2-2004

Trophic Ecology of the Deep-Sea Fish *Malacosteus niger* (Pisces: Stomiidae): An Enigmatic Feeding Ecology to Facilitate a Unique Visual System?

Tracey Sutton

Harbor Branch Oceanographic Institution, Inc, tsutton1@nova.edu

Follow this and additional works at: https://nsuworks.nova.edu/occ_facpresentations

Part of the [Marine Biology Commons](#), and the [Oceanography and Atmospheric Sciences and Meteorology Commons](#)

NSUWorks Citation

Sutton, Tracey, "Trophic Ecology of the Deep-Sea Fish *Malacosteus niger* (Pisces: Stomiidae): An Enigmatic Feeding Ecology to Facilitate a Unique Visual System?" (2004). *Marine & Environmental Sciences Faculty Proceedings, Presentations, Speeches, Lectures*. 244.
https://nsuworks.nova.edu/occ_facpresentations/244

This Conference Proceeding is brought to you for free and open access by the Department of Marine and Environmental Sciences at NSUWorks. It has been accepted for inclusion in Marine & Environmental Sciences Faculty Proceedings, Presentations, Speeches, Lectures by an authorized administrator of NSUWorks. For more information, please contact nsuworks@nova.edu.

Sutton, T. T., Harbor Branch Oceanographic Institution, Fort Pierce, USA, tsutton@hboi.edu

TROPHIC ECOLOGY OF THE DEEP-SEA FISH MALACOSTEUS NIGER: AN ENIGMATIC FEEDING STRATEGY SUPPLIES CHLOROPHYLL FOR VISION?

The 'dragonfishes' and their relatives (family Stomiidae) are among the top predators of the mesopelagic zone of the open ocean. Based on feeding morphology (e.g., large gape, long fangs, and no gill-rakers or ethmoid membrane), the meso/bathypelagic fish *Malacosteus niger* would also be expected to be a large-item predator, as are the other members of its family. However, analysis of specimens from different ocean basins revealed that the most common prey items are calanoid copepods, despite an apparent inability to handle such small prey. *Malacosteus niger* is considered advanced within the Stomiidae, so this feeding mode represents a secondary reversion to planktivory. Feeding mechanics are unknown, but the integration of trophic, visual and distributional ecology may explain this finding. *Malacosteus niger* is unique in the possession of a chlorophyll-derived photosensitizer (bacterial pheophorbide), which it uses to see its own far-red bioluminescence. This pigment, whose synthesis by vertebrates is unlikely, may be incorporated through an anaerobic phototrophic bacteria (protist?)-copepod-fish trophic linkage. In essence, the atypical diet of *Malacosteus niger* may be driven by the need for this pigment rather than by energetics per se.

Suzuki, Y., Shizuoka University, Shizuoka, Japan, seysuzu@ipc.shizuoka.ac.jp;
Haneda, A., Shizuoka University, Shizuoka, Japan, ayayah@hotmail.com;
Fujii, M., National Environmental Research Institute, Tsukuba, Japan, fujii@nies.go.jp;
Smith, L., Frontier Research System, Yokohama, Japan, lanimal@jamstec.go.jp

ROLE OF DECOMPOSITION, AGGREGATION AND DISSOLUTION OF DIATOMS IN THE SINKING FLUX OF ORGANIC MATTER TO THE MESOPELAGIC LAYER

Diatoms play an important role in the biological pump of CO₂. The contribution of diatoms to the biological pump depends on the fate of diatoms via their production, decomposition, aggregation and dissolution in the pelagic layer. We have tried to clarify coupling of organic matter decomposition and biogenic silica dissolution with laboratory experiment. We also compared observations in the field and model calculation using parameters obtained from laboratory experiments. Two different incubation experiments were conducted in the dark, at constant temperature: 1) decomposition and aggregation experiments using *Skeletonema costatum* which is cultivated phytoplankton, 2) decomposition and dissolution experiments using natural seawater collected at depths of 20m, 100m, 800m. We found that there are strong co-relationship among rates of decomposition, aggregation and dissolution, these three processes depend on temperature and initial size of fresh phytoplankton, not concentration of organic matters. An increase of 10 degree C in water temperature doubled the rate constant of decomposition, aggregation and dissolution. Our results suggest that the structure of the ecosystem and mineral and organic matter content of organisms controls the sinking flux of organic matter.

