Larval Fish Assemblage Structure and Prey Availability in Liberty Island.

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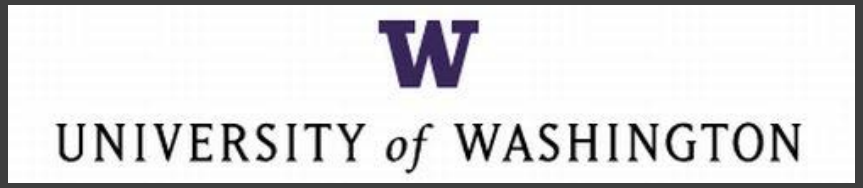


Cache Slough Collaborative Group

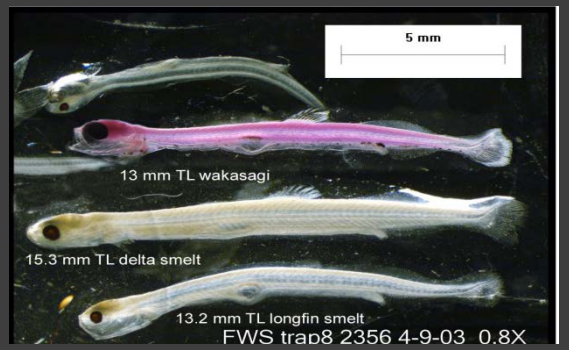
2014 SFCWA RFP –

Factors affecting the distribution and abundance of fish prey within the Cache Slough Complex

USFWS and University of Washington

Initial Objective:

Evaluate the temporal and spatial variation of prey availability, diet composition and the production base of food webs for larval Delta Smelt, Longfin Smelt, and Sacramento Splittail within Liberty Island and the Cache Slough Complex.



USFWS and University of Washington

Secondary Objective:

Evaluate the temporal and spatial variation of prey availability, diet composition and the production base of food webs for **Threadfin Shad, Prickly Sculpin, Striped Bass Inland Silverside, Tridentiger gobies** within Liberty Island and the Cache Slough Complex.

Principal Investigators

Lori Smith, US Fish and Wildlife Service

- Larval fish and zooplankton collection,
- Larval fish identification and assemblage assessment

Charles Simenstad, University of Washington

- Emphasis on shallow water, vegetated food web pathways supporting nekton

Emily Howe, University of Washington

- Food web sources study

Jeff Cordell, University of Washington

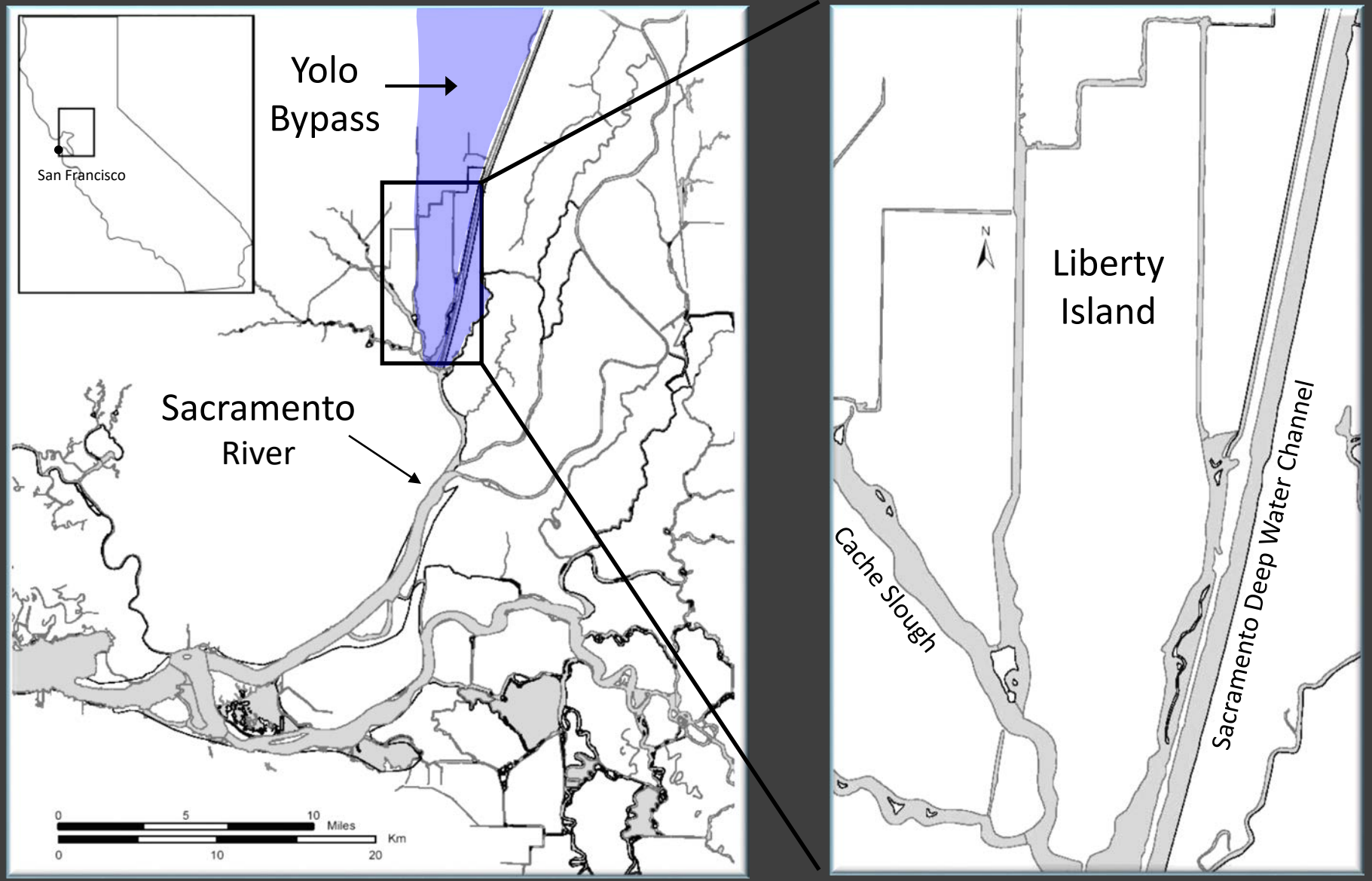
- Zooplankton Identification
- Fish diet analysis

