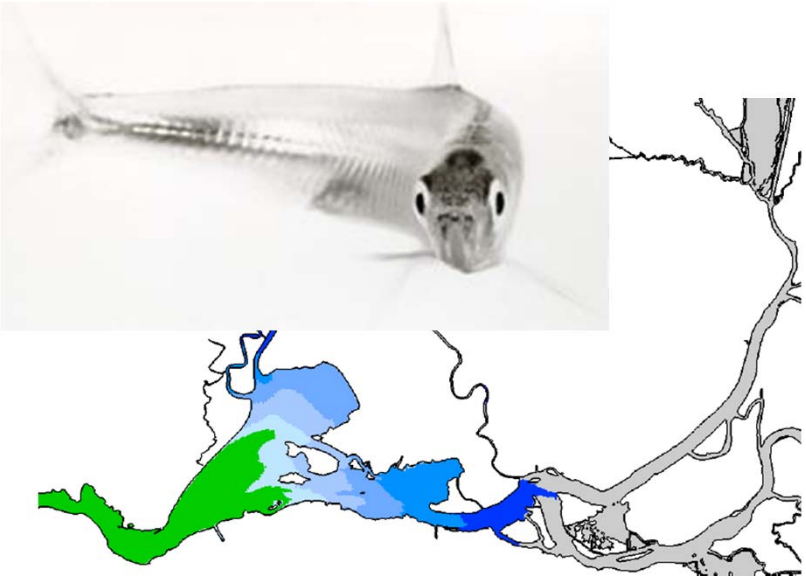
Delta Smelt Distribution & Diet Fall 2011

