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Regional and temporal variability in Puget Sound zooplankton: bottom-up links to juvenile salmon

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Regional and temporal variability in Puget Sound zooplankton

Julie Keister, Julia Bos, BethElLee Herrmann, Christopher Krembs, Mya Keyzers, John Mickett, Jan Newton, Wendi Reuf, Amanda Winans, and *numerous* partners.

SALISH SEA MARINE SURVIVAL PROJECT
www.marinesurvivalproject.com

UNIVERSITY OF WASHINGTON 1861 LVX SIT

DEPARTMENT OF ECOLOGY
State of Washington

Puget Sound Zooplankton Monitoring Program

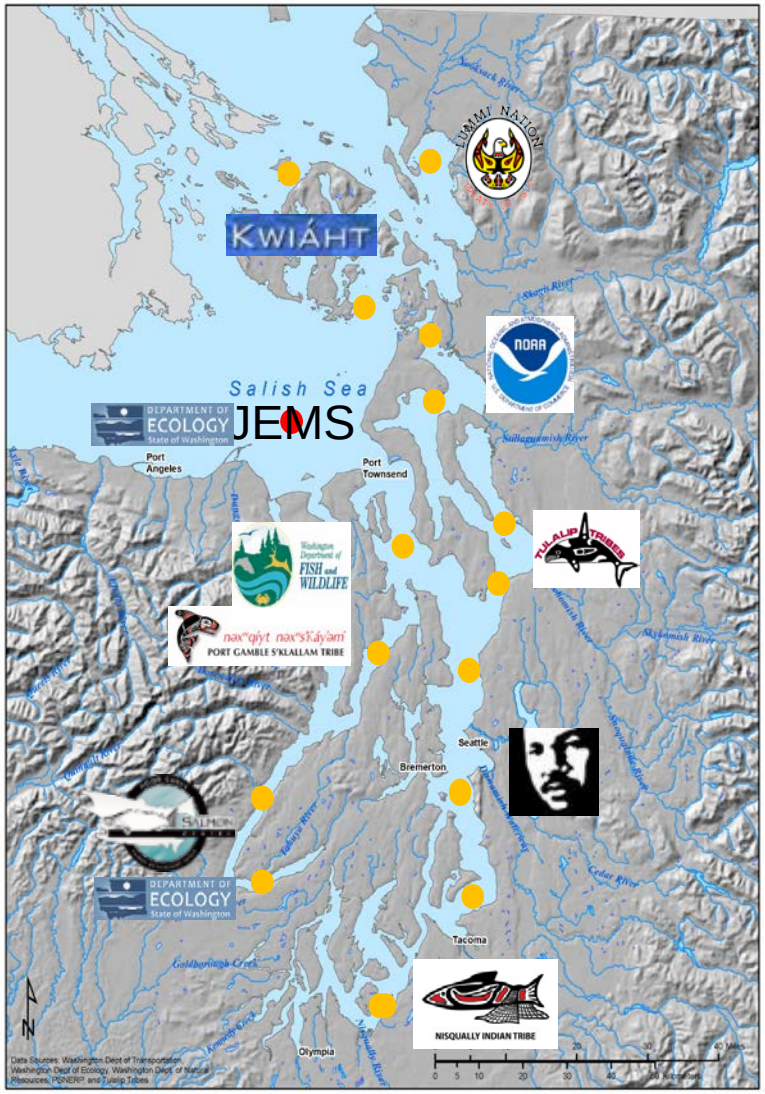
Initiated in 2014 to address hypotheses of bottom-up controls on salmon survival.

Provides data on:

1) Response of zooplankton community to environmental change.

2) Patterns in prey availability for salmon and other fish and seabirds.

Fills long-standing data gap for fishery and ecosystem modelers and managers.

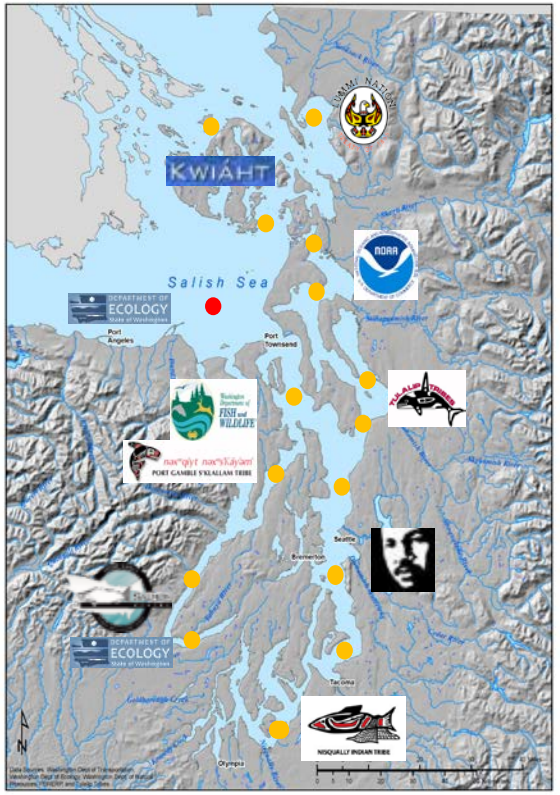


Sampling Methods:

At most locations:

