LOICZ

ANNUAL REPORT
2002

LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE

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About LOICZ

The world's coastal zone forms a long narrow boundary between land and ocean that is highly valued by human societies. Since 1993 the Land-Ocean Interactions in the Coastal Zone (LOICZ) core project of the International Geosphere-Biosphere Programme (IGBP) on Global Change studies this heterogeneous, relatively small but highly productive, dynamic and sensitive area of the earth's surface. The LOICZ International Project Office is hosted by the Royal Netherlands Institute for Sea Research (Royal NIOZ) and funded by the Netherlands government.

Major questions that LOICZ addresses on a global scale are:

- Is the coastal zone a sink or source of CO_2?
- What are the mass balances of carbon, nitrogen and phosphorus in the coastal zone?
- How are humans altering these mass balances, and what are the consequences?
- How do changes in land use, climate and sea level alter the fluxes and retention of water and particulate matter in the coastal zone and affect coastal morphodynamics?
- What is the role of the coastal zone in trace gas (e.g., DMS, NO_X) emissions?
- How can knowledge of the processes and impacts of biogeochemical and socio-economic changes be applied to improve integrated management of the coastal environment?

The focus of LOICZ research is on horizontal material fluxes and scaling of processes through environmental and socio-economic sciences. LOICZ depends on national programmes of research and contributions from individual scientists, and works with researchers to develop collaborative and multidisciplinary projects to meet the goals. While directed research is initiated to fill gaps in knowledge, LOICZ aims to value-add to the global knowledge base through focussed workshops in which experts address issues relating to the project questions. The LOICZ Implementation Plan (1995) describes in detail the approaches and purpose of LOICZ.

The year 2002 marked the sunset of the first decade of LOICZ and the beginning of the planning for a second decade in which a new and redesigned LOICZ is expected to continue as a major science contributor to the new phase of IGBP II and the Earth System Science Partnership of IGBP, IHDP, WCRP and DIVERSITAS.

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1. Chair's Report

2002 was the final year of the first decade of LOICZ, thus an important if not the most important one for both the synthesis and the future of the project. Consequently throughout the year, the LOICZ SSC has consulted widely in the further development of the synthesis book chapters and in the preparation of a comprehensive discussion document aimed at identifying the key issues for the "New" LOICZ. A final sequence of regional workshops and the international LOICZ Synthesis and Futures Meeting held in Miami (May/June 2002) provided a crucial forum for discussion of both the synthesis findings and consideration of outcomes, and for a lively debate and concurrence towards the New LOICZ research thematics.

With this invaluable input from the global scientific community the LOICZ synthesis book got well underway with five of its six chapters prepared in preliminary draft stages, the sixth introductory chapter is being drafted. Publication is foreseen in early 2004.

It became evident during the year that LOICZ after almost a decade of collaborative research will be able to provide a first global synthesis of nutrient fluxes and C, N and P metabolism in the nearshore coastal seas. This can draw on more than 200 site studies, addressing questions of land-based drivers and best approximations for coastal system functions. Riverine sediment transport to coastal seas and change under environmental and anthropogenic pressure will also have a global scale focus while human-induced changes and impact on the coastal part of the water cascade originating in the river catchments will be based on estimates of single rivers to continental scales including Africa, Europe, Asia, South America, the Caribbean and Oceania. Substantial support for the LOICZ synthesis was generated by the further development of the LOICZ Typology database and clustering software. Providing the "glue" between sites of primary and empirical data and those with only secondary information, it has grown into a mature upscaling tool with a dynamic range of applications on different scales. Other issues that found continued attention in 2002 and will therefore be reflecting in the synthesis book comprise groundwater flows, processes along the continental margins, coastal habitats and ecosystems, trace gas fluxes, management of river deltas, sea level issues and capacity building.

It cannot be overlooked that in all activities, including synthesis and futures discussions, the important role of humans in the coastal realm became more and more apparent. Qualitative and quantitative data are providing firm support for this milestone in LOICZ' contribution to the IGBP Global Change evaluation. To further strengthen these directions in particular in the second phase of LOICZ the traditional physical-chemical-biological community of LOICZ in 2002 has increasingly engaged with the human dimension community (notably within IHDP) in developing the futures discussion document. The discussion document was widely circulated, generating an array of correspondence and ideas from coastal zone scientists, managers and policy makers from around the world. It provides the basis for the work to be done by the interdisciplinary scientific scoping team appointed by the LOICZ SSC and the IHDP, which started drafting the "New" LOICZ Science Plan at the end of the year. In recognition of the non-linearities in system processes and the co evolution of the environmental and social systems, the plan (to be accompanied by an implementation strategy) is expected to truly promote high level integration and interdisciplinarity. It is expected to be ready for approval in the first half of 2004.

The good and hard work at the IPO, mainly funded by several Dutch agencies and hosted at the Royal Netherlands Institute for Sea Research (NIOZ) continued. Chris Crossland and Hartwig Kremer again travelled all over the world, initiating new activities and supporting on-going ones. A milestone of course was an independent review of these supporting IPO operations and the achievements motivated by the Dutch funders. I am glad to say that this

review came to an encouragingly positive conclusion recommending to extend the support for the IPO for at least a transition time of another three years. Based on this recommendation the Chair and IPO have further enhanced contacts with the funding agencies to maintain the financial support for continued operations of the office on Texel.

However, the intended continuation urges the SSC, its Chair and the IPO to also develop plans that can meet not only the financial demands but include structural aspects for the future management and scientific questions. Ultimately the establishment of more official LOICZ Nodes as part of a distributed IPO around the world with some central organisation are being considered. Negotiations with other potential financiers of global research have started. Considerations of potential collaboration of a continue LOICZ with IHDP or even going under the umbrella of both IGBP and IHDP are on going.

The SSC has also formally invited Hartwig Kremer to favourably consider a continued commitment to LOICZ in the position of Executive Officer from 2003 onwards. Chris Crossland has taken on the "blessings and curses" of retirement Down Under. Editorial support by Jan Crossland strengthened the IPO to edit another set of eight LOICZ Reports and Studies volumes and at the end of the year another special volume of a refereed journal based on scientific results presented at our Open Science Meeting in Bahia Blanca was published. Hester Whyte continues to keep track of all LOICZ activities including meeting and travel arrangements and Mildred Jourdan in particular kept the database up to date.

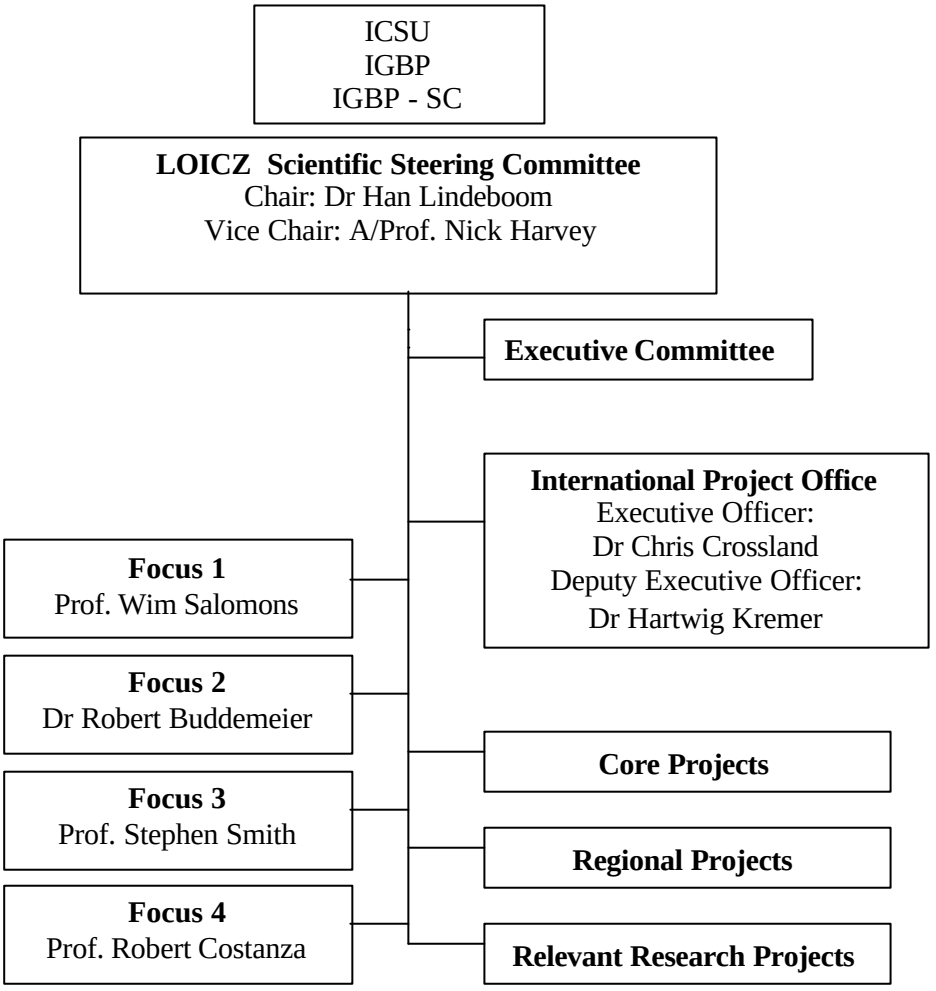
Yes, our future is taking shape but much work remains to be done by all involved in LOICZ.

After a successful final year of the first decade of LOICZ science and synthesis, even more challenging years await us when officially entering our future phase.

Han Lindeboom
Chair
LOICZ Scientific Steering Committee

2. Structure and Organisation

The core project, Land-Ocean Interaction in the Coastal Zone (LOICZ), was established by IGBP in December 1992 with the adoption of the LOICZ Science Plan (IGBP Report No. 25), and became the sixth core project of IGBP (itself a program of ICSU).



LOICZ Organisation Schema (2002)

The **Scientific Steering Committee (SSC)** provides scientific guidance and oversees the development, planning and implementation of the LOICZ Core Project. The IGBP Science Committee (IGBP-SC) established the SSC and is also responsible for the subsequent appointment of the Chair, Vice-Chair and members.

SSC Membership

Dr Han Lindeboom (Chair)	Netherlands Institute for Sea Research, The Netherlands
A-Prof. Nick Harvey (Vice-Chair)	University of Adelaide, Australia
Dr Robert W. Buddemeier	University of Kansas, USA
Prof. Peter Burbridge	University of Newcastle, UK
Prof. Robert Costanza	University of Maryland/moved to Delaware
Prof. Shu Gao	Nanjing University, China
Dr Jozef Pacyna	NILU, Norway

Dr Gerardo M.E. Perillo	Instituto Argentino de Oceanografica, Argentina
Prof. Wim Salomons	GKSS Research Centre, Germany, Free University
Dr James Syvitski	Institute of Arctic and Alpine Research, Colorado, USA
Dr Liana Talaue McManus	Marine Science Institute, University of the Philippines, The Philippines

Ex officio members

Prof. Frederik Wulff	*Stockholm University, Sweden*
Prof. Stephen V. Smith	*University of Hawaii, USA*

Both were involved in 2002 SSC activities reflecting their crucial contribution to the synthesis process and in accordance with earlier determination of the SSC and IGBP

The SSC 13 met on 27 May and 2 June, 2002 in Miami, Florida, USA.
The **Executive Committee** (EXCOMM) is a subcommittee of the SSC that, at the direction of the SSC, deals with special issues and reports to the SSC with recommendations. The EXCOMM comprises the SSC Chair, Vice-Chair and the four Focus Leaders.

While the EXCOMM did not meet in 2002, Focus Leaders maintained and intensified their strong interaction with the IPO throughout the year, in particular in their role as lead authors for the Synthesis Book. With two exceptions, members of the EXCOMM met for the Lead authors meeting in Washington DC in early October. This was followed up by an informal briefing and exchange with US funding agencies. The two meetings mostly addressed synthesis but also funding and future research issues.

The **Foci** are the four key programme activities of LOICZ (see Section 3) co-ordinated by the Focus Leaders. **Core Projects** directly address goals of the LOICZ Science Plan and are co-ordinated by the SSC. **Regional Projects** are closely linked to the Science Plan (but may have additional aims) and are co-ordinated at regional levels. **Relevant Research Projects** make a scientific contribution to LOICZ, often at local or thematic levels. Activities of the project research elements of LOICZ are outlined in Section 3.

The **LOICZ International Project Office** (IPO) is responsible for the administration of the project on a day-to-day basis, under the strategic guidance of the SSC. The IPO role includes: co-ordination, planning, communication, advocacy and provision of a technical secretariat. It is located at the Royal NIOZ, Texel, The Netherlands.

The LOICZ secretariat comprised: Executive Officer (Dr Chris Crossland), Deputy Executive Officer (Dr Hartwig Kremer), Office Manager (Ms Hester Whyte), P/T Administrative Officer (Ms Mildred Jourdan) and contract Editor (Ms Jan Crossland). A Liaison Officer (Maarten Scheffers) was located at the RIKZ Coastal Zone Management Centre, The Hague.

3. Status Reports

3.1 LOICZ FOCI

3.1.1 Focus one

Effects of changes in external forcing or boundary conditions on coastal fluxes

Focus Leader: Prof. Wim Salomons

Work in Focus 1 aims to describe and model the status and changes of horizontal fluxes of water, nutrients, carbon and, to a limited extent, contaminants into the coastal sea through river catchments, the atmosphere, and exchange processes along continental margins. Natural and human forcing are key elements, and the DPSIR model is used as a framework for the major thrust of the Basins studies. Emphasis is given to the dynamics and delivery of materials from the global catchment basins. The core project activities of the LOICZ/JGOFS Continental Margins Task Team (CMTT; see Section 3.2.4) provides the main route towards understanding shelf margin transfers.

The main effort in 2002 in Focus 1 has been consolidating the flurry of activities of the previous years in LOICZ-Basins. The regional assessment and synthesis projects conducted in 2001 have been finalised and along with publication of the related LOICZ R&S reports (see Section 7):

a) East Asia Basins; R&S published, follow up projects under discussion with APN and an international Japanese and Chinese Yellow river project took off in 2002;
b) South American Basins, SAmBas; further Focus 1 related work using the LOICZ biogeochemical modelling and Basins approaches has been approved for funding by the IAI as a collaborative effort between Ecuador, Chile and the USA. Project developments in Latin America using the EuroCat model are continuing.
c) AfriBasins; R&S published and an additional study proposal commenced.
d) Wider Caribbean (CariBas): R&S published, including a desk study report on Oceania islands.

An extensive desk study on the Russian Arctic Basins was commissioned and developed to a first full draft. The study focuses on the major rivers draining to the Russian Arctic by applying the LOICZ Basins approach. Most recent data have been included in the analysis. Publication as a LOICZ R&S report is expected in 2003.

A specific web site on LOICZ-Basins was established and is regularly updated. In addition the reports were, with the help of the editors, transformed for use in the chapters for the upcoming LOICZ synthesis book.

The AfriBasins initiative resulted in a new regional project (AfriCat) which covers four contrasting catchment-coastal sea studies on the African continent. The focus here is on the issue of damming. A detailed description is given in Section 3.3.

The EuroCat project was enlarged with two new sites. One is located in Bulgaria and covers a catchment-coastal sea system draining to the Black Sea; a second team joined and is working in Slovenia. Here the impacts from past mercury mining activities on the coastal system is the key issue, including important aspects of human health.

To date, all EuroCat sites have prepared assessments dealing with indicators, scenarios, quality assurance and data management. These are available through the LOICZ-Basins website http://w3g.gkss.de/projects/loicz_basins or directly through the EuroCat website (http://www.iia-cnr.unical.it/EUROCAT/project.htm).

3.1.2 Focus two

Coastal biomorphology and global change

Focus Leader: Dr Robert W. Buddemeier

supported by A/Prof. N. Harvey (sea-level issues) and Drs G. Perillo & J. Syvitski (sediment studies)

Focus 2 addresses the role of ecosystems in determining coastal morphodynamics under varying environmental conditions and coastal biomorphological responses to human activities. The response of systems such as coral reefs, mangroves and sea grasses to changing environments, sea level change, and groundwater implications for coastal habitats, sedimentary processes, and the development of classification systems (typologies) are areas emphasised in this Focus. A key issue is how to deal with spatial and temporal scales of change in the coastal zone.

The Typology core activity and its contributions to the integrated LOICZ Synthesis has been the dominant theme for the past year. The major thrusts of activity have been the analyses and reporting of the UNEP-GEF project (LOICZ Reports and Studies No. 24), and the preparation of chapters for the LOICZ synthesis volume. In conjunction with the latter activity, a major effort went into preparations and presentations for the LOICZ Synthesis and Futures meeting (Miami, May 29-June 1 2002), and for the Lead Author's workshop convened in Arlington, VA (6-7 October 2002) .