Swan, C., University of California Santa Barbara, Santa Barbara, CA, USA, swan@lifesci.ucsb.edu;
Prezelin, B. B., University of California Santa Barbara, Santa Barbara, CA, USA, prezelin@lifesci.ucsb.edu

UVA PHOTOECOLOGY OF SUBSURFACE CHLOROPHYLL-A MAXIMA OF THE SANTA BARBARA CHANNEL

Our findings suggest UVA radiation (320-400nm) may be a significant control on the vertical distribution of subsurface Chl-a maxima within the Santa Barbara Channel. Data presented comprise 25 days spanning all four seasons of 1998, and include coverage of water masses with diverse hydrographic characteristics and phytoplankton community composition. Values are based upon in situ GUV-PUV determinations of the UV-PAR underwater light field, and upon coincident CTD-fluorescence profiles. 92% of Chl-a maxima studied were located at depths characterized only by UVA-PAR light fields [i.e., where no UVB (280-320nm) was present]. Chl-a maxima were never localized in PAR-only light environments. Our dataset is further supported by in situ drifter determinations of UV effects on phytoplankton pigmentation and primary production. Certain UVA wavelengths affect PAR-based primary production by inhibiting carbon fixation as much as 10%, and/or enhancing PAR-based production by up to 30% (Mengel and Prezelin, this conference). We continue to assess whether subsurface Chl-a maxima are associated with a definable range of UVA-PAR, and whether this ratio is a tool for estimating UVA controls on marine primary production and bio-optical properties.

Swift, J. H., UCSD Scripps Institution of Oceanography, La Jolla, USA, jswift@ucsd.edu

FIRST HYDROGRAPHIC RESULTS FROM THE 2003 SBI SURVEY CRUISE

The primary scientific goal of the Arctic Shelf-Basin Interactions (SBI) 2003 Survey cruise, 05 July - 20 August on R/VIB Nathaniel B. Palmer, was to carry out a CTD/IADCP/O2/nutrient/chl-a survey of the outer shelf and slope of Chukchi and Beaufort seas. The survey included high-resolution sections (5 km station spacing) across key regions, covered the entire SBI study area more comprehensively than feasible during other SBI cruises, and repeated two of the intensely-sampled sections during the cruise.

The 329 stations provided a finely detailed, coherent view of the variations across the shelf and continental slope. A potpourri of early results includes: identifying and tracing two shelf water masses from their regions of origin, through Barrow Canyon, and into the slope regime; clear identification of shelf-influenced intermediate waters over the slope, and the transition to basin interior characteristics; observations across several eddies; and a surprise finding of a strong broad westward flow of upper layer water 75 km off the Beaufort slope with nearly identical properties to those over the slope itself.

Swope, B. L., University of San Diego, San Diego, USA, bswope@sandiego.edu;
Kaufmann, R. S., University of San Diego, San Diego, USA, kaufmann@sandiego.edu

SPATIAL AND TEMPORAL DYNAMICS OF PHYTOPLANKTON IN MISSION BAY OVER A COMPLETE ANNUAL CYCLE

Mission Bay is a shallow estuary flushed primarily by tidal circulation. The eastern region of the bay receives little or no tidal flushing, compared to areas closer to the mouth. From November 2002 through November 2003, biweekly sampling was conducted at six sites within Mission Bay. Hydrographic, nutrient, and phytoplankton abundance data were gathered at each site. Spatial variation in sea surface temperatures was observed, with temperature differences up to 8.1 degrees Celsius between sites located near the mouth and back bay during the summer. Nutrient levels also varied spatially, with highest concentrations in the back regions of the bay, decreasing with proximity to the ocean. Areas with higher nutrient concentrations generally had lower phytoplankton diversity, while the regions with lower nutrient concentrations had higher phytoplankton diversity. Distinct fluctuations were observed between communities dominated by either diatoms or dinoflagellates, with pronounced seasonal shifts in the east bay. Phytoplankton densities generally were highest when diatoms dominated the community. Densities fluctuated throughout the year, with peaks in abundance observed during the spring and summer months.