Bi-weekly sampling March-October, 2014-2017

+ Year-round sampling in Central Basin by King County



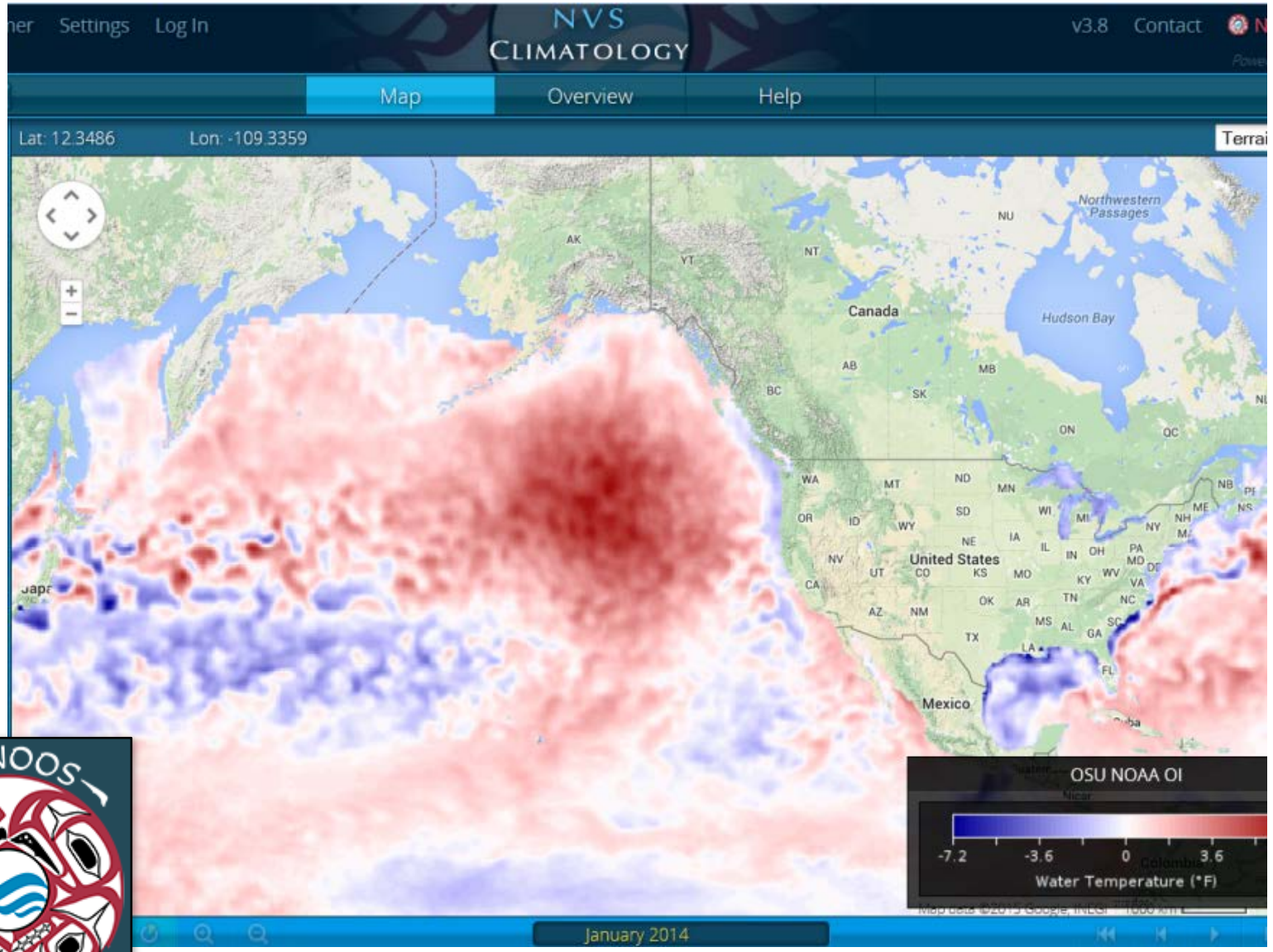
- **Vertical net tows**
  Full water column tows
  60-cm dia., 200-µm mesh

  Targets smaller, diverse taxa
  Used as indictors of environmental changes

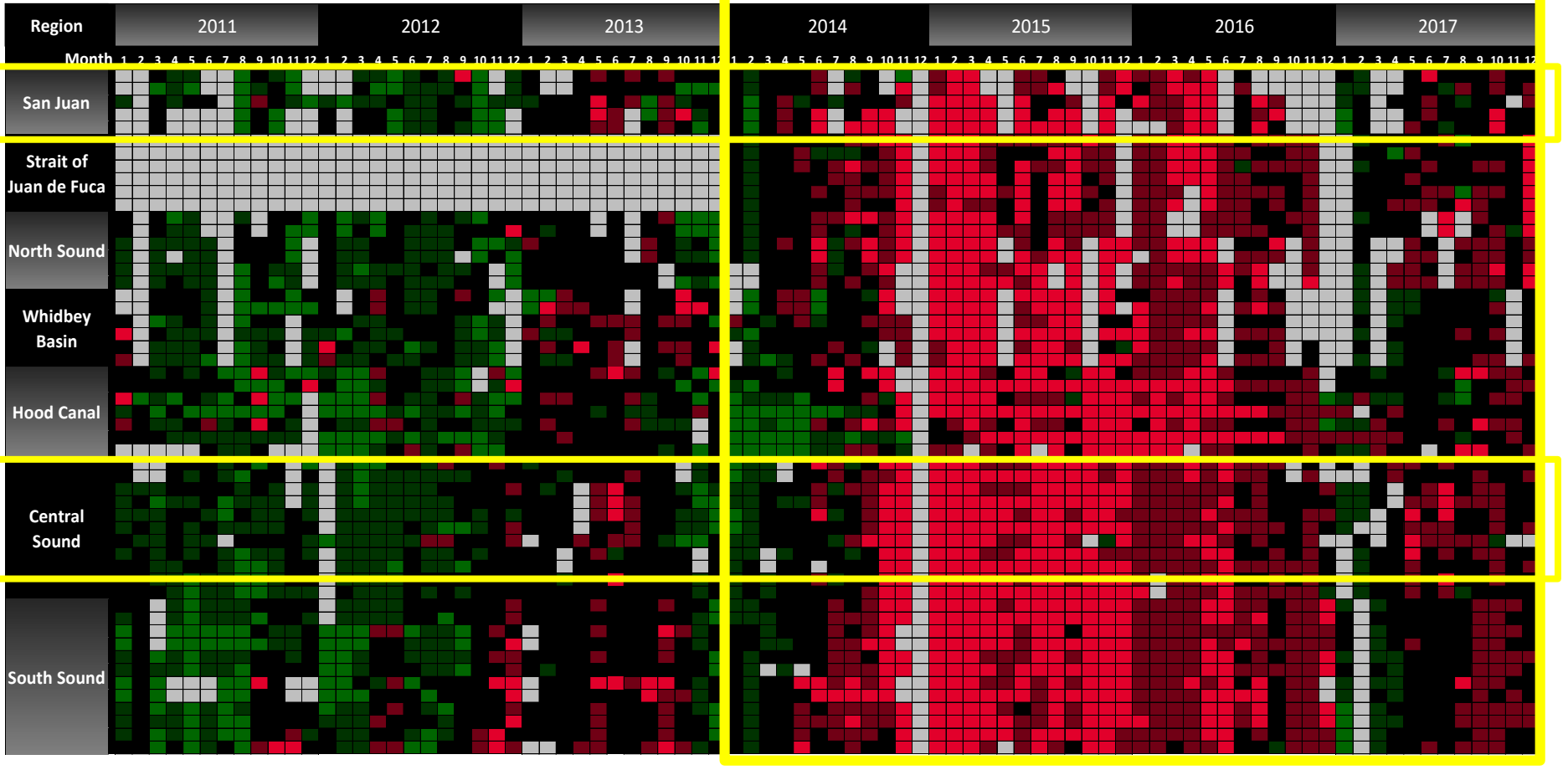
- **Oblique bongo net tows**
  Upper 30 m
  60-cm dia., 335-µm mesh

