

Who cares about the Hydrozoa of the Mediterranean Sea? An essay on the zoogeography of inconspicuous groups

FERDINANDO BOERO*, JEAN BOUILLON**,
CINZIA GRAVILI*, STEFANO PIRAINO*

**Dipartimento di Scienze e Tecnologie Biologiche e Ambientali, Stazione di Biologia
Marina e Museo dell'Ambiente, Università di Lecce, I-73100 Lecce (Italy).*

***Laboratoire de Biologie Marine, Université libre de Bruxelles, 50 Av. F.D. Roosevelt,
1050 Bruxelles (Belgium)*

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SUMMARY

The Messinian crisis, 5 MY before present, marked the recent history of the Mediterranean Sea. The opening of Gibraltar, and the inflow of Atlantic water, brought in the ancestors of the species that inhabit the Mediterranean today. The opening of the Suez Canal allowed the entrance of Indo-Pacific species. Ships and aquaculture transported species from all over the world. At present, the Mediterranean Sea is a melting pot of a blend of biota that probably has no equivalent in any other part of the world. The tropicalisation of the Mediterranean and Lessepsian migration are conducive to the establishment of tropical species into the basin, with some outstanding examples like that of *Caulerpa* species, and of the scyphomedusa *Rhopilema nomadica*. At present, the arrival of new conspicuous species is well monitored and researchers are ready to publish new records of recognisable species. These usually belong to popular groups such as fish, molluscs and decapod crustaceans, or to groups that cannot pass unnoticed due to a marked attitude to form outbreaks, like dinoflagellates or scyphozoan jellyfish and ctenophores. What about the other groups? The bulk of biodiversity, in terms of species numbers, is made of poorly known and inconspicuous species that, usually, can be noticed only by specialised taxonomists. Taxonomy is disappearing from most scientific communities, so that our appreciation of biodiversity is being biased towards conspicuous groups. The Hydrozoa are taken as an example of inconspicuous group whose knowledge has greatly progressed in the last decades due to the presence of some specialists in the Mediterranean area. The number of species recorded from the Mediterranean almost doubled in thirty years and the number of new records is still increasing. The ecological rôle of these animals, especially those represented also by a medusa stage, can be great due to their general ability to feed upon fish eggs and larvae and/or on the plankton that fish larvae feed upon, so acting as potential predators and/or competitors of commercial species. They might even be keystone predators, depressing potentially monopolising fish species, so leaving space for less competitive species. Neglecting this component of biodiversity might lead to ecological misunderstandings that, in their turn, might lead to misleading interpretations of the causes affecting the yield of fisheries. The main question arising from the example of the Hydrozoa is: are conspicuous groups sufficient to appreciate marine biodiversity and understand its functioning? The answer deriving from the example of the Hydrozoa is: No!

THE MEDITERRANEAN FRAMEWORK

The Mediterranean Sea lies in an almost closed basin, communicating with the Atlantic Ocean via the Strait of Gibraltar, with the Red Sea via the Suez Canal, and with the Black Sea via the Bosphorous and the Dardanelli Straits. Surface temperatures range between 11-13 °C (with extremes of 4-5 °C in the Gulf of Trieste) in the winter and 25-30 °C in the summer, determining cold-temperate to warm-temperate conditions in the cold season, and tropical conditions in the warm one. Deep-water temperature is about 13 °C and, normally, this is also the surface temperature in winter, when the basin becomes homeothermic. Summer thermoclines divide the variable surface waters from the more stable, deep waters. Water loss due to evaporation is higher than water gain from rivers; as a consequence, salinity, with an average of 37‰, is higher than in the Atlantic Ocean, but lower than in the Red Sea.

During the Messinian crisis, about 5.5 MyBP, the Mediterranean Sea became closed and evaporated almost completely, with just a few “islands” of water that allowed survival of some paleoendemics, whereas the rest of the local biota went through a mass extinction. After the crisis, the present-day biota originated from a contingent that entered in the basal Pliocene (5.3 MyBP) from the Atlantic Ocean through the newly-opened Strait of Gibraltar.

