

What is “Sensitive” for a Particularly Sensitive Sea Area?

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Particularly Sensitive Sea Areas (PSSAs) are the foremost tool in international law to protect high-value parts of the ocean from the risks of shipping of a global nature. A large part of the equation for the designation of these areas by the International Maritime Organization works around the question of whether an area is sensitive enough to warrant such a designation. This article seeks to examine how the IMO understands sensitivity, and then juxtaposes a contemporary marine area, the Salish Sea, to fully explore the concept.

1. INTRODUCTION

This article is designed to examine what does “sensitive” mean in terms of a Particularly Sensitive Sea Area (PSSA), as designated by the International Maritime Organization (IMO). To examine this question, the 14 PSSA sites which have already been recognised by the IMO are set out, and then juxtaposed against a further possible contender for PSSA status, namely the Salish Sea. This article is not concerned with the issue of the second criteria for PSSA, namely the vulnerability of an area to international shipping. This question has been dealt with elsewhere.¹

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¹ See A Gillespie “Vulnerability and Response to International Shipping” *RECIEL* (forthcoming).

2. THE EVOLUTION OF MARINE SENSITIVITY IN INTERNATIONAL LAW

In the first half of the 1970s, the international community, acting through the IMO, began to consider the question of identifying potentially sensitive areas in need of additional protection from international shipping. First, it identified:²

maritime coastal, port or estuarine activities, including fisheries activities, constituting an essential means of livelihood of the persons concerned; tourist attractions of the area concerned; [and/or] health of the coastal population and the well-being of the area concerned, including conservation of living marine resources and of wildlife.

Second, the international community recognised the Great Barrier Reef of Australia as “an area of unique scientific importance and of extraordinary international significance, particularly in the field of tourism”.³ Third, rules on the dumping of waste into the ocean were designed in relation to not polluting areas where the dumping would “create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea”.⁴ Finally, in 1973, the International Convention for the Prevention of Pollution from Ships (MARPOL) created the first annexes to control the operational discharges of specific pollutants into clearly identified areas. Annex I created the Special Areas to regulate the operational discharges of oil in the Mediterranean, Baltic, Black and Red seas, as well as the Gulf of Aden and what is known as the “Gulfs’ area”.⁵

2 Article II(4) of the 1970 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties. This is reprinted in A Kiss *Selected Multilateral Treaties in the Field of the Environment* (UNEP, Nairobi, 1983) at 230.

3 This was recognised in IMO Resolution A.232(VII), 12 October 1971, which was an amendment to the 1954 International Convention for the Prevention of Pollution of the Sea by Oil which gave enhanced protection to the Reef by extending the area covered to prevent operational discharges.

4 Article 1 of the 1972 London Dumping Convention. See also Annex III, ss B and C, which discusses amenity areas, spawning, nursery and fishing areas and other exploitable resources.

5 The 1973 International Convention for the Prevention of Pollution from Ships, reprinted in IMO *MARPOL 73/78* (IMO, London, 2002) at 3–10; Regulation 10 of Annex I lists the Special Areas (at 60).

At the end of the 1970s, when the MARPOL was amended and expanded to encompass more annexes for additional pollutants,⁶ an additional resolution⁷ called for:⁸

an inventory of sea areas around the world which are in special need of protection on account of the areas’ particular sensitivity in respect of their renewable natural resources or in respect of their importance for scientific purposes.

The United Nations Convention on the Law of the Sea (UNCLOS) also recognised that areas with “rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life”,⁹ as well as areas of unique “oceanographical and ecological conditions”,¹⁰ could warrant additional protection.

3. PARTICULARLY SENSITIVE SEA AREAS (PSSAs)

In 1991 the IMO finally concluded criteria on how to identify a PSSA that may acquire additional protection from the risks of international shipping.¹¹ These criteria were revised in 2001¹² and were further updated in 2005.¹³ Despite these revisions, the core criteria remain unchanged so that particular sensitivity must be shown in ecological; social, cultural and economic; or scientific and educational values. That is, even if only one of these values is identified the entire area can be recognised as a PSSA.¹⁴

6 The Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships, 1973 (with annexes, final act and International Convention of 1973), concluded at London on 17 February 1978, No 22484 in the *United Nations Treaty Series* 1983 at 61.

7 Resolution 9, on Particularly Sensitive Sea Areas, passed at the International Conference on Tanker Safety, which can be found in the *United Nations Treaty Series* 1983 at 61.

8 The language from the quotes is found in ss B, C and E of Resolution 9.

9 Article 194(5).

10 Article 211(6)(a).

11 IMO (1991) Resolution A.720(17), 6 November 1991.

12 See IMO Resolution A.927(22), 29 November 2001, Annex 1, Guidelines for the Designation of Special Areas Under MARPOL 73/78 and Annex 2, Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas [Special Areas Guidelines].

13 The last edition were adopted at the 24th IMO Assembly in early December 2005 as Resolution A.982(24), 6 February 2006.

14 IMO Resolution A.982(24), above n 13, para 4.4.

4. ECOLOGICAL CRITERIA

The considerations for ecological criteria began in 1991 with six criteria,¹⁵ before being expanded to eight criteria in 2001.¹⁶ The criteria are:

- uniqueness or rarity¹⁷
- dependency¹⁸
- representativeness¹⁹
- diversity²⁰
- productivity²¹
- naturalness²²
- integrity²³ and
- fragility.²⁴

15 IMO Resolution A.720(17), above n 11. The six criteria were dependency, representativeness, diversity, productivity, naturalness, integrity and vulnerability.

16 IMO Resolution A.927(22), above n 12. The tenth consideration went from “vulnerability” in 2001 to “fragility” in 2005.

17 Section 4.4.1. Including being one of a kind or holding rare, threatened, or endangered species that occur only in one area.

18 Section 4.4.3. As in, an area where ecological processes are highly dependent on biotically structured systems, where there is high diversity, where there is dependency on the structuring organisms, and/or migratory species.

19 Section 4.4.4. This being an area that is an outstanding and illustrative example of specific biodiversity, ecosystems, ecological or physiographic processes, or community or habitat types or other natural characteristics.

20 Section 4.4.5. With regard to its exceptional variety of species or genetic diversity or highly varied ecosystems, habitats and communities.

21 Section 4.4.6. Referencing an area that has a particularly high rate of natural biological production which results in an increase in biomass in areas such as oceanic fronts, upwelling areas and some gyres.

22 Section 4.4.8. In terms of having a relative lack of human-induced disturbance or degradation.

23 Section 4.4.9. As in, a biologically functional unit, an effective, self-sustaining ecological entity.

24 Section 4.4.10. This refers to areas that are highly susceptible to degradation by natural events or by the activities of people. It also covers biotic communities associated with coastal habitats that may have a low tolerance to changes in environmental conditions, or that may exist close to the limits of their tolerance (for example, water temperature, salinity, turbidity or depth), either natural or anthropogenic.

These criteria were reiterated in 2005 when the following three new criteria were added:²⁵ critical habitat,²⁶ spawning or breeding grounds,²⁷ and biogeographic importance.²⁸

4.1 Recognition of Ecological Criteria in Other Fora

The clearest way the ecological values of a potential PSSA site can be recognised is when other reputable international or regional bodies, dealing with the same question, recognise them as such areas. The Guidelines on PSSAs make provision for such overlap.²⁹ The four international fora which currently examine such matters of ecological quality are the World Heritage Convention, Special Areas as recognised by the IMO, wetlands of international importance as per the 1971 Ramsar Convention, and Biosphere Reserves, as recognised by UNESCO.

4.1.1 World Heritage areas

A World Heritage area is the foremost example of an area which has the highest possible pre-existing recognition of its ecological values, prior to an area being nominated as a PSSA. Recognition as a World Heritage area means that the international community — as represented by the World Heritage Committee — recognises the site as possessing what is known as Outstanding Universal Value (OUV). In essence, only 1 to 2 per cent of all of the world’s protected areas are deemed to be of sufficient standard to be World Heritage. A natural site can be recognised for its values in one of five areas. Each of these areas is critically examined by the foremost experts globally, and the World Heritage Committee.³⁰ Accordingly, when an area is designated to be a World Heritage site on the basis of its ecological qualities, it is a very small step to assume

25 IMO Resolution A.928(24), above n 13.

26 Section 4.4.2. Such as a sea area that may be essential for the survival, function or recovery of fish stocks or rare or endangered marine species, or for the support of large marine ecosystems.

27 Section 4.4.7. Including areas that may be a critical spawning or breeding ground or nursery area for marine species which may spend the rest of their life-cycle elsewhere, or is recognised as migratory routes for fish, reptiles, birds, mammals or invertebrates.

28 Section 4.4.11. This refers to areas that either contain rare biogeographic qualities or are representative of a biogeographic “type” or types, or contain unique or unusual biological, chemical, physical or geological features. For comment see JM Van Dyke and SP Broder “Particularly Sensitive Sea Areas: Protecting the Marine Environment in the Territorial Seas and Exclusive Economic Zones” (2012) 40(1) *Denver Journal of International Law and Policy* 472 at 478.

29 IMO Resolution A.982(24), above n 13, s 6.2.

30 See A Gillespie *Conservation, Biodiversity and International Law* (Elgar, London, 2011) at ch 7.

that the area could also qualify for recognition as a PSSA. In many cases, the information is the same for both designations. To date, seven PSSAs are closely associated with World Heritage sites.

The Great Barrier Reef was the first ever PSSA, being designated in 1990.³¹ In 1981, this 348,000-square-kilometre site covering 133 different biogeographical zones, from coral reefs to mangroves, was recognised as a World Heritage site on the basis of four criteria. First, it was considered to contain exceptional natural beauty as it contains 2,500 individual reefs and over 900 islands. Second, Great Barrier Reef also holds outstanding examples of major stages of the earth's history as a reef system that evolved over millennia. Third, it contains important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of OUV from the point of view of science or conservation. Finally, the Reef was recognised as having global importance because it possesses over 1,500 species of fish, 400 species of coral, 4,000 species of mollusc, and some 240 species of birds. In addition, it contains a great diversity of sponges, anemones, crustaceans and other species, including dugong, at least 30 species of whales and dolphins as well as the world's largest green turtle breeding site. With such statistics, it was, and still is, considered by many to be the foremost reef in the world.³²

Although the Galapagos Islands were not made a PSSA until 2005,³³ they pre-dated the Great Barrier Reef as a World Heritage site by three years. It was one of the first sites to be recognised as being of global importance due to its natural features in 1978.³⁴ This famous archipelago, which is located about 1,000 kilometres from continental Ecuador, is composed of 127 islands, islets and rocks and it is considered to be of OUV in four areas. One, it has exceptional natural beauty, especially in terms of marine life and ecosystems. Two, as Charles Darwin had recognised, it represents five million years of evolutionary history within a near complete continuum of geological and geomorphological features. Three, it represents significant ongoing ecological and biological processes in the evolution and development of terrestrial,

31 Identification of the Great Barrier Reef Region as a PSSA, IMO Resolution MEPC.44(30), 16 November 1990, reprinted in IMO *Particularly Sensitive Sea Areas* (IMO, London, 2007) Annex 6.

32 See Fifth Session of the World Heritage Committee (CC-81/CONF/003/6, Paris, 5 January 1982) at 10–12. For contemporary figures see WWF *The Living Planet: Great Barrier* (WWF, Sydney, 2014) at 23–29; T Stewart *The Great Barrier Reef: The Seventh Great Wonder* (University of Brisbane Press, Brisbane, 2015) at 1–9, 24–35; L DeVantier and others “Species Richness and Community Structure on the Great Barrier Reef” (2006) 25(3) *Coral Reefs* 329–340.

33 Designation of a Galapagos Archipelago as a PSSA, IMO Resolution MEPC.135(53), 22 July 2005, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 14.

34 UNESCO, World Heritage Committee, Second Meeting of the Intergovernmental Committee of the WHC (CC-78/CONF.100/10 Rev, Paris, 9 October 1978) at 18–20.

freshwater, coastal and marine ecosystems and communities of plants and animals. Four, it is valued because it contains diverse and endangered species, including the highest percentage of endemism in the world (1,600 insects, 80 spiders and 2,090 marine species) for its size. In addition, it hosts the megafauna that are giant tortoises, marine iguana, sharks, rays and cetaceans.³⁵

The sea area around Malpelo Island, some 500 kilometres off the Pacific coast of Colombia, was made a PSSA in 2002,³⁶ and in 2006 the island was recognised as a World Heritage site.³⁷ It was recognised of being of OUV for its aesthetic value and its holding of a diverse range of biodiversity within a largely pristine marine protected area with unaltered and non-threatened ecosystems. In addition to hosting the second-largest masked booby colony in the world (over 24,000 birds), the area is renowned as the richest location in the Colombian Pacific for echinoderms (starfish) with over 84 species. Finally, the presence of steep walls and caves beneath the ocean surface help entice large populations of predators and pelagic species (such as aggregations of over 200 hammerhead sharks and over 1,000 silky sharks, whale sharks and tuna) where they maintain natural behavioural patterns within a large no-take zone.³⁸

The Wadden Sea was designated as a PSSA in 2002.³⁹ This area, under the trilateral protection of The Netherlands, Germany and Denmark since 1978, is the largest unbroken system of intertidal sand and mud flats in the world, accounting for 60 per cent of all tidal areas in Europe and North Africa. It is a large, temperate, relatively flat coastal wetland environment, formed by the intricate interactions between physical and biological factors that have given rise to a multitude of habitats with tidal channels, sandy shoals, seagrass meadows, mussel beds, sandbars, mudflats, salt marshes, estuaries, beaches and dunes. It was for such unparalleled scale and diversity that the Wadden Sea was awarded its PSSA designation.⁴⁰ These criteria also underpinned the Wadden Sea’s recognition for OUV under the World Heritage Convention in 2009, with such recognition being extended in 2014. The extended area of OUV was due to

35 M Cattaneo and J Trifoni *The World Heritage Sites of UNESCO: Nature Sanctuaries* (White Star, Vercelli, 2003) at 20–30; R Mittermeier and N Myers *Hotspots* (University of Chicago Press, Chicago, 2000) at 30–38; N Brummit “Biodiversity: Where’s Hot and Where’s Not” (2003) 17(5) *Conservation Biology* 1442–1448.

