



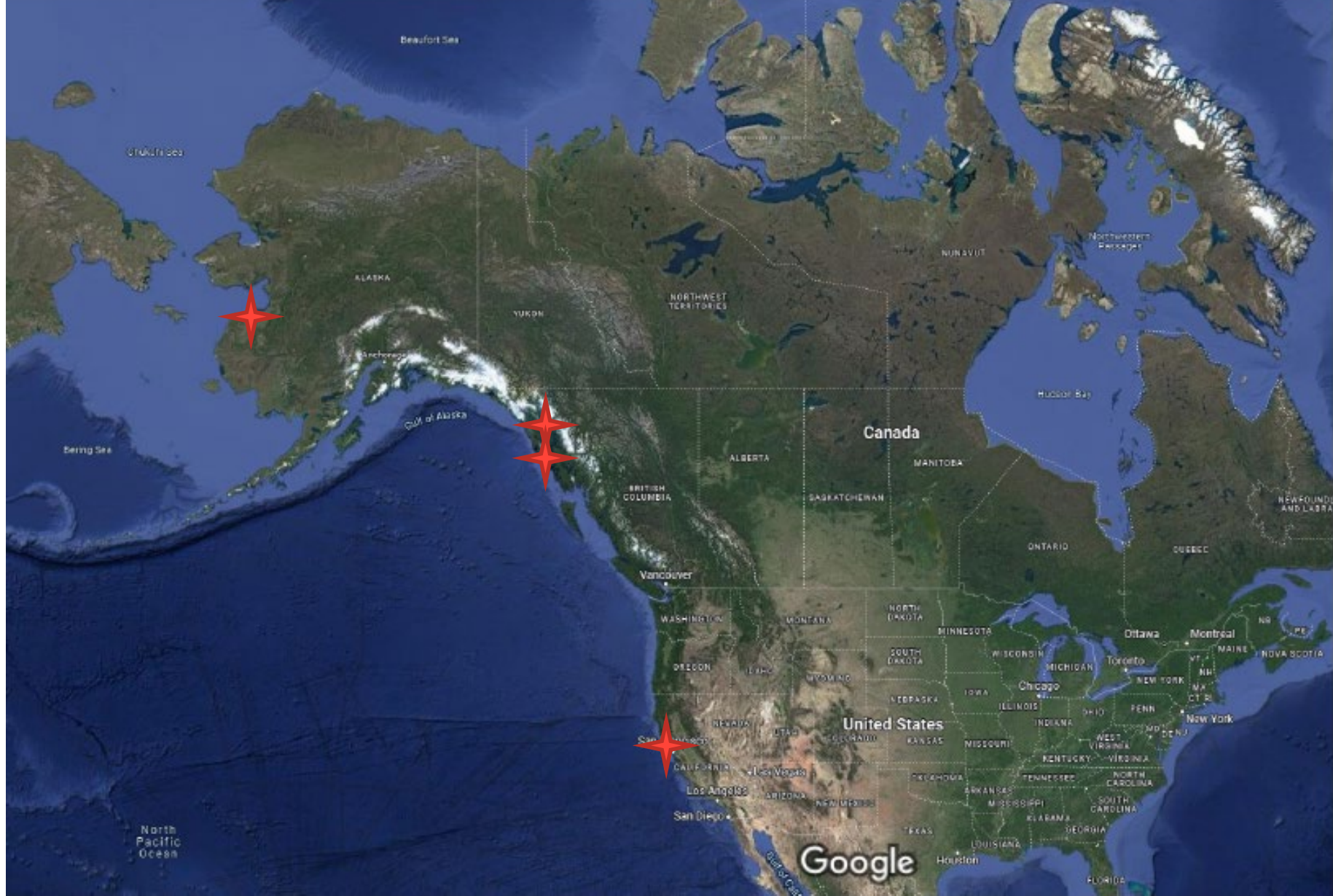
**NOAA**  
**FISHERIES**

# A Review of the Thiamine Status of Alaskan Chinook Stocks and the U.S. West Coast

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Imagery ©2022 TerraMetrics, Map data ©2022 Google, TMap Mobility, INEGI 200 mi



