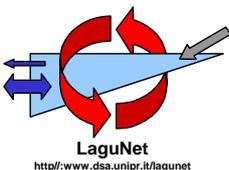


# ITALIAN LAGOON OBSERVATIONAL NETWORK

## LaguNet



*A Network in support of the IGBP core programme:  
Land Ocean Interaction in the Coastal Zone (LOICZ)  
and a contribution to  
the implementation of the Water Framework Directive  
with the collaboration of  
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### LaguNet

LaguNet is a scientific observational network studying the fluxes of nutrients and other contaminants from lagoon catchments to the near coastal environment. The objectives of LaguNet are to support and encourage co-operation of research groups studying lagoons, wetlands and saltmarsh systems situated along the Italian coast and to evaluate the application of the LOICZ (Land Ocean Interactions in Coastal Zones, a core project of IGBP) biogeochemical flux model and typology classification to such sites.



**Figure 1:** LaguNet sites around the Italian peninsula

The idea of a network of Italian researchers who are involved in the study of lagoons and coastal transitional ecosystems was developed during a workshop "Coastal and estuarine systems of the Mediterranean and Black Sea regions: carbon, nitrogen and phosphorous fluxes" organised in Athens (2-5<sup>th</sup> February 2001) by LOICZ (Land Ocean Interactions in Coastal Zones) with the support of UNEP and ELOISE. In the proceedings of the workshop are included a first series of estimates on the fluxes of nitrogen and phosphorous

from selected transitional ecosystems of the Italian coast (Report and Studies No. 19) that contribute to filling an information gap on information on the Mediterranean coast (for more information refer to LOICZ home page: <http://www.nioz.nl/loicz/>).

In Italy there exist numerous studies, including over the long-term, investigating coastal processes, it thus seems important to propose and develop a working network in which the LOICZ methodology could be applied to sites and studies of transitional ecosystems along the Italian coast. A further objective is to evaluate the prospect of presenting joint National (COFIN, CNR, etc.) or European projects (Sixth Framework Programme).

### OBJECTIVES

LaguNet was inaugurated during the workshop "Trasporto dei nutrienti negli ambienti acquatici di transizione lungo le coste italiane: valutazione dei flussi e delle funzioni dell'ecosistema" held in Venice 14-15<sup>th</sup> April 2002, and has the following objectives:

- i. To provide a forum for discussion and cooperation between researchers who are studying biogeochemical processes in lagoons, wetlands and salt-marshes at sites along the Italian coast.
- ii. Evaluate available information and present understanding of the biogeochemistry of carbon, nitrogen and phosphorous in transitional and coastal waters under the influence of catchment basins.
- iii. Discuss the feasibility of the application of the LOICZ Biogeochemical Model to such areas.
- iv. Promote an agreed common approach to studies of biogeochemical processes in these transitional ecosystems that can provide support to management or policy applications.
- v. Consider the feasibility of developing one or more projects either in Italy or in Europe (with Mediterranean EU partners as well as eventually from Eastern Europe and North Africa).

Presently LaguNet comprises of sites distributed around the whole of the Italian peninsular and islands (see figure 1). Some such as the Port of Genoa and the Marinello lakes consist of several

independent systems (see table 1). In total there are presently 22 ecosystems under investigation where the Biogeochemical Model of LOICZ has been applied for well-defined time period. In total 79 flux estimations have been undertaken considering a wide range of systems and different time periods. For some sites, for example, such as the S'Ena Arrubia lagoon it has been possible to compare the results obtained with the model for different periods of time, such as to obtain valuable information on the evolution of the lagoon. Certain results have already been published in LOICZ Report and Studies volume 19, while others are in course of evaluation. The first preliminary results of the exercise have been reported at the 3<sup>rd</sup> National Congress of Marine Sciences held in Bari, Italy 27-30<sup>th</sup> November 2002.

Due to the shape of the Italian peninsular it has been possible to study systems that cover a wide range of latitudes: from the Venice lagoon in the North (45,40<sup>0</sup> N) to the Rada di Augusta in the South (37,21<sup>0</sup>N). Although the distances between these ecosystems are relatively modest compared to other LOICZ studies that have been organised at continental-level scales, the present network of sites present a very wide range of varying characteristics, and a very high density of data.