36 Identification of the Sea Area Around Malpelo Island as a PSSA, IMO Resolution MEPC.97(47), 8 March 2002, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 8.

37 World Heritage Committee, Thirtieth Meeting of the Committee (WHC-06/30.COM/INF.19, 25 April 2007) Decision 30 COM 8B.28.

38 S Bessud and others “The Malpelo Fauna and Flora Sanctuary” (2009) 5(3) *Check List* 702–711; R Pitman “The Marine Birds of Malpelo Island” (1995) 18(1) *Colonial Waterbirds* 303–314.

39 Designation of the Wadden Sea as a PSSA, IMO MEPC 48/7/2, 28 June 2002.

40 Section 3.12.

the Sea's geological and geomorphologic features, which are closely entwined with biophysical processes and salt marshes in particular. These features make the North Sea, in terms of biomass productivity, one of the richest seas in the world. The result of such processes, for which the third criteria was recognised, is that the area is a critical habitat for 2,500 marine species in the intertidal and subtidal zones and about 2,300 semi-terrestrial species. This number includes 2,000 species of spiders, insects and other invertebrates in the salt marshes and 1,800 species in the marine and brackish areas. There are nearly 20,000 common seals, 1,200 micro species and 50 species of fish. The Wadden Sea is also essential to some 10 to 12 million birds, which migrate from the breeding grounds in the Arctic tundra of northeast Canada, Greenland, Scandinavia and North Siberia, through to the wintering grounds in Europe and west South Africa. Over 50 per cent of some 30 avian species are critically dependent on this area.⁴¹

The Canary Islands, which were made a PSSA in 2005,⁴² are a Spanish archipelago located 100 kilometres off the northwest coast of mainland Africa. Evidence suggests that there are 14,352 terrestrial species and sub-species belonging to the kingdoms of the fungi, plants and metazoans, and a total of 5,232 marine species and 63 sub-species of algae, fungi, plants and animals. This concentration makes the Canary Islands archipelago one of the biologically richest temperate zones in the world. The rate of endemism is very high for plants (21 per cent), reptiles (100 per cent) and invertebrates (39 per cent). In addition, the Canary Islands are also home to five species and 31 sub-species of endemic birds, including the near threatened Bolle's laurel pigeon, the white-tailed laurel pigeon and the blue chaffinch. The La Gomera giant lizard is another iconic endemic species of these islands. Deepwater coral reefs surround these islands to depths of 50 metres and host over 500 species of fish and 29 species of whales.⁴³ Many of these species are contained within the two Canary Islands' World Heritage sites. The Garajonay National Park, in the middle of the island of La Gomera, was added to the World Heritage List in 1986 due to its aesthetic beauty and possession of a diversity of species. The Teide National Park was recognised in 2007 for its OUV because of the

41 K Reise *The Wadden Sea As a Universally Outstanding Tidal Wetland* (Common Wadden Sea Secretariat, Wilhelmshaven, Germany, 2010) at 3–7, 13–18; Designation of the Wadden Sea as a PSSA, IMO MEPC 48/7/2, above n 39, s 3.3.

42 IMO Resolution MEPC.134(53), 22 July 2005.

43 R Rodrigo "Out of Sight, Out of Mind: Threats to Marine Biodiversity of the Canary Islands" (2014) 86(1) *Marine Pollution Bulletin* 303–310; M Carrillo "Cetacean Diversity and Distribution Off Tenerife" (2010) 3 *Marine Biodiversity Records* 145–158; R Moreno "The Canary Island Biodiversity Data Base" (2004) *International Journal of Island Affairs* 193–205.

aesthetics of its volcanic features and as an exceptional example of a slow-moving, geologically complex and mature volcanic system.⁴⁴

The northwestern portion of the Hawaiian Islands, known as the Papahānaumokuākea area, contains a vast and isolated linear cluster of small, low-lying islands and atolls. This area, some 250 kilometres northwest of the populated, southeastern Hawaiian Islands, extends over some 1,931 kilometres. It is made up of pelagic and deepwater habitats, with notable features such as seamounts and submerged banks, extensive coral reefs, lagoons, eroded high islands, pinnacles, atoll islands and cays (small, low-elevation sandy islands on the surface of a coral reef). This area, with domestic conservation accords dating back to 1909,⁴⁵ was made a PSSA in 2008,⁴⁶ and a World Heritage site in 2010, under five different criteria for OUV, which is remarkable.⁴⁷

The site was recognised as being of global significance due to its geological importance as an example of island hotspot progression, as a result of a relatively stationary placement and stable tectonic plate movement. In terms of being outstanding for its representation of ecological and biological processes, the diversity of habitats, ranging from 4,600 metres below sea level to 275 metres above sea level, including abyssal areas, seamounts and submerged banks, coral reefs, shallow lagoons, littoral shores, dunes, dry grasslands and shrublands and a hypersaline lake, were all noted. A high degree of endemism (a quarter of the nearly 7,000 presently known marine species in the area are endemic, as is 40 per cent of the coral) and its natural state with large predators such as sharks, giant trevally and groupers still at the apex and operating in an area of remarkable biomass concentration, was also acknowledged as being of global importance. The final area in which the Papahānaumokuākea area was

44 World Heritage Committee, Thirty-First Meeting of the Committee (WHC-07/31.COM/24, Paris, 31 July 2007) at 34–36; World Heritage Committee, Tenth Meeting of the Committee (CC-86/CONF.003/10, Paris, 5 December 1986) at 40–43.

45 In the 21st century President GW Bush designated the area as a Marine National Monument. See Proclamation No 8031, 71 Fed Reg 36,443 (26 June 2006). See also Proclamation No 8112, 72 Fed Reg 10,031 (6 March 2007).

46 As approved, IMO Resolution MEPC.171(57), Designation of the Papahānaumokuākea Marine National Monument as a PSSA, in IMO MEPC 57/21, 7 April 2008. The resolution is in Annex 12. The full file on Papahānaumokuākea, Annex I to IMO MEPC 57/7, 4 December 2007, Identification and Protection of Special Areas and PSSA: Note by Secretariat. Also, United States, Designation of the Papahānaumokuākea Marine National Monument as a PSSA, IMO MEPC 56/8, 5 April 2007; and United States, Designation of the Papahānaumokuākea Marine National Monument as a PSSA, IMO MEPC 56/INF.2, 5 April 2007.

47 Decision 34 COM 8B.10. A Rieser “Papahānaumokuākea Precedent: Ecosystem Scale Marine Protected Areas in the EEZ” (2012) 13 Asian-Pacific Law and Policy Journal 246; Anon “Marine National Monument Designated Sensitive Sea Area” (2008) 49(5) Sea Technology 60–61; Anon “Papahānaumokuākea Marine National Monument designated a ‘Particularly Sensitive Sea Area’” (2008) 14(3) Ocean News & Technology 20–21.

recognised as being of OUV was with regard to holding significant natural habitats for in situ conservation of biological diversity including the critically endangered Hawaiian monk seal, four endemic bird species, the green turtle and six species of endangered plants. Papahānaumokuākea is also a vital feeding, nesting and nursery habitat for many other species, including turtles, cetaceans and up to 14 million seabirds residing in the area, making it, collectively, the largest tropical seabird rookery in the world, including 99 per cent of the world's Laysan albatross (vulnerable) and 98 per cent of the world's black-footed albatross (endangered).⁴⁸

The Western European Waters⁴⁹ were approved as a PSSA in 2003. The significance of the Western European Waters PSSA, as submitted by Belgium, France, Ireland, Portugal, Spain and the United Kingdom, was that “from the north to the south of the PSSA, and within the transition between the bio-geographical moderate heat and boreal areas, there is a rich variety of ecosystems”.⁵⁰ Although there was considerable political opposition to the proposal as it encompassed an area that was too great in size and was not coherent, and the specific ecosystems at risk were not clearly identified, the overall coherency of the entire region as a sensitive area was accepted by a majority of the members of the relevant committees within the IMO in the middle of 2003. Part of the price of this acceptance was a revision of the PSSA Guidelines in 2005.⁵¹

The World Heritage sites which are on the coastal zone in Europe and which are covered by this PSSA are Skellig Michael off the coast of southwest Ireland; in England, Dorset and East Devon Coast (renowned for their fossils); Giant's Causeway in Northern Ireland (for its 40,000 basalt columns projecting out of the sea); and, in Scotland, the stunning Saint Kilda site with recognition under five classes of OUV, including being the most important seabird breeding

48 H Spalding “Biodiversity of Mesophotic Macroalgae in the Papahānaumokuākea Marine National Park” (2013) 52(4) *Phycologia* 324–349; J Dale “The Ecology of Coral Reef Top Predators in the Papahānaumokuākea Marine National Monument” (2011) *Journal of Marine Biology* 134–150; N Seavy “Seabird Nest Counts” (2009) 80(3) *Journal of Field Ornithology* 204–216; A Friedlander “Contrasts in Density, Size and Biomass of Reef Fishes Between the Northwestern and the Main Hawaiian Islands” (2002) 230 *Marine Ecology Progress Series* 253–264 at 260.

49 Designation of the Western European Waters as a PSSA, IMO Resolution MEPC.121(52), 15 October 2004, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 12, 93. This PSSA was slightly modified in 2009. See IMO MEPC 59/24, 27 July 2009, 69.

50 Designation of the Western European Waters as a PSSA, IMO Resolution MEPC.121(52), above n 49, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 12, 93.

51 Note the new s 8.3 of the 2005 Guidelines, which stipulated the overall size of the area must be critically assessed, as must the question of whether the size is commensurate with that necessary to address the identified need. Also M Detjen “The Western European PSSA — Testing a Unique International Concept to Protect Imperilled Marine Ecosystems” (2006) 30 *Marine Policy* 442.

station in northwest Europe with over one million birds (including 60,000 gannets, 62,000 fulmars and up to 136,000 pairs of puffins). Finally, in France, the stunning Mont Saint Michel and its immediate surrounding sea area is recognised as a World Heritage site. In addition, the rich fishing grounds and biological diversity of the west coast of Ireland was drawn out (28 species, 20 million birds, 200 species of fish and very large grey seal populations as well as a wide variety of cetaceans). The Bay of Biscay is considered to be among the richest areas in the world for marine mammals and migrating birds, hosting more than 500,000 every winter, including 60 to 80 per cent of the population of Balearic shearwaters. In Belgium, the area is recognised as particularly important for flatfish and brown shrimp fisheries, with the coastal zone being recognised as an essential spawning and nursery area for these species. The productivity and diversity of species off the Spanish Atlantic coasts were highlighted for holding more than 200 species of seaweed, invertebrates and fish, of which 30 were endangered and 10 were unique. Four species of turtle and two species of cetacean were also noted. In Portugal, more than 50 per cent of the mainland coast is classified as either protected areas, Special Areas of Conservation or Natura 2000 sites. Ria Formosa, the major wetland in south Portugal, provides residency for more than 40,000 waders and 15,000 ducks.⁵²

4.1.2 Special Areas

Special Areas are identified spaces which, through the MARPOL 73/78, are provided with a higher level of protection than other areas of the sea by the regulation of specific pollutants. This focus on specific pollutants under Special Areas is different to the focus on Associated Protective Measures for PSSAs.

The Guidelines for the Designation of Special Areas Under MARPOL 73/78 were revised in 2001.⁵³ These Guidelines provide assistance on the designation of Special Areas under Annexes I (oil), II (noxious liquid substances) and V (garbage) to the Convention. Annex I, II and V defined a Special Area as:⁵⁴

a sea area where for recognized technical reasons in relation to its oceanographical and ecological conditions and to the particular character of its traffic, the adoption of special mandatory methods for the prevention of sea pollution by oil, noxious liquid substances, or garbage, as applicable, is required.

The criteria “which must be satisfied for an area to be given Special Area status”⁵⁵ (as in, all three criteria must be met, unlike the PSSA where only one

52 Designation of a Western European PSSA, IMO MEPC 49/8/1, 11 April 2003, Annex 1, s 3.

53 Annex 1 of IMO Resolution A.927(22), above n 12.

54 See IMO MARPOL 73/78 (IMO, London, 2002) at 39, 60–65, 386–389.

55 Section 2.3 of Annex I of the Special Areas Guidelines, above n 12.

criteria of sensitivity is required) are grouped into three categories. First, the area possesses oceanographic conditions which may cause the concentration or retention of harmful substances in the waters or sediments of the area.⁵⁶ Second, ecological conditions must indicate that protection of the area from harmful substances is needed to preserve endangered species and/or critical habitats.⁵⁷ Finally, the vessel traffic characteristics must show that the existing regulations of the MARPOL 73/78 “would be unacceptable in the light of the existing oceanographic and ecological conditions in the area”.⁵⁸ Other considerations that may also be taken into account are the threats to amenities posed by possible discharges, and the social, economic, scientific and/or cultural significance of the area.⁵⁹ Annex VI created Emission Control Areas. Although these are not Special Areas of the same type created under Annexes I, II or V, the criteria for Annex VI still requires applicants to show how the specific air pollution from ships (in terms of excess emissions of nitrogen and/or sulphur) is adversely impacting on the surrounding environments.⁶⁰ With such considerations, it is no surprise that a number of PSSA sites are also Special Areas, as the criteria for both have a significant overlap.⁶¹

The foremost example of this overlap is the Baltic Sea, which is located between Central and Northern Europe and bounded by the Scandinavian Peninsula, the mainland of Europe and the Danish islands. Special Areas under Annex I (oil) covers 10 areas, including the PSSA areas of the Baltic Sea (as adopted in 1973) and the North West European Waters (as adopted in 1997). The Baltic is also covered in Annex V (garbage, also from 1973) as part of eight Special Areas in this category, in addition to Annex IV (sewage) following its adoption in 2011. The Baltic Sea was also made an Emission Control Area under Annex VI in 1997.⁶² The cumulative result is that the Baltic Sea is covered by significantly more Special Areas than any other ocean on earth. Moreover, the establishment of the values of the Baltic Sea as a Special

56 Section 2.4.

57 Section 2.5.

58 Section 2.6.

59 Sections 2.8 and 3.3.

60 See Appendix III, Criteria and Procedures for Designation of Emission Control Areas, IMO Resolution MEPC.176(58), Amendments to the 1973/78 MARPOL, MEPC 58/23/Add.1, 10 October 2008; Anon “Marine Environment Protection Committee Progresses Key Issues” 2007(3) IMO News 21; Report of the MEPC on its 52nd Session, IMO MEPC 52/WP.13, 14 October 2004, 2.