Throughout this final and transitional year for LOICZ I, the Typology database and tools have continued to be developed and expanded. The LOICZ/Hexacoral on-line database was further modified to improve ease of access, with both variables and additional variable selection tools added. LOICZ biogeochemical budget variables were reviewed and updated, and data on the refined, higher resolution drainage basins associated with the budgets were added. An interactive mapping tool has been added to both the data selection interface (http://hercules.kgs.ku.edu/hexacoral/envirodata/locationcart/loccartmap.cfm) and the output view for geo-referenced locational or biological data. This is linked to default environmental variables, and can be used to query the full database for selected variables. Under the auspices of the Ocean Biogeographic Information System (http://www.iobis.org), the database was made interoperable with several other biological databases (NMITA, Fishbase, and Cephbase), which make dynamic use of both the mapping tools and the environmental database.

Dr. Bruce Maxwell and students have continued to maintain the web-based LOICZView geospatial clustering tool that is linked to the database, but have also developed the next-generation successor application, DISCO (password controlled prototype at http://narya.engin.swarthmore.edu/disco/, which has been supported in part by a US NSF grant to D. Weinstein and D. Swaney (Cornell), B. Maxwell (Swarthmore) and R. Buddemeier (KGS): "SGER: Ecological time series and model analyses using a web-based classification tool \(WLV\)". In addition to this successful proposal, substantial effort has been invested in seeking continuation funding for the tools and data support effort. In addition to a meeting with NSF program officers in conjunction with the October 2002 Lead Author's workshop, personnel associated with LOICZ or its Hexacoral partner submitted a total of 6 proposals to NSF and NOAA during 2002. None of these were funded, although some proposals submitted in early 2003 are still pending.

Liaison with the chairs and members of SCOR-LOICZ Working Group 112 (Groundwater Flux to the Coastal Zone) has continued during the wrap-up phase of that activity, and as funding for continued co-ordination and research is being sought.

3.1.3 Focus three

Carbon flux and trace gas emissions

Focus Leader: Prof. Stephen V. Smith
supported by Prof. Fred Wulff and Dennis Swaney (synthesis & web site development)

The emphasis of Focus 3 is on the development of a suite of global sites describing the biogeochemical budgets for carbon, nitrogen and phosphorus fluxes and processes in estuaries and coastal seas. This follows an approach developed by LOICZ during the early phase of the project as a way to deal with limited data at sites within a heterogeneous area of the globe (LOICZ R&S No. 5, 1996). A key goal is determining the relative autotrophy and heterotrophy of the coastal zone i.e., is the coastal zone a net source or sink for CO2? A watching brief is maintained on the development of knowledge about the net vertical flux estimations for trace gases in the coastal zone.

During 2002, Focus 3 efforts have been directed towards synthesis of the findings of the preceding UNEP–GEF project which culminated in a set of some 200 individual C-N-P models across all climatic and geographical regions of the globe. Still challenging was (and is) the task of synthesising the outcomes in terms of the effect of global change, notably climate and human dimensions. This includes development of simple best proxies for coastal metabolism based on catchment- derived and demographic parameters.

A joint APN-SASCOM-LOICZ regional workshop was held in Sri Lanka December to address material fluxes to the coastal zone in South Asia and their impacts. The workshop was an extension of earlier biogeochemical and coastal zone initiatives between the three sponsoring programs and the scientific network, and delivered several new biogeochemical budget site assessments for the region – a region that remains relatively poorly represented in the "global budgets" data set. Additional field and analysis work is proceeding with the continuing support of APN.

Outcomes are included in publications (see Section 7) and through the publicly accessible LOICZ websites that linked to a variety of tools and techniques.

Scaling and integration of the biogeochemical performance of the global coastal zone has primarily involved working with Focus 2 in moving from individual site budgets to upscale and generalize the budget results via typology. In preparation for the Miami Open Science meeting (May/June 2002), a manuscript was drafted describing the typology of DIN and DIP loading to the ocean. That manuscript was submitted to BioScience and has recently been published (March 2003) and is available on-line:

S. V. Smith, D. P. Swaney, L. Talue-McManus, J. D. Bartley, P. T. Sandhei, C. McLaughlin, V. C. Dupra, C. J. Crossland, R. W. Buddemeier, B. A Maxwell, F. Wulff,. 2003. Humans, hydrology, and the distribution of inorganic nutrient loading to the ocean. BioScience. **53**(3):235-245; http://ecologia.cicese.mx/archi/svsmith-01.pdf

In addition to this publication, the Focus 3 group has been working on its contribution to the LOICZ synthesis book and to the CMTT synthesis book.

A literature review of the significance and the cycles and fluxes of trace (non-CO_2) gases in the coastal zone was completed by the Norwegian Institute for Air Research. With emphasis on CH_4, N_2O, VSC (such as DMS and COS) and Hg, the evaluation of existing information confirmed that flux rates from coastal waters to the air are generally much higher than for the open ocean. In total that the contribution of coastal areas to the total oceanic emissions can be significant on a global scale. While coastal seas emissions, as a function of the total global contribution seems to be below 2% (except for nitrous oxide), they can be important at local

and even regional scales. Key research questions were identified for consideration in the development of the "New" LOICZ and for potential collaboration with the new SOLAS project within IGBP, phase II. A peer reviewed journal article of this desk study was published in October 2002 (see Section 7).

3.1.4 Focus four
Economic and social impacts of global change in coastal systems
Focus Leader: Prof. Robert Costanza

This Focus addresses the two human dimensions in the coastal zone, looking at the co-evolution of coastal systems under different scenarios of global change (essentially the impacts of humans) and the effects of changes in coastal systems on social and economic activities. The first element aims to link natural and social scientists in researching key coastal issues to describe and model socio-economic pressures driving coastal changes in the use of coastal space and how this influences material fluxes and ecosystems.

The second element seeks to develop tools and measures for producing regional and global forecasts of the effects of coastal changes on the human dimension, particularly through coupling of natural science and economic models. This work involves the building of a database on economic valuation and cost-benefit approaches, within a context of community and wider stakeholder evaluations, in order to assess the vulnerability of coastal systems and human populations to global changes.

In 2002, the true integration of human dimension work within LOICZ was increasingly addressed in both, the development of an outline for the future science plan and as an inherent element of the synthesis of the first decade of LOICZ. In particular the biogeochemical investigations within the core project, namely in Focus 3, resulted in a first model allowing to estimate coastal system metabolism by simple catchment based demographic and run off parameters. The typology upscaling tool and the database increasingly included socio economic information and assisted in visualising the LOICZ findings more and more in relation to "people" effects. In the catchment coast studies of Focus one the DPSIR approach nourished both the development of future scenarios of coastal change under different management options as well as the related discussions with stakeholders in the policy advisory groups in some of the projects.

However, a key specific initiative directed to assessment and evaluation of assessing the economic value of biogeochemical changes in the coastal zone continued through work at the University of Maryland. In this LOICZ study, a framework for the assessment and valuation of goods and services provided by coastal systems is developed. It includes a typological approach capturing the functional diversity for classifying and valuing ecosystem services, emphasising that no single ecological or economic methodology can deliver the total value of these complex systems. Based on existing information and case studies the project also demonstrates the process of ecosystem service valuation. Conclusions on coastal system values and implications for the advancement of coastal management are expected for 2003.

3.2 LOICZ CORE PROJECTS

The LOICZ core projects address global issues, either by production and testing of widely applicable models of change in the coastal zone or by providing wide geographic syntheses of information about coastal properties, coastal fluxes or coastal processes and their rates of change.

Eight core projects are established in LOICZ (those marked with an asterisk were completed before 2002; related foci indicate directions of application of tools and/or results or information exchange between foci; see LOICZ web-page **www.nioz.nl/loicz/** for further details).

Title	**Related Foci**
Biogeochemical Budgets and Modelling	3
Coastal Typology Development	2 (3)
Continental Margins Task Team (CMTT)	1&3
River Catchments and Basins	1,2&4
Deltaic Processes and Management	1,2&4
ELOISE	1 to 4
Submarine Groundwater Discharge (LOICZ/SCOR)	1,2&3
SARCS/WOTRO/LOICZ Southeast Asia Research *	1,3&4 (2)

3.2.1 Biogeochemical Budgets and Modelling

The biogeochemical budgets project aims to compile regional carbon/nitrogen/phosphorus data and budget models for numerous coastal areas of the world that can be used to produce global synthesis models of their flux in the coastal zone. The LOICZ strategy to deal with estimating these CNP fluxes for the global coastal zone is to develop a global inventory of these budgets. To date, more than 200 sites have been budgeted.

The project uses a robust, widely applicable, uniform methodology that has minimal data requirements and that can work with secondary data (Gordon et al. 1996). In broad summary, water and salt budgets are used to estimate water exchange in coastal systems. Nutrient budgets (as a minimum, dissolved inorganic phosphorus and dissolved inorganic nitrogen) are also developed, and departure of the nutrient budgets from conservative behaviour as a measure of net system biogeochemical fluxes. Non-conservative flux of dissolved inorganic phosphorus, scaled by an estimate of the carbon/phosphorus ratio of the reacting material, is used to estimate primary production minus respiration (p-r). The discrepancy between the observed non-conservative flux of dissolved nitrogen, scaled by the N:P ratio of the reacting organic matter, is used as an estimate of nitrogen fixation minus denitrification (nfix-denit). While this is clearly a great simplification of the details of processes and reaction pathways in ecosystems, it provides some insight into possible net reactions accounting for nutrient uptake and release. This approach is preferred to estimates based on carbon flux, because carbon data are available for relatively few systems. Similarly, “direct estimates” of production, respiration, nitrogen fixation, and denitrification are difficult to obtain at system scales.

A global “typology” (or classification) of the coastal zone, or perhaps a series of typologies, is used to extrapolate from the budget sites to the remainder of the coastal zone. Literature research, workshops including a strong capacity building component, and information sharing via the World Wide Web (http://data.ecology.su.se/MNODE) are the major tools being used to share and develop the budget database. The web site also provides software and methods for model/budget development, and PowerPoint tutorials.

Activities in 2002 are summarised in the Focus 3 Core report. Some 200 biogeochemical budgets have been developed for estuaries and coastal seas using the LOICZ approach, supported especially by a network of global researchers and the UNEP GEF-funded project (The Role of the Coastal Ocean in Disturbed and Undisturbed Nutrient and Carbon Cycles). The project reached a fairly much global spatial coverage with some exception in the South Asia region (currently subject to field and assessment work through national programs and support from APN and LOICZ). Integration of the budget sites information to address core LOICZ questions about C, N and P sinks/sources and fluxes continues to be conducted by a networked group of scientists, making use of the LOICZView typology tools as a key approach.

3.2.2 River Catchments and Basins

Major work of the project deals with the impact of human society on horizontal transport of materials to the coast. Pathways under consideration comprise surface run-off as well as groundwater. The coastal impact of these mass transports is being assessed, in particular their change under natural and human forcing, and aims to provide feasible management options within a context of analysis of success and failure of past regulatory measures. Since the changes in fluxes are mostly land or river catchment based, the Basins approach treats the catchment-coastal sea as one unit – a water continuum. Applied to coastal impact or issues, this scale means that in addition to economic activities (e.g., agriculture, fisheries, urban development, industry, transport, tourism), morphological changes (e.g., damming) have to be taken into account as driver/pressure settings affecting the fluxes. In particular the parameters assessed are:

- material flow of water, sediments, nutrients and priority substances such as contaminants (past, current and future trends);
- socio-economic drivers which have changed or will change the material flows;
- indicators for the impact on coastal zone functioning; and to derive from them
- "critical load" estimates of nutrients, contaminants, sediment (water fluxes) affecting system stability and functioning of the coastal zone.

The global assessment of river basins (see Section 3.1 Focus 1) has continued with a regional approach based on the DPSIR framework as a tool for integrating human dimensions, biogeochemical state changes and environmental impact assessment at various spatial scales. The teams involved also seek to develop a better understanding of how key indicator parameters influence critical thresholds of environmental functioning and health. This effort ultimately aims to fit into the critical load concept (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 approach, reports and updates on the project status are available via: http://w3g.gkss.de/projects/loicz_basins/.

Activities in 2002 are summarised in the Focus 1 report.

3.2.3 Coastal Typology Development

LOICZ has as one of its primary goals the characterisation of the role of the coastal zone in material fluxes – in coastal estuaries and seas, and in terrestrial catchments and river basins. Recognising that the world coastal zone is complex, heterogeneous and largely unstudied, this functional globalisation is being carried out by upscaling biogeochemical and human dimension data and generalising from well-studied areas to similar but less well-known regions. This activity has been pursued with two integrated elements. First, the collection of validated and consistently expressed coastal biogeochemical budgets (Section 3.2.1) and river catchment information (using the DPSIR framework; Section 3.2.2). Second, the classification of coastal systems by typology.

Typology (the study of, or analysis or classification based on, types) provides a strategy to use available or derived geospatially referenced data, and to search for the patterns and connections within. The approach divides the world coastal zone into land, coast and sea cells half a degree on a side, and is populating those cells with data for many variables ranging from air temperature to population density and from bathymetry to soil texture (data base development; for environmental database used refer to http://www.kgs.ukans.edu/Hexacoral/Envirodata/envirodata.html). The various populations of cells can be statistically clustered to identify similarities and differences (clustering analysis) - which will in turn be examined for their ability to explain or describe the distribution of types of biogeochemical budgets and basins in the coastal database. Once data selection, weighting and tuning has resulted in a set of typologies that are robustly predictive of the coastal systems, the process of extrapolating to regional and global coast zone function can be started.

While there are many possible ways, both conceptually and methodologically, to classify and extrapolate coastal characteristics, LOICZ has selected and is applying a consistent method. The LOICZView geospatial clustering software package, has been developed by Dr Bruce Maxwell (Swarthmore College; http://www.palantir.swarthmore.edu/loicz/help) specifically for this application. The software currently runs on UNIX and LINUX platforms, and is adapted for deployment on the Internet. It is being actively used for a variety of applications (http://www.kgs.ukans.edu/Hexacoral/Workshops).

Activities in 2002 are summarised in the Focus 2 report.

3.2.4 CMTT

The Continental Margins Task Team (CMTT) is a joint activity with JGOFS addressing material fluxes of major biogenic elements and processes at the interface between the ocean realm and the continental shelf relevant to climate change. The 6-member Team includes three scientists (Dr Larry Atkinson, co-chair; Dr Liana McManus, Prof. Shu Gao) nominated by LOICZ and three from IGBP JGOFS, and draws on and co-ordinates relevant research and skills in the global community. It has divided the task up into sub-groups: eastern and western boundary systems, polar margins, tropical margins and marginal seas.

Throughout 2002 the CMTT Synthesis writing was in progress with a final workshop on synthesis rescheduled from December 2002 to spring 2003. The team and other SSC members have contributed a LOICZ Biogeochemical chapter and a sediments commentary; an outlook chapter will be added. Deadline for the draft chapters was November 2002 Outcomes from the CMTT synthesis need to be promoted in the new IGBP Oceans project and in the new LOICZ Futures planning.

3.2.5 Deltaic Processes and Management

Deltas are the result of strong interactions with rivers and the sea, with riverine influence generally dominant over marine forces. Due to the growing economic interests and increasing population in the world's coastal zone, the vulnerability to pollution and natural hazards is increasing. Furthermore, the impacts of climate change and other external factors must be added to the already existing problems of coastal management – whether it be Modified Mega-Deltas (MMDs) or other types of global coastal geography – such as low elevation islands (e.g. Maldives). These pressures require the urgent development and application of adaptive planning and management arrangements.

In the past, measures were taken and constructions were built for human use of delta resources and environments. Not all of these were successful; on the contrary, developments

such as the armouring of the deltaic coastline, or isolation by dikes or levees of the rivers flowing into and through the delta have isolated fresh inputs and flooding into the deltas wetlands and estuaries. The isolation of rivers and distributaries from deltas and armouring delta shorelines are two of the more notable problems that have caused billions of dollars in losses to development and populations in the delta as well as in degradation and loss of delta resources and environments.

The Delta Project derives from both the Land-Ocean Interactions in the Coastal Zone Project (LOICZ) and the program of the Coastal Zone Management Centre (CZMC) in the Netherlands Ministry for Transport, Public Works and Water Management. The Project contributes to Focus 4 (Human Dimension) of the international LOICZ program (see http://www.nioz.nl/loicz). The project also contributes to the evaluation of integrated coastal zone management practices in modified mega-deltas. This information has direct application to the activities of Netherlands' Coastal Zone Management Centre (see http://www.netcoast.nl).