Sites range from very large ecosystems such as the Venice lagoon (area open to tidal expansion and assessed as relevant for budgeting: 360 km<sup>2</sup>, total area of the system 550 Km<sup>2</sup>) to extremely small ones such as Laghetto Fondo Porto (0.013 km<sup>2</sup>), from deep systems such as the Gulf of Genoa (28 m) to very shallow ones such as Torre Guaceto (0.38 m) or S'Ena Arrubia (0.40 m).

Further the biological communities are very diversified; in some systems the dominant primary producers are phytoplankton, whereas in others they may be floating macro-algae or floating or rooted phanerogams.

Also the exploitation and management of these systems are very varied: fish farming, oyster or mussel farming, tourism, recreation and water sports or nature reserves. Many of the ecosystems are in protected areas, others are subject to intense anthropogenic pressures, others to only slight human impact and stress.

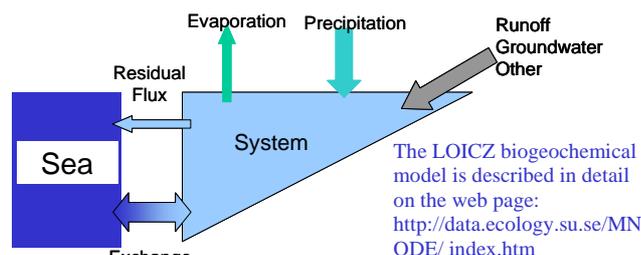


Figure 2: LOICZ biogeochemical model

The LOICZ biogeochemical model is based on mass balance of water, salt and nutrients, in which their conservative behaviour is used to estimate the mass movement of water; non-conservative behaviour is used to estimate important ecosystem processes such as net metabolism (i.e. the difference between production and respiration) or the difference in the rates of nitrogen fixation and denitrification (nfix-denitr.). The application of the LOICZ approach to very widely varying coastal systems has allowed the comparison and classification of some 200 sites worldwide.

	Name of system	Province	Latitude °N	Longitude °E	Area for budgeting Km <sup>2</sup>	Mean depth (m)	Period investigated
1	Laguna di Venezia	Venezia	45.40	12.40	360	1.50	1999-2001
2	Sacca di Goro	Ferrara	44.80	12.29	26	1.00	1997
3	Valle di Comacchio	Ferrara-Ravenna	44.63	12.28	115	0.80	1997
4	Valle Smarlacca	Ravenna	44.58	12.23	2	0.80	1997
5	Piallassa Baiona	Ravenna	44.50	12.25	11.8	0.75	2000
6	Laguna di Lesina	Foggia	41.88	15.35	51.5	0.80	1998-1999
7	Laguna di Varano	Foggia	41.41	15.47	64	4.00	1999-2000
8	Torre Guaceto	Brindisi	40.71	17.80	1.19	0.38	2001-2002
9	Aquatina	Lecce	40.44	18.24	0.45	0.50	1995
10	Alimini Grande	Lecce	40.20	18.45	1.4	1.50	1998-1999
11	Rada di Augusta	Siracusa	37.21	15.23	23.5	14.90	1998-1999
12	Capo Feto	Trapani	37.68	12.48	1.4	1.75	2001
13	Stagnone di Marsala	Trapani	37.83	12.45	20.0	0.95	1996
14	Lago Ganzirri	Messina	38.26	15.62	0.34	2.50	1998-1999
15	Laggetti di Marinello (verdi)	Messina	38.13	15.05	0.017	1.60	1997-1998
16	Laggetti di Marinello (fondo porto)	Messina	38.13	15.05	0.013	1.50	1997-1998
17	Laguna di Orbetello	Grosseto	42.44	11.23	25.25	1.00	1999-2000
18	Golfo di Genova	Genova	44.40	8.93	52.0	28.00	1996
19	Porto di Genova (old port area)	Genova	40.40	8.90	2.7	13.00	2002
20	Porto di Genova (Multedo Oil Terminal)	Genova	40.40	8.90	1.4	15.00	2002
21	Porto di Genova (Volti Container Terminal)	Genova	40.40	8.90	2.1	15.00	2002
22	S'Ena Arrubia	Oristano	39.83	8.67	1.2	0.40	1994-1995 2001-2002

Table 1: LaguNet sites characteristics

## LAGUNET: INPUT TO NATIONAL AND EUROPEAN POLICY

Other than the application of LOICZ methodology for the purpose of studying the impact of climatic change on fluxes of nutrients to coastal ecosystems, there is an increasing need of policy oriented scientific information.