In spite of some relicts of the Tethys Sea (the Indopacific-Atlantic connection of ancient times) most Mediterranean species are of Atlantic origin, having entered through Gibraltar either from the African or the European portion of the Atlantic. Species of northern affinity are thus pre-adapted to deep-water and/or winter temperature conditions, whereas species of southern affinity are pre-adapted to surface and/or summer conditions. Most Mediterranean life, in fact, is characterised by a sharp seasonality in its rhythms of activity, either in terms of actual presence (many species spend the adverse season as dormant or encysted stages) or in terms of sexual reproduction (Boero, 1994; Boero et al., 1996; Marcus and Boero, 1998).

Seasonality is the key for the high richness of Mediterranean biodiversity. The same physical space can widen its potential for life in another dimension, with the alternation of species in time.

The availability of proper conditions for both tropical and temperate species makes the Mediterranean a perfect sea for biological invasions. The opening of the Suez Canal, in fact, allowed the entrance of Senegalese species that thrive now in the Easternmost part (warmer in the winter than the rest of the basin) and can also widen their geographic range under particularly favourable conditions. Very few Mediterranean species entered the Red Sea, since the more stable physical conditions have selected there a specialised biota that easily outcompete the less focused Mediterranean species.

Besides the entrance of new species from both Suez and Gibraltar (the Atlantic flow never stopped), the Mediterranean is experiencing also the transport of exotic species (Zaitsev and Öztürk, 2001) by ships, both in hulls' fouling and in the ballast waters of big cargoes. These enter the basin while empty, release their ballast in the harbour of destination, and sail away with a load of goods. This pattern is particularly evident in the Black Sea, with the traffic of oil tankers that brought in ctenophores that impaired the yield of fisheries by feeding on fish larvae and on their food. Another source of biological invasions is aquaculture. In addition, the growing number of allochthonous species recorded from the basin (e.g. the algal *Caulerpa* spp pool) can be surely due to unwanted (but very effective) human-mediated spreading.

A further impulse to the presence of alien species of tropical affinity is the undeniable temperature increase that characterises the Mediterranean surface waters since several years and that is probably due to a tendency towards global warming. The biological response to this trend is dramatic. Southern species are widening their geographical range; tropical species that enter the basin establish successful populations, like the *Caulerpa* spp., medusae like *Rhopilema nomadica* (Lotan et al., 1992; Kideys and Gücü, 1995; Avsar, 1999) and many fish species. Species of cold water affinity, furthermore, are affected by the deepening of surface thermocline and warm waters in the summer. Mass mortalities of gorgonians in the Ligurian Sea are most probably due to such impacts.

From all the above, it is evident that the Mediterranean biota are at the opposite extreme of Indo-Malayan ones, characterised by an extremely long stability that yielded a very rich biodiversity that, in its turn, was exported to both nearby and distant zones. If seen in the framework of source and sink ecology (Pulliam, 1988), the Indo-Malayan region is a source and the Mediterranean is a sink.

As stressed by Maurer (1999), the extremely rich biodiversity of a given place might be an epi-phenomenon due to the immigration of species coming from different source populations. Applied to the Mediterranean, the problem is: are the newly formed populations liable of undergoing a separate evolution in respect to the source ones? Following the allopatric model of speciation, genetic bottlenecks and founder effects should affect the propagules originating new populations, leading to evolutionary novelties (or to dramatic failures). As a matter of fact, the number of Mediterranean endemics is very high (the most outstanding example is *Posidonia oceanica*, the trademark of the Mediterranean Sea) and accounts for the originality of the Mediterranean biota.

The natural experiment (enhanced by human activities) of species immigration is leading to an extraordinary blend of species that makes of the Mediterranean the ecological crossroad of the world ocean, with the fastest evolving biota in terms of both ecological and evolutionary time.

