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Predicting Biodiversity Patterns in Deep Water Coral Ecosystems: Lessons from Phylogenetic Studies of Shallow Water Coral Reef Crustacea

James Darwin Thomas
Nova Southeastern University, thomasjd@nova.edu

Thigpen, J. F., North Carolina Sea Grant, Raleigh, USA, jack_thigpen@ncsu.edu;
Bacon, R. H., South Carolina Sea Grant Consortium, Charleston, USA, robert.bacon@scseagrant.org ;
Spence, L., SE -COSEE, Charleston, USA, lundie.spence@scseagrant.org;
Spranger, M. S., Florida Sea Grant, Gainesville, USA, msspranger@mail.ifas.ufl.edu ;
Gates, K. W., Georgia Sea Grant, Brunswick, USA, kgates@uga.edu;
Goble, P. G., Florida COSEE, ST Peterburg, USA, pcoble@marine.usf.edu;
Esliger, S., SC Sea Grant Consotium, Charleston, SC, USA, Sandy.Eslinger@scseagrant.org

INTEGRATING OUTREACH AND EDUCATION INTO A REGIONAL OBSERVING SYSTEM: THE SEA-COOS EXAMPLE

The South East Atlantic Coastal Ocean Observing System (SEA-COOS) is organized into four working groups: 1)observing, 2) data management, 3) modeling, and 4) outreach and education. The goal of the outreach and education workgroup is to identify non-scientific users of ocean observation information, the specific information needed and the preferred delivery methods. To accomplish this, the four workgroups collaborate to design useful information delivery systems . Two primary concepts guide the efforts. One concept is to provide multiple situation-dependent educational products. These are 1) information, 2) products , 3) training , 4) informal networks, and 5) formal networks. The second concept is that the team must prioritize opportunities and focus on what we can deliver. This is accomplished by a "phased approach" to user engagement and assistance in which groups are categorized as Phase I: users we can help now with information currently available; Phase II: users we can help in 2-3 years ; and Phase III: users groups we can help in 3-5 years. These two concepts form a matrix that provides a structural dimension for identifying and prioritizing outreach and education opportunities.

Thomas , F. I., University of South Florida, Tampa, USA, fthomas@cas.usf.edu;
Bell, S. S., University of South Florida, Tampa, USA, sbell@cas.usf.edu

A MACROALGAE TO SEAGRASS SHIFT IN A BENTHIC CANOPY: EFFECTS ON TURBULENCE, NUTRIENT EXCHANGE, AND INVERTEBRATE POPULATIONS

Sites within Tampa Bay Florida have recently been found to have an extensive cover of a rhizophytic green alga, Caulerpa prolifera in regions that have historically been vegetated predominantly by seagrass. The presence of C. prolifera in these habitats has implications for both the biological and physical attributes of the ecosystem. The morphology of the canopy can affect turbulence within and above the canopy which in turn affects nutrient exchange rates. Thus, the change in vegetation may have significant impacts on the benthic/pelagic exchange of nutrients. Further, the characteristics of the canopy influences the types of invertebrates using the habitat. In this paper, we assess the implications of the shift in canopy type to invertebrate and epiphyte abundance, hydrodynamic regime (e.g turbulent energy dissipation), and nutrient exchange between the benthos and the water column. We measure the hydrodynamic regime within and above canopies of C. prolifera and Thallasia testudinum, measure nutrient uptake rates by the canopy, identify the importance of uptake by epiphytes in both types of canopies and quantify the invertebrates present. Results indicate that the change from seagrass to macroalgae significantly impacts invertebrate populations and the hydrodynamic regime of the benthos. Further, turbulent energy dissipation differs between the two canopy types. This difference is reflected in rates of nutrient uptake.

