

Scientific Information to Describe Areas Meeting Criteria for Ecologically or Biologically Significant Marine Areas (EBSAs)

Title/Name of the area:

The Sargasso Sea

Presented by

The Government of Bermuda (United Kingdom), in collaboration with the Sargasso Sea Alliance (HSJ Roe ed.)

Based upon “The Protection and Management of the Sargasso Sea” (in draft) by

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Abstract

The Sargasso Sea is a fundamentally important part of the world ocean, located within the North Atlantic sub-tropical gyre with its boundaries defined by the surrounding currents. Its importance derives from a combination of physical and oceanographic structure, complex pelagic ecosystems, and its role in global ocean and earth system processes. The Sargasso Sea is home to an iconic pelagic ecosystem with the floating *Sargassum* seaweeds, the world’s only holopelagic algae, as its cornerstone. It hosts a diverse community of associated organisms that includes ten endemic species, and provides essential habitat for key life stages of a wide diversity of species, many of which are endangered or threatened. The Sargasso Sea is the only breeding location for European and American eels, the former being listed as critically endangered, and is on the migration route of numerous other iconic and endangered species. A variety of oceanographic processes impact productivity and species diversity, and the area plays a disproportionately large role in global ocean processes of oxygen production and carbon sequestration. The sea floor has two large seamount chains, home to specialized, fragile and endemic communities, and models predict the presence of numerous other isolated seamounts. Both pelagic and benthic ecosystems are impacted by a range of human activities and the currents of the gyre act to concentrate pollutants. The portion of the Sargasso Sea described here meets all of the criteria for Ecologically and Biologically Significant Areas (EBSAs) under the Convention on Biological Diversity.

Introduction

First recorded by Columbus and named after the characteristic floating brown algae, *Sargassum spp.*, the Sargasso Sea is an area of open-ocean within the North Atlantic Subtropical Gyre, bounded on all sides by the clockwise flow of major ocean currents. It is one of the best known areas of the world's ocean, studied since the 1870s and home to Hydrostation S, the longest running time series of oceanographic measurements, begun in 1954. Data from the Sargasso Sea are critical to our understanding of global ocean processes and global change. Water retention within the North Atlantic gyre is estimated to be up to 50 years (Maximenko et al 2011), and a variety of oceanographic features and processes influence the ecology and biology of the Sargasso Sea on different spatial and temporal scales.

Cyclonic or anticyclonic rings and eddies spun off the Gulf Stream may persist as distinct entities for many months to years (Richardson et al 1978, Cornillon et al 1986, McGillicuddy et al 1999). There are also smaller mode water eddies that form in midwater. The different types of eddies create localised upwelling and downwelling and impact the upper layers of the Sargasso Sea by mixing surface and deeper waters. This affects nutrients, heat and salinity which together create localised areas of high or low productivity (Volk and Hoffert 1985, Maurino-Carballido and McGillicuddy 2006, Glover et al 2008). The eddies impact biodiversity by 'capturing' and bringing 'foreign species' into the area creating relic populations which may persist for months or, conversely, by spinning species out into the Gulf Stream (Boyd et al 1978, Wiebe and Boyd 1978, Ring Group 1981).

The Subtropical Convergence Zone (STCZ) occurs between 20° and 30°N in the western Sargasso Sea, where warm and cold water masses meet and create distinct thermal fronts in the upper 150 m of the ocean from fall through spring (Katz 1969, Weller 1991). *Sargassum* weed accumulates in this area, along with other organisms, so the fronts are important feeding areas for predatory pelagic fishes and migratory marine mammals in the Sargasso Sea. These fronts are also zoogeographic boundaries between warm and cold water masses (Backus et al 1969, Miller and McCleave 1994), and the presence of organisms from different biogeographic provinces enhances diversity in the area.

Conventionally regarded as an area of low nutrients and low productivity enhanced by localized upwellings, the Sargasso Sea, per unit area, has a surprisingly high net annual primary production rate that matches levels found in some of the most productive regions in the global ocean (Steinberg et al 2001, Rho and Whitledge 2007, Lomas et al 2012). This is due to a complex combination of factors - the production of carbon in the surface waters by photosynthesis, the location of the Sargasso Sea in the sub-tropics which results in a deep euphotic layer, and differences in phytoplankton communities and associated nitrogen fixation (Chisholm et al 1988). The difference is that in the Sargasso Sea most of the production is recycled by bacteria in the so-called microbial loop rather than channelled into biomass of larger, harvestable organisms (Carlson et al 1996, Steinberg et al 2001). As a result of this high primary productivity, to which must be added the annual production of *Sargassum* weed which is now being estimated from satellite measurements (Gower and King 2008, 2011), the Sargasso Sea plays a key role in both global oxygen production and ocean sequestration of carbon (IPCC1996, 2001 and 2007, Ullman et al 2009, Lomas et al 2011 unpub).

The bathymetry of the Sargasso Sea from west to east passes from the continental rise of the North American continental margin at around 2000m depth, descends gently into part of the Hatters, Nares and Sohm abyssal plains with depths reaching over 4500m, then becomes progressively shallower toward the mid-Atlantic Ridge where water depth is less than 2500m. This regional relief is modified dramatically by extinct volcanoes that form the Bermuda Islands,

seamounts and associated Bermuda Rise, the Muir seamount chain, and the New England and Corner Rise seamount chains further north (Figure 1). Modelling also indicates that there are numerous smaller isolated seamounts distributed across the eastern part of this area. Several major fracture zones, the Atlantis, Northern, Kane and Blake Spur cross the area (Figure 1). (See Uchupi et al 1970, Vogt and Jung 2007, Parson and Edwards 2011 unpub, Yesson et al 2011, Halpin et al 2012 unpub).