**NOAA**  
FISHERIES

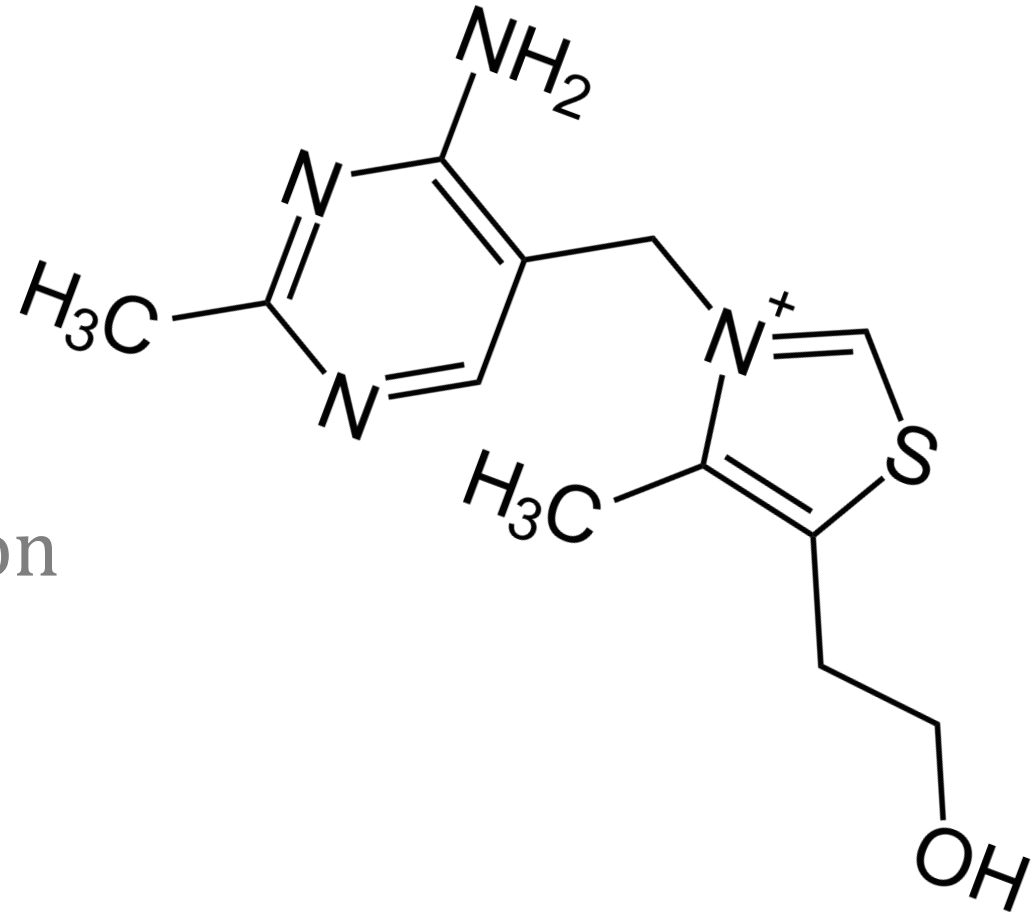
# Thiamine

Essential dietary nutrient

ATP Production

Metabolic and Immune function

Neuromuscular Function



# Thiamine Deficiency

Abnormal Behavior

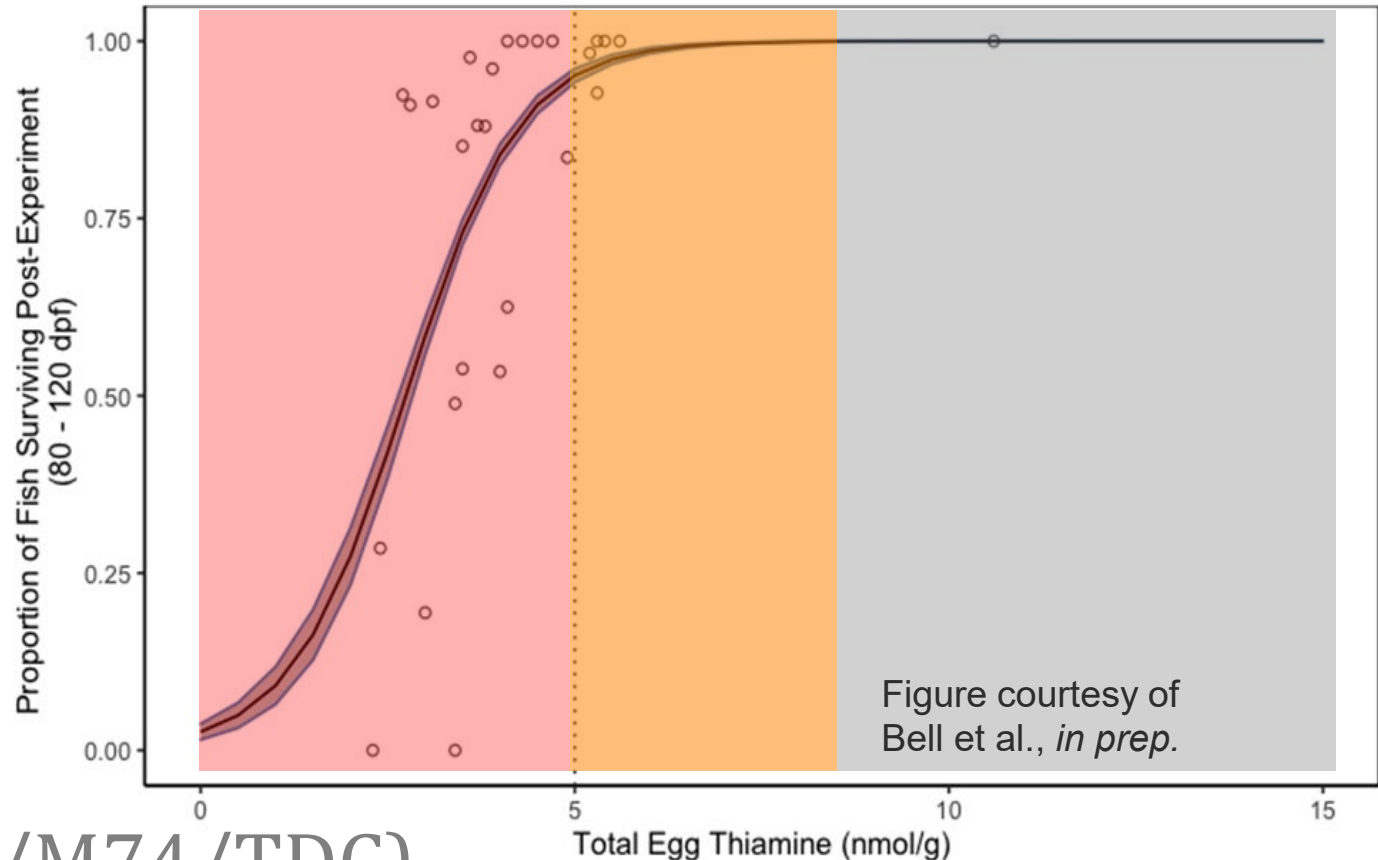
Limit Energy

Decreased Growth

Affects Vision

Predator/Prey

Reduced Fitness (EMS/M74/TDC)



# Thiamine Deficiency/Mortality

Abnormal Behavior

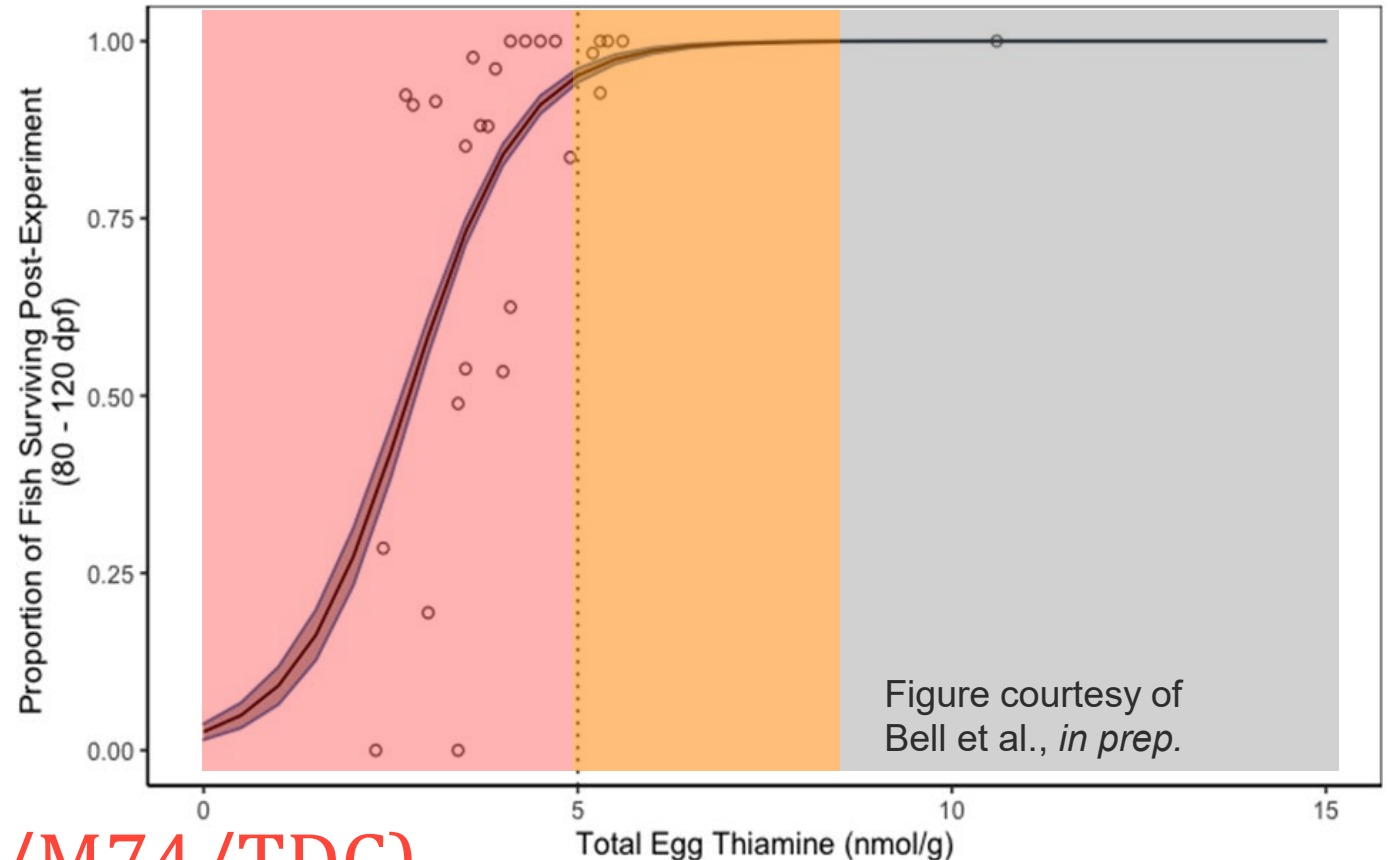
Limit Energy

Decreased Growth

Affects Vision

Predator/Prey

Reduced Fitness (EMS/M74/TDC)



