UNEP

CBD

Convention on Biological Diversity

Distr.
GENERAL

UNEP/CBD/SBSTTA/20/INF/56
1 April 2016

ENGLISH ONLY

SUBSIDIARY BODY ON SCIENTIFIC,
TECHNICAL AND TECHNOLOGICAL ADVICE
Twentieth meeting
Montreal, Canada, 25-30 April 2016
Item 4 of the provisional agenda*

A REVIEW OF MARINE MIGRATORY SPECIES AND THE INFORMATION USED TO DESCRIBE ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS

Note by the Executive Secretary

1. The Executive Secretary is circulating herewith, for the information of participants in the twentieth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, a report received from the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

2. The report was organized and prepared by the Global Ocean Biodiversity Initiative (GOBI) and by the Marine Geospatial Ecology Lab at Duke University, as commissioned by the CMS Office – Abu Dhabi.

3. The report reviews the results of the first nine regional workshops to facilitate the description of ecologically or biologically significant marine areas (EBSAs) under the Convention on Biological Diversity, which were considered by the eleventh and twelfth meetings of the Conference of the Parties to CBD. The review focused on information regarding the extent to which marine mammal, seabird, sea turtle, shark and ray migratory species listed under CMS (Appendices I and II) were covered in describing EBSAs. It also contained preliminary case studies on cetaceans, seabirds and marine turtles to explore the potential for the scientific data and information describing EBSAs to contribute to the conservation of migratory species in marine areas within and beyond the limits of national jurisdiction, particularly with respect to ecological networks and connectivity.

4. The report (document UNEP/CMS/COP11/Inf.23) was submitted for consideration to the 11th meeting of the Conference of the Parties to CMS (Quito, Ecuador, 4-9 November 2014). COP 11 to CMS noted the relevance of the EBSA criteria with regard to migratory species in UNEP/CMS/Resolution 11.25 on Advancing Ecological Networks to Address the Needs of Migratory Species. In the same resolution, the Parties to CMS were encouraged to engage in the ongoing work taking place within the Convention on Biological Diversity to develop EBSA descriptions, noting that CBD decision XI/17 states that the description of areas meeting the EBSA scientific criteria is an evolving process to allow for updates.

5. The information is provided in the form and language in which it was received by the Secretariat.

* UNEP/CBD/SBSTTA/20/1/Rev.1.

UNEP

CMS

CONVENTION ON MIGRATORY SPECIES

Distribution: General

UNEP/CMS/COP11/Inf.23
21 October 2014

Original: English

11th MEETING OF THE CONFERENCE OF THE PARTIES
Quito, Ecuador, 4-9 November 2014
Agenda Item 23.4.1

A REVIEW OF MARINE MIGRATORY SPECIES AND THE INFORMATION USED TO DESCRIBE ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS (EBSAS)

Summary:

Resolution 10.3 on The Role of Ecological Networks noted that processes underway within the Convention on Biological Diversity (CBD) can assist in identifying habitats important for the lifecycles of marine migratory species listed on CMS Appendices. The Global Ocean Biodiversity Initiative (GOBI) has undertaken a review with respect to marine migratory species of the CBD's process on Ecologically or Biologically Significant Marine Areas (EBSA). A draft Resolution taking note of the review can be found in document UNEP/CMS/COP11/Doc.23.4.1.1.

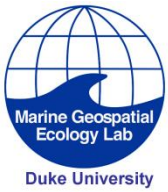
A REVIEW OF MARINE MIGRATORY SPECIES AND THE INFORMATION USED TO DESCRIBE ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT AREAS (EBSAS)

FINAL REPORT

Report prepared for:
The Convention on the Conservation of Migratory Species of Wild Animals (CMS)

Global Ocean Biodiversity Initiative (GOBI)
Prepared by:
Marine Geospatial Ecology Lab, Duke University
October 2014

This Review was commissioned by CMS Office – Abu Dhabi, which is generously hosted by Environment Agency – Abu Dhabi, on behalf of the Government of the United Arab Emirates. This Review was organized for the CMS Office – Abu Dhabi by the Global Ocean Biodiversity Initiative (GOBI) and was prepared for GOBI by the Marine Geospatial Ecology Lab at Duke University (http://mgel.env.duke.edu).



The geographic designations referred to in this report do not imply the expressions of any opinion whatsoever on the part of GOBI or the Convention on Migratory Species concerning the legal status of any country, territory or area, or area of its authorities, or concerning the delineation of its frontiers or boundaries.

Acknowledgements

We thank Lyle Glowka (CMS Office – Abu Dhabi), Jillian Grayson (formerly CMS Office – Abu Dhabi), Donna Kwan (CMS Office – Abu Dhabi), and David Johnson (GOBI) for helpful comments and guidance on this assessment and CMS Office –Abu Dhabi for financial support. We would like to acknowledge the numerous data providers and projects that helped with this assessment. We also are grateful to the many participants involved in the CBD EBSA process and those who contributed their time, data, and expertise on marine migratory species.

Suggested Citation

Kot, C.Y., P. Halpin, J. Cleary, D. Dunn. (2014) "A Review Of Marine Migratory Species and the Information Used to Describe Ecologically or Biologically Significant Areas (EBSAS)". Information document prepared by Global Ocean Biodiversity Initiative (GOBI) for the Convention on Migratory Species. Assessment conducted by Marine Geospatial Ecology Lab, Duke University.

Inquiries should be addressed to:
Patrick Halpin
Marine Geospatial Ecology Lab, Duke University
Durham, NC, USA
Telephone : +1 919 613 8062
Email : phalpin@duke.edu
Web : http://mgel.env.duke.edu

Table of Contents

Acknowledgements **2**

Abstract **5**

Introduction **6**

Methods **7**

Review of scientific data and information from the EBSA process **7**
Migratory species data role in the description of EBSAs **16**
Potential contribution of the scientific data and information within EBSA descriptions **18**

Results **19**

Review of scientific data and information from the EBSA process **19**
Migratory species data role in the description of EBSAs **20**
Potential contribution of the scientific data and information within EBSA descriptions **39**
Leatherback sea turtles 40
Green sea turtles 42
Humpback whales 42
Pediunkers / grey petrels 45
Wandering albatross 46
White-chinned petrel 47

Discussion **48**

Review of scientific data and information from the EBSA process **48**
Migratory species data role in the description of EBSAs **49**
Potential contribution of the scientific data and information within EBSA descriptions **49**

Conclusion **51**

References **53**

Appendices **59**

Appendix A. The number of migratory species mentioned in each EBSA description **59**
Appendix B. The migratory species level (MSL) score for each EBSA description **68**
Appendix C. Summary of OBIS-SEAMAP datasets used as a foundation of recorded locations for select migratory species **77**

List of Tables and Figures

Table 1. Marine mammal, seabird, sea turtle, shark and ray species listed under the CMS..... 9
Table 2. EBSAs and migratory seabird, marine mammal, sea turtle, and shark / ray species data mentioned as the principal role 22
Table 3. The number of marine mammal, seabird, sea turtle, shark / ray species listed under the CMS Appendices and mentioned within the EBSA descriptions 27
Table 4. EBSAs and the number of marine mammals, seabirds, sea turtles, sharks / rays species listed under CMS and mentioned within the EBSA description, the total number of CMS listed species, MSL score, habitat use score, and migratory species data role within the EBSA description..... 28
Table 5. Results from the contingency table analyses to compare of criteria rankings among EBSAs that were described with migratory species data as a principal, contributory, or without any role (none) 38
Table 6. Results from the partitioned chi-square analyses to compare of criteria rankings among EBSAs categorized according to migratory species data role (principal, contributory, or none) 38

Figure 1. The regional extent considered by the EBSA process in nine regions..... 7
Figure 2. The role of marine mammal, seabird, sea turtle, shark, and ray migratory species data in describing global EBSAs within the CBD regional reports 21
Figure 3. Migratory species data that were mentioned as playing a principal role in more than one EBSA..... 21
Figure 4. Global EBSAs and the migratory species data role (Principal, Contributory, or None) for a) marine mammals, b) seabirds, c) sea turtles, and d) sharks / rays 24
Figure 5. The number of EBSAs that CMS listed marine mammals, seabirds, sea turtles, and sharks were mentioned within EBSA descriptions 26
Figure 6. Three metrics used to assess migratory species data within EBSA descriptions for all nine regions: a) number of migratory species, b) migratory species level score, and c) habitat use scores 36
Figure 7. The average number of species, MSL score, and habitat use score for EBSAs within each region, based on named species within EBSA descriptions 37
Figure 8. EBSAs categorized by migratory species data role and their percent frequencies of signficantly different rankings for EBSA criteria 39
Figure 9. Leatherback sea turtle, *Dermochelys coriacea*, presence, and in areas of reproduction and / or foraging as described in EBSAs 41
Figure 10. Green sea turtle, *Chelonia mydas*, presence and areas of foraging and / or reproducing as described in EBSAs 43
Figure 11. Humpback whale, *Megaptera novaeangliae*, presence, and in areas of reproduction and / or foraging as described in EBSAs 44
Figure 12. Pediunker / grey petrel, *Procellaria cinerea*, presence and areas of foraging as described in EBSAs 45
Figure 13. Wandering albatross, *Diomedea exulans*, presence and areas of foraging as described in EBSAs..... 46
Figure 14. White-chinned petrel, *Procellaria aequinoctialis*, presence and areas of foraging and foraging / reproducing as described in EBSAs 47

Abstract

Through a series of regional workshops organized by the Convention on Biological Diversity (CBD), over 200 sites have been described as meeting the CBD criteria for ecologically or biologically significant marine areas (EBSAs). Products and results from the EBSA process were assessed with respect to marine migratory species listed under the Convention of Migratory Species (CMS). The aim of this study was to determine: (1) to determine how marine migratory species have factored in the description of EBSAs; and (2) through the use of preliminary case studies on cetaceans, seabirds and marine turtles, to explore the potential for the scientific data and information describing EBSAs to contribute to the conservation of migratory species in marine areas within and beyond the limits of national jurisdiction, particularly with respect to ecological networks and connectivity. Results showed that migratory species data contributed to the description of EBSAs on two different levels. First, migratory species data played the principal role in approximately 10% of all EBSAs because these sites were described to support the life history requirements and / or were a globally unique location for a particular migratory species. Second, 80% of all EBSAs had descriptions that relied on migratory species data as a contributing factor in their justification, particularly sea turtles, large cetaceans, and seabirds. Detailed analyses of the EBSA workshop reports showed that although some EBSAs may not have been described primarily to support migratory species, the reports cited a large number of CMS listed migratory species as present or using the areas for reproduction and foraging. The information gathered from the EBSA workshop process contributed to the general knowledge of CMS listed species' distribution and habitat needs. Migratory sharks and rays were also included in EBSA descriptions, although to a lesser degree than marine mammals, seabirds, and sea turtles. The different roles CMS listed migratory marine mammal, seabird, sea turtle, shark and ray species data have in the description of individual EBSAs, along with the different numbers of migratory species mentioned, criteria migratory species were used to justify particular EBSAs, or how a site was described to be used by migratory species can all have implications for the conservation and management priorities of CMS listed migratory species. In addition, these results suggested that data within the EBSA descriptions could be used to provide regional states and other intergovernmental organizations information on the needs and requirements to promote the connectivity of ecological networks for migratory species. At the same time, it was clear that such networks require further consideration within areas already examined by the EBSA process, along with areas outside of the current extent considered for EBSAs or recognized by other criteria.

Introduction

1. The Convention of Biological Diversity (CBD) was established as "an international legal instrument for the conservation and sustainable use of biological diversity" and entered into force in 1993 (CBD Secretariat 2005). Since the Jakarta Mandate in 1995, the CBD has been actively working towards the conservation and sustainable use of the biological diversity and productivity of marine and coastal areas (CBD 1997, Goote 1997). In 2008, the CBD adopted a set of scientific criteria for ecologically or biologically significant marine areas (EBSAs) (Decision IX/20) and, in 2010, adopted recommendations calling for regional workshops to describe areas meeting the CBD criteria (Decision X/29).

2. From 2011-2014, states and intergovernmental organizations have been involved in a scientific and technical exercise to apply the criteria, describing over 200 EBSAs within nine regions around the world (Figure 1). The best available data to facilitate this process were compiled for each region, including biological and environmental datasets at various spatial scales (e.g., regional, national, global) along with information within other areas that have been previously identified as important based on a variety of similar, but different standards (i.e., marine reserves, parks, protected areas, important bird areas, heritage sites, etc.). Workshops for each region used the compiled data and expert knowledge to describe EBSAs that were accepted by consensus and then collated in regional reports for review by the CBD Subsidiary Body for Scientific, Technical and Technological Advice (Dunn et al. 2014). After review, a synthesis report with recommendations would be sent to the CBD Conference of the Parties (COP), and then accepted EBSAs would be published in a public data repository and a report would be submitted to the United Nations General Assembly (CBD 2010).

3. The Convention on the Conservation of Migratory Species of Wild Animals (CMS) is an international treaty "for the conservation and sustainable use of migratory animals and their habitats" (CMS 2013). Complementary to the CBD, the CMS is also concerned with marine biological diversity and will benefit from lessons learned through the EBSA process. The information and results compiled for and by the regional workshops can be used to further specific objectives of the CMS. The Global Ocean Biodiversity Initiative, an international partnership aiming to help countries meet CBD adopted goals, was requested by the CMS Secretariat to review the scientific data and results from the CBD EBSA process (1) to determine how marine migratory species have factored in the description of EBSAs; and (2) through the use of preliminary case studies on cetaceans, seabirds and marine turtles, to explore the potential for the scientific data and information describing EBSAs to contribute to the conservation of migratory species in marine areas within and beyond the limits of national jurisdiction, particularly with respect to ecological networks and connectivity.

