

The Mediterranean Sea

lack of information on them, and this makes species-specific, effective conservation and sustainable harvesting plans impossible.

For this purpose, the bluntnose sixgill shark *Hexanchus griseus* was chosen as a candidate species requiring further study in the Central Mediterranean, since it is caught on a regular basis by fishermen (both as target and as by-catch) and data on its catches, biology and stocks are extremely limited.

Through this study, which has been running since 2004, a detailed assessment of its vulnerability to fisheries exploitation can be conducted on scientific data collected both from the field and through the use of genetic markers. Such research shall assess the genetic variability within the stock/s being exploited, thus determining the genetic structure and diversity within and among populations of this shark species, mainly around the Maltese Islands. Also, since sampling is being conducted over a period of years, data collected will help to pinpoint not only present genetic variation but also identify any seasonal/yearly changes in local stocks. Better understanding of genetic variation will ensure that, in the implementation of management plans, present and future generations will be protected through the maintenance of genetic variability that leads to reproductive vitality,

resistance to disease and the ability to adapt to changing conditions.

Thus, with the aid of ecological, biological, economic and genetic data, a more holistic approach towards the conservation and long-term persistence of wild stocks, together with their genetic character and diversity, can be conducted. In this regard, both the FAO and IUCN admit a lack of knowledge and highlight the necessity for more scientific research in the area. Within this scenario, elasmobranch conservation is important for the important role that elasmobranchs play within marine ecosystems, where they usually occur among the top predators. In other terms, the latter may mean that a decline in elasmobranchs could have a significant effect on marine ecosystems, allowing other species to increase rapidly in number. This would be rather ironic considering that elasmobranchs have played a role in the equilibrium of the marine environment for more than 400 million years. Thus, this study aims to make an effective contribution to the better understanding of this deep-sea shark species and, furthermore, should provide a clearer picture of the present genetic stock in the Central Mediterranean region, thus helping to protect the species and the future of the fishermen who earn a living using this resource.

Samples of the species are being collected from various locations in the Mediterranean, and anyone wishing to contribute to this conservation molecular genetics research project through samples is most welcome to do so by contacting myself or Dr Adriana Vella (contact details below).

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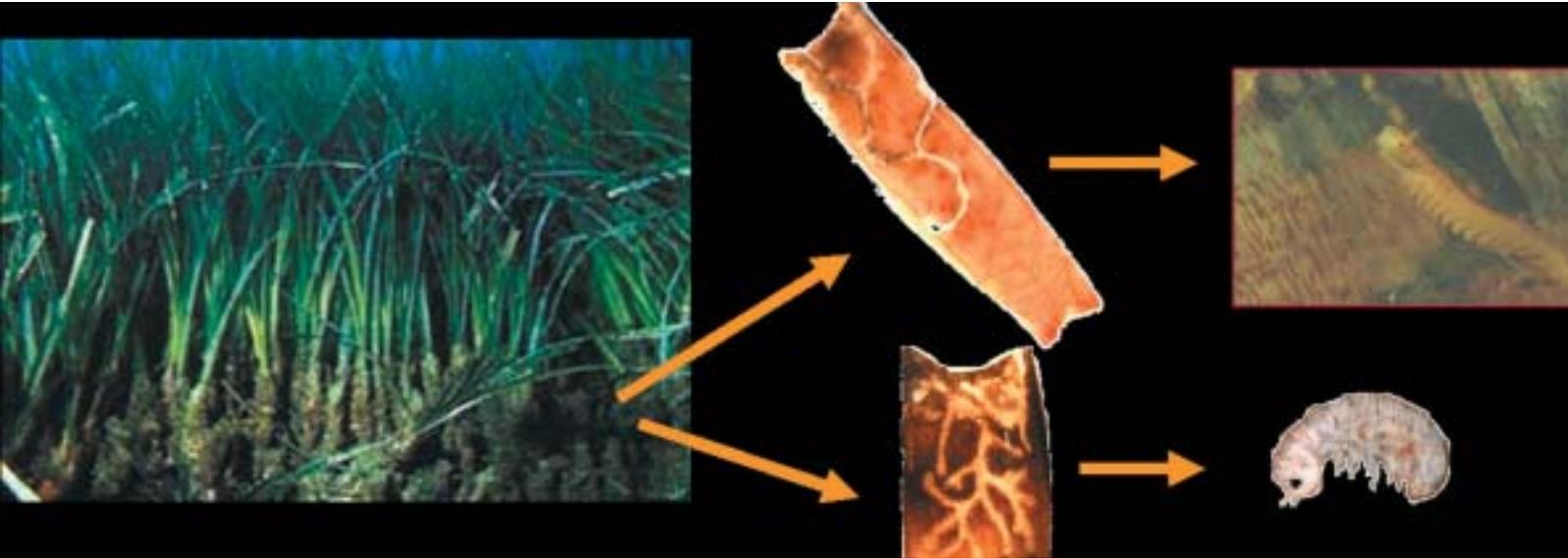
Invertebrates in *Posidonia* sea-grass meadows

Spatio-temporal variability in the distribution of invertebrates in seagrass *Posidonia oceanica* meadows off the Tyrrhenian Sea (Italy): relationships with meadow and canopy features

By **Claudio Vasapollo and Maria Cristina Gambi**

Posidonia oceanica is an endemic seagrass of the Mediterranean Sea. It forms dense and extensive meadows (>1000 shoots in very shallow waters and in ideal light conditions with no disturbance) at depths ranging from 1 m to 40m. These meadows are one of the most productive and complex ecosystems in the Mediterranean Sea.

