

LOICZ

**ANNUAL REPORT
1999**



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 individual scientists' contributions, 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

All around the world people are rapidly changing the coastal areas and seas. During the last 50 years, this has speeded up so much that in many areas the resulting change starts to go beyond our imagination. In more than half of the world's rivers the water flow has been significantly altered by dam construction. The amount of pollutants and nutrients reaching the vulnerable coastal zones and shelf seas is still increasing. The shape of coastlines is getting further away from the natural state. And the amount of food taken from the coastal seas puts tremendous burden on the natural carrying capacity, biodiversity and ecological functioning.

On a global scale, humans have become the major cause of a rapidly changing marine environment. This will have far-reaching implications for the future of this environment. Where will this unabated development of the coastal ecosystems lead and where will it end? LOICZ tries to answer some of these questions on a global scale

Two years into the second phase of LOICZ, with a synthesis of our coastal science due at the end of 2002, we can see a significant increase in our science products. Many of the projects in LOICZ have been published in global literature and are available via the LOICZ web-site; new projects at local and regional scales are being contributed and a start has been made with the integration and synthesis of LOICZ research.

Regional workshops in Latin America, Africa, Asia and Europe have been integrating new and existing information into an early stage of answering the LOICZ questions. Major advances have been made in the building of biogeochemical budgets, and various patterns are starting to emerge and form "derivative models" that relate systems inputs and responses in regions. Allied and recent advances in methods for scaling-up of local system information to regional and global dimensions are putting our actions at the cutting edge of this "hot" issue. Here, products are starting to flow and a wider collaboration across IGBP projects is evolving that should yield fascinating pictures of material flux in a coastal catchment/seas context.

River basin work has refined its focus towards the critical load concept and, linked with the human dimension, has seen some strong assessments and coherence developing, especially from European and Latin American sectors. Thematic and integrative regional projects are being put in place, and the Southeast Asia (SWOL) project has delivered vital case study information on the people-environment processes interaction and is a model that should be transferable to other regions.

Collaboration with other IGBP project (e.g., START, BAHC, LUCC, GLOBEC) continues to grow and joint workshops are increasing as we join our agenda within the themes and regions. Importantly, we have made headway in linking to science end-users such as the European Union and the Intergovernmental Oceanographic Commission, ensuring that our science will be accessible and useful to policy and coastal managers. Further work is being done to extend this network.

LOICZ success depends on the work and global network of researchers. The LOICZ 4th Open Science Meeting in Bahia Blanca, Argentina in 1999 provided a strong stimulus for further international cooperation. An increasing number of science-delivery workshops is now in preparation and planned. The execution of UNEP-GEF funded biogeochemical research provides further strengthening of LOICZ research in developing countries.

The LOICZ SSC has decided to enter its first integration and synthesis stage to report in three years time. At least two books are foreseen: one on coastal margins (together with JGOFS)

and one addressing the six LOICZ questions. The first outlines have been prepared and lead scientists for initial coordination identified.

We continue to try and build better communication within and beyond LOICZ in an effort to gain contributions from key science researchers, and to improve our collegiate approach.

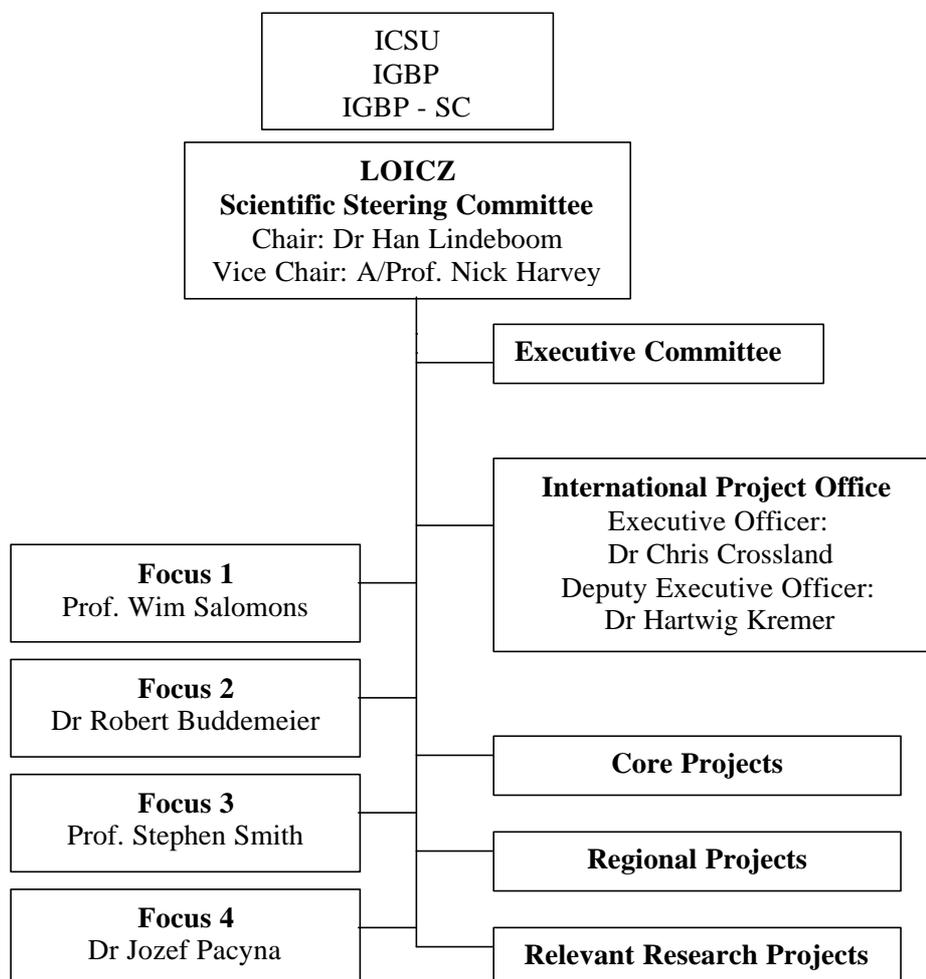
Han Lindeboom

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 (1999)

The **Scientific Steering Committee (SSC)** provides scientific guidance and oversees the development, planning and implementation of the LOICZ Core Project. The SSC was established by the IGBP Science Committee (IGBP-SC) which is also responsible for the 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 Awosika	Nigerian Institute for Oceanography, Nigeria
Dr Robert Buddemeier	University of Kansas, USA
Prof. Hu Dunxin	Chinese Academy of Science, Peoples Republic of China
Dr Silvia Ibarra-Obando	CICESE, Mexico

Dr Liana Talaue McManus	Marine Science Institute, University of the Philippines, the Philippines
Dr Jozef Pacyna	NILU, Norway
Dr Gerardo Perillo	Instituto Argentino de Oceanografica, Argentina
Prof. Wim Salomons	GKSS Research Centre, Germany
Prof. Stephen Smith	University of Hawaii, USA
Dr James Syvitski	Institute of Arctic and Alpine Research, Colorado, USA
Prof. Kerry Turner	University of East Anglia, UK (to 31 March 1999)
Prof. Frederik Wulff	Stockholm University, Sweden
Prof. Jahara Yahaya	University of Malaya, Malaysia

The SSC met twice in 1999 at Shonan Village, Yokohama, Japan (7 & 13 May) and at Bahia Blanca, Argentina (18-19 November).

The **Executive Committee** (EXCOMM) is a subcommittee of the SSC which, at the direction of the SSC, deals inter-meeting 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 informally in 1999 at Shonan Village, Yokohama, Japan.

The **Foci** are the four key programme activities of LOICZ (see Section 3) coordinated by the Focus Leaders. **Core Projects** directly address goals of the LOICZ Science Plan and are coordinated by the SSC. **Regional Projects** are closely linked to the Science Plan (but may have additional aims) and are coordinated 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 long-term guidance of the SSC. The IPO role includes: coordination, 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 Cynthia Pattiruhu) and P/T Administrative Officer (Ms Mildred Jourdan). A Liaison Officer (Maarten Scheffers) is located at the RIKZ Coastal Zone Management Centre, The Hague.

3. Status Reports

The scientific activities of LOICZ are directed at two major thrusts. The first is the development of horizontal material flux models from continental Basins through regional seas to continental margins, based on our understanding of biogeochemical processes and data for coastal ecosystems and habitats and the human dimension. The second is the scaling of the material flux models at spatial scales from local to global and across temporal scales.

LOICZ activities are organised through focal groups (Foci), particularly for integrative and developmental action on thematic issues and workshops involving global researcher expertise. Core projects of on-going work address global scale issues and cross-Foci objectives. Regional project research involves large spatial-scale questions, often cross-boundary and multidisciplinary. Relevant research projects contribute information crucial to LOICZ objectives but at local or short temporal scales; this information is brought together through thematic or regional workshops initiated through the Foci.

In 1999, major priority and effort by the Foci was placed on further determining biogeochemical budgets (Focus 3), developing methods for coastal typologies and scaling to global spatial dimensions (Focus 2), and integrating catchment basin process understanding and the human dimension (Foci 1 and 4). Work to date has been mainly of an assessment and analysis nature. Planning of the LOICZ integration and synthesis phase was initiated during 1999 with the intention of producing a globally integrated report addressing the LOICZ questions and objectives by the end of 2002. Funding opportunities were pursued to support the project activities.

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 nutrients, carbon and sediments into the coastal sea through river catchments, the atmosphere, and exchange processes along the continental margins. Emphasis is given to the dynamics and delivery of materials from the global catchment Basins. The core project activities of the joint LOICZ/JGOFS Continental Margins Task Team (CMTT) provides the main route towards understanding shelf margin transfers.

In 1999 efforts continued to concentrate on flux changes driven by human activities in the catchments. Delivery of materials to the coastal system was and will be reviewed from the viewpoint of critical loads i.e., quality and quantity of flux changes, threshold levels for system functioning and effects on the anthropogenic system. Co-operation with Focus 4 continued, applying the DPSIR (Drivers-Pressures-State-Impact-Response) framework for site description.

The Basins approach has been streamlined throughout 1999 in order to enable a series of workshops in various regions which follow a common work plan and time line. As a general strategy towards synthesis, two workshops are foreshadowed for each global region following the model:

Workshop 1 Extended abstracts, synthesis of existing information against LOICZ objectives, establishment of a database; LOICZ R&S Report.

Workshop 2 Review of papers prepared in the interregnum, project plans, database and submission of pilot study proposals. Potential for a later up-scaling and a strong human dimensions element will be features of the pilot study proposals.