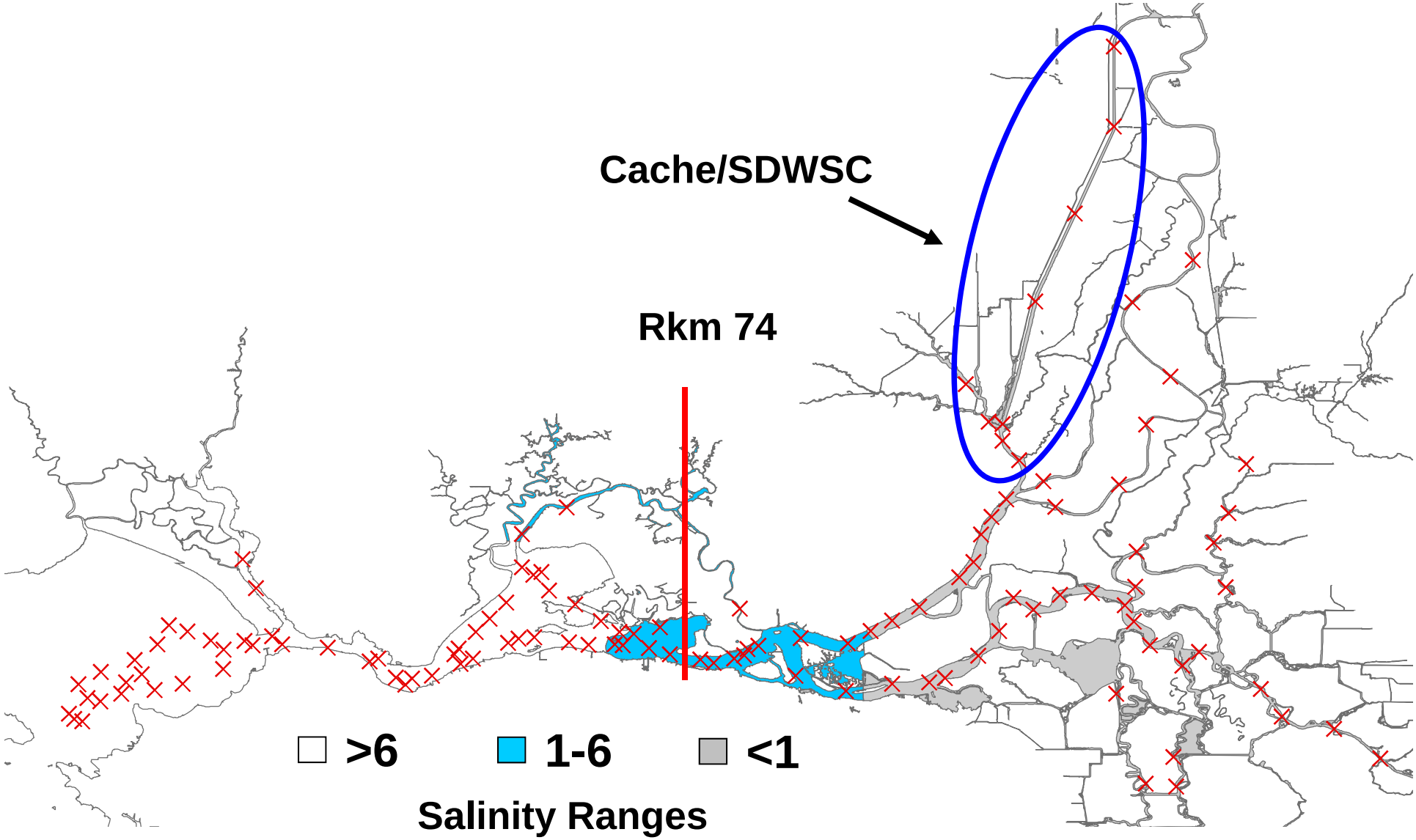


Randall Baxter & Steven Slater

California Department Of Fish & Game
FLaSH Science Review Panel
July 31, 2012

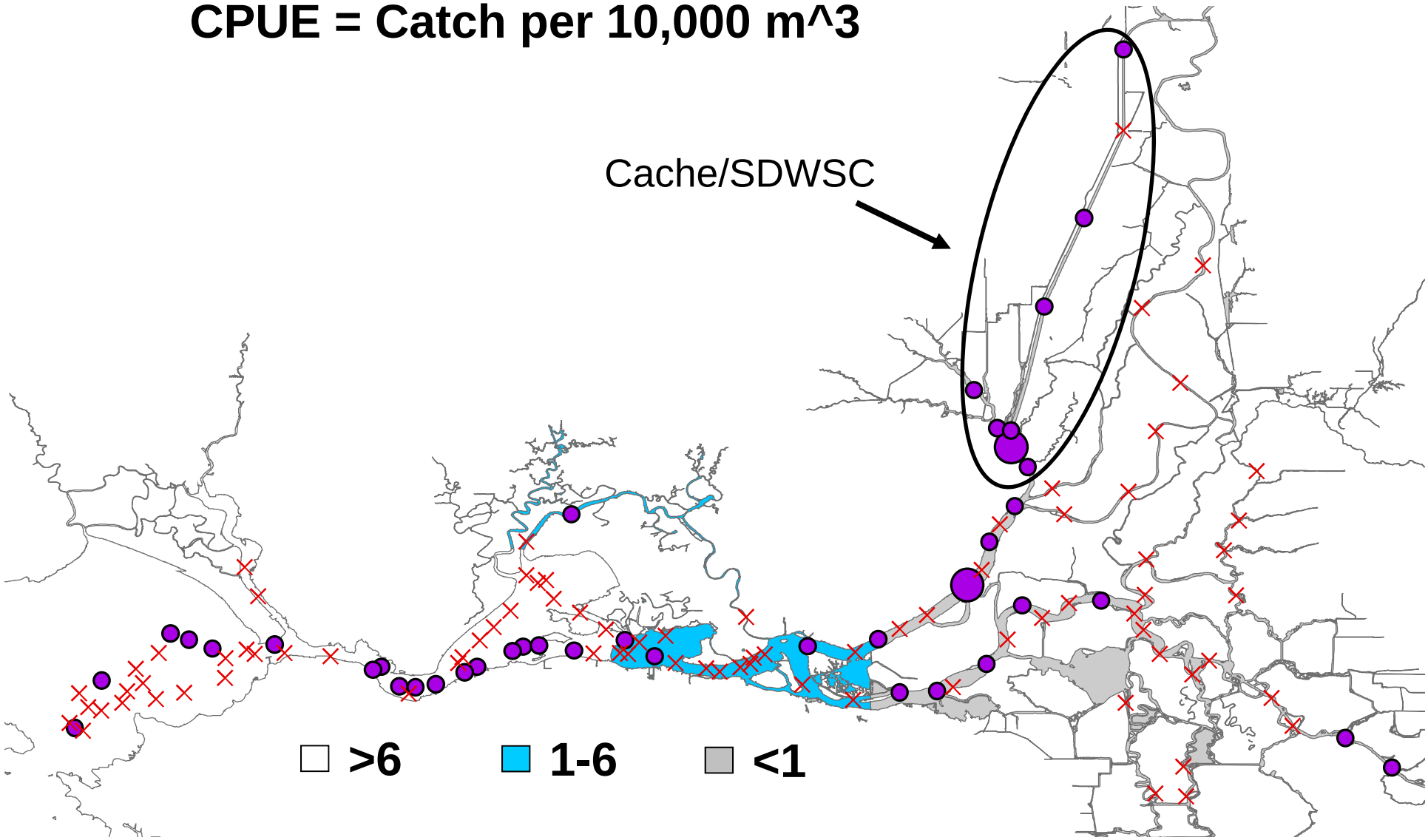
Data organization: 3 Salinity Zones

& Cache Sl/Sac. Deepwater Ship Channel

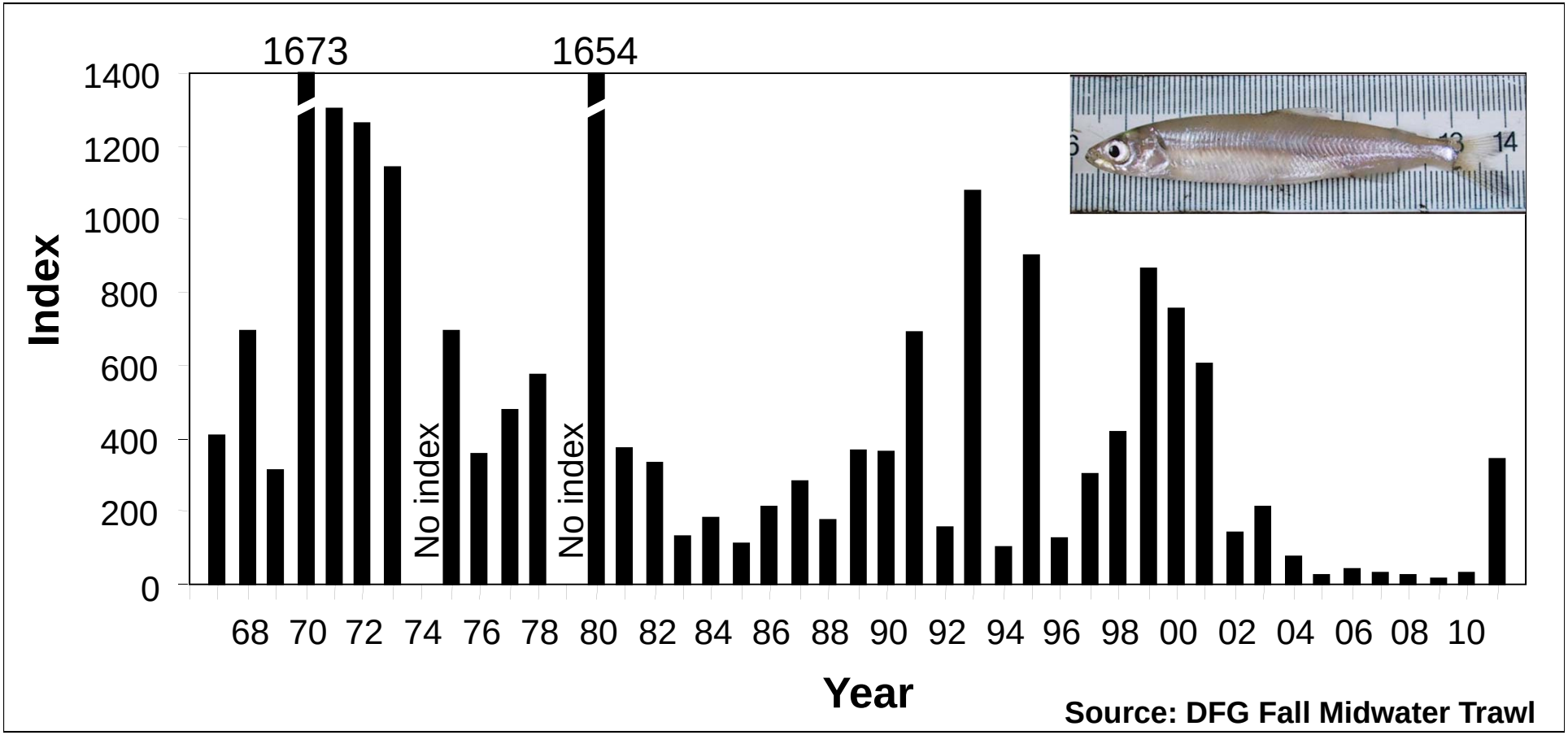


Generalized Distribution

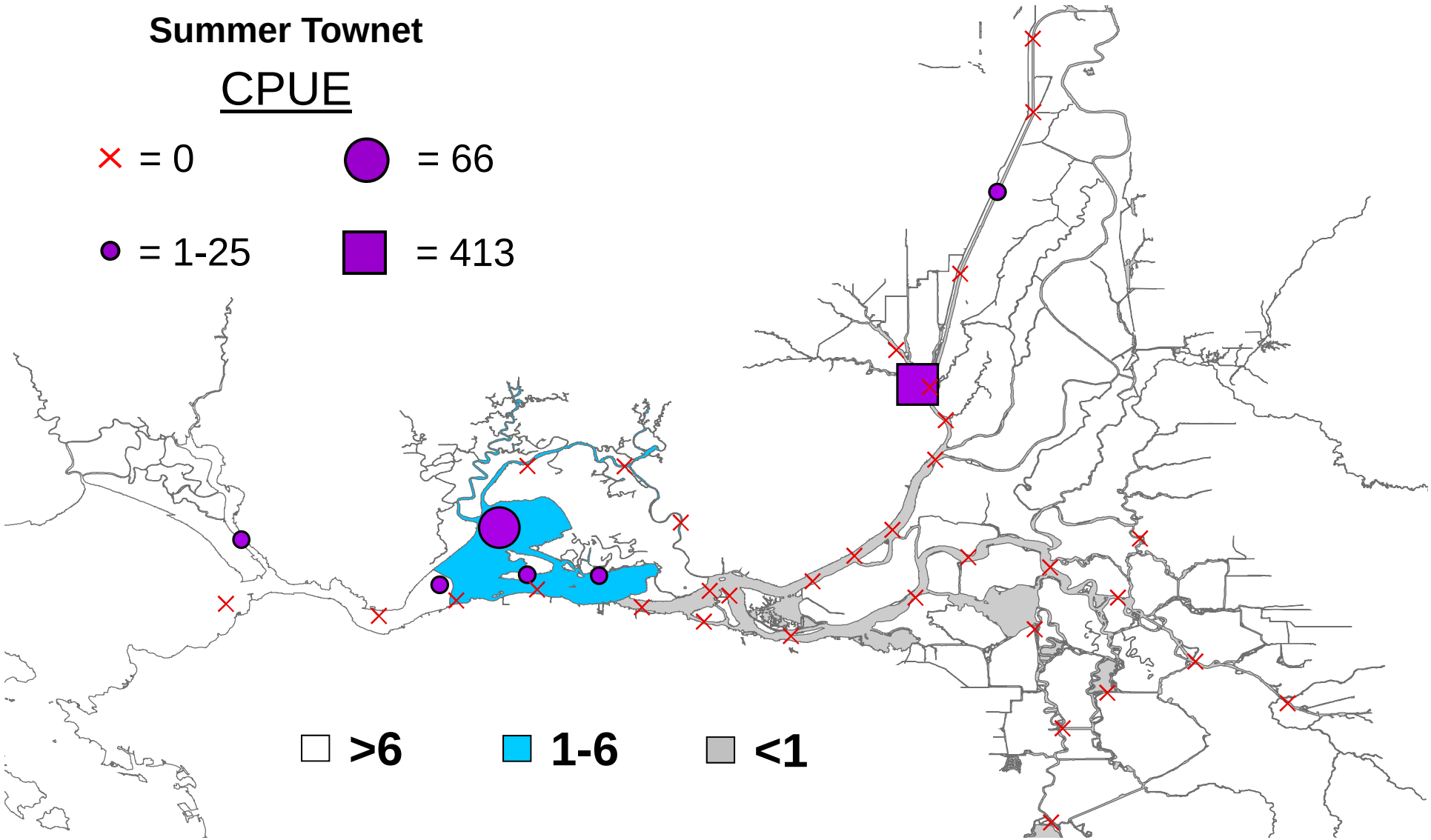
CPUE = Catch per 10,000 m^3



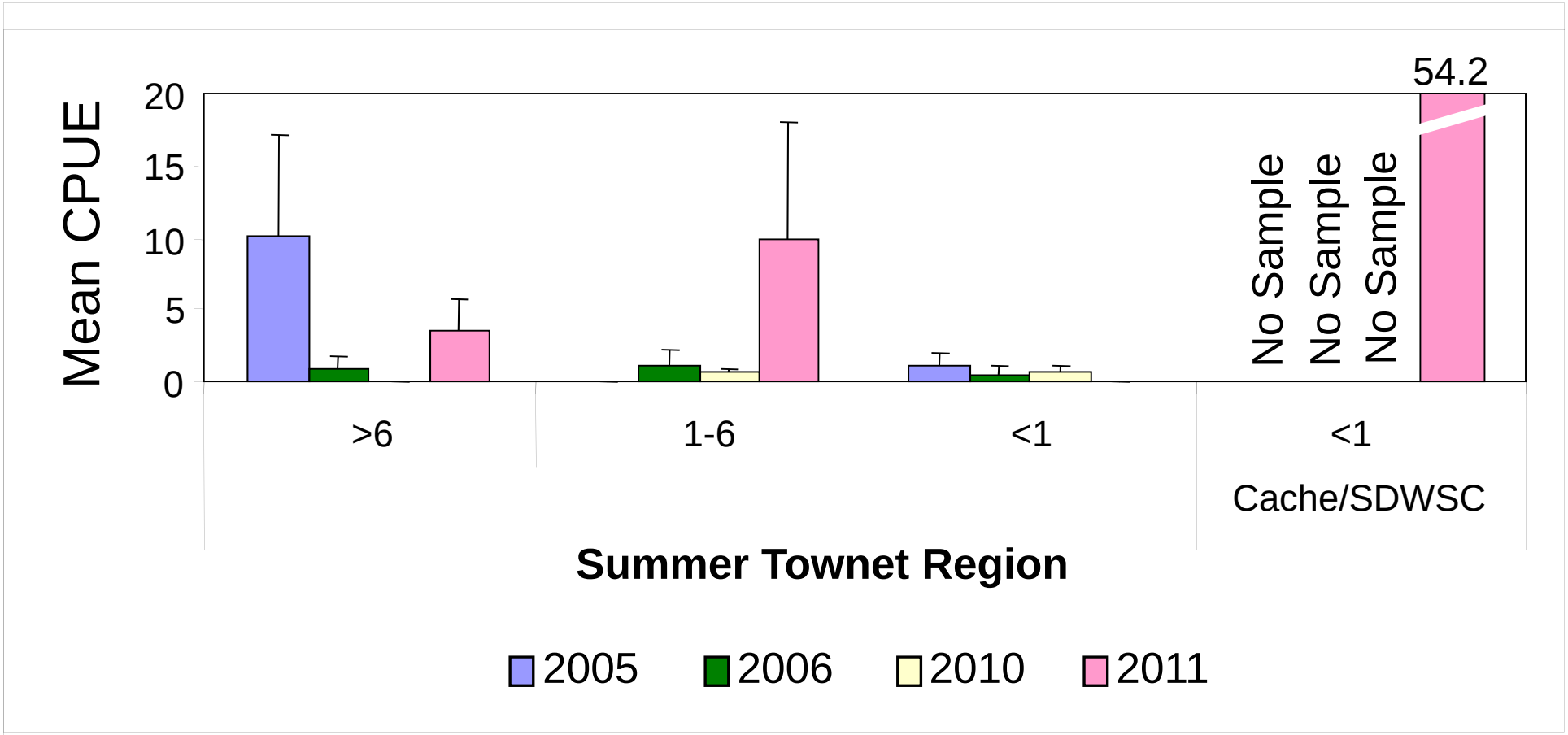
Highest delta smelt abundance since 2001