# Thiamine Deficiency/Secondary Effects

Abnormal Behavior

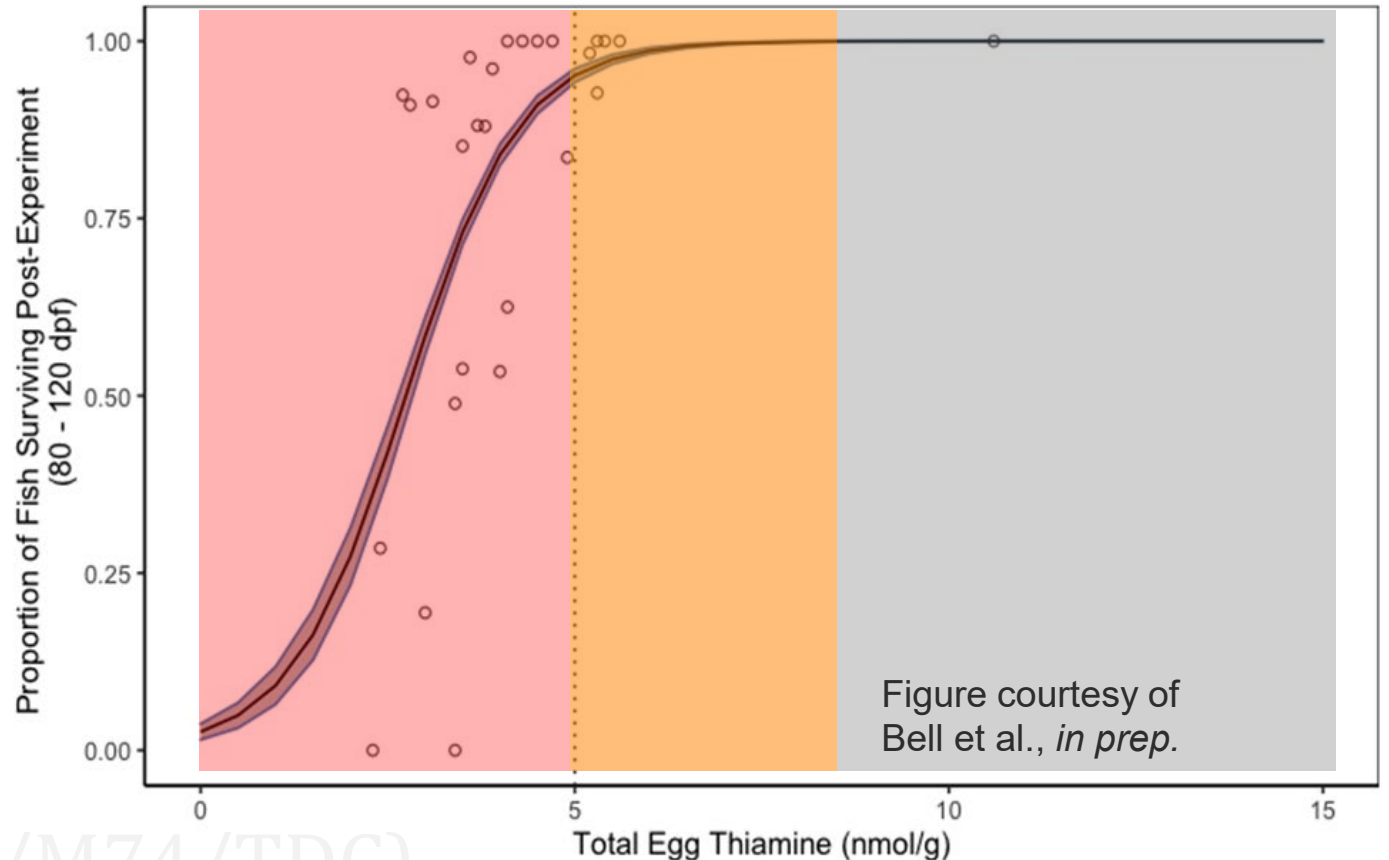
Limit Energy

Decreased Growth

Affects Vision

Predator/Prey

Reduced Fitness (EMS/M74/TDC)





# Thiaminase

What is Thiaminase?

Potential Sources

Prey Fields

Lower Trophic Levels

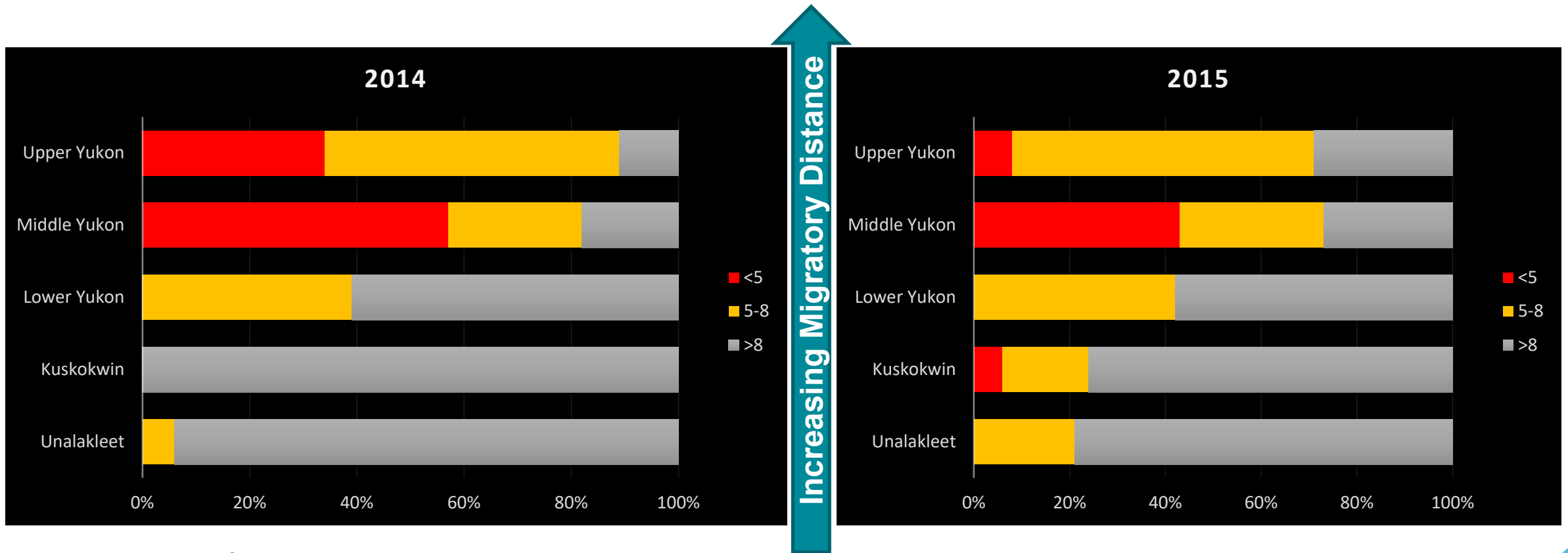


**Cyanobacteria, Image by Adelaide Laboratories of CSIRO.**





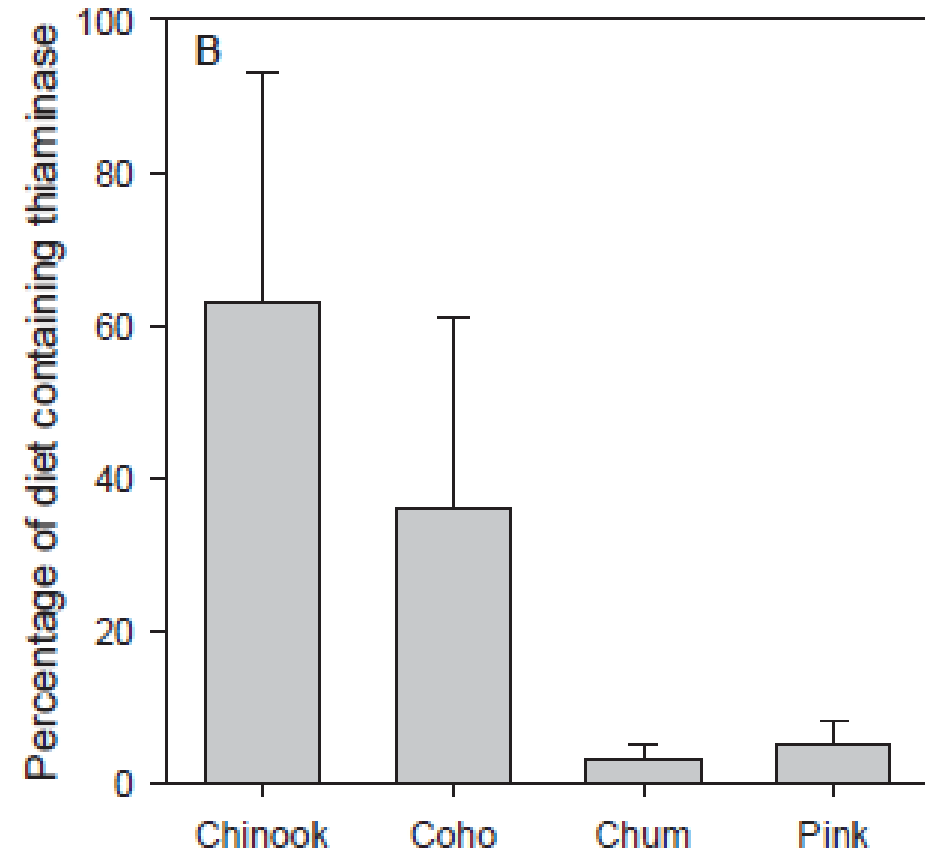
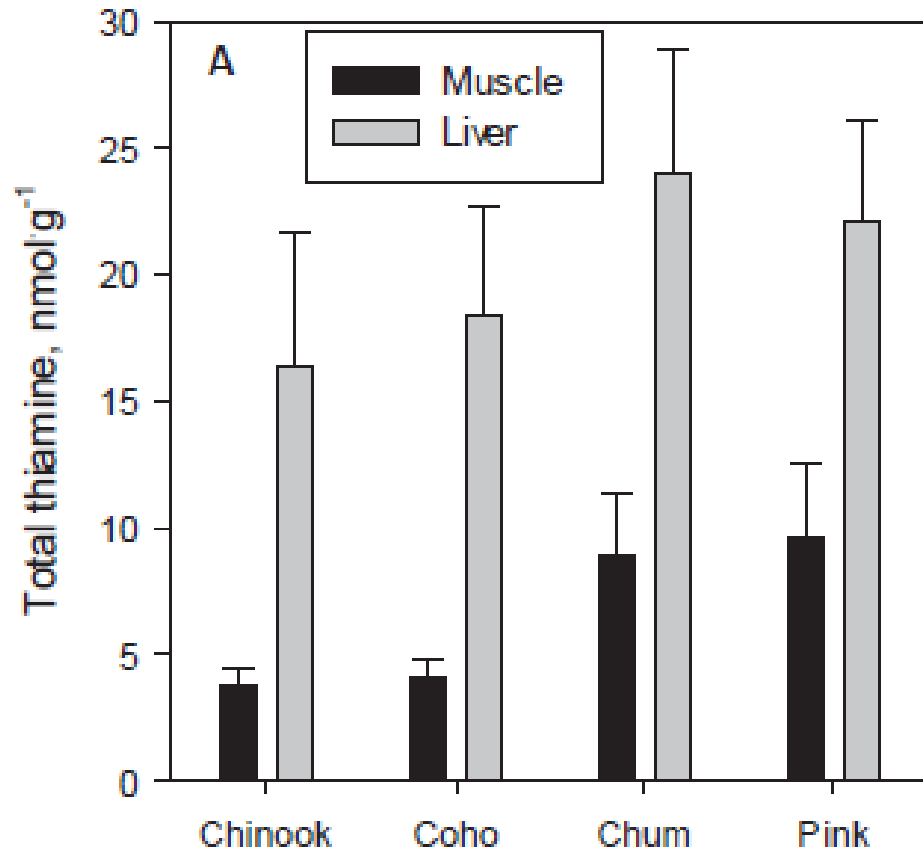
# Western AK Egg Thiamine



