Appendix III

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

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Appendix IIIA: <u>Workshop Participants</u>

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1 July   Arrival of participants in Den Haag

2 July: (am) Plenary Session
<u>Introductory, overview and tutorial presentations</u>:
- Welcome, introductions, local arrangements – Maarten Scheffers
- IGBP-LOICZ introduction – Chris Crossland.
- Typology overview – Bob Buddemeier.
- Clustering and LOICZVIEW – Bruce Maxwell/Casey Smith.

Review of pre-workshop tests, outcomes, questions (participant discussion).
Refinement of workshop strategy; development of teams and assignments.
(pm) Breakout work.
Teams of participants and resource people address specific subsets of issues and techniques.
Emphasis on classification, calibration, mastering technique.

3 July: (am) Continue breakouts.
Participants to confirm questions and projects.
Groups commence project work, supported by resource people.
Midday plenary -- evaluate progress, share experiences and interim results.
(pm) Resume breakouts.
Continue project work.

4 July: (am) Continue breakouts –
Midday plenary presentation: *Dr Bob Buddemeier – Humans in a changing coastal zone*
(pm) Resume breakouts start on product definition.

5 July:(am) Assisted breakouts – resource advisors work with participants to coordinate synthesis activities,
final preparations of products.
<u>CD master produced at noon/early pm</u> for duplication and distribution.
(pm) Plenary synthesis – overview, participant products, follow-up plans.
Meeting closure.

6 July: Departure.

<u>Postworkshop</u>:
15 September – all electronic products edited, summarized/explained, and posted to website.
Preparation of workshop report for CD and print LOICZ R&S series.

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Welcome
Participants were welcomed to the Coastal Zone Management Centre of RIKZ, The Hague, The Netherlands by Maarten Scheffers and coordination details were provided. Support arrangements and the purpose of the workshop were outlined by the workshop leader, Dr Robert Buddemeier. Participants were introduced and working documents were reviewed.

An overview of LOICZ purpose was presented by Dr Chris Crossland, as a context for the biogeochemical budgets assessments and the typological goals of the workshop.

Introduction
An introduction to the LOICZ typology approach for interpolation of data were provided by Dr Robert Buddemeier. While the typology tool has a number of applications, its relevance to the LOICZ initiatives involving global up-scaling of local assessment and evaluation of nutrient biogeochemical budget models data were identified as a primary objective for LOICZ. The application to the Africa-Europe region was central to the theme and action of the workshop, recognising that activities would be addressing a range of scales, regions and sub-regions, and global-scale trials of data cluster analysis. Additional and wider applications were considered both within LOICZ and more widely to meet participant research and interests with application to LOICZ. The LOICZ typology software and tools provided a unique method for scaling and to achieve the global assessment goals of LOICZ.

Tutorials
Database
Dr Buddemeier outlined the structure of the database, including the up-grades made especially to the Environdata sets, noting that climatic data clusters are contained only in the terrestrial cells. Apparently duplicate data sets for variables may have different discriminatory features subject to their derivation. For example the Willmot data sets are modelled to ocean and global cover (e.g., precipitation) and time-series data have been synthesised to annual statistics. It is important to understand the dataset foundation; this can be accessed through the attached metadata decriptors for each set.

The use of the database was demonstrated by Jeremy Bartley, including selection of global areas, cell types and variables. A demonstration case was carried out to address the question: "How to estimate water exchange times?" and linked to the LOICZView clustering tool for product

Upload/download of datasets was demonstrated, to provide participants with example of ability to introduce custom geo-referenced data sets or to modify existing datasets to derivative indices before clustering.

LOICZView
Dr Bruce Maxwell described the clustering tool in detail and the various sections of operation were discussed, including:
i)   Data and data variables
ii)   Processing (including selection of distance calculation and statistics)
iii)   Visualisation and options
iv)   Downloading, data format and statistical assessment of clusters, and file and image storage.
An array of new tools was discussed and demonstrated – dual and overlay function, subset tools, Eigenvector analyses and application of various filters.