The aim of the mega-deltas project is to learn from the experiences of development within deltas and their associated drainage basin, and from the planning and management of deltas. The overall goal is to determine how deltas can be sustainably developed. Information about the project and the world's 21 Modified Mega-Deltas is now available on the Delta website, www.deltasnetwork.nl.

The mega-delta project addresses the following questions:

- What are - or will be - the most significant changes in modified mega-deltas during the next to ten years.
- How are the fluxes of nutrients and sediment in deltas altered by human interventions?
- What information is available about best management practices in deltas? Are they being evaluated? What can we learn from these practices?
- Which concepts and tools are available for the sustainable development of modified mega-deltas? Have they been applied, and if so, in what respect have they been effective?
- What research is needed for further elaboration on delta management practices?

In 2002, the final draft report of the first international workshop on planning and management of the world's modified mega-deltas was prepared and sent for review to the workshop participants. The workshop was held from September 24-26, 2001 at the Coastal Zone Management Centre that is based at the National Institute for Coastal and Marine Management (RIKZ) of the Ministry of Transport, Public Works and Water Management in The Hague, the Netherlands. Among the outcomes of the Workshop was a proposed Action Plan for developing and operating an international information exchange network. A number of other products from the Workshop were:

1) a list of issues commonly involved in the planning and management of modified mega-deltas,
2) a comparative analyses between the deltas, and
3) improved data on the deltas derived from the questionnaires.
4) The Workshop recommended applying the ecosystem approach for the planning and management of deltas.
5) The importance of pulsing events (e.g. river-borne floods, flooding from ocean-borne storms) for a sustainable development of deltas was stressed.

These findings are intended to give guidance for future research in order resolve the major issues that are common to the modified mega-deltas. The final report will become available in 2003.

3.2.6 ELOISE

The European Land-Ocean Interaction Studies (ELOISE) is a "Project Cluster" supported by the European Commission. As a core project of LOICZ, ELOISE is the official contribution of the European Union to the global Land Ocean Interaction studies. Coastal zone research projects in the Commission are combined, with additional support, to focus on the important question of how the land-ocean interaction operates and how this is influenced by human activities. ELOISE started under the 4th RTD Framework Program of the EU as an initiative of the Environment & Climate and the MAST (Marine Science and Technology) Research Programmes, acting in concert with the Program for International Co-operation (INCO) and the research programmes of the Member States. It continued under the 5th and a call under the 6th Framework Program is awaited.

ELOISE aims to develop a broad pool of European coastal zone research information of high scientific value and relevance to human society. It is intended that, in addition to the value of the basic science produced, ELOISE will contribute to other activities of the Commission underpinning in particular the efforts to develop a coherent European strategy for integrated coastal zone management and spatial planning. This entails generation information on catchment-based processes affecting the coastal zones in support of the implementation of the European Water Framework Directive. Further information can be found on the WWW page of ELOISE (http://europa.eu.int/comm/dg12/eloise/eloise-h.html) or from the ELOISE secretariat (http://www.nilu.no/projects/eloise).

At the end of 2002, 27 of a total of 56 projects since 1996 were active under the ELOISE cluster. Since the extensive review of their status and perspectives during the 4th Annual ELOISE conference in Rende, Italy, in autumn 2001, discussions within ELOISE and among the projects have been focussing on improving the capacity:

a) to synthesize the outcomes of ELOISE research, especially in the context of the new European Research Area (ERA), and
b) to forge the links into the competitive surrounding of the 6th Framework Program (2002-2006).

In order to enhance the "Community Added Value" of the ELOISE Cluster and the synthesis of its science a balanced mix of fundamental and applied science encapsulated in a harmonized and effective synthesizing and communication mechanism is projected to be established in the next years. This is aimed to overcome the current fragmentation of activities through system-based integrated approaches and improved scaling including river catchments and socio-economics. Meeting these and related policy objectives will allow both better testing of the robustness of, for example, the products of ELOISE, and an improved contribution to sustainable development in Europe as outlined in the recently formulated communication to the Parliament. To achieve these objectives ELOISE began the planning of three Workshops:

1: Upscaling and demands at the European and global levels,
2: Integration into European Policy,
3: Developing coastal futures for Europe,

launched a Secretariat website, and began to issue a regular Newsletter (see website above for download). Initial approaches were made to current ELOISE projects concerning the content of a long-term web-based database of ELOISE results.

LOICZ continued to contribute to this process in 2002 through a joint workshop (Italy) and an intensified exchange with the new ELOISE secretariat which was established in 2002 at four locations in the Netherlands, Norway and UK following the Commission Call for tenders for institutional support in the ELOISE synthesis. As part of its own "synthesis and futures" process, LOICZ underlined its preparedness to assist in forging the links between ELOISE and the global change dimension and to support the up-scaling and inter-comparison work of the European research group. The dialogue between the LOICZ SSC and science community

and the EU Commission on this issue continued and was further strengthened through strong participation of the relevant Directorates General in the LOICZ Synthesis and Futures Meeting in Miami in summer 2002. Discussions and collaboration during the design for the new decade of European Coastal research will be a priority issue of the next ELOISE Conference to be held in Gdansk, Poland, March 2003. In parallel, discussions were started concerning harmonization between databases held by ELOISE and LOICZ. Concrete measures are anticipated during the first half of 2003.

3.2.7 SCOR/LOICZ Working Group 112 and continued global assessment of submarine groundwater discharge (with support from IOC and IHP/UNESCO and IAEA)

Direct discharge of submarine groundwater, SGD, into the coastal zone may occur anywhere that a coastal aquifer is hydraulically connected to the sea. Usually the magnitude of such discharge is considered to be relatively minor, although recent studies indicate that groundwater may occasionally account for a significant fraction of the coastal fresh water inflow. On global scales, groundwater attracts growing attention as a potential significant, but still poorly quantified, source of nutrients and other dissolved species to coastal waters.

The overall goal of the project is to define more accurately and completely the magnitude of SGD and how it may influence chemical and biological processes in the global coastal ocean. To this end, three task areas address the following goals: Calculation and Modelling; Measurement; Sampling, and Experimental Design; and Typology, Integration and Globalisation.

Activities completed in 2002:

- members of the WG participated in a Co-ordinated Research Programme (CRP) project on "Nuclear and Isotopic Techniques for the Characterisation of SGD in Coastal Zones" of the International Atomic Energy Agency (IAEA) and UNESCO's International Hydrological Programme (IHP). Fieldwork was carried out in Donnalicata, Sicily, March 18-24, 2002. This is a known site of extensive groundwater discharge to the ocean.
- WG members organized and participated in a 3rd SGD assessment inter-comparison experiment of the Intergovernmental Oceanographic Commission (IOC) and IHP of UNESCO on Shelter Island, New York, USA during May 2002.
- a contribution to the LOICZ synthesis chapter ("Dynamics of the Coastal Zone," James Syvitski, lead author) on SGD was prepared and group members participated in the LOICZ Synthesis and Futures Meeting in Miami, 2002.
- WG members established and developed an IUGG (International Union of Geodesy and Geophysics) joint commission on "Groundwater-Seawater Interactions" (CGSI) between IAPSO (International Association for the Physical Sciences of the Ocean) and IAHS (International Association of Hydrological Sciences). The CGSI operates under the following terms of reference:

  1. To foster research concerning the flow of groundwater into the coastal zone.
  2. To participate and collaborate in research on submarine groundwater discharge within developing countries.
  3. To engage in capacity building and training

  The new Commission will follow up on the SCOR/LOICZ WG-112, and increase its activities with a broad scientific scope and fostering the improvement of a global expert

network. It will provide a platform encouraging in particular participation of young scientists.

In late 2002 preparation of this new concept was already well advanced with almost 100 scientists covering a range of disciplines having been recruited from 37 countries in all continents. It is planned that regional groups will work independently with the synthesising capacity being provided through the Commission. Further information concerning CGSI can be found in the LOICZ newsletter No. 26 (March 2003).

- During July 2002 members of the WG/CGSI directed a scoping mission to Lingayen Gulf, Philippines, one of the perspective field sites to be included in a proposal for the future SGD filed study. This follows up on initial groundwater discharge calculation undertaken as part of the earlier SARCS-WOTRO-LOICZ project finished in 2000 (see LOICZ R&S No. 17)
- A SGD session was organised during the joint IHP/UNESCO, OHP/WMO International Conference on Low-lying Coastal Areas – Hydrology and Integrated Coastal Zone Management, 9-12 September 2002, Bremerhaven, Germany
- WG members participating in a meeting held at the IAEA Headquarters in Vienna, Austria during December, 2002 provided a preliminary assessment of the results of the fieldwork in Sicily, Italy conducted earlier. Reports were prepared and papers are planned for submission during 2003.
- Jointly with SCOR WG 114 a Gordon Research Conference on Permeable Sediments was created during 2002 to stimulate communication and research on aquatic permeable sediments. The conference will be held during June 2003 in Bates College, Lewiston, Mane, USA.

Preparing for 2003:

- Two symposia were organised during 2002 for the 2003 IUGG Congress in Sapporo, Japan: (1) "Groundwater Inputs to the Ocean" (JSP03) and (2) "Quantitative Approaches to Hyporheic Flows and Their Biogeochemical Consequences" (JSH-03). More than 50 abstracts were received for these symposia.
- contributions were submitted to the International Open Science Conference on Ocean Biogeochemistry and Ecosystems Analysis (IGBP-Oceans), IOC, SCOR Paris, 7-10 January, 2003, and to the 3rd World Water Forum, Kyoto, 16-23 March 2003.

Proposals:

- The Asia Pacific Network (APN) was approached to support a direct measurement study of submarine groundwater discharge into Lingyagen Gulf, The Philippines (see above). Unfortunately, the proposal was declined but resubmission is being considered.
- A proposal to the Southeast Asia Regional Committee for START (SARCS) entitled "Contribution of Carbon and Nutrient Species into SE Asian Waters via Submarine Groundwater Discharge" was successful and will support measurements in the Gulf of Thailand.
- A research project proposal was developed for the International Commission for the Scientific Exploration of the Mediterranean (CIESM) entitled "Submarine Groundwater Discharge and Its Influence on Hydrological Trends in the Mediterranean Sea".
- WG members participated in the development of a research proposal for the 6th Framework Programme (2002-2006) of the EU Commission entitled "Soil-water systems under regional climate change and environmental pressure." Main research foci are (i) to understand and quantify the dynamics of soil-water interfaces and how this impacts on the hydrological cycle and in particular on water quality at nested scales (micro to meso

to macro to landscape scale) and (ii) to understand and quantify dynamics and fluxes at the aquatic sediment-river interface and subsurface coastal salt/fresh water interface and how this impacts on both water quality and quantity (macro to landscape to regional scale).

Publications

- A feature article was published in EOS on the two SGD methodological inter-comparisons (Florida and Australia) conducted to date, co-authored by several working group members. The reference citation is shown below.
- One of the major efforts during 2002 was also the preparation of a special issue of the journal "Biogeochemistry" on submarine groundwater discharge. This is intended to be the major product of the Working Group. All papers were submitted during 2002 and most of them have now been reviewed and accepted. We anticipate that this volume will be published by the end of 2003. For a detailed list of publications from the working group and related activities please refer to Section 7

3.2.8 SARCS-WOTRO-LOICZ (SWOL)

The SWOL project addressing the modeling and economic evaluation of land-based activities and related biogeochemical change in coastal areas in South East Asia finalised and published its Phase I report (McManus et al. 2001, LOICZ R&S No. 17).

In summer 2002 the scientific expertise of the SWOL approach and potential for a future phase of the project were elaborated during a workshop in Hanoi which included the major funding agencies. Further development of budgeting methodology and potential for typological up-scaling were part of intensive discussions for a new proposal. Until end 2002 this effort was still underway.

Irrespective of the chance for a second phase of SWOL the potential of this interdisciplinary approach and the application to catchment/coast scales was subject to considerable review in the discussions for the New LOICZ phase. The Synthesis and Futures Meeting in Miami underlined its relevance and the need for a enhanced scientific efforts in this direction including the human dimensions and the need for a growing attention on the role of groundwater input to the coastal seas.

Other Core Project activities are reported in Workshops (Section 4) and elsewhere in this report.

3.3 LOICZ REGIONAL PROJECTS

Regional projects contribute to LOICZ global issues within a regional framework. Of the twelve major regional projects three new ones became part of the LOICZ portfolio including DINAS Coast, AfriCat, and the Dutch and Flemish LOICZ project cluster (for details refer to newsletter 26, Section 3.4 of this report, and www.nioz.nl/loicz/)

Title	Investigator	Location
River Catchment – Coast Interaction and management Studies of the Coastal zone estuary and waterway management, Co-operative Research Centre	Roger Shaw	Australia
DINAS - Coast	Richard Klein	Germany/Europe
LOICZ/START/IOC – AfriCat – Pilot project	Russell Arthurton & regional PIs	Africa (Morocco, Senegal, Kenya, Tanzania)
Dutch LOICZ Project	various	Netherlands/ Europe
Land-ocean interactions in southern South America	J-L Probst	European Union
Ecology of tropical coastal systems: mangrove dynamics and management: MADAM	Ulrich Saint-Paul	Germany
European catchment assessment: EuroCat	Wim Salomons	Germany/ Netherlands/ Europe
Integrated coastal zone management in Banten Bay, Indonesia	A. Nontji	Indonesia
Studies for integrated coastal zone management	Maria Snoussi	Morocco
Key processes of ocean flux in the East China Sea (POFLECS)	Dunxin Hu	P R of China
Land-ocean interactions in China seas and their impacts on coastal marine environments, ecosystems and living resources	Dunxin Hu	P R of China
Land-ocean interactions in the Russian Arctic (LOIRA)	A.P. Lisitzin	Russia

3.3.1 New Regional Projects

DINAS-COAST (**D**ynamic and **In**teractive **As**sessment of National Regional and Global Vulnerability of **Coast**al Zones to Climate Change and Sea-Level Rise - EVK2-2000-22024).

Over the past decade, extensive research has been produced to assess coastal vulnerability to impacts of accelerated sea-level rise from local to global perspectives. National studies have been commissioned, for example, by the US Country Studies Programme and the Netherlands Climate Change Studies Assistance Programme. Interpretation of local/national results is, however, constrained by the fact that these studies used a range of methods, scenarios and assumptions. Throughout the 1990s, a first evaluation of coastal impacts and adaptation at regional and global scales was developed via the Global Vulnerability Assessment Framework (Hoozemans et al., 1993). DINAS-COAST will update and improve this early effort to satisfy current information needs for international climate policy.

DINAS-COAST is a top-down modelling efforts which builds on state-of-the-art science and data to help policy makers to interpret and evaluate coastal vulnerability to impacts of

accelerated sea-level rise, and adaptation options. The project will develop DIVA (Dynamic Interactive Vulnerability Assessment) which will allow the user to produce quantitative data:

- on a range of coastal vulnerability indicators,
- for user-selected climatic and socio-economic scenarios and adaptation policies, and
- on national, regional and global scales, covering all 180+ coastal nations.

DIVA will enable its users:

- to explore the effects of, on the one hand, climate change mitigation and on the other, adaptation in coastal zone,
- to explore potential cost-effective policies that combine mitigation with adaptation,
- to set priorities for international cooperation with respect to climate change and development, and
- to identify particularly vulnerable coastal areas and allow for the evaluation of a range of alternative responses.

DIVA will be a valuable tool for training and awareness raising. Its resolution will not allow coastal managers to make decisions at their scale of operation. However, DIVA will provide insight into the sensitivity of the coast to climate change and will thus be useful in informing coastal managers and national and international policy makers of the issues at stake in relation to climate change, coastal impacts and adaptation strategies.

The project is funded by the European Commission under the 5th Research Framework. It is led by Richard Klein (Potsdam Institute for Climate Impact Research, Germany). Four other partner institutes collaborate within DINAS-COAST (Flood Hazard Research Centre, UK; Hamburg University, Germany and WL|Delft Hydraulics and the Centre for Environmental Studies, The Netherlands). For more information of the project, please log on our website: http://www.PIK-Potsdam.DE/~richardk/dinas-coast/ or contact Dr. Anne C. de la Vega-Leinert at delavega@pik-potsdam.de

Reference:

Hoozemans, F.M.J., Marchand, M. and Pennekamp, H.A. (1993): *A Global Vulnerability Analysis, Vulnerability assessments for population, coastal wetlands and rice production on a global scale*, 2nd Edition, Delft Hydraulics and Rijkswaterstaat, Delft and the Hague.