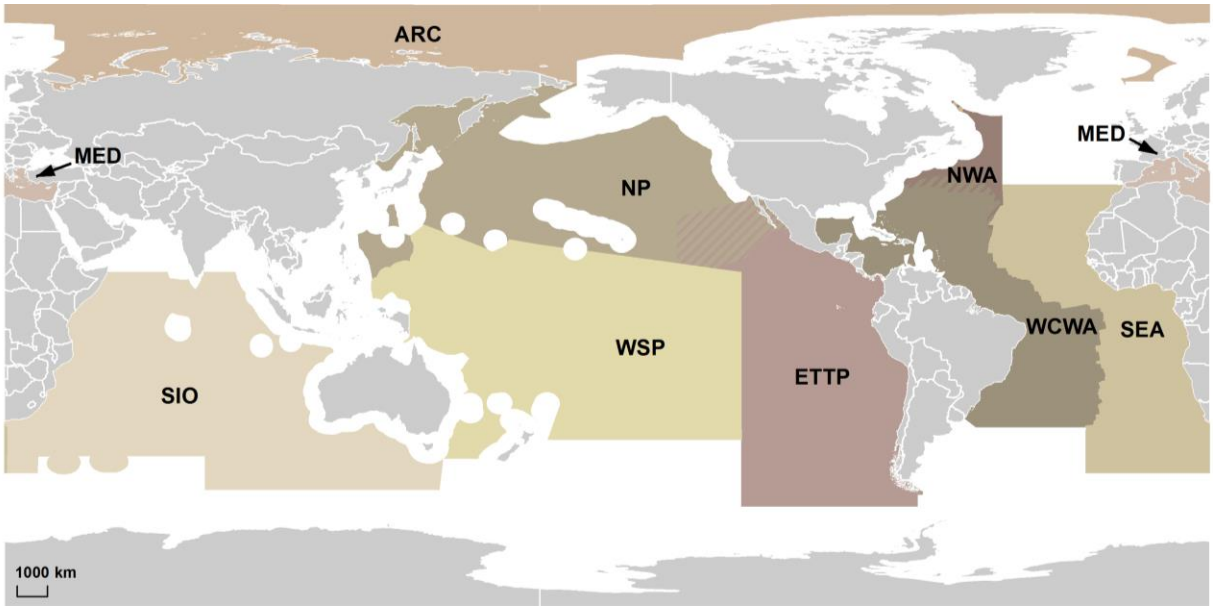


Figure 1. The regional extent considered by the EBSA process in nine regions as of 2014. Workshop regions include the Arctic (ARC), Eastern Tropical and Temperate Pacific (ETTP), Mediterranean (MED), North Pacific (NP), North-west Atlantic (NWA), South-eastern Atlantic (SEA), Southern Indian Ocean (SIO), Western South Pacific (WSP), and Wider Caribbean Western Mid-Atlantic (WCWA).

Methods

Review of scientific data and information from the EBSA process

4. There are currently 145 species listed within the CMS Appendices I and II that were considered in this assessment (marine mammals = 63, seabirds = 68, sea turtles = 6, sharks / rays = 8; Table 1). Marine mammals were defined as mammals listed under Cetacea, Carnivora (with the exception of Felidae), and Sirenia; seabirds were defined as birds from the Families Alcidae, Spheniscidae, Diomedeidae, Procellariidae, Pelecanoididae, Pelecanidae, Laridae (with the exception of two sandpipers); sea turtles were listed under Testudinata (with the exception of Pelomedusidae); sharks / rays were listed under Elasmobranchii. All 145 species were considered potential contributors to the description of EBSAs, with the majority (n = 82) having ranges that include marine areas beyond national jurisdiction (ABNJ) (Table 1). To be more inclusive, when animals named within reports were listed only to the species level, these were noted even if the CMS listing was for a subspecies or population delineation. Likewise, species mentioned in the workshop reports at population or subspecies level were matched to the species level of animals that were listed under the CMS.

5. Prior to each regional workshop, data reports were compiled using the best available biological and environmental data and circulated during the workshop to facilitate the delineation of EBSAs (Dunstan and Fuller 2011, 2012, Halpin et al. 2012a, Halpin et al. 2012b, Dunstan and Fuller 2013, Halpin et al. 2013a, Halpin et al. 2013b, Halpin et al. 2014a, Halpin et al. 2014b). The listed biological data compiled within the data reports were reviewed in relation to migratory

marine mammals, seabirds, sea turtles, sharks, and rays. Environmental data included in the reports were also noted for potential contributions towards migratory species conservation. Any perceived biases, other important data needs not included, and workshop participant influences were also explored.

6. A total of 206 EBSAs under consideration by the CBD Conference of the Parties were assessed, using the CBD regional workshop reports from the Arctic (ARC) (CBD 2014a), Eastern Tropical and Temperate Pacific (ETTP) (CBD 2013), Mediterranean (MED) (CBD 2014b), North Pacific (NP) (CBD 2014c), North-west Atlantic (NWA) (CBD 2014d), South-eastern Atlantic (SEA) (CBD 2014e), Southern Indian Ocean (SIO) (CBD 2014f), Western South Pacific (WSP) (CBD 2012a), and Wider Caribbean Western Mid-Atlantic (WCWA) (CBD 2012b). Workshop reports were reviewed to extract information on the extent to which marine mammal, seabird, sea turtle, shark and ray migratory species listed under the CMS (Appendices I and II) were involved in describing EBSAs. Areas that were listed for future consideration were not included in this assessment and source information came directly from the annexes describing the areas.

7. Within the reports, each EBSA considered was described with a text section of general information (with various parts, including the abstract, introduction, geographic location, feature description of the area, etc.), followed by tables for ranking the proposed area (high, some, low, don't know) relevant to the seven EBSA criteria:

1) Uniqueness or rarity,
2) Special importance for life-history stages of species,
3) Importance for threatened, endangered or declining species and / or habitats,
4) Vulnerability, fragility, sensitivity, or slow recovery,
5) Biological productivity,
6) Biological diversity, and
7) Naturalness.

8. Furthermore, the CBD COP 10 provided guidance for the regional EBSA workshops to consider "other relevant compatible and complementary nationally and intergovernmentally agreed scientific criteria" (CBD COP X/29 Recommendation 36) (CBD 2010). Therefore in some cases, EBSAs had additional criteria customized for the particular area that were ranked (high, some, low, don't know). Each criterion template had a section for the explanation of rankings, where marine mammal, seabird, sea turtle, shark and ray species could be mentioned and noted.

Table 1. Marine mammal, seabird, sea turtle, shark and ray species listed under the CMS (Appendices I and II) with ranges that include marine areas both within and beyond national jurisdiction (ABNJ) and mentioned in EBSA descriptions for all nine regional workshop reports (1 = listed, *listed as principal role in one or more EBSAs). To be more inclusive, listings were matched to those with data in EBSAs at the species level only, not subspecies / subpopulations.

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Aves	Sterna bernsteini	Chinese crested tern		1			
Aves	Sterna lorata	Peruvian tern		1			1
Aves	Synthliboramphus wumizusume	Japanese murrelet		1			
Aves	Chlidonias leucopterus	White-winged tern	West Eurasian and African		1		
Aves	Chlidonias niger niger	Black tern			1		
Aves	Larus armenicus	Armenian gull			1		
Aves	Larus atlanticus	Olrog's gull		1			
Aves	Larus audouinii	Audouin's gull		1	1		1*
Aves	Larus genei	Slender-billed gull			1		1
Aves	Larus hemprichii	Sooty gull			1		
Aves	Larus ichthyaetus	Great Black-headed gull	West Eurasian and African		1		
Aves	Larus leucophthalmus	White-eyed gull		1	1		
Aves	Larus melanocephalus	Mediterranean gull			1		1
Aves	Larus relictus	Relict gull		1			
Aves	Larus saundersi	Saunders's gull		1			
Aves	Sterna albifrons	Little tern			1		1
Aves	Sterna balaenarum	Damara tern			1		1*
Aves	Sterna bengalensis	Lesser crested tern	African and Southwest Asian		1		1
Aves	Sterna bergii	Great crested tern	African and Southwest Asian		1		1
Aves	Sterna caspia	Caspian tern	West Eurasian and African		1		1
Aves	Sterna dougallii	Roseate tern	Atlantic		1		1

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Aves	Sterna hirundo hirundo	Common tern	breeding in the Western Palearctic		1		1
Aves	Sterna maxima albidorsalis	Royal tern			1		1
Aves	Sterna nilotica nilotica	Gull-billed tern	West Eurasian and African		1		1
Aves	Sterna paradisaea	Arctic tern	Atlantic		1		1
Aves	Sterna repressa	White-cheeked tern			1		
Aves	Sterna sandvicensis sandvicensis	Sandwich tern			1		1
Aves	Sterna saundersi	Saunders's tern			1		
Aves	Pelecanus crispus	Dalmatian pelican		1	1		
Aves	Pelecanus onocrotalus	Great white pelican	only Palearctic	1			
Aves	Pelecanus onocrotalus	Great white pelican	Western Palearctic		1		
Aves	Diomedea amsterdamensis	Amsterdam albatross		1		1	1
Aves	Diomedea antipodensis	Antipodean albatross			1	1	1*
Aves	Diomedea chrysostoma	Grey-headed albatross			1	1	1
Aves	Diomedea dabbenena	Tristan albatross			1	1	1*
Aves	Diomedea epomophora	Royal albatross			1	1	1
Aves	Diomedea exulans	Wandering albatross			1	1	1*
Aves	Diomedea irrorata	Waved albatross			1	1	1
Aves	Diomedea sanfordi	Northern royal albatross			1	1	1
Aves	Phoebastria albatrus	Short-tailed albatross		1		1	1
Aves	Phoebastria immutabilis	Laysan albatross			1	1	1*
Aves	Phoebastria nigripes	Black-footed albatross			1	1	1*
Aves	Phoebetria fusca	Sooty albatross			1	1	1*
Aves	Phoebetria palpebrata	Light-mantled albatross			1	1	1
Aves	Thalassarche bulleri	Buller's albatross			1	1	1*
Aves	Thalassarche carteri	Indian yellow-nosed albatross			1	1	1
Aves	Thalassarche cauta	Shy albatross			1	1	1

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Aves	Thalassarche chlororhynchos	Yellow-nosed albatross			1	1	1
Aves	Thalassarche eremita	Chatham albatross			1	1	1
Aves	Thalassarche impavida	Campbell albatross			1	1	
Aves	Thalassarche melanophris	Black-browed albatross			1	1	1
Aves	Thalassarche salvini	Salvin's albatross			1	1	1*
Aves	Thalassarche steadi	White-capped albatross			1	1	1*
Aves	Pelecanoides garnotii	Peruvian diving petrel		1			1
Aves	Macronectes giganteus	Southern giant petrel			1	1	1
Aves	Macronectes halli	Northern giant petrel			1	1	
Aves	Procellaria aequinoctialis	White-chinned petrel			1	1	1*
Aves	Procellaria cinerea	Pediunker / grey petrel			1	1	1*
Aves	Procellaria conspicillata	Spectacled petrel			1	1	1
Aves	Procellaria parkinsoni	Black petrel			1	1	1*
Aves	Procellaria westlandica	Westland petrel			1	1	1
Aves	Pterodroma atrata	Henderson petrel		1		1	
Aves	Pterodroma cahow	Bermuda petrel		1		1	1
Aves	Pterodroma phaeopygia	Galapagos petrel		1		1	1
Aves	Pterodroma sandwichensis	Hawaiian petrel		1		1	
Aves	Puffinus creatopus	Pink-footed shearwater		1		1	1
Aves	Puffinus mauretanicus	Balearic shearwater		1		1	1*
Aves	Spheniscus demersus	Jackass penguin			1		1
Aves	Spheniscus humboldti	Humboldt penguin		1			1
Chondrichthyes	Cetorhinus maximus	Basking shark		1	1	1	1
Chondrichthyes	Carcharodon carcharias	Great white shark		1	1	1	1*
Chondrichthyes	Isurus oxyrinchus	Shortfin mako			1	1	1
Chondrichthyes	Isurus paucus	Longfin mako			1	1	1
Chondrichthyes	Lamna nasus	Porbeagle			1	1	1
Chondrichthyes	Manta birostris	Atlantic manta		1	1	1	1

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Chondrichthyes	Rhincodon typus	Whale shark			1	1	1
Chondrichthyes	Squalus acanthias	Spiny dogfish			1	1	1
Mammalia	Lontra felina	Marine otter		1			1
Mammalia	Lontra provocax	Southern river otter		1			1
Mammalia	Arctocephalus australis	South American fur seal			1	1	1
Mammalia	Otaria flavescens	South American sealion			1		1
Mammalia	Halichoerus grypus	Atlantic gray seal	only Baltic Sea		1		1
Mammalia	Monachus monachus	Mediterranean monk seal		1	1		1*
Mammalia	Phoca vitulina	Harbor seal	Baltic and Wadden Sea		1		1
Mammalia	Balaena mysticetus	Bowhead		1		1	1
Mammalia	Eubalaena australis	Southern right whale		1		1	1*
Mammalia	Eubalaena glacialis	North Atlantic right whale	North Atlantic	1		1	1
Mammalia	Eubalaena japonica	North Pacific right whale	North Pacific	1		1	1
Mammalia	Balaenoptera bonaerensis	Antarctic minke whale		1		1	1
Mammalia	Balaenoptera borealis	Sei whale		1	1	1	1
Mammalia	Balaenoptera edeni	Eden's whale			1	1	1
Mammalia	Balaenoptera musculus	Blue whale		1		1	1*
Mammalia	Balaenoptera musculus brevicauda	Pygmy blue whale				1	1
Mammalia	Balaenoptera omurai	Omurai's whale			1	1	
Mammalia	Balaenoptera physalus	Fin whale		1	1	1	1*
Mammalia	Megaptera novaeangliae	Humpback whale		1		1	1*
Mammalia	Cephalorhynchus commersonii	Commerson's dolphin	South American		1		1
Mammalia	Cephalorhynchus eutropia	Black dolphin			1		1
Mammalia	Cephalorhynchus heavisidii	Heaviside's dolphin			1		1*

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Mammalia	Delphinus delphis	Short-beaked common dolphin	North and Baltic Sea, Mediterranean, Black Sea and eastern tropical Pacific		1	1	1*
Mammalia	Delphinus delphis	Short-beaked common dolphin	only Mediterranean	1		1	1*
Mammalia	Globicephala melas	Long-finned pilot whale	only North and Baltic Sea		1		1*
Mammalia	Grampus griseus	Risso's dolphin	only North Sea, Baltic Sea and Mediterranean		1	1	1*
Mammalia	Lagenodelphis hosei	Fraser's dolphin	Southeast Asian		1	1	1
Mammalia	Lagenorhynchus acutus	Atlantic white-sided dolphin	only North and Baltic Sea		1		1
Mammalia	Lagenorhynchus albirostris	White-beaked dolphin	only North and Baltic Sea		1		1
Mammalia	Lagenorhynchus australis	Peale's dolphin			1		1
Mammalia	Lagenorhynchus obscurus	Dusky dolphin			1		
Mammalia	Orcaella brevirostris	Irrawaddy dolphin		1	1		
Mammalia	Orcaella heinsohni	Australian snubfin dolphin			1		
Mammalia	Orcinus orca	Killer whale			1	1	1
Mammalia	Sotalia fluviatilis	Gray dolphin			1		1
Mammalia	Sotalia guianensis	Costero			1		1
Mammalia	Sousa chinensis	Chinese white dolphin			1		1
Mammalia	Sousa teuszii	Atlantic humpback dolphin		1	1		1
Mammalia	Stenella attenuata	Pantropical spotted dolphin	eastern tropical Pacific population, Southeast Asian		1	1	1
Mammalia	Stenella clymene	Clymene dolphin	West African		1	1	1
Mammalia	Stenella coeruleoalba	Striped dolphin	eastern tropical Pacific population, Mediterranean		1	1	1*