<u>Biogeochemical budgets datbase</u>
The status of development and refinements to the biogeochemical budgets database was outlined by Dennis Swaney. More than 160 budget sites are collated with another 50-60 in the process of development and entry to the central database. Key variables (20-25) are being extracted from each site description to form a matrix table for typological and other analyses. (This compares with 49,000 typology cells containing about 100 variables.). The spatial range of biogeochemical variables extends up to six orders of magnitude and residence times exceed four orders of magnitude; this requires development of derivative data to obviate bias in cluster developments. The range of data quality is being assessed for the sites. Further development of the dataset and some derivative products are being addressed by a core group before final posting of the data for general access.

Tasks and Typologies Development
Participants carried out trials with the databases and clustering tools, developing familiarity with the application system in consultation with the workshop resource people. Simple typologies, mainly using climatic data, were developed during the earlier part of the workshop and these were extended to specific regional case questions or new questions through the body of the workshop.

Break-out groups (2-3 participants) and individuals worked interactively during Days 2-4 on the development of different typologies, supplemented with methodological and problem/project tutorials and discussions. Daily plenary sessions addressed progress and problems encountered by the groups, ranging from utility of the existing tools to questions for variation and amendment of the datasets and clustering/visualisation tool box. Amendments were made to the database and clustering tools as new methodological improvements were made during the workshop, including refinement and evaluation of biogeochemical budgets database and assessment of approaches and options for typological assessment.

Presentation of Developed Typologies
The task outcomes were summarised and constructive comments made on the utility of the databases and analytical techniques contained in the typology suite (Table V-1).

TABLE V-1.   Participant Contributions.

#	Name(s)	Region(s)	Subjects
1	Dr Bob Buddemeier	Global	Humans in a changing coastal zone
2	Dennis Swaney, Dr Bruce Maxwell	Global	Assessment of ΔDIP and ΔDIN from biogeochemical models data set
3	Dr Howard Waldron, Prof. Dan Baird, Prof Tickie Forbes	Southern Africa	Regional characteristics of sub-equatorial Africa for budgets settings
4	Drs Xavier Niell, Ricardo Prego	Iberian region	Gradients and drivers describing coastal types in Iberian Peninsular
5	Natasha Brion	European North Atlantic	Typology for linked riverine N and P loads to the ocean
6	Dr Amani Ngusaru, Prof. Mwakio Tole	East Africa	Comparison of expert coastal typology and differentiating variables
7	Dr J-P Gattuso	Europe	Characterising estuary and ecosystem types, and human pressures
8	Drs Lars Ramm, Christoph Humborg, Sukru Besiktepe, Adriana Cociasu, Inna Yurkova, Prof. Fred Wulff	Europe	Comparison of Baltic and Black Seas
9	Drs Charles Gabche, Nick Murray	Western Africa	Coastal typology and variables influencing nutrient fluxes
10	Dr. Christos Anagnostou, Prof Hassan Awad	Eastern Mediterranean	Scaling issues and data trials for ocean and coastal site sensitivities
11	Dr Steve Duardze	North west Africa	Evaluation of applications to land cover and oceans typologies

| 12 | Dr Laura David | Global | Tool development – Portable search engine |
| 13 | Dr Hartwig Kremer | Global | Scaling and database integration for riverine DPSIR and chemical data |

1.   Humans in a changing coastal zone (Dr Buddemeier)

Human activities in the coastal zone are key elements for change and demographic typologies will be needed for interpretation and predictions to derive from the current LOICZ "synthesis". Interestingly, there is no substantiated assessment of global population associated with the global coastal zone – oft-quoted proportions range from less than 40% to as high as 80%. Using data filters (deleting the polar region, offsetting the megacities to remove overwhelming influence on clustering) and selecting population densities >10 people per km^2 plus >5% croplands, a typology was developed based on the human demographic data set (from night sky assessment). While this yielded no surprises in global distribution of population – distribution is patchy with Europe, South East Asia, South Asia and north east America as major areas of coastal populations) - it gives a template of likely coastal perturbation areas as a setting for biogeochemical (and other) information. From the population data statistics associated with the typology, some 52% of the global population lives in the coastal zone; an area prescribed by about 100 km inland from the coastal-ocean interface. The information contributes to a lead paper presented at the IGBP Congress in Amsterdam, July 2001.