  Targets larger taxa
  Used as indictors of salmon prey fields

Late 2014 = Intrusion of “The Blob” into the Salish Sea



Water column heat content



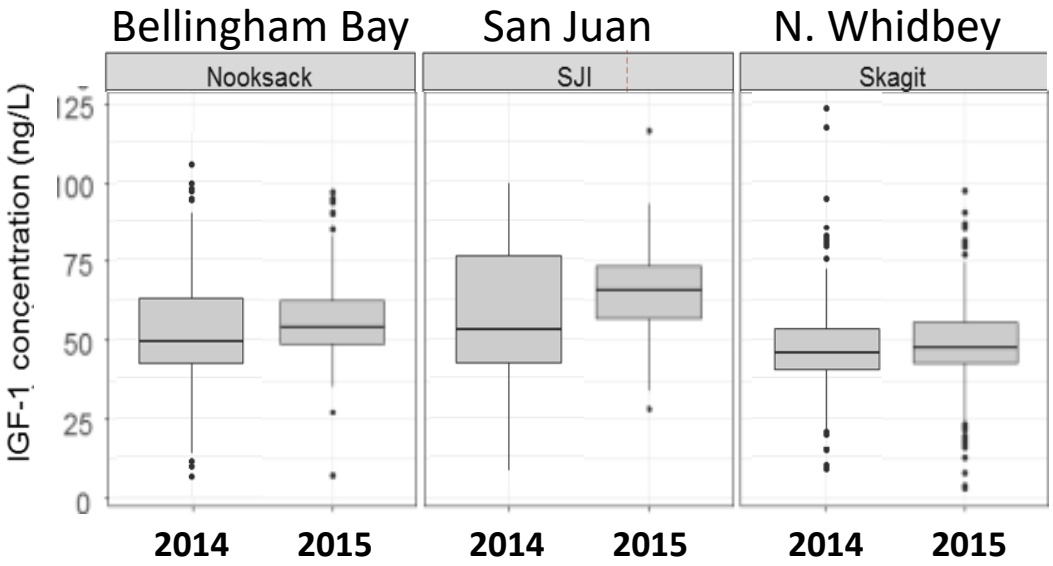
= higher than expected (> *IQR)
= higher than previous measurements
= expected (= *IQR)
= no data
= lower than expected (< *IQR)
= lower than previous measurements

*IQR = Interquartile Range (25th – 75th percentiles); **n = 17**

Juvenile Chinook salmon growth and size:

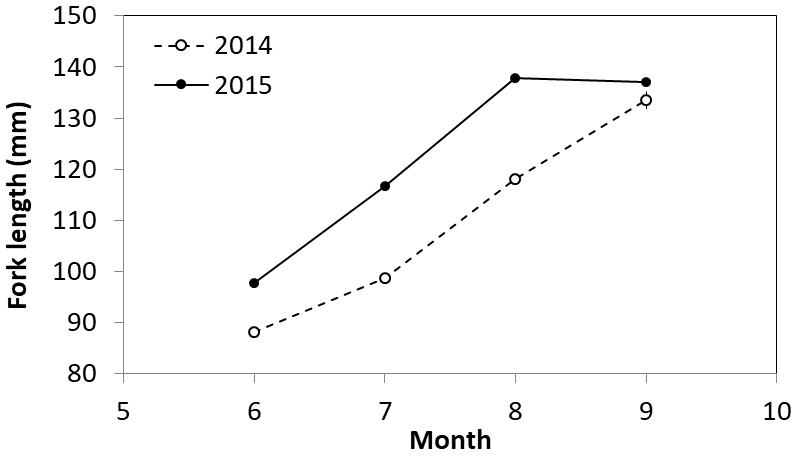
Tended to be lower and more variable in 2014 than 2015

