OCEANA Protecting the World's Oceans


© OCEANA / Eduardo Sorensen


© OCEANA / Carlos Suárez


© OCEANA

December 2020

SEAMOUNTS

Giants in danger

Introduction

Underwater seamounts are often referred to as oases of the ocean, as they are home to rich ecosystems living at various depths on their slopes, benefiting from ocean currents that increase biological productivity and attract other marine life. Used as 'stepping stones' for transoceanic dispersion of species, and as reproduction or feeding grounds for migratory species, seamounts also host diverse benthic fauna dominated by corals and sponges. Their recognised importance as biodiversity hotspots makes them a clear priority for deep-sea conservation.

Despite their importance, seamounts in Europe remain largely underrepresented in networks of marine protected areas (MPAs). In this document we focus specifically on two EU countries, Spain and Italy, that have a high number of seamounts in their waters, many of which have been well documented by scientists. Oceana hopes to stimulate efforts to protect seamounts in both countries and beyond, to safeguard their valuable role in the marine environment for years to come.

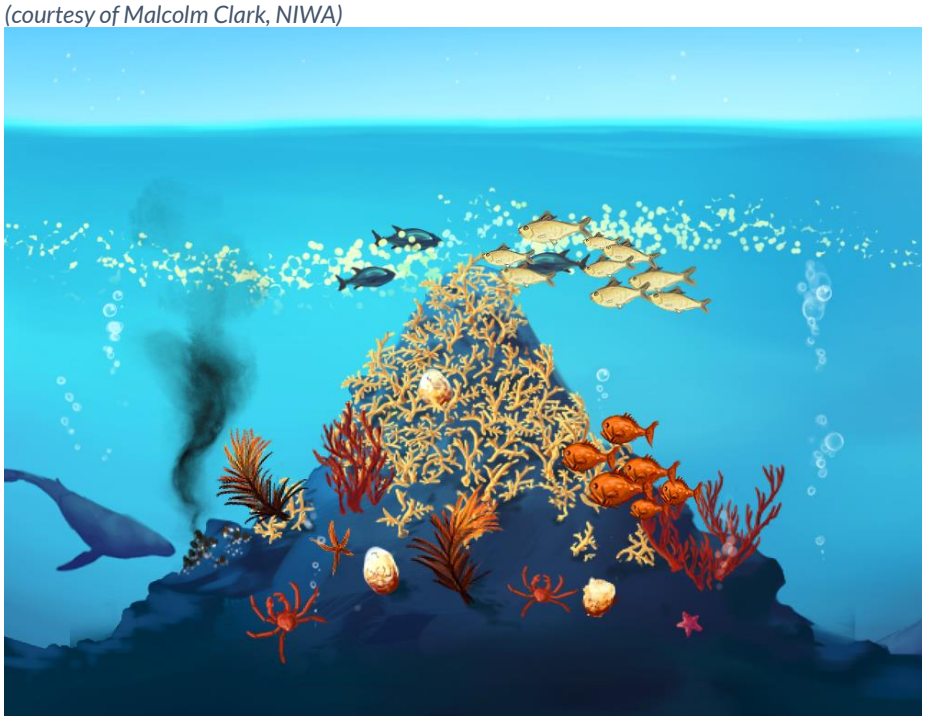
What is a seamount?

A variety of definitions exist for these underwater mountains. Some argue that actual seamounts occur when they rise more than 1000 metres above the seafloor. Others explain that smaller elevations, such as knolls and hills, that can be a few hundred metres, may have important ecological roles.

Ecological importance of seamounts

Seamounts play a crucial role in the functioning of deep-sea ecosystems, both in terms of benthic habitats and the surrounding pelagic area (Pitcher et al. 2007; Bo et al. 2011; Aïssi et al. 2013; Bo et al. 2020). Because they are usually isolated, and due to their elevation above the seabed, seamounts alter local current systems, providing suitable conditions for the suspension of organic matter. Thus, they become highly productive areas that support rich benthic communities, dominated by filter-feeders (such as corals and sponges). These organisms form complex colonies that serve as habitat and provide structure to the surface of the seamount.

Figure 1. Diagram of a seamount community, showing the primary components and zonation (courtesy of Malcolm Clark, NIWA)



Seamounts may provide habitat for a wide variety of marine life, sustaining complex food chains that can include species over 100 years old (Rogers, 2012). Certain deep-sea coral communities are particularly abundant in these structures, along with soft corals, stony corals, black corals and sponge aggregations (Gubbay, 2003; Probert et al. 2007). Large pelagic and highly migratory species (such as sharks, whales, turtles, and tuna-like fishes) are found in the water column, using seamounts as stepping-stones on their longer journeys for navigation, mating, resting and/or breeding (Litvinov, 2008; Vasallo et al. 2018). More recent findings also show they are used as larval highways by coral species (Miller and Gunasekera, 2017). Figure 1 illustrates a typical seamount, with zonation of related species and communities.

In many cases due to their isolation, a high level of endemism occurs around seamounts; they harbour species that make them unique places on the planet (WWF, 2003). More than 11% of the fish species caught around seamounts are estimated to be endemic and this percentage can even reach 50% in some cases (Hart, 2008).

Benthic communities on seamounts have ***low resilience*** *to the impacts of* ***bottom trawling***

Clark et al. 2019

Growing threats

Seamounts host a wide variety of fish species that aggregate around them to reproduce or feed, making them a target for fisheries. In the 1970s, seamounts were among the first targets of the expansion of long-distance fishing fleets from Japan and the Soviet Union. (Clark, 2009). According to Pitcher et al. (2010), global seamount fisheries catches were estimated to be about 3 million tons per year and increasing – vastly exceeding estimated sustainable levels. In general, it is well recognised that many seamounts around the world are threatened, because of the overexploitation of their fish resources and damage to sessile habitat-building organisms caused by destructive fishing gear (Morato et al. 2010). For example, recent research has shown the low resilience of benthic communities on seamounts to the effects of bottom trawling (Clark et al. 2019).

In addition to fishing, seamounts are affected by various stressors, including ocean warming and acidification, pollution, and extractive industries such as the extraction of minerals and hydrocarbons. Seabed mining is a particular threat, as cobalt-rich crusts are mostly found on seamount flanks and summits. The multiplication of human pressures around seamounts, combined with the effects of climate change, underscores the need to protect the structure and function of seamount ecosystems (Vasallo et al. 2018).