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Mammalia	Stenella longirostris	Spinner dolphin	eastern tropical Pacific populations, Southeast Asian		1	1	1*
Mammalia	Tursiops aduncus	Indian Ocean bottlenose dolphin	Arafura / Timor Sea		1		1
Mammalia	Tursiops truncatus	Bottlenose dolphin	North Sea, Baltic Sea, Mediterranean and Black Sea		1	1	1*
Mammalia	Tursiops truncatus ponticus	Black Sea bottlenose dolphin		1		1	
Mammalia	Inia geoffrensis	Amazon River dolphin			1		
Mammalia	Delphinapterus leucas	Beluga			1	1	1
Mammalia	Monodon monoceros	Narwhal			1	1	1
Mammalia	Caperea marginata	Pygmy right whale			1	1	
Mammalia	Neophocaena asiaeorientalis	Yangtse River porpoise			1		
Mammalia	Neophocaena phocaenoides	Finless porpoise			1		
Mammalia	Phocoena dioptrica	Spectacled porpoise			1	1	
Mammalia	Phocoena phocoena	Harbor porpoise	North and Baltic Sea, western North Atlantic, Black Sea and North West African		1	1	1
Mammalia	Phocoena spinipinnis	Burmeister's porpoise			1		1
Mammalia	Phocoenoides dalli	Dall's porpoise			1	1	1
Mammalia	Physeter macrocephalus	Sperm whale		1	1	1	1*
Mammalia	Platanista gangetica gangetica	Ganges River dolphin		1	1		
Mammalia	Pontoporia blainvillei	Franciscana		1	1		1
Mammalia	Berardius bairdii	Baird's beaked whale			1	1	1
Mammalia	Hyperoodon ampullatus	North Atlantic bottle-nosed whale			1	1	1
Mammalia	Dugong dugon	Dugong			1	1	1*
Mammalia	Trichechus inunguis	Amazonian manatee			1		1

Class	Genus species	Common name	Population	Appendix I	Appendix II	ABNJ Range	EBSA
Mammalia	Trichechus manatus	Caribbean manatee	populations between Honduras and Panama	1	1		1*
Mammalia	Trichechus senegalensis	West African manatee		1	1		1
Reptilia	Caretta caretta	Loggerhead sea turtle		1	1	1	1*
Reptilia	Chelonia mydas	Green sea turtle		1	1	1	1*
Reptilia	Eretmochelys imbricata	Hawksbill sea turtle		1		1	1*
Reptilia	Lepidochelys kempii	Atlantic ridley sea turtle		1		1	1
Reptilia	Lepidochelys olivacea	Olive ridley sea turtle		1		1	1*
Reptilia	Dermochelys coriacea	Leatherback sea turtle		1	1	1	1*

Migratory species data role in the description of EBSAs

9. In order to determine how migratory species data have been involved in the description of EBSAs, two methods were used. First, a broad overview was used to determine if the principal factor in describing a site that met the CBD criteria were scientific data and information on marine migratory species. Second, a structured assessment to determine the specific roles migratory species data played in the description process was used. While the broad overview identified EBSAs where migratory species data were a principal role in its description (mainly from the general text section), the second method further assessed the levels that migratory species data contributed to the description of EBSAs in more detailed categories of contribution (gathering information from all sections). Taken together, these approaches measured the contribution and significance of marine migratory species data within EBSA descriptions and give insights as to how the available data and other marine migratory species' needs affected EBSA descriptions. This combined assessment also set the foundation for how information within the EBSA descriptions can contribute to promoting the connectivity of ecological networks that support migratory marine mammals, seabirds, and sea turtles.

10. For the broad overview, EBSAs described with information on at least one marine mammal, seabird, sea turtle, shark, or ray migratory species listed under the CMS (Appendices I and II) perceived as the principal factor, or having the principal role in the justification for the EBSA site, were defined as "principal" migratory species EBSAs. First, information captured mainly within the text section of the EBSA description was used to determine if migratory species data were generally relevant. During this first pass, 94 EBSAs were determined not to be directly relevant to migratory species while all others were relevant at some level, based on the information within the CBD EBSA workshop reports. For the second pass, two independent reviewers assessed all sections of 149 EBSA descriptions (including all 112 EBSAs initially deemed relevant), scoring EBSAs either as being described principally due to marine migratory species data or not. EBSAs with migratory species data as a principal role were often described and clearly justified in the general text sections as important because information was often included about one or more migratory species using the area for a key portion of its life cycle. EBSAs described as important by listing more than one reason, such as migratory species presence along with high productivity and / or high diversity, or EBSAs that were described as significant because of information on the habitat or organisms other than migratory species, were not included as principal migratory species EBSAs. All independent scores were compared and discrepancies were discussed for agreement.

11. For the more detailed assessment, all sections (text, tables, figures) within the annexes of the regional workshop reports were reviewed to include all data on marine mammal, seabird, sea turtle, shark / ray migratory species mentioned within the description. Also noted were any comments about animals using the area for reproduction (i.e., mating, breeding, birthing / calving, colonies, nesting, etc.) and food (i.e., foraging, feeding, prey, etc.). Three metrics were then calculated for all EBSAs: 1) the total number of migratory species listed under the CMS Appendices that were mentioned in any section of the description, 2) a migratory species level (MSL) score based on the use of migratory species to justify EBSA criteria, and 3) a habitat use score that was related to the degree of importance for migratory species, as measured by the number of species that were mentioned to use the area for reproduction plus the number of

species mentioned as using the area for food (this was distinguished from animals that were merely present in the area, often without much more information, or pass through the area during migration to other destinations).

12. The MSL score for all EBSAs was calculated by weighing the seven criteria as either high, medium, or low, determined *a priori*, based on the relative significance of each criterion in capturing species dependence on the area's resources. For example, if the EBSA was justified as unique (criterion 1) by mentioning migratory species, it was perceived that the migratory species depended more on the EBSA's resources than other areas, and therefore given a higher weight than if migratory species were only mentioned as part of a greater community contributing to the justification for biological diversity within the EBSA (criterion 6). Connectivity has long been recognized as an important factor for determining conservation areas in relation to migratory species (Dearden and Topelko 2005, Marra et al. 2011, Willis et al. 2012) and can be considered as related to criterion 1 (CBD 2007). Furthermore, criteria 2 and 3 apply to species that are highly mobile, have large geographic ranges, and are vulnerable to multiple threats (CBD 2007). Criteria 2 and 3 are applicable to migratory species in that these were species-level criteria and EBSAs specifically described based on their importance to migratory species (due to presence of critical life history stages or population status) would utilize these criteria. Therefore, a high score (4) was assigned where migratory species were named as a justification for EBSA criteria 1, 2, or 3, a medium score (2) where migratory species were named within criteria 4, 5, 6, or 7, and a low score (1) where migratory species were named in the text, figures, or supplemental tables. These three scores were summed to give a maximum MSL score of 7 (where species were named in the text, figures, or supplemental tables, at least one high level criterion, and at least one medium level criterion) and a minimum of 0 (no species were named at all). The quantified MSL score was used to highlight migratory species data prominence within the EBSA description.

13. The role that migratory species data had in each description was used to categorize all EBSAs as "principal" (using results from the broad overview), "contributory" (using results from the more detailed approach), or "none" (using results from the more detailed approach). Migratory species data had a contributory role in EBSAs when one or more migratory species were mentioned, but may not have been the principal justification. EBSAs without any noted migratory species in any section of the description were classed as "none." Finally, the Wilcoxon rank-sum test was used to compare all of the summed values from the numbers of each taxa, total number of taxa, number of species, habitat use scores, and habitat use score components for principal and contributory EBSAs ($\alpha = 0.05$, $\alpha_1 = 0.0057$ after Dunn-Sidak correction). Contingency table analyses were used to compare MSL and MSL component scores (i.e., high, medium, low level) for principal and contributory EBSAs (Pearson's χ^2, $\alpha = 0.05$, $\alpha_1 = 0.013$ after Dunn-Sidak correction). Contingency tables were also used to compare the rankings for the seven criteria of EBSAs categorized as principal, contributory, and none (Pearson's χ^2, $\alpha = 0.05$, $\alpha_1 = 0.012$ after Dunn-Sidak correction). Post hoc partitioned chi-square analyses were conducted for any significant differences found with the contingency table analyses of EBSA category and criteria ranking (Pearson's χ^2, $\alpha < 0.05$, $\alpha_1 = 0.0051$ after Dunn-Sidak correction). Analyses of rankings for additional criteria, customized beyond the standard seven, were not conducted, as these were rare (n = 29) and information from these criteria was mostly included within the other sections of the EBSA description.

Potential contribution of the scientific data and information within EBSA descriptions

14. The potential for the information within EBSA descriptions to promote migratory species conservation and connectivity of ecological networks was also examined for selected marine mammal, seabird and sea turtle species that most often had data presented within EBSA descriptions. Current knowledge on habitat use and ranges from ocean biogeographic databases for selected species were used to compare with the location of described EBSAs, and how migratory species used certain EBSAs for different stages within the species' life history, according to EBSA descriptions on presence, reproduction and / or foraging. Species' ranges and habitat use data from various databases such as the Global Registry of Migratory Species (GROMS) (Riede 2004), International Union for Conservation of Nature (IUCN 2014), BirdLife International seabird species distribution (BirdLife International and NatureServe 2013), and the State of the World's Sea Turtles (SWOT) sea turtle species distribution (Wallace et al. 2010) were compared to the EBSA spatial coverage. When species' spatial ranges varied among data sources, the largest possible extent was used for comparison.

15. Since migratory species ranges were broad, for each species selected as a case study, all available recorded locations from OBIS-SEAMAP (Halpin et al. 2009) and nesting sites from SWOT (SWOT 2006, 2007, 2008, Halpin et al. 2009, SWOT 2009, 2010, 2011, 2012, 2013, Kot et al. 2014, SWOT 2014) were downloaded (August 22, 2014) and a simple point density layer was created using ArcGIS 10.2 (ESRI 2014) to show relative known presence within the overall species range distribution. The OBIS-SEAMAP database contains observation point locations of marine mammal, seabird, and sea turtles recorded from various datasets and projects around the world, collected by multiple platforms such as surveys (i.e., aerial, shipboard, land-based platforms), telemetry tags, and georeferenced museum specimens (Halpin et al. 2009). The SWOT nesting database contains monitored sites potentially used for sea turtle nesting; all confirmed and unconfirmed (0 nesting numbers for years of data monitored) were included in this analysis to be conservative. Both the OBIS-SEAMAP and SWOT databases have collated large quantities of geographic information on marine migratory species, voluntarily contributed from a variety of sources, with large spatial and temporal coverage. While they may not include all existing georeferenced data, they are currently the most comprehensive in global coverage for these selected case study species (Kot et al. 2010), and can be used as a guideline for examining what was known versus where information from EBSA descriptions can fill gaps. Overlaps and gaps were assessed as to how well information on EBSAs were represented within areas with high densities of records and in what ways information from EBSA descriptions corresponded to various migratory species' habitat uses.

16. Key information presented within the EBSA descriptions of the workshop reports that were often linked to migratory species (i.e., current management within EBSAs, agreements recognizing the importance of habitat and resources within EBSAs, conservation agreements for migratory species mentioned within EBSAs, data sources for migratory species presence and habitat use, etc.) were summarized. Furthermore, known marine areas established for protection or designated as important for marine species and world protected areas (e.g., Birdlife IBAs [Birdlife International 2013]) were compared to EBSA locations to evaluate connectivity and potential overlaps.

Results

Review of scientific data and information from the EBSA process

17. The review of all nine regional data reports compiled to inform the CBD workshops (IUCN and UNEP-WCMC 2014) showed that the most common biological datasets included that related to migratory species, across regions, were the OBIS (Ocean Biogeographic Information System) marine species georeferenced records (CBD 2012a, 2012b, 2013, 2014a, 2014b, 2014c, 2014d, 2014e, 2014f), Birdlife important bird areas (IBAs) (Vanden Berghe 2007, OBIS 2014), Wildlife Conservation Society's historical whale captures (Birdlife International 2013) and the OBIS-Spatial Ecological Analysis of Megavertebrate Populations / State of the World's Sea Turtles / Wider Caribbean Sea Turtle Network (OBIS-SEAMAP/SWOT/WIDECAST) (Townsend 1931, 1935, Reeves et al. 2004) sea turtle data. These datasets were also often referenced in the CBD regional workshop reports. Other datasets not included in OBIS or OBIS-SEAMAP were local or regional biological datasets from sea turtle, marine mammal, and seabird telemetry tags or modeled density data (e.g., Shillinger et al. 2010, Hazen et al. 2013, Humphries and Huettmann 2014). Although some EBSAs may have been justified with data independent from the baseline datasets compiled in the CBD data reports and boundaries were discussed, decided upon, and / or submitted as candidates before the workshops were held, it was assumed that any additional data about specific migratory species would be captured within the EBSA descriptions in the workshop reports.

18. Within the compiled data reports to facilitate the EBSA regional workshops, there were little data included on sharks and rays (e.g., most often only included in composite maps of all marine species within the OBIS database) compared to marine mammals, seabirds, and sea turtles (Dow et al. 2007, Halpin et al. 2009, Kot et al. 2014). Only the data report for the northwest Atlantic region included a specific dataset on a shark or ray (Halpin et al. 2013a); however, the dataset was for blue shark, *Prionace glauca,* which is not listed as a migratory species under the CMS. Other data on sharks were referenced in EBSA descriptions within workshop reports, such as telemetry analysis from the Tagging of Pacific Predators (TOPP) program for the Northeast Pacific White-Shark Offshore Aggregation Area in the ETTP (CBD 2013). Data sources for marine mammals, seabirds, and sea turtles that were also potential sources of shark and ray information included satellite tag tracking and sightings projects, regional GIS databases, data portals, atlases, and species status and trends datasets.

19. Environmental datasets compiled within the data reports included information related to the geology (i.e., seamounts, vents and seeps, canyons, bathymetry, sediment thickness), physical oceanography (i.e., salinity, temperature, currents, fronts), and chemistry (i.e., oxygen, phosphate, and nitrate climatologies) of the oceanic region. Most common physical datasets compiled within the EBSA data reports, such as bathymetry, sea surface temperature, seamounts, and climatology had global coverage so that the same datasets were used for multiple regions, with fewer regional environmental datasets (CBD 2013) and other related management areas (e.g., Arctic regional climatology [Boyer et al. 2012]). These environmental datasets can be a foundation for predictive habitat models that are necessary to fill in gaps for migratory species distributions in places where it is unknown or comprehensive survey coverage is not available.

Some examples of migratory species distribution models based on environmental datasets were included in the biological datasets compiled for the EBSA process (FAO 2006).

Migratory species data role in the description of EBSAs

20. After broadly reviewing all 206 EBSA descriptions, it was determined that 20 used data on at least one migratory species as the principal justification for its description (Figure 2). Information on 36 migratory marine species were mentioned as the principal EBSA justification (marine mammals = 15, seabirds = 15, sea turtles = 5, sharks / rays = 1). All regions except for the ARC and NWA contained an EBSA with marine migratory species data as the principal justification, with the WSP region having the most number of EBSAs categorized as "principal" for migratory species data (Tables 1 and 2). Most migratory species listed (n = 30) were identified to have ranges in ABNJ, with 16 species listed under Appendix I and 30 species listed under Appendix II (total number of animals listed under both appendices was greater than 36 because some animals were listed under both).