2.   Assessment of ΔDIP and ΔDIN from biogeochemical models data set (Dennis Swaney and Dr Maxwell)

The developing database for the biogeochemical budgets information was interrogated by trials to assess relationships of ΔDIP and ΔDIN with human demographic data. This initial work was aimed to trial the data and tools as well as to get insight into the "people pressure" relationships and net metabolism characteristics of the budgets set. The data were filtered for outliers (water residency, 1 day - >1 year); population density was log-transformed (only works for positive, >0 values); budget variables for ΔDIP and ΔDIN were clustered and plotted against each other; log population was overlaid on the clusters; statistics of the overlays were examined to assess how clusters fall into various population categories, and how various population categories fall into clusters of ΔDIP and ΔDIN. Outcomes were promising, and provide a basis for further follow-up, generally including:

ΔDIN, ΔDIP around 0 (balanced)   correspond to low population density (most sites)

ΔDIN <0/-ve, ΔDIP>0 and ΔDIP<0   corresponds to high population density (some sites)
    or ΔDIP>0   high N load?

ΔDIN >0, ΔDIP around 0   corresponds to intermediate population density (only a few sites. N fixing systems due to N limitations?

3.   Regional characteristics of sub-equatorial Africa for budgets settings (Dr Waldron, Profs. Baird and Forbes)

The coastline of Africa below the equator was characterised from predominantly climatic data and the broad spatial scale was minimised to southern Africa, into which were added human dimension variables. Toggling between the two spatial scales allowed consideration and ideas for controlling factors influencing settings for the biogeochemical budgets e.g., the relative dominance of ocean *vs* land in different coastal regions. Generally, the typology was consistent with broadscale and regional characteristics from expert typology data and participant knowledge. The coastal setting for the budgets were assessed by climatic variable (including arid, subtropical, transitional classifications) and tested against the existing budget site data. Estuarine metabolic characteristics provided little differentiation between Berg River estuary (arid coast) and Thukele and Mhlathuzi River estuaries (sub-tropical coast). However, analysis and normalisation of VR resulted in differentiation of the arid coast Berg system from the sub-tropical river systems. Could now compare sub-tropical systems with other similar regions in sub-equatorial Africa.

4.   Gradients and drivers describing coastal types in Iberian Peninsula (Drs Niell and Prego)
Applied clustering and eigenvector assessments to characterise the ocean-coastal waters around the Iberian peninsular. By aggregating the main gradients and drivers the key coastal types of the Peninsular were described. Application of all coastal and ocean variables yielded 6 clusters to describe the coastal region (included 80% variability) and 5 clusters to describe the Ocean I region (included 91% of the variability).

5.   Typology for linked riverine N and P loads to the ocean: Europe (Dr Brion)
The goal was to derive and evaluate a classification of European North Atlantic coastal environments based on typological data that reflect N and P loads from rivers and adjacent basins. Existing database variables for typology and budgets were downloaded and filtered, with new (own) data added for nine river sites and estuaries. The uploaded database was clustered and N-load data overlaid. Initial evaluation showed that N load is greatest from the "large basins" rivers (e.g., Elbe, Rhine); further analysis with rainfall, population and cropland variables to be applied. Phosphorus was highest mainly from "large basins" rivers, and corresponded with N load. A strong correlation was evident with population and cropland values. Caveat: the sample size of nine river systems is too small for a reliable assessment. However the work gave a nice suggested trend outcome for further evaluation. [Dr Prego offered to supply a number of additional data for Spanish river systems for input.]

6.   Comparison of expert coastal typology and differentiating variables: East Africa (Dr Ngusaru and Prof. Tole)
A WWF expert typology was compared with ones developed from the LOICZ dataset. Total variable sets were taken and, through a process of reduction and individual variable analyses, a set of determinant variables were established yielding a good fit. About five variable were required to replicate the expert classification. [It was noted that both tide and wave variable in the LOICZ database need be improved; the GLOSS database in UK or the new TOPEX database (0.25 degree scale) are possible sources.]

