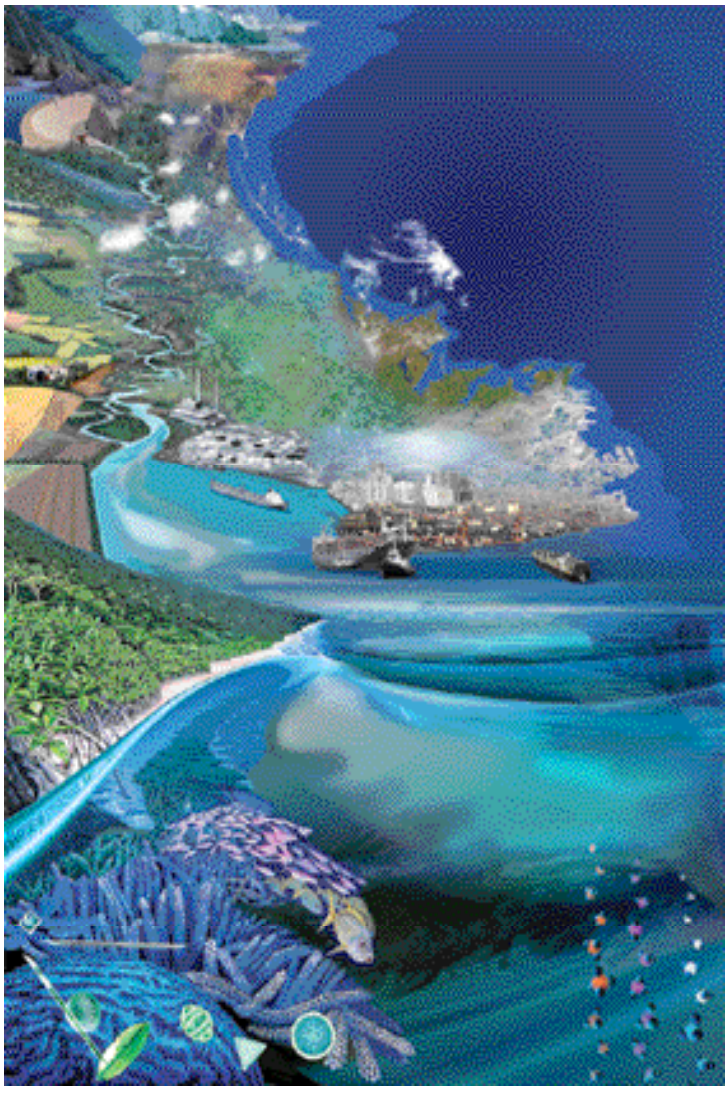
Land-Ocean Interactions in the Coastal Zone

INPRINT

The IPO and SSC wish you all a happy and successful New Year. We thank you for great LOICZ work in 2006 and look forward to even more good collaboration and new and exiting LOICZ science in 2007.



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Morphodynamics of Deltas and the Influence of Humans

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A delta forms through the interaction between:

1. sediment supply from a river's bedload and suspended load, a reflection of drainage-basin charac- teristics, water discharge and sediment yield;
2. accommodation space, as controlled by sealevel fluctuations, offshore bathymetry, tectonics, subsidence, compaction, and isostasy;
3. coastal energy, through the influence of waves and tides, longshore and cross-shelf transport; and
4. density differences between river and coastal waters critical in defining the dynamics of discharge plumes.

Most deltas started to form between 4,000 y BC and 6,000 y BC, with the recovery of global sea level. A delta's various distributary outlets may be differentially influenced by river discharge, wave action and tides.

Deltas and their estuaries hold both ecological and economic value and are major centers of population and agriculture. Approximately 0.5 billion people now reside on deltas, often focused on major metropolitans, e.g. Shanghai (Yangtze), Guangzhou (Zhujiang), Bangkok (Chao Phraya), Yangon (Irrawaddy), Karachi - Hyderabad (Indus), Buenos Aires (Parana), Vancouver (Fraser), New Orleans (Mississippi), Lagos (Niger), Ho Chi Minh City (Mekong), Houston (Brazos), Hanoi/Haiphong (Song Hong), and Marseilles (Rhone). The Nile alone has close to 50 million people populating its delta plain, and hosts the mega-cities of Alexandria and Cairo. The Ganges-Brahmaputra delta is home to 130 million people, including the megacities of Calcutta & Dhaka. Today, Asian deltas contain 0.25 billion people and probably 0.33 billion by the year 2015 (Woodroffe et al., 2006). Humans often control key factors that affect a delta's morphodynamics: sediment flux (Syvitski et al., 2005a), water flux (Vörösmarty and Sahagian, 2000), flow pathways (Syvitski et al., 2005c), and the shoreline position (Syvitski et al., 2005b).

Delta plains, once the home to vast areas of wetlands, now host vast agriculture infrastructures.

A new study (Syvitski and Saito, in press) describes the morphodynamics of global deltas under human influence, in terms of ratios of key environmental characteristics:

1. cumulative distributary channel width to river width,
2. marine power to fluvial power,
3. short-term sediment supply to sediment dispersal,
4. long-term sediment supply to sediment retention, and
5. peak discharge to average discharge, Qmx/Qav.

Type deltas (Fig. 1) include those influenced by low marine energy, polar and desert deltas, temperate rainforest and tropical deltas, and wave or tide-dominated deltas.

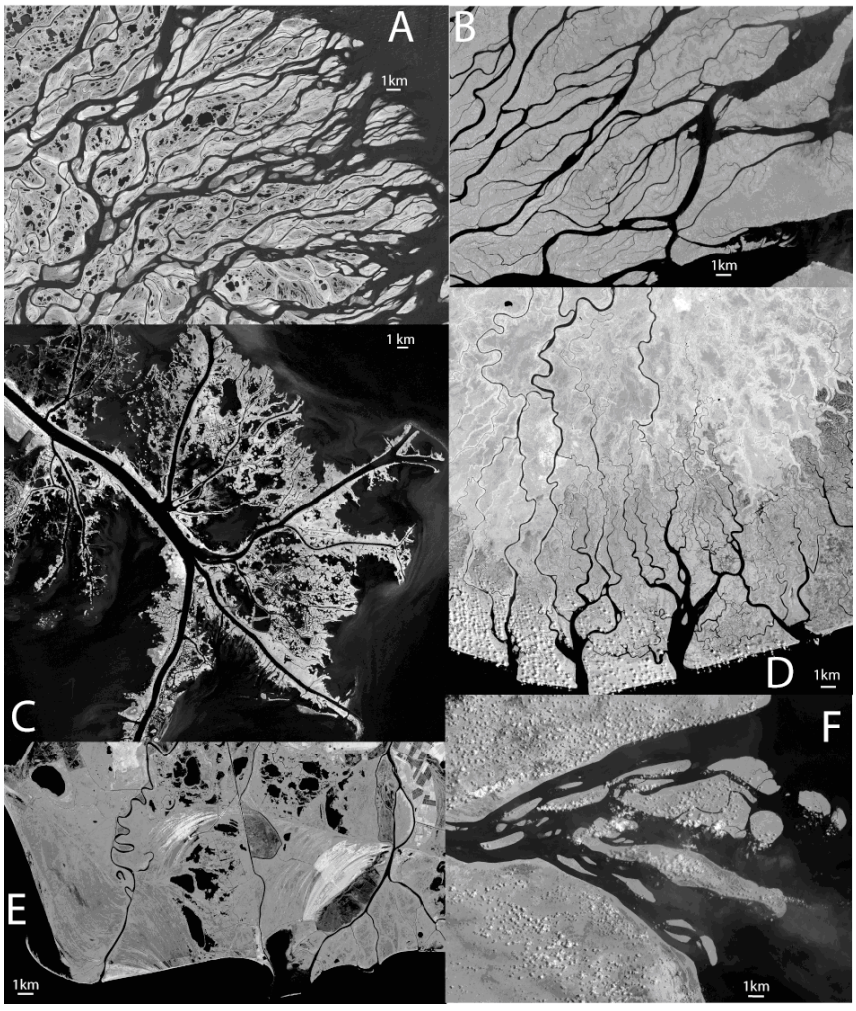

Figure 1: *Examples of distributary channels draining type deltas: A) A small portion of the giant polar and river-dominated Lena delta. B) A small portion of the giant tropical Orinoco delta. C) The low-tide, low-wave, river-influenced Mississippi delta, developed since 1400 A.D. D) The central portion of the tide and wave-influenced, tropical, Niger delta. E) The southern portion of the wave-dominated temperate Danube delta. F) The tide-dominated tropical Fly delta. For details see Syvitski and Saito, in press.*

Deltas influenced by low marine energy, i.e. no to low tides and wave action (e.g. Mississippi: Fig. 1C; Volga), are truly unique, displaying channels developed from bank failure and crevasse splays, leading to channel splitting and/or channel feathering. Smaller deltas (e.g. Squamish, Var) are invariably dominated by ocean energy and sediment dispersal. Polar deltas, located along the shores of the Arctic Ocean, are influenced by river discharge (Fig. 1A). Sea ice eliminates the impact of wintertime storm-generated waves, and Arctic Ocean tides are typically small, although high tidal regions do occur (e.g. Pechora). Polar rivers have some of the highest Qmx/Qav ratios, comparable to desert rivers, and their many smaller distributary channels are active for less than one month.

Deltas that receive a high level of precipitation include the temperate rainforest deltas (e.g. Homathko, Klinaklini) and most tropical deltas (e.g. Amazon, Orinoco, Fly, Irrawaddy). Rapid growth of vegetation stabilizes newly developed channel levees and mouth bars. Tropical deltas experience intense convective rainfall and establish runoff channels that influence the pathway and connectivity of their distributary channels (e.g. Orinoco: Fig. 1B, Niger: Fig. 1D). Desert deltas are located mostly in the sub-tropics (e.g. Nile, Tigris-Euphrates, Indus and Orange) and today are often irrigated for crop production. Barriers and beaches develop where wave energy is high, as conditioned by longshore transport (e.g. Copper, Danube: Fig. 1E). Where tidal energy is high, funnel-shaped channels develop with mouths widened by the tidal currents (e.g. Fly: Fig. 1F): the larger the tidal energy, the larger the distributary mouth widths relative to the river width.

