Juvenile Chinook Diet and Prey Availability

Ecosystem Monitoring Program

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R. Tabor USFWS photo credit

2018 Sample Inventory

- Juvenile Chinook Diet
  - Welch & Whites (Feb-May)
  - Campbell Slough (May, Jun)
- Prey Availability – Neuston Tows
  - All sites (Feb-May; Oct)
  - Limited sampling in Jun, Jul, Sept

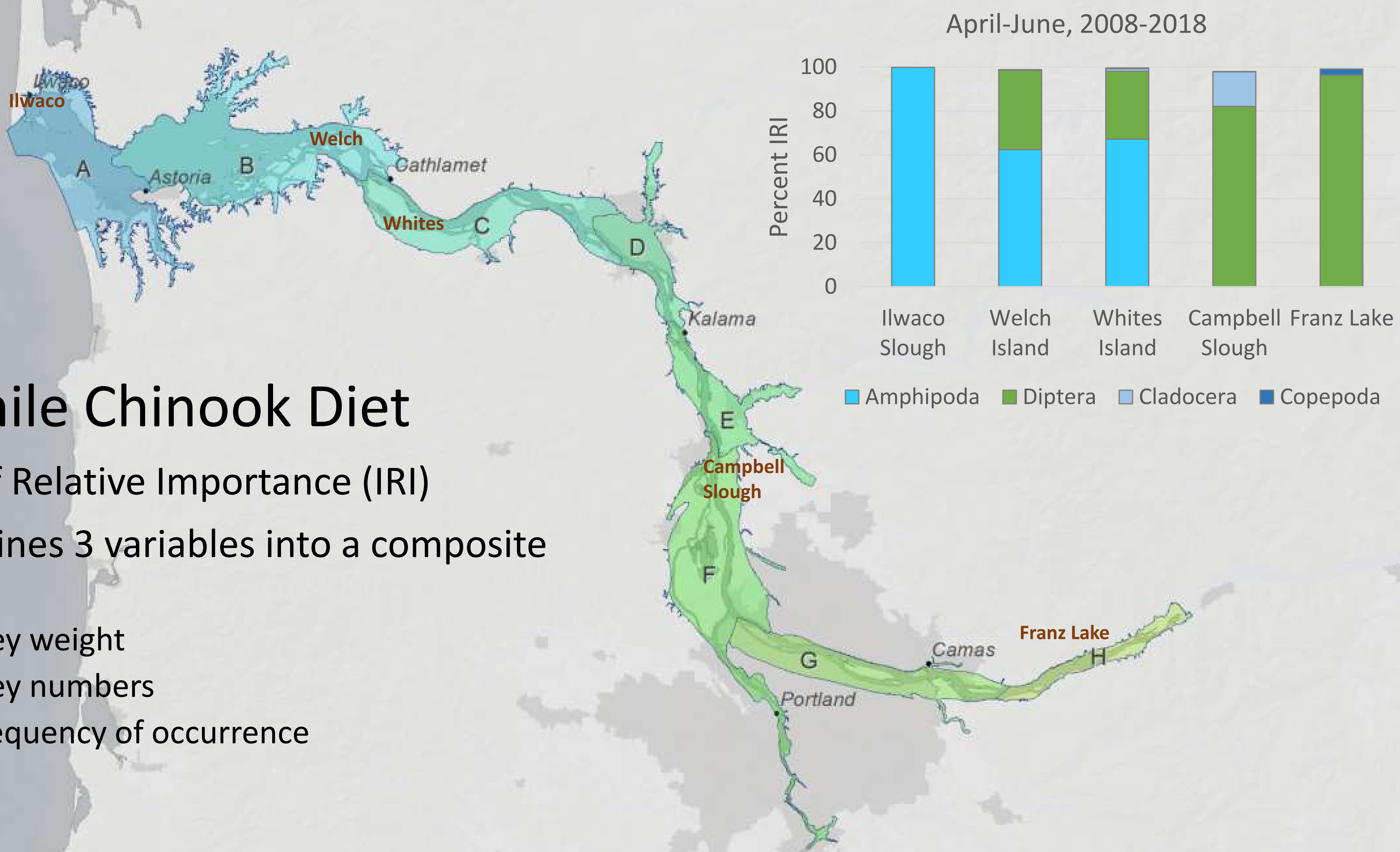
Diet samples processed in 2018

Site	Month	30-59	60-79	80-99
Welch Island	February	15		
	March	16		
	April	15	4	
	May	17	7	
Whites Island	February	4		
	March	15		
	April	16	4	
	May	15	15	
Campbell Slough	May	3	3	16
	June			1
Total		*116*	*33*	*17*