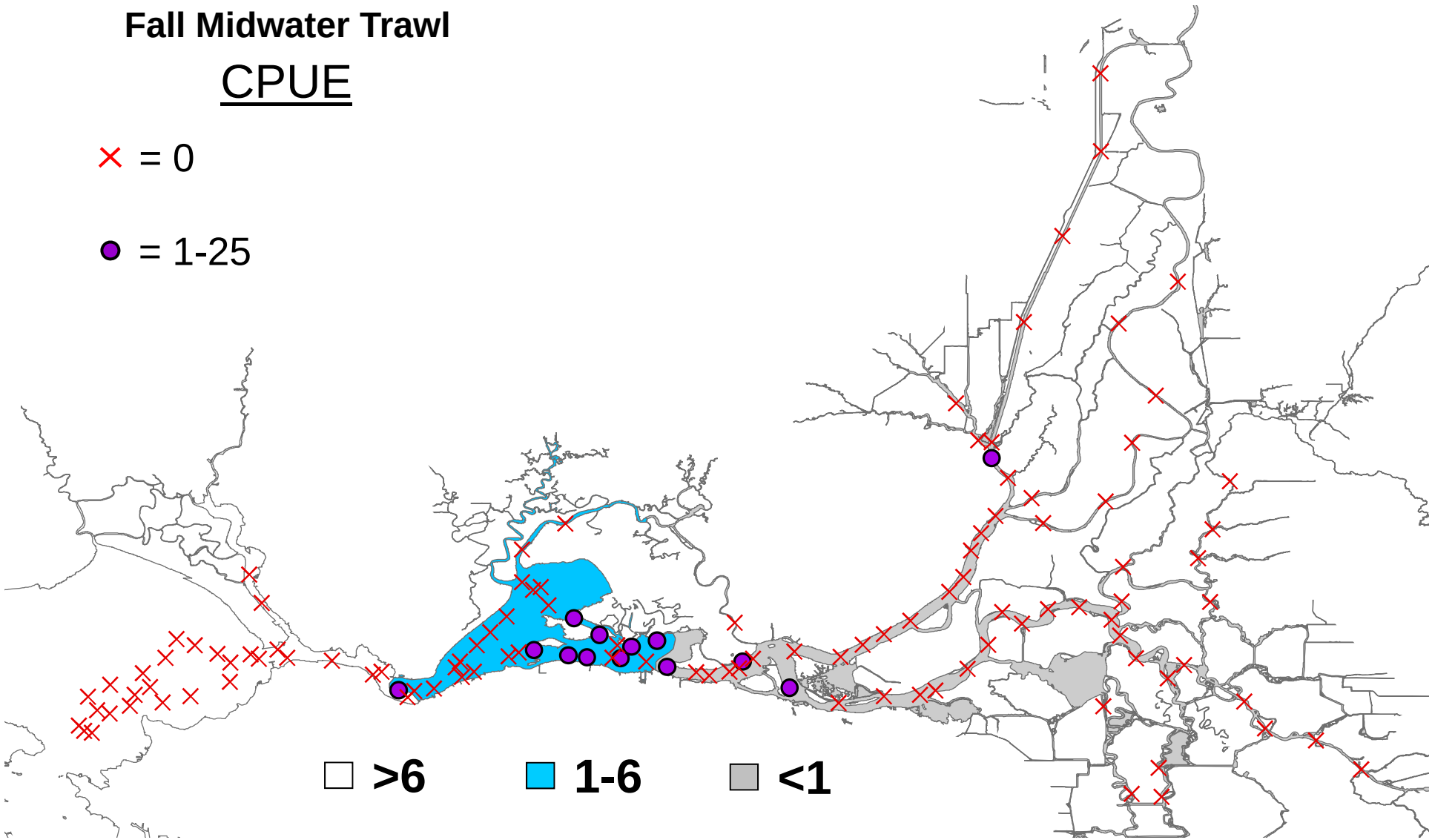
August 2011
Delta Smelt In Low Salinity Zone



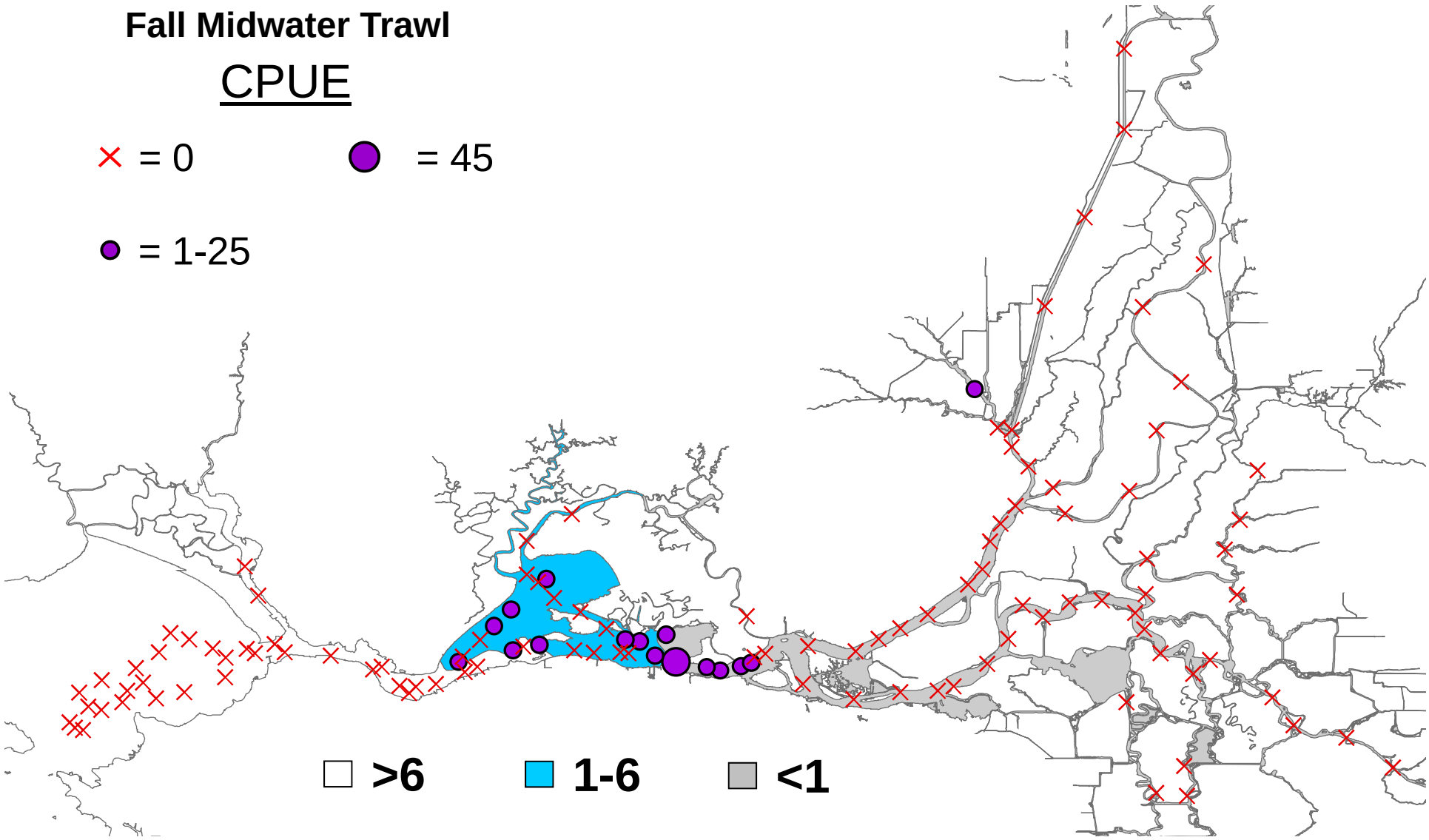
August Delta Smelt Distribution



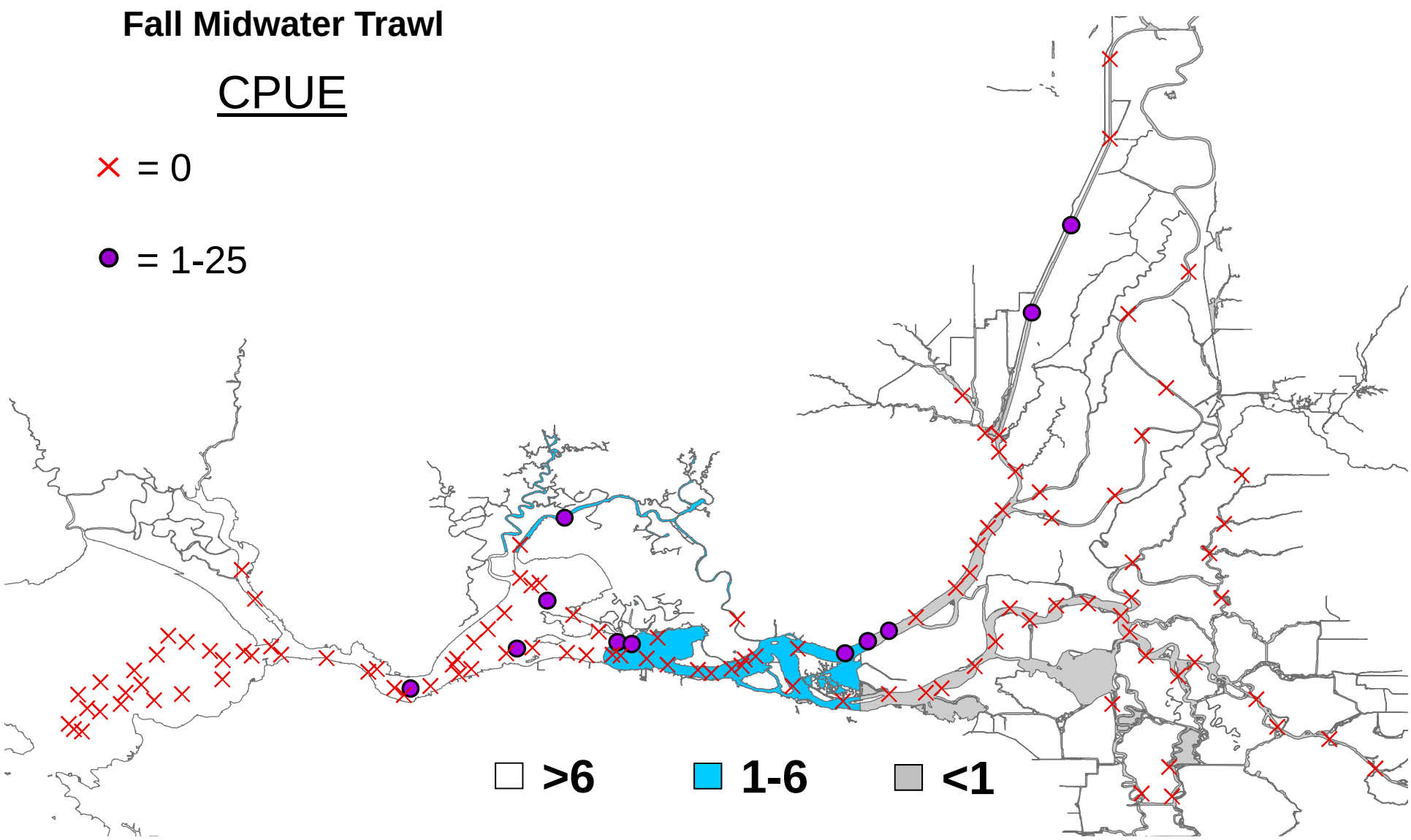
September 2011
Delta Smelt in upper Low Salinity Zone