IGF-1 index of <u>growth</u> by region



Chamberlain et al. 2017

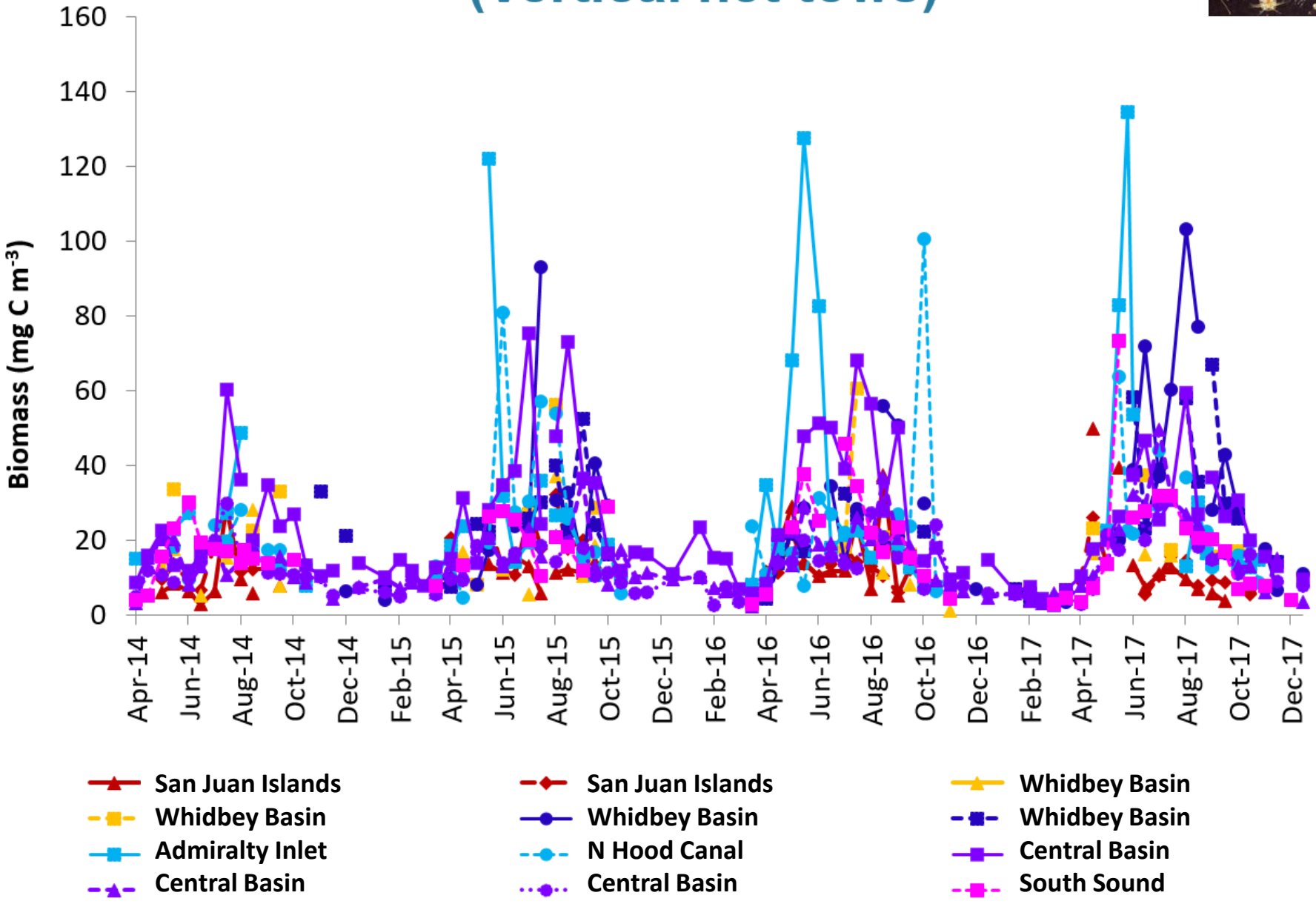
N. Whidbey juvenile salmon <u>size</u>



Courtesy of C. Greene et al., NOAA

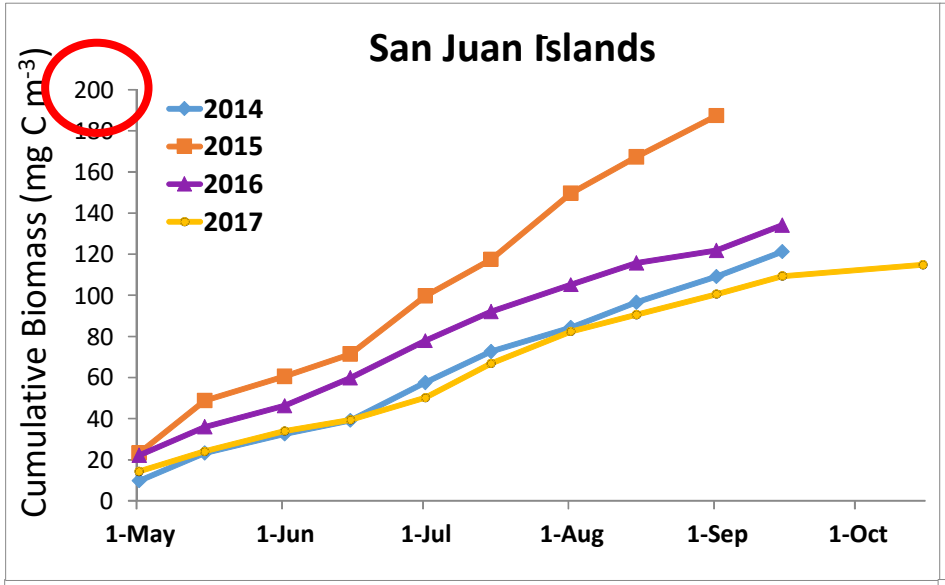

How was this big variability in years reflected in the zooplankton?

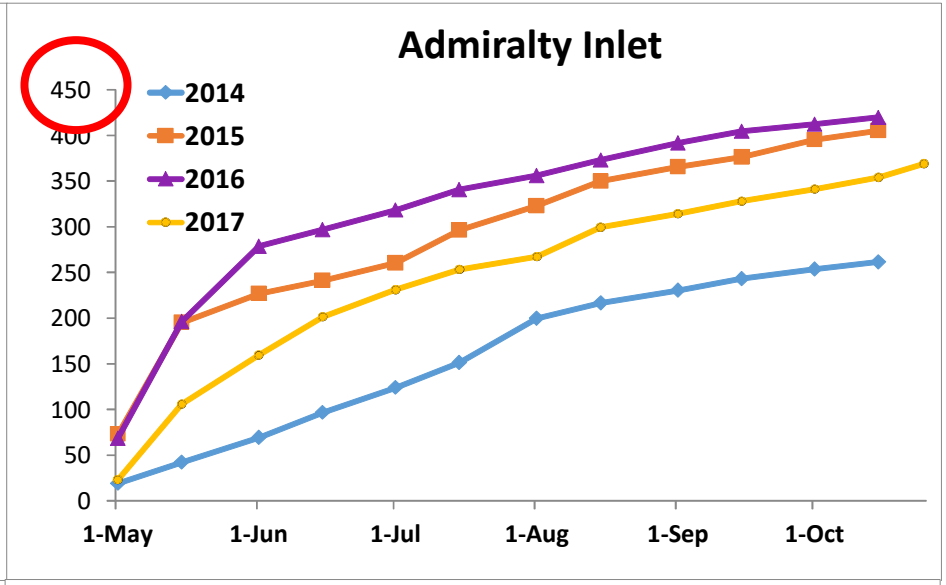
Total Zooplankton Biomass (Vertical net tows)

