Chapter 50. Sargasso Sea

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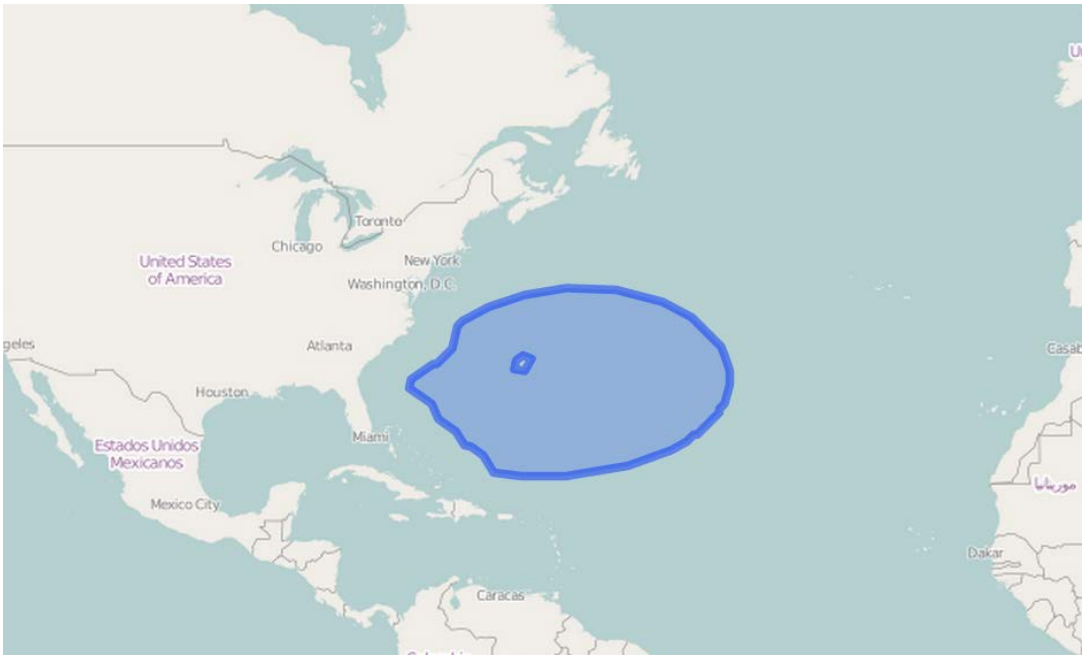
1. Inventory

The Sargasso Sea is a fundamentally important area of the open ocean within the North Atlantic Sub-Tropical Gyre, bounded on all sides by clockwise rotating currents (Laffoley et al., 2011).



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Figure 1. Source: https://chm.cbd.int/database/record?documentID=200098.

Named after its iconic *Sargassum* seaweed, the Sargasso Sea's importance derives from the interdependent mix of its physical oceanography, its ecosystems, and its role in global-scale ocean and earth system processes. It is a place of legend, with a distinct pelagic ecosystem based upon two species of floating *Sargassum*, the world's only macroalgae that spend their whole life-cycle in the water column (holopelagic), which hosts a rich and diverse community, including ten endemic species. *Sargassum* mats are home to >145 invertebrate species and >127 species of fish; the mats act as important spawning, nursery and feeding areas for fish, turtles and seabirds. In deeper water, the Sargasso Sea is the only known spawning area for both the European and American Eels (*Anguilla anguilla*, *A. rostrata*). Porbeagle Sharks (*Lamna nasus*) migrate from Canada to the Sargasso Sea, where they are suspected of pupping in deep water; several other shark species undertake similar migrations and may be using the area as nursery areas. Thirty species of whales

occur in the Sargasso Sea and Humpback Whales (*Megaptera novaeangliae*) make regular migrations through the area en route from the Caribbean to the northern North Atlantic. Many other species, including several tuna spp., turtles, rays and swordfish, migrate through the Sargasso Sea: it is truly an ecological crossroads in the Atlantic Ocean, linking its own distinct ecosystem with Africa, the Americas, the Caribbean and Europe. Seamounts and volcanic banks rise up from the sea floor and host diverse and fragile communities of invertebrates and fish, including endemic species and others that are currently undescribed. Many of the species that occur in the Sargasso Sea are endangered or threatened and are listed on the IUCN Red List, and/or in the appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora[1] (CITES) or in the annexes of the 1990 Caribbean Protocol Concerning Specially Protected Areas and Wildlife[2] to the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region[3] (SPAW) (see Laffoley et al., 2011). Laffoley et al. (2011) present a summary of the scientific case for the protection and management of the Sargasso Sea which maps the area and describes its status, its importance and the threats to its continued existence.