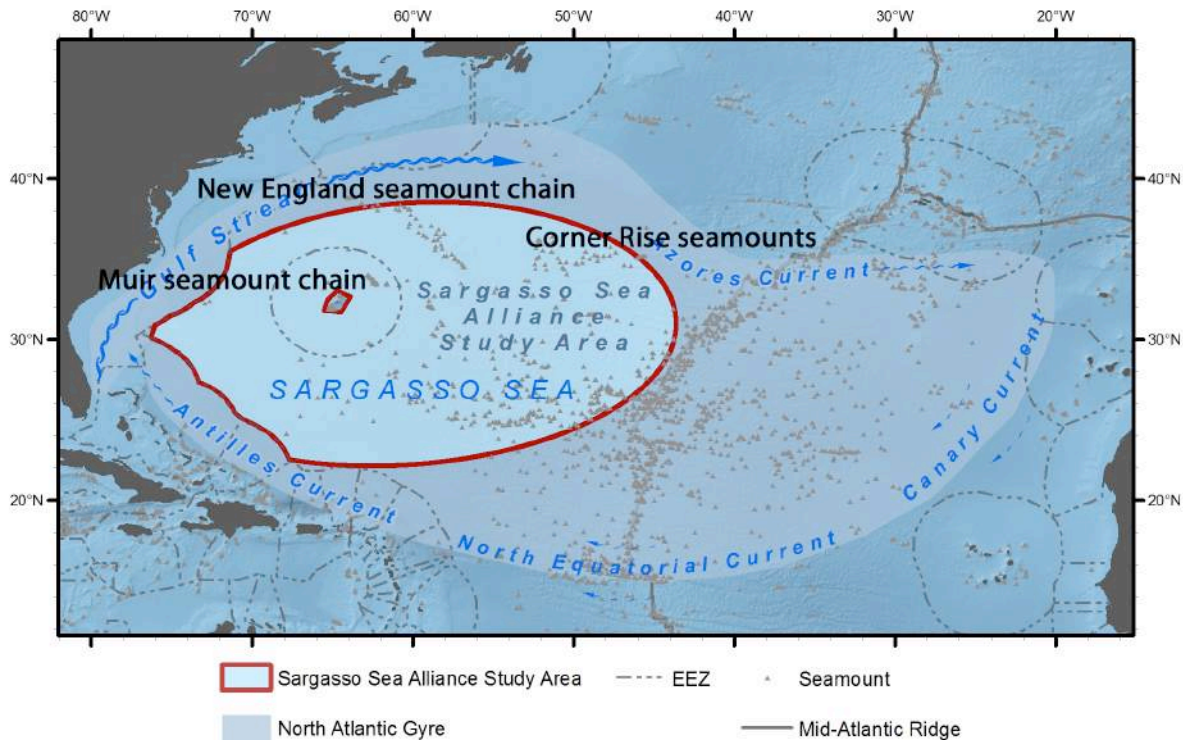


Figure 1. Map showing known and predicted seamounts beneath the Sargasso Sea (using data from Yesson et al 2011) in relation to the proposed EBSA.

Location

The Sargasso Sea is surrounded by the Gulf Stream to the west, the North Atlantic Drift to the north, the more diffuse Canary Current to the east, and the North Equatorial Current and the Antilles Current to the south (Figure 1). These currents vary, however, particularly the Canary Current, so the precise boundaries of the Sargasso Sea also vary (Ryther 1956, Butler et al 1983, Coston-Clements et al 1991). A map of the Sargasso Sea showing characteristics such as ocean current and eddy occurrence, remote sensing of *Sargassum* weed distributions and seabed topography (Ardron et al 2011, unpub) was commissioned by the Sargasso Sea Alliance in order to refine the area under consideration in a variety of proposals including this EBSA submission. It accounts for the variable eastern boundary current and the EEZs of adjacent countries, while ensuring that the full range of ecologically important features is included. For pragmatic reasons, the eastern boundary is considered to lie to the west of the mid-Atlantic Ridge in the western basin of the Atlantic Ocean, and boundaries were placed outside the current EEZs of all adjacent countries except for Bermuda. For the purposes of describing this EBSA, the Sargasso Sea ecosystem is deemed to officially transition into the shallow water habitats associated with the Bermuda platform at the base of the Bermuda Rise. The resultant map agrees broadly with the

overlap of previous delineations and is shown in Figure 2, with the area described in this proposal outlined in red at both its outer and inner limits. The area of the Sargasso Sea considered here occupies $\sim 4,163,499 \text{ km}^2$ and extends between $22^\circ - 38^\circ\text{N}$ and $76^\circ - 43^\circ\text{W}$, centred on 30°N and 60°W .

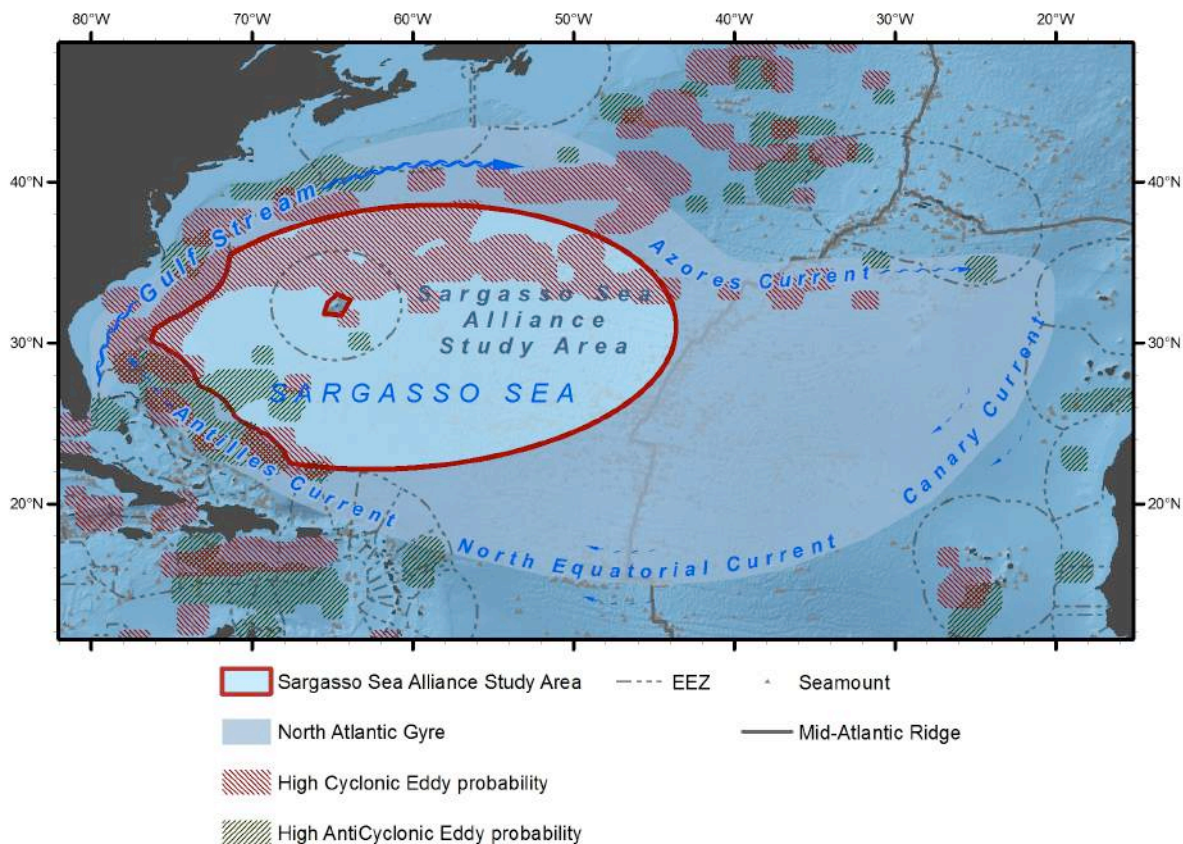


Figure 2. Map of the proposed Sargasso Sea EBSA, including some of the major features that influence overall boundary definition and location. (Ardron et al 2011, unpub)

Feature description of the proposed area

The features proposed here for international recognition are the diverse pelagic communities dependant on the *Sargassum spp.*, the iconic and threatened pelagic species that migrate into or through the area, the lesser known mid-water communities and the specialised benthic communities that live on the seamounts. Together, these communities and species occupy the Sargasso Sea from the surface to the sea floor.

Sargassum and *Sargassum* communities

The Sargasso Sea has a characteristic surface ecosystem based upon *Sargassum*, which hosts its own unique communities, acts as a nursery and feeding area for many species, and serves as a migration route for others. It is a vital habitat for many species of economic importance to Bermuda and to countries on both sides of the Atlantic – the Sargasso Sea is the ecological cross-roads of the Atlantic Ocean.

The surface ecosystem is based upon two species of floating *Sargassum*, both of which reproduce solely by fragmentation and are thus holopelagic and distinct from all other seaweeds (Deacon

1942, Stoner 1983). There is an estimated biomass of one million tonnes of *Sargassum* in the Sargasso Sea (Gower and King 2008, 2011), making it the only area of significant distribution for these species in the deep open-ocean where they provide a rare and valuable structurally complex habitat. Although it is part of a broader tropical western Atlantic distribution of *Sargassum*, the Sargasso Sea contains the most northerly persistent ecosystem formed around this floating seaweed.

