Apr 5th, 4:15 PM - 4:30 PM

Zooplankton variability in the Northern Salish Sea over the past 3 decades, and relationships with Coho salmon

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Zooplankton variability in the Northern Salish Sea over the past 3 decades, and relationships with Coho salmon

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Salish Sea Marine Survival of Salmon Program
Pacific Salmon Foundation (PSF-SSMSP)

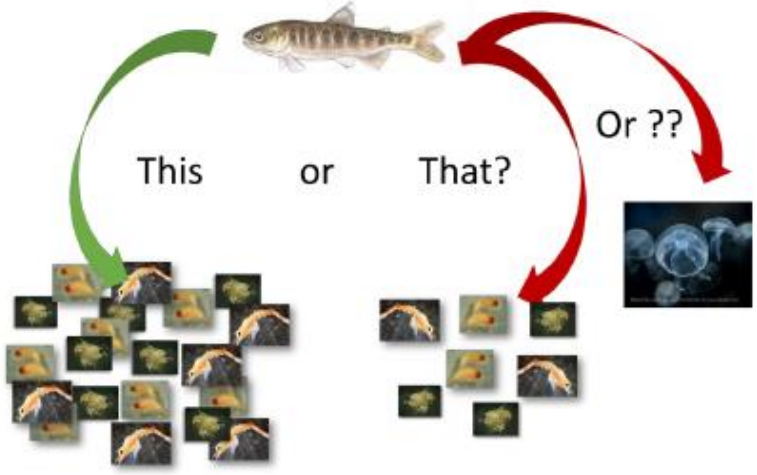
Plankton project main objectives:

1. What are the seasonal patterns of zoo/ichthyoplankton species composition, abundance, and biomass in the northern Salish Sea areas?

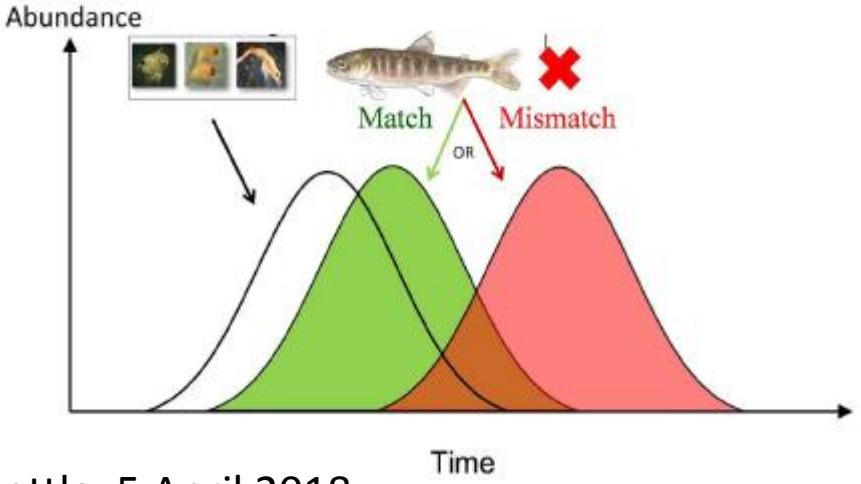
2. How do these properties vary with changes in physical conditions?

3. How do variations in these properties influence the marine growth and survival of juvenile salmon in these areas?

Food supply and quality



Match-Mismatch



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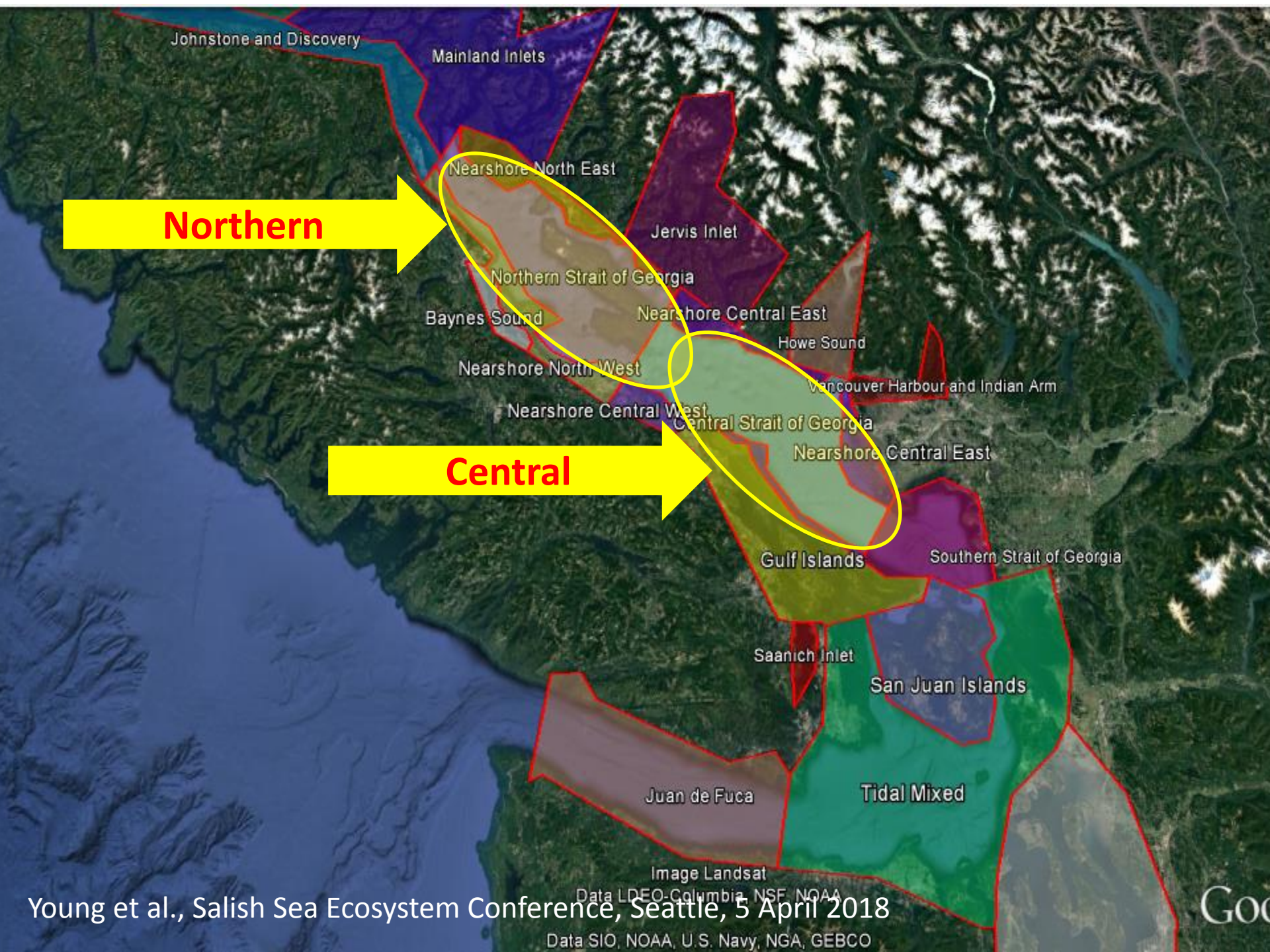
Objectives

