



The Sargasso Sea High Seas EBSA After Ten Years: Is It Still Relevant and How Has It Helped Conservation Efforts?

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OPEN ACCESS

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Specialty section:

This article was submitted to
Marine Affairs and Policy,
a section of the journal
Frontiers in Marine Science

Received: 23 November 2021

Accepted: 16 May 2022

Published: 24 June 2022

Citation:

Roe HSJ, Freestone D and
Sapsford F (2022) The Sargasso
Sea High Seas EBSA After Ten
Years: Is It Still Relevant and How
Has It Helped Conservation Efforts?
Front. Mar. Sci. 9:821182.
doi: 10.3389/fmars.2022.821182

The Sargasso Sea is a high seas ecosystem located within the North Atlantic Subtropical Gyre. The floating *Sargassum* macroalgae for which it is named support a diverse and productive ocean ecosystem. The floating mats and windrows of *Sargassum* house distinct communities of animals including endemic species, and provide shelter, nursery areas and food for many others including juvenile turtles, fish, and birds. A decade ago, in 2012, the two million square mile core area of the Sargasso Sea was “described” by the parties to the Convention on Biological Diversity (CBD) as an Ecologically or Biologically Significant Marine Area (EBSA), having scored highly on six of the seven designated criteria. At the time it was the largest high seas EBSA to be so described. This paper reviews the scientific evidence supporting the finding that it meets the rigorous criteria for an EBSA and assesses whether there have been major changes in the decade since. It puts this in the context of the work of the Sargasso Sea Commission and the Hamilton Declaration Signatories to “conserve the Sargasso Sea for the benefit of present and future generations” and assesses the extent to which being an EBSA has assisted with these conservation efforts.

Keywords: sargasso sea, EBSA, sargasso sea commission, conservation, high seas, GEF, FFEM

INTRODUCTION

The Sargasso Sea is a high seas area within the North Atlantic sub-tropical gyre. It is the only sea without land boundaries – rather, it is enclosed by clockwise rotating currents; the Gulf Stream to the North and West, the more diffuse Canary Current to the East, and the North Equatorial Current and Antilles Current to the South. These currents essentially trap water within the gyre – and with it an iconic surface ecosystem based upon two species of holopelagic macroalgae for which the Sea is named (*Sargassum fluitans* and *S. natans*). The Sargasso Sea is home to the world’s longest time series of oceanographic measurements, started in 1954 and hosted by the Bermuda Institute of Ocean Sciences (BIOS) – the Bermuda Atlantic Time Series site (BATS) (BIOS, 2021). Data from BATS have made major contributions to understanding the changes that have occurred and are

occurring in the sub-tropical ocean, and continues to be essential to monitoring global change (Neuer et al., 2017). Knowledge obtained from BATS allowed Venter et al. (2004) to describe the Sargasso Sea as “one of the best-studied and most well-characterised regions of the global ocean.” However, global interest in conserving it was stimulated by its inclusion in the list of ten “High Seas Gems” promulgated in 2008 by the International Union for the Conservation and Nature and Natural Resources (IUCN, 2008). That IUCN initiative identified ten important and valuable high seas ecosystems to provide graphic illustrations of the need to conserve and sustainably manage biodiversity in the high seas to support the work of an “*Ad Hoc* Open-ended Informal Study Group” established in 2004 by the United Nations General Assembly (UNGA) (Freestone, 2018).

IUCN also approached the Government of Bermuda to host a meeting in 2009 to examine ways of providing better protection to the open ocean areas of the Sargasso Sea around Bermuda. The Government of Bermuda then agreed to lead that initiative, involving a wider range of partners, that became known as the Sargasso Sea Alliance (SSA) (Freestone and Morrison, 2012). The SSA aimed to secure global recognition for the importance of the Sargasso Sea and to explore and progress protection measures for the area. To establish why the area was – and remains – so important, the first major step in the initiative was to develop a baseline science case to support its work. To this end the SSA convened in 2011 a meeting in Bermuda of key scientists and other partners. That meeting commissioned twelve detailed reports on different aspects of the ecosystem and human impacts. These reports together with contributions from 46 other authors were drawn together and synthesised by Professors Dan Laffoley and Howard Roe who edited the baseline study entitled - *The Protection and Management of the Sargasso Sea: The Golden Floating Rainforest of the Atlantic Ocean. Summary Science and Supporting Evidence Case* (“Summary Science Case”) (Laffoley et al., 2011). To ensure government support for its recommendations, it was reviewed before publication by the Bermuda Cabinet and the UK government.

The baseline Summary Science Case focused on the western basin of the Sargasso Sea to the west of the Mid-Atlantic Ridge, some 4,163,499 km² in area. It described an iconic *Sargassum* based ecosystem, wherein accumulated mats of the algae acted as nursery and feeding areas for juvenile turtles and many species of fish and seabirds. It also described the role of the Sargasso Sea and its associated seamounts as a cross-roads in the Atlantic for many migratory species of fish, adult turtles, and cetaceans. It also highlighted the importance of the Sargasso Sea as the only suspected spawning area for both the European eel (*Anguilla anguilla*) and the American eel (*A. rostrata*); its importance to the global ocean and as a site for ocean research, and its major economic significance (Laffoley et al., 2011; Pendleton et al., 2014).

