VENICE LAGOON-ITALY

[1]Cossarini, G., [2]Castellani, C., [2]Barbanti, A., [3]Bernstein A., [3]Cecconi, G., [4]Collavini, F., [5]Guerzoni, S., [3]Montobbio, L., [6]Pastres, R., [5]Rabitti, S., [5]Socal, G., [1]Solidoro, C., [7]Vazzoler, M., [4]Zaggia, L.

[1]*Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Trieste;* [2]*Thetis S.p.A., Venezia;* [3]*Consorzio Venezia Nuova;* [4]*CNR - Istituto per la Dinamica delle Grandi Masse –Venezia;* [5]*CNR - Istituto di Biologia del Mare, Venezia;* [6]*Università di Venezia;* [7]*Agenzia Regionale per l'Ambiente del Veneto*

The lagoon of Venice is the largest Italian Lagoon and one of the largest in Europe. It is located in the northern part of the Adriatic Sea (45.2° - 45.6°N, 12.2° and 12.6°E). Three narrow inlets connect the lagoon to the Adriatic sea, entailing a subdivision in three sub-basins, separated by two watersheds along which the intensity of the tidal currents is low. Part of the lagoon is devoted to aquaculture and closed to water exchanges; the surface open to tidal expansion and assessed as relevant for LOICZ computation (beneath 0 m on the sea level, estimated from CVN 1990 bathymetry), is 360 km^2, with a volume of 0.545 Km^3 and an average depth of 1.5 m.

Figure. 1: *Lagoon of Venice and its drainage basin (Source:CVN)*

The drainage basin is densely populated and conveys into the lagoon both industrial and agricultural waste waters. The loads of nitrogen and phosphorous which are discharged into the lagoon by the tributaries were estimated by DRAIN project (MAV-CVN, 2001), during which the main tributaries have been monitored for nearly two years (1998 - 2000). The largest fraction of these loads of nitrogen and phosphorous is discharged into the Northern sub-basin. Other relevant nutrient sources come from the industrial area of Porto Marghera (MAV-SAMA, 2000 - 2002), from a civil wastewater treatment plant located close to the lagoon (Aspiv, 2000; Vesta, 2002) and from atmospheric depositions, were investigated in the frame of the "2023 project" (MAV- CVN, 2000a).

Figure 2: *View of Venice lagoon*

In the last decades the lagoon environment has been studied in the frame of several projects. Recently experimental data concerning the concentrations of dissolved nitrogen and phosphorous in the lagoon were systematically collected by MAV/CVN (MELa1 Project). The analysis of the recent results show that the lagoon is a complex system, which presents variability, in time and space, of dissolved nutrients, chlorophyll a, dissolved oxygen and turbidity (MAV-CVN, 2002a and MAV-CVN, 2002b). As regards the nutrients, in summary, dissolved nitrogen and phosphorous are higher in the Northern sub-basin and, within each basin, their concentrations are inversely correlated with the salinity.

Impact of the anthropogenic activities affects the various sub-areas to a different extent, in response to local water renewal and position with respect to the pollution sources. Adverse effects, such as anoxic crises and pollutant accumulation in the sediment generally occur in the more confined sub-

areas. The latter are mainly located near the mainland border, where the tidal influence is lower than in other areas and where pollutants from terrestrial sources flow into the lagoon. From the drainage basin, the lagoon receives the major fresh water input; other sources are the effluents from the urban and industrial areas and inhabited islands, as well as direct rainfall.

Figure 3: the industrial area of Porto Marghera and the Fusina waste water treatment plant.

Contaminants of different origin are transferred by fresh water inputs to the lagoon and are dispersed in the water body by tidal circulation. A part of the contaminant loading accumulates in the bottom of slack hydrodynamics areas, but release processes occur as a consequence of resuspension, modification of the redox condition and bioturbation. A fraction of the loading is eventually transferred to the Adriatic Sea by tidal currents, during the ebb tide.

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 saltmash 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.

The methodology has been applied by LOICZ to approximately 170 coastal environments worldwide; it is based on a mass balance approach and provides important information on the flux of nutrients and ecosystem functions; the approach used is applicable to a majority of coastal ecosystems with data that are normally available from conventional monitoring campaigns. In this way it is possible to compare and to group aquatic

systems having different characteristics based on properties related to biogeochemical cycles and to the ecosystem functions that result from these processes.

Figure 4: LaguNet sites around the Italian peninsular

On the basis of this experience and considering the paucity of LOICZ sites in the Mediterranean and Southern Europe it was decided to apply this methodology to a series of Italian coastal environments where sufficient data are available.

Contact Persons

Chiara Castellani (castellani.c@thetis.it) Andrea Barbanti (barbanti.a@thetis.it) Thetis S.p.A. Cossarini Gianpiero (gcossarini@ogs.trieste.it) , Cosimo Solidoro (csolidoro@ogs.trieste.it). Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Trieste

References

ASPIV, 2000. Relazione annuale 1999: impianto di depurazione di Campalto. Venezia Servizi Territoriali Ambientali.

MAV-CVN, 2001. Progetto DRAIN. Trasferimento di acqua dolce e inquinanti dal bacino scolante alla laguna di Venezia. Documento di Progetto 15A. Ed. by Collavini, F., Zonta, R., Bettiol, C., Fagarazzi, O., Zaggia, L., 2001

MAV-CVN, 2002a. Attività di monitoraggio ambientale della laguna di Venezia (MELA1). Trattamento ed analisi dei dati, elaborazioni in linea ed interpretazioni spazio temporali. Ed. by Pastres, R., Ciavatta, S., Petrizzo, A.

MAV-CVN, 2002b. Attività di monitoraggio ambientale della laguna di Venezia (MELA1). Interpretazione della dinamica spazio temporale dei dati mediante un modello di produttività primaria. Rapporto 1° anno. Trattamento ed analisi dei dati, elaborazioni in linea ed interpretazioni spazio temporali. Ed. by Solidoro, C., and Cossarini, G.