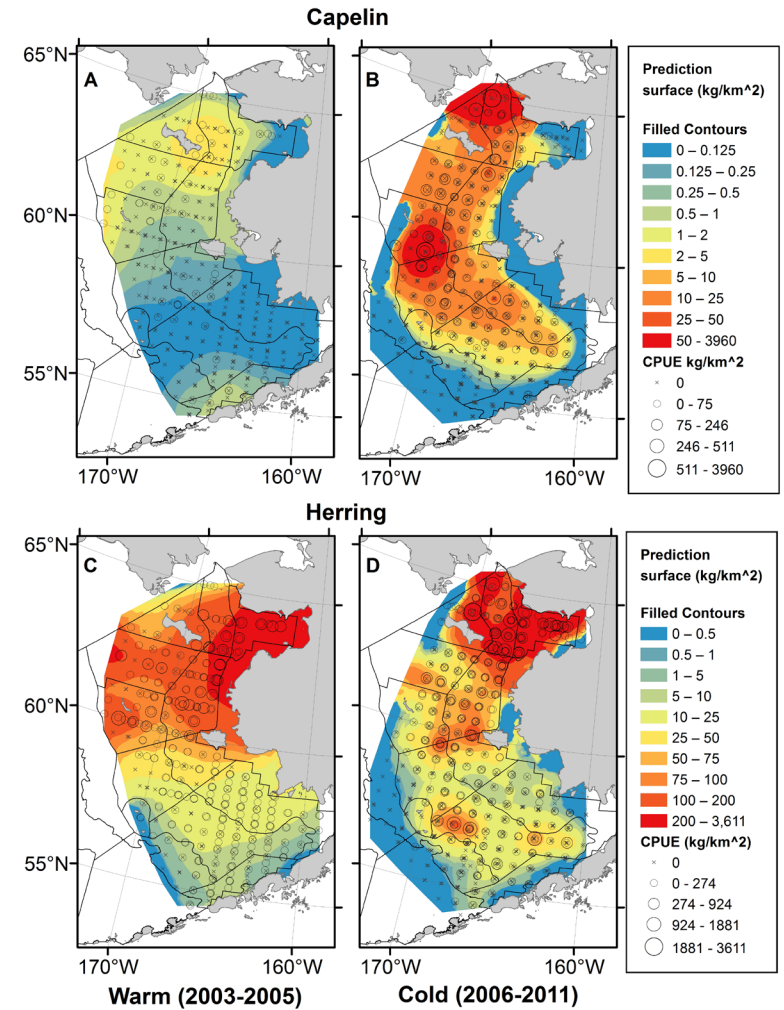
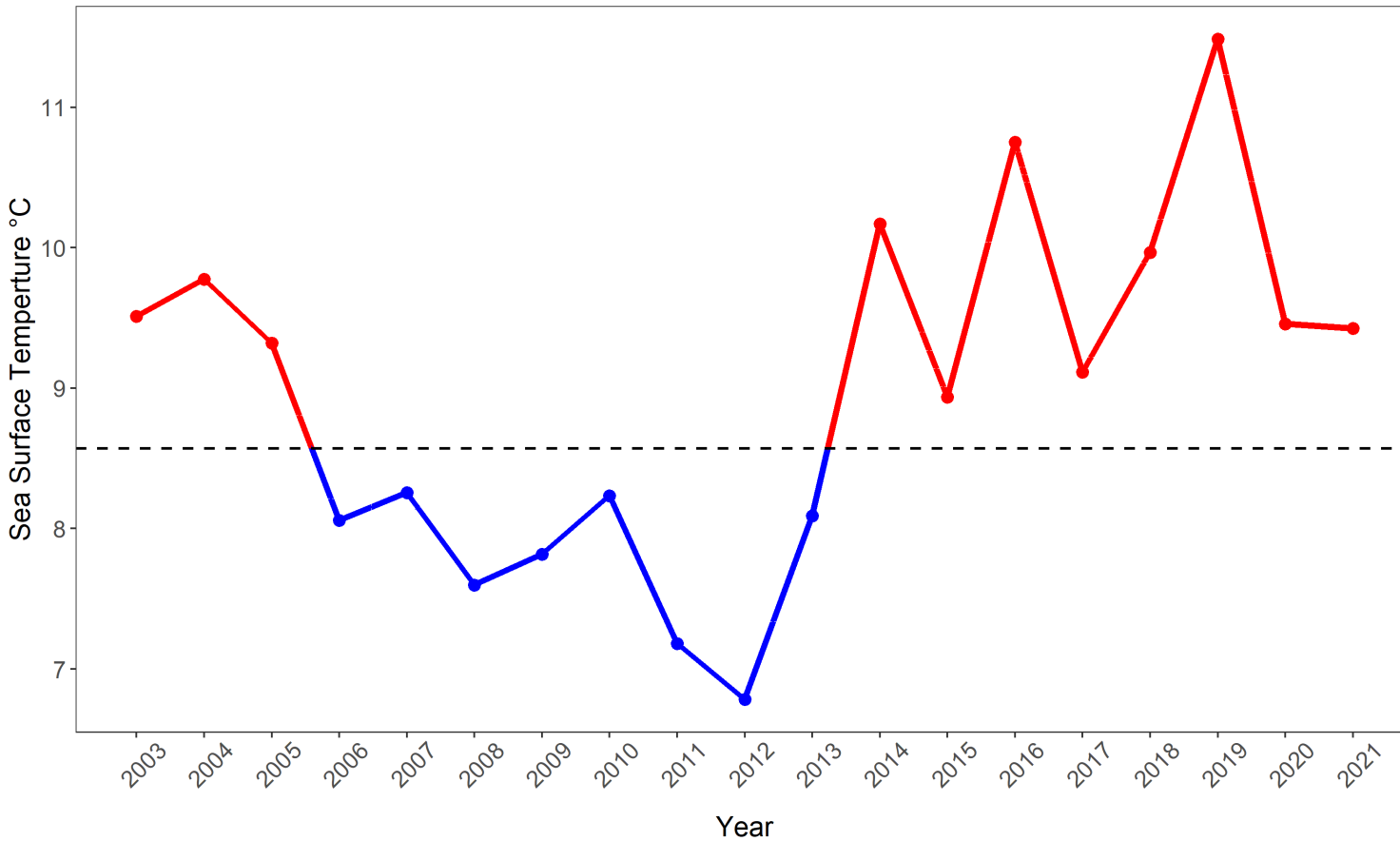
Data from Larson and Howard, 2019.



