

LOICZ

**ANNUAL REPORT
2001**



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. 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 Netherlands Institute for Sea Research (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 CO₂?
- 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.



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1. Chair's Report

2001 was an important year for both the synthesis and future of LOICZ. The drafting of the six chapters of our synthesis book, to be published in 2003, continued. The effects of human-induced changes in river catchments were estimated on single river to continental scales in Africa, Europe, Asia, South America, the Caribbean and Oceania. Our database on nutrient fluxes and cycling now contains more than 200 sites, and several workshops were organized to establish the net C, N and P metabolism of the nearshore coastal seas on local, regional and global scales. The important role of humans in the coastal realm was further studied by employing the DPSIR concept as a framework for integration of human dimensions with natural system and resources assessments. Groundwater flows, processes along the continental margins, trace gas fluxes, sediment budgets, coastal zone typology, management of river deltas, sea level issues and capacity building were other major topics addressed during this year.

Now that it is clear that Land Ocean Interactions in the Coastal Zone will be one of the six fundamental projects within the new IGBP, more and more time is dedicated to develop a LOICZ future programme. Our Scientific Steering Committee meeting held in Amsterdam in July 2001 was linked to the IGBP Global Change Congress. Many SSC members actively participated in this IGBP meeting, flagging the importance of scientific knowledge of the coastal zone to understand natural and human-induced changes in the Earth's system. During the SSC meeting lively discussions on the LOICZ synthesis and future took place, adding many new and exciting topics to our future programme. The increasing pressure on the coastal zone, the advancement in communication and research techniques and the growing awareness that only integrated approaches, both for scientific understanding and proper management, will support sustainable use, underlines the importance of the LOICZ approach.

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, most important being the synthesis and the development of the future LOICZ. Many fruitful discussions between the Executive Officers and the Chair took place, shaping the plans for our future. Jan Crossland strengthened the IPO to edit six LOICZ Reports and Studies volumes and two special volumes of refereed journals based on scientific results presented at our Open Science Meeting in Bahia Blanca. Hester Whyte continues to keep track of all LOICZ activities and again organized many meetings and travel arrangements.

The end of 2002 will mark the end of LOICZ's second five-year phase. The intended continuation urges the SSC, its Chair and the IPO to develop plans for the future management structure and to secure funding. After 10 years of Dutch support, which hopefully will continue in part after 2002, we are now also looking for additional sponsoring possibilities. A new host country, co-funding by different countries, or the establishment of more official LOICZ nodes around the world with some central organization are being considered. Negotiations with other potential financiers of global research have started. The importance of humans as major actors in the coastal zone leads to the intention to continue LOICZ under the umbrella of both IGBP and IHDP. Yes, our future is taking shape but much work remains to be done by all involved in LOICZ.

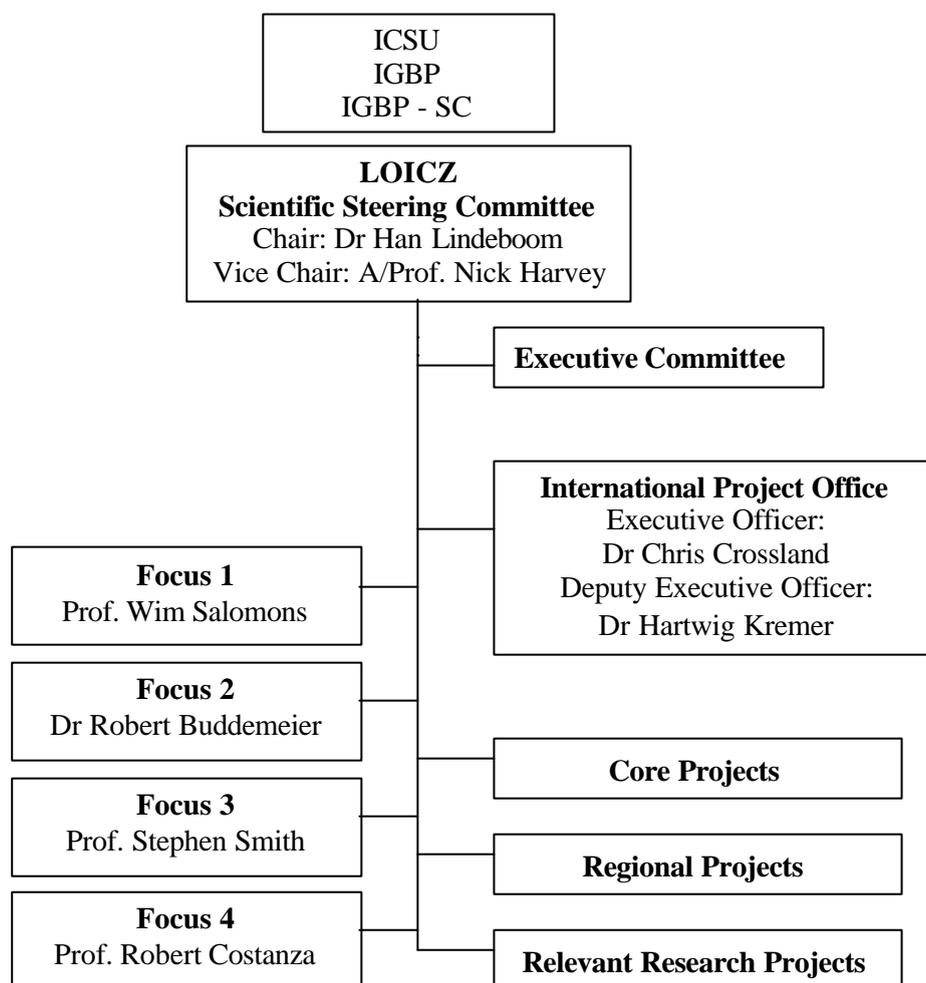
After a successful year for LOICZ science and synthesis, even more challenging years await us.

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 programme of ICSU).



LOICZ Organisation Schema (2000)

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 Larry F. Awosika	Nigerian Institute for Oceanography, Nigeria
Dr Robert W. Buddemeier	University of Kansas, USA
Prof. Peter Burbridge	University of Newcastle, UK
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
Prof. Stephen V. Smith	University of Hawaii, USA
Dr James Syvitski	Institute of Arctic and Alpine Research, Colorado, USA
Dr Liana Talaue McManus	Marine Science Institute, University of the Philippines, The Philippines
Prof. Frederik Wulff	Stockholm University, Sweden
Prof. Jahara Yahaya	University of Malaya, Malaysia

The SSC met once on 7-8 July, 2001 in Amsterdam, The Netherlands.

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.

The EXCOMM met once on 6 July 2001 in Amsterdam, The Netherlands. Focus Leaders maintain a strong interaction throughout the year with the IPO.

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 NIOZ, Texel, The Netherlands.

The LOICZ secretariat comprises: 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) is 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.

In 2001 LOICZ Basins continued improvement and development of the standardised regional assessment and synthesis process. A Basins task group was set up (H. Behrendt, J. Pacyna, N. Pirrone, W. Salomons, K. Turner) to advise and further develop guidelines and their use in river basin assessments. The results of application of the guidelines can be described as a regional “expert typology” of river – coast interaction, covering local or catchment, sub-regional and fully regional or continental scales. Where quantitative information on critical loads of materials to the coastal zone and distances of coastal systems to thresholds for functioning (e.g., erosion versus coastal stability due to shortage of riverine sediments) can be provided it is included and underpins the qualitative ranking of the experts. Participants in Basins assessments usually cover both natural and socio-economic science disciplines. This approach was favorably considered for application to research and project design under the upcoming 6th framework program by the European Commission during the annual ELOISE Conference (Rende, Italy in September) and by the UNESCO 3rd International Great Rivers Conference (Nizhny Novgorod, Russia in May).