It is evident, from all this, that the Mediterranean has always been changing (both physically and biologically) and that the change of today is not the first revolution that the basin passed through. It is important, however, to distinguish human-generated changes from changes due to natural (or more global) forces. The example of *Caulerpa* might be considered as paradigmatic. It might be possible, in fact, that *C. taxifolia* had been introduced in the basin by the careless management of some human enterprise (Meinesz, 1999), but the invasion by other species of the same genus, and their extraordinary success, calls for reconsideration of the causes of this phenomenon. Probably, exotic *Caulerpa* species reached the Mediterranean many times in the past, but did not find proper conditions for development, whereas the present situation is conducive to their establishment.

THE HYDROZOA OF THE MEDITERRANEAN SEA

The study of Mediterranean Hydrozoa dates back to the dawn of modern zoology. Several Linnean species thrive also in the Mediterranean and, in 1785, Cavolini reported on *Eudendrium racemosum*, probably the first species described as new to science from this Sea. Since the 19th century, oceanographic vessels allowed the exploration of the seas in distant parts of the world, but only few expeditions regarded the Mediterranean. The establishment of the Zoological Station of Naples in the same century, however, signed also the dawn of modern marine biology: people from all over the world came to the Mediterranean to study biodiversity on a residential basis. Biological oceanography and marine biology stemmed from completely different approaches (oceanographic vessels vs. marine stations) but had the same original aim: the exploration of marine biodiversity. Oceanographers focused on distant parts of the world and/or to deep waters, whereas marine biologists focused on coastal areas that were particularly rich in biodiversity. Another possible location for a marine station was Messina, due to the strong currents of the Strait, which brought to the coast the unusual animals of deep waters. Metchnikoff and Kölliker worked extensively at Messina and gave important contributions to the knowledge of the Hydrozoa. The founders of Hydrozoan Zoology, with very few exceptions, were from Northern European Countries characterised by hostile climates and relatively poor faunas. They soon started to move towards the warmer and richer Mediterranean to perform their studies on living organisms. The pattern of activity of these non-residential researchers was dictated by climate and by their academic obligations. They usually worked in their home Countries during the winter and moved towards the Mediterranean (mainly Naples) during the summer. This tendency marked sharply the type of Hydrozoan fauna that was going to be described because, as we have seen, the Mediterranean is a sharply seasonal sea.

A very particular student of marine biology was Rupert Riedl. He went to Naples, and then to many other parts of the Mediterranean Sea, at the beginning of the Fifties and started the exploration of marine caves with SCUBA diving techniques. A new era of marine biology began, with the entrance of the scientist in the environment that was the object of his studies. Riedl (1959) studied the hydroids of marine caves and of rocky coasts in general, producing the first ecological paper on the group.

Other places where research on marine life became prominent were located in the Austro-Hungarian Empire at Trieste, Rovinj, Split, and in France at Villefranche-sur-Mer, Endoume and Banyuls. In the first half of the 20th Century the British school of Hydrozoan zoology, led by F.S. Russell and W.J. Rees, started to work at the building of a single classification for both hydroids and medusae, opening a research project that is still very far from being accomplished. In the Mediterranean, at the Naples Zoological Station, this project was the basis for a great enterprise that was expected to lead to the Hydrozoan Fauna of the Mediterranean. Bouillon, Brinckmann-Voss, Petersen, Stechow, Tardent, Vannucci, Uchida, Yamada and others amongst the most prominent researchers of Hydrozoa gathered at Naples and worked there for more than a decade. Unfortunately the project was accomplished only in part and Brinckmann-Voss (1970) published just the first of a series of monographs that should have covered the Hydrozoa of the Mediterranean Sea. Another great contribution to the knowledge of Mediterranean Hydrozoa came from the work of Picard and a group of his pupils who, at the Endoume Marine Station, bridged taxonomy, phylogenetics and ecology. At the Zoological Station of Villefranche a long series of papers mainly by Carré and Carré gave a great contribution to the knowledge of the Siphonophora and, occasionally, of the hydromedusae.

In 1985, at the Laboratory of Benthic Ecology of the Zoological Station of Naples, at Ischia, the Hydrozoan Society was founded, gathering most of the active students of the Hydrozoa from all over the world. This gave new impulse to the study of the Hydrozoa and set the basis for a host of collaborations.