Work is In Progress

Analyses and sampling are continuing

Objectives for this presentation:

1) Describe recent (2015 - 2017) patterns of zooplankton for Central Strait of Georgia;
2) Describe patterns of zooplankton for Central Strait of Georgia among years (1995-2017);
3) Compare long-term (1990-2017) zooplankton patterns in Central and Northern Strait of Georgia with Coho marine survival patterns in this region.



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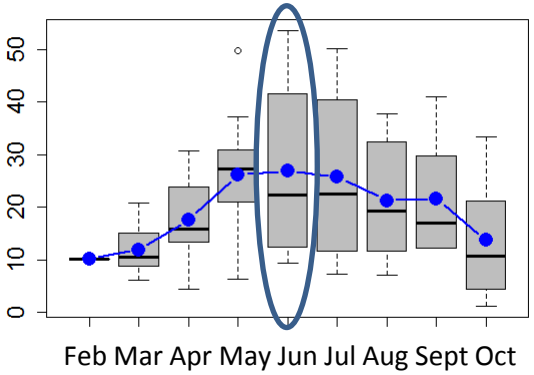
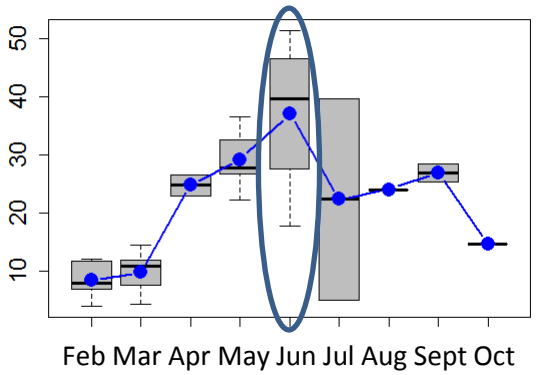
Total plankton biomass (g DryWt/m^2) – biomass peaks in June-July

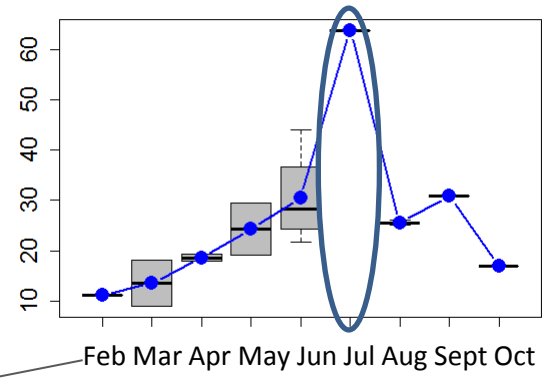
2015 by month



2016 by month



2017 by month



Blue dots are means

GEO1 (central SoG) 2017

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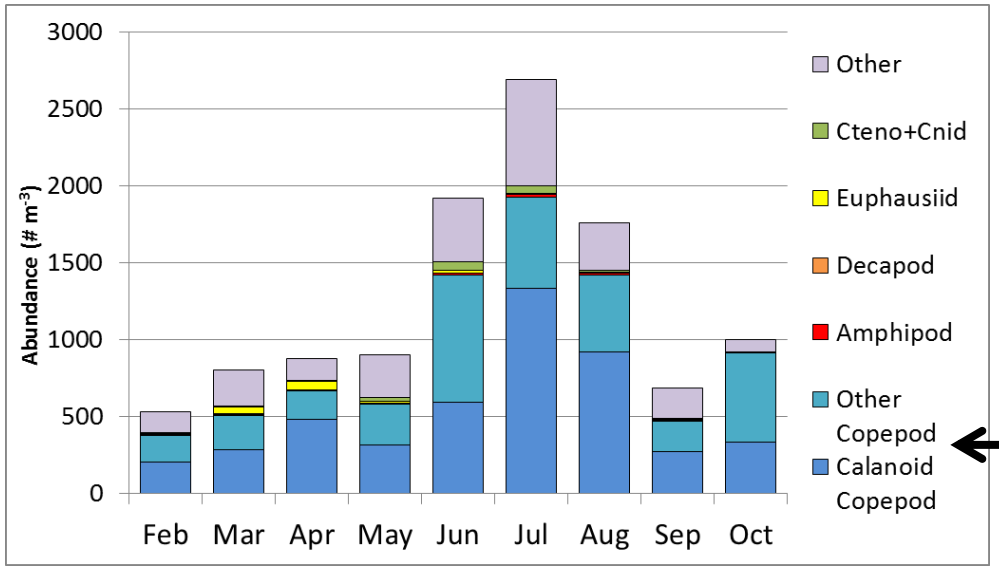
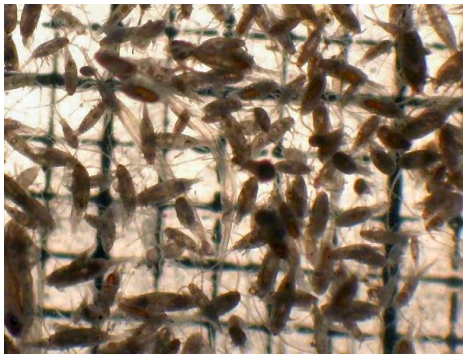
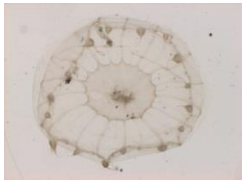
2017 Taxonomic abundance & Biomass

