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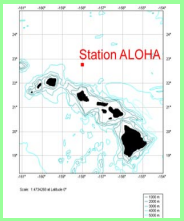
Assessing decadal change in zooplankton community function:
a case study from the subtropical North Pacific Ocean

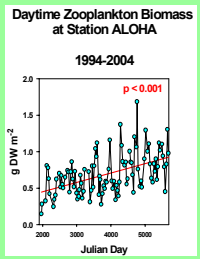
Background

My goal is to understand climate-induced variation in marine zooplankton community function. This project focuses on changes in ecosystem function at Station ALOHA (22.45ºN, 175ºW), located in the subtropical North Pacific Ocean. Station ALOHA is a major sampling site for the 15-year old Hawaii Ocean Time-series (HOT) program.

Multidisciplinary studies conducted at Station ALOHA have focused on:

- water mass movement
- elemental cycles
- nutrient dynamics
- phytoplankton physiology
- microbial diversity
- plankton food webs





We recently observed a significant increase in zooplankton biomass over the past ten years at Station ALOHA. My goal is to link this change in zooplankton community structure with concurrently observed changes in subtropical marine ecosystem function.

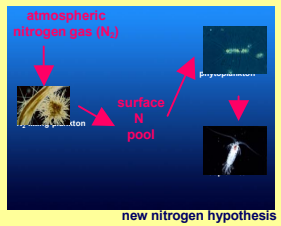
Research Foci

It is likely that long-term change in the subtropical North Pacific zooplankton community is connected to climate-induced perturbation of allochthonous, or "new" nitrogen sources.

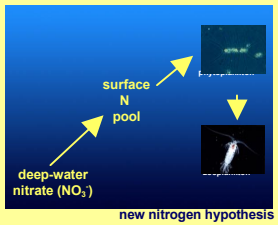
Two scenarios could explain how perturbation of new nitrogen sources has altered the subtropical North Pacific food web.

EITHER:

(1) enhanced nitrogen fixation by unicellular and colonial cyanobacteria



new nitrogen hypothesis 1



new nitrogen hypothesis 2

or (2) increased entrainment of deep-water nitrate

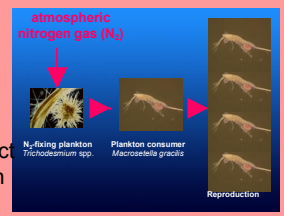
may have resulted in enhanced zooplankton production and biomass at Station ALOHA.

Research Highlights

An Ecosystem Approach

My first approach focuses on the trophic link between a N_2-fixing plankton (*Trichodesmium* spp.) and its primary consumer (the copepod *Macrosetella gracilis*).

Assessing long-term change in reproduction of *M. gracilis* will allow me to qualitatively evaluate the impact of nitrogen-fixation on the subtropical food web.



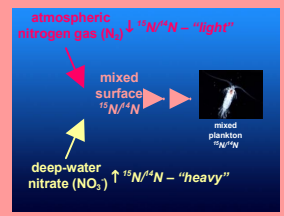
A Biochemical Approach

My second approach focuses on differences in the ratio of heavy (^{15}N) and light (^{14}N) isotopes between "new" nitrogen sources.

Measurement of nitrogen isotopic ratios ($^{15}N/^{14}N$) in plankton will allow me to quantitatively assess the contribution of nitrogen fixation to the subtropical food web.

I will focus on
- bulk isotope &
- CSIA

measurements.



Significance

Despite more than 20 years of observations, the impact of climate variability on plankton, fish and seabird populations remains poorly understood. My project will significantly advance our understanding of climate forcing on marine plankton communities.

This study is unique in that it:

- Will link long-term change in a zooplankton community to microbial food web dynamics
- Can be used to connect temporal variation in the subtropical environment with long-term change in other North Pacific ecosystems
- Will apply a novel isotopic approach to time-series research on plankton communities
- Will help to distinguish between top-down and bottom-up climate forcing of marine ecosystems

Acknowledgements

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