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Biodiversity protection and sustainable management of coastal areas: The Marine Protected Area of Egadi Islands

The Marine Protected Area (MPA) of Egadi Islands, northwest coast of Sicily Island, is the largest area in the Mediterranean Sea, stretching over with its 53,992 hectares. Established in 1991, since 2001 it is managed by the Municipality of Favignana on behalf of the Italian Ministry for the Environment, Land and Sea. The Egadi's archipelago is located in the Strait of Sicily, and includes the islands of Favignana, Levanzo, Marettimo and the islets of Formica and Maraone.

The archipelago lies on the continental shelf of western Sicily, which is an extension of the northern geological nature, characterised by the presence of vast calcarenitic deposits on most of the seabed between the Islands of Favignana and Levanzo. The archipelago emerges from a platform which is characterized by erosive and depositional forms, such as underwater cliffs, terraces, river valleys, paleo-beaches and dunes, which testify different stages of the last cycle of glacio-eustatic sea level changes. The seabed morphology is very irregular: wide flat areas are alternated by very steep slopes related to the presence of the Islands, ridges, paleocliff and valleys. Favignana and Levanzo are closer to Sicily and connected to the mainland by a platform and a slight depression. Marettimo is in the outer platform, constantly separated from the

mainland since the Pliocene by a 350 m deep channel. Exchange of water masses within this channel, generates strong currents between the western and the eastern Mediterranean Sea.

Medium-fine sand characterises the seabed. Its organogenic component is derived by shells, whereas the limestone component is derived from erosion of the rocky outcrops. The submerged vegetation of the archipelago varies over different substrates, transparency of the water column and the hydrodynamics. The seabed of Favignana and Levanzo is characterised by bionomic features typical of intertidal and infralittoral plans, frequently dominated by brown algae up to 10-12 meters of depth, followed by a dense *Posidonia oceanica* meadow. In these two islands, the populations of the circalittoral plane are present only in some sites of the southern side of Favignana and offshore shallows. Around Levanzo (between -60 and -100 m), the *Laminaria rodriguezii* facies occupies large areas of the seabed, where hard substrate and intense bottom currents are concentrated.

Marettimo has a similar infralittoral zone, but also a wide circalittoral zone up to the edge of the continental shelf. The upper infralittoral seabed has photophilic biocenosis, characterized by a wide belt *Cystoseira amentacea var. stricta* and *C. brachycarpa*. The *C. amentacea var. stricta* creates a continuous belt around



the archipelago, always with top covers above 60-80%, and sometimes above 100%. In Marettimo, below the belt *C. amentacea* var. *stricta*, populations of *C. Mediterranean* and / or *C. elegans* are sometimes present.

The vermetid “trottoir” (or reef), is a biogenic construction, due to sessile gastropod *Dendropoma petraeum*, which is extremely abundant and with a great amount of structure on the coastal strip of the three islands of the archipelago.

It develops close to the mean sea level for an estimated length of more than 10 km along the coast, playing a vital role for protection against coastline erosion. The *Astroides calycularis*, is a thermophilic madreporite colony species –which suffers regression phenomena in many areas along the Mediterranean– stretches over the first infralittoral fringe just below the vermetid reef: extensive colonies are mainly found along the submerged cliff of the integral reserve (Zone A) and in shallow water caves of Marettimo.

Both *Dendropoma petraeum* and *Astroides calycularis* are among the species in jeopardy or at risk of extinction within the Mediterranean.

The carbonate coasts of Egadi Islands are characterised by a superficial and deep karst system, which represents a typical landscape. A large number of caves and coastal tunnels as well as the underwater karst system are part of many submerged and semi submerged caves. The whole carbonate component habitat extension to the sea is estimated to be about 4,000 hectares.

The low brightness of the seabed overhanging, in many cases favours the development of sciafili and

corals concretions. The roughness of limestones also increases the settlement of meroplanktonic larvae and formation of shelters occupied by a rich endolithic fauna.