In fact, many organisms exploit *P. oceanica*, both for feeding and as nursery areas, as it represents an incredible source of oxygen (20l/m²/d), is an important primary producer and, most of all, its dense canopy creates an intricate "labyrinth" to which small fishes and invertebrates (and their juveniles) can repair to avoid big predators, which cannot penetrate



Scheme (by M.C. Gambi) of the scales bored by both the polychaetes (here *Lysidice collaris*) and the isopods (*Limnoria mazzellae*).

the leaves or the rhizome (the stem of the plant) net.

The system formed by the *Posidonia* plant can be divided into three main compartments, which create an extremely high spatial complexity: leaves, rhizomes and sediment/roots layer. Each one of them requires peculiar adaptations for the associated organisms. Due to this architectural complexity, *Posidonia* meadows host one of the highest animal and algal biodiversities (more than 750 associated species censused in a single meadow in the Tyrrhenian Sea). Thus, by understanding the relationships between plant features and animal assemblages, we could be able to recognise the key steps in the possible "cascade effects" that cause seagrass meadow regression and/or loss. In fact, several disturbances (e.g. coastal development, boat anchoring, pollution, dredging, "alien" species' invasions and other anthropogenic activities) threaten the plant and the ecosystem it builds.

Since the effective management of *Posidonia oceanica* habitats depends on the knowledge of the processes that govern the spatial and the temporal properties of seagrass coverage and canopy features, there is the urgent need to study the ecological consequences of the physical alteration of seagrass habitats. A knowledge of spatial and temporal variability, both of plant and of associated organisms, and the correlations between the plant features and the assemblages hosted, is essential to design and optimise any environmental habitat and management programme that can discriminate between the natural and anthropogenic disturbances.

The spatial structure of *P. oceanica* beds and the scale at which it is studied are crucial elements to evaluating the expansion/regression, both of the meadows themselves and of their associated communities. To date, investigations have focused mainly on variations on a geographical scale or within meadows along depth gradients (e.g. shallow vs. deep stands), but relatively few studies have examined variations within a meadow at a given depth, or examined horizontal scales in spatial distribution variability of animals and of epiphytes. Recent findings demonstrate that the variability and dishomogeneity of shoot

density at medium and small scales (anisotropy) in *Posidonia* beds is higher than those at larger scale, something that has been widely observed in other assemblages in different habitats (e.g. intertidal rocky shores). In fact, it seems that *Posidonia* shoots tend to create aggregates or "nuclei" in which the density can increase or decrease depending on local substratum features (nutrients, grain size, etc.), light availability and bottom morphology. Moreover, relatively few studies have focused on the relationships between plant features and faunal distribution and abundance (most of them have considered other species of seagrasses).

One recent study concerned the distribution of borer polychaetes on *Posidonia oceanica*. These organisms represent a peculiar guild of animals which bore into the sheaths (the bases of the leaves that remain on the rhizomes after leaf-fall) and exploit a low-palatability and tough detritus source within the *Posidonia* system. The spatial distribution of these organisms follows the same distribution at medium scale of the shoot density of *Posidonia*, and it is organised in nuclei of increasing density, although this trend is sometime mismatched with respect to that of the shoot density. These results suggest that there is still limited knowledge on the correlations between *Posidonia* shoot density and canopy features and the frequency and dynamics of associated organisms. After the discovery of this kind of distribution at medium scale, both for the plant and for the polychaetes, it is interesting to evaluate whether the same pattern of variability is followed by other vagile organisms associated with the canopy, or whether it is reproduced at different spatial scales and in meadows submitted to different environmental features.

Our main aim is, in fact, to compare the levels of variability in relation to meadow status in order to understand, not only the distribution of these animals *per se*, but also if any of them could be used as a bioindicator of the health of the meadow. Three meadows were therefore selected, all located in the island of Ischia (Tyrrhenian Sea, Italy). One of the meadows (Lacco Ameno) is subjected to various sources of human disturbance (water-waste outfall,

anchoring, proximity to a tourist marina, etc.), while the other two meadows (Scarrupata and Cava) are pristine areas with very limited anthropogenic impact. In each meadow, various sites have been randomly selected at 15m depth and spaced at least 150m apart. Within each site, two subsites, spaced 20-30m apart, have been chosen and, finally, at each subsite, three plots spaced 2-3m apart are being sampled, each plot consisting of two replicates of a 40x40 quadrat, situated 1m apart and sampled with an air-lift suction sampler for the vagile fauna (not destructive method) and shoot collection for borers and plant features (morpho-chronology). The collection of samples will be conducted during the summer and winter, corresponding to the maximum and minimum in canopy development and epiphyte coverage, respectively (replicated twice in each season), and will permit us to estimate the relation of the fauna with density of the shoots and the phenology of the canopy.

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