Inter- and intra-annual variability of zooplankton abundance in Saanich Inlet, B.C.

Mei Sato[1*], David Mackas[2], John Dower[3], Richard Dewey[3]

[1]School of Aquatic and Fishery Sciences, University of Washington, Seattle, U.S.A., *e-mail: meisato@uw.edu
[2]Institute of Ocean Sciences, Fisheries and Oceans Canada, Sidney, Canada
[3]School of Earth and Ocean Sciences, University of Victoria, Victoria, Canada

Abstract

Variability of zooplankton abundance in Saanich Inlet, British Columbia, is quantified using 200-kHz echosounder data collected through the VENUS cabled observatory. The continuous and high-resolution nature of our observations enables monitoring of zooplankton abundance in daily, seasonal and annual scales. By detecting seasonal changes in migration timing, area backscattering strength (S_a) of nocturnal backscattering layers is estimated. This study highlights the importance of high sampling resolution and long records for characterizing the variability and complexity in zooplankton populations.

I. Introduction

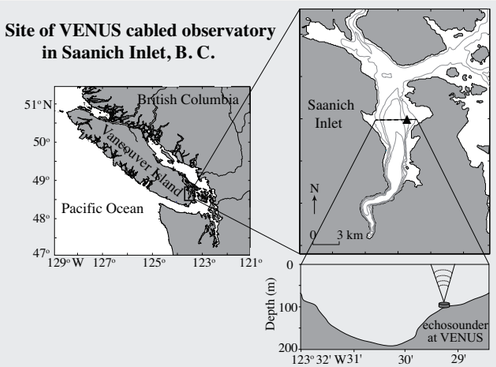
- Diel vertical migration (DVM) is a predator-avoidance strategy: organisms ascend to the surface waters at dusk, feed in the surface waters at night, and descend again at dawn to avoid visual predators.
- DVM timing relative to sunset/sunrise changes seasonally: early dusk ascent and late dawn descent occur during spring - fall, while late dusk ascent and early dawn descent occur during winter (Sato et al. 2013).
- Changes in migrating biomass can affect effciency of biological pump. Estimates of carbon transport by DVM of zooplankton range from 4-34% of the gravitational flux of organic particles (Hernandez-Leon et al. 2010).

Research Objective

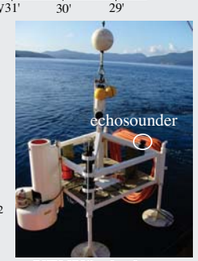
To quantify seasonal, inter- and intra-annual variability of zooplankton abundance in Saanich Inlet.

II. Methods

Site of VENUS cabled observatory in Saanich Inlet, B. C.

