# MEIOFAUNAL COMMUNITY STRUCTURE ACROSS AN OMZ TRANSECT OFF SAN DIEGO, CALIFORNIA


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## ABSTRACT

*Oxygen minimum zones (OMZs) play a major role in the global carbon system and strongly influence the distribution of benthic marine communities. Metazoan meiofauna was studied in sediment samples collected by multiple corer off San Diego, southern California to examine the influence of the OMZ (< 0.5 ml L$^{-1}$) on community structure. Six sites were sampled along a depth transect across the continental margin, spanning from the upper slope above the OMZ (300 m) to the mid mid continental slope (1200 m) beneath the OMZ. By using meiofauna samples collected during two seasons (July and December) during 2012, we tested the hypothesis that variation in organic matter availability and bottom-water oxygen concentrations would be reflected in changes in meiofauna community density, composition and vertical distribution in the sediment. Overall, 21 meiofaunal taxa were found. Meiofaunal communities along the OMZ did not respond to oxygen thresholds as expected. Mean meiofauna densities (core depth 0-10 cm) ranged from 202 to 456 ind 10 cm$^{-2}$ in July, and from 235 to 530 ind 10 cm$^{-2}$ in December, respectively. In contrast to other nearby oxygenated sites or other OMZ settings of the eastern Pacific OMZ, where hypoxic conditions are more intense, unexpectedly low nematode and relatively high copepod densities within the OMZ core (~0.2 ml L$^{-1}$) were found. Changes in community composition with depth and season may be the result of top-down (predation) influences and bottom-up control (organic matter) as well as other environmental parameters.*


## INTRODUCTION

In contrast to the coastal areas that typically experience only episodic or seasonal hypoxia, continental margins intercepted by OMZs are permanently hypoxic in the deep sublittoral to bathyal benthic environment, creating strong gradients of bottom-water oxygen concentrations and organic matter input.

The most common benthic system response to OMZ conditions is altered size structure. At very low oxygen levels (<0.1 ml/l) the fauna often consists of **meiofaunal size organisms**. Past literature suggests that meiofaunal communities intercepted by oxygen minima:

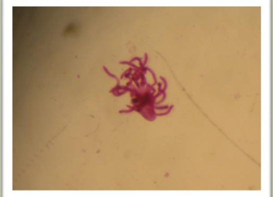
- **Exhibit high abundance but low taxonomic diversity, and**
- **Exhibit high nematode density at lowest oxygen levels.**

*Nematoda*

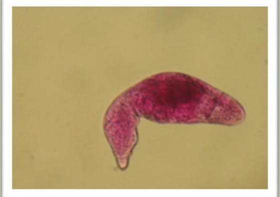
Harpacticoidea

Aplacophora

Kinorhyncha



*Hydrozoa*



Turbellaria

The following questions were addressed:

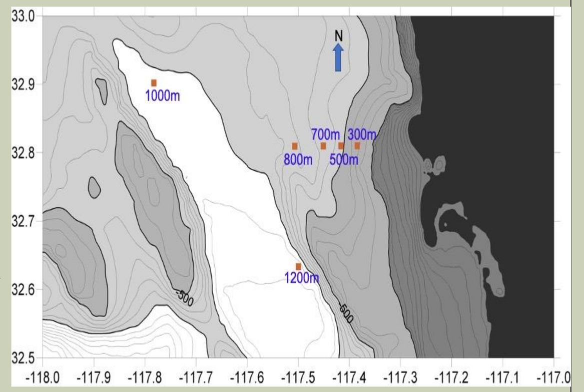
- *Are there differences in meiofaunal biodiversity (taxon richness) and assemblage structure among sites? And,*
- *Temporally between periods?*

## MATERIALS AND METHODS

- 2 cruises – July (MV1209) and December (MV1217) 2012 off San Diego.
- At 6 sites along a transect across the OMZ (300, 500, 700, 800, 1000, and 1200 m water depth) sediments were sampled in triplicate using a multicorer. From each replicate, two subsamples were taken simultaneously for meiofauna and sediment properties. Sediment cores were sectioned at the vertical intervals of 0-1, 1-2, 2-3, 3-5, and 5-10 cm.