Together with its persistence, it is the great area and thickness of the floating *Sargassum*, which in turn attracts a great density and diversity of associated organisms, that distinguishes this floating ecosystem from that of any other drift algae (Coston-Clements et al 1991, Moser et al 1998, Casazza and Ross 2008). As the *Sargassum* drifts round it collects “passengers” which increases the diversity of attached invertebrates that settle upon it; this biodiversity varies seasonally, as well as with location in the gyre and the age of the algae (Stoner and Greening 1984).

Ten species are known to be endemic to floating *Sargassum*, most of which have quite specific adaptations and are camouflaged in some way. Perhaps the most iconic of these is the *Sargassum* Angler Fish (*Histrio histrio*), (Coston-Clements et al 1991, South Atlantic Fishery Management Council 2002, Trott et al 2011). More than 145 invertebrate species have been recorded in association with floating *Sargassum* (Fine 1970, Morris and Mogelberg 1973, Butler et al 1983, Coston-Clements et al 1991, Sterrer 1992, Calder 1995, South Atlantic Fishery Management Council 2002, Trott et al 2011), and it also provides a habitat for over 100 species of fish (Dooley 1972, Fedoryako 1980, Coston-Clements et al 1991, South Atlantic Fishery Management Council 2002, Casazza and Ross 2008, Sutton et al 2010). This diverse community of organisms living at the surface also interacts with the oceanic fauna, many of which migrate vertically up at night and down during the day, thus providing connectivity between the surface community and the deep-sea. The overall importance of *Sargassum* for fish has been recognised by the USA as essential fish habitat (NMFS 2003). ICCAT has also recognized the importance of *Sargassum* as fish habitat and has requested that Contracting Parties assess the ecological status of *Sargassum* as habitat for tuna, billfish and sharks (ICCAT 2005, ICCAT 2011b).

Sargassum and the Sargasso Sea as a resource for key life stages

Oceanic fish that spawn in the *Sargassum* include flying fish (Exocoetidae) that build bubble nests for their eggs within the weed and have eggs with long extensions for attaching to the weed (Dooley 1972, Sterrer 1992). Other fish that spawn in the Sargasso Sea include white marlin (*Tetrapturus albidus*), and blue marlin (*Makaira nigricans*) (South Atlantic Fishery Management Council 2002, Luckhurst et al 2006, White Marlin Biological Review Team 2007) and various species of eels, of which the European and American eels are the most iconic (Schmidt 1922, Schoth and Tesch 1982, Kleckner and McCleave 1988, McCleave and Miller 1994, Miller and McCleave 1994, Miller 2002, Miller and McCleave 2007).

Juveniles of many fish species live within the *Sargassum* canopy (Fedoryako 1980, Coston-Clements et al 1991, South Atlantic Fishery Management Council 2002, Casazza and Ross 2008, Rudershausen et al 2010). Larger predatory species feed in association with *Sargassum* include jacks (*Caranx* spp.), amberjacks (*Seriola* spp.), rainbow runners (*Elagatis bipinnulata*), dolphins (*Coryphaenus* spp.), barracudas (Sphyraenidae), various mackerels, wahoo and tunas (Scombridae), and billfishes (Istiophoridae) (Gibbs and Collette 1959, Stephens 1965, Dooley 1972, Fedoryako 1980, Manooch and Hogarth 1983, Manooch and Mason 1983, Manooch et al 1984, Manooch et al 1985, Coston-Clements et al 1991, South Atlantic Fishery Management Council 2002, Casazza and Ross 2008, Rudershausen et al 2010, Trott et al 2011).

Green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricate*), loggerhead turtles (*Caretta caretta*), and Kemp's Ridley turtles (*Lepidochelys kempii*), all of which are threatened or endangered, use *Sargassum* as a nursery habitat (Carr and Meylan 1980, Carr 1987, Schwartz 1988, Manzella and Williams 1991, Luschi et al 2003). Hatchlings swim hundreds of miles to the Sargasso Sea, where they hide in the *Sargassum* to feed and grow in relative safety, spending their so called 'lost years' amongst the weed (Carr and Meylan 1980, Carr 1987, Schwartz 1988, Luschi et al 2003).

Haney (1986) observed seabirds foraging in association with *Sargassum* mats to the west of the Gulf Stream off the Georgia coast and recorded 26 different species, with bird densities being up to 32 - 43 times greater in areas with *Sargassum* than in areas without. Further offshore the diversity of bird species is lower and this is reflected in Table 1 which combines Haney's observations (1986) with those of Thomas (2005) who examined the oceanic bird habitat further from land. The endangered endemic Bermuda petrel, the cahow (*Pterodroma cahow*), protected under Appendix 1 of the Convention on Migratory Species (http://www.cms.int/documents/appendix/cms_app1.htm) travels across the northern Sargasso Sea and beyond (Hallett 2011, unpub). Tracking data from Birdlife International show that the western Sargasso Sea is an important feeding area for Audubon's shearwater (*Puffinus lherminieri*) and white-tailed tropic birds, (*Phaethon lepturus*) from the Bahamas (B. Lascelles, pers. comm., www.seabirdtracking.org).

The Sargasso Sea as a migration area

A number of species of sharks and rays inhabit or migrate through the Sargasso Sea including whale sharks, tiger sharks, manta rays and spotted eagle rays (Hallett 2011, unpub). New satellite tagging data has revealed that the Sargasso Sea is important habitat for several shark species that have only recently been reported to occur there. For instance, basking sharks (*Cetorhinus maximus*) make regular seasonal movements to the Sargasso Sea during winter months at depths of 200-1000m meters (Skomal et al 2009). Satellite tagging has also recently shown that large female porbeagle sharks (*Lamna nasus*) migrate over 2,000 km at depths of up to 500m from Canadian waters to the Sargasso Sea where they may be pupping (Dulvy et al 2008, Campana et al 2010). Most recently, a large female white shark (*Carcharodon carcharias*) was tracked from coastal Massachusetts to Sable Island on the Scotian Shelf, and then down into the Sargasso Sea during winter months of 2010/2011 (G. Skomal and S. Thorrold 2011, pers. comm.). The observation of large, potentially pregnant females of several threatened shark species in the Sargasso Sea raises the intriguing possibility that this area represents critical nursery habitat for these species.

Eastern and western populations of Atlantic bluefin tuna (*Thunnus thynnus*) migrate through or to the Sargasso Sea (Lutcavage et al 1999, Block et al 2001, Block et al 2005, Wilson and Block 2009). Both populations are in decline and are below 15% of the unfished, historical baseline (ICCAT 2008). Lutcavage et al (1999) noted that some of the giant bluefin tuna tagged in their study were in the Sargasso Sea at the same time as other giants were located in a known spawning ground in the Gulf of Mexico. This evidence suggested that the Sargasso Sea was, and may still be, a spawning location for bluefin tuna in the western Atlantic Ocean.

Several other tuna species, including yellowfin (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*), also move through the Sargasso Sea, and further west into coastal U.S. waters, from spawning grounds in the eastern tropical Atlantic (ICCAT 2010). Yellowfin tuna appear to migrate through the Sargasso Sea to frontal boundaries along the Gulf Stream. Bigeye tuna may be residing for some time in the Sargasso Sea based on tagging and depth distribution data.