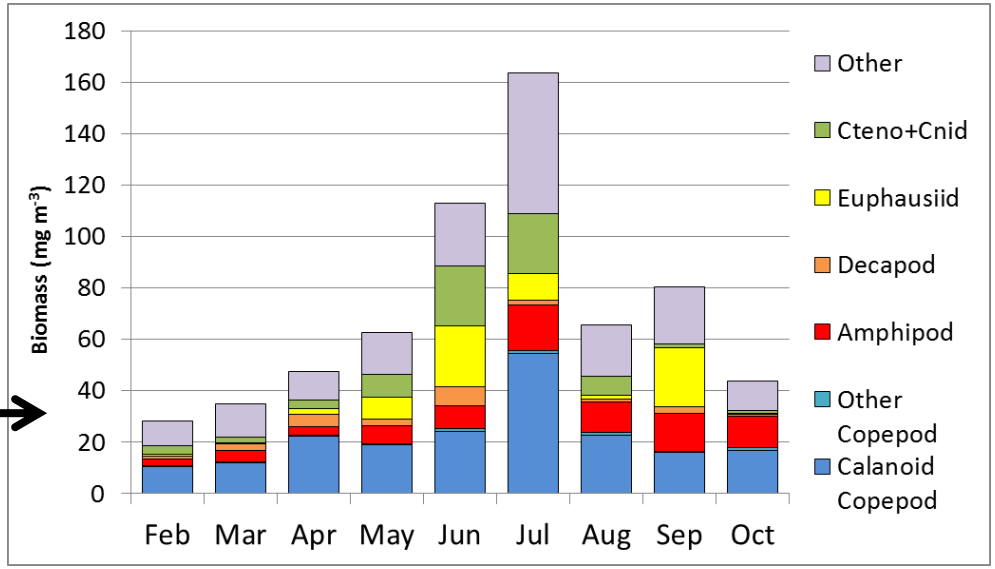




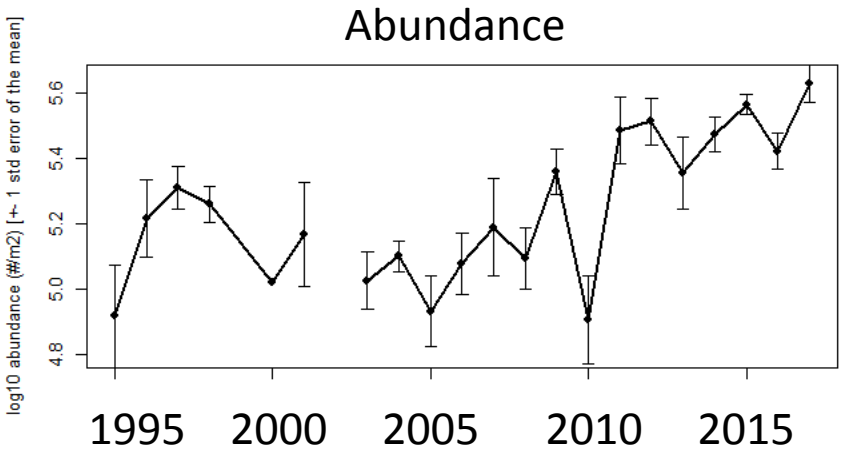
Mostly copepods by abundance (blue colours)

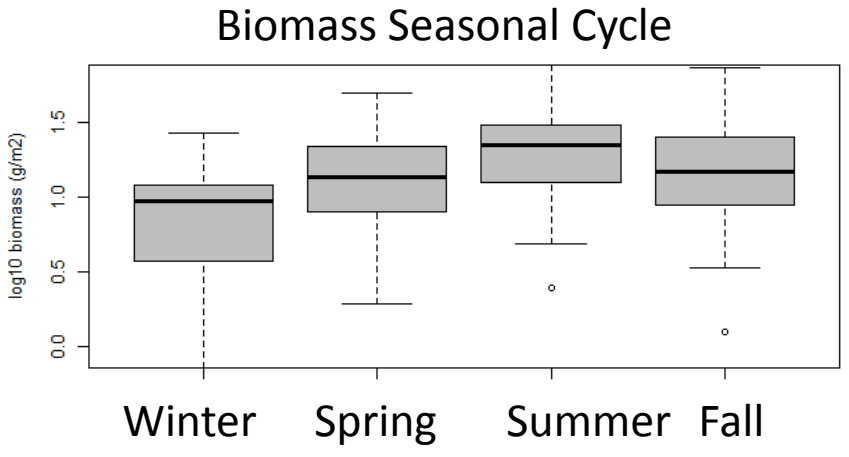


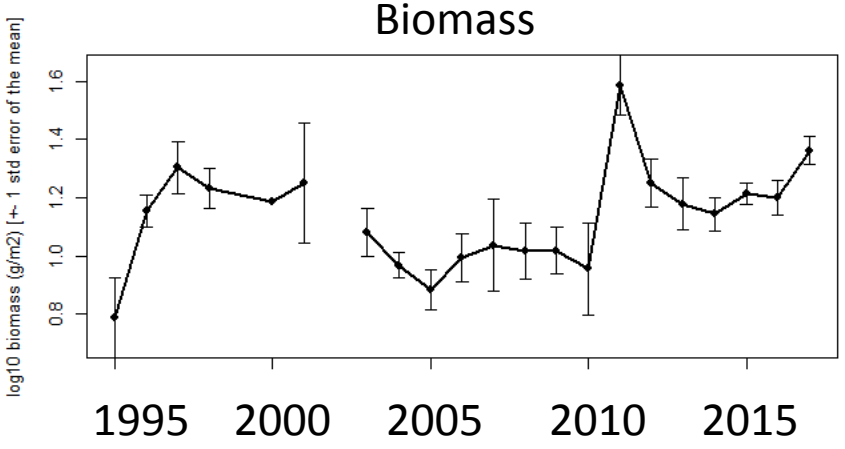
More euphausiids (yellow), amphipods (red) and jelly (green) by biomass

