



DISCUSSION

Jason Hall-Spencer has proved how habitats built up by living organisms in shallow waters, as is the case of *maerl* bottoms, which also occur in some Mediterranean areas, require long periods of time for their recovery. The single passage of a heavy, highly efficient scallop dredge produces effects still visible after 5 years of observations! The importance of adopting proper protective measures is clear, although we still do not exactly know the functional meaning of such types of environment characterised by high diversity (an example of precautionary principle), if necessary through mechanisms and incentives directly involving fishermen.

Fabio Pranovi demonstrated the short-term effects of the passage of a gear producing one of the most severe types of impact on Northern Adriatic benthic biocenosis: the "rapido". Such a productive basin is not easily suitable for this type of study; for example, it is difficult to find control areas of significant size not subject to trawl fishing (it is easy to prove how most of the coastal areas are covered by trawl nets several times a year on average: e.g., if only the rapido is considered, it has been estimated 8 times/year in the case of a 2-mile-wide and 45-mile-long Venetian coastal area). Moreover, the waters are characterised by low visibility, which force researchers to look for offshore oligotrophic areas where, however, deeper bottoms do not help scuba operations necessary for sampling, which must necessarily be precise. In this case, in addition to classic investigations on macrofauna, the behaviour of meiofauna, subject to indirect impact, has also been observed.

Gianluca Franceschini has presented some preliminary results on the direct impact of the rapido in the Northern Adriatic, obtained with the aid of a cover net. As was to be expected, the effects are highly differentiated, being above all related to the morphology and fragility of the species and even to the type of environment and biocenosis fishermen work on.

Anna De Biasi has shown some of the aspects related to choosing an experimental area within a more general research project, to be carried out in two different sites in the North-Western Mediterranean on the short- and long-term impact of the otter trawl, the so-called Italian 'tartana'. Research is in progress and its presentation, although preliminary, provides some useful information.

Jim Atkinson has presented his work on burrowing structures and the eco-ethology of burrowing fauna in the Adriatic. A high number of species build up and live in burrows normally presenting species-specific architectures and are certainly influenced by the passage of trawl nets, especially those penetrating the upper layer of sediment such as the rapido or hydraulic dredges. The great variability of the distribution of the fishing effort, benthic fauna and sediment granulometry in the Adriatic contributes to making quantification of such effects rather complicated, in both short- and long-terms.

Michele Scardi has carried out elaborate research on historical data (from the 1930s up to recent years) related to Adriatic benthic biocenoses which, although understandably difficult to standardise, has identified some causal hypotheses, still to be investigated and proved. He proposes at least two determining factors: a series of quantitative



variations in terrigenous contributions, and the enormous recent increase in trawl fisheries, especially after the 1960s. This effect certainly acts synergically with many other factors and is therefore difficult to treat on its own. But it is highly likely that fishing has contributed to the depression of spatial variability on small and medium scales and favoured the reduction of ecotones.

John Caddy summarised underwater and fishing gear research conducted by him in the 1960s and 1970s, providing the context for some guidelines for future research.

Some participants here have asked reporters for better explanations and information. Some speakers also remarked how difficult it is to distinguish, on the basis of analyses of ecosystems and the structure of benthic populations in the long run, between the number of variations related to fishing and those related to other factors (both anthropic and natural). Even earlier than 60 years ago, trawl fishing was well developed in the Adriatic (obviously then a more limited effort, without rapido gears). Moreover, the yearly amount of nutrients derived from rivers outflow, particularly the Po, was probably very different the period in question. It is useful to identify indicators, e.g. biological, for better comparison of variations and their causes.

One aspect arising from the discussion is the need to pass from small-scale, direct effects on biological communities (shown in various contributions to this workshop), to basin-scale and medium-long terms. This could be done, on one hand by determining new methods and, on the other, by choosing techniques allowing us to extend results obtained on small-medium scales to a larger one.

Better knowledge of the effects of fisheries may come from the creation of protected or "no take" areas in significant parts of the basins. Situations and basic features, being equal comparisons, represent a valid methodological approach, also because they allow new types of evaluations for better management of efforts, gears, operators, etc. In view of the current strong reservations by operators when discussing the establishment of areas forbidden for fishing, it is necessary to have remarkably good information on the involvement and diversification of activities, including tempting opportunities for reconversion of fishermen's activities. It may be possible to derive valid ideas from experiences in pilot areas, so as to create the foundations for new types of management.