During the year regional Basins assessment were carried out for:

- a) East Asia; covering catchments from Russia to Vietnam, including Japan and Taiwan. This was a direct flow-on of the 1st East Asian LOICZ Meeting held in Quingdao, China, in 1999. An R&S volume is in final preparation and papers are in review for a special issue of Regional Environmental Change.
- b) South America (SAMBas II); the R&S volume (No. 21) was published electronically through the LOICZ Basins website and will be available as hard copy by mid-March 2002. Papers are being contributed to a special issue of Regional Environmental Change. SAMBas experts have identified hot spots for continued or future Basins research and generated national funding for sites in north-east and southern Brazil. Further work using the LOICZ biogeochemical modelling and basins approaches has been suggested for funding to the IAI for collaborative effort between Ecuador, Chile and the USA. Project development using the EuroCat model is continuing.
- c) AfriBasins II; a comprehensive first full African synthesis will be published in the first half of 2002. This, along with the coastal biogeochemical modelling assessments (see Focus 3), is a direct flow-on from the PACSICOM and START-IOC-LOICZ Cotonou workshops initiatives in 1998 and has a high relevance for the regional initiatives of the Dutch coastal management co-operation. Projects that have been approved and fit into a broader future AfriCat development have been set up for the Incomati Catchment (Mozambique) and project designs and assessment results have been provided to the ACOPS IOC African Programme of Intervention.
- d) Oceania islands; desk studies following the Basins regional assessment approach have been conducted and a report will be published in early 2002.

- e) Wider Caribbean (CariBas); a workshop involving key researchers mainly from the CARICOMP network has produced an assessment to be published in the first half of 2002. The work contributes to collaborative effort with the IOC sub-commission, IOCARIBE.

The EuroCat project (3 year, EU-funded), building on initial results and a network established in 1998/99, started in February 2001. A consortium of about 20 scientific institutes including socio-economic scientists to catchment modellers is assessing six major European catchments and rivers draining into the three regional seas in Europe: Baltic, Mediterranean and North. Key objectives include:

1. To collect and assess information on sources, fluxes and concentration levels.
2. To evolve/develop the DPSIR framework into a practical working tool for a wide spectrum of users, including policy, planning and regulatory bodies.
3. To apply the DPSIR framework to determine the critical load of selected substances, under different development scenarios.
4. To develop methods and tools which give the possibility to distribute the critical loads within the basins according to the ecological potential of the sub-basins and an optimal economic use.
5. To facilitate increased interdisciplinary collaboration between natural and social scientists and to ensure policy-relevant findings by the active incorporation of representatives of stakeholders and citizens groups both at the regional and European level.

To date, assessments dealing with indicators, scenarios, quality assurance and data management have been prepared, and are available through the LOICZ Basins website or directly through the EuroCat website (<http://www.iiu-cnr.unical.it/EUROCAT/project.htm>).

In a related study, commissioned by the Port Authority of Rotterdam and encompassing LOICZ-Basins approaches, the present and future quality of sediments (dredged material) in the Rhine catchment was evaluated. Point and diffuse sources in the Rhine catchment area were identified for heavy metals, PCBs and PAHs. Scenarios were based on estimates for point and diffuse sources, reduction potentials (including future policies) and pathways of contaminants. The results were linked to the quality of dredged material in the Port of Rotterdam. Current and future policies and regulatory frameworks on the national, supranational (EU) and international level were part of the analysis.

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 has been the dominant theme for the past year. The major focus of activity was the series of regional and global synthesis workshops and products associated with the UNEP-GEF project. In close cooperation with Focus 3 (Prof. S. Smith), Regional Synthesis workshops were held in: Brisbane, Australia in January 2001, covering Asia-Australasia; Ensenada, Mexico in April 2001, covering the Americas; and The Hague,

Netherlands, in July 2001, covering Europe and Africa. These have culminated in a report summarizing the Regional workshop outcomes (LOICZ Reports and Studies No. 22, 2002)

Preparatory mini-meetings in August (Lawrence, KS) and September (Swarthmore, PA) led up to the global synthesis workshop, which was held in Lawrence, KS in November 2001 and addressed the theme of hydrologic variability. The report on the Global synthesis workshop, addressing the development of the first-cut estimates of how to assess the coastal zone role in global C, N and P fluxes, is in the final stages of preparation in early 2002. This will be an integral part of and contribute substantially to the overall LOICZ synthesis effort. Both Regional and Global Synthesis meetings included participants in the LOICZ Basins (Focus 1) process, and the Global Synthesis Workshop was attended by members of Dr. Charles Vorosmarty's team which is collaborating in typology developments from within IGBP BAHC.

The series of workshops led to substantial further development of the Typology database and tools. Prof. Bruce Maxwell and his student further refined the LOICZView geospatial clustering package, with added capabilities including principal components (eigenvector) analysis, refined supervised clustering capabilities, a genetic algorithm option, and various additional display features. The LOICZ/Hexacoral online database was reorganized, with both variables and variable selection and analysis tools added. Budget variables as well as coastal typology variables were included in the database, making it possible to do online analysis and clustering of both types of variables, together or independently. Under the auspices of the Ocean Biogeographic Information System, the database was made interoperable with several other biological databases, promising greatly expanded power and opportunities in the future.

Liaison with the SCOR-LOICZ Working Group 112 (Submarine Groundwater Discharge) has continued (see separate report by Prof. W. Burnett, WG chair – Section 3), and the results of a joint workshop held in Sicily have led to the preparation of a draft groundwater chapter for submission to the LOICZ Synthesis.

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.

2001 was a transition year for Focus 3 and the UNEP-GEF project. Budget workshops held during the year were designed to "fill in" where effort was still needed. In addition, the budget team participated in two Regional Synthesis workshops and the Global Synthesis workshop (see Section 4.1). Below is a list of budget workshops held during the year, including their venue and participants:

- Mediterranean—Black Sea workshop (Athens, Greece; 5-8 February 2001). Resource personnel: F. Wulff, D. Swaney, L. David, V. Dupra, C. Crossland. 34 participants and contributing authors.
- Latin America workshop (Ensenada, Mexico; 25-26 April 2001). Resource personnel: V. Camacho, S. Smith, L. David. 22 participants and contributing authors.
- Southern Africa workshop (Cape Town, South Africa; 3-6 September 2001). Resource personnel: H. Waldron, T. Switzer, S. Smith, L. David. 13 participants and contributing authors.
- Arctic Seas workshop (Stockholm, Sweden; 9-11 September 2001). Resource personnel: F. Wulff, D. Swaney, C. Crossland. 9 participants and contributing authors.

In addition to these workshops following the standard 2-4 day format used for the UNEP-GEF workshops, an afternoon workshop was held by S. Smith and D. Swaney in St Petersburg, Florida, during the Estuarine Research Federation meeting (6 October, 2001). That workshop was designed to introduce the US marine science community to the process; it was received enthusiastically (about 50 participants), and it is hoped that several budgets will be forthcoming.

The LOICZ database contains more than 200 coastal sites for which C-N-P models have been developed across all climatic and geographical regions of the globe. The challenge of synthesising the outcomes in terms of the effect of global change, notably climate and human dimensions is continuing. Allied work on scaling and integration of the biogeochemical performance of the global coastal zone with the LOICZ Typology group (Focus 2) included one global and four regional workshops during 2001. Outcomes are included in publications (see Section 6) and through the publicly accessible LOICZ websites that linked to a variety of tools and techniques.

A literature review of the significance and the cycles and fluxes of trace (non-CO₂) gases in the coastal zone was completed by the Norwegian Institute for Air Research. With emphasis on CH₄, N₂O, DMS, 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, and 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 a new LOICZ program within IGBP phase II.

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 2001, the human dimension work within LOICZ was increasingly integrated with the biogeochemical approaches and workshop activities within the other three foci of the core project. However, specific initiatives directed to assessment and evaluation of socio-economic approaches and methodologies were pursued as companion developments. Presentation on the concepts and tool developments that integrate human dimensions into the coastal zone management and planning arena were made within various regional forums. A project assessing the economic value of biogeochemical changes in the coastal zone continued through work at the University of Maryland.

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 (see web-page www.nioz.nl/loicz/).

Title	Related Foci
Biogeochemical Budgets and Modelling	3
Coastal Typology Development	2
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

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 is 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, will be used to extrapolate from the budget sites to the remainder of the coastal zone. Literature research, workshops, and information sharing via the World Wide Web (<http://www.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 2001 are summarised in the Focus 3 Core report. Some 180 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 (see lead article). The spatial coverage is now fairly much global with the exception of the South Asia region – field and assessment work is current in South Asian sites through national programs and support from APN. Integration of the budget sites information to address core LOICZ questions about C, N and P sinks/sources and fluxes is being 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 impacts 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) will continue 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 will aim 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.