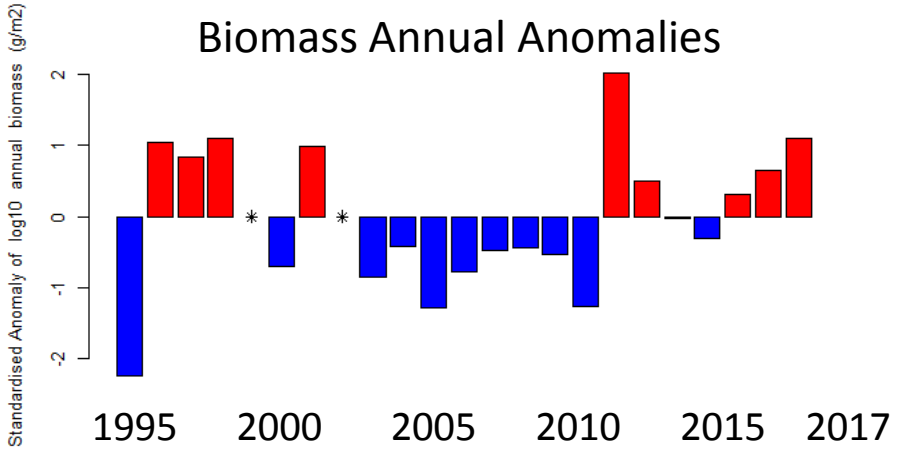


Central Strait of Georgia – total zooplankton biomass (log_{10} g/m^2)









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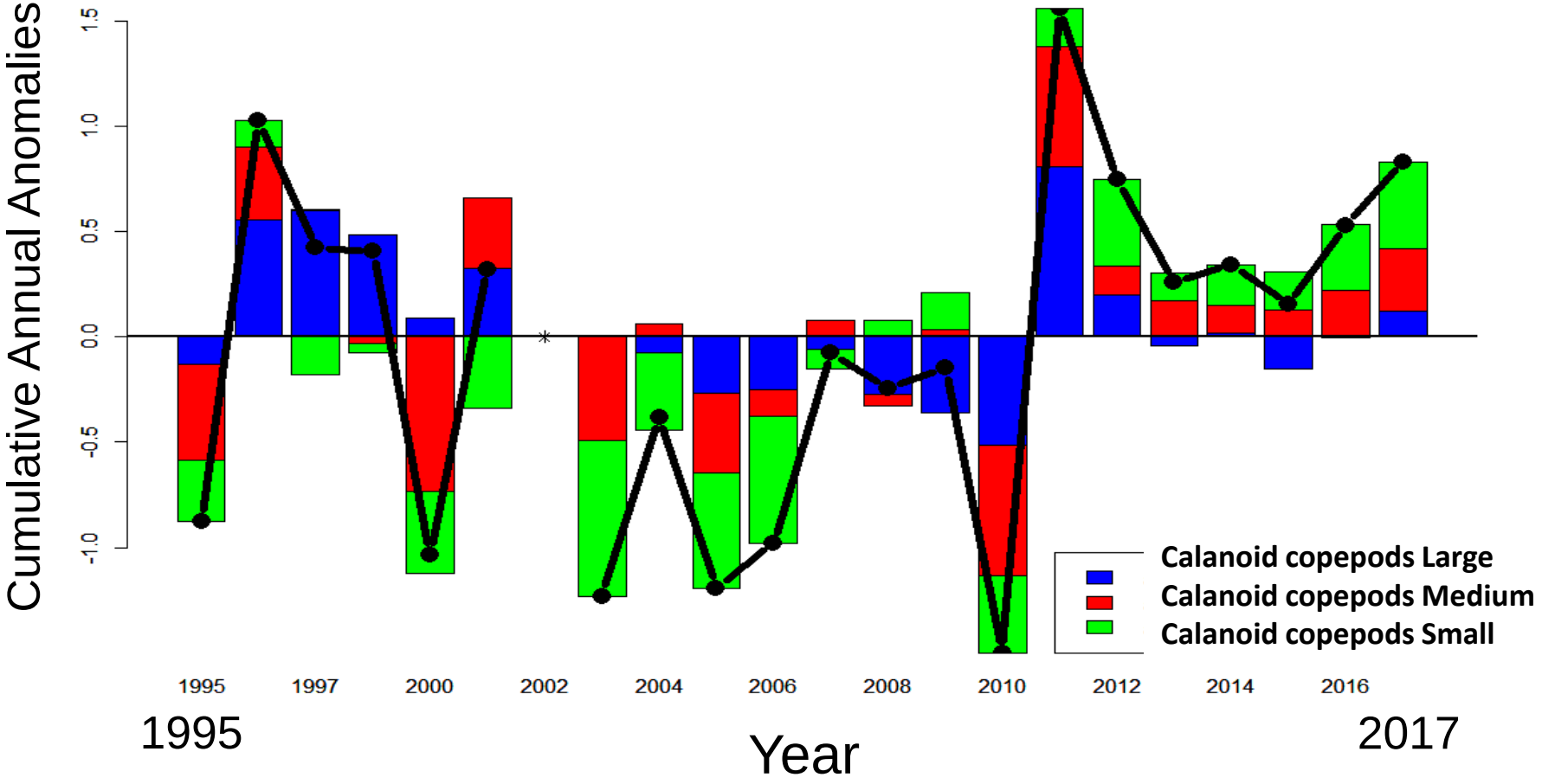
Central Strait of Georgia – Calanoid copepod biomass anomalies