Thomas, G. L., Center for Sustainable Fisheries, Rosenstiel School for Marine and Atmospheric Sciences, U. Miami, Miami, USA, gthomas@rsmas.miami.edu;
Bakun, A., Center for Sustainable Fisheries, Rosenstiel School for Marine and Atmospheric Science, U. Miami, Miami, USA, abakun@rsmas.miami.edu;
Thorne, R. E., Prince William Sound Science Center, Cordova, USA, thorne@pwssc.gen.ak.us

REDEFINING THE ROLE OF OPERATIONAL FISHERIES OCEANOGRAPHY IN MARINE ECOSYSTEM OBSERVING PROGRAMS

Many of the major marine ecosystem programs throughout recent history have been justified by major fisheries issues and usually after a population collapse. Ironically, the science that followed often was only indirectly and sometimes not at all related to the fisheries problem. Today, there has been a proliferation of ocean observing programs, which use similar fisheries justifications to generate funding. However, little has been done to define the criteria necessary to qualify a program as responsive of fisheries problems. We provide examples of what fisheries information need to be part of an marine observing program if it is to use fisheries as justification for its funding.

Thomas, J. D., National Coral Reef Institute, Ft. Lauderdale, USA, thomasjd@nova.edu

PREDICTING BIODIVERSITY PATTERNS IN DEEP WATER CORAL ECOSYSTEMS: LESSONS FROM PHYLOGENETIC STUDIES OF SHALLOW WATER CORAL REEF CRUSTACEA

Comprehensive studies of coral reef biodiversity suggest that diversity patterns may be more congruent with geotectonic events than with the reigning paradigms of dispersal, center of origin, and vicariance. Geotectonic processes slowly accumulate taxa in areas exemplified by the presence of composite or lineage-based evolutionary diversity. This process-pattern model can suggest additional areas where similar patterns are likely to occur. Information on types and levels of diversity should be a primary concern in emerging conservation efforts for deep-water coral ecosystems. Current marine conservation efforts in shallow reef systems rely primarily on identifying “hotspots” that reflect measures of species richness and endemicity rather than intrinsic evolutionary relationships. Recent phylogenetic and molecular research from shallow reef systems questions the validity of the hotspot approach. Biodiversity assembly rules for both deep-sea and shallow coral assemblages are likely congruent and thus should exhibit similar diversity patterns. Given logistic and expense concerns in studying deep coral systems, a predictive and testable biodiversity model that suggests areas where composite, lineage-based diversity may be located would help focus and allocate scarce resources.

Thompson, J. K., U.S. Geological Survey, Menlo Park, USA, jthompso@usgs.gov;
Koseff, J. R., Stanford University, Stanford , Mexico, koseff@stanford.edu;
Monismith, S. G., Stanford University, Stanford , Albania, monismith@stanford.edu;
Lucas, L. V., U.S. Geological Survey, Menlo Park, USA, llucas@usgs.gov

MODELING AND FIELD OBSERVATIONS OF ALGAL BLOOMS IN SOUTH SAN FRANCISCO BAY, 4: INTEGRATION OF NUMERICAL MODELS AND FIELD OBSERVATIONS

Aquatic ecologists have long recognized that numerical models are useful in developing hypotheses and examining processes that include parameters with varying spatial and temporal scales. However, integration of such parameters is challenging because field data are rarely available at the scales used in models. Ecologists can use models to inform their decisions about relevant sampling scales and processes, but for the models to be accurate, the modelers need appropriate data during model development. In answer to this conundrum we have developed an iterative process between modeling and field sampling in South San Francisco Bay (SSFB) that has allowed us to better understand the critical processes in algal bloom development. We will show how our field program "dynamically" changed in response to results from 1-D, Pseudo-2D, and 2-D models and how these changes resulted in models that accurately characterize field observations and helped us understand the relevant ecological processes. This integrative approach has highlighted new directions for model development (eg. small scale variations in light availability (May et al. this session), possible nutrient limitation) and for future field programs.