7.   Characterising estuary and ecosystem types, and human pressures: Europe (Dr Gattuso)
Established a set of questions to explore the typology tools, databases and to address science questions; a constructive critique was developed as well as further insights into utility and science outcomes.
a) Surface area of the European coastal zone: The LOICZView approach yielded an estimate of 25.4×10^6 km^2 (compared with 26×10^6 km^2, Gattuso *et al.* 1998).
b) Identify and categorise European estuaries for habitat type and ecosystem type. Runoff data needed log transformation, but generally had discrimination of estuaries.
c) Categorise human pressures on estuaries. Log transform of population data probably unnecessary. Yielded 11 clusters with two variables and should be able to reduce cluster number with additional human dimension variables. However, this suggests that human pressure varies widely.
d) Application of own database. Tried P and R data for offshore Mediterranean and looked for drivers to relate to the data. Merging of the databases was difficult.
e) Linking LOICZ typology and budgets database files. Split to positive and nul values delta-DIP *vs* negative values delta-DIP. Best application may be to prepare a physical typology and a metabolic typology and overlay with the Dual function
The tools performed well and a number of problems were identified in ease of use or options for development, some of which were put into play during the workshop.

8.   Comparison of Baltic and Black Seas (Drs Ramm, Humborg, Besiktepe, Cociasu, Inna Yurkova and Prof. Wulff)
Trial of the typology tool for up-scaling between basins, comparison of climatological-hydrographic-hydrological-human pressure variables, and application of calculated external variable on runoff and loading. Some of the problems identified (and solutions) included double accounting by addition of cells for human population (database problem); runoff is modelled and is a problem [log-transformation (Dr Gattuso) may be an intermediate answer]. Database is generally sound and the ability to examine and manipulate data is good. Clustering technique is robust. Trial of salinity

intercomparison for the two seas required Ocean II data – interestingly, the outcomes showed gyres and plumes which could be useful in determining boundary settings for budgetting.

9.   Coastal typology and variables influencing nutrient fluxes: Western Africa (Drs Gabche and Murray)
Characterised the western African coast from Morocco to Namibia, identifying parameters influencing nutrient flows to the coastal zone. The works yielded gross climatological representation discriminating regions. A preliminary assessment was made of the settings for the existing four budget sites; and will be continued post-workshop. Cropland variable was not very useful as a discriminating variable in the region, showing about 60% reliability based on expert judgement.

10.   Scaling issues and data trials for ocean and coastal site sensitivities: Eastern Mediterranean (Dr Anagnostou and Prof. Awad)
Trial of the ocean variables for the eastern Mediterranean region using Ocean-I and Ocean-II yield a relatively poor agreement with expert judgement. This is a data quality problem as a test with dummy database yielded an effective outcome. Further work will be done post-workshop using existing institutional data (on a LOICZ gridded system provided by Jeremy Bartley). The developed typology will then be used to explore lower, small-scale applications, especially to compare the highly populated and averaged descriptor institutional data set using the LOICZ 0.5 degree cell structure. This will allow vital comparison of variance and data dispersion characteristics during inter-scaling and to see how much is detail is captured or homogenised in the process.

11.   Evaluation of applications to land cover and oceans typologies: North West Africa (Dr Duardze)
The land-based cover database was not adequate to develop detailed typologies at the regional scale. Evaluation of salinity typologies yielded five classes from Ocean I data sets and showed salinity increased with latitude across Zone 12 – similar to the typology developed for Atlantic South America. Precipitation gradient south to north and a drier drainage network to the south were demonstrated in the typology. Generally, the LOICZView has good capabilities for regional analyses.

12.   Tool development -Portable search engine (Dr David)
The search engine was developed for use by people with slow or no internet access, utilising the CD-ROM version of the tools. The program uses MS Access, has "read me" files, can search the LOICZ database and has a demonstration database for Asia/Australasia. The tool is to be included in CD-ROM versions of the typology tool and to be available through the typology web-site.