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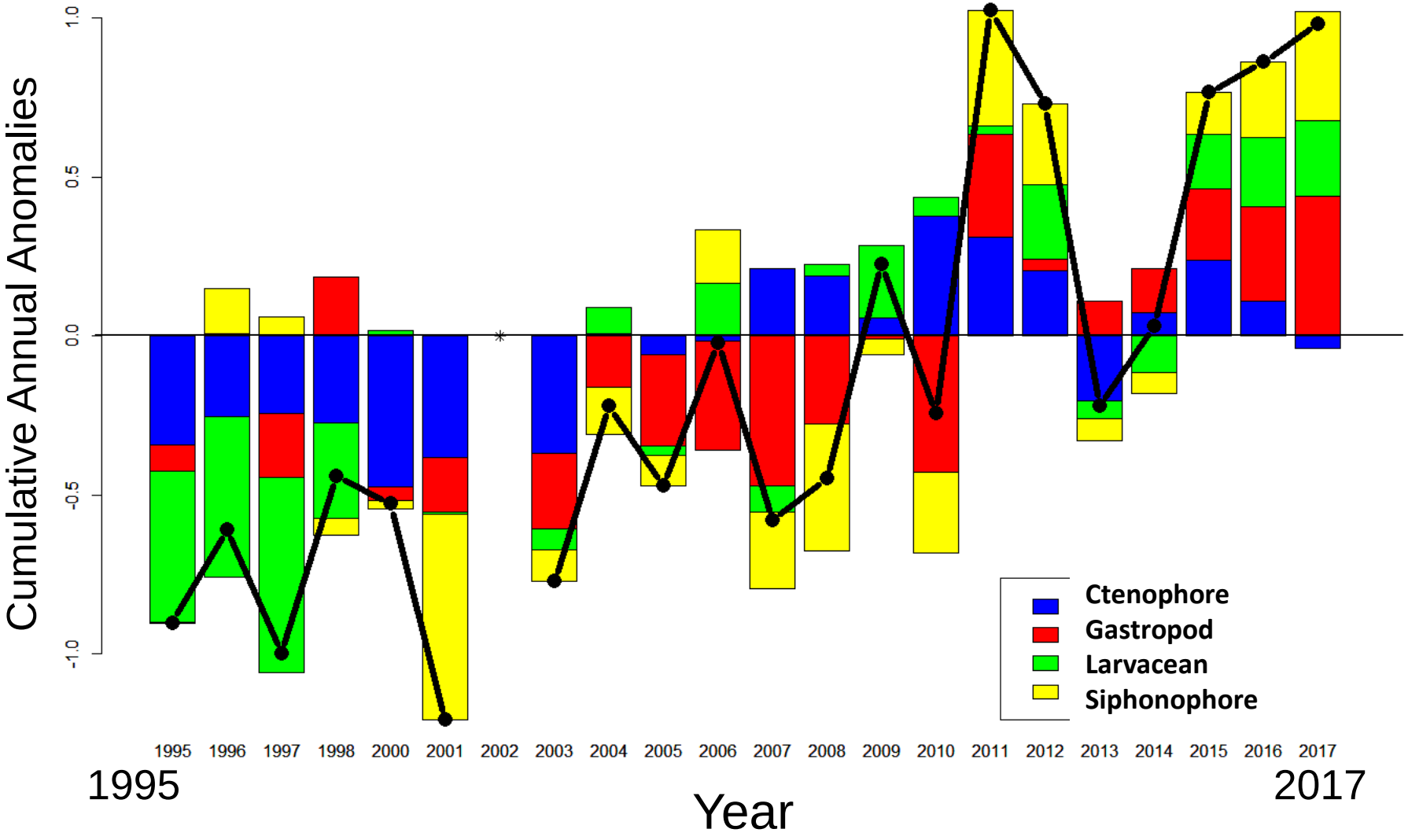
Central Strait of Georgia – Gelatinous plankton biomass anomalies



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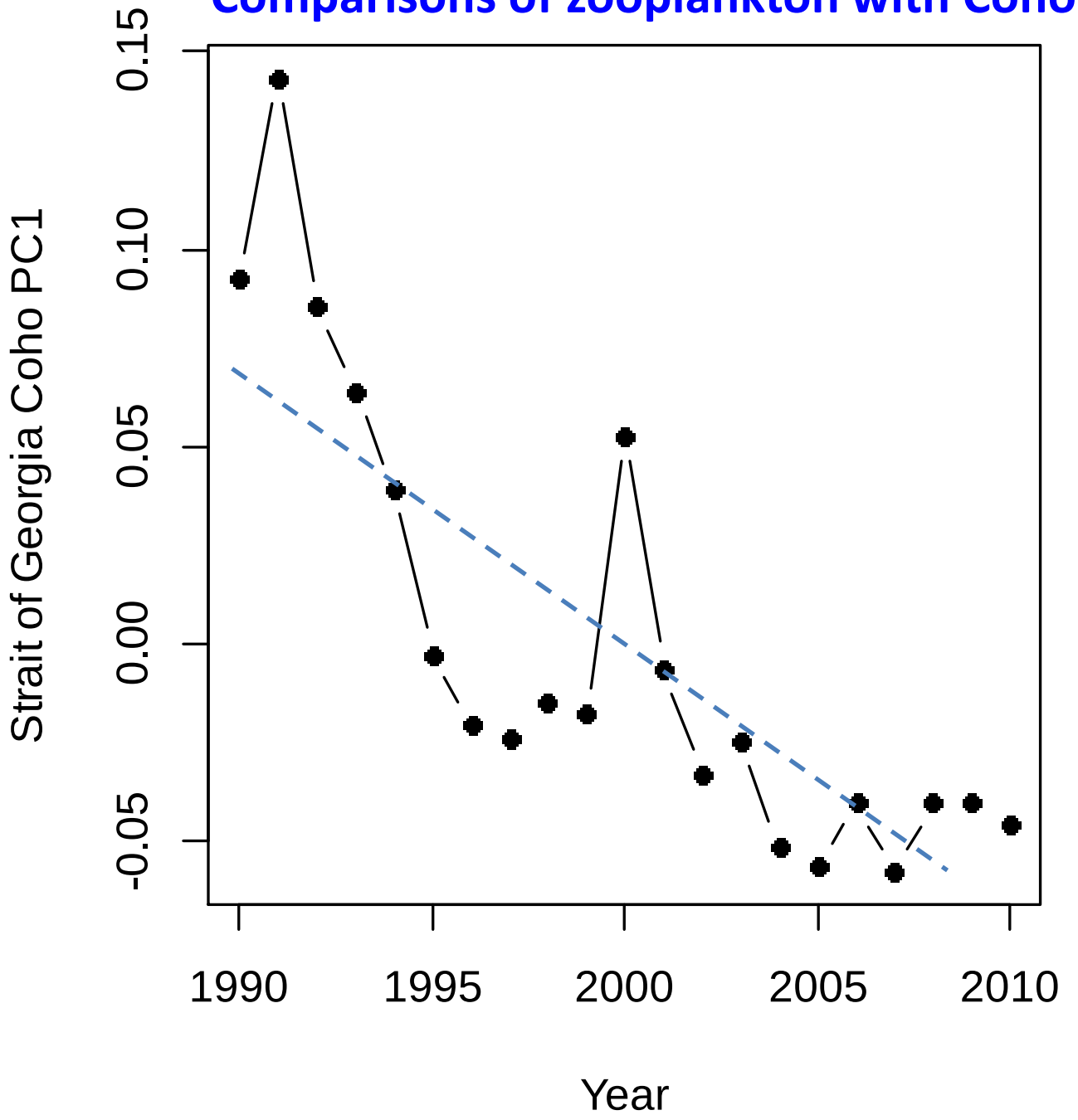
Comparisons of zooplankton with Coho marine survival