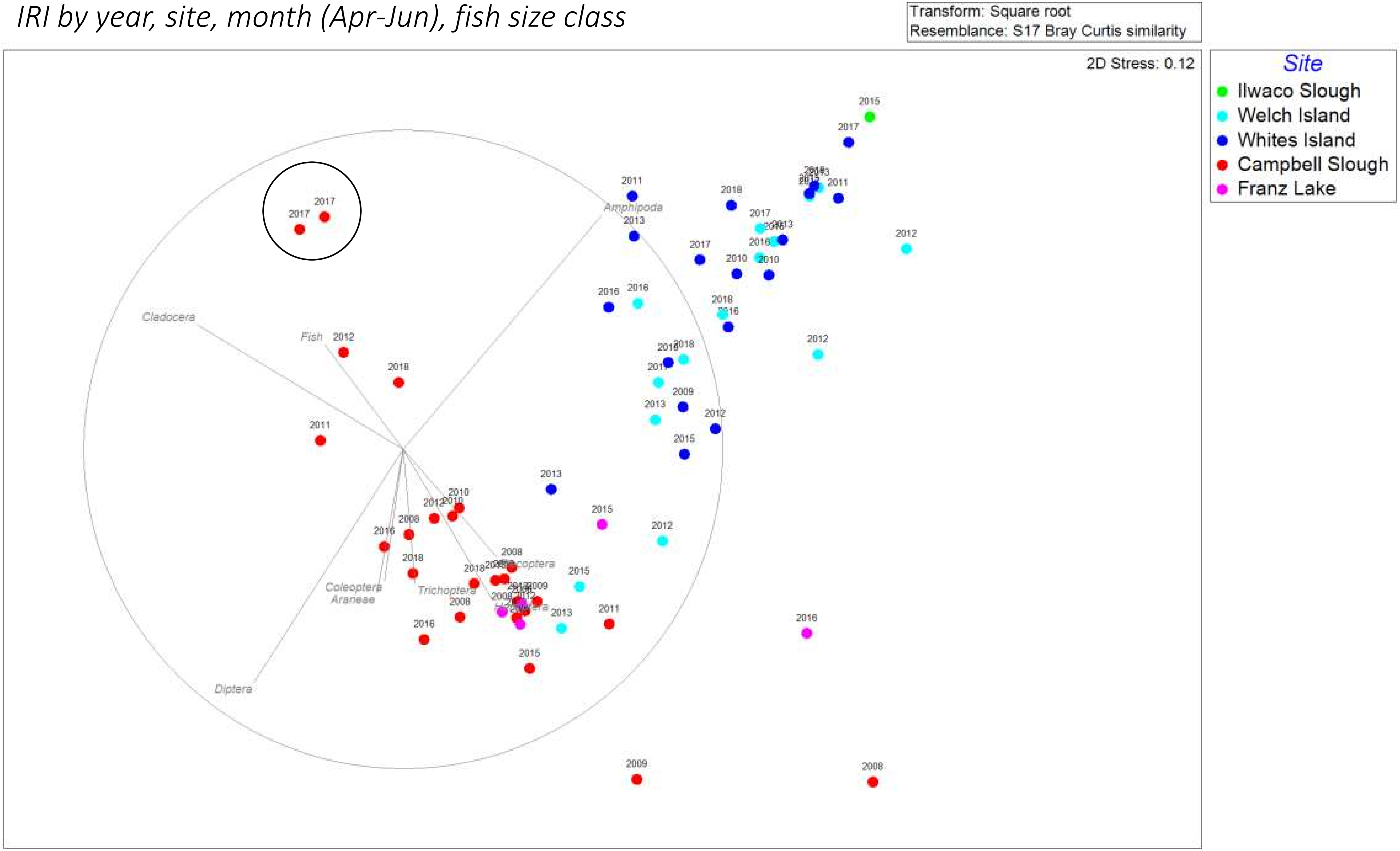
Juvenile Chinook Diet

Index of Relative Importance (IRI)

- Combines 3 variables into a composite index:
  - Prey weight
  - Prey numbers
  - Frequency of occurrence



