A regional GIS for benthic diversity and environmental impact studies in the Gulf of Trieste, Italy

V. Solis-Weiss (1), P. Rossin (2), F. Aleffi (2), N. Bettoso (2), and S. Fonda Umani (3)

(1) Instituto de Ciencias del Mar y Limnologia, Universidad Nacional Autonoma de México, UNAM, Apdo Postal 70-305. Mexico, D.F. 04510, Mexico. Present address: (2)

(2) Laboratorio di Biologia Marina, Via A. Piccard 54, 34010 Trieste, Italy

(3) Università degli Studi di Trieste, Via Weiss 2, 34100 Trieste, Italy

E-mail: solisw@mar.icmyl.unam.mx

The aim of this study was to build a database and apply GIS techniques with data obtained from 1966 to 2001 in the Gulf of Trieste, in order to determine, for management purposes, the diversity, distribution and evolution in time and space of the local macrofauna in this heavily anthropized region. The application to marine environments of modern tools such as GIS techniques to evaluate biodiversity or sensitivity areas in environmental impact studies is still very limited in Italy. This, in spite of its proved capacity for synthesis and comprehensive visualization of complex interactions among the different components of an ecosystem, which makes it an increasingly sought-after tool for management or protection of the coastal zone. The macrobenthos, in turn, constitutes a most effective indicator of the recent history and health of any given aquatic habitat.

A custom-built relational database was created compiling biological, physico-chemical and sedimentological data from 450 stations, 187 sampling sites and 20 projects. A total of 278,770 organisms from 691 species (Polychaetes: 145,950 individuals, 276 species; Mollusks: 100,432ind, 198sp; Crustaceans: 16,962ind, 109sp; Echinoderms: 10,181ind, 42sp; "Others": 5,245ind, 66sp) were included. The methodological problems caused by different types of sampling gear and sieving used, as well as seasonal variability were solved, homogeneizing all data. Taxonomy was updated in all cases. Feeding guilds, biocoenotic characterization and Borja *et al.*'s (2000) Biotic Index were included for all the species where information existed. Interactive user-friendly operations as well as complex types of queries were also rendered possible and constant updatings are being carried out.

All the surface analyses were performed using Surfer 7, Didger 2, Idrisi 32 and Cartalinx 1.2. The vectorial map supplied is in Arcview shape file. The reference system is UTM 33-N. Distributions of the specific abundance maps were interpolated using the inverse distance to a 2 power gridding method.

The GIS analysis allowed us to individuate the main stress factors affecting the macrozoobenthic communities and determine the "sensitivity areas" based on intensity and persistence in time of the different disturbances (urban development, industrial and port activities, mariculture, fishing and tourism), as evidenced by their effect on the benthos. Severe impacts were evident in the eighties, while the application of ecological laws since then, seems to have had beneficial effects. The changes in time and space of the dominant species indicated the evolution of the bottom conditions in the Gulf. In this respect, the variations in distribution of the well-known instability indicator mollusk *Corbula gibba* was especially useful and helped to establish the resilience of the system.