Activities in 2001 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

dimensions data and generalising from well-studied areas to similar but less well-known regions. This activity is being 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). 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; www.palantir.swarthmore.edu/~maxwell/loicz) 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 2001 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 and processes at the interface between the ocean realm and the continental shelf. 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.

The Continental Margin Task Team (a joint LOICZ/JGOFS) effort has been tasked with assessing the fluxes of major biogenic elements in continental margins relevant to climate change. The CMTT has divided the task up into sub-groups: eastern and western boundary systems, polar margins, tropical margins and marginal seas. Throughout 2001 the CMTT has continued to address the current knowledge of these regions through a series of targeted workshops, with funding support from JGOFS, LOICZ and UNESCO's IOC.

A global "synthesis" book is planned for completion in early 2003 and work is on-track for its preparation. Several publications were contributed to global literature. Work in 2001 will continue with workshops on polar seas, and marginal and tropical seas.

3.2.4 Deltaic Processes and Management

Deltas are the centre of gravity of the catchment areas. In deltas fresh and salt water meet, creating gradients that are of great importance for the existence of a variety of ecosystems. Deltas also attract economic activities, like industry, transport and agriculture, but also people. This results in an increased pressure on the delta, its adjacent river basin, the coastal zone and the sea. The relation between deltas and river basins can be explained from the need for energy, fresh water (creation of large reservoirs), the need for building material (i.e.

timber) and its natural systems relation with water, sediment, and ecology. Due to the growing economic interests and increasing population the vulnerability to pollution and natural hazards is increasing. The impacts of climate change and other external factors should be added to the already existing problems. These pressures require the urgent development and application of adaptive solutions.

In the past a great number of measures were taken and constructions were build for the development of deltas. Not all of them were successful and many caused problems to the population and to the environment. The need for an international information exchange network on the planning and management of deltas is being addressed by the project.

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://nioz.nl/loicz>). The project will also contribute 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?

The importance of good management of mega-deltas was highlighted in last year's annual report. That report announced that a LOICZ/CZMC project on deltas had started. In 2001 the project initiated a number of activities. These included: 1) the distribution of a detailed questionnaire to experts on each of world's 21 modified mega-deltas, 2) collection and comparative analysis of information derived from the questionnaire, 3) the organization of a workshop (see the workshop section) and 4) the development of a website (www.deltasnetwork.nl) for international information exchange.

In 2001, effort was placed on establishing a global network of participants and in the development of the website information. The first international workshop on the planning and management of the world's modified mega-deltas was held from September 24-26 at the Coastal Zone Management Centre of the Netherlands, RIKZ in The Hague. 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. The Workshop recommended applying the ecosystem approach for the planning and management of deltas. The importance of pulsing events (e.g.

river-borne floods, flooding from ocean-borne storms) for a sustainable development of deltas was stressed. The outcomes of the Workshop are intended to give guidance for future research in order to resolve the major issues that are common almost all the modified mega-deltas.

3.2.6 ELOISE

The European Land-Ocean Interaction Studies (ELOISE) is a “Thematic Network” or “Project Cluster” supported by the European Commission. 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 Programme of the EU as an initiative of the Environment & Climate and the MAST (Marine Science and Technology) Research Programmes, acting in concert with the Programme for International Co-operation (INCO) and the research programmes of the Member States. It continues under the Fifth Framework Programme.

ELOISE aims at developing a coherent European coastal zone research network 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 in the fields of integrated coastal zone management and of spatial planning. Further information can be found on the WWW page of ELOISE (<http://europa.eu.int/comm/dg12/eliose/eliose-h.html>) or from the individual coordinators.

In 2001, 35 projects originating from the two programs Environment and Climate and Marine Science and Technology (MAST) were active under the ELOISE cluster of the European core project contribution to LOICZ. Their status and perspectives were reviewed during the 4th Annual ELOISE conference in Rende, Italy and emphasis was put 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).

The Commission underlined that the future of European coastal research would have to see a balanced mix of fundamental and applied science encapsulated in a sound synthesizing and communication mechanism. This is aimed to overcome the current fragmentation of activities through system based integrated approaches and improved scaling including the 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 a better contribution to sustainable development in Europe as outlined in the recently formulated communication to the Parliament.

LOICZ continued to contribute to this process in 2001 through a joint workshop on the Mediterranean and Black Sea Estuaries held at NCMR, Athens, 5-8 February (R&S Report No.19) and continued exchange with the JRC ELOISE secretariat in Ispra. LOICZ at the annual meeting in Rende confirmed as part of its own synthesis and futures process willingness 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. In late 2001 the Commission made a call for the ELOISE synthesis to be executed in 2002.

3.2.7 SCOR/LOICZ Working Group 112 Workshop: Global assessment of submarine groundwater discharge

The overall goal of the project is to define more accurately and completely the magnitude of submarine groundwater discharge (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 Modeling; Measurement; Sampling, and Experimental Design; and Typology, Integration and Globalization.

In 2001, the Working Group:

- Consolidated and analysed data from an SGD assessment intercomparison experiment in Cockburn Sound, Australia Nov. 25 - Dec. 6, 2000. That experiment was co-sponsored by LOICZ and IOC. A feature article (attached) was written for the LOICZ newsletter which was published in the Spring, 2001 issue.
- Prepared for publication in EOS a feature article on the two method intercomparisons (Florida and Australia) conducted to date, co-authored by several working group members.
- Held a scientific meeting in Catania, Sicily (June 11-16, 2001).
- Participated in the development of a Cooperative Research Program (CRP) with the International Atomic Energy Agency (IAEA) and UNESCO's International Hydrological Program (IHP). Preliminary fieldwork was accomplished immediately following the meeting in Sicily with the main field studies scheduled for 2002. Several working group members will be active in the project.
- Authored a short proposal to IUGG to establish a joint commission on submarine groundwater discharge between IAHS (International Association of Hydrological Sciences) and IAPSO (International Association for the Physical Sciences of the Ocean). The proposal was accepted and the first board meeting was held during the IAHS Congress in Maastricht, July 2001. Another meeting was held during the IAPSO Congress in Argentina, October 2001.
- Developed a proposal to the Asia Pacific Network (APN) to perform a direct measurement study of submarine groundwater discharge into Lingyagen Gulf, The Philippines. The proposal includes a significant training and capacity building component.
- Planned for: publication of a special issue of the journal "Biogeochemistry" on submarine groundwater discharge; preparation of a synthesis chapter for the LOICZ volume in collaboration with members of WG-114, flow through permeable sediments; a special session on SGD at the LOICZ Synthesis and Futures Meeting, Miami, 2002; and conduct of an SGD assessment intercomparison experiment on Shelter Island (eastern Long Island, New York), June, 2002 co-sponsored by LOICZ and IOC.

3.2.8 SARCS-WOTRO-LOICZ (SWOL)

The SWOL project addressing the modelling 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).

The SWOL team developed four further proposals – one from each participating country team (Malaysia, Philippines, Thailand, Vietnam) aiming to expand the economic evaluation and biogeochemical modelling to additional study sites in the region. In a two-pronged effort, the further validation and development of the modelling tools developed in Phase I, and the integration of additional data and regional up-scaling through a typological approach are the key features of a second phase of SWOL. The proposals were submitted to various agencies for co-sponsored funding and commitments have been achieved making the start of a second phase likely in 2002.

The scientific expertise of the SWOL approach and potentials for collaboration in particular in a second Phase were also provided to and discussed during the CariBas synthesis workshop held in Miami, in June 2001. SWOL could become one of the key elements in a CariCat project to be developed out of this assessment; similarly, for a project currently set up at the Gulf of Ecuador as part of the SAmBas follow-up. (for details on SAmBas and CariBas see Focus 1 report).

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. Thirteen major regional projects were completed in 2001, and two new ones added.

Current projects are listed below and further information is available from the LOICZ webpage (www.nioz.nl/loicz/).

Title	Investigator	Location
Coastal zone estuary and waterway management	Roger Shaw	Australia
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
Integrated coastal zone management in Banten Bay, Indonesia	A. Nontji	Indonesia
Studies for integrated coastal zone management	Maria Snoussi	Morocco
Sustainable use of international river Basins: definitions, criteria and assessment	W. P. Cofino	Netherlands
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

3.4 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.