Darwin's slimehead (Gephyroberyx darwinii), sponges, and entangled fishing lines on Tritón seamount (Canary Islands, Spain)

Deep-sea protection framework

In 2006, seamounts were recognised by the United Nations as vulnerable marine ecosystems (VMEs), reflecting both their ecological value and their vulnerability to impacts (UNGA, 2006; FAO, 2013). This recognition and resulting developments in VME protection have helped to advance seamount conservation in specific areas.

For example, countries like New Zealand, Chile and Portugal have adopted bold protection measures for their seamounts, including prohibiting bottom-fisheries in parts or all of their waters. Some European MPAs have been created specifically for seamounts too, such as the Gorringe Bank (Portugal), Anton Dohrn (The UK), El Cachucho and Seco de los Olivos (Spain). Regional Fisheries Management Organisations have also adopted fisheries closures over seamounts, often in cooperation with Regional Sea Conventions (Weaver et al. 2011), such as in the North-East Atlantic.

Models indicate the presence of roughly ***700*** *seamounts in the North-East Atlantic*

Harris et al. 2014

However, many seamounts and other underwater elevations (e.g., spurs, knolls, banks, and mounds) remain unprotected in Europe. This can be partly explained by the lack of *in situ* data, as scientific expeditions are expensive. Nevertheless, detailed mapping and information on habitats do exist, and provide a sufficient basis for the adoption of precautionary management and conservation measures.

There are ***242*** *seamounts within the Mediterranean Basin*

Bo et al. 2020

While the international community is looking ahead to the post-2020 global biodiversity framework, a number of regional initiatives are similarly committing to marine policy targets. The EU has adopted a target to protect 30% of the EU marine area as MPAs, with 10% under strict protection, and Regional Sea Conventions will also develop their strategies and targets. Such initiatives provide a strong incentive for creating new MPAs to protect areas of high biodiversity importance – including seamounts.

Additionally, some fisheries regulations to protect deep-sea ecosystems have been in place since 2005: the EU banned trawls and gillnets in waters deeper than 200 metres around the Canary Islands (European Union, 2005); and the GFCM banned trawling below 1000 metres in the Mediterranean Sea (GFCM, 2005). The EU deep-sea fisheries regulation (EC 2016/2336) also introduced a ban on bottom-trawling below 800 metres in the North-East Atlantic and obligations to create closure where VMEs are known or likely to occur.

Kelp forest (Laminaria ochroleuca), *Gorringe Bank (Portugal)*

Black coral forest (Stichopathes sp.) on Dacia seamount (Canary Islands, Spain)

Spanish and Italian seamounts

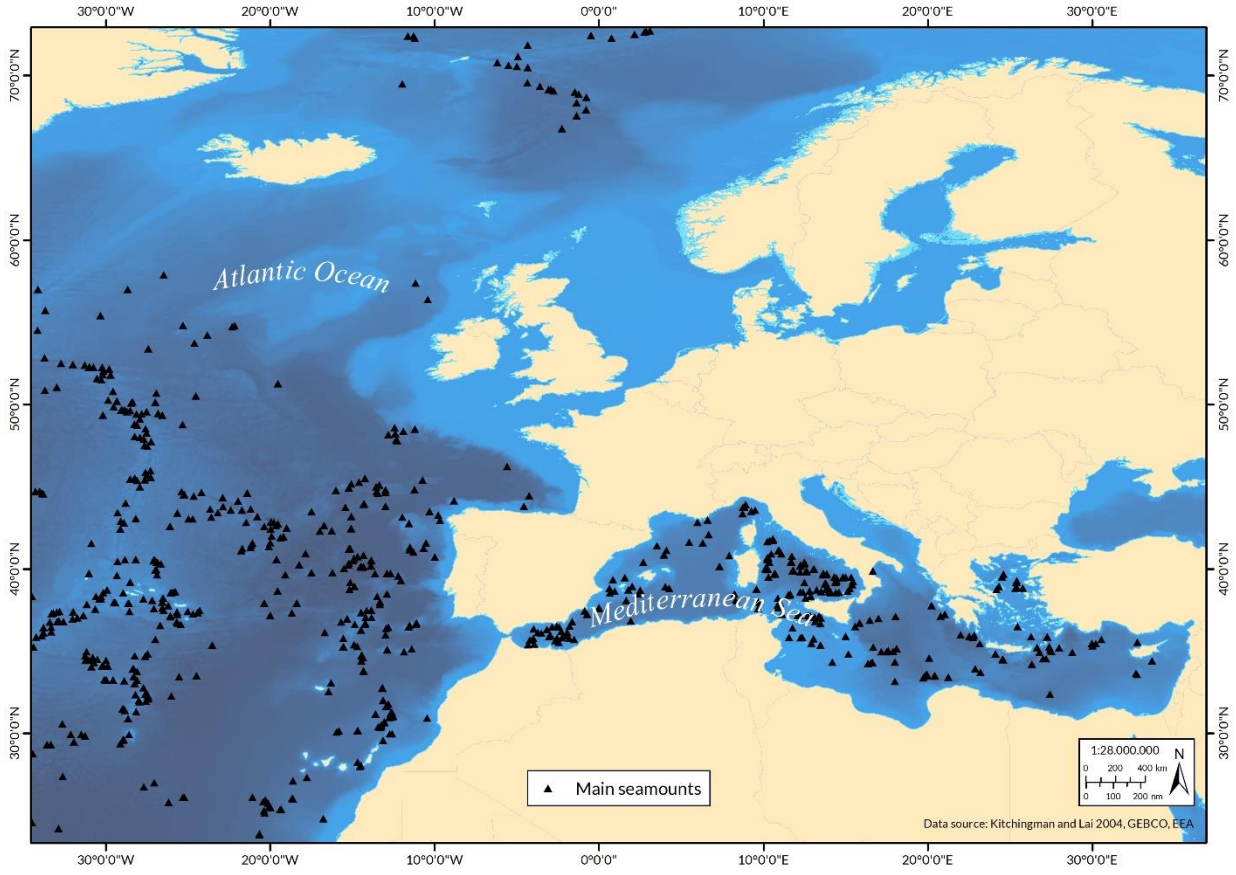
Oceana has long highlighted the importance of seamounts. Our expeditions have produced valuable first-hand information about unique habitats found on these features (Aguilar et al. 2013), and these data have helped to bring about their protection. In 2011, Oceana published a comprehensive proposal for an MPA network in the Mediterranean Sea, called MedNet, based on geomorphological features that included seamounts, as a unique asset to complete gaps in the protection of deep-sea ecosystems.

