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

Fact Sheet

Project Information

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Coordinated by
Università degli Studi di Roma La Sapienza
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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 - lagoonaire 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 - lagoonaire
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 lagoonal habitats were measured qualitatively and quantitatively.

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