NSF-Supported Presentations at the American Society of Limnology and Oceanography Meeting January 25-30, 2009

All times are local.

Monday, 26 January

0900 h

The oceans in a warming world: circulation, carbon and calcification

Scientist Jo Ellen Russell of the University of Arizona contends that the westerly winds in both hemispheres have been shifting polewards and getting stronger over the past 40 years, partly in response to warming from higher atmospheric carbon dioxide concentrations. In her talk, she will explore the implications of these changes for ocean ecosystems.

1630 h

New ways of analyzing planktonic predator-prey relationships

If one were to snorkel in Jellyfish Lake, Palau, just before dawn, one would find millions of *Mastigias* jellyfish milling around the western half of the lake. However, everything changes at dawn (which arrives at approximately 6:00 a.m., year-round) when, with the sky brightening in the east, the jellyfish turn and swim toward the rising sun. For an hour or more they swim, with incessant contractions of their bells, until they approach the eastern end of the lake. Algae-like zooxanthellae within the jellies' tissues need sunlight to survive; they in turn sustain the jellies.

Still swimming eastward with the rising sun, the jellyfish are stopped, not by the edge of the lake, but by the shadows cast by overhanging trees--which they meticulously avoid. Millions of jellyfish that started out in the west are now packed densely around the illuminated eastern rim of the lake with nowhere to go until later in the day, when the solar cycle--and jellyfish cycle--reverses. Eventually the jellyfish complete one round-trip migration from west to east and back, every day between sunrise and sunset.

Scientist John Dabiri of the California Institute of Technology and colleagues have developed a new method of analyzing predator-prey relationships in jellyfish and plankton. Jellyfish like *Mastigias* and the moon jelly *Aurelia aurita* use their body motion, Dabiri has found, to generate water flow that transports small plankton like copepods within feeding range.

Tuesday, 27 January

0900 h

Aquatic microbes, and their biodiversity and ecosystems: results, predictions, and challenges

Much of what we know about aquatic microbes, and their biodiversity and ecosystems, comes from laboratory studies of relatively simple systems, according to Peter Morin of Rutgers University in New Brunswick, New Jersey. According to Morin, current techniques used to monitor and manipulate microbial diversity need advances; the true nature and extent of microbial diversity in natural aquatic systems is one of the grand challenges facing aquatic ecologists.

1545 h

Variability of phytoplankton communities tracked by automated instrumentation

Francois Ribalet of the University of Washington will discuss development of a new generation of automated flow cytometers that enables continuous observation of very small phytoplankton--the microphytoplankton. A detailed analysis of populations of these phytoplankton, made possible by the new instrumentation, is allowing scientists to discover factors influencing phytoplankton growth rate. It is also helping oceanographers interpret patterns such as those recorded by satellites, which can be indicators of the effects of global climate change.

Wednesday, 28 January

0900 h

Societal and environmental challenges to water management and use: lessons and insights from Mexico City

Scientist Patricia Romero-Lankao of the National Center for Atmospheric Research in Boulder, Colo., will discuss the main socio-environmental features and consequences of water management and use in Mexico City. She will review the challenges they pose to a more sustainable use of water, and to more resilient methods of water management--ways that allow water-users to cope with climate change and other stresses. Romero-Lankao will make the case that water systems in many urban areas share similar socio-environmental features. These socio-ecological impacts have major effects on the hydrological cycle and on ecosystems, in turn affecting water management methods.

Global water initiatives and world water governance

Over the last century, water governance issues have extended beyond local and regional levels to the global level, according to Robert Varady of the University of Arizona. Until recently, little had been written about the historical development of global water governance, institutional connections within the field, and organizational successes and failures. Varady will chart the emergence of global water initiatives, or GWIs, using a survey of water experts and other research. His overview will address changing paradigms in water management, an evaluation of results of the growth and proliferation of numerous new GWIs in recent decades, and recommendations for supporting efforts to improve water management in the future.