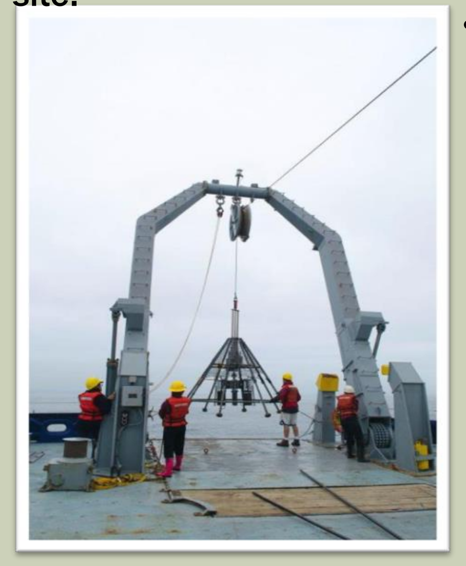
## MATERIALS AND METHODS

- Metazoan meiofauna were extracted by successive suspension and decantation on a 40 μm mesh. Meiofauna were counted and identified at higher taxon level.
- Environmental variables and their impact on community structure were examined for each study site.



Sampling sites visited during the San Diego Coastal Expedition.

- Here we present the results based on the top 10 cm sediment layer from multicore tubes.



Sampling Process: Multicorer recovery (FAR LEFT) Sediment Processing (RIGHT, UP).

## RESULTS

Table 1. Environmental parameters, for both sampling periods.

MV1209 July 2012

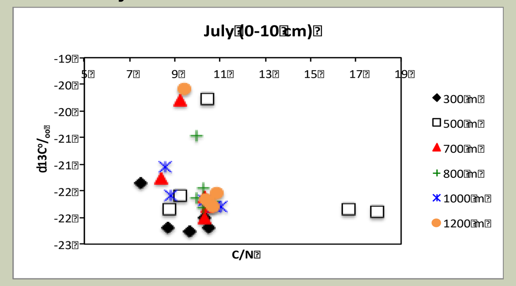
| Site (Depth) | DO ml/L | T | S | pH | TOC | Chl a/Phae ratio | chl a/TOC ratio | NPP* |
|---|---|---|---|---|---|---|---|---|
| 300 m | 0.8228 | 9.2597 | 34.297 | 7.593 | 0.762 | 0.88 | 7.70 | 675.44 |
| 500 m | 0.3564 | 6.818 | 34.306 | 7.551 | 1.004 | 1.54 | 14.76 | 687.00 |
| 700 m | 0.1958 | 5.7354 | 34.36 | 7.545 | 1.045 | 1.04 | 13.89 | 675.44 |
| 800 m | 0.209 | 5.0896 | 34.407 | 7.552 | 1.183 | 0.78 | 10.29 | 633.44 |
| 1000 m | 0.4092 | 4.0297 | 34.479 | 7.583 | 0.89 | 0.77 | 13.53 | 484.11 |
| 1200 m | 0.5566 | 3.6724 | 34.468 | 7.596 | 1.151 | 0.95 | 8.24 | 507.22 |

*Surface Net primary production (mgC m$^{-2}$ d$^{-1}$) (Courtesy M. Kahru)

MV1217 December 2012

| Site (Depth) | DO ml/L | T | S | pH | TOC | Chl a/Phae ratio | chl a/TOC ratio | NPP* |
|---|---|---|---|---|---|---|---|---|
| 300 m | 1.54 | 8.6137 | 34.145 | 7.654 | 1.565 | 0.41 | 2.20 | 675.44 |
| 500 m | 0.35 | 6.6217 | 34.313 | 7.566 | 2.194 | 0.96 | 7.15 | 687.00 |
| 700 m | 0.26 | 5.8975 | 34.348 | 7.555 | 2.161 | 0.46 | 9.45 | 675.44 |
| 800 m | 0.29 | 5.0491 | 34.405 | 7.561 | 0.980 | 0.37 | 9.56 | 633.44 |
| 1000 m | 0.44 | 4.1685 | 34.476 | 7.581 | 2.116 | 0.34 | 4.91 | 484.11 |
| 1200 m | 0.58 | 3.8231 | 34.501 | 7.591 | 2.075 | 0.33 | 4.42 | 507.22 |

