LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE

March '98 No. 6

LOICZ NEWSLETTER

Linking the natural sciences with the social sciences

Silvia E. Ibarra-Obando, Stephen V. Smith, Robert W. Buddemeier and Fredrik Wulff

The LOICZ project is interested in understanding, at regional and global scales, the nature of interaction between land, ocean and atmosphere; how changes in components of the Earth System affect the coastal zones and alter its role in global cycles; how future changes in this region will affect its human use. Such information provide a sound scientific basis for future integrated management of coastal areas (IGBP Report No. 33, LOICZ Implementation Plan).

The interest in understanding human influence on the Earth System has extended to other IGBP projects, but none of them, including the LOICZ efforts, has met with total success. For this reason, we decided to hold a workshop and develop a conceptual model that might facilitate the linking between the natural and social sciences.

We selected the San Quintin system (30°N, on the Baja California peninsula, Mexico) a valley and bay where natural influences are clearly defined and anthropogenic influences are strong. Weak coupling between the land and bay allow study of the two sub-systems independently. A workshop was held from February 1 to 7, in San Quintin. Participants included two systems ecologists (Stephen V. Smith, U. Hawaii and Fredrik Wulff, U. Stockholm), one hydrogeochemist (Robert W. Buddemeier, U.Kansas) one geologist (Jose Carriquiry, U. Baja California), one marine chemist (Victor Camacho-Ibar, U. Baja California), two biologists (Barbara W. Massey, U. California, Long Beach and Silvia Ibarra-Obando, Center of Scientific Research and Higher Education of Ensenada), and one socio-economist with background in oceanography (Alfonso Aguirre-Muñoz, College of the Nothern Frontier). The co-authors of this article are also LOICZ Scientific Steering Committee Members.

As part of the workshop we visited the agricultural area located in the coastal plain of the Valley. Agriculture occupies about 15,000 hectares, with tomatoes and strawberries being the main crops. This activity provides employment for about 15,000 people, most of them migrants from the Mexican states of Oaxaca, Guerrero, Veracruz and Sinaloa. The agriculture is not sustainable. The Valley and adjacent watershed are desert, with the agriculture supported by

This is the sixth newsletter of the Land Ocean Interactions in the Coastal Zone (LOICZ) International Project of the IGBP. It is produced quarterly to provide news and information regarding LOICZ

Photo: San Quintin Bay

extraction of groundwater to such an extent that the water table is declining and saltwater intrusion is occurring. Agricultural production is almost entirely for export to the USA. With this activity, the local population is about 60,000; without it, they would probably number no more than a few thousand.

Along the bay, the main economic activity is oyster aquaculture, occupying only 400 of the 50,000 hectares of the bay. Seasonal coastal upwelling along the Pacific coast of Baja California results in a high productivity of the ocean. Biogeochemical budgeting of the bay demonstrates that there is an import of organic detritus associated with the upwelling. This detrital supply is an important food supply to organisms in the bay, including the cultured organisms. No other food or raw materials are required to support the aquaculture. The aquaculture provides employment for 350 people, and only 30% of the production is exported. This activity is sustainable at its present level, because the oysters are maintained by exchange of water and organic matter with the highly productive coastal water. Intensive mixing of water by wind and tides ensures that the biota have an ample food supply and that the water is well aerated.

During the workshop, we interviewed local government officials, field migrant workers and aquaculture people, all of whom were very interested and supportive of our work. After five days of intensive work, we are now refining a model that we hope can be used as a “blueprint” for similar studies in other coastal areas, to link land and ocean and natural and social sciences, and ultimately to lead to predictions and management decisions at local and global scales.

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Corals, Carbon Dioxide and co-operation

Robert W. Buddemeier,
LOICZ Focus 2 Leader

Increasing atmospheric carbon dioxide inhibits calcification by many marine calcifying organisms and by coral reef ecosystems. This is the first major indication of large-scale negative biological effects as a direct result of CO_2 itself rather than as an outcome of its possible effects on climate, and it was one of the major conclusions of a symposium and working group cosponsored by LOICZ in January of this year (see also Science vol. 279, p. 989 (1998), and http://coral.aoml.noaa.gov/themes/coral_cg.html).

This striking conclusion arose from observations that calcification rates of corals, coralline algae, and coral-algal communities depend on the calcium carbonate saturation state of surface sea-water, which is reduced by rising atmospheric carbon dioxide. This global, systemic, climate-related stress on the functioning of reef ecosystems interacts with the more immediate anthropogenic local threats to an important and already threatened coastal ecosystem. The findings also emphasize the importance of coastal processes in the complex relationships among marine, atmospheric, and terrestrial contributions to the interacting organic and inorganic components of the carbon cycle -- key IGBP concerns.

