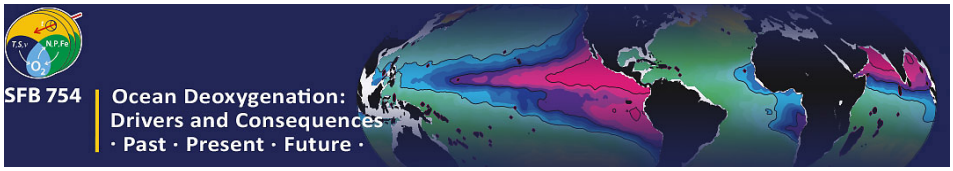

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In situ respiration rates of meso- and bathypelagic animals

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In order to understand the effects of deoxygenating oceans on their inhabitants, we need accurate assessments of the animals' oxygen consumption rates and their ability to regulate their metabolism under the conditions where they normally live. While an abundance of metabolic rate data for many meso- and bathypelagic species is available in the literature, these determinations were made primarily by taking animals that were captured by net, extracted from the depth/pressures that they normally experience, and then incubated at atmospheric pressure in the lab. More recent collections often utilized submersibles and more gentle collection techniques, thus reducing the trauma of collection; but the incubations are still primarily made after forced decompression, under laboratory conditions quite different from the animals' natural environment. An exception to these methods was a short-lived, in situ midwater respiration system developed at Harbor Branch Oceanographic Institution (HBOI) in the late 1980s, where initial experiments showed evidence of significantly higher in situ respiration rates 2 to 5 times higher in two ctenophores species, a trachymedusa and a pelagic holothurian than those obtained in the laboratory. Unfortunately, that system was compromised before further experiments could be conducted.

In an effort to determine if removing deep-sea animals from their natural environment affects their respiration rates, MBARI developed an ROV-deployed, in situ Midwater Respirometry System (MRS) similar to that of the original HBOI system. Newer and more stable electronics and optical sensors, as well as quartz-walled chambers and circulating, flushing and injection pumps have been incorporated into the MBARI MRS. The result is a very stable system that allows us to manipulate conditions within the chambers, as needed, for a particular experiment. The MRS enables us to collect animals at depth and then deploy the MRS module on a mooring in the midwater for 24 to 48 hours at the approximate depth of collection, while continuous oxygen measurements are made.

We will present the results of over 10 years of MRS-derived respiration rates for a variety of midwater and bathypelagic fish, jellies, cephalopods, worms and crustaceans collected between 200 to 3000 m in depth. The in situ rates will then be compared to parallel rates determined in our shipboard and shore-based labs, as well as those found in the literature.

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