USFWS Objectives

1. How does larval fish assemblage structure differ between vegetated and open water habitats (within Liberty Island and greater Cache Slough Complex)?

2. What abiotic and biotic factors(zooplankton species) are most associated with changes in the larval fish community across Liberty Island and the greater Cache Slough Complex.

Liberty Island



Larval trawls

February – June 2015 (3 days/month)

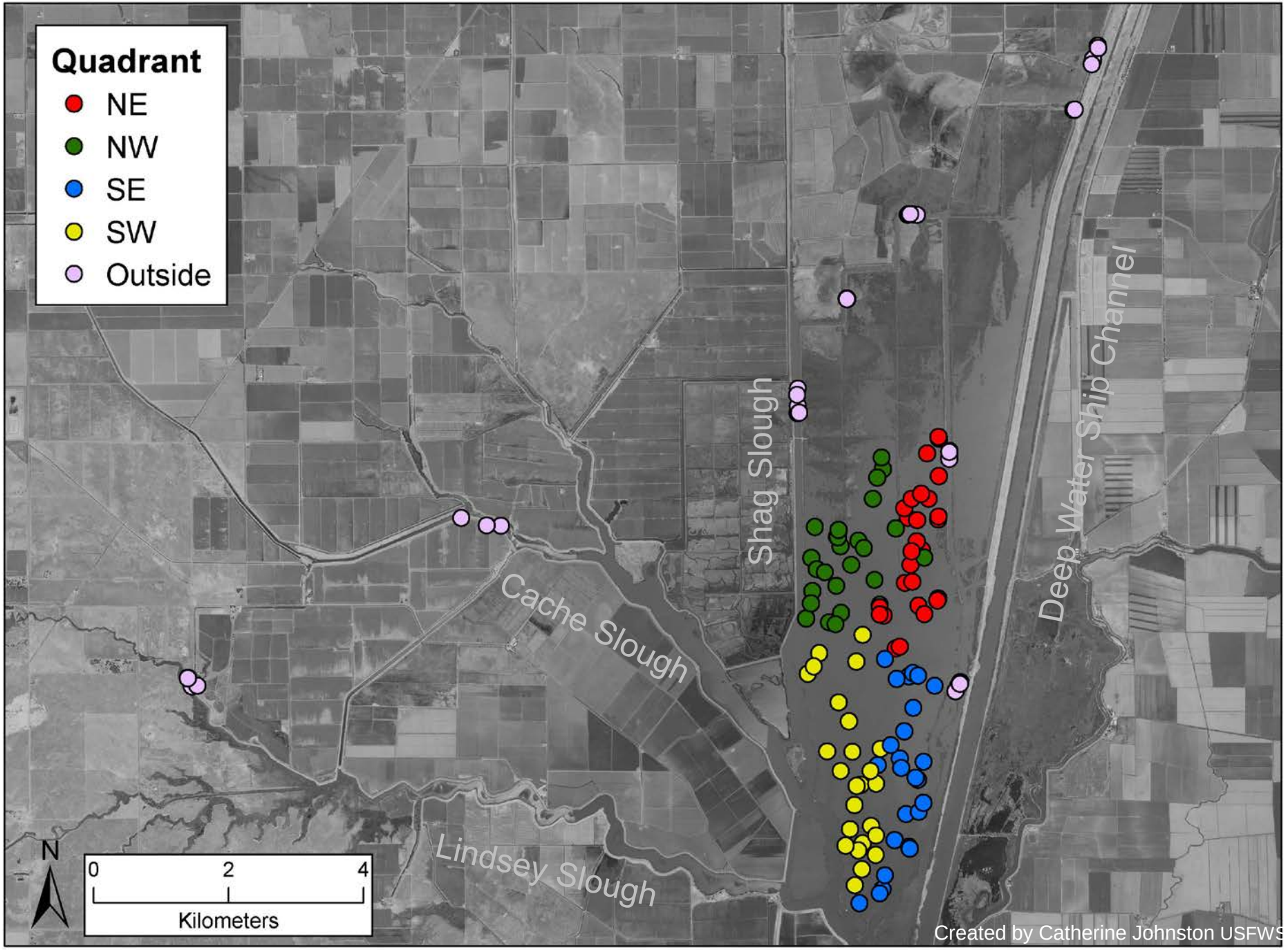
- Ten 10 min tows/day
- Two 500 µm nylon net (surface trawls)
- Stratified Random Sampling design (within LI)
- Predetermined sites (outside LI)
- physical-chemical properties of the water and substrate
- Fish Identified to species (when possible)