Other important outcomes of the meetings offered additional insights into coral reef systems -- all of interest to both researchers and managers, and not all of them negative in their implications. Corals, and to some extent reef communities, were shown to possess numerous mechanisms for acclimatization and adaptation -- diverse reproductive strategies, flexible symbiotic relationships, physiological acclimatization, habitat tolerance, and a range of community interactions. However, current understanding of these mechanisms, as well as of the critically important calcification mechanisms, is still inadequate for reliable predictions or for effective contribution to the design of sustainable management practices.

It was also made clear that coral reef stresses and responses involve communities and populations that are products of processes operating over a wide range of interacting time and space scales, with fundamentally different controls operating at different scales. While short-term responses will be controlled by local environmental conditions and biotic responses, the longer-term sustainability of a reef system depends on the recruitment, dispersal, persis-tence, and interactions of populations at scales larger than those of most current management and assessment practices.

These contributions were made possible by a very high level of the co-operation mentioned in the title -- both among the scientific contributors to the meetings, and also among a diverse range of organizations. The initial organization was by the Scientific Committee on Oceanic Research (SCOR), which established Working Group 104 to address the issues of coral reef responses to global change, and especially the role of adaptation. LOICZ recognized the topical relevance to its own issues, and promptly offered to cosponsor the group. The symposium received support and sponsorship from the Society for Integrative and Comparative Biology (SICB), the International Society for Reef Studies (ISRS), and the Ecological Society of America (ESA); it was presented at a joint meeting of those societies January 3-7 in Boston, USA, with additional support from the Coastal Ocean Program of the US National Oceanic and Atmospheric Administration (NOAA). This consortium of international organizations, national agencies, and scientific societies provided a conceptually
and organizationally global approach to a geographically global problem, and may serve as a useful model for future efforts.
A peer-reviewed proceedings of the symposium will be published as an issue of the journal American Zoologist. For further information please contact the author via the LOICZ IPO.

LOICZ and coastal research in Australia

Nick Harvey
Vice-Chair LOICZ SSC

The LOICZ SSC will meet in the southern hemisphere this April when it comes to Adelaide in South Australia. Although there is considerable LOICZ related research being undertaken in Australia, there is currently no national LOICZ committee despite two attempts to form one. In December 1994, a major scientific meeting at the Academy of Science in Canberra discussed the future needs for coastal research in Australia. Professor Patrick Holligan (current LOICZ SSC member) was a key speaker at this forum. A second much smaller meeting was again convened at the Academy of Science in April 1996 but no LOICZ national committee was ever formed.

More recently, an initiative has been taken by the Institute of Australian Geographers (IAG) to set up a Coastal Study Group which will incorporate both coastal management related research interests together with coastal biogeomorphology research falling more within the scope of LOICZ Focus Two. This has provided an ideal opportunity for a specialised coastal session at the next IAG Conference to be held in Perth, Western Australia, 30 June-3 July, 1998. At this conference it is also planned to team up with a group of PAGES researchers who have coastal interests in order to hold a joint IAG/LOICZ/PAGES coastal session in Perth.
The type of research outlined in the LOICZ Implementation Plan, Activity 2.3, appears well suited to this joint meeting. For example, the palaeoenvironmental re-construction of parts of the coastal zone in South Australia has not only provided evidence of coastal responses to past global change but has also enabled the extraction of neotectonic effects from historic tide gauge data which are being used in current global mean sea level averages.

MANGROVES and SALT MARSHES

Eric Wolanski
Australian Institute of Marine Science

Mangroves and salt marshes are inter-tidal wetlands common in tropical and temperate coastal environments. They play a vital role as producers of nutrients, in primary and secondary productivity, in providing protection against wind and storms, in stabilising the coast, and in supporting genetically diverse communities of terrestrial and aquatic organisms of direct and indirect socio-economic value. The marine environment, the dynamics and the ecology of salt marshes and mangroves appear similar, hence the need for cross-fertilisation of knowledge on how mangroves and salt marshes work as an ecological engine. These wetlands play a vital role in the interaction between the land and the coastal ocean, one of the key objectives of LOICZ.

Mangrove ecosystems in tropical countries are at present being destroyed at an alarming rate reminiscent of what happened to salt marshes until recently. Can science and technology help to preserve and better manage these ecosystems? To address this question, the scientific journal Mangroves and Salt Marshes, now in its second year, addresses the important physical, ecological and management processes and problems of these coastal ecosystems. The journal encourages multidisciplinary research in these processes and aims to offer solutions to the various problems of these environments. The journal is unique in its focus on coastal wetlands world-wide.
Mangroves and Salt Marshes is quarterly published by Kluwer Academic Publishing, a Dutch publishing company with a long, solid reputation in scientific publications. Special issues will be considered and guest editors appointed. This may be useful to LOICZ members.

