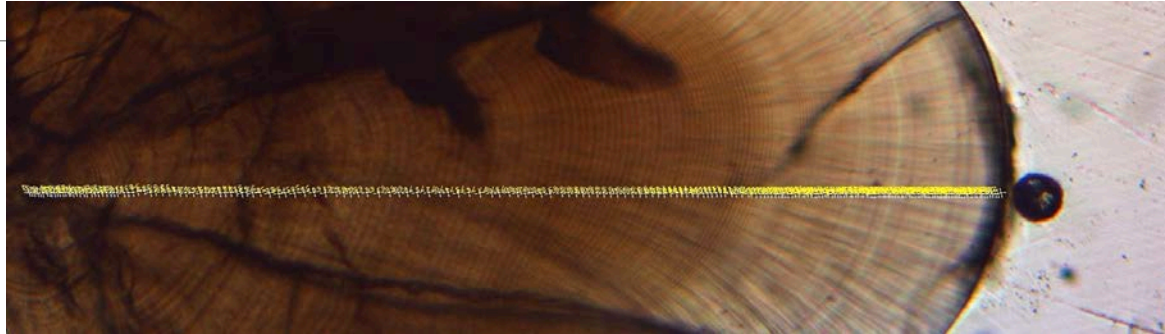
Migration - Usually defined as purposeful, persistent, undistracted movement of an individual

Partial migration - Defined as a type of intrapopulation variation where migration only occurs in a fraction of the total population