Zooplankton trawls

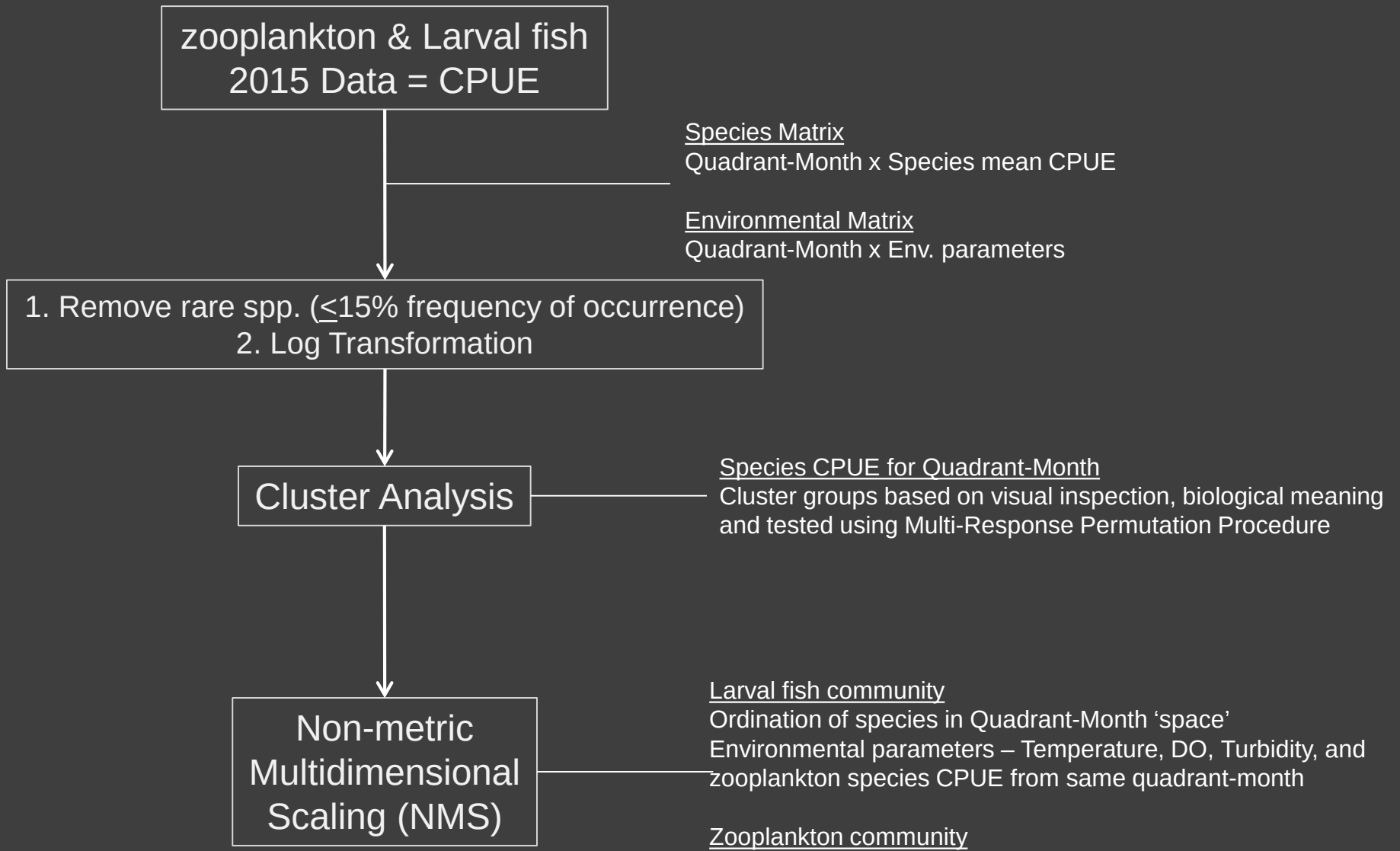
February – June 2015 (3 days/month)