Assessing climate change impacts on marine phytoplankton

Predicted effects of climate change on the open ocean point to alteration of many factors that determine phytoplankton community structure, set rates of primary production, and control carbon and nutrient cycling. In turn, these shifts in phytoplankton assemblages could drive feedbacks to global climate. Changing light, temperature, availability of nutrients and trace metals, increasing ocean acidification, and biological competition and trophic interactions will potentially alter ecosystems and the entire ocean's biogeochemistry.

1115 h

The whole is greater (or lesser) than the sum of its parts: synergisms among multiple global change variables

With the current urgent need to predict the biological effects of ocean acidification, "we sometimes neglect the fact that global change influences on ocean biota extend well beyond this single factor," says Dave Hutchins of the University of Southern California. "Along with acidification, phytoplankton must deal with simultaneous changes in temperature, solar irradiance, nutrient and iron supplies, and predation and competition. Virtually every important limiting factor for phytoplankton growth is now in flux in the rapidly changing ocean." Hutchins will discuss the effects of these global change variables, some of which may reinforce each other, while others may cancel each other out.

1645 h

Climate change has substantial impact on phytoplankton at NSF's California Current Ecosystem Long-Term Ecological Research (LTER) Site

Research by oceanographers Mike Landry, Mark Ohman and colleagues at the Scripps Institution of Oceanography is investigating ocean processes to gain insight into the response of marine animal and plant communities to climate change. The scientists tracked phytoplankton communities in the California Current Ecosystem to observe rates of change. Their results indicate that climate change is having substantial impacts on phytoplankton at the California Current Ecosystem Long-Term Ecological Research (LTER) site, one of 26 such NSF LTER sites around the globe.

1715 h

Doliolids: What are they, and how do "blooms" of these unusual animals happen?

When it comes to knowledge of filter-feeding doliolids (relatives of sea squirts), studies of these animals are limited. What do doliolids eat, and at what rate? Do phytoplankton control the formation and demise of huge "blooms" of doliolids? Based on laboratory studies that replicate field conditions, Deirdre Gibson of Hampton University in Hampton, Va., and Mark Frischer and Gus Paffenhofer of the Skidaway Institute of Oceanography in Savannah, Ga., discuss the hypothesis that small doliolids experience difficulties ingesting their prey--large diatoms--limiting the size of blooms of these unusual animals.

1730 h

Ecosystem impacts of the predatory comb jelly, or ctenophore, *Mnemiopsis leidyi*

The comb jelly, or ctenophore, *Mnemiopsis leidyi* is a voracious predator increasing in oceans and seas around the world. To understand its impact in marine ecosystems, Sean Colin of Roger Williams University in Bristol, R.I., examined how *M. leidyi* manipulates its surrounding environment to feed. He visualized the jellies' activity using fluorescene dye. *M. leidyi* is capable of acting as a "stealth predator" on adult copepods, Colin found. He estimated the amount of water that passes between the ctenophores' lobes to discover the jellies' feeding rates, and how this increases with the size of the ctenophores.

Thursday, 29 January

Poster Session

Feeding mechanisms and prey selection by the ctenophore *Mnemiopsis leidyi*

Although well-documented as a copepod predator, *M. leidyi*, an invasive comb jelly species, also consumes a variety of other prey. Weekly samples of *M. leidyi* gut contents by Jack Costello of Providence College over a two-year period showed a significant preference by these ctenophores for copepod nauplii and mollusc larvae, and against adult copepods. Copepod nauplii and mollusc larvae are captured via entrainment in *M. leidyi*'s feeding currents, or water flow through the animals. These results indicate the importance of this ctenophore's feeding currents for understanding its broader impacts in the oceans, says Costello.

Zooplankton in Lake Superior: driving phytoplankton to depth--and death

Lake Superior's Deep Chlorophyll Maximum (DCM), a floating layer of chlorophyll-packed microscopic algae, or phytoplankton, appears in the lake during summer months. Factors causing the DCM are something of a mystery, according to scientists Bridget Seegers and Robert Sterner of the University of Minnesota.