3.3.2 AfriCat

The LOICZ AfriBasins Workshops, held in Nairobi in 2000 and 2001, provided a ranked overview of African coastal issues and impacts, their driving forces and pressures at catchment to regional scales, based on expert knowledge and judgement from the region (Arthurton et al. 2002). Apart from climate change, the principal internal drivers of environmental change within the African catchment-to-coast systems are agricultural development and urbanisation, and their associated activities – deforestation, industrialisation and in particular damming.

As a follow-up to AfriBasins, LOICZ-AfriCat, which broadly follows the EU/ELOISE-EuroCat design, provides a framework for investigating in more detail the linkages between human activities in African catchments and their impacts at the coast. A pilot project for AfriCat, funded by START and with additional support from IOC, entitled '*The coastal impact of water impoundment and abstraction in catchments, past, present and future*', commenced in November, 2002.

Damming, water diversion and groundwater abstraction are practices that have increased significantly in Africa during the last 50 years, in response to development demands for

agricultural irrigation, freshwater supply (particularly to fast-growing urban areas) and hydro-electric power (World Commission on Dams 2000). This foundation project is assessing the past, present and future impacts of damming in four countries; Morocco, Senegal, Kenya and Tanzania. The selected catchments comprise:

- Sebou and Moulouya, (the two largest rivers in Morocco) both of which have been dammed;
- Senegal, a large, transboundary West African river with a seasonal barrage on its lower course;
- Tana and Sabaki in Kenya, the former having been dammed and for which additional damming is planned;
- Rufiji in Tanzania, for which damming is planned.

While the catchments differ in the state and scale of their damming and in the nature of the impacts and issues at the coast, the project has adopted a standardised approach, placing a strong emphasis on human dimensions through consultation with catchment and coastal managers and stakeholders. A key element of the project is the assessment of the contributions that socio-economic and climate-related changes have made over the last 50 years, and are predicted to make over the next 50 years under a range of published scenarios (e.g., by the IPCC), to coastal state changes and their environmental and socio-economic impacts. In the long term the overarching aim of AfriCat is to improve the scientific basis for national, trans-national and regional policy-making and management responses as they relate to catchment-to-coastal sea systems in Africa, in respect of not only damming but all human-activity and natural drivers. Operational links with EuroCat and new related research in Europe are anticipated to be value-adding in the future of AfriCat.

The regional contacts for this AfriCat project are:
Morocco: Maria Snoussi, snoussi@fsr.ac.ma, Senegal: Alioune Kane, akane@ucad.sn, Kenya: Johnson Kitheka, jkitheka@recoscix.org, Tanzania: Yohanna Shaghude, shaghude@ims.udsm.ac.tz

References

Arthurton, R.S. et al. 2002. LOICZ R & S No. 25: (see Section 7)

World Commission on Dams, 2000. Dams and Development – A New Framework for Decision-Making. The Report of the World Commission on Dams: xxxvii+404 pages, Earthscan Publications Ltd, London and Sterling, VA.

3.3.3 The Dutch LOICZ project and associated research

Following a call in 2001, the Netherlands government continues to provide the vital support needed for the LOICZ IPO and to assist in the overall science activities of LOICZ. In addition the Netherlands government, through NWO, recently approved five research projects within a new and significant Dutch LOICZ programme involving several million Euro in funding, including:

- Budgeting of carbon and related nutrient pools and fluxes in the North Sea employing a coupled hydrodynamic ecosystem model (PI: Dr Helmuth Thomas; NIOZ).
- The transport of suspended particulate matter in the Dutch coastal zone (PI: Dr H. Ridderinkhof; NIOZ, Delft Technical University, RIKZ, IMAU).
- Archeal carbon fixation and burial and terrestrial organic matter input in the coastal system as revealed by tetraether membrane lipids (PI: Dr Sinninghe Manste; NIOZ, NIOO).
- Bio-geomorphological interactions within floodplains and their role in sediment transport and ecological transformation processes in the lower Rhine delta (PI: Prof. E.E Koster; Utrecht University, University of Nijmegen).

- Mechanisms involved in salt-marsh rejuvenation (PI: Prof. J.P. Bakker; University of Groningen, NIOO, Alterra, RIKZ).

This new regional work is extended by recent approval of substantial new research projects by the Flemish-Dutch Coastal-associated Marine Research on:

- The balance between heterotrophic amd autotrophic processes in the Scheldt Estuary: consequences for the carbon and nitrogen cycles (Co-PI:s Dr D. Frank & Dr J. Middelburg: University of Brussels, NIOO).
- Diversity – productivity relationships in microphytobenthos (Co-Pis: Dr V. Wim & Dr S. Lucas; University of Gent, NIOO).
- Food, oxygen and bioturbation: an experimental study of meiofauna community structure (Co-Pis: Dr V. Magda & Dr H. Peter; University of Gent, NIOO).
- Tidal freshwater marshes as processors and sinks of nitrogen in estuaries: a whole ecosystem 15M-labeling study (Prof. P. Meire & Dr H.T.S. Boschker; University of Antwerp, NIOO).

3.4 LOICZ RELEVANT RESEARCH PROJECTS

The relevant research projects are contributed by chief investigators and institutions, and usually involve local- or national-scale studies. Sixty projects were completed in 2001 and publications are in-train to journals; a comprehensive publication list is being prepared for the LOICZ website. [HK – again, update the text of this paragraph after review of status of projects]

The LOICZ database of projects is continually updated and is subject to annual review of the detailed status and outcomes from each project. Recognising this dynamic, the following listing is representative rather than comprehensive and project listings and support information is available on the LOICZ webpage (www.nioz.nl/loicz/).

Chief Investigator	Project Title	Country
Dr S. Appleyard & Dr B. Patterson	Role of groundwater discharge in causing environmental degradation in the coastal marine environment, Perth, Western Australia.	Australia
Mr C. Ajuzie	Monitoring for the presence of harmful microalgae in the Lagos and Lekki Lagoons, Nigeria.	Belgium
Dr E. Hong	A study on the transportation and sedimentation patterns of sediments in the Tseng-Wen River deltaic system.	China ROC
Dr N. Ramanujam	Monitoring and modelling of groundwater behaviour and cliff recession in relation to wave climate in the coastal belt.	India
Dr M.K.W. Osore	Assessment of marine pollution in a former mangrove creek.	Kenya
Dr R.P.M. Bak	Dynamics and diversity of coral reefs.	Netherlands
Dr R.P.M. Bak	Gradients in coastal reefs and adjacent systems.	Netherlands
Dr R.P.M. Bak	Small food web/benthos studies.	Netherlands
Prof. J.P. Bakker *	Mechanisms involved in salt-marsh rejuvenation.	Netherlands
Prof. H.Camp Op den	Carbon cycling in the coastal zone of Tanzania.	Netherlands
Dr P. Hoekstra	Dynamics of suspended sediment in a marginal reef environment.	Netherlands
Prof. E.A. Koster *	Biogeomorphological interactions within floodplains and their role in sediment transport and ecological transformation processes in the lower Rhine delta.	Netherlands
Dr H. Ridderinkhof *	Transport of suspended particulate matter in the Dutch coastal zone.	Netherlands
Dr J.S. Sinninghe Damste *	Archeal carbon fixation and burial and terrestrial organic matter input in the coastal system as revealed by tetra-ether membrane lipids.	Netherlands
Dr H. Thomas	The continental shelf pump: a pilot study in the North Sea	Netherlands
Dr H. Thomas *	Budgeting of carbon and related nutrient pools and fluxes in the North Sea employing a coupled hydrodynamic ecosystem model	Netherlands
Prof. N.I Alekseevsky	Regime and dynamics of river mouth on the coast of the Caspian Sea under the influence of large-scale sea-level changes.	Russia
Dr V.N. Korotaev	Investigation of estuarine-deltaic systems morpholithodynamics.	Russia

Prof. V.N. Mikhailov	Delta forming processes and their mathematical modelling.	Russia
Prof. V.N. Mikhailov	Mixing of river and sea waters at the nearshore zones.	Russia
Dr E.S. Povalishnikova	Seawater intrusion into rivers and its mathematical modelling.	Russia
Dr M. J. Bray	Environmental changes and management of coastal systems.	United Kingdom
Dr T. Jickells	Nutrient and metal cycling in estuaries and coastal environment.	United Kingdom
Dr T. Jickells	Air-sea exchanges of trace elements particularly nitrogen and trace metals.	United Kingdom
Dr C. Reynolds	Long-term assessment of physical and biological components in the waters of the Windermere catchment.	United Kingdom
Prof. F.T. Mackenzie	Model analysis of global change in coupled C-N-P-S biogeochemical cycles in the land-coastal margin atmosphere ecosystem.	United States of America
Dr Tran Duc Thanh	Sediment budgets and influence of moving and closing the inlets on the Tam Giang Lagoon ecosystem.	Vietnam

*** Part of Regional Project Dutch LOICZ**

4. Workshops & Synthesis

4.1 LOICZ WORKSHOPS

4.1.1 LOICZ Synthesis and Futures Meeting, "Coastal Change and the Anthropocene", Rosenstiel School of Marine and Atmospheric Science, University of Miami, Florida, 29 May – 1 June, 2002

The Synthesis
After almost a decade extending and building on initial plans and collaborative research addressing Global Change in the coastal zones, the LOICZ Core Project started a first synthesis of its major findings. Drawing on the extensive work provided by a network of more than 2500 scientists around the world, the LOICZ Synthesis and Futures Meeting provided a forum for:

- discussion of draft chapter developments leading to delivery of a book that provides a first integrated assessment of global change in the coastal zone, and
- discussion and development of thematic research areas for a "New" LOICZ (2003+).

At the meeting, more than 120 scientists, coastal managers and representatives of agencies from all parts of the world engaged in lively and constructive discussion and debate on the range of issues and questions put to the meeting.

In the opening Otis Brown, Dean of the Rosenstiel School for Marine and Atmospheric Science, University of Miami, welcomed the participants and noted that LOICZ makes an important contribution in a surrounding of largely disciplinary sciences and rather unlinked institutional structures. The Executive Director of IGBP, Dr Will Steffen, provided a synopsis of the spatial and temporal findings from the wider IGBP by demonstrating that the Earth environment is operating in a no-analogues state and changing at an unprecedented rate. Extraordinary pressures of human development, especially over the last 50–100 years (e.g., more nitrogen is now chemically produced by humans than is fixed by the natural system) are pushing the Earth System further towards new equilibria.

The Chair of the LOICZ Scientific Steering Committee, Dr Han Lindeboom, provided an overview of the LOICZ project to date. He reviewed the directions taken to gain answers to the major questions on global change in the coastal zone that had been the focus of the wider LOICZ research endeavors over the last decade. While most of the scientific research has been focussed at local to regional scale, the role of LOICZ in integration of data and information at regional to global scale assessment was emphasised. Some of the major findings from the river catchment-basins, biogeochemical budgeting, and scaling approaches were provided as examples of outcomes from the global LOICZ effort. Most of this work was being captured by the synthesis work in preparation of the LOICZ book, and the key messages and outcomes were addressed in detail during the subsequent plenary and workshop activities of the meeting.

The first major task of the meeting participants was to review and, refine the chapter assessments to derive the key implications for the changing coastal environments under natural and anthropogenic forcing. Preliminary draft chapters of the LOICZ Synthesis were presented in plenary and formed the basis for review and discussion in the subsequent working groups. Chapter themes included:

1. Coastal Ecosystems and Resources
2. Water and the Coastal Zone.
3. Dynamics of the Coastal Zone.
4. C, N and P Cycling in the Coastal Zone.
5. Science for Management in the Coastal Zone.

Combined plenary presentations were considered by the meeting participants as a whole, with suggestions and issues such as chapter structure, gaps in information and potential additional information being noted for detailed consideration during the deliberations of the allied working groups. Ultimately the recommendations, along with comments contributed by the wider meeting forum, provided constructive advice for the LOICZ SSC and lead authors. Work continues on the chapters and the LOICZ Synthesis book publication is anticipated for 2004. A companion synoptic overview of the LOICZ findings and messages also will be published as part of the IGBP Science Series.

Details of the discussions and the recommendations are available in hardcopy (Coastal Change and the Anthropocene; Conference Proceedings) from LOICZ IPO and will also be linked to the LOICZ website (including related presentations). See Section 4.4 for more detail.

The LOICZ Future

The second task of the Meeting was to consider the future design of LOICZ, with a continuing role in IGBP II and contributing to the Earth System Science Partnership of IGBP, IHDP, WCRP and DIVERSITAS. Sessions were built around the preliminary thematics identified in the "LOICZ Futures discussion paper" (Version 7):

- River Basins and Human Dimensions
- Spatial Issues: Implications of Land Use Changes in the Coastal Zone
- Fate and Transformation of Materials in Coastal and Shelf Waters
- Towards System Sustainability and Resource Management
- Risk and Vulnerability

Introductory plenaries from other related projects planned or implemented by IGBP (Oceans, SOLAS, Land) provided a focus for discussion of LOICZ future directions. Institutional perspectives by the European Commission, the IAI, and UNESCO/IOC gave a client's view of LOICZ science and products. Further insight was given into current and potential applications of LOICZ science by representatives of the Coastal GOOS (Global Oceans Observation System) of IOC and the EU 6th Framework Programme. The immediate relevance of river basin/coastal sea assessment scales was supported and the implications for policy advice (EU water framework directive), were highlighted.

A principal outcome of the discussions was an in principle consensus on the proposed thematics and cross-cutting activities (scaling, variability, dissemination and acquisition). The outcomes and advice of the Meeting will add to the development of a LOICZ II Science Plan into 2003. Throughout, the point was made that a stronger involvement of human dimension disciplines, stakeholder participation and coupling of natural and social science perspectives would be crucial.

Allocation of value functions to coastal zones and habitats along with assessment of non-marketable goods and services were identified as valid needs in the future LOICZ. River basins were seen to provide an important scale for action and assessment.

The LOICZ coastal typology methodology and approach was seen as having a high potential for application across national and regional levels. Key issues for a future LOICZ Science Plan in the context of the Earth System and its change include altered hydrology and sea-level rise on global scales, climate change in polar regions, eutrophication in temperate regions and soil erosion in tropical regions.

The LOICZ SSC is grateful for the constructive input provided by all participants, for organisation by RSMAS and funding support from IAI, IGBP IOI, KNAW, NSF, UNESCO/IOC, START and WOTRO.

4.1.2 Land-Ocean Interactions in China Seas (LOICZ/JGOFS) organised by the Institute of Oceanology of the Chinese Academy of Sciences, Mt. Laoshan, Qingdao, China, 30 June - 2 July 2002

A workshop on Land-Ocean Interactions in China Seas was organized by the Institute of Oceanology of the Chinese Academy of Sciences in Mt. Laoshan, Qingdao, China from June 30 through July 2, 2002. The aim of this workshop, designed and carried out by former LOICZ SSC member Prof. Dunxin Hu, the Chairman of the Chinese LOICZ/JGOFS Committee was to summarize the results of research carried out in China on land-ocean interactions in the coastal zone of China.

Welcome remarks were delivered by Prof. Jianhai Xiang, the Director of the Institute of Oceanology of the Chinese Academy of Sciences, who outlined the importance of land-ocean interaction studied in China. It was noted that about 40% of the Chinese population lives in the coastal zone, producing 60% of the Chinese GNP. These numbers are likely to increase in the near future.

The first day of the meeting was dedicated to discussions of progress in the Chinese Academy of Sciences Innovation Project "Land-Ocean Interactions in Chinese Main Estuaries and the Adjacent Continental Shelf"(2000-2003). The aim of the project is to explore and understand the dramatic variations of the materials (nutrients and sediments) discharged from the Changjiang River, resulting from strong anthropogenic activities in China and their impacts on coastal environment, such as on the Zhoushan Fishery Ground. Several surveys in different seasons have been carried out in the Changjiang River estuary and catchments of the Changjiang and Yellow Rivers, since the project began in July 2000. Based on field and historic data, variations of nitrogen flux in the Changjiang River, sand transportation in the Yellow River, primary production limitation and thermohaline distributions were discussed. Other experts, including the Chinese LOICZ Committee members, presented various topics related to the main subject of the meeting including:

- future LOICZ research activities in China;
- the importance of carbon cycling research;
- studies of the impacts of changes in the catchments on the state of the coastal environment in China;
- an innovation project on Land-Ocean Interactions in Chinese Main Estuaries and Adjacent Continental shelf (summarizing some 30 years of research [1968-1997] showing a 5 time increase of nutrient releases in the case study of the Changjing River and a 10 times increase of DIN levels, mostly due to the enhanced use of fertilizers in the region was identified);
- shifts of the water flow and modern evolution of the Huanghe Delta;
- land-ocean interactions along the late quaternary coast with strong tide and abundant sand;
- sediment fluxes from the Changjiang River to the East China Sea indicating a clear decrease of the sediment transport rate;
- concepts of biological pump mechanisms for CO_2 through phytoplankton, zooplankton to fecal pellets;
- seasonal variations of the circulation and suspended matter transport in the Yellow and East China Seas;
- shelf circulation in the East China Seas, and

- a project of Global Nutrient Modeling, supported by UNESCO with model calibration and final runs expected for 2004; areas included are: the Mediterranean Sea, the Chongjiang River basin, the US East Coast and the Gulf Coast (the Mississippi River), the Seine River, and the Baltic Sea catchments.