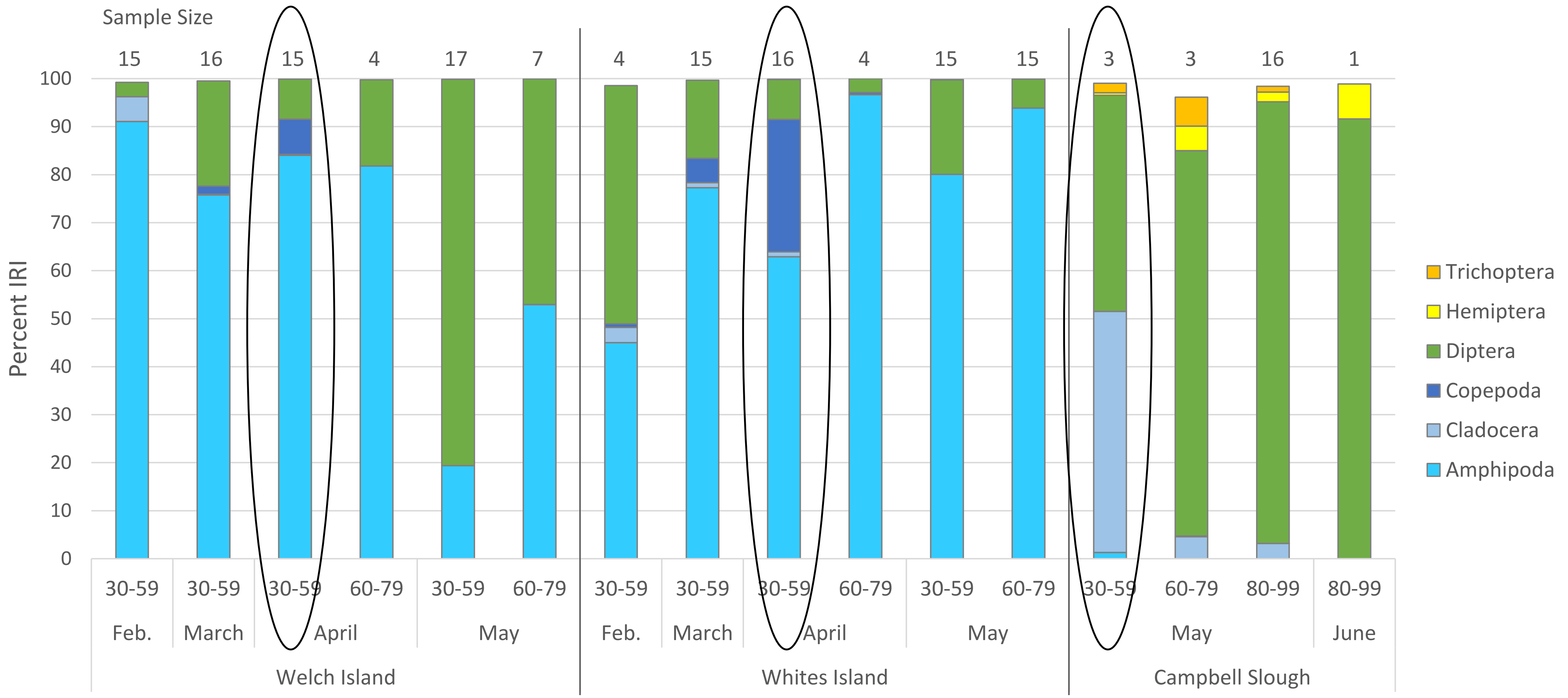
IRI by year, site, month (Apr-Jun), fish size class