Determining Life Histories



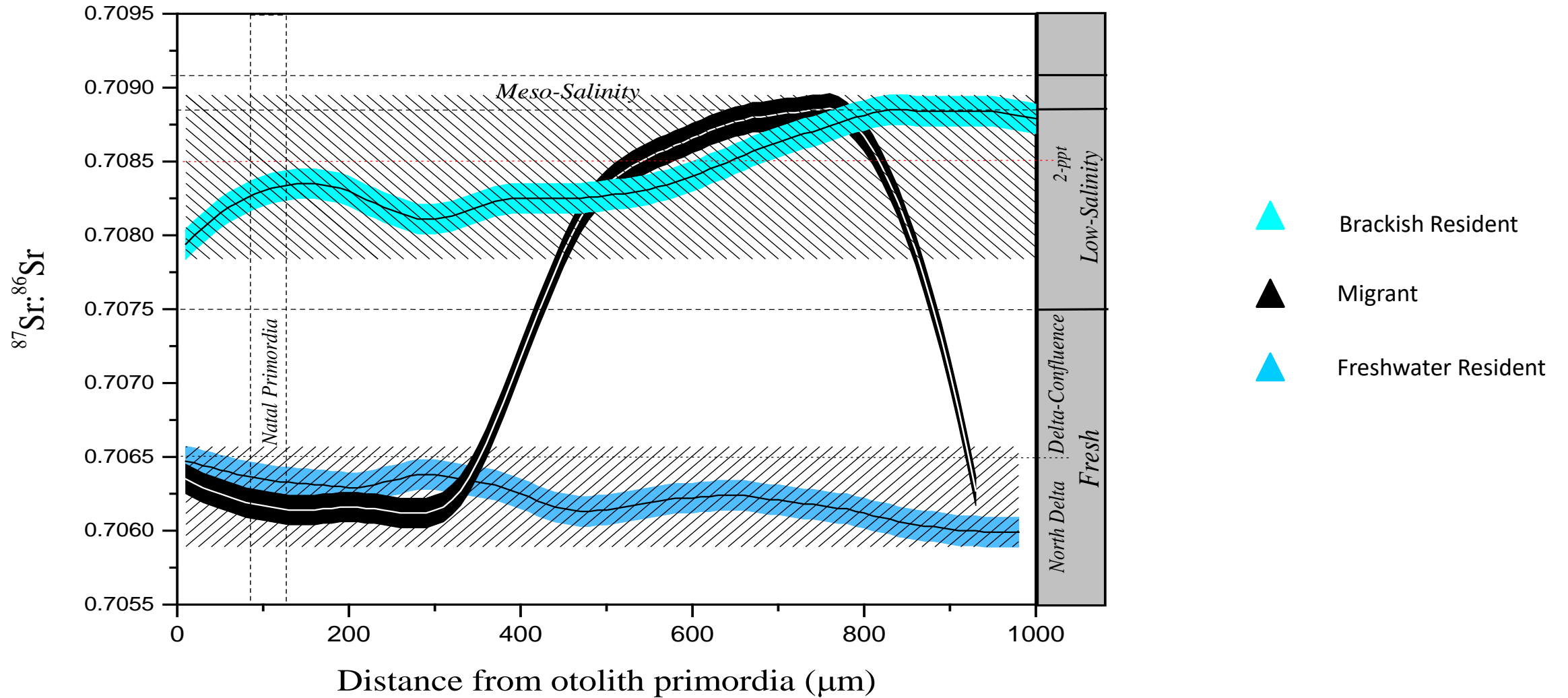
Life History Details



$^{87}\text{Sr}:^{86}\text{Sr}$ Profiles

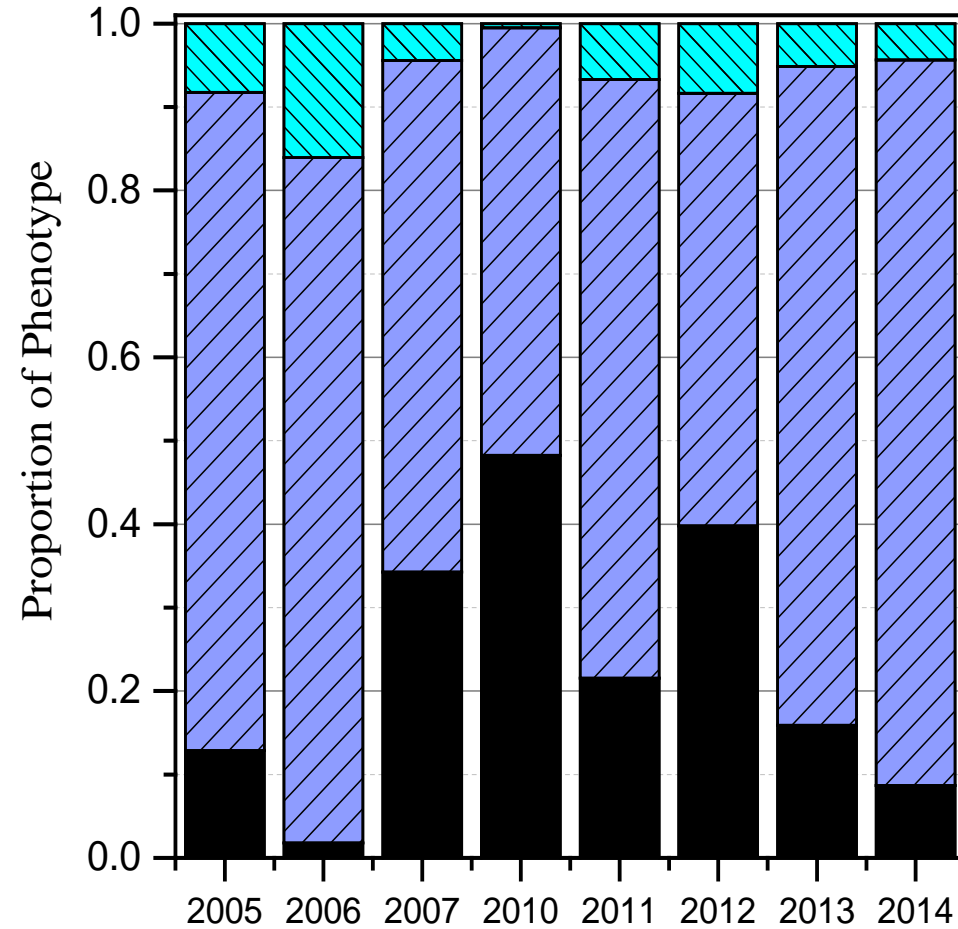