Information on the impact of watershed processes on nearshore coastal environments is becoming increasingly important for the protection of biodiversity and sustainability of terrestrial aquatic ecosystems as well coastal systems under their influence. Such integrated systems require an approach that closely links science and policy for a more efficient development and implementation of EU Directives.

Too often science information is not adequately assessed for its implications in the development of policy even if it is well prepared, or alternatively the science information is not presented (or is not adequate) in a form that can be easily used for policy development.

The role of networks, such as **LaguNet**, can contribute significantly to bridging the gap between science and policy by bringing together individual research groups working on similar or common themes using benchmarked methodologies, allowing comparison of processes over a wide range of ecosystems (under varying pressures and impacts),

more easily identifying information gaps and building a solid science base for the development and implementation of Directives and input to national or EU policy discussions. It also provides a strong basis for cooperation with other national or European networks.

## A SCIENTIFIC OBSERVATIONAL NETWORK OF EUROPEAN RIVER BASINS AND COASTAL ZONES

In order to provide focused and timely support to DG Environment for the implementation of the Water Framework Directive, the Institute of Environment and Sustainability of the Joint Research Centre, in collaboration with DG Environment set-up a demonstration project in the 5<sup>th</sup> FP. The project aims at investigating the effects of EU Water Policy on reducing different types of pollution sources in terms of water quality and socio-economic cost-benefit.

This is being achieved by identifying and developing an observational research network (European Watershed-Coastal Zone Integrated Study EW-CZ) on selected river basins-coastal zones across a range of European conditions. The network takes advantage of already existing national or regional initiatives with the aim of enhancing their integration in a European context, filling information gaps, and satisfying a set of geographical and partnership criteria:

- ❖ representativeness of different regions in Europe covering a ranges of climatic and ecosystem characteristics and to assure that multiple soil and water pollution problems are considered;
- ❖ involvement of scientific networks and local and regional agencies with natural resource
- ❖ responsibilities within the selected watersheds