61 IMO Resolution A.982(24), above n 13, s 4.5.

62 V Matthias “The Contribution of Ship Emissions to Air Pollution in the North Sea Regions” (2010) 158 Environmental Pollution 2241–2250; Anon “North Sea SECA Now In Effect” 2008(1) IMO News 6.

Area went on to overlap the establishment of the values of the Baltic Sea as a PSSA in 2005.⁶³

Although each of the Special Areas for the Baltic Sea was different, the underlying theme in each application was the same — namely, that it is a globally unique and highly sensitive northern brackish-water ecosystem. It is geologically young, semi-enclosed and shallow with a mean depth of 53 metres. The exchange of water with the North Sea, due to geomorphological and climatological reasons, is limited and slow, resulting in a long residence time of the water, in some parts of up to 35 years. The water is vertically stratified with two distinct layers, with low levels of salinity and large parts being ice covered. The large archipelago has tens of thousands of small islands and associated coastal biotopes which are not found outside the Baltic Sea.⁶⁴

The significance of the Special Area designation to the application which turned the area into a PSSA⁶⁵ is that the considerations which made the oceanic ecosystem sensitive were the same (in substance) in both submissions that had been made to the IMO. Where the PSSA application differed from the Special Area application was in its elaboration of the biodiversity in the area. Specifically, the shallow bottom areas of the Baltic Sea combined with the brackish and low-salinity waters of the area create a unique habitat for 2,730 species. Seventy per cent of the species (1,898) are benthic invertebrate species. There are 239 fish (including the most important commercial marine fish species of cod, herring, salmon, sprat, eel, pike, perch and pikeperch, which all spawn in the area) and lamprey species, and 531 macrophytes. Above the water, there are 57 bird species and five mammal species. Although these are relatively low numbers of diversity, it is believed that what is here, due to the unique ecology, is special. The area is also of importance for migrating waterfowl, including millions of Arctic ducks, geese, swans, cranes and waders, on their way to northern breeding grounds in springtime. The Baltic Sea is also the principal wintering area for the velvet scoter in Europe (93 per cent of the populations), the common scoter (60 per cent) and the long-tailed duck (91 per cent).⁶⁶

63 Helsinki Commission *The Baltic Sea Area: A MARPOL Special Area* (Helsinki Commission, Finland, 2011) 3–8; S Klumbyté “Marine Protected Areas in the Baltic Sea Under International, European Union and Lithuanian Law” (2006) 3(81) *Jurisprudencija* 40–46.

64 See Denmark and others “Proposal to Amend MARPOL Annex IV to include the possibility to establish Special Areas for the Prevention of Pollution by Sewage and to Designate the Baltic Sea as a Special Area under Annex IV of MARPOL” IMO MEPC 60/6/2, 7 December 2009, paras 3–5. Also M Lepparanta *The Physical Oceanography of the Baltic Sea* (Springer, NYC, 2010); T Vihma “The Geophysics of Sea Ice in the Baltic Sea” (2009) 80(3) *Progress in Oceanography* 245.

65 Designation of the Baltic Sea as a PSSA, IMO Resolution MEPC.136(53), 22 July 2005, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 15, 136–144.

66 See Proposed Designation of the Baltic Sea as a PSSA, IMO MEPC 51/8/1, 19 December 2003, ss 3.6–3.13; Klumbyté, above n 63; M Bučas and others “Empirical Modelling of

The Wider Caribbean region, which includes the Saba Bank PSSA, is an Annex V Special Area which controls the discharge of garbage into the region. This area is somewhat unique as two other PSSAs, namely the Paracas National Reserve⁶⁷ and the Sabana-Camaguey Archipelago, laid down strict prohibitions on discharges of oil, garbage or harmful substances in the PSSA area without going to the trouble of seeking a formal Special Area designation, although the Sabana-Camaguey was subsequently incorporated into the one on the Wider Caribbean region.⁶⁸ The justification for the Annex V area in the Wider Caribbean was that the physical oceanography of the area tended to concentrate marine debris in this area, with long residence times of inflowing Atlantic waters and a restricted outflow of Gulf waters due to the Loop Current, which acts as a barrier to exchange. There are also multiple persistent eddies and wind forcing of coastal currents which make many valuable and sensitive tourist areas at risk from the discharge of garbage. Threatened and endangered species of whales, birds and sea turtles, important commercial and recreational fisheries, as well as being an area of high productivity with rare and fragile ecosystems, were all highlighted.⁶⁹

Two years after the Wider Caribbean region was made a Special Area, a specific part of that area, the Saba Bank atoll, was inscribed under the 1990 Protocol Concerning Specially Protected Areas and Wildlife (SPAW Protocol) for the Caribbean, thus highlighting its regional significance. In exactly the same year, the Saba Bank atoll was also made a PSSA.⁷⁰ Here, the general oceanographic considerations mentioned in the Special Area designation were considerably elaborated upon in the PSSA application. This was easy to do, as this atoll, in The Netherlands Antilles, situated only 5 kilometres off the coast of Saba, is one of the three largest atolls on earth, measuring around 2,200 square kilometres, and the total reef area has been estimated at approximately 150 kilometres. The Bank is a flat-topped seamount rising 1,800 metres (5,905 feet) from the seafloor and it is crowned by a ring of growing coral reef on its fringes.

Benthic Species Distribution, Abundance and Diversity in the Baltic Sea” (2013) 70(6) ICES Journal of Marine Science 234–249; Helsinki Commission *Checklist of Baltic Sea Macro Species* (Helsinki Commission, Finland, 2012) at 3–4; L Wennerstrom “Genetic Biodiversity in the Baltic Sea” (2011) 22(13) Biodiversity and Conservation 100–115.

67 Designation of the Paracas National Reserve as a PSSA, IMO Resolution MEPC.106(49), 18 July 2003, part II(4), reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 11.

68 K Gjerde “Cuba’s Sabana-Camaguey” (1998) 13(2) International Journal of Marine and Coastal Law 246–247.

69 Antigua and Barbuda “Proposal for the Wider Caribbean Region as a Special Area under MARPOL Annex V” IMO MEPC 60/8/2, 15 January 2010, paras 3–5.

70 Designation of the Saba Bank as a PSSA, submitted by The Netherlands, IMO MEPC 62/9, 8 April 2011. Also “Proposal to Designate the Saba Bank as a PSSA” IMO MEPC 62/WP.12, 2011, Annex III.

This atoll, which is recognised for its largely untarnished character, holds 81 sponge species, 150 to 200 seaweed species, 48 octocoral species, 43 species of different types of coral (including five sites with critically endangered coral types) and 97 fish species of all types, from forage fish at the bottom of the food chain through to large sharks at the top. It also provides critical habitat for a number of endangered species including the hawksbill and green turtle, whilst also being an important area for humpback whales and other cetaceans.⁷¹

4.1.3 Ramsar sites and Biosphere Reserves

The Ramsar Convention on Wetlands of International Importance was concluded in 1971. The parties to this regime agreed to “promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands”.⁷² By 2015, nearly 2,000 wetlands had been inscribed by their respective governments, in a non-competitive process, whereby the sites were identified for their importance to waterfowl especially, but also to water-related species. Unsurprisingly, as many wetlands are close to coastal areas, a number of PSSAs include Ramsar sites.⁷³

The PSSAs which include World Heritage areas and Ramsar sites are the Wadden Sea (which is one of the most renowned Ramsar sites anywhere), the Western European PSSA (which includes four Ramsar sites linked to the ocean in Ireland alone — Trawbreaga Bay, Commeen Strand, Killala Bay and Blacksod Bay), as well as sites in Belgium and the Baltic PSSA, which has Ramsar sites but no World Heritage designations.

The PSSAs which have Ramsar sites as their top internationally recognised areas (ie no World Heritage areas or Special Areas) are off Cuba and Peru respectively. The Cuban archipelago of Sabana-Camaguey hosts the Ramsar sites of the Bay of Buena Vista and the Humedal Rio Maximo-Caguey, with the latter being most famous as the largest nesting area for flamingos in the Caribbean and many other migratory birds.⁷⁴ These two Ramsar sites are part of an ecosystem that occupies a strip of approximately 465 kilometres along the central north zone of Cuba. The entire PSSA constitutes the largest system of cays in the Wider Caribbean and represents 60 per cent of all the Cuban cays in

71 N Esteban “Green and Hawksbill Turtles in the Lesser Antilles” (2015) 162(6) *Marine Biology* 174–189; M Diaz “Preliminary Assessment of Sponge Biodiversity on Saba Bank, Netherlands Antilles” (2010) 5(5) *PLoS ONE* 100–117; M Littler “Marine Macroalgal Diversity Assessment of Saba Bank” (2010) 5(5) *PLoS ONE* 118–128; P Etnoyer “Octocoral Diversity and Habitat on Saba Bank” (2010) 5(5) *PLoS ONE* 129–140; M Vermeij “Reef fishes of Saba Bank” (2010) 5(5) *PLoS ONE* 155–162.

72 The Ramsar Convention 996 UNTS 245; 11 ILM 963 (1972).

73 See Gillespie, above n 30, at ch 8.

74 Identification of the Archipelago of Sabana-Camaguey as a PSSA, IMO Resolution MEPC.74(40), 25 September 1997.

number (2,515 cays). Along its outer edge there is a coral reef 400 kilometres long. This area represents a high degree of interaction and interdependence between the coastal and marine ecosystems, especially in the sequence of coastal lagoons/dune systems/beaches/algae/coral reefs; and, similarly, the combination of mangrove swamps, lagoons, coral reefs and seagrass beds is believed to be unique. Some 340 species of marine flora (including 60 types of coral and 90 types of sponge) have been identified, as well as 1,354 species of marine fauna. Among the most notable species in the marine and coastal zone are the manatee, dolphins, the hawksbill turtle, the loggerhead turtle, the green turtle, the leatherback turtle, crocodiles and the queen conch.⁷⁵

The second PSSA of which Ramsar sites are its premier international designations is the Paracas National Reserve, which was made a PSSA in 2003. The PSSA reserve, 265 kilometres south of the capital city of Lima, is located in Ica, Peru and consists of the Paracas Peninsula, coastal areas and tropical desert extending to the south slightly past Punta Caimán to a total of 335,000 hectares. The Paracas National Reserve is an ideal example of Pacific subtropical coastal desert influenced by the effects of the Humboldt Current's cold water that flows from the south and converges over the shallow coastal waters, thus encouraging photosynthetic processes or primary productivity of phytoplankton. This results in part of one of the most biologically productive marine areas in the world, serving as a major habitat for some 1,543 identified species. The Ramsar sites host the core of more than 215 species of migratory birds which spend at least part of their lives in Paracas, several species of which have been declared endangered, including, inter alia, the Humboldt penguin, American flamingo, the Peruvian diving petrel, and blue-footed and masked boobies. The wider PSSA also encompasses whales, orcas, sea lions and sea otters among the 36 species of marine and land mammals found in the reserve, including three large colonies of South American fur seals. Other marine animals include octopus, as well as green, leatherback and hawksbill turtles. There are 160 fish species and 254 recorded species of marine algae, as well as a plethora of mussels, winkles, scallops, cabrilla, pintadilla and chita.⁷⁶

Biosphere Reserves are designated internationally through UNESCO. The programme, which began work in 1971, possesses a long-standing commitment

75 Government of Cuba *Mainstreaming and Sustaining Biodiversity Conservation in three Productive Sectors of the Sabana Camaguey Ecosystem* (UNDP, NYC, 2014) at 17–21 and Annex 3; P Alcolado “The Cuban Coral Reefs” in E Dahlgren (ed) *Latin American Coral Reefs* (Elsevier Science, NYC, 2003) 234–253; E Dinerstein *A Conservation Assessment of the Terrestrial Ecoregions of Latin America and the Caribbean* (The World Bank, Washington, 1995) at 17–21, 50.

76 Designation of the Paracas National Reserve as a PSSA, IMO Resolution MEPC.106(49), above n 67, para 2.1.3, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 11.

to the conservation of ecosystems and representative habitats. This commitment is especially strong with regard to habitats which are rare, unique, or threatened, yet also closely related to well-regulated human communities.⁷⁷ The recognised PSSA sites, which include at least one UNESCO-designated Biosphere Reserve, include the Wadden Sea and Sabana-Camaguey, with the latter including the renowned Biosphere Reserve (the Buenavista). The Western European PSSA contains Biosphere Reserves on the west coasts of Britain (Loch Druidibeg, Tanish and Braunton Burrows) and France (Iroise). Finally, the Canary Islands contain three UNESCO Biosphere Reserves — La Palma, Lanzarote and the small island of El Hierro, which was declared a UNESCO Biosphere Reserve in the year 2000.

4.2 Areas of Bilateral and/or National Importance

Three PSSAs have obtained recognition of their ecological sensitivity without recourse to any pre-existing international designations, relying primarily on national, or sometimes regional, recognitions to bolster their claims. The recognition of the regional importance of conservation areas is most common in Europe, where areas have been designated as conservation areas under the European Habitat and/or Birds Directives; or as Natura 2000 sites (a network of nature protection areas in the territory of the European Union, made of Special Areas of Conservation and Special Protection Areas designated to protect important habitats). For example, in the Canary Islands, 24 areas are listed under the European Natura Network 2000.⁷⁸ Such designated areas also exist within the PSSAs for the Baltic, Wadden and Western European sea areas. In all of these instances, the regional designations are supplementary to a more substantive international designation, such as a World Heritage, Special Area or Ramsar site.

The exception to this approach is the Strait of Bonifacio, which was made a PSSA in 2011,⁷⁹ where the recognition of regional and domestic environmental sensitivities only was sufficient. This strait between Corsica (France) and Sardinia (Italy) is 11 kilometres wide and, at maximum, 100 metres deep. The ecological foundations for the justification of this site were that its waters and associated lands contain 1,745 species. Amongst the 977 species of fauna are

77 UNESCO *International Coordinating Council for the Programme on Man and the Biosphere* (MAB Report Series No 1, 1971); The Statutory Framework of the World Network of Biosphere Reserves, arts 3(1) and 4(2); Seville + 5 Recommendations, Recommendation Number 3.