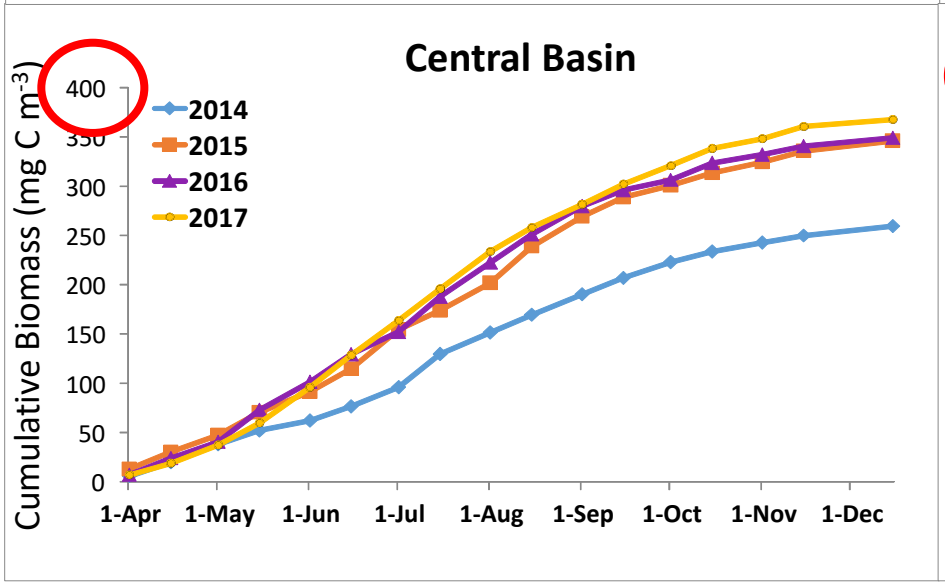


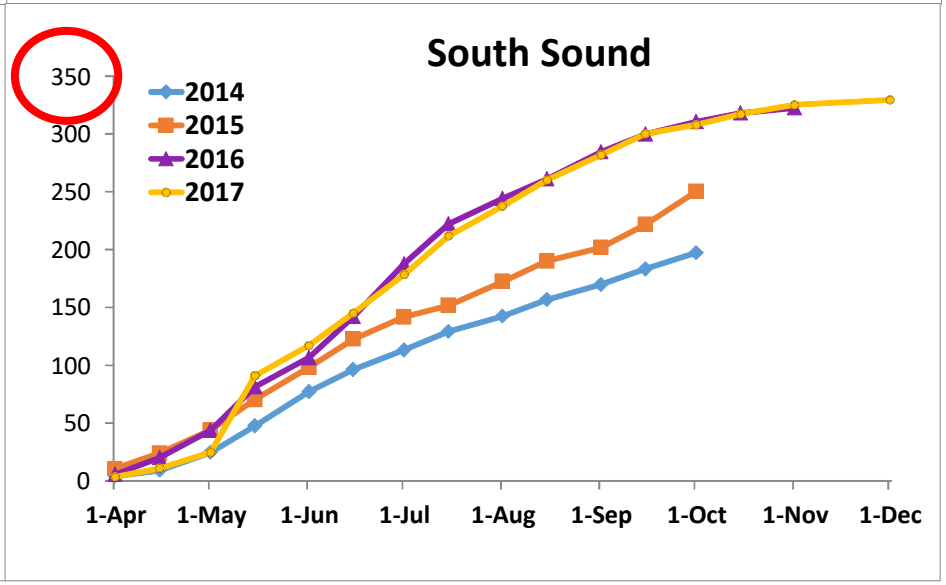
Total zooplankton biomass (vertical net tows):

2015-16 biomass was high. Big differences among regions.