LISTS OF MEDITERRANEAN HYDROZOA

Picard (1958) made a complete list of Mediterranean Antho- and Leptomedusae, summing up 191 species, to set the basis for a never to be made Faune de France volume on the group. Boero and Bouillon (1993) updated the work of Picard, treating all the Hydrozoa besides the Siphonophores, bringing the list to 346 records. Boero et al. (1997) further updated the list to 379 species. To these, the Siphonophora are to be added. Boero and Bouillon (1993) treated the life cycle patterns of the Hydrozoa and their bearing on the distribution of these organisms. They also defined zoogeographical regions having the

Mediterranean as their centre, and made an analysis of the affinities of the fauna. These topics will not be treated further here.

A complete bibliographic database on the Hydrozoa is on line, and can be found at the following address: <<http://siba2.unile.it/ctle/hydro/index.php3>>.

THE RECORDS

All species reported at least once from the Mediterranean are part of the list. Some records are old and need reconfirmation, but they were kept to help future workers that might find them again. As it happens for all groups, also in the Hydrozoa there are common and rare species. The history of records, however, indicates that the species contingent of the Mediterranean is going through great changes and that species that were not recorded in the past, presumably due to their rarity, are now common, whereas species that have been found in the past are not being reported anymore.

Species records can be divided into the following categories:

1. “Evident” common species

These species are known since a long time and can be found in almost every sample from a proper environmental setting. Their list comprises popular species such as *Eudendrium racemosum*, *E. glomeratum*, *Aglaophenia* spp., *Clytia hemisphaerica*, *Obelia dichotoma*, *O. geniculata*, *Dynamena disticha*, *Sertularella gaudichaudi* and *S. crassicaulis*. The set of species inhabiting *Posidonia* leaves are part of this group, even though one of them, a *Sertularella*, is still to be described formally. Some common species, even of large size, can have been misidentified in the past, so that their names might be rather obscure. The most striking case is possibly *Eudendrium armatum*, a large species that can be invariably found on the roofs at the entrance of caves and crevices. Its general aspect resembles that of *Eudendrium rameum* and is possibly often reported with this name. Riedl (1959), in his monograph on the hydroids of Mediterranean caves, did not mention it, but recorded repeatedly *E. rameum*, even figuring it in his popular guides of the Adriatic and the Mediterranean flora and fauna. As a matter of fact, confirmed records of *Eudendrium rameum* are very rare, whereas *E. armatum* is extremely common.

2. Cryptic species now collected more frequently due to increased sampling efficiency

Halocoryne epizoica, a species described by Hadzi in 1917 from the Adriatic Sea, was not found again until Picard reported it from the Ligurian Sea, fifty years later (see Piraino et al., 1992). The species was anyway so “rare” that

Brinckmann-Voss (1970) could not find it while working at her monograph on capitate hydroids and medusae. *Halocoryne epizoica* is strictly symbiotic with the bryozoan *Schizoporella sanguinea*, a very abundant species in sea urchin barrens, at low depth. This type of environment is easily reachable by SCUBA diving techniques, but is not easy to sample from the surface with grabs and dredges. The yield of samplings, thus, can be biased by the employed techniques. This means that *H. epizoica* might have been common even in the past but that it passed unnoticed due to difficulties in sampling. The same is true for *Cytaeis schneideri* (formerly referred to as *Perarella schneideri*), another specialist for symbiosis with bryozoans.