Strait of Georgia **Coho**
PC1 (90% of variance)

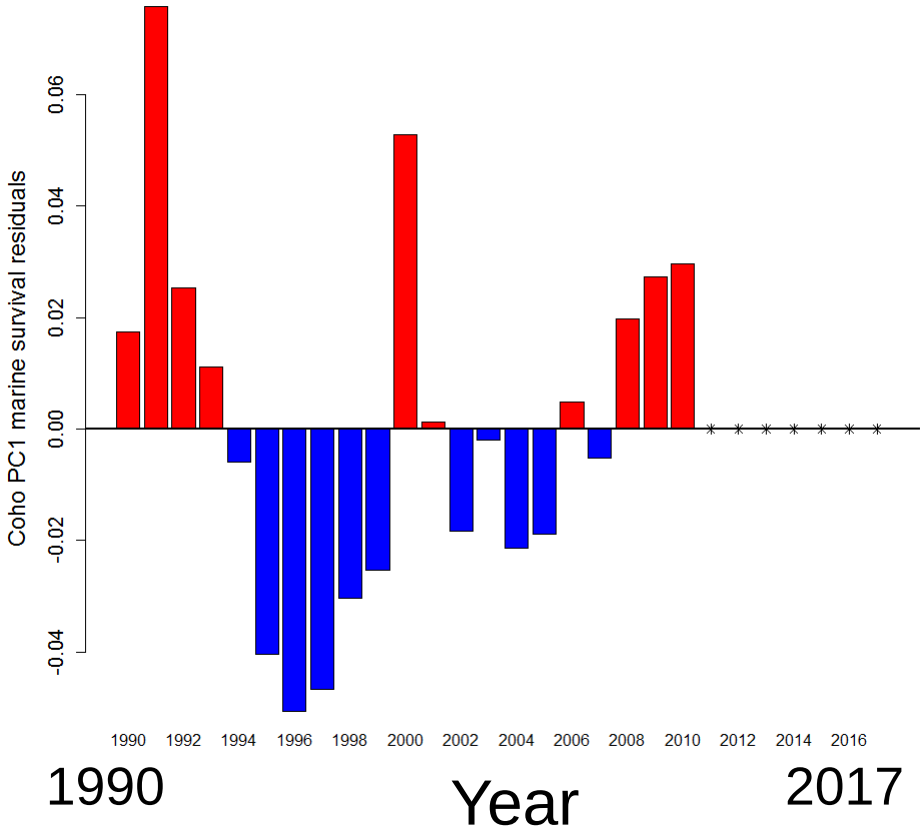
Big Qualicum
Inch Creek
Quinsam
Black Creek (wild)

Marine survival vs
Ocean Entry year

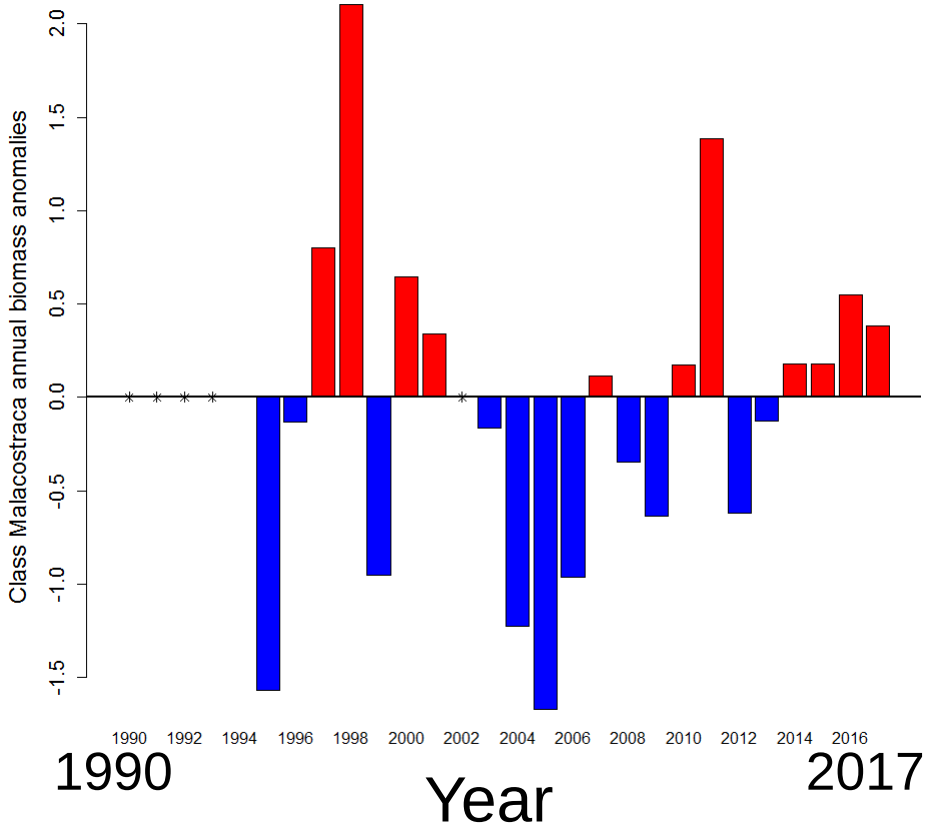
Dashed line represents linear trend

Data courtesy Jim Irvine

Residuals after removing the decreasing linear trend from the PC1 Coho marine survivals



Biomass anomalies of key juvenile Coho prey (Crabs, Amphipods, Shrimp: represented by Class Malacostraca)