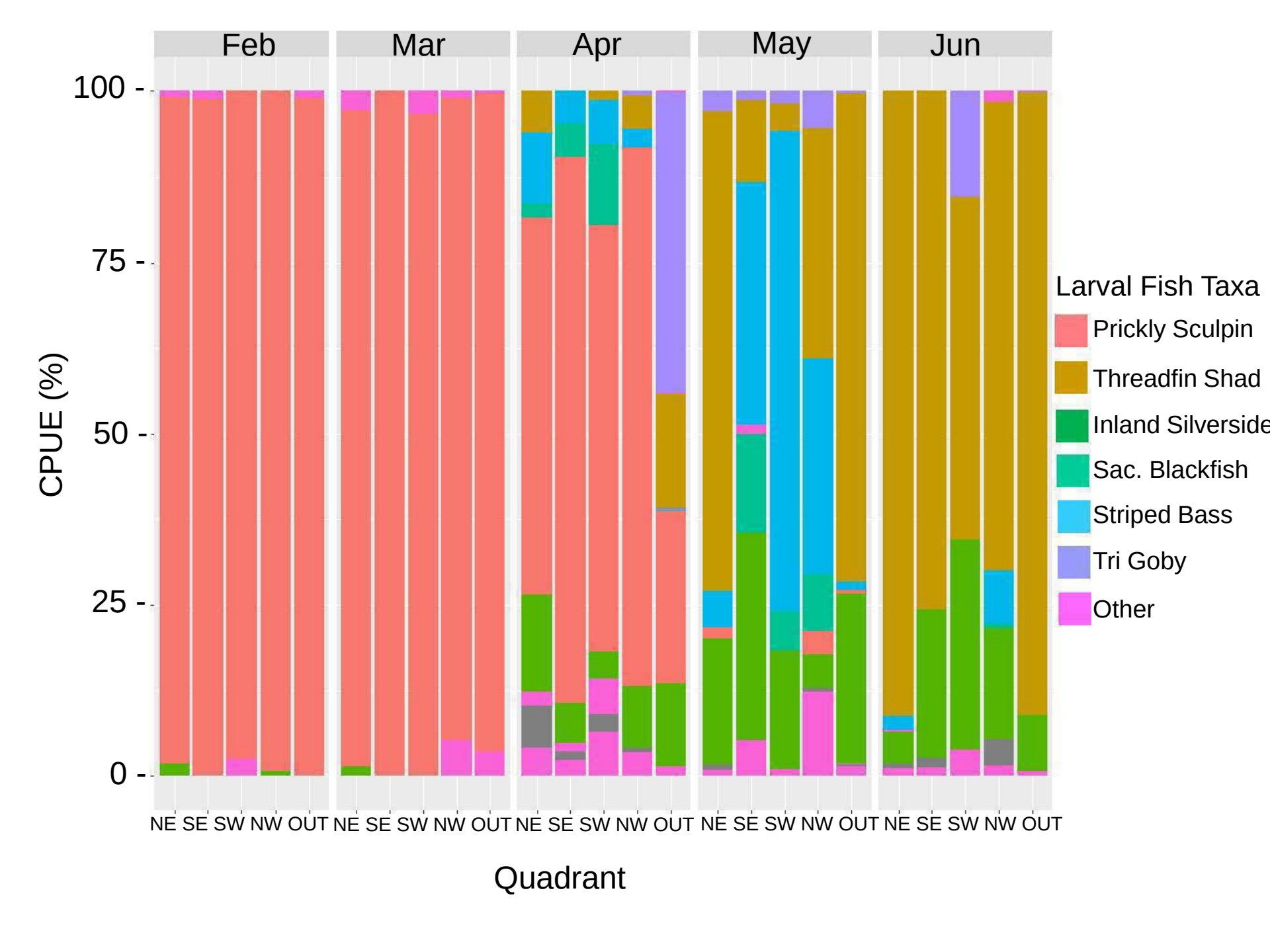
- Ten 1 min tows/day
- Clarks-Bumpus net (0.5m diameter, 53-µm mesh)
- In conjunction with larval trawls
- UW identified to species and life stage