The 2011 meeting, which included the key members of the nascent EBSA epistemic community (Dunn et al., 2014), recommended that an important first step for the SSA would be to make the case for the description of the Sargasso Sea as a

high seas EBSA. In those early days it was hoped that the scientific recognition of the significance such an area, based on rigorous objective criteria, might provide an important impetus for its protection by other international bodies with appropriate powers. The work already underway for the Summary Science Case provided the basis for the preparation of an EBSA proposal and that proposal was presented by the Government of Bermuda – on behalf of the SSA – at the Wider Caribbean and Western Mid-Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, 28 February–2 March 2012, held in Recife, Brazil. This proposal was recommended by the Scientific Workshop and the Workshop Report was further recommended by the 16th Meeting of the CBD Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) in April/May 2012 and passed on for action to the 11th CBD Conference of the Parties (COP) that met in Hyderabad in October 2012 (CBD, 2012a).

At the Hyderabad COP, the Parties to the Conventions (by its Decision XI/17) requested the CBD Executive Secretary to “include the summary reports on the description of areas that meet the criteria for ecologically or biologically significant marine areas, prepared by the Subsidiary Body on Scientific, Technical and Technological Advice at its sixteenth meeting and contained in the annex to its current decision, in the Repository maintained by the CBD Secretariat.” This approach was deliberately designed to avoid the perception that the COP was politically “endorsing” these EBSAs. The decision also noted that “the application of the scientific criteria for ecologically or biologically significant marine areas is a scientific and technical exercise and emphasized that the identification of ecologically or biologically significant marine areas and the selection of conservation and management measures is a matter for States and competent intergovernmental organizations, in accordance with international law, including the United Nations Convention on the Law of the Sea”. (CBD, 2012b; Freestone, 2016). As Dunn et al. (2014) recorded: “Several countries questioned whether this recommendation was in line with the process outlined in Decision X/29. There was consensus, however, that the results of the CBD EBSA workshops should provide an important contribution to UN negotiations on how to manage and conserve biodiversity in ABNJ and they have been communicated accordingly”.

In addition to securing global recognition of the ecological importance of the Sargasso Sea, the project was also designed to explore ways in which conservation measures could be put in place in this high seas area by working with existing sectoral organisations. In that sense the Sargasso Sea has been one of the few high seas initiatives to attempt to use the EBSA process, which was “directly linked to a call for more effective conservation in ABNJ” (Dunn et al., 2014), to persuade sectoral organisations of the need to enact conservation measures. Indeed, it was acknowledged that while no adequate legal process existed for EBSAs to bring about binding conservation measures in and of themselves – instead they were deliberately designed to “inform existing regional and global management bodies in both conservation and sustainable use” (Dunn et al., 2014). The experience of the Sargasso Sea initiative over the last decade is therefore of much broader significance.

In the meantime, the Sargasso Sea initiative itself developed further. At a meeting in March 2014, hosted by the Bermuda Government, the representatives of five governments: the Azores, Bermuda, Monaco, UK and US signed *the Hamilton Declaration on Collaboration for the Conservation of the Sargasso Sea* (Freestone and Morrison, 2014). This political declaration, the text of which had been negotiated among some 12 countries and 8 organisations (Freestone, 2016), established a light institutional structure for this collaboration with a defined role for the Signatory Governments, and a Sargasso Sea Commission composed of “distinguished scientists and other persons of international repute committed to the conservation of high seas ecosystems that would serve in their personal capacity” who would be appointed by the Government of Bermuda. The Declaration envisaged that a small secretariat would facilitate both the meetings of the Signatories and work of the Commission. The mandate of the Commission is to “exercise a stewardship role for the Sargasso Sea and keep its health, productivity and resilience under continual review; and to develop a work programme and action plans for the conservation of the Sargasso Sea ecosystem” (Freestone and Morrison, 2014; SSC, 2014).

Since 2014 five more governments have signed the Declaration bringing the total number of Government Signatories to ten – British Virgin Islands, Bahamas, and Canada in 2016, Cayman Islands in 2017, and Dominican Republic in 2018. The Commission replaces the role of the SSA and continues to work for the conservation of this unique high-seas ecosystem (Freestone, 2021).

LEGAL FRAMEWORK FOR HIGH SEAS GOVERNANCE

The overarching legal framework for the high seas is provided by the 1982 UN Convention on the Law of the Sea (United Nations, 1982). Part VII of the Convention on the “High Seas” has been described as an “unfinished agenda” (Freestone, 2016). It is structured around the concept of freedom of the seas, with six guaranteed freedoms: navigation; overflight; freedom to lay submarine cables and pipelines; freedom to construct artificial islands and other installations; fishing and scientific research. All these freedoms are subject to a number of conditions, some of which (such as those for fishing) are quite onerous, however the obligation to ensure compliance with these conditions falls primarily upon the flag state of the vessel exercising the freedom. It is well known that some flag states are more rigorous in their enforcement activities than others.

Restrictions of these basic freedoms, such as through the imposition of binding conservation measures, can only be done by treaty or by an international organisation established by treaty which has been specifically granted regulatory powers. It is worth highlighting the fact that these international treaty regimes only bind states that are party to them; nevertheless, from a conservation perspective these treaty regimes provide the only fora within which legally binding conservation and management

measures can be enacted. The work of the Sargasso Sea Commission is based on a political Declaration, not a legally binding treaty, so it does not have a legal mandate to enact conservation measures itself. Collaboration with the existing sectoral organisations is therefore crucial to the success of any high sea conservation initiative and such collaboration has always been the declared strategy of the Sargasso Sea Commission and the Signatories to the Hamilton Declaration (Paragraph 3, SSC, 2014).