3. Species that are alternately rare and common

Paracoryne huvei became frequent and abundant for a relatively narrow time window. It cannot be missed or mistaken with anything else, since it lives in the infralittoral zone and is the only known Mediterranean hydroid that settles higher above the mean sea level. It forms large pink patches on black mussels and on bare rocks that can be seen while walking along the shore. Its polymorphic colonies are so different from those of any other species that Picard (1957) described the new species and proposed for it a new genus and a new family! It is almost impossible that such a species passed unnoticed to all the people who worked earlier on Mediterranean hydroids, if not for its extreme rarity. In the Seventies and Eighties *Paracoryne huvei* became fairly common along the northern coasts of the Mediterranean and was repeatedly reported. Then it disappeared again and is presently back to rarity. The presence of resting stages in its cycle can be the reason why the species is able to disappear and reappear. Extra long diapause might be rather widespread in most species since all hydroids can become dormant while regressing to resting hydrorhizae. This pattern of presence makes it possible to be active during the favourable season, but might be also the way these animals can disappear for decades and be suddenly back again. This pattern is even more evident for their medusae! The second example refers to a species that was formerly very abundant and is now apparently rarer: *Ectopleura crocea* (= *Tubularia crocea*). Pierre Tardent worked extensively on populations of this species living in the Gulf of Naples. He chose it as experimental animal due to the ease of finding specimens in the harbour on every season. He went back to Naples after thirty years, considering the opportunity of performing more work but had to give up his project because he could not find a single specimen (personal communication). It is possible that the period of commonness is rather long, as that of rarity. It is part of the ecology of all gelatinous plankton (and of its benthic counterpart) to be present with massive blooms or even outbreaks and to be absent even for decades thereafter. This is

possible mainly due to the presence of benthic stages that can become encysted, so escaping most sampling efforts.

4. Species that newly entered the basin

The study of Lessepsian migration from the Red Sea to the Mediterranean through the Suez Canal originated a wealth of information about Indo-Pacific species entering the basin (Por, 1978; Spanier and Galil, 1991). No such records regarded the Hydrozoa until recent times. *Clytia gravieri*, a nominal campanulariid species, however, was described on the basis of specimens coming from the Suez Canal by Billard (1938). Subsequently, it was considered as conspecific with *Clytia linearis*, a species first described from the Indo-Pacific. This species was first recorded from the Mediterranean in the Fifties and might be one of the first (and undetected as such) Lessepsian migrants. Now it is one of the commoner hydroids of shallow rocky Mediterranean coasts. Due to its branched habit, it cannot be mistaken with any other *Clytia* and it is highly improbable that in the past it was as abundant and frequent as it is now and that it simply passed unnoticed. Hydrozoan researchers were finding much more inconspicuous and relatively rare species than this one, so that they should have reported it frequently if it had been around. Being a tropical species, it is probable that the recent tropicalisation of the Mediterranean favoured its success in the basin. Another way to enter the Mediterranean, of course, is the Strait of Gibraltar. The study of the Hydrozoa of the Alboran Sea (Ramil and Vervoort, 1992; Medel and Vervoort, 1995; Medel et al., 1998) is leading to many new records and this is evidently a hot spot of new Mediterranean entries from the Atlantic Ocean. A recent introduction is *Clytia hummelincki*. It has been recorded from the Mediterranean for the first time in 1996, along the coasts of Calabria (Boero et al., 1997), almost in the centre of the basin. Being present both in the Atlantic and in the Pacific (with rare records) it is difficult to establish if it entered from Suez or from Gibraltar. At present, this species is very successful, forming a belt at 0.5-1 m depth in sea urchin barrens along the Apulian coast, where it is extremely common and abundant. Its distribution in the rest of the basin is unknown, probably due to the fact that it can be mistaken with species of the genus *Campanularia* and only hydrozoan specialists can identify it properly. In the same period, Bitar and Bitar-Kouli (1995) recorded *Macrorhynchia philippina* from the coasts of Lebanon, undoubtedly a Lessepsian migrant.