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/).

<i>Chief Investigator</i>	<i>Project Title</i>	<i>Country</i>
Dr S. Appleyard & Dr J. Turner	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 D.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	Morphodynamics of wave-dominated coastal environment in Teluk Banten: managing deltaic shorelines and reef systems.	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	Archael carbon fixation and burial and terrestrial organic matter input in the coastal system as revealed by tetraether 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
Dr W. Campos & Dr R. Baleña	An oceanographic survey of Philippines Archipelagic waters: 1. Central Philippines.	Philippines
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
Prof. A.N. Voronov	Pollution transport to the Baltic Sea via groundwater runoff.	Russia
Dr H. Holden	Remote sensing of shallow submerged coral reefs: identifying areas under stress.	Singapore & Indonesia
Dr M. J. Bray	Environmental changes and management of coastal	United Kingdom

	systems.	
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 H. Echezuria & Dr E. Bilbao	Geo-environmental characterisation of the Orinoco Delta.	Venezuela
Dr Tran Duc Thanh	Sediment budgets and influence of moving and closing the inlets on the Tam Giang Lagoon ecosystem.	Vietnam

4. Workshops

4.1 LOICZ WORKSHOPS

4.1.1 LOICZ/UNEP Regional Synthesis Thematic Workshop for the Asian-Australian Region. CRC for Coastal Zone Estuary & Waterways Management, Brisbane, Australia 14-17 January 2001.

The UNEP GEF project supported the first regional “integration” workshop in Brisbane addressing the Asian and Australasian regions. The workshop provided an introduction to and training in use and application of the LOICZ typology methods for 32 researchers and environmental managers. Remote and local networked database and typology clustering tools were successfully trialled.

Participants developed typologies at various scales to address coastal forcing function and vulnerability, habitat and estuarine distribution, and coastal processes. Typologies describing and analysing climatic settings were the predominant products. Biogeochemical budgets information for the region was refined and effort was placed on linking the budget site characteristics and settings to a range of ecosystem, nutrient loading and latitudinal drivers.

The typology databases (located at University of Kansas) and the LOICZView methodology (Swarthmore College, Pennsylvania) were evolved as workshop participants highlighted applications beyond the LOICZ purpose. Application of the typology tools and approach has been made in New Zealand for purposes of environmental classification to underpin estuarine management (LOICZ Newsletter No. 19, June 2001). This application has provided a successful test of use of the methodology at much finer spatial scales than currently applied by LOICZ to answering its global questions.

The workshop outcomes are contained in a workshop report and accompanying CD - LOICZ R&S No. 22. LOICZ/UNEP Regional Synthesis Workshops: Australasia–Asia, The Americas, Africa–Europe. Summary Report and Compendium, to be published in January 2002. This regional synthesis work was extended to the Americas and Africa-Europe regions by two later workshops and a final synthesis workshop at the end of 2001 to develop a global typology of estuarine system performance.

4.1.2 LOICZ/EU Basins Task Group and EuroCat Project Workshop.

Hamburg/Geesthacht, Germany 3-5 February 2001.

In order to allow global comparison of the regional LOICZ Basins assessments, a task group of six LOICZ SSC and other members was formed to further develop tools and approaches for the standardised Basins assessment and synthesis procedures. The aim was not only to improve the assessment of coastal state changes and to make predictions of future trends under various natural and human forcing of the water cascade but also to identify the distance (as a means of resilience capacity) to critical thresholds.

The task group (Wim Salomons, Horst Behrendt, Jozef Pacyna, Nicola Pirrone, Kerry Turner, Hartwig Kremer) confirmed use of the DPSIR framework and a set of standardised assessment tables in the regional syntheses (see Focus 1 and core projects). The group confirmed its continued support to provide resource capacity to this global effort. Key regions which should – if possible – be covered in the synthesis in 2002 were identified to be Latin America, Asia, Africa, Russia and Europe. In Europe the first set of EuroBasins workshops resulted in the EuroCat project (6 Mio EURO 2001-2003) supported by the EU.

The initial Meeting of EuroCat held at the GKSS Research Centre, Geesthacht, was the official start of a broad-scale assessment of major European river systems and their interaction with coastal zones. EuroCat combines biogeochemical state investigations with socio-economic assessment on catchment scale using advanced multi-criteria analysis as well

as LOICZ assessment protocols. Six major catchment from Poland to Greece are involved and the French Afico Project under leadership of Prof. M. Meybeck is associated. As in the global Basins project EuroCat treats the catchment-coast as one system and aims to provide information relevant for decision support and management through providing nested scenarios simulating various management options. A web page has been set up (<http://www.iiu-cnr.unical.it/EUROCAT/project.htm>).

4.1.3 LOICZ/EU-ELOISE/UNEP Workshop on Estuarine Systems of the Mediterranean and Black Sea Region. National Centre for Marine Research, Institute of Oceanography, Athens, Greece 5-8 February 2001.

The further development of estuarine and coastal biogeochemical budgets, following the LOICZ approach, gained further impetus through a workshop held in Athens that addressed the Mediterranean and Black Sea region.

The 32 participants represented coastal science research in 12 countries. More than a dozen C-N-P budgets for sites in North Africa, from Spain to Turkey, and within the Black Sea were developed, ranging from systems of a few km² to large seas. The participants continue to evaluate additional sites following the workshop. The participants spent time considering the LOICZ typology approach and its application for a variety of scientific purposes, including use as a tool in assisting the further synthesis of ELOISE project outcomes.

The workshop contributed to the regional series that has been supported by UNEP GEF over the last 18 months, wherein training and use of the LOICZ budgetting approach has been coupled with the delivery of budget sites in regions of the world (Latin America, South East Asia, East Asia, South Asia, sub-Saharan Africa). Outcomes of the workshop are included in the LOICZ Budgets and Modelling website and in a workshops report: LOICZ R&S No. 19. Coastal and Estuarine Systems of the Mediterranean and Black Sea Regions – Carbon, Nitrogen and Phosphorus Fluxes. 2001.

4.1.4 LOICZ/APN/START East Asia Basins Workshop on East Asian River Catchment/Coastal Zone Interaction and Human Dimensions (Impacts of land-based activities on coastal seas of East Asia). Baptist University, Hong Kong, China 26-28 February 2001.

The LOICZ East Asia Basins regional assessment workshop, supported by the Asia Pacific Network for Global Change (APN) and START, saw 18 regional and global experts provided a first report of river catchment-coastal seas interactions in East Asia. Using the DPSIR-based LOICZ Basins Regional Assessment Tables, they came up with a first order ranking of the importance of land-based drivers and related coastal state change. Results will be published as a LOICZ R&S in early 2002 and are part of a LOICZ special issue of the journal *Regional Environmental Change* (Springer) currently in the review process.

Three working groups focusing on the sub-tropical sub-region (Vietnam and Gulf of Tonkin), the central part including Yellow and Bohai Seas and the north with the Sea of Japan addressed key issues such as:

- adverse effects of growing coastal erosion and saltwater intrusion from reduced runoff;
- anthropogenic forcing in the form of rapid demographic change and economic development;
- multi-driver impacts on coastal systems resulting from changing fluxes of materials through the catchments (it is estimated that more than 50% of fertiliser production, water management and damming activities occur in Asia and increasing power and water demands accelerate these, for instance in the Yellow and Yangtze River catchments);
- increasing trend expectations for catchment-based coastal impacts.

Taiwan and Japan were included using catchment and full island scales.

The development of a regional follow-up proposal drawing on the hot issues identified and applying integrated modelling approaches is under discussion. Likewise with other regional Basins networks, the East Asian group will investigate the application of existing LOICZ-related project designs such as EuroCat and seek links to other projects and organisations such as UNEP, GIWA, IOC-UNESCO (GOOS and ICAM), START and IHDP. A first follow-up proposal on anthropogenic and sea-level rise effects on estuaries and deltas in East Asia has been submitted to the APN for support in 2002.

4.1.5 LOICZ/UNEP Workshop on Estuarine Systems of the Latin American Region.

Instituto de Investigaciones Oceanologicas, Universidad Autonoma de Baja California, Ensenada, Mexico 25-26 April 2001.

