Temporal Dynamics of Nearshore Zooplankton Communities in the Strait of Georgia using ZooSCAN

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INTRODUCTION

Zooplankton assemblages in the Strait of Georgia (SoG) show significant inter-annual variability driven by climate oscillations, yet **nearshore** zooplankton assemblages, crucial for **forage fish and juvenile salmon**, remain understudied.

Citizen Scientists John and Andre collecting zooplankton samples as part of PSF's Citizen Science Oceanography program. August 2024.

Malaspina Strait in the northeast SoG is a key migration route for **juvenile salmon**. The Pacific Salmon Foundation's (PSF) Citizen Science Oceanography program has been collecting time series data on the physics, chemistry, phytoplankton, and zooplankton of Malaspina Strait **since 2015**.

What are the seasonal nearshore zooplankton assemblage dynamics in Malaspina Strait?

METHODS

Sample collection

Zooplankton samples were collected ~2 times per month from December 2023-July 2024 using a ring net, hauled from just above bottom for the shallow station (IS-2) and from 150m depth for deep stations (IS-4 and IS-6) . Additionally, temperature, salinity, depth, fluorescence, macronutrients (NO3-, PO4-, Silicate), and phytoplankton were collected.

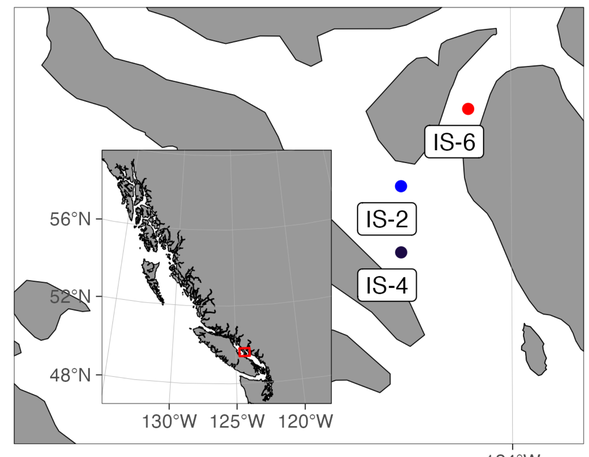


Figure 1. Map of sampling sites in Malaspina Strait. Sites are IS-2 (<30m depth), IS-4 (~420m depth), and IS-6 (~250m depth).

ZooSCAN images will be used to create an open access database of zooplankton in the SoG.

Semi-automated image processing

ZooSCAN was used to capture and process **high-resolution images** of zooplankton samples and image analysis using deep learning to rapidly identify:

- Major taxonomic groups
- Organism size
- Organism biovolume
- Community size spectra and biomass.

RESULTS

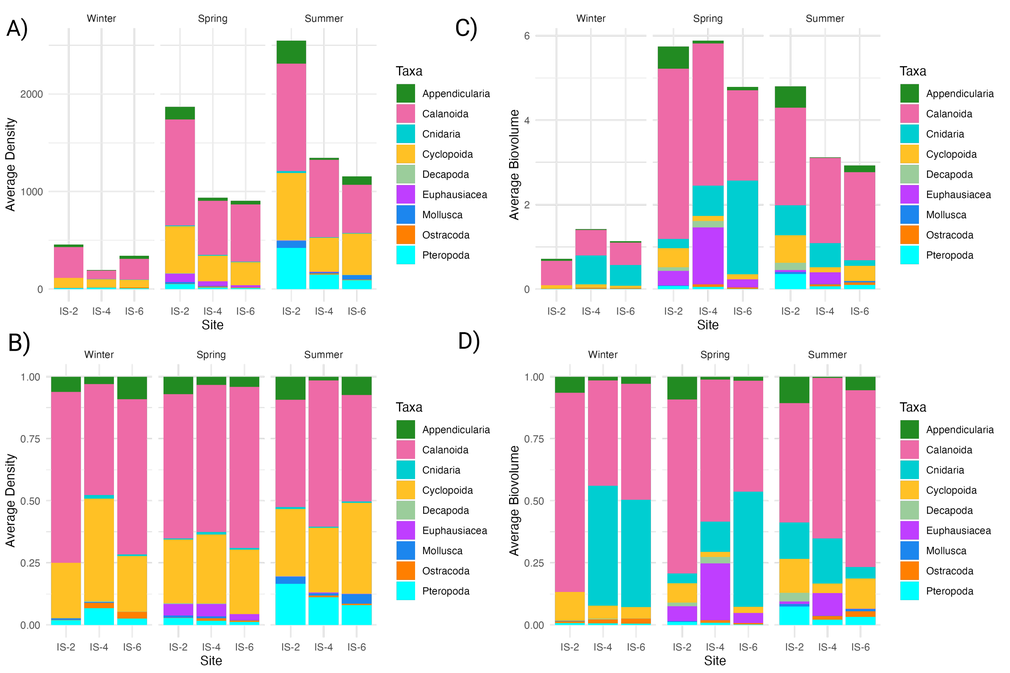


Figure 2. Seasonal and spatial variation in zooplankton assemblage. Average (A) and proportional (B) zooplankton density by taxa are shown on the left. Average (C) and proportional (D) zooplankton biovolume by taxa are shown on the right.