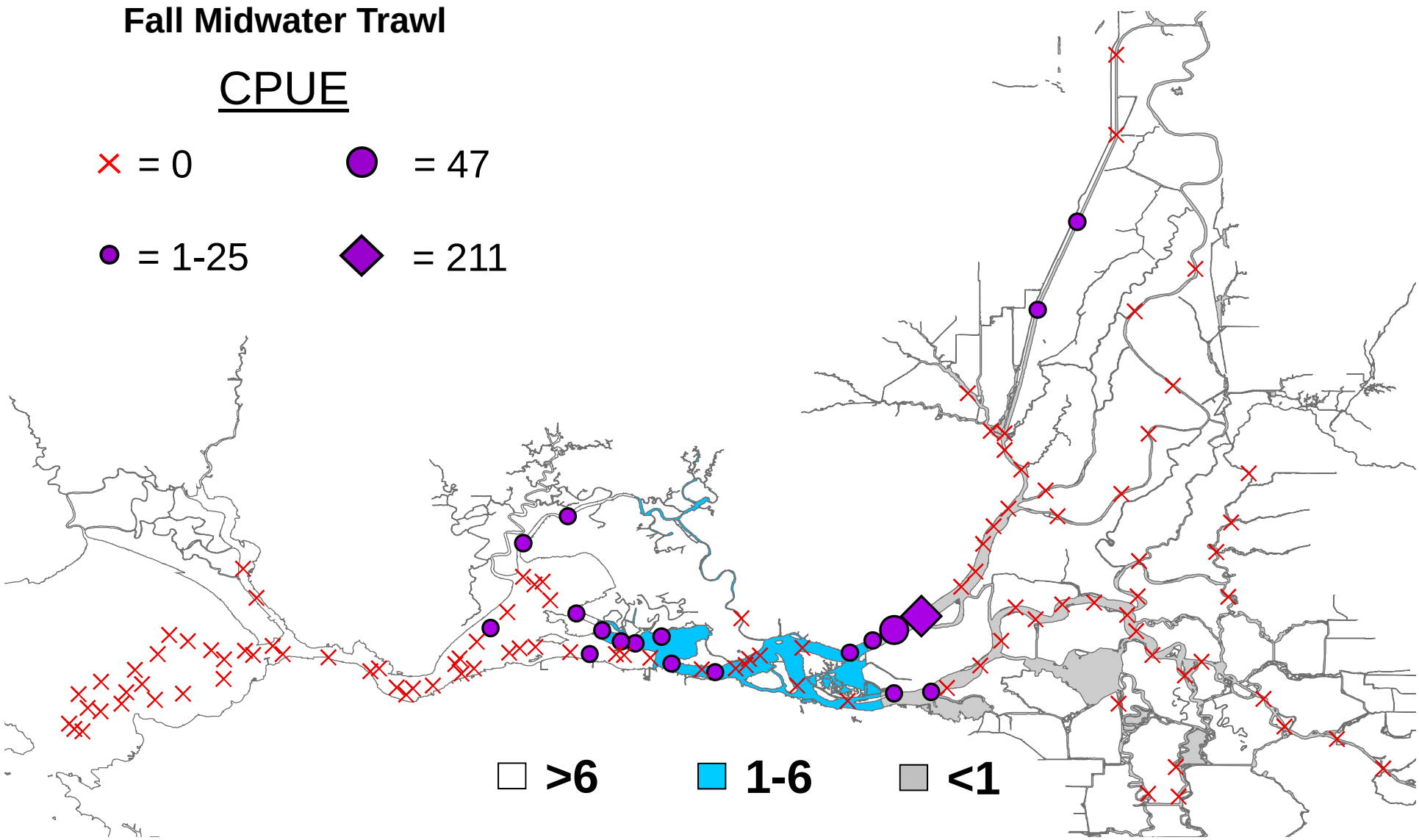
October 2011
Delta smelt within & above Low Salinity Zone



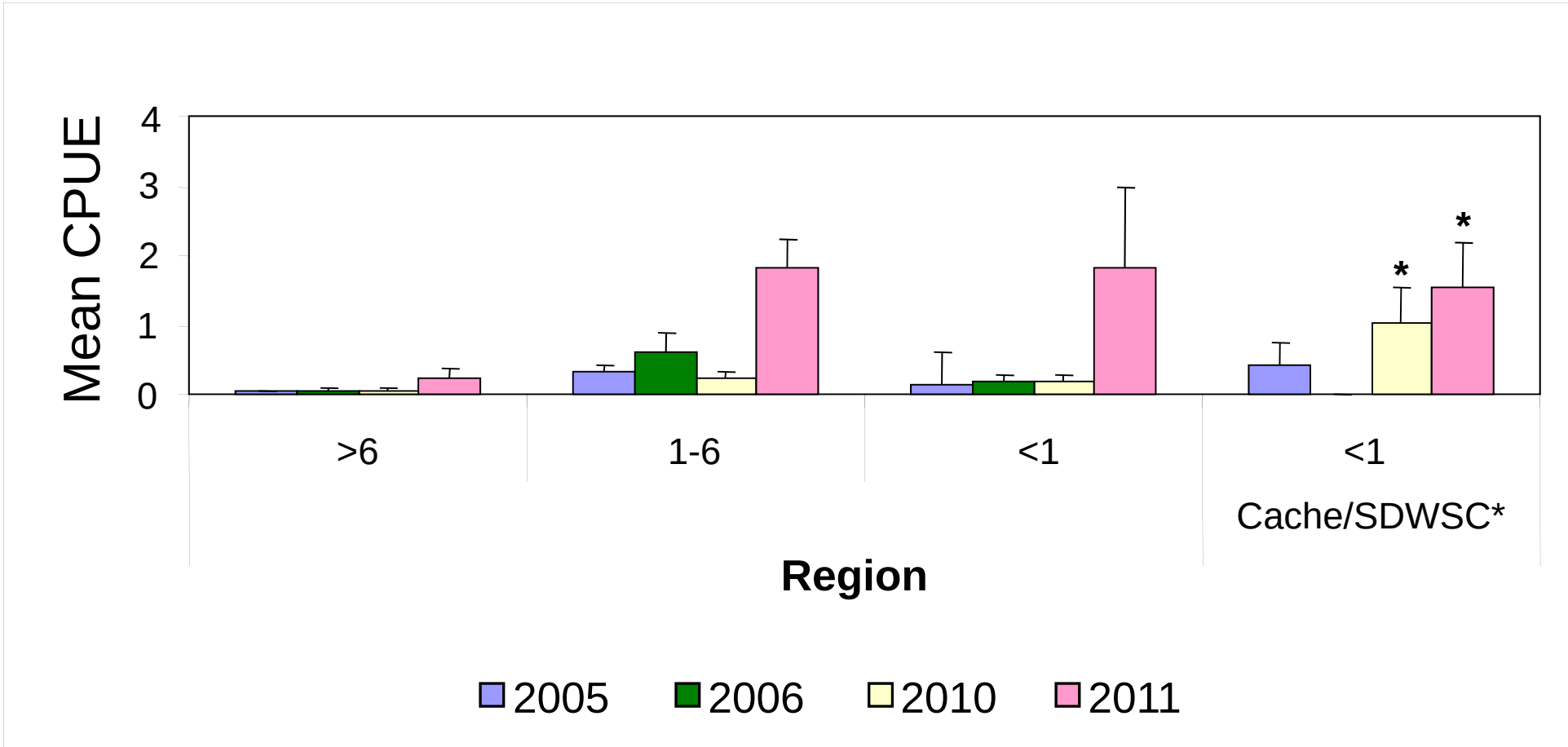
November 2011



December 2011
Delta smelt follow the Low Salinity Zone



FMWT
Delta Smelt Distribution Density, Sept – Dec



*** Represents when the SDWSC was sampled**

Summary

- **Delta smelt primarily centered in the low salinity zone (1-6 ppt)**

- **A few delta smelt remained in Cache/ SDWSC**

Overview of the 2011 Delta Smelt Diet Study

No explicit FLaSH prediction for prey use -> diet documented to better understand delta smelt response to zooplankton predictions

- Feeding incidence
- Description of diet
  - Diet by % weight
  - Use of available zooplankton

Feeding Incidence

Feeding incidence was high in 2011 (number of empty stomachs = 3).

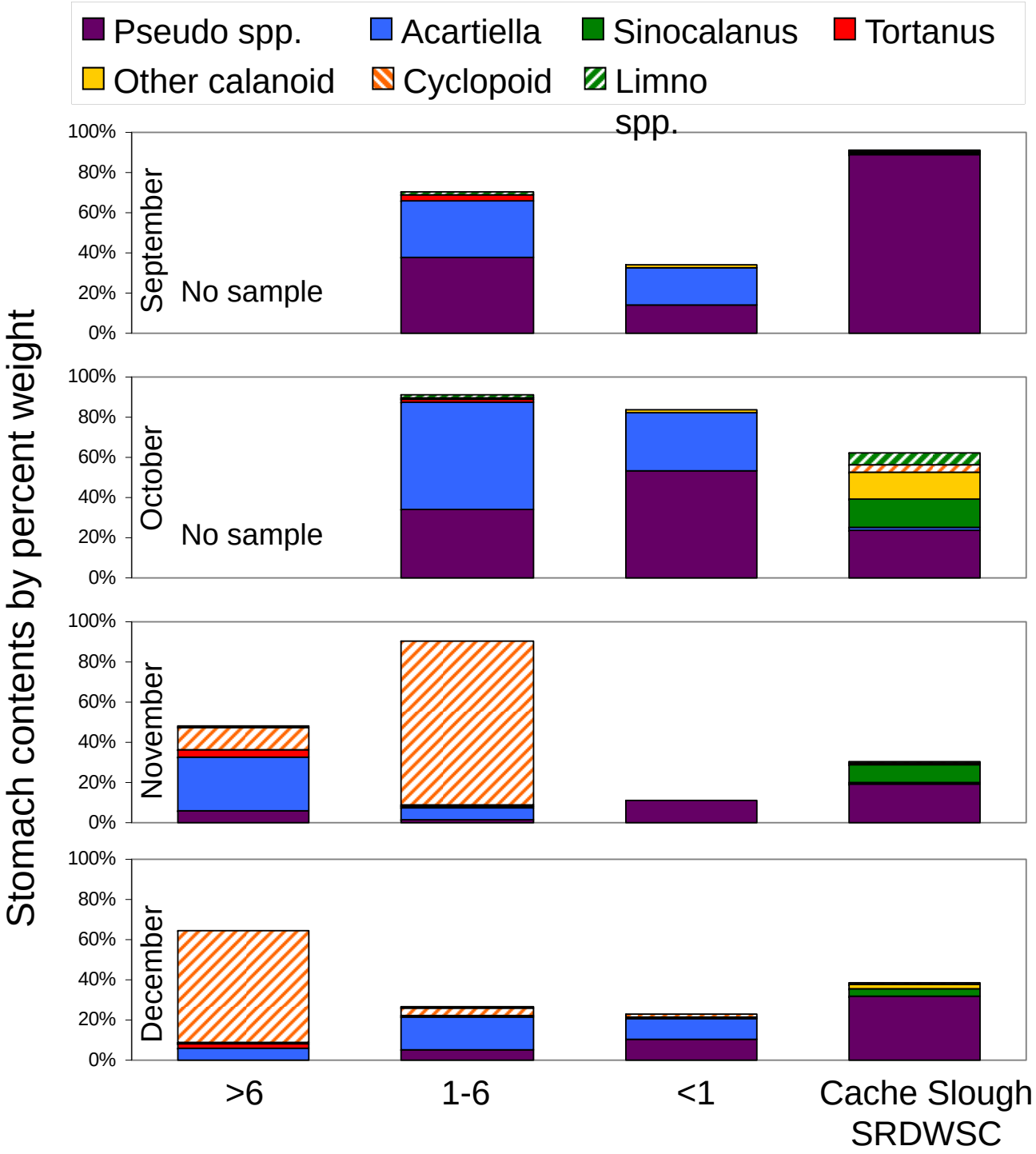
	Number of stomachs per salinity region				
Month	>6	1-6	<1	CS-SRDWSC	Mean FL (mm)
Sep	0	32 (1)	6	2	52
Oct	0	10	33	3	56
Nov	5 (1)	13	5	16	57
Dec	17	31	42 (1)	7	60
Total	22	86	86	28	