78 See Gillespie, above n 30, at ch 7.

79 Designation of the Strait of Bonifacio as a PSSA, submission by France and Italy, IMO MEPC 61/INF.26, 9 September 2010; IMO MEPC 61/9, 25 June 2010; “Proposal to List the Strait of Bonifacio as a PSSA” IMO MEPC 62/WP.12, 2011, Annex I.

18 mammals, 165 birds, seven reptiles, two amphibians and 187 fish species. The area is especially important for hosting a number of endangered species, including 77 avian species (including 7 per cent of the world's shags) listed under the Birds Directive and 139 species under the Berne Convention for the Conservation of European Wildlife,⁸⁰ as well as 33 species under the Barcelona Convention for the Protection of the Mediterranean Sea.⁸¹ The Strait of Bonifacio was recognised as a Specially Protected Area under the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean in 2009.⁸² Most of the species in the area are found within six Natura 2000 sites, three Habitat Directive sites, 12 sites of community significance and associated national parks on either side of the Strait.⁸³

The Torres Strait and the Florida Keys are two PSSA sites which did not have strong prior recognition of their ecological values in terms of either international or regional importance. The Torres Strait avoided detailed scrutiny by being added to the existing Great Barrier PSSA in 2005. It is comprised of the waters between Cape York Peninsula, in the extreme north of Australia, and Papua New Guinea. This area is the overlapping point of two ocean systems in which there is limited exchange of salt water in and out of the Strait, but where there are also large influxes of fresh water and sediment from nearby coastal rivers. The area provides a critical habitat for many species, including dugongs, green and flatback turtles, as well as several thousand people who live on only 18 of the islands which are habitable. At least one species in this small area is endangered, and a further nine species are vulnerable to extinction. In addition, there are 68 species with greater than 50 per cent of their recorded range in the region. Of these, 46 species have 100 per cent of their recorded range in the region.⁸⁴

The sea area around the Florida Keys, which was made a PSSA in 2002,⁸⁵ is the last PSSA which was justified, primarily, for its ecological values which are recognised domestically but not internationally. The Keys are a coral

80 The 1979 Berne Convention on the Conservation of European Wildlife and Natural Heritage 1284 UNTS 209.

81 The 1976 Convention for the Protection of the Mediterranean Sea Against Pollution 1102 UNTS 27.

82 The 1995 Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean 2102 UNTS 203.

83 D Mouillot "A New Index and an Application to the Bonifacio Strait Natural Reserve" (2008) 41 *Biological Conservation* 1569–1580.

84 See Australian Government, Australian Maritime Safety Authority [AMSA] *The Torres Strait Particularly Sensitive Sea Area* (Government Printer, Townsville, 2014); AMSA *The Biodiversity Assessment for the Torres Strait* (Government Printer, Townsville, 2013) at 3–5; J Beckett *Torres Strait Islanders: Custom and Colonialism* (Cambridge University Press, Cambridge, 1990) at 17–25.

85 IMO Resolution MEPC.98(47), 8 March 2002.

archipelago in the southeast United States, which consists of a slender thread of land, made up of more than 1,700 islands, that extends more than 320 kilometres into the sea and encompasses some 2,900 nautical miles of waters. The islands lie along the Florida Straits and divide the Atlantic Ocean to the east from the Gulf of Mexico to the west. It is the third-largest barrier reef system in the world. It has a unique mixture of corals, mangroves, the largest documented seagrass bed globally and a resident population of more than 6,000 species of plants, fish, coral and other invertebrates. There are 47 migratory bird species and 21 resident land-bird species. Five species of endangered sea turtles are found throughout the area, including the hawksbill, green turtle, Kemp’s ridley, loggerhead and leatherback turtles. It was also, at the time of designation, a critical habitat for a variety of endangered or threatened species, including 75 plant, four invertebrate, four fish, 14 reptile, 21 bird, 13 mammal and one amphibian species, all of which were protected under domestic laws.⁸⁶ With such a collection of considerations, the Florida Keys National Marine Sanctuary and Protection Act 1990 recognised the “extensive conservation, recreational, commercial, ecological, historical, research, educational, and aesthetic values which give this area special national significance”.⁸⁷

5. SOCIAL, CULTURAL AND ECONOMIC CRITERIA

The social, cultural and economic criteria for a PSSA designation have been largely unchanged since 1991, although the importance of subsistence and cultural heritage has been increasingly emphasised. The criteria, as set out in 2005,⁸⁸ are social or economic dependency,⁸⁹ human dependency,⁹⁰ or cultural heritage.⁹¹

86 Designation of the Marine Area Around the Florida Keys as a PSSA, IMO MEPC 46/6/2, 19 January 2001, s 3.1.2–3.1.6; US Department of Commerce *Biodiversity and Ecosystem Function of Shallow Bank Systems Within the Florida Keys National Marine Sanctuary* (Marine Sanctuaries Conservation Series ONMS-12-03, 2012) at 3–17; N Lemoine “Structurally Complex Habitats On A Reef in the Florida Keys” (2012) 31(3) *Coral Reefs* 217–230; M Main “Species Richness and Diversity of Resident and Migratory Landbirds in the Florida Keys” (2011) *International Journal of Ecology* 34–48.

87 Section 2(3) of the Florida Keys National Marine Sanctuary and Protection Act, Public Law 101–605 (HR 5909).

88 IMO Resolution A.982(24), above n 13, s 4.

89 Section 4.4.12. Including fishing, recreation, tourism, and the livelihoods of people who depend on access to the area.

90 Section 4.4.13. Such as with the support of traditional subsistence or food production activities or for the protection of the cultural resources of the local human populations.

91 Section 4.4.14. Cultural heritage — as testified with the presence of significant historical and archaeological sites.

5.1 Economic Criteria

The economic value of an area is typically divided between its financial worth in terms of tourism and fisheries or other maritime extraction. At the lower end of the scale, the Saba Bank PSSA has only artisanal fisheries which generate close to USD 1.2 million per year, while tourism brings 22,500 visitors annually, generating about USD 30 million per year. The Malpelo PSSA, famed for its pristine underwater environment, attracts tens of thousands of tourists per year.⁹² The archipelago of Sabana-Camaguey is visited by 300,000 foreign tourists per year, and with fisheries, the ecology of the area generates around USD 20 million annually.⁹³ The Paracas PSSA has some 120,000 visitors per year.⁹⁴

Moving up the scale of the economic worth of the regions which PSSAs have come to cover, the market value for the reef-dependent fisheries in the Florida Keys has been estimated at approximately USD 50 million with commercial and recreational fishing, combined, accounting for approximately 3,000 local jobs. Lobster, snapper and mackerel are credited for generating at least USD 60 million a year for the industry, whilst recreational fishing annually generates more than USD 60 million in the local economy. In addition, per year in 2002, some 2.5 million visitors spent about USD 1.2 billion in the Florida Keys and supported some 22,000 part- or full-time jobs.⁹⁵

With the Western European PSSA, amongst others, nearly 10,000 people in Spain, 20,000 in Ireland and 30,000 in France draw their livelihoods directly from the sea or aquaculture. The economic value of these resources, collectively within the PSSA area, is over 1 billion euro per year. The tourism value of the same areas was not specified collectively, but is probably greater, with all of the countries involved having established strong tourism markets around their coastal regions. For example, 90 per cent of tourism in Portugal is related to the

92 S van de Kerkhof *The Tourism Value of Nature on Saba* (Ministry of Economic Affairs, The Netherlands, 2014) at 3–6.

93 Government of Cuba *Mainstreaming and Sustaining Biodiversity Conservation in three Productive Sectors of the Sabana Camaguey Ecosystem* (UNDP, NYC, 2014) at 9–10.

94 Designation of the Paracas National Reserve as a PSSA, IMO Resolution MEPC.106(49), above n 67, para 2.1.3, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 11.

95 Designation of the Marine Area Around the Florida Keys as a PSSA, IMO MEPC 46/6/2, above n 86, s 3.2.1. See also R Craig “Coral Reefs, Fishing, and Tourism: Tensions in U.S. Ocean Law and Policy Reform” (2008) 27(1) *Stanford Environmental Law Journal* 3 at 15–18; M Bhat “Application of Non-Market Valuation to the Florida Keys Marine Reserve Management” (2003) 67(4) *Journal of Environmental Management* 315.

coast, constituting about 4.2 per cent of Portuguese GDP and employing about 5 per cent of the Portuguese population.⁹⁶

Tourism provides over nine million visitors to the Canary Islands each year and with them comes over 80 per cent of the income for the region.⁹⁷ The numbers of tourists visiting the Galapagos Islands has grown from 2,000 per year in 1960 to 200,000 per year in 2014. The economic value of this industry is in excess of USD 418 million per year.⁹⁸ Similarly in Europe, the Wadden Sea has been noted as being of particular importance to the utilisation of the living marine resources including commercial, recreational and subsistence fishing, harvesting and aquaculture. Over eight million visitors per year came at the time of inscription, progressing to over 10 million by 2014, producing about 4 billion euro per year, or 20 per cent of the regional income.⁹⁹ Finally, the value of tourism at Great Barrier Reef in 1990, just as it was about to become a PSSA, was worth nearly AUD 1 billion per year. Twenty-five years later, nearly 70,000 jobs are dependent on the Great Barrier Reef, which is generating close to AUD 7 billion per year from recreational and commercial fishing, scientific research and tourism, with the last category generating the lion’s share at AUD 6.5 billion.¹⁰⁰

5.2 Cultural Criteria

The cultural component of PSSA applications is relatively undeveloped when compared to the economic component, as it is only noted in five applications. The Wadden Sea region emphasised the cultural-historic and landscape values of this area, encompassing many age-old landscape elements, hidden archaeological objects, works of art, folklore and traditions as one of the oldest and most complex cultural landscapes in Europe that has been inhabited for

96 Designation of a Western European PSSA, IMO MEPC 49/8/1, above n 52, Annex 1, s 3.3.1.

97 L Gil-Alana “Tourism in the Canary Islands” (2008) 27(7) *Journal of Forecasting* 621–636.

98 H Nicholls *The Galápagos: A Natural History* (Penguin, Harmondsworth, 2014) at 3–9; R Self “Marketing Tourism In The Galapagos Islands: Ecotourism Or Greenwashing?” (2010) 9(6) *The International Business & Economics Research Journal* 111–125; J Taylor “Ecotourism and Economic Growth in the Galapagos: An Island Economy Wide Analysis” (2009) 14(2) *Environment and Development Economics* 100–121; A Jansson *Investing in Natural Capital: The Ecological Economics Approach to Sustainability* (Island Press, California, 1995) at 140–145.

99 Designation of the Wadden Sea as a PSSA, IMO MEPC 48/7/2, above n 39, s 3.16. Also UNESCO *Sustainable Tourism in the Wadden Sea* (UNESCO, Paris, 2014) at 7–8.

100 Deloitte *Economic Contribution of the Great Barrier Reef* (Australian Government Printer, Townsville, 2013) at 3–4; P Ottesen “Shipping Threats and Protection of the Great Barrier Reef Marine Park — The Role of the Particularly Sensitive Sea Area Concept” (1994) 9 *International Journal of Marine and Coastal Law* 507–527.

more than 5,000 years.¹⁰¹ The other three PSSA applications in this area have all focused exclusively on indigenous cultural interests in the sites. For example, the Paracas site contains 104 archaeological sites from the indigenous people of the area, covering every period of pre-Hispanic Andean societies.¹⁰² The Great Barrier application emphasised that many Aboriginal peoples relied upon the traditional use of marine resources in the area, with over 30 per cent of the area being covered by some form of relationship, legal and/or cultural, with the original inhabitants.¹⁰³ When the Torres Strait was added to the Great Barrier PSSA in 2005, the importance of the vulnerability of local populations of indigenous Torres Strait islanders who lived in this region (less than 10,000 individuals), possessing an intimate relationship with the sea, in terms of culture, economics and sustenance, was drawn out.¹⁰⁴

The Papahānaumokuākea PSSA is the strongest in the cultural bracket. This was highlighted for holding the underwater cultural heritage of over 120 vessels from the 19th century through to the Second World War. Papahānaumokuākea is the title Native Hawaiians selected for the monument and which combines the names of two sacred Hawaiian deities, Papahānaumoku, the goddess of the earth, and Wakea, her husband and god of the sky. This title reflects the traditional, and ongoing, role of this area in terms of ancient Hawaiian religion, cosmology and traditional society. This is also testified by some 140 cultural sites found on the islands of Nihoa and Mokumanamana which are listed on the National and State Register for Historic Places.¹⁰⁵ It was due to these existing shrines and ongoing traditions that the site was recognised under two of the criteria (III and IV) of the World Heritage Convention as OUV.

101 Designation of the Wadden Sea as a PSSA, IMO MEPC 48/7/2, above n 39, s 3.17.

102 Designation of the Paracas National Reserve as a PSSA, IMO Resolution MEPC.106(49), above n 67, para 2.1.3, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 11.

103 T Stewart *The Great Barrier Reef: The Seventh Great Wonder* (University of Brisbane Press, Brisbane, 2015) at 38–41.

104 See AMSA *The Torres Strait Particularly Sensitive Sea Area*, above n 84, and AMSA *The Biodiversity Assessment for the Torres Strait*, above n 84, at 3–5; J Beckett *Torres Strait Islanders*, above n 84, at 17–25.

105 P Jokiel “Marine Resource Management in the Hawaiian Archipelago: The Traditional Hawaiian System in Relation to the Western Approach” (2011) *Journal of Marine Biology* 34–45; K Kekuewa “Rebirth of an Archipelago: Sustaining a Hawaiian Cultural Identity for People and Homeland” (2010) 6 *Hūlili: Multidisciplinary Research on Hawaiian Well-Being* 73 at 89–102.