Against this background, the Sargasso Sea provides a classic example of the fragmented nature of high seas governance, with significant gaps in the regulation of human activities there. For example, maritime transport and vessel source pollution are regulated globally by the International Maritime Organization (IMO); exploration for, and exploitation of, deep seabed minerals in areas beyond national jurisdiction (ABNJ) is regulated by the International Seabed Authority (ISA) established by the 1982 Law of the Sea Convention (United Nations, 1982). All other high seas regulatory bodies are regional and despite the fact that the Sargasso Sea lies in the North Atlantic sub-tropical zone between Europe and North America – two of the more developed regions of the globe – there is a remarkable absence of regional bodies with regulatory powers over this high-seas ecosystem. In the fisheries sector the regulation of fishing for tunas and “tuna like species” throughout the Atlantic is the responsibility of the International Convention for the Conservation of Atlantic Tunas (ICCAT, 1966). There is at present no general regional fisheries convention covering others species in the Sargasso Sea – such as there is further North with the North East Atlantic Fisheries Commission (NEAFC, 1980) and the North West Atlantic Fisheries Organisation (NAFO, 1979). The jurisdictional area of NAFO which regulates high seas and deep-sea fishing activity does extend south but only to latitude 35°N – just touching the northern edge of the Bermuda 200 nm Exclusive Economic Zone (EEZ). All other fishing activities in the high seas area of the North West Atlantic are currently unregulated, although there is a move afoot to amend the treaty establishing the Western and Central Atlantic Fisheries Commission (WECAFC, 1973) that is currently only an advisory body, to give it high seas regulatory authority.

Similarly, there is in the North East Atlantic an international environmental treaty regime – known as OSPAR. It was formed in 1992 by the merging of two previous treaty regimes: the Oslo and the Paris Conventions. The OSPAR parties have established a series of High Sea marine protected areas within its jurisdiction zone (OSPAR, 2021). They are only binding on the OSPAR Treaty Parties but have important practical importance nevertheless. There is unfortunately no equivalent regional environmental treaty regime on the western west side of the North Atlantic.

THE 2012 EBSA DESCRIPTION – IS IT “STILL FIT FOR PURPOSE”?

As discussed above, the Sargasso Sea was successfully described as an EBSA in 2012 (CBD, 2012b). Subsequently, the two discrete

and separately bounded areas of the New England and the Corner Rise Seamounts were described as a static multiple feature EBSA by the Northwest Atlantic regional EBSA workshop in Montreal, Canada, 24–28 March 2014 (Johnson and Froján, 2021) and subsequently “identified” as an EBSA by CBD COP 12 in Pyeongchang, Republic of Korea, 6–17 October 2014 (CBD, 2014). There are therefore two EBSAs identified by the CBD within the geographical “Area of Collaboration” agreed by the Signatories to the 2014 Hamilton Declaration. Both were published on the CBD data base in 2015 and are referred to hereafter as CBD, 2015a (Sargasso Sea) and CBD, 2015b (Seamount Chain). The extensive supporting bibliography in CBD (2015a) should be referred to for details of the Sargasso Sea case, and to a lesser extent that in CBD (2015b) for the separate seamount case. New information to support the EBSA for both the Sargasso Sea and the separate Corner Sea Rise and New England Seamount Chain is described below for each of the EBSA criteria.

This international “identification” of the ecosystem’s importance, based on rigorous scientific evidence, was further demonstrated when, through the work of the Commission, the Sargasso Sea was featured in its own chapter in both the First and the Second UN World Ocean Assessments (Freestone et al., 2016b; Roe et al., 2021).

The development of international recognition for the Sargasso Sea has taken place against a changing background of both the science and the environment, and also the development of legal and political initiatives to better conserve the open ocean. Now more than 10 years on from the 2011 Summary Science Case, the Sargasso Sea itself is changing. Lomas et al. (2013) and more recently Bates and Johnson (2020) analysed biogeochemical and oceanographic changes and variability from BATS data collected over a 40-year period from the 1980s. Bates and Johnson (2020) show a marked acceleration in changes to temperature, salinity, oxygen levels and acidity in recent decades. Some of the biological changes are summarised in Roe et al. (2021). So, against this background of a changing ocean and changing legal and political agendas we review below the status of the Sargasso Sea with respect to the rigorous criteria for an EBSA.

APPLYING THE EBSA CRITERIA TO THE SARGASSO SEA

In 2009 the CBD COP9 by Decision IX/20 on “Marine and coastal biodiversity” adopted seven scientific criteria for identifying EBSAs (CBD, 2009). EBSAs were initially designed to help stop the rapid loss of biodiversity in the open ocean and deep sea i.e., in ABNJ. However large numbers of EBSAs described by the regional scientific workshops are actually in areas within national jurisdiction. Although technically each EBSA only needs to meet one of the seven criteria, at the Recife workshop in 2012 scientists decided that the Sargasso Sea met all seven criteria. Six of the criteria were subsequently evaluated as highly relevant and one as medium.