Under the aegis of the UNEP project addressing global coastal biogeochemical processes, further training in the LOICZ biogeochemical approach was provided to researchers from Mexico and South America.

The group of nine researchers from seven countries contributed a further 20 budget site models to the geographical coverage of the region. These have been incorporated into the LOICZ Biogeochemical Modelling Web Site and the detailed description and outcomes of the workshop will be published in a LOICZ R&S No. 23 early in 2002.

4.1.6 LOICZ/UNEP Regional Synthesis Thematic Workshop for the Americas Region.

Instituto de Investigaciones Oceanologicas, Universidad Autonoma de Baja California, Ensenada, Mexico 29 April – 2 May 2001.

The second regional synthesis workshop addressing biogeochemical estuarine models and the typologies of coastal forcing and environmental setting for the Americas extended the LOICZ-UNEP project on coastal biogeochemical assessment to the Americas region.

The 30 scientists representing most North, Central and South American coastal nations, gained familiarity with the use of the LOICZ typology tools. Participants developed typologies at national, regional and global scales for climatic and oceanographic context of coastal biogeochemical budgets, catchment forcing conditions and thematic elements such as calcification and coral reef distribution.

Progress was also made in the challenging task of synthesising the biogeochemical models database and its scaling from local to global assessment, especially in relation to the Americas region. New attributes were developed for the LOICZView tools, adding features that extended the statistical evaluation to the user and providing manipulative features such as overlays, supervised clustering and enhanced visual-comparison access. Products from the workshop and the upgrade of LOICZView were incorporated into the Typology website and detailed outcomes are included in the workshop report: LOICZ R&S No. 22. LOICZ/UNEP Regional Synthesis Workshops: Australasia–Asia, The Americas, Africa–Europe. Summary Report and Compendium is to be published in January 2002.

Scoping and database developments to support typologies for the wider ocean regions were subject of a small workshop to support the OBIS project that is allied to LOICZ.

4.1.7 LOICZ South American Basins (SAMBas) II. South American River Catchment–Coastal Zone Interaction and Human Dimensions. Fortaleza, Universidade Federal do Ceará, Brazil 2-5 May 2001.

Supported by the Universidade Federal do Ceará and UNESCO/IOC, the South American Basins assessment study (SAMBas) held a second workshop with 20 participants including representatives of the LOICZ Basins task group and IOC. Key questions were addressed using the LOICZ Regional Assessment Tables (see Newsletter 18). Two working groups

(Pacific and Atlantic coasts) refined the regional SAmBas synthesis and filled gaps, addressing rivers and coastal issues along the Pacific coast and better assessing the “human dimensions” of river-based flux changes to the coastal ocean. A ranking of drivers, pressures and impacts was developed allowing between-site and sub-regional comparison of issues.

Further attention was paid to critical loads of riverine material flows for environmental and social system functions. Approximations were made of distances of current system states and fluxes from "critical thresholds" with implications for sustained provision of coastal goods and services. The workshop also considered human development indicators as approximations for observed biogeochemical coastal change. UNESCO/IOC expressed interest in this approach, to find and apply effective indicators of change in the frame of Coastal-GOOS and to provide tools for scenario simulation in coastal management.

The gaps and hot spots identified during the two SAmBas workshops provided a set of potential key study areas/catchments covering the Pacific and Atlantic coasts:

- San Juan and Patia, two high sediment yielding rivers in Colombia
- Magdalena River, the largest continental contribution to Caribbean Colombia
- Guayas River - Gulf of Guayaquil, Ecuador
- Biobio River-Concepcion/Talcahuano Bay, northern Chile
- Jaguaribe and Ceará rivers, north-eastern Brazil
- Paraíba do Sul River/Sepeitaba/Guanabara bays, south-eastern Brazil
- Patos Lagoon, south Brazil
- La Plata River estuary including the Uruguayan and Argentinean coasts
- Negro River, Patagonia, Argentina

Key persons in the SAmBas network agreed to develop proposals for the case-study sites and to investigate potential funding on national and international levels. The regional co-ordinators of SAmBas will be Prof. L. Drude de Lacerda (Fortaleza) and Dr. Giovanni Daneri (Valparaiso). A first follow-up proposal addressing the Gulf of Guayaquil is currently in the review for an MSP grant at the IAI office – collaboration here is expected to include Chile, Ecuador and the USA.

The workshop findings are included in LOICZ R&S No. 21 to be published in February 2002, contained in the LOICZ Basins web site and contributions are being published in a peer-reviewed special issue in the journal: *Regional Environmental Change* (Springer).

4.1.8 LOICZ Caribbean Basins (CariBas) II. Caribbean Regional River Catchment–Coastal Zone Interaction and Human Dimensions. Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, Florida, USA, 28-30 June 2001.

Following recommendations of its 4th Open Science Meeting in 1999 LOICZ, supported by IOC, launched a CariBas core group in 2000. At its 2^d synthesis meeting in Miami, the group, mainly from the CARICOMP network evaluated naturally and human induced flux changes to the coastal seas, impacts and critical loads in this heterogeneous area covering islands of various size, as well as continental, mountainous lands.

Coastal change in this sub-region originates from driver patterns such as seasonal tourism, agriculture, oil exploitation and urbanization. Amplified impact arises from natural drivers including higher numbers of climatic extreme events. In reviewing current states against historical developments, an interesting conclusion was that almost all of the Caribbean has been modified by man, apart from a few places too harsh or too wet for intervention.

Within this synthesis and following the tabulated DPSIR approach, sites addressed in detail for future in-depth investigations were the Magdalena River and Golfo Triste and Aroa-

Yaracuy River along the Venezuelan coast. Their agriculture and urbanization influences affected the biodiversity in reef areas, where live coral cover has fallen from 35% to 5% and broader biodiversity is down to 20%; trend expectations are pessimistic. In Costa Rica, agricultural and logging activities in the Estrella River catchment caused deterioration in the Cahuita reef exceeding the critical thresholds. In a sub-regional approach the Meso-American Reef area stretching from Mexico via Belize south to Guatemala and Honduras, was evaluated. This second biggest barrier reef in the world - subject of a recent comprehensive GEF/WB project - has not yet been addressed from the viewpoint of land-based pressures. Future regional LOICZ activities will seek links to the GEF/WB project on the Meso-American Reef.

Island-based sites included in the more detailed CariBas assessment include the polluted and urbanized area of Kingston Harbor and the Caroni River basin and Gulf of Paria on Trinidad/Tobago. Further island sites e.g., on Cuba and Hispaniola, are likely to be included in the proposal development at a later stage.

The project synthesis and future developments have been added to the regional projects conducted under the aegis of UNESCO-IOC's IOCARIBE Sub-Commission. The report of the workshop, which will include a comparable study conducted as a LOICZ desk study in 2001 on the Western Pacific Island Regions will be published as a LOICZ R&S in April 2002. Future scientific LOICZ-type work in the Caribbean will be considered in 2002.

4.1.9 LOICZ/UNEP Regional Synthesis Thematic Workshop for the Africa-Europe Regions. Coastal Zone Management Centre, RIKZ, The Hague, The Netherlands 2-5 July 2001.

The third regional synthesis workshop in the LOICZ-UNEP series aimed to provide training and familiarity with the LOICZ typology methods and tools and to develop regional typological settings in which to couch and interpret the biogeochemical site evaluations for the African and European regions.

The 32 participants from 19 countries applied the typology tools to sub-regional questions of scaling and to issues relating to biogeochemical budgets. The LOICZView tool was further refined to include additional statistical elements. Climate, nutrient loading and scaling typologies were developed across the continental regions as context to biogeochemical models. Further advances were made in the analysis and synthesis work and approaches to assessment of the array of biogeochemical sites database.

Products from the workshop and the upgrade of LOICZView were incorporated into the Typology website and detailed outcomes are included in the workshop report: LOICZ R&S No. 22. LOICZ/UNEP Regional Synthesis Workshops: Australasia-Asia, The Americas, Africa-Europe. Summary Report and Compendium, to be published in January 2002.

4.1.10 LOICZ-UNEP Workshop on Estuarine Systems of the Southern African Region. Oatlands Holiday Village and Conference Centre, Simonstown, Republic of South Africa 3-6 September 2001.

A further training workshop in the LOICZ biogeochemical approach was provided to researchers from Africa, as part of the LOICZ-UNEP coastal biogeochemical assessment project.