The synthesis of all workshops will be a book prepared in 2001-2, "Management of Catchments and Coastal Seas", with chapters for each region: Europe, Latin America, Asia, Africa (CanAmBasins is expected to be built around peer-reviewed papers). The proposed workshop schedule includes: LatinBasins (2nd half 2000), AfriBasins (2000 or 2001), EuroBasins (2nd half 2000 or 1st half 2001), AsiaBasins (2nd half 2000 or 2001), CanAmBasins (review articles). Because of its integrative character, LOICZ and the EU Commission have identified the Basins work as a vital contribution to the 5th Framework Programme on a European level.

The European Basins (EuroBasins) were a priority regional focus addressed in a targeted workshop in Amsterdam in January 1999 (see 4.1.2), which was a follow-up on two earlier meetings in December 1998. A comprehensive proposal to establish a European synthesis on catchment processes and interactions with coastal seas will be submitted for EU funding early in 2000. It will include a science network and proposals for integrative pilot research on selected European Basins under pressure. The concept of critical loads and client involvement in Basins research was addressed, jointly with Focus 4, at the ELOISE/LOICZ meeting on "Socio-economic Aspects of Fluxes of Chemicals into the Marine Environment" hosted at the NILU in Kjeller, Norway in March 1999 (see 4.1.3).

Two workshops, on South American (SAmBas) and Caribbean Basins, were held during the 4th Open Science Meeting in Bahia Blanca, Argentina in November 1999 (see 4.1.11). A LOICZ R&S is being prepared which will set the stage for a follow-up workshop and proposals in 2000 and beyond. A database on LatinBasins is being compiled to capture both South American and Caribbean information.

A meeting with African LOICZ representatives was held during OSM 4 to initiate a review of available experts and potential terms of reference for an AfriBASINS 1 workshop in 2000. This is currently being followed up at GKSS, Geesthacht, Germany supported by Dr Martens on sabbatical from Nigeria.

As a contribution to the 3rd Annual ELOISE OSM in December 1999 in Noordwijkerhout, the Netherlands, a workshop on Basins reviewed the state of the art of catchment coastal sea interactions in ELOISE and LOICZ research (see 4.1.14).

Focus 1 and 4 activities also produced a comprehensive book on coastal zone management, expanding on regional knowledge and on available tools for integrated modelling and multidisciplinary system analysis for management purposes (see Section 6). A new peer-reviewed journal "Regional Environmental Change" from Springer Publishers, with Focus 1 leader as Chief Editor, has integration of natural and socio-economic sciences as the main objective (web link <http://link.springer-ny.com/link/service/journals/10113/index.htm>). This will provide a valuable platform for publication of directed LOICZ science including a special issue on OSM 4. Foci 1 and 4 also contributed to the 2nd ELOISE implementation report published by the European Commission in 1999.

Focus 1 in collaboration with 4 joined in the co-development of a Dahlem Conference on the coastal zone and management issues involving a number of LOICZ scientists, in Berlin in December 1999 (see 4.3.3).

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)

Work in Focus 2 addresses the role of ecosystems in determining coastal morphodynamics under varying environmental conditions and coastal biomorphological responses to anthropogenic activities. The response of systems such as coral reefs and mangroves 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 the activities of this Focus. A key issue is how to deal with spatial and temporal scales of change in the coastal zone.

A number of activities not formally identified with Focus 2, as defined in the LOICZ Implementation Plan, have become associated with Focus 2 activities on decision of the Scientific Steering Committee and are reported on here.

1. Focus-related activities:

a. Biogeomorphic Communities

Coral reefs and related issues – a number of outcomes of previous activities (e.g., SCOR/LOICZ Working Group 104) have continued to emerge, some with high scientific impact and response from policy-makers. Among the products have been:

American Zoologist **39**(1) 1999, an issue dedicated to the proceedings of the SCOR/LOICZ WG-104 results symposium.

Kleypas, J. A. *et al.* (1999) Geochemical consequences of increased atmospheric carbon dioxide on coral reefs. *Science* **284** (2 April 1999): 118-120.

There has been a significant upsurge of interest in related issues, and particularly in the question of the effects on calcification of the changes in carbonate mineral saturation state in the surface ocean due to rising atmospheric CO₂ concentrations. In addition to ongoing assessments of coral reef vulnerability, the Working Group membership has provided the basis for establishing the LOICZ coastal calcification task team (see discussion under item 2 below).

Seagrass communities have been the focus of a literature review and database of seagrass studies prepared by Silvia Ibarra-Obando. Dr Robert Buddemeier is a co-investigator in a Japanese-funded project investigating the potential of eco-engineered seagrass beds to serve as carbon sinks. There is potential for further collaboration to develop maps and models of potential habitats for seagrass beds as well as for coral reefs.

b. Sediment Issues and Processes

Initiatives led by Drs Gerardo Perillo and James Syvitski are establishing a Working Group to address issues of sediment flux and budgeting in the coastal zone. It is anticipated that this group will be organized with sponsorship of LOICZ, SCOR and possibly other participating organizations. It would be the first coherent attempt to address a number of key issues, including points developed from LOICZ OSM 4, such as the changing residence time of sediments (sand/mud) within the coastal zone due to the impacts of man, two-way interactions between biology and sediments that need to be incorporated into future flux/budget models, and possible changes in the importance of input of sediment from the ocean due to decrease in river loads.

c. Sea-level Issues

There are three developments from LOICZ on sea-level issues:

First, two funding applications were submitted to APN in late 1999. One of these was an outcome of a START-Oceania initiative examining late Holocene sea-level change and capacity building in Oceania. The other is a joint IHDP proposal developed by Dr. Jill Jaeger (IHDP) to fund a workshop on man impacts in the coastal zone.

Second, a request for LOICZ participation was made by IGBP-GAIM in a conference on “Global and Regional Sea-level Changes and the Hydrological Cycle,” held in October 1999 in Sardinia. A LOICZ-related paper by N. Harvey, A. Belperio and R.A. Bourman was presented by A. Belperio.

Third, the joint PAGES-LOICZ workshop on late-Holocene sea level and climate change (see 4.1.8) originally planned for mid-1999 was rescheduled to November 1999 to coincide with the new IGCP Project 437, examining coastal response during sea-level highstands. The meeting and workshop were very successful and the project has received strong support from IGBP-PAGES CEO (Frank Oldfield). In the short term, it is planned to produce a joint PAGES-LOICZ newsletter for June 2000, and a report will be submitted for publication in EOS. A steering committee has been set up consisting of Dr Ian Goodwin, A/Prof. Nick Harvey, Dr Orson van de Plassche, and Dr Robert Oglesby.

2. Other Activities:

- a. *Calcification Task Team* – at the IGBP Congress in Japan (May 1999), it was agreed that a team of contributors should be identified to provide LOICZ input on coastal calcification both to the LOICZ synthesis process and to the joint LOICZ-JGOFS Continental Margins Task Team. This has been accomplished. The group consists of Dr Bradley Opdyke (ANU, Australia, task leader), Dr Joan Kleypas (NCAR, USA), and Dr Jean-Pierre Gattuso (CNRS, France), with Dr Robert Buddemeier participating as LOICZ SSC liaison.
- b. *Groundwater Flux* – SCOR/LOICZ Working Group 112, chaired by Profs W. Burnett and E. Kontar has initiated its work, and held a well-attended meeting in conjunction with the IUG/IAHS meetings in Birmingham, UK in July 1999. A bibliography and database of submarine groundwater discharge sites has been developed, and plans are in progress for a meeting in conjunction with a field methods intercalibration exercise in Perth, Australia in November 2000 (for additional information see 3.2.3 and 4.1.6 of this report).
- c. *Typology Activities* – typology development is nominally a LOICZ Framework activity, but has operationally fallen under the purview of Focus 2. Substantial progress has been made during 1999, culminating in reports at LOICZ OSM 4 detailing the development of the LOICZView clustering tool, cooperation with IGBP-BAHC in developing a joint river-flux/coastal typology, and a variety of typologic applications. Major activities are expected to continue in the coming year as the typology methods are developed, distributed together with an upgraded data set, and applied to the first of the scheduled regional synthesis activities.

3.1.3 Focus three

Carbon flux and trace gas emissions

Focus Leader: Prof. Stephen V. Smith

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 phase 1 of the project (LOICZ R&S No. 5, 1996). The key goal is determining the relative autotrophy or heterotrophy of the coastal systems 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 flux estimations of trace gases in addition to CO₂ (such as N₂O and CH₄) in the coastal zone.

Focus 3 has become, *de facto*, primarily the development of C-N-P budgets according to the LOICZ Modelling Guidelines (Gordon *et al.* 1996). The budgeting effort is under the direction of Profs S.V. Smith and F. Wulff, with the assistance of D. Swaney and V. Dupra.

Through the “regional mentors” programme that has been established with UNEP-GEF funding (see section 7), three regional mentors are enhancing the budget efforts in their regions (Dr V. Camacho, Latin America; Drs L. David and M. San-Diego McGlone, S-E and S Asia).

Three biogeochemical budgeting workshops were held during 1999: Merida, Mexico in January 1999 - 10 regional participants, 14 budgets (see 4.1.1); Manila, Philippines in July 1999 - 14 regional participants, 24 budgets (see 4.1.5); Bahia Blanca, Argentina November 1999 - 10 regional participants, 11 budgets (see 4.1.10). The Merida workshop report is published (Smith *et al.* 1999b), and the Manila report will be out soon (Dupra *et al.* 2000). The report of the October 1998 Australasian Biogeochemical Estuarine Systems workshop has also been published (Smith *et al.* 1999a). The Manila and Bahia Blanca workshops were undertaken under the auspices of the UNEP GEF project initiated in LOICZ this year. Mr N. Huan (Vietnam), an attendee at the Manila workshop, spent October 1999 at the University of Hawaii as a visiting scholar on UNEP GEF funding, under the direction of Prof. Smith.

An important software development is also occurring as part of UNEP GEF project and is presently in a “beta-testing” mode: CABARET (Computer Assisted Budget Analysis, Research, Education and Training, developed by Dr L. David). A version of this software will be available for downloading from the LOICZ Biogeochemical Budgeting web pages in early 2000.