European waters are particularly important for seamounts, with high concentrations in parts of the North-East Atlantic and in the Mediterranean Sea (see Map 1). The following sections focus specifically on the seamount-rich waters of Spain and Italy, highlighting the importance of protecting certain known seamounts for their ecological value and the contribution they would make to broader MPA networks.

***Mediterranean seamounts** remain largely **unexplored**, particularly the Ligurian ones*

Bo et al. 2020

Map 1. Distribution of seamounts in the North-East Atlantic and the Mediterranean Sea



Seamounts around Italy

While Italian waters have one of the highest concentrations of seamounts in the Mediterranean basin, knowledge about their benthic ecosystems is limited to a few well-known seamounts in the Ligurian and Tyrrhenian Seas. Although in some cases biological information is scarcer than geological data, there is nevertheless enough information available to identify a selection of key seamounts to be protected.

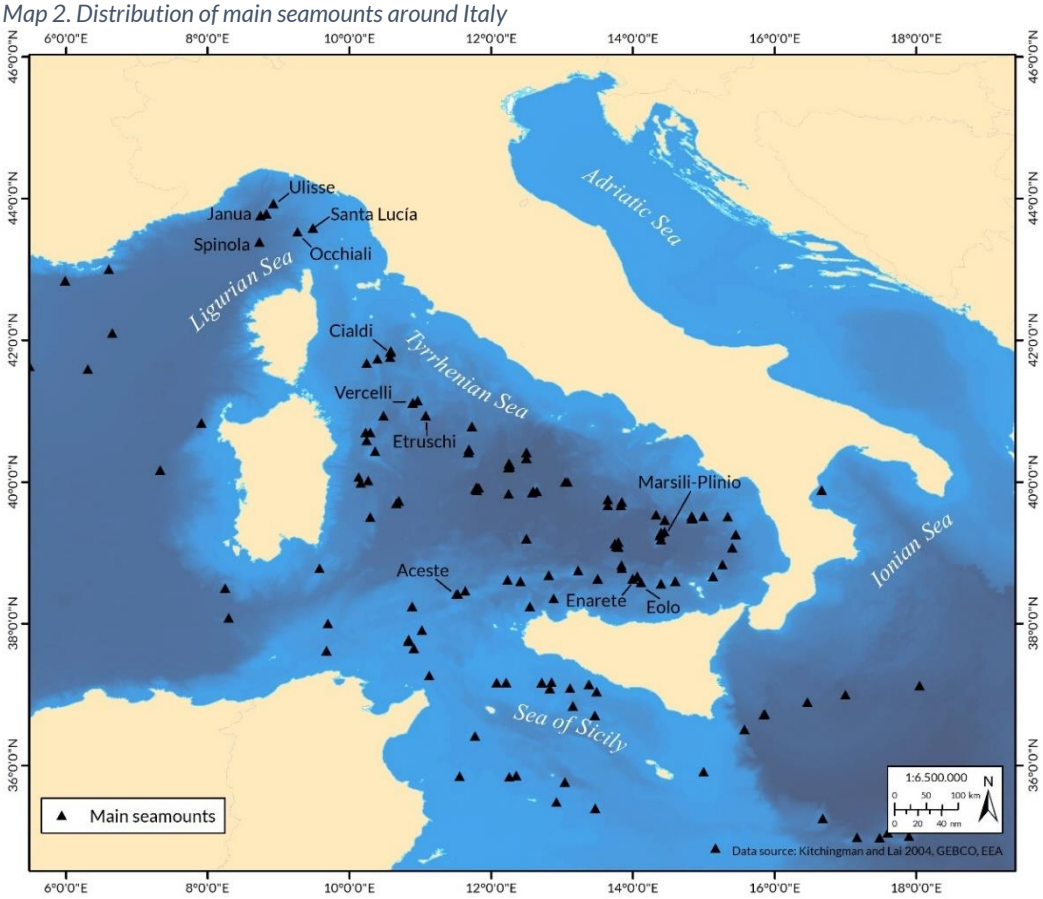
For example, research has shown the role of Tyrrhenian seamounts in attracting pelagic top predators, such as tuna-like species, cetaceans, sea turtles and seabirds. Higher abundances of predators have been found at a distance of 5–10 miles from seamounts. (Aïssi et al. 2013; Villani et al. 2014; Fiori et al. 2016; Vassallo et al. 2018). Recent surveys (BioMount, RAMOGE) also identified the main benthic assemblages found on Ligurian and Tyrrhenian seamounts, including communities of black corals, sea fans, gorgonians, sponges and hexactinellids. (Bo, 2018; Fabri et al. 2018).

Seamounts are not currently well-represented in the Italian MPA network, which mainly comprises coastal ecosystems. The European Commission's 2016 assessment of marine protection under the Natura 2000 framework concluded that Italy has not protected sufficient areas of reef; designating seamount areas as MPAs is a straightforward means of addressing this gap in the network. Plans exist to research seamounts, such as **Vercelli**, **Palinuro**, and **Santa Lucia**, but there have been no major advances so far with regards to their protection.

The ***Tyrrhenian bathyal plain*** *is dotted with at least* ***14*** *large and medium-sized* ***seamounts***

Bo et al. 2011

Map 2. Distribution of main seamounts around Italy



To date, scientific information available for **Ligurian** seamounts comes exclusively from research efforts made under the BioMount and RAMOGE projects, which conducted several expeditions in 2017 and 2018 (Daniel et al. 2019). The **Janua**, **Penelope**, **Ulisse**, **Occhiali**, **Spinola**, and **Santa Lucia** seamounts have been documented in this area (see Map 2). Most of these seamounts are historical fishing grounds for both professional and recreational fishers (Bo, 2018) targeting demersal fish and crustaceans, as well as pelagic species such as swordfish (Würtz and Rovere, 2015). Rich benthic biodiversity has been documented on their surfaces, including commercial species like Norway lobster, seabreams, hake, and spiny lobster. Protected coral species have also been found (Würtz and Rovere, 2015), with dense gardens of deep-sea gorgonians (e.g., *Callogorgia verticillata*) (Daniel et al. 2019), black coral forests (*Parantipathes* sp., *Antipathes dichotoma*) (Würtz and Rovere, 2015; Bo, 2018), living colonies of cold-water corals (e.g., *Lophelia pertusa*, *Dendrophyllia cornigera*), coral thanatocoenosis (Daniel et al. 2019) and aggregations of massive sponges (Fabri et al. 2018; Bo et al. 2020). Cetaceans such as striped dolphins, Cuvier's beaked whales, sperm whales, and long-finned pilot whales are frequently observed surrounding these seamounts (Würtz and Rovere, 2015).

