Résumé de thèse

Trophic relationships in demersal communities of western Mediterranean: Case studies from coastal and deep-sea ecosystems, par Emanuela FANELLI (1).


The present study focused on the trophic web structure and trophic levels of demersal communities in two different marine environments: coastal (chapters 2, 3 and 4) and deep-sea (chapters 5 and 6) ecosystems.

The coastal ecosystem, up to 80 m, was explored by considering two fishery exclusion zones (the gulfs of Castellammare and Patti) and two intensively trawled areas (the gulfs of Termini Imerese and S. Agata) in the southern Tyrrhenian Sea (northern Sicily-Italy). The deep ecosystem was investigated off the Balearic basin (Cabrera Archipelago-Spain) at middle slope depths (550-750 m). Three fish species from costal ecosystems and three from deep-sea were selected as representative of different trophic guilds (benthophagous, suprabenthic feeder and planktophagous). Moreover, a complete examination of prey (i.e. zooplankton, suprabenthos and benthos) and predators, based on stable isotope analysis, was carried out in order to define the trophic structure of coastal and deep-sea communities.

Three chapters (2, 3 and 5) explore the role of suprabenthos as an important resource for demersal species and deal with the dynamic of this compartment in both coastal and deep-sea ecosystems. Suprabenthic resources emerged as a link between benthic and pelagic environments and of primary importance as forage for juveniles of coastal fish species and for deep-sea fishes. In chapter 2, the trophodynamics of suprabenthic communities of the Gulf of Castellammare was studied; by means of stable isotopes analysis of nitrogen and carbon seasonal variations in trophic levels and source of carbon was given. In chapter 3, the suprabenthic assemblages of four Gulfs of Northern Sicily were defined. Moreover, an attempt to distinguish different trophic levels within suprabenthos and to determine spatial changes in trophic levels and source of carbon was given. In chapter 4, spatial variations in feeding habits and trophic level of Pagellus erythrinus, Arnoglossus laterna and Merluccius merluccius, on the muddy bottoms of Northern Sicily, were studied, contrasting trawled vs un-trawled areas. Polychaetes and decapods (mainly Goneplax rhomboidea) were the preferred prey of P. erythrinus in the four gulfs. Differences in diet of samples from protected and unprotected areas were evident, with a more specialized diet in the protected gulfs. A. laterna fed mainly on decapods and gobid fish (i.e., Lesueurigobius sueri). Ontogenetic changes were evident with juveniles mainly preying on suprabenthic species, e.g., mysids and small decapods. Suprabenthic species, nantian decapods and fish were dominant in the diet of juveniles of European hake, M. merluccius. Juveniles smaller than 160 mm of total length, mainly fed on crustaceans, while a shift to a strongly pelagic diet occurred in larger specimens. Stable isotopes analyses confirmed gut content results with significance differences in δ15N signatures between protected and unprotected areas only for the benthic feeder P. erythrinus. Stable isotopes evidenced a complex food web in coastal demersal community with at least two trophic levels among suprabenthic species and with fish as top-predators.

In chapter 5, the trophodynamics of suprabenthos and zooplankton was analysed off Cabrera Archipelago, at a seasonal scale between August 2003 and June 2004. Temporal variations were evident among benthepelagic species both in terms of biomass, abundance and assemblage structure. Stable isotope analysis evidenced temporal variations in trophic levels and source of carbon, probably due to oceanographic features.

Temporal variations in the diet of three deep-sea demersal fish on the continental slope off Cabrera were analysed in chapter 6. Samples of Hoplostethus mediterraneus, Hymenocephalus italicus and Nezumia aequalis were collected at bi-monthly intervals, between 550 and 750 m of depth. Classical stomachs contents and stable isotopes analyses were contemporarily applied in order to detect temporal variations in diets and trophic levels. H. mediterraneus mainly preyed on isopods (Natalolana borealis) and, on lesser extent, on amphipods and mysids. H. italicus fed on mysids (mainly Boreomysis arctica) and amphipods, captured in the Benthic Boundary Layer, while N. aequalis seemed to exhibit a more benthic behaviour with benthepelagic and benthic prey in its diet (e.g. polychaetes and tanaids). Strong temporal variations were observed in the diet of H. mediterraneus, with February as a period of change in feeding habits. Temporal changes were less evident in the two macrourids and depth seemed to be a more structuring factor of diet than month. An experiment using formalin preserved specimens and frozen specimens as control was also performed in order to verify if preserved material could be used for stable isotope analysis. Formalin did not affect δ15N signatures, while time of preserving strongly influenced δ13C values, with different pattern among the three species. Temporal variations of δ15N values were evident in the three species: the lowest values were observed in September and the highest in April-June. Among the three species, N. aequalis had the highest trophic level (4.47), occupying a high position in the deep-sea trophic web. In general, deep-sea trophic webs were complex, with at least three trophic levels among benthepelagic resources and with fish as top-predators: marine snow seemed to be the only primary source of material.

Key words. - Pagellus erythrinus - Arnoglossus laterna - Merluccius merluccius - Hoplostethus mediterraneus - Hymenocephalus italicus - Nezumia aequalis - Trophic webs - Trophic guilds - Feeding habits - Demersal communities - Suprabenthos - Stable isotopes analysis - Trawl-ban.

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