Albacore tuna (*Thunnus alalunga*) are also regular visitors to the Sargasso Sea, and are believed to spawn in the Sargasso Sea (ICCAT 2010 and 2011a).

The Sargasso Sea is also important habitat for Atlantic swordfish (*Xiphias gladius*), moving through the Sargasso Sea as part of a seasonal migration from the tropical Atlantic to temperate northwest Atlantic waters. They make diurnal vertical movements spanning at least 1,000m (Loefer et al 2007) that mirror those of mesopelagic fishes. These fishes undoubtedly transfer a significant fraction of primary production from the epipelagic (near-surface) zone of the Sargasso Sea to mesopelagic depths.

In addition to the movements of the other turtle species within the Sargasso Sea, adult leatherback turtles (*Dermochelys coriacea*) migrate north through the Sargasso Sea from nesting sites in the Caribbean Sea (Ferraroli et al 2004, Hays et al 2004), and seasonally to the Sargasso Sea from foraging locations in coastal waters of New England and Nova Scotia (James et al 2005).

Thirty cetacean species (whales and dolphins) have been recorded from the Sargasso Sea (Kaschner et al 2011). Of particular note are humpback whales (*Megaptera novaeangliae*) that pass through the Sargasso Sea during their annual migrations between the Caribbean and the northern North Atlantic (Martin et al 1984, Stone et al 1987, G. Donovan and R. Reeves 2011, pers. comm.). Adults are often seen within sight of the south shore of Bermuda during March and April with their newborn calves. The same individuals are seen year after year at Bermuda and further north in the Stellwagen Bank Marine Sanctuary off the east coast of the USA (Stevenson 2011, unpub). The importance of this connectivity was recognised in 2011 by the signing of a collaboration arrangement between the Government of Bermuda and the Stellwagen Bank National Marine Sanctuary. Some of these individuals have also been recorded at another proposed EBSA site, the Marine Mammal Sanctuary – Banco de la Plata y Banco de la Navidad, off the Dominican Republic (Omar Reynoso, pers. comm., <http://www.intec.edu.do/ballenas>). The other large whale seen regularly in the Sargasso Sea is the sperm whale (*Physeter catodon*). Groups including calves are commonly seen (Antunes 2009) and it is likely that they feed in the frontal convergence, around the boundaries of Gulf Stream rings and above the seamounts (National Marine Fisheries Service 2010).

Tracking data from Birdlife International show 8 species of seabirds migrating through the Sargasso Sea in significant numbers (B. Lascelles, pers. comm., www.seabirdtracking.org). *Sargassum* patches can be dense enough for some birds, notably bridled and sooty terns (*Sterna anaethetus* and *Sterna fuscata*) to roost upon (Haney 1986).

Threatened species

Many of the species utilising the Sargasso Sea are of considerable global conservation interest, appearing on the International Union for the Conservation of Nature (IUCN) Red List of endangered species, and/or under the Convention on International Trade in Endangered Species (CITES) (Hallett 2011, unpub) (see Table2). They feature in the annexes of the 1990 Specially Protected Areas and Wildlife Protocol to the Convention on the Protection and Development of the Marine Environment of the Wider Caribbean Region (SPAW Protocol, <http://www.cep.unep.org/cartagena-convention/spaw-protocol>). Although the geographical area of the Protocol does not extend to the Sargasso Sea, the Protocol does require countries in the Caribbean region to implement conservation measures to protect and recover and, where relevant, to maintain populations of these species at optimal levels. Species of relevance to the Sargasso Sea include seabirds in the air above, turtles in the floating *Sargassum*, large pelagic fishes and cetaceans in the waters below, and a wide variety of corals on seamounts rising from the seabed

(Table 3). Tables 2 and 3 list examples of threatened species, but they are only an indication of the numbers of endangered species that occur in the Sargasso Sea.

European and American eels (*Anguilla spp*)

The Sargasso Sea is of considerable international importance for the economically valuable American and European eels, *Anguilla rostrata* and *A. anguilla*, which spend their adult lives in freshwater and migrate thousands of miles to the Sargasso Sea to spawn (Schmidt 1922, Kleckner et al 1983, Friedland et al 2007). The larvae of both species develop in the Sargasso Sea and then take 7 to 24 months to follow the Gulf Stream back to their respective freshwater habitats in North America and Europe, where they metamorphose into juvenile “glass eels” (ICES 2010). Both species of eel are the subjects of important fisheries, as both “glass eels” and as adults (Wirth and Bernatchez 2003). The exact location and circumstances of eel spawning in the SW Sargasso Sea remain unknown although there is evidence that oceanographic features such as thermal fronts may direct eels to spawning locations (Kleckner and McCleave 1988). The small larvae, or leptocephali, of both species have broad distributions in overlapping areas of the Sargasso Sea.

Recruitment and populations of both species are in significant decline, with the European eel listed by CITES and classified by IUCN as ‘critically endangered’ and at increasing risk of global extinction. Tentative links have been proposed between changes in the Sargasso Sea and the decline of both American and European eel species (Friedland et al 2007). These include changes in location of their spawning areas, changes in wind driven currents that transport eel larvae to adult habitats in Europe and North America, and potential changes to feeding success for eel larvae (Miller et al 2009). A range of other causes has been suggested to affect the juveniles and adults including pollution (particularly substances like PCBs) (Robinett and Feunteun 2002, Pierron et al 2007), the effects of the swimbladder parasite (*Anguillicoloides crassus*) (Gollock et al 2005, Gollock 2011, unpub), the poor condition of migrating silver eels (Svedäng and Wickström 1997), and the destruction of their freshwater habitat (Haro et al 2000). The evidence for some of these factors is greater than others (often varying with region), but it is unlikely that there is one single cause.

In 2007 the European Union adopted an eel recovery plan (EC 2007). This plan directs European member states to reduce eel fishing efforts by at least 50% relative to average efforts deployed from 2004 to 2006. Similarly in Canada, the American eel has been identified as an Endangered Species under Ontario’s Endangered Species Act of 2007. Quebec, Newfoundland and Labrador, have also introduced measures to regulate eel fishing and eel escapement back to the sea. Recognising the importance of the Sargasso Sea is a first step towards international measures to complement these regulations.

Deep water pelagic species

Beneath the *Sargassum* layer, the Sargasso Sea descends to depths of around 4500m and is populated throughout by deep ocean animals. *Sargassum*, once it sinks, contributes to the food webs of these deepwater communities, as well as providing up to 10 % of the energy inputs to communities on the seabed (Schoener and Rowe 1970, Rowe and Staresinic 1979 in Angel and Boxshall 1990, Butler et al 1983). The Sargasso Sea has been sampled intensively by deep-sea biologists and oceanographers for over a century and numerous accounts show that Sargasso Sea assemblages of species are generally similar to those found throughout the subtropical Atlantic (e.g. Marshall 1979, Herring 2002).