In the **northern sector of the Tyrrhenian Sea**, data are available only for three main seamounts: **Cialdi**, **Etruschi** and **Vercelli**. These data have been collected during various expeditions by Italian scientific institutions (BioMount project, 2007 PRIN project). Fishing activity appears to be less important in this area, although some abandoned nets and lines have been observed (Würtz and Rovere, 2015). **Vercelli** seamount is one of the most important underwater elevations in the area, and includes a wide diversity of benthic habitats, including dense kelp forests of *Laminaria rodriguezii* on the summit and areas dominated by octocorals (*Paramuricea clavata*, *Eunicella cavolini*) (Bo et al. 2011; (Würtz and Rovere, 2015). This rich benthic community may be related to the availability of substrate and the hydrodynamic conditions of the area, which is characterised by upwelling (Bo et al. 2011). The most striking discovery on **Cialdi** seamount was a dense forest of *Parantipathes* sp., while high densities of *Spondylus* covering the hard substrate were found together with sponges and gorgonians on **Etruschi** seamount (Bo, 2018).

The **southern Tyrrhenian sector** is one of the main spawning locations for bluefin tuna in the Mediterranean, and an important area for fisheries targeting large pelagic species (ICCAT, 2010). To date, the elevations that have been explored in this area are **Marsili-Plinio** and **Aceste** seamounts, as well as two seamounts in the Aeolian arch (**Enarete** and **Eolo**). Oceana also explored **Aceste**, **Enarete** and **Eolo** seamounts in 2018. **Marsili** is the largest volcanic edifice in the south Tyrrhenian Sea (3000 metres high); **Aceste** is a 60-km-long ridge (Würtz and Rovere, 2015); **Enarete** rises roughly 2000 metres from the seabed (Angioletti et al. 2018); and **Eolo** is close to 800 metres high (Würtz and Rovere, 2015). The area is highly affected by hydrothermal activity and there is some evidence of chemosynthetic communities associated with cold hydrocarbon seeps and hydrothermal vents (Dekov et al. 2007; Carey et al. 2012; UNEP-MAP-RAC/SPA, 2010). The most remarkable benthic communities found on southern Tyrrhenian seamounts are rich soft-bottomed assemblages made of gorgonians (Notarbartolo di Sciara and Agardy, 2009), like the Critically Endangered *Isidella elongata* (Álvarez et al. 2019; Carbonara et al. 2020) (in **Eolo** and **Aceste**) (Aguilar et al. 2013) and sea pens, sensitive

*Symbiotic fauna on bamboo coral (*Isidella elongata*), Eolo seamount (Tyrrhenian Sea, Italy)*

habitats such as crinoid beds (*Leptometra phalangium*) and large brachiopod beds on detritic bottoms (Álvarez et al. 2019). Other communities documented include rocky bottoms harbouring protected cold-water corals (e.g., *Dendrophyllia cornigera*, *Desmophyllum dianthus*), gorgonian gardens along with large black corals, as well as impressive sponge grounds including glass sponges and rare "lollipop" sponges (Aguilar et al. 2013; Álvarez et al. 2019). Regarding pelagic species, cetaceans and turtles (*Caretta caretta*) have been observed close to the seamounts (Villani et al. 2014; Würtz and Rovere, 2015).

