

Annual Report for Period:01/2000 - 12/2001

Submitted on: 07/13/2001

Principal Investigator: Carpenter, Edward J.

Award ID: 9981618

Organization: SUNY Stony Brook

Title:

BIOCOMPLEXITY: Collaborative Research: Factors Affecting, and Impact of, Diazotrophic Microorganisms in the Western Equatorial Atlantic Ocean

Project Participants

Senior Personnel

Name: Carpenter, Edward

Worked for more than 160 Hours: Yes

Contribution to Project:

Post-doc

Graduate Student

Name: Kustka, Adam

Worked for more than 160 Hours: Yes

Contribution to Project:

Adam studies iron concentrations in cyanobacteria and in seawater

Name: Foster, Rachel

Worked for more than 160 Hours: Yes

Contribution to Project:

Rachel studies symbioses between cyanobacteria and other planktonic organisms

Name: Chao, Leslie

Worked for more than 160 Hours: Yes

Contribution to Project:

Leslie works on zooplankton associated with the cyanobacterium Trichodesmium.

Name: Gordon, Erin

Worked for more than 160 Hours: Yes

Contribution to Project:

Erin studies UV effects on cyanobacteria

Name: Rutherford, Kendra

Worked for more than 160 Hours: Yes

Contribution to Project:

kendra works on molecular biology of Trichodesmium

Undergraduate Student

Research Experience for Undergraduates

Organizational Partners

University of Southern California

I work with Douglas Capone from USC as a collaborator on this research

University of Maryland College Park

Dr. Ajit Subramaniam is a collaborator in this research, and he works on remote sensing.

Stockholm University (Sweden)

Prof. Birgitta Bergman in the Botanical Institute at Stockholm University is a close collaborator in this research program.

Other Collaborators or Contacts

Activities and Findings

Project Activities and Findings: (See PDF version submitted by PI at the end of the report)

Project Training and Development: (See PDF version submitted by PI at the end of the report)

Research Training:

Those who have worked on the project have learned the use of stable and radioisotopes in studies of nutrient uptake, measurement of primary production, pigment analysis by fluorometry and spectrophotometry, microscopy and identification of marine phytoplankton species, in-water biooptics plus general techniques of seamanship and sampling at sea.

Outreach Activities:

We have presented results at major scientific meetings. Data from the cruises are also used as examples in courses taught at San Francisco State University and the University of Southern California.

Journal Publications

Dupuoy, C., J. Neveux, A. Subramaniam, M.R. Mulholland, J.P. Montoya, L. Campbell, D.G. Capone & E.J. Carpenter., "Dupuoy, C., J. Neveux, A. Subramaniam, M.R. Mulholland, J.P. Montoya, L. Campbell, D.G. Capone & E.J. Carpenter.", EOS, p. 14, vol. 81, (2000).
Published

Zehr, J., E.J. Carpenter, and T. Villareal., "New perspectives on nitrogen fixation in the open ocean: evidence for new sources of fixed nitrogen in the marine environment", Trends in Microbiology, p. 68, vol. 8, (2000). Published

Carpenter, E.J. and S. Janson., "Intracellular symbionts in the marine diatom *Climacodium frauenfeldianum* Grunow", J. Phycology, p. 540, vol. 36, (2000). Published

Sanudo-Wilhelmy, S.A., A. Kustka, D.G. Capone, D. Hutchins, C. Gobler, M. Yang, & E.J. Carpenter., "Phosphorus limitation of N₂ fixation in the central Atlantic Ocean.", Nature, p. 66, vol. 411, (2001). Published

Lin, S., and E.J. Carpenter, "Conservation of flavodoxin by the marine cyanobacteria *Trichodesmium* spp.", Molecular Ecology, p. , vol. , (2001). Accepted

Karl, D., A. Michaels, B. Bergman, D. Capone, E.J. Carpenter, R. Letelier, F. Lipschultz, H. Paerl, D. Sigman, & L. Stal., "Nitrogen Fixation in the world's oceans", SCOPE Report. Biogeochemistry., p. , vol. , (2001). Accepted