LOICZ Focus 3 organized session 4 of LOICZ OSM 4 (Inter-regional Comparisons of Coastal Zone Systems: a LOICZ Biogeochemical Approach, Dr S. Ibarra and Prof S. Smith, co-chairs). Papers in that session included regional summaries for Europe, Australasia, South-East Asia and Latin America, as well as a brief look as to how the biogeochemical budgeting group will work with the typology group to globalize the local budgeting information.

Finally, the LOICZ Biogeochemical Budgeting web pages have undergone considerable expansion over the past year. Dennis Swaney has considerably expanded the guidelines, with information from several sources; has added budgets from the workshops to those pages; and has added several other budgets by himself and other individuals during the year.

3.1.4 Focus four

Economic and social impacts of global change in coastal systems

Acting Focus Leader: Dr Jozef Pacyna (from May 1999)

This Focus addresses the two elements of 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 to 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 for producing regional and global forecasts of the effects of coastal changes on the human dimension, particularly through coupling 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 vulnerability of coastal systems and human populations to global change.

In 1999 the deliberate collaboration between Foci 1 & 4 has continued to gain momentum as the Basins work (see 3.1 Focus 1) is making efforts for integration of human dimensions and material fluxes in its strategic approach to the LOICZ questions.

Human dimensions also became a leading issue of a joint EU-ELOISE/LOICZ workshop held in Oslo, Norway, 8-10 March 1999 (see 4.1.3). A monograph containing the discussions, conclusions and recommendations of the workshop is to be published by the European Commission in the first quarter of 2000. LOICZ contributed to the joint meeting of the EU-ELOISE project coordinators (see 4.2.5), addressing the human dimensions of coastal change on various scales as a key item for ICZM, noting that LOICZ could probably contribute its typology approach and the experience gained in the integration of natural and socio-economic sciences. Further it was considered that the DPSIR framework (as developed further in the LOICZ) might prove valuable for site description, comparison and scaling purposes.

Focus 4, with help from Focus 1, provided information and assistance to the meeting of the European Commission Joint Research Centre, Ispra, Italy in May 1999 (see 4.2.4), where a proposal for shared cost action on a European River Basin-Coastal zone Observational Network was discussed and designed. The SWOL project economist participated in the SASCOM-LOICZ estuarine modelling and coastal zone management workshop in Colombo, Sri Lanka in April 1999 (see 4.1.4). The SWOL modelling and work experience was highlighted as a “transferable approach” that could be applied to regional issues, and contribution is continuing in the South Asia project proposal under development.

As part of the LOICZ OSM 4 a special workshop focussed on global island states and the Wider Caribbean region, establishing strong commitment from scientists and agencies for LOICZ- related work based on the DPSIR approach. CARICOMP is expected to engage with LOICZ on developing a scientific overview of the Caribbean region (and linked to IOC Coastal GOOS and ICAM initiatives). Joint delivery of coastal vulnerability assessments in the Oceania region is proposed with SOPAC.

The ELOISE 3rd Open Science Meeting held in Noordwijkerhout, the Netherlands on 1-4 December 1999 included a session on Focus 4-related issues in the field of cycling of pollutants and socio-economic impacts. Also included was a session on integrated science with a description of the SWOL project as a model for quantifying economic sector residual production of C-N-P and modelling ecosystems.

1999 also saw the preparation of a set of project proposals to the European Commission on sustainable development of the marine ecosystem in Europe, including socio-economic aspects of catchments or specific driving sectors.

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 on coastal properties, coastal fluxes or coastal processes and their rates of change. Seven 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
Deltaic Processes	2
ELOISE	1 to 4
Submarine Groundwater Discharge (LOICZ/SCOR)	1,2&3
SARCS/WOTRO/LOICZ Southeast Asia Research	1,3&4

The Biogeochemical Budgets and Modelling project (see section 3.1 Focus 3) received added impetus by support to LOICZ from UNEP GEF (USD720 000; 1999-2001) in a project

entitled “The Role of Coastal Ocean in Disturbed and Undisturbed Nutrient and Carbon Cycles”. The UNEP GEF project provides opportunity for 6 regional workshops (addressing site budgets and providing training in LOICZ methodologies), 3 thematic workshops and a global workshop (integrating the biogeochemical information through the typology approach), and significant training and mentoring in the budgets and typology protocols.

The Coastal Typology Development project (see section 3.1 Focus 2) continues to gain increasing external funding support and additional people skills in the collaborative expansion of the work within LOICZ.

3.2.1 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 nominated by LOICZ and JGOFS, and draws on and coordinates relevant research and skills in the global community.

In 1999, the Team personnel changed (as planned within the rotational representation arrangements). Prof Shu Gao (LOICZ Co Chair with JGOFS Co Chair Prof K.K.Lui), Dr Liana McManus and Dr Larry Atkinson joined the Team as LOICZ representatives.

The CMTT met at the IGBP Congress in Japan (May 1999) and developed a plan for further work and synthesis. A synthesis book (Assessment of CO₂ Sequestration and C₂N and P Fluxes in the Continental Margin) is scheduled for publication in 2002. The structure of the book was outlined and a work plan was established and approved by LOICZ SSC. Members and CMTT-associates have continued to publish key papers and to engage other international researchers to contribute to the synthesis work and book publication.

3.2.2 ELOISE

ELOISE (the European Land-Ocean Interaction Studies, supported by the European Commission), became in 1999 an official core project of LOICZ. It is an action (called “Thematic Network” or “Project Cluster”) where 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 will continue under the Fifth Framework Programme beyond the year 2000.

A Science Plan for ELOISE, noting that it formed the nucleus of a coherent and coordinated European contribution to the IGBP LOICZ project, was developed in late 1994 and published by the Commission as Ecosystems Research Report No.11: “ELOISE”. In 1995, calls for proposals in the two research programmes yielded 15 successful projects in the first phase; these started in 1996. Another 14 projects were selected from a second call in 1997.

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 course of 1999, 15 of the original 29 projects were completed, while 14 are still running in the second phase of ELOISE. Phase III will probably receive another 30 contributing projects entering the programme until 2002, 6 of which will be approved soon. While current efforts

aim to optimize the organizational structure for the steering of ELOISE the discussion of how best to synthesise the outcomes is under consideration. LOICZ will continue to assist in this process through its global network and communication measures as well as through scientific and personal input to the ELOISE annual meetings and working groups, which are:

- WG 1: Biogeochemical Fluxes and Cycles
- WG 2: Ecosystem Structures and Functioning, Human Impacts
- WG 3: Modelling and Data Management
- WG 4: Coastal Zone Management and Integration of Natural and Socio-Economic Science

Activities in 1999 comprised the 3rd Annual ELOISE Open Science Meeting in Noordwijkerhout (December 1999) and other workshops and meetings which received direct LOICZ contribution (see, 4.1.3 and 4.2.4). Contributions to the ELOISE Open Science Meeting involved sessions run in the LOICZ context on Basins, the socio-economic aspects of fluxes, and biogeochemical budgeting of nutrient and carbon transport through coastal seas and continental margins (see 4.1.14). The LOICZ Focus 4 leader and IPO contributed to a joint meeting of the ELOISE project coordinators and the DG XI Integrated Coastal Zone Management Demonstration Programme representatives, emphasising the importance of human dimensions of coastal change on various scales as a key item for ICZM (see 4.2.6).

The published product of the ELOISE/LOICZ workshop in Norway will be a monograph. The Commission has published the outcomes of the joint working group discussions held in Huelva during the 2nd Annual ELOISE Meeting in September-October 1998 as part of the ELOISE Implementation Report – Phase II – in the series “Ecosystem Research Reports” (No. 33).

The next annual meeting is planned for either November 2000 in Venice or April/May 2001 in Calabria. A working group meeting involving stakeholder participation is scheduled to take place around September 2000.

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

The overall goal of WG-112 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 coastal ocean. Direct groundwater flow into the ocean occurs as springs and seeps in near-shore areas in many parts of the world. Although submarine groundwater discharge has been recognised for many years, the process has not received much scientific attention because of either (i) a perception that it is unimportant; and/or (ii) the difficulty in measurement. Studies performed over the past few years have presented convincing arguments that direct groundwater flow to the ocean can be important, at least in some regions of the world.

The working group has organized themselves into three task-oriented units based on the following goals:

- (1) Review and evaluate existing methods for assessment of SGD via modelling approaches. Identify needs and improvements in the field. (*Calculation and Modelling* group headed by Igor Zektser, Russia)
- (2) Define the existing methods and tools useful for direct measurement of groundwater fluxes to the coastal zone. (*Measurement, Sampling, and Experimental Design* subgroup, headed by Makoto Taniguchi, Japan)

- (3) Develop and refine a typological approach to assess SGD over broad areas (*Typology, Integration and Globalization* group headed by Robert Buddemeier, USA)

Activities this year have included:

- construction of a web page (see <http://www.jhu.edu/~scor/WG112.html>),
- publication of a general interest article about the group in EOS and several Japanese journals,
- participation (with LOICZ) in the IGBP Congress (see 4.2.4),
- submission of a proposal to the IOC for groundwater-related research,
- proposal to ASLO/Groundwater-2000 for a joint symposium,
- working group meeting in Birmingham, UK, 22-24 July 1999 (see 4.1.6),
- planning of an intercalibration experiment in Florida, 1999.

The SGD proposal was discussed at the 20th session of the IOC Assembly in Paris, 29 June-9 July 1999, and gained active support (IOC Resolution XX-2 entitled “Measurement and Management of Submarine Groundwater Discharge in the Coastal Zone as a Contribution to the IOC/ICAM Program”). A group of experts will meet at IOC, Paris early in 2000 to prepare plan relating to IOC-ICAM and an intercalibration programme to resolve existing measurement problems and develop new techniques.

The next working group meeting will be held in conjunction with the “Hydro-2000” Meeting in Perth, Australia on 20-23 November 2000, and the group is expecting to contribute to two concurrent meetings being held in Copenhagen in early June, 2000: ASLO 2000 (5-9 June) and Groundwater-2000 (6-8 June).

3.2.4. SARC-WOTRO-LOICZ (SWOL)

The SWOL Regional Project (Economic Evaluation and Biogeochemical Modelling in Southeast Asia) accomplished a number of major activities in its final year in 1999. Foremost was the development of four proposals from each of the four participating country teams. These aimed to expand the economic evaluation and biogeochemical modelling to more study sites in the region with the aim of validating the modelling tools developed during the first phase of the project. To assess the status of the first phase and in order to develop a common outline, the principal investigators met in Hanoi, Vietnam on 2-3 June 1999. The proposals were submitted to WOTRO in October 1999 for review and approval.