Using predictive relationships, Syvitski and Saito (in press) show how present and future anthropogenic impacts will alter deltaic systems away from their natural state. A delta's size depends on the river's discharge of water and sediment, and the water depth of the receiving basin. As bedload and suspended sediment delivery to the coastal ocean is almost universally decreasing with reservoir construction and mitigation of the flood wave, most deltas are expected to shrink, some (e.g. Mississippi, Ebro, Nile, Huanghe) already are.

The seaward gradient of a delta depends on the ratio of sediment supply to sediment retention, being inversely impacted by a river's discharge. For small discharge rivers, their delta gradient varies little from the river gradient. Breaking waves disperse sediment down a coast thus limiting a delta's area and allowing a delta's gradient to remain relatively steep. As sediment supply is reduced, most deltas will see steeper channel gradients develop (e.g. Colorado, Huanghe). Recent engineering of the Huanghe has reduced the length of the main distributary channel by 16 km, and steepened the riverbed gradient by 2.9 times, resulting in upstream scouring (Hui and Huang, 2005). Under a global warming scenario, arctic deltas likely will receive greater discharge (Syvitski 2003) and thus their delta gradients should decrease. The number of distributary channels depends on the ratio of peak river discharge to marine power. If the ratio is large, then over time more distributary channels will form. With upstream dams reducing the seasonal flood wave, the number of distributary channels is thus decreasing on many deltas (e.g. Po, Nile, Magdelena). Waves work to super-elevate the delta plain with coarse material, tides enlarge existing channels. Both marine influences are limiting the formation of distributary channels.

Human engineering now controls the growth and evolution of more and more deltas. One intervention is for the control of the flow path of distributary channels, either to redirect (e.g. Po, Huanghe, and Colorado (TX) deltas), or to harden and stabilize (e.g. Fraser, Rhone). Another intervention is for the mitigation of the seasonal flood wave (e.g. Mekong, Yangtze, Indus). A third intervention is for the irrigation of increasingly diverse crops (e.g. Nile, Krishna). These engineering feats are not widely appreciated in the natural science literature. For example, the collapse of the Tongwaxiang dike in 1855 caused the Huanghe to change course, from discharge into the Yellow Sea to discharge into the Bohai Sea where a new delta formed at a rate of ca. 22 km2/y. The main distributary channel remains under engineering control to support of oil-field infrastructure. An act of the US Congress opened up historical log jams on the Colorado River, Texas, which prior to 1929 carried little sediment to its river mouth. Since 1929, a bird-foot delta grew rapidly into the bay under the control of engineers for the sole purpose of aiding the construction of a highway to an offshore barrier island. In Europe, habitants have been re-directing the Po River since 1150 initially in aid of transportation (Syvitski et al., 2005c), and later (1600) to keep unwanted sediment out of the Venice Lagoon. Artificial subsidence (from methane production), riverbed excavation, and hinterland reservoir construction have combined to stop the growth of the delta, while stop banks (flood protection levees) and water gates confine and control the flow through the modern distributary channels. The number of distributary channels has continuously decreased under the influence of humans (Fig. 2A).

Our African example dates from the beginning of the 20th century, when 15 distributary channels coursed through the Nile delta. With the construction of the Aswan Dam and mitigation of the annual flood wave, many of the seasonal-overflow distributary channels no longer carry water (Fig. 2B). Today only 6 distributary channels can be recognized with countless irrigation canals re-supplying water for year-round crops (Fig. 2C).

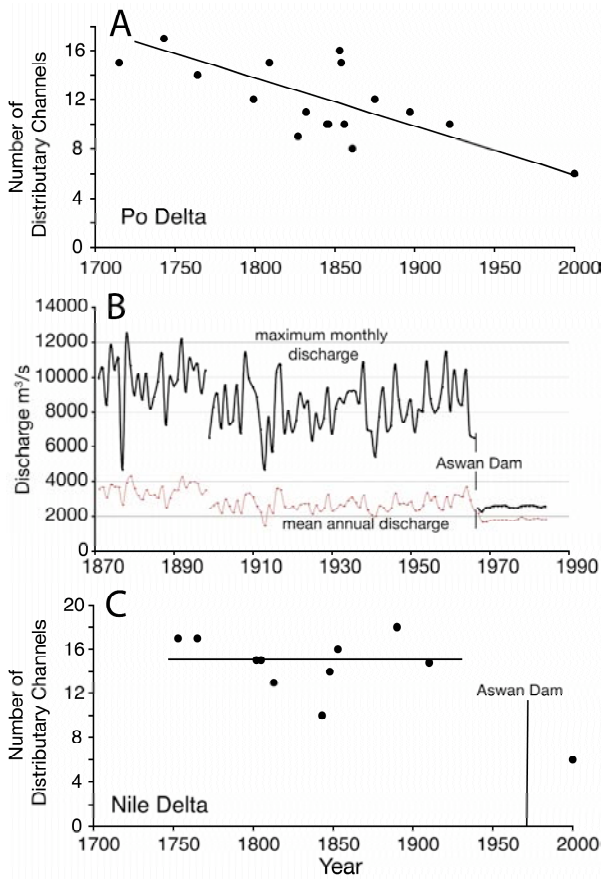

Figure 2: *A) The Po delta shows a slowly decreasing number of distributary channels over the last 300 years, reflecting decreases in the sediment flux and human intervention through channel manipulation and reservoir construction. B) Mean annual and maximum monthly discharge for the Nile River. Operation of the Aswan dam and loss of water to evapotranspiration through crop irrigation has reduced mean discharge by 64%, virtually eliminated (82%) the seasonal flood wave, and (not shown) reduced the sediment flux to the coastal zone by 98%. C) The Nile delta shows a high number of distributary channels for much of the last 300 years (with variation) until the construction and operation of the Aswan Dam. Data after Syvitski and Saito, in press.*

A similar story exists for deltas from the Indian subcontinent (e.g. Krishna, Mahanadi).

On deltas still subject to seasonal flood waves, distributary channels are often hardened and fixed in space to protect both infrastructure and habitants. On the eastern portion of the Rhone delta, France, levees are hardened to protect the infrastructure associated with saltwater extraction mining and associated shipping facilities. On the northern portion of the Fraser delta, Canada, the Vancouver International Airport, located on an interdistributary bar, is protected by hardened levees. These and countless other examples demonstrate that the morphodynamics of modern deltas is commonly much different under human influence and engineering. The cost of this morphodynamic engineering, in terms of ecosystem diversity, coastal fisheries and human habitat, remains a largely unanswered question.

Acknowledgements

This study forms a formal contribution to the SCOR/LOICZ working group 122 dealing with the global influence of competing factors in estuarine sediment retention.

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Assessment of Estuarine Trophic Status using the ASSETS methodology - Rationale, development and examples.

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Rationale

Increased nutrient loading to the coastal zone has resulted in eutrophication problems in estuarine and coastal systems in many parts of the world (e.g. US, Italy, Germany, Australia, U.K., Japan and China). Assessment of eutrophication in coastal systems, and particularly in estuaries, is challenging for a number of reasons:

1. The symptoms are diverse, may potentially be due to a range of causes, and vary widely in scale (e.g. river to estuary to continental shelf).

2. The association between pressure and state is strongly modulated by estuarine geomorphology and hydrodynamics: estuaries subject to similar nutrient related pressures frequently exhibit totally different eutrophic symptoms, or none at all. Water residence time, tidal range, and turbidity play a major role in determining the nature and magnitude of symptom expression.

3. Biological interactions, such as top-down control of phytoplankton, may affect the expression of eutrophication symptoms. These may occur in similar types of estuaries, due to natural variability, but also due to human activities such as shellfish aquaculture. In the latter case, selective filtration may additionally affect biodiversity by altering the phytoplankton species composition.

4. Changes in biodiversity may be natural, related to eutrophication or xenobiotic pollution, or linked to phenomena such as climate change.

An improved understanding of these issues is driven by regulatory requirements in order to support water quality management in estuarine and coastal systems. In the EU, Directive 2000/60/EC (Water Framework Directive - WFD) establishes the division of transitional and coastal systems into different types based on physical factors. For each type reference conditions must be defined in order to determine Ecological Quality Ratios (see e.g. Vincent et al., 2003). Complementary EU directives such as "Habitats" and the forthcoming Marine Strategy directive are also of importance. In the US, the federal legislative context is based on the Environmental Protection Agency (EPA) Clean Water Act (1977; see e.g. Gibson et al., 2000), and there is widespread recognition that type-specific reference conditions for eutrophication symptoms are a prerequisite for appropriate assessment and management (e.g. Bricker et al., 2004; Buddemeier et al., in press).

Development

History and main components

The Assessment of Estuarine Trophic Status (ASSETS) model, developed from the US National Estuarine Eutrophication Assessment (NEEA), is a method for evaluating the impact of eutrophication on coastal water bodies with the intent to inform the management concerned (Bricker et al. 1999, 2003). It uses a (three part) Pressure-State-Response framework:

1. Influencing factors (IF) on development of conditions (Pressure),

2. Overall eutrophic conditions (OEC) within a water body (State), and

3. Future outlook (FO) for conditions within the system (Response).

Pressure - Influencing Factors

The influence of human related inputs relative to the natural tendency of a system to either retain or flush nutrients (i.e. susceptibility) is determined by combination of an estimation of susceptibility of a system and the level of nutrient inputs from the watershed in a matrix. A simple model which compares anthropogenic nutrient loading and natural background concentrations is used to determine the nutrient load component. It factors in potential nutrient inputs from oceanic sources, thus is addressing the question of whether management measures would be successful.