Uniqueness or Rarity

Evaluated as HIGH by CBD (2012b). When the EBSA proposal was submitted in 2012 the Sargasso Sea was the major centre of distribution for two species of holopelagic brown algae, *S. fluitans* and *S. natans* together with their associated endemic species and diverse and specialised communities. More recently these communities have been shown to vary both annually and over decades. Different species and forms of *Sargassum* host different communities and intraspecific variability at molecular level occurs within the slender *Sargassum* shrimp; these findings all have implications for future conservation (see references in Roe et al., 2021).

But the greatest changes have been in the occurrence and abundance of *Sargassum* in areas outside the Sargasso Sea. In 2011 the first mass strandings of *Sargassum* occurred on the beaches of West Africa, Central and South America and the Caribbean, and mass strandings of millions of tons of *Sargassum* have now occurred every year except for 2013. The initial blooms were composed mostly of a hitherto rare form of *Sargassum*, *S. natans VIII* (Schell et al., 2015; Amaral-Zettler et al., 2017) but subsequent blooms have been largely composed of the more common *S. fluitans* and *S. natans I* (García-Sánchez et al., 2020). Johns et al. (2020) concluded that the initial bloom resulted from prior variability in the North Atlantic Oscillation whereby surface *Sargassum* was blown from the Sargasso Sea into the Canary Current and the North Equatorial Current. Here it bloomed and was carried into the Caribbean. Residual populations of *Sargassum* remained in the North Equatorial Current system to the south of the North Atlantic gyre which then seeded future blooms. The causes of the blooms are the subject of much ongoing research but may include climate change, increasing temperature and changes in ocean currents, as well as enhanced nutrient levels from the rivers Congo, Niger, Amazon and Orinoco, and wind-blown dust from the Sahara (see references in Roe et al., 2021). More recently Lapointe et al. (2021) have confirmed the importance of enhanced nutrient levels from terrestrial run-off in supporting blooms. Satellite observations show the blooms extending through the tropical Atlantic from West Africa to the Gulf of Mexico containing more than 20 million tons of *Sargassum* (termed the Great Atlantic *Sargassum* Belt by Wang et al., 2019). These blooms may well be the new norm for this region and are causing major socio-economic problems for local communities, health risks due to the production of hydrogen sulphide from decaying *Sargassum*, and environmental catastrophes including considerable faunal mortality, blanketing of coral reefs and seagrass meadows and destruction of turtle nest sites (see, for example, van Tussenbroek et al., 2017, Resiere et al., 2018, Bartlett and Elmer, 2021). There are currently many national and international efforts to understand the causes of the blooms, the development of warning systems, their impacts and possible mitigation measures, and the potential uses for huge quantities of decaying *Sargassum*. Summaries of many of these efforts can be found on the *Sargassum* Information Hub (2021).

These changes in abundance and occurrence of *Sargassum* mean that *Sargassum* can no longer be regarded as rare or unique

to the Sargasso Sea. The remaining justifications for this EBSA category – that is, the endemic species within the *Sargassum* community and midwater fishes, remain the same – as do the benthic communities living on the New England seamount chain and the Corner Sea Rise seamount. As indicated above, the latter features have also been separately identified as an EBSA (CBD, 2015b) and their importance has been emphasised recently by the NOAA North Atlantic Stepping Stones Expedition by the *Okeanos Explorer* (NOAA, 2021).

Special Importance for the Life-History Stages of Species

Evaluated as HIGH by CBD (2012b). The justification here described the Sargasso Sea as the only known spawning area for both *A. anguilla* and *A. rostrata*. It also described the use of *Sargassum* mats as nursery habitats and feeding areas for a wide variety of fish species, seabirds and turtles, and the overall importance of the Sargasso Sea as a migratory route for fish, turtles, whales and birds (see CBD, 2015a).

There has been more recent research in all these areas. Satellite tracking of both European and American eels confirms the importance of the area and *in situ* sampling of *A. anguilla* larvae (known as leptocephali) has shown a wide spawning area bounded by temperature fronts in the southern Sargasso Sea (see references in Roe et al., 2021). There has also been a suggestion based upon mathematical modelling that spawning of European eels might occur over the mid-Atlantic ridge (Chang et al., 2020) but there are no observations to support this hypothesis.

New information on feeding and spawning for species of tuna, tuna-like species and sharks managed by ICCAT reinforces the importance of the area for these migratory species (Luckhurst, 2013; references in Roe et al., 2021), and satellite tracking of juvenile loggerhead and green turtles has confirmed the importance of the Sargasso Sea as a nursery area and migratory route for developing turtles (Mansfield et al., 2014; Mansfield et al., 2021). Further work on White (Gaube et al., 2018), and Blue sharks (Vandeperre et al., 2014; Braun et al., 2019) emphasise the importance of the Sargasso Sea and its surrounding currents and mesoscale eddies to these long distance migrants. Cetaceans also migrate through the area; Humpback whales are increasing in numbers (Grove and Stevenson, 2021; Whales Bermuda, 2021) whilst Sperm Whales congregate on the New England seamount chain (Wong and Whitehead, 2014).