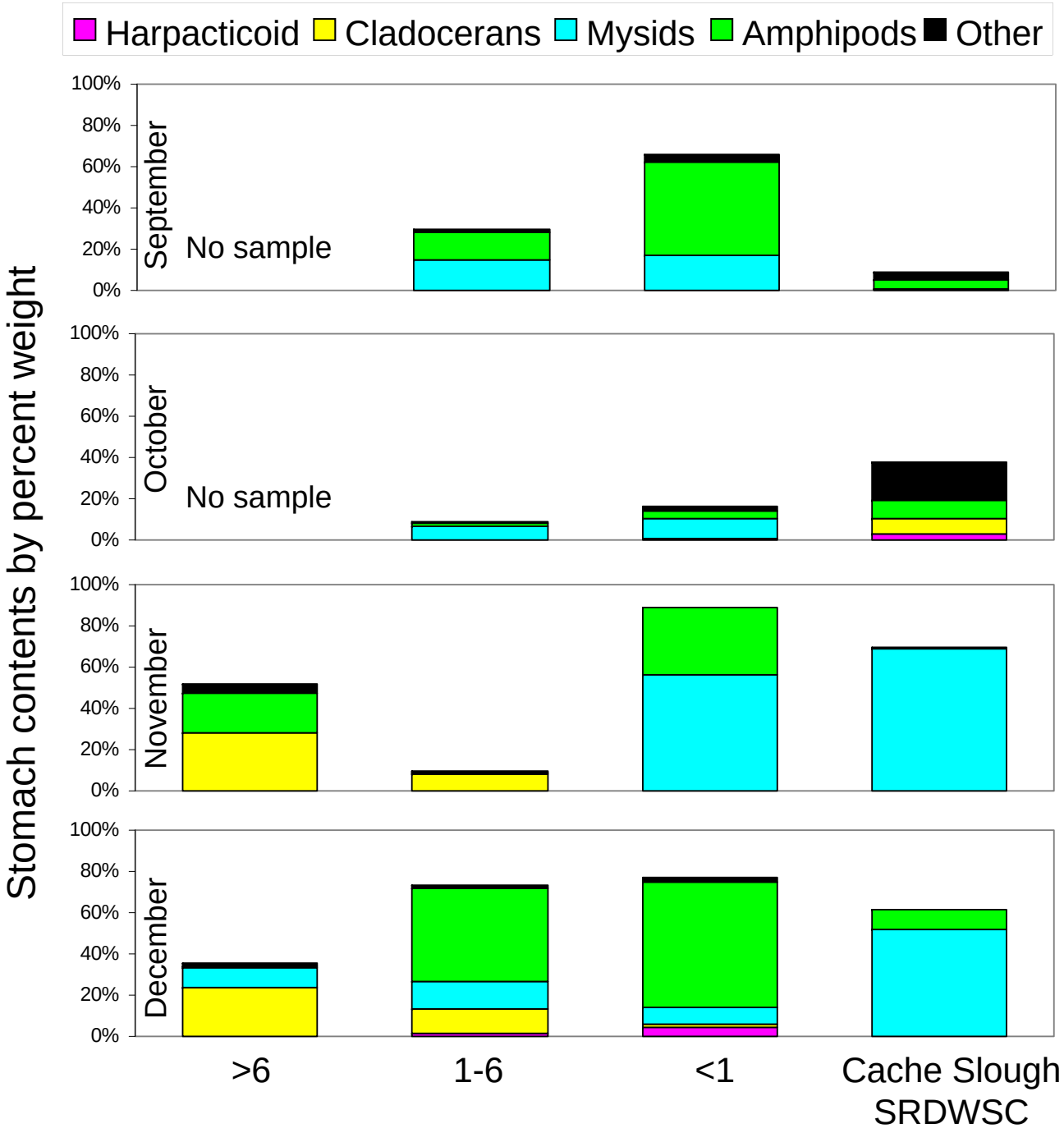
Delta Smelt Stomach Contents
Sep-Dec 2011

- The following slides are diet by percent **weight** for
  - 1) calanoid and cyclopoid copepods and
  - 2) other invertebrates.

- Bar charts sum to 100%

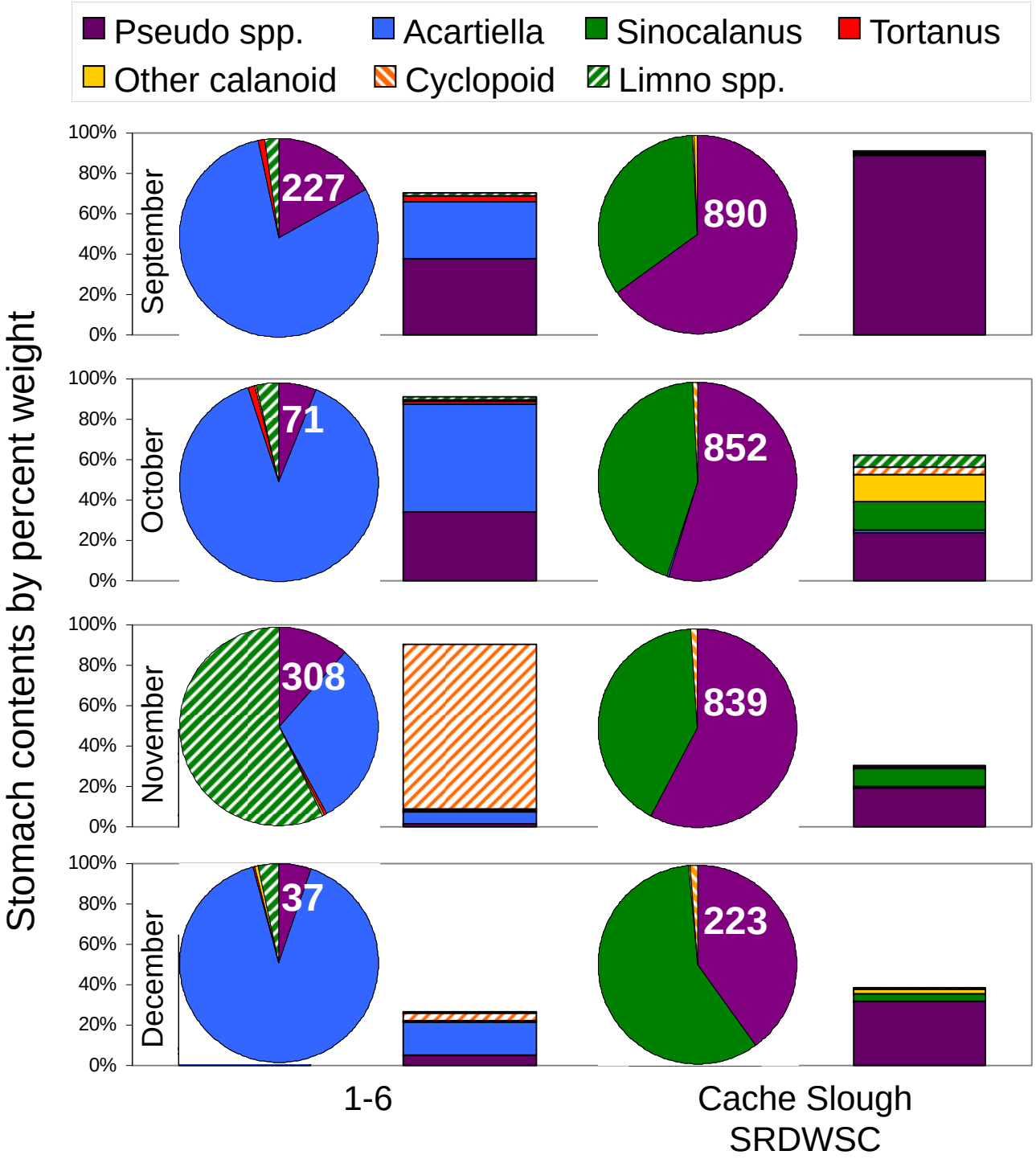
- Copepod categories included all age classes (nauplii, copepodites, and adults)
  - Adults dominated stomach contents


Pseudo spp.
Acartiella
Sinocalanus
Tortanus
Other calanoid
Cyclopoid
Limno spp.
Stomach contents by percent weight
September
No sample
October
No sample
November
December
100%
80%
60%
40%
20%
0%
>6
1-6
<1
Cache Slough SRDWSC


Harpacticoid
Cladocerans
Mysids
Amphipods
Other
Stomach contents by percent weight
September
No sample
October
No sample
November
December
100%
80%
60%
40%
20%
0%
>6
1-6
<1
Cache Slough SRDWSC

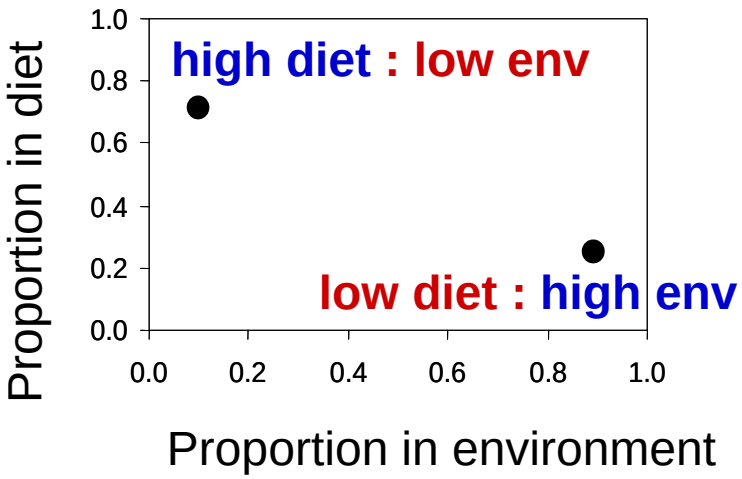
A Second Look at Delta Smelt Stomach Contents