State - Overall Eutrophic Condition

Five variables are used to determine the eutrophic condition. They are divided into two groups: primary or early stage symptoms (chlorophyll a (Chl a) and macroalgae) and secondary or well developed symptoms (Dissolved Oxygen (DO), Submerged Aquatic Vegetation (SAV) loss, harmful algal bloom occurrence). The level of each indicator combines the extreme concentration or condition of the variable (e.g. bloom concentration of Chl a, or lowest concentration of DO), the spatial area over which the extreme conditions occur, and the frequency with which it is observed (e.g. annually, periodically, episodically). Separate salinity zone results are combined to give a

weighted average value for the estuary, which is then converted to a categorical rating (i.e. High, Moderate, Low). Primary symptom level is determined by averaging the values for Chl a and macroalgae, but for the secondary symptoms, a precautionary approach is used by selecting the worst of the three symptoms. The values are combined to determine an overall rating of eutrophic conditions for the estuary.

This suite of variables was designed to be broad enough to assess all estuarine types and to provide clear distinction of conditions among systems. Ranges were developed from US estuarine data and selected to be simple to use and to distinguish the magnitude of impacts among estuaries. However, these ranges do not work universally and there are efforts underway to more accurately characterize conditions by type of estuary (sensu WFD). Nevertheless, these variables are consistent with international requirements: for instance, phytoplankton is listed in the WFD as a biological quality element for both transitional and coastal waters, and phytoplankton indicators are an integral part of the OSPAR Comprehensive Procedure (OSPAR, 2002) and ICES eutrophication assessment methods (ICES, 2004), with biomass, abundance and composition defined as the key parameters.

Response - Determination of Future Outlook

The Response (Future Outlook) component estimates changes that might occur given predicted changes in nutrient input to a system. This component is determined by a matrix that combines susceptibility of the system with expected future changes in nutrient loads. Predictions of nutrient loading (increase, decrease, unchanged) are based on predicted population increase, planned management actions and expected changes in watershed uses - for many watersheds agricultural uses and practices are a key component.

Synthesis - Grouping pressure, state and response indicators

The ASSETS synthesis uses a matrix to combine IF, OEC, and FO into a single overall score falling into one of five categories: high, good, moderate, poor, or bad. These categories conform to the WFD and the framework provides a scale for setting eutrophication-related reference conditions for different types of systems on an international basis.

Comparison with other assessment methods

Several other eutrophication assessment methods are available, including the Oslo Paris Convention for the Protection of the North East Atlantic Comprehensive Procedure (OSPAR COMPP; OSPAR, 2002), the National Coastal Assessment method used by the US Environmental Protection Agency (EPA NCA; USEPA, 2004), the eutrophication model developed by the Organization for Economic Cooperation and Development (OECD; see e.g. Lee et al., 1978) and the Nutrient Index (NI) used to evaluate Chinese coastal water bodies. While there is much overlap among indicators used (Table 1), each method combines them to a final rating in a different manner (Table 2).

Variables	ASSETS and NEEA	EPA NCA	OSPAR COMPP	OECD	China Nutrient Index
Nutrient (DIN, DIP) Concentration or Ratio		X	X		X (and COD)
Nutrient Load	X		X	X	
Chlorophyll *a*	X	X	X	X	
Dissolved Oxygen	X	X	X	X (depletion rate)	
Water Clarity		X		X	
HABs/algal Toxins	X		X		
Phytoplankton Indicator Species			X		
Macroalgal abundance	X		X		
SAV loss	X		X		
Zoobenthos/Fish kills			X		

Table 1: *Comparison of indicator variables used by the assessment methods (See Bricker et al., 1999, 2003; OSPAR, 2002; USEPA, 2004; Vollenweider, 1976; Lee et al., 1978)*

OSPAR

The OSPAR COMPP (OSPAR, 2002) is applied to all areas that are initially identified as Problem Area (PA) or Potential Problem Area (PPA), and results in classification of a water body as a PA, PPA or NPA (Non Problem Area) based on a combination of indicators from four categories: Causative Factors, Direct Effects, Indirect Effects, and Other Possible Effects of nutrient enrichment. A score is determined for every element in each category where, in general, an indicator that is equal to or below a background or reference level (RL) (determined from a similar but pristine site, from historical data or from model results) is indicated as a NPA. Values between RL and 1.5RL are considered PPA, and values above 1.5RL are considered indicative of a PA. Increasing trends, compared to previous years (or decreasing in the case of DO concentrations), can be used in the evaluation to indicate a PA. An overall classification is determined by considering the category scores using a one-out-all-out criterion. For example, one PA score in a category will result in the entire category being classified as a PA. Thus, there is no weighting of direct and indirect effects with respect to potential consequences for the ecosystem or severity of impact.

EPA NCA

The NCA Program is implemented through a federal - state partnership and is national in scope with several

overall indicators; the Water Quality Indicator (WQI) describes nutrient related conditions (US EPA, 2004). Samples for the WQI are taken once per year during an index period in all estuaries and coastal water bodies included in the study at sampling locations determined via a random probabilistic model. All samples are collected during late summer, within a three month window, with the assumption that conditions are constant during that time period. The WQI combines data on the status of 5 indicators: Dissolved Inorganic Nitrogen (DIN), Dissolved Inorganic Phosphorus (DIP), chlorophyll, water clarity, and Dissolved Oxygen (DO), with no weighting of the indicators. The WQI is intended to characterize acutely degraded conditions within coastal regions, not individual water bodies.

OECD

During the 1970s the OECD sponsored an international study of the relationship between nutrient loading and nutrient related water quality for 22 countries and 200 lakes and impoundments based on preliminary work of Vollenweider (1976). His work showed a relationship in lakes between normalized phosphorus load and mean summertime Chl a, Secchi depth and hypolimnetic oxygen depletion rate. Data for about 800 lakes were used to determine thresholds among eutrophication impact levels which were termed: eutrophic, mesotrophic and oligotrophic. Studies using this method have included a few estuaries. However, due to the focus on phosphorus as the limiting nutrient to algal growth this method is primarily used in freshwater systems. The complexity and dependencies of eutrophic symptoms reduce the applicability of this approach to estuarine and coastal systems.

China

Various methods exist, largely based on water chemistry. For instance, the Nutrient Index (NI) in seawater compares Chemical Oxygen Demand (COD), Dissolved Inorganic Nitrogen (DIN) and Dissolved Inorganic Phosphorus (DIP) to a standard product of COD, DIN and DIP in Chinese waters to determine eutrophic status (Eq. 1). A water body is considered eutrophic if NI > 1.

$$NI = \frac{C_{COD} C_{DIN} C_{DIP}}{4500} \quad \textit{(Eq. 1)}$$

		ASSETS and NEEA	EPA NCA	OSPAR COMPP	OECD	China Nutrient Index
Grouping of Variables	Pressures (Influencing Factors)	Nutrient load		DIN, DIP Concentration Nutrient Load	P load normalized by depth, area and hydraulic residence time	
	Primary Symptoms (Direct Effects)	Chl a, Macroalgae		Chl a, Phytoplankton indicator spp, macroalgae /microphytobenthos		
	Secondary Symptoms (Indirect Effects)	HABs, SAV loss, DO		DO, zoobenthos / fish kills		
	Other or No grouping		DIN, DIP, Water Clarity, Chl a, DO	Algal toxins	Chl a, Secchi depth, DO depletion rate	COD, DIN, DIP
	Temporal focus	Annual cycle	Summer index period	Growing season for Chl, winter for nutrients, annual for DO	Summertime	
	Indicator Criteria	Thresholds determined from national studies	Thresholds determined from national studies	Comparison to reference station		NI >1 is eutrophic
	Combination Method	Average of Primary symptom and Highest Secondary symptom scores are combined by matrix. Secondary impacts have higher weight.	Ratio of indicators: good/fair indicators to poor/missing data. No weighting of variables.	One-out-all-out for each indicator group, ratio of results for 4 indicator groups. No weighting of variables.	Log/log relationship used to determine from Chl a and normalized P load data the thresholds between eutrophic, mesotrophic, oligotrophic conditions	(DOC*DIN*DIP)/4500

Table 2: *Summary comparison of three assessment methods (See Bricker et al., 1999, 2003; OSPAR, 2002; USEPA, 2004; Vollenweider, 1976; Lee et al., 1978)*

Applications

US National Surveys

NEEA 1999: Data for conditions and trends in 138 US estuaries and the Mississippi/Atchafalaya River Plume were collected in a series of questionnaires, site visits and regional workshops. Results show that 84 of 138 US systems have moderate to high eutrophic conditions, representing 65% of estuarine and coastal water bodies. Further, 86 systems were expected to become worse in the future, with only 8 expected to improve from the early 1990s to the year 2020 (Bricker et al., 1999).

NEEA Update 2004: Preliminary results of a recent update of the 1999 NEEA shows that in the early 2000s there are still a significant number of US systems that are

highly impacted. Eutrophic conditions were moderate to high in 63 systems (57% of the total water body surface). As in the 1999 analysis, estuaries with high levels of eutrophic conditions were found in every region. During the decade between studies, conditions improved in 35 systems but worsened in 27 systems. Moreover, these results show that we know less now than we did a decade ago; the number of systems with inadequate data for assessment increased from 17 in the early 1990s to 43 in the early 2000s (http://www.eutro.us; Bricker et al., in prep.).

Interaction with other models

ASSETS is a highly aggregated screening model and may draw on measured data and/or research models as information sources. In particular, the evaluation of management scenarios can be made by using ecosystem models to assess changes in pressures due to management action on drivers (see e.g. Nobre et al., 2005). Additionally, a subset of the ASSETS approach can be used at the local scale, as in the example below.

Aquaculture screening models

Table 3 shows an application of the FARM model for the evaluation of the role of shellfish in reducing eutrophication. This assessment uses a simplified version of ASSETS (http://www.farmscale.org). A medium density of mussels in suspended raft culture provides the best solution with respect to production, Average Physical Production (APP - the ratio of harvest to seed biomass), income and reduction of eutrophication symptoms.