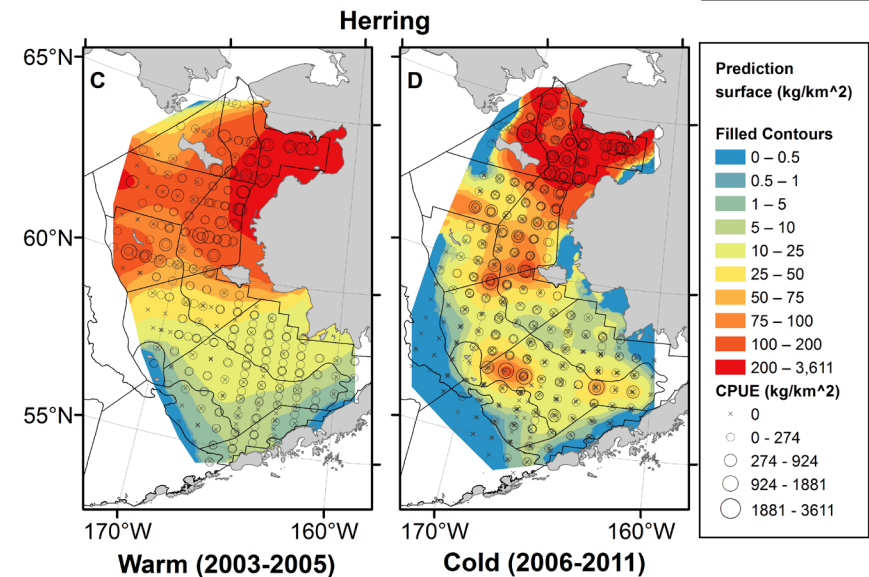
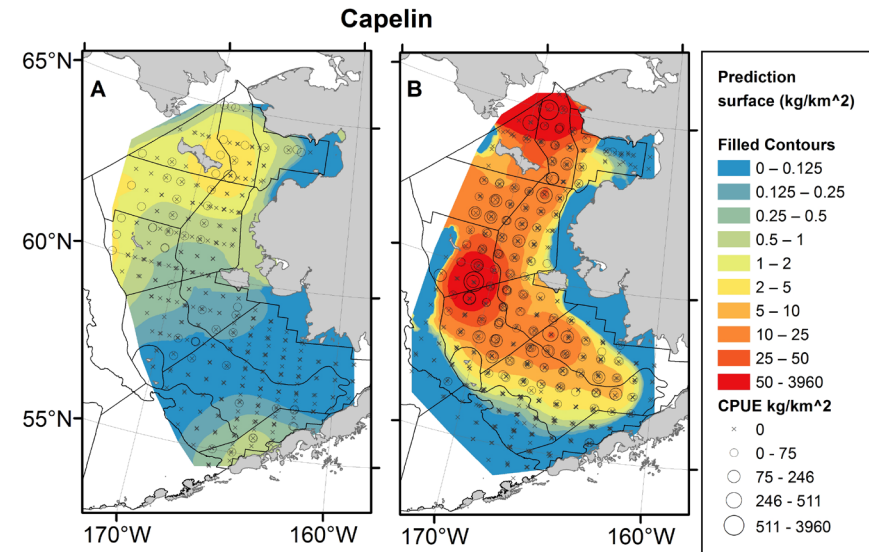
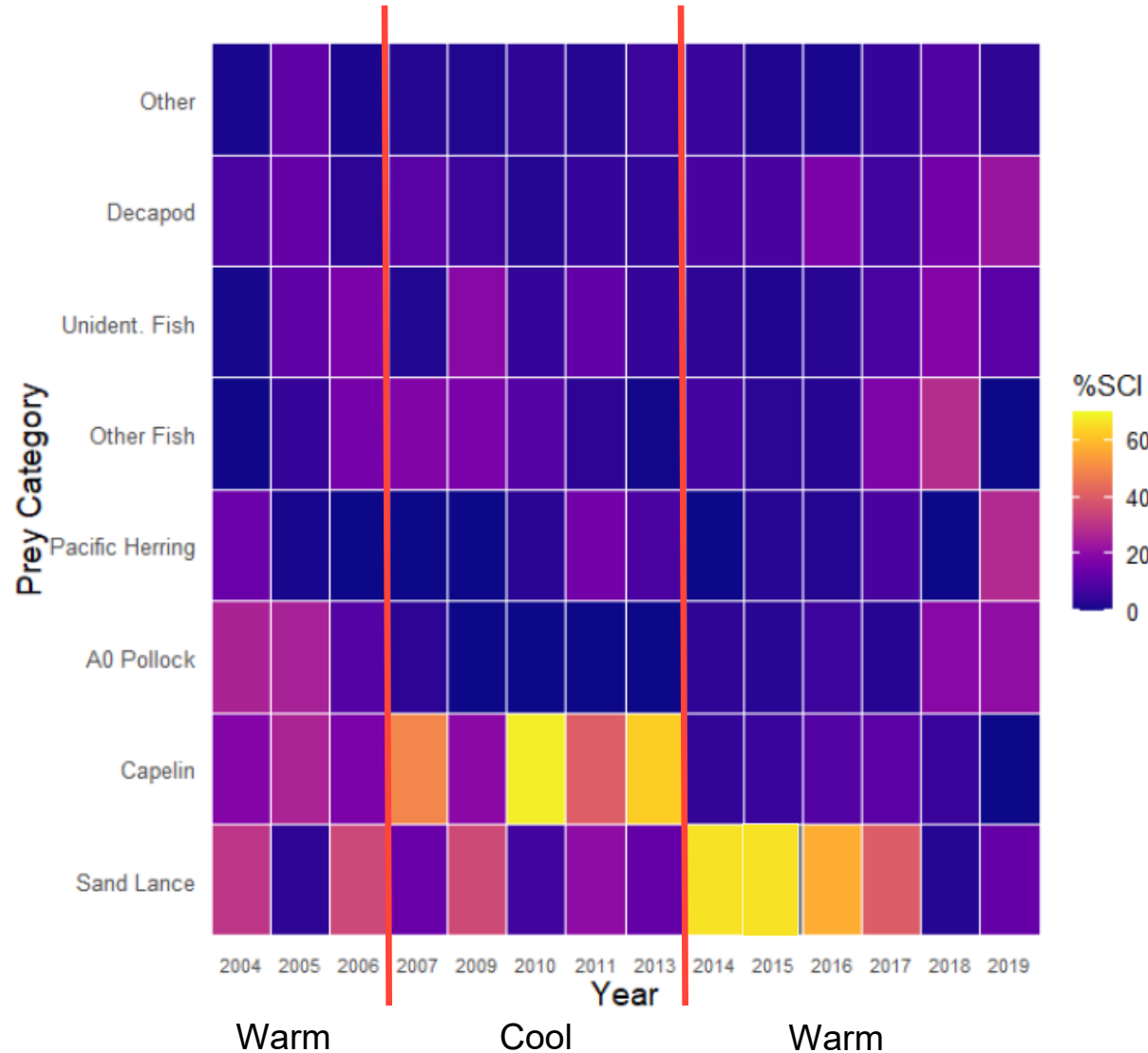
# NBS Juvenile Thiamine