July 2012





December 2012

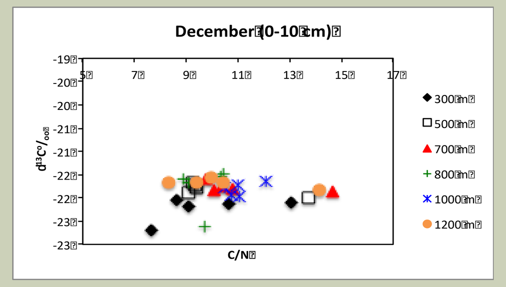




*Figure 1. Changes in relationship between C/N ratio and δ$^{13}$C-TOC occurred in the two seasons (top 10 cm sediment).*

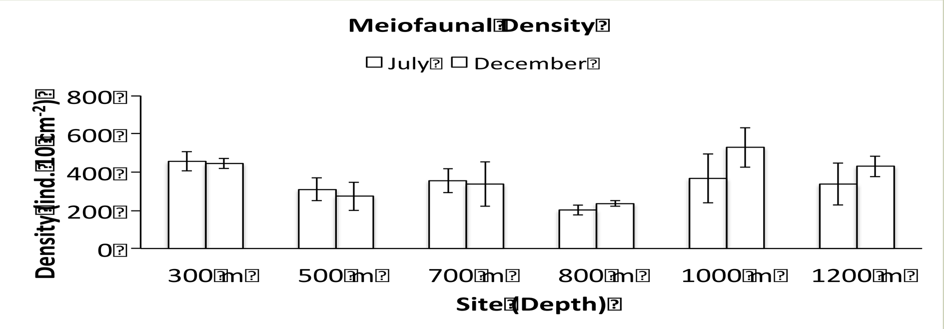
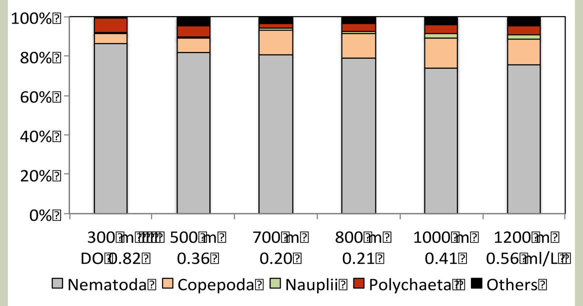




*Figure 2. Total meiofaunal densities did not vary significantly.*



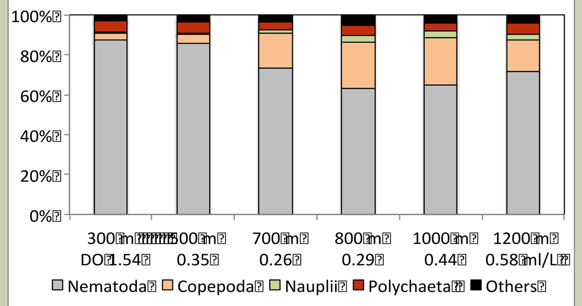
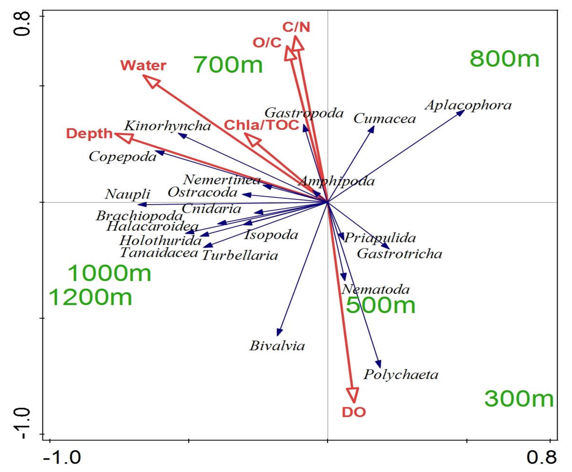




Figure 3. Meiobenthic communities did not respond to oxygen thresholds as expected.