Farm	Dimensions (m)	Species	Cultivation (d)
	300X20X10	Blue mussel	180
Food	Chl *a* (µg L^{-1})	POM (mg L^{-1})	TPM (mg L^{-1})
	15	15	25
Environment	Current speed (m s^{-1})	T (°C)	O_2 (mg L^{-1})
	0.01	15	5.8
Cultivation scenario	Low	Medium	High
Density (ind m^{-2})	10 (all)	100 (all)	400 (all)
Sections 1,2,3			
Total seed (X10^3 ind)	600	6000	24000
Total harvest	14.6	60.3	63.3
(ton fresh weight)			
Average physical product	0.72	4.02	1.06
Final mean Chl *a* (µg L^{-1})	11.9 →	4.15 →	1.1
Final minimum O_2 (mg L^{-1})	5.7 →	5.28 →	4.7
ASSETS score	Good →	High →	Good
Income (k)	73	202	217

Table 3: *Environmental assessment for a shellfish aquaculture farm - the ASSETS model (above the dotted line: initial conditions, with scenario changes underlined; below the line: model outputs)*

Low cultivation densities have very little impact on Chl a concentration in the water column, high densities exceed the farm carrying capacity, resulting in very low growth (APP H 1). The reduction in DO due to mussel respiration at high cultivation densities worsens the ASSETS score for this secondary symptom.

International application

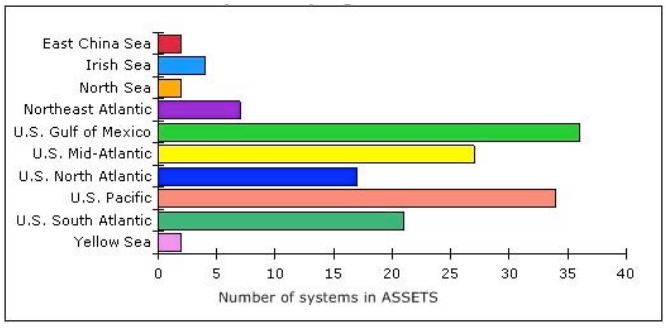

Figure 1: *Application of ASSETS to coastal systems*

The ASSETS model has been applied to a number of estuarine and coastal systems in the European Union and China (Fig. 1). From this work, which has taken place over the last five years, there have been significant developments to the rationale. As an example, the practice in China of using the opportunistic seaweed Enteromorpha (Fig. 2) as a food source means that the occurrence of this primary eutrophication symptom is seen as an asset rather than a liability by the local population.

Figure 2: *Seaweed Enteromorpha (photo: Joao Ferreira)*

The model now reflects this perspective, and a large-scale evaluation of coastal eutrophication in China is currently starting through a collaborative project - Trophic Assessment In China (TAICHI) - with the collaboration of Chinese LOICZ. The initial focus is on keystone systems such as the Changjiang and Pearl River estuaries (http://www.eutro.cn).

The application of ASSETS is implemented through a web-based interface (http://www.eutro.org and the US NEEA through http://www.eutro.us). Scientists who are interested in applying this approach to estuarine or coastal areas throughout the world are welcome to contact the authors.

Acknowledgements

We are grateful to A. Newton for introducing and promoting the ASSETS methodology to the LOICZ community, and to A.J.S.Hawkins for making available the ShellSIM model.

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LOICZ News

SPICE/LOICZ/ATSEF/SEACORM (SLAS) Southeast Asia Coastal Governance and Management Forum: Science Meets Policy for Coastal Management and Capacity Building, Bali, 14th - 16th November 2006

Dr. Eberhard Krain (SPICE), eberhard.krain@zmt-bremen.de, and Frida Sidik (SEACORM), frida_sidik@yahoo.com

From November 14-16 the Southeast Asia Coastal Governance and Management Forum: Science Meets Policy for Coastal Management and Capacity Building

took place at the Balihai, in Bali. The conference had been jointly organized by the Indonesian-German research Initiative Science for the Protection of Indonesian Coastal Marine Ecosystems (SPICE), the Land-Ocean Interactions in the Coastal Zone (LOICZ) project, the Arafura & Timor Seas Expert Forum (ATSEF) and the Indonesian host, the Southeast Asia Center for Ocean Research and Monitoring (SEACORM).

About 120 scientists, policy-makers and coastal practitioners from 11 countries participated. The conference was opened by the Chairman of the Marine and Fisheries Research Agency of the Ministry of Marine Affairs and Fisheries. The conference dealt with four themes:

1. Supporting policy development for a resilient coast,
2. The coast as a vulnerable social-ecological system: I. Coral reefs, sea grass beds, mangroves,
3. The coast as a vulnerable social-ecological system: II. Rivers, estuaries and up-welling systems, and
4. Disaster risk and coastal management as a multi-level governance issue. Each session was introduced by a renowned keynote speaker and then followed by oral presentations. In total 4 keynotes and 35 oral presentations were held. Additional topics were presented on 58 posters.

Figure 1: *Beverly Goh, leader of the LOICZ Southeast Asia Node, gave an introductory speech about LOICZ activi-*

On the second day of the conference two excursions were undertaken in order to familiarize conference participants with coastal issues in Bali. One excursion was conducted to the SEACORM facilities at Perancak in the West of Bali, where the remote sensing facilities were shown and a trip made to Perancak village where a turtle conservation project was visited. A second excursion was conducted to the Mangrove Information Center (MIC), Bali Post Group office, and to sites near and around the famous beaches of Sanur and Kuta where environmentally friendly tourism examples were shown and discussed.
On the last day of the conference participants also deliberated about a) how the SPICE program can be further improved for the future second phase, b) how the linkages between SPICE and other networks can be strengthened, and c) how the gap between science and coastal management can be better bridged.

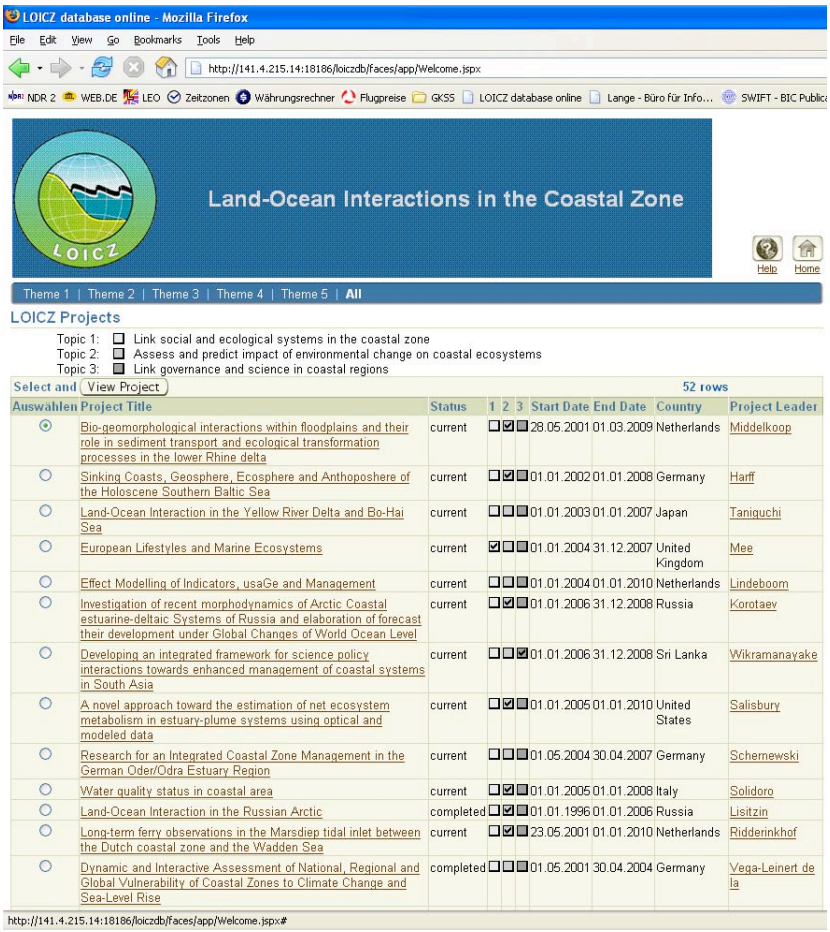
During the conference a wealth of interesting scientific results was presented and discussed. Progress was also made with respect to introducing socio-economic to otherwise strong natural science related research. An important connection was also made between research addressing gradual and sudden changes because of extreme events such as tsunamis. The link between science and policy- and decision making was strengthened through the conference to some extent. Overall the conference had been a very successful event bringing together many scientists from Indonesia, Germany, Australia and the southeast Asian region.

The LOICZ project database - a new feature on the website

LOICZ provides a forum to assimilate, integrate and synthesise the outputs of affiliated projects. Additionally, it provides an opportunity to communicate and disseminate these outputs making them available not only to other scientists, but also the public, decision-makers and managers. Information on affiliated projects is held on a central database that is accessible online through the LOICZ website now. It makes basic information and regular updates available to the wider community as well as to LOICZ for its reporting requirements.
The database accomplishes an essential element that applies for all LOICZ interdisciplinary studies within and beyond the project namely data sharing and exchange.

LOICZ protects its community members by restricting access to contact details in the public part of the database. But every community member and person interested in the activities affiliated to LOICZ is invited to register and then view full contact details and be able to submit and edit own projects.