Carpenter, E.J., and S. Janson, "Anabaena *gerdii* (sp. nov.), a new heterocystous, filamentous cyanobacterium from the South Pacific Ocean and Arabian Sea", Phycologia, p. , vol. , (2001). Accepted

Lundgren, P., E. Soderbak, B. Bergman, and E.J. Carpenter, "Katagnymene spp.: characterization of a planktonic, nitrogen-fixing, non-heterocystous marine cyanobacterial genus.", J. Phycology, p. , vol. , (2001). Accepted

Hood, R. A. Subramaniam, L. May, E.J. Carpenter and D.G. Capone, "Hood, R. A. Subramaniam, L. May, E.J. Carpenter and D.G. Capone", Deep-Sea Res, p. , vol. , (2001). Accepted

Subramaniam, A., C.W. Brown, R.R. Hood, E.J. Carpenter and D.G. Capone, "A classification algorithm for mapping Trichodesmium blooms using SeaWiFS", Deep-Sea Res., p. , vol. , (2001). Accepted

Kustka, A., S.A. Sanudo-Wilhelmy, J.A. Raven, E.J. Carpenter, "A revised iron use efficiency model of nitrogen fixation, with special reference to the marine N₂ fixing cyanobacterium, Trichodesmium spp.", Limnol. Oceanogr., p. , vol. , (2001). Submitted

Carpenter, E.J., D.G. Capone and B. Bergman., "Marine Planktonic cyanobacteria: known and potential nitrogen fixers.", J. Phycology, p. , vol. , (2001). Submitted

Carpenter, E.J. and D.G. Capone, "Photosynthetic rates of Trichodesmium spp. and other phytoplankton in the SW North Atlantic Ocean", Deep-Sea Res., p. , vol. , (2001). Submitted

Books or Other One-time Publications

Web/Internet Site

URL(s):

Description:

Other Specific Products

Contributions

Contributions within Discipline:

We have shown the importance of N₂ fixation as a source of 'new' N in tropical seas. Furthermore, our research has shown the importance of iron inputs in regulating N₂ fixation in the sea.

Contributions to Other Disciplines:

Contributions to Human Resource Development:

In educating graduate students (6 students at present), we have contributed to human resource development.

Contributions to Science and Technology Infrastructure:

Contributions: Beyond Science or Engineering:

Tropical seas are more productive than previously thought. Many areas of these seas support commercial fisheries. We hope to determine factors which affect productivity of tropical seas, and in the future this may have relevance for managing these waters.

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Unobligated funds: less than 20 percent of current funds

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Book

Any Product

Contributions: To Any Other Disciplines

Contributions: To Any Science or Technology Infrastructure

Our major activities on this grant have centered on three research cruises. The first cruise (ca 30 days) in the Equatorial Atlantic Ocean in January-February 2001. The second was in April (ca 3 weeks) in the Central North Pacific Gyre, and the third in June through August (ca 60 days) in the tropical and subtropical Atlantic Ocean. On the two Atlantic cruises we investigated the significance of nutrient input from the Amazon River and dust from the Sahara Desert on the biology and ecology of plankton in Equatorial Seas. In the Pacific, we studied the importance of planktonic processes in fixation of carbon. For the cruises we studied planktonic C and N₂ fixation, biomass, CO₂ drawdown, dust input, natural isotopic ratios of N and C, in-water biooptics, and physical properties of the water column.

In regard to Education, graduate students from several major universities took part in the cruises and worked with our guidance. Schools participating were: University of Southern California, San Francisco State University, MIT, University of Georgia, and SUNY Stony Brook.

We are still analyzing the data, but the initial results indicate that both Sahara Dust and Amazon River water have a stimulatory effect on C and N₂ fixation by plankton in the Equatorial Atlantic. CO₂ drawdown appears to be positively correlated with Amazon River water. Furthermore, it appears that N₂ fixation in the Atlantic Ocean is not limited by availability of iron, but is limited by phosphorus. Our calculations of the iron requirement for N₂ fixation indicates that concentrations of Fe required are about tenfold lower than previously assumed. We have determined that N₂ fixation is a major source of N input to equatorial seas. Data from the Pacific Cruise is still being analyzed, and it is too early to draw conclusions.