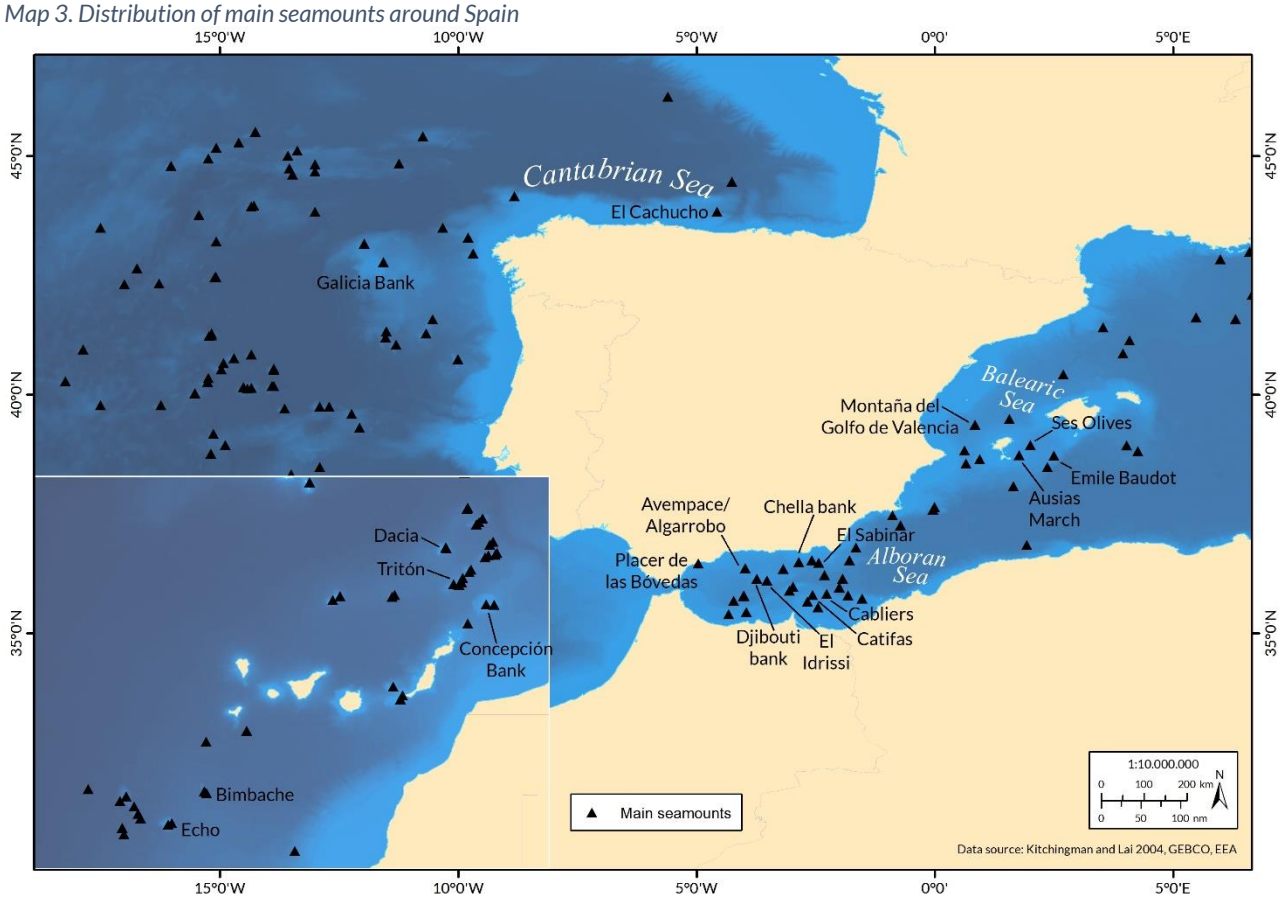
Seamounts around Spain

Large seamounts and dozens of minor elevations, such as mounds and hills, are found in Spanish waters, from the Cantabrian Sea to the Canary Islands and the Mediterranean Sea (see Map 3).

Geological and biological studies have been carried out on some Spanish seamounts, but many others remain, undocumented. Spanish elevations are home to very diverse ecosystems, such as rhodolith beds, coral forests, vulnerable sponge aggregations and pristine burrowed muddy bottoms. Rare and endangered species are present, such as carnivorous sponge (*Asbestopluma hypogea)*, giant oyster (*Neopycnodonte zibrowii*) and angular rough shark (*Oxynotus centrina*), as well as valuable commercial species. Marine turtles and cetaceans are also common in the waters surrounding these marine features.

Only four seamounts *are currently protected inside Spanish MPAs*

Map 3. Distribution of main seamounts around Spain



Four large seamounts have been protected to date in Spain, all of which are home to rich communities and threatened species. **El Cachucho**, in the Cantabrian Sea, is one of the largest (3500 metres high) and most biodiverse seamounts in Spain; in 2011 it was designated as a Natura 2000 MPA. In 2014, three more seamounts were designated as Natura 2000 sites: **Galicia Bank** (off the Galician coast), which rises more than 3000 metres from the abyssal plain; **Concepción Bank**, in the Canary Islands; and **Chella Bank** (also known as Seco de los Olivos) in the Alboran Sea, home to the Critically Endangered angular rough shark (*Oxynotus centrina*).

The European Commission's 2016 assessment of marine protection under Natura 2000 concluded that gaps exist in Spanish protection of reefs, in both inshore and offshore areas. Protection of seamounts and minor elevations would clearly help to address these gaps, while also safeguarding underwater areas of broader ecological significance.

Many unprotected Spanish seamounts are strong candidates for MPA designation, given that there is relatively good knowledge of their ecological importance (Vázquez et al. 2015). Scientists and NGOs have already developed proposals for several seamounts, in various regions of Spain. In other cases, further research is required to evaluate the potential for conservation.

In the **Canary Islands**, Oceana has documented rich seamount ecosystems (Aguilar et al. 2009; Álvarez et al. 2016), such as the Sahara seamounts (**Echo**, also known as Endeavour, and **Bimbache**) to the Southwest, and **Dacia** and **Tritón** to the Northeast. These elevations were exploited by fisheries for decades and are therefore well known for hosting cetaceans, turtles and valuable benthic communities. Among other features, these seamounts are home to black coral gardens (*Stichopathes* sp.), documented in **Dacia** and **Tritón**; very diverse habitats, such as coral framework and *Corallium niobe* and *C. tricolor* gardens on the deep summit of **Bimbache** (c. 1000 metres depth); white corals (*Madrepora oculata* and *Lophelia pertusa*) were also documented in **Tritón** and Bimbache; whip coral gardens (*Viminella flagellum*) in **Echo** seamount; and lithistid sponge aggregations (*Leiodermatium* sp.) on all four of them. Oceana, WWF, and more recently the LIFE IP INTEMARES project, have proposed the protection of these seamounts (Ayala, 2006; LIFE IP INTEMARES, 2020; Oceana, 2020).

In the **Mediterranean Sea**, threatened species and vulnerable habitats have been recorded in association with many Spanish seamounts. In this sea, contrary to other regions, even a small elevation may have significant effects on both pelagic and benthic communities (Würtz and Rovere, 2015). Although detailed information is available for many seamounts in Spanish Mediterranean waters, the **Chella Bank** is the only such seamount that has been designated as a whole (a management plan is still pending approval, despite the fact that it was designated as an MPA in 2014). In addition, partial protection was given to two Mallorca Channel seamounts, **Ausiàs March** and **Emile Baudot** (in the Balearic Islands) by closing their summits to trawling, due to the presence of rhodolith beds (BOE, 2014).

*School of mackerels (*Trachurus *sp.) in Dacia seamount (Canary Islands, Spain)*

Efforts to document and protect specific seamount areas are ongoing within the Spanish government-led LIFE IP INTEMARES project. One such area is the Mallorca Channel, where three seamounts (**Emile Baudot**, **Ses Olives** and **Ausiàs March**) are home to valuable habitats and species like black coral forests (*Leiopathes glaberrima*), bamboo coral gardens (*Isidella elongata*), carnivorous sponge (*Asbestopluma hypogea*), and giant oyster (*Neopycnodonte zibrowii*). Another focal area under this project is Palos Bank (**Seco de Palos**), which is covered by soft corals (*Chironephthya mediterranea*) and various rare species, such as the giant foraminifera *Spiculosiphon oceana*. These seamounts are being studied through a series of oceanographic expeditions and are expected to be protected as Natura 2000 sites in the near future.