21. Data on leatherback sea turtles were used as a principal justification in the largest number of EBSAs, followed by green sea turtles and humpback whales (Figure 3). Out of the 20 principal migratory species EBSAs, 12 were justified as "principal" using information on at least one marine mammal species while only 1 was justified principally with shark or ray data (Table 2; Figure 4). Furthermore, 1 EBSA in the MED and 3 EBSAs in the SEA mentioned marine mammal, seabird, and sea turtle species taxa data as the principal contributors, while 6 EBSAs within the ETTP, WSP, MED and SIO and WCWA mentioned data on two different taxa playing principal roles (Table 2).

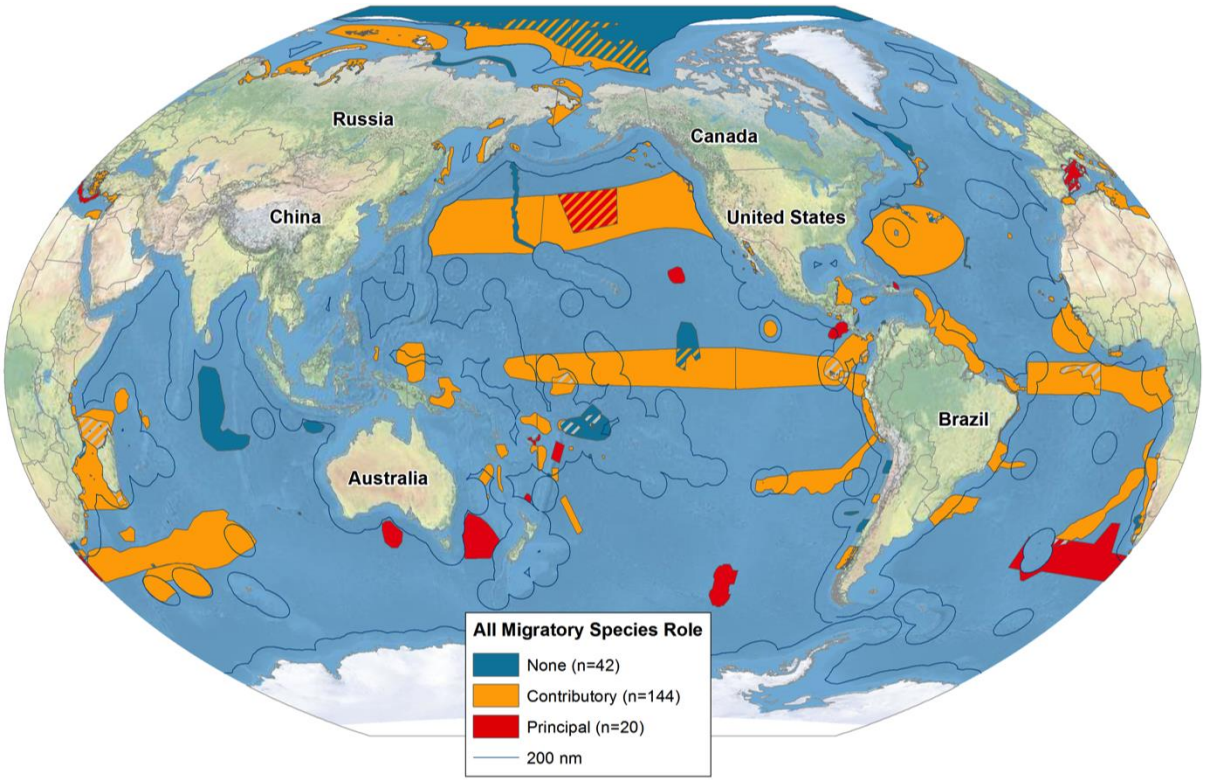


Figure 2. The role of marine mammal, seabird, sea turtle, shark, and ray migratory species data in describing global EBSAs within the CBD regional reports (none = no migratory species mentioned; contributory = at least one migratory species mentioned; and principal = at least one migratory species mentioned as a main factor).

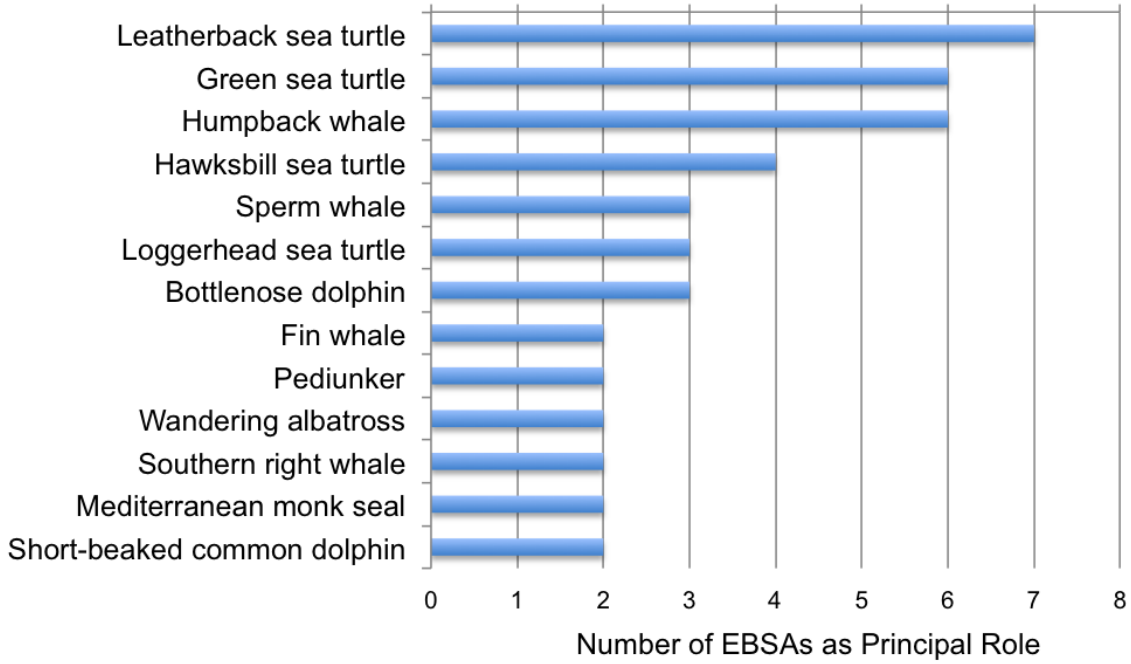
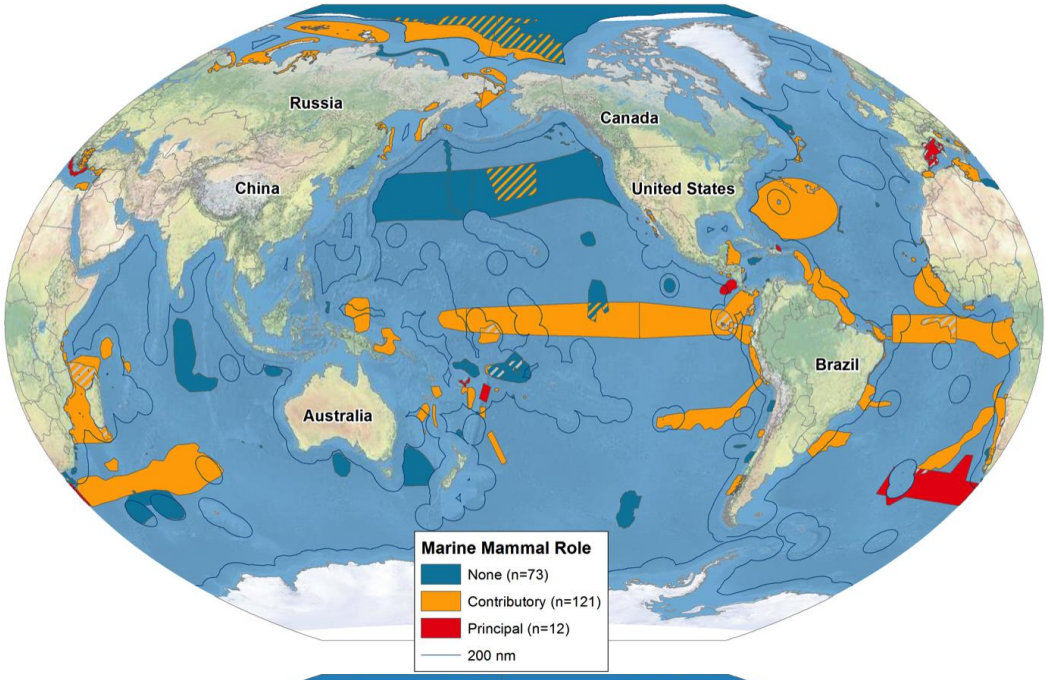


Figure 3. Migratory species data that were mentioned as playing a principal role in more than one EBSA, as described within the nine regional workshops.

Table 2. EBSAs and migratory seabird, marine mammal, sea turtle, and shark / ray species data mentioned as the principal role in the EBSA descriptions (1 = present). See Table 3 for region code definitions; see respective CBD regional reports for EBSA names listed by EBSA number. EBSA number refers to the area number listed within the original CBD regional workshop reports.

Region Code	EBSA Number	Marine Mammal	Sea Turtle	Sea-bird	Shark / Ray	Species
ETTP	1				1	Great white shark
ETTP	7	1	1			Blue whale, Leatherback sea turtle
ETTP	21			1		Pediunker / grey petrel
MED	6	1	1	1		Audouin's gull, Balearic shearwater, Bottlenose dolphin, Fin whale, Leatherback sea turtle, Loggerhead sea turtle, Long-finned pilot whale, Risso's dolphin, Short-beaked common dolphin, Sperm whale, Striped dolphin
MED	14	1	1			Green sea turtle, Loggerhead sea turtle, Mediterranean monk seal
MED	15	1				Bottlenose dolphin, Mediterranean monk seal, Short-beaked common dolphin, Sperm whale
NP	20			1		Black-footed albatross, Laysan albatross
SEA	16		1			Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle, Loggerhead sea turtle, Olive ridley sea turtle
SEA	42	1	1	1		Bottlenose dolphin, Damara tern, Fin whale, Heaviside's dolphin, Humpback whale, Leatherback sea turtle, Southern right whale
SEA	45	1	1	1		Leatherback sea turtle, Southern right whale, Tristan albatross
SIO	25	1	1			Dugong, Green sea turtle, Humpback whale
SIO	39			1		Sooty albatross, Wandering albatross
WCWA	4	1	1			Caribbean manatee, Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle
WCWA	5		1			Green sea turtle, Hawksbill sea turtle, Leatherback sea turtle
WCWA	9	1				Humpback whale
WSP	14	1	1			Humpback whale, Sea turtle, Sperm whale, Spinner dolphin
WSP	15			1		Antipodean albatross, Buller's albatross, Pediunker / grey petrel, Salvin's albatross, Wandering albatross, White-capped albatross, White-chinned petrel
WSP	21			1		Black petrel
WSP	22	1	1			Green sea turtle, Hawksbill sea turtle, Humpback whale
WSP	26	1				Humpback whale

a)



b)

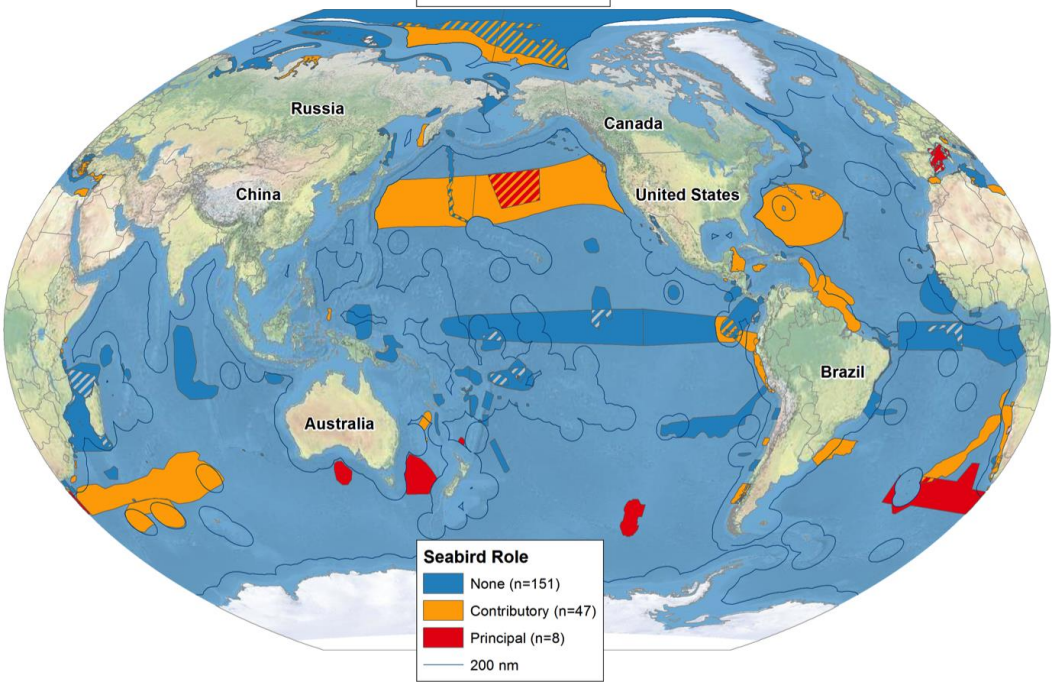


Figure 4. Continued on next page.