Figure 1: *The database provides a comprehensive list of affiliated projects and links allow to learn about individual projects in more detail.*



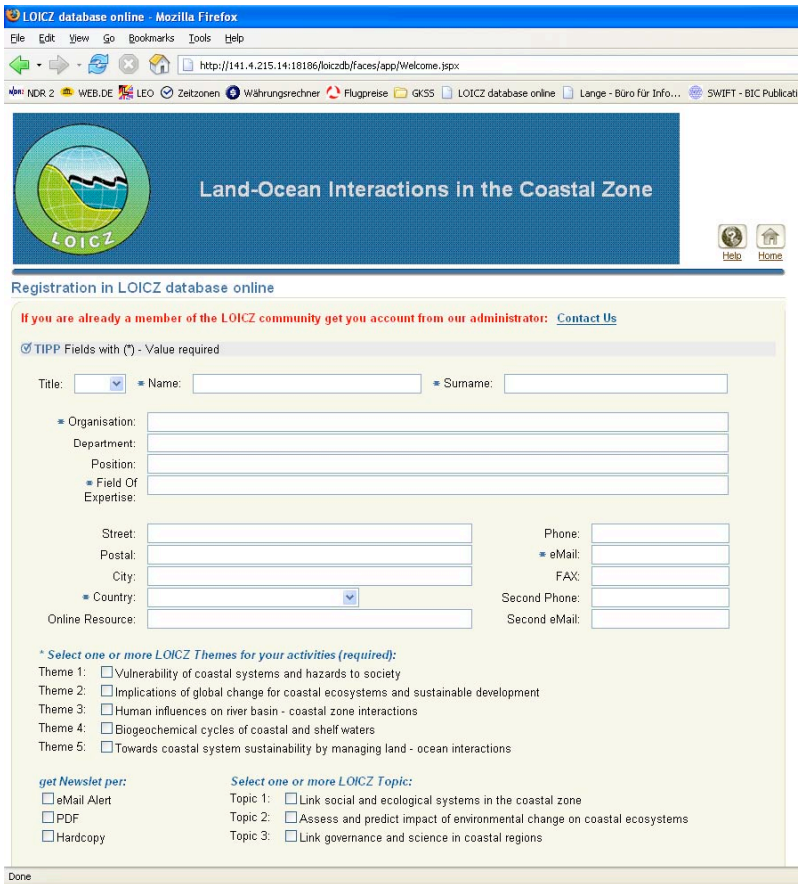


Figure 2: *Registration form of the LOICZ database. Active or formerly active members of the LOICZ community should contact the IPO for registration. Everybody else is invited to fill in this form. Fields marked with a * are required, but the more information we hold about community members the better can we inform them about relevant activities and involve them in LOICZ work.*

As the database is linked to the LOICZ contact database, all newsletter recipients are already recorded. If you wish to receive your login name and password for the database, please do not use the form as shown in figure 2, but send us an email to loicz.ipo@loicz.org

Call for research proposals concerned with Land-Ocean Interactions in the Coastal Zone

LOICZ has developed three key topics that will form the focus of research interest in the coming years. Within all three topics, LOICZ seeks to expand its network of scientists by endorsing research activities concerned with any of these topics on a global, regional or national level. Within these topics LOICZ strives to develop:

- methodologies or models that allow data assimilation, processing and synthesis, including up and/or down scaling;
- scenarios of change and/or response to change in socio-ecological systems;
- scientific context for the evaluation of existing policies and structures
- globally applicable tools for scientific synthesis, decision support and structure development; and
- dissemination interfaces to provide information and assist sustainable coastal development on appropriate scales.

To achieve this, **LOICZ is calling for proposals to bring high quality research activities into the LOICZ cluster of affiliated projects.** As well as fundamental science projects, we also seek projects that have a multidisciplinary perspective, especially combining natural and social sciences. Projects can have global, regional or local scales and be focussed on coastal sciences and/or coastal management. Projects that collaborate with other Earth Science System Partnership (ESSP) projects, especially with other Core Projects of IHDP and IGBP, are sought in particular, as well as projects that synthesise and analyse research outcomes already available or involve dissemination and outreach that will lead to better public knowledge. Examples of projects already affiliated to LOICZ can be found on the LOICZ website under Projects.

Although LOICZ cannot offer funding to affiliated projects, its endorsement provides the following benefits:

- support in proposing for funding;
- promotion of the project and associated activities, its contributing team, outputs and outcomes through the LOICZ website and/or newsletter;
- contribution to workshops, conferences and meetings organised by LOICZ and hence establish linkages to other projects operating in similar fields and/or addressing similar issues; and
- access to a wide circle of information related to funding and the science community that is available through the LOICZ database.

Researchers whose work fits into this LOICZ portfolio are encouraged to submit proposals to the LOICZ IPO as soon as possible. The required form and additional information can be obtained from the LOICZ website or via contacting the LOICZ IPO.

Water, Sea level, Storms and Urbanization - Coasts at Risk

At the 1st ESSP Open Congress (09-12. Nov. Beijing, China) LOICZ and Earth System Partners took an interdisciplinary look onto coastal change, risks and risk-perception, and challenges to science

The first Earth System Science Partnership (ESSP) Congress proved to be a platform for vital discussions about the central role of coastal zones for social and ecological development. As "Society's Edge" coastal zones had quite correctly been characterized earlier as a major trajectory of human development and a mirror of welfare and also of pressures and change. LOICZ, drawing on its new Science Plan, focuses on socio-ecological system perspectives. By looking into biogeochemical and physical change in the wider context of human choice and governance LOICZ engaged in three topical sessions. The multiplicity and competence of the co-convening partners were an expression of the high complexity of current and future coastal change issues underlining strongly the need for partnership and collaborative action in future coastal earth system science. Here a brief summary and highlights of the sessions:

In **"How do coastal and freshwater systems interact under the global water system?"** (Session 21) Global Water Systems (GWSP) and LOICZ jointly looked into a variety of issues. The river-coast continuum, and its characteristic material fluxes and change received central attention, because they trigger the increasing risk of deltaic regions. The rational for the session was to cover issues common to freshwater, coastal systems and the global water system such as:

- effective and efficient governance,
- environmental flows,
- freshwater and coastal nutrient fluxes and the global nutrient cycles,
- impacts of river diversions,
- land use change, and
- climate change.

The goal was to develop a framework for linking science and resource management, and to define a strategy for collaboration and a network for research. In review of current knowledge and understanding of links between hydrological processes and coastal change it was intriguing to review the relevance of human intervention in the water and material flux cycles and to see the relative impact this triggers in observed coastal change, e.g. erosion. Society's increasing water demand in tandem with and partly as a response to global change is triggering enormous efforts of catchment engineering. While this phenomenon can be traced back for thousands of years of human development and intervention, pressures to date have reached a level where in many places signals of coastal subsidence in highly populated areas can be attributed much more to anthropogenic forcing inland rather than for instance sea level rise. Oral papers in detail:

F. Lansigan (Philippines): Rationale for Session 21, Link between GWSP and LOICZ;
A. Ducharne (France): Evolution of water and nutrient fluxes from a human impacted river under plausible changes of anthropogenic pressures during the 21st century;
V. Kourafalou (USA): Changes in freshwater and nutrient fluxes around the Florida keys national marine sanctuary: Everglades restoration project and river inputs;
S. Haida (Morocco): Geomorphological response of regulated rivers and climate change in the Sebou coastal zone;
T. R. Healy (New Zealand): Climate change impact on sedimentation in New Zealand estuaries;
J. Alcamo (Germany): New scenarios of future freshwater inflows to major world estuaries under climate change;
M. B. Endejan (Germany) Providing a holistic view of the global water system through a digital water atlas.

Session 26 focused on **"Global environmental change, natural disasters, and their implications for human security in coastal urban areas".** Together with IHDP's Human Security and Urbanization projects GECHS and UGEC catastrophic events of recent years were investigated to look at the linkages between human security and global environmental change. This included discussing whether and to which extent hazards to coastal communities can exclusively be attributed to global, namely climate driven changes, as compared to anthropogenic forcing. It became clear that in some cases human intervention of coastal land and sea use can actually override those signals currently attributed to climate change. However, it is an interesting observation that relatively little attention has been given to the differential vulnerability extreme events expose and the opportunities that exist for reducing their negative consequences. This is a very complex issue because beyond scientifically proven facts or credible scenarions there is an obviously strong role human perception plays in the evaluation of what determines coastal risk and the uncertainty, triggering the level of preparedness to respond. Being specifically prone to coastal hazards that affect a large number of people at the same time and in their role as a key pillar for multiple national economies coastal urban areas are in the center of this discussion. Integrated approaches are needed to describe the links between global environmental change, and coastal urban security. Oral papers in detail:

M. Pelling (UK): Natural disasters and social instability in urbanized coastal zones;
H. von Storch (Germany): Storm surges: The case of Hamburg, Germany;
A. de Sherbinin (USA): Interactive vulnerabilities: A systematic assessment of population and land area in distribution in urban coastal zones;
N. B. Alungal (India): Management strategies for urban coastal zones: Integrating DPSIR concepts with GIS tools in people's participatory programmes.

For **"Sealevel rise, vulnerability and impacts"** (Session 36) NOAA, WCRP and LOICZ joined forces to explore challenges the climate and global change research community is increasingly facing as to better focus on coastal people, infrastructure, ecosystems, and their goods and services. While it is commonly shared that sea level rise and variability is a global issue spanning the earth sciences as a whole, this session revealed the still considerable level of uncertainties in our understanding of observed sea level rise. In addressing the consequences of those uncertainties and expected impact scenarios it became clear that public perception is often based on limited or even false information. Commonplace arguments that evolve around the impacts of warming, storm surges and sea level rise may hold for the global scale but need to undergo scientifically sound regional review, if impact scenarios are to be developed on regional or even smaller scale. In other words Synthesis and initial modeling efforts need to look at both, the global change factors that determine vulnerability of socio-ecological coastal systems and - more on regional or smaller scale potential ways for adaptation to avoid and/or mitigate the physical, ecological and societal impact of sea level rise on all levels relevant for human society. Monetarization of coastal goods and services, their eventual losses and

response options are helpful tools for improvement of informed decision making. This will also generate new demands for the monitoring and observation community as well as quality and variety of data which help building meaningful scenarios. Oral papers in detail:

J. A. Church (Australia): Understanding sea level rise;
H. von Storch (Germany): Detailed projections of coastal climate change until 2100 in Northern Europe, (PS 37/O3);
N. Mimura (Japan): Impacts of sea level rise and coastal vulnerability in the Asia and Pacific Region;
N. Harvey (Australia): Australian approaches to coastal vulnerability assessment and sea level change;
R. J. Nicholls (UK): Coastal vulnerability and sea level rise and variability: A national to global perspective.

We are grateful to the conference organizers for the excellent setup and for providing this great opportunity for exchange and we express our sincere gratitude in particular to all the presenters including the numerous high quality posters. We are planning (subject to permission) to post the presentations of the contributors to these very inspiring sessions on the LOICZ website early 2007.

