LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE

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LOICZ NEWSLETTER

LOICZ Integration and Synthesis

LOICZ is entering its third phase of activities – integration and synthesis. This means our effort over the next two years will be focussed on drawing together the evolved understanding of the global coastal zone developed by LOICZ scientists. From our beginings in 1993, LOICZ has built a network of scientists contributing to research to answer the key questions posed in the LOICZ Science Plan (1993). The LOICZ Implementation Plan (1994) provided a detail of the wide challenges to science that exist in the global coastal zone, outlining the array of research opportunities and directions that could be followed to build a comprehensive picture. The LOICZ Scientific Steering Committee has continued to work with global scientists and funding bodies to address priority tasks, as individual and national contributing research projects, and to establish directed core projects on global coastal research.

In these last two years of the current LOICZ core project, we will continue with thematic workshop activities and contributing research but increasingly focus on scientific workshops and involvement of all LOICZ associated-scientists in the development of a synthesis. The product of the "synthesis" will be a book addressing material fluxes and the human dimension in the global coastal zone, to be published in late 2002 as part of the IGBP Series. The joint LOICZ-JGOFS Continental Margins Task Team is working to produce a companion volume addressing in particular, the flux of carbon in the global margins.

To the future?

Over the last 18 months the IGBP has been working in consultation with related global programs (IHDP, WCRP) to explore the need and issues for a second phase of global research addressing the function of the Earth System. The results of wide ranging discussions with related agencies and programs, and outcomes of various "futures" working groups will be couched in a proposed IGBP II program for consideration at the IGBP Congress in Amsterdam July 2001. LOICZ has been part of these activities and it is expected that the issue of the global coastal zone will continue to be a vital element of a new program. Details such as key questions of science and an operational structure will be developed from ongoing consultation within the wider global science and users community.

This is the seventeenth 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 activites

LOICZ Synthesis The Book

In keeping with the approach taken across IGBP, LOICZ will produce a "Synthesis Book" as a compendium of outcomes from the synthesis process on which we are currently embarking. We expect the volume to be published at end 2002 and it will address the key issues and questions posed for LOICZ within the LOICZ Science Plan (IGBP Report Number 23, 1993).

The integration of data and information collected and developed by LOICZ on status and changes in the global coastal zone from the efforts of a large number of scientists around the world will be a major task coordinated by the SSC over the next 2 years. This will require a team effort across LOICZ both to distil information and to carry out a final synthesis about what we know and the gaps in our understanding on global coastal systems and material fluxes, under natural and anthropogenic pressures and change. Work has begun in identifying the key elements as chapters for the synthesis book, outlined below.

The lead authors for each chapter are building collaborative teams and enlisting leading scientists to contribute to sections of the chapters. All scientists are encouraged to contribute to this effort; initially to talk with the chapter lead authors about contributions that can be made.

Chapter 1. Introduction

Change, Drivers of Change, and Consequences of Change in the Coastal Zone.

(Lead authors: Chris Crossland, Hartwig Kremer and Han Lindeboom)

This chapter will provide an introduction and framework for:

- defining the coastal zone for LOICZ purposes;
- the LOICZ questions on material fluxes and the human dimension;
- a context for global change in the coastal zone including scenarios for

change, coastal heterogeneity and variability, human dimensions (in a DPSIR framework), coastal habitats and fluxes, scales of changes in relation to impacts and forcing function;
- a presentation of the "LOICZ view", considering coastal zone research on global change, dimensions of change, fluxes (horizontal and vertical), resolution of variability and a systems view of the coastal zone; and
- a consideration of threats, problems, issues and perceptions of pressures and global change.

Chapter 2. Coastal Habitats and Living Resources

Changing habitats on land and in the coastal seas, and changing resources

(Lead authors: Han Lindeboom, Silvia Ibarra-Obando)

The world's coastal zones are long narrow features of mainland, islands and seas generally forming the outer boundary of the coastal domain. More than 40% of the people in the world live in this relatively small but highly productive, highly valued, dynamic and sensitive area which occupies 18% of the surface of the globe. It is the area where about 25% of global primary productivity occurs, and it supplies about 70% of global fish catch. At the same time it is one of the most threatened and changing areas. Pollution, eutrophication, changing sediment load, urbanization, land reclamation, overfishing, mining and tourism continuously threaten the future of coastal ecosystems. Although most impacts are still regional, the scale of development along all coasts of the world is increasing such that it has become a real global issue. Despite the rapidly increasing knowledge about coastal ecosystems, crucial questions on the causes of natural variability and the effects of human impacts are still unanswered. Although the perception of politicians and managers of our coasts is shifting from a mainly shortterm economical approach towards a longterm economical ecological perspective, the consequences of this shift (read changes of management practice) are often ignored or difficult to sell. The major challenge that we face today is managing the human use of these habitats, so that future generations can also enjoy the wide visual, cultural and edible products that it provides.