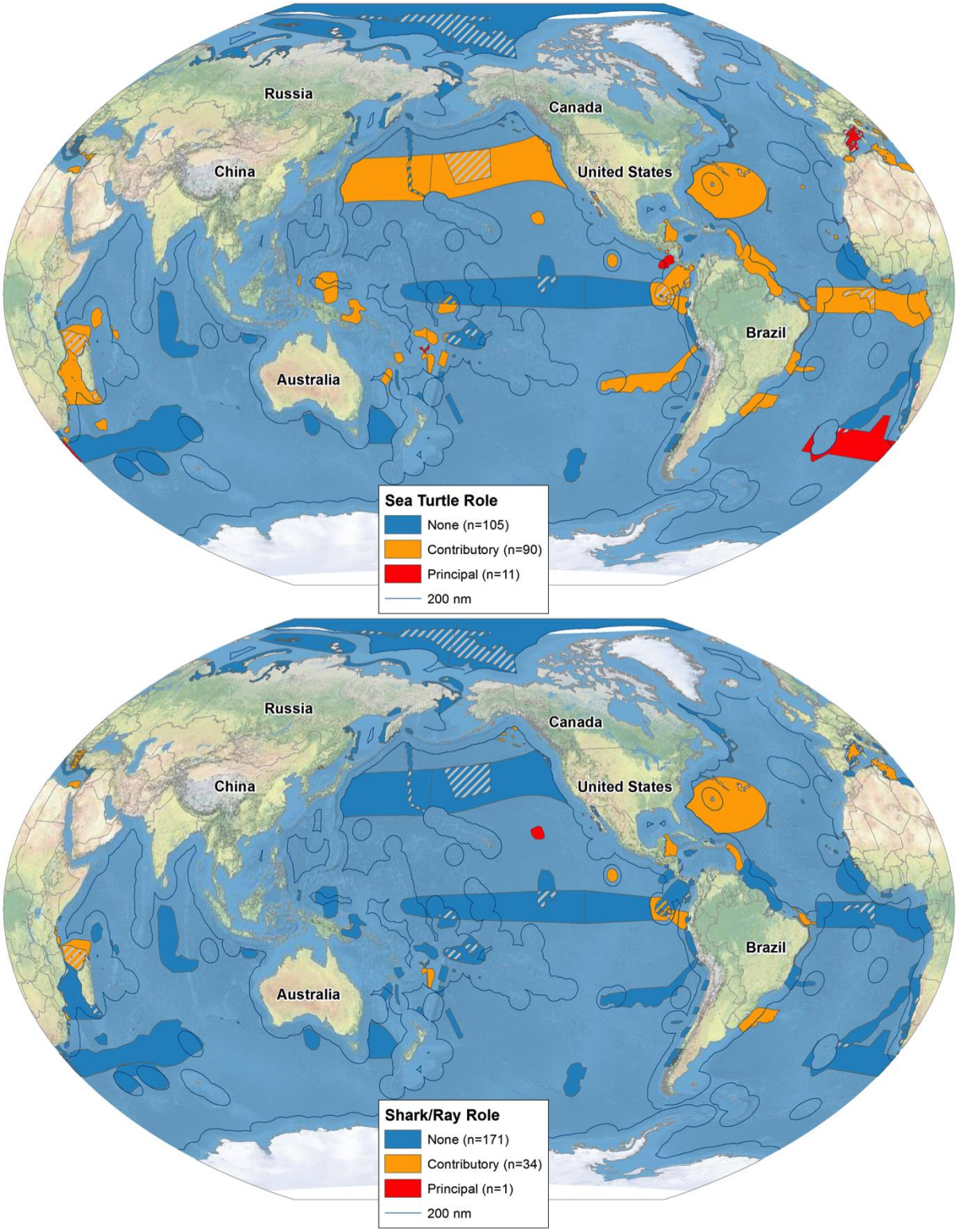


Figure 4. Global EBSAs and the migratory species data role (Principal, Contributory, or None) for a) marine mammals, b) seabirds, c) sea turtles, and d) sharks / rays. Roles were defined based on the scientific data and information presented within the EBSA descriptions in the CBD EBSA workshop reports.

22. Results from the structured assessment of workshop reports showed that a majority of EBSAs (n = 164) listed a total of 115 migratory species (marine mammals = 52, seabirds = 49, sea turtles = 6, sharks / rays = 8; Tables 1 and 3). A total of 75 species were identified to have ranges that included ABNJ, with 37 species listed under Appendix I and 93 species listed under Appendix II (total number of animals listed under both appendices was greater than 115 because some animals were listed under both). There were 42 species that were mentioned across more than four EBSAs (marine mammals = 22, seabirds = 12, sea turtles = 5, sharks / rays = 3; Figure 5). Across regions, green and leatherback sea turtles were the most frequently mentioned species, followed by humpback whales, and loggerheads sea turtles, respectively (Figure 5).

23. Out of the 164 EBSAs with CMS listed species, the ETTP region mentioned the most species (n = 52) while the ARC EBSAs mentioned the least (n = 11) (Table 3; Appendix A). The greatest number of species mentioned within one EBSA was in the WCWA Eastern Caribbean area (referenced as EBSA number 12 in the workshop report; n = 26), closely followed by the ETTP's West Wind Drift Convergence area (referenced as EBSA number 20 in the workshop report; n = 25) (Table 4). Both the Eastern Caribbean and West Wind Drift Convergence EBSAs had high numbers of migratory marine mammal species mentioned within their descriptions (n = 16 and 15, respectively) (Table 4). In addition to the WCWA's Eastern Caribbean, 13 other EBSAs in the ETTP, MED, NP, SIO, and WCWA regions had migratory species from all four taxa mentioned in their descriptions (Table 4).

24. There were 42 EBSAs (20%) that did not mention data on any migratory species and the remaining 144 EBSAs (70%) were classed as "contributory" because their descriptions mentioned information on at least one migratory species, but were not considered to have migratory species data as a principal justification (Figure 2). Although the three metrics calculated for each EBSA were correlated (Spearman's ρ, $p < 0.0001$) (Figure 6), further investigations showed that each metric explained the differences among EBSAs to varying degrees. Comparisons among principal and contributory EBSAs showed that the number of marine mammal, seabird, sea turtle, shark / ray species listed, the total number of taxa, the total number of species, the habitat use score, and the number of species described as using the EBSA for reproduction were not significantly different (Wilcoxon rank-sum test, $p > 0.10$). The number of species described to use resources within the EBSAs for food was significantly higher for principal EBSAs at $\alpha = 0.05$, but not after the Dunn-Sidak correction to reduce the probability of Type I error (Wilcoxon rank-sum test, $p = 0.0444$).

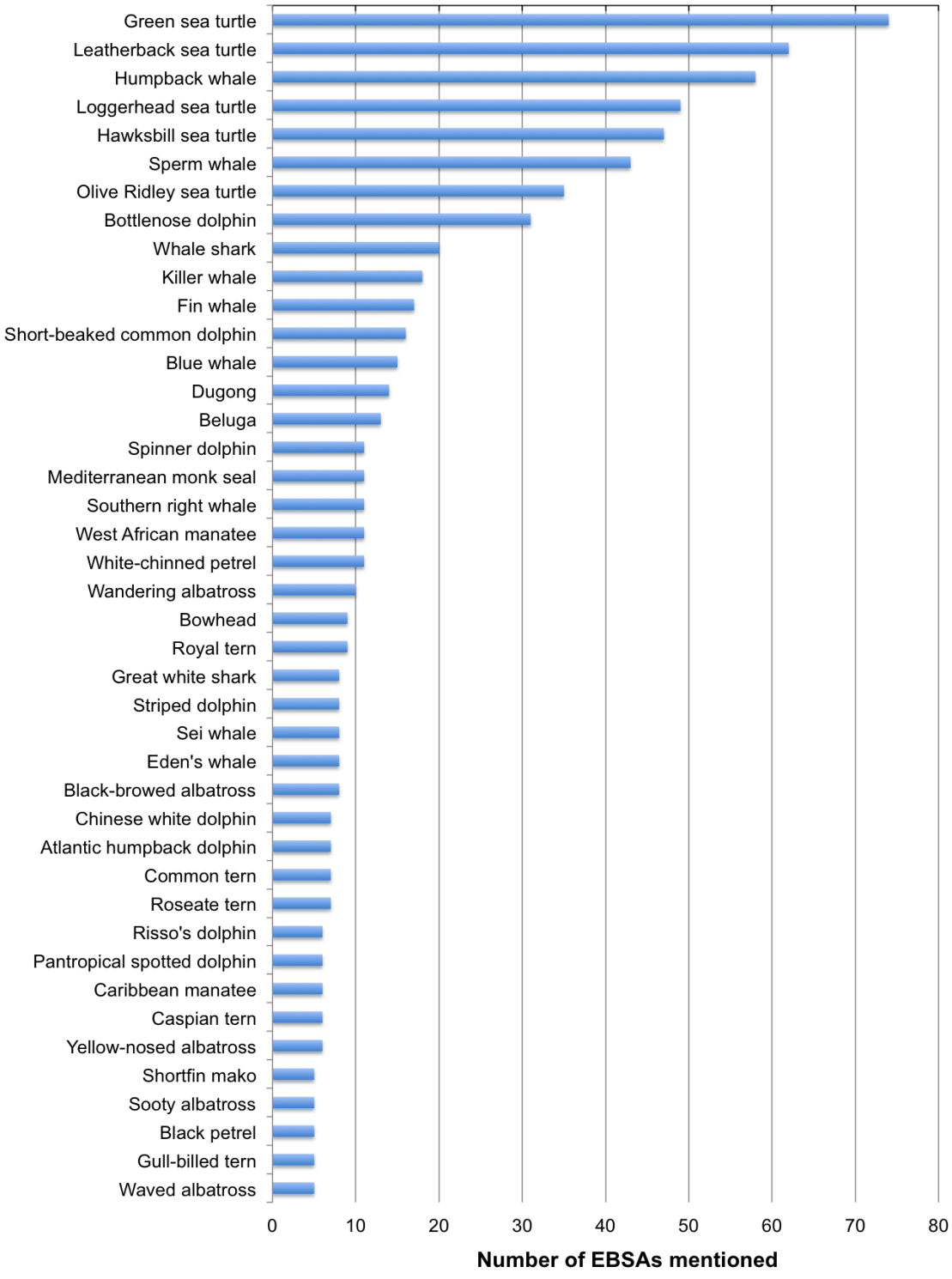


Figure 5. The number of EBSAs that CMS listed marine mammals, seabirds, sea turtles, and sharks were mentioned within EBSA descriptions. Only species with data and information mentioned in more than four EBSAs are shown here.

Table 3. The number of marine mammal, seabird, sea turtle, shark / ray species listed under the CMS Appendices and mentioned within the EBSA descriptions in the nine CBD regional workshop reports.

	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	EBSAs (n)
Total unique	51	49	6	8	114	206
By region						
Arctic (ARC)	10	1	0	0	11	11
Eastern Tropical and Temperate Pacific (ETTP)	21	23	5	3	52	21
Mediterranean (MED)	11	14	3	4	32	17
North Pacific (NP)	17	3	4	2	26	20
Northwest Atlantic (NWA)	13	0	0	0	13	7
Southeast Atlantic (SEA)	14	21	6	0	41	45
Southern Indian Ocean (SIO)	13	13	5	2	33	39
Wider Caribbean and Western Mid-Atlantic (WCWA)	21	16	6	7	50	20
Western South Pacific (WSP)	6	9	3	1	19	26

Table 4. EBSAs and the number of marine mammals, seabirds, sea turtles, sharks / rays species listed under CMS and mentioned within the EBSA description, the total number of CMS listed species, MSL score, habitat use score, and migratory species data role within the EBSA description. For region code definitions, refer to Table 3; EBSA number refers to the area number listed within the original CBD regional workshop reports; for maps, see Appendices A and B.

Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
ARC	1	3	1			4	5	2	Contributory
ARC	2								None
ARC	3	8				8	5	8	Contributory
ARC	4	1				1	7	1	Contributory
ARC	5	1				1	5	1	Contributory
ARC	6	1				1	1		Contributory
ARC	7	3				3	5	1	Contributory
ARC	8	1	1			2	5	1	Contributory
ARC	9								None
ARC	1	2				2	5	1	Contributory
ARC	11	1				1	5	1	Contributory
ETTP	1			1	1	2	7	2	Principal
ETTP	2			1	1	2	1		Contributory
ETTP	3	8	4			12	1		Contributory
ETTP	4	8	2	4	1	15	7	6	Contributory
ETTP	5	2		3		5	5	5	Contributory
ETTP	6	5	1	5	2	13	7	1	Contributory
ETTP	7	4		1		5	7	5	Principal
ETTP	8	1		3		4	5	5	Contributory
ETTP	9	1				1	3	1	Contributory
ETTP	1	4	2	4	1	11	5	3	Contributory
ETTP	11	4	1	1	1	7	6	4	Contributory
ETTP	12	2	2			4	4	3	Contributory
ETTP	13	6	7			13	4	15	Contributory
ETTP	14	3	6			9	7	13	Contributory

Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
ETTP	15								None
ETTP	16	5	9			14	4	5	Contributory
ETTP	17								None
ETTP	18	1		1		2	5	1	Contributory
ETTP	19								None
ETTP	2	15	1			25	7	7	Contributory
ETTP	21		3			3	7	1	Principal
MED	1	2	1	1		4	7	3	Contributory
MED	2				1	1	7		Contributory
MED	3	3		1		4	7		Contributory
MED	4	4		2		6	1		Contributory
MED	5	6	2	1		9	7	13	Contributory
MED	6	9	8	2	1	2	7	24	Principal
MED	7								None
MED	8	3		3	1	7	7	4	Contributory
MED	9	2	3	2		7	7	1	Contributory
MED	1		1	1		2	5	2	Contributory
MED	11	1	5	3	1	1	5	6	Contributory
MED	12	6		3	1	1	7	4	Contributory
MED	13	1	1	2		4	7	6	Contributory
MED	14	1		2		3	7	4	Principal
MED	15	4				4	7	6	Principal
MED	16	5	3		1	9	7	7	Contributory
MED	17	7			1	8	7	2	Contributory
NP	1				1	1	5	1	Contributory
NP	2	4	1			5	1		Contributory
NP	3	4				4	5	1	Contributory
NP	4	1				1	5	1	Contributory
NP	5								None

Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
NP	6	11				11	7	2	Contributory
NP	7	3				3	5	2	Contributory
NP	8	3				3	5		Contributory
NP	9	2				2	5	2	Contributory
NP	1	1			1	2	1		Contributory
NP	11	1		1		2	3	2	Contributory
NP	12	3	2	4	2	11	7	2	Contributory
NP	13	3				3	1		Contributory
NP	14	5		1		6	1		Contributory
NP	15	1		1		2	7	2	Contributory
NP	16								None
NP	17				1	1	4	1	Contributory
NP	18								None
NP	19		2	1		3	5		Contributory
NP	2		2	2	1	5	7	7	Principal
NWA	1								None
NWA	2								None
NWA	3								None
NWA	4	1				1	5	1	Contributory
NWA	5	12				12	7	2	Contributory
NWA	6								None
NWA	7								None
SEA	1	2	2	2		6	5	2	Contributory
SEA	2								None
SEA	3	1				1	5		Contributory
SEA	4								None
SEA	5			4		4	4		Contributory
SEA	6			4		4	7	3	Contributory
SEA	7	2	2	4		8	6	6	Contributory

Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
SEA	8	2		1		3	6	1	Contributory
SEA	9	1		1		2	6	3	Contributory
SEA	1			3		3	4	2	Contributory
SEA	11	4		5		9	7	1	Contributory
SEA	12	2		5		7	7	5	Contributory
SEA	13	1	1			2	7	1	Contributory
SEA	14			1		1	4		Contributory
SEA	15	1	4	3		8	7		Contributory
SEA	16			5		5	1	5	Principal
SEA	17	1		4		5	7	4	Contributory
SEA	18								None
SEA	19	1		4		5	6	4	Contributory
SEA	2	2		4		6	6		Contributory
SEA	21	7		4		11	7	3	Contributory
SEA	22	1		6		7	5	5	Contributory
SEA	23	6		4		1	5	4	Contributory
SEA	24			5		5	4	2	Contributory
SEA	25			5		5	7		Contributory
SEA	26			5		5	7	5	Contributory
SEA	27	2		6		8	5	1	Contributory
SEA	28								None
SEA	29	1				1	5		Contributory
SEA	3	2		4		6	6		Contributory
SEA	31	1				1	7		Contributory
SEA	32	1	1	3		5	7	3	Contributory
SEA	33	4		1		5	4		Contributory
SEA	34		1			1	5	2	Contributory
SEA	35								None
SEA	36								None