The future of the LOICZ Typology - Conceptualizing coastal classification and interpretation of complex data relations

Realistic scenarios and scientific questions require data on multiple biophysical and human dimension attributes of the coastal zone at a variety of spatial and temporal scales. One of the difficulties with interpreting the scientific results of data collection or modeling of coastal systems is visualizing and understanding the large amount of spatial and temporal data produced. Typology is one method of data exploration and visualization by compressing high-dimensional spatial and temporal data into categories that are easier to visualize and comprehensive. It enhances understanding of models and data by connecting complex relationships within the data to semantic meaning. This is done by grouping the data into categories that exhibit similar variable values and consistent relationships between different variables.

All typologies, fully supervised or data-driven ones, require various levels of expert knowledge to define group exemplars, group boundaries or to create the categories and to define their semantic meaning, to weight their importance, or to select the method of identifying the natural groupings within the data. In LOICZ typology has been developed and used to discover relationships between variables within a data set. Because each typological group exhibits particular relationships between variables, it can be used for analogy-based reasoning and for discovering spatially or temporally disparate areas that exhibit similar patterns. In other words it is very helpful for example as a means for up-scaling.

In LOICZ I the development of databases and software, primarily in connection with user-based workshops has made substantial progress. However, development of auxiliary materials such as tutorials, user guides, and demonstration datasets fell behind. These materials represent value-added to scientific, management, and educational audiences and their development will be a primary focus of the next few years. Development of these materials will occur both as targeted activities in small working meetings of LOICZ scientists and as somewhat larger (but still focused) workshops. These will involve members of the above audience groups focusing on multiple non-scientific user groups as well as partners from the Earth System Science community. As such the typology cross cutting activity in LOICZ will provide both downloadable materials for capacity building, and educational activities themselves.

Figure 1: *The workshop participants are discussing past and future of the LOICZ typology. From left: Bruce Maxwell, Bob Buddemeier, Ganapuram Sreedhar, Dennis Swaney, Gianmarco Giordani, Maike Paul, Martin Le Tissier*

A workshop was held at the IPO between 17 and 21 November to develop a first strategic outline of the maintenance and the future direction of the LOICZ typology study and approaches that meet the demands of the new LOICZ. The workshop was attended by Bob Buddemeier, Bruce Maxwell, Dennis Swaney, Gianmarco Giordani and Ganapuram Sreedhar (Erasmus Mundus Fellow) along with Hartwig Kremer, Maike Paul and Martin Le Tissier from the IPO and Gisbert Breitbach from the GKSS Institute for Coastal Research. Three general areas were discussed:

- LOICZ typological tools and their development
- LOICZ datasets and their development
- Personnel and financial requirements in support of the above

Besides the further development of methods and tools as well as multiple user interfaces, the future typology will seek to make biophysical and human dimension data easily accessible and include them into the manipulation and visualization tools. An element of the capacity building mentioned above will also be developed to educate the coastal zone science, management, and stakeholder community about the value of typology as a method of

enhancing understanding of complex data and communicating results and implications to managers and policy-makers. Specific areas that will be developed include:

- Further development of the DISCO tool (http://www.loicz.org/loicz_nl/1143436b19f9ec83839a82b9b5676207.php)
- Development of the next generation of database and typology tools
- Development of links and partnerships with other projects and researchers whose data could contribute to the LOICZ typology
- Instigation of a series of workshops to facilitate the development and use of the LOICZ typology

GKSS has enabled LOICZ to establish a solid foundation for the necessary hardware and pave the way for the long-term further development of coastal typologies in Earth Sciences. This includes establishment of a server that will allow LOICZ in a first step to set up a mirror of the database currently hosted by the Kansas Geological Survey - this should be online by mid to late 2007 - with analytical software to follow in the third and fourth quarters of 2007. The scientific work in the further development of the typology will run in parallel likely for the lifetime of the project. A more detailed article will be featured in one of the next LOICZ INPRINT volumes.

New LOICZ Regional Node to be set up in Yantai, China - Initial talks underway between LOICZ IPO and YIC

The Yantai Institute of Coastal Zone Research for Sustainable Development (YIC) is in discussion with the LOICZ IPO on hosting a LOICZ Regional Node in the institute. The YIC is newly established by the Chinese Academy of Sciences in collaboration with the Shandong Provincial Government and the Yantai City Government. The institute is focusing its research on coastal-zone resources and environment and their sustainable utilization (http://www.yic.ac.cn/). Initial fruitful discussions have been made between Dr. Hartwig Kremer, CEO of the LOICZ IPO, and Prof. Dr. Ping Shi, Director of the YIC. They both agree that a LOICZ Regional Node in the YIC would be mutually beneficial in promoting LOICZ activities and fostering the scientific networking in coastal change research throughout China and in East Asia but also in fostering the YIC research capacity building.

START/PACOM Regional Node for Wetlands and Coastal Zone Management - a nucleus for regional LOICZ research

Host Institution: Centre of African Wetlands, University of Ghana, Legon Accra Ghana
Prof. Chris Gordon, cgordon@ug.edu.gh

Africa's wetlands and coastal zones are critical to the livelihoods of several million people, supplying vital resources of fish and materials, as well as providing critical ecological functions and services. The rapid growth of coastal cities is one of the most pressing environmental concerns in Africa and coastal zones mirror all the pressures originating from demographic change, agriculture, fisheries, and water management in one place, the interface between marine and river systems, infrastructure, and urban and industrial development.

This new initiative creates a regional node for wetlands and coastal zone management in Africa under START/PACOM (Pan-African Regional Committee for START). The immediate target group is African researchers and young scientists working in the area of conservation and management. The overall objective is to understand the implications of global change on ecosystems so as to provide data and research results that will contribute to the integrated management of a healthy and productive environment in Africa. This would be a significant contribution to the fundamental human needs expressed in the Millennium Development Goals such as clean water, appropriate sanitation, food security and economic development all of which largely depend on a healthy environment.

The **specific objective** of the START/PACOM node is **to catalyse concerted regional research and training in the area of Global Change science focusing on wetland and coastal habitats.** The node will accomplish its objective by creating an enabling environment for conservation and management. It will deliver three outcomes:

1. Formation and consolidation of regional networks of experts, practitioners, decision makers and other stakeholders.
2. Enhanced capacity for wetlands management and research at regional level by the support of young scientists.
3. Increased awareness of the importance and values of wetlands and the coastal zone amongst decision makers and other stakeholders at regional level.

These three specific goals are integral to the underlying mission of the Centre for African Wetlands which is to contribute to the preservation of **the global, regional, national and local values of West African wetlands for the benefit of society as a whole.** The activities of the Centre seek to maintain wetland biodiversity and enhance the general ecological integrity of wetlands and through this improve the quality of life for people living within and around wetlands. After a stakeholder analysis and participatory identification of research priorities spanning 12 West African countries, the Centre and its network selected several over arching issues as core; these are Poverty Alleviation; Gender equity; Capacity

building; Partnerships; Conflict Resolution; Trans-boundary Issues; Good Governance. The research focus for the network was distilled into four main areas:

- Inventory and Classification: Mapping; Hydrology; Biodiversity; Sustainable Use;
- Long term Assessment and Monitoring: Methodologies; Indicators; Key wetland areas; Ramsar support activities;
- Pollution/Degradation/Contamination: Climate Change; Invasive and Exotic Species; Watersheds; Disease;
- Conservation and Utilization: Local Livelihoods; Ecotourism; Traditional Knowledge Systems; Laws and Policy.

The current activities of the Centre and the planned activities of the START/PACOM regional node (i.e. Graduate Student support; Information dissemination, Communications, Sub-Regional Workshops) provide opportunities for synergy with the LOICZ regional and global implementation, specifically focusing on its three priority topics:

- Linking Social and Ecological Systems in the Coastal Zone
- Assessing and Predicting Impact of Environmental Change on Coastal Ecosystems
- Linking Governance and Science in Coastal Regions

The Centre activities in the START/PACOM regional node also support the ideas underlying the ICARM concept (Integrated Coastal Area and River Management) of UNEP (UNEP/MAP/PAP, 1999) as well as the management requirements outlined in the FreshCo Partnership (Ipsen, et al., 2002, and http://teams.dhi.dk/freshco), that is the need for:

- The enabling environment - the general framework of national legislation, strategies and policies, and the dissemination of information for natural resources management stakeholders. This framework constitute the "game board and the rules of the game" and enable all stakeholders to play their respective roles in the development and management of the resources.
- The institutional roles that allow effective interaction between various administrative levels and stakeholders. Collaborative mechanisms and "fora" are needed to facilitate the stakeholder participation.
- Management instruments, including operational instruments for effective planning, regulation, implementation, monitoring and enforcement. With such instruments the decision-makers will be able to make informed choices between alternative actions. These choices are based on agreed policies, available resources, environmental impacts and the social and economic consequences. (Ipsen, et al., 2002)

The institutional setting and location of the Centre for African Wetlands as a NGO hosted by the University of Ghana promotes rapid response to issues as well as providing an academic environment for its work. It is governed by a Management Board and a Scientific Steering Committee made up of senior scientists from the region and international wetland experts. The Centre for African Wetlands has its own purpose-built structures on the park like campus of the University. The 1200 m^2 building is made up of eleven offices; a seminar room for up to 50 people, a library and a laboratory. The Centre also has an auditorium for 150 people and an ICT connected basement facility. The START/PACOM regional node will support and promote all relevant LOICZ projects and activities and this new initiative is expected to improve the flow of information and the quality of research within the region.

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Figure 1: *General view of the Centre for African Wetland*

Figure 2*: Group discussions in the Centres' library by participants the Centre for African Wetlands (CAW)-United Nations Development Programme (UNDP) Capacity Building in Integrated Water Resources Management in Ghana Training Workshop for Key stakeholders*

The backbone of LOICZ: affiliated projects

LOICZ has a mandate to address key issues of coastal change and use in the context of scenarios of future human activity and environmental change. LOICZ endorses and seeks to support both fundamental coastal zone research and research that synthesises and up-scales results for dissemination within the scientific c o m m u n i t y, and outreach to policy makers and the public.