A possible contributor is heavy grazing by zooplankton on phytoplankton in the lake's surface waters. Seegers and Sterner conducted a series of experiments to determine zooplankton grazing rates on phytoplankton above, within and below the DCM. Grazing rates were highest in the surface layer above the DCM, lowest near the DCM depth and high again below the DCM depth. After Lake Superior's waters naturally mix each summer, leaving a warm layer of water atop cold layers below, phytoplankton, or microscopic algae, sink until they hit deeper waters where they eventually die, leaving the floating graveyard known to limnologists as the DCM.

1430 h

Microbiology and biogeochemistry in oxygen-deficient water columns

Oxygen-deficient conditions in the water column can be found in many aquatic systems, such as the Oxygen Minimum Zone (OMZ) near fjords with restricted water circulation (such as the Black Sea and Baltic Sea). Recent research has revealed new insights into the composition and functions of the animal and microbe communities in these systems, including the identification of microbial key players and major functional groups. But many open questions remain, such as how animal and microbe communities are linked with biogeochemical processes.

1445 h

Zooplankton distributions in the eastern tropical Pacific Ocean: seeking food, plankton migrate into and out of Oxygen Minimum Zone

As part of the Eastern Tropical Pacific Project, zooplankton distributions and trophic webs through the Oxygen Minimum Zone (OMZ) are being studied by scientist Karen Wishner of the University of Rhode Island. During oceanographic cruises in October 2007 and December 2008, Wishner sampled zooplankton with day and night net tows. Divers provided additional information about larger near-surface organisms. The larger zooplankton migrated up and down the water column, into and out of the OMZ daily, says Wishner. Migration into the OMZ was at different depths and oxygen levels for different species.

1500 h

Jumbo squid suppress metabolism during forays into ocean's Oxygen Minimum Layer

The jumbo squid, *Dosidicus gigas*, is a top predator in the eastern tropical Pacific Ocean. It migrates daily up and down into an oxygen minimum layer. Marine scientist Brad Seibel of the University of Rhode Island investigated the physiological mechanisms that enable this active squid to tolerate extreme hypoxia, or low oxygen, despite its high need for oxygen. The squids can suppress their metabolism, extending their survival time in the OMZ by conserving finite body resources. The giant squid also can extract oxygen from low-oxygen deep waters. These adaptations, however, says Seibel, may be not work as well in oceans affected by climate change and acidification.

Friday, 30 January

0900 h

Can geo(bio)engineering of aquatic systems alleviate future climate change?

Engineered ocean carbon storage: benefits and costs

Various schemes have been proposed to engineer an increase in ocean carbon storage with the intent of decreasing atmospheric carbon dioxide concentrations or allowing use of additional fossil fuels, according to Ken Caldeira of Stanford University.

These proposals include direct addition of carbon dioxide into the ocean, fertilization of the ocean with iron or other nutrients, and burial of carbon dioxide in the sea floor. Benefits claimed are decreased economic costs of carbon storage, decreased effects of climate or chemistry changes on marine ecosystems, and/or enhancement of fisheries, said Caldeira. Costs are economic, potential environmental damage, and the interaction of ocean storage options and broader socio-political systems.

"Decisions are difficult because of competing claims on a 'global commons,' with different parties having different interests," Caldeira said. "Choices are compounded by the high degree of uncertainty involved, which in turn is dependent on our limited understanding of marine biogeochemical systems and the potential impact of various human activities on those systems."

1445 h

Ferritin used for iron storage in bloom-forming diatoms

Scientist Adrian Marchetti of the University of Washington will discuss the ecological significance and crystal structure of the protein ferritin, used for iron storage in diatoms like *Pseudo-nitzschia*. The diatoms' abundance, Marchetti and colleagues found, is regulated by their iron levels: enhanced iron storage by ferritin fueled growth in diatoms, even in waters where iron is relatively scarce, such as the northeast Pacific Ocean.