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Preface

# Special issue: nutrient dynamics in coastal ecosystems—linking physical and biological processes

Ecosystems are entities comprising both communities of interacting organisms and physical aspects of the environment in which they live. Healthy coastal ecosystems can be characterised as having high species diversity and high rates of productivity (although there are of course exceptions to this). The growth of primary producers requires adequate light and nutrients. However, when the concentration of nutrients in the water column is modified by changing ocean currents or anthropogenic pollution, large changes in the structure of both benthic and pelagic ecosystems can be evident (McCook, 1999).

Chronic elevated-nutrient inputs have been posited as at least partly responsible for large scale shifts in reef assemblage structure, often seen as a shift in frondose macroalgal cover from a minor to major component (Hughes et al., 1999; Lapointe, 1999). An abundance of nutrients can facilitate large blooms of phytoplankton that, when dead, provide carbon for substrate-bound bacteria resulting in anoxic substrate and lethal oxygen-deplete bottom water. These and other problems linked to elevated nutrient loading have fuelled efforts to understand the processes associated with nutrient inputs into coastal systems, with a goal to better managing coastal marine resources.

The biology of marine organisms and their responses to nutrients in the environment have long been the subject of research. Experimental studies have addressed a wide variety of topics ranging from detailed examination of the kinetics of nutrient uptake and assimilation by phototrophs, to the interactions among individuals consuming these phototrophs (trophic cascade studies). The use of molecular techniques in the investigation of physiological mechanisms and the increasing accessibility of sophisticated ecological models have enabled remarkable advances in our understanding of the biology of marine organisms.

Likewise, the physical description of water movement at the scales of oceans or boundary layers has been intensively examined. In particular, the advent of new technology has increased our capacity for continuous monitoring of physical parameters (conductivity, temperature, dissolved nutrients, water velocity, etc), which in turn has enabled the development of large-scale models providing accurate and useful predictions of large water-body motion. At smaller scales, studies of boundary layer dynamics have become a standard technique in many research laboratories (e.g. Glud et al., 1999). The new technology that is now available for use in marine physical process studies provides us with a degree of temporal and spatial resolution that has been unavailable until recently.

We now have at hand sophisticated models describing the physiology and ecology of marine organisms. We also have the tools and knowledge for measuring and interpreting the physical environment that directly influences marine biota. However, interdisciplinary research efforts are less common. The constraints of publication relevant to a particular journal, and the traditional dividing lines drawn between University departments of Biology, Oceanography, Chemistry and Physics have until recently often maintained separate research groups that are in reality addressing similar coastal ecosystem-related issues. Such an issue of contemporary importance is the effects and significance of elevated nutrient levels on marine ecosystem function. It is timely for studies to incorporate both biological and physical sciences in order to better understand ecosystem responses.

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In February 2002, the American Society for Limnology and Oceanography and the American Geophysical Union held a joint meeting in Honolulu, Hawaii. The special session "Nutrient dynamics in coastal ecosystems—linking physical and biological processes" convened by John Runcie and Jennifer Smith held at this meeting presented 36 oral papers and 30 posters. This issue of Journal of Marine Systems has arisen from the clear interest in this area of research that was evident at the meeting.

We provide here a selection of papers from the session that illustrate the wide scope of the combined subject area. Topics include the importance of sediment resuspension to elevated water column nutrient levels, the influence of seasonal environmental variables on a nutrient replete system, and the significance of possible future climate scenarios on predictive models describing hypoxic events caused by large riverine freshwater discharges. There is discussion of the importance of silicate measurements in environmental monitoring, and further support for the premise that diatoms can be the primary engines of new production. Finally, an argument is presented for the growth-promoting effect of subsurface nutrient-rich waters during the El Niño winter on the southern distribution of giant kelps in Central Baja, CA.

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John W. Runcie*
*Hawaii Institute of Marine Biology,*
*P.O. Box 1346, Kaneohe, HI 96744, USA*
Present address: Institute of Water and
Environmental Sciences
University of Technology, Sydney
PO Box 123, Broadway NSW 2007, Australia
*E-mail address:* john.runcie@uts.edu.au

Jennifer E. Smith
*Botany Department, University of Hawaii at Manoa,*
*3190 Maile Way, Honolulu, HI 96822, USA*

* Corresponding author.