The MPA includes the largest (about 7,700 hectares) and best preserved *Posidonia oceanica* meadow of the Mediterranean Sea. The *Posidonia o.*, is a priority habitat and represents the most important biotic community as it is abundant and well distributed within the Egadi Islands, especially on medium-fine sand, which is scarce in deep water. The upper limit of the meadow ranges between -2/-9 m, at Favignana, and -12/-15 m at Marettimo. In the Egadi archipelago the foliar length of *Posidonia o.* can reach more than 2 m and it grows up to -52 m of depth. At lower depth and in coves, scattered *Posidonia* patches alternated with biotic photophilic and rocky seabed are frequently observed.

Posidonia is considered the green lung of the Mediterranean Sea, playing different roles crucial to the marine ecosystem.

In addition, the *Posidonia o.* forms an area of vital nursery as it protects the youth of hundreds of species of organisms, produces oxygen, absorbs a very considerable amount of CO₂, and helps to mitigate the coastal erosion through the formation of “*banquette*” on beaches, that are produced by the accumulation of dead leaves in the winter.

Another important species, discontinuously distributed on the seabed of Egadi Islands is *Lithophyllum byssoides*, a calcareous algae that can form large concretions (“trottoirs”), currently steadily distributed in various areas of the Mediterranean Sea, which hosts specific and rich wildlife

communities. Around the Egadi Islands there are also several rocky sites which are spectacular from both an aesthetic and naturalistic point of view as they are dominated by gorgonians, sponges with a highly structured marine population.

A very high biodiversity is generated by the habitat described above, resulting in a marine life that includes many protected and endangered species. After numerous reports and sightings, ISPRA and the MPA of Egadi Islands have recently documented the presence of at least one specimen of monk seal (*Monachus monachus*) during the winter season, a species classified as critically endangered by the IUCN and included in several international conventions and directives.

Numerous sightings have occurred as well as recovery of specimens of sea turtle *Caretta caretta*, which do not nest in the Islands, but is an assiduous frequenter of the MPA's waters. Bottlenose dolphins (*Tursiops truncatus*) and spinner dolphins (*Stenella coeruleoalba*) are present among the marine mammals even if they have to be accurately determined. Sightings of sperm whales (*Physeter microcephalus*) are not rare. The porbeagle sharks (*Lamna nasus* and *Prionace glauca*) are widespread. Two charismatic species are more rarely encountered, the white shark (*Carcharodon carcharias*) that goes in the Channel of Sicily during reproduction, and the elephant shark (*Cetorhinus maximus*). Among corals, real "forests" of gorgonian *Paramuricea clavata* and, in other sites, specimens of *Corallium rubrum*, *Gerardia savaglia* and *Centrostephanus longispinus* are found. Among the shellfish it is worth mentioning the widespread presence of

a species at increasing risk, the *Patella ferruginea*, and numerous colonies of the famous bivalve *Pinna nobilis*. Among the crustaceans, it is important to mention the presence of *Palinurus elephas*, *Scyllarides latus* and *Scyllarus arctus*. Also the fish fauna is rich and varied. Many species reported an increase in the average size and number of individuals: stone bass (*Epinephelus marginatus* and *Polyprion americanus*); corvina (*Sciaena umbra*); umbrine (*Umbrina cirrhosa*); sea breams (*Dentex dentex*; *Diplodus cervinus*; *Seriola dumerili*); swordfish (*Xiphias gladius*); bluefin tuna (*Thunnus thynnus thynnus*). The marine avifauna is another attraction, especially with the presence of a colony of the rare storm petrel, *Hydrobates pelagicus*.

The fauna, flora and habitats described above have an exceptional value for environmental conservation, and represent a major tourist attraction for all sea-sports fans. The MPA has 76 diving sites. They are both superficial (with exceptional values), and deep (cave or underwater archaeological sites as a famous battle at sea between the Romans and Carthaginians took place in the area located north-west of Levanzo). They can be visited only with guides and authorized divers, likewise, snorkelling and sea-watching are practised under supervision.

The institutional mission of the MPA is the protection and enhancement of the marine environment, environmental education, awareness and information of users, research and monitoring, integrated management of the coastal zone, and the promotion of sustainable development, with particular reference to the eco-compatibility of tourism. It is divided into four areas



of different protection levels and with different access possibilities and use limitations.