However, a study of the bathypelagic fish family Stomiidae found a suite of sub-tropical endemic species in the northern Sargasso Sea, primarily from the genus *Eustomias* but also in the genera

Photonectes and *Bathophilus*, and determined that the area exhibited higher levels of endemism for this group than other North Atlantic biogeographic provinces (Porteiro 2005). Other recent studies include have focused on fish during the 2006 Census of Marine Life Programme (Sutton et al 2010), amphipod crustaceans (Gasca 2007), and chaetognaths (Pierrot-Bults and Nair 2010), whilst a selection of older work includes decapod crustacean (Donaldson 1975), general zooplankton (Deevey 1971), biomass profiles (Angel and Baker 1982, Angel and Hargreaves 1992), and ostracod crustaceans (Angel 1979). Gelatinous zooplankton are well-represented in the Sargasso Sea, being a heterogeneous assemblage of generally large-bodied, jellyfish-like species including medusae, siphonophores, ctenophores, thaliaceans and some polychaetes and pteropods. Salps are diverse and frequently abundant in the vicinity of Bermuda (Madin et al 1996). *Pyrosoma*, a colonial thaliacean, also migrates over similar distances. The only really different feature of deep-sea animals in the Sargasso Sea is the impact of Gulf Stream rings and mesoscale eddies upon their distribution described earlier. The impact of Gulf Stream rings on groups ranging from protozoa to fish has been well documented (Weibe and Boyd 1978, Fairbanks et al 1980, Backus and Craddock 1982, Wiebe and Flierl 1983). In addition to these conventional studies, the Sargasso Sea is one of the few ocean areas that has been studied using cutting edge intensive DNA barcoding efforts to document the biodiversity of its inhabitants at all different depths (Bucklin et al 2010; Sutton et al 2010).

Despite the apparent overall similarity between the midwater communities in the Sargasso Sea and elsewhere, an inventory of planktonic ostracods for the Atlantic ocean found that 10% of the species caught below 2000m were new to science and speculated that, if the sampling had reached the benthopelagic zone near the sea-bed, the novel component would have soared (Angel 2010). The ostracods are likely to be an indicator of the potential numbers of new invertebrate species yet to be discovered in the deep ocean.

Benthic communities

The biology of the abyssal plains is best known through work done on a repeated transect between Bermuda and Gay Head in the USA in the 1960s and 70s (Sanders et al 1965) - work that remains a milestone in our knowledge of deep-ocean bottom faunas. Very recently a new observational programme on the larger bottom fauna has started using baited cameras (MBARI Sargasso Sea Expedition 2011 www.mbari.org).

The best known seamounts below the Sargasso Sea are the New England Seamount chain and the Corner Rise seamounts, with peaks rising as much as 4000m from the abyssal plain. These seamounts support complex coral and sponge communities, including numerous endemics, which provide habitat for diverse invertebrate communities that include some highly dependent commensal species (Watling 2007, Watling et al 2007, Cho 2008, Simpson and Watling 2011, Pante and Watling 2011, ICES 2011, Shank 2010). These seamounts also host abundant populations of deep-water fish, which have been heavily exploited commercially since 1976 (Vinnichenko 1997), but despite this they remain important as aggregating and spawning areas for the alfonsino (*Beryx splendens*). Deep-sea and seamount fish stocks are particularly vulnerable to exploitation because the fish are very long lived, take many years to reach sexual maturity, and have very low fecundities (Norse et al 2012). Limited observations of the Muir seamount chain within the Bermuda EEZ show that its surface is covered with abundant hydroids, sponges, calcareous algae, and rubble (Pratt 1962).

Feature condition and future outlook of the proposed area

Despite its remote location, the Sargasso Sea does not remain totally natural. A recent global analysis of human impacts of marine ecosystems concluded that the area has sustained moderate to high impacts over time (Halpern et al 2008).

Fisheries landings for many species in the North Central Atlantic have declined significantly in the last 50 years, indicative of impacts on those populations (Sumaila et al 2011, unpub, Pauly and Watson 2005, Pauly et al 2005). Regulatory actions by ICCAT aim to address this. Bottom trawling between 1976 and 1995 on the Corner Rise seamounts caused extensive destruction of the benthic fauna (Vinnichenko 1997, Waller et al 2007, Shank 2010). As a precautionary management measure, 13 fishable seamounts, including 25 peaks shallower than 2,000 m on the New England and Corner Rise seamounts were closed to demersal fishing by the Northwest Atlantic Fishery Organization (NAFO) from January 1st 2007. This closure was recently extended until Dec 31 2014 (NAFO 2011). The recovery of these habitats in the coming years should be monitored.

Floating plastic particles were reported in the Sargasso Sea as early as 1972 (Carpenter and Smith 1972), and today the currents of the North Atlantic gyre have trapped floating debris on a scale similar to the more infamous North Pacific garbage patch with concentrations of plastic particles reaching in excess of 100,000 pieces km⁻² in some places (Law et al 2010). This clearly impacts the naturalness of the area, and the negative impacts of plastic debris on organisms such as turtles and seabirds are well documented (Witherington 1994, Rios et al 2007). There are also numerous submarine communications cables that have a minor effect on the naturalness of the seabed (Telegeography 2011) and this is likely to be an ongoing issue.

The Sargasso Sea lies within one of the world's busiest international shipping areas and is crossed by a large number of vessels each year (Roberts 2011, unpub). This affects the naturalness of the area, but impacts on condition are unclear as appropriate research is lacking (GESAMP 2009). Areas of concern include the possible introduction of "foreign" organisms via ballast water (South Atlantic Fishery Management Council 2002, Halpern et al 2008, Roberts 2011, unpub), the potential impact of underwater noise generated by ships on marine mammals (Wright et al 2009), and the risk of collision with whales, dolphins and turtles (Laist et al 2001, Jensen and Silber 2003, Panigada et al 2008). Shipping transiting the Sargasso Sea may also have a direct physical impact on the *Sargassum* mats, destroying the integrity of the floating community. Research is clearly needed to quantify the degree of pressure that shipping exerts on the Sargasso Sea.

Despite these concerns regarding the condition of the Sargasso Sea, the ecological and biological functionality of the ecosystem remain intact, allowing this unique area to still fulfil its role as a home and an essential resource for a great diversity of species, many of which are of considerable conservation interest. Actions to address some of these concerns can only serve to improve the future outlook for the area. Concerns for the future include the potential for commercial extraction of *Sargassum* seaweed and seabed mining activities (Parson and Edwards 2011, UN, 2009). Application of the precautionary approach is vital to ensure the continued ecological and biological importance of this area into the future.