In July 1999, SWOL scientists participated and led in a LOICZ-UNEP Biogeochemical Budget Workshop held in Manila, Philippines. The workshop aimed to train scientists in the region on the use of the LOICZ Biogeochemical Budget approach, as a necessary step in identifying coastal types within the context of Southeast Asia.

On 12-13 November 1999, the SWOL Project held its final project workshop in Bahia Blanca, Argentina to present the synthesis reports by the Malaysian, Philippine, Thai and Vietnamese country teams. Based on the country reports, the project made final agreements on approaches that would enhance the ability to provide a regional picture for coastal areas in Southeast Asia. Among these was the need to characterize watershed areas and their associated catchments within each participating country, and for each team to develop a national coastal typology.

Finally, a regional synthesis of the SWOL results was presented at the 4th LOICZ Open Science Meeting held in Bahia Blanca, Argentina on 15-18 November 1999.

For year 2000, it is hoped that proposals for the phase will have been approved by WOTRO by the end of January for immediate implementation. The proposed outputs for year 2000

have been made to increase the capability of the project to contribute significantly towards a regional typology and coastal assessment for Southeast Asia.

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.

Regional project activities have been extended by the addition of two regional projects, in Morocco and UK (SURVAS). Current projects are listed below and further information is available from the LOICZ webpage (www.nioz.nl/loicz/).

Title	Investigator	Location
Great Barrier Reef	Terry Done	Australia
Land-ocean interactions in southern South America	J-L Probst	European Union
AFFORD	W. Ebenhoeh	Germany
Ecology of tropical coastal systems: mangrove dynamics and management: MADAM	Ulrich Saint-Paul	Germany
Sustainable use of coastal ecosystems : EUROBASIN	Wim Salomons	Germany
Lower Volta mangrove project : Phase 1 Assessment of environmental, economic and social factors	Christopher Gordon	Ghana
Integrated coastal zone management in Banten Bay, Indonesia	A. Nontji	Indonesia
Carbon and nutrient fluxes and socio-economic studies of the Merbok mangrove ecosystem	Ong Jin-Eong	Malaysia
Studies for integrated coastal zone management	Maria Snoussi	Morocco
BOA research theme on tidal areas	Herman Riderinkhof	Netherlands
Economic and technological aspects of internationally coordinated strategies	H. Verbruggen	Netherlands
EROS 2000 Black Sea	Peter Herman	Netherlands
Sustainable management of the coastal area of SW Sulawesi	Pieter G. E. F. Augustinus	Netherlands & Indonesia
Sustainable use of international river Basins: definitions, criteria and assessment	W. P. Cofino	Netherlands
Economic evaluation and biophysical modelling of the marine environment of Bolinao: supporting sustainable use (SWOL)	Liana Talaue-McManus	Philippines
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)	V. Gordeev	Russia
Economic evaluation and biophysical modelling of impacts of shrimp farming on mangrove systems in Ban Don Bay (SWOL)	Gullaya Wattayakorn	Thailand

Land-ocean interaction study (LOIS)	Graham Leeks	United Kingdom
Synthesis and upscaling of sea-level rise vulnerability assessment studies (SURVAS global project)	Robert Nicholls	United Kingdom
Economic evaluation studies of mangrove conservation and rehabilitation in Nam Ha Province, Vietnam (SWOL)	Nguyen Hoang Tri	Vietnam

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

<i>Chief Investigator</i>	<i>Project Title</i>	<i>Country</i>
Prof. F.I. Isla	Coastal dynamics and comparative evolution of the eastern and southern barriers of Buenos Aires.	Argentina
Prof. F.I. Isla	Coastal evolution of the eastern barrier of Buenos Aires.	Argentina
Prof. F.I. Isla	Morphological characterization of the coast of Tierra Del Fuego, between San Sebastian and San Diego Capes.	Argentina
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 M. Frankignoulle	Biogas transfer in estuaries (BIOGEST).	Belgium
Dr M. Frankignoulle	Carbon fluxes in coral reefs.	Belgium
Dr E. Hong	A study on the transportation and sedimentation patterns of sediments in the Tseng-Wen River deltaic system.	China ROC
Dr J.J. Hung	Fluxes and biogeochemical processes of carbon and heavy metals in the Tseng-Wen estuarine and coastal environment.	China ROC
Dr J.T. Liu	Sediment dynamics of the Tseng-Wen River coastal dispersal zone - numerical model and GIS application.	China ROC
Dr K. T. Shao & Dr S. R. Kuo	The role of fish communities in the coastal dispersal of Tseng-Wen River (II) – feeding ecology.	China ROC
Dr Yung-Chi Chen	Trace element biogeochemistry in mangrove swamp.	China ROC
Dr T. Dalsgaard	Nitrogen cycling in estuaries (NICE).	Denmark
Prof. B.v. Bodungen	Transport and turnover in the Pomeranian Bight (TRUMP).	Germany
Mr S. Dick	TRANSWATT subproject: transport processes.	Germany
Dr P. Hupfer	Contribution to the knowledge of climate impact on the German coast of the Baltic Sea.	Germany
Prof. Dr. L.A.Meyer-Reil	Interdisciplinary research project, OKOBOD.	Germany
Mr A. Mueller	SWAP-modelling of some abiotic and biotic aspects	Germany

	in the Sylt-Rømø Bight.	
Prof. Dr. Rullkoetter	PAKOMIN Subproject: sedimentation, conservation and diagenesis of organic matter under the influence of high sediment accumulation.	Germany
Prof. Dr. J. Sündermann	KUSTOS: Coastal mass and energy fluxes – the land sea transition in the south eastern North Sea.	Germany
Dr A.L. Paropkari	Eastern Arabian sea marginal exchange processes (EASMEX).	India
Dr N. Ramanujam	Monitoring and modelling of groundwater behaviour and cliff recession in relation to wave climate in the coastal belt.	India
Dr K. N. Rao	Remote sensing studies on coastal biogeomorphological environments in the Godavari Delta region.	India
Dr T. Miyagi	Organic material and sea-level changes in mangrove habitat.	Japan
Dr M.K.W. Osore	Assessment of marine pollution in a former mangrove creek.	Kenya
Dr Gi Hoon Hong	Inner continental shelf in the southern sea of Korea: processes and products (INCOSPR).	Korea
Dr E. Shumilin	Trace elements in coastal sediments of Baja California Peninsula, Mexico.	Mexico
Dr R. Akkerman	Marine Monitoring System 2000+ for the North Sea Region.	Netherlands
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
Dr Ir. A.G. Brinkman	Modelling the impact of climate change on the Wadden Sea ecosystem.	Netherlands
Prof. D. Eisma	Fluxes of ²¹⁰ Pb and associated radioisotopes in coastal seas (North Sea, Adriatic).	Netherlands
Prof. D. Eisma	Transport and deposition processes of inorganic and organic suspended material in the North Sea.	Netherlands
Prof. D. Eisma	Transport and deposition processes of suspended matter in several west European estuaries.	Netherlands
Dr H.G. Fransz	Effects of nutrient supply on plankton primary and secondary production and species composition.	Netherlands
Dr H.G. Fransz	Particulate matter in the North Sea: semi-empirical algorithm development.	Netherlands
Dr W.W.C. Gieskes & Dr J. Stefels	Entangled sulphur and carbon cycles in <i>Phaeocystis</i> dominated ecosystems (ESCAPE).	Netherlands
Prof. C.H.R. Heip	Impacts of nematodes on physical properties of sediments.	Netherlands
Dr P. Hoekstra	Morphodynamics of wave-dominated coastal environment in Teluk Banten: managing deltaic shorelines and reef systems.	Netherlands
Dr P. Hoekstra	Three-dimensional flow patterns and sediment fluxes in Teluk Banten.	Netherlands
Dr J. Middelburg	Carbonate dissolution in vegetated and bioturbated estuarine and coastal sediments.	Netherlands
Dr J. Middelburg	Methane and nitrous oxide emission, production and consumption rates.	Netherlands
Dr W.A. Oost	PROMARIS	Netherlands
Dr J. van der Plicht	Origin and characterisation of suspended and sedimental organic matter by means of carbon isotopes.	Netherlands

Prof. G. D. Vogels	Carbon cycling in the coastal zone of Tanzania.	Netherlands
Dr J. Voogt	Morphological and ecological effects of sea-level rise on the Wadden Sea.	Netherlands
Prof. W.J. Wolff	Ecological research to support the development of management strategies for West African estuaries.	Netherlands
Dr E.I.C. Agwu	Developing methodologies for integrated socio-economic and natural science research of changes in the Imo River Estuary.	Nigeria
Prof. J. S. Gray	Key coastal processes in the mesotrophic Skagerak and oligotrophic north Aegean (KEYCOP).	Norway
Prof. Yngvar Olsen	Comparative analysis of food webs based on flow networks: effects of nutrient supply of structure and function of coastal plankton communities (COMWEB).	Norway
Prof. G. Fang	Studies on impacts of climate and land environmental changes to the hydrographic structures in the Bohai Sea.	P.R. China
Prof. H. Hong	The biogeochemical processes of C, N and P in the Taiwan Strait related to the pelagic fishery resources.	P.R. China
Dr F. Li	Impact of human activities on ecological environment in the Yellow River estuary and its adjacent sea.	P.R. China
Dr Xie Qinchun	Behavior of fine sediment in Jiaojiang Estuary.	P.R. China
Dr W.W.S. Yim	International Geological Correlation Program Project No.396: 'Continental shelves in the Quaternary	P.R. China
Dr W.W.S. Yim & Prof. P. Li	Holocene record of typhoons in coastal sediments of southern China.	P.R. China
Dr W. Campos & Dr R. Baleña	An oceanographic survey of Philippines Archipelagic waters: 1. Central Philippines.	Philippines
Prof. Dr. C. Borrego	AMAZOC – Atmospheric environment in coastal zones: assessment of ecosystem load capacity.	Portugal
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
Mr A.N. Voronov	Pollution transport to the Baltic Sea via groundwater runoff.	Russia
Mr I. Wright	The Quaternary evolution of the northern KwaZulu-Natal coastal plain using the Kosi Lake/Estuary.	South Africa
Dr H. Holden	Remote sensing of shallow submerged coral reefs: identifying areas under stress.	Singapore & Indonesia
Dr D. Taylor	Rapid environmental changes in central Sumatra: ecological and socio-economic impacts in coastal environments.	Singapore
Dr A. Polonsky	Hydrometeorological and hydrographic field variability over the Black Sea coastal zone.	Ukraine
Dr M. J. Bray	Environmental changes and management of coastal	United Kingdom