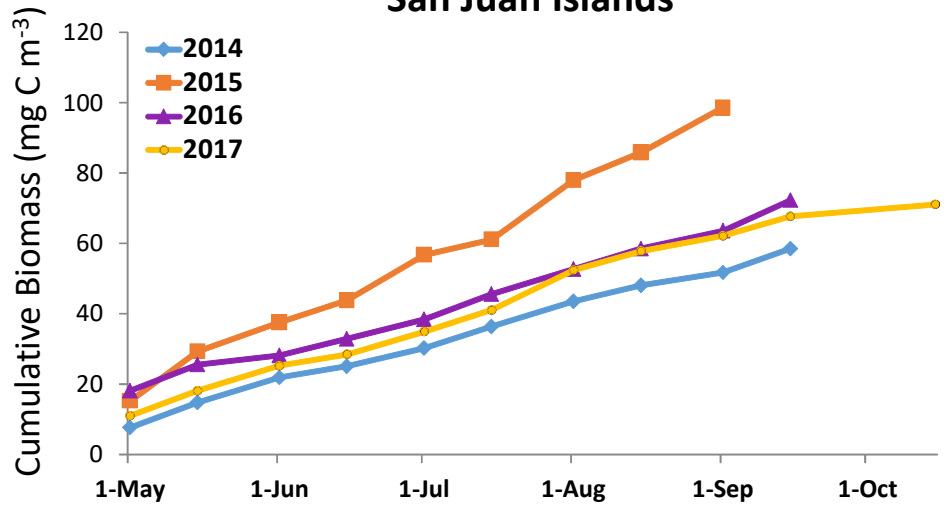


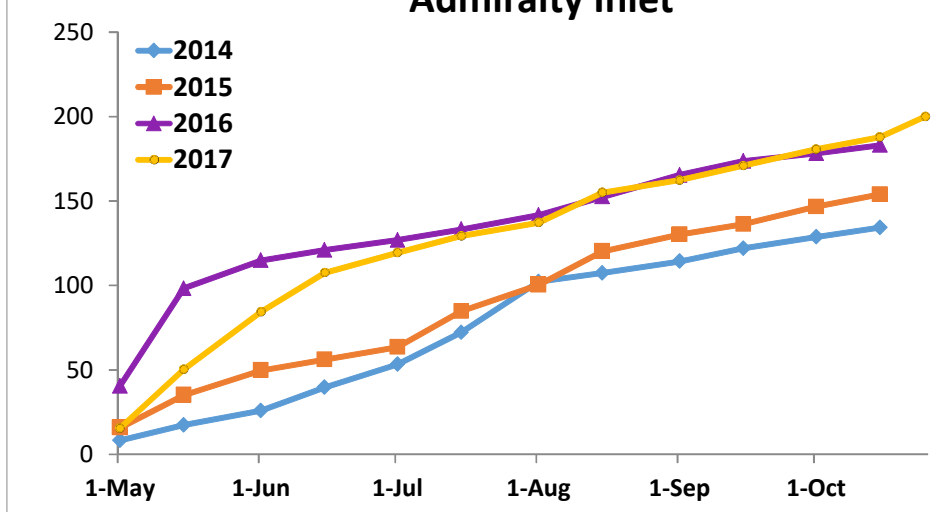


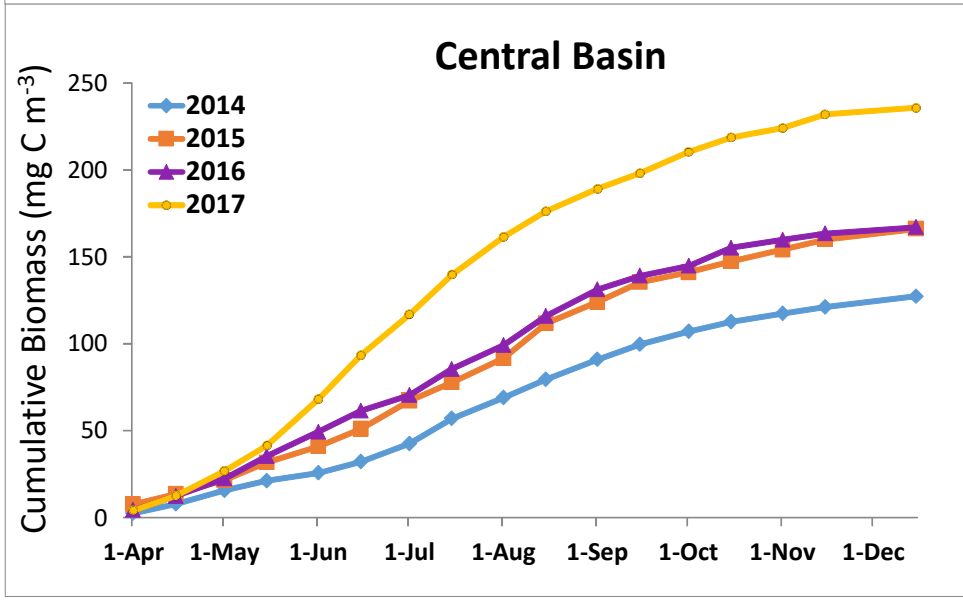


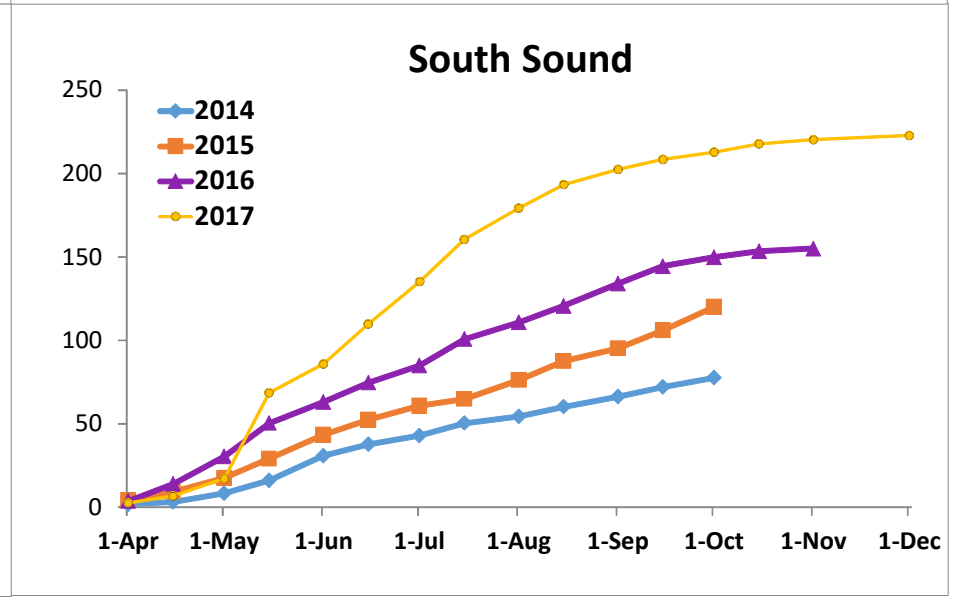
Copepod biomass:

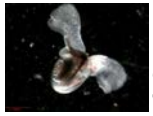
Comprises most of the total biomass.