6. SCIENTIFIC AND EDUCATIONAL CRITERIA

The last set of criteria which may lead to qualification as a PSSA are scientific and educational criteria. Fulfilment of these criteria may be in terms of high scientific interest for research,¹⁰⁶ providing a baseline for monitoring studies,¹⁰⁷ or as an area that offers exceptional educational opportunities to demonstrate particular natural phenomena.¹⁰⁸ For this criterion, each of the PSSA applications makes a number of statements. Some had little to claim in this area. For example, the Saba Bank PSSA could only claim to be “just beginning to be realised” for its scientific and educational value, although it was envisaged that both monitoring and research activities would grow quickly.¹⁰⁹ With the Paracas PSSA, scientific, technical, fisheries and marine research programmes, including the creation of baseline studies, were noted as being common in the reserve, with Peruvian national authorities, in terms of their navy, universities and public institutions, all being active in their scientific research in the area.¹¹⁰ The Western European PSSA made similar generic claims,¹¹¹ as did the Canary Islands, boasting international, regional and national research projects, supplemented by the work of two universities and a national research centre.¹¹² Others, such as the Sabana-Camaguey, were vague, simply drawing out that the area holds a series of regionally important scientific research and monitoring centres.¹¹³ The Strait of Bonifacio claimed it was an ideal place for the collection of reliable scientific data for the establishment of sustainable development models,¹¹⁴ whilst the Galapagos Islands’ application in this area was largely of the belief that the sentence of “Charles Darwin, science and the Galapagos” spoke for itself. For its PSSA designation, the Papahānaumokuākea

106 IMO Resolution A.982(24), above n 13, s 4.4.15.

107 Section 4.4.16. Such as with areas that have not had substantial perturbations or have been in such a state for a long period of time such that it is considered to be in a natural or near-natural condition.

108 Section 4.4.17.

109 Designation of the Saba Bank as a PSSA, submitted by The Netherlands, IMO MEPC 62/9, above n 70, para 3.5. Also “Proposal to Designate the Saba Bank as a PSSA”, IMO MEPC 62/WP.12, above n 70, Annex III.

110 Designation of the Paracas National Reserve as a PSSA, IMO Resolution MEPC.106(49), above n 67, para 2.3.1, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 11.

111 Designation of a Western European PSSA, IMO MEPC 49/8/1, above n 52, Annex 1, s 3.4.

112 Designation of the Canary Islands as a PSSA, IMO Resolution MEPC.134(53), above n 42, paras 2.2.2 and 2.2.3, reprinted in IMO *Particularly Sensitive Sea Areas*, above n 31, Annex 13.

113 Designation of the Sabana-Camaguey Archipelago as a PSSA, submitted by Cuba, IMO MEPC 38/19, 31 January 1996.

114 Designation of the Strait of Bonifacio as a PSSA, submission by France and Italy, IMO MEPC 61/9, above n 79, para 2.2.1.

area was highlighted for its pristine conditions, from which research could be undertaken, as it had been for the previous three decades by federal, state and academic institutions.¹¹⁵

Better exemplars of scientific and educational criteria come from the PSSA applications for the Wadden Sea and the Florida Keys. In the former, it was demonstrated that the Wadden Sea is one of the most intensively used scientific study areas in the world, with oceanographic research stations in the region (in The Netherlands) dating to 1876. Three-way cooperative, contemporary scientific and educational research started in 1975, although long-term surveys for baseline and monitoring studies date back to the 1960s.¹¹⁶ Of the latter, although the scientific research could only be traced to the beginning of the 20th century, the scope of what was being done was and still is impressive. Specifically, the National Oceanic and Atmospheric Administration has, through the University of North Carolina, established a National Undersea Research Center for the Gulf of Mexico and Southeast Coastal areas. A number of monitoring activities are occurring in and around the Florida Keys, including water quality, coral, seagrass, fisheries, algal blooms, wind speed, wind direction, precipitation, barometric pressure, air temperature, solar irradiance, seawater temperature and salinity. The most comprehensive, long-term water quality monitoring programme under way in the Keys is conducted through the Water Quality Protection Program, which began in 1994.¹¹⁷

7. THE SALISH SEA

The final part of this article seeks to try to yardstick all of the above criteria for a PSSA in terms of sensitivity, to another ocean, to see if that area does, or does not, meet the same standards. The area chosen for this part of the study is the Salish Sea.

The Pacific Northwest is one of the youngest and most geologically dynamic places on earth. At its core are volcanoes and ice-sculptured mountain landscapes which frame the Salish Sea and which many regard as the jewel of the entire area. This area was created by tectonic movement and the repeated advance and decline of glacial ice sheets thousands of years ago. Today, the area corresponds to the ancestral home of the Coast Salish people. The ecosystem

115 Designation of the Papahānaumokuākea Marine National Monument as a PSSA, IMO MEPC 56/8, above n 46, ss 3.14–3.17.

116 Designation of the Wadden Sea as a PSSA, IMO MEPC 48/7/2, above n 39, s 3.18; P Kabat “The Wadden Sea Region: Towards a Science for Sustainable development” (2012) 68 *Ocean & Coastal Management* 4–17.

117 Designation of the Marine Area Around the Florida Keys as a PSSA, IMO MEPC 46/6/2, above n 86, s 3.3.1.

stretches from Olympia in the south to Campbell River in the north and extends from the crest of the surrounding mountain ranges (Olympic, Cascade, Vancouver Island and Coast Range) to the deepest part of the marine waters. The area south of the international border is called the Puget Sound Basin, and to the north, the Georgia Basin. The Strait of Juan de Fuca, connecting both basins to the Pacific Ocean, and the San Juan Islands, is also part of this area. Thousands of streams and a dozen large rivers drain 7,470 kilometres of coastline into 16,925 square kilometres of marine water and 419 islands. This draining of fresh water, which is then mixed with salt water, is facilitated by deep submarine channels, which range from 60 metres to over 600 metres in depth and often only within a few metres of the shore.¹¹⁸

7.1 Ecological Criteria

The foremost international recognition of the environmental values of the Salish Sea area lies with the Olympic National Park which can be reached from the southern side of the Strait of Juan de Fuca and along the Olympic Coast. This area was established as a forest reserve in 1897, a National Monument in 1909, and a National Park in 1938.¹¹⁹

The Olympic site is recognised to be of global importance due to its exceptional natural beauty and aesthetic importance. First, the complex ecosystems, from ocean edge through temperate rainforest, alpine meadows and glaciated mountain peaks, are recognised as being globally unique. Glacier-clad peaks interspersed with extensive alpine meadows are surrounded by an extensive old-growth forest, within which is the best example of intact and protected temperate rainforest in the Pacific Northwest. Second, the site

118 A Benedict and J Gaydos *The Salish Sea: Jewel of the Pacific Northwest* (Sasquatch Books, Seattle, 2015) at 20–30; D Preikshot and others “A Dynamic Model Describing Ecosystem-Level Changes in the Strait of Georgia from 1960 to 2010” (2013) 115 *Progress in Oceanography* 28–40; N Nidzieko “Tidal Asymmetry and Velocity Skew Over Tidal Flats and Shallow Channels Within a Macrotidal River Delta” (2012) 117(3) *Journal of Geophysical Research* 356–376; D Sutherland “A Model Study of the Salish Sea Estuarine Circulation” (2011) 41(6) *Journal of Physical Oceanography* 1125–1143; K Tarang “Tidally Averaged Circulation in Puget Sound” (2011) 93(4) *Estuarine, Coastal and Shelf Science* 240–254; L Dmitri “Sill Dynamics and Fjord Deep Water Renewal” (2009) 29(1) *Continental Shelf Research* 324–345; A MacFadyen “Influences of the Juan de Fuca Eddy on Circulation, Nutrients, and Phytoplankton Production in the northern California Current System” (2008) 113(8) *Journal of Geophysical Research: Oceans* 214–249; M Foreman and others “Modeling the Generation of the Juan de Fuca Eddy” (2008) 113(3) *Journal of Geophysical Research of Oceans* 435–452; R Thomson and others “Estuarine Versus Transient Flow Regimes in Juan de Fuca Strait (2007) 112(9) *Journal of Geophysical Research* 345–360.

119 Fifth Session of the World Heritage Committee (CC-81/CONF/003/6, Paris, 5 January 1982) at 5–6.

possesses outstanding examples of significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems and communities of plants and animals. The coastal rainforest reaches its maximum pristine growth within the park confines and has a living standing biomass which may be unsurpassed anywhere else in the world. The park also includes more than 60 miles of wilderness coastline, the longest undeveloped coast in the contiguous United States. This coastline is characterised by rocky headlands, log-strewn beaches and a wealth of intertidal life; rocky islets along the coast are remnants of a continuously changing coastline. Tidal pools are filled with hundreds of species of invertebrate life, and seals, sea lions, sea otters and several species of whale are often seen offshore. The park also holds, amongst others, critical populations of the endangered northern spotted owl, marbled murrelet and bull trout.¹²⁰

The Salish Sea is not part of any Special Areas under Annexes I, II or V of the MARPOL. It is, however, part of the Annex VI Emissions Control Area. This area, which covers all of North America, includes both the United States and Canada.¹²¹ This Emissions Control Area was justified on account of the growing rate of air pollutants from vessels in these waters, wherein the Salish Sea was notable, and the damage that such vessels were causing in terms of, inter alia, the economic, environmental and social costs. Work in this area was strongly supplemented by the United States–Canada Border Air Quality Strategy and its flagship programme which was/is the Georgia Basin–Puget Sound International Airshed Strategy.¹²²

The Salish Sea, with its mosaic of deltas, rivers and other estuarine ecosystems, is also rich in the type of habitat that the Ramsar Convention covers. Although some parts of these habitats in the Salish region are degraded and/

120 T McNulty *The Olympic National Park: A Natural History* (University of Washington Press, Seattle, 2009) at 151–215.

121 United States and Canada “Proposal to Designate an Emission Control Area for Nitrogen Oxides, Sulphur Oxides and Particulate Matter” IMO MEPC 59/6/5, 2 April 2009.

122 R Kotchenruther “A Regional Assessment of Marine Vessel PM_{2.5} Impacts in the U.S. Pacific Northwest” (2013) 68 *Atmospheric Environment* 103–111; R McLaren “A Survey of NO₂:SO₂ Emission Ratios Measured in Marine Vessel Plumes in the Strait of Georgia” (2011) 46 *Atmospheric Environment* 655–658; O Schinas “Cost Assessment of Environmental Regulation and Options for Marine Operators” (2010) 25 *Transportation Research Part C: Emerging Technologies* 81–99; J Winebrake “Mitigating the Health Impacts of Pollution from Oceangoing Shipping: An Assessment of Low-Sulfur Fuel Mandates” (2009) 43(13) *Environmental Science and Technology* 4776–4785; C Han “Strategies to Reduce Air Pollution in Shipping Industry” (2010) 26(1) *The Asian Journal of Shipping and Logistics* 7–30; D Fraser “Collaborative Science, Policy Development and Programme Implementation in the Transboundary Georgia Basin/Puget Sound Ecosystem” (2006) 113 *Environmental Monitoring and Assessment* 49–69.

or modified from their original condition,¹²³ the majority of the core functions remain, ultimately making the Salish Sea one large estuary. Of the 12 rivers feeding the sea, the Fraser River alone can pump millions of gallons of water per day into the ocean, thus contributing greatly to sediment-rich intertidal habitats which are extraordinarily important to the food web both inside and outside of the Salish Sea. That is, when the nutrients emerge from the Strait of Juan de Fuca, which is the outlet for the Salish Sea estuary, the Pacific Northwest shelf becomes the most biologically productive region in the California Current System, accounting for almost half of the primary productivity on the Vancouver Island shelf, a third of the productivity on the Washington shelf, and a fifth of the productivity on the Oregon shelf during the upwelling season.¹²⁴

Canada designated the associated delta of the Fraser River a Ramsar site in 1982. In 2012 the site was expanded from 586 to 20,682 hectares. The site is formed by six components, all in the Metro Vancouver region and part of the most important river delta/estuary for fish and birds on the west coast of Canada. The complex provides an internationally critical migratory stop-over area for the western sandpiper. It provides feeding and roosting sites to an additional 250,000 migrating and wintering waterfowl and one million shorebirds. A number of provincially and federally listed fish species of concern can be found within the estuarine habitats, including *Acipenser transmontanus*, *Acipenser medirostris* and *Thaleichthys pacificus*. The complexity of ecosystems found in the site, such as estuarine marsh, mudflats, floodplains, sloughs and river channels, are all critical feeding and rearing areas for anadromous salmon during their transition between river and marine stages of their life-cycle.

The avian species found at the Fraser River Ramsar site are a subset of 172 species of bird within the Salish Sea region which are migratory and are also of regional, if not international, importance. This status is recognised by their habitat designations as Important Bird Areas (IBAs).¹²⁵ On the Washington side

123 For the damage see C Wong “Health of the Salish Sea as Measured Using Transboundary Ecosystem Indicators” (2014) 17(4) *Aquatic Ecosystem Health & Management* 463–471; S Morley “Ecological Effects of Shoreline Armoring on Intertidal Habitats of a Puget Sound Estuary” (2012) 35(3) *Estuaries and Coasts* 208–220; K Fresh and others “Implications of Observed Anthropogenic Changes to the Nearshore Ecosystems in Puget Sound” (Puget Sound Nearshore Ecosystem Restoration Project, Technical Report 2011-03, 2011) 4–9; C Simenstad and others “Historic Change and Impairment of Puget Sound Shorelines” (Puget Sound Nearshore Partnership, Technical Report 2011-01, 2011) 3–7.

124 K Davis “Estuary Enhanced Upwelling of Marine Nutrients Fuels Coastal Productivity in the US Pacific Northwest” (2014) 119(12) *Journal of Geophysical Research: Oceans* 303–324; B Hickey and others “Three Interacting Freshwater Plumes in the Northern California Current System (2009) 114 *Journal of Geophysical Research* 432–449.