Additional seamount areas have also been recommended by experts for protection (LIFE IP INTEMARES, 2020), such as the Alboran Sea seamounts and mounds (**Avempace**/Algarrobo, **Djibouti Bank** and **El Idrissi**), where remains of cold-water corals *Lophelia pertusa* and *Madrepora oculata* have been documented (Pardo et al. 2011), and which the Spanish government has committed to protect (MITECO, 2019); and a peculiar sponge reef-like formation (*Leiodermatium pfeifferae*) identified by Oceana at **Stone Sponge Seamount** (Montaña del Golfo de Valencia), another unique place (Maldonado et al. 2015).

Oceana has documented valuable habitats and species on other Spanish seamounts and banks and proposed that they be protected (Oceana, 2020). This is the case for Avenzoar Bank (**El Sabinar**), characterised by soft-bottom species of ecological importance, such as sea pens (*Funiculina quadrangularis*, *Pennatula phosphorea*), yellow tree coral (*Dendrophyllia cornigera*), and crinoids (*Leptometra phalangium*). Oceana has also proposed the protection of the **Cabliers Coral Mound Province** (Cabliers and Catifas banks, in waters shared with Morocco). This area is home to the impressive and only growing cold-water coral reef in the Mediterranean, which is formed by *Lophelia pertusa*, *Madrepora oculata*, and *Desmophyllum dianthus* (Pardo et al. 2011; Corbera et al. 2019).

Lophelia pertusa *reef on Cabliers Bank (Alboran Sea, Spain)*

Delivering conservation of seamounts

In the face of the biodiversity and climate crises, both of which have significant implications for the marine environment, the EU recently committed to protecting 30% of our oceans by 2030, including 10% under strict protection (European Commission, 2020). This represents an opportunity to protect areas of high-biodiversity value within MPA networks, including seamounts, which are associated with high productivity and act as 'islands' for epibenthic and pelagic fauna.

The 2016 Tangier Declaration set up objectives to complete the MPA network in the Mediterranean Sea with a specific focus on better protection of deep-sea ecosystems, which are underrepresented in the network. Similarly, in the Atlantic, OSPAR has listed seamounts as threatened and declining, and offers tools for their protection (OSPAR, 2014). Even though the Canary Islands are currently outside the OSPAR maritime area, the potential nevertheless exists for stronger regional cooperation to better conserve seamounts in the North-East Atlantic.

Consequently, Oceana calls on Italy and Spain to strengthen their efforts to protect these features, as 'umbrella' habitats for other threatened marine life (including bony fishes, sharks and rays, cetaceans, corals, and sponges). Spain and Italy are both very well placed to lead these efforts regionally: they have robust scientific institutions with years of experience and extensive data, clear legal jurisdiction to exercise sovereignty, and the means to advance marine protection. Spanish and Italian seamounts have also already been identified in several Ecologically Biologically Significant Areas (EBSA) in the Mediterranean Sea, such as in the South Adriatic Ionian Strait, Alboran Sea, North-Western Mediterranean Benthic Ecosystems, and Sicilian channel (UNEP/CBD, 2014). Together, these factors provide a strong basis for developing ambitious conservation action to protect seamounts.

As an obvious starting point, seamounts should be prioritised for protection that have been well-studied, and for which there is clear scientific evidence demonstrating their ecological importance (see Table 1).

Table 1. Priority seamounts for conservation in Italy and Spain.

Area	Seamounts
ITALY	
Ligurian Sea	Ulisse and Janua
Northern Tyrrhenian	Vercelli
Southern Tyrrhenian	Aceste Eolo and Marsili
SPAIN	
Alboran Sea	Cabliers Coral Mound Province
Balearic Sea	Emile Baudot, Ausiàs March and Ses Olives Seco de Palos Stone Sponge seamount
Atlantic Ocean	Echo and Bimbache Dacia and Tritón

Recommendations

Beyond the protection of those specific areas, Oceana issues the following recommendations to Spanish and Italian policy-makers regarding seamount conservation:

- **Protect seamounts and their communities under national law**, through marine protected areas, and adopt precautionary management measures that include banning extractive activities;
- **Establish strictly protected MPAs** (no-take marine reserves) on seamounts to create 'reference areas' for scientific monitoring;
- **Ensure stronger implementation of the EU deep-sea fisheries regulation** (Regulation 2016/2336) in particular the closure of areas where Vulnerable Marine Ecosystems (VMEs) are known or likely to occur below 400 m;
- **Prioritise research efforts focused on seamount identification and conservation**, and consider supporting this research with EU funds such as through the LIFE programme, following the example of LIFE INDEMARES (Spain);
- **Consider regional protection to complement national measures,** such as under Regional Seas Conventions (e.g., Barcelona Convention SPAMIs and OSPAR MPAs) and Regional Fisheries Management Organizations (e.g., fisheries closures under the GFCM or NEAFC);
- **Adopt a general ban on bottom-fishing** in the waters surrounding all Mediterranean seamounts, under the GFCM;
- **Report VME information to both ICES and the GFCM,** to inform future scientific advice on possible closures;
- Include specific seamount-related actions in **the next update of the Dark Habitats Action Plan under the Barcelona Convention,** aiming to strengthen protection of these valuable features.

Sei whale (Balaenoptera borealis*) navigating over Dacia seamount (Canary Islands, Spain)*

References

Aïssi M, Alessi J, Fiori C. 2013. PROMETEOS Project: Evidence of seamounts and submarine canyons effects on cetacean aggregation in the central Mediterranean Sea. In: *27th Conference of the European Cetacean Society*, Setubal, 249–250.

Aguilar R, Álvarez H, Campmany I, Sánchez N, Marín P, Blanco J. 2020. España: buceando entre plásticos. Oceana, 18 pp. 10.5281/zenodo.4286204

Aguilar R, de la Torriente A, Peñalver J, López J, Greenberg R, Calzadilla C. 2009. Propuestas de áreas marinas de importancia ecológica: Islas Canarias. Oceana, 298 pp.

Aguilar R, Pastor X, García S, Marín P, Ubero J. 2013. Importance of seamount-like feature for conserving Mediterranean marine habitats and threatened species. *Rapports de la Commission international pour la Mer Méditerranée*, 40: 716.

Álvarez H, Perry AL, Blanco J, Aguilar R. 2016. Expedición 2014 'Atlantic Seamounts'. El Hierro y montañas submarinas. Oceana, 84 pp.