Photo: CDFW

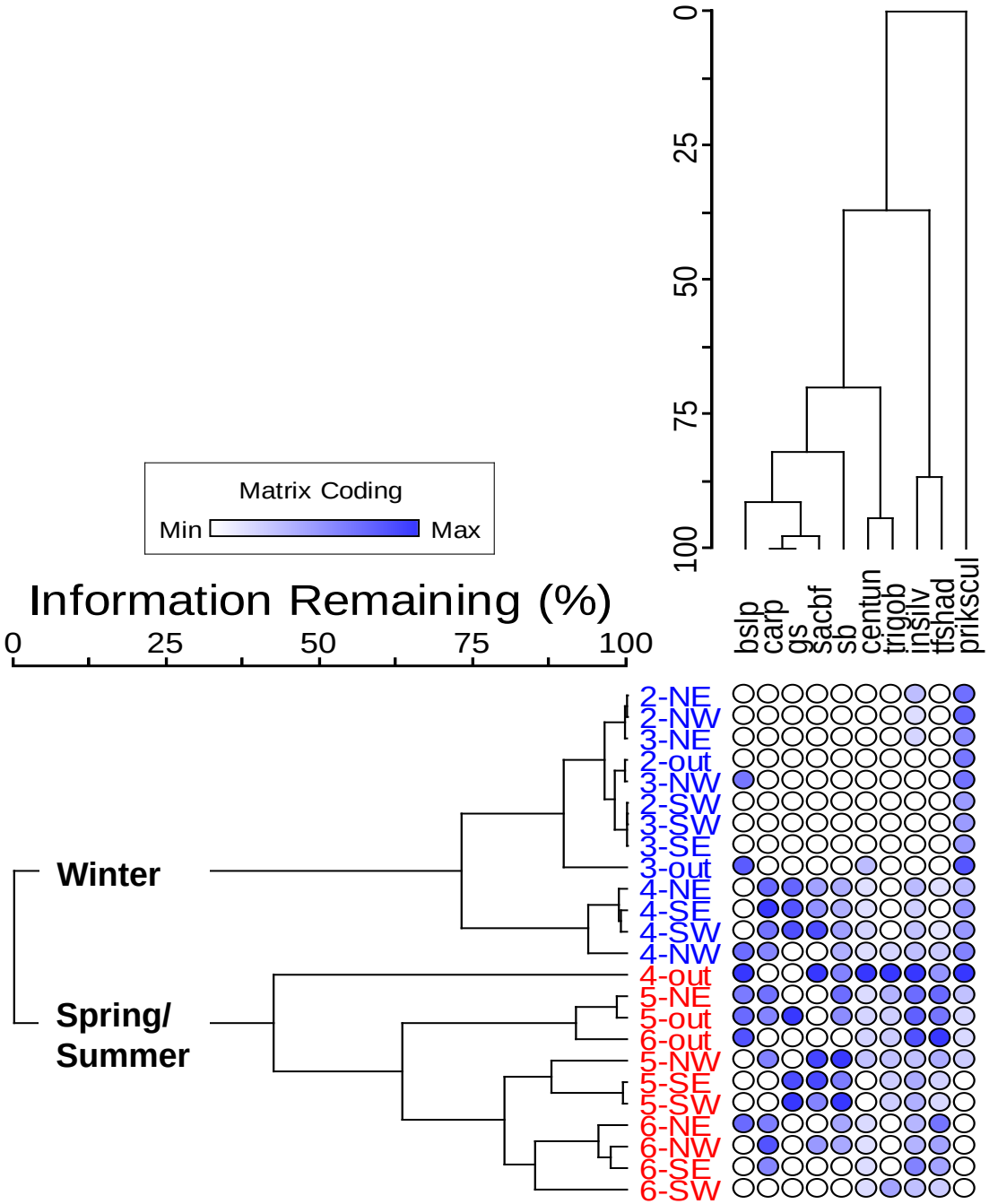

Quadrant
NE
NW
SE
SW
Outside
Shag Slough
Deep Water Ship Channel
Cache Slough
Lindsey Slough
N
0
2
4
Kilometers
Created by Catherine Johnston USFWS

Analysis


zooplankton & Larval fish
2015 Data = CPUE
Species Matrix
Quadrant-Month x Species mean CPUE
Environmental Matrix
Quadrant-Month x Env. parameters
1. Remove rare spp. (≤15% frequency of occurrence)
2. Log Transformation
Cluster Analysis
Species CPUE for Quadrant-Month
Cluster groups based on visual inspection, biological meaning and tested using Multi-Response Permutation Procedure
Non-metric Multidimensional Scaling (NMS)
Larval fish community
Ordination of species in Quadrant-Month 'space'
Environmental parameters – Temperature, DO, Turbidity, and zooplankton species CPUE from same quadrant-month
Zooplankton community
Ordination of species in Quadrant-Month 'space'
Environmental parameters – Temperature, DO and Turbidity