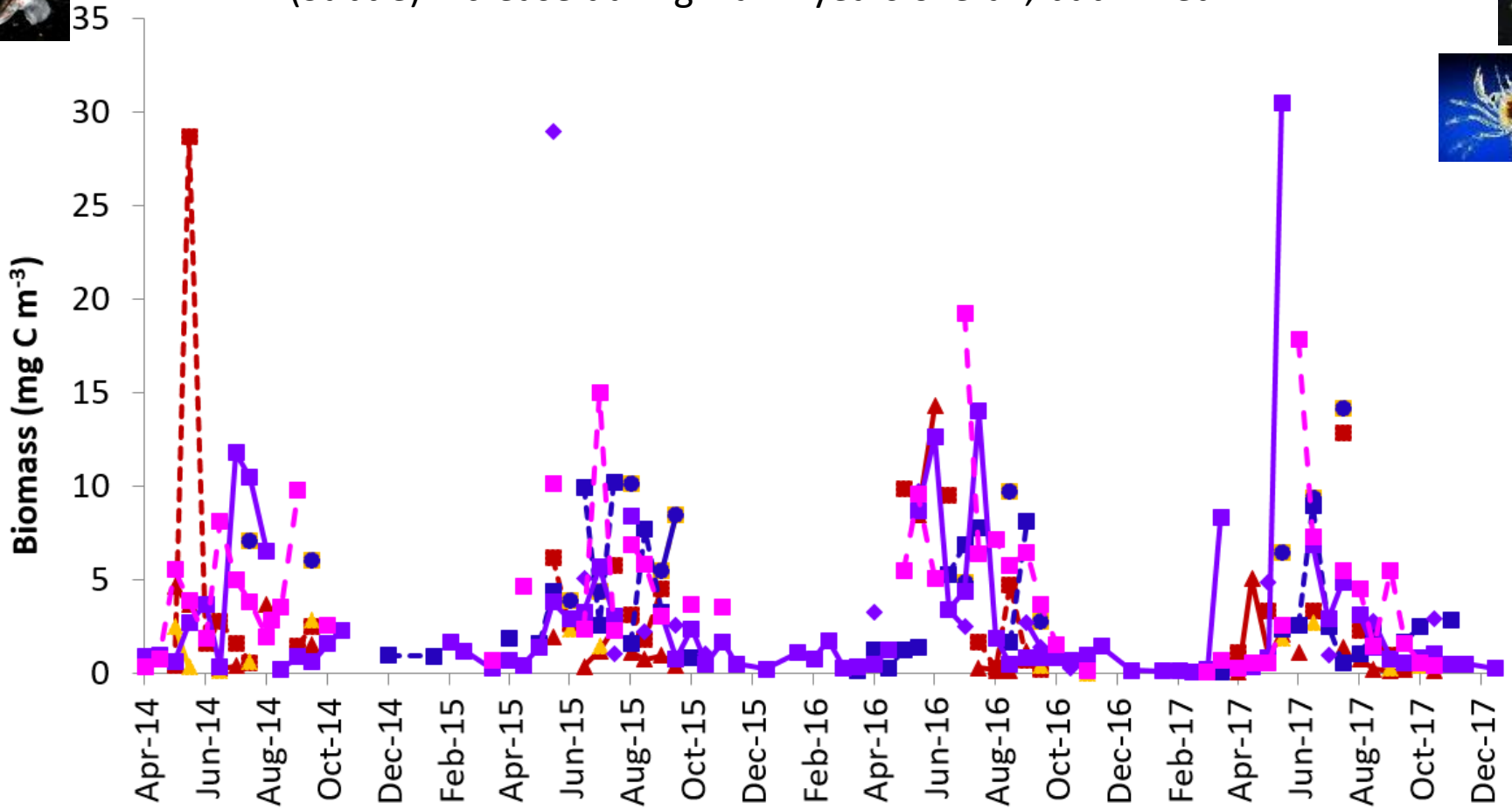




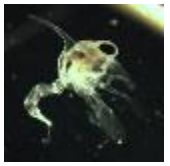



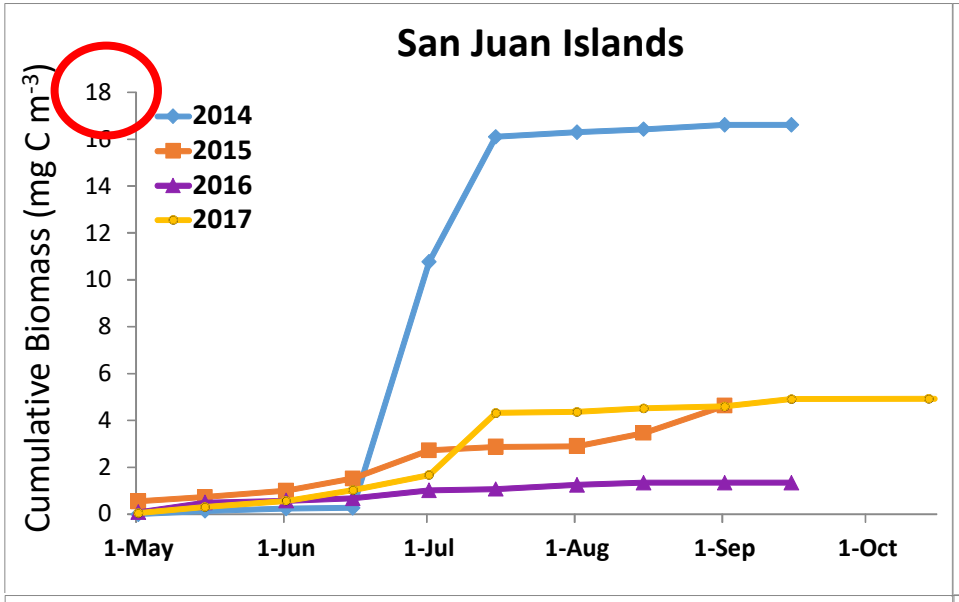

Juvenile Salmon Prey Field Index

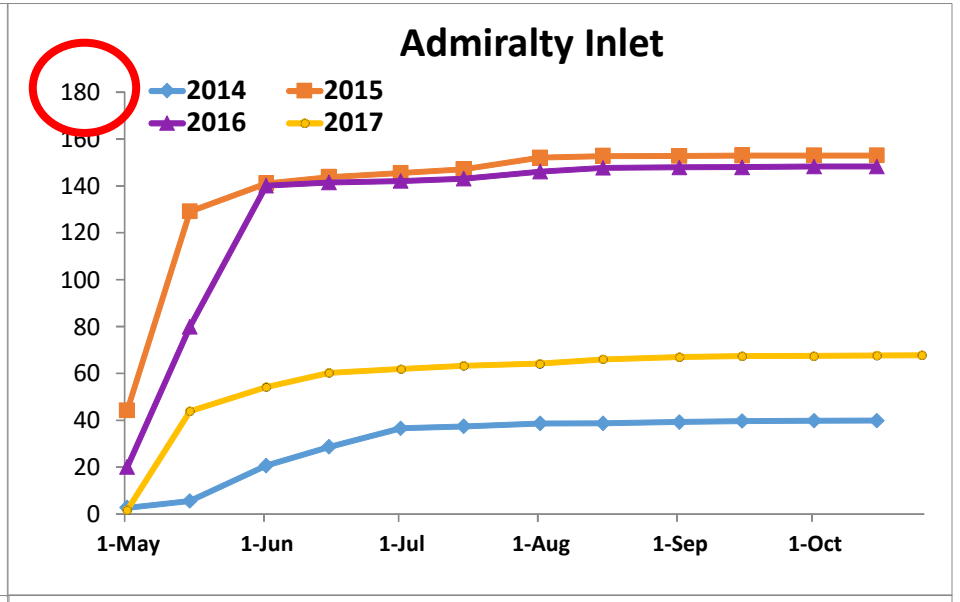
(Subtle) increase during warm years overall, but mixed.

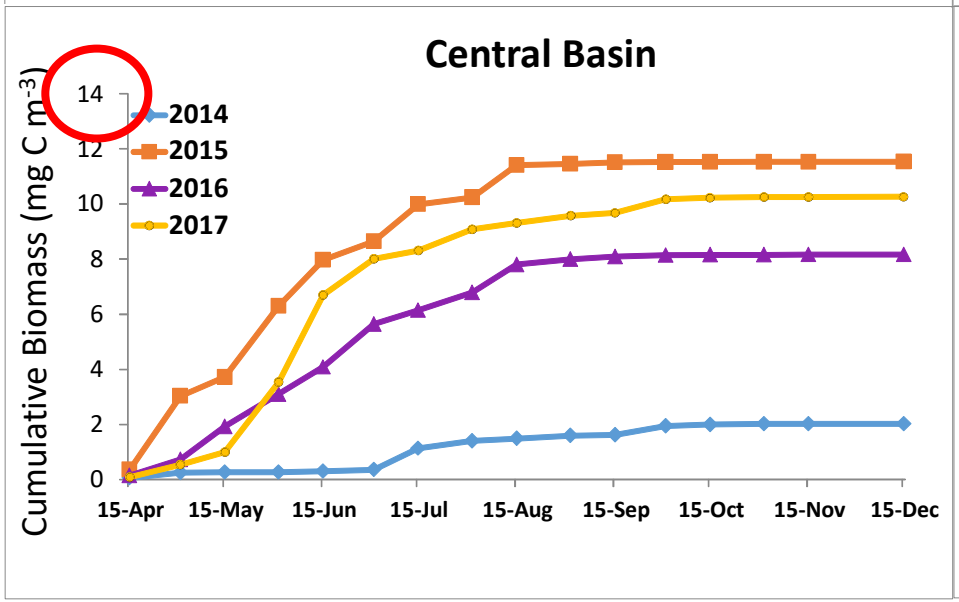


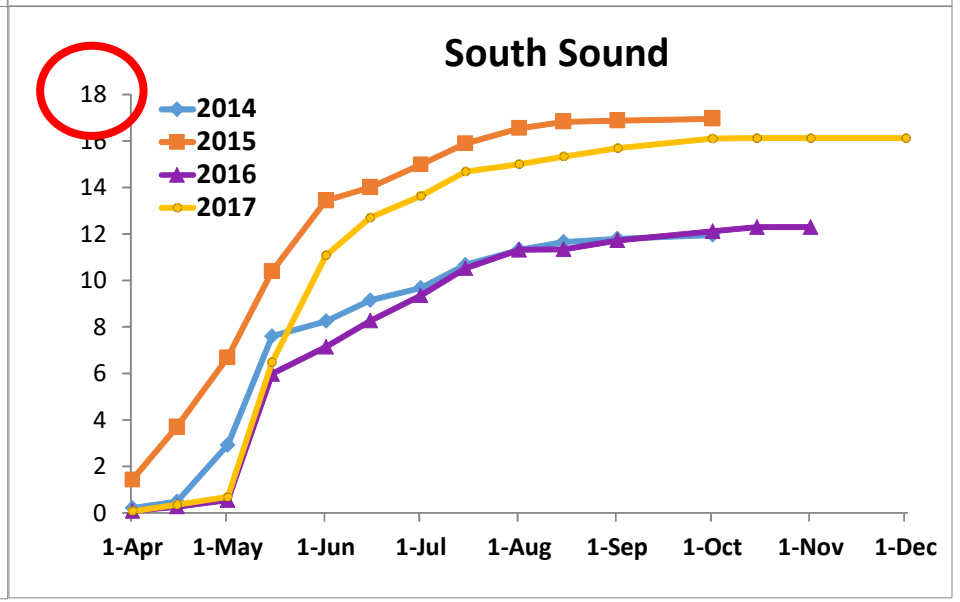
Crab larvae biomass (vertical net tows):