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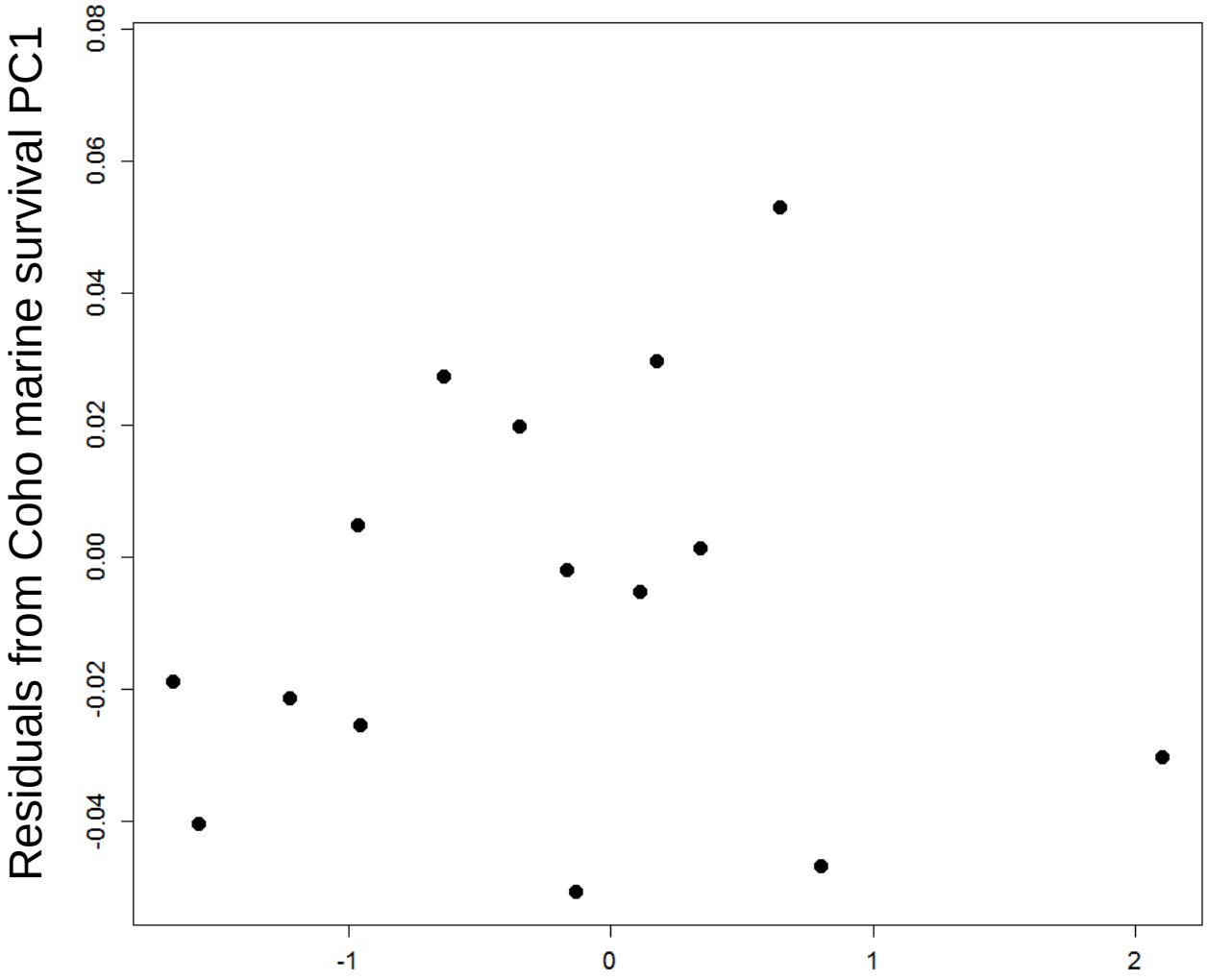
Coho salmon marine survival *vs* 'Fish food' plankton



Residuals from Coho marine survival PC1 are not correlated with Class Malacostraca biomass anomalies: p=0.09

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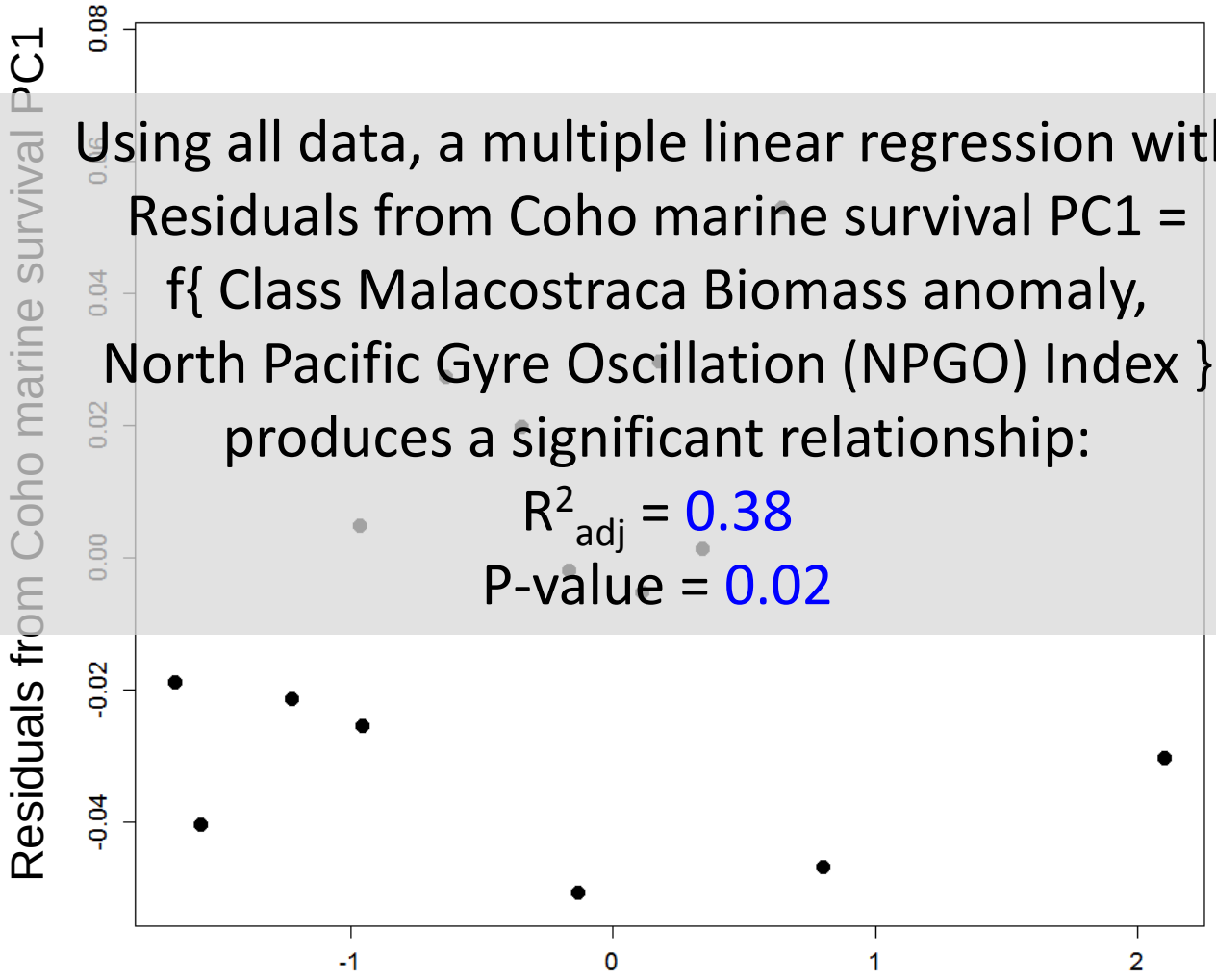
Coho salmon marine survival *vs* 'Fish food' plankton