Importance for Threatened, Endangered or Declining Species and/or Habitats

Evaluated as HIGH by CBD (2012b). Table 2 of the EBSA submission of 2012 (CBD, 2015a) lists species of fish, turtles, whales and birds that occur in the Sargasso Sea that are on the IUCN red list of threatened and endangered species and are listed under CITES. Table 3 of the same submission lists examples of birds, turtles, whales and dolphins that occur in the Sargasso Sea and require conservation in the wider Caribbean region (CAR-SPAW-RAC, 2021). These lists are taken from the

Appendices to the 1990 Specially Protected Areas and Wildlife (SPAW) Protocol to the 1983 Cartagena Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (Cartagena, 1983). Thirty-five species are listed in these two tables which remain valid today. There have been some additions to the IUCN Red List, for example Alfonsina (*Beryx decadactylus*), a fish found on the seamounts which was listed as threatened, and the oceanic Giant Manta Ray (*Mobula birostris*), assessed as vulnerable in 2011 and 2018, was reassessed as endangered in 2019 (IUCN Red List, 2013; IUCN Red List, 2019). *A. rostrata* was first assessed in 2014 and listed as endangered (IUCN Red List, 2014). The SPAW also lists benthic Hydrozoans and Anthozoans which occur on the New England Seamount chain. There are also other listings, for example in 2014 as a result of proposal by Monaco with the support of the Sargasso Sea Commission, the Convention on Migratory Species (CMS, 1979) listed *A. anguilla* in Appendix II as a species with a “conservation status which would significantly benefit from the international cooperation that could be achieved by an international agreement” (CMS, 2014). More recently ICES has concluded that the status of *A. anguilla* remains critical and advises zero catches in all habitats (ICES, 2021)

Vulnerability, Fragility, Sensitivity or Slow Recovery

Evaluated as HIGH by CBD (2012b). The main justification here relates to the vulnerability of deep-sea species and communities living on the New England and Corner seamounts, see also (CBD, 2015b). The earlier case remains strong, there has been new research on the communities living on these seamounts e.g., Lapointe et al. (2020a); Lapointe et al. (2020b) and a number of papers discussing the conservation status of seamounts and these New England seamounts in particular e.g., Diz (2016); Watling and Auster (2017); Watling and Auster (2021). The recent NOAA North Atlantic Stepping Stones expedition to the area has brought live video transmission of the fauna living on these seamounts to a wide public audience (NOAA, 2021).

Biological Productivity

Evaluated as HIGH by CBD (2012b). Primary productivity due to the microbial loop remains high, and research into microbial ecology in the Sargasso Sea continues in the BIOS-SCOPE programme (BIOSSCOPE, 2021). Cotti-Rausch et al. (2020) provide further evidence of the importance of picophytoplankton to primary production in the Sargasso Sea but the adverse effects of ocean warming on production are also apparent (see e.g., Richardson and Bendsten, 2017; D’Alelio et al., 2020).

Wang et al. (2018) and Baker et al. (2018) reviewed earlier estimates of the biomass of *Sargassum* in the Sargasso Sea with estimates ranging from 7 to 10 million tons. Later (Wang et al. (2019) estimated the biomass of the “Great Atlantic *Sargassum* Belt” in the North Equatorial Recirculation Region (NERR) as >20 million tons. This too is likely to be an underestimate as the satellite used by Wang et al. (2019) could not detect small rafts of *Sargassum* nor any *Sargassum* below the sea surface (Bach et al., 2021). Baker et al. (2018) found large quantities of

Sargassum on the deep-sea floor beneath the NERR, and estimated that the biomass of this was several times higher than that estimated from *Sargassum* collected at the surface; they concluded that such large-scale sedimentation of *Sargassum* must be considered as a regular carbon input to the deep-sea floor of the Atlantic.

Biological Diversity

Evaluated as HIGH by CBD (2012b). The diversity of species living in association with *Sargassum* remains high (see CBD, 2015a). There is new information on animal groups within the Sargasso Sea e.g., Squid (Lischka et al., 2017), Hydroids (Govindarajan et al., 2019) and fish (Ayala et al., 2016); molecular diversity within a species – the slender Sargassum shrimp (Sehein et al., 2014), and changes in time and scale in *Sargassum* communities (Huffard et al., 2014). Compared to *S. fluitans* III, *S. natans* VIII hosts a reduced community of motile epifauna in terms of both species abundance and diversity (Martin, 2016; Martin et al., 2021). This may lead to it being less attractive to turtles, fish and seabirds which feed on or beneath *Sargassum* mats. Benthic diversity on the Corner Rise and New England seamount chain is very high (see CBD, 2015a; CBD, 2015b) and the importance and biodiversity of seamounts generally is the subject of much recent and on-going research (IUCN, 2017; Rogers, 2019; Goode et al., 2020; and Lapointe et al., 2020a; Lapointe et al., 2020b).

Naturalness

Evaluated as MEDIUM by CBD (2012b). No part of the world ocean remains entirely natural. Roe et al. (2021) summarise changes in the Sargasso Sea due to global climate change and heat waves, increasing fishing activity, increased plastic pollution and the environmental impacts due to the recent mass blooms of *Sargassum* in the open ocean and the surrounding coasts. These changes are all externally driven, and the remote location of the Sargasso Sea within the North Atlantic subtropical gyre reduces the effects of many of them. The seamounts within the area were extensively damaged in the past by deep pelagic and bottom trawling (see e.g., Waller, 2007). In 2017 demersal trawling on these seamounts was suspended until 2020 by the Northwest Atlantic Fishery Organisation (NAFO) a moratorium that has recently been extended to 2025 (Diz, 2016; NAFO, 2021);

The Sargasso Sea continues to meet the seven EBSA criteria, and the categories awarded by the CBD in 2012 are still valid. The Sargasso Sea exceeds EBSA requirements, as only one of the given EBSA criteria must be met in order for a submission to be successful. Whilst *S. fluitans* and *S. natans* can no longer be regarded as rare or unique to the Sargasso Sea, the wider definition of EBSA Category 1 *viz* rare or endemic species, habitat and communities still hold true for the Sargasso Sea. The mass blooms of *Sargassum* do not originate in the Sargasso Sea and as yet are having little apparent impact there. The North Atlantic gyre with its central oligotrophic water mass and *Sargassum* communities remains intact – and it may be that if the causes of the present mass blooms are brought under control by, for example, reducing terrestrial run-off, the *Sargassum*-based ecosystem within the Sargasso Sea will remain as unique

and iconic. Similarly, the cases made for the New England and Corner Rise Seamounts (CBD, 2015b) remain valid.