In this chapter we will focus on different coastal habitats, and the development of (human) pressures, especially in relation to these habitats. Also the role of the coastal area in food production and the possible protection of the different habitats and new threats will be described across a global scale. For the different subchapters (see below) we invite expert scientists to draft concept texts. Those interested in contributing to this challenging task are invited to contact Han Lindeboom (h.j.lindeboom@alterra. wagur)

1. Introduction

2. Present situation
2.1. Coastal habitats
2.1.1 Coral reefs -Including calcification and CO^2 effects
2.1.2 Mangroves
2.1.3 Seagrass meadows and salt marshes
2.1.4 Rocky shores and kelp beds
2.1.5 Arctic shores
2.1.6 Sandy beaches
2.1.7 Estuaries
(The global distribution and changes of these habitats will be derived from the LOICZ typology exercise)
2.2 Variability
(natural and changes in major processes e.g., calcification)

3. Increasing (human) pressures
3.1. Demographics
3.2. Recreation and tourism
- beaches, swimming, recreational boating;
- ecotourism (marine animals such as seals and birds, whalewatching)
3.3. Coastal protection and engineering
3.4. Mining
3.5. Pollution in relation to water quality
3.6. Coastal hazards

4. Food production
4.1 Aquaculture
4.2 Fisheries

5. Protection and threats
5.1 Habitats
5.2 Invertebrates and fish
5.3 Mammals and birds
5.4 Harmful algae
5.5 Invasive species

6. Conclusions and recommendations
6.1. Major management issues
6.2. Scientific priorities

Chapter 3. Water and the Coastal Zone

River basin-coast interactions: the flow of substances and changes in the hydrological cycle

(Lead author: Wim Salomons)

Coasts worldwide are subject to many pressures which are expected to continue or increase in the future. Despite the decrease in inputs, the "classical" contaminants such as heavy metals, nutrients and PCB's are still of concern in a number of areas and will remain important. Past and planned physical changes in rivers (e.g. damming) influence the natural flow of water, nutrients and sediments to the coast. New classes of chemicals have entered the priority lists of international organizations and will require coastal zone impact and monitoring studies. In addition the increase in economic activities from tourism, fisheries, urbanization and the generally expected increase in traffic will offer challenges for coastal zone managers and regulators. Management issues and their solutions require an integrated approach of the natural and socioeconomic sciences. Numerous studies (often monodisciplinary) have been conducted to deal directly with these issues but could benefit from more integrated assessment.
This integration of the results of past studies requires a framework for analysis. For the integration we have chosen the DPSIR framework since it allows the combination of results from the natural and social sciences as well feedback from and to policy/ management options. As already stated the pressures are manifold, hence we have to narrow them down within the LOICZ context, which deals with changes in biogeochemical cycles as major indicators. Hence, LOICZ-BASINS deals with the impact of human society on the material transport such as water, sediments, nutrients, heavy metals and man-made chemicals to the coast. It assesses their coastal impact and tries to provide feasible management options together with an analysis of success and failure of past regulatory measures. Since the changes in fluxes are mostly land or river catchment based we will treat the catchment/coastal sea as one unit – a water continuum. Furthermore, applying this scale to coastal change phenomena means that as well as activities from agriculture, fisheries, urban development,

industry, transport and tourism, morphological changes (e.g. damming) must also be taken into account to the extent that they affect the fluxes.

In particular the following parameters will be assessed:

- material flow of water, sediments, nutrients and priority substances (past, current and future trends);
- socioeconomic drivers which have changed or will change the material flows;
- indicators for the impact on coastal zone functioning and to derive from them
- a "critical load" for the coastal zone.

This critical load concept can be used (as has been done for atmospheric pollution abatement) for a cost-benefit analysis of management options. Scenario building is an integral part of this analysis.

The LOICZ-BASINS approach faces three major challenges:

1) to determine the time delay between changes in landbased material flows (due to socioeconomic activities, morphological changes or regulatory measures) and their impact on the coastal zone system.
2) to generate an improved understanding of the complexities of the coastal sea environments and to derive from this complex environment the “critical loads”.
3) to consider the multiplicity of interests and stakeholders affected. In particular, there may be local, regional, national, and multinational governmental bodies with conflicting interests.