Using all data, a multiple linear regression with Residuals from Coho marine survival PC1 = f{ Class Malacostraca Biomass anomaly, North Pacific Gyre Oscillation (NPGO) Index } produces a significant relationship:

R^2_{adj} = 0.38

P-value = 0.02

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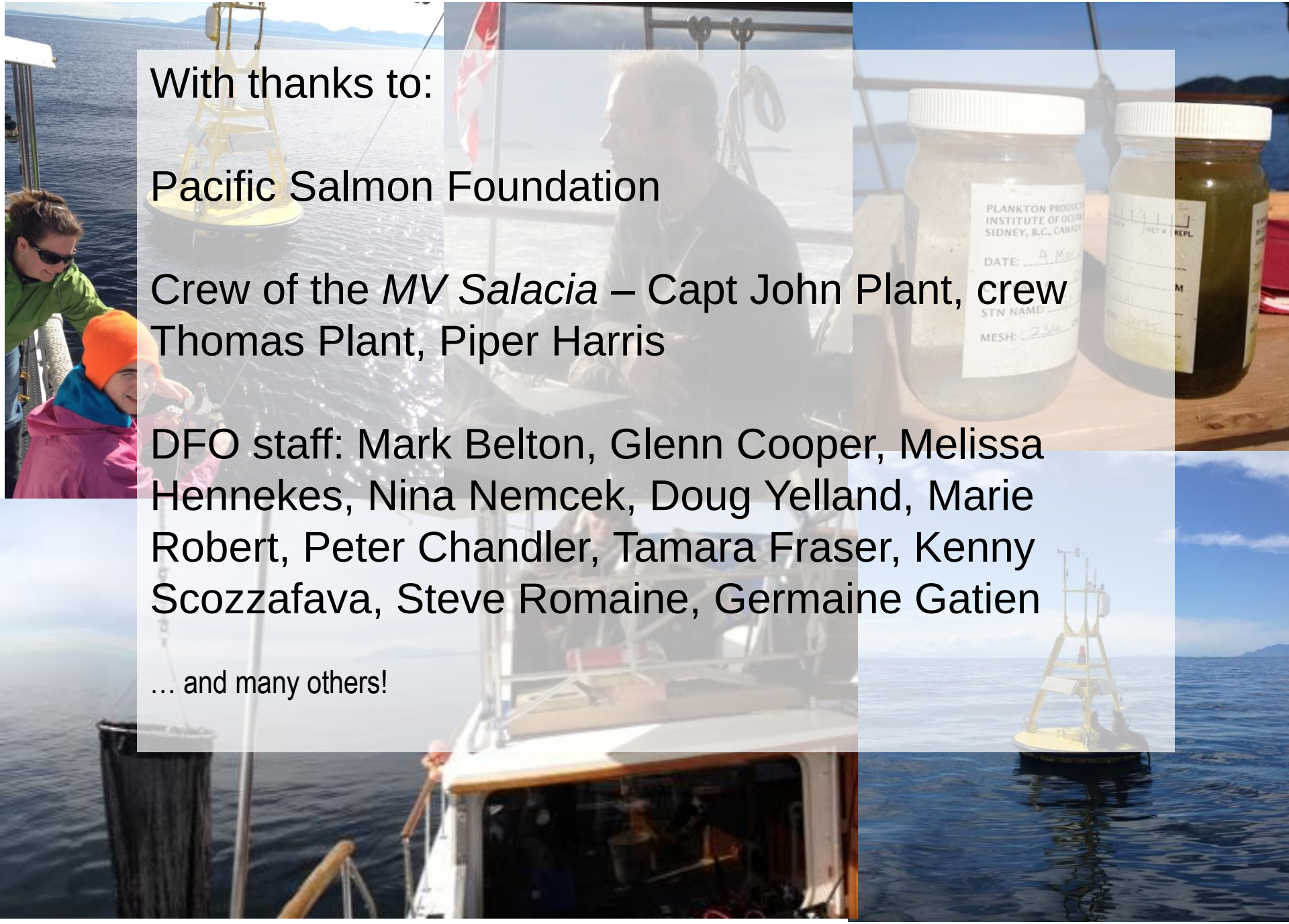
Summary

1. Zooplankton biomass peaks in the summer months (June-July) (most plankton sampling programs have focussed on Spring);
2. Total zooplankton biomass in Central Strait of Georgia has been increasing since 2014; 2017 is similar to that during the late 1990's;
3. Annual biomass anomalies of Calanoid copepods display a U-shaped pattern, with minima during 2003-2010; Annual biomass patterns of gelatinous plankton have been increasing since 1995;
4. The residuals of Coho salmon marine survival (i.e. with the declining trend from 1990 to 2010 removed) are significantly related to a combination of the annual biomass anomalies of their preferred crustacean zooplankton prey (a local influence), and the North Pacific Gyre Oscillation Index (a large-scale influence). Zooplankton prey is the more important independent variable in this relationship.
5. A consistent zooplankton monitoring program in the Salish Sea can assist with projections of future abundances of juvenile salmon.



With thanks to:

Pacific Salmon Foundation

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DFO staff: Mark Belton, Glenn Cooper, Melissa Hennekes, Nina Nemcek, Doug Yelland, Marie Robert, Peter Chandler, Tamara Fraser, Kenny Scozzafava, Steve Romaine, Germaine Gatien

… and many others!