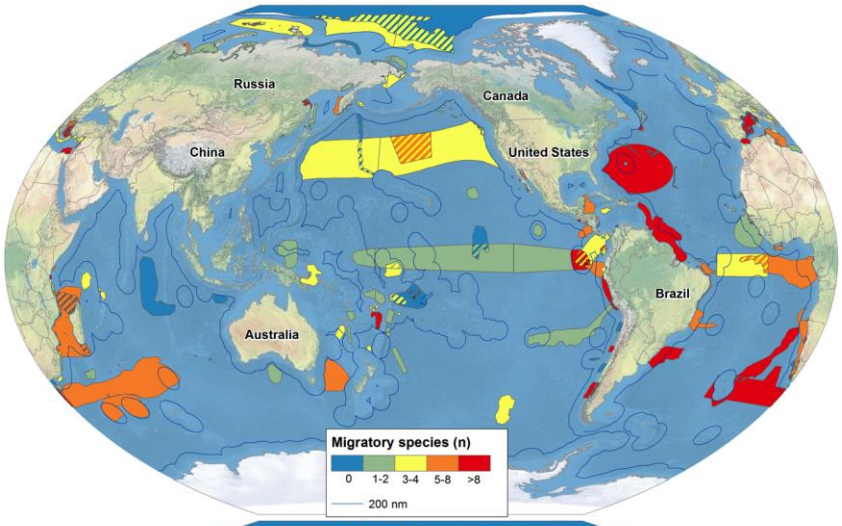
Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
SEA	37								None
SEA	38								None
SEA	39	2	8			1	4	2	Contributory
SEA	4		1			1	7		Contributory
SEA	41								None
SEA	42	5	1	1		7	7	1	Principal
SEA	43	2	5			7	5	8	Contributory
SEA	44	2	1			12	6	3	Contributory
SEA	45	2	6	1		9	5	1	Principal
SIO	1								None
SIO	2			1		1	4		Contributory
SIO	3		3	1		4	5	2	Contributory
SIO	4		1			1	4	1	Contributory
SIO	5			1		1	4	1	Contributory
SIO	6	1		3		4	7	4	Contributory
SIO	7	2		1	1	4	5	3	Contributory
SIO	8	4		3	1	8	7	3	Contributory
SIO	9	3			2	5	7	5	Contributory
SIO	1	3				3	1		Contributory
SIO	11	1	4			5	7	5	Contributory
SIO	12	4		3		7	1	7	Contributory
SIO	13	6	2	4	1	13	5	9	Contributory
SIO	14								None
SIO	15	3			1	4	5		Contributory
SIO	16	1			1	2	5		Contributory
SIO	17	3	1	3	1	8	5	7	Contributory
SIO	18	2		5	1	8	7	1	Contributory
SIO	19	2		5		7	5	7	Contributory
SIO	2	1		2		3	1	3	Contributory

Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
SIO	21	1	1	5		7	7	5	Contributory
SIO	22	1		1		2	5	1	Contributory
SIO	23								None
SIO	24	2		2	1	5	5	3	Contributory
SIO	25	9		5		14	1	6	Principal
SIO	26		8			8	5	3	Contributory
SIO	27	5		3		8	3	2	Contributory
SIO	28			1		1	5	1	Contributory
SIO	29	1		2		3	7	5	Contributory
SIO	3								None
SIO	31								None
SIO	32	3		1		4	5	2	Contributory
SIO	33	2		1	1	4	5	1	Contributory
SIO	34								None
SIO	35								None
SIO	36								None
SIO	37								None
SIO	38								None
SIO	39		2			2	5	2	Principal
WCWA	1	1	1	4	1	7	5	12	Contributory
WCWA	2	2		3		5	7	3	Contributory
WCWA	3								None
WCWA	4	1		3		4	7	4	Principal
WCWA	5	3		3		6	7	5	Principal
WCWA	6		3			3	1	2	Contributory
WCWA	8	1				1	4		Contributory
WCWA	9	1				1	7	1	Principal
WCWA	11	4		3		7	1		Contributory
WCWA	12	16	4	5	1	26	7	8	Contributory

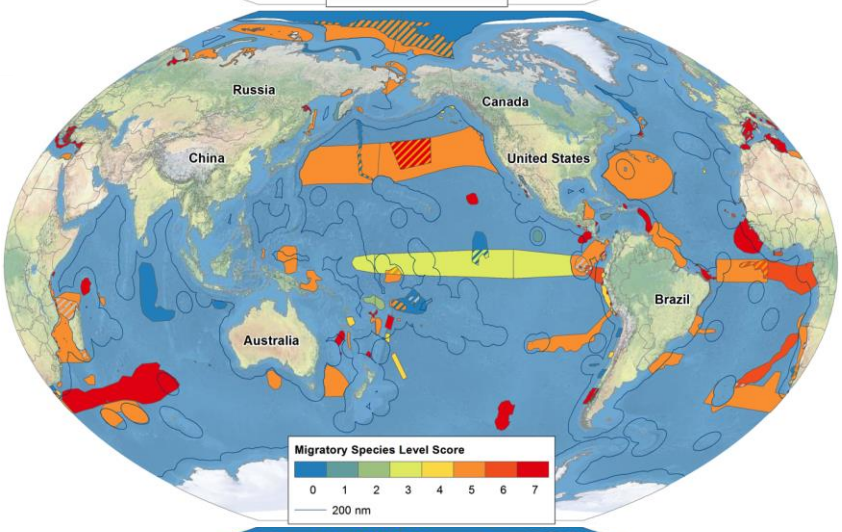
Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
WCWA	13	2	4	5	6	17	5		Contributory
WCWA	14								None
WCWA	15								None
WCWA	16	3	3	5		11	5	7	Contributory
WCWA	17								None
WCWA	18	1		3	1	5	7	7	Contributory
WCWA	19	3		3	1	7	5	7	Contributory
WCWA	2	1		2		3	5	4	Contributory
WCWA	21	4		4		8	5	13	Contributory
WCWA	22	2	1	3	3	18	5	18	Contributory
WSP	1	1		2		3	5	2	Contributory
WSP	2								None
WSP	3	1				1	5	1	Contributory
WSP	4	1		1		2	5	1	Contributory
WSP	5	5		3	1	9	5	3	Contributory
WSP	6	2				2	4		Contributory
WSP	7								None
WSP	8	1		2		3	5	1	Contributory
WSP	9	1		1		2	4		Contributory
WSP	1	1				1	1		Contributory
WSP	11	1		2		3	5		Contributory
WSP	12	2		2		4	5	3	Contributory
WSP	13			1		1	2	1	Contributory
WSP	14	3				3	7	1	Principal
WSP	15		7			7	5	3	Principal
WSP	16	1				1	3		Contributory
WSP	17	1				1	4		Contributory
WSP	18								None
WSP	19								None

Region	EBSA Number	Marine mammals	Seabirds	Sea turtles	Sharks / rays	Total spp.	MSL Score	Habitat Use Score	Role
WSP	2	1	1	1		3	7	1	Contributory
WSP	21		3			3	7	3	Principal
WSP	22	2		2		4	7	4	Principal
WSP	23								None
WSP	24	3				3	5		Contributory
WSP	25		1	1		2	5	2	Contributory
WSP	26	1		1		2	7	1	Principal

a)



b)



c)

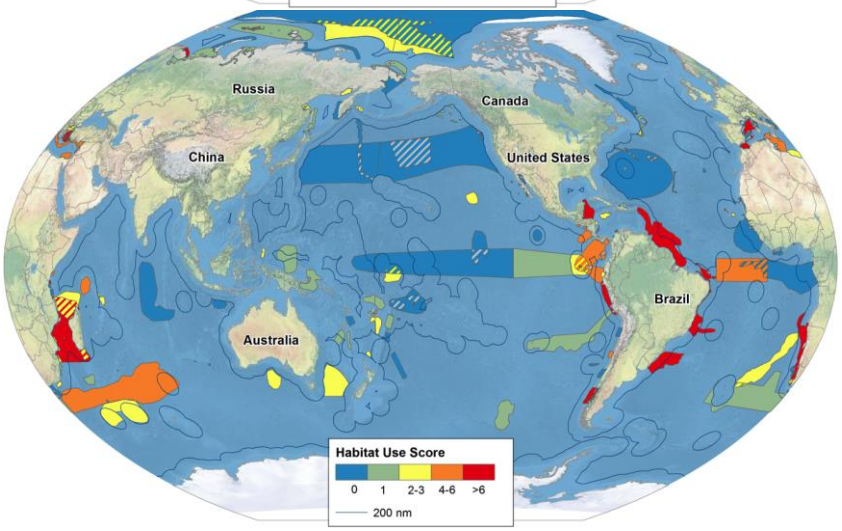


Figure 6. Three metrics used to assess migratory species data within EBSA descriptions for all nine regions: a) number of migratory species, b) migratory species level score, and c) habitat use scores. For regional maps of panels a and b, see Appendices A and B.

25. Relative average MSL and habitat use scores were similar to the relative average number of species when comparing across regions (Appendices A and B). Higher averages for the number of species and MSL scores were found for the ETTP, WCWA, and MED while low numbers were found for the ARC and NWA regions (Figure 7). Lowest average habitat use scores were found for the NP and WSP, corresponding to fairly low average numbers of species. Principal EBSAs had significantly higher MSL scores than contributory EBSAs (contingency table analysis, $p = 0.0068$). In particular, principal EBSAs had scores from the medium-level criteria (criteria 4, 5, 6, or 7) that were significantly higher (contingency table analysis, $p = 0.0018$) and low-level scores were significantly higher at $\alpha = 0.05$, but not after the Dunn-Sidak correction (contingency table analysis, $p = 0.0383$). These results showed that for principal EBSAs, all sections were essential in determining migratory species relevance, including criteria that were weighed less, *a priori*, such as criteria 4, 5, 6 and 7 (medium level criteria). Principal EBSAs also had a higher likelihood of having migratory species mentioned within the text sections (the low-level score = 1), which was expected given that text descriptions often discussed key species that would help define whether or not migratory species were the principal role.

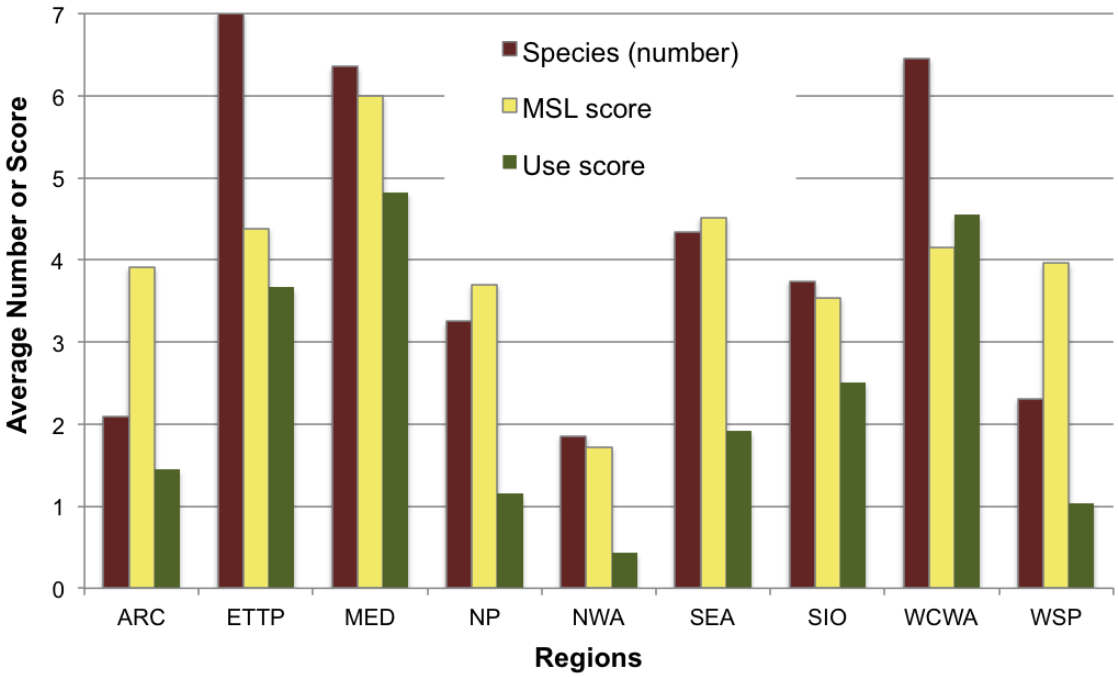


Figure 7. The average number of species, MSL score, and habitat use score for EBSAs within each region, based on named species within EBSA descriptions. For EBSA region code definitions, refer to Table 3.

26. When comparing across all EBSAs and their criteria rankings, criteria 2, 3, 5, 6, and 7 were significantly different (contingency table analysis, $p < 0.05$) (Table 5). Principal or contributory EBSAs were more likely to have "some" and "high" rankings for criteria 2, 3, and 5 while EBSAs categorized as "none" were more likely to have "low" or "don't know" rankings (Table 6; Figure 8). For criterion 6, EBSAs with migratory species as a contributory role were significantly different from other EBSAs (more likely to rank high). Criterion 7 (naturalness) was significantly different between principal and contributory EBSAs (at $\alpha = 0.05$), but not between EBSAs with and without any migratory species mentioned (Table 6).

Table 5. Results from the contingency table analyses to compare of criteria rankings among EBSAs that were described with migratory species data as a principal, contributory, or without any role (none). *significant at $\alpha_1 = 0.012$ after Dunn-Sidak correction.

EBSA Criteria	χ^2	p	
1. Uniqueness or rarity	4.031	0.6725	
2. Special importance for life-history stages of species	33.242	<0.0001	*
3. Importance for threatened, endangered or declining species and / or habitats	63.648	<0.0001	*
4. Vulnerability, fragility, sensitivity, or slow recovery	5.445	0.4881	
5. Biological productivity	26.387	0.0002	*
6. Biological diversity	22.826	0.0009	*
7. Naturalness	16.555	0.0111	*

Table 6. Results from the partitioned chi-square analyses to compare of criteria rankings among EBSAs categorized according to migratory species data role (principal, contributory, or none). *significant at $\alpha = 0.05$; **significant at $\alpha_1 = 0.0051$ after Dunn-Sidak correction. For criteria names, see Table 5.