Assessment of the area against CBD EBSA Criteria

CBD EBSA Criteria (Annex I to decision IX/20)	Description (Annex I to decision IX/20)	Ranking of criterion relevance (please mark one column with an X)			
		Don't Know	Low	Medium	High
<i>Uniqueness or rarity</i>	Area contains either (i) unique (“the only one of its kind”), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				X
<p>The two species of floating <i>Sargassum</i> are the world’s only holopelagic macroalgae, distinct from all other complex seaweeds in not having an attached benthic stage (Deacon 1942, Stoner 1983). Although these species occur in the Gulf of Mexico and Caribbean, the extent of their occurrence in the Sargasso Sea provides a unique and valuable structurally complex habitat in deep, open ocean waters. Here, the areal extent of the <i>Sargassum</i> and the thickness of the mats it forms, along with their persistence, attract and retain a great density and diversity of associated organisms, distinguishing the Sargasso Sea ecosystem from other drift algal habitats (Stoner and Greening 1984, Coston-Clements et al 1991, Moser et al 1998, Casazza and Ross 2008). The Sargasso Sea is also the northerly limit of persistent <i>Sargassum</i> presence.</p> <p>The Sargasso Sea is home to numerous endemic species that are, by definition, rare. The floating <i>Sargassum</i> community hosts ten endemic species from a broad range of taxa (Coston-Clements et al 1991, SAFMC 2002). The mid-water fish community of the Sargasso Sea includes a suite of sub-tropical endemics from three genera in the family Stomiidae (Porteiro 2005). On the sea floor, the New England seamount chain and the Corner Sea Rise seamounts are known to host endemic species and specialised communities, and models indicate that other isolated seamounts occur throughout the area (Figure 1).</p>					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.				X
<p>The Sargasso Sea is of considerable international importance as the only spawning area for American and European eels, <i>Anguilla rostrata</i> and <i>A. anguilla</i>. Both species spend their adult lives in freshwater but migrate thousands of miles to the Sargasso Sea to spawn (Schmidt 1922, Kleckner et al 1983, Friedland et al 2007). The larvae of both species develop in the Sargasso Sea and migrate along the Gulf Stream back to their respective freshwater habitats in North America and Europe. Satellite tagging has also recently shown that large female porbeagle sharks (<i>Lamna nasus</i>) migrate over 2,000 km at depths of up to 500m from Canadian waters to the Sargasso Sea where they may be pupping (Dulvy et al 2008, Campana et al 2010).</p> <p>The <i>Sargassum</i> anglerfish (<i>Histrio histrio</i>) and pipefish (<i>Syngnathus pelagicus</i>) lay their eggs in the <i>Sargassum</i> mats, and oceanic flying fish (Exocoetidae) build bubble nests for their eggs within the weed and have eggs with long extensions for attaching to the weed (Dooley 1972, Sterrer 1992). Other fish that spawn in the Sargasso Sea include white marlin (<i>Tetrapturus</i></p>					

albidus), and blue marlin (*Makaira nigricans*) (South Atlantic Fishery Management Council 2002, Luckhurst et al 2006, White Marlin Biological Review Team 2007) and various additional species of eels (Schoth and Tesch 1982, McCleave and Miller 1994, Miller and McCleave 1994, Miller 2002, Miller and McCleave 2007). Albacore tuna are also believed to spawn in the Sargasso Sea (ICCAT 2011a).

The Corner Rise and New England Seamounts host abundant populations of deep-water fish and, despite heavy commercial exploitation, remain important as aggregating and spawning areas for the alfonsino (*Beryx splendens*).

The mats of *Sargassum* and their associated communities are essential as nursery habitats and feeding areas for many species of fish, seabirds, and turtles. Fish living within the *Sargassum* canopy include juvenile swordfish (*Xiphius gladius*), juvenile and sub-adult jacks (Carangidae), juvenile and sub-adult dolphinfish (Coryphaenidae), filefish and triggerfish (Balistidae) of all life stages, and driftfish (Stromateidae) (Fedoryako 1980, Coston-Clements et al 1991, South Atlantic Fishery Management Council 2002, Casazza and Ross 2008, Rudershausen et al 2010). These fish are in turn a food resource for larger predatory species.

Green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricate*), loggerhead turtles (*Caretta caretta*), and Kemp’s Ridley turtles (*Lepidochelys kempii*), all of which are threatened or endangered, use *Sargassum* as a nursery habitat (Carr and Meylan 1980, Carr 1987, Schwartz 1988, Manzella and Williams 1991, Luschi et al 2003). Hatchlings swim hundreds of miles to the Sargasso Sea, where they hide in the *Sargassum* to feed and grow in relative safety, spending their so called ‘lost years’ amongst the weed (Carr and Meylan 1980, Carr 1987, Schwartz 1988, Luschi et al 2003).

A variety of seabirds feed in association with *Sargassum* in the Sargasso Sea (Table 1) (Haney 1986, Thomas 2005). Tracking data from Birdlife International show that the western Sargasso Sea is an important feeding area for Audubon’s shearwater (*Puffinus lherminieri*) and white-tailed tropic birds (*Phaethon lepturus*) from the Bahamas (B. Lascelles, pers. comm., www.seabirdtracking.org).

The Sargasso Sea provides critical food and shelter for a variety of organisms on migratory routes between the tropical and temperate Atlantic. Nearly all the large tunas and tuna-like species managed by ICCAT, including the Bluefin tuna (*Thunnus thynnus*), migrate through the Sargasso Sea (Lutcavage et al 1999, Block et al 2001, Block et al 2005, Wilson and Block 2009, ICCAT 2010). Basking sharks (*Cetorhinus maximus*) make regular seasonal movements to the Sargasso Sea during winter months at depths of 200-1000m meters (Skomal et al 2009). Adult leatherback turtles (*Dermochelys coriacea*) migrate north through the Sargasso Sea from nesting sites in the Caribbean Sea (Ferraroli et al 2004, Hays et al 2004), and seasonally to the Sargasso Sea from foraging locations in coastal waters of New England and Nova Scotia (James et al 2005).

Humpback whales (*Megaptera novaeangliae*) pass through the Sargasso Sea during their annual migrations between the Caribbean and the northern North Atlantic (Martin et al 1984, Stone et al 1987, G. Donovan and R. Reeves 2011, pers. comm.). The same individuals are seen year after year off Bermuda and further north in the Stellwagen Bank Marine Sanctuary off the east coast of the USA (Stevenson 2011, unpub). Some of these individuals have also been recorded at another proposed EBSA site, the Marine Mammal Sanctuary – Banco de la Plata y Banco de la Navidad, off the Dominican Republic (Omar Reynoso, pers. comm., <http://www.intec.edu.do/ballenas>).

Tracking data from Birdlife International show 8 species of seabirds migrating through the Sargasso Sea in significant numbers (B. Lascelles, pers. comm., www.seabirdtracking.org).

Sargassum patches can be dense enough for some birds, notably bridled and sooty terns (*Sterna anaethetus* and *Sterna fuscata*) to roost upon (Haney 1986).

Importance	Area containing habitat for the survival				
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for threatened, endangered or declining species and/or habitats	and recovery of endangered, threatened, declining species or area with significant assemblages of such species.				X
<p>Many of the species utilising the Sargasso Sea are of considerable global conservation interest, appearing on the IUCN Red List of endangered species, and/or under CITES (Hallett 2011, unpub) (see Table2). They feature in the annexes of the 1990 SPAW Protocol of the Cartagena Convention (http://www.cep.unep.org/cartagena-convention/spaw-protocol), which requires countries in the Caribbean region to implement conservation measures for these species (Table 3). Tables 2 and 3 list examples of threatened species, but they are only an indication of the numbers of endangered species that occur in the Sargasso Sea.</p> <p>Important examples include European and American eels, porbeagle sharks and four species of turtle - Kemp's Ridley, Hawksbill, Loggerhead and Green – which are heavily dependent on the Sargasso Sea and/or <i>Sargassum</i>. Some 30 cetacean species live in or migrate through the Sargasso Sea, as do several species of endangered or threatened tuna and sharks. Leatherback turtles also migrate through the area.</p> <p>The distinct Seamount communities are rare habitats which are home to a variety of endemic species with very limited distribution that are thus at high risk of extinction.</p> <p>Threatened and endangered species utilising the Sargasso Sea include seabirds in the air above, turtles in the floating <i>Sargassum</i>, large pelagic fishes and cetaceans in the waters below, and a wide variety of corals on seamounts rising from the seabed.</p>					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				X
<p>Deep sea organisms and their communities are considered extremely vulnerable because such species are generally long-lived, slow to mature and have low reproductive rates, leading to slow recovery times if their populations are perturbed (Norse et al 2012). In addition, many organisms in the deep sea are physically fragile and easily damaged. The benthic communities on seamounts are particularly vulnerable as they may be isolated from external sources of replenishment and they often contain endemic species with very limited distributions.</p> <p>Within the proposed Sargasso Sea EBSA, the Corner Rise, New England and Muir seamount chains support complex coral and sponge communities, including numerous endemics, which provide habitat for diverse invertebrate communities that include some highly dependent commensal species (2007, Watling et al 2007, Cho 2008, Simpson and Watling 2011, Pante and Watling 2011, ICES 2011, Shank 2010). These seamounts also host abundant populations of deep-water fish. Deep-sea and seamount fish stocks are particularly vulnerable to exploitation because the fish are very long lived, take many years to reach sexual maturity, and have very low fecundities (Norse et al 2012). These fish stocks have been heavily exploited commercially since 1976 (Vinnichenko 1997), and the fragile seamount ecosystems of the Corner Rise and New England chains have already sustained considered damage from these deep sea trawling activities. Despite this the seamounts remain important as aggregating and spawning areas for the alfonsino</p>					