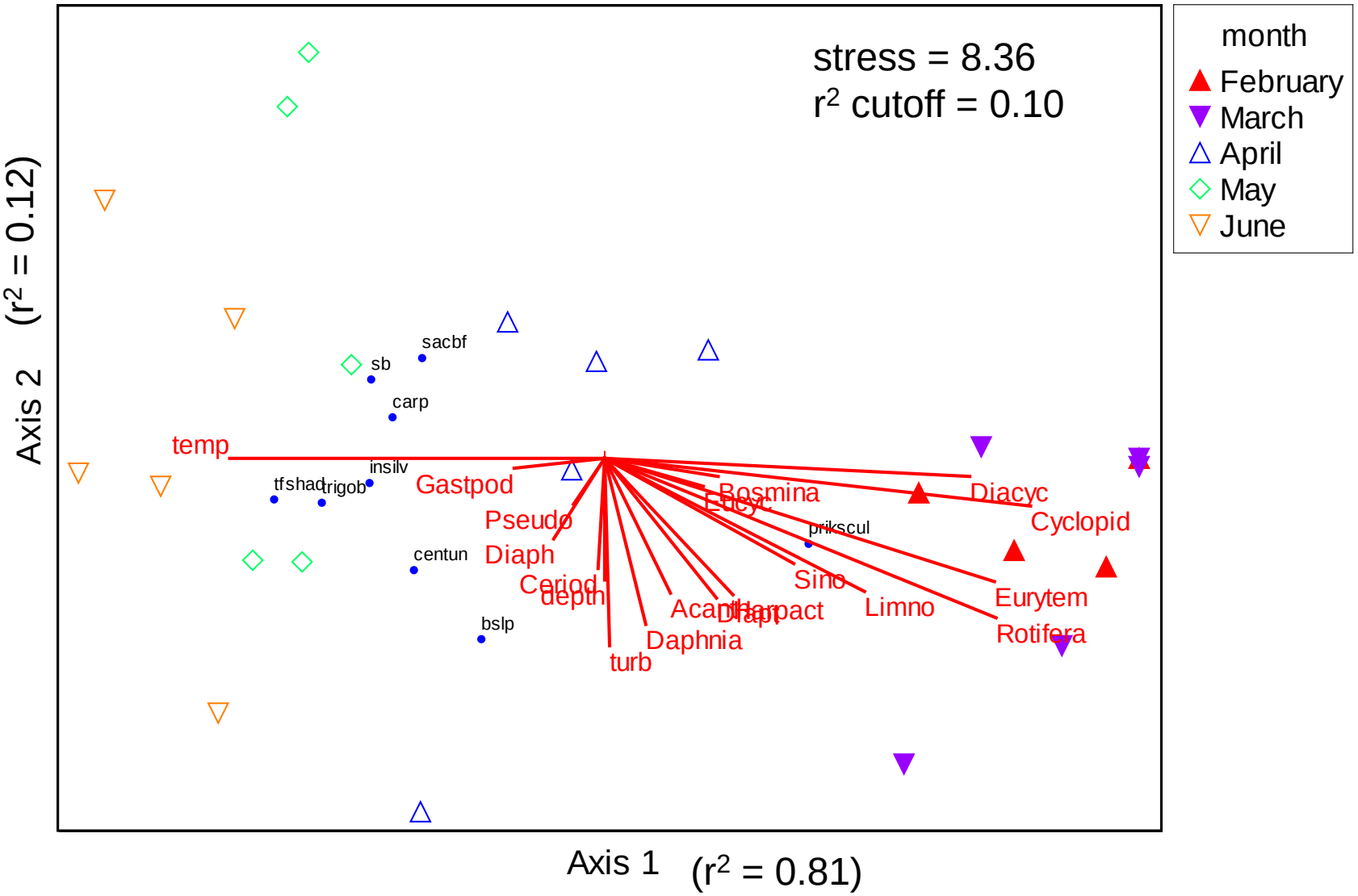

Feb
Mar
Apr
May
Jun
100
75
50
25
0
CPUE (%)
NE SE SW NW OUT
Quadrant
Larval Fish Taxa
Prickly Sculpin
Threadfin Shad
Inland Silverside
Sac. Blackfish
Striped Bass
Tri Goby
Other