Large catchments seem to be obvious examples to be addressed within a global LOICZ synthesising effort (e.g. Amazon). However, a major portion of the flows to the coastal seas are generated in small to medium size catchments with high socioeconomic activities. These areas are also of priority interest to the global BASINS effort. The same also applies to island dominated regions such as the South Pacific or the Caribbean where often the whole island is a catchment affecting its coastal zone and influences are generated by both anthropogenic drivers and global forcing.

As mentioned, numerous studies have been conducted, which can contribute to LOICZ-BASINS. Through regional workshops on a global scale these studies are identified and synthesized. In addition the workshops identify the pertinent regional issues and followup workshops assist in preparing research proposals for local and regional funding agencies. To date successful workshops have been held in Europe, Latin America and Africa. For 2001 workshops and studies are planned for East Asia and Oceania. Followup workshops aiming at finalising a first regional synthesis and at formulating research proposals take place in 2001 in Latin America and Africa. In 2001 the EUROCAT project funded by the European Union, which deals with the interaction between its major catchments and coastal seas, will start and contribute to LOICZ-BASINS.

Through the global workshops BASINS offers a common framework for analysis assessment of coastal zone and management issues. This common framework not only assists the regional synthesis efforts and the acquisition of funding but will also allow LOICZ to address its global issues. In this respect are important the contribution of BASINS to the LOICZ synthesis book and its interaction with other focal areas. In particular BASINS is expected to provide an index system enabling the categorisation of the links between catchment changes and response observed in the coastal zone to the typology upscaling effort considering global river run off and coastal biogeochemistry (joint project of LOICZ and BAHC).

The synthesis chapter on LOICZ focus 1 and in particular the BASINS results will contain the subchapters listed below. Those interested in contributing to this challenging task are invited to contact Wim Salomons
(wim. salomons@gkss.de)

1. Introduction

The flow of water (and materials) to the coastal zone addressing surface flows and the role/significance of groundwater; consideration and context of DPSIR framework and critical loads approach to natural and human dimensions.

2. Material Mass flow

River basins to the coast (point and diffuse sources) and consideration of the concepts of mass flow. Linkage to IGBP BAHC synthesis and estimates for material fluxes, and biogeochemical transformations of materials during river transport.

3. Data, Trends and Scenarios

At regional levels (particularly built upon outcomes from the suite of LOICZ river basin assessment workshops and allied research) including:

3.1 Europe (EUROCAT EU project)
3.2 South America and the Caribbean (LOICZ SAmBas and CariBas)
3.3 Africa (LOICZ AfriBas)
3.4 Asia and Australia (LOICZ Austral-AsiaBas)
3.5 Oceania Bas

4. Global trends

Material flows (e.g., scaling up from 3.) and regional hotspots of change, and nutrient and regional inputs to coastal seas.

5. Major trends and outlook

(pressures, impacts, success/failure regulations).

Chapter 4. Stability of the Coastal Zone

Fate and process of materials including sediments and “nonreactive” matter

(Lead author: James Syvitski; with Bob Buddemeier, Nick Harvey, Bob Costanza, Eric Wolanski)

The world’s coastline has evolved for many thousands of years, experiencing changes to habitat, coastal dynamics, and the input of sediment from the continental interior. Sea level has risen in some areas, but fallen elsewhere. Human impact ranges from massive (e.g. reduction in wetlands, urbanization) to non-existent (i.e. high Arctic, Antarctica). The Stability of the Coastal Zone documents how humans and climate shifts can and have affected the stability of our coastlines on a global scale.

The Chapter begins with a discussion on the meaning of pristine conditions, and how human development has modified these conditions in various locales around the globe. Modifications include deforestation, cultivation, changes in habitat, urbanization, agricultural impoundment, and upstream modification to flow characteristics. However, our concern is not just in the magnitude of change, but also in the recent and

accelerated rate of change. LOICZ interests extend to whether alterations on the local level can cumulatively give rise to coastal zone changes of global significance.

It is important to recognize the range in natural variability within a given coastal zone, given the influence of longer-term geological processes. However, we focus on how humans or climate shifts can amplify or ameliorate this range in natural variability. Our collective global data on the ambient conditions of our coasts are based on observations unfortunately determined during times of transition. Therefore it is fair to suggest that our understanding of natural variability may itself be suspect. Future prediction of coastal change must take into account these types of biases.