The chief editors are Eric Wolanski (E-mail: e.wolanski@aims.gov.au) at the Australian Institute of Marine Science, Townsville, Australia, and Charles Hopkinson (E-mail: chopkins@lupine.mbl.edu) at the Marine Biological Laboratory, Woods Hole, USA. The editorial board includes Dan Alongi (Australia), Laurie Boorman (UK), John Chappell (Australia), Daniel Childers(USA), Ong Jin Eong (Malaysia), Miguel Fortes (Philippines), John L. Gallagher (USA), David M. John (UK), Bjorn Kjerfve (USA), Els Martens (Belgium and Kenya), Yoshihiro Mazda (Japan), Gerardo M. Perillo (Argentina), Marianne Popp (Austria), Carlos E. Rezende (Brazil), Jelte Rozema (Holland), Peter Saenger (Australia), Robert Twilley (USA), Joseph Vallino (USA), Gullaya Wattayakorn (Thailand), Yuk-Shan Wong (Hong Kong - China) and Alejandro Yanez-Arancibia (Mexico).

In its first year the journal has already published a number of exciting papers in science and management. These include water circulation, sedimentation, traditional use of mangroves, sewage pollution in mangroves, the role of crabs, salt marsh productivity, use of mangroves as a wave absorber for coastal protection, and heavy metals pollution in salt marshes. A number of great papers are in press covering oil pollution in mangroves, groundwater influence in salt marshes and medicinal uses of mangroves.
Please refer to http://www.wkap.nl/journals/m_and_s for information and your free on-line sample copy.

Goodbye from our Project Scientist

Paul Boudreau

At the end of 1997 my original contract as Project Scientist with the LOICZ Project was completed. My family and I have decided to return to our home in Canada where I will take up a position with the Department of Fisheries and Oceans.

Professionally, I have enjoyed the opportunity over the last three years with the IPO to play a role in developing both the LOICZ organisation and research. As was evident at the recent Open Science Meeting, there is now a large body of global coastal zone work being carried out that addresses the LOICZ research priorities. The commitment of the Netherlands government to another five years of funding provides the necessary stable support to continue the tasks that have been initiated. The future looks very bright.

Personally, I find it somewhat difficult to leave this position that has provided me with many enjoyable and valued contacts. I have been fortunate to have received the support of friends and colleagues from many countries of the world and to them I owe many thanks.

To all who have assisted me, and the LOICZ Project, during my time in the IPO, I would like to extend my most sincere thanks. To my friends, I extend my best wishes and a promise to keep in touch.
It has been challenging work that I will remember for a lifetime.

Han Lindeboom

FROM THE CHAIR

A difficult time for LOICZ is almost behind us. When Paul Boudreau left in December the IPO became very understaffed, but Cynthia, Mildred, Martijn and Judith kept it going very well. From here I want to thank Paul for the great effort he has put into LOICZ and wish him and his family all the best in Canada.
Now, we are eagerly awaiting the start of the new Executive Officer at the end of April. Once the office is completely staffed again, the new LOICZ will go into full swing. And there is a lot of work ahead. We hope to establish several new core projects before the end of the year, and as the SC-IGBP stressed, the question whether the coastal zone is a source or sink of CO_2 still needs to be answered. From April 29th till May 2nd, we will have the 8th SSC-LOICZ meeting in Adelaide and in the next newsletter I hope to announce many new LOICZ initiatives.
LOICZ initiatives.

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NEW LOICZ PUBLICATIONS

* Meeting Reports are not available for general distribution

Report on the JGOFS/LOICZ Workshop on non-conservative fluxes in the continental margins. The Netherlands, 6-9 October 1997. Meeting Report No. 25.

Report on the SARCS/WOTRO/ LOICZ Coastal zone Science in Southeast Asia. Philippines, 24 - 28th November 1997. Meeting Report No. 28.

Third LOICZ Open Science Meeting Report. The Netherlands, 10 - 13th October 1997. Meeting Report No. 29.

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LOICZ Calendar

- 8th Scientific Steering Committee Meeting 29th April - 2nd May 1998, Adelaide, Australia.
- Second Annual Scientific ELOISE Conference 30th September- 3rd October 1998, Huelva, Spain.

LOICZ Typology dataset

As noted in Newsletter No. 5 a first version of the LOICZ Typology data set is made available through the Internet and can be downloaded from:
http://www.nioz.nl/loicz/projects/core/typo.htm for review and analysis.

The LOICZ IPO is preparing the publication of part of the Typology data set on CD-ROM in co-operation with the United Nations Food and Agriculture Organization (FAO). The Typology data set and FAO data will become part of FAO's CD-ROM sequence called "Land and Water Digital Media Series". In this way the data will become available for researchers without an Internet connection and reach a larger research community.

The current publication of the LOICZ Typology data set does however not imply that it should be considered a static product. It will change as a result of new demands and the availability of new data sources. In the near future the Typology data set will be updated with additional marine information.