THE IMPACT OF THE SARGASSO SEA EBSA DESCRIPTION

As discussed above, at the 2011 science workshop in Bermuda, attended by many members of the EBSA epistemic community, the possible future description of the Sargasso Sea as an EBSA was seen an important tool to further the SSA agenda of working with existing international organizations to put effective conservation measures into effect.

In particular, it was hoped that the CBD EBSA process, offering a government-led, objective, scientific determination of the environmental importance of a particular marine area, would mean that other sectoral organizations would take seriously proposals for the Sargasso Sea's conservation or protection. All the international bodies discussed above with regulatory jurisdiction over the high seas in general, and the Sargasso Sea in particular, have the power to establish or recognize marine areas where human activities are in some way restricted. These are known in UN jargon as Area Based Management Tools (ABMTs). What is of interest is that most of these bodies have criteria strikingly similar for implementing ABMTs for activities under their control as those that are used to identify an EBSA description. The States that are members of those bodies are also the parties to the CBD – which has 196 State parties.

Dunn et al. (2014) discussed the broad similarities between the EBSA criteria and the criteria used by other bodies for their sectoral conservation criteria in declaring protection areas. More recently Rice et al. (2022 forthcoming) have drilled down at a more sophisticated level into the actual practice of these organizations in putting conservation measures in place, but for present purposes the Dunn chart is more than adequate (edited version reproduced here as **Table 1**).

The IMO has the power to designate Particularly Sensitive Sea Areas (PSSAs) to reduce or eliminate threats from shipping in such areas. The PSSA criteria (IMO, 2005) cover essentially the same issues. As do the August 2008 UN Food and Agriculture Organization (FAO) International Guidelines for the Management of Deep-Sea Fisheries in the High Seas to protect Vulnerable Marine Eco-systems (FAO, 2008) (with the exception of productivity and biodiversity – as VMEs are specifically designed to protect discrete deep water coral habitats). The UNESCO criteria for the recognition of World Heritage Sites are also broadly similar (6 out of 7 criteria) although they are less directly relevant at this point as the World Heritage Committee has yet to recognize that the World Heritage Convention permits the inscription of sites in ABNJ (although see Freestone et al., 2016). The ISA developed the concept of Areas of Particular Environment Interest (APEIs) for the management plan for the Clarion Clipperton Zone in the Pacific Ocean and its 2011 concept paper, developed by the ISA Legal and Technical Commission, drew explicitly on the criteria developed by the CBD for EBSAs and FAO for VMEs (ISA, 2011; ISA, 2021). The similarity in scientific criteria for identifying marine areas in

TABLE 1 | ¹Correspondence between the CBD EBSA criteria and other international criteria used by IGOs.

Organization	CBD	FAO	IMO	UNESCO
<i>Site criteria</i>	EBSA	VME	PSSA	WHS
Uniqueness or rarity	✓	✓	✓	✓
Special importance for life history stages of species	✓	✓	✓	✓
Importance to threatened or endangered species	✓	✓	✓	✓
Vulnerability, fragility, sensitivity or slow recovery	✓	✓	✓	X
Productivity	✓	X	✓	✓
Biodiversity	✓	X	✓	✓
Naturalness	✓	X	✓	✓
Structure	X	✓	✓	X
Historical geomorphological importance	X	X	X	✓

¹ Adapted from Dunn, D., Ardon, J., Bax, N., Bernal, P., Cleary, J., et al. (2014). The Convention on Biological Diversity's Ecologically or Biologically Significant Areas: Origins, development, and current status. *Mar. Pol.* 49, 137-145. doi: 10.1016/j.marpol.2013.12.002

need of enhanced protection and management by FAO (VMEs), CBD (EBSAs) and IMO (PSSAs) are summarized in ISA (2019) and these criteria also resonate with the new ISA concept of APEIs.

The wider significance of this issue is that the UNGA has been discussing possible actions to support the conservation and management of biodiversity in ABNJ since the first meeting of the *Ad hoc* Open-ended Working Group in 2006 (Freestone, 2019). In 2017 the UNGA agreed to establish an Intergovernmental Conference (IGC) to develop an international legally binding instrument (ILBI) under the 1982 Law of the Sea Convention on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ) (UNGA, 2017a). A major part of the agenda of this ongoing conference is the establishment of global norms for implementation of ABMTs, particularly marine protected areas (MPAs) for the high seas that would be binding on all States.

Against this background is it possible to make an assessment of the extent to which the 2012 identification of the Sargasso Sea as an EBSA has assisted the Sargasso Sea Commission with its goal of putting conservation measures in place for the Sargasso Sea though collaboration with the existing sectoral organizations. Others have reviewed the work of the Commission – and its predecessor the SSA – since 2010 (Freestone, 2016; Freestone, 2021; Gjerde and Varmer, 2021).