## RESULTS CONT.

July 2012



December 2012

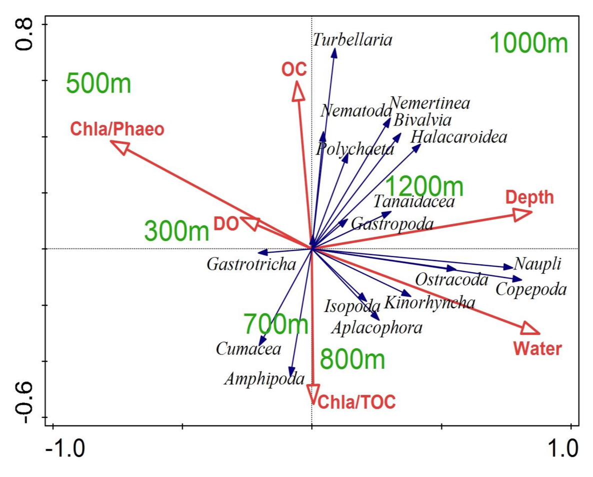
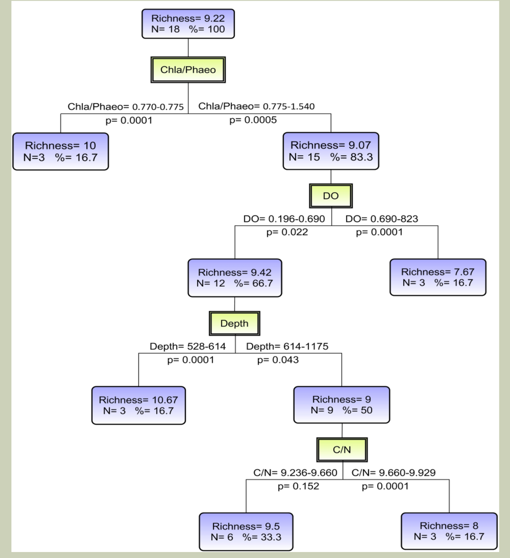


*Figure 4. Environmental variables that best explained variation in meiofaunal taxa among sites and periods.*

July 2012



December 2012

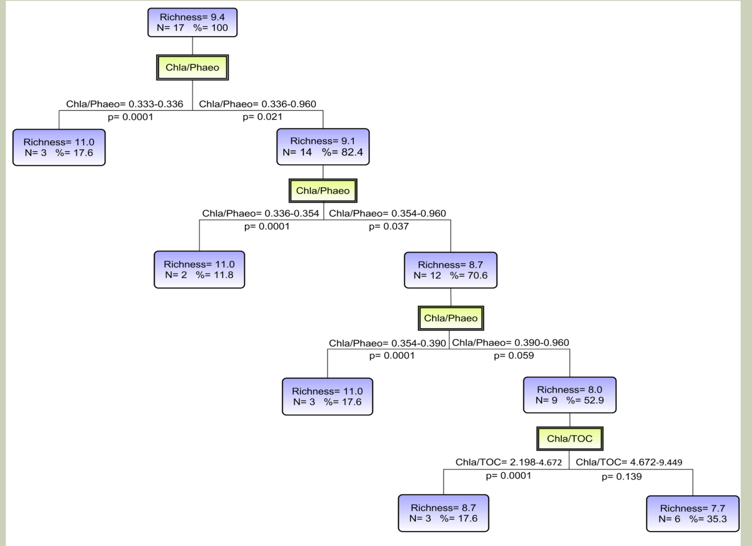


*Figure 5. Freshness of organic matter appears to be the primary explanatory variable in meiofaunal taxon richness variation.*

## CONCLUSION / DISCUSSION

- Meiobenthic communities along the OMZ off San Diego did not respond to oxygen thresholds as expected, e.g., increase in copepods and nauplii and reduction in nematodes in the OMZ.
- Meiobenthic biodiversity within the OMZ was not significantly reduced.
- Other environmental parameters, and indicators (TOM, OM freshness, Temperature, Salinity, pH), though significantly different between the two periods, do not significantly influence the meiobenthic community.
- Freshness of OM appears to be the primary explanatory variable in taxon richness variation. DO, C/N ratio and depth were secondary variables in July, while in December it was the bioavailability of OM.
- Differences in community composition may be a result of Top-Down (predation) control by macrofauna and Bottom-Up control (OM), being more susceptible to changes in oxygen, or other environmental parameters.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