The University of Cape Town hosted 12 participants from seven countries in a workshop that applied the LOICZ nutrient budget methodology to the development of a suite of additional site nutrient models and to provide further training and awareness in Africa. The sub-Saharan region now has a broad representation of budget sites across a range of climatic and landscape settings, with the workshop adding a dozen new budgets in the region, plus a budget assessment for the Nile Delta.

The models and assessments have been incorporated into the LOICZ Biogeochemical Modelling website and the detailed description and outcomes of the workshop has been published in LOICZ R&S No. 20: Estuarine Systems of Africa (Regional Workshop II): Carbon, Nitrogen and Phosphorus Fluxes.

4.1.11 LOICZ/UNEP Workshop on Estuarine Systems of the Arctic Region.

Department of Systems Ecology, University of Stockholm, Stockholm, Sweden 9-11 September 2001

The LOICZ-UNEP biogeochemical assessment project held a first workshop of experts to discuss the application of the LOICZ modelling methodology to polar regions which are under-represented in the suite of coastal site nutrient budgets. The polar climate offers a number of special issues, for example, seasonal land flow, that provide challenges to coastal modelling assessments.

The workshop activities and subsequent home-institute work successfully applied the LOICZ methodology and developed four budget assessments for estuarine and regional seas across the Russian polar coast, and within the Bothnian Sea. This provided a vital latitudinal extension to the LOICZ information with indications that the N and P inputs are predominantly from the ocean rather than from land sources. Further extension of site assessments is expected to continue as part of field and laboratory work being carried out under the Russian LOICZ programme - LOIRA.

The models and assessments have been incorporated into the LOICZ Biogeochemical Modelling website and the detailed description and outcomes of the workshop are included in LOICZ R&S No. 23 to be published in January 2002.

4.1.12 LOICZ/Netherlands CZMC Delta Workshop: The Research Agenda for Improved Management of Deltas. National Institute for Coastal and Marine Management/RIKZ, The Hague, The Netherlands, September 2001.

The first international workshop on the planning and management of the world's modified mega-deltas was the first step in the establishment of a network of planners and applied scientists whose work focuses on modified mega-deltas (MMDs). The goal of the deltas network was refined during the workshop: "Sharing knowledge to attain or maintain sustainable functioning of MMDs to achieve a balance of human society, natural processes and environmental needs." The Workshop's specific objectives were to:

- Provide a report on developments and management practices in a number of deltas around the world;
- Identify lessons that could be learned from management practices in deltas;
- Identify from the cases elaborated during the workshop a number of unifying issues for research and management of deltas that could evolve into a research agenda and eventually lead to research proposals;
- Establish an international delta network to continue the science for management of deltas and exchange of information about delta management.

The deltas represented at the Workshop - as well as background papers and questionnaires prepared before the Workshop - were the Chang Jiang (Yangtze), Huang He (Yellow), Pearl River, Red River, Mekong, Irrawaddy, Indus, Tigris-Euphrates, Ganges-Brahmaputra-Meghna, Nile, Rhine, Rhône, Po, Ebro, Danube, Paraná, Mississippi, Sacramento/San Joaquin and the Usumacinta/Grijalva.

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. The Workshop recommended applying the ecosystem approach for the planning and management of deltas. The importance of pulsing events (e.g. river-borne floods, flooding from ocean-borne storms) for a sustainable development of deltas was stressed. The outcomes of the Workshop are intended to give guidance for future research in order to resolve the major issues that are common to almost all the modified mega-deltas.

4.1.13 LOICZ/IOC/NORAD/PASS African Basins (AfriBasins) II. African River Catchment/Coastal Zone Interaction and Human Dimensions (Impacts of land-based activities on coastal seas of Africa). UNEP headquarters, Nairobi, Kenya 29 October – 01 November 2001

Hosted by UNEP's Regional Office for Africa in co-operation with PASS (the Pan African START Secretariat) and supported by START/NORAD and UNESCO/IOC, the workshop identified coastal change and river catchment-based forcing of change in eight sub-regions of Africa. Key variables included coastal geomorphology, coastal habitats/biodiversity, climatic conditions, people relationships (demography and drivers), catchment size and seasonal runoff, land use and cover. The sub-regions were:

- the Nile;
- East Africa (Somalia to northern Mozambique), featuring the small- and medium-sized catchments under monsoonal forcing;
- Southern/central Mozambique, again with high seasonality in runoff characteristics and transboundary issues;
- South-east Africa, ranging from subtropical in the north to warm temperate on the Cape coast and characterised by generally small catchments that are subject to plans for intensive damming;
- Southwest Africa, mainly dominated by the upwelling system of the Benguela Current, with limited river runoff;
- the Congo, a central African sub-region with a very large catchment and extensive rainforest but little information available about its land-based drivers and how they relate to coastal issues;
- West Africa, featuring a variety of large rivers subject to major damming resulting in reduced sediment and water fluxes that cause coastal instability as a growing threat to the lagoon-based cities; and
- the relatively arid North-west Africa, with seasonal runoff and, at least in Morocco, major human pressure through diversion and damming.

The catchments chosen for assessment were considered representative for their sub-region. The big four river basins (Nile, Zambezi, Congo and Niger) were included, as were the important basins of the Senegal, Volta, Cross and Gariep Rivers on the western coast, and the Limpopo and Incomati rivers on the eastern coast. Medium and small basins were also assessed including the Sebou and Moulouya in Morocco, the Olifants and Berg west of the Cape and Tugela, Kariega, Kromme and Groot Brak rivers east of the Cape in South Africa, the Rufiji in Tanzania and the Sabaki and Tana in Kenya.

Coastal geomorphological change, erosion and sedimentation were identified as a significant and progressive impact in nearly all of the sub-regions, the problem being acute in the Nile delta and in West African lagoon systems. Damming was viewed as the principal driver in such change, with consequent reductions in stream flow and sediment flushing. Other coastal impacts ascribed to river damming include salinisation, e.g., in the Incomati estuarine plain in Mozambique, and nutrient depletion in coastal seas, e.g., KwaZulu-Natal. In most sub-regions deforestation and agriculture were important drivers, particularly in respect of coastal sedimentation from medium and small catchments, e.g. the Tana and Sabaki rivers in Kenya. Human settlement was regarded as a major contributor to eutrophication and the occurrence

of aquatic weeds in the large West African catchments. Elsewhere, while eutrophication and pollution were recognised as important issues, they were related in many cases to local (coastal) urban-industrial sources, e.g., Alexandria, Mombasa, Saldanha Bay and Cape Town. Loss of biodiversity or biological functioning was another common issue, though related probably to complex ranges of human and natural pressures.

In general these data characterise developing economy situations where growth and water use exceed development of the necessary urban and industrial infrastructure. This finding parallels those made in the South American (LOICZ R&S No. 21), and East Asian (Hong *et al.*, in prep.) basins assessments. However, the heterogeneity of the African sub-regions seems to be more pronounced, making the ranking of issues and drivers in Africa a more complex challenge.

As a second task, the AfriBasins assessment was used to identify potential demonstration sites for future holistic studies. “Hot spots” for future research and a project design applicable to various spatial and temporal scales were discussed. The workshop concentrated on the draft AfriCat proposal, which was modelled on the EuroCat project. Emphasis was on adjustment of this draft to the regional African needs and case studies – a process that is ongoing. In close co-operation with IOC and the Advisory Committee on the Protection of the Sea (ACOPS), results of this LOICZ effort complement the design of the GEF MSP “Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa“. This project, based on root cause analyses in 11 African countries, is seeking links with LOICZ; a Partnership Conference is to be held in Johannesburg in 2002.

4.1.14 LOICZ/UNEP Global Synthesis Expert Workshop on Coastal Biogeochemistry and Scaling. Kansas Geological Survey, Lawrence, Kansas, USA 11-14 November 2001.

A global integration workshop was held in Kansas to draw together and analyse patterns and trends for the existing biogeochemical nutrient site assessments, to synthesise the information in terms of disturbed and undisturbed coastal systems, to consider global and sub-regional variability and how to grapple with it, and to elucidate general trends and relationships between coastal ecosystem net metabolic performance and nutrient loading variables.