(*Beryx splendens*).

The communities dependent on the *Sargassum* mats are also vulnerable, although to a lesser degree, as their existence relies on the presence of the complex physical structure provided by the seaweed.

Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.				X
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The discovery of *Prochlorococcus* and the development of techniques able to evaluate the role of picoplankton in primary production measurements have revolutionized our perceptions of productivity in the Sargasso Sea and subsequently of the global ocean (Chisholm et al 1988). Conventionally the Sargasso Sea was regarded as an area of low nutrients and low productivity, enhanced by localized upwellings. Yet despite having low nutrient levels and therefore being officially classed as ‘oligotrophic’, the Sargasso Sea, per unit area, has a surprisingly high net annual primary production rate that matches levels found in some of the most productive regions in the global ocean (Steinberg et al 2001, Rho and Whitley 2007, Lomas et al 2012). This is due to a complex combination of factors - the production of carbon in the surface waters by photosynthesis, the location of the Sargasso Sea in the sub-tropics which results in a deep euphotic layer, and differences in phytoplankton communities and associated nitrogen fixation.

Integrated over the entire area of the Sargasso Sea the annual net primary production, the balance of primary production and plankton respiration, is estimated to be some three times higher than in the Bering Sea (Steinberg et al 2001, Lomas et al 2012), conventionally regarded as one of the world’s most productive seas. The difference is that in the Sargasso Sea most of the production is recycled by bacteria in the so-called microbial loop rather than channelled into biomass of larger, harvestable organisms (Carlson et al 1996, Steinberg et al 2001).

As a result of this high primary productivity, to which must be added the annual production of *Sargassum* weed which is now being estimated from satellite measurements (Gower and King 2008, 2011), the Sargasso Sea plays a key role in both global oxygen production and ocean sequestration of carbon (IPCC1996, 2001 and 2007, Ullman et al 2009, Lomas et al 2011 unpub). Production in the upper ocean, particularly of *Sargassum*, contributes to food webs in mid-water and benthic regions, providing up to 10% of the energy inputs to communities on the seabed (Schoener and Rowe 1970, Rowe and Staresinic 1979 in Angel and Boxshall 1990, Butler et al 1983).

Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X
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The biodiversity of the Sargasso Sea is exemplified by the diverse population of species that live on or amongst the *Sargassum*. More than 145 species of invertebrates have been recorded, including a variety of gastropod and nudibranch molluscs, portunid and amphipod crustaceans, pycnogonids, serpulid and nereid polychaetes, flatworms, bryozoans and hydroids (Fine 1970, Morris and Mogelberg 1973, Butler et al 1983, Coston-Clements et al 1991, Sterrer 1992, Calder 1995, South Atlantic Fishery Management Council 2002, Trott et al 2011). In addition, over 100 species of fish associate with floating *Sargassum* offshore (Dooley 1972, Fedoryako 1980, Coston-Clements et al 1991, Casazza and Ross 2008, Sutton et al 2010). Most of these species would not live in the open ocean without the floating algae. Ten of these species are endemic to floating *Sargassum*: the *Sargassum* anglerfish (*Histrio histrio*), *Sargassum* pipefish (*Syngnathus pelagicus*), *Sargassum* slug (*Scyllea pelagica*), *Sargassum* snail (*Litiopa melanostoma*),

Sargassum crab (*Planes minutes*), *Sargassum* shrimp (*Latreutes fucorum*), the amphipods *Sunampithoe pelagica* and *Biancolina brassicacephala*, the platyhelminth *Hoploplana grubei* and the *Sargassum* anemone (*Anemonia sargassensis*).

The diversity of oceanic plankton and micronekton within the Sargasso Sea is enhanced as species are drawn in from the surrounding currents via rings and eddies (Boyd et al 1978, Wiebe and Boyd 1978, Ring Group 1981).

Overall, mesopelagic diversity is not considered to be higher than other similar locations, but a variety of species from a wide range of taxa have been documented from this deeper part of the ocean. A study of the bathypelagic fish family Stomiidae found a suite of sub-tropical endemic species in the northern Sargasso Sea, primarily from the genus *Eustomias* but also in the genera *Photonectes* and *Bathophilus*, and determined that the area exhibited higher levels of endemism for this group than other North Atlantic biogeographic provinces (Porteiro 2005). In addition, it is worth noting that Angel (2010), in drawing up an inventory of planktonic ostracods for the Atlantic ocean, observed that 10% of the species caught below 2000m were new to science and that if the sampling had reached the benthopelagic zone within a few metres of the sea-bed the novel component would have soared. The ostracods are likely to be an indicator of the potential numbers of new species yet to be discovered in the deep ocean.

Benthic diversity is very high on the Corner Rise and New England seamount chains where there are numerous endemic and novel species of coral which host specific commensal invertebrates, and some 670 species have been found (Watling 2007, Watling et al 2007, Cho 2008, Simpson and Watling 2011, Pante and Watling 2011, ICES 2011, Shank 2010). Less is known about the Muir seamount chain, but limited observations have shown it is covered with abundant hydroids, sponges, calcareous algae and rubble (Pratt 1962). The diversity of fauna living on and within the abyssal plain of the Sargasso Sea may well be amongst the highest on the planet (Sanders et al 1965, MBARI Sargasso Sea Expedition 2011 www.mbari.org).

Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			X	
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Despite its remote location, the Sargasso Sea does not remain totally natural. A recent global analysis of human impacts of marine ecosystems concluded that the area has sustained moderate to high impacts over time (Halpern et al 2008).

Fisheries landings for many species in the North Central Atlantic have declined significantly in the last 50 years, indicative of impacts on those populations (Sumaila et al 2011, unpub, Pauly and Watson 2005, Pauly et al 2005). Deep pelagic and bottom trawling between 1976 and 1995 on the Corner Rise seamounts caused extensive destruction of the benthic fauna (Vinnichenko, 1997, Waller et al 2007, Shank 2010). As a precautionary management measure, 13 fishable seamounts, including 25 peaks shallower than 2,000 m on the New England and Corner Rise seamounts were closed to demersal fishing by the Northwest Atlantic Fishery Organization (NAFO) from January 1st 2007. This closure was recently extended until Dec 31 2014 (NAFO 2011). The recovery of these habitats in the coming years should be monitored.

