Use of Parasite Species Composition Indices of Fishes to Measure the Degree of Environmental Deterioration due to Polluants and Other Men-Made Adverse Effects

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Project details

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Coordinated in: Italy

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Objective

- The objective of the proposed research was to develop a biological methodology to measure the environmental quality of an estuarine - lagoonal habitat by an analytical study of the parasite assemblage of an ubiquitous estuarine fish host - the grey mullets (Liza aurata, Liza ramada and Liza saliens). This should allow to detect pollution and other detrimental environmental effects. The methodology was based on a working hypothesis that the ratio between heteroxenous (developing via several hosts) and monoxenous (depending on single host for their development) parasites (in the habitat as a whole or on a single host population) can provide a measurable bioassay of the habitat: parasites with heteroxenous development can only complete their development in diverse - stable - habitats.

- A bio-indicator based methodology for the investigative assessment of the state of the environment in estuaries and lagoons was developed and tested at a range of sites around the Mediterranean sea (Italy, Greece, Israel, Egypt). Different indicators were used in order to respond to specific questions.

In order to standardise the methodologies of fish examination and parasite species identification a comprehensive protocol was defined. Data were included in a data-base, using Excel programme. Taxonomic identification has led to the detection of many parasite species including bacteria, protozoans, helminths and crustaceans. Collected data were processed for biometric and ecological parameters such as prevalence, abundance and intensity of infections, calculation of ratios of heteroxenous to monoxenous species, similarity indices among localities and statistical processing of confidence level. A novel approach was applied for the evaluation of species richness as a function of sampling size. The occurrence of parasitic species proved to be significantly correlated to biogeographical aspects and to the different size classes within host samples. Differences in the species richness, biodiversity and evenness values were obtained analysing parasite communities from habitats showing different environmental conditions. The calculation of ratios of heteroxenous to monoxenous species has proved to be very fruitful as a discrimination tool of polluted and not polluted areas. Adverse environmental conditions were expected to affect the total diversity of aquatic habitats, resulting in a lack of intermediate hosts that are necessary for the completion of life cycle of heteroxenous parasitic species, i.e. within helminths, molluscs for digeneans and crustaceans for cestodes, nematodes and acanthocephalans. In some regions rare species play a major role in contributing to the similarity between habitats, whereas in other regions dominant species appear to markedly characterise habitats. The study of species richness as a function of sampling size has provided different curves in polluted and not polluted areas. The results obtained indicate that a biological methodology to measure the environmental quality of an estuarine - lagoonal habitat using parasite species composition indices is suitable and advantageous.

Concluding remarks
- The studies of parasitic organisms provide a number of advantages with respect to those carried out on free-living organisms. As animals with complex life cycles, parasites should be considered as excellent integrators of environmental conditions and hence are useful as indicators for environmental change or ecosystem health. Since parasites are obligate symbionts, their hosts represent precise and unambiguous boundaries within which matters related to spatial and temporal distribution can be measured and compared in a nested system. For these reasons the study of biodiversity in parasite communities could represent a model for the analysis of diversity in endangered aquatic ecosystems. The potential of studies on parasite ecology should stimulate scientists to explore new approaches in the study of the structure of parasite communities, and set up ad hoc indices rather than applying those used in free-living species ecology.

- Sampling programs, parasites' collection and diagnosis, and data registrations were carried out by a co-ordinated standard methodology. All obtained data from each country were compiled into one comprehensive data base and were jointly processed by the team members. Species diversity indices of parasites in sampled young of the year mullets in selected polluted and seemingly pollution-free estuarine and lagoonar habitats were measured qualitatively and quantitatively.

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