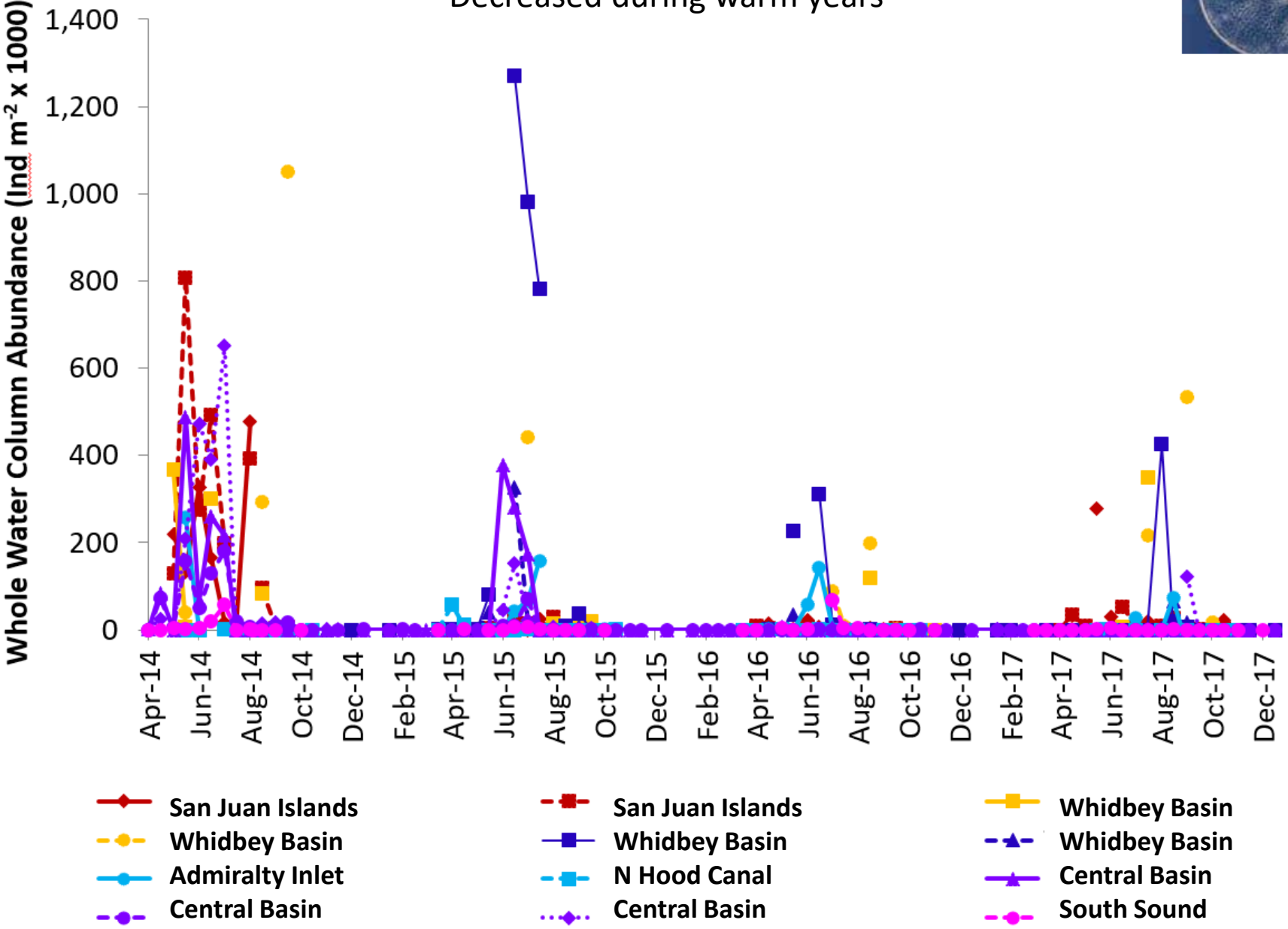


Siphonophore Biomass

Large decreases during warm years

Noctiluca Abundances

Decreased during warm years



Conclusions

- Puget Sound zooplankton monitoring began just prior to the warmest years on record.
- Total zooplankton and biomass of important fish prey were higher in 2015-16 than 2014.
- Biomass of some “unfavorable” taxa declined during the warm years.
- Large regional variability observed.
- Funding beyond 2019 has not been secured!

Partnerships & Funding

SALISH SEA
MARINE SURVIVAL PROJECT

nəxʷqíyt nəxʷsƛ̓áyəm
PORT GAMBLE S'KLALLAM TRIBE

PugetSoundPartnership
LEADING PUGET SOUND RECOVERY

Many rare taxa observed in 2015-2017

	Genus Species	2014	2015	2016	2017	Location
Copepod	***Candacia bipinnata***	x			x	Bellingham, Central Basin, South Sound
	Clausocalanus*	x		x	x	Bellingham
	Clytemnestra rostrata*	x		x	x	Bellingham
	Eucalanus californicus	x	x			Bellingham, San Juan
	Euchirella pulchra	x				Bellingham, San Juan, Whidbey, Central Basin
	*Mesocalanus tenuicornis**	x	x	x		Bellingham, San Juan
	Pleuromamma abdominalis	x	x		x	South PS
	Scaphocalanus brevicornis	x	x		x	Central Basin, South Sound
	Scolecithricella ovata*	x	x	x		N Hood Canal
	Tharybis fultoni	x				Bellingham, Whidbey, Central Basin, N&S Hood Canal
	Triconia conifera	x				Throughout
Crabs	*Emerita analoga*	x			x	Main PS
Krill	*Nematoscelis difficilis*	x	x			San Juan, Central Basin
Shrimp	*Sergestes similis*	x	x	x		San Juan, Admiralty
Tunicate	Thaliacean	x			x	Bellingham, Central Basin, South Sound

* = species seen only once; x= not present; **Bold** = species observed off Oregon during the warming years of 2014-2016.