Back-Calculation
of length-at-age

Life History Strategies

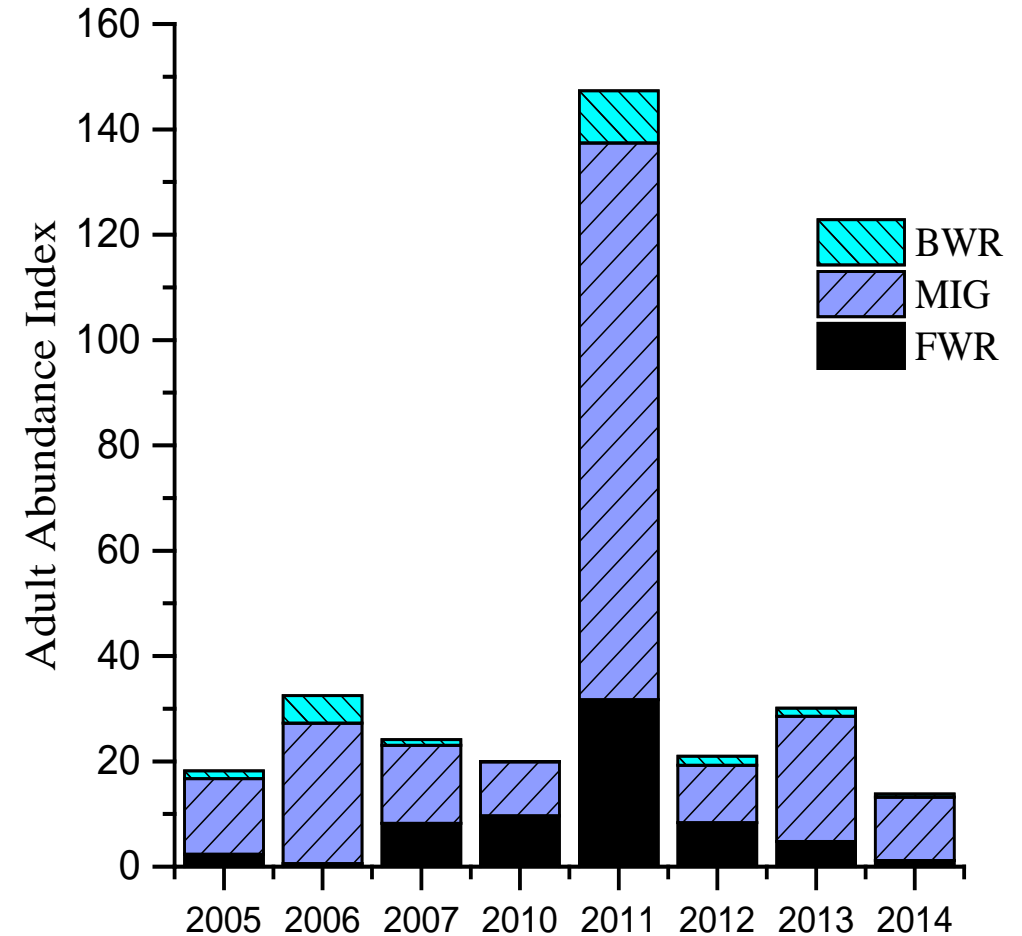


Contribution of each Life History Strategy

A.