All sites showed **peak density in the summer** and **peak biovolume in the spring.**

IS-2 (shallowest site) had the **highest density** of all sites across all seasons .

Biovolume in **IS-2** was **lowest** of all sites in **winter**, and **highest in summer.**

Calanoid copepods where the **largest** contributors to **density and biovolume** across all sites and seasons.

Cnidarians were prominent contributors to **IS-4 and IS-6 biovolume**, particularly in **winter** and **spring**.

IS-2 was likely comprised of **smaller species** with **higher turnover**.

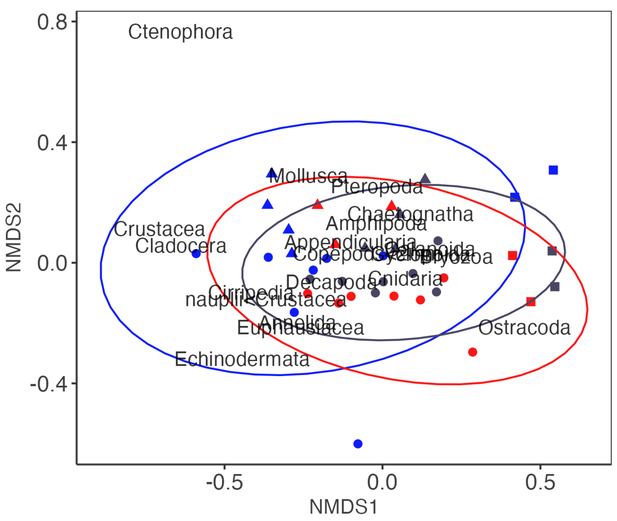


Figure 3. Non-metric multidimensional scaling (NMDS) ordination plot showing the zooplankton assemblage structure across sites and seasons. Taxa densities were logarithmically transformed prior to analysis

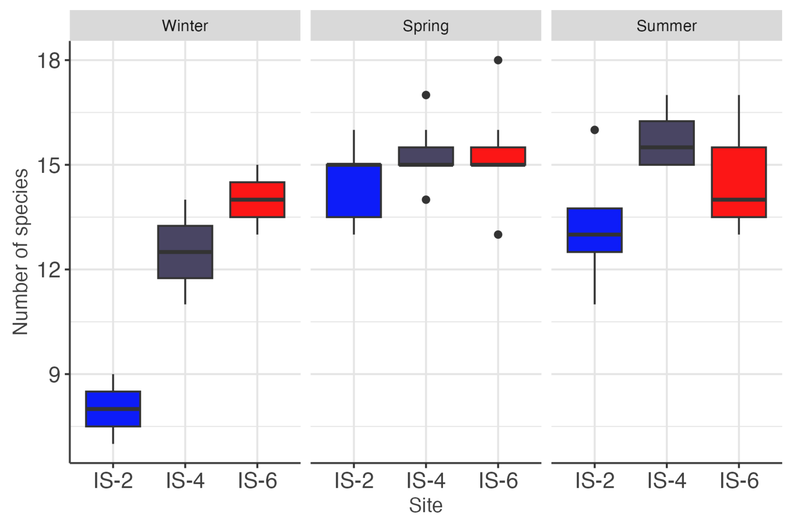


Figure 4. Variation in species richness across sites and seasons. Each box represents the interquartile range of species richness at each site and outliers are shown as individual points.

Despite the **shallowest sites (IS-2)** having the **highest density**, it has the **lowest number of species** across all seasons.

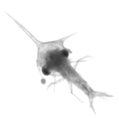
IS-2 has the **highest variability** in species composition. The **deeper sites (IS-4 and IS-6)** are more **similar** to each other and are more **stable** throughout the seasons.

Low biovolume and **species richness in IS-2** could be due to **less large overwintering species.**

CONCLUSIONS

Depth plays a role in structuring zooplankton assemblage composition.

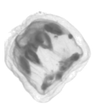
Zooplankton assemblages in **shallower** environments are **distinct** and have more **seasonal variability** compared to nearby deeper environments.



This variation in the zooplankton assemblage in the nearshore could be attributed to multiple factors including change in **depth**, **increased predation pressure** from forage fish, **increased mixing**, and **proximity to terrestrial influences** (such as fresh water or impacts of urbanization).

Future work:

Expand analysis to include additional years of zooplankton data (2015-2023).



Incorporate samples from different locations, including a more urbanized site for comparative analysis.

Investigate the influence of oceanographic drivers, such as temperature, salinity, and currents, on zooplankton community structure and dynamics.

Explore potential anthropogenic impacts, especially in urbanized areas, on zooplankton distribution and diversity.

ACKNOWLEDGEMENTS

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1. Pelagic Ecosystems Laboratory, University of British Columbia
2. Pacific Salmon Foundation