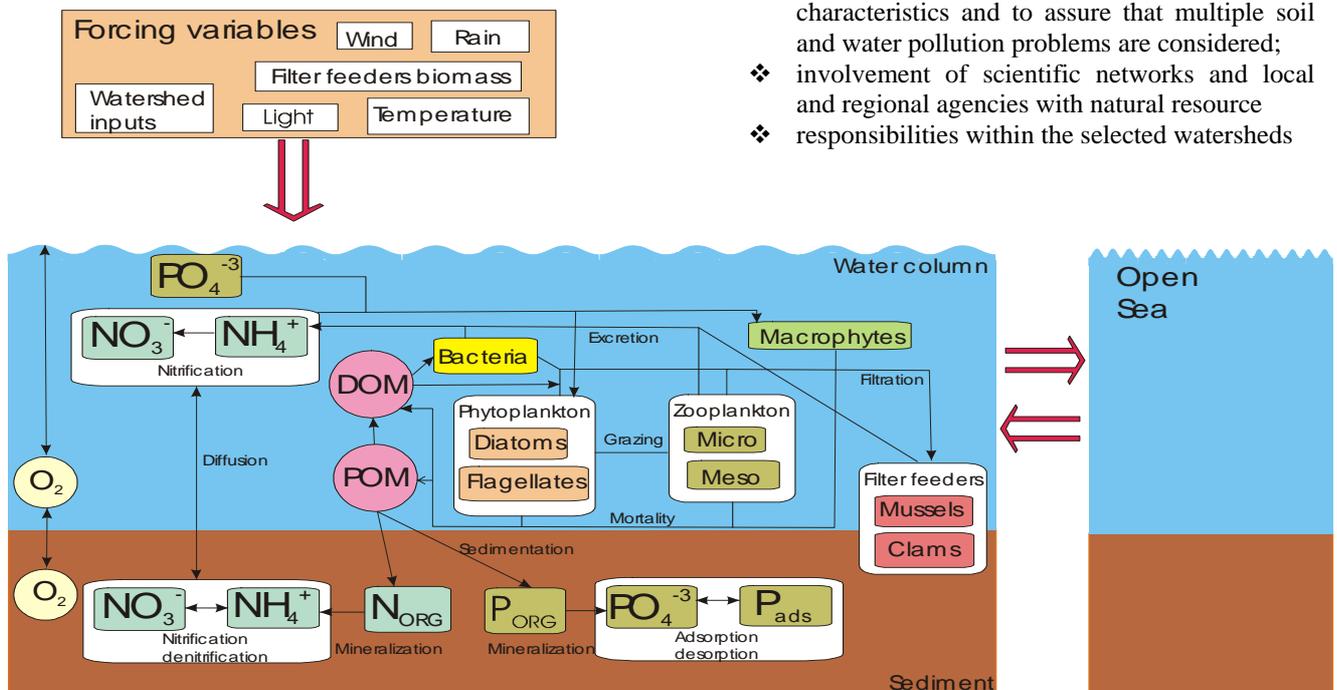


Figure 3: Representation of the different compartments in the Sacca di Goro biogeochemical model

Among others the creation of a network of European well monitored watersheds (some hundreds to thousand km<sup>2</sup>) is allowing a range of short and medium term studies on:

- Relations between anthropogenic inputs (organic matter, nutrients, chemicals), retention/release during their transfer to water bodies, and the evolution of downstream aquatic ecosystems,
- Impact of preventive and remedial measures and environmental policies on those polluting effects (Pressure, State, Impacts, Response approach),
- Calibration and validation of models (e.g. for diffuse sources of nutrients, erosion transfers, release from sediments, marine eutrophication).



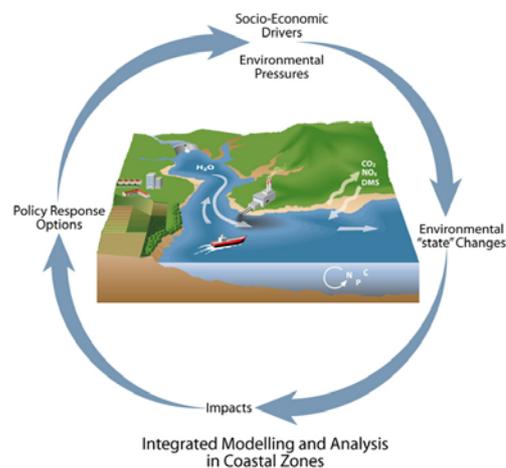
*Figure 4: typical Mediterranean lagoon*

Such a network could also contribute to the study of Pan European socio-economic aspects of the implementation of EU Directives; improve the knowledge of water quality and quantity management under different economic and political conditions (e.g. EU candidate countries); justify cross-border nested environmental investigations and help develop a common and harmonized database of water quality and quantity parameters

**Scientific Research Themes.** A number of specific research themes have been identified which make up the main core activities of the Network and thus contribute to the assessment of the efficiency of the application of EU Directives. These include:

- Based on changes in land use and land use management in selected European watersheds, consider the possible effect of modifications in policy and legislation and their impact on sources of pollution and associated activities (non-point versus point, industry versus

agriculture etc.) in order to obtain an estimation of current and likely future quality of water and soil resources. Identify and value changes induced by abatement measures. Compare least cost means of achieving policy targets; economic optimisation approaches.



*Figure 5: Integrated Modelling and Analysis in Coastal Zones*

- Consider spatial dependent and time-lagged processes of pollutant emissions from point (urban and industrial) and diffuse (agriculture, atmospheric-industry) sources, and their dynamics and interactions in surface and ground-water environments.
- Couple ecosystem and hydrodynamic models to investigate long-term changes in eutrophication in near coastal waters. Investigate whether indexes/indicators can be derived that would allow inter-comparison of different coastal sites and estimation of anthropogenic to natural processes.