Prof. Jozef Pacyna, representing the international community of LOICZ and the SSC presented preliminary results from the LOICZ synthesis. He has also outlined the general plans for the next phase of LOICZ starting in 2003 and their interface with the objectives and themes of IGBP II.

Finally the EU European Land-Ocean Interaction Studied (ELOISE) program including some of its projects were discussed with the special focus on the EuroCat project. It was concluded that several of the current Chinese studies have similar objectives. Thus, future cooperation between the Chinese/LOICZ/JGOFS projects and the ELOISE projects is likely to result in mutual benefits. This interregional cooperation can become a vital support mechanism for the successful implementation of the "New" LOICZ and should be pursued through the Scientific ELOISE Secretariat.

The Chinese LOICZ/JGOFS Committee reviewed the Global Change Open Conference held in July 2001 in Amsterdam and the LOICZ Synthesis & Future Meeting held in May-June 2002 in Miami. The working report of the Chinese LOICZ/JGOFS Committee was presented to the Chinese IGBP Meeting held in December 2001 in Chongqing. Attributed to the work of the committee, the LOICZ and carbon cycle studies have been included in the Chinese National Basic Research Developing Programme. In response, the meeting set up a strategy for LOICZ/JGOFS studies in China, including issues such as fund raising from the state and coastal regions, exposing younger members to the committee, and improving communication and cooperation between natural and social scientists.

4.1.3 **LOICZ Synthesis, Lead Authors Meeting,** Arlington, Virginia, USA, 6-7 October 2002

Following up on the discussions and recommendations that came out of the Synthesis and Futures Meeting (Section 4.1.1) LOICZ held a lead authors meeting in autumn in Arlington. The task was to review the comments and suggestions and to feed them into a first draft of each of the chapters for the LOICZ synthesis book. In principle the variety of scales addressed by the various LOICZ research activities as reflected in the potential chapters was seen to be of advantage. It was agreed that the book should not become "another" text book on coastal zones and change but emphasis should be put on the issue of spatial and temporal change and its implications for the people. The book should provide a coherent storyline with vignettes and text boxes to show case some of the findings in concrete examples.

The authors agreed to rearrange the sequence of the chapters. The idea is to enable the reader to gain an introduction to the various issues with a global view and to subsequently scale-down to regional and sub-regional perspectives. In particular, some of the catchment-coast interaction studies of the LOICZ Basins project will encompass issues on a local scales. The following sequence of chapters was suggested:

1 *Introduction* (Lead author/s LOICZ IPO)
2 *Coastal habitats and living resources* (Lead author, Han Lindeboom)
3 *Dynamics of the Coastal Zone* (considers water and sediment fluxes, lead author James Syvitski)
4 *Impacts and feedbacks in C, N and P cycling*, (considers the riverine and human-induced fluxes and loads of nutrients, lead author, Stephen V. Smith)

5 *Water and the Coastal Zone* (draws on assessment and synthesis results at full regional scale and breaking information down to catchment scale, lead author, Wim Salomons)
6 *Science for Management* (Lead authors P. Burbridge / R. Costanza)

The last chapter is expected to drawing on the key findings to distil the most important implications for the future management issues in the global coastal zone including the gaps and needs for appropriate engagement with the user community and to generate truly interdisciplinary future science. It will provide vital information for the future directions of the "New" LOICZ. The typology will be reflected in almost all chapters, providing the "glue" between primary information sites and allowing for up- and down-scaling and comparison.

The meeting agreed to put the editorial work during the production of the book on to one focal point outside the IPO. This would be appropriate since the staff situation at the office in 2003 is unclear and the office will have to put its principal efforts into the transition and the necessary structural and operational challenges. On request of the authors, the current EO, Chris Crossland, agreed to take over the editorial co-ordination after his retirement at the end of 2002. It is planned to have a full draft ready for printing at the end of 2003 leaving the whole year for the writing and peer-review process and to have the book published in 2004.

4.1.4 LOICZ – US Agencies Informal Meeting on Synthesis and Future issues including advancement of performance and networking in the US, Arlington, Virginia, 8 October, 2002

Following the Lead Authors Meeting, an informal discussion was arranged between LOICZ and US funding agencies. A variety of desk officers of the National Science Foundation was introduced to the LOICZ project and provided with the latest update of the Synthesis and Futures process. Subsequent discussion addressed options for an improved engagement of LOICZ in the US including setting up a regional thematic IPO node. Multiple ways were addressed underlining the high potential for mutual benefits and agendas in the field of database exchange and management, the link to integrated data (including the human dimensions) and shelf processes. Potential roles of different funders, such as NOAA and its international departments were discussed. Mainly the US-based members of the LOICZ SSC are following up in this process.

4.1.5 APN/SASCOM/LOICZ Regional Workshop on Material Fluxes to the Coastal Zones in South Asia and their Impacts, Negombo, Sri Lanka, 8-11 December, 2002. (Visit www.coastal-fluxes.slt.lk or contact: Dr. Janaka Ratnasiri, e-mail: janakar @itmin.com)

The Sri Lanka Association for the Advancement of Science (SLAAS) hosted a 3-day regional workshop on "Assessment of Material Fluxes to Coastal Zone in South Asia and their Impacts" from 8-11 December, 2002 in Negombo, Sri Lanka. Objectives were to: (1) review and analyse the findings of the related APN project, (2) compare results and present the LOICZ-type biogeochemical budgets for different sites, and (3) discuss key issues related to the origins of nutrient, sediment and carbon, quantification of fluxes to the coast and, environmental and socio-economic impacts, and their human dimensions. Some 48 experts including national and overseas resource persons and guests participated in this workshop.

Following the inauguration by Mr T. Hewage, Secretary to the Ministry of Environment and Natural Resources of Sri Lanka, twenty-six technical papers and 4 posters were presented. Individual country reports included discussions on gaps and potential fields for improvement such as the integration of research and management in the region. Specific attention was paid

to future Sri Lanka's coastal zone management initiatives and related regional programmes. This was put in the context of the current LOICZ Synthesis and Future plans for the next decade of LOICZ research and its implications for South Asia. The scientific program also addressed the remote forcing of estuarine circulation and provided an interactive session, introducing methods of flux calculations and biogeochemical budgeting. Where sufficient data were available, participants calculated nutrients fluxes using the LOICZ modelling approach, while in other cases a ranking of impacts and priority issues was generated broadly following the LOICZ-Basins approach. A field trip highlighted the environmental issues of the wetlands and mangroves of the Negombo Lagoon.

An immediate outcome of the workshop is a collaboration of regional experts with LOICZ aiming to publish a set of selected papers on the biogeochemistry of South Asian Estuaries. As part of the LOICZ R&S series this will complement the global efforts of the related earlier UNEP/GEF project. The volume is currently in the review process. Publishing is expected in mid 2003. A second effort will be aimed to apply the LOICZ-Basins regional assessment and synthesis method to provide a state-of-the-art overview of current scientific understanding of catchment–coast interaction. The focus will be across a range of river scales (large, medium and small; and islands) in South Asia. Starting as a desk study with support of LOICZ expertise, the synthesis and conclusion of this analysis will likely be in the form of a regional South Asia Basins workshop. In principle, LOICZ in its second phase will investigate further options to strengthen its regional activities and networking in South Asia.

4.2 ASSOCIATED WORKSHOPS

4.2.1 EuroCat (contributing to LOICZ Basins/ELOISE) Principle Investigators and Policy Advisory Board Meeting, Rhodes, Greece, June 2002.

The principle investigators of the EU FP5 EuroCat project including the teams of the two new sites in Bulgaria and Slovenia met in Rhodes, Greece, to discuss the status of integrated assessment and modelling activities. Integration of the two new sites dealing in particular with industrial pollution and health issues as well as inputs to the Black Sea was addressed.

A meeting of the policy advisory board of the EuroCat project discussed the status and potential deliverables of the project for potential users including HELCOM, OSPAR and the EU Commission. The issues where embedded in the broader discussion of the needs and new features for an effective science–user link in the next framework programme (FP6) and during the implementation of the EU Water Framework Directive. EuroCat (and comparable projects such as "daNUbs" dealing with fluxes of nutrients to the Black Sea under scenarios of change in the transboundary Danube catchment) are expected to be key scientific initiatives underpinning the implementation of the Directive. For further information on EuroCat meetings and other ELOISE projects refer to the web pages of EuroCat and the ELOISE secretariat (http://www.iia-cnr.unical.it/EUROCAT/project.htm and www.nilu.no/projects/eloise).

4.2.2 **IHDP-IDGEC –Exclusive Economic Zone, Implications for Asia Pacific,** Bali, 4-6 June 2002

An important element for the new LOICZ direction is to closely engage with the human dimensions scientific fraternity, especially through the International Human Dimensions Program (IHDP). Recognizing that more than half of the world's population lives in the coastal zone and that humans are increasingly affecting the global processes, the imperative for a strong collaboration between natural and socio-economic scientists in the new LOICZ program is obvious. This development was strongly endorsed at the LOICZ Miami meeting and LOICZ is increasingly involves sociologists, economists and institutional researchers in its Future planning.

In early June, LOICZ representatives joined with regional scientists in a symposium in Bali on the Exclusive Economic Zone in the Asia Pacific. This included a wide-ranging discussion about the effect of EEZ institutional arrangements and its impact on sustainable development, fostered by the IHDP Institutional Dimensions of Global Environmental Change (IDGEC). The opportunity was taken to discuss collaboration and potential joint research projects with IDGEC and we look forward to close working relationships as we proceed into the new LOICZ program.

In addition, the LOICZ SSC resolved that an interdisciplinary scoping team of IHDP and LOICZ experts be established to develop a new Science Plan (2003-2012, see Section 6).

4.2.3 START/APN/TEA Workshop on Global Change and Sustainable Development in Coastal Northeast Asia, 7-8 October 2002, Vladivostok, Russia (Contact Vladimir Kasyanov, inmabio@mail.primorye.ru) associated with the **APN/START Global Change Awareness Raising Symposium** held at ACFES SEIYO Hotel, Vladivostok, Russia, 3-11 October, 2002.

In the context of identifying future regional research priorities for Northeast Asia with special focus on the coastal zones, LOICZ was invited to present its own future visions and an outline of the status of the synthesis. SSC member, Prof Shu Gao, provided two presentations, i.e., "Coastal Zone and the Anthropocene", and "Mud Deposits over the Eastern China Continental Shelves". The final part of the symposium was a discussion about the preparation and submission of a research proposal to APN (Asian-Pacific Network for Global Change). It was decided that a consortium of scientists from Russia, South Korea and China will submit the proposal jointly. The proposal (concerned with land-ocean interaction in the coastal regions adjacent to the Armur and Tumen Rivers) was completed and submitted in late 2002, and some "seed money" has been obtained for an initial study and further improvement of the proposal. The proposal can be considered as a follow-up from the earlier LOICZ East Asia Basins assessment and synthesis study (Hong et al 2002) which was supported by START, IOC and the APN.

4.2.4 **Coast to Coast meeting, Source to Sea, Tweed Heads, Australia** National Coastal Conference**,** 4-8 November 2002,

Coastal management and the complex role of science, institutional issues and participation under scenarios of increasing demographic and climate change pressures were addressed in the Coast to Coast conference hosted by the states of New South Wales and Queensland in Tweed Heads, Australia, 4-8 Nov. 2002. With a view on federal and state levels, a status review was provided and perspectives of change–response options were investigated extensively. While in the global context Australia's coastal issues seem to be less concerning, on local scales there is growing concern about the impacts of changing demography (increasing tourism) and potential climate change affects expected to impact the coastal zone. Public participation and involvement has generated a sound basis and considerable ownership of issues for integrated management in Australia, to a higher level than in most other places of the world. However, the often missing link between the catchments and their land-based issues with coastal seas as a single water cascade system remains to be made in the institutional and participatory approaches that are being taken to address and resolve coastal issues..

LOICZ was invited to comment on and review the regional role Australia plays in the context of coastal change on global scales. The conference also served as a platform to investigate a future formal and operational link between the Australian scientific institutional network and the "New" LOICZ. For more details of the contributions and reports of the thematic working groups are available at: http://www.coastal.crc.org.au/coast2coast2002/orderproceedings.pdf and http://www.coastal.crc.org.au/coast2coast2002/proceedings.html#conclusions

4.2.5 **DINAS Coast Scientific Steering Committee,** Hamburg, Germany 27-29 November 2002

LOICZ in its role as a member of the SSC of DINAS Coast (see Section 3 more details) participated in their annual Meeting in order to provide the PIs and research teams with an overview of the current LOICZ Synthesis and Future discussions. The dialogue concentrated on the role DINAS can play as a regional project, acknowledging that this will be most

relevant in the early phase of the "New" LOICZ. The meeting agreed that the contribution will be of relevance in particular in the new LOICZ Theme 5 and partly Theme 4 (see Section 5.). DINAS provides a consortium of interdisciplinary scientists covering both traditional natural and human dimension sciences, and agreed to contribute to the development of the LOICZ science plan. Input has been received and made available to the wider public in an updated version of the LOICZ Futures discussion document version 10 (see www.nioz.nl/loicz/). Also the meeting agreed that before the sunset clause for DINAS (mid 2004) efforts would be undertaken to hand the database over to LOICZ who will seek an arrangement to secure its continued maintenance and use of the DIVA (Dynamic Interactive Vulnerability Assessment tool) and to investigate future links to the wider LOICZ typology developments.

4.2.6 LOICZ/JGOFS Continental Margin Task Team, Workshop for the Global Synthesis of the 5 regional workshops,

4-6 December 2002, Washington DC, USA. (Contact: Larry Atkinson, atkinson@ccpo.odu.edu, Renato Quinones, rquinone@udec.cl and Richard Jahnke, rick@skio.peachnet.edu)

With additional financial assistance from the Intergovernmental Oceanographic Commission (IOC), the joint LOICZ/JGOFS CMTT organized a synthesis of its five regional workshops that focused on the major continental margin types. This global synthesis outlined a book for the IGBP Book Series on our present knowledge of continental margins, tentatively titled *Carbon and nutrient fluxes in continental margins: a global synthesis.*

It will document the emerging view of the CMTT indicating that global ocean margins are most likely a CO_2 sink and not a major source of CO_2 to the atmosphere as once thought. This is based on comprehensive information on air-sea gas exchange, coastal discharge of terrigenous carbon and nutrients to the shelf, carbon cycling and storage on the margins and potential transfer to the deep ocean. Information has been gathered form as many different continental systems as possible including regional carbon and nutrients budgets and box modelling of horizontal fluxes across continental margins.

The editors Kon-Kee Liu, Larry Atkinson, Renato Quiñones and Liana Talaue-McManus will describe the group's synthesis and modelling approach. The book will also address cross-cutting issues of exchanges across land and sea, air and sea, water and sediment and margins and open ocean boundaries, and finally discuss arising issues, new approaches, global views and future prospects. Publication by Springer Verlag of this extensive synthesis effort is expected in early 2004.

4.3 OTHER WORKSHOPS AND CAPACITY BUILDING

In 2002, LOICZ scientists were involved in wide-ranging coastal zone activities, including assessment, scoping meetings and networking activities. Emphasis was on provision of the status of the LOICZ Synthesis and its Future planning, including investigation of opportunities for formal and operational links. LOICZ has been consulted by agencies for comment on and help with their future planning and has been involved in the development of visions and science plans of allied core projects and joint projects of the IGBP II and the Earth System Science Partnership, namely Oceans, SOLAS, OCEANS-Vision and LAND-Vision and the Global Carbon Project, GECAFS and the Global Water Systems Project, GWSP.