- The following slide is diet by percent **weight** for calanoid and cyclopoid copepods
  - 1-6 ppt and CS-SRDWSC
- Pie charts are **proportional densities** of adult calanoid and cyclopoid copepods from FMWT CB mesozooplankton samples
  - Number is density (# m-3) of adult *P. forbesi*


Pseudo spp.
Acartiella
Sinocalanus
Tortanus
Other calanoid
Cyclopoid
Limno spp.
Stomach contents by percent weight
September
October
November
December
100%
80%
60%
40%
20%
0%
227
890
71
852
308
839
37
223
1-6
Cache Slough
SRDWSC

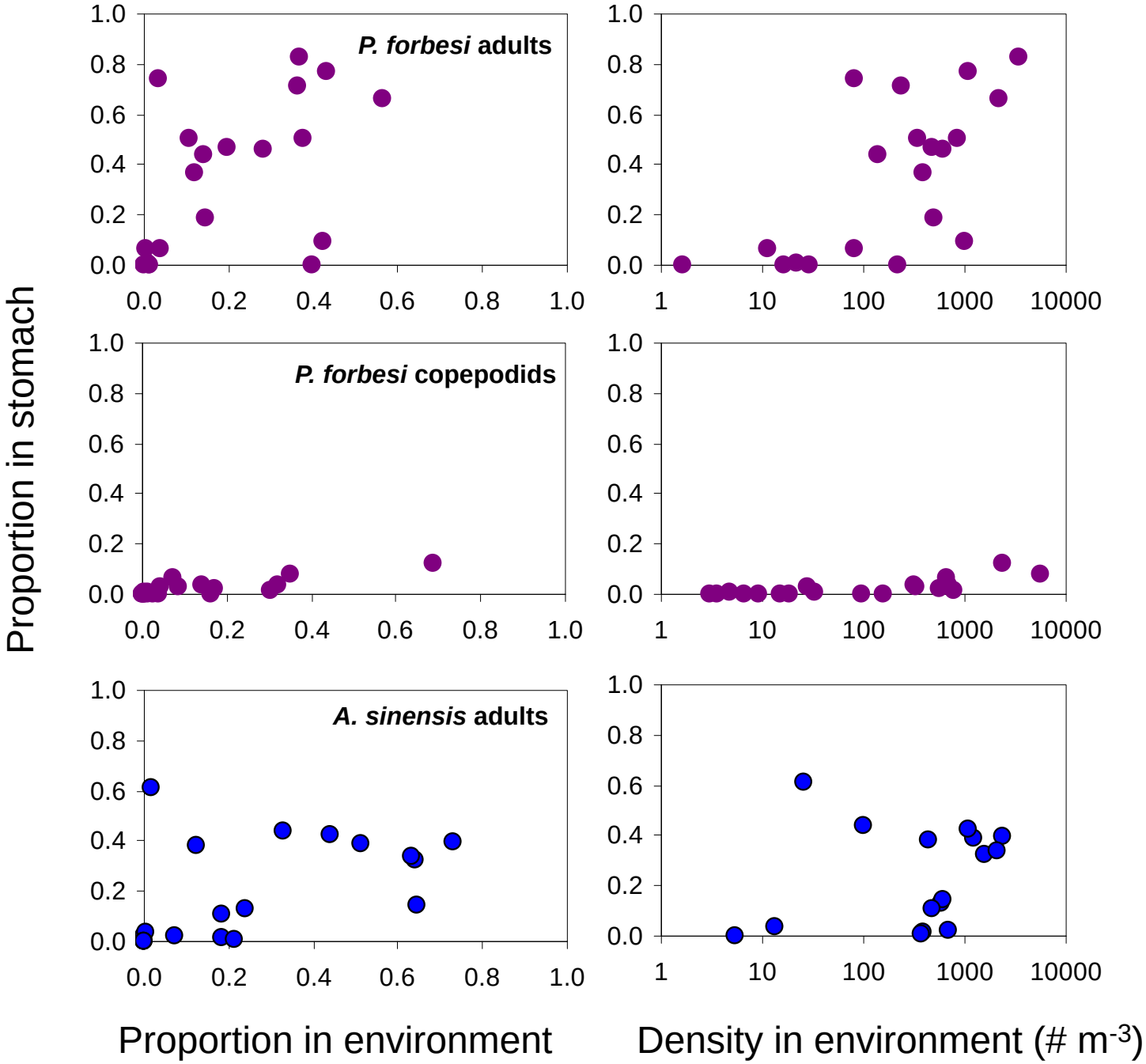
Use of Available Prey

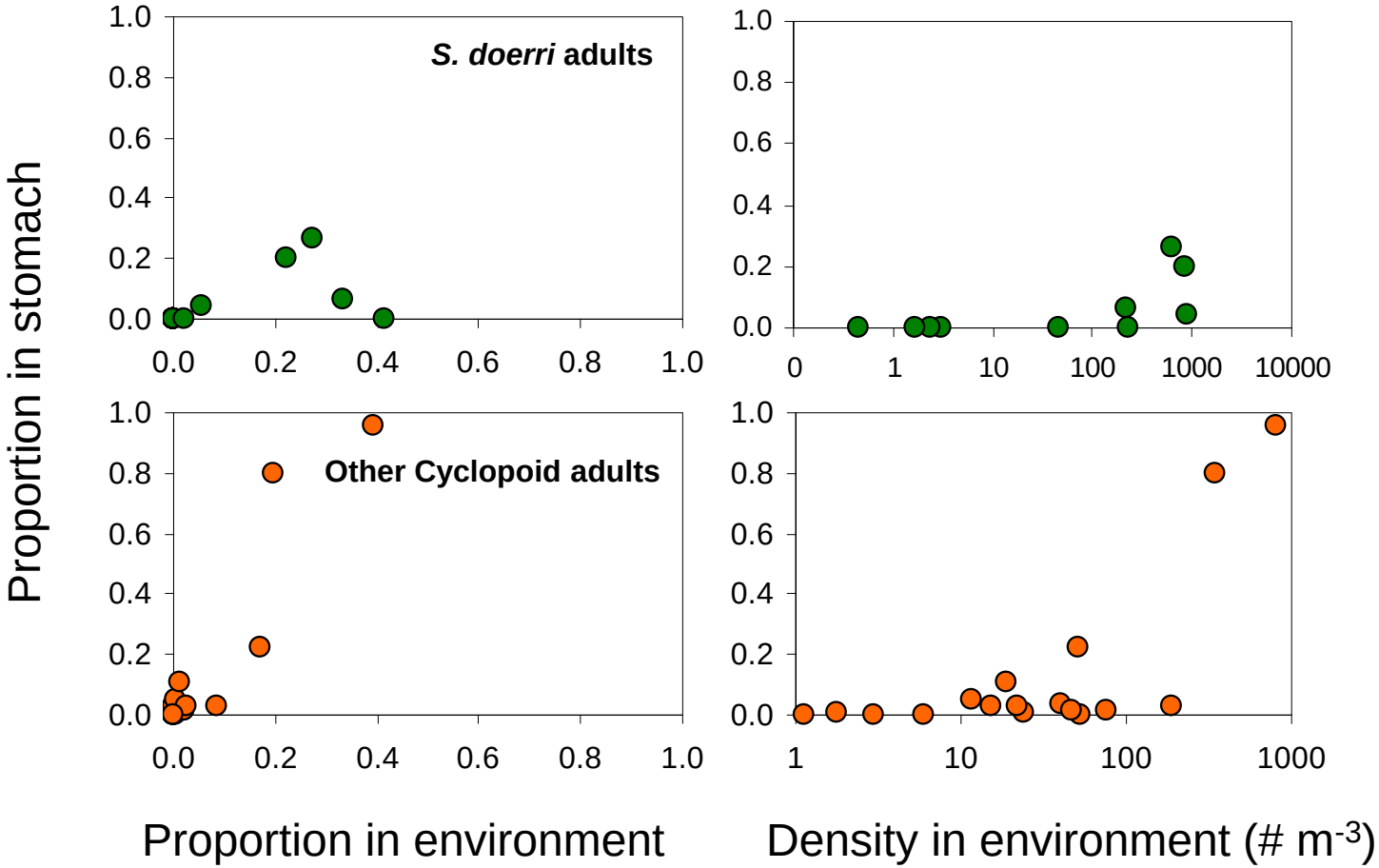
- The left column plots are proportional zooplankton densities



- The right column plots are actual zooplankton densities

- FMWT Sep-Dec samples n = 20; 1-13 (mean=5) fish each


P. forbesi adults
P. forbesi copepodids
A. sinensis adults
Proportion in stomach
Proportion in environment
Density in environment (# m-3)
0.0
0.2
0.4
0.6
0.8
1.0
1
10
100
1000
10000


S. doerri adults
Other Cyclopoid adults
Proportion in stomach
Proportion in environment
Density in environment (# m-3)
1.0
0.8
0.6
0.4
0.2
0.0
0
1
10
100
1000
10000

Summary

- Use of prey varied between regions and among months
  - Decline in availability of *Pseudodiaptomus*

- Major prey use by type and size
  - CS/SDWSC: *Pseudodiaptomus* with mysids

  - 1-6 (LSZ): *Pseudodiaptomus*, *Acartiella*, and cyclopoids with amphipods, mysids, and cladocerans