	systems.	
Dr A.J. Edwards	Evaluation of uses and the relative cost effectiveness of remote sensing technologies for coastal resources assessment and mapping.	United Kingdom
Dr. T. Jickells	Air-sea exchanges of trace elements particularly nitrogen and trace metals.	United Kingdom
Dr T. Jickells	Nutrient and metal cycling in estuaries and coastal environment.	United Kingdom
Dr I. G. Littlewood	River mass load estimation techniques (LOIS).	United Kingdom
Prof. R.F.C. Mantoura	Marine organics.	United Kingdom
Dr D.C. Mason	Inter-tidal digital elevation models using satellite data.	United Kingdom
Prof. J. Orford	The morpho-sedimentary response of gravel-based coastal barriers to sea-level rise.	United Kingdom
Prof. J. Orford	The impact of climate change and relative sea-level rise on the environmental resources of European coasts.	United Kingdom
Prof. J. Orford	Variation in coastal forcing and its coastal response along the European Atlantic shoreline.	United Kingdom
Dr J.M.C. Plane	Land-Ocean Interaction Study (LOIS)-RACS (Atmosphere).	United Kingdom
Dr C. Reynolds	Long-term assessment of physical and biological components in the waters of the Windermere catchment.	United Kingdom
Prof. I. Shennan	Land-Ocean Interaction Study (LOIS)-Land-ocean evolution perspective study (LOEPS).	United Kingdom
Prof. J.H. Simpson	Land-Ocean Interaction Study (LOIS) – Shelf edge study (SES).	United Kingdom
Prof. R.K. Turner	Integrated coastal zone management framework.	United Kingdom
Prof. R.K. Turner & Dr S. Crooks	Coastal environmental science and management.	United Kingdom
Prof. D.E. Walling	Sediment sources, sediment delivery and longer-term sediment responses of RACS river Basins.	United Kingdom
Dr E.M. Young	Integrated lagoon management in coastal Ghana	United Kingdom
Dr 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 F. Muller-Karger, Dr R. Varela, Dr R. Thunell, Dr M. Scranton & Dr Y. Astor	Carbon retention in a coloured ocean (CARIACO)	Venezuela & United States of America
Dr Tran Duc Thanh	Sediment budgets and influence of moving and closing the inlets on the Tam Giang Lagoon ecosystem.	Vietnam

4. Workshops

4.1 LOICZ WORKSHOPS

4.1.1 LOICZ Workshop II on Mexican and Central American Coastal Lagoons, Merida, Mexico (January 1999)

A workshop on Mexican and Central American coastal lagoons was held at CINVESTAV, Merida 12-16 January 1999. The aim was to extract C-N-P flux budget information from existing research data on estuarine sites across climatic regimes ranging from cool (arid) temperate to wet and dry tropics, and to provide active researchers in the region with advice on use and application of the LOICZ Biogeochemical Modelling Guidelines.

The 14 participants developed 12 site budgets, ranging from the Gulf of California and the Yucatan to Venezuela. These provided new descriptions for the region and, together with the results of a previous workshop in Ensenada, provided a range of examples across climatic zones, areas of human impact and influence, size and water residence times and system structures.

The workshop discussions led to the development of new protocols in the LOICZ Guidelines that allow more detailed quantification of groundwater contribution of materials to the flux estimates. Of particular value was the derivation of calculation protocols based on silicate tracer, which is a feature of groundwater's chemical composition. These protocols will contribute significantly to assessments not only in the region, but also to budgets developed in other global areas where systems have a significant groundwater component.

A workshop report was published (LOICZ R&S 13, 1999) and posted to the LOICZ web site.

4.1.2 LOICZ European Basins II Workshop, Amsterdam, The Netherlands (January 1999)

A workshop addressing European river basins and coastal regions was hosted by the Institute for Environmental Studies (IVM) of the Free University in Amsterdam in January 1999. It was the third in a series organized by LOICZ as a contribution to the IGBP Water Group initiative since late 1998. Following the first overview of European catchment/coastal sea interaction studies of the earlier meetings, about 10 interdisciplinary researchers from European institutes continued to refine a draft proposal aimed at a European synthesis on catchment processes within the perspective of various pressures. Issues of concern included damming, intense agriculture and changes on societal and political conditions (e.g., eastern European rivers. The proposal will be submitted for EU funding in early 2000 through) the 5th Framework Programme of the EU Commission.

In addition, the group developed a proposal for a targeted workshop on socio-economic aspects of material fluxes to marine areas (see 4.1.3), to enable a science management/policy interface for enhanced user involvement, issue-driven science, and science exploitation as recommended in EU Framework Program 5.

4.1.3 ELOISE-LOICZ Socio-Economic Dimensions of Fluxes of Materials to Coastal Seas: Science & Users Workshop, Kjeller, Norway (March 1999)

The joint ELOISE-LOICZ workshop held at NILU, Kjeller, Norway on 8-10 March 1999, (involving social and natural scientists, and private and public sector users) aimed to develop and elaborate on future strategies to foster the exploitation of scientific results by end-users.

The workshop addressed:

- the potential for exploitation of European Union DG XII funded research for issue-driven outcomes, which are relevant to management needs;
- the input and expectations on science at the user level;
- communication between scientists and decision-makers, including the appropriate language and/or mechanisms of translation;

- the DPSIR (Drivers, Pressure, State, Impact, Response) framework and its applicability to the process of integrated modelling;
- constraints in developing and using integrated models for coupling natural and socio-economic science disciplines; and
- the current status of ELOISE research, data and management needs, and strategies for future improvement.

The meeting agreed that large projects such as ELOISE and LOICZ must play an increasingly important role as brokers between the users and the scientific community and considered ways to achieve this goal. It underlined the need to allow development of scientific approaches for coupling natural and socio-economic disciplines to enable evaluation of relationships between environmental impacts and responses by policy-makers and managers. Major drivers and state changes can already be identified from existing information in respective LOICZ and ELOISE research.

A full meeting report is being published in the European Commission Research Development series.

4.1.4 SASCOM-LOICZ Workshop on Estuarine Modelling and Coastal Zone Management, Colombo, Sri Lanka (April 1999)

Under the aegis of the IGBP-START South Asia Committee (SASCOM), a joint START/LOICZ/IGBP Sri Lanka workshop was held in Colombo on 28 April-1 May 1999. The aims were to extend the regional research network of START and to initiate and promote research on mathematical modelling on coastal aquatic systems, especially that which will contribute to solutions for coastal zone management problems.

The workshop reviewed the regional experience in the area of estuarine modelling and coastal zone management, identified coastal zone problems common to the region (which could be investigated by regional cooperation), and identified areas needing capacity building.

Key outputs included:

1. Development of a draft project proposal for regional cooperation, initially at four sites: Ganges Brahmaputra delta and estuary (India/Bangladesh), Indus delta and estuary (Pakistan), Negombo Lagoon (Sri Lanka) and Goidhoo Atoll (Maldives). Funding sources are being pursued.
2. Identification of an opportunity for a LOICZ-related workshop on biogeochemical budgets of estuaries, to describe C, N and P fluxes in representative systems in the region. A workshop is planned for February 2000.
3. A report and recommendations for regional cooperation in the areas of estuarine modelling and coastal zone management, to go to national governments and regional economic and environmental organisations.

4.1.5 LOICZ-UNEP South China Seas Estuarine Systems Workshop, Manila, The Philippines (July 1999)

The Manila workshop was the first of the UNEP-GEF supported suite of project activities assessing the role of the coastal ocean in disturbed and undisturbed nutrient carbon cycles. The workshop addressed the South China Seas region. Some 14 scientists from China, Indonesia, Malaysia, Philippines, Thailand, and Vietnam joined a LOICZ resource group. Dr Liana Talaue-McManus and the “dynamic crew” from the Marine Science Institute, University of the Philippines hosted the workshop.

About 25 site budgets were developed across the region and training was received in the use of the LOICZ Biogeochemical Guidelines. New assessment guidelines for a) waste load calculations and b) water catchment inputs were developed, along with a preliminary

typology on water flux and population parameters. Mr Nguyen Huu Huan from Vietnam, accepted the first UNEP-LOICZ Biogeochemical Budgets Traineeship and spent 4 weeks work with Prof. Steve Smith and Ms Vilma Dupra at the University of Hawaii.

A LOICZ R&S Report (No. 14) is ready for publication.

4.1.6 SCOR-LOICZ Working Group 114 Submarine Ground Water Discharge Meeting, Birmingham, United Kingdom (July 1999)

About 25 participants attended the SCOR-LOICZ working group meeting on groundwater discharge (SGD) held at the University of Birmingham, UK, 22-24 July, 1999 in conjunction with the IUGG Congress. Discussions included:

Task 1: Assessment and Modelling

- Components of SGD include fresh and/or brackish water originating from on-shore recharge areas, recirculating seawater and saline groundwaters, but a clear definition is being developed, with a focus on the quantification of fluid discharge by SGD.
- Scaling is an issue encompassing: (1) the meter scale, for example, seepage meters, (2) the ten-meter scale characteristic of saline water intrusion and recharge, (3) the ten-kilometer scale common in the assessment of nutrient fluxes to the near-shore environment: and (4) the hundred meter to hundred-kilometer scale relevant to regional oceanographic studies and typology.
- A report describing the strengths and limitations of each modelling and calculation methodology.

Task 2: Measurement, Sampling and Experimental

- Various regions were reviewed including: Perth region and Spencer Gulf, Australia; Southern India; Florida; Japan; and continental USA. Limited published data on water flux estimates is available from South America, Africa, India and China.
- The intercalibration plan intends to assess the different methods and uncertainties of determining SGD. Funding is being sought from the IOC and some initial work will proceed in Florida and Perth.