There have been some successes. There can be little doubt that the Sargasso Sea is now internationally recognized as a fundamentally important part of the global ocean. It was the only named marine ecosystem in both the 2016 (United Nations, 2017b) and the 2021 UN World Ocean Assessments (United Nations, 2021). The 2012 identification as an EBSA undoubtedly assisted that recognition.

In 2016, NAFO imposed a temporary moratorium on demersal trawling on the New England and Corner Rise Seamounts (NAFO, 2015; NAFO, 2016) that was extended in 2021 to 2025 (NAFO, 2021). That action was prompted by a proposal supported by the US and the EU from 2012 (Diz, 2016), relying on the fact that the Sargasso Sea had been identified as an EBSA. That case was made even stronger when the seamounts were themselves identified as an EBSA in 2015.

The SSA worked with Bermuda to support the designation of the Bermuda EEZ as a marine mammal sanctuary by the Government

of Bermuda in 2012 as well as the finalisation of a sister sanctuary agreement with the Stellwagen Bank National Marine Sanctuary in the US (NOAA, 2012). With the championship of the Government of the Principality of Monaco, the SSC was able to secure the listing of the European eel in Appendix II of the Convention on Migratory Species (CMS, 1979; CMS, 2014). The Commission continues to work with the Convention on Migratory Species on a Single Species Action Plan for the European Eel authorised by the CMS Conference of Parties in February 2020 (CMS, 2020), and with support from Canada and the US has convened two workshops of the range states of the American Eel that have active eel fisheries (SSC, 2021). A commission sponsored team has been working with the Ecosystem Subcommittee of the Science Body of ICCAT for more than a decade and has led important work developing indicators for an ecosystem-based approach to fisheries – using the Sargasso Sea as a pilot area (Kell and Luckhurst, 2018; Kell et al., 2019).

There has been push back in other organizations however. In 2012 Bermuda attempted – on behalf of the SSA – to draw attention to the Sargasso Sea EBSA in a 2012 Resolution at ICCAT. That reference was expressly edited out by other ICCAT parties before final approval (ICCAT, 2012). Nor has the SSC been able to date to make any traction with the IMO to develop measures which might support the designation of the Sargasso Sea as a PSSA. The EBSA scientific process has already shown that the Sargasso Sea meets the necessary criteria to meet the PSSA Guidelines requirements. However, the IMO PSSA process is a discrete process; failure to make progress there has more to do with the reluctance of the IMO Parties to take action on high seas issues than the merits of the case. It seems that to take it forward it effectively needs substantial resources and a motivated champion. It may be some consolation that the IMO parties have not yet designated any high seas area as a PSSA (Freestone and Harris, 2017). Such a move would be a major new step (or more appropriately change of course) – but it would also demonstrate that the IMO Parties are listening to what is going on in New York at the BBNJ IGC.

LOOKING FORWARD

The work of the SSC has demonstrated the difficulties of trying to secure conservation measures in the high seas that are the subject

of the current negotiations taking place within the Intergovernmental Conference convened by the UN since 2018 (Freestone, 2019). In the current fragmented system of ocean governance, it seems that proposals for conservation measures require, at the very least, a long timeframe and significant resources (Freestone and Gjerde, 2016).

Taking advantage at least of parts of the EBSA title, in 2018 the Sargasso Sea Commission put forward a proposal to the Global Environment Facility (GEF) for a project entitled – “Strengthening the Stewardship of an Economically and Biologically Significant High Seas Area.” The proposal was modeled on the approach taken by a number of previous GEF funded Large Marine Ecosystem (LME) projects. This however was the first directed solely at a high seas ecosystem. The two key activities proposed were to conduct an Ecosystem Diagnostic Analysis (EDA) of the Sargasso Sea ecosystem and develop a Strategic Action Programme (SAP) for its long-term management and conservation. This \$3 million proposal was adopted by the FAO led high seas “Common Oceans” programme and was approved by the GEF Council in June of 2020. The UN Development Programme (UNDP) will act as the implementing agency and the Intergovernmental Oceanographic Commission (IOC) of UNESCO will be the executing agency. The final documentation was approved in May 2022 and work will start later in the second half of 2022 (Freestone, 2021). The Summary Science Case (Laffoley et al., 2011), the successful EBSA proposal (CBD, 2012b) and the two UN World Ocean Assessments (Freestone et al., 2016b; Roe et al., 2021) constitute an important baseline for the forthcoming work. As the previous discussion has indicated the 2011 and 2012 analyses are still robust, but the last decade has seen further evidence of ecosystem degradation from anthropogenic sources, principally through climate change (Bates and Johnson, 2020; Boers, 2021) but also from garbage, particularly plastics, and fishing activities (Roe et al., 2021). The emergence of Sargassum strandings from the Great Atlantic Sargassum Belt has become a major problem in the Caribbean, West African and Central American countries and the phenomenal growth of aquaculture of anguillid eels – mostly in Asia – depends on the harvesting, both legal and illegal, of large quantities of glass eels throughout their range (SSC, 2021; CITES, 2022).