2008-2018 Index of Relative Importance

Sample size ranges from 4 (Franz Lake 2015) to 76 (Welch 2017); average 30

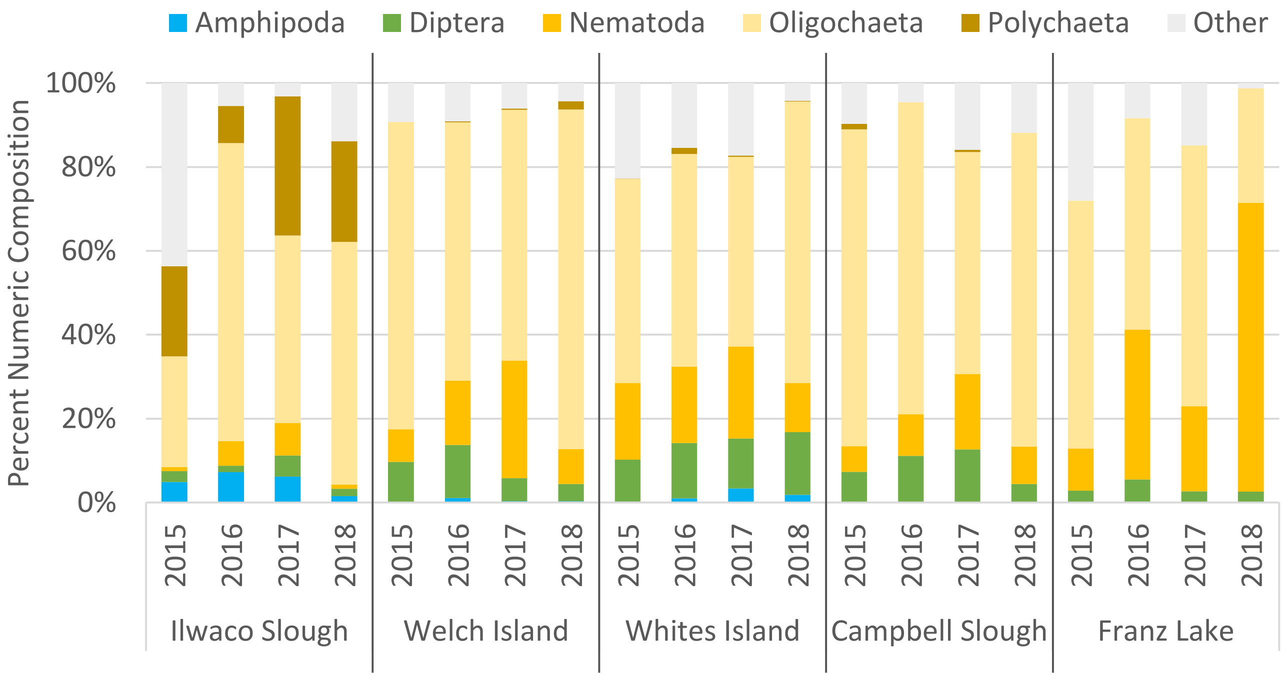
2018 Index of Relative Importance

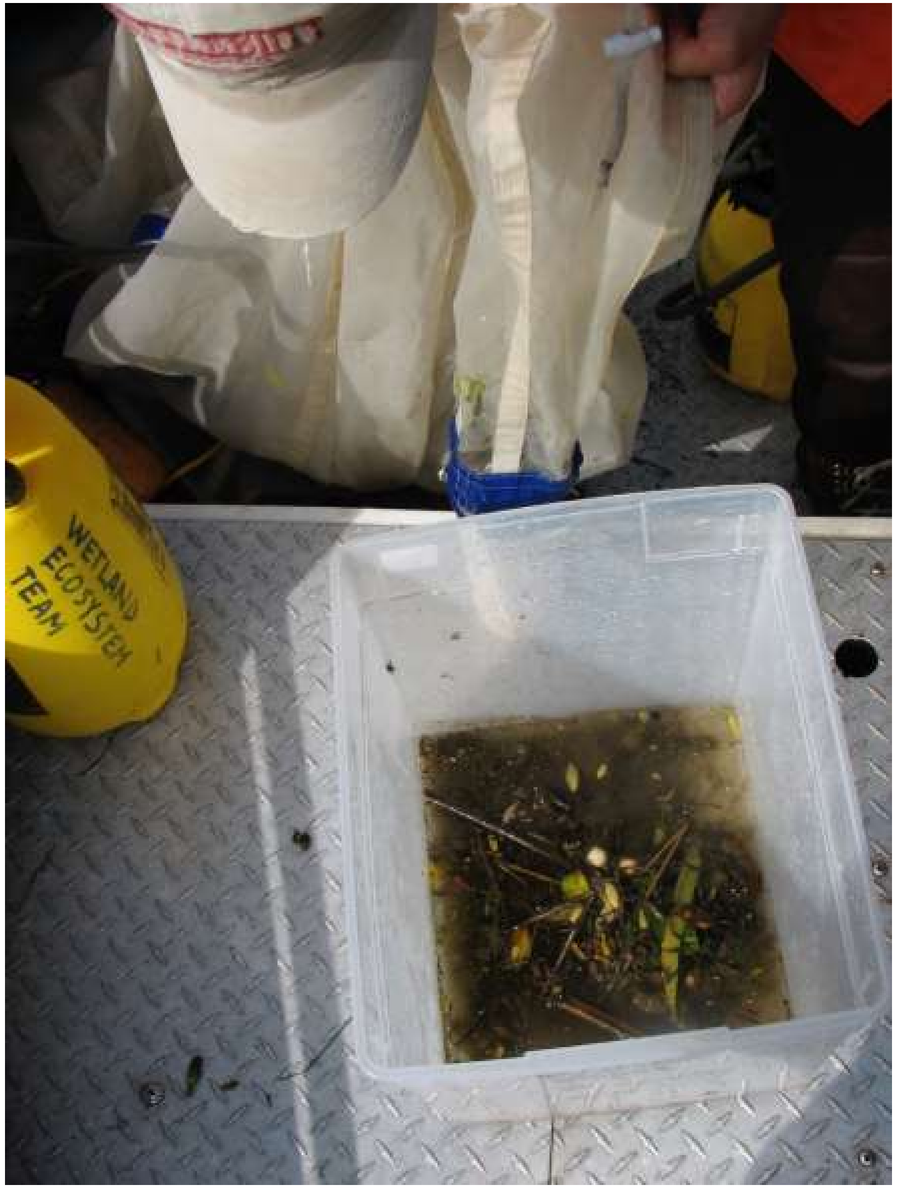


Prey Availability

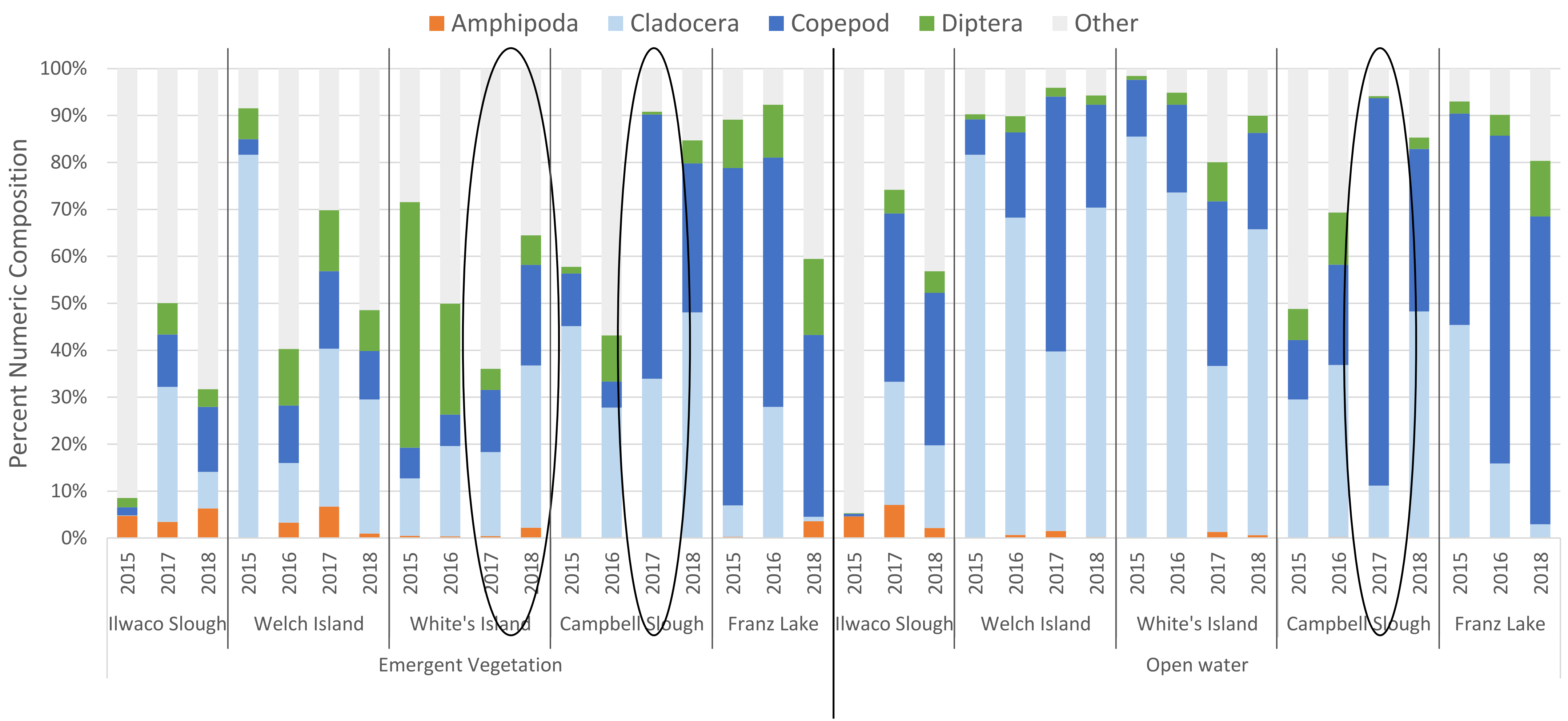
Benthic Cores

- Dominated by worms (70-80% of counts)
- Amphipods primarily collected from Ilwaco Slough
- Chironomids and other flies consistently collected from all sites





Neuston Tows



What can prey selection and availability tell us about the quality of a habitat?

Energy Ration (ER)

calculated as a measure of energy consumption for each juvenile Chinook salmon and is driven by prey availability and quality.