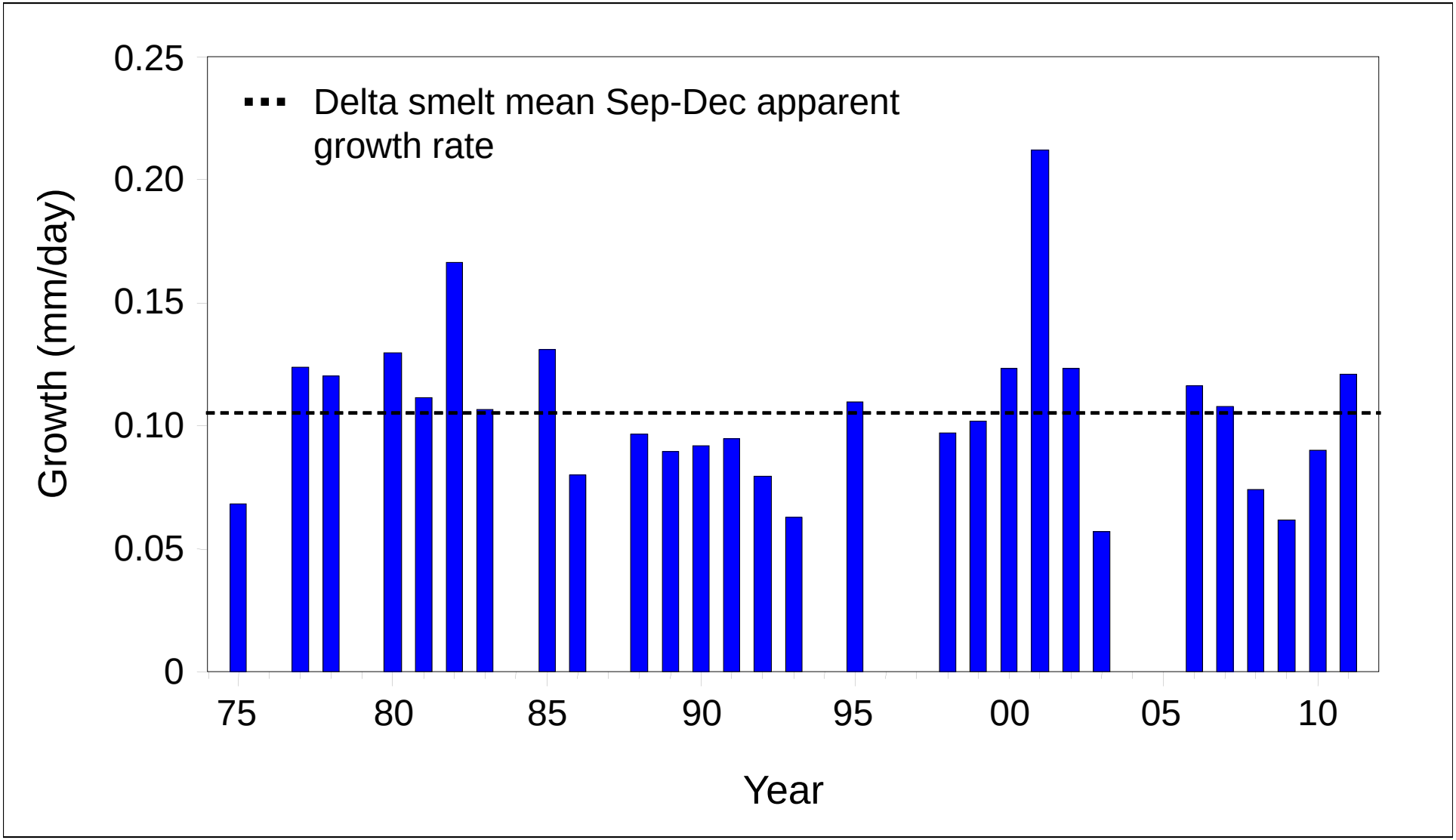
  - Selection against or difficulty in use of *Sinocalanus* and smaller items (copepodites, *Limnoithona*)

- Switch to use of larger prey types (mysids and amphipods) in Nov-Dec

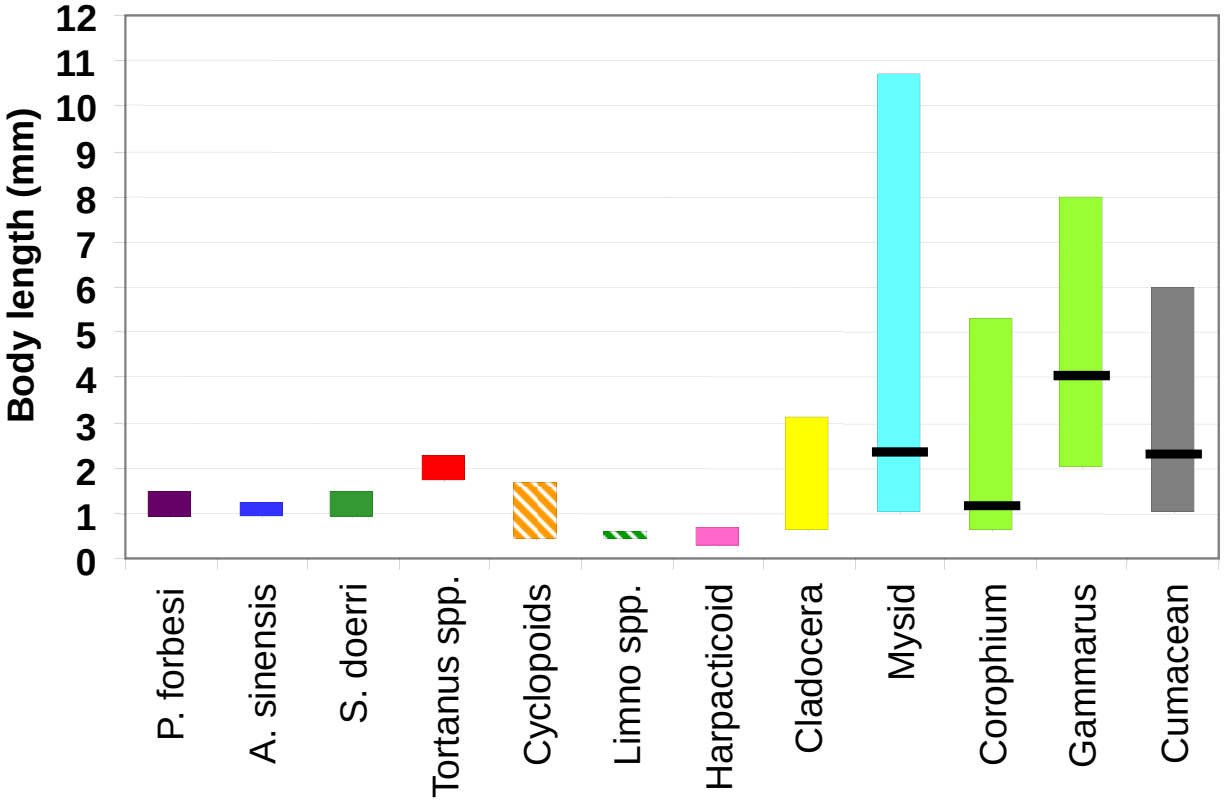
Acknowledgements

- Field Ops -- Ken Flowers, Gary Webb, Mike Silva, Brian Delano, David Hull, and Ramiro Soto.
- DFG lab staff --Tricia Bippus, Alina Cardoza, and Phillip Poirier
- Dr Swee Teh and staff
- Dave Contreras, April Hennessy, and Patrick Hennessy
- The Townet and Fall Midwater Trawl field crew

Good apparent growth in 2011



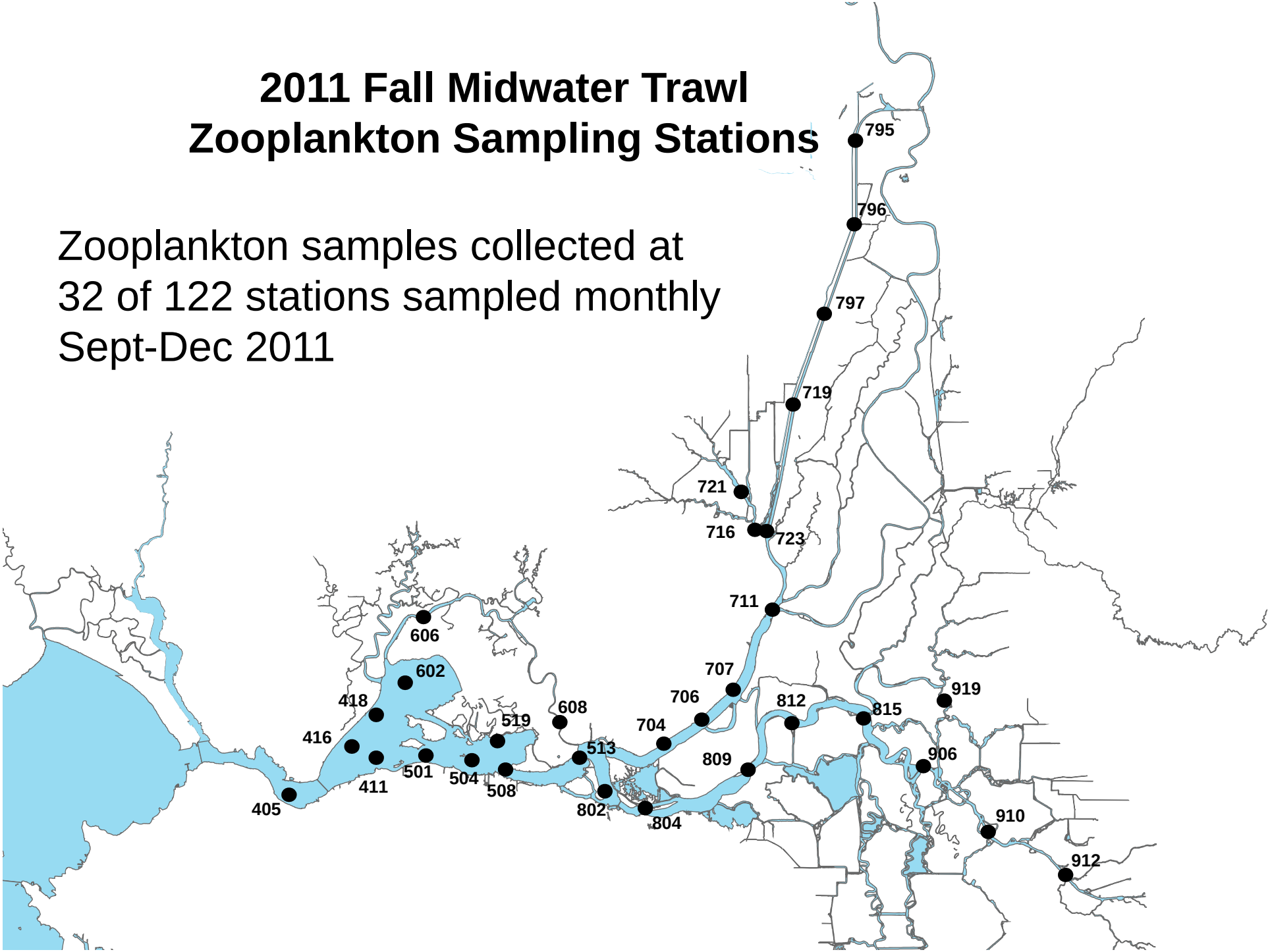
Size of Food



- Sample of adult copepod body lengths and actual length measurements (bar = mean) for mysids, amphipods, and cumaceans.