125 National Audubon Society *Important Bird Areas Program: A Global Currency for Bird Conservation* (Audubon, Washington, 2015) at 3, 15, 20–27.

there are 17 state-recognised IBAs¹²⁶ and nine globally recognised IBAs.¹²⁷ In British Columbia there are six nationally recognised,¹²⁸ one globally recognised¹²⁹ and seven IBAs that are both nationally and globally recognised.¹³⁰ There is also one IBA that is both nationally and continentally recognised,¹³¹ two of global and continental recognition,¹³² and four IBAs that have been recognised as all three global, continental and national IBAs.¹³³ Many of the bird species in these areas are migrants and are linked into the Pacific Flyway. Cooperation between the United States and Canada to protect many of these migratory avian species is entrenched under the Migratory Bird Treaty Act.¹³⁴ In addition, many of these species, both migratory and non-migratory, are iconic and/or endangered. Double-crested cormorants have declined by 66 per cent in Washington and British Columbia since 2009. Marbled murrelets have declined in the range of 30 per cent between the years of 2000 and 2010 in many regions, including in the Pacific Northwest. Long-term declines in wintering numbers of scoters and limited populations of harlequin and long-tailed ducks have also been recorded. Similarly, the tufted puffin, once considered common in the San Juan Islands, the Strait of Juan de Fuca and particularly along the outer coast of the Olympic Peninsula, has seen its numbers fall from about 25,000 to less than 3,000 in the last 100 years.¹³⁵

126 Crescent Harbor Marshes; Crockett Lake; Deception Pass; Drayton Harbor/Semiahmoo; Deer Lagoon; Dungeness Bay; Eld Inlet/Mud Bay; Indian-Marrowstone Island/Oak Bay; Lower Dungeness Riparian Corridor; Nisqually Delta; Nisqually Reach; Penn Cove; Port Susan; Quartermaster Harbor; Sequim Bay; The Great Bend; Totten Inlet.

127 La Perouse Bank; North Olympic Marbled Murrelet; Olympic Continental Shelf; Point No Point; Port Angeles Harbor/Ediz Hook; Port Angeles Marbled Murrelet; Protection Island; Samish/Padilla Bays; Skagit Bay.

128 Carmanah Walbran Forest; Greater Vancouver Watershed; Jervis Inlet/McRae Islet; McFadden Creek Heronry; Pacific Spirit Regional Park; Snake Island.

129 Desolation Sound.

130 Active Pass; Amphitrite and Swiftsure Banks; Barkley Sound; Chain Islets & Great Chain Island; Cowichan Estuary; Little Qualicum Estuary to Nanoose Bay; White Islets and Wilson Creek.

131 Mitlenatch Island.

132 English Bay & Burrard Inlet; Porlier Pass.

133 Boundary Bay — Roberts Bank — Sturgeon Bank (Fraser River Estuary); K'omoks; Mandarte Island; Sidney Channel.

134 16 USC 703. Note also the *North American Waterfowl Management Plan between Canada and the United States*.

135 D Bertram “Estimation of Coast-Wide Population Trends of Marbled Murrelets in Canada” (2015) 10(8) PLoS ONE 545–563; L Vilchis and others “Assessing Ecological Correlates of Marine Bird Declines to Inform Marine Conservation” (2015) 29(1) Conservation Biology 154–163; A Miller and others “Brominated Flame Retardant Trends in Aquatic Birds from the Salish Sea Region” (2015) 502 Science of the Total Environment 60–69; T Hanson *Washington State Status Report for the Tufted Puffin* (Washington Department

On the United States side of the Salish Sea, a Biosphere Reserve was created in the Olympic National Park in 1976. Canada’s Biosphere site at Mount Arrowsmith was inscribed in the year 2000. This Biosphere Reserve, with a mixed population of Coast Salish First Nations and European immigrants, is located on the east coast of Vancouver Island in British Columbia. It is close to the Clayoquot Sound Biosphere Reserve, located on the other side of the island. The Biosphere Reserve includes the entire watershed draining the area and management focuses on the maintenance of healthy aquatic, coastal estuarine and intertidal ecosystems. The area is on the Pacific migratory bird flyway. The endangered Vancouver Island marmot and Vancouver Island white-tailed ptarmigan occur in alpine habitats and two endemic species of stickleback occur in one freshwater lake.¹³⁶

In terms of bilateral importance, the governments of Washington State and British Columbia have been actively working together since 1992, through their agreed Environmental Cooperation Agreement, on marine issues in the Salish Sea.¹³⁷ This bilateral work is strongly supplemented by unilateral conservation work dating back over a century during which time multiple areas have been recognised for their conservation importance. In terms of sites which have already been recognised as being of national, regional or local importance, on the British Columbia side there are two sites of national importance,¹³⁸ nine

of Fish and Wildlife, Olympia, Washington, 2015) at 3–5; J Adkins and others “Recent Population Size, Trends and Limiting Factors for the Double Crested Cormorant in Western North America” (2014) 78(7) *The Journal of Wildlife Management* 213–243; S Miller “Recent Population Decline of the Marbled Murrelet in the Pacific Northwest” (2012) 114(4) *The Condor* 290–312; J Gaydos and others “Birds and Mammals that Depend on the Salish Sea: A Compilation” (2011) 92(2) *Northwestern Naturalist* 213–230; K Elliot “Density Dependence in the Survival and Reproduction of Bald Eagles: Linkages to Chum Salmon” (2011) 75(8) *The Journal of Wildlife Management* 1688–1699; J Bower “Changes in Marine Bird Abundance in the Salish Sea: 1975 to 2007” (2009) 37 *Marine Ornithology* 9–17.

136 UNESCO *Report of the meeting of the Bureau of the International Co-ordinating Council for the Programme on Man and the Biosphere (MAB), Paris, 22–24 June 1976* (UNESCO, Paris, 1976) at 14–17.

137 C Brown “Scale and Subnational Resource Management: Transnational Initiatives in the Salish Sea Region” (2015) 32(1) *Review of Policy Research* 60–73; S Kristensen “Capacity for Watershed Cumulative Effects Assessment and Management: Lessons from the Lower Fraser River” (2013) 52(2) *Environmental Management* 100–115.

138 The two national parks located in the Salish Sea region of BC are the Gulf Islands National Park Reserve of Canada (2003) and the Pacific Rim National Park Reserve (1970).

national parks and 52 provincial parks,¹³⁹ 16 identified ecological reserves¹⁴⁰ and three wildlife management areas,¹⁴¹ all in, or adjacent to, the Salish Sea. On the American side of the Salish Sea, including the Puget Sound, there exist six sites of national importance. These are divided into two national parks and

- 139 Anderson Bay Provincial Park (2000); Apodaca Provincial Park (1954); Arbutus Grove Provincial Park (1966); Bellhouse Provincial Park (1964); Bodega Ridge Provincial Park (2001); Boyle Point Provincial Park (1989); Buccaneer Bay Provincial Park (1989); Burgoyne Bay Provincial Park (2004); Collision Point Provincial Park (2004); Copeland Islands Marine Provincial Park (1971); Dionisio Point Provincial Park (1991); Discovery Island Marine Provincial Park (1972); Drumberg Provincial Park (1971); Fillongley Provincial Park (1954); Francis Point Provincial Park (2004); French Beach Provincial Park (1974); Gabriola Sands Provincial Park (1960); Gowlland Tod Provincial Park (1995); Halkett Bay Provincial Park (1988); Hardy Island Marine Provincial Park (1992); Helliwell Provincial Park (1966); Jedediah Island Marine Provincial Park (1995); Juan de Fuca Provincial Park (1996); Kin Beach Provincial Park (1966); Kitty Coleman Beach Provincial Park (1944); Miracle Beach Provincial Park (1950); Mitenatch Island Nature Provincial Park (1961); Montague Harbour Provincial Park (1959); Mount Erskine Provincial Park (2007); Mount Geoffrey Escarpment Provincial Park (2004); Newcastle Island Marine Provincial Park (1961); Peace Arch Provincial Park (1939); Petroglyphs Provincial Park (1948); Pirates Cove Marine Provincial Park (1968); Plumper Cove Marine Provincial Park (1960); Rath Trevor Beach Provincial Park (1967); Roberts Memorial Provincial Park (1980); Rosewall Creek Provincial Park (1956); Ruckle Provincial Park (1974); Sabine Channel Marine Provincial Park (2001); Sandy Island Marine Provincial Park (1966); Sandwell Provincial Park (1988); Sargeant Bay Provincial Park (1990); Simson Provincial Park (1986); Smelt Bay Provincial Park (1973); Smuggler Cove Marine Provincial Park (1971); South Texada Island Provincial Park (1997); Squitty Bay Provincial Park (1988); Tribune Bay Provincial Park (1978); Wakes Cove Provincial Park (2002); Wallace Island Marine Provincial Park (1990); Whaleboat Island Marine Provincial Park (1981).
- 140 Ballingall Islets Ecological Reserve (1963); Bowen Island Ecological Reserve (1973); Canoe Islets Ecological Reserve (1971); Francis Point Ecological Reserve (2004); Galiano Island Ecological Reserve (1990); Hudson Rocks Ecological Reserve (1996); Lasqueti Island Ecological Reserve (1971); Mount Maxwell Ecological Reserve (1972); Mount Tuam Ecological Reserve (1971); Oak Bay Islands Ecological Reserve (1979); Race Rocks Ecological Reserve (1980); Rose Islets Ecological Reserve (1971); San Juan River Estuary Ecological Reserve (1996); Satellite Channel Ecological Reserve (1975); Ten Mile Point Ecological Reserve (1975); Trial Islands Ecological Reserve (1990).
- 141 Boundary Bay Wildlife Management Area (1995); South Arm Marshes Wildlife Management Area (1991); Sturgeon Bank Wildlife Management Area (1998).

four national wildlife refuges.¹⁴² In addition, there are 69 state parks which are in, or buttress, the Salish Sea.¹⁴³ There are also 42 marine protected areas,¹⁴⁴ which are broken into three natural area preserves,¹⁴⁵ 10 conservation areas,¹⁴⁶

- 142 The national parks include: Olympic National Park (1938); San Juan Islands National Monument (2013). The national wildlife refuges include: San Juan Islands National Wildlife Refuge (1976); Flattery Rock National Wildlife Refuge (1907 & 1940); Dungeness National Wildlife Refuge (1915); Nisqually National Wildlife Refuge (1974).
- 143 These 69 state parks were chosen based on their proximity to the Salish Sea. Anderson Lake State Park; Bay View State Park (1925); Belfair State Park (1952); Birch Bay State Park; Blake Island State Park (1974); Blind Island State Park; Cama Beach State Park (2008); Camano Island State Park (1949); Clark Island State Park; Cone Island State Park; Cutts Island State Park; Dash Point State Park (1962); Deception Pass State Park (1923); Doe Island State Park; Dosewallips State Park; Dot Rock State Park; Eagle Island State Park; Fort Casey State Park (1980); Fort Ebey State Park; Fort Flagler State Park (1976); Fort Townsend State Park (1953); Fort Worden State Park (1955); Freeman Island State Park; Hope Island State Park — Skagit County; Hope Island State Park — Mason County; Illahee State Park (1934–1954); James Island State Park (1964); Jarrell Cove State Park (1953–1969); Joemma Beach State Park (1961 & 1995); Jones Island State Park (1983); Joseph Whidbey State Park; Kinney Point State Park; Kitsap Memorial State Park; Kopachuck State Park; Larrabee State Park (1923); Lime Kiln Point State Park (1984); Manchester State Park; Matia Island State Park (1959); McMicken Island State Park; Moran State Park (1921); Mukilteo State Park; Mystery Bay State Park; Obstruction Pass State Park; Old Man House State Park (1990); Olga Marine State Park; Patos Island State Park; Penrose Point State Park; Pleasant Harbor State Park; Posey Island State Park; Potlatch State Park; Reid Harbor State Park; Saddlebag Island State Park; Saint Edwards State Park; Saltwater State Park (1926); Scenic Beach State Park; Sequim Bay State Park; Shine Tidelands State Park (1967); Skagit Island State Park; Skull Island State Park; South Whidbey State Park (1974); Spencer Spit State Park (1967); Stretch Point State Park; Stuart Island State Park (1952–1975); Sucia Island State Park (1952 & 1972); Tolmie State Park; Triton Cove State Park (1990); Turn Island State Park; Twanoh State Park; Victim Island State Park.
- 144 NOAA *The Marine Protected Areas Inventory* (NOAA, Washington, 2014); Washington Department of Fish and Wildlife *Marine Protected Areas within Puget Sound* (WDFW, Washington, 2015).
- 145 Dabob Bay Natural Area Preserve (1987); Kennedy Creek Natural Area Preserve (1990); Skookum Inlet Natural Area Preserve (1986).
- 146 Brackett’s Landing Shoreline Sanctuary Conservation Area (1970); City of De Moines Park Conservation Area (1998); Keystone Conservation Area (2002); Octopus Hole Conservation Area (1998); Orchard Rocks Conservation Area (1998); Saltar’s Point Beach Conservation Area (2000); South 239th Street Park Conservation Area (1998); Sund Rock Conservation Area (1994); Waketickeh Creek Conservation Area (2000); Woodard Bay Natural Resources Conservation Area (1987).

16 marine preserves,¹⁴⁷ seven aquatic reserves,¹⁴⁸ eight underwater parks,¹⁴⁹ two fish management areas,¹⁵⁰ two sanctuaries¹⁵¹ and one wildlife area.¹⁵²

These existing conservation agreements are needed in the attempt to conserve over 250 different species of fish, 172 species of bird, 38 different species of marine mammal and over 3,000 different species of invertebrates that the Salish Sea is home to. The invertebrates alone include the world's largest burrowing clam, largest chiton, largest barnacle, tallest anemone and the giant Pacific octopus which, weighing in at up to 68 kilograms, is the world's largest octopus. Beneath the invertebrates, it is estimated there are a further 3,000-plus species of macro-invertebrates.¹⁵³

Of these species, 119 are of conservation concern and are listed on either regional or national registers in either the United States or Canada.¹⁵⁴ In addition, many of the species (29 types of marine mammals and 73 types of birds) are highly dependent upon this particular ecosystem and its highly interrelated food webs. Thus, if one species (from the top to the bottom of the food chain) is removed, knock-on effects follow for the species with high

147 Admiralty Head Marine Preserve (2002); Argyle Lagoon San Juan Islands Marine Preserve (1990); Carkeek Park Marine Preserve (2005); Colvos Passage Marine Preserve (2000); Discovery Park Marine Preserve (2005); Emma Schmitz Memorial Marine Preserve (2005); False Bay San Juan Islands Marine Preserve (1990); Friday Harbor San Juan Islands Marine Preserve (1990); Golden Gardens Park Marine Preserve (2005); Lincoln Park Marine Preserve (2005); Richey Viewpoint Marine Preserve (2005); San Juan County/Cypress Island Marine Biological Preserve (1923); Shaw Island San Juan Islands Marine Preserve (1990); Titlow Beach Marine Preserve (1994); Yellow and Low Islands San Juan Islands Marine Preserve (1990); Zee's Reef Marine Preserve (2002). Six of these Marine Preserves are owned by the City of Seattle.