5. Species that are rare since their very discovery

Rarity can be either soffusive, when a species is rare at many places but common at least at one, or diffusive, when a species is rare everywhere it occurs (Schoener, 1987). The number of records is not so great for most of rare species,

and it is difficult to distinguish between the two types of rarity for any of them. Rarity, furthermore, can be geographical or ecological. Geographically rare species live in restricted areas, and are absent in other areas that, nevertheless, have the same features as the areas where they thrive. Ecologically rare species have very strict ecological requirements that are met just at few places; if their particular requirements are met, however, they are often present. For the Hydrozoa, furthermore, rarity can be also linked to seasonality, since some species can be present over a very short time window and become encysted (usually as hydrorhizae) for the rest of the year. The best example of this is *Rhysia autumnalis*, a species present only in autumn and that, furthermore, is strictly linked to serpulid tubes (Brinckmann, 1965). *Hydractinia inermis*, on the contrary, is present for a short period in the spring, and disappears for the rest of the year. Information about rare species, though, is often insufficient to assign them to any particular category. The only Mediterranean hydrozoan that is mentioned in red lists is *Errina aspera*, probably due to its calcified skeleton, its resemblance to a coral and its restriction to the Strait of Messina (Zibrowius, and Cairns, 1992) where, however, is very abundant, so being an example of soffusive rarity. A good example of rare species is *Codonorchis octaedrus*, described by Haeckel in 1879 from the Atlantic coast of France and never found again since Boero et al. (1997) reported its hydroid from a cave of the Ionian Sea, reconstructing its life cycle. In this case, however, rarity might be an artefact due to inconspicuousness of the hydroid and to the resemblance of the medusa to those of the genus *Amphinema*, so that the species might have been passed unnoticed as hydroid and misidentified as medusa.

6. Declining species

This category is very elusive and might be included in the one comprising species that are alternately rare and common. The concern about species threatening and extinction invariably regards popular and conspicuous species, as the above mentioned *Errina aspera*. This attitude is partly linked to the perception of species by the lay people, but has its foundation also in the attitude of researchers. If it is easy to recognise that a species has become abundant, in fact, it is more difficult to demonstrate that it has become rare, since absence is less evident than presence. In other words, researchers tend to stress what they find instead of what they do not find. To recognise decline we should be able to check the presence of species from the published records of all the researchers that worked on the group, comparing their results. A declining species might be one that is not found since fifty years, after having been found repeatedly during the previous fifty years, taking care of both the types of sampled environments and seasonality. If *Eudendrium rameum* is really a Mediterranean species and its

records are not simply misidentifications of *E. armatum*, then this species is probably a declining one. It is important, thus, to reconstruct the history of the study of all species, so to have maps of their records and keep their “health” under control. At present, however, there are no hydrozoan species that are sufficiently well known to deserve the status of either threatened or endangered.

SEASONALITY AND LIFE CYCLES

As stressed above, the Mediterranean is a markedly seasonal sea and its summer and winter faunas have different zoogeographical affinities and ecological requirements. The Hydrozoa, in particular, are particularly seasonal in occurrence and the possibility for the polyps to become encysted as resting hydrorhizae contributes to the presence of great differences in the species that can be found at a given place according to the season. Boero and Fresi (1986) studied the seasonality of nearly one hundred species of Antho- and Leptomedusan polyps at a single study site of the Ligurian Sea, showing the existence of two distinct hydroid faunas, characterising the warm and the cold season respectively. Boero et al. (1986) studied the seasonality of *Eudendrium glomeratum*, illustrating the sudden growth of its colonies and their equally sudden decline. The pattern of growth of most hydroids involves sudden colony appearance, production of gonophores (either fixed or as free medusae) and subsequent decline. The life of most medusae ranges between a few hours to one month, and the production of planulae, thus, takes place with such a delay from medusa liberation, whereas the colonies with fixed gonophores usually produce planulae directly. A reasonable expectation is that, after fertilisation and planula development, the population of hydroids will increase in number and density; instead, it usually suddenly declines. The obvious explanation is that either planulae or newly formed colonies are able to encyst and to wait for the following favourable season (or even successive ones) to produce noticeable and reproductive colonies.

Colonies, furthermore, can remain asexual for long times, without producing reproductive bodies (either medusae or fixed gonophores). This was stressed by Edwards (1973) who observed that medusae of some species can be absent for years, being continuously present as hydroids only.