Storage capacity (shortterm versus longterm) and residence time of material (say, mud versus sand) are other important parameters that coastal scientists use to understand how different coast zones (estuaries, deltas, lagoons, wetlands) adapt to change. The LOICZ typological approach provides us with insight to the globalization of our understanding of coastal zone dynamics and environments. Typology relies on a minimum level of data quality for defining parameters, and a minimum data resolution. Typology offers us insight into data poor regions of the world. Various techniques in upscaling and downscaling allow us to identify which coastlines are sensitive to changes in sea level, storminess, river fluxes, and human impacts.

The impact of sea level fluctuations on coastal stability takes on different meaning when considering a local region in a global context. Many of the regional controls on sea level involve longterm geological processes (subsidence, isostasy), and have a profound influence on controlling shortterm dynamics. As sea levels fluctuate, the morphology of a coastal zone will evolve, changing the boundary conditions of other coastal processes: circulation, waves, tides, and the stor age of sediment on flood plains. The influence of humans can also affect changes in sea level at the local scale. For example, as we remove groundwater and hydrocarbons from subterranean reservoirs, sea level may rise in nearby areas. Climate warming may also contribute significantly to sea level fluctuations. IPCC predictions suggest that sea level is rising globally (15 to 95 cm by 2100) as a result of the recent warming of the ocean and the melting of ice caps. As sea levels rise, we may destabilize a coast due to accelerated beach erosion and the trapping of river sediment on flood plains. The predicted IPCC climate-warming scenario will undoubtably impact one coastline more than another. For example, the Siberian coast is presently experiencing a reduction in offshore sea ice cover, and this in turn provides an increase in ocean fetch. The consequence is higher sea levels during the openwater summer, and acceleration of coastal erosion. Recent studies also suggest that tropical to temperate coastal environments are experiencing stormier conditions (i.e. number and severity of hurricanes). Will local storm surges magnify the impact of a global sea level rise, increasing the risk to humans and their infrastructure? Are there negative feedbacks to our engineering of the protection of our coastal settlements?

Perhaps the largest impact to coastal stability is from our modification to the global flux of sediment to the coastal zone. Changes in global hydrology have modified the timing and intensity of floods, and therefore the effective discharge available for sediment transport. Climate shifts have varied the contributions from meltwater (snow, ice), altered the intensity of rain, changed a drainage basins water storage capacity, and altered precipitation and evaporation rates. Humans have also modified downstream flow significantly.

Over half of the world rivers have seen stream flow modification through the construction of large reservoirs. These and other rivers have also been impacted by water withdrawl for agriculture, industry and settlements. Some rivers that once had continuous flow now run dry every year due to these impacts. Some rivers can no longer provide the necessary energy to disperse sediment up and down the coastal zone, and thereby replenish beaches with new sediment. Other rivers that were once dominated by suspended load have become bedload rivers, through the trapping efficiency of upstream reservoirs. Other rivers can no longer sweep the finegrained organic matter and mud out from their estuarine system.

Human migration to the coastal zone and concomitant land use change has also greatly impacted the stability of our coastal areas. Population shifts impact the natural habitat, including wetland use and extent, stability of river channels and flood plains, and the health of coastal reefs and mangrove swamps. These alterations almost always destabilize the coastal environment.

Chapter 4 of the LOICZ Synthesis volume will be multiauthored. Colleagues are asked to submit contributions (data, figures and text) on these topics and toward the synthesis volume. Full reference and acknowledgement of material will be provided to all participants. Contributions should be directed to authors with topical responsibility:
typology and coastal habitat
- Robert Buddemeier *(Buddrw@kgs.ukans.edu)*,

population impacts
- Robert Costanza *(Costza@cbl.umces.edu)*,

sea level impacts
- Nick Harvey *(Nharvey@adelaide.edu.au)*, and

river influences
- James Syvitski *(James.syvitski@colorado.edu)* or
- Eric Wolanski *(E.Wolansk@aims.gov.au)*.