Task 3: Typology, Globalization, and Integration

- Typology may be applied to the estimation of groundwater flux potential using such parameters as soil type, precipitation, evaporation or aquifer thickness. In addition, it may be applied as a means of scaling up site-specific or local studies to a regional or global estimation based on similarity of coastal types or regions.
- Some typology data which are needed in the correct form are: rock type (e.g., limestone or granite coverage), depth of geologic features, geologic settings (e.g., coastal plain or volcanic terrain coverage), and aquifer characteristics (hydrogeologic parameters). Also required are morphologies relevant to SGD such as karats, deltas, coastal plains, volcanic terrain and urban systems.
- Fractal dimension of the shoreline should provide a measure of the shoreline's tortuosity, and hence, the degree to which SGD is focused into embayments as opposed to a more diffuse discharge into the open coastal ocean

4.1.7 LOICZ-SCOPE Workshop on Land-Ocean Nutrient Fluxes: The Changing Silica Cycle, Linköping, Sweden (October 1999)

An International Workshop was held at Linköping, Sweden, on 3-4 October, 1999; part of a series sponsored by SCOPE (Scientific Committee on Problems of the Environment) and LOICZ. The workshop was jointly organised by the Universities of Linköping and Stockholm in Sweden, and Hamburg in Germany.

The workshop addressed the overall issue of degradation of water bodies from land-based activities, with special reference to the mobilization and retention of silicate on land and its fluxes to the oceans and, *inter alia*:

- (1) considered historical data sets on nutrient inputs to the ocean with emphasis on silicate,
- (2) assessed nutrient removal in reservoir lakes behind dams and its effect on the nutrient mix,
- (3) assessed the impact of changes in hydrological cycles associated with climate change on land-ocean nutrient fluxes, and
- (4) investigated the link between land-ocean nutrient fluxes and changes in fisheries, biodiversity and the carbon cycle.

4.1.8 LOICZ-PAGES Workshop on Late-Holocene Sea-level and Climate Change, Honolulu, Hawaii (October 1999)

The workshop was held in Honolulu, Hawaii on 6-8 November 1999, with 20 invited participants. The goals included:

- examination of the evidence, forcing and coverage of relative sea-level histories over the last 2000 years,
- assessment of geochronological control, databases; and development of projects to address coupled sea-level and paleoclimate, and
- a time series of steric sea-level (forced by sea surface temperature and circulation) over the last 2000 years.

Presentations and discussion addressed the crucial requirement of disentangling and quantifying climate-linked variability from responses to tectonic and other processes affecting evidence for changes in sea level. The meeting considered this should be possible for at least a range of favorable coastal/island localities (some of which were identified). Data and research requirements to do this were determined with emphasis on coupled oceanographic and atmospheric dynamics, and a working group was established to promote the research initiatives within the framework of PAGES and LOICZ, and relevant agencies.

The LOICZ SSC has subsequently endorsed, in principle, the joint initiative.

4.1.9 LOICZ-START-IOCAS East Asia Coastal Zone Workshop, Qingdao, China (October 1999)

The workshop was hosted by the Institute of Oceanology, Chinese Academy of Science (IOCAS) in Qingdao, China on 12-14 October 1999. Participants (12) were from China, Korea, Russia, Vietnam and Japan with correspondent interests expressed from the USA and Europe. The workshop aimed to consolidate a network of researchers and activities in the East Asia region, to build a basis for collaborative coastal research and capacity, to synthesise information, and to develop joint research addressing material flux and related human dimension issues for the land-ocean compartment of the region.

Presentations reviewed the scientific research, capacities and derived information on material fluxes through the major regional basins and coastal estuaries and shelves. The human dimension influencing the fluxes and changes was highlighted.

The workshop established an East Asia LOICZ Committee (EALOICZ) which is developing a core project and work plan including international co-operation, multidisciplinary research and key sites from which to further develop scientific information on the relevant processes operating in the wider coastal zone of the region. Research and integrating workshops are planned.

4.1.10 LOICZ-UNEP South American Estuaries Workshop, Bahia Blanca, Argentina (November 1999)

The South American workshop was the second of the UNEP-GEF supported project activities and was held as a pre-meeting of the LOICZ OSM 4 at Instituto Argentino de Oceanografia in Bahia Blanca, Argentina 10-12 November 1999. Ten scientists from Argentina, Brazil, Chile and Uruguay joined a LOICZ resource group. About 11 site budgets were developed across the region and training was received in the use of the LOICZ Biogeochemical Guidelines.

The prototype computer programme for biogeochemical budget assessments (CABARET) was evaluated and further developed during the workshop. Mr Weber Landim de Souza, from Brazil has accepted the second UNEP-LOICZ Biogeochemical Budgets Traineeship and will spend up to 8 weeks in early 2000 working with the Regional Mentor, Dr Victor Camacho, at UABC, Ensenada in association with Prof. Steve Smith, University of Hawaii. Participants attended the LOICZ OSM4, contributing a number of presentations and posters; Ms Monica Gil received the LOICZ OSM Poster Award that will support attendance at an international conference in 2000.

A LOICZ R&S Report (No. 15) is being prepared for publication. Additional site budgets and training are continuing at research institutes in the region, assisted by participants in the workshop. An additional flow-on will be a national workshop in Colombia in early 2000, coordinated by the Regional Mentor.

4.1.11 LOICZ Latin American Basins Workshop, Bahia Blanca, Argentina (November 1999)

Preceding the LOICZ 4th Open Science Meeting, 16 mainly Latin American experts met to assess the scientific knowledge about catchment/coastal sea interactions in South America, including continental parts of the Caribbean region. Discussions followed the approach taken in EuroBASINS and reviewed the various regional settings within the DPSIR framework. The heterogeneity of natural conditions such as catchment size, geological activity (Andes versus Eastern Plains), as well as of the human dimensions such as land use and pollution were identified and considered for effort in deriving a regional synthesis.

The Meeting started preparation of a LOICZ R&S report – to be published in early 2000 – expanding on the currently available knowledge and giving emphasis to future changes of fluxes, considering major pressures relating to water, sediments and contaminants issues. It will also address the research niche of land-use change in catchments and their impacts on the coastal zone.

Another product currently under development is a database on catchment characteristics and fluxes in Latin America, which is expected to link with information compiled through the BAHIC project (Dr M. Meybeck). Review articles to be prepared in 2000 following the DPSIR framework will focus on specific rivers in Patagonia, the Rio de la Plata, the Rio San Francisco, Par del Sul, the Orinoco River, the Rio Magdalena and rivers along the Pacific coast. Database, review articles and the R&S report will form the scientific background from which to develop a science plan and targeted project proposals for integrated BASIN research in the forthcoming years. This work is planned for presentation the SAMBAS meeting in Caracas, Venezuela, September 2000, with a view to marrying the two LOICZ BASINS efforts in South America and the Caribbean.

4.1.12 SARCS-WOTRO-LOICZ (SWOL) Annual Meeting and Workshop: Linking Regimes of Coastal Flux Changes to Socio-Economic Drivers in Southeast Asia - Phase I (final synthesis meeting), Bahia Blanca, Argentina (November 1999)

The meeting held in Bahia Blanca, Argentina on 12-13 November 1999 was hosted by Instituto Argentino de Oceanografia. The national SWOL research groups summarized their

final results and considered the proposals for a potential SWOL Phase II as prepared in 1999 and submitted to the Dutch WOTRO. The synthesis demonstrated an overall structure for the integration of biogeochemical budgets and the human dimension in terms of socio-economic data. Results will be published in a LOICZ R&S Report in 2000.

Key output of the meeting included:

- Synthesis of the first four-years research at each site providing for the design and requirements of a potential new project phase foreseen for 2000.
- Agreement on the final reports for each of the four sites and the content of the joint project proposal.
- Agreement to pursue national typology efforts in each country i.e., to gather data, which are inputs to a regional typology as a necessary step towards generalizing site-specific scientific results and generating a regional picture of coastal areas in Southeast Asia.
- To continue training activities for SE-Asian and non SWOL scientists and regional projects as in 1999.
- To continue the work in the LOICZ network (presuming that the project will continue) and to provide the overall scientific framework for the SWOL II project. It was considered that the expansion and elaboration of Phase 1 will require new and diversified models and their application to new sites. Additional expertise and analytical techniques will have to be employed, which parallels the internal developments in LOICZ.
- To pursue efforts to link the SWOL Project with other IGBP projects being implemented in the region, particularly through with SARCS and LOICZ to tie in with Land Use and Cover Change (LUCC), Global Change and Terrestrial Ecosystems (GCTE), and Biospheric Aspects of the Hydrological Cycle (BAHC).
- To seek links to the UNEP South Asian Sea Programme and to the Southeast Asia/basins project (APN-START-University of Washington, USA).

4.1.13 Fourth LOICZ Open Science Meeting, Bahia Blanca, Argentina (December 1999)

The 4th LOICZ Open Science Meeting (OSM4) was hosted by the Instituto Argentino de Oceanografía, Bahia Blanca, Argentina on 15-18 November 1999. It brought together nearly 170 key researchers and coastal managers. While the major regional focus was on Latin America, all other regions were well represented. Participants contributed more than 120 presentations and posters, and the Argentinean chapter of IAPSO held its annual meeting.

OSM 4 represented a major step in our integration and synthesis process, providing a status review of the LOICZ programme and recommending directions for further research. The Meeting also served a focal point for continued improvement of the working relationships with potential users, and for links with intergovernmental bodies.

The human dimension of coastal change regimes provided a vital strand in the tapestry of the discussions, working groups and the three workshops. Understanding processes and derivation of models and budgets for materials (C-N-P and sediments) across the whole coastal water continuum of catchments, estuaries and coastal seas, was a second strand. The scaling of findings and modelling from local-to-global scales continues to be an issue and the coastal typology approach taken by LOICZ is crucial to its global commitment. Discussion on typology included a joint BAHC/LOICZ river basin/coastal zone typology working group. The final synthesis of the SARCS/WOTRO/LOICZ (SWOL) project demonstrated that considerable experience has been gained in quantifying residual production and flux changes driven by various socio-economic activities. LOICZ made efforts to enhance its scientific presence and networking in the wider Caribbean and in island/atoll regions, including

Oceania and South Asia. The DPSIR framework provided a platform on which to develop two regional projects in the Indian Ocean/Pacific region and the Caribbean.

The OSM 4 Proceeding were published in December 1999 and further products will include three LOICZ R&S publications as well as special issues of the Journal of Sea Research and the journal Regional Environmental Change.

4.1.14 Third Annual ELOISE Conference, Noordwijkerhout, The Netherlands (December 1999)

During the 3rd ELOISE Open Science Meeting in Noordwijkerhout, the Netherlands, on 1-4 December 1999 four LOICZ related sessions were specially organized:

- a) Biogeochemical budgets in coastal systems (ELOISE/LOICZ), convened by Dr C. Crossland;
- b) Continental aquatic systems: the BASIN approach (ELOISE/LOICZ), convened by Focus 1 leader, Prof. W. Salomons;
- c) Cycling of pollutants and socio-economic impacts (ELOISE/LOICZ), convened by Focus 4 leader, Dr J. Pacyna;
- d) Plenary Session on interdisciplinary science approaches in LOICZ, the current scientific status of global coastal change research and future developments globally and in the Netherlands, convened by Dr H.H. Kremer.