2. Trends

The Sargasso Sea is a globally important area for ocean research and monitoring, hosting the world's longest continuous open-ocean time series of ocean measurements (i.e., Hydrostation S and the associated Bermuda Atlantic Time-series Study (BATS) arrays) which make it possible to observe trends and changes over time (Figure 1). These include significant warming of the surface ocean, an increase in salinity in the upper 300 m, and a decrease in surface pH (Figure 2). These data are critical for our understanding of global processes and the role of the Sargasso Sea in these processes. The annual net primary production in the Sargasso Sea is surprisingly high, due largely to picoplankton, and as such the area plays a key role in the sequestration of carbon in the global ocean. Changes are occurring in both phytoplankton biomass and primary production in the northern Sargasso Sea, and the possible connections between such changes and any resulting effects in the ecosystem with global climate change is an active area of research (Laffoley et al., 2011).

[1] United Nations, *Treaty Series*, vol. 993, No. 14537.
[2] United Nations, *Treaty Series*, vol. 1506, No. 25974.
[3] United Nations, *Treaty Series*, vol. 1506, No. 25974.

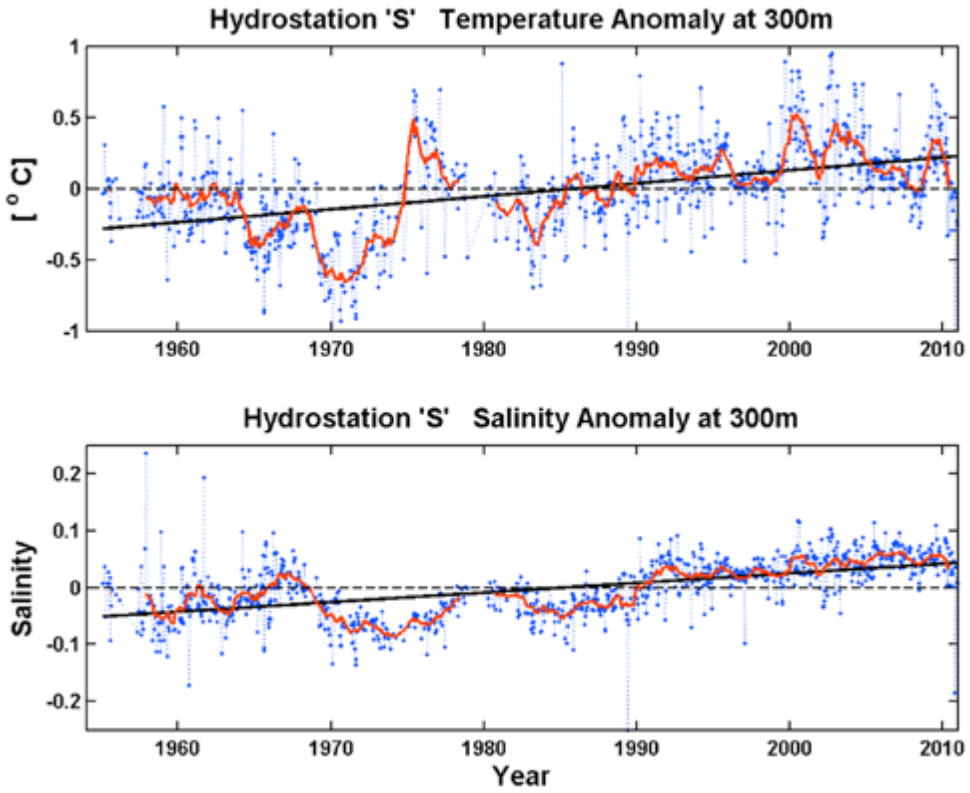


Figure 2. Time-series plots of temperature and salinity anomaly at 300 m (STMW) for Hydrostation 'S' 1955-2011. Anomaly computed by subtracting the long-term mean for this depth. Red line shows a one-year central running mean and the observed data are shown as blue dots. Long-term trends for temperature and salinity are determined as 0.009 ^{0}C year^{-1}($p>0.01$) and 0.002 year^{-1}($p<0.01$), respectively. Source: Lomas, et al (2011).