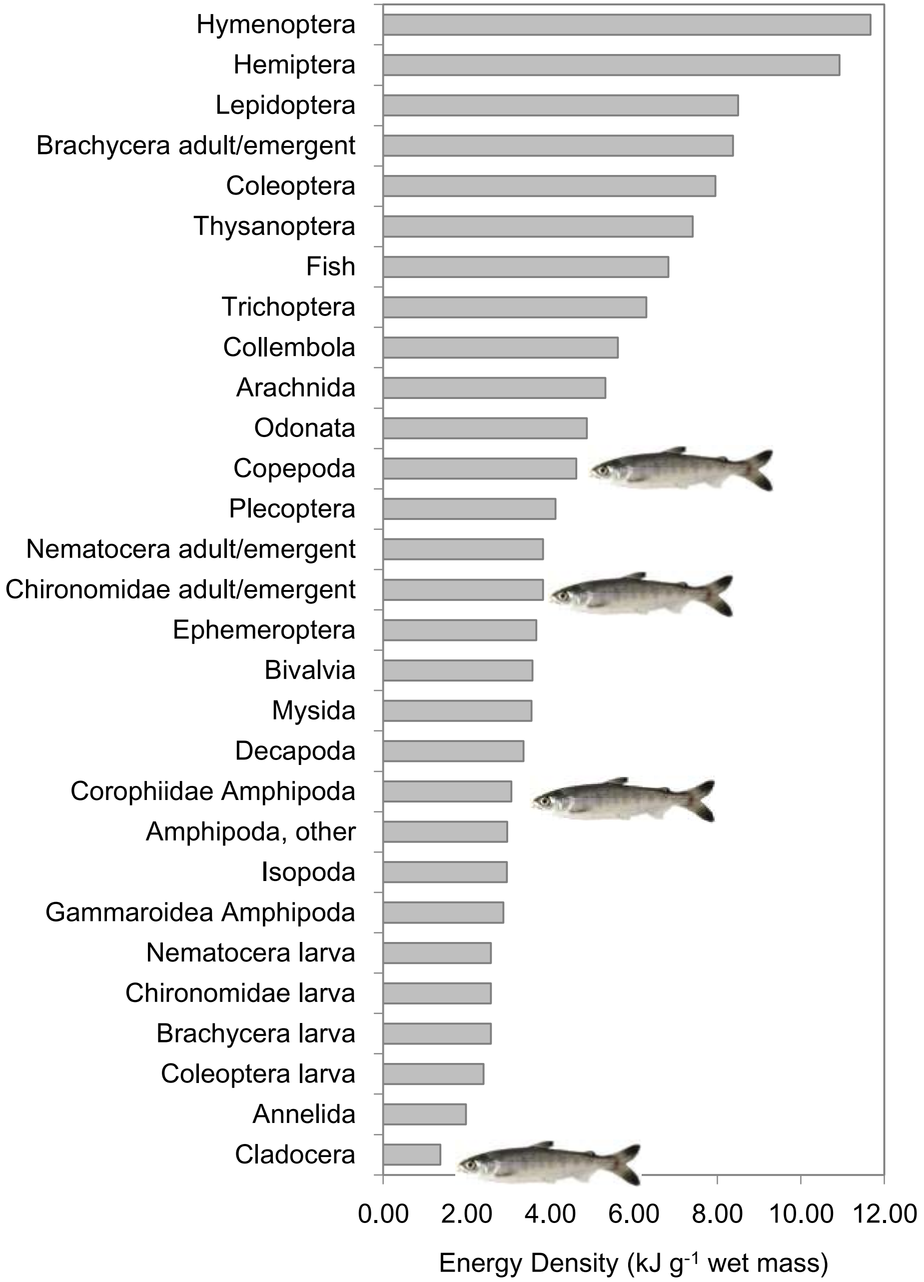
$$ER = \frac{\sum w_i \cdot k_i}{W}$$

w = prey mass consumed of prey taxa *i*

k = energy density (kJ g^{-1} wet mass) of prey taxa *i*

W = total fish mass (g)

Energy Ration equals kilojoules consumed per gram of fish.



Energy densities were acquired from the literature and compiled in David et al. (2016)

Maintenance Metabolism (J_M)

- Used in bioenergetics model to identify the effects of environmental conditions on juvenile Chinook growth and condition;
- Represents the cost of metabolic upkeep (energy used) and varies with temperature and body mass
- Maintenance metabolism **<u>increases with higher temperatures and with fish size</u>** such that larger fish in warmer temperatures would have higher metabolic needs

$$J_M = j_m \cdot e^{dT} \cdot W$$

j_m = mass specific maintenance cost at 0° C = 0.003 (Fiechter et al. 2015)

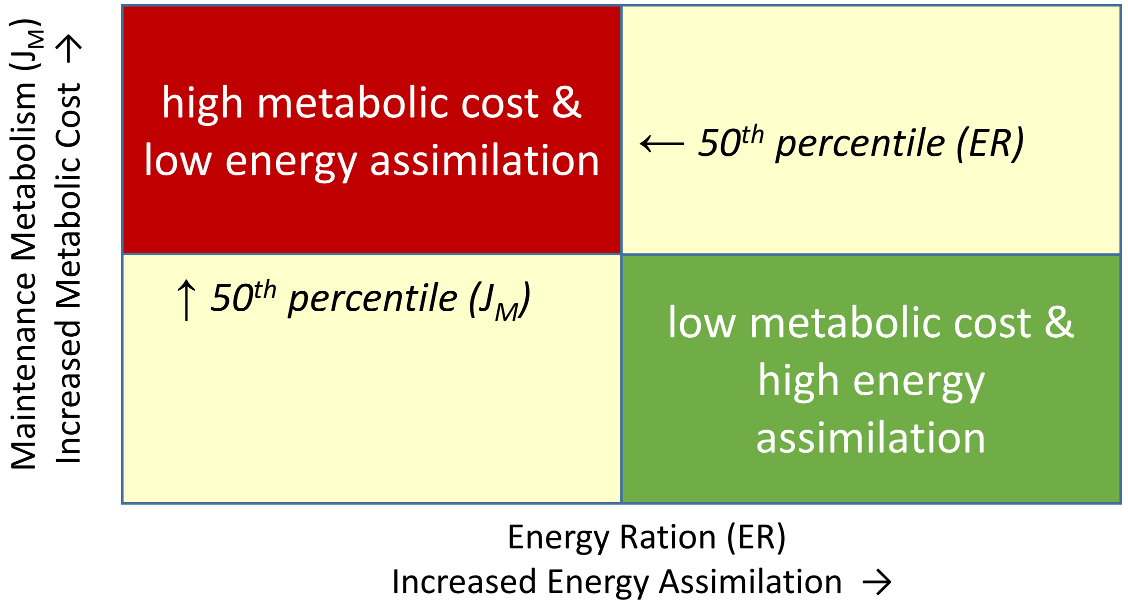
d = temperature coefficient for biomass assimilation = 0.068 (Stuart and Ibarra, 1991)