# Changing Ecosystems

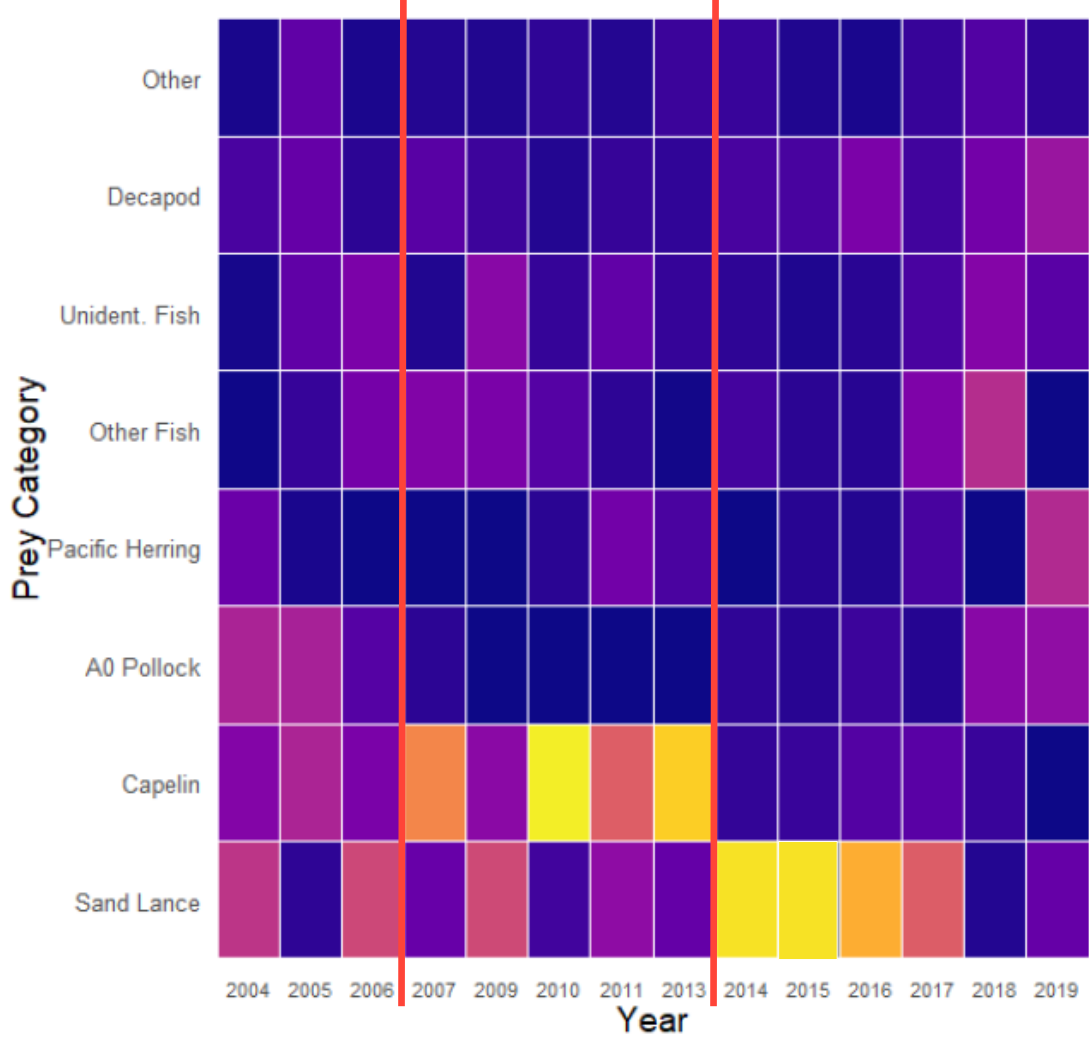


# Changing Ecosystems

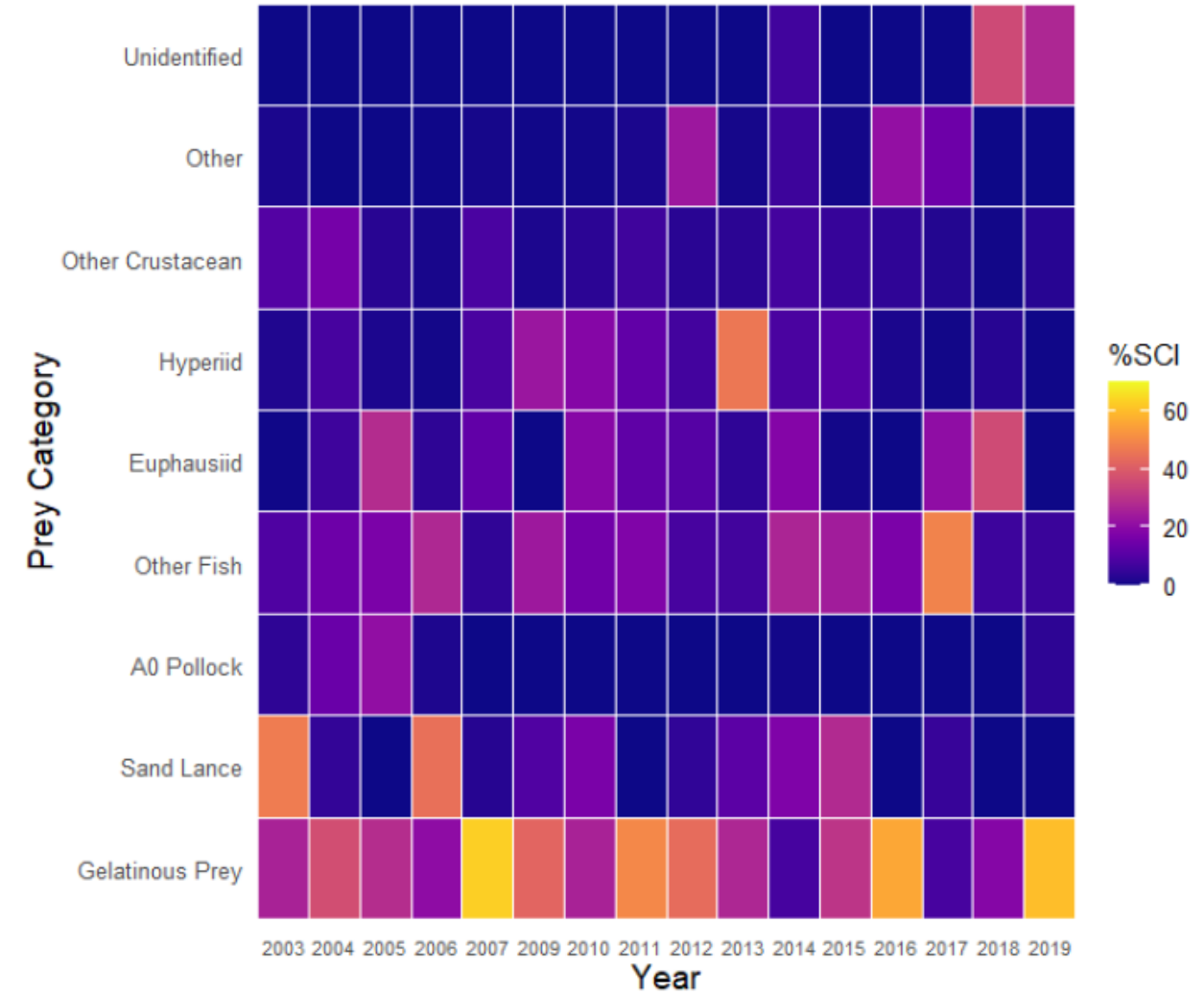


# Changing Ecosystems

## Juvenile Chinook



## Juvenile Chum



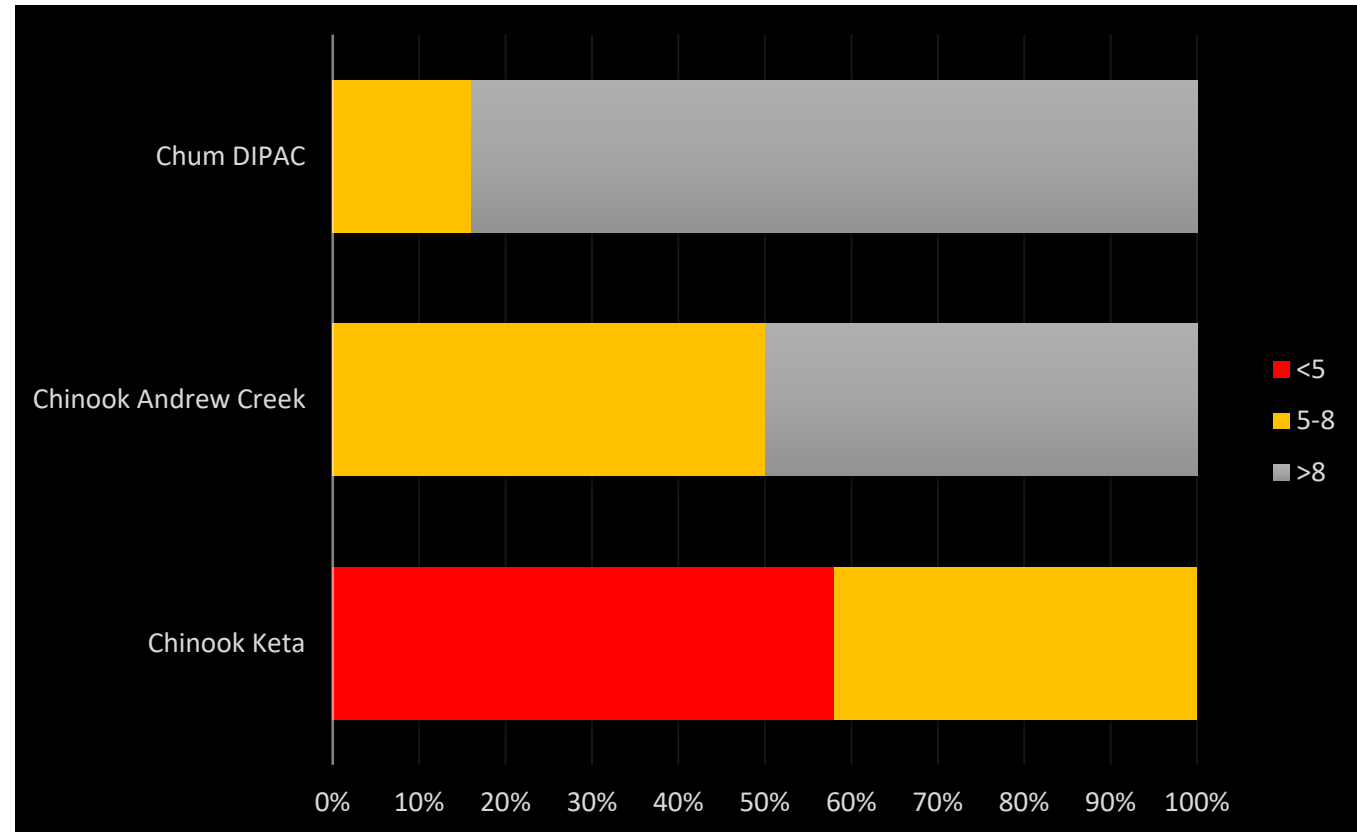
# Southeast Alaska Egg Thiamine

Variable