In addition, presentations of research findings and materials and operational approaches taken by LOICZ on how to engage with the user community and address coastal management issues were fed into an increasing number of capacity building efforts LOICZ has supported. The following meetings have been attended by LOICZ representatives:

- GKSS – Horizonte eines Integrierten Kuestenzonen Managements, Kuestenkonferenz 12-15 February 2002, Hamburg, Germany
- AGU/ASLO meeting Honolulu, Hawaii, February 2002
- ACOPS, GEF, IOC African Process Meeting, Accra, Ghana 17-21February 2002
- IOC/UNESCO, Workshop on the Role of Indicators for Integrated Coastal Zone Management, Ottawa, Canada 29 April-01 May 2002
- UNESCO/IHP and WMO/OHP Joint Meeting on "Low Lying Coastal Areas – Hydrology and Integrated Coastal Zone Management, 9-12 September 2002, Bremerhaven, Germany
- First panel meeting for developing the coastal module of the **G**lobal **T**errestrial **O**bserving **S**ystem, GTOS. 15-18 October 2002. East Carolina University, Greenville, N. C.
- APN/UNU Round table, Science and Global Change, Tokyo, 1-2October 2002
- SCOR General Meeting, Hokkaido University, Sapporo, Japan, 1-5October 2002
- IOC Indian Ocean, Global Ocean Observing System, GOOS, conference (supported by LOICZ), Mauritius, 1-9 November, 2002

Capacity Building and Training:

International Ocean Institute, Malta, Coastal Management School, Astrakhan (Russia) and Teheran (Mosl. Rep. Iran), 30 March–13April 2002

Coastal Management and science, integrated approaches for the Caspian Sea. Theme-sessions and software training provided by H. Kremer, LOICZ IPO:

- Land-Ocean Interactions in the Coastal Zone – the IGBP LOICZ core project – Introduction and approach;
- Linking coastal sciences and users – improved strategies and examples;
- LOICZ-Basins - regional assessment and synthesis of river catchment - coast interaction and human dimensions;
- Integrating anthropogenic drivers of change in assessing the coastal zones of Southeast Asia: The LOICZ - SWOL Project (1996-2000)*
- Coastal zone systems under pressure: The future of global change science in coastal areas (including a demonstration of multi criteria analysis and decision support software

developed and supported by the Institute for Environmental Studies, IVM, Free University Amsterdam – for detailed information please contact the LOICZ IPO)

Teaching Course, Guayaquil, Ecuador, 16-23 November 2002:
Geomorfología y Dinámica de Estuarios. Profesor: Dr Gerardo M. E. Perillo, IADO, Argentina. Instituto Oceanográfico de la Armada (INOCAR), Guayaquil, Ecuador. Co-sponsored by LOICZ and INOCAR. 15 students from Ecuador.

4.4 SYNTHESIS

In 2002, LOICZ has been fully engaged in completing its Phase 1 (1993-2002) commitments and developing a new plan and appropriate operational structure for LOICZ Phase 2 (2003+) that fits the evolving Earth System Science Partnership (IGBP, IHDP, WCRP, Divesitas). In addition to the number of regional assessments of changes in the coastal zone which were completed throughout the year and published in the LOICZ R&S Series (see Section 7), considerable information had been attracted through the Synthesis and Futures Meeting in Miami and the ongoing consultative processes engaging the wider LOICZ community.

The LOICZ synthesis book is underway with five of its six chapters prepared in preliminary draft stages; the sixth introductory chapter is being drafted. The work has involved a large number of scientists from many countries in writing teams, each co-ordinated by a chapter lead author. The synthesis will have considerable focus at regional levels, global assessments and delivery of findings against the five LOICZ objectives. The LOICZ synthesis book is planned to be published by Springer and a challenging target for galley state has been set for early 2004.

Below is a brief summary of the scientific key features to be reflected in the Synthesis Book chapters:

The focus of the Synthesis work is on material flux models and processes, and the human dimensions. While most of the scientific research has been focussed at local to regional scale, a principal role of LOICZ is in the integration of data and information at regional to global scale. This comprises findings from the river catchment-basins, biogeochemical budgeting, and scaling approaches and how they relate to the key features of the changing earth system, identified by IGBP:

- The Earth is a system that life itself helps to control.
- Global change is much more than climate change. It is real, it is happening now, and in many ways it is accelerating.
- The human enterprise drives multiple, interacting effects that cascade through the Earth System.
- The Earth's dynamics are characterized by critical thresholds and abrupt changes. Human activities could inadvertently trigger changes with catastrophic consequences for the Earth System.
- The Earth is currently operating in a no-analogue state.

These findings have opened up serious conundrums for scientists in order to understand issues such as the extent and effects of teleconnections across large spatial scales of processes, the increased awareness of the non-linearity of biogeochemical system responses to multiple forcing, and questions about the potential for feedback and sudden changes in the poise of systems, and thresholds for change in Earth systems processes.

With these findings in mind, the major purpose of each of the preliminary draft chapters is as follows:

Preface
A short overview about the history, the mission statement, development and approaches of LOICZ, its major questions and set up of the network and its position in the broader IGBP frame will guide the reader to the introductory chapter:

1. Coastal Ecosystems and Resources

The key purpose of the chapter is: to describe succinctly the coastal habitats, the living resources and increasing human pressures that are important for the global coastal zone, and to provide support information and a context for the other chapters.

2. Dynamics of the Coastal Zone

The chapter is primarily addressing the physics of the global coastal zone and non-reactive material fluxes, looking to document how human impacts and environmental shifts can affect and have affected the stability of our coastlines on a global scale

3. C, N and P Cycling in the Coastal Zone

A somewhat different approach is being made to that of other chapters with a quantitative, internally consistent methodology being applied to the derivation of site-specific nutrient budgets and the up-scaling to regional and global assessments using a typology. A study of trace gases and their significance is included.

4. Water and the Coastal Zone

The chapter is aimed at assessment of river basin or catchment units and is underpinned by a modified DPSIR framework in order to evaluate the continuum of water and allied material fluxes in relation to human activities. One important goal is development of critical load/threshold assessments of coastal impacts across local to regional (continental) scales.

5. Science for Management in the Coastal Zone

The chapter will focus on what is "new" from LOICZ, translated into key issues for management, and will build on the messages from earlier chapters – challenges, questions, new knowledge and knowledge needs. Socio-economic elements will address goods and services provision in the coastal zone and will consider approaches and models for assessment and evolution of the DPSIR framework to support integration of scientific information into management utility. An emphasis will be put on identifying where management can effectively intervene in the global coastal zone. This chapter will also embark on the gaps and new approaches to be considered in setting up the "New" LOICZ.

5. The Future

The Mandate

While the Synthesis of the first decade of LOICZ has been continuing throughout 2002, increasing efforts have been made to continue shaping the future design of a New LOICZ. Part of the background is the decision of the IGBP SC Meeting, Chiang Mai, in February 2001, which identified LOICZ as a continuing structure to further address land-ocean interactions at Earth System scales.

In response throughout 2002, the LOICZ SSC has consulted widely in the development of a comprehensive discussion document aimed at identifying the key issues for a "New" LOICZ. Gaps in knowledge and key questions derived from the Synthesis and Futures Meeting in Miami and from on-going consultation with the wider scientific and institutional communities (including IOC, SCOR and the European Community) that feed into this process. However, in recognition of the crucial human dimensions influence in the global coastal zone, the traditional physical-chemical-biological community of LOICZ has given priority attention to engage with the human dimension community (notably within IHDP) in developing the discussion document and identifying core thematics for the future Science Plan. Ultimately, and with support by the IHDP IPO and its core projects, an interdisciplinary scoping team of LOICZ and IHDP experts was established in late 2002. Based on the discussion document, this team will be asked to develop a draft of the Plan (including an Implementation Strategy) throughout 2003. The Plan is expected to be ready for discussion and approval to the IGBP and also the IHDP Scientific Committees in early 2004.

Also it has been realised that funding and core project structures would require substantial review and adjustment to support the sensitive transition phase towards the "New" LOICZ. This includes considerable change in structure, operations to meet the new scientific objectives and scope of the project and in particular to allow for advanced regional performance and networking of the project.

The Review

Considerations on the side of the Dutch funding agencies whether or not to allow for another extended funding period during the transition of approximately 3 years (2003-5) cumulated in an independent international review of IPO operations. For this purpose LOICZ submitted a detailed summary of activities and results including budgetary information and return on investment (document available on request from the IPO). The review included consideration of the plans for a future LOICZ focusing in particular on the structural and operational changes suggested to support the project implementation (see further details below).

In its conclusion, the Review Panel recommended that the LOICZ IPO should maintain a structure with a centralised node to support the SSC and to direct the operations. Although, the Panel was in agreement with the LOICZ SSC that the establishment of additional "Regional/Thematic Nodes" as part of the IPO would be value-adding to the regional performance of the project. Continued funding was recommended for a transition period of an additional 3 years (2003-2005) which should enable the IPO to maintain its current office in the Netherlands and the staff structure to set up the "New" LOICZ and develop a Science Plan and an accompanying implementation strategy. The Dutch funding agencies then started to investigate options to generate the necessary funding beyond 2002 on various levels. To the end of 2002 this has partly been accomplished but the process is on-going.

5.1. THE PLAN

The original LOICZ Science Plan is now more than 10 years old and reflects the ideas, concepts and needs prevalent more than a decade ago. Over the past years it has become clear that there have been human-induced changes at the global level and a major increase in human demands on the coastal zone. Examples are major changes in hydrology on global scales, the increase in fluxes of substances and in some cases a decrease (due to damming in river catchments) all affecting the coastal ecosystem. Exploitation of its natural resources for food, as well as use of spatial coastal resources for human habitats or economic activities, such as mineral exploitation, tourism and traffic, pose additional pressures on the coastal system.

We have developed an understanding that the human dimension and natural systems closely interact and are intimately bound together in the various pressures and resultant state and state changes of the coastal domain. At a limited scale, tools have been developed to translate this understanding to management and policy. There is, however, still a lack of both, understanding and tools for a clear differentiation and quantification of these anthropogenic drivers and global environmental pressures. This is crucial information if we are to see how they take effect on regional and global scales compared to those drivers which are exclusively regional or national in nature: a distinction essential for appropriate coastal zone management.

In this context, LOICZ faces increasing demand upon and recognition of the project as a source of regional-global expertise and information on the science of the coastal zone – either directly or indirectly, using our network and access points. This responsiveness is an important consideration in our planning, and includes:

- Need to overcome traditional disciplinary fragmentation, to provide a framework for integrated analysis of existing information and to act as a means to focus on key issues concerning human uses of the coastal zone (including to apply the full catchment scale as part of the water-continuum). The "people dimension": strong/collaborative links should be put in place with IHDP – for joint tasks, access to expertise, and in development of encompassing activities. Human issues and demands of society in the coastal zone need even more attention than in the past; the future LOICZ will continue bridging the gaps between biogeochemistry (IGBP), coastal system functioning, and human dimension (IHDP).

- Global and regional scale projects are in place which complement and can draw from the LOICZ scientific program, for example, UNESCO-IOC's ICAM & Coastal-GOOS monitoring programs, UNESCO-IHP, UNEP-sponsored GIWA and EU initiatives. Dialogue with designers and activities of these programs provide an effective science-user dimension – we have taken steps to consolidate these relationships which should be further strengthened in the future LOICZ towards operational partnerships.

- Continued effort in LOICZ to improve its close cooperation with the research community and policy-makers at the national level. This can be greatly assisted through the wider establishment of national LOICZ committees, and should have the added effect of attracting more national experts to work under the LOICZ umbrella.

- Promotion of ways to transfer information to the stakeholders about what is being learned from the science, and to identify what needs to be answered by science. Communications and transfer of information to targeted agencies and forums are therefore fundamental operational concerns to LOICZ. This requires a funded, operational task team of necessary skills to assist in planning and implementation of a communication strategy, to promote access and use of the resultant coastal science information. Measures are already being taken to address this within the current life of LOICZ.

Clear goals, objectives and thematic priorities are in the process of development by the SSC through discussion with the joint LOICZ–IHDP scoping team. The preliminary LOICZ objective serving as a working basis for the team is:

to assess, model and predict the change in adaptive capacity of the global coastal zone as an integral part of the Earth System under multiple forcing, including the contribution of, and consequences for human use

In acceptance of this objective the expectations from a "New" LOICZ will be to provide both, i) scientific information for advanced Earth System analysis and modelling and ii) better science for better management. The project will have to provide the mechanisms to satisfy short-term information needs and to back them by in-depth sophisticated interdisciplinary science. This also means that major coastal change issues should play the leading role in driving the science and the "New" LOICZ needs to capitalise on the gains/successes of the first phase of collaborative research by:

- maintaining and enhancing the networks of scientific contributors and peers, which bring different cultural perspectives, science priorities and funding options;
- building on the typology approach/tools to guide questions and actions including statistical analysis regionally and to visualise and map change, vulnerability and risks;
- consolidating knowledge gained at planetary and regional scales (e.g., the biogeochemical budgets);
- applying the full catchment scale in assessment, synthesis and upscaling and identifying those management units (and their key environmental system functions) where intervention (response) can best be implemented; and
- pursuing compelling topics (e.g., restoration, mitigation, thresholds, carrying capacity and links to biogeochemical cycles) and move forward to in-depth consideration of different of pressure/impact scenarios.

5.2 THE FUTURE DISCUSSION DOCUMENT

Beyond the consideration on scientific and structural achievements, gaps and needs discussions on concrete scientific thematics in a new LOICZ within and beyond the LOICZ community has also taken into consideration a sub-set of the "Hilbertian" questions posed in the IGBP-GAIM program. They are shown here including a brief description of their potential implications for LOICZ:

- A typology of coastal vulnerability to global change on various spatial and temporal scales (referring to GAIM question 7: *Which are the most vulnerable coastal regions under global change*?);
- Description of the response of the environment and society (as co-evolving systems) to spontaneous and hazardous extremes (referring to GAIM question 8: *How are abrupt and extreme events processed through nature-society interactions*?);
- Meeting the general challenge to find ways for successful integration between natural and social sciences and to overcome the traditional disciplinary divide (referring to GAIM question 14: *What are the most appropriate methodologies for integrating natural-science and social-science knowledge*?);
- Identification of criteria to distinguish, and consequently the indicators to measure, key parameters of sustainable and less sustainable future developments (referring to GAIM question 15: *What are the general criteria and principles for distinguishing non-sustainable and sustainable futures*?);
- Elucidation of the question of social choice and people's preferences regarding environmental conditions and standards of living (referring to GAIM question 18*: What kind of nature does modern society want*?);
- Identification of key proxies for land use and cover change that are reflected in coastal functioning and change and thus provide advice on optimal decomposition of the planetary surface into nature reserves and managed areas (referring to GAIM question 21: *What is the optimal decomposition of the planetary surface into nature reserves and managed areas*?); and
- Investigation of the institutional dimensions of coastal change, teleconnections and impact-response relationships to provide a scientific basis for advise on effective and efficient systems of global environment and development institutions (referring to GAIM question 23: *What is the structure of an effective and efficient system of global environment and development institutions*?).

From both the considerations of a plan for a New LOICZ and the Hilbertian questions a number of priority issues, as well as critical research, management and policy needs were identified from which five (more or less coherent) themes have been developed and are reflected in the futures discussion document (currently version 10, see www.nioz.nl/loicz/ for the full document:

Theme 1 – River basins and human dimensions
Theme 2 – Coastal development and change: implications of land and sea use
Theme 3 – Fate and transformation of materials in coastal and shelf waters
Theme 4 – Towards system sustainability and resource management issues
Theme 5 – Vulnerability of Coastal Systems and Human Safety

Crosscutting activities, such as scaling and modeling, variability, dissemination and acquisition (of data and funds) support these five themes (Figure 1).

