Vertical Zooplankton Distribution on Continental Slope off Oregon Coast

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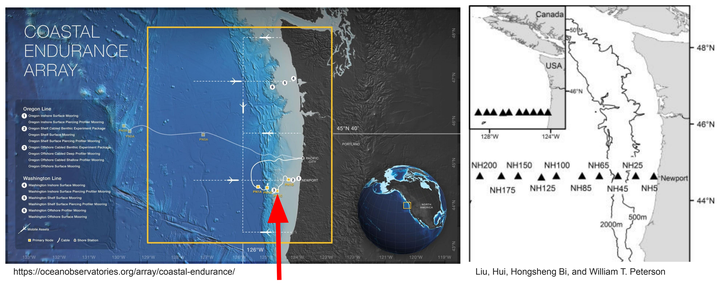
Introduction

- *NH-Line Hydrographic and Zooplankton Time Series* takes biweekly measurements of zooplankton biomass at sites off the coast of Newport, Oregon
- OOI Endurance Array now located near NH-Line sampling sites
- Bioacoustic sonar systems capture long-term, high temporal-resolution, high depth-resolution data of biomass in the water column
- Correlating this new, high-resolution data and the many prior years' data from the NH-Line Time Series will create a powerful new dataset from which greater understanding of both short-term and long-term movements in the water column may be developed

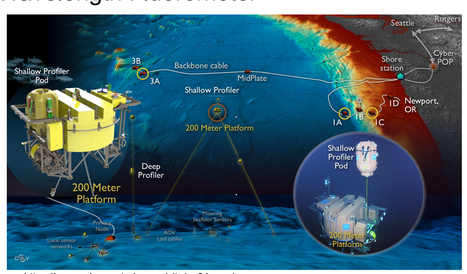
Methods and Instruments

- OOI: Oregon Offshore Cabled Shallow Profiler Mooring (CE04OSPS)
- Comparing with NH-Line Time Series Data



https://oceanobservatories.org/array/coastal-endurance/ Liu, Hui, Hongsheng Bi, and William T. Peterson

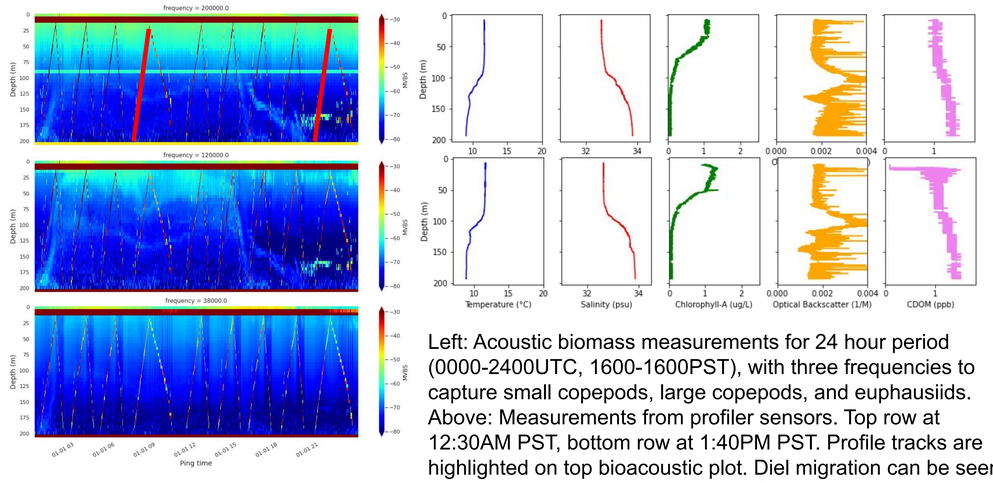
- EK-60 Bio-Acoustic Sonar located on 200m platform
- Profiler Instruments
  - CTD
  - 3-Wavelength Fluorometer



https://oceanobservatories.org/site/ce04osps/

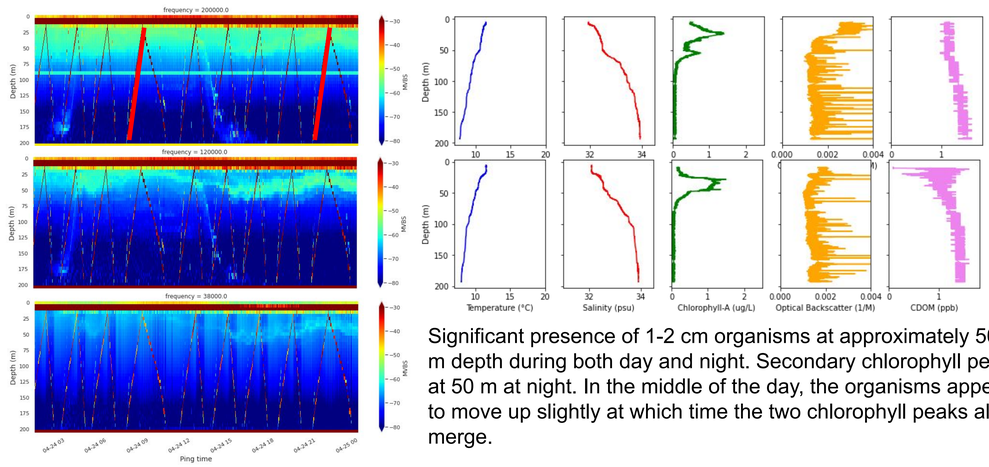
- Bioacoustic sonar file conversion and data analysis performed with echopype using Google Colab notebooks