148 Cherry Point Aquatic Reserve (2000); Cypress Island Aquatic Reserve (2000); Fidalgo Bay Aquatic Reserve (2000); Maury Island Aquatic Reserve (2000); Nisqually Reach Aquatic Reserve (2011); Protection Island Aquatic Reserve (2010); Smith and Minor Island Aquatic Reserve (2010).

149 Blake Island Underwater Park (1970); Deception Pass Underwater Park (1970); Kopachuck Underwater Park (1971); Fort Casey Underwater Park (1970); Fort Ward Underwater Park (1970); Fort Worden Underwater Park (1977); Saltwater Underwater Park (1970); Tolmie Underwater Park (1971).

150 Haro Strait Special Management Fishery Area (1972); San Juan Channel and Upright Channel Special Management Fishery Area (1972).

151 Tongue Point Marine Life Sanctuary (1989); Zella M Schultz/Protection Island Seabird Sanctuary (1975).

152 South Puget Sound Wildlife Area (1988).

153 Benedict and Gaydos *The Salish Sea: Jewel of the Pacific Northwest*, above n 118, at 65–72; Puget Sound Institute *Puget Sound Fact Book* (University of Washington, Tacoma, 2015) at 92–97; J Downing *The Coast of Puget Sound* (University of Washington Press, Seattle, 1983) at 7–11.

154 J Gaydos and J Zier "Species of Concern Within the Salish Sea Nearly Double Between 2003 and 2013" (Salish Sea Conference, 2014, referenced in Puget Sound Institute *Puget Sound Fact Book*, above n 153, at 78).

dependency. Some species, such as salmon, are particular keystones, with up to 138 different terrestrial and marine species being dependent on the existence of these animals.¹⁵⁵

The Salish Sea is utilised by 38 different species of mammal including, amongst others, the black-tailed deer, red fox, both black and brown bear, mink, river otter, beaver and muskrat. Marine mammals of note include the stellar sea lion and the harbour seal. The large cetaceans that are the grey, humpback and minke whales are present, as are the small cetaceans that are the harbour porpoise, short-beaked common dolphin and Pacific white-sided dolphin. Although many of these species are of conservation concern, one sub-species in particular, the iconic resident pods of killer whales around the San Juan Islands, known as the southern resident killer whale (SRKW), are of particular conservation concern. The SRKW represent the smallest of four resident sub-species of killer whale within the eastern North Pacific Ocean. The SRKW comprises three pods (termed J, K and L). Although the group rebuilt to 97 animals in 1996, it has subsequently fallen to 82. Due to such depleted numbers, SRKW are recognised as an endangered species in both the United States and Canada, and both countries have agreed to protect both them and their critical habitat. The southwest portion of San Juan Island is important for foraging and the southwest of Lopez Island is important for resting, as is the south and west of Henry Island. One pod (L) appears to frequent the area in the Strait of Juan de Fuca south of Vancouver Island. The habitat which encompasses part of the Haro Strait is particularly critical.¹⁵⁶

The Salish Sea is also home to over 250 different species of fish. The most renowned of these is salmon. The Salish Sea supports all five species of Pacific salmon (pink, sockeye, coho, chum, chinook) as well as three other closely related anadromous fish species (bull trout, steelhead and cutthroat). All seven spawn in fresh water and feed, grow and mature in marine waters. During their transition from fresh water to salt water, juvenile salmon occupy near-shore ecosystems. This period of near-shore residence is critical to the viability,

155 L Vilchis and others “Assessing Ecological Correlates of Marine Bird Declines to Inform Marine Conservation” (2015) 29(1) *Conservation Biology* 154–163; J Gaydos and others “Birds and Mammals that Depend on the Salish Sea: A Compilation” (2011) 92(2) *Northwestern Naturalist* 213–230; National Marine Fisheries Services *The Effects of Salmon Fisheries on Southern Resident Killer Whales: Final Report of the Independent Science Panel* (NOAA, Seattle, 2012) at 3–4; K Elliot and others “Density-Dependence in the Survival and Reproduction of Bald Eagles: Linkages to Chum Salmon” (2011) 75(8) *The Journal of Wildlife Management* 1688–1699.

156 NOAA *Southern Resident Killer Whales: Ten Years of Research and Conservation* (NOAA, Washington, 2014) at 3; C Wong “Health of the Salish Sea as Measured Using Transboundary Ecosystem Indicators” (2014) 17(4) *Aquatic Ecosystem Health & Management* 463–471; National Marine Fisheries Service *Southern Resident Killer Whales: Five Year Review* (NMFS, Seattle, 2011) at 5.

persistence and abundance of all of the salmon species. Cooperation through bilateral treaties between the United States and Canada to conserve such salmon species dates to 1945, although this cooperation was subsequently updated with the 1985 Pacific Salmon Treaty.¹⁵⁷ Despite such cooperation, chinook and coho salmon abundances have declined rapidly in recent decades to such an extent that coho is designated as endangered and is now subject to strict conservation measures. Chinook salmon is also subject to conservation concern after falling in abundance by 60 per cent since 1984, with just over 485,000 individuals reported to be in the Salish Sea. Although some sub-populations seem to be stabilising, this is not the overall trend. Both they and their critical habitat including, amongst others, estuaries, floodplains, riparian areas and particularly important near-shore areas, are protected, conserved and subject to restoration.¹⁵⁸

At the other end of the spectrum of fish species are the Pacific herring and Pacific sand lance, which are smaller forage species which exist as critical cogs within the overall ecosystem. Some species, like herring, spawn in only a few geographically distinct areas, whereas others, such as surf smelt and sand lance, have widespread spawning grounds, although some areas are much more important than others. There is only limited scientific knowledge about most of these forage species. Nonetheless, evidence suggests that many of these species are already at, or close to, sustainable limits of take.¹⁵⁹

Other marine species which are recognised as endangered within the Salish Sea and are also given the protection of critical habitat conservation include yelloweye rockfish, canary rockfish, the Salish sucker, and bocaccio. Critical habitat has also been designated for the Puget Sound steelhead, as well as for the culturally important eulachon which had experienced widespread decline and possible extirpation in some river systems. As a sign of the seriousness of the need to conserve these species, more than 20 years after the Congress of

157 Public Law 99-5, Approved 15 March 1985, 99 Stat 7.

158 C Holt "Cautions On Using Percentile-Based Benchmarks of Status For Data-Limited Populations of Pacific Salmon" (2015) 171 *Fisheries Research* 321-330; G Ruggerone "Productivity and Life History of Sockeye Salmon" (2015) 72(6) *Canadian Journal of Fisheries and Aquatic Sciences* 239-249; Puget Sound Partnership *The 2012 State of the Sound: A Biennial Report on the Recovery of Puget Sound* (PSP, Seattle, 2012) at 22, 24; C Holt "Evaluating Benchmarks of Population Status for Pacific Salmon" (2011) 31(20) *North American Journal of Fisheries Management* 456-467; T Gregory and others "Magnitude and Trends in Abundance of Pacific Salmon" (2010) 2(1) *Marine and Coastal Fisheries* 17-30; K Fresh *Juvenile Pacific Salmon in Puget Sound* (Puget Sound Nearshore Partnership, Technical Report 2006-06, 2006).

159 T Quinn "Patterns of Surf Smelt: Intertidal Spawning Habitat Use in Puget Sound" (2012) 35(5) *Estuaries and Coasts* 1214-1228; G Williams and others "Rockfish in Puget Sound" (2010) 34 *Marine Policy* 1010-1020; T Therriault "Biological Overview and Trends in Pelagic Forage Fish Abundance in the Salish Sea" (2009) 37 *Marine Ornithology* 3-8.

the United States passed the Elwha Ecosystem and Fisheries Restoration Act in 1992, the largest dam removal project in the world was completed, opening up 70 miles of spawning habitat to steelhead and all five species of Pacific salmon.¹⁶⁰

Beneath the ocean surface, the area is complemented by a plethora of rich habitats. Vital kelp forests (up to 20 metres in length) and eelgrass habitats provide everything from food to protection. Over 80 per cent of the region’s commercially important fish, as well as species of shellfish, are dependent upon these two habitats. These habitats also directly support estuarine productivity and improve water quality through the production of oxygen and absorption of nutrients, and sequestration of greenhouse gases. Finally, ancient glass sponge reefs, which may reach heights of 15 metres or more, also offer a refuge for juvenile rockfish and other small marine mammals. Easily damaged by human activities due to their glass-like fragility, sponge reefs are exceedingly rare and under consideration for marine protected status.¹⁶¹

7.2 Economic, Cultural and Scientific Criteria

The total economic value of the Salish Sea, when all of the values of the wider ecosystem (such as the economic value of carbon sequestration, disturbance regulation and waste filtration), as well as the more conventional economic benefits related to industries, such as tourism and fisheries, are combined, would be close to USD 100 billion per year. The economic activity associated with each of the major ports of Seattle and Vancouver is also probably in excess of

160 Y Cheng and others “Evaluation of Creel Survey Methods to Estimate Recreational Harvest of Surf Smelt in Puget Sound” (2015) 35(3) *North American Journal of Fisheries Management* 56–77; NOAA *Designation of Critical Habitat for the Distinct Populations of Segments of Yelloweye Rockfish, Canary Rockfish and Bocaccio* (NOAA, Washington, 2014) at 1–15; D Penttila *Marine Forage Fishes in Puget Sound* (Puget Sound Nearshore Partnership, Technical Report 2007-03, 2007) at 4–9; C Rice “Effects of Shoreline Modification on a Northern Puget Sound Beach: Microclimate and Embryo Mortality in Surf Smelt” (2006) 29(1) *Estuaries and Coasts* 303–330.

161 Benedict and Gaydos *The Salish Sea: Jewel of the Pacific Northwest*, above n 118, at 34–35; G Jamieson *Identification of Ecologically and Biologically Significant Areas on the West Coast of Vancouver Island and the Strait of Georgia* (Canadian Science Advisory Secretariat, Document 2014/101, BC, 2014) at 33; S Yang “Relative Impacts of Natural Stressors on Life History Traits Underlying Resilience of Intertidal Eelgrass” (2013) 36(5) *Estuaries and Coasts* 198–214; C Harvey and others “Food Web Structure and Trophic Control in Central Puget Sound” (2012) 35(3) *Estuaries and Coasts* 234–254; H Shipman *A Geomorphic Classification of Puget Sound Nearshore Landforms* (Puget Sound Nearshore Partnership, Technical Report 2008-01, 2008) at 1–4; T Mumford *Kelp and Eelgrass in Puget Sound* (Puget Sound Nearshore Partnership, Technical Report 2007-05, 2007) at 3–4.

USD 100 billion each year.¹⁶² Despite the attraction of these large numbers, the economic focus for PSSAs is more to do with tourism and resource extraction from the marine environment, which could be lost if there was an accident in the region. Although final figures would depend on what type and scale of accident it was, and where it was, the expectations are that the impact could cost billions of dollars to fix and would result in the loss of thousands of jobs.¹⁶³

In terms of tourism, British Columbia nets some CAD 13.4 billion in tourism per year, whilst Washington State nets about USD 17 billion per year. In terms of the two largest cities, about 10 million people visit Seattle each year, whilst 8.2 million visit Vancouver, generating some CAD 4.7 billion in related spending, whilst Vancouver Island welcomes 3.8 million tourists and their CAD 1.3 billion in spending.¹⁶⁴ As regards direct nature-related tourism, per year, some 3,243,000 visitors come to the Olympic World Heritage area (generating USD 263 million), 269,000 visitors to the San Juans (generating USD 15 million) of the Klondike National Park (generating USD 3.5 million). When added together, and depending on what is counted, the total value from nature-related tourism is probably about USD 4 billion, per year, although it could be much higher. Collectively, perhaps 200,000 jobs are tourism dependent in this region. There are over 122 kayak companies servicing over 70,000 visitors per year, with annual revenue of USD 20 million. There are over 400,000 people per year coming just to see the birds and at least 500,000 go whale-watching via 47 different companies (which net close to USD 25 million per year). On the Canadian side, some 24,000 scuba divers utilise the Salish Sea each year, of which a similar number could be expected in Washington State.¹⁶⁵

162 See David Suzuki Foundation *Nearshore Natural Capital Valuation* (Earth Economics, Tacoma, 2011); also Martin Associates *The 2013 Economic Impact of the Port of Seattle* (Martin Associates, Seattle, 2014) at 1–5.

163 Department of Ecology/Puget Sound Partnership *Improving Oil Spill Prevention and Response in Washington State: Lessons Learned From the BP Deepwater Horizon Oil Spill* (DoE, Publication Number: 11-08-002, 2011) at 7.

164 Destination British Columbia *Regional Tourism Profile — Vancouver Island* (DBC, Vancouver, 2015) at 1–7; British Columbia Statistics *Tourism Indicators* (British Columbia, Vancouver, 2014) at 3–6.