1. Introduction
   - pristine conditions vs present and future conditions
   - rates of change at the temporal (±100 years) and spatial scale (local vs regional)
   - natural variability vs trends in change
   - storage capacity and residence time

2. Understanding the coastal zone through typology
   (Robert Buddemeier)
   - spatial distributions of properties
   - identification of sensitive coastlines

3. Impacts of local, regional and global sea level fluctuations
   (Nick Harvey)
   - processes and mechanisms: coastal dynamics
   - evolving morphology and boundary conditions
   - coastal storms, coastal protection

4. Changes in the flux of water and sediment
(Eric Wolanski)
- processes and mechanisms
- evolution of water flow to the ocean: climate vs man
- evolution of sediment discharge to the ocean: agriculture, deforestation, dams

5. Patterns of Change in the World of Global Change
(Robert Costanza)
- impacts of people: human migration and land use change
- impacts of climate change: rainfall, air temperature, storminess
- sea level rise and sediment retention
- biostability, shoreline modification, reclamation: wetlands, coral reefs, delta plains, deforestation of man-groves

6. Summary
Patterns of change
Danger signals
Mapping the future

Chapter 5. Impacts and Feedbacks in C, N and P Cycling in the Coastal Zone

Fate and process of chemically reactive materials carried in the coastal sea.

(Lead authors: Stephen V. Smith, Fred Wulff, Robert Buddemeier and Chris Crossland)

A major consideration for Earth System Science is to estimate the role of the coastal ocean in the processing of carbon, nitrogen, and phosphorus as materials move from the land to the ocean. This question needs to be addressed globally; it needs to be addressed regionally and by ecosystem type; and time trends in this role need to be addressed.

Of particular interest is to consider why the coastal zone should be treated as a zone, rather than as a hard boundary between the land and ocean. In general terms, the reasons are that important transformations occur as materials move from land to the ocean. These transformations differ both quantitatively and qualitatively from reactions in the interior of the ocean, largely out of contact with the sea floor. A related issue important but not unique in the coastal zone concerns the role of horizontal fluxes in global balances. Further, rates change for the reaction of any particular material as it moves from one system box to another.

In this Chapter, analysis will estimate the magnitude of fluxes, the biogeochemical pathways of the fluxes, and large-scale controls on the fluxes, with particular considerations to changes in fluxes in response to global environmental changes. A particularly important component of change to be considered is the interactions of those fluxes with humans: human perturbations and consequences. It is assumed -and will be further evaluated- that changing land use, human population density, and changing technology are the primary drivers of change.

One primary tool for the assessment of these processes in the coastal ocean will be biogeochemical budgets - the site-specific budgets being generated by LOICZ according to the LOICZ guidelines, additional budgets available in the literature but not following the LOICZ guidelines, and generic (global) budgets that do not capture the detail of the site-specific analyses. It is felt that budgets according to the LOICZ guidelines must be the primary information used, in order to assure objective comparison. However, there exists a great deal of information that does not conform to those guidelines but that is nevertheless of great use.

A second major tool will be the use of the LoiczView tools for typological (classification) analysis of the global coastal zone. This analysis will allow both for a general classification of the coastal zone and a statistical analysis of the budget data by coastal type; hence extrapolation from budgeted to unbudgeted portions of the coastal zone. It is assumed that the global budgets will be the most dependable descriptions of global performance, but that the local budgets and typological analyses will provide the best bases for regional understanding.

[The lead editors listed below may choose co-editors and/or sub-chapter authors.]

1. Introduction
(Stephen V. Smith, Fred Wulff)

1.1 Why C, N, and P?
- discussion of other elements, such as Si

1.2 Why the coastal zone?
- land influence
- ocean influence
- bottom influence
- human influence

1.3 Horizontal versus vertical fluxes

1.4 Turnover versus net flux in nutrient cycling
- changing turnover between system boxes

1.5 Pathways of nutrient uptake, release, retention, and loss
- organic versus inorganic pathways for C
- biotic versus abiotic pathways for P
- alternative pathways for N

1.6 Factors influencing change on time scales of decades to centuries
- variability versus trends in change - time scales of change
- past, present, and possible future conditions

2. Classifying the world's coastal zone
(Robert Buddemeier, Dennis Swaney)

2.1 Expert versus statistical typology

2.2 Terrestrial and marine influences on typology

2.3 Physical and social influences on typology

2.4 Typology versus regression to examine the coastal zone.

3. CNP fluxes by coastal type
(Robert Buddemeier, Fred Wulff, Stephen V. Smith)

3.1 A look at information availability
- the LOICZ methodology
- the LOICZ research strategy
- other information availability

3.2 Fluxes and variability of fluxes under "pristine" conditions

3.3 Influences of environmental change on CNP fluxes
- systemic changes
- cumulative changes

3.4 Global aggregation of coastal CNP fluxes
- top-down versus bottom-up analysis of aggregate behavior
- role of the coastal zone in global ocean fluxes