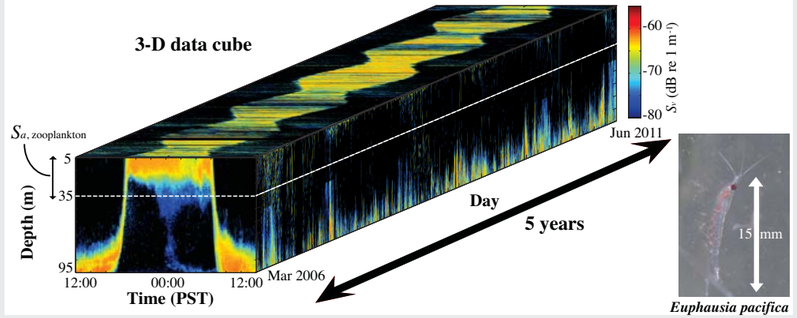


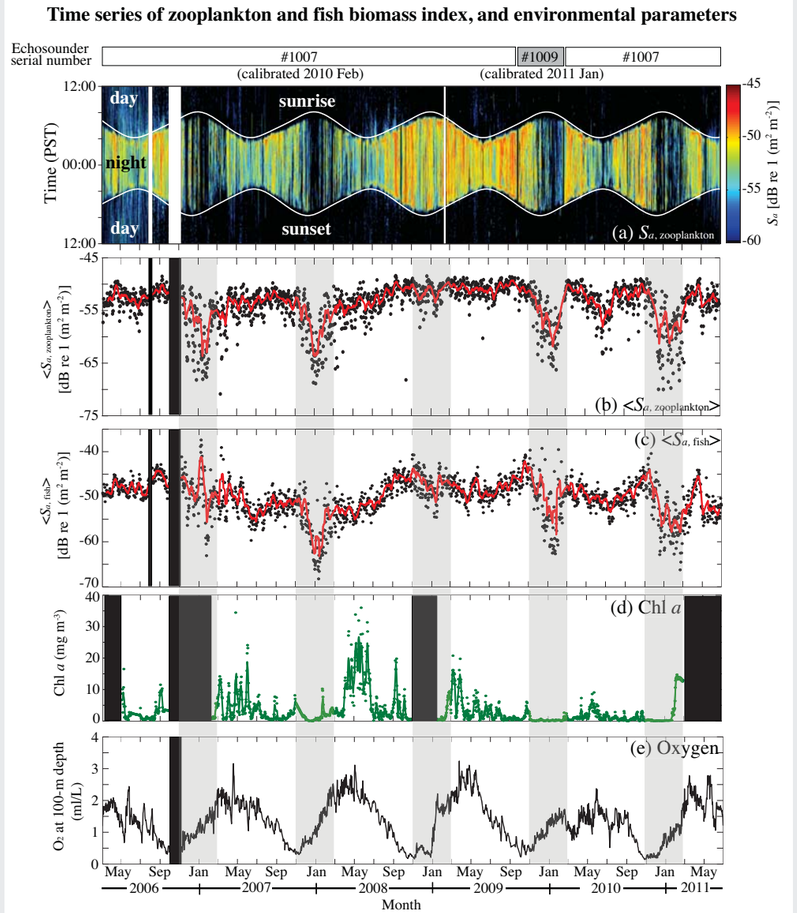
- Instruments
  200-kHz echosounder (ASL Env. Sci.) at 100 m
  CTD at 100 m
  Fluorometer at 8 m
- Groundtruthing: zooplankton community was sampled during sunset/sunrise in Apr, Jun, Jul 2010, Oct, Dec 2011, and Feb 2012 using a 1 m^2 Tucker trawl (1 mm mesh).



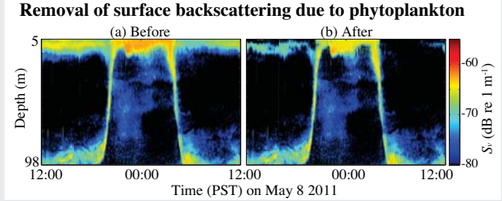
VENUS platform

III. Observations

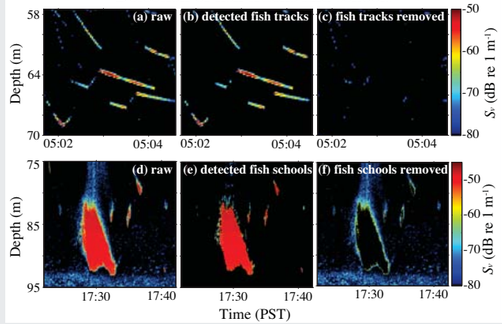




Removal of surface backscattering due to phytoplankton

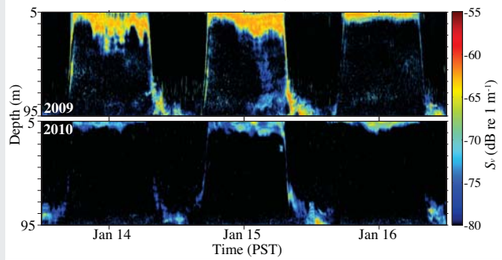


Detection of fish tracks and schools



Comparison of DVM patterns in winter

- Strong DVM throughout winter 2009 corresponds to strong phytoplankton blooms in fall 2008 and early blooms in Feb 2009.
- DVM in most winters is weak throughout the water column.



IV. Conclusions

- $<S_{a,\ zooplankton}>$ reaches maximum in fall when euphausiids become adult, while its minimum occurrs in winter with > 10 dB decrease from the peak value.
- Continuous DVM throughout the winter during Nov 2008 - Mar 2009 is the only exception to the low backscattering in winter.
- 3-D data cube can be used as biomass index for zooplankton monitoring through cabled observatory.

References

- Sato et al. 2013. Second-order seasonal variability in diel vertical migration timing of euphausiids in a coastal inlet. MEPS 480: 39-56.
- Hernandez-Leon et al. 2010. Carbon sequestration and zooplankton lunar cycles: Could we be missing a major component of the biological pump? L&O 55: 2503-2512.

Acknowledgements

We thank the VENUS staff, ASL Environmental Sciences, J. Gower, Capt. K. Brown and the crew of MSV *Strickland*, and J. Horne. We are grateful for support from the U.S. Office of Naval Research, the NSERC Discovery Grants Program and University of Victoria.