T = temperature at time of capture

W = fish body mass

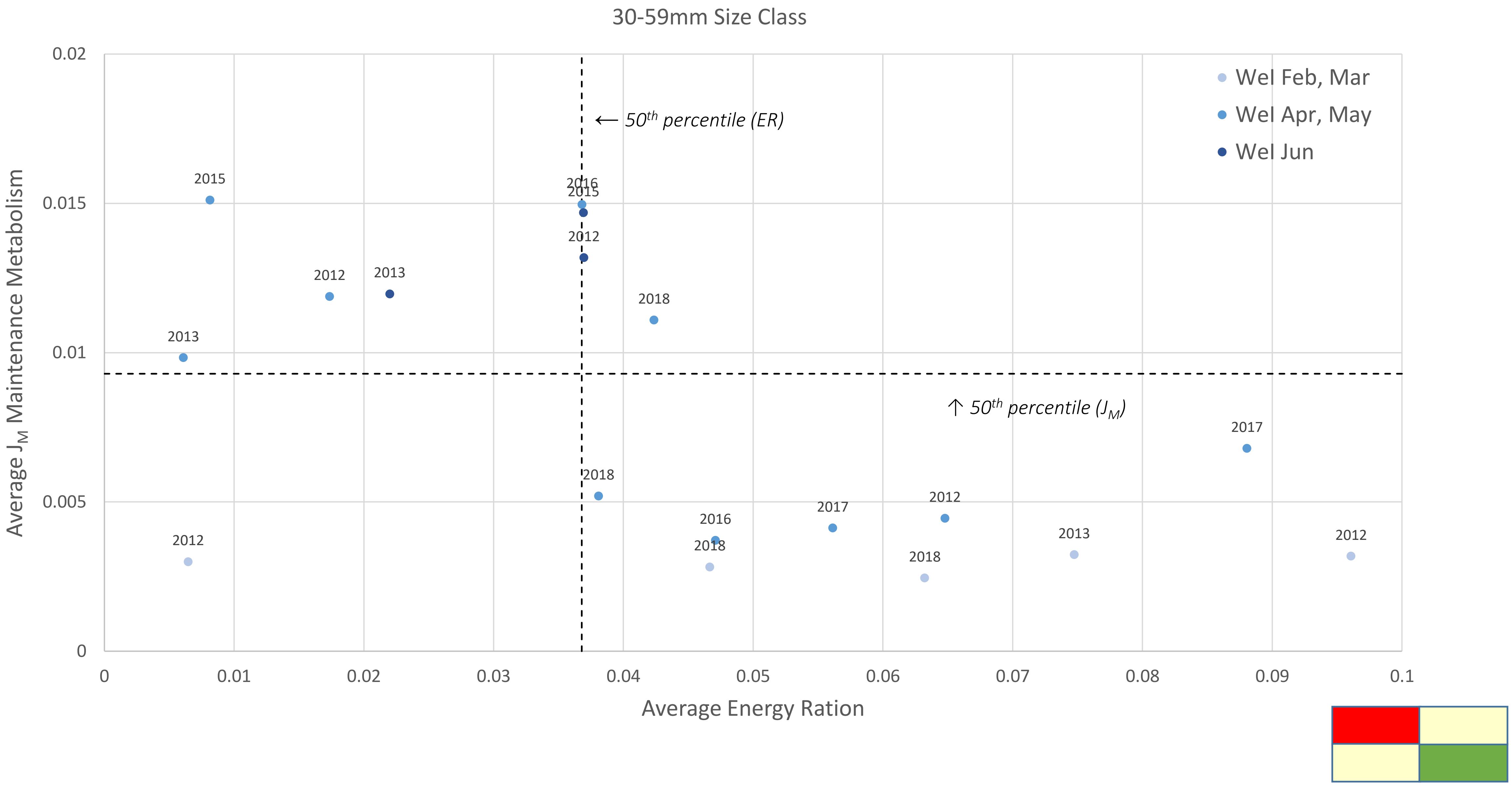
Fiechter, J., D.D. Huff, B.T. Martin, D.W. Jackson, C.A. Edwards, K.A. Rose, E.N. Curchitser, K.S. Hedstrom, S.T. Lindley, and B.K. Wells. 2015.Environmental conditions impacting juvenile Chinook salmon growth off central California: An ecosystem model analysis. Geophysical Research Letters.