3.5 Prospects for future fluxes

4. Implications of coastal zone CNP fluxes
(Chris Crossland, Robert Costanza and Peter Burbridge)

4.1 Implications in Earth System Science

4.2 Implications for management

5. Summary and conclusions
(Stephen V. Smith, Robert Buddemeier, Fred Wulff and Chris Crossland)

Chapter 6. Science for Management in the Coastal Zone

Hot issues, key findings and implications of the LOICZ program

(Lead Authors: Peter Burbridge, Robert Costanza)

Ecosystem functions refer variously to the habitat, biological, or systems properties or processes of ecosystems. Ecosystem goods (e.g., food) and services (e.g., waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions. For simplicity, we refer to ecosystem goods and services together as ecosystem services. Daily (1997) provides a detailed recent compendium on describing, measuring, and valuing ecosystem services. Only renewable ecosystem services, excluding non-renewable fuels and minerals and the atmosphere are included. Note that ecosystem services and functions do not necessarily show a one-to-one correspondence. In some cases a single ecosystem service is the product of two or more ecosystem functions, whereas in other cases a single ecosystem function contributes to two or more ecosystem services. It is also important to emphasize the interdependent nature of many ecosystem functions. For example, some of the net primary production in an ecosystem ends up as food, the consumption of which generates respiratory products necessary for primary production. Even though these functions and services are interdependent, in many cases they can be added because they represent "joint products" of the ecosystem which support human welfare.

A preliminary assessment of the value of ecosystem services at the global scale (Costanza et al. 1997) indicated that they provide a significant portion of the total contribution to human welfare on this planet. This study estimated that the annual value of these services (in 1994 $US) at $16-54 trillion, with an estimated average of $33 trillion (which is significantly larger than global GNP). Because of the nature of the uncertainties in this estimate, it is almost certainly an underestimate. Coastal environments, including estuaries, coastal wetlands, beds of sea grass and algae, coral reefs, and continental shelves were estimated to be of disproportionately high value in this study. They cover only 6.3% of the world's surface but are responsible for 43% of the estimated value of the world's ecosystem services. These environments are particularly valuable in regulating the cycling of nutrients that control the productivity of plants on land and in the sea.

1. Key research findings

Coastal regions focus of human activity. Implications for humans: loss of ecosystem, services in watersheds, coastal margins, nearshore marine areas.

1.1 Flooding vulnerability - Urban and Rural Regions
- sea-level rise
- storm surges
- changes in river basin hydrology
- abstraction of ground water-soil subsidence and erosion/deflation of land surface
- removal of buffers (reefs, mangrove, narrowing of estuaries and reclamation of wetlands)
- inappropriate coastal engineering that disrupts coastal processes and increases vulnerability of people, property, crops and investment
- (examples - urban regions: Calcutta, Venice; rural regions: Bangladesh/ Bay of Bengal, Orissa, Mozambique)

1.2 Disease vulnerability
- contamination of surface waters, groundwater, ballast water discharge in nearshore and estuarine environments
- human disease vectors - Cholera
- diseases of plants and animals e.g. loss of aquaculture production (salmon production loss in Scotland, Chile; seal and canine distemper virus)
- poor sanitation - loss of shellfish producing areas

1.3 Decreasing Food Security
- plant and animal disease vectors reducing cultivated crops, aquaculture
- loss of capture fisheries from loss of coastal habitat support functions, loss of marine protein important to poorer communities

1.4 Freshwater Shortages
- changes in regional hydrology, water-shed/ catchments/land cover
- changes in groundwater recharge rates, excessive abstraction
- salinisation
- global shift in climate/rainfall
- contamination of surface waters (agriculture, industry, human wastes)
- inefficient use of water resource

1.5 Nutrient Cycling
- loss of wetlands in respect to inorganic to organic transformation, support to estuarine and marine food chains
- N, P fluxes 1.6 Waste management
- loss of wetland water purification, removal of pollutants from water column
- pollution - agriculture, industry, human wastes

1.7 Sediment control
- accelerated erosion due to reduction in sediment supplies from watersheds to coastal margins
- dredging - need for better disposal of dredge spoil to allow wetlands to serve as receptors of spoil
- maintain functions of estuaries as absorbers of wave and tidal energy
- increased storminess, relative sealevel rise retreat of coastal margins- Managed retreat
- changes in Sediment fluxes

1.8 Biodiversity
- degradation of estuarine and coastal systems with loss of biological diversity

2. Scope for Action

2.1 Results of LOICZ research to determine what scope there is for action to moderate or reverse changes in earth systems associated with coastal systems that constrain sustainable use of coastal regions, ecosystems and natural resources.