**Selected Nodes of the Network.** Presently the project is starting to obtain information on selected river basin-coastal sites in Europe that have characteristics permitting the development of methodologies for the testing of the efficiency of the application of Directives. Contacts and discussions have started with a number of groups (PNEC, France, ELOISE cluster, EW-CZ-JRC, LaguNet) working in the Mediterranean, as well as other areas in Europe.

#### **APPLICATION: WATER FRAMEWORK DIRECTIVE**

Water Framework Directive- WFD came into force on 22 Dec. 2000. The implementation of this Directive will have very considerable long-term implications on information needs and research

objectives covering all European river basin and coastal zones.

An effective and coherent water policy must take into account of the vulnerability of all surface and ground waters, including aquatic ecosystems located near the coast and estuaries or in gulfs or related closed seas, as their equilibrium is strongly influenced by the quality of inland waters flowing into them.

### CHALLENGES OF IMPLEMENTATION: COMMON EUROPEAN STRATEGY

The implementation of the Water Framework Directive raises major challenges. These include an extremely demanding timetable, in particular, in the nine preparatory years; the complexity of the text and the diversity of possible solutions to scientific, technical and practical questions; the problem of capacity building and an incomplete technical and scientific basis with a large number of fundamental issues in the Directive (specially in Annex II and V), which need further elaboration. A strict limitation of human and financial resources in Member States further adds to the challenge.

The tasks that flow from the adoption of the Water Framework Directive (WFD) can be divided into a number of core areas (some running in parallel) to be completed within the first nine years (from 2000-2009). These are shown in Table 2.

Phase	Action	Deadline
Phase 1	<ul style="list-style-type: none"> <li>• Transposition</li> <li>• Identification of River Basin districts</li> </ul>	Dec 2003
Phase 2	<b>Status Review:</b> <ul style="list-style-type: none"> <li>• Establishment of reference conditions and sites for intercalibration exercise</li> <li>• Preparation for specification values for the ecological status classification systems</li> <li>• Analysis of the characteristics of river basins, of pressures and impacts and the economics of water use</li> </ul>	Dec. 2004
Phase 2a	<ul style="list-style-type: none"> <li>• Establishment of Community criteria for assessing groundwater (Commission proposal)</li> <li>• Individual Member State action in absence of adoption criteria</li> </ul>	Dec. 2002 Dec. 2005
Phase 3	<ul style="list-style-type: none"> <li>• <b>Operational monitoring Programme</b></li> </ul>	Dec 2006
Phase 4	<ul style="list-style-type: none"> <li>• <b>River Basin Management plans</b></li> <li>• <b>Programmes of measures</b></li> </ul>	Dec 2009

*Table 2: Phases of Implementation of WFD 2000 - 2009*

In order to respond to this problem a Common Strategy on the Implementation of the Water Framework Directive is being developed by the European Commission and Member States. The aim of the development of this Common Strategy is to allow, as far as possible, a coherent and harmonious implementation of the Directive.

Most of the challenges and difficulties arising will inevitably be common to all Member States and many of the European river basins are shared, crossing administrative and territorial borders, where a common understanding and approach is crucial to successful and effective implementation.

Focus is on methodological questions related to a common understanding of the technical and scientific implications of the Directive. The aim is to clarify and develop, where appropriate, supporting technical and scientific information to assist in the practical implementation of the Directive. Guidance documents, advice for operational methods and other supporting documents will be developed for this purpose. This is where national networks can make a significant contribution

Guidance documents have been developed based on the already existing practices in the Member States with a strong emphasis on pragmatic and operational quality and practicability. It is in this sense that the strategic document highlights the needs for testing the guidelines and stresses the constant interaction that should exist between guidance document and testing on Pilot River Basins, i.e. the testing and the development of the guidance documents should evolve in parallel where possible.



*Figure 6: Pilot River Basins accepted by EU Water Directors*

A further problem is that a common understanding and methodologies for the application of the different areas of the WFD do not necessarily exist. Member States have, historically, developed approach to monitoring, impact assessment, economic analysis etc. that will need to be compared in order to be certain that they provide comparable level of results over the range of ecosystems covered in the European Union.

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