Álvarez H, Perry AL, Blanco J, García S, Aguilar R. 2019. Towards the creation of a marine protected area in the Aeolian Islands. Results of the 2018 Aeolian Expedition. Oceana, 136 pp. 10.31230/osf.io/b9dqc

Ayala B. 2006. Propuesta de red representativa de Áreas Marinas Protegidas en España. Archipiélago Canario. World Wildlife Fund (WWF)/Adena. 23 pp.

Angioletti A, Tadini A, Ceramicola S, Verdicchio G, Tibaldi A, Freiwald A, Savini A. 2018. A geomorphological map of the Enarete seamount. In: *Proceedings of the 20th EGU General Assembly*, *EGU2018*, 4-13 April 2018, Vienna, Austria, p.17301

Bo M. 2018. BioMount project. https://biomount.macisteweb.com/

Bo M, Bertolino M, Borghini M, Castellano M, Covazzi Harriague A, et al. 2011. Characteristics of the Mesophotic Megabenthic assemblages of the Vercelli Seamount (North Tyrrhenian Sea). *PLoS ONE*, 6(2): e16357. 10.1371/journal.pone.0016357.

Bo M, Coppari M, Betti F, Massa F, Gay G, Cattaneo-Vietti R, Bavestrello G. 2020. Unveiling the deep biodiversity of the Janua Seamount (Ligurian Sea): first Mediterranean sighting of the rare Atlantic bamboo coral *Chelidonisis aurantiaca* Studer, 1890. *Deep Sea Research Part I: Oceanographic Research Papers*, 156: 103186. 10.1016/j.dsr.2019.103186.

Bo M, Coppari M, Betti F, Enrichetti F, Bertolino M, Massa F, Bava S, Gay G, Cattaneo-Vietti R, Bavestrello G. 2020b. The high biodiversity and vulnerability of two Mediterranean bathyal seamounts support the need for creating offshore protected areas. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 10. 1002/aqc.3456.

BOE. 2014. Orden AAA/1504/2014, de 30 de julio, por la que se establecen zonas protegidas de pesca sobre determinados fondos montañosos del Canal de Mallorca y al este del Parque Nacional Marítimo-Terrestre del Archipiélago de Cabrera.

Carbonara P, Zupa W, Follesa M, Cau A, Capezzuto F, Chimienti G, D'Onghia G, Lembo G, Pesci P, Porcu C, Bitetto I, Spedicato MT, Maiorano P. 2020. Exploring a deep-sea vulnerable marine ecosystem: *Isidella elongata* (Esper, 1788) species assemblages in the Western and Central Mediterranean. *Deep Sea Research Part I: Oceanographic Research Papers*, 166: 103406. 10. 1016/j.dsr.2020.103406.

Carey SN, Bell KLC, Rosi M, Marani M, Nomikou P, Walker SL, Faure K, Kelly J. 2012. Submarine Volcanoes of the Aeolian Arc, Tyrrhenian Sea. In: *New Frontiers in Ocean Exploration: The E/V Nautilus and NOAA Ship Okeanos Explorer 2011 Field Season*. Bell KLC, Elliott K, Martinez C, Fuller SA (eds.). *Oceanography*, 25(Suppl): 32-33. 10.5670/oceanog.2011.supplement.01.

Clark MR, Bowden DA, Rowden AA, Stewart R. 2019. Little Evidence of Benthic Community Resilience to Bottom Trawling on Seamounts After 15 Years. *Frontiers in Marine Science*, 6: 63.

Corbera G, Iacono CL, Gràcia E, Grinyó J, Pierdomenico M, Huvenne VA, ..., Gili JM. 2019. Ecological characterisation of a Mediterranean cold-water coral reef: Cabliers Coral Mound Province (Alboran Sea, western Mediterranean). *Progress in Oceanography*, 175: 245-262.

Daniel B, Tunesi L, Aquilina L, Vissio A. 2019. RAMOGE. Explorations 2015 and 2018: A cross-border experience of deep oceanographic explorations (Conference Paper). In: *Proceedings of the 2nd Mediterranean Symposium on the conservation of Dark Habitats (Antalya, Turkey, 17 January 2019)*. UNEP/MAP – SPA/RAC, 2019. Langar H, Ouerghi A, edits, *SPA/RAC Publications*, Tunis, 76 p.

Dekov VM, Kamenov GD, Stummeyer J, Thiry M, Savelli C, Shanks WC, Fortin D, Kuzmann E, Vertes A. 2007. Hydrothermal nontronite formation at Eolo Seamount (Aeolian volcanic arc, Tyrrhenian Sea), *Chemical Geology*, 245(1-2): 103-119.

European Commission. 2020. EU Biodiversity Strategy for 2030: Bringing nature back into our lives. COM(2020) 380 final.

European Union. 2005. Council Regulation (EC) No 1568/2005 of 20 September 2005 as regards the protection of deep-water coral reefs from the effects of fishing in certain areas of the Atlantic Ocean. *Official Journal of the European Union*, 252, 28.9.2005.

Fabri MC, Daniel B, Et Tous Les Participants. 2018. Logbook de la campagne RAMOGE 2018. RST.ODE/LER-PAC/18-08.

FAO. 2013. Report of the thirteenth session of the Sub-committee on Marine Environment and Ecosystems (SCMEE). FAO HQs, Rome, Italy, 18–20 February 2013.

Fiori C, Paoli C, Alessi J, Mandich A, Vassallo P. 2016. Seamount attractiveness to top predators in the southern Tyrrhenian Sea (central Mediterranean). *Journal of the Marine Biological Association of the UK*, 26: 769-775. 10.1017/S002531541500171X.

GFCM. 2005. GFCM/29/2005/1 on the management of certain fisheries exploiting demersal and deep-water species and the establishment of a fisheries restricted area below 1000 m.

Gubbay S. 2003. Seamounts of the North-East Atlantic. OASIS, Hamburg, WWF Germany, Frankfurt am Main.

Harris PT, MacMillan-Lawler M, Rupp J, Baker EK. 2014. Geomorphology of the oceans. *Marine Geology*, 352: 4-24.

Hart PJB. 2008. Could seamounts be important for fish speciation? International Council for the Exploration of the Sea. ICES CM 2008/C:05. Theme Session on Midocean ridges and seamounts: oceanography, ecology, and exploitation.