Around 20-30 European scientists addressed various issues of current research in fields such as biogeochemical and gas fluxes following horizontal transport processes including groundwater. Nutrients and trace gas cycling were reviewed, considering biotic and abiotic system functions and transboundary processes including the atmospheric and benthic interfaces. River catchment (coastal sea interaction - the BASINS approach) was reflected in various contributions e.g., from the Mediterranean and Black Sea and was also picked up by the Commission itself through the JRC, Ispra which provided some background on a scientific network on European rivers/coastal zone studies. The human dimensions were addressed in many of the contributions.

In response to the new requirements of the EC 5th Framework Programme to move toward issue-driven science, a final plenary session on integrated science expanded on the efforts taken in the Southeast Asian LOICZ core project, SWOL. The quantify of anthropogenically-driven residual production of C, N and P by different economic sectors, modelling ecosystem and management implications were outlined by an economist of the Philippines study team. Through introduction of valuation terms – monetary or others – this approach might soon provide sound scientific scenario simulation for the needs of decision making.

4.2 ASSOCIATED WORKSHOPS

4.2.1 LOICZ Conference on Marine Environment – The Past, Present and Future, Kaohsiung, Taiwan (January 1999)

The Conference was organised by the Taiwan LOICZ Committee and held at Kaohsiung, Taiwan on 26-28 January 1999. It involved extensive representation from the Taiwan and the region.

Presentations covered the broad issue of catchments and coastal seas including recent research results on material fluxes and processes in the context of the LOICZ questions and objectives. Papers from the Conference and a review of activities and discussions were published as a Conference Proceedings in mid-1999.

4.2.2 C-GOOS Planning Panel Meetings, Accra, Ghana (April 1999) and Beijing, PR China (November 1999)

The GOOS programme is recognised as a major initiative being orchestrated through the International Oceanographic Commission (IOC) of UNESCO and forms part of the broad-scale Global Observing Systems (GTOS – terrestrial; and GCOS) being implemented and established throughout the world. The coastal panel of GOOS, led by Prof. Tom Malone, is developing a science plan and an implementation plan that should take effect in the next 12 months. LOICZ and C-GOOS are strongly complementary.

LOICZ has been an invited participant to these developments and, with members of the panel including a number of LOICZ scientists, has been contributing to and forging close relationships in this development phase of C-GOOS.

4.2.3 IOCARIBE and Caribbean-GOOS and Users Meeting, San Jose, Costa Rica (April 1999)

On invitation from IOC and the regional IOCARIBE, LOICZ participated in two regional workshops in the Caribbean:

- a) the IOCARIBE Users and GOOS Capacity Building Workshop, San José, Costa Rica, 22-24 April 1999, and
- b) Sixth Session of IOCARIBE, San José, Costa Rica, 26-29 April 1999

IOC and LOICZ are continuing to improve their operational links and pursue joint efforts to address their significant areas of common agenda, including projects in the wider Caribbean region (including C-GOOS regionally). In addition to these developments, mutual interests and common objectives were identified during the meetings between LOICZ, the UNEP Regional Seas Programme, CARICOMP and the Inter-America Institute (IAI).

Extension of these initial organisational links were a key action of the later LOICZ OSM4 which saw further project development and scientific activities get under way.

4.2.4 IGBP Congress, Shonan Village, Yokohama, Japan (May 1999)

Shonan Village, Yokohama, Japan, was the meeting place for about 300 scientists representing the 11 core projects of IGBP on 6-13 May 1999. The theme “IGBP synthesis” was the central focus of the meeting.

The IGBP clearly made some major gains in its scientific work and building synergies between core projects. LOICZ also gained much. The SSC took the opportunity to deal with the full agenda of progress and planning issues that accompanies its annual meeting. Importantly, we struck up some vital collaborative actions with other IGBP core projects (especially BAHC, GLOBEC, PAGES) and developed a blueprint for the first synthesis of our results due for completion at end 2002. These collaborations were further extended at LOICZ OSM4.

The joint JGOFS-LOICZ Continental Margins Task Team (CMTT) took on a second phase of activity aimed at assessment and global synthesis of CO₂ and nutrient fluxes in marginal seas and boundary currents.

The broad synthesis of the START projects, gave LOICZ a wider picture of opportunities to extend existing joint actions. Regional studies are a fundamental tool in the LOICZ programme, and the building of synergies through links with START (and Lucc) are being acted on.

4.2.4 European Commission Joint Research Committee Workshop: A European Network and Programme for Basins Issues and Science Exploitation, Ispra, Italy (May 1999)

Following the recommendations of the European Commission and the results of an investigation of the Environment-Water Task Force, the Joint Research Centre, Ispra, held a two-day working meeting to investigate the needs, scientific contents and contributing partners for a potential European Network and Programme for Basins Issues and Science Exploitation. Around 20 European experts discussed the need to establish a network aimed at: i) enhancing synthesis of ongoing catchment research, and ii) providing adequate science exploitation to meet the needs of European policy making. Another objective was to improve co-ordination among the respective projects running under the ELOISE banner.

LOICZ provided background information on its experiences with the BASINS approach, the IGBP water group and the socio-economic/natural science linkage as a necessary tool in integrated basins research. Participants agreed to join efforts to design a shared-cost action proposal to be submitted to the Commission in Brussels.

4.2.5 European Commission Joint EU Strategy for Integrated Coastal Zone Management, Brussels, Belgium (July 1999)

The first joint meeting of the project leaders of ELOISE (European Land Ocean Interaction Studies, supported by Directorate General, DG XII) and the EU ICZM Demonstration Program (run by DG XI) discussed potential of promoting exchange of knowledge and information between coastal science and management. Communication between stakeholders in science and management, and questions on what EU policy could contribute received priority attention. Followed by a plenary of several Directorates General and user groups, the question was posed of how such links might facilitate the implementation of a European strategy for ICZM, as previously recommended in 1992/94 by the European Council of Ministers.

User needs for scientific products were discussed at an associated gathering of executive bodies of the EU Commission, clients and users including the EEA (European Environment Agency, Copenhagen) and the EUCC (European Union for Coastal Conservation) as well as national CZM centres. The political and scaling dimensions received more detailed consideration.

In the working groups LOICZ highlighted that the human dimensions of coastal are considered the key item for ICZM. Specific input from the coastal global change community in LOICZ would be expected to come through its typology approach as well as through the experiences gained in Focus 4 related integration of natural and socio-economic science. The DPSIR framework as developed further in LOICZ might prove a basis for site description, comparison and scaling purposes. LOICZ and ELOISE might also provide a neutral platform for enhancement of stakeholder involvement and science communication.

4.3 OTHER WORKSHOPS

In 1999, LOICZ scientists were involved in the presentation of materials, activities and preparation of scientific publications in a number of key workshops held by related agencies addressing coastal research and the transfer of scientific knowledge to coastal managers, policy and industry sectors, including:

- IGBP Scientific Steering Committee annual meeting, Estoril, Portugal (February)
- WOTRO Southwest Sulawesi project synthesis meeting, Leiden, The Netherlands (March)
- Intergovernmental Oceanographic Commission (UNESCO, IOC) Assembly, Paris, France (June)

- IOC-SCOR meeting on Ocean Science Perspectives in 2020, Potsdam, Germany (October)
- IGBP-GAIM workshop on Global and Regional Sea-Level Changes and the Hydrological Cycle, Loiri-Porto San Paolo, Sardinia (October)
- Dahlem Conference on the coastal zone, Berlin, Germany (December)

5. Collaboration

LOICZ has continued to build and expand collaborative actions throughout 1999; internally within IGBP and associated programmes, and externally with international agencies and science “users”.

LOICZ depends on an extended global network of scientists to achieve its goals. A major element of the project is the support provided through national governments and their research agencies and universities. In 1999, the LOICZ network has expanded to include more than 2400 people and key agencies involved in the activities and science delivery that underpins LOICZ enterprise. The list of contributed projects (see section 3) provides a taste of the success of these collaborations and the LOICZ web-site (www.nioz.nl/loicz/) is a source of continually updated information.

In many countries, a national LOICZ Committee has been established, usually associated with a national IGBP Committee. Through this aegis, projects are developed which address LOICZ objectives and researchers contribute their science to the wider spatial picture being developed. In 1999 the Taiwan workshop (4.2.1) provided one example and, in a similar vein, the Dutch LOICZ Committee has developed a science plan and is calling for proposals to address the USD2.5 million implementation phase. We encourage these arrangements, but recognise that national organisations contribute to LOICZ through different structures and working arrangements. In some countries and regions, LOICZ is supported by institutions and networks of specialist scientists, often supported in the thematic task activities, such as typology development and the calcification group implementing elements of LOICZ Focus 2.

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 1999, through the ELOISE project of the EU, the development of the Russian LOIRA project, and the UNEP GEF project on nutrients. Further collaborative actions within Asia, West Africa, Latin America, and Oceania regions are being followed with the aim of enhancing or establishing regional programmes.

Within IGBP, LOICZ has further developed strong working collaboration with the terrestrial and ocean projects, notably BAHC, GLOBEC, JGOFS and PAGES. Future work will deal with IGBP cross-cutting projects such as assessments of global change in carbon and water. LOICZ has continued to work closely with the START project on capacity building and training in regions, jointly organising several workshops during 1999. These initiatives, and the developing contacts with other agencies pursuing capacity building projects (e.g., the Inter Americas Institute and the Asia Pacific Network) are continuing.

A close association with the SCOR global programme has been sustained e.g., the jointly-sponsored Working Group (112) on Submarine Groundwater Discharge. A working association with the International Human Dimensions Programme (IHDP) has been developed and is being extended.

A major goal for LOICZ is to ensure that the scientific research is utilised by coastal zone managers and policy makers. LOICZ has built a strong 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 in 1998 has been towards joint actions and consultation on integrated coastal area management (ICAM), developments in Coastal-GOOS, and capacity building in world regions, including Asia and Oceania. These “brokering” and application

initiative is being enhance through close and joint actions with RIKZ Coastal Zone Management Centre and the Netherlands Institute for Sea Research (NIOZ).