2.2 Limitations imposed on human action resulting from natural changes in earth systems.

2.3 Identification of key actions, prioritisation and scaling of actions

2.4 Estimation of economic costs and benefits associated with key actions.

3. Research Needs

Identification of key areas/subjects where further strategic use of scientific investigation is required to enhance the effectiveness of management and to enable the evaluation of options for sustainable use of coastal regions and resources to meet human needs and aspirations.

Chapter 7. Preliminary/First Synthesis

The Way Ahead

(Lead Author: TBA)

Chapter 8. Epilogue

"So What?"

(Lead author: TBA)

Chapters 7 and 8 will be addressed as the substantive analyses and earlier chapters are developed. These will represent the major synthesis findings to date from the LOICZ project. An Open Science Meeting planned for early 2002 will contribute to a wide audience input not only to review and identify gaps in the earlier chapter topics but, will provide a major forum for drawing together the content and substance of these final chapters.

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The Global International Waters Assessment Methodology Protocol

UNEP/GEF GIWA presents a new water assessment method and calls for comments

UNEP/GEF GIWA invites scientists of all levels, institutions, private sector, NGOs, water stakeholders and the public to peer review and comment on the new GIWA Assessment Methodology Protocol. The method has been developed to address environmental problems in Intentional Waters of globally 66 Subregions and to identify the societal root causes behind the problems.

The GIWA assessment focuses on transboundary water problems -in lakes, rivers, groundwater, coastal zone and marine area - of global importance and their environmental and socio-economic aspects. In short the GIWA assessment methodology deals with Scoping, Detailed Environmental and Socio-economic Impact Assessment and the Causal Chain Analysis as well as Indicators.

The UNEP/GEF GIWA web site **www.giwa.net** provides access to the methodology documentation, further information and contains an easy to handle report engine for your comments. It will be open for comments until **18 February 2001**.

IPO Notes

HESTER AND JAN

In Newsletter 16, we welcomed Hester Whyte as Office Manager and Jan Crossland as 'editor'

Hester has the following to say about herself:

I was born in Great Britain in the summer of 1974, to an English father and a Dutch mother. We moved to Texel when I was three. After finishing school on Texel I moved to The Hague to study Educational Media. When I graduated I decided to check out some other parts of the world. After being in a lot of trains, planes and automobiles going through Thailand, Australia, the US and Mexico I returned to Texel with a lot more memories but a lot less money.

I worked for 6 months in a shop selling sporting goods, then in the flower bulb business. After a cold Texel winter, I applied for an indoor job as co-ordinator at ChildRight Worldwide, a foundation that fights against every form of child exploitation. The foundation, originally situated just outside Oosterend (on Texel), where I happened to live, moved back to Amsterdam. I followed and worked in Amsterdam for nearly two years. For financial reasons they had to let me go last September.

I had already moved back to Texel, so I thought it was time to get a job on the island and decided that the NIOZ might be the place. By coincidence, or was it, there were several vacancies at the NIOZ, and the LOICZ IPO was looking for a new office manager - and here I am!

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Jan Crossland is currently employed on contract to LOICZ to edit and publish the UNEP project workshop reports.

Jan has worked in various scientific and educational capacities, including echinoderm taxonomy and scientific conference organisation, mostly part-time, as she has tried to keep up with Chris's various career moves, and at the same time raise two daughters, now teenagers. Living on Texel and working with the international LOICZ community has opened yet more doors and made possible a long-term European experience for all members of the Crossland family.

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FIRST ANNOUNCEMENTS AND CALLS FOR PAPERS

Climate Change and Variability in Northern Europe (CLIC)
- June 6-8, 2001,
University of Turku, Finland
For further information contact Dr Jaana Vormisto, FIGARE-coordination,
University of Turku FIN-20014
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Email: jaavor@utu.fi

International Human Dimensions Programme (IHDP) on Global Environmental Change
4th Open Meeting - October 6-8 2001, Rio de Janeiro, Brazil.
Emphasis in this meeting will be placed on research with a regional perspective and links between natural and social sciences, as well as between local, regional and global scales. Plenary themes of the meeting will address the challenges of integration in human dimension research across disciplines, across hemispheres and across the science/policy interface.
Information will be available on:
<http//sedac.ciesin.org/openmeeting>.
Enquiries can be addressed to
open.meeting@ciesin.org.
The deadline for submission of abstracts and session proposals is March 29, 2001.