The species of gelatinous plankton without benthic stages, however, can be sharply seasonal too, so generating doubts about their holoplanktonic way of life. Many plankters, in fact, have inconspicuous resting stages (see Boero et al., 1996 and Marcus and Boero, 1998 for reviews) and easily escape detection. Many calanoid copepods, traditionally considered as holoplanktonic, spend the adverse season as benthic cysts, wrapped in a chitinous sheath. The perisarc of the Hydrozoa is made of chitin and the polyps easily form cysts with their hydrorhizae.

The list of hydrozoan species from a given area, thus, cannot be the result of a single sample. Boero and Fresi (1986) reported two main seasons, having their centre in February and July, so that these two months might be sufficient to have an almost complete species list for a given locality. This, however, is not enough to find reproductive colonies, since gonophores can be produced for very short periods or, as we have seen, can be absent for several years, just as the whole colonies can, remaining present as dormant hydrorhizae. Carefully taken samples often give some novelties, even from the most explored coast, in terms of new records for the area, or of reproductive colonies of species with unknown life cycle, if not of species new to science. Boero et al. (1997), keeping a small substrate fragment in an aquarium, observed, in sequence, the appearance of *Zanclaea* sp., *Trichydra* sp., *Thecocodium brieni*, *Turritopsis nutricula* and *Codonorchis octaedrus*. Evidently, these species coexisted as hydrorhizae on that small space and alternated in becoming active, a quite common behaviour for most hydroids.

THE "ROLE" OF THE HYDROZOA

Ecological roles have been taken as a very important issue to emit judgement about the relevance of species, so to produce convincing evidence about the need for their protection (Piraino et al., 2002). This attitude, of course, implies that if a species has no recognised role, it is implicitly regarded as less important than a renowned species. This causes a great bias in the way we perceive biodiversity. We are attracted by conspicuous species. Only recently, for instance, it is generally perceived how phytoplankton is more important than (or at least as important as) tropical rain forests in maintaining the climate of the whole planet the way it is (Falkowski, 2002). Diatoms and flagellates are not as impressive as oaks and redwoods, just as copepods and small jellies are not as impressive as whales and sharks. Marine systems are based on microscopic life and are, thus, generally undervalued. Most conservation purposes are first biased in favour of terrestrial systems and, when the sea is considered, in favour of big, charismatic species, usually vertebrates and higher plants (with the sole exception of corals and some molluscs). The Hydrozoa are no exception and, thus, tend to be considered as "negligible" if compared to more "visible" groups. This attitude is based on a naive way of conceiving ecology and is simply wrong. The case of *Mnemiopsis lleydi*, for instance, shows that a gelatinous predator can impair larval survival and subsequent recruitment of commercial fish, greatly impacting on human activities (Boero and Briand, 2001). This ecological role might be played also by hydromedusae, since many species are of the right size to predate on fish eggs and larvae and, furthermore, also on their prey, so acting as both predators and competitors. The arrival of the already cited *Clytia hummelincki* in the

Mediterranean, and its large hydroid populations, producing great numbers of relatively large medusae might play an important role in the success of fish recruitment, by removing eggs and larvae from the environment. The impact on biodiversity, however, might even be positive, since predation on the larvae of particularly successful fish species might decrease their abundance so to leave space for the development of previously outcompeted fish species, so enhancing fish diversity. The hydroid polyps, furthermore, are also very important in the passage of energy from pelagic to benthic systems (Gili et al., 1998). Our knowledge on the roles of species is so scant that we cannot consider any species as unimportant *a priori*.

CONCLUSION

The knowledge of the biogeography of the Hydrozoa is far from being complete, not only due to the continuous arrival of new species in the basin, but also due to insufficient or geographically too concentrated (e.g., the Tyrrhenian or the North Adriatic seas) research efforts, so leading to inefficient coverage of possible areas of distribution.

The case of the Hydrozoa shows that we are still very far from a proper evaluation of the structure of biodiversity, in terms of species presence and distribution, and that the understanding of biodiversity function, via the identification of species roles, is even less developed. The lack of specialists in almost every marine group will rapidly lead to the impossibility of pursuing this kind of studies, with the paradox that, in the era of biodiversity, biodiversity experts are disappearing, at least from Europe (Boero, 2001).

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