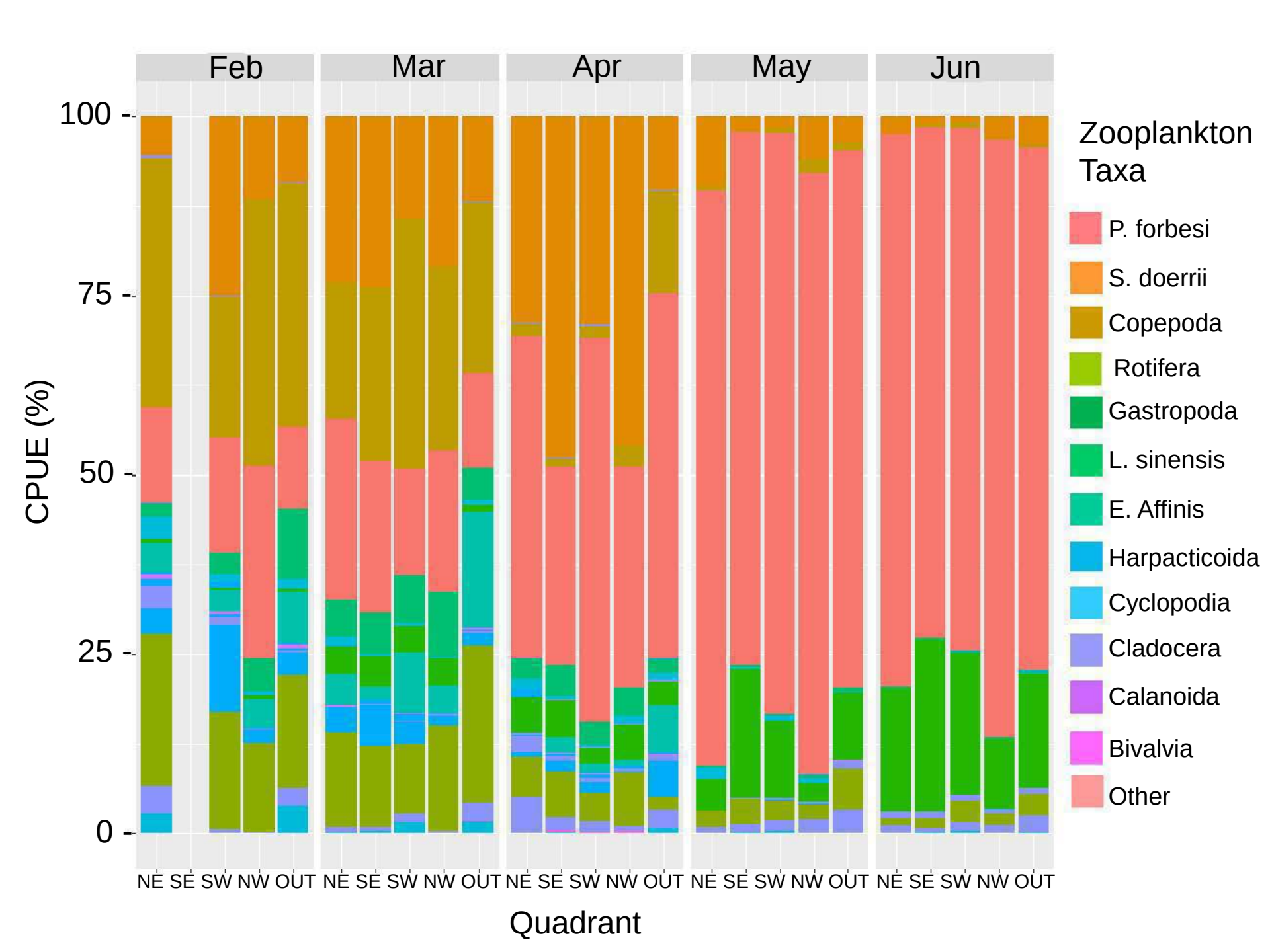
Larval Fish Community

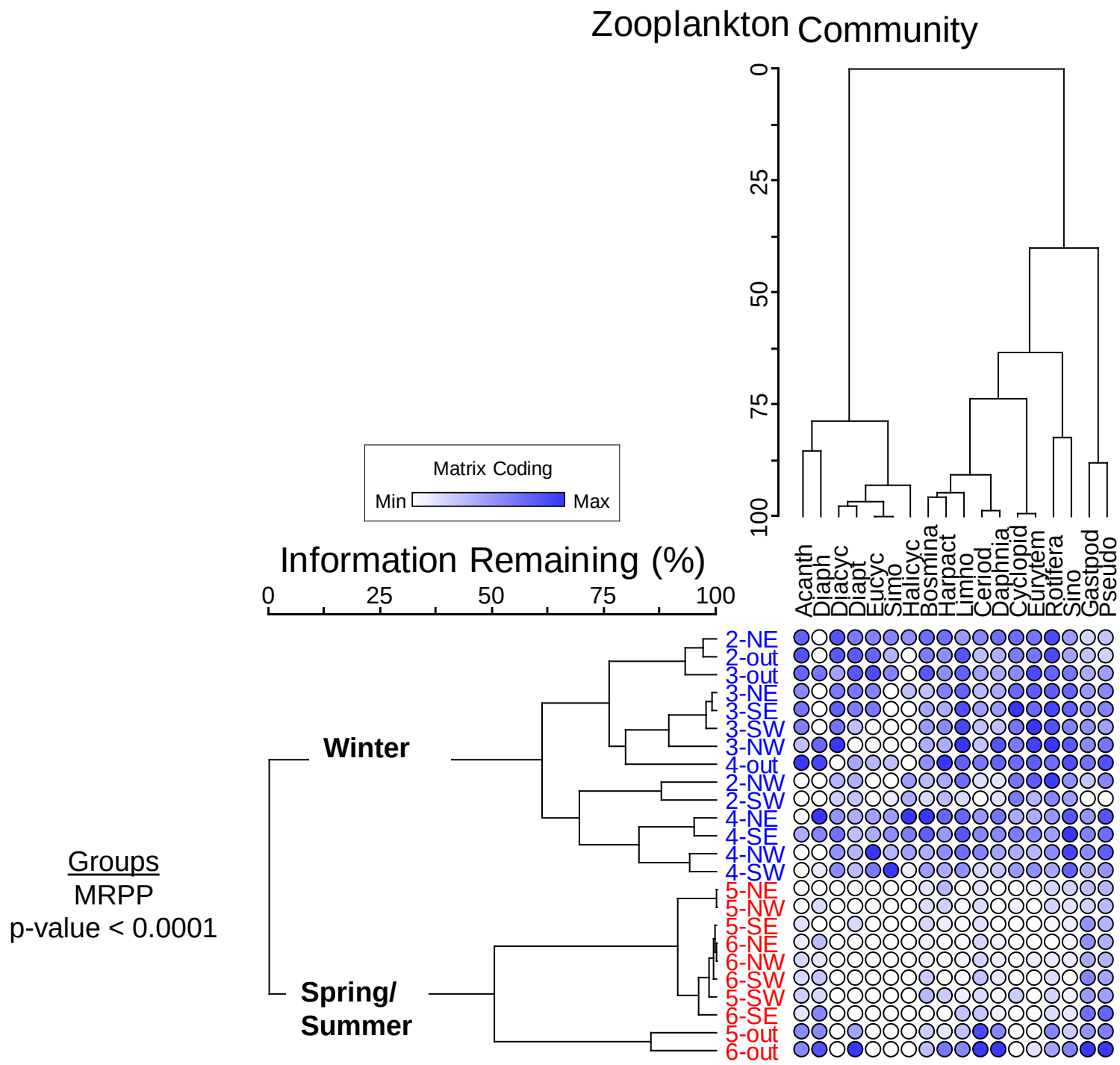


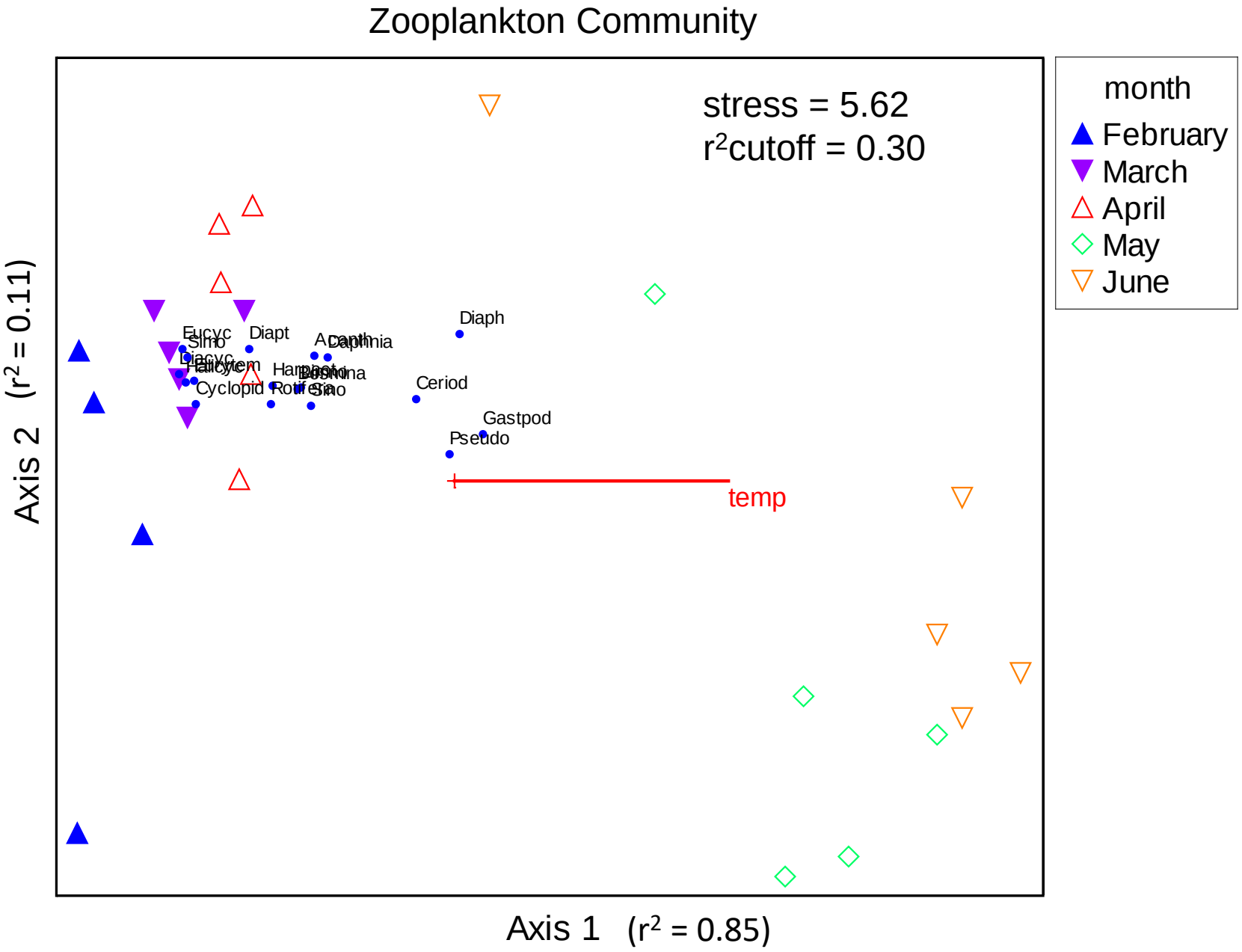
2 cluster groups
MRPP
p-value < 0.0001

Larval Fish Community




Feb
Mar
Apr
May
Jun
100
75
50
25
0
CPUE (%)
NE SE SW NW OUT
Quadrant
Zooplankton Taxa
P. forbesi
S. doerrii
Copepoda
Rotifera
Gastropoda
L. sinensis
E. Affinis
Harpacticoida
Cyclopodia
Cladocera
Calanoida
Bivalvia
Other


Zooplankton Community
0
25
50
75
100
Matrix Coding
Min
Max
Information Remaining (%)
0
25
50
75
100
Acanth
Diaph
Diacyc
Diapt
Eucyc
Simo
Halicyc
Bosmina
Harpact
Limno
Ceriod
Daphnia
Cyclopid
Eurytem
Rotifera
Sino
Gastpod
Pseudo
2-NE
2-out
3-out
3-NE
3-SE
3-SW
3-NW
4-out
2-NW
2-SW
4-NE
4-SE
4-NW
4-SW
5-NE
5-NW
5-SE
6-NE
6-NW
6-SW
5-SW
6-SE
5-out
6-out
Winter
Spring/
Summer
Groups
MRPP
p-value < 0.0001


Zooplankton Community
stress = 5.62
r2cutoff = 0.30
month
February
March
April
May
June
Diaph
Eucyc
Diapt
Simo
Daphnia
Ceriod
Cyclopid
Gastpod
Pseudo
temp
Axis 2 (r2 = 0.11)
Axis 1 (r2 = 0.85)

Conclusions

- No difference in the larval fish assemblage structure between the vegetated and less vegetated habitat in Liberty Island.
- The change in the community structure for both zooplankton and larval fish are driven by temperature.
- Larval fish and zooplankton communities exhibit two seasonal groups
- No difference in Larval fish communities or Zooplankton communities inside and outside of Liberty Island. Except in April for Larval fish.
- In April the larval fish community outside Liberty seems to transition to the summer community earlier which may be driven by higher temperatures and a peak in Tridentiger abundance outside Liberty Island.

Next steps

Analyze 2016 data

- GLM's to describe larval fish habitat relationships
  inter-annual and seasonal variation

- Combine prey availability with fish, habitat, and diet data to determine if the prey availability explains variation in the larval fish assemblage structure.

Acknowledgements

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Charles Simenstad - UW

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DEPARTMENT OF THE INTERIOR

UNIVERSITY of WASHINGTON

Questions?