Species Dependent

Stock Dependent

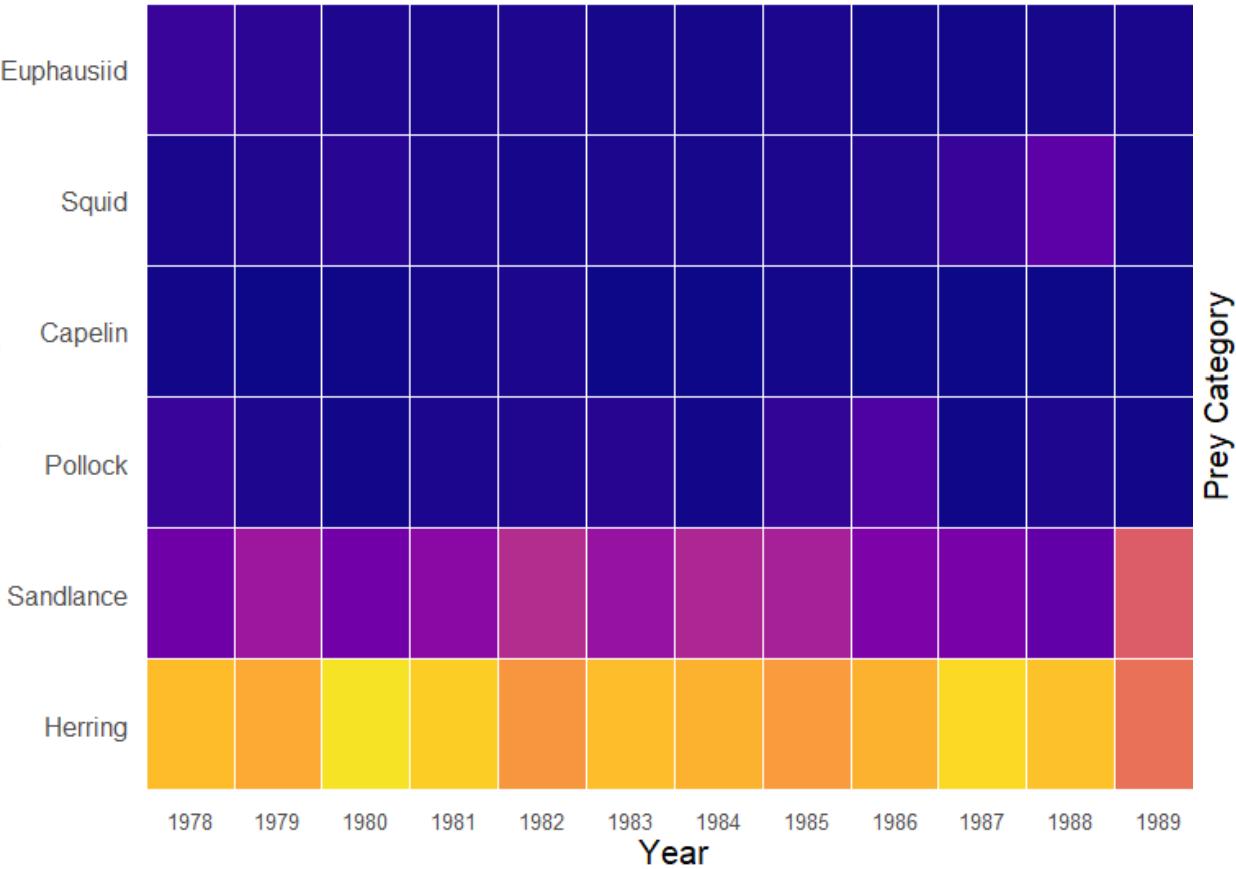
Differences with LHS



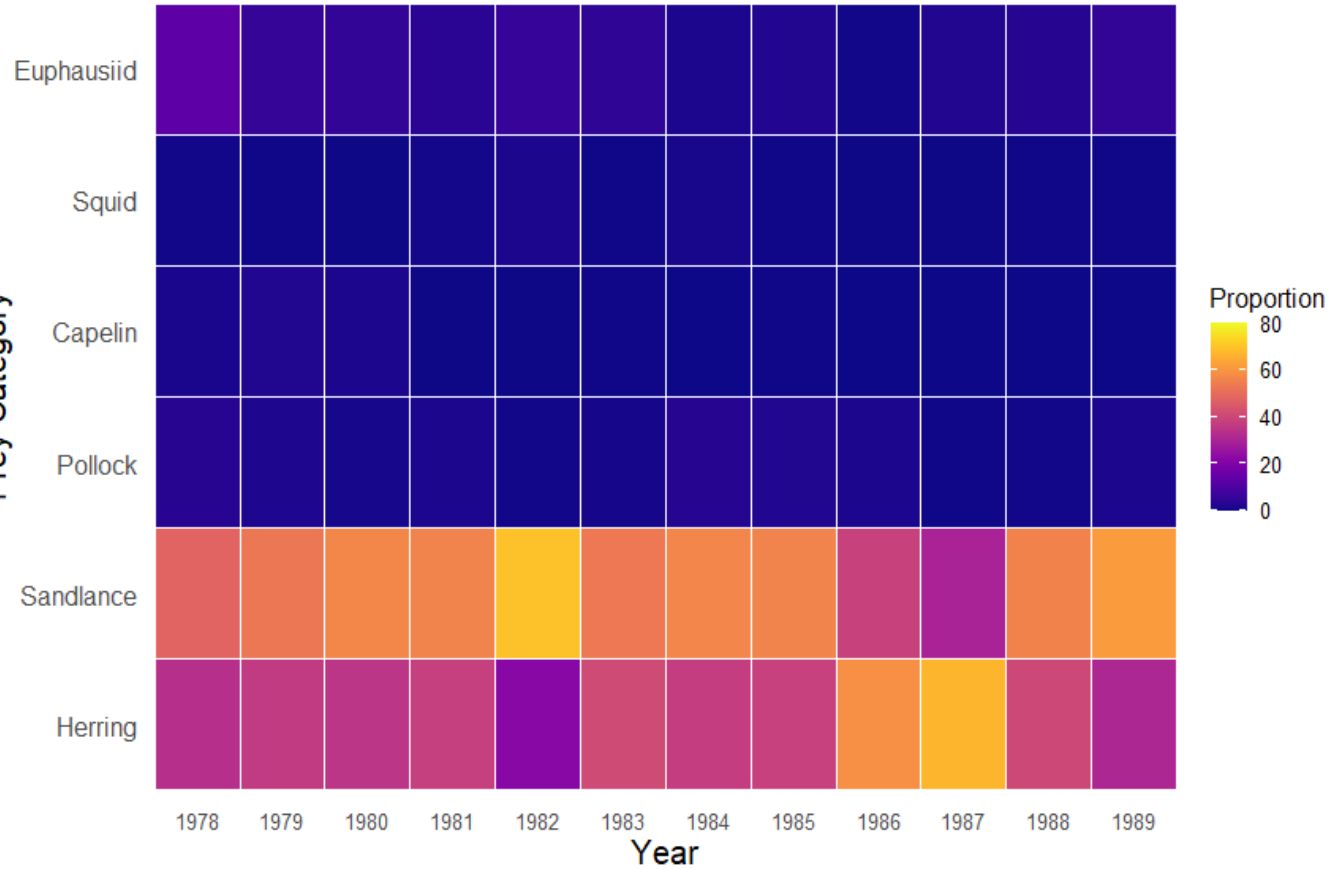


# Changing Ecosystems

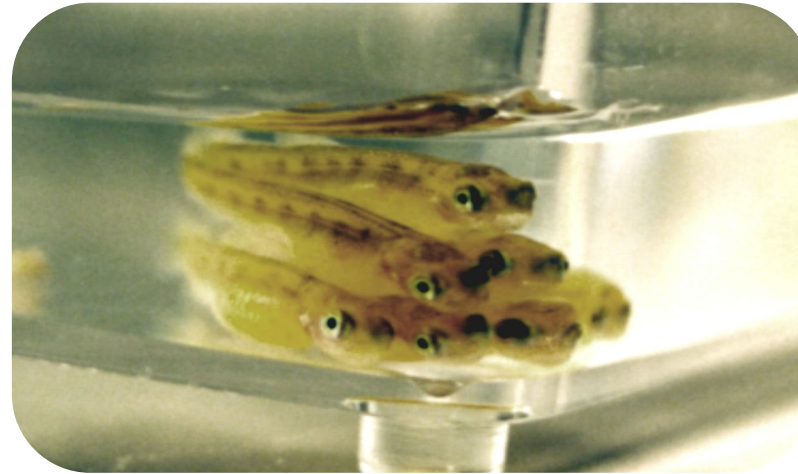
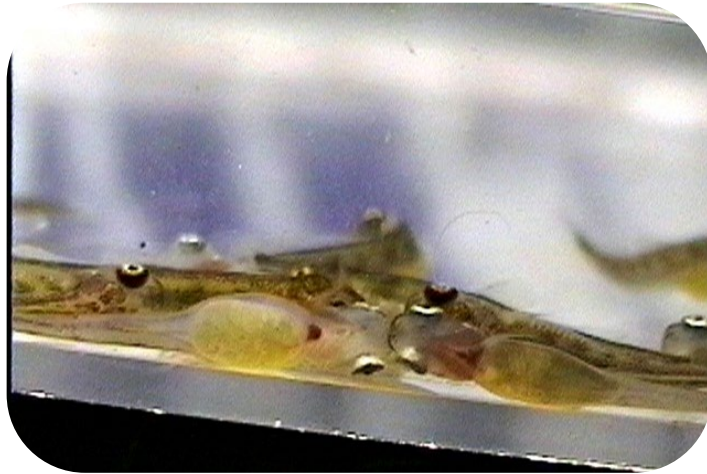
## Inside Waters