Thompson, J. R., Massachusetts Institute of Technology and Woods Hole Oceanographic Institution, Cambridge, USA, janelle@mit.edu;
Randa, M. A., Temple University, Philadelphia, USA, mranda@astro.temple.edu;
Marcelino, L. A., Massachusetts Institute of Technology, Cambridge, USA, luisam@mit.edu;
Tomita-Mitchell, A., Massachusetts Institute of Technology, Cambridge, USA;
Lim, E., Temple University, Philadelphia, USA, elim@astro.temple.edu;
Polz, M. F., Massachusetts Institute of Technology, Cambridge, USA, mpolz@mit.edu

DIVERSITY AND DYNAMICS OF A NORTH ATLANTIC COASTAL VIBRIO COMMUNITY

Vibrios are ubiquitous marine bacteria harboring many ecologically significant and some facultatively pathogenic strains. We hypothesized that seasonal changes in coastal waters lead to distinct Vibrio communities and sought to characterize their level of differentiation. A novel technique was employed to quantify shifts in 16S rRNA gene abundance in samples from Barnegat Bay, NJ, collected over 15 months. Quantitative PCR (QPCR) using highly Vibrio-specific primers was combined with separation and quantification of amplicons by constant denaturant capillary electrophoresis (CDCE). Vibrio populations identified by CDCE-QPCR showed little overlap between summer and winter samples suggesting distinct "warm-water" and "cold-water" populations. Cloning and sequencing of 16S rRNA genes from two summer and two winter samples confirmed this distinction, showing that CDCE populations corresponded in most cases to ~98% rRNA similarity-groups. Phylogenetic comparison yielded closely related cultured and often pathogenic representatives for most sequences and temperature ranges for these isolates confirmed the trends seen in the environmental samples. This suggests that temperature is a good predictor for the occurrence of closely related vibrios but that considerable microdiversity of unknown significance co-exists within this trend.

Thoms, S., Alfred Wegener Institute for Polar and Marine Research , Bremerhaven, Germany, sthoms@awi-bremerhaven.de;
Engel, A., Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany, aengel@awi-bremerhaven.de

MODELING THE FORMATION OF TRANSPARENT EXOPOLYMER PARTICLES DURING A BLOOM OF THE COCCOLITHOPHORID EMILIANIA HUXLEYI

A simple two-size-class aggregation model is developed to describe the time-dependent carbon content of dissolved polysaccharides (PCHO) and of transparent exopolymer particles (TEP) during the bloom. A conservative estimate for the effective collision kernel is obtained from the Smoluchowski equation under the assumption that the growth of aggregates is controlled by a Brownian process near the scaling regime. In the model, PCHO are assumed to represent a fraction of the photosynthetic carbon, which is not used for net algal growth. Time dependence of chlorophyll a and of cellular carbon during the bloom is modelled in terms of algal growth and sinking of single and aggregated algal cells. The aggregation of exopolysaccharides into TEP may have important implications for the organic carbon cycle in the ocean, as TEP promote the aggregation of algae during a bloom.

Thor, P., Göteborg University, Dept. of Marine Ecology, Fiskebäckskil, Sweden, peter.thor@kmf.gu.se;
Koski, M., Institute for Fisheries Research, Dept. of Marine Ecology and Aquaculture , Copenhagen, DENMARK, mak@dfu.min.dk;
Tang, K. W., Virginia Institute of Marine Science, Gloucester Point, VA, USA, kamtang@vims.edu;
Colin, S. P., Roger Williams University, Biology Department, Bristol, RI, USA, scolin@rwu.edu;
Selander, E., Göteborg University, Dept. of Marine Ecology, Strömstad, Sweden, Erik.Selander@tmbl.gu.se;
Jonasdottir, S. H., Institute for Fisheries Research, Dept. of Marine Ecology and Aquaculture, Copenhagen, Denmark, sjo@dfu.min.dk

INFLUENCE OF COPEPOD ABSORPTION EFFICIENCY ON PELAGIC ORGANIC MATTER FLUX

Marine copepods often exhibit high grazing pressure on primary producers. The efficiency with which organic matter is absorbed (AE) in copepods therefore constitutes a key determinator of organic matter flux in the pelagic ecosystem. It controls the amount of matter directed to higher trophic levels within the epipelagic. On the other hand it also controls the amount of matter that either sinks to the ocean floor or alternatively becomes remineralized. In a series of studies we demonstrated that AE depends not only on food quantity or ingestion rate but also on diet quality and copepod species. AE's ranged from 30% to 70%. They decreased linearly