165 Earth Economics *Economic Analysis of Outdoor Recreation in Washington* (Earth Economics, Tacoma, 2015) at 4–6; Raincoast Conservation Foundation *What's At Stake? The Cost of Oil to British Columbia's Priceless Coast* (RCF, Sidney, British Columbia, 2015) at ch 4; National Park Service *2014 National Park Visitor Spending Effects* (Natural Resource Report NPS/NRSS/EQD/NRR—2015/947, 2015) at 17–21; P Edwards “The Economic Value of Viewing Migratory Shorebirds on the Delaware Bay: An Application of the Single Site Travel Cost Model Using On-Site Data” (2011) 16 *Human Dimensions of Wildlife* 435–444; R Dolesh “Assessing the Value of Feathered Workers: Birds Perform a Multitude of Services that Contribute to Our Well-Being” (2011) 25(4) *Birder's World* 12–20; Dean Runyan Associates *The Economic Impacts to Visitors of Washington State Parks* (Washington State Parks and Recreation Commission, Olympia, Washington, 2009);

Ship and boat building, maintenance, logistics, fishing and seafood processing are the oldest and most established sectors in both Washington State and British Columbia. The total value of these industries is in excess of USD 15 billion per year. The economic value of seafood extraction from the Salish Sea, the sector in Georgia Strait and its 41 commercial, recreational and First Nations fisheries areas is worth around USD 790 million to provincial GDP, and is responsible for about 12,900 full-time workers. In Washington, commercial and recreational fishing directly and indirectly supports an estimated 16,300 jobs and in excess of USD 540 million in personal income. Support for the recreational fishing (and the 824,000 anglers in Washington State) provides for over 13,000 of these jobs. The commercial fishery landings total about USD 110 million per year. In addition, between 1990 and 2010, over 30.4 million pounds of fish and shellfish were kept for personal use by commercial fishing vessels whose homeports were within the Puget Sound. This majority of this, some 85 per cent, was for tribal fishermen, and probably has a value in excess of USD 50 million per year.¹⁶⁶

The cultural values of the Salish Sea are exemplary. The “Salish” Sea is a name, accepted by both Washington State and British Columbia, to honour the Coast Salish, who were the first people to live in the region. These people who lived on the coast of western Washington and British Columbia are known collectively after the name of the 14 related languages, as spoken in the 19th century, which they shared. Their history in this area is very deep. As President Obama explained when he declared the San Juan Islands a National Monument in 2013:¹⁶⁷

The islands are part of the traditional territories of the Coast Salish people. Native people first used the area near the end of the last glacial period, about 12,000 years ago. However, permanent settlements were relatively uncommon until the last several hundred years. The Coast Salish people often lived in villages of wooden-plank houses and used numerous smaller sites for fishing and harvesting shellfish. In addition to collecting edible plants, and hunting various birds and mammals, native people used fire to maintain meadows of

B Kriete *Orcas in Puget Sound* (Puget Sound Nearshore Partnership, Technical Report 2007-01, 2007) at 3–5.

166 Puget Sound Institute *Puget Sound Fact Book*, above n 153, at 22, 24; M Molnar and others *Valuing the Aquatic Benefits of British Columbia’s Lower Mainland: Nearshore Natural Capital Valuation* (David Suzuki Foundation and Earth Economics, Vancouver and Tacoma, 2012) at 19, 44–45; TCW Economics *Economic Analysis of the Non-Treaty Commercial and Recreational Fisheries in Washington State* (TCW, Sacramento, 2008) at 3–6.

167 The White House “Presidential Proclamation on the San Juan Islands as a National Monument” (25 March 2013) at <<https://www.whitehouse.gov/the-press-office/2013/03/25/presidential-proclamation-san-juan-islands-national-monument>>.

the nutritionally rich great camas. Archaeological remains of the villages, camps, and processing sites are located throughout these lands, including shell middens, reef net locations, and burial sites. Wood-working tools, such as antler wedges, along with bone barbs used for fishing hooks and projectile points, are also found on the islands. Scientists working in the San Juan Islands have uncovered a unique array of fossils and other evidence of long-vanished species. Ancient bison skeletons (10,000–12,000 years old) have been found in several areas, indicating that these islands were an historic mammal dispersal corridor. Butcher marks on some of these bones suggest that the earliest human inhabitants hunted these large animals.

In contemporary times, the naming, division and identities for indigenous communities around this area is a matter of debate. This has been complicated by sovereign boundaries between countries and political divisions within them, both of which are not easy to reconcile with the cosmologies, genetics and tribal interconnections that originally built these relationships.¹⁶⁸ Nonetheless, it is estimated that on the Canadian side of the border, there are 31,600 Coast Salish. On the side of the United States, the figure is 31,700. These numbers then divide into 19 federally recognised tribes on the American side of the border (with 15 tribes bordering the sea). The Makah Indian Tribe does not identify as Coast Salish but they reside around Neah Bay, Washington and a small fishing village along the Strait of Juan de Fuca.¹⁶⁹ There are 55 Coast Salish tribes on the Canadian side. Of the 55 tribes, 24 of these groups inhabit the Fraser River Valley and lower Fraser Canyon. The Hoh and Quileute do not consider themselves to be Coast Salish, but they are situated along the Pacific Coast on the Olympic Peninsula. Many of these tribes are directly connected

168 B Tucker “Decolonising the Map? Toponymic Politics and the Rescaling of the Salish Sea” (2015) 59(2) *The Canadian Geographer* 100–119; M Marker “Geographies of Indigenous leaders: Landscapes and mindscapes in the Pacific Northwest” (2015) 85(2) *Harvard Educational Review* 78–100; B Miller “Life on the Hardened Border” (2012) 32(2) *American Indian Culture and Research Journal* 170–182; B Miller *Invisible Indigenes: The Politics of Nonrecognition* (University of Nebraska Press, Lincoln, 2003); A Harmon *Indians in the Making: Ethnic Relations and Indian Identities Around Puget Sound* (University of California Press, California, 1998) at 34–54, 67–88, 100–108; W Elmendorf “Coast Salish Status Rankings and Intergroup Ties” (1971) 27(4) *Southwestern Journal of Anthropology* 353–380; W Suttles “Aboriginal Ties, Subsistence and Prestige Amongst the Coast Salish” (1960) 62(2) *American Anthropologist* 296–305.

169 These include the Chehalis; Cowlitz; Duwamish Quinault; Jamestown S’Klallam; Lower Elwha Klallam; Lummi; Makah; Muckleshoot; Nisqually; Nooksack; Port Gamble S’Klallam; Puyallup; Samish; Sauk-Suiattle; Skokomish; Snohomish; Snoqualmie; Stillaguamish; Squaxin Island; Swinomish; Suquamish; the Tulalip Tribes; and the Upper Skagit Indian Tribes. Note: additional tribal communities without federal recognition also have claims in this area; see T Norris *The American Indian and Alaska Native Population: The 2010 Census Briefs* (US Department of Commerce, Washington, 2012) at 17.

to the ocean and/or particular species in terms of geographical proximity, as well as in terms of sites of both tangible and intangible importance reflecting intimate relationships which go back up to 10,000 years.¹⁷⁰ Many of these sites are recognised in both original treaties with the individual tribes, and/or as standalone areas under independent national legislation. For example, there are two historical sites of national importance on the Washington side of the Puget Sound, which includes Ebey’s Landing National Historical Reserve (1978) and San Juan Island National Historical Park (1966). In British Columbia, there are four national historic sites.¹⁷¹ There are also over 900 registered historic sites in the Salish Sea¹⁷² (over 500 in Canada and 420 in Washington) and 19 reef-net sites (14 in Canada, five in Washington).¹⁷³

In the case of the Salish Sea, scientific research in the area dates to, at least, the turn of the 20th century with studies on fisheries and salmon. Since then, scholarship into all areas of the sea has proliferated as have the number of agencies engaged in such scholarship. To date, nine federal-based organisations do scientific research in the Salish Sea,¹⁷⁴ eight authorities are engaged at the provincial/state level,¹⁷⁵ and four universities in Canada and six universities in

- 170 I McKechnie and others “Archaeological Data Provide Alternative Hypotheses on Pacific Herring” (2014) 111(9) *Proceedings of the National Academy of Sciences of the United States of America* 345–363; E Norman “Cultural Politics and Transboundary Resource Governance in the Salish Sea” (2012) 5(1) *Water Alternatives* 138–160; B Miller (ed) *Be of Good Mind: Essays on the Coast Salish* (2010, University of British Columbia Press, Vancouver, 2010) at 1, 12, 31; J Gaydos and others “Evaluating Threats in Multinational Marine Ecosystems: A Coast Salish Fish Nations and Tribal Perspective” (2015) 10(12) *Plos ONE* e0144861; B Thom “The Paradox of Boundaries in Coast Salish Territories” (2009) 16(2) *Cultural Geographies* 179–205; R Ruby and J Brown *A Guide to the Indian Tribes of the Pacific Northwest* (University of Oklahoma Press, Norman, 1992) at 84, 106–108, 111, 125–128, 133, 150, 152, 164, 166, 178–179, 181, 185, 187, 209, 211, 212, 221.
- 171 The four national historic sites include: Figgard Lighthouse National Historic Site (1958); Fort Rodd Hill National Historic Site (1958); Gulf of Georgia Cannery National Historic Site (1994); Stanley Park National Historic Site (1988).
- 172 See the Sencoten Alliance Traditional Use and Occupancy Study citing BC Archaeology Branch and Washington State Department of Archaeology and Historic Preservation. Mapped by Trailmark Systems, QGIS 2015.
- 173 See 2002 Sencoten Alliance GSX Study (Tsayout data only), 2014 Tsawout Marine Use Study and 2012 Parks Canada Traditional Use Study.
- 174 US Environmental Protection Agency, US National Oceanic and Atmospheric Administration, US Geological Survey’s Western Fisheries Research Center; Bureau of Land Management, San Juan Islands National Monument; Environment Canada; Canada Department of Fisheries and Oceans; Transport Canada, Pacific Pilotage Authority Canada; Parks Canada and the Gulf Islands National Park Reserve.
- 175 British Columbia Ministry of Environment, Institute of Marine Science; the Vancouver Island Health Authority; BC Parks; Puget Sound Partnership; Washington Department of Ecology; Washington Department of Fish and Wildlife; Washington Department of Natural Resources; Washington State Parks.

the United States conduct research into the Salish Sea area, with the earliest being the University of Washington which began its Friday Harbor Laboratory (in the San Juan Islands) in 1903.¹⁷⁶ Most of the tribes conduct their own contemporary and traditional scientific studies of the region, of which the Salish Sea Marine Survival Project is most notable. Contemporary research which is evolving from baseline studies, such as that around acidification and climate change, is second to none due to the unique sensitivities of both the ecosystems, species and indigenous peoples.¹⁷⁷

8. CONCLUSION

The question that this article has sought to answer is what does the term “sensitive” mean within the concept of a Particularly Sensitive Sea Area. Then, once this answer was adduced, the goal was to see how these standards would work as benchmarks, against prospective, future, PSSAs. For that purpose, the Salish Sea was selected for the case study.

The clearest way that the ecological values of a potential PSSA site can be recognised is via its prior recognition as accorded by other reputable international or regional bodies which deal with the same question. The four international fora which currently examine such matters of ecological quality

176 Other universities engaged in this area include Northwest Indian College, Western Washington University, Washington State University, Evergreen State College and Seattle Pacific University. In Canada, the University of British Columbia, University of Victoria, Simon Fraser University and Royal Roads University are all active.

177 P Kilduff “Changing Central Pacific El Niños Reduce Stability of North American Salmon Survival Rates” (2015) 112(35) *Proceedings of the National Academy of Sciences* 440–453; R Haigh and others “Effects of Ocean Acidification on Temperate Coastal Marine Ecosystems and Fisheries in the Northeast” (2015) 10(2) *PLoS ONE* 54–78; T Okey and others “Effects of Climate Change on Canada’s Pacific Marine Ecosystems: A Summary of Scientific Knowledge” (2014) 24 *Reviews in Fish Biology and Fisheries* 519–560; D Grossman “Indigenous Community Health and Climate Change: Integrating Biophysical and Social Science Indicators” (2014) 42(4) *Coastal Management* 312–340; J Reum and others “Seasonal Carbonate Chemistry Covariation with Temperature, Oxygen, and Salinity in a Fjord Estuary: Implications for the Design of Ocean Acidification” (2014) 9(2) *PLoS ONE* 450–471; TA Okey and others *Climate Change Impacts and Vulnerabilities in Canada’s Pacific Marine Ecosystems* (CPAWS BC and WWF-Canada, Vancouver, 2012); S Alin and others “Coastal Carbon Synthesis for the Continental Shelf of the North American Pacific Coast (NACP): Preliminary Results” (2012) 5(1) *Ocean Carbon and Biogeochemistry News* 7–12; E Martins “Climate Effects on Growth, Phenology, and Survival of Sockeye Salmon” (2012) 22(4) *Review of Fish Biology and Fish* 887–914; T Reed and others “Time to Evolve? Potential Evolutionary Responses of Fraser River Sockeye Salmon to Climate Change and Effects on Persistence” (2011) 6(6) *PLoS ONE* 380–393.

are the World Heritage Convention, Special Areas as recognised by the IMO, wetlands of international importance under the 1971 Ramsar Convention, and Biosphere Reserves, as recognised by UNESCO. To date, seven PSSAs are closely associated with World Heritage sites. Special Areas are evident with at least three PSSAs, but only one PSSA site fully draws this relationship out. In comparison, the Salish Sea can claim credit with the Olympic National Park World Heritage area, and although the Salish Sea is not part of any Special Areas under Annexes I, II or V of the MARPOL, it is part of the Annex VI Emissions Control Area.

In terms of Ramsar sites, two PSSA sites have only Ramsar sites as their top internationally recognised areas. Biosphere Reserves are found in four PSSA sites. By comparison, the Salish Sea, with 172 species of birds, contains one of the most notable Ramsar sites globally, interlinked to 17 state-recognised Important Bird Areas and nine globally recognised IBAs. Many of these bird species are migrants and are linked into the Pacific Flyway. In addition, two Biosphere Reserves also exist in the Olympic National Park and at Mount Arrowsmith.

With regard to the possibility of showing ecological value with only national or bilateral designations (ie without World Heritage, Ramsar, Special Areas or Biosphere Reserves), two PSSAs have obtained recognition in this way. By comparison, even without the existing international designations in the Salish Sea, the area compares favourably in terms of species count (250 species of fish, 38 mammal species, 3,000-plus invertebrate species), iconic species (especially in terms of salmon and killer whales), numbers of protected areas and political cooperation.

In relation to cultural and economic criteria, the importance of the economic value of tourism related to all of the sites is now a primary concern. Secondary, but growing in importance, is the cultural values of a site. The Salish Sea is at the upper end of all of the existing PSSAs in terms of worth stemming from both tourism and marine resource extraction. Similarly, with cultural values, when viewed in terms of the traditional and contemporary importance placed upon the area by indigenous peoples, the Salish Sea is likely to exceed most, if not all, of the existing PSSAs in this area. Finally, with regard to a tradition of scientific and educational value, the Salish Sea is comparable with best international standards for PSSAs in this area with research dating back to the beginning of the 20th century. In terms of contemporary western, and indigenous, scientific research in the Salish Sea, the Salish Sea could be considered very good.