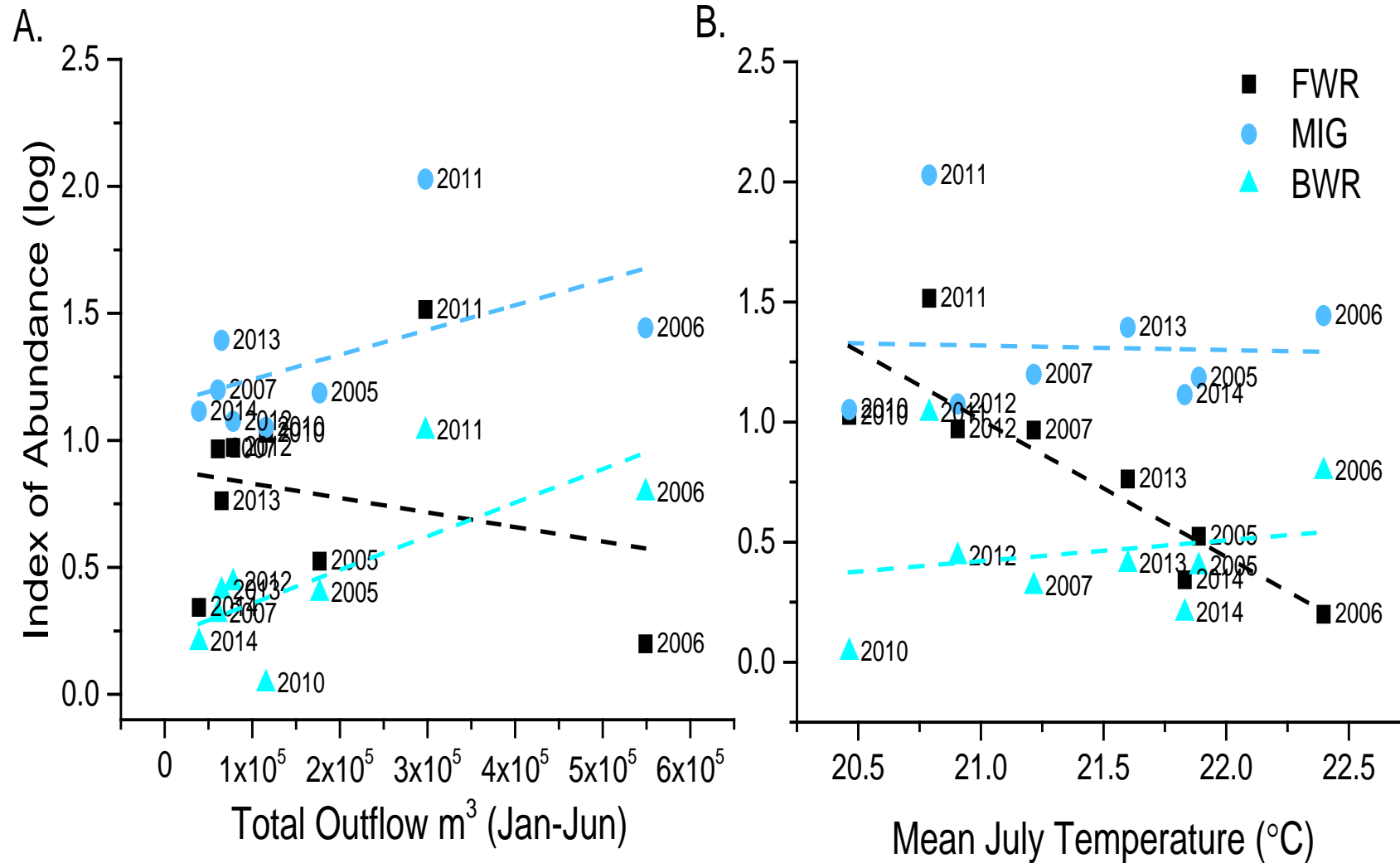