All tourist (bathing, navigation, anchoring, mooring, diving, recreational fishing) or commercial (fishing and marine services to tourism) activities are regulated by the MPA's Rules and Disciplinary measures, annually drawn up by the managing authority.

The Marine Protected Area is a member of Federparchi, of MedPan network, it is twinned with the Monterey Bay Marine Sanctuary (California, USA) and constantly works in synergy with the major Italian environmental associations and local associations.

In recent years, the Park Authority has started up a process of management, monitoring and control of the territory based on participation and sharing of local stakeholders. Beside the projects with ENEA, other research developments, studies and monitoring activities are carried out in collaboration with numerous national research institutions (ISPRA, CNR, University of Palermo, CoNISMa). Every summer, the MPA uses a fleet of four ships, operating every day to support surveillance activities, crime prevention and control at sea. These activities are carried out by the competent authorities (Coast Guard, Municipal Police, Carabinieri, Prison Police, Financial Police and State Police). The MPA has obtained, among all the 27 Italian protected marine areas, the best management assessment by the Ministry of the Environment, for the allocation of government funds on 2013. The MPA is self-financed thanks to the procedures of permits, ticket entrance and sanctions; it started up

various forms of sponsorship and fundraising at the local, regional, and national levels.

Among the major projects carried out by the MPA in recent years (2010-2015), the project MASTER was aimed to the positioning of bollards on the seabed of the Archipelago in order to reduce the impact of illegal trawling, that affects the seabed by rooting out the *Posidonia oceanica* meadows and depletes fish resources. It has produced outstanding results in just two years (-50% abuses, based on the blue-box data). Phase 2 of the project is currently underway in Levanzo and Marettimo. Also MPA installed 14 mooring fields, in many sensitive areas within the 3 islands, where a total of 150 buoys are placed during the summer in order to prevent recreational boats from damaging the seabed with their anchors. Accessibility to the most beautiful and popular coves represents one of the most significant income to the economy of the Islands.

In collaboration with ENEA, the environmental certification of tourism services (accommodation, catering, rental boats, cars, motorcycles and bicycles, guided tours at sea, passenger transport on land and sea, fishing, diving, bathing facilities, mooring services) has been appositely implemented and adopted by more than 60 operators.

In addition, within the GERIN Project, new management strategies for the reuse of seagrass wrack have been tested in order to avoid disposal of this natural bio-resource into landfill. The results of this studies and best practices have led to a change, after many years. The regulation of the MPA has been modified in 2015, by inserting an article



entirely devoted to the management of the beached vegetal biomass in order to allow local authorities to turn this problem into an opportunity for economic development.

With the project “Sea Guardians” we have been involved for two years in the monitoring of protected species within the Archipelago through the collaboration of 40 professional fishing boats. The Castle of Punta Troia, in Marettimo, is a property of the Favignana city council, dedicated to the Museum of prisons that is now hosting the “Observatory of the Monk Seal” and used as an information centre for visitors and as a residence for researchers involved in monitoring species. At the prestigious Palazzo Florio in Favignana, the first recovery centre for sea turtles has been set up. The centre is managed in cooperation with WWF Italy and Legambiente, and thanks to the project Life+2012 “TartaLife” it will be strengthened in order to become a reference rescue centre in the Mediterranean Sea.

The MPA is also partner to the “ENPI CBC Med-Jellyrisk”, for environmental monitoring and mitigation of the proliferation of jellyfish along the coastal areas of the Mediterranean Sea, with the role of deploying three experimental anti-jellyfish nets. Within the project “Fishermen and dolphins”, the MPA operates in order to mitigate potential conflicts between the fishing industry and whales by direct reimbursement

to fishermen of the fishing nets damaged by bottlenose dolphins. The MPA constantly promotes responsible tourism and sustainable sports, such as sailing, windsurfing, kayaking, swim-trekking, triathlon, cycling, hiking and climbing.

In recent years, the MPA of Egadi Islands has consolidated its role as a laboratory for advanced sustainable management of coastal areas, applying and implementing best practices that have been appreciated at national and regional levels and also proposed in other areas upon recommendation of the Italian Ministry of the Environment. The Egadi’s MPA has also become a reference for the eco-sustainability of the local market.

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