In support of this project the French Global Environment Facility (Fond Français pour L’Environnement Mondiale, FFEM) has launched a complementary project, called SARGADOM, which identifies the Sargasso Sea and the Costa Rica Thermal Dome – both EBSAs – as two remarkable high seas ecosystems and aims to support the development of “hybrid governance for those areas” (Mackey and Arroyo, 2020). It is expected that the resources available from the grant will allow a more comprehensive analysis than was possible hitherto. In addition to innovative new remote sensing data available through the NASA COVERAGE project, which uses the Sargasso Sea as a pilot site (see for e.g. Kell et al., 2021), and bodies such as Global Fishing Watch, the FFEM financed activities will allow the Ecosystem Diagnostic Analysis to draw on extensive data sources developed by key partners such as the Bermuda

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The resources provided through the GEF and FFEM projects will allow a contemporary assessment of the state of the Sargasso Sea, the ecosystem services provided by the Sargasso Sea, and the impact of external drivers on it. The latter will include, for example, oceanographic changes, the impact of fisheries, and the impact of maritime traffic through the Sargasso Sea (which has demonstrably increased after the widening of the Panama Canal in 2016). The results from these projects will contribute to the protection of biodiversity and ecosystem services in the High Seas of both the Sargasso Sea and the Costa Rica Dome. The results will also be used to develop possible models for regional and global international coordination of governance for areas like the Sargasso Sea which hopefully will both inform and contribute to the ongoing BBNJ discussions. The science case for the importance of the Sargasso Sea and the urgent need for conservation of the unique Sargasso Sea ecosystem has been made and is internationally accepted. The requirement now is for international conservation measures which both recognize the need and deliver appropriate conservation and management outcomes. The GEF/FFEM financing should provide the resources for the SSC to approach this with renewed vigour.

It is now more than a decade since the launch of the EBSA process by the Parties to the CBD. It has been a remarkable process: EBSA workshops held all over the world have “examined more than 75% of the global ocean and [have] yielded a portfolio ... that encompasses a wide range of species, habitats, ocean features and biogeographic provinces” (CBD, 2021). More than 300 sites have been “described” as EBSAs (CBD, 2021); one of the earliest, and at the time the biggest, was the 2 million square miles of the Sargasso Sea ecosystem. The process has indeed, as the CBD claims, “demonstrated the value of an intensely collaborative approach to marine biodiversity evaluation that is rare in contemporary marine science and management.” (CBD, 2021)

So, has being described as an EBSA helped conservation efforts in the Sargasso Sea? For those – like the Sargasso Sea Commission – involved in the challenging work of high seas conservation and governance, the concept of a government-led, objective, scientific determination of the environmental importance of a particular marine area seemed like a godsend. There is no doubt that it has served to increase the global recognition of the importance of the Sargasso Sea ecosystem. It was, as discussed above, the main driver for the process within NAFO for the further protection of the Seamounts within the Sargasso Sea – and indeed the NAFO process proceeded largely as one could have hoped – with a proposal by the EU and the US for recognition of the importance of the EBSA by appropriate protection measures. Identification as an EBSA may also have assisted to strengthen the case in applying for a grant from the GEF, and the FFEM application also took advantage of the fact that both the Sargasso Sea and the Thermal Dome had been identified as EBSAs.

In other international fora however, the EBSA concept has not been as successful in effecting conservation aims for high seas systems as the Commission had hoped. There have been more than fifteen years of discussions within the UNGA on the issue of conservation and sustainable use of biodiversity in ABNJ and there is now an ongoing IGC negotiating an ILBI on this issue. Nevertheless, the existing sectoral organizations – although comprised of representatives of the same countries as the CBD parties, have not to date taken advantage of the wealth of scientific information now available on EBSAs to pre-emptively use their own regulatory powers to enact protection measures in response to actual or possible future impacts (as a precautionary approach would prescribe) – of their activities (Freestone and Gjerde, 2016).

It is in relation to this issue of “bringing aboard” existing organizations to exercise their potential powers in ABNJ that the grants financing the Sargasso Sea may really be able to make a difference. In addition to the comprehensive EDA, the GEF will finance the development of a SAP through an inclusive deliberative process where detailed conservation proposals, supported by rigorous scientific evidence, can be developed on a collaborative basis with a wide variety of stakeholders. These stakeholders will include the existing competent organizations with regulatory authority over the Sargasso Sea area such as the fishery organizations (NAFO and ICCAT, and possible WECAFC), the IMO and the ISA. The active involvement and support of the Hamilton Signatory States and other interested States – such as France that is financing the FFEM project – that are members of these organizations, will be an important factor in developing concrete collaboration over the Sargassos Sea. This project comes at a time when the BBNJ IGC is likely to conclude its work finalizing an ILBI regarding the conservation and

sustainable use of biodiversity in ABNJ (Freestone, 2021). Parties to that ILBI will be keen to ensure that there are good models for its implementation. The Sargasso Sea will provide an important and replicable case study of how this may be done thereby fulfilling one of the original aims of the initiative (Laffoley et al., 2011). The GEF SAP that will be developed under this four-year project will set out an ambitious future work programme. Provided that it is endorsed by the key stakeholders there is an expectation that follow-up GEF financing could be available, as has been the case for the majority of previous LME TDA-SAP development projects (Vousden and Hudson, 2017).

For the Sargasso Sea the recognition as an EBSA has brought relatively little benefit – certainly much less than was hoped for ten years ago. But moving forward the results and collaborations from the on-going GEF and FFEM projects will provide additional data and stimulus for positive high seas conservation action by the existing “competent organizations.” The authors remain optimistic but there is a lot of room for improvement.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

All authors have contributed to this paper.

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