While these internal and external institutional arrangements are vital to the success of LOICZ, it is the individual scientists, coastal managers and policy-makers that ensure the operational products and the achievement of LOICZ goals. Networking and collaboration with global researchers continues to gain success.

6. Communication

The personal synergies that develop in expert workshop environments are clearly fundamental to LOICZ activities and underpin the enterprise. However, communication within and beyond LOICZ is also vital to the effectiveness and success of the project. The networking nature of LOICZ and its continuing evolution of science impose a challenge that is increasingly being met through electronic media. However, 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 to cyberspace. Consequently, LOICZ disseminates information by a mix of printed and electronic publications. The personal synergies that develop in expert workshop environments are clearly fundamental to LOICZ activities and underpin the enterprise.

In 1999, LOICZ has continued to use a mix of communication tools to disseminate its findings and to promote the network of players, internally and with users.

Newsletter

Three editions of the LOICZ Newsletter (Nos. 10-12) were produced and each was distributed to about 2400 people and agencies. The Newsletter contained at least one scientific article, along with news and updates on the LOICZ project activities, and provided notice of the calendar of relevant meetings and workshops within and associated with the project.

Brochures and Posters

A LOICZ brochure (published in four languages - English, French, Portuguese, Spanish) was widely distributed through national contact points and various meetings and workshops. A second and updated edition is in preparation along with support posters.

A page within the LOICZ website is being developed which will contain accessible and current presentation materials about LOICZ and its projects for global participants to use in presentations

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 upgraded through 1999 and a continuing process of addition and modification is being followed. Copies of all new printed materials are available through the site, contributing project lists are kept current along with contacts for chief investigators, 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, especially for biogeochemical budgets and typology. Additional thematic web-pages are being developed to address LOICZ core projects. Much of this work is being managed through dedicated websites which provide access to day-to-day progress.

Publications

Numerous scientific publications have been produced from research projects contributing to LOICZ Core, Regional and Relevant Research projects. An index and listing of this work is expected to be accessible from the website in 2000.

LOICZ publishes a variety of meeting and workshop reports, listed on the LOICZ website. Some of these deal with project planning and development issues and are generally of limited interest within elements of the LOICZ project. However, LOICZ has been placing increased effort on integration and publication of its science across a range of journals and media vectors. This will continue as a major activity. Examples of science and key workshop publications and media include:

American Zoologist **39** (1):1-183 1999 *Coral Reefs and Environmental Change – Adaptation, Acclimation, or Extinction*, organised by Robert W. Buddemeier and Howard R. Lasker (Special issue symposium papers).

Chen, C-T.A. and Wang, S-L 1999 Carbon, alkalinity and nutrient budgets on the East China Sea continental shelf. *J. Geophysical Research* **104** (C9): 20675-20686.

Chen, C-T.A., Bychkov, A.S., Wang, S.L. and Pavlova, G.Yu 1999 An anoxic Sea of Japan by the year 2000. *Marine Chemistry* **67**: 249-265.

Gattuso, J-P., Frankignoulle, M. and Smith, S.V. 1999 Measurement of community metabolism and significance in the coral reef CO₂ source-sink debate. *Proceedings National Academy of Science* (9 November) **96** (23):13017-13022.

Kleypas, J.A., Buddemeier, R.W., Archer, D., Gattuso, J-P., Langdon, C. and Opdyke, B.N. 1999 Geochemical consequences of increased atmospheric carbon dioxide on coral reefs. *Science* (2 April) **284**: 118-120.

Kremer, H.H. and Pirrone, N. 1999 ELOISE WG 4 coastal zone management and integration of natural and socio-economic science: progress report of the meeting in Huelva, Spain (October 1998). In: ELOISE Implementation Report Phase 2, Ecosystem Research Report No.33 EUR 18599. EU-Commission, Brussels.

LOICZ 1999a *Australasian Estuarine Systems: Carbon, Nitrogen and Phosphorus Fluxes*. Eds. S.V. Smith and C.J. Crossland. LOICZ Reports & Studies No. 12. LOICZ International Project Office, Texel, The Netherlands, 182pp.

LOICZ 1999b *Mexican and Central American Coastal Lagoon Systems: Carbon, Nitrogen and Phosphorus Fluxes (Regional Workshop II)*. Eds. S.V. Smith, J.I. Marshall Crossland and C.J. Crossland. LOICZ Reports & Studies No. 13. LOICZ International Project Office, Texel, The Netherlands, 115pp.

LOICZ 1999c *Report of LOICZ Open Science Meeting 1999: Regimes of Global Change*. LOICZ International Project Office, Texel, The Netherlands, 147pp.

LOICZ 1999d *Annual Report 1998*. LOICZ International Project Office, Texel, The Netherlands, 27pp.

LOICZ in press *Estuarine Systems of the South China Seas: Carbon, Nitrogen and Phosphorus Fluxes*. Eds. V. Dupra, S.V. Smith, J.I. Marshall Crossland and C.J. Crossland. LOICZ Reports & Studies No. 14. LOICZ International Project Office, Texel, The Netherlands.

LOICZ Taiwan 1999 *Proceedings of the Conference on Marine Environment – Past, Present and Future*. LOICZ Committee, Kaohsiung Taiwan, 256pp.

Pacyna, J.M. and Kremer, H.H. 1999 ELOISE WG1 Biogeochemical fluxes and cycles: progress report of the meeting at 2nd annual ELOISE conference, Huelva, Spain (October 1998). In: *ELOISE Implementation Report Phase 2*. Ecosystem Research Report No.33, EUR 18599. EU-Commission, Brussels.

Pacyna, J.M., Kremer, H.H, Pirrone, N. and Barthel, K-G. (eds.) in press *Scientific Report on Socio-economic Aspects of Fluxes of Chemicals into the Marine Environment*. EU Monograph Series EUR 19089. EU-Commission, Brussels.

Salomons, W., Turner, R.K., de Lacerda, L.D. and Ramachandran, S. (eds.) 1999 *Perspectives on Integrated Coastal Management*. Springer, 386pp + CD-ROM.

Smith, S.V., Buddemeier, R.W. and Crossland, C.J. 1999 The LOICZ biogeochemical budget project and implications for the carbon cycle. *IGBP Newsletter* (March) **37**: 10-12.

Workshop Report 1999 *Workshop on climate change and coastal processes in West Africa*. START-IOC-LOICZ, 20pp. (Full proceedings in press)

Yanagi, T. 1999 Seasonal variations in nutrient budgets of Hakata Bay, Japan. *Journal of Oceanography* **55**: 439-448.

7. Funding

The Netherlands government generously continues to support the LOICZ International Project Office and core activities during this second phase of the project, 1998-2002. This vital funding is received from the NWO and RIKZ, supplemented with support from IGBP for meetings of the LOICZ Scientific Steering Committee.

In addition to major core funding support for the IPO from the Netherlands government, in 1999 LOICZ gained significant project funding from the Netherlands WOTRO, and finalised arrangements for a project with UNEP supported by GEF funds (“The role of coastal ocean in the disturbed and undisturbed nutrient and carbon cycles”: 1999-2001, USD720 000). The European Union has provided support funding for a workshop project and further project proposals are with the European Union, The World Bank, the Asia Pacific Network and the Inter American Institute.

Funding support for the LOICZ OSM4 in Argentina was received from IOC, IAI, NSF, KNAW, WOTRO and APN. Strong working collaboration has been established with other core projects of IGBP and jointly-funded activities have been engaged with BAHC, PAGES and START.

In-kind support, especially from NIOZ and RIKZ, and many national government agencies continues to underpin LOICZ activities. In particular, the support from CINESTAV (Mexico), NILU (Norway), the Vrij University (The Netherlands), University of the Philippines, China Academy of Science, and Instituto Argentina de Oceanografia (CRIBBAB) have contributed to workshop activities. The LOICZ SSC and the member activities are supported by a range of universities and national agencies, notably the universities of Hawaii, Kansas and Stockholm, and GKSS (Germany).

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

A detailed and fully audited financial statement is prepared annually by the LOICZ IPO host institution, NIOZ, and reported to the Netherlands funding agencies.

The income funding stream for LOICZ in Year 1 and 2 of **Phase 2** is listed below with indicative figures for Year 3 (2000)

	1998	1999	2000 (projected)
LOICZ Phase 2 (1998-2002)	Year 1	Year 2	Year 3
(Dutch Guilders)			
Cash			
Core support	890 000	887 000	890 000
Additional support	65 500	436 200	694 000
total	955 000	1 323 200	1 584 000
Inkind			
NIOZ and RIKZ	260 000	260 000	260 000
Additional support	183 000	540 000	620 000
total	443 000	800 000	880 000

8. Abbreviations list

ANU	-	Australian National University, Canberra
APN	-	Asia Pacific Network
BAHC	-	Biospheric Aspects of the Hydrological Cycle (IGBP core project)
CARICOMP	-	Caribbean Coastal Marine Productivity Programme
CICESE	-	Centro de Investigación Científica y de Educación Superior de Ensenada
DIS	-	Data and Information Support (IGBP core project)
DPSIR	-	Drivers-Pressure-State-Impact-Response framework
EALOICZ	-	East Asia LOICZ Committee
ELOISE	-	European Land-Ocean Interaction Studies
EU	-	European Union
EU FP5-	-	European Union Fifth Framework Programme
GLOBEC	-	Global Ocean Ecosystem Dynamics
GOOS	-	Global Ocean Observing System
IAI	-	Inter America Institute
ICAM	-	Integrated Coastal Assessment and Management
ICSU	-	International Council of Scientific Unions
IGBP	-	International Geosphere-Biosphere Programme
IOC	-	Intergovernmental Oceanographic Commission
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)
LOIS	-	Land-Ocean Interaction Study, United Kingdom
LUCC	-	Land-Use Cover Change (IGBP core project)
MAST	-	Marine Science and Technology
NILU	-	Norwegian Institute for Air Research, Oslo
NIOZ	-	Netherlands Institute for Sea Research, Texel
NSF	-	National Science Foundation, USA
OSM	-	Open Science Meeting (e.g., LOICZ OSM4, Argentina)
PAGES	-	Past Global Changes (IGBP core project)
SARCS	-	Southeast Asia Regional Committee for START
SASCOM	-	South Asia Regional Committee for START
SCOR	-	Scientific Committee on Oceanic Research
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
WOTRO	-	Netherlands Foundation for the Advancement of Tropical Research