The Mediterranean Sea – Southern Balearics and the Sicilian Channel

A Greenpeace Briefing to the CBD, 29 September – 2 October 2009, Ottawa, Canada

This Briefing is intended to inform delegates to the CBD Expert Workshop of 29 September – 2 October 2009 about two high seas areas in the Mediterranean Sea – the Southern Balearics and the Sicilian Channel. Available scientific information is summarised to demonstrate the ways in which these areas meet the CBD criteria for ecologically and biologically significant marine areas. This briefing will also discuss the issues that arise as a result of the unique circumstances of Mediterranean high seas areas.

This briefing summarises the findings of a technical report on proposed Marine Reserves in the Southern Balearics and Sicilian Channel that explores in greater detail the biological and ecological characteristics of these areas (available at: www.greenpeace.to/publications/Mediterranean-CBD-report-August-2009.pdf)

Introduction

The Southern Balearics and Sicilian Channel are productivity and biodiversity hotspots within the Mediterranean – a sea where temperate and subtropical influences combine to produce very high levels of biodiversity[1] in a region of intense and prolonged human activity, that is renowned as one of the birthplaces of civilisation. The Mediterranean represents only 0.7% of the area of the world's oceans, but contains 8 – 9% of known marine species – some 10,000 – 12,000 species have been recorded to date, of which 28% are endemics[1]. The unique geopolitical situation in the Mediterranean means that nations have not claimed 200nm EEZs and consequently, the high seas begin from as little as 12nm from the shoreline[2]. As a result, the Mediterranean contains some of the most complex and diverse high seas regions in the world. Proximity to the shoreline means that shallow-water species and habitats, that are absent from high seas areas elsewhere, are present in large numbers on the high seas of the Mediterranean. The topographic and bathymetric features of the coastal zone create complex oceanographic conditions that can lead to very high levels of productivity and diversity on the high seas.

The Balearic Islands is one of the most species rich marine regions in Europe, with habitats ranging from shallow-water maerl beds to abyssal plain at depths of 3000m. Complex oceanographic conditions, including fronts and eddies, result from the interaction of two water masses, with different physical characteristics, and complex topographic features[3], which include: the islands themselves; three seamounts (Emile Baudot - summit depth <100m, Monts del Oliva - summit depth ~300m and Mont Ausias Marc - summit depth ~125m[4]); a submarine volcanic field[5]; two canyon systems; and a submarine ridge[4]. The Sicilian Channel is an area of complex and high-energy oceanographic processes, where the western and eastern sub-basins of the Mediterranean meet[6]. The Channel consists of two sill systems separated by a deep basin and contains a number of canyons, trenches and seamounts[7]. Eruptions of the submarine volcano Empedocles caused the emergence of the ephemeral island of Ferdinandea during the nineteenth century – its summit is currently 6m below sea level[8]. The Southern Balearics and Sicilian Channel regions are subject to intense pressure as a result of human influence. Fishing activities include: longlining; purse-seine fishing for bluefin tuna[9]; shallow- and deep-water demersal trawling[10]; artisanal gillnetting; and recreational fisheries[11]. Other human impacts result from coastal development; noise, chemical and plastic pollution; shipping; climate change; invasive species[12]; and tourism.

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The Southern Balearics and Sicilian Channel are included within a proposed network of marine reserves for the Mediterranean that was developed by Greenpeace on the basis of species and habitat distribution[13] (see figure 1). Greenpeace and WWF have proposed an area closed to tuna fishing that incorporates the Southern Balearics (see figure 2).