This research is partly carried out by groups of scientists, aided and supported by the LOICZ IPO, Regional Nodes and/or SSC, with funds that LOICZ has secured from external funding agencies. Another important part of the LOICZ project is carried out by researchers who affiliate their projects to LOICZ thereby becoming part of the global network of LOICZ. These projects build the backbone for up- and down-scaling of LOICZ results and the LOICZ synthesis. LOICZ has recently restructured the affiliation process so that applications for affiliation will be reviewed by the IPO and the coordinator of the theme/topic they are contributing to most. This new procedure will allow LOICZ to maintain an up-to-date record of global research activity as relates to the LOICZ Science Plan as well as ensure that affiliated projects are given opportunity to fully participate in LOICZ activities such as workshops and joint projects.

LOICZ provides a forum to assimilate, integrate and synthesise the outputs of affiliated projects. Additionally, it provides an opportunity to communicate and disseminate these outputs making them available not only to other scientists, but also the public, decision-makers and managers. Information on affiliated projects is held on a central database that will in the near future be made available on-line so that basic information and regular updates are available to the wider community as well as to LOICZ for its own reporting requirements.

An essential element that applies for all LOICZ interdisciplinary studies within and beyond the project is data sharing and exchange. To facilitate this exchange LOICZ has developed a Data Policy to help affiliated projects and LOICZ to fully benefit from each other. Both documents, the Terms of Reference for affiliated activities and the Data Policy, can be found on the LOICZ website.

Call for research proposals concerned with Land-Ocean Interactions in the Coastal Zone

LOICZ has developed three key topics that will form the focus of research interest in the coming years. Within all three topics, LOICZ seeks to expand its network of scientists by endorsing research activities concerned with any of these topics on a global, regional or national level. Within these topics LOICZ strives to develop:

- methodologies or models that allow data assimilation, processing and synthesis, including up and/or down scaling;
- scenarios of change and/or response to change in socio-ecological systems;
- scientific context for the evaluation of existing policies and structures;
- globally applicable tools for scientific synthesis, decision support and structure development, and
- dissemination interfaces to provide information and assist sustainable coastal development on appropriate scales.

To achieve this, **LOICZ is calling for proposals to bring high quality research activities into the LOICZ cluster of affiliated projects**. As well as fundamental science projects, we also seek projects that have a multidisciplinary perspective, especially combining natural and social sciences. Projects can have global, regional or local scales and be focussed on coastal sciences and/or coastal management. Projects that collaborate with other Earth System Science Partnership (ESSP) projects, especially with other Core Projects of IHDP and IGBP, are sought in particular, as well as projects that synthesise and analyse research outcomes already available or involve dissemination and outreach that will lead to better public knowledge. Examples of projects already affiliated to LOICZ can be found on the LOICZ website under Projects.

Although LOICZ cannot offer funding to affiliated projects, its endorsement provides the following benefits:

- support in proposing for funding;
- promotion of the project and associated activities, its contributing team, outputs and outcomes through the LOICZ website and/or newsletter;
- contribution to workshops, conferences and meetings organised by LOICZ and hence establish linkages to other projects operating in similar fields and/or addressing similar issues; and
- access to a wide circle of information related to funding and the science community that is available through the LOICZ database.

Researchers whose work fits into this LOICZ portfolio are encouraged to submit proposals to the LOICZ IPO as soon as possible. The required form and additional information can be obtained from the LOICZ website

IPO Notes

SSC Update

After serving on the LOICZ SSC for 2 years Dr. Nalin Wikramanayake from Colombo, Sri Lanka has served his term and will rotate off the SSC as of the 1st of January 2007. We would like to thank Nalin on behalf of the whole SSC and IPO for his valuable input.

The regional IPO Node for the South Asia Region remains in the capable hands of Dr. Wikramanayake and we look forward to continue our collaboration in the future.

New face in the SSC

Prof. Dr. R. Ramesh

ramesh@annauniv.edu

Prof. Dr. R. Ramesh is currently Director and Professor at the Institute for Ocean Management, Anna University, Chennai, in India.

The main activities of the Centre are to coordinate in research, dissemination of information and development of interaction with multi-disciplinary groups and user industries working in coastal zone issues.

Prof. Dr. R. Ramesh received his M.Phil and Ph.D in Environmental Sciences from Jawaharlal Nehru University, New Delhi and another Ph.D degree in Marine Sciences from McGill University, Canada.

His current research interests include Global Climate Change and Biogeochemical Cycles in Coastal and Riverine Ecosystems, Coastal and Ground water Hydrology .

He is a recipient of the Technology BOYSCAST Department of Science (Better Opportunities for Young scientists in Chosen Areas of Science and Technology) Award and the Indian National Science Academy's Exchange Award to conduct advanced research in Global Climate Change at Harvard University, USA during 1994 and the MaxPlanck Institute for Chemistry, Germany in 1996-97 respectively. In the year 2002 he was awarded DST-JSPS (Japan) Award to conduct advanced research in groundwater management. He has to his credit more than 40 research papers published in international journals. He had authored a book and edited four others relating to coastal systems research and water resources management. Dr. Ramesh has been operating several research projects sponsored by the Government of India as well as International funding agencies.

We welcome Professor Ramesh in the Scientific Steering Committee of LOICZ.

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IPO staff changes

„May I introduce myself?“

My name is Ellen-Barbe Goldberg. In the passed years in Hamburg I have been working as an assistant to senior management as well as to project managers. This was in companies who closely cooperate with Universities in national and international projects.

Most of my experiences I gained in the competency centre for broadband network in Bremen, which had the goal to promote Bremen`s path into the information society.

My recent professional involvement was in contribution to the so called “Bologna Process”, which is aimed to harmonize graduation procedures across European Universities and promotes international links and cooperation of academic institutions. My emphasis was on project management, marketing and public communication.

Since the 1st of December 2006 I support the LOICZ IPO and I very much look forward to talking to you and get to know you.

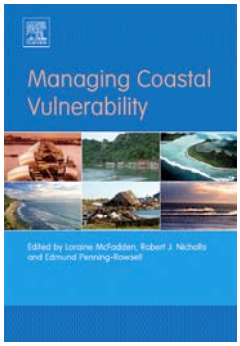
I wish you a successful and exciting new year and for 2007 all the best.

Ellen-Barbe Goldberg

Publications

Managing Coastal Vulnerability

L. McFadden, R.J. Nicholls and E.C. Penning-Rowsell (eds.) 2006: Managing Coastal Vulnerability. An Integrated Approach, Elsevier Science, Amsterdam, The Netherlands, 282 pages, ISBN-13: 978-0-08-044703-2, ISBN-10: 0-08-044703-1



This book explores the role of vulnerability analysis as an important component of Coastal Zone Management. The primary focus of the book is not on the problems that define vulnerable coastal systems per se or on methodologies or tools to quantify the vulnerabilities of coastal systems. Rather, the context and challenge of this volume is to identify opportunities and barriers to applying this knowledge in order to improve the basic status of coastal environments and their communities. Limited information currently exists as to how vulnerability can be actively reduced to promote the sustainable development and use of the coastal zone. This volume explicitly addresses this question, discussing how vulnerability can be managed to ensure sustainable coastal futures.

The book brings together a wide range of international experts to share their experience on the challenges and opportunities for managing vulnerable coasts. The chapters explore coastal behaviour across a range of spatial and temporal scales, physical coastal types and socio-economic settings. They address questions such as the purpose of coastal areas, how they function, and the dynamics of the balance between potential impacts and the effects of adaptation to climate and human-induced forcing. Building on the approaches presented within this book, cross-cutting lessons for vulnerability reduction in coastal environments and communities are developed, as well as suggestions for future research.

Communicating Science Effectively - A Practical Handbook for Integrating Visual Elements

J Thomas, A Jones, T Saxby, T Carruthers, E Abal, W Dennison, 2006, 136 p., Paperback, ISBN: 1843391252

This is a practical handbook on how to communicate science effectively. The first part is an introduction to the principles of science communication – what effective science communication is, why it is important, and how to do it. This introduction is followed by chapters outlining techniques and principles for communicating in different media - desktop publishing (including posters and newsletters), presentations and websites. Techniques in these chapters include image, color, and font formats, resolution and design tips for different media.

The book is accompanied by a case study and extensive internet resources, including interactive software tutorials for the different software programs commonly used in communication, discussion forums for science communication issues, and links to other websites of interest.
This book will be a valuable resource for scientists, working in government, research, management agencies, and education.

Although environmental scientists are the primary audience, the principles and techniques discussed are applicable to scientists from all fields.

The changing faces of Europe's coastal areas - EEA report no. 6/2006

This report provides information on the state of the environment in the coastal areas of Europe, and provides evidence of the need for a more integrated, long-term approach. Since 1995, concern about the state of Europe's coastline has led to a number of EU initiatives, which build on the concept of integrated coastal zone management (ICZM). ICZM attempts to balance the needs of development with protection of the very resources that sustain coastal economies. It also takes into account the public's concern about the deteriorating environmental, socio-economic and cultural state of the European coastline.

Delta Sedimentation - East Coast of India

Singh, I.B., Swamy, A.S.R.

Deltas are the most dynamic parts of a coastal region witnessing high rates of sedimentation, responding to the coastal evolution in response to tectonic and sea level changes. Delta-related deposits usually have a high potential of hydrocarbons as stratigraphic traps.

This book offers a comprehensive account of deltas and geological evolution of the east coast of India since its separation from Antarctica-Australia assembly and the present situation of Bay of Bengal. Oceanographic processes, sedimentation, depositional patterns of coastal zone, continental margin and Bengal Fan are discussed. The east coast of India shows a number of small and large deltas with varying hydrologic characteristics. Seven important deltas of the east coast, namely Ganga, Subarnarekha, Mahanadi, Godavari, Krishna, Penner and Cauvery are discussed in detail. Geomorphology, river mouth processes, depositional environments, vertical facies model and sand distribution patterns of each delta are given. This information is useful to develop hydrocarbon exploration strategies for a variety of delta systems.