Joint IAPSO/IABO Assembly 2001: An Ocean Odyssey
– 21-28 October 2001,
Mar del Plata, Argentina.
Information at
<http//www.criba.edu.ar/2001_ocean

LOICZ PUBLICATIONS

[Available as printed copies or from the LOICZ web site: www/nioz.nl/ loicz]

Estuarine Systems of the South America Region: C, N, P Fluxes, 2000. LOICZ UNEP workshop report. Eds. V. Dupra, S.V. Smith, J.I. Marshall Crossland and C.J. Crossland. LOICZ R&S no. 15.

Estuarine Systems of the East Asian Region: C, N, P Fluxes, 2000. LOICZ UNEP workshop report. Eds. V. Dupra, S.V. Smith, J.I. Marshall Crossland and C.J. Crossland. LOICZ R&S no. 16.

LOICZ Web Site: *Biogeochemica Budgets and Modelling* – new sites and tutorial materials (http://data.ecology.su.se/MNODE/).

LOICZ Web Site: *Typology* (http://water.kgs.ukans.edu:8888/public/Typpages/index.htm) Also (www.kgs.ukans. edu/ Hexacoral/ Workshops)

Coming soon:
South American Basins: River Catchment Effects on Coastal Seas, 2001. Compiled by D. Lacerde, B. Kjerfve, W. Salomons and H. Kremer LOICZ R&S no. 17.

LOICZ CALENDAR

- LOICZ UNEP Asia and Oceania thematic workshop on upscaling and assessment of nutrient fluxes in coastal estuarine systems.
  14-17 January 2001.
  Brisbane, Australia *(by invitation)*.
  Contact: LOICZ IPO.

- LOICZ-UNEP-EU Mediterranean, Black Sea, North Africa workshop on biogeochemical modelling of estuarine systems.
  5-8 February 2001. Athens, Greece *(by invitation)*. Contact: LOICZ IPO.

- East Asia BASINS workshop on river catchments/coastal fluxes and human dimensions.
  26-28 February 2001, Hong Kong *(by invitation)*. Contact: LOICZ IPO

- SAMBAS II workshop on South American Basins and Caribbean river catchments/coastal fluxes and human dimensions.
  26-29 March 2001, Brazil
  (by invitation). Contact: LOICZ IPO

- LOICZ UNEP Americas thematic workshop on upscaling and assessment of nutrient fluxes in coastal es-tuarine systems.
  29 April - 2 May 2001.
  Ensenada, Mexico
  (by invitation). Contact: LOICZ IPO.

- AfriBASINS II workshop on African river catchments/ coastal fluxes and human dimensions.
  2-5 July 2001, Europe TBA
  (by invitation). Contact: LOICZ IPO

- LOICZ UNEP Africa and Europe thematic workshop on upscaling and assessment of nutrient fluxes in coastal estuarine systems.
  2-5 July 2001, The Netherlands
  (by invitation). Contact: LOICZ IPO.

- LOICZ Scientific Steering Committee Meeting.
  7-8 July 2001, Amsterdam.
  Contact: LOICZ IPO.

OTHER MEETINGS

- IGBP Science Committee annual meeting.
  19-23 February 2001.
  Chiang Mai, Thailand
  (by invitation). IGBP Secretariat.

- GEOTROP 4th International Conference on Environmental Chemistry & Geochemistry in the Tropics.
  7-11 May 2001. Townsville, Australia.
  Contact: Greg Brunskill (g.brunskil@aims.gov.au) or www.tvl.clw.csiro.au/geotrop2001/

- CoastGIS 2001: 4th International Conference on Computer Mapping and GIS for CZM – Managing the Interfaces.
  18-20 June 2001.
  Halifax, Nova Scotia, Canada.
  More information on http:\\agc.bio.ns.ca/coastgis2001
- IGBP Open Science Conference.
  10-14 July, 2001.
  Amsterdam, The Netherlands.
  Contact: igbp@congrex.nl, www.sciconf.igbp.kva.se

- 3rd International Conference on Land Degradation and Meeting of the IUSS SubcommissionC – Soil and Water Conservation.
  24-28 September 2001.
  Rio de Janeiro, Brazil.
  More informaion on www.cnps.embrapa.br/ICLD

- Joint IAPSO-IABO Assembly and XII Colloquium: 2001 - An Ocean Odyssey.
  21-28 October 2001,
  Mar del Plata, Argentina.
  Contact: gmper-ill@criba.edu.ar or iado@criba.edu.ar

- Global Conference on Oceans and Coasts at Rio+10: Assessing Progress, Addressing continuing and New Challenges.
  3-7 December 2001. UNESCO, Paris.
  Contact IOC Secretariat, Paris.

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