January 1, 2019



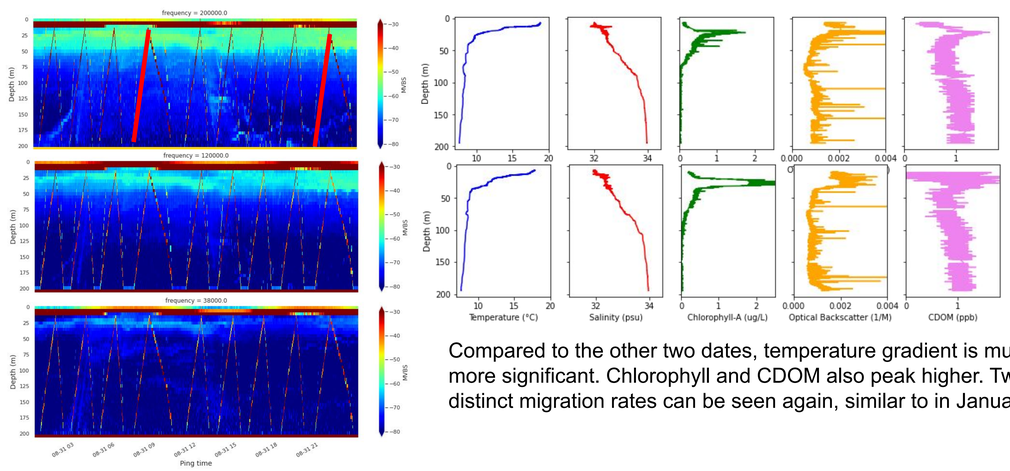
Left: Acoustic biomass measurements for 24 hour period (0000-2400UTC, 1600-1600PST), with three frequencies to capture small copepods, large copepods, and euphausiids. Above: Measurements from profiler sensors. Top row at 12:30AM PST, bottom row at 1:40PM PST. Profile tracks are highlighted on top bioacoustic plot. Diel migration can be seen particularly well in the second plot. Two distinct migration rates of approximately 1.4 cm/s and .2 cm/s are visible.

April 24, 2019



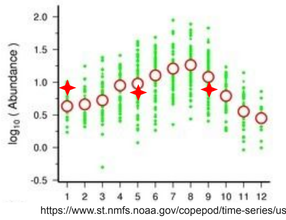
Significant presence of 1-2 cm organisms at approximately 50 m depth during both day and night. Secondary chlorophyll peak at 50 m at night. In the middle of the day, the organisms appear to move up slightly at which time the two chlorophyll peaks also merge.

August 31, 2019



Compared to the other two dates, temperature gradient is much more significant. Chlorophyll and CDOM also peak higher. Two distinct migration rates can be seen again, similar to in January.

Discussion and Comparison



Plot shows abundance from NH-5 data with three estimated abundances from the 120 kHz (least noisy) Sonar shown with ✦

https://www.st.nmfs.noaa.gov/copepod/time-series/us-50501/

- Significant noise in the data means that, while qualitative analysis is possible, quantitative analysis similar to that done with the NH data would require better quality control and denoising routines
  - In January and April data, as the profiler descends normally, the backscattering strength decreases. When descending slower for additional measurements, strips of greater and less backscattering strength exist

Conclusions and Next Steps

- Diel migration and trends (rates, times, and differences in rates) very clearly observable
- More dates would be required to observe seasonal trends, but initial observations show interesting differences in frequency of highest backscattering strength and depth of peaks of backscattering strength
- Benefit of OOI data is long-term, high temporal-resolution. This work looks only at short events, but next step would be performing similar analysis on the entire continuous time dataset
  - Depth of maximum biomass as a function of day of year
  - Integral of biomass as a function of day of year (and compare to NH Time Series)

References

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Lee, Wu-Jung, Kavin Nguyen, and Valentina Staneva. 2019. "Echopype: Toward Interoperable and Scalable Ocean Sonar Data Processing". ESIP. doi:10.6084/m9.figshare.8942312.v1.

Acknowledgements

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