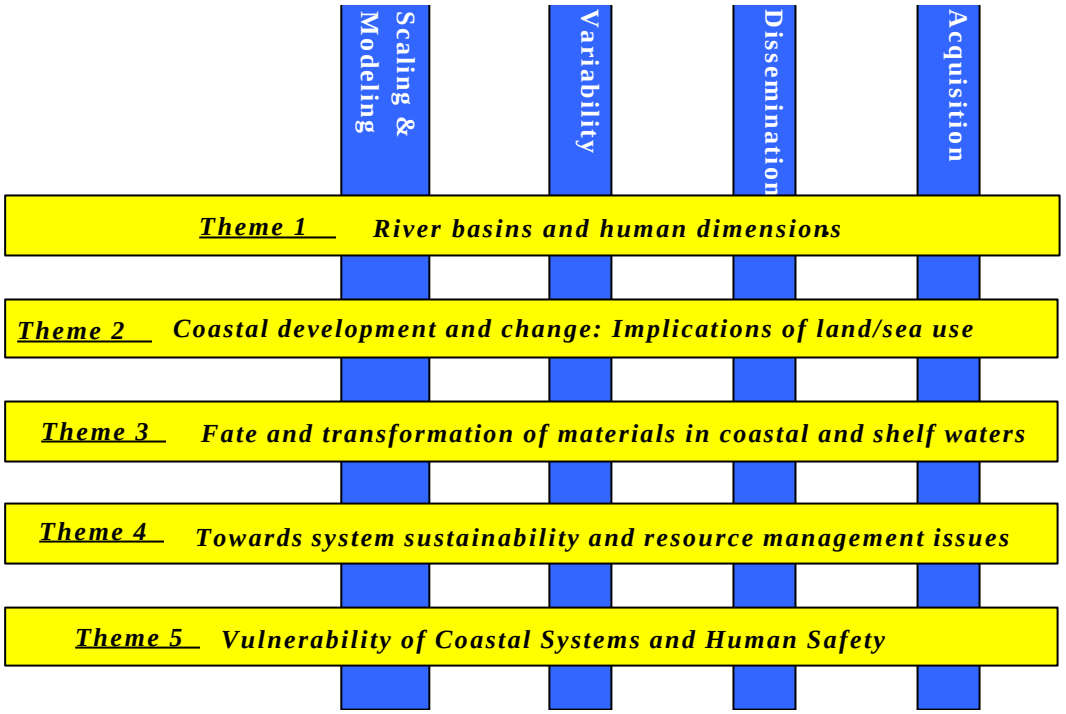


Figure 1. The LOICZ themes and crosscutting activities as part of a matrix structure

River basins and human dimensions addresses the river catchment – based issues that influence the coastal domain considering the whole water cascade as a single system. Spatial and temporal issues of the coastal zone and how they influence natural resources availability and natural systems sustainability are becoming increasingly contentious; they are addressed in the second theme, *Coastal development and change: implications for land and sea use*. Drawing on the results of the first two, the third theme, *Fate and transformation of materials in coastal and shelf waters*, addresses the cycling and exchange with the ocean of carbon nutrients and sediments in the coastal and shelf waters. This recognises that the coastal waters are the principal locality for vital benthic effects influencing global chemical cycles, and that processes here are changing. The last two themes are integrative in nature. *Towards system sustainability and resource management issues* addresses the development of the coastal zone and management of its resources in the context of strong and weak sustainability options whereas *Vulnerability of Coastal Systems and Human Safety* deals with human and ecological change, carrying capacities and vulnerability issues including different scenarios of future change.

All five themes have three challenges in common:

- Up-scaling of regional science results and management issues for global science and policy/management agencies and, similarly, down-scaling and making global science results available to the regional stakeholder and manager.
- Distinguishing at the regional scale between the impacts of regional versus global drivers and pressures.
- Combining the expertise from the natural and social scientists and stakeholders to understand and contribute to solutions for sustainable use of the river basin-coast-shelf continuum.

They are currently being reviewed by the joint scoping team and will be fed into the draft science plan - an ongoing process.

5.3 STRATEGY

Support and operational structure
The heart and purpose of LOICZ is scientific research and assessments addressing the agreed objectives and goals of the Core Project and contributing to understanding the role of the coastal zone in Earth function. Operationally, this requires a structure for the scientific networks and activities, along with an accompanying administrative element to assist and co-ordinate the effort.

Scientific Themes
The joint scoping team of IHDP and LOICZ SSC representatives started to develop the "New" LOICZ Science Plan in late 2002. Each IHDP core project and the recently launched urbanisation task team are represented. A first scoping meeting will be held prior to the upcoming 14th SSC Meeting in Banff, Canada, June 2003.

It is anticipated that the "New" LOICZ Science Plan would be organised along five themes. In addition, there will be joint and cross-cutting tasks with other IGBP and IHDP core projects (e.g., OCEANS, GLOBEC, SOLAS, PAGES, IDGEC, GECHS, IT, LUCC and the urbanisation initiative). Further over-arching initiatives are required across the wider LOICZ project (e.g., development of additional tools and activities for scaling, scenario developments, integration and indicators of change). Specific thematic workshops or *ad hoc* working groups will support this approach.

Theme Leaders will be appointed and supported by a working group of scientists in planning, implementing and co-ordinating each research activity. Task work in each thematic area, while addressing the global perspective, would be directed in particular at studying and evaluating at regional scales and would aim to have support from national research funding and actions.

IPO
The IPO will maintain responsibilities comparable to the present situation (LOICZ Implementation Plan 1994 pp. 199-200). However, building on the experience of the first decade which showed the necessity for an operational focus at regional scales - the IPO has intensified its efforts to identify and establish "**Thematic/Regional IPO Research Nodes**". The objective of this distributed IPO model is to improve the networks and visibility of LOICZ research regionally, and to broaden the operational base by better accessing regional funding mechanisms.

The regional nodes through their active participation in a distributed LOICZ IPO , will access the global framework and thinking of the LOICZ science network and provide a platform for global synthesis of thematic issues by regional experts into the global LOICZ work, supported by external funding. This interface will enable regional scientists to better engage with the global scientific and user community. It is anticipated that the nodes will establish and maintain networks of excellence in a particular field or fields of the future LOICZ research interests as endorsed by the LOICZ SSC.

In late 2002, successful talks took place in Singapore (with the Division. of Environmental & Water Resource Engineering, the Environmental Engineering Research Centre, Nanyang Technological University), in Australia (with the Co-operative Research Centre for Coastal Zone, Estuaries and Waterways Management and several Queensland State agencies), and Germany (with the GKSS Research Centre, Geesthacht). A draft ToR has been exchanged and letters of agreement are under development, tailored to the individual needs of the institutional host of each potential nodes. Generally, the funding basis for node operations

has been agreed on in-principle and options for implementation are being developed. At the beginning of 2003, Singapore was the first LOICZ IPO Node starting operations. Potential for further IPO nodes is being discussed with Sri Lanka, Brazil, the US and China.

6. Collaboration

LOICZ has continued to actively seek collaboration throughout 2002, building on and extending earlier relationships both internally in the IGBP "family" and recently the Earth System Science Partnership, ESSP, and externally with international agencies and science "users". The extended global network of scientists associated with LOICZ is the heart of the project. The LOICZ network has been sustained and more than 2500 people and key agencies are involved in the activities and science delivery.

A major element of the project is the support provided through national governments and their research agencies and universities, often involving a national LOICZ representative or sub-committee associated with a national IGBP Committee. Many research actions and projects are developed and implemented through these arrangements, and outcomes contribute to thematic and regional synthesis work of the LOICZ program. In 2002, the Dutch research agencies funded research proposals as components of a national LOICZ project cluster with a total of US$3.5 million over another three years. The utility of the LOICZ typology methods was further applied and extended with support from the US National Oceanographic Partnership/Alfred P. Sloan Foundation, through associated research work (Biogeoinformatics of Hexacorallia) on a global taxonomic database linked to the typology tools.

Major regional programmes also are part of LOICZ, including projects with varying degrees of integration which provide regional assessments of the LOICZ key questions. There has been continued opportunity and collaboration in this area during 2002. The EU supported UK initiative for the SURVAS addressing sea-level vulnerability using a common methodology has been completed but the European DINAS Coast projects (see Section 3.3) has gained full thrust dealing with integrated modeling of coastal vulnerability in different change scenarios. The European Basins study, EuroCat, was extended by another set of two full-scale national research sites in Bulgaria and Slovenia with funding from the European Union. The implementation of the Russian LOIRA project has gained continued support from IASC in particular, and from other polar research funding sources including NSF. The UNEP GEF project on biogeochemical modelling of estuaries and coastal seas has finalized its synthesis feeding a whole set of some 200 investigation sites into the LOICZ synthesis. Collaborative actions within the EU-funded ELOISE program are providing regional and thematic research outcomes and the ELOISE synthesis has now gained full thrust through the establishment of a secretariat and a scientific consortium. The involved institutions have close working relations to the international, and also to the Dutch, LOICZ. Further collaborative activities have been consolidated with the Joint Research Centre in Ispra focusing on estuarine biogeochemical assessment of the Mediterranean and Black Seas; these originate from an earlier LOICZ-UNEP-EU workshop held in 2001.

Following the UNEP GEF-funded estuarine biogeochemical project, LOICZ continues building an association with UNEP and other global programs. The Basins task in LOICZ is a catalyst in this arena, with the AfriBasins process (2000/2001) cumulating in a new AfriCat pilot project supported by START, IOC and LOICZ. Reviewing catchment-based damming issues, the project encompasses four complementing sites in different countries broadly following the EuroCat approach. Interest has been shown by UNESCO/IHP to consider follow-up support of this project on a bigger scale after 2003. A related proposal was submitted to IHP at the end of 2002 as part of a broader consideration of future co-operation between LOICZ and IHP. Basins further provided the platform for discussions and collaborative opportunities, linking with UNEP, ACOPS and other regional programs dealing with the African Partnership Process in preparation of the WSSD in Johannesburg. All effort have been pursued throughout 2002 to establish stronger collaborative and operational

activities that continue into the second decade of LOICZ. Special focus on Africa and the regional LOICZ network was subject of negotiations with the African Centre for Wetlands in Accra, Ghana. This is working in 11 West African states and has indicated its willingness to support the future LOICZ work – options for an MOU are investigated.

Within IGBP, LOICZ has extended joint work with the terrestrial and other marine projects, notably GLOBEC (with joint typology interests), and JGOFS (by the joint CMTT activities). Earlier collaboration with the BAHC project after its finalisation has been continued at the level of scientists through typology and synthesis assessment, databases and tools exchange. PIs of the ex-BAHC project have joint the LOICZ SSC or are closely collaborating and this relation has led directly to a close consultation between LOICZ and the Global Water Systems Project (GWSP), which is the "old" Joint Water Project, under the four Earth System Science partners.

Additional contributions to the cross-cutting projects of the ESSP (IGBP, IHDP, WCRP and DIVERSITAS) have been made to the Food Systems Project (GECAFS) by drawing on networks and results from the LOICZ CariBasins assessment, and to the Global Carbon Project through consultation during its Science Plan development.

LOICZ highly values its close working relationship with the START project on capacity building and regional assessment. Training in regions has continued in the form of the pilot project, AfriCat, and through LOICZ involvement in the considerations of future scientific agendas for regional studies in Monsoonal Asia and Northeast Asia. A joint APN-SASCOM-LOICZ workshop to address coastal material fluxes in South Asia (December 2002) was another milestone in a collaborative journey started in 1999. The full records of our successful collaboration with START were outlined in a recent submission on collaboration with START requested by IGBP. In principle, initiatives and the collaborative contacts and funding with other agencies pursuing capacity building projects (e.g., IOC, the Inter American Institute for Global Change, IAI, the Asia Pacific Network for Global Change, APN) continue to provide efficiency and valuable outcomes from joint ventures. Growing engagement in the training campaigns of the International Ocean Institute (IOI) Malta has complemented them. Mutual agendas and potential of a closer collaboration with IOI are subject to considerations of an MOU between the two organisations in the new phase of LOICZ. In addition the mentoring program launched as part of the UNEP GEF biogeochemical budgeting assessment continued to add value to the regional performance of LOICZ.

A close association with the SCOR global program has been maintained in addition to the jointly-sponsored Working Group (112) on Submarine Groundwater Discharge having finalised its report. Their work will be continued with the ongoing intercalibration experiment. Potentially research collaboration with SCOR is subject to a proposal for a Working Group on "Mechanisms of Sediment Retention in Estuaries" lead by Gerardo M.E. Perillo and Björn Kjerfve with the participation of James Syvitski which was submitted to SCOR in June 2002. SCOR support is depending on funds from ONR and US Sea Grant. This WG will be co-sponsored by LOICZ.

Following the presentation of the LOICZ Synthesis and Futures plans in response to an invitation to the last SCOR General Meeting, SCOR has now formally become a scientific co-sponsor of LOICZ. Funds will have to be sought mostly among US agencies.

Interest to support continued LOICZ research on groundwater issues has been indicated by UNESCO/IHP and options are under exploration by the IPO. To date, the joint work with SCOR has been extended with common interests and additional support from UNESCO's IOC and IHP. A closer working association with the International Human Dimensions Programme (IHDP) also is being extended.

A major goal for LOICZ is to ensure that the scientific research is made available to coastal zone managers and policy makers. LOICZ has sustained a strong and close working association with the Intergovernmental Oceanographic Commission (IOC), and continues to develop accords with other international bodies that can act as science "brokers", such as the European Commission, UNESCO IHP, and the Global Program of Action on Land Based Sources GPA (UNEP).

With IOC, a focus since 1998 has been towards joint actions and consultation on integrated coastal area management (ICAM), developments of the coastal-GOOS plans (now COOP), and capacity building in world regions. In 2002, this close collaboration was extended further into synthesis and publication of regional basins activities and preparation for the WSSD in 2002. Major support was provided by IOC for the LOICZ Synthesis and Futures Meeting in Miami. These "brokering" and application initiatives were extended through additional links and joint actions with RIKZ Coastal Zone Management Centre (e.g., the continued new Deltas task) and the Royal Netherlands Institute for Sea Research (NIOZ). The Coastal Management Centre through its liaison officer and leading senior scientist participated in the Miami Meeting has provided valuable input in particular into the futures discussions. A collaborative link with the Centre at RIKZ, is envisioned beyond 2002 and will include exchange of information in the area of ecosystem indicator development.

Particular efforts have been directed towards improved involvement of developing economy regions. Strengthening the regional collaboration and institutional networking is seen to facilitate the necessary data and information exchange and lead to internal and cross-regional flow of expertise and capacity building. LOICZ wants to support this structurally and provide the platform for regional scientists to play a leading intellectual role here. This means, *inter alia,* targeted effort by LOICZ to be responsive in mentoring and support for scientists especially in developing economies, and aiding in addressing topics where International Conventions oblige countries to take action (e.g., Climate Convention, Biodiversity Convention, Wetlands Convention). The Climate Convention (UNFCCC) for example, involves effects of sea-level rise, CO_2 and methane emissions. LOICZ may take on the role of an active partner in the Conventions, helping to foster political will and financial support to resource necessary scientific efforts directly or via regional "aid" organisations. This should have potential generally to advance LOICZ's networking and information transfer.

The establishment of "Regional/Thematic IPO" Research Nodes is expected to add strongly to the role LOICZ can play in these regions by advancement of networking, funding and providing an institutional focal point for the regional science efforts. A fully implemented communication strategy will be a pivotal element in accomplishing this goal and making LOICZ also a provider of scientific information in a relevant form. Currently Singapore (for South East Asia) has been established while Germany (for Europe, Africa and the Arctic), and most likely Australia (for Australia and Oceania) are under negotiation. Further inquiries are underway for China, Brazil and Sri Lanka.

7. Communication

Personal contacts within workshops and LOICZ integrative activities are a key part of the interactions between "members" of the LOICZ community. But, communication within and beyond LOICZ is also vital to the effectiveness and success of the project. Increasingly, we are meeting these needs through electronic media – websites and interactive e-pages, a network of email contacts, and transfer of information. We recognise that people are the key resource and that while electronic media provides for broad contacts, not all scientists and science-users have the same level of access. Hence, LOICZ tries to disseminate information by a mix of printed and electronic publications.

In 2002, LOICZ has continued to use a mix of media to spread its research findings and to promote the network of players, internally and with users.

Newsletter

Four editions of the LOICZ Newsletter (No. 21-25) were produced and each was distributed to about 2500 people and agencies. Generally, each Newsletter contained two scientific articles, news and updates on LOICZ and related project activities and key publications and a calendar of relevant meetings and workshops within and associated with the project. At the end of the year a reader survey was started as part of an initiative towards improved science communication and networking – the evaluation is ongoing.

LOICZ and related websites

The LOICZ website (www.nioz.nl/loicz/) is of increasing importance as a means of communication and as an archive. Copies of new LOICZ printed materials are available through the site, links are provided to other coastal science sites, and new publications are listed which deal with coastal research and coastal zone management.

The LOICZ website provides direct and indirect access to LOICZ databases and tools, especially for biogeochemical budgets, typology, basins and deltas management project. Links are made to additional thematic web-pages e.g., SURVAS, DINAS. The list below contains some of the most relevant web sites for LOICZ work:

LOICZ home page: http://www.nioz.nl/loicz

LOICZ Biogeochemical Modelling and Budgets:http://data.ecology.su.se/MNODE

LOICZ Typology and Scaling: http:/www.kgs.ukans.edu/Hexacoral/Workshops
http://palantir.swarthmore.edu/~maxwell/loicz

LOICZ River Basins: http://w3g.gkss.de/projects/loicz_basins/

Deltas Management: http://www.deltasnetwork.nl

SURVAS: http://survas.mdx.ac.uk

South Asia Coastal Fluxes: http://www.coastal-fluxes.slt.lk

DINAS: http://www.PIK-Potsdam.DE/~richardk/dinas-coast/

ELOISE: http://europa.eu.int/comm/dg12/eloise/eloise-h.html
secretariat http://www.nilu.no/projects/eloise

Publications

In 2002, LOICZ scientists besides concentrating on the Synthesis and Futures Process were involved in wide-ranging coastal zone activities. Those include assessment, presentation of research findings and materials, the preparation of scientific publications in a number of journals and for a variety of meetings held by related agencies addressing coastal research and in the transfer of scientific knowledge to coastal managers, policy and industry sectors. Examples of communication products include:

Numerous scientific publications have been produced from research projects contributing to LOICZ Core, Regional and Relevant Research projects – research papers, special issues of peer-reviewed journals and a number of books, technical reports and thematic workshop proceedings.

