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## Seasonal changes in trophic interactions in the plankton community in the Strait of Georgia

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# Seasonal changes in trophic interactions in the plankton community in the Strait of Georgia

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## 1 Problem

The plankton community composition and trophic interactions vary greatly throughout a year, but these details aren't often represented well in numerical simulations.

Understanding the seasonal food web dynamics within the plankton community can lend insights into energy transfer to higher trophic levels.

### Research Question

What does the plankton food web structure look like in the SoG and how does it change seasonally?

### Implementation

Built 3 detailed, seasonal food web models for the plankton community in the SoG in spring, summer, and winter

## 2 Methods

### Biomass Data

Phytoplankton: based on pigment data derived from HPLC from 2015 – 2017 and 2019 – 2020, analysed using Chemtax

Zooplankton: net tows from 2006 – 2017, only tows > 200 m

Microzooplankton: cell counts from STRATOGEM, 2002 - 2005

### Ecopath Model

Assumes mass balance between and within functional groups (FGs)

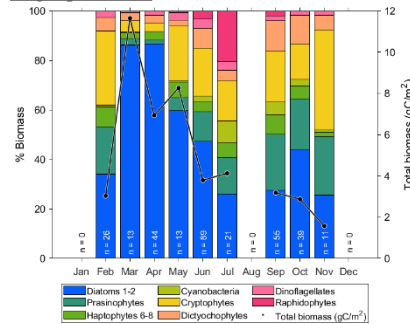
$$B_i \cdot (P/B)_i \cdot EE_i - \sum_{j=1}^n B_j \cdot (Q/B)_j \cdot DC_{ji} = 0$$

$$Q_i = P_i + R_i + (1 - GS_i) \cdot Q_i$$

## 3A Results

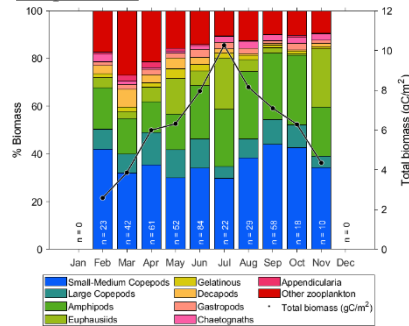
### Plankton community composition

Monthly average over time series  
Phytoplankton



- Clear diatom bloom in spring
- Flagellates increase in dominance in remainder of year

### Zooplankton

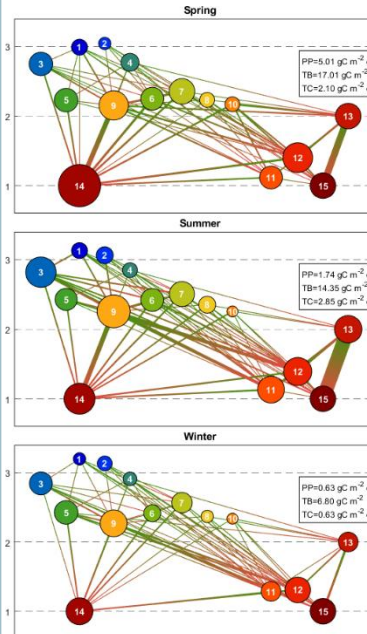


- Copepods are 35-55% of biomass year-round
- Other large crustaceans (amphipods, euphausiids) dominate the rest of the biomass

Defined 3 seasonal periods: spring (March-May), summer (June-October), and winter (November – February)

## 3B Results

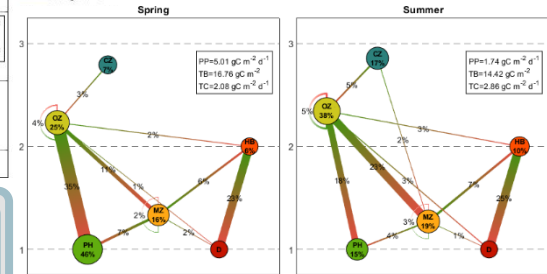
### Seasonal food web structure



- 1 Gelatinous
  - 2 Chaetognaths
  - 3 Amphipods
  - 4 Decapods
  - 5 Euphausiids
  - 6 Large copepods
  - 7 Other zooplankton
  - 8 Gastropods
  - 9 Small-medium copepods
  - 10 Appendicularians
  - 11 Ciliates
  - 12 Flagellates
  - 13 Heterotrophic Bacteria
  - 14 Phytoplankton
  - 15 Detritus
- 1.00 gC m<sup>-2</sup>  
0.05 gC m<sup>-2</sup> d<sup>-1</sup>

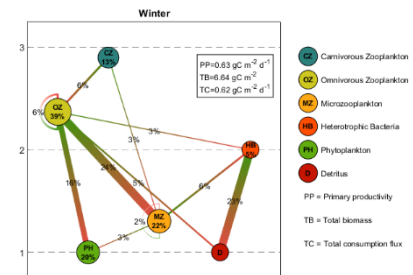
- Plankton community spans 3 TLs
- TLs are highest in winter, then summer, then spring
- In spring, autotrophic phytoplankton (diatoms) contribute 81% of PP in spring, and ~50% in summer and winter, with mixotrophic groups contributing the rest
- ~50% of system flow originates from each of primary producers and detritus
- Over the year, 43% of zooplankton production is unused within the plankton system
- Gives estimates of parameters that are hard to directly measure or that we have limited information about, i.e. bacterial biomass, zooplankton production and respiration
- Microbial loop becomes more important in summer and winter, when primary production is under limiting conditions

### Aggregated & relative structure



## 4 Implications

- Showed the importance of the microbial loop, which is currently understudied
- Can estimate the changes in availability and nutritional quality of food for planktivorous fish
- Understanding the small-scale interactions at the bottom of the food-web is important as the climate continues to vary



- TL Carnivorous Zooplankton
  - TL Omnivorous Zooplankton
  - MZ Microzooplankton
  - HB Heterotrophic Bacteria
  - PH Phytoplankton
  - DE Detritus
- PP = Primary productivity  
TB = Total biomass  
TC = Total consumption flux