The typology tool, LOICZView, was applied to the regional and global synthesis by the 32 participants representing 15 countries from all regions of the world. In particular, advances were made in the development of coastal classifications based on climate and other physico-chemical factors, and to the question of land-derived loads of nutrients to the coastal zone. A variety of scaling and statistical approaches was applied in the wide-ranging analyses, and initial trend information was derived from the extensive database on biogeochemical performance of estuaries and coastal seas.

The workshop marked the final activity of the UNEP GEF project carried out by LOICZ and outcomes are contributing to the overall LOICZ Synthesis activities in 2002. Further synthesis and assessment of the biogeochemical characteristics of the global coastal zone are proceeding through a networked group of LOICZ scientists. A LOICZ R&S containing the synthesis relating to the UNEP project is to be published in March 2002.

4.2 ASSOCIATED WORKSHOPS

4.2.1 SCOR/LOICZ/IOC/IHP Working Group on Submarine Groundwater Discharge – Annual Meeting and Second Field Assessment. Catania and Syracuse, Sicily, Italy 14-19 June 2001.

The 4th meeting of the SCOR/LOICZ working group on groundwater discharge met in conjunction with another group with interests in using isotopes for measuring SGD that is

sponsored by the International Atomic Energy Agency (IAEA) and the International Hydrological Program (IHP). The meeting was thus somewhat larger than earlier meetings, with 31 participants and observers.

The Co-Chairs reviewed the activities of the group over the previous year, including approval of a proposal to the Intergovernmental Oceanographic Commission (IOC) for partial support of a series of SGD assessment intercomparison experiments; development of a cooperative link between the working group and a research effort initiated by the International Atomic Energy Agency (IAEA) and the International Hydrological Program (IHP) to use isotopic approaches to evaluate SGD; acceptance of a proposal to the IUGG for establishment of a joint commission (between IAHS and IAPSO) on "Groundwater - Seawater Interactions"; and the organization and running of two SGD assessment intercomparison experiments.

The group members reported on the status and developments of work within each of the core themes - Calculation and Modelling; Measurement, Sampling and Experimental Design; Typology, Integration and Globalization. The group noted that a major portion of the emerging interest in SGD has been centered on the coastal zone management implications and, following discussion on integrated coastal zone management (ICZM) issues aimed to develop a brochure (with IHP and IOC) and may also put up information on the website.

The group was scheduled to conclude by end 2001 as a SCOR-based activity. However, the group resolved to continue as a network, still allied to LOICZ, through 2002 in the first instance, recognising that:

- in completing a group information synthesis (for publication in a major volume) it will work closely and align its analyses/reporting timetable with the LOICZ Synthesis efforts in 2002;
- momentum of the group can be maintained to meet the needs expressed through the extensive links built with interested bodies; and
- inter-calibration field exercises can be sustained to examine additional settings for SGD that will provide further rigor to current findings.

After the meeting in Catania, many of the participants stayed on to participate in preliminary sampling of the submarine springs and groundwater in anticipation of IAEA's Cooperative Research Project that will begin next year.

4.2.2 ELOISE 4th Annual Conference. Istituto sull' Inquinamento Atmosferico, Rende, Italy 5-7 September 2001.

The status of the ELOISE project cluster – a LOICZ core project - and perspectives for improved synthesis especially in the new European Research Area (ERA), and the competitive surroundings of the 6th Framework Program (2002-2006) were discussed at the ELOISE Conference. The European Commission expects that the future of European coastal research will see a balanced mix of fundamental and applied science encapsulated in a sound synthesizing and communication mechanism. A challenge will be to overcome 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 (with currently 35 projects in operation) and a better contribution to sustainable development in Europe as outlined in the recently formulated communication to the European Parliament. However, it was underlined that the global change dimension would be a crucial link for up-scaling and inter-comparison of the European research.

In the longer term the European Research Area, an initiative proposed in 2000, will be the platform where both national programs and the 6th Framework Program and thus any sort of continued ELOISE cluster will have to fit in. The ERA aims to facilitate the development of a European Policy for research and to anticipate the future science and technology needs on

EU level. It needs to build on research which meets the above criteria with special emphasis on interdisciplinary, transboundary scaling and on an improved coherence of national research agendas. Future projects which will meet the new criteria for support will include much broader networks of excellence than in the past and form a sort of “virtual” laboratories. An improved visibility for and operational links to Global Change science will be another key feature of European coastal research.

In principle the Commission expressed its expectations that the growing operational links between the EU research and LOICZ will be strengthened further in the future. In particular LOICZ is expected to play an important role in complementing and supporting the synthesis and in bringing in the global perspective and a global set of links to application. At the Commission end the ELOISE synthesis to be executed in 2002 has recently been made subject to a call for tender.

4.3 OTHER WORKSHOPS

In 2001, LOICZ scientists were involved in wide-ranging coastal zone activities and assessment, presentation of research findings and materials, in the preparation of scientific publications in a number of key workshops held by related agencies addressing coastal research and in the transfer of scientific knowledge to coastal managers, policy and industry sectors, including:

- 6th International Conference on Public Communication of Science and Technology, PCST2001. Geneva, Switzerland 1-3 February 2001.
- IGBP SC 16th Meeting and IPO Executive Officers Meeting. Chiang Mai, Thailand 20-26 February 2001.
- Millennium Ecosystem Assessment Technical Design Workshop I. Utrecht, The Netherlands 8-11 April 2001.
- Advisory Group of Experts on the IOC/ICAM Programme “Marine Science for Integrated Coastal Area Management”. UNESCO, Paris, France 15-17 May 2001.
- ICEF Great Rivers Forum – Volga-Caspian Basin planning and development workshop. Nizhny Novgorod, Russian Federation 15-18 May 2001.
- IOC Coastal Ocean Observing Programme (COOP) Planning Meeting. Trieste, Italy 6-8 June 2001.
- Intergovernmental Oceanographic Commission Assembly. UNESCO, Paris, France 3-7 July 2001.
- LOICZ Scientific Steering Committee meeting. KNAW, Amsterdam, The Netherlands 7-8 July 2001.
- IGBP Congress. Amsterdam, The Netherlands 10-13 July 2001.
- XIth General Assembly & Scientific Symposium of SCOPE. Bremen, Germany 24-28 September 2001.
- Millennium Ecosystem Assessment Technical Design Workshop II. Cape Town, Republic of South Africa 8-11 October 2001.
- Global International Water Assessment Assembly. Kalmar, Sweden 9-11 October 2001.
- LOICZ Typology Development Workshop. Swarthmore College, Philadelphia, Pennsylvania USA 13-15 October 2001.
- Earth Research Foundation Conference. St Petersburg, Florida, USA 5-8 November 2001.
- SCOR/IGBP Planning Group on Future Oceans Research in Earth System Science, Second Meeting. Barcelona, Spain 2-5 December 2001.
- Global Conference on Oceans and Coasts at Rio+10. UNESCO, Paris, France 3-7 December 2001.

5. Collaboration

LOICZ has continued to actively seek collaboration throughout 2001, building on and extending earlier relationships both internally in the IGBP “family” of projects 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 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 programme. In 2001, the Dutch research agencies called for research proposals as components of a US\$3.5 million project to support LOICZ focussed research by Dutch institutions over the next 4 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 increased opportunity and collaboration in this area during 2001. The EU supported UK initiative for the SURVAS addressing sea-level vulnerability using a common methodology has been completed. The new European Basins study was initiated 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 continued into its synthesis stage. Further collaborative actions within the EU-funded ELOISE program are providing regional and thematic research outcomes. For example, support for a joint LOICZ-UNEP-EU workshop on estuarine biogeochemical assessment of the Mediterranean and Black seas has led to further collaborative planning on coastal system assessment and integration of information, especially using the LOICZ methods for modelling and typology; a workshop is planned for early 2002.

LOICZ is building an association with UNEP and other global programs beyond the current GEF-funded estuarine biogeochemical project. The Basins task in LOICZ is a catalyst in this arena, with the AfriBasins II workshop in 2001 providing a platform for discussions and collaborative opportunities, linking with UNEP, ACOPS and other regional programs. Effort will be invested throughout 2002 to establish stronger collaborative operational activities.