	Criteria	χ^2	p	
Contributory or Principal vs. None	2	29.13	<0.0001	**
	3	54.883	<0.0001	**
	5	18.793	0.0003	**
	6	8.7684	0.0323	*
	7	5.272	0.1529	
Contributory vs. Principal	2	4.744	0.1915	
	3	8.929	0.0303	*
	5	9.75	0.0208	*
	6	15.331	0.0016	**
	7	11.916	0.0077	*

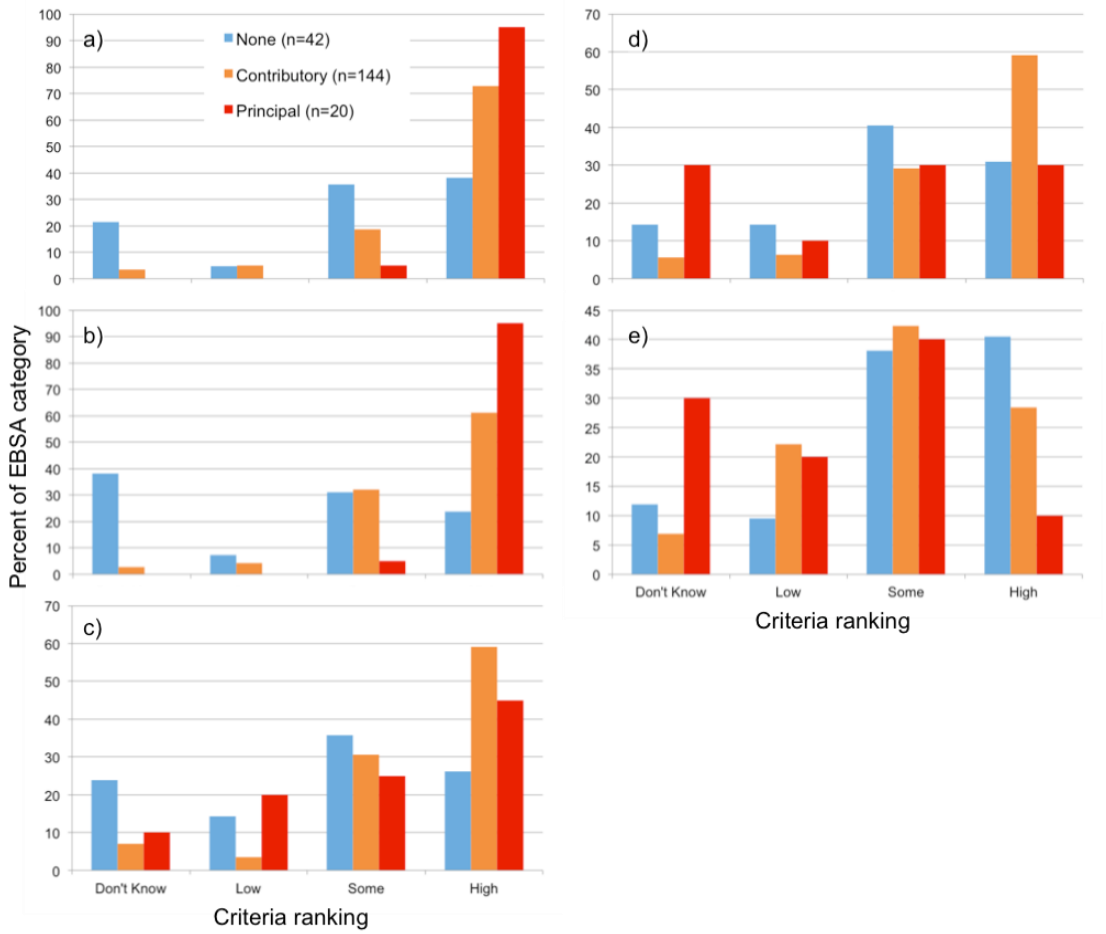


Figure 8. EBSAs categorized by migratory species data role and their percent frequencies of signficantly different rankings for EBSA criteria (contingency table analysis, $p < 0.05$): a) Criterion 2: Special importance for life-history stages of species, b) Criterion 3: Importance for threatened, endangered or declining species and / or habitats, c) Criterion 5: Biological productivity, d) Criterion 6: Biological diversity, and e) Criterion 7: Naturalness.

Potential contribution of the scientific data and information within EBSA descriptions

27. Data on the leatherback sea turtle (*Dermochelys coriacea*), humpback whale (*Megaptera novaeangliae*), pediunker / grey petrel (*Procellaria cinerea*), and wandering albatross (*Diomedea exulans*) were used as the principal justification in the greatest number of EBSA descriptions (Figure 3). Regardless of the data role (principal or contributory), information on the green sea turtle (*Chelonia mydas*), humpback whale, and white-chinned petrel (*Procellaria aequinoctialis*) were most frequently mentioned among EBSA descriptions, within their respective taxa (Figure 5). Therefore, information on these species were used as case studies to further investigate the potential of the scientific data and information used to describe EBSAs to contribute to the conservation needs of migratory species and promote the connectivity of migratory species' ecological networks in ABNJ.

28. In the GROMS database, species distribution and habitat use (feeding and reproduction) were available for all six case study species except for the sea turtles, where only general distribution was available (Riede 2004). For this study, OBIS-SEAMAP location data for the selected case study species were collected from 1756-2014, with the most data available for humpbacks, green and leatherback sea turtles, and relatively little data

for pediunker / grey petrel and white-chinned petrels (Appendix C). SWOT nesting data on leatherback sites were collected from numerous data projects from 1979-2013 (n = 715) and for green sea turtle sites from 1930-2013 (n = 1222).

Leatherback sea turtles

29. Leatherback sea turtles are a cosmopolitan species and all EBSAs that mentioned data on leatherback sea turtles were within the species' known range (Riede 2004). When comparing EBSAs that mentioned data on nesting leatherback sea turtles (n = 24), most overlaps occurred in the Caribbean and western Africa (Figure 9a). There were also relatively high nesting site densities in Sri Lanka and in the Andaman Sea (south of Myanmar) where EBSAs were not present; Sri Lankan waters were considered for EBSAs while the Andaman Sea was not (Figure 1). Meanwhile, there were also relatively high leatherback nesting site densities near Papua New Guinea, Solomon Islands, and Vanuatu where EBSAs were present, and have mentioned leatherback sea turtles in their descriptions. In addition, there were 19 EBSAs that mentioned leatherback sea turtle foraging and when overlaid with OBIS-SEAMAP locations, there were several EBSAs in the Pacific and south Atlantic where there were relatively low densities (Figure 9b).

30. Leatherback sea turtle data were described as the principal role in seven EBSAs, many of them overlapping with relatively high densities of recorded locations and nesting sites except for the Mediterranean. Areas that had a relatively high density of recorded locations occurred in the United States (US) Exclusive Economic Zone (EEZ), mid-northern Atlantic and near the Azores, and EEZs of countries in northern Europe. These areas had little to no overlap with the extent considered by the EBSA process at the regional workshops, although there were several protected areas already in place that have recognized the importance of resources within these regions (Wallace et al. 2010). The absence of described EBSAs in areas within the US and northern European EEZs was mainly a result of the exclusion of these areas from the EBSA process (Figure 1). However, areas north and west of the Azores EEZ, Sri Lanka EEZ and areas around the Solomon Islands had a high density of locations or nesting sites recorded and were within the extent considered by the EBSA process (Figure 9). While there were several protected areas near the Azores, there were relatively few in the Indian, Sri Lankan, Andaman Sea, Papua Vanuatu, and Solomon Islands EEZs. Therefore, areas where high densities of leatherback observations occur without EBSAs or other protected areas still need to be recognized to help select areas for conservation.

a)

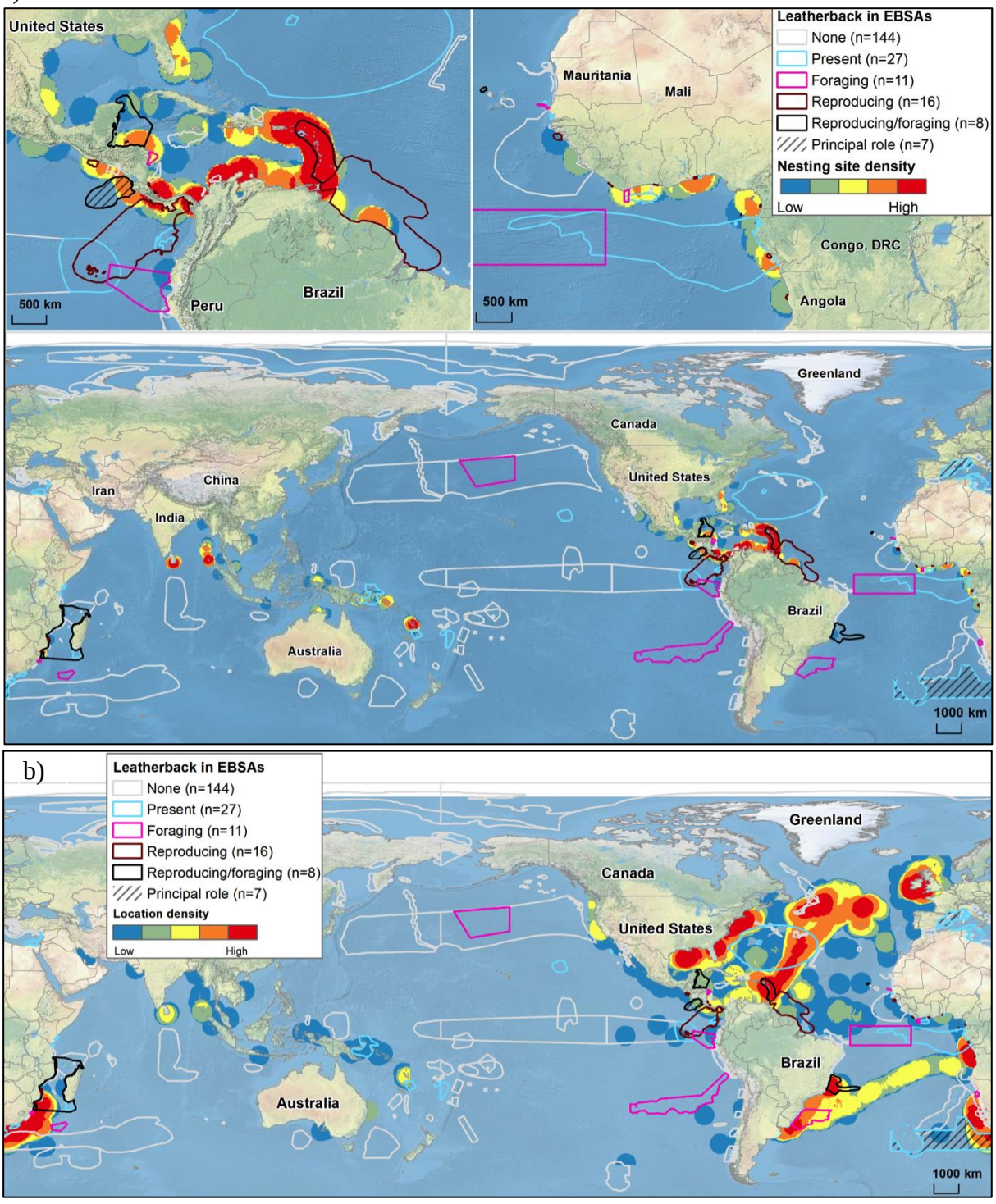


Figure 9. Leatherback sea turtle, *Dermochelys coriacea*, presence, and in areas of reproduction and / or foraging as described in EBSAs with a) relative densities of nesting site locations (Ban et al. 2014a, Ban et al. 2014b, Merrie et al. 2014, Warner 2014), and b) relative densities of OBIS-SEAMAP recorded locations (Appendix C) (SWOT 2006, 2007, 2008, Halpin et al. 2009, SWOT 2009, 2010, 2011, 2012, 2013, Kot et al. 2014, SWOT 2014). Densities are described using quintiles.

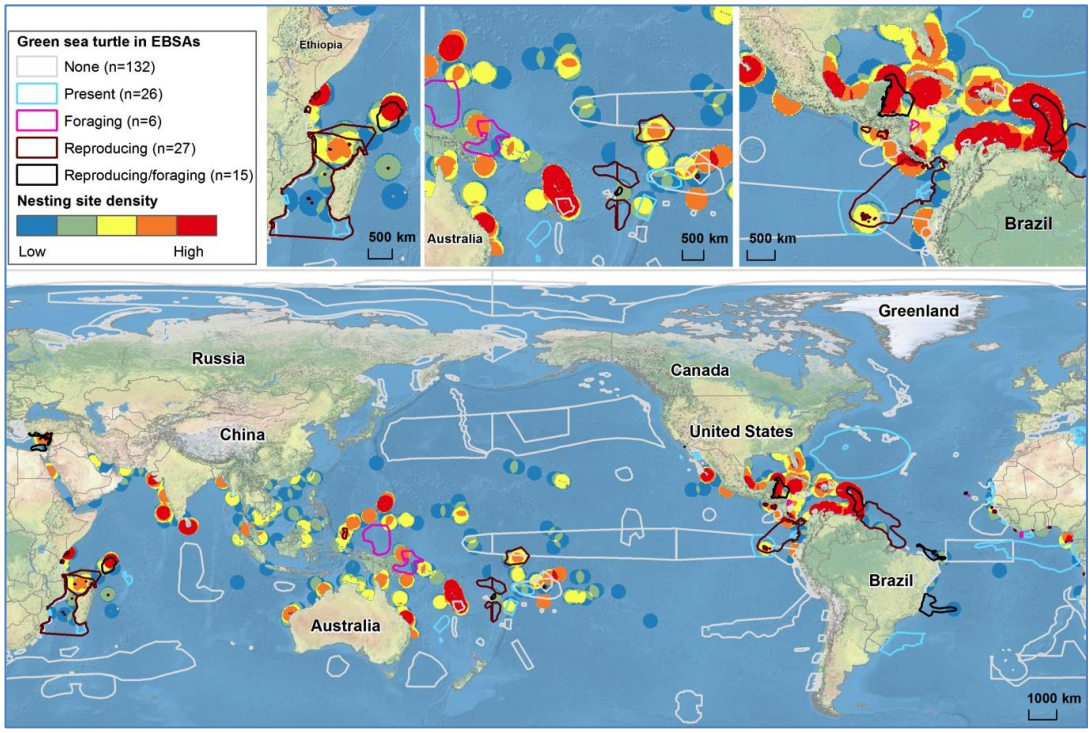
Green sea turtles

31. Green sea turtles are distributed widely except for near the poles, and all EBSAs with green sea turtle data in the descriptions were found within the species' largest known range (IUCN and UNEP-WCMC 2014). When comparing EBSAs that mentioned data on nesting green sea turtles (n = 42), most overlaps with high nesting site densities occurred in the Caribbean, Mediterranean, and eastern and western parts of Africa (Figure 10a). Meanwhile, some described EBSAs in the southwest Pacific and southwest Atlantic that mentioned green sea turtle data overlapped with areas of relatively low densities of nesting sites (Figure 10a). There were also relatively high nesting site densities in southern Baja California Peninsula and Gulf of Mexico coasts of Mexico, the US eastern EEZ, Cayman Islands, off western India and Sri Lanka, northern Australian coasts, and Guam and the Northern Mariana Islands EEZ where no EBSAs were present. Most areas with a relatively high density of green sea turtle nesting sites were considered in the EBSA process except for EEZs of the US, India, and Australia (Figure 1). There were 21 EBSAs that mentioned green sea turtle foraging and when overlaid with OBIS-SEAMAP locations, there were several described EBSAs in the southwest Pacific and south Atlantic where there were relatively low densities (Figure 10b). Six described EBSAs where green sea turtle data played a principal role overlapped with high densities of recorded locations and nesting sites in the Caribbean, southern Indian Ocean, south Pacific and Mediterranean but not the southeast Atlantic. Areas that had a relatively high density of recorded locations and were considered in the EBSA process include the Canary Islands, without any described EBSAs overlapping, the eastern and western coasts of the southern part of Africa, the Mediterranean, and the Persian Gulf. As with the other migratory species case studies assessed here, the lack of EBSAs areas of high numbers of records was mainly a result of the exclusion of some EEZs from being considered in the EBSA process (Figure 1). These excluded areas have been recognized to have important resources, with several protected areas already in place (IUCN and UNEUP-WCMC 2014).