3. Pressures

In addition to climate change, the Sargasso Sea is threatened by other human activities. Overfishing and the side effects of fishing (e.g., by-catch, lost gear) affect pelagic species e.g., blue marlin and western bluefin tuna are estimated to be overexploited; benthic trawling on seamounts has severely reduced stocks of alfonsino and destroyed benthic communities. Ship-related impacts may include pollution from discharges, introduction of alien species through ballast water, underwater noise, collisions with whales, and physical damage to *Sargassum* mats (Laffoley et al., 2011, 2015 in prep). Surface pollutants, including plastics, accumulate in the central Sargasso Sea, because the encircling currents trap water for periods of 50 years or more. Plastics and debris concentrate in *Sargassum* mats and in frontal zones where animals also concentrate to feed. Other potential pressures include the continuing commercial interest in harvesting *Sargassum,* the impact of submarine cables, and seabed mining (see Laffoley et al., 2011).

4. Ecosystem Services

The economic importance of the Sargasso Sea is derived from direct exploitation, via fisheries and tourism, and indirect benefits from ecosystem services. Pendleton et al. (2015), Sumaila et al. (2013), and Laffoley et al. (2011) provide varying estimates of the values of pelagic fisheries, eel fisheries in Canada, Europe and the United States of America that depend upon eels that spawn in the Sargasso Sea, recreational fishing, reef-associated tourism, and whale and turtle watching. Sumaila et al. (2013) also provide estimates of the indirect-use values for the Sargasso Sea associated with the open ocean, coral reefs, coastal systems and coastal wetlands. The accuracy of many of these estimates is questionable, but all values are large and emphasize the economic importance of the Sargasso Sea and the need to conserve and restore the ecosystem.

Although *Sargassum* generally is considered a unique feature of the Sargasso Sea, in reality mats of *Sargassum* have occasionally been seen in many places in the mid-North Atlantic and even to wash up on island beaches from time to time. However, in 2011 large mats of *Sargassum* appeared on beaches in many Caribbean areas, the coast of Brazil and even the coast of West Africa. Similar mass strandings occurred in 2014 and are continuing in 2015. The source of the *Sargassum* is not the Sargasso Sea but the north equatorial recirculation region (NERR) south of the Sargasso Sea between the north equatorial current and the equator. The causes of these mass blooms and strandings are uncertain but may include nutrient availability from the Amazon and Orinoco Rivers, warmer surface temperatures and changes in circulation associated with climate change (Franks et al 2011-2015 in http://www.usm.edu/gcrl/sargassum/index.php, Johnson et al 2012, Smetacek and Zingone 2013)). The impact of these mass strandings on local economies is severe, affecting tourism and recreation, as the mats are difficult to dispose of and are unsightly and smelly as they decompose (see chapter 27).

5. Conservation Responses

The importance of the Sargasso Sea is now recognised internationally. In October 2012, the Sargasso Sea was accepted by the Conference of Parties to the Convention on Biological Diversity as meeting the criteria for an ecologically and biologically significant area (EBSA) (see https://chm.cbd.int/database/record?documentID=200098). Also in 2012, the Bermuda Government declared the Bermuda exclusive economic zone (EEZ) to be a marine mammal sanctuary and signed a Sister Sanctuary Agreement with the United States' Stellwagen Bank National Marine Sanctuary (Bermuda/United States MOA, 2012). The overall importance of *Sargassum* as a habitat for pelagic fish has been recognised by the United States (National Marine Fisheries Service 2003) and by the International Commission for the Conservation of Atlantic Tunas (ICCAT) (see Laffoley et al., 2011), and in 2012 ICCAT agreed to examine the ecological importance of the Sargasso Sea for tuna and tuna-like species (ICCAT Resolution 12-

12). The Northwest Atlantic Fisheries Organization (NAFO) is also considering proposals to protect further the seamounts in the Sargasso Sea section of their regulatory area. On 11 March 2014, five Governments (the Azores, Bermuda, Monaco, the United Kingdom of Great Britain and Northern Ireland and the United States) signed the Hamilton Declaration on Collaboration for the Conservation of the Sargasso Sea, committing themselves to collaborate on conservation in this area, and set up a Sargasso Sea Commission to facilitate this work (Freestone and Morrison, 2014). The Sargasso Sea Commission is working with the Convention on the Conservation of Migratory Species of Wild Animals—(CMS 1979) regarding conservation of the European eel (*Anguilla anguilla*) and in November 2014 the CMS Conference of the Parties added it to Appendix II as a "having a conservation status which would significantly benefit from international co-operation …". (UNEP/CMS 2014). It is also in discussions with the International Maritime Organization (IMO) and the Bermudian shipping authorities concerning ways of mitigating shipping risks and it has recently opened a dialogue with the cable-laying industry to develop best environmental practices (SSC Newsletter, 2015). The United Nations General Assembly has taken note of the efforts of the Sargasso Sea Alliance, led by the Government of Bermuda, to raise awareness of the ecological significance of the Sargasso Sea (Resolutions 67/78, 68/70 and 69/245).

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