Within IGBP, LOICZ has extended joint work with the terrestrial and other marine projects, notably BAHC (through typology and synthesis assessment, databases and tools), GLOBEC (with joint typology interests), and JGOFS (by the joint CMTT activities). Additional collaboration has resulted from contributions to the cross-cutting projects Earth System Science Partnership (IGBP, IHDP, WCRP), such as assessments of global changes in water. LOICZ highly values its close working relationship with the START project on capacity building and regional assessment. Training in regions was enhanced by jointly organising workshops during 2001, for example, the South American Basins, African Basins and East Asian Basins workshops. These initiatives and the collaborative contacts and funding with other agencies pursuing capacity building projects (e.g., IOC, the Inter Americas Institute, the Asia Pacific Network) continue to provide efficiency and valuable outcomes from joint ventures.

LOICZ research continued to gain support from the Asia Pacific Network, both for co-funded workshops and for research activities, especially in Oceania and the South Asia. A close association with the SCOR global program has been sustained e.g., the jointly-sponsored Working Group (112) on Submarine Groundwater Discharge, and the joint work has been extended with common interests and support from UNESCO's IOC and IHP. A closer working association with the International Human Dimensions Programme (IHDP) 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. 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 2001, this close collaboration was extended further into regional basins activities and preparation for the WSSD in 2002. These "brokering" and application initiatives are being extended through additional links and joint actions with RIKZ Coastal Zone Management Centre (e.g., the new Deltas task) and the Netherlands Institute for Sea Research (NIOZ).

6. 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 2001, 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 (Nos. 17-20) 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.

Brochures and Posters

The IGBP Conference in Amsterdam (July 2001) provided a major opportunity to build greater knowledge about the LOICZ project within both the research and science-user communities. A poster display was presented (indeed, the IGBP display was co-ordinated by LOICZ with NIOZ and IGBP support), well attended and supported by distribution of LOICZ multi-lingual brochures and LOICZ Reports and Studies publications.

LOICZ Website

The LOICZ website (www.nioz.nl/loicz/) is of increasing importance as a means of communication and as an archive. The website was partially upgraded in 2001. 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.

Publications

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 2001 include:

Aguire-Munoz, A., Buddemeier, R.W., Camacho-Ibar, V., Carriquiry, J.D., Ibarra-Obando, S.E., Massey, B.W., Smith, S.V. and Wulff, F. 2001. Sustainability of coastal resource uses in San Quintin, Mexico. *Ambio* **30** (3): 142-149.

- APN/SURVAS/LOICZ 2001. Global change and Asia Pacific Coasts. Proceedings of APN/SURVAS/LOICZ joint conference on coastal impacts of climate change and adaptation in the Asia-Pacific region, Kobe, Japan 14-16 November 2000. Mimura, N and Yokiki, H (eds). 285p. Asia Pacific Network for Global Change Research and Centre for Water Environment Studies, Ibaraki University, Japan.
- von Bodungen, B and Turner, R.K. 2001. Science and integrated coastal management: an introduction. In: Report of the 85th Dahlem Workshop on Science and Integrated Coastal Management Berlin, 12-17 December 1999, pp.1-14. Dahlem University Press, Berlin.
- Cattaneo, E., Zaldivar, J.M., Murray, C.N., Varioli, P. and Giordani, G. 2001. Application of LOICZ methodology to a Mediterranean coastal lagoon: Sacca di Goro (Italy). European Commission Joint Research Centre, 29p. EUR 19921 EN European Communities, Ispra, Italy.
- Crossland, C.J. and Kenchington, R.A. 2001. The Great Barrier Reef, Australia: partnerships for wise use. In: Report of the 85th Dahlem Workshop on Science and Integrated Coastal Management Berlin, 12-17 December 1999, pp.135-148. Dahlem University Press, Berlin.
- Crossland, C.J., van Raaphorst, W. and Kremer, H.H. (eds) 2001. Special issue: land-ocean interactions in the coastal zone. *Journal of Sea Research* **46** (2): 85-185.
- Gren, I-M, Turner, R.K. and Wulff, F. (eds) 2000. *Managing a sea: the ecological economics of the Baltic*. Earthscan Publications Ltd., London. 138p.
- Lindeboom, H. and others. (in press). The coastal zone: an ecosystem under pressure. Coastal operations and processes. In: *The Ocean – 2020*. Intergovernmental Oceanographic Commission, UNESCO.
- LOICZ/UNEP 2001. Estuarine systems of Sub-Saharan Africa: carbon, nitrogen, and phosphorus fluxes. Dupra, V., Smith, S.V., Marshall Crossland, J.I. and Crossland, C.J. (eds). LOICZ R&S No. 18, 83p. LOICZ IPO, Texel, The Netherlands.
- LOICZ/UNEP/EU 2001. Estuarine systems of the Mediterranean and Black Sea region: carbon, nitrogen, and phosphorus fluxes. Dupra, V., Smith, S.V., Marshall Crossland, J.I. and Crossland, C.J. (eds). LOICZ R&S No. 19, 101p. LOICZ IPO, Texel, The Netherlands.
- LOICZ/UNEP 2001. Estuarine systems of Africa: carbon, nitrogen, and phosphorus fluxes. Dupra, V., Smith, S.V., Waldron, H., Marshall Crossland, J.I. and Crossland, C.J. (eds). LOICZ R&S No. 20, zzz p. LOICZ IPO, Texel, The Netherlands.
- Murray, C.N. (ed.) 2001. Special issue: ELOISE – European land-ocean interaction. *Continental Shelf Research* **21** (18-19): 1919-2183.
- Pacyna, J.M. and Hov, O. 2001. Literature review: trace gases in the coastal zone. Norsk Institutt for Luftforskning, Norway. 38p.
- SARCS/WOTRO/LOICZ 2001: Biogeochemical and human dimensions of coastal functioning and change in Southeast Asia. Final report of the SARCS/WOTRO/LOICZ project 1996-1999. Talaue-McManus, L., Kremer, H.H. and Marshall Crossland, J.I. (eds). LOICZ R&S No. 17, 277p. LOICZ IPO, Texel, The Netherlands.

Smith, S.V., Renwick, W.H., Buddemeier, R.W. and Crossland, C.J. 2001. Budgets of soil erosion and deposition for sediments and sedimentary organic carbon across the conterminous United States. *Global Biogeochemical Cycles* **15** (3): 697-707.

Talaue-McManus, L. 2001. Integrated coastal management: the Philippines experience. In: Report of the 85th Dahlem Workshop on Science and Integrated Coastal Management Berlin, 12-17 December 1999, pp.213-228. Dahlem University Press, Berlin.

Wulff, F.V., Rahm, L.A. and Larsson, P. (eds) 2001. A systems analysis of the Baltic Sea. *Ecological Studies* 148, 455p. Springer, Berlin.

Websites

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>

7. Funding

The Netherlands government continued to generously support the LOICZ International Project Office and core activities during this second phase of the project, 1998-2002. 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 support of a new research project from the Netherlands government, in 2001 LOICZ (and associated projects) gained significant project funding from UNEP-GEF, APN, USNOPP/Alfred P. Sloan Foundation, and the EU. The European Union has provided support funding for a workshop project and the suite of ELOISE projects.

Funding for regional activities has come from IOC, IHP, IAI, NSF, WOTRO and APN. Working collaboration has been established with other core projects of IGBP and jointly-funded activities have been engaged especially with BAHC, 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 Years 1 - 4 of **Phase 2** is listed below with indicative figures for Year 5 (2002).

	1998	1999	2000	2001	2002 (projected)
LOICZ Phase 2 (1998-2002) (Euro)	Year 1	Year 2	Year 3	Year 4	Year 5
Cash					
Core support	405 500	403 200	406 800	405 500	405 500
Additional support	29 800	198 300	353 300	356 100	308 800
subtotal	435 300	601 500	760 100	761 600	714 300
Inkind					
NIOZ and RIKZ	118 200	118 200	118 200	118 200	118 200
Additional support	83 200	245 400	328 600	336 400	290 400
subtotal	201 400	363 600	446 800	454 600	408 600
TOTAL	636 700	965 100	1 206 900	1 216 200	1 122 900

8. 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
ELOISE	-	European Land-Ocean Interaction Studies
ERA	-	European Research Area
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
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
WG	-	Working group
WOTRO	-	Netherlands Foundation for the Advancement of Tropical Research