Foraging Performance



1. Evaluate where/when salmon experience relatively good or poor growing conditions.
2. Compare habitat quality across different time scales.
   a) How do the conditions at a site change over the juvenile Chinook out-migration season?
   b) How do the conditions at a site change over years or decades that experience large scale differences in climate?
3. Compare habitat quality among different sites.
   a) E.g., salmon sampled from a new restoration site could be plotted along the long term averages from the trend sites to provide an evaluation of the new habitat relative to other areas in the estuary. As well as tracking the progress of a restored site over years or decades.

*Each point represents the **average** of fish collected at a site, month, year, within length size class*



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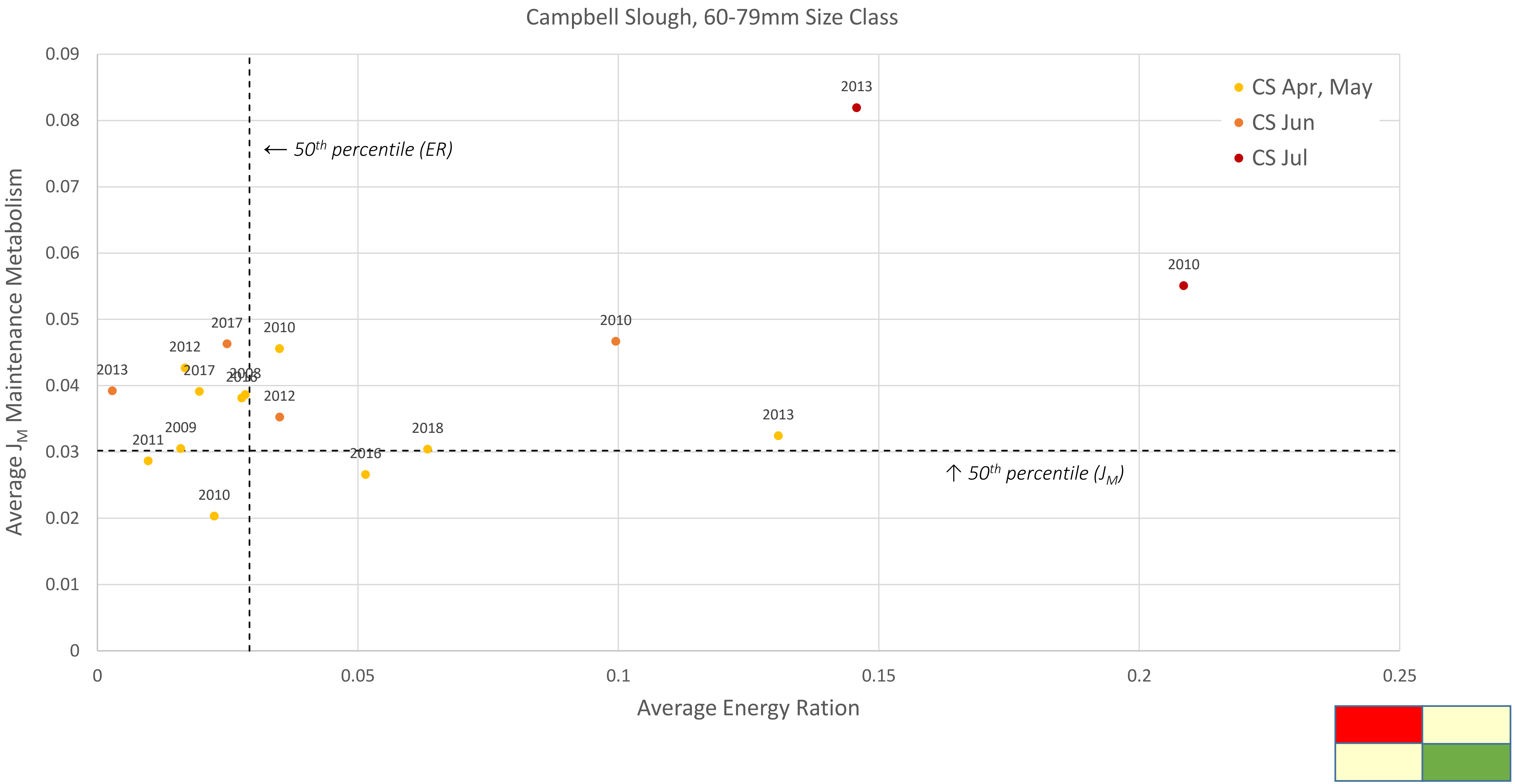

Conclusions

- Building long-term dataset to track status and trends and make comparisons to changing conditions
  - 2018 data generally fit typical patterns with some potential exceptions…
    - Low dipteran abundance?
    - Cladocerans consumed by small fish upriver (though not at the levels in 2017)
- Calculating and examining average metabolic costs and energy assimilation experienced by fish may be a useful tool to allow us to evaluate habitat quality across various time scales

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Thank You

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