13.   Scaling and database integration for riverine DPSIR and chemical data (Dr Kremer)
Development of a data matrix for capture of river basins information within non-contiguous coastal cells, allowing the typology tools to be used in regional and global scaling analyses. An East Asia basins dataset was used, aiming to develop a common matrix for use across all global regions. Advances were made in this process of developing ways to achieve the basin data integration.

Outcomes and Wrap-up
Typologies were developed to interim draft stage of completion during the workshop; text additions and checks on data sources were required for subsequent completion of most tasks. A schedule for contribution of final documents, report and publication, along with the process for review and editing was agreed, noting that hard-copy reports, web-posting and CD-ROM products are planned.

A CD-ROM of workshop databases, materials and developed typologies was prepared and distributed to all workshop participants as an interim product and for further use by participants.

The participants joined with LOICZ in expressing thanks to Dr Maarten Scheffers and assistants for their preparation and support throughout the workshop, and to the Coastal Zone Management Centre and RIKZ for hosting the workshop. The financial support of the Global Environmental Facility was

gratefully acknowledged for regional participant attendance; LOICZ supported attendance of participants from non-GEF eligible countries.

Appendix IIID: <u>**Terms of Reference**</u>

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Background Information:
A major overall objective of LOICZ (http://www.nioz.nl/loicz/) and the facilitating UNEP GEF project is to provide an assessment of uptake and release of nutrients (nitrogen and phosphorus) in the global coastal zone. The tools being used to meet this objective are biogeochemical budgets of nitrogen and phosphorus for specific sites (primarily bays, estuaries and lagoons) in the coastal zone, and application of an objective classification, or "typology," (http://water.kgs.ukans.edu:8888/public/ Typpages/index.htm) to extrapolate from individual sites to the global coastal zone. To date, approximately 150 site budgets have been developed (http://data.ecology.su.se/MNODE), mostly through a series of workshops sponsored by GEF. The primary classification tool will be the geospatial clustering program "LOICZView," which has been developed for this specific application (http://www.palantir.swarthmore.edu/~maxwell/loicz/; refer LOICZ Newsletter No.15 June 2000, available on LOICZ web site).

Over the course of the year 2001, a series of three regional synthesis workshops will be held in order to develop objective classifications for the global coastal zone, to reconcile the objective classifications with "expert classifications" and to relate the coastal classes to the budgets. The workshops will be targeted at specific regions, but each will also have a classification theme to provide a conceptual as well as a geographic focus. The first of these workshops was held in Brisbane, Australia, in January 2001 to address the Asia-Australasia regions and the second in Ensenada, Mexico in May 2001 to address the Americas region.

This workshop will provide the regional synthesis for the Africa-Europe regions, and the classification theme will be small *vs* large rivers and human influences on the systems. An extensive spread of data for estuaries and river load characteristics is available, though in parts of Africa and at the latitudinal extremes there is only a limited set of information. Four budgeting workshops have been held in the regions; two in Africa and two in Europe; a number of estuarine biogeochemical systems budgets for regions are contained on the LOICZ biogeochemical modelling web-site and in LOICZ publications.

Primary Goals:
To work with resource persons and researchers dealing with coastal fluxes and biogeochemistry in the regions of Africa and Europe, in order to relate C, N, P biogeochemical budgetary information to coastal system classifications that will be developed by cluster analysis of suites of environmental and human-dimension variables.

The workshop provides the opportunity to test and develop coastal and budget classification techniques for the region and selected sub-regions, and to apply these to a regional synthesis of biogeochemical fluxes and budgets as well as to the initial steps of a global synthesis.