ICCAT. 2010. Report of the 2010 ICCAT Bluefin Tuna Data preparatory meeting. Madrid, Spain, 14–19 June 2010.

LIFE IP INTEMARES. 2020. Informe de resultados del segundo taller participativo sobre hábitats de interés comunitario. Madrid. 118 pp.

Litvinov F. 2008. Fish Visitors to Seamounts: Aggregations of Large Pelagic Sharks Above Seamounts. In: *Seamounts: Ecology, Fisheries and Conservation*. TJ. Pitcher, T. Morato, P. Hart, M. Clark, N. Haggan and R. Santo (eds.). *Blackwell Fish and Aquatic Resources* Series 12: 202. 10.1002/9780470691953.ch10b.

Maldonado M, Aguilar R, Blanco J, García S, Serrano A, Punzón A. 2015. Aggregated Clumps of Lithistid Sponges: A Singular, Reef-Like Bathyal Habitat with Relevant Paleontological Connections. *PLoS ONE*, 10(5): e0125378. 10.1371/journal. pone.0125378.

Miller K, Gunasekera R. 2017. A comparison of genetic connectivity in two deep sea corals to examine whether seamounts are isolated islands or stepping-stones for dispersal. *Scientific Reports*, 7: 46103. 10.1038/srep46103.

MITECO. 2019, October 23. "*España se compromete a declarar 9 nuevas áreas marinas protegidas antes de 2024*" [Press Release].

Morato T, Pitcher TJ, Clark MR, Menezes G, Tempera F, Porteiro F, Giacomello E, Santos RS. 2010. Can We Protect Seamounts for Research? A call for conservation. *Oceanography*, 23 (1): 190-199.

Morato T, Hoyle S D, Allain V, Nicol SJ. 2010. Seamounts are hotspots of pelagic biodiversity in the open ocean. *Proceedings of the National Academy of Sciences*, 107(21): 9707-9711.

Notarbartolo di Sciara G, Agardy T. 2009. Identification of potential SPAMIs in Mediterranean Areas Beyond National Jurisdiction. Contract N° 01/2008_RAC/SPA, High Seas. 70p.

Oceana. 2020. Unprotected marine treasures. An Oceana proposal to protect 15 marine biodiversity hotspots in Europe. Madrid, 20 pp. 10.5281/zenodo.3813183.

OSPAR. 2014. Recommendation 2014/9 on furthering the protection and conservation of seamounts in Regions I, IV and V of the OSPAR maritime area.

Pardo E, Aguilar R, García S, De la Torriente A, Ubero J. 2011. Documentación de arrecifes de corales de agua fría en el Mediterráneo occidental (Mar de Alborán). *Chronica Naturae*, 1: 20-34.

Pitcher TJ, Clark MR, Morato T, Watson R. 2010. Seamount Fisheries: Do They Have a Future? *Oceanography*, 23(1): 134-144.

Pitcher TJ, Morato T, Hart, PJB, Clark M, Haggan N, Santos RS (eds.). 2007. Seamounts: Ecology, Fisheries and Conservation. *Blackwell Fish and Aquatic Resources Series*, 12. 527 pp.

Probert PK, Christiansen S, Gjerde KM, Gubbay S, Santos RS. 2007. Management and conservation of seamounts. In: *Seamounts: Ecology, Fisheries and Conservation*. TJ. Pitcher, T. Morato, P. Hart, M. Clark, N. Haggan and R. Santo (eds.). *Blackwell Fish and Aquatic Resources Series* 12: 442.

Rogers AD. 2012. An Ecosystem Approach to Management of Seamounts in the Southern Indian Ocean. Volume 1 – Overview of Seamount Ecosystems and Biodiversity. Gland, Switzerland: IUCN. 18+ii pp.

UNEP-MAP-RAC/SPA. 2010. Fisheries conservation and vulnerable ecosystems in the Mediterranean open seas, including the deep seas. By de Juan, S. and Lleonart, J. Ed. RAC/SPA, Tunis, 103 pp.

UNEP/CBD. 2014. UNEP/CBD/EBSA/WS/2014/3/4 Report of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas. Málaga, 7–11 April 2014, 212 pp.

UNGA. 2006. Resolution adopted by the General Assembly on 8 December 2006. 61/105. Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments. A/RES/61/105.

Vassallo P, Paoli Ch, Alessi J, Mandich A, Wurtz M, Fiori C. 2018. Seamounts as hotspots of large pelagic aggregations. *Mediterranean Marine Science*, 19(3): 444-458. 10.12681/mms.15546.

Vázquez JT, Alonso B, Fernández-Puga MC, Gómez-Ballesteros M, Iglesias J, Palomino D, Roque C, Ercilla G, Díaz-del-Río V. 2015. Seamounts along the Iberian Continental Margins. *Boletín Geológico y Minero*, 126(2-3): 483-514.

Villani N, Alessi J, Roccatagliata N, Fiori C. 2014. Tyrrhenian seamounts influence on pelagic visitors: cetaceans, sea birds, sea turtles and pelagic fishes. *28th Annual Conference of the European Cetacean Society*. Liége, Belgium, 5-9 April 2014.

Weaver PPE, Benn A, Arana PM, Ardron JA, Bailey DM, Baker K, Billett DSM, Clark MR, Davies AJ, Durán Muñoz P, Fuller SD, Gianni M, Grehan AJ, Guinotte J, Kenny A, Koslow JA, Morato T, Penney AJ, Perez JAA, Priede IG, Rogers AD, Santos RS, Watling L. 2011. The impact of deep-sea fisheries and implementation of the UNGA Resolutions 61/105 and 64/72. Report of an international scientific workshop, National Oceanography Centre, Southampton, 45 pp.

Würtz M, Rovere M (eds). 2015. Atlas of the Mediterranean Seamounts and Seamount-like Structures. IUCN, Gland, Switzerland and Málaga, Spain, 276 pp.

WWF. 2003. Saving the treasures of the sea by creating networks of Marine protected areas in the North-East Atlantic. 12 pp.

OCEANA Protecting the World's Oceans

Yellow tree coral (Dendrophyllia cornigera) in Eolo seamount (Aeolian Islands, Italy)

The European Commission support for the production of the production of this publication does not constitute endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.