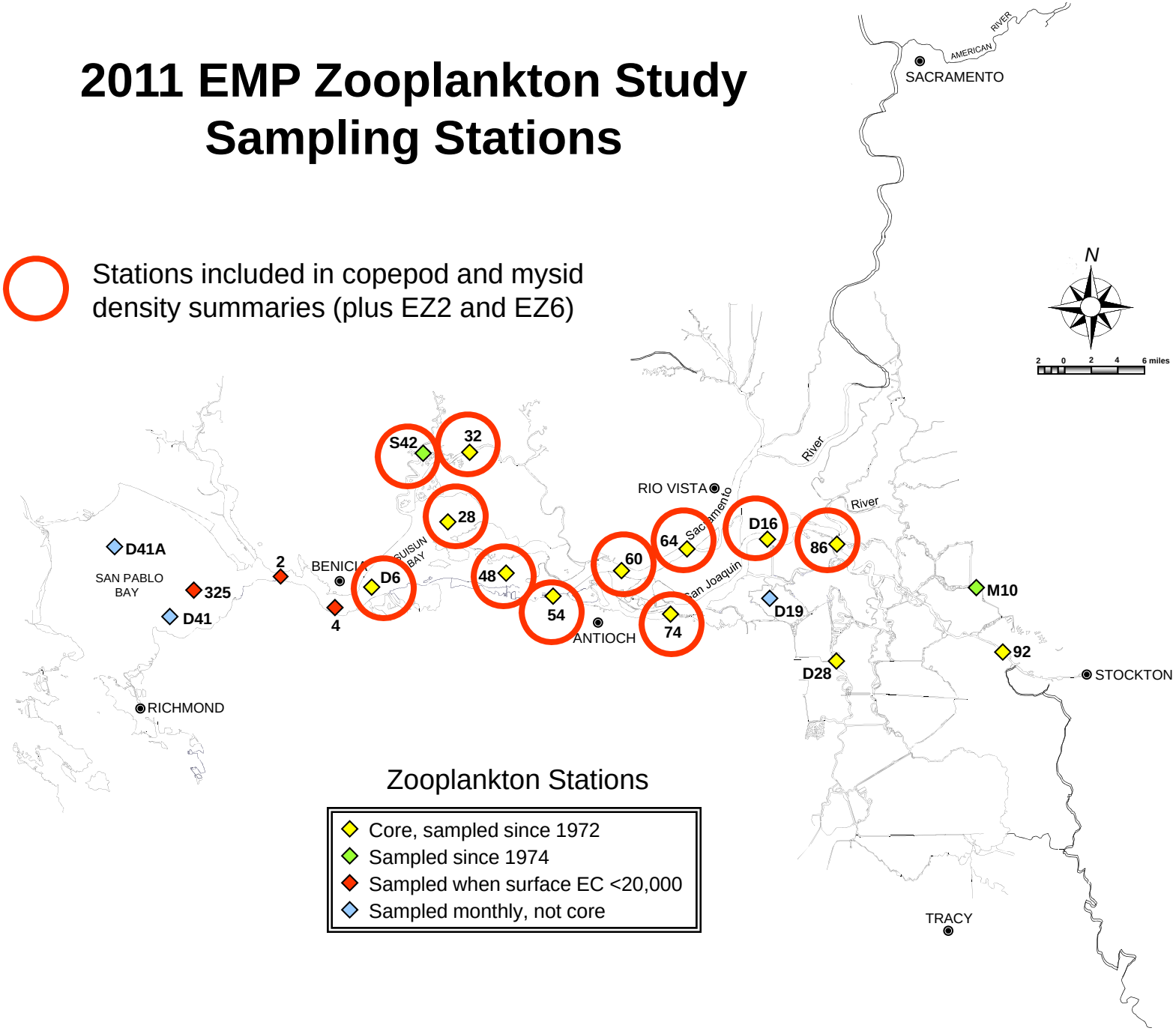
2011 Fall Midwater Trawl Zooplankton Sampling Stations

Zooplankton samples collected at
32 of 122 stations sampled monthly
Sept-Dec 2011

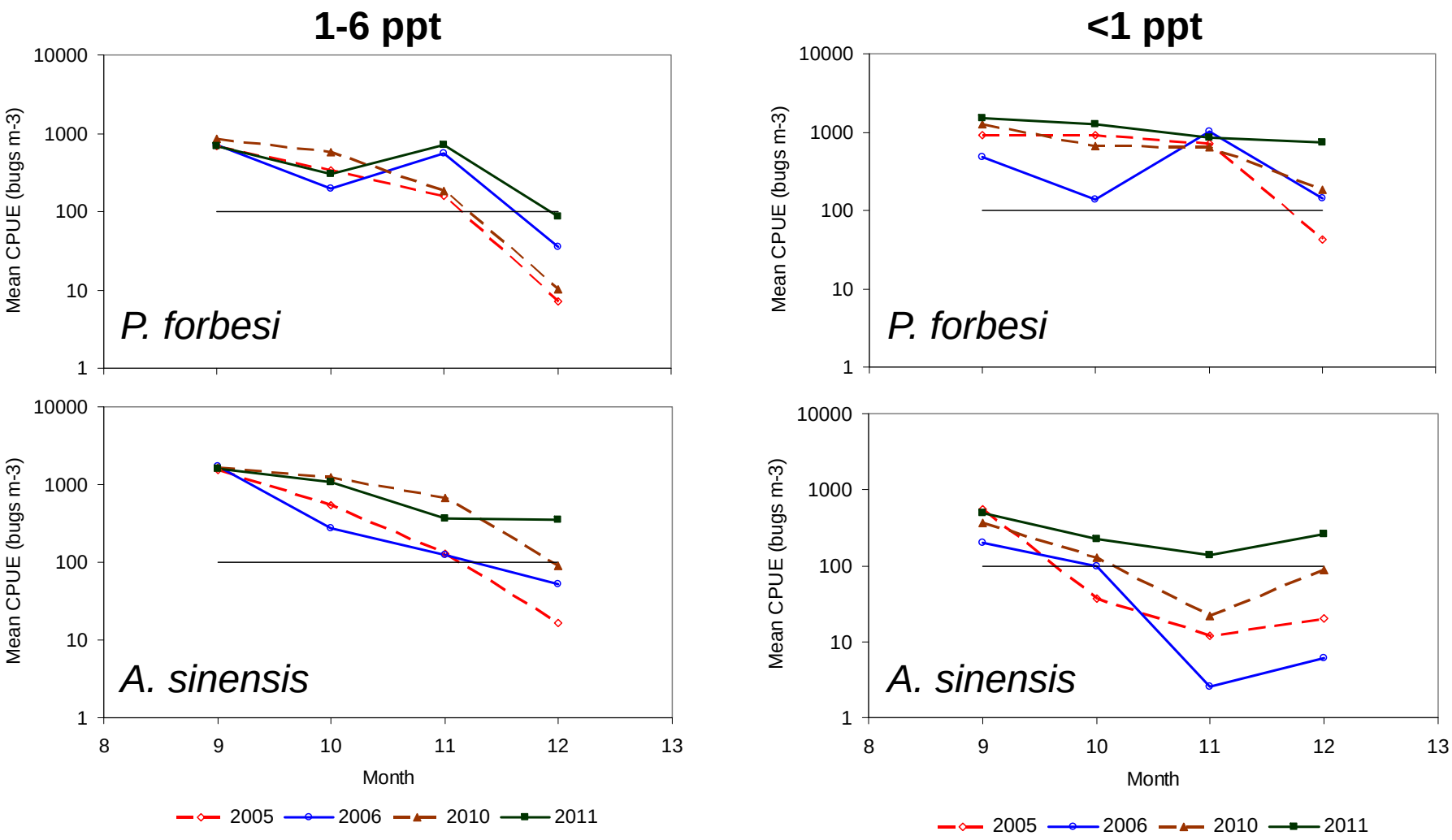
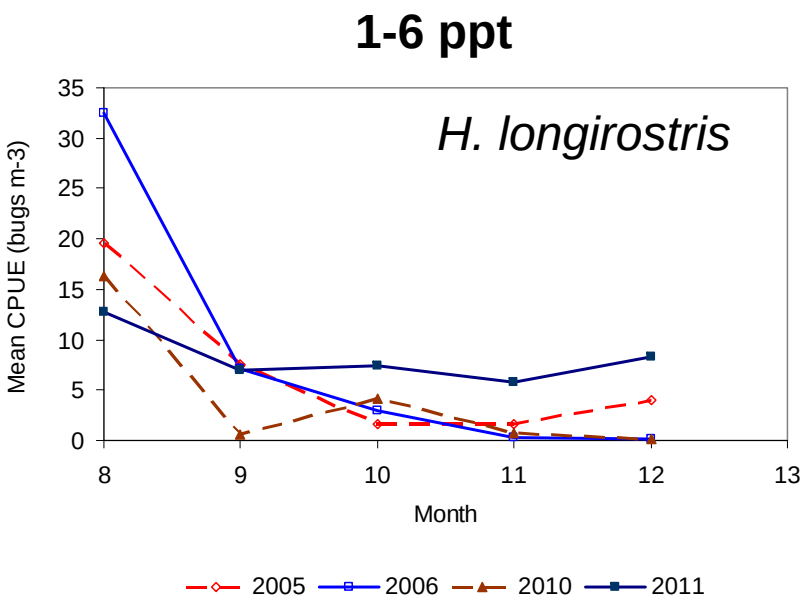
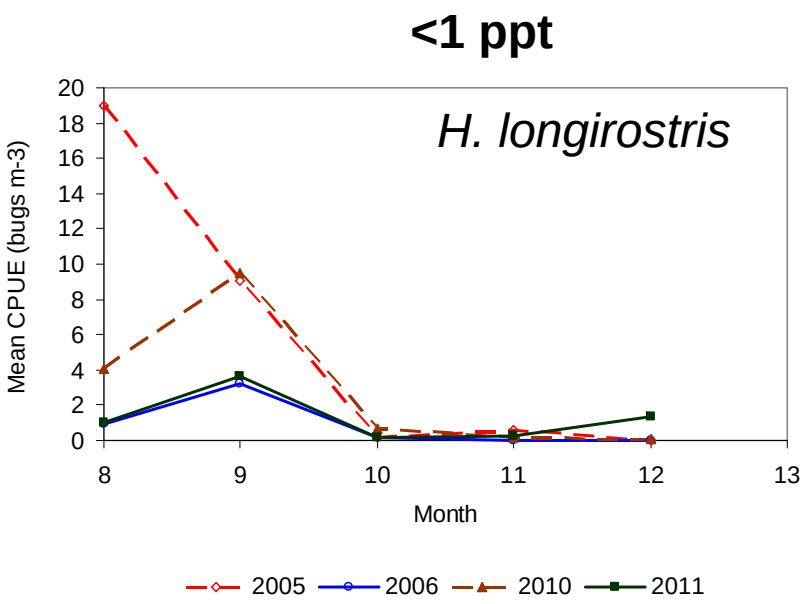


2011 EMP Zooplankton Study Sampling Stations

Stations included in copepod and mysid density summaries (plus EZ2 and EZ6)



Adult Copepod Densities Among Dry and Wet Years (EMP Zoo Study)



Mysid Densities Among Dry and Wet Years (EMP Zoo Study)