LOICZ publishes the Reports & Studies series encompassing regional integration of thematic issues, usually derived from workshops. These are listed and accessible on the LOICZ website. LOICZ has been placing increased effort on integration and publication of its science across a range of peer-reviewed journals and media. Examples of science and key workshop publications and media in 2002 include:

Arthurton, R.S., H.H. Kremer, E. Odada, W. Salomons and J.I. Marshall Crossland, eds. 2002. African Basins: LOICZ Global Change Assessment and Synthesis of River Catchment-Coastal Sea Interactions and Human Dimensions. LOICZ Reports & Studies No.25, ii + 344 pages, LOICZ IPO, Texel, The Netherlands.

Buddemeier, R.W., C.J.Crossland, B.A. Maxwell, S.V. Smith, D.P. Swaney, J.D. Bartley, G. Misgna, V.C. Dupra and J.I. Marshall Crossland, eds. 2002. LOICZ/UNEP Regional Synthesis Workshops: Australasia-Asia, the Americas, Africa-Europe, Summary Report and Compendium. LOICZ Reports & Studies No. 22, ii + 77 pages, LOICZ UNEP workshops report including CD-ROM.

Buddemeier, R.W., S.V. Smith, D.P. Swaney and C.J. Crossland 2002 The role of the coastal ocean in the disturbed and undisturbed nutrient and carbon cycles. LOICZ Reports & Studies No. 24, ii + 83 pages and CD-ROM, LOICZ, Texel, The Netherlands.

Camacho-Ibar, V., V. Dupra, F. Wulff, S.V. Smith, J.I. Marshall Crossland and C.J. Crossland 2002. Estuarine systems of the Latin American Region (Regional workshop V) and estuarine systems of the Arctic region: carbon, nitrogen and phosphorus fluxes. LOICZ Reports & Studies No. 23, ii+103 pages, LOICZ, Texel, The Netherlands

Dupra, V., S.V. Smith, L.T. David, H. Waldron, J.I. Marshall Crossland and C.J. Crossland, Eds., 2002. Estuarine Systems of Africa (Regional Workshop II): C, N and P fluxes. LOICZ Reports & Studies No. 20, i + 81 pages. LOICZ UNEP workshop report.

Hong G.H., H.H. Kremer, J. Pacyna, Chen-Tung Arthur Chen, H. Behrendt, W. Salomons and J.I. Marshall Crossland eds. 2002. East Asia Basins: LOICZ Global Change Assessment and Synthesis of River Catchment-Coastal Sea Interaction and Human Dimensions. LOICZ Reports & Studies No. 26, ii+262 pages, LOICZ IPO, Texel, The Netherlands.

Kjerfve, B., W.J. Wiebe, H.H. Kremer, W. Salomons and J.I. Marshall Crossland (Caribbean); N. Morcom, N. Harvey and J.I. Marshall Crossland (Oceania) eds., 2002. Caribbean Basins: LOICZ Global Assessment and Synthesis of River Catchment/Island-Coastal Sea Interaction and Human Dimensions; with a desktop

study of Oceania Basins. LOICZ Reports & Studies No.27, ii + 174 pages, LOICZ IPO, Texel, The Netherlands.

Kremer, H. and C. Crossland, 2002. Coastal Change and the "Anthropocene" – Past and Future perspectives of the IGBP-LOICZ project; in: IHP/OHP Berichte, Sonderheft 13 (reports, special issue 13), National Committee for the IHP and OHP, Germany, Koblenz, pp 3-19

Kremer, H., Pacyna, J. and N. Pirrone, eds., 2002. Regimes of Regional and Global Coastal Change: A selection of papers from the 4th LOICZ Open Science Meeting, Bahia Blanca, Argentina, Nov. 1999; Regional Environmental Change, Special Issue, Volume 3, number 1-3, 117 pages; Springer, Berlin, Heidelberg, New York.

Lacerda, de Luiz Drude (ed) 2002. Mangrove Ecosystems: Function and Management. Springer Verlag, ISBN 3-540 422080.

Lacerda, de L. D., H.H. Kremer, B. Kjerfve, W. Salomons, J.I. Marshall Crossland and C.J. Crossland, eds., 2002. South American Basins LOICZ Global Change Assessment and Synthesis of River Catchment – Coastal Sea Interaction and Human Dimensions. LOICZ Reports & Studies No. 21, ii + 212 pages. LOICZ UNEP, UNESCO/IOC and CNPq workshop report.

Talaue-McManus, L. 2002. Global change in the coastal zone: The Case of Southeast Asia. In: Steffen, W., Jaeger, J., Carson, D. and Bradshaw, C. (eds.). Challenges of a Changing Earth. Proceedings of the Global Change Open Science Conference, Amsterdam, 10-13 July 2001. Global Change: The IGBP Series. Springer-Verlag, Heidelberg, Germany.

Publications form the SCOR/LOICZ Working Group 112 and continued global assessment of submarine groundwater discharge (see Section 3.2.7):

Burnett, W.C., J. Chanton, J. Christoff, E. Kontar, S. Krupa, M. Lambert, W. Moore, D. O'Rourke, R. Paulsen, C. Smith, L. Smith, and M. Taniguchi, 2002. Assessing methodologies for measuring groundwater discharge to the ocean. EOS, 83, 117-123.

Taniguchi, M., W.C. Burnett, J.E. Cable, and J.V. Turner, 2002. Investigations of submarine groundwater discharge. Hydrological Processes, 16, 2115-2129.

Lobkovsky L.I., Kontar E.A., Garagash I.A. and Ozorovich Y.R., 2002. Monitors and Methods for Investigation of Submarine Landslides, Seawater Intrusion and Contaminated Groundwater Discharge as Coastal Hazards. Kluwer Publishers, Volume NATO "Risk Science and Sustainability: Science for Reduction of Risk and Sustainable Development of Society" edited by T. Beer and A. Ismail-Zadeh, 191-207.

Kontar, E.A., Yu.R. Ozorovich, A. Salokhiddinov, and Ye.B. Azhigaliyev, 2002. Study of Groundwater-Seawater Interactions in the Aral Sea Basin. Proceedings of the International Conference on Low-lying Coastal Areas – Hydrology and Integrated Coastal Zone Management, 9-12 September 2002, Bremerhaven, Germany, 225-230.

Kontar, E.A., 2002. Submarine Monitors and Tracer Methods for Investigations of Groundwater Discharge into the Coastal Zone. Proceedings of the 34th International Liege Colloquium on Ocean Dynamics, Liege, May 6-10, 2002, 30.

Kontar, E.A., Burnett, W.C., and Povinec, P.P., 2002. Submarine Groundwater Discharge and Its Influence on Hydrological Trends in the Mediterranean Sea. Proceedings of the CIESM
Workshop: Tracking long term hydrological change in the Mediterranean Sea. Monaco, 22-24 April, 2002, 109-114.

Kontar, E.A., Shapiro, G.I., and Lobkovsky L.I., 2003. Estimation of the Impact of Submarine Groundwater Discharge on the Biogeochemical Parameters of Coastal Waters. Proceedings of the International Open Science Conference on Ocean Biogeochemistry and Ecosystems Analysis. IOC/SCOR, Paris, 7-10 January, 2003, PS1: 2.13, 44.

SCOR/LOICZ Working Group 112, special issue
"Submarine Groundwater Discharge: Its Measurement, Modelling, and Globalization"
Special Issue of Biogeochemistry -- W. Burnett and J. Chanton, Guest Editors

Authors	Tentative Title	Status
W. Burnett , J. Chanton, E. Kontar	Preface to Special Issue	pending
W. Burnett, H. Bokuniewicz, M. Huettel, W. Moore, M. Taniguchi	Groundwater and Pore Water Inputs to the Coastal Zone	accepted
M. Taniguchi, W. C. Burnett, C. F. Smith, R. J. Paulsen, D. O'Rourke, S. Krupa and J.L. Christoff	Seepage meter results from Florida Intercomparison experiment	revision pending
W. Moore	Ra isotope studies at the Florida intercomparison	accepted
M. Lambert et al.	Seepage estimates during the Florida intercomparison based on continuous radon measurements	accepted
L. Smith	Hydrogeological modelling results from the Florida intercomparison experiment	review pending
J. Chanton et al.	Geochemical evidence for tidally-driven seepage in the Florida Keys	revision pending
J. Turner and A.J. Smith	A Review of SGD Estimates on the South West Coast of Western Australia and Experimental Designs of SGD Investigations – CS Inter-comparisons	review pending
M. Taniguchi, J.V. Turner and A Smith	Evaluations of groundwater discharge rates from subsurface temperature in Cockburn Sound, Western Australia	review pending
A.J. Smith and S. P. Nield	Groundwater discharge from the superficial aquifer into Cockburn Sound Western Australia: Estimation by inshore water balance	review pending
J. Oberdorfer	"Groundwater Modelling Estimates of SGD: How Do These Relate to Other Quantitative Methods?"	revision pending
Georgia Destouni and Carmen Prieto	On the possibility for generic modelling of submarine groundwater discharge	revision pending
H. Bokuniewicz, R. Buddemeier, Bruce Maxwell, Casey Smith	The typological approach to submarine groundwater discharge (SGD)	revision pending

Presented papers
Numerous papers and presentations where given on various occasions for example many of those listed under Section 4.3. They are not listed here in detail but publications and training efforts shown above capture most of their scientific content.

8. Funding

The Netherlands government continued to generously support the International Project Office and core activities during this final year of the first decade of LOICZ. This funding is received from the NWO and RIKZ, supplemented with support from IGBP for meetings of the LOICZ Scientific Steering Committee.

In addition to this major core funding for the IPO and continued support of the research project from the Netherlands government, in 2002 LOICZ gained significant funding for its Synthesis and Futures Meeting. The LOICZ SSC is grateful for this crucial support namely from IAI, IGBP, IOI, KNAW, NSF, UNESCO/IOC, START and in particular WOTRO. The European Union has provided continued and major support funding for the suite of ELOISE projects.

Funding for regional activities has come from IOC,SCOR, APN, UNEP, UNESCO/IHP, IAI, and START. Working collaboration has been established with other core projects of IGBP and jointly-funded activities have been engaged especially with, JGOFS and START.

In-kind support, notably from NIOZ and RIKZ, and many national government agencies continues to underpin LOICZ activities. In particular, the support from NILU (Norway), University of the Philippines and Japanese institutes have contributed to global research activities. Vital core research support has been contributed by a range of universities and national agencies, notably the Universities of Hawaii, Kansas, Maryland and Stockholm, NILU (Norway), Colorado and GKSS (Germany).

In addition, national and international agencies support an extensive number of the Regional and Relevant Research projects (listed in Section 3); these financial contributions are not included here.

The estimated income funding stream for core operations LOICZ (including cash and in-kind to IPO only) in the years 1998 - 2002 is listed below.

	1998	**1999**	**2000**	**2001**	**2002**
LOICZ Phase 2 (1998-2002)	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
	(Euro)				
Cash					
Core support	405 500	403 200	406 800	405 500	406 200
Additional support	29 800	198 300	353 300	356 100	141 000
subtotal	435 300	601 500	760 100	761 600	547 200
Inkind					
NIOZ and RIKZ	118 200	118 200	118 200	118 200	118 200
Additional support	83 200	245 400	328 600	336 400	314 900
subtotal	201 400	363 600	446 800	454 600	432 900
TOTAL	**636 700**	**965 100**	**1 206 900**	**1 216 200**	**980 100**

Future Funding

The"New" LOICZ will obviously need to involve a wider group of sponsoring agencies – supporting Core Operations and Core Research activities. Based on the recommendations of the independent Review Panel (see above), Dutch funding agencies are in the process of seeking funding support for the central IPO for a transition period, 2003-5. At copy dead-line for this report a verbal confirmation for continued support until the end of the transition period was received from the funders.

UNESCO's IOC and IHP have expressed their interest in becoming sponsors for LOICZ targeted research activities, and several national governments have indicated similar interest. Following a General Meeting decision, SCOR has agreed to be a formal co-sponsor of LOICZ Future Theme 3 (*Fate and transformation of materials in coastal and shelf waters*) from 2003, although support will be subject to funds available to SCOR.

IHDP is considering joining with IGBP as a core sponsor of the "New" LOICZ but decisions about the final form of collaboration will not be taken until the IHDP SC Meeting in 2004 and will be subject to approval of the new LOICZ Science Plan. Other forms of collaboration and/or support between LOICZ and IHDP are under discussion.

In principle, core funding for the future LOICZ is directed to the project as a whole. Core funding and in-kind contributions will provide the support for each node (staff, operations) and the thematic and wider integration work of the future LOICZ program. IPO research node locations reflect national sources of major core funding and act as key regional centers for wider operations.

Abbreviations List

ACOPS	-	Advisory Committee on Protection of the Sea
APN	-	Asia Pacific Network
BAHC	-	Biospheric Aspects of the Hydrological Cycle (IGBP core project)
CMTT	-	Continental Margins Task Team (joint LOICZ and JGOFS project)
CRC	-	Cooperative Research Centre
DPSIR	-	Drivers-Pressure-State-Impact-Response framework
GECAFS		Global Environmental Change and Food Systems (of the ESSP)
GWSP		Global Water Systems Project (of the ESSP)
ELOISE	-	European Land-Ocean Interaction Studies
ERA	-	European Research Area
ESSP		Earth System Science Partnership of IGBP, IHDP, WCRP & DIVERSITAS
EU	-	European Union
GKSS	-	GKSS Research Centre, Germany
GLOBEC	-	Global Ocean Ecosystem Dynamics
GOOS	-	Global Ocean Observing System
IAI	-	Inter America Institute
IASC	-	International Arctic Science Committee
ICAM	-	Integrated Coastal Assessment and Management
ICSU	-	International Council of Scientific Unions
IGBP	-	International Geosphere-Biosphere Programme
IHDP	-	International Human Dimensions Program on Global Environmental Change
IHP	-	International Hydrological Program
IAEA	-	International Atomic Energy Agency
IOC	-	Intergovernmental Oceanographic Commission of UNESCO
IUGG	-	International Union of Geodesy and Geophysics
JGOFS	-	Joint Global Ocean Flux Study (IGBP core project))
JRC	-	Joint Research Centre (EU Com.)
KNAW	-	Netherlands National Academy of Sciences
LOICZ	-	Land-Ocean Interactions in the Coastal Zone (IGBP core project)
LOIRA	-	Land-ocean Interactions in Russia
LOIS	-	Land-Ocean Interaction Study, United Kingdom
LUCC	-	Land-Use Cover Change (IGBP core project)
MAST	-	Marine Science and Technology
MMD	-	Modified Mega Deltas
MSP	-	Medium-Size Project
NILU	-	Norwegian Institute for Air Research, Oslo
NIOZ	-	Netherlands Institute for Sea Research, Texel
NORAD	-	Norwegian Agency for Development Corporation
NSF	-	National Science Foundation, USA
OSM	-	Open Science Meeting (e.g., LOICZ OSM4, Argentina)
PAGES	-	Past Global Changes (IGBP core project)
PASS	-	Pan African START Secretariat
SARCS	-	Southeast Asia Regional Committee for START
SASCOM	-	South Asia Regional Committee for START
SCOR	-	Scientific Committee on Oceanic Research
SGD	-	Submarine groundwater discharge
SOLAS		Surface Ocean Lower Atmosphere Study
SOPAC	-	South Pacific Applied Geoscience Commission
START	-	Global Change System for Analysis Research and Training (IGBP core Project)
SWOL	-	SARCS/WOTRO/LOICZ
UNEP GEF	-	United Nations Environment Programme and Global Environment Facility
UNESCO	-	United Nations Educational, Scientific and Cultural Organisation
USNOPP	-	United States National Oceanographic Partnership Program
WCRP		World Climate Research Programme
WG	-	Working group
WOTRO	-	Netherlands Foundation for the Advancement of Tropical Research