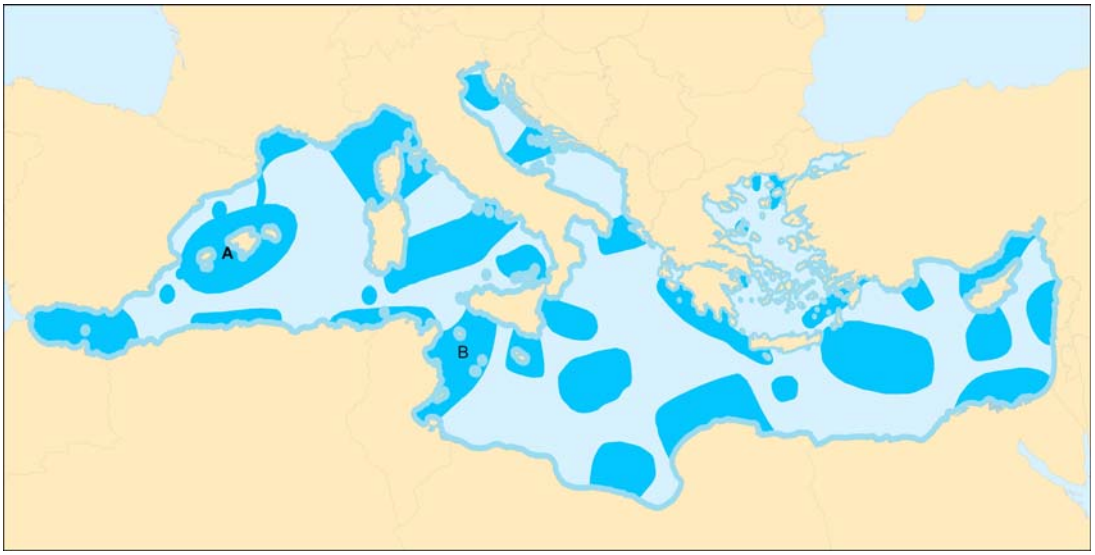

Fig. 1. Proposed marine reserves in the Mediterranean – A: Balearic Islands; B – Sicilian Channel

Data availability and interpretation of the criteria

Proximity to land has ensured that the Mediterranean is one of the most studied high seas regions in the world. A wide range of direct evidence was available to demonstrate the ecological and biological significance of the Southern Balearics and Sicilian Channel on the basis of all seven criteria. Research has been undertaken by a large number of institutions and for a range of purposes, including: fisheries research; marine reserve designation; exotic species control; endangered species conservation; and oceanography. As well as commercially important and iconic species, there was evidence for the distribution and status of less-studied species, for example Cavanagh and Gibson's (2007)[14] overview of the status of chondrichthyans in the Mediterranean. Despite the wealth of information available by comparison with other high seas areas, significant knowledge gaps remain. For example, research on the volcanic seamounts of the Sicilian Channel has been primarily oceanographic and biological knowledge of these habitats is limited[15].

The presence of a large number of rare, and less rare, habitats and species at both of these sites raised an issue with regards to the interpretation of the 'uniqueness and rarity' criteria. A number of the habitats present, for example maerl beds and deepwater coral mounds, have very wide distribution but may be rare within the regions where they occur, due partly to degradation resulting from human activity. The meaning of 'rare' should be clarified in this context, to ensure that the most important sites are recognised, without allowing either locally or globally rare species or habitats to 'fall through the gap.'

The extremely long history of human exploitation of the Mediterranean raises an issue with regards to the interpretation and applicability of the naturalness criteria. The extent to which many, particularly nearshore, areas of the Mediterranean can be considered 'natural' is questionable. In this situation, the creation of marine reserves gains added importance, as a means by which ecosystems can be allowed to recover to something more closely approximating a natural state, providing managers with a benchmark by which the rest of the Sea can be judged.

Ecological and biological significance of the Southern Balearics and the Sicilian Channel