## Offshore Waters

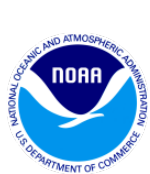


# Central Valley California

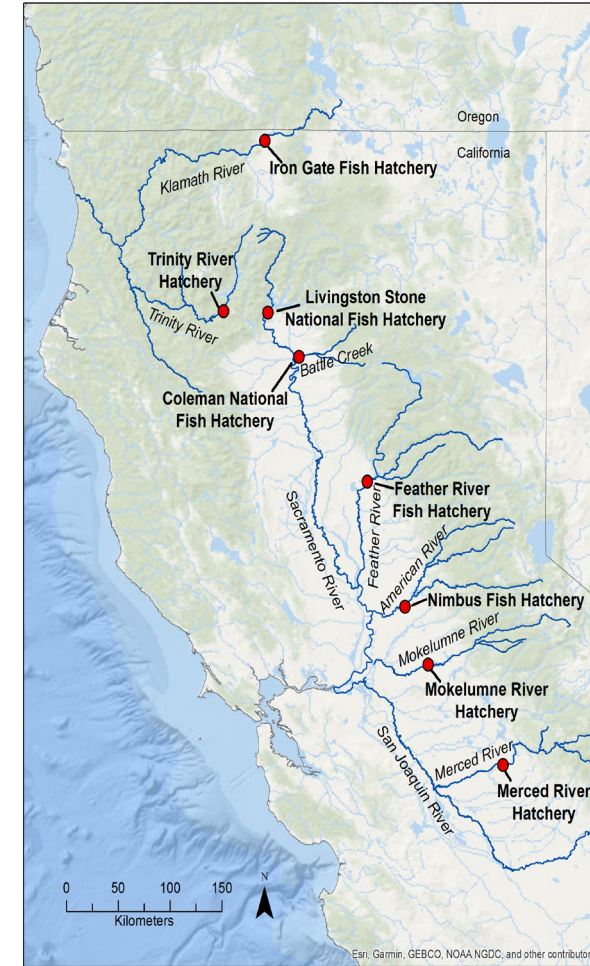
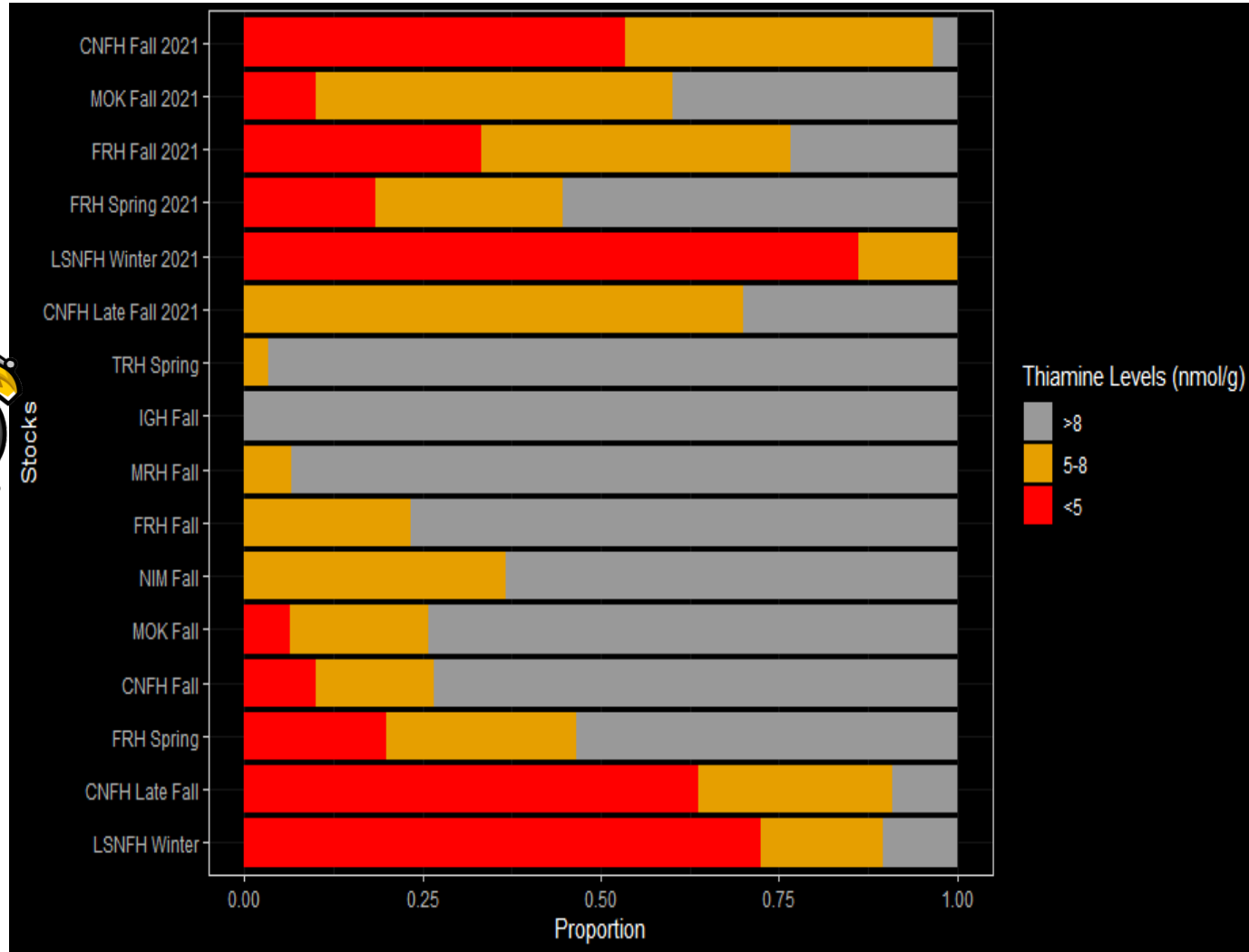


Photos courtesy Dale Honeyfield, USGS

Rachel C. Johnson<sup>1,2</sup>, Carson Jeffres<sup>2</sup>, Miranda Bell-Tilcock<sup>2</sup>, Alexandra Chu<sup>2</sup>, John Field<sup>1</sup>, Bruce Finney<sup>3</sup>, Dale Honeyfield<sup>4</sup>, Brett Kormos<sup>5</sup>, Danhong Ally Li<sup>2</sup>, Steve Lindley<sup>1</sup>, Steve Litvin<sup>6</sup>, Jacques Rinchar<sup>7</sup>, Iliana Ruiz-Cooley<sup>8</sup>, Donald Tillitt<sup>4</sup>, Abigail Ward<sup>2</sup>, and Nate Mantua<sup>1</sup>



# Central Valley California Egg Thiamine





# Changing Ecosystems

Increased Temperature

Compressed Offshore Habitat

Changing Prey Fields

Altered Diet

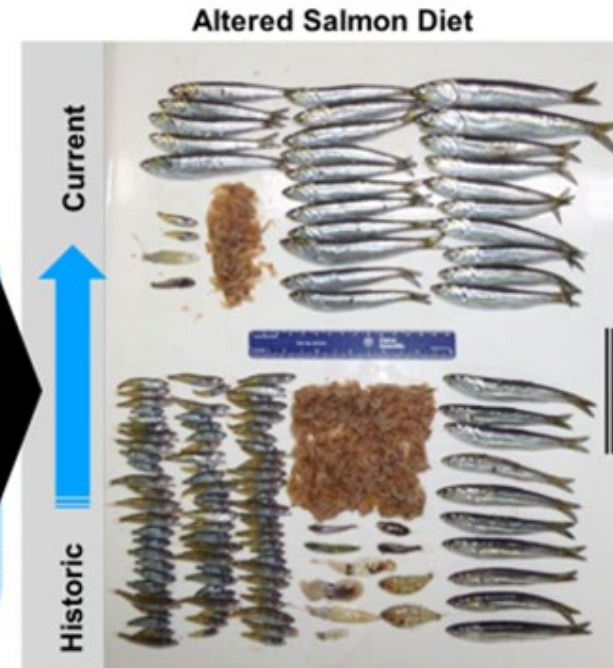
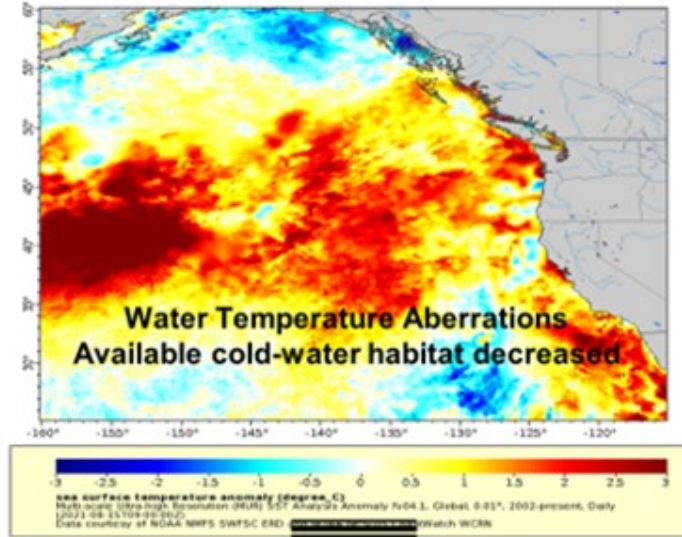


Figure courtesy of Freya Rowlands

# Conclusions

Stock Specific Drivers

Migratory Dynamics

Life History Strategy