Anticipated Products:
1. The following tests of coastal and budget classification schemes [Note: it is expected that much of this will be accomplished, posted electronically, and disseminated to participants during the 2-month pre-workshop period]:

a) Preliminary whole-region classifications based on physical environmental variables (list to be posted).
b) Exploratory tests of coastal classification by sub-region (e.g., tropical vs. temperate, rainfall/runoff or other classes).
3. Classification of budget types by selected key variables, and initial correlations with environmental variables.
4. Classification of coastal regions by human-dimension and related variables.
5. [Note: the following are the primary in-workshop and post-workshop goals] Classifications of the region and reconciliation of objective and expert classifications for the region, based on physical variables and the results of #1 above.
6. Trial extrapolations of classifications from this region to the remainder of the global coastal zone.
7. Overprinting of variations in socio-economic conditions onto these physically-based classifications.
8. Estimates of mean and variability of budget variables (water, salt, nutrients) within the coastal classes deemed most suitable for optimisation and extrapolation.
9. Prompt, updated electronic presentations (WWW and stand-alone files) of the typology/synthesis results and progress; further development of databases, procedures and tools on the basis of experience gained.
10. Printed reports and submissions to the scientific literature as appropriate.

Workplan:
Participants will be expected to come prepared to contribute actively to the classification and synthesis process. Preparation should include: reading, examination of the data, tools, and tutorials presented on the LOICZ Typology and Web-LOICZView web pages (see URLs, above), and completion (on- or off-line) of pre-workshop tests and exercises (see item #1 under Anticipated Products). This pre-workshop activity should include electronic submission of preliminary results in agreed format so that these can be posted and made available as the resource base for the workshop.

NOTE: This is one of a series of workshops that will rely heavily on use of on-line internet tools and data, and on prompt web-site posting and electronic dissemination of products and progress. Alternative distribution and access channels for those lacking ready WWW access will be provided, and it is anticipated that the workshops will be run via local networks on-site. Some of the procedures are necessarily experimental, and will be developed throughout the synthesis process.

Further Details:
LOICZ will arrange travel, and make other workshop arrangements in consultation with the Centre. LOICZ will pay for all travel, accommodation and support costs for the participants.

Further details will be provided to participants during the lead-up to the workshop.

Draft Workshop Schedule:
(All participants are expected to stay for the entire workshop):
Workshop:
July 1:   Arrival; set up and test hardware and software.
July 2:   (am) General introduction to workshop schedule, plans and goals. Plenary review of pre-workshop tests and outcomes. Refinement of workshop strategy; development of teams and assignments.
(pm) Breakout work as decided -- teams of participants and resource people address specific subsets of issues and techniques. Emphasis on classification and calibration.
July 3:   Continue breakouts; midday plenary to evaluate progress, shift activity emphasis to budget extrapolation via typology.
July 4:   Breakouts/plenary as above -- transition to developing synthesis.

July 5:   (am) Breakouts continue coordinated synthesis activities

                (pm) Plenary synthesis overview and assembly; plan for follow-up and completion

July 6:   Departure.

Post-workshop:

      ca. September 20 -- all electronic products edited, summarized/explained, and posted to website. Preparation of workshop report for LOICZ R&S series.

Background Documents:

1. Gordon, D.C., P.R. Boudreau, K.H. Mann, J.-E. Ong, W. Silvert, S.V. Smith, G. Wattayakorn, F. Wulff, and T. Yanagi. 1996. LOICZ Biogeochemical Modelling Guidelines. LOICZ Reports and Studies 5, 96 pp.

2. All LOICZ R&S budget workshop reports from the region: The earlier workshops on African systems (Lagos - LOICZ R&S No.9, 1996; Zanzibar - LOICZ R&S No.17, 2001) are available in hard copy or electronically from the LOICZ web site. Reports from Mediterranean-Black Sea region (Athens workshop) is in preparation and will be made available to participants before the workshop.

3. All LOICZ "typology" reports. These are in preparation and will be made available to all participants in the near future.

4. LOICZ Modelling web page, for everyone with www access: (http://data.ecology.su.se/MNODE/).

   - The web pages, including the guidelines, are frequently updated. *Recent additions to the site include several PowerPoint presentations designed to familiarize you further with the budgeting procedures and with an overview of the LOICZ budgeting efforts.*

   - If you do not have access to the worldwide web but do have access to a computer with a CD-ROM, please let us know; we will send you a CD with the web page. Please do not request the CD at this time if you have access; you will be furnished one during the workshop.

   - CABARET (Computer Assisted Budget Analysis, Research, Education, and Training). *A version of this software and a PowerPoint demonstration of its use are now available on the web site.*