The book is emphasizing possible delta building activities of different east coast basins in the geological past, Holocene evolution of deltas, response to changing sea-levels and systems tract concept. It is useful to hydrocarbon exploration geologists engaged in delta systems, oceanographers, physical geographers, geologists and land planners of coastal areas.

Other Publications

Buddemeier, R.W., S.V. Smith, D.P. Swaney, C.J. Crossland and B.A. Maxwell. Coastal Typology: An integrative "neutral" technique for coastal zone characterization and analysis. Estuarine, Coastal and Shelf Science, accepted.

Christian, R. R., P. M DiGiacomo, T. C. Malone and L. Talaue-McManus. 2006. Opportunities and challenges of establishing coastal observing systems. Estuaries and Coasts 9(5): 871-875.

Giordani, G., M. Austoni, J. M. Zaldívar, D. P. Swaney and P. Viaroli. Modelling ecosystem functions and properties at different time and spatial scales in shallow coastal lagoons: an application of the LOICZ biogeochemical model. Estuarine, Coastal and Shelf Science, accepted.

IGOS. A Coastal Theme for the IGOS Partnership - For the Monitoring of our Environment from Space and from Earth. Paris, UNESCO 2006. 60 pp. IOC Information Document No. 1220. http://www.igospartners.org/docs/theme-reports/IGOS COASTAL REPORT midrez.pdf

Liu, K. K., L. Atkinson, R. Quiñones and L. Talaue-McManus (eds). Carbon and nutrient fluxes in continental margins: a global synthesis. Global Change: The IGBP (International Geosphere-Biosphere Project) Series. Springer-Verlag, in prep.

Olsen, S.B., Ipsen, N., Adrianse, M. 2006. Ecosystem-based Management: Markers for Assessing Progress. The Global Program of Action on Land-based Sources of Pollution, Amsterdam, The Netherlands.

Olsen, S.B., Padma, P.V., Richter, B. 2006. Managing Freshwater Inflows to Estuaries: A Methods Guide. The Nature Conservancy and Coastal Resources Center.

Update us so we can update you

LOICZ INPRINT informs you about the LOICZ Project and its activities. But LOICZ has access to much more information and wants to make this information available to you as effectively as possible. To be able to provide you with LOICZ information that fits your expertise and interests most, we need input from your side telling us what your interests in LOICZ are and how we can contact you.

Please complete the following form where applicable and return by fax, post or e-mail to the LOICZ IPO.
(An electronic version of this form can also be found on www.loicz.org under Newsletter.)

First name:	
Last name:	
Organization/Institution:	
Address:	
Place:	
Postal code:	
Phone (include country code):	
Fax (include country code):	
e-mail:	
(Organization's) website:	
Field of expertise:	

Please indicate which LOICZ theme(s)* you are contributing to:

❑ Theme 1 ❑ Theme 2 ❑ Theme 3 ❑ Theme 4 ❑ Theme 5

Please indicate which LOICZ key topic(s)** you are interested in:

❑ Topic 1 ❑ Topic 2 ❑ Topic 3 ❑ other

How do you want to receive the LOICZ Newsletter in the future?

❑ hardcopy ❑ pdf-file via e-mail ❑ e-mail alert ❑ not at all

* More detailed information on the LOICZ Research Themes is available in the Science Plan on the LOICZ website (www.loicz.org)

** Detailed descriptions of the topics are featured in first issue of INPRINT and on the website

Please return this form by:

- e-mail to loicz.ipo@loicz.org
- fax to +49(0)4152 87 2040
- mail to LOICZ IPO – GKSS Research Centre
  Institute for Coastal Research
  Max-Planck-Strasse 1
  D-21502 Geesthacht, Germany

continued Publications

Olsen, S.B., Sutinen, J.G., Juda, L., Hennessey, T.M. 2006. A Handbook on the Governance and Socioeconomics of Large Marine Ecosystems. The Coastal Resources Center, Narragansett, Rhode Island.

Smith, S.V., DP Swaney, and L. Talaue-McManus. Carbon-Nitrogen-Phosphorus Fluxes in the Coastal Zone: The LOICZ Approach to Global Assessment. In: Liu, K. K., L. Atkinson, R. Quiñones and L. Talaue-McManus (eds). Carbon and nutrient fluxes in continental margins: a global synthesis. Global Change: The IGBP (International Geosphere-Biosphere Project) Series. Springer-Verlag, in prep.

Swaney, D.P., D. Scavia, R.W. Howarth, and R.M. Marino. Estuarine Classification and Response to Nitrogen Loading: Insights from Simple Ecological Models. Estuarine, Coastal and Shelf Science, in press.

Talaue-McManus, L. 2006: Pressures on Rural Coasts in the Asia-Pacific Region (Chapter 8). In: N. Harvey (ed.) Global Change and Integrated Coastal Management; The Asia-Pacific Region, APN, Springer Dordrecht, The Netherlands, Coastal Systems and Continental Margins - Volume 10, pp 197-229.

Talaue-McManus, L. Examining human impacts on global biogeochemical cycling via the coastal zone and ocean margins. In: Liu, K. K., L. Atkinson, R. Quiñones and L. Talaue-McManus (eds). Carbon and nutrient fluxes in continental margins: a global synthesis. Global Change: The IGBP (International Geosphere-Biosphere Project) Series. Springer-Verlag, in prep.

Wilson, M. A., R. Costanza, R. Boumans, and S. Liu. 2005. Integrated assessment and valuation of ecosystem goods and services provided by coastal systems. Pp. 1-24 in J. G. Wilson (ed) The Intertidal Ecosystem, Royal Irish Academy Press, Dublin 206 pgs.

Have you seen

EDULINK is the first ACP-EU Cooperation Programme in Higher Education. It is open to all countries of the African, Caribbean and Pacific Group of States (ACP) and to the 15 EU Member States that are signatories to the 9th European Development Fund (EDF).

EDULINK's overall objective is to foster capacity building and regional integration in the fi eld of higher education through institutional networking, and to support a quality higher education system that is relevant to the needs of the labour market and consistent with ACP socio-economic development priorities.
EDULINK is a programme of the ACP Secretariat and the European Commission to improve the effectiveness and the impact of ACP-EU cooperation in the field of higher education. More information is available on http://www.acp-edulink.eu/

IGBP/IHDP-LOICZ/IASC/AMAP Arctic Coastal Workshop 2007

Arctic Coastal Zones at Risk is the current working title of an interdisciplinary workshop LOICZ is planning for September 2007 jointly with International Arctic Science Committee (IASC), the Arctic Monitoring and Assessment Program (AMAP) and the International Human Dimensions Programme for Global Environmental Change (IHDP). Currently IASC and LOICZ have taken the initiative to organize this workshop addressing the physical, ecological and social Arctic Coastal issues, which will be held in Tromsø (Norway), September 2007. Focusing on processes, people and the socio-ecological coupling the workshop program will be built around the ICARP II science plan of working group 3 (Arctic Coastal Processes), the IASC Projects Arctic Coastal Dynamics (ACD) and Arctic Coastal Biodiversity (ACBio) and the LOICZ priority topics. More information will be available at the LOICZ (www.loicz.org) and IASC website (www.iasc.se) soon.

Bremen International Graduate School for Marine Sciences – Global Change in the Marine Realm

Funded by the Excellence Initiative of the German federal and state governments this Graduate School aims at educating young scientists in the field of marine sciences. Within a global-change framework these encompass the natural sciences as well as the humanities. Besides becoming experts in their special field the PhD students will get a solid background across many disciplines of marine sciences.
Structured into four Research Areas, (a) Oceans and Climate, (b) Coastal Zone Processes, (c) Marine Ecology and Biogeochemistry, (d) Challenges to Society the Graduate School covers a variety of disciplines. It offers a well-structured curriculum with a broad research training programme and the possibility to compete for internal funds.
The Graduate School offers 4 Associate Scientist Positions (one per Research Area) and 3 PhD positions. Further details and application forms are available at www.rcom.marum.de/glomar.html.

Update us so we can update you

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Calendar

Arctic Frontiers Science conference on Food web dynamics and biogeochemical fluxes in the Arctic Ocean.
21-26 January, Tromsø, Norway
www.arctic-frontiers.com

International Dialogue on Science and Practice in Sustainable Development: Linking knowledge with action.
23-27 January, Chiangmai, Thailand
www.sustdialogue.org

International Conference on Coastal Zone Environment and Sustainable Development Vulnerability, Adaptation and Beyond 12-15 February, New Delhi, India
http://czesd.tripod.com/

Workshop on the Interdisciplinary Science of Climate Changes: Basic Elements
12 March - 4 April, Buenos Aires, Argentina,
http://agenda.ictp.it/smr.php?1877

Beach drainage technology: The Way ahead?
15 April, Gold Coast, Australia
http://www.griffith.edu.au/school/eng/ics2007

For more meetings and regular updates please also visit the LOICZ website www.loicz.org

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LOICZ in brief

LOICZ aims to provide science that contributes towards understanding the Earth system in order to inform, educate and contribute to the sustainability of the world's coastal zone. LOICZ is a core project of the International Geopsphere-Biospere Programme (IGBP) and the International Human Dimensions Programme on Global Environmental Change (IHDP).

The LOICZ IPO is hosted by the Institute of Coastal Research at GKSS Research Centre which is part of the Helmholtz foundation.

LOICZ research as outlined in the science plan and implementation strategy is organised around five themes:

- Vulnerability of coastal systems and hazards to society
- Implications of global change for coastal ecosystems and sustainable development
- Human influences on river-basin-coastal zone interaction
- Biogeochemical cycles of coastal and shelf waters
- Towards coastal system sustainability by managing land-ocean interactions

The Science Plan and Implementation Strategy is available electronically on the LOICZ website and in hard copy at the LOICZ IPO.

Get involved

If you wish to contribute to **LOICZ INPRINT** please send an e-mail to: **loicz.ipo@loicz.org** or visit the LOICZ website **www.loicz.org** for article requirements.

If you have a project you would like to affiliate to LOICZ please go to **www.loicz.org** and click on research for detailed information.