Humpback whales

32. Humpback whales are also globally distributed, and data on humpbacks were mentioned in 58 EBSAs that were mostly near the coasts, and overlapping with some of the highest densities of recorded locations in OBIS-SEAMAP (Figure 11) (Wallace et al. 2010, IUCN 2014). Humpback whales migrate between feeding areas in the upper latitudes, where many of the described EBSAs did not overlap, and breeding grounds in the lower latitudes, where there were some overlap with described EBSAs (Figure 11a) (Halpin et al. 2009). Humpback foraging data were mentioned in 12 EBSAs and information on reproduction were mentioned in 18 EBSAs, but these described EBSAs did not overlap with known feeding and reproduction areas (CAFF 2001, Riede 2004) because many of these areas were not within the extent considered by the EBSA process. Areas with a relatively high density of locations and EBSA overlap include the Pacific coast of Mexico, Caribbean, off Ecuador and Colombia in the ETTP, off western Africa in the south Atlantic, eastern Africa in the southern Indian Ocean, off of Russia in the northern Pacific, and near the southern Pacific Islands (Figure 11b). The six EBSAs where humpback whale data were described as the principal role also overlapped with high densities of recorded locations in the south Pacific, southeast Atlantic, Caribbean, and southern Indian Oceans. Meanwhile, high densities were found in the southern Indian Ocean and the EEZs of Canada, US, Greenland, northern Europe, and Norway, where EBSAs were not considered. There were no protected areas in ABNJ in the southern Indian Ocean, along with minimal coverage in other areas shown to have humpbacks without EBSAs (Riede 2004).

a)



b)

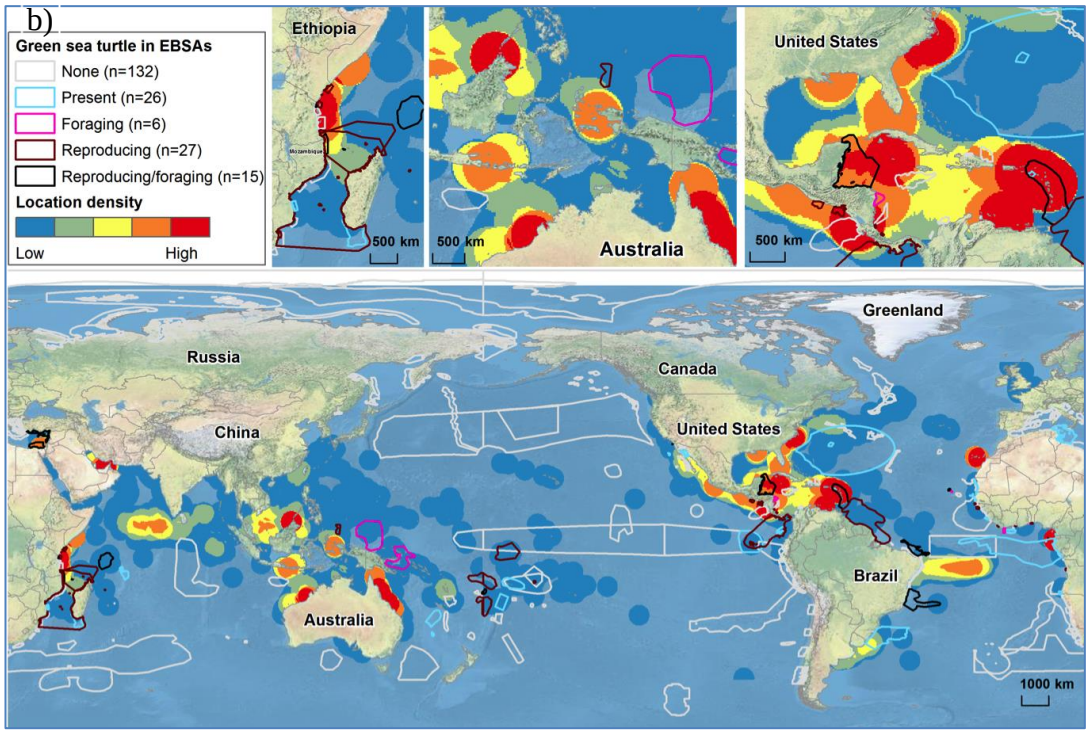


Figure 10. Green sea turtle, *Chelonia mydas*, presence and areas of foraging and / or reproducing as described in EBSAs with a) relative densities of SWOT nesting site locations (Halpin et al. 2009), and b) relative densities of OBIS-SEAMAP recorded locations (Appendix C) (SWOT 2006, 2007, 2008, Halpin et al. 2009, SWOT 2009, 2010, 2011, 2012, 2013, Kot et al. 2014, SWOT 2014). Green sea turtle data were the principal role in the description of 6 small EBSAs, not shown here because of the scale. Densities are described using quintiles.

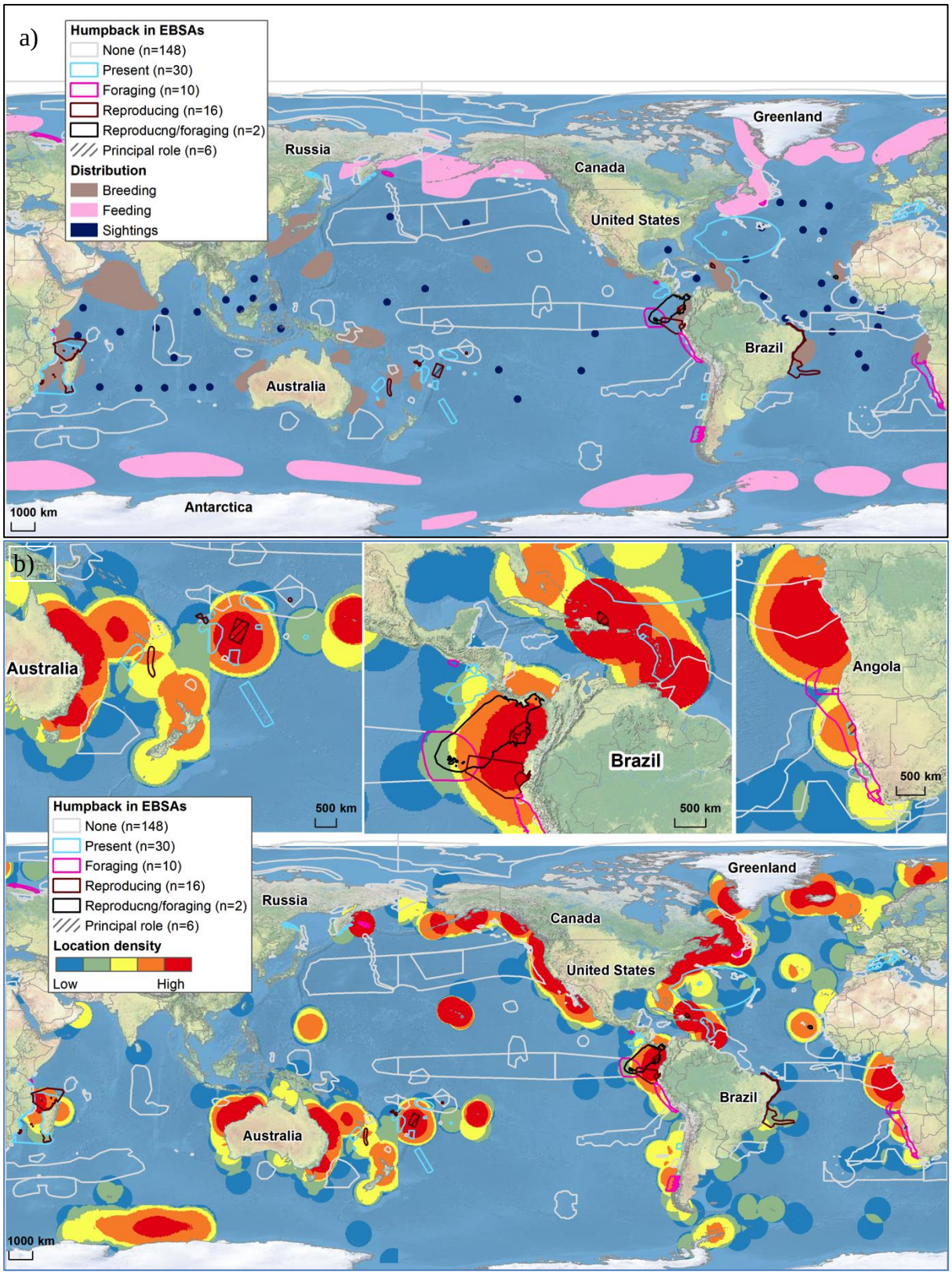
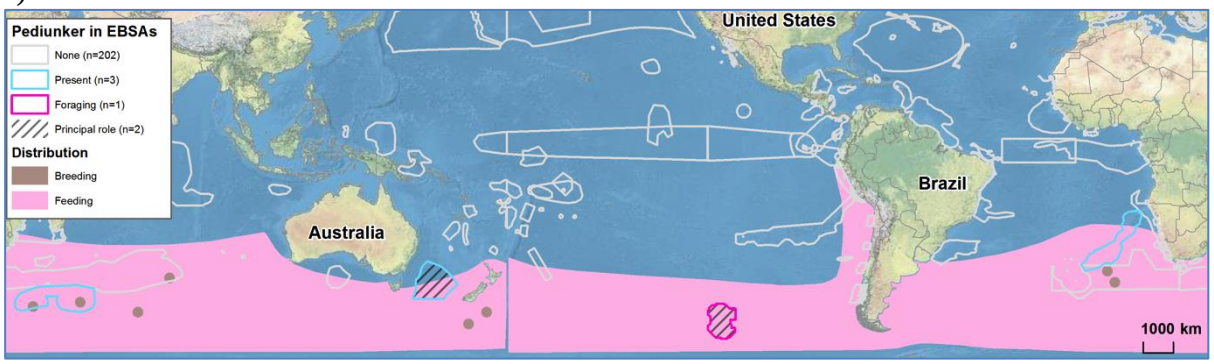


Figure 11. Humpback whale, *Megaptera novaeangliae*, presence, and in areas of reproduction and / or foraging as described in EBSAs with a) sightings, feeding and breeding sites (Halpin et al. 2009), and b) relative densities of OBIS-SEAMAP recorded locations (Appendix C) (Riede 2004). Densities are described using quintiles.

Pediunkers / grey petrels

33. Pediunkers / grey petrels were mentioned in four EBSAs within the Southern Ocean, where one in the ETTP mentioned that they feed. A portion of the pediunker / grey petrel's circumpolar distribution in the southern hemisphere was considered in the EBSA process, with one breeding site in the Indian Ocean and two in the south Pacific occurring south of the areas considered (Figure 12a) (IUCN and UNEP-WCMC 2014). Furthermore, the two EBSAs where they played a principal role (off southeast Australia and in the ETTP) did not overlap with mapped breeding sites (Riede 2004, BirdLife International and NatureServe 2013) or any recorded locations in OBIS-SEAMAP (Riede 2004) (Figure 12). There were some overlaps of breeding sites with EBSAs, mainly in the southeast Atlantic, where pediunkers / grey petrels were not included in the description, and the southern Indian Ocean where pediunkers / grey petrels were mentioned as present, but as a contributory role in the description (Prince Edward Islands, Del Cano Rise and Crozet Islands EBSA). Outside of the areas considered in the EBSA process, where high location densities did occur, there were currently a high presence of protected areas (Halpin et al. 2009) and IBAs (IUCN and UNEP-WCMC 2014), recognizing the importance of marine resources for multiple species. Overall, there were relatively little location data available on OBIS-SEAMAP (Appendix C) (Birdlife International 2013) and actual distribution for pediunker / grey petrel is likely broader than recorded observations (Figure 12b).

a)



b)

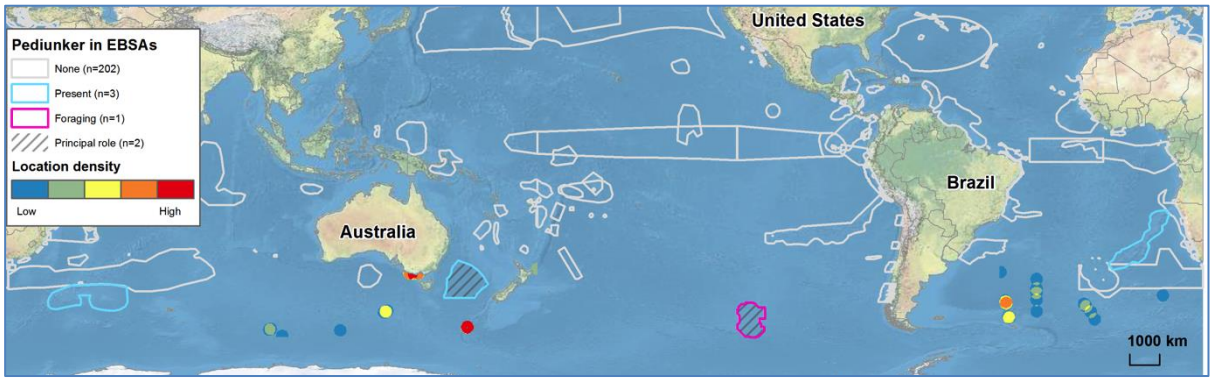
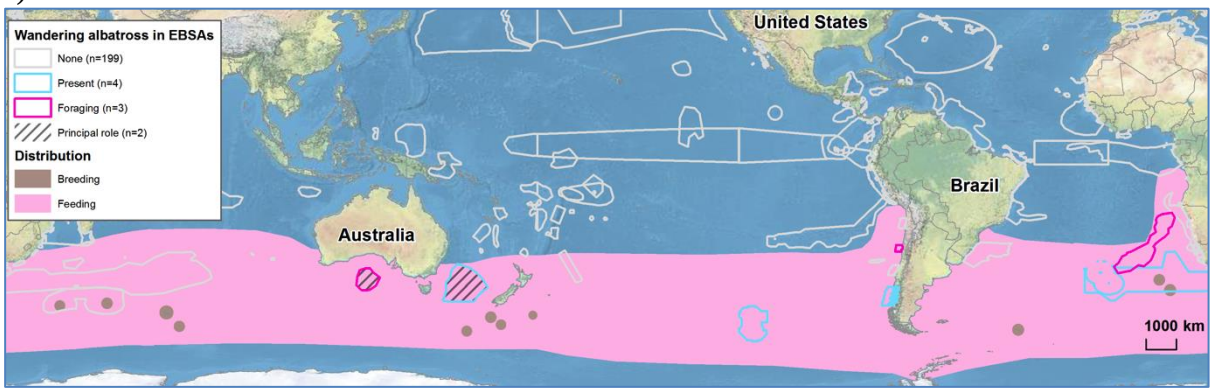


Figure 12. Pediunker / grey