Criteria	Southern Balearics	Sicilian Channel
Uniqueness or rarity	Habitats present that could be considered rare, dependent on the scale of observations, include: maerl beds and other coralligenous beds[16,17]; Peyssonnelia (soft red algae) beds at 40m – 80m[18]; Leptometra (crinoid) beds[16]; stands of the deepwater scleractinian corals *Lophelia pertusa* and *Mardrepora oculata*[19]; colonies of the deepwater octocoral *Isidella elongata*[16]; and *Funiculina quadrangularis* (cnidarian) communities[20]. *The potential presence of cold seep communities is indicated by pockmarks in the Ibiza and Mallorca Channels*[5]. Balearic shearwater *Puffinus mauretanicus* is an endemic species, which breeds only in the Balearic Islands[21]. It has been estimated that 25.4% of bathyal pericarid crustaceans in the Catalano-Balearic Basin are endemics[22].	Habitats/species/geomorphological features present that could be considered rare, dependent on the scale of observations, include: areas of submarine volcanic activity[8]; mud volcanoes[54]; the scleractinian coal *Cladopsammia rolandi*, which is endemic to the Mediterranean[55]; white coral mounds (known locally as 'canelleri'), composed of *Lophelia pertusa*, *Madrepora oculata* and Balanus spp. barnacles, which occur at 250 – 500m depth[56]; other habitat-building species, recorded in the Sicilian Channel by ROV survey, include the yellow tree coral *Dendrophyllia cornigera*, the octocoral *Isidella elongata*, red coral *Corallium rubrum* and *Funiculina quadrangularis* (cnidarian) communities[57]. *The potential presence of cold seep communities is indicated by pockmarks*[58]. Maltese skate *Leucoraja melitensis* is now confined largely to the Sicilian Channel. The species was previously common throughout ¼ of the Mediterranean[14]. A colony of an undescribed species of large (>20cm), deepwater oyster (Neopycnodonte sp.) has been recorded living on fossilised coral mounds in the Linosa Trough[59].
Special importance for life history stages of species	Complex oceanography creates conditions suitable for the spawning of a large number of pelagic fish species. Important spawning area for the eastern stock of Atlantic bluefin tuna *Thunnus thynnus*[23]. Other species that spawn here include: albacore *Thunnus alalunga*, bullet *Auxis rochei*, frigate *Auxis thazard* and skipjack *Katsuwonus pelamis* tuna; little tunny *Euthynnus alletteratus*; Atlantic bonito *Sarda sarda*; common dolphinfish *Coryphaena hippurus*; swordfish *Xiphias gladius*; Tetrapturus sp. (marlins and spearfish); and foragefish species including anchovy *Engraulis encrasicolus* and round sardinella *Sardinella aurita*[24,25]. The Balearic Islands contain breeding colonies of Balearic shearwater (endemic)[21]; Audouin's gull *Ichthyaetus audouinii* (one of three western Mediterranean breeding colonies, that together account for 80% of the global population, is located at Cabrera archipelago)[26]; Yelkouan shearwater *Puffinus yelkouan* (a colony of 100 – 150 pairs breeds at Minorca)[27]; Cory's shearwater *Calonectris diomedea*[28]; European shag *Phalacrocorax aristotelis* (estimated 96.6% of the Mediterranean subspecies)[29]. Sperm whales *Physeter macrocephalus* are regularly observed in the vicinity of the Balearic Islands, where the complex oceanographic and topographic conditions are suitable for feeding[30]. Social units with calves were observed historically on a frequent basis, suggesting that calving sites could potentially occur[31]. Fin whales *Balaenoptera physalus* are	Reproductive and nursery grounds of the great white shark[60]. Spawning aggregations and nursery grounds of hake *Merluccius merluccius* at 100 – 200m on the Adventure and Malta Banks[61]. Nursery grounds of the greater fork beard *Phycis blennoides* at 200 – 400m on Adventure Bank and in the eastern Strait[62]. Spawning and nursery grounds of the red mullet *Mullus barbatus* to 100m on Adventure and Malta Banks[63]. Interactions of strong currents with island topography create suitable spawning conditions for a number of pelagic fish species, including: anchovy (possible Sicilian Channel subpopulation)[64]; bluefin tuna[65]; small tuna species, including Atlantic bonito, Auxis spp. and little tunny[66]; and swordfish[67]. Nesting colonies of loggerhead turtle on the islands of Lampedusa and Linosa in the Pelagie Archipelago – these are amongst the few remaining nesting sites for this species in this part of the Mediterranean[68]. Fin whale feeding area – fin whales congregate off the coastline of Lampedusa during February and early March to feed on *Nyctiphanes couchii* euphausids[69]. Breeding colonies of Cory's shearwater on islands and rocky coastline of the Sicilian Channel[70].

Special importance for life history stages of species, cont.	sighted year-round in the vicinity of the Balearic Islands – frontal zones, such as the North Balearic Front, provide areas of high zooplankton concentration suitable for feeding[32]. A putative subpopulation of bottlenose dolphins *Tursiops truncatus* in the Balearic Islands is considered to be amongst the best preserved in the Spanish Mediterranean[33]. Important feeding area for late juvenile loggerhead turtles *Caretta caretta* from rookeries in the eastern Mediterranean and NW Atlantic[34,35]. Aggregations of basking sharks *Cetorhinus maximus* have been observed in the Balearic region[36]. Strong correlation with basking shark prey abundance suggests that this could be an important feeding area[37].	
Importance for threatened, endangered or declining species and/or habitats	Balearic shearwater (CR)[38] – estimated population of 3300 breeding pairs in early 1990s[39], has declined to an estimated population of <2000 breeding pairs[40]. There is a predicted 50% probability of extinction over three generations if current trends continue[41]. Yelkouan shearwater – breeding numbers are declining rapidly and has recently been upgraded to NT[27]. Bluefin tuna - populations are declining drastically as a result of overfishing[42] and a recent analysis has suggested that the Mediterranean spawning stock could be extinct by 2012[43]. Bottlenose dolphin (VU)[31]; sperm whale (EN)[38]; fin whale (EN)[38]; short-beaked common dolphin *Delphinus delphis* (EN)[44,31]; striped dolphin *Stenella coeruleoalba* (VU)[31]; *Blue shark Prionace glauca* (VU)[14]; great white shark *Carcharadon carcharias* (EN)[45,14]; Squatina spp. (angel shark and sawback and smoothback angel shark)[14]; the rabbitfish is classified as NT but high levels of fishing mortality have led to concerns that it may soon qualify as VU[46,14]. Loggerhead turtle (EN)[38]; leatherback turtle (CR)[47,38]. Protected species included in the annexes of the Protocol concerning Specially Protected Areas and Biodiversity in the Mediterranean (BARCOM-SPAM)[49] occur on the Emile Baudot and Aurias March seamounts, including triton snail *Charonia lampas*, elephant ear sponge *Spongia agaricina* and the carnivorous sponge *Asbestopluma hypogea* (previously known only from shallow-water environments)[17]. The Balearic Islands are within the historical range of the Mediterranean monk seal *Monachus monachus* (CR), which is considered to be the world's most endangered pinniped[38].	Bottlenose dolphins (VU) inhabit inshore waters around the Pelagie Archipelago[71,31]; striped dolphin (VU)[31]; fin whales (EN)[38]. Loggerhead turtles (EN)[38]; leatherback (CR)[38] and green turtles (EN – was listed as CR in the Mediterranean but has been delisted as Mediterranean is no longer considered to contain a distinct subpopulation[72]) are observed occasionally[73]. Maltese skate (CR)[38]; great white shark (EN)[14]; porbeagle (CR)[14]; shortfin mako (CR)[14]; sandbar shark (EN)[14]; giant devil ray (EN)[38]; and blue shark (VU)[14]. Bluefin tuna - populations are declining drastically as a result of overfishing[42] and a recent analysis has suggested that the Mediterranean spawning stock could be extinct by 2012[43].

Vulnerability, Fragility, Sensitivity, or Slow recovery	Vulnerable and fragile benthic habitats include: maerl beds, which occur on sandy and gravelly bottom at depths to 90m[16]; maerl and other forms of red algal bio-concretion (thin sheets, 'cobbles' and large bio-concretions), which occur on the Emile Baudot and Aurias March seamounts to depths of 160m[17]; Leptometra (crinoid) beds[16]; stands of the deepwater scleractinian corals *Lophelia pertusa* and *Madrepora oculata*[19]; colonies of the deepwater octocoral *Isidella elongata*[16]; *Funiculina quadrangularis* (cnidarian) communities[20]. Species with vulnerable life histories include: Balearic shearwater; sperm whales; fin whales; bottlenose dolphins; striped dolphins; common dolphins; chondrichthyan species; loggerhead and leatherback turtles.	Vulnerable and fragile benthic habitats and species include: white coral mounds composed of *Lophelia pertusa*, *Madrepora oculata* and Balanus spp. barnacles[56]; the scleractinian coral *Cladopsammia rolandi*[55]; the yellow tree coral; the octocoral *Isidella elongata*; red coral; and *Funiculina quadrangularis* (cnidarian) communities[57]. Species with vulnerable life histories include: fin whales; numerous species of elasmobranchs; loggerhead turtles; and the occasional presence of leatherback and green turtles.
Biological productivity	Areas of high primary productivity and zooplankton concentration are created by oceanographic features that result from interaction between two water masses and complex island topography. Plankton biomass is concentrated by a strong front in the Mallorca Channel[49]. Frontal oscillations associated with the Balearic Currents create areas of high chlorophyll concentration in the Deep Chlorophyll Maximum layer[50]. Areas of elevated primary productivity result from upwelling of nutrient-rich deepwater associated with topographic features, such as canyons and seamounts[51]. Productive benthic habitats include: maerl beds; other forms of red algal bio-concretion; stands of the deepwater scleractinian corals *Lophelia pertusa* and *Madrepora oculata*; colonies of the octocoral *Isidella elongata*; *Funiculina quadrangularis* (cnidarian) communities; Peysonnelia (soft red algae) beds; Leptometra (crinoid) beds; *and cold seeps*. Seamounts and canyons create area suitable for the development of productive deepwater habitats, eg. large specimens of yellow tree coral *Dendrophyllia cornigera* have been observed on the flanks of Menorca Canyon[52].	Areas of high primary productivity and zooplankton concentration are created by oceanographic features that result from the interaction of strong currents and complex topography. Current patterns are likely to retain productivity and fish larvae in the Sicilian Channel[74]. Upwelling is driven by wind and the meandering of the Atlantic-Ionian Stream[75]. Total biomass of demersal fish species is particularly high on the Adventure Bank, to depths of 100m. This includes commercially important species, such as hake and red mullet[76]. Productive benthic habitats include: white coral mounds composed of *Lophelia pertusa*, *Madrepora oculata* and Balanus spp. barnacles[56]; deepwater coral and octocoral assemblages; *cold seeps*[58]; *Funiculina quadrangularis* (cnidarian) communities[57].
Biological Diversity	High pelagic fish species diversity, as a result of oceanographic features, which create conditions suitable for feeding and spawning[24,25]. High ichthyoplankton diversity in summer months due to the large number of pelagic fish species that spawn in the vicinity of the Balearic Islands[24,25]. Benthic habitats with high associated levels of species diversity include: maerl beds; other forms of red algal bio-concretion - ~300 species were identified at coralligenous beds on Emile Baudot and Aurias March seamounts, of which ~150 were particularly associated with that habitat[17]; stands of the deepwater scleractinian corals *Lophelia pertusa* and *Madrepora oculata*; colonies of the octocoral *Isidella elongata*, which are associated with elevated levels of invertebrate species diversity[53]; *Funiculina quadrangularis* (cnidarian) communities, which provide habitat for some commercial crustacean species[20]; Peysonnelia (soft red algae) beds; Leptometra (crinoid) beds, which provide habitat for juveniles and adults of commercially important fish species[53].	Persistent area of high demersal fish species diversity (58 species recorded) on the Adventure Bank, to depths of 100m[76]. High demersal fish species diversity also recorded at 400 – 600m in the northwest of the Sicilian Channel and on the eastern edge of the Maltese Exclusive Fishing Zone[76]. *Potential presence of shallow-water species on the summit of the submerged volcanic island of Ferdinandea.* Benthic habitats with high associated levels of species diversity include: white coral mounds composed of *Lophelia pertusa*, *Madrepora oculata* and Balanus spp. barnacles[56]; deepwater coral and octocoral assemblages; *Funiculina quadrangularis* (cnidarian) communities[57].

Naturalness		Shipwrecks create artificial refuges from trawling pressure on parts of the Adventure Bank[77].

Nb. *Italics* denotes characteristics that have been extrapolated from indirect data
VU = vulnerable; EN = endangered; CR = critically endangered.

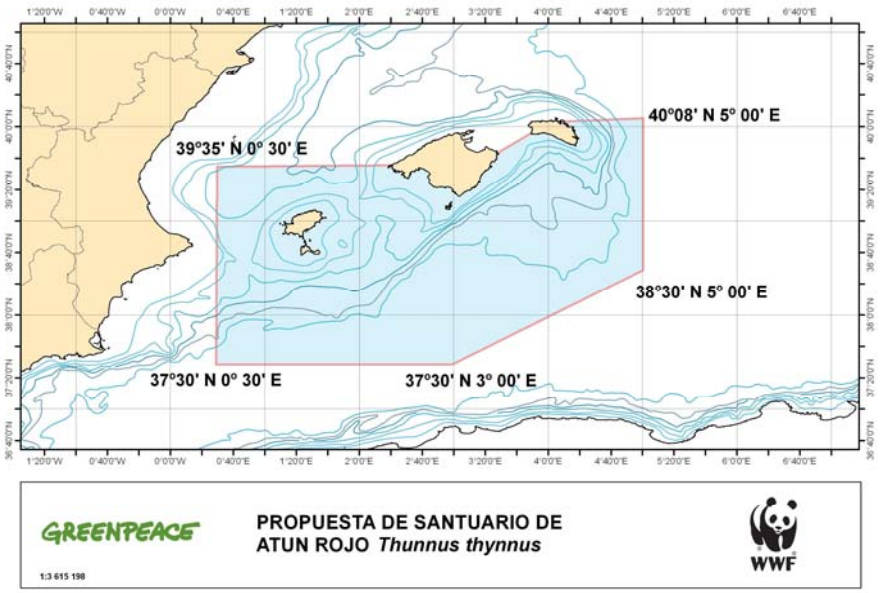

Fig. 2. Proposed closed area for tuna fishing in the Balearic Islands – Greenpeace and WWF.

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