Sydor, M., University of Minnesota Duluth, Duluth, USA, msydor@d.umn.edu;
Arnore, R. A., Naval Research Laboratory, Stennis Space Center, USA, arnora@nrlssc.navy.mil;
Gould, R. W., Naval Research Laboratory, Stennis Space Center, USA, gould@nrlssc.navy.mil;
Goode, W. M., Naval Research Laboratory, Stennis Space Center, , goode@nrlssc.navy.mil

THE QUESTION OF UNIQUENESS IN REMOTE SENSING OF THE INHERENT OPTICAL PROPERTIES OF OCEAN WATER

We examine the problem of uniqueness in the relationship between the Remote Sensing Reflectance (Rrs) and the Inherent Optical Properties of ocean water (IOPs). The results point to the fact that diffuse reflectance of plane irradiance is inherently ambiguous. Furthermore, in the 400 to 750 nm region of the spectrum, Rrs also suffers from ambiguity caused by the similarity in the wavelength dependence of the absorption coefficients due to particulate and Color Dissolved Organic Matter (CDOM). The two absorption coefficients have overlapping exponential response leading to the fact that more than one combination of IOPs can produce nearly same Rrs spectrum. This ambiguity in absorption parameters demands that we identify the regions of Rrs spectrum where we can isolate the effects that can be attributed only to the scattering by particulate and the absorption by pure water. Our results indicate that the spectral shape of the absorption coefficient by phytoplankton, *aph*, cannot be derived from multi-parameter fit to Rrs. However, its magnitude and its spectral dependence can be estimated from the difference between measured Rrs and the best fit to Rrs in terms of IOPs that exclude *aph*. We answer two questions: Why are algorithms for IOPs not global especially in presence of CDOM? Why do we need hyperspectral measurements of Rrs rather than measuring Rrs at few well-placed wavelengths in order to retrieve IOPs from Rrs data?

Tafader, M. K., Institute of Marine Sciences, Chittagong, Bangladesh, tafader_ims@yahoo.com;
Zafar, M., Institute of Marine Sciences, Chittagong, Bangladesh;
Chowdhury, M. I., Radioactivity Testing and Monitoring Laboratory, Chittagong, Bangladesh;
Alam, M. N., Bangladesh Atomic Energy Commission, Chittagong, Bangladesh

ASSESSMENT OF RADIOACTIVITY IN SOIL, SEDIMENT AND GRASS ON KUTUBDIA ISLAND IN BANGLADESH USING HIGH RESOLUTION GAMMA-RAY SPECTROMETRY

A series of measurements have been conducted to study the concentration of natural radionuclides (U-series, Th-series and K-40) and artificial radionuclides (Cs-137) in the soil, sediment and grass on Kutubdia island in the Chittagong region of Bangladesh. A total of 33 soil samples, 30 grass samples and 10 sediment samples were collected and then the measurements were carried out using gamma-ray spectrometry with a high purity germanium detector, coupled with Personal Computer Analyzer Sierra-2008. The exact isotopes used were Th-232, Th-228, Ra-226, K-40 and Cs-137. The ranges and average values of activity concentration were calculated in Bq/kg for each isotope in soil, sediment and grass. The results revealed that the activity of K-40 in soil samples has been found to be relatively higher than that of other places in the Chittagong region. The activity of Cs-137 in soil samples varies. The maximum activity of Cs-137 was found to be 8.66±0.50 Bq/kg in the sediment samples and in almost all the grass samples the activity was below detection level.

Tagliabue, A., Stanford University, Stanford, USA, atag@ocean.stanford.edu;
Arrigo, K. R., Stanford University, Stanford, USA, arrigo@ocean.stanford.edu

THE IMPORTANCE OF IRON CYCLE COMPLEXITY WHEN PREDICTING C-CYCLE RESPONSE TO FE FERTILIZATION

Ecosystem models currently use iron (Fe) cycles of varying detail and complexity, from simple, one species models to more mechanistic parameterizations including a variety of chemical and biological processes. How sensitive are model predictions of carbon cycling to the detail of the Fe cycle when simulating Fe fertilization? In this study we present a new version of the CIAO model of the Ross Sea (Antarctica), parameterized to include phosphate, the carbonate system, and an Fe cycle of varying complexity. We examine the overall impact of Fe fertilization and shifts in the taxonomic composition of the phytoplankton on the Ross Sea carbon cycle. Model results were found to exhibit a high degree of spatial heterogeneity; dependent on both existing degree of Fe supply and biological pump efficiency, and variability in taxon-specific Fe demands. The impact of including a more mechanistic Fe cycle, including Fe²⁺ and Fe³⁺, photoproduction, scavenging, and redox reactions is assessed. Model predictions are compared and contrasted and the necessary detail required of the modeled Fe cycle will be discussed.