Floating plastic particles were reported in the Sargasso Sea as early as 1972 (Carpenter and Smith 1972), and today the North Atlantic gyre has a patch of floating debris akin to the more famous North Pacific garbage patch with concentrations of plastic particles reaching in excess of 100,000 pieces km⁻² in some places (Law et al 2010). This clearly impacts the naturalness of the area, and the negative impacts of plastic debris on organisms such as turtles and seabirds, are well documented (Witherington 1994, Rios et al 2007). There are also numerous submarine communications cables that have a minor effect on the naturalness of the seabed (Telegeography

2011).

The Sargasso Sea lies within one of the world's busiest international shipping areas and is crossed by a large number of vessels each year (Roberts 2011, unpub). This affects the naturalness of the area, but precise impacts are unclear as appropriate research is lacking (GESAMP 2009) and this absence of data should be addressed.

Despite these impacts, the ecological and biological functionality of the Sargasso Sea ecosystem remain intact, allowing this unique area to fulfil its role as a home and an essential resource for a great diversity of species.

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Maps and Figures

Figure 1. Map showing known and predicted seamounts beneath the Sargasso Sea in relation to the proposed EBSA, based on modelling data in Halpin et al 2012, unpub.

Figure 2. Map of the proposed Sargasso Sea EBSA, including some of the major features that influence overall boundary definition and location. (Ardrón et al 2011, unpub)

Table 1. Seabird species known to be associated with *Sargassum* and the Sargasso Sea (composite list developed from Haney 1986 and Thomas 2005).

Species	Common Name
<i>Pterodroma hasitata</i>	Black-capped Petrel
<i>Calonectris diomedea</i>	Cory's Shearwater
<i>Puffinus gravis</i>	Greater Shearwater
<i>Puffinus Iherminieri</i>	Audubon's Shearwater
<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel
<i>Oceanodroma leucorhoa</i>	Leach's Storm-Petrel
<i>Puffinus griseus</i>	Sooty Shearwater
<i>Phaethon lepturus</i>	White-tailed Tropicbird
<i>Phaethon aethereus</i>	Red-billed Tropicbird
<i>Sula dactylatra</i>	Masked Booby
<i>Sula leucogaster</i>	Brown Booby
<i>Phalaropus lobatus</i>	Red-necked Phalarope
<i>Phalaropus fulicaria</i>	Red Phalarope
<i>Phalaropus sp.</i>	Phalarope sp.
<i>Stercorarius pomarinus</i>	Pomarine Jaeger
<i>Stercorarius parasiticus</i>	Parasitic Jaeger
<i>Stercorarius longicaudis</i>	Long-tailed Jaeger sp.
<i>Larus argentatus</i>	Herring Gull
<i>Sterna maxima</i>	Royal Tern
<i>Sterna hirundo</i>	Common Tern
<i>Sterna paradisaea</i>	Arctic Tern
<i>Sterna antillarum</i>	Least Tern
<i>Sterna anaethetus</i>	Bridled Tern
<i>Sterna fuscata</i>	Sooty Tern

Table 2. Oceanic species using the Sargasso Sea and Bermuda's EEZ that are on the IUCN Red List of threatened or endangered species and listed under CITES.

Species	Common Name	IUCN Status	CITES Status
<i>Megaptera novaeangliae</i>	Humpback Whale	n/a	Appendix 1
<i>Physeter macrocephalus</i>	Sperm whale	Vulnerable	Appendix 1
<i>Thunnus thynnus</i>	Bluefin Tuna	Endangered	Not listed
<i>T. albacores</i>	Yellowfin Tuna	Near Threatened	Not listed
<i>T. alalunga</i>	Albacore Tuna	Near Threatened	Not listed
<i>T. obesus</i>	Bigeye Tuna	Vulnerable	Not listed
<i>Makaira nigricans</i>	Blue Marlin	Near Threatened	Not listed
<i>Tetrapterus albidus</i>	White Marlin	Near Threatened	Not listed
<i>Anguilla anguilla</i>	European Eel	Critically Endangered	Appendix 2
<i>Rhincodon typus</i>	Whale Shark	Vulnerable	Appendix 2
<i>Cetorhinus maximus</i>	Basking Shark	Vulnerable	Appendix 2
<i>Carcharodon carcharius</i>	White Shark	Vulnerable	Appendix 2
<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark	Vulnerable	Not listed
<i>Carcharhinus falciformis</i>	Silky Shark	Near Threatened	Not listed

<i>Carcharinus galapagensis</i>	Galapagos Shark	Never Threatened	Not Listed
<i>Lamna nasus</i>	Porbeagle Shark	Vulnerable	Not listed
<i>Isurus oxyrinchus</i>	Shortfin Mako Shark	Vulnerable	Not listed
<i>Prionace glauca</i>	Blue Shark	Near Threatened	Not listed
<i>Sphyrna lewini</i>	Scalloped Hammerhead	Endangered	Not listed
<i>Galeocerdo cuvier</i>	Tiger Shark	Near Threatened	Not listed
<i>Caretta caretta</i>	Loggerhead turtle	Endangered	Appendix 1
<i>Chelonia mydas</i>	Green turtle	Endangered	Appendix 1
<i>Eretmochelys imbricata</i>	Hawksbill turtle	Critically Endangered	Appendix 1
<i>Lepidochelys kemp</i>	Kemp's Ridley turtle	Critically Endangered	Appendix 1
<i>Dermochelys coriacea</i>	Leatherback turtle	Critically Endangered	Appendix 1
<i>Pterodroma cahow</i>	Cahow	Endangered	Not listed

Table 3. Endangered and threatened species commonly associated with the Sargasso Sea and waters around Bermuda requiring conservation measures in the wider Caribbean region to protect and recover and, where relevant, to maintain their populations at optimal levels. These species are examples taken from the annexes of the Convention on the Protection and Development of the Marine Environment of the Wider Caribbean Region (SPAW Protocol). For a comprehensive list of all species covered by the SPAW Protocol, please see <http://www.cep.unep.org/cartagena-convention/spaw-protocol>.

Species	Common name	SPAW status
<i>Puffinus lherminieri</i>	Audubon's shearwater	Annex II (Article 11(1)(b))
Cetacea – all spp.	Whales and dolphins	Annex II (Article 11(1)(b))
<i>Caretta caretta</i>	Loggerhead turtle	Annex II (Article 11(1)(b))
<i>Chelonia mydas</i>	Green turtle	Annex II (Article 11(1)(b))
<i>Eretmochelys imbricate</i>	Hawksbill turtle	Annex II (Article 11(1)(b))
<i>Lepidochelys kemp</i>	Kemp's Ridley turtle	Annex II (Article 11(1)(b))
<i>Dermochelys coriacea</i>	Leatherback turtle	Annex II (Article 11(1)(b))
<i>Phaethon lepturus</i>	White-tailed Tropicbird	For inclusion in Annex II
<i>Phaethon aethereus</i>	Red-billed Tropicbird	For inclusion in Annex II
<i>Sula dactylatra</i>	Masked Booby	For inclusion in Annex II
<i>Sula leucogaster</i>	Brown Booby	For inclusion in Annex II
<i>Sterna maxima</i>	Royal Tern	For inclusion in Annex II
<i>Sterna hirundo</i>	Common Tern	For inclusion in Annex II
<i>Sterna anaethetus</i>	Bridled Tern	For inclusion in Annex II
<i>Sterna fuscata</i>	Sooty Tern	For inclusion in Annex II