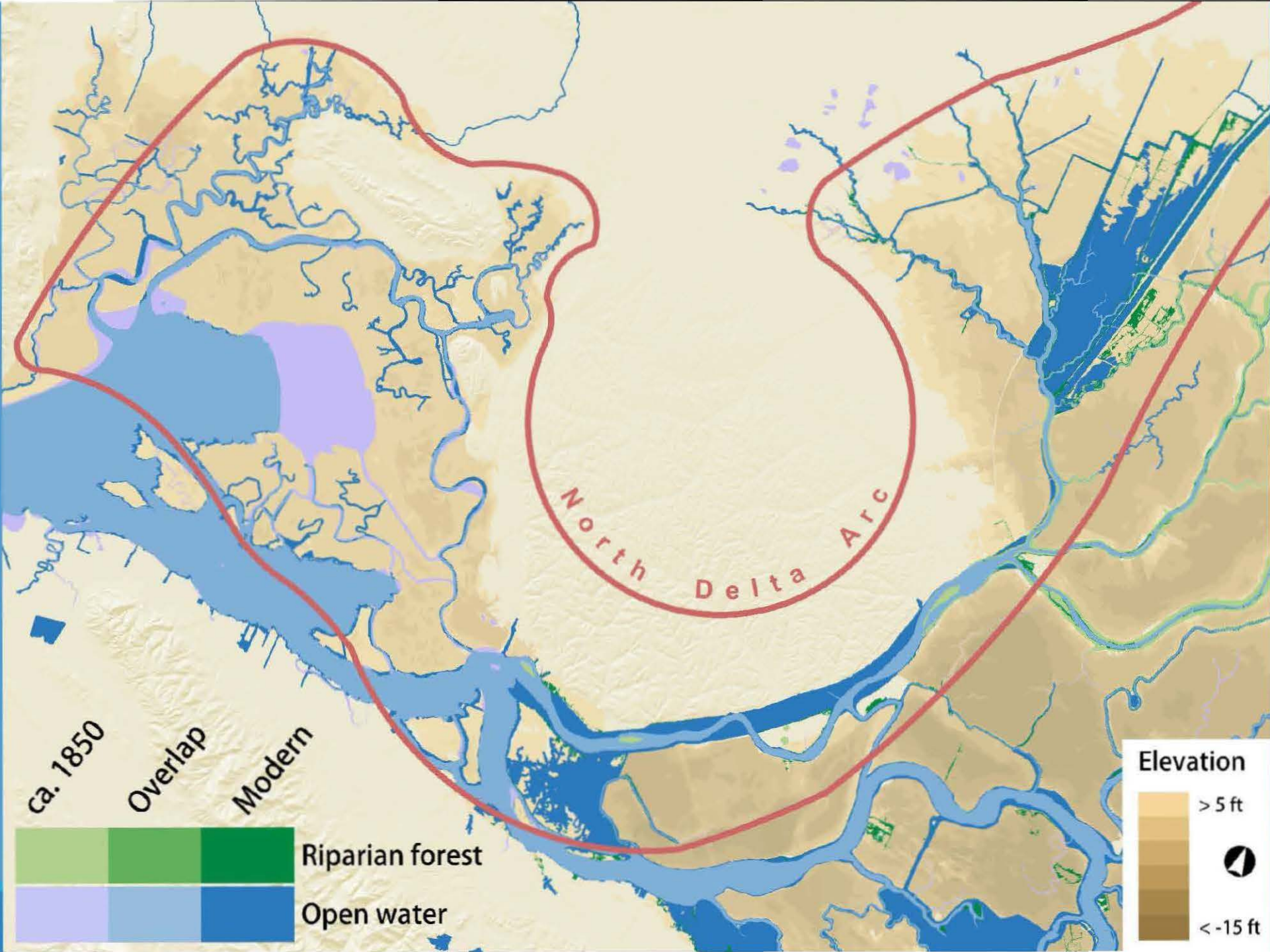
B.



Year-Class

The effect of outflow and temperature on life history phenotype

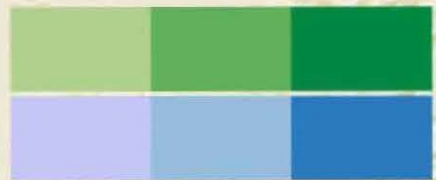




Ca. 1850

Overlap

Modern



Riparian forest

Open water

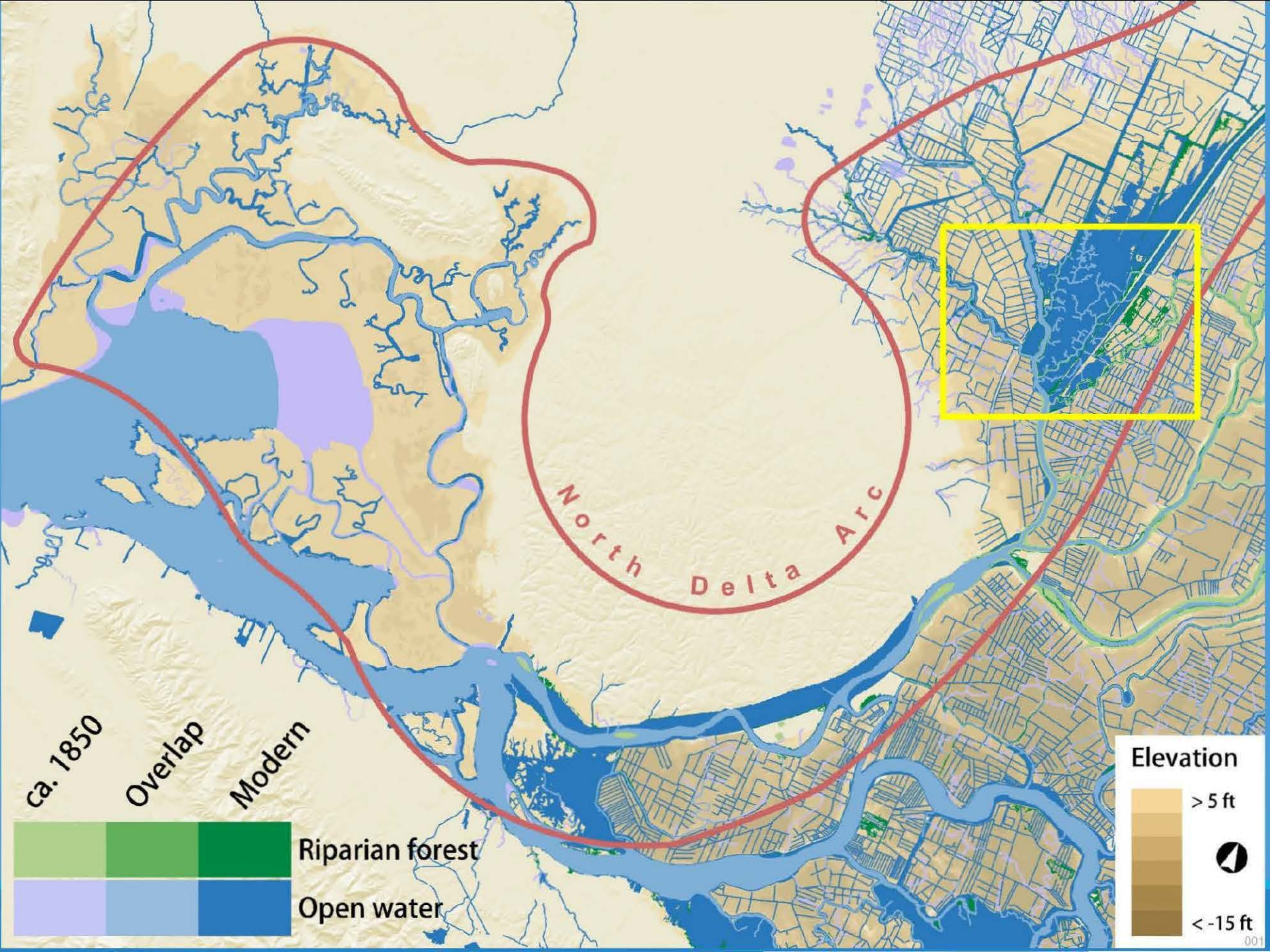
Elevation

> 5 ft

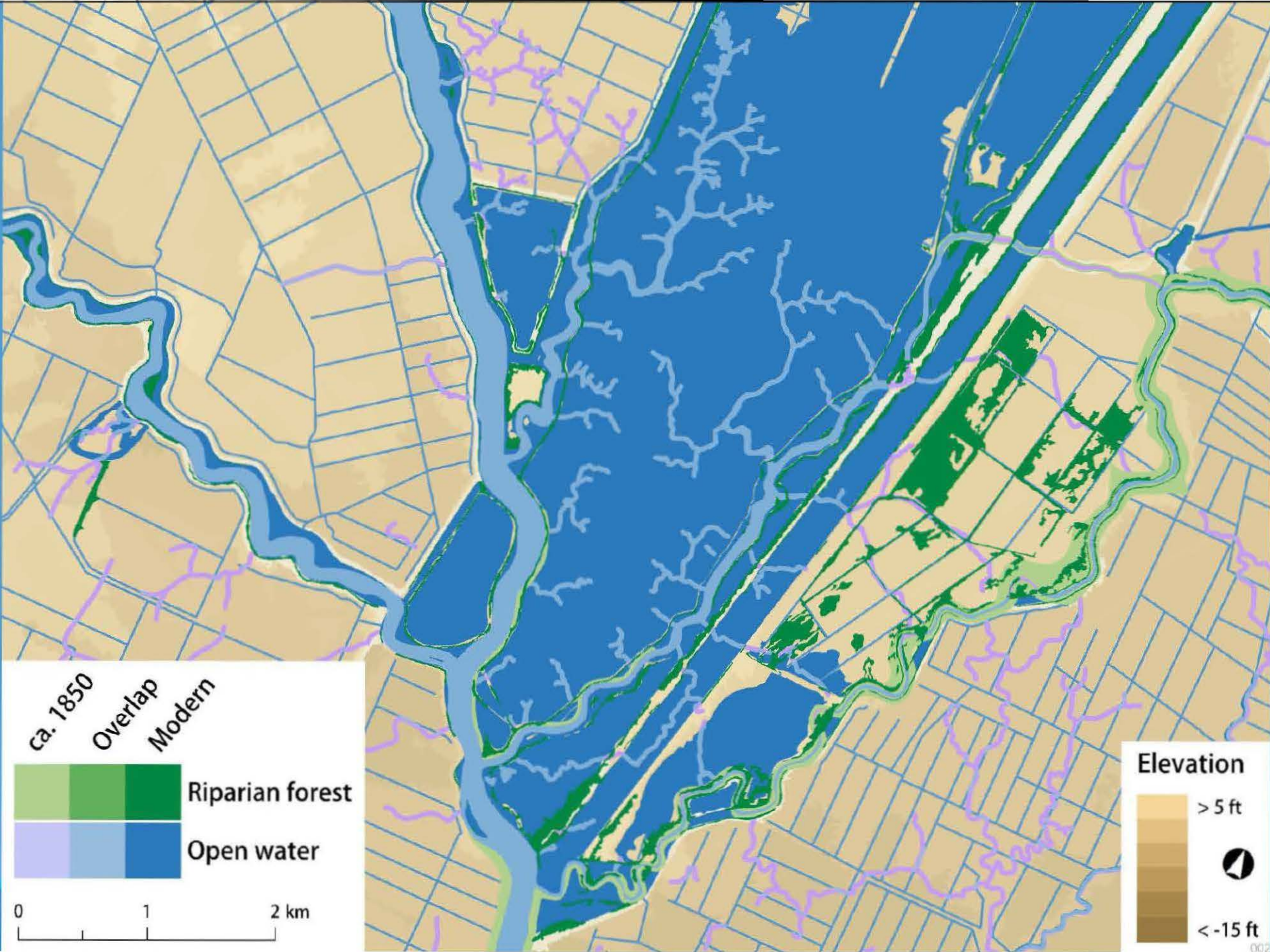


< -15 ft

Map by
Amber Manfree



Map by
Amber Manfree



ca. 1850
Overlap
Modern

Riparian forest
Open water

0 1 2 km

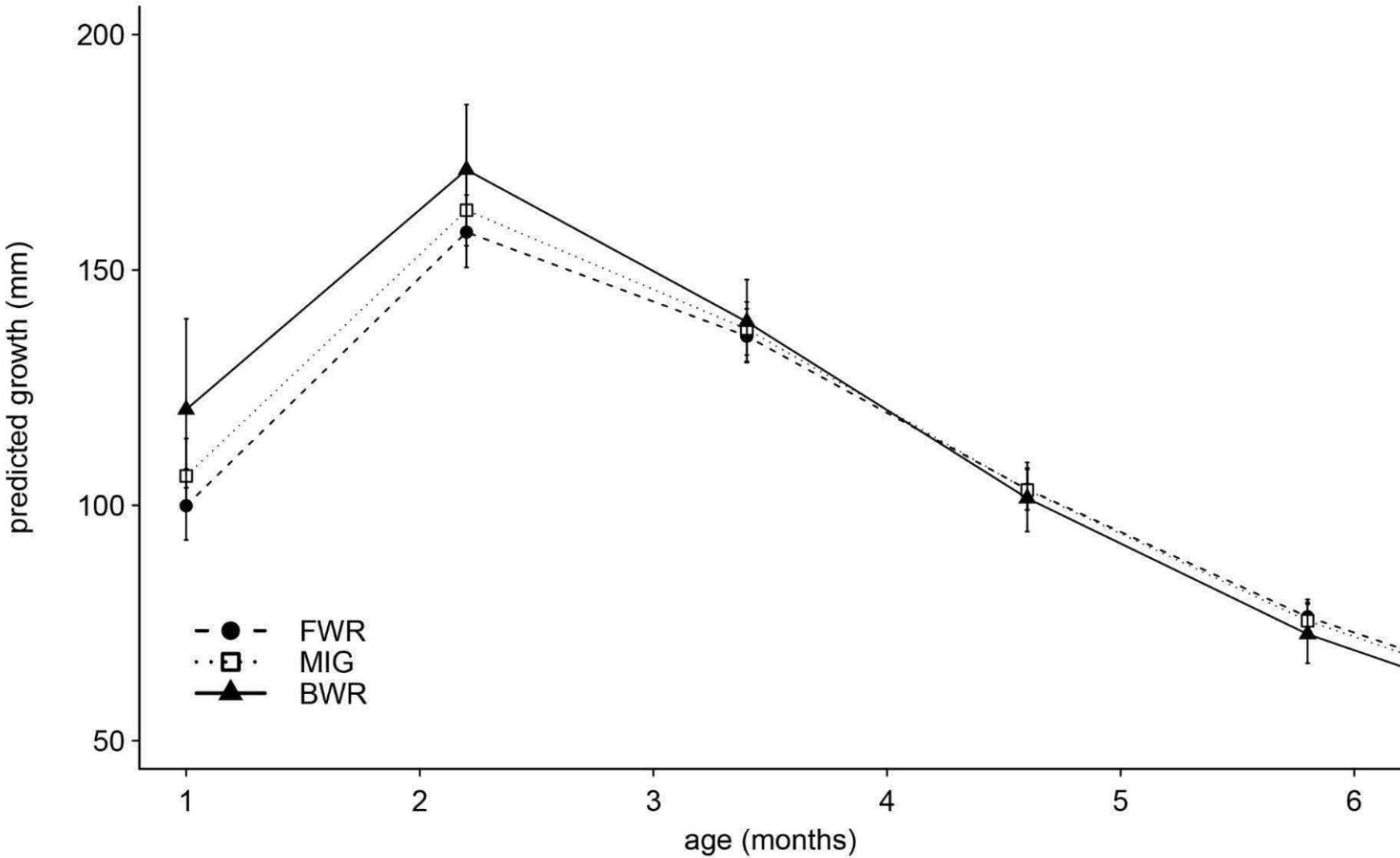
Elevation

> 5 ft
< -15 ft

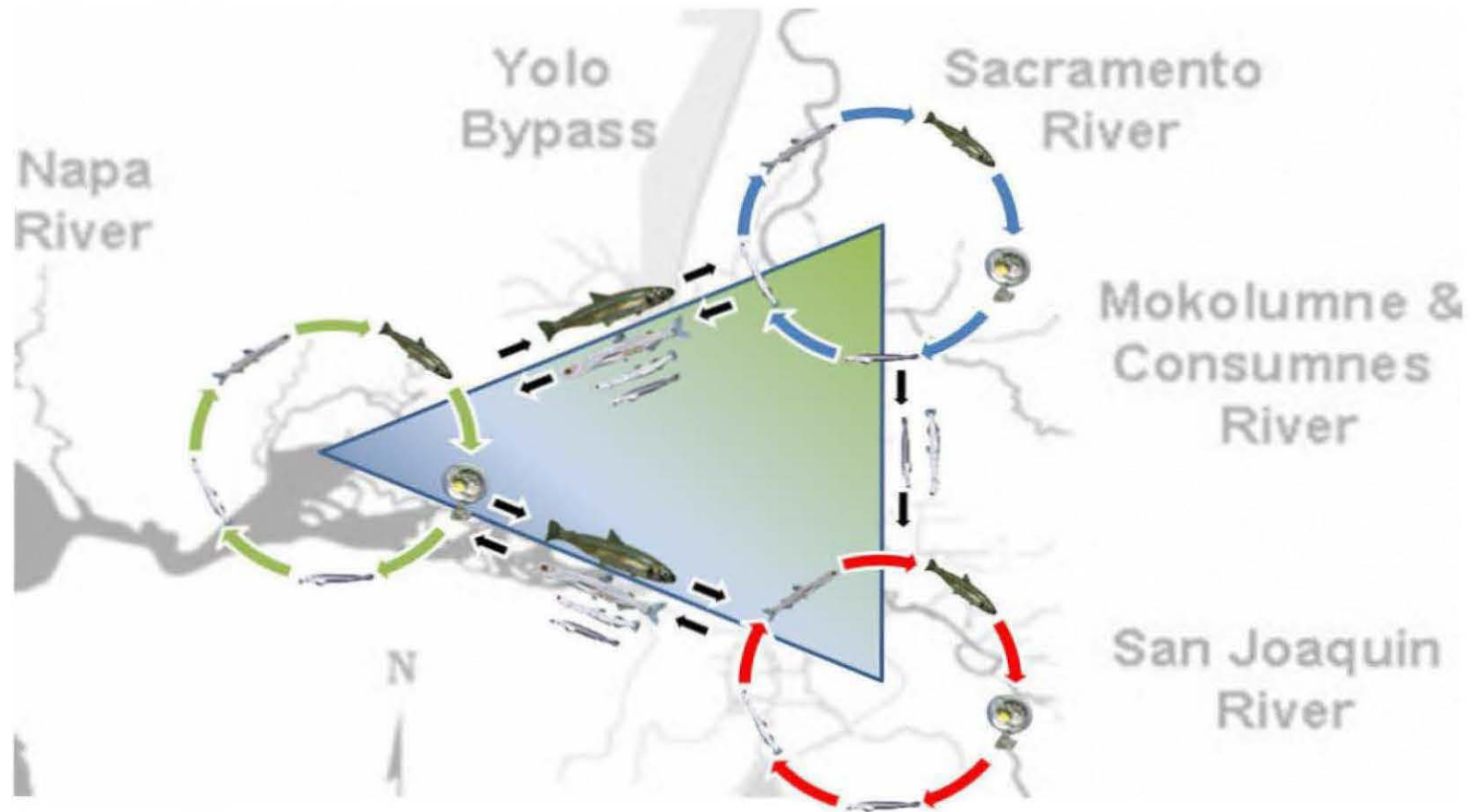


Map by
Amber Manfree

The effect of outflow and temperature on early growth



Migratory Triangle for Delta Smelt



Take home Points

Resiliency of Delta smelt population may be based on the ability to use all the different life history strategies they evolved

To retain the resident part of the population flow is not a lone solution, the combination of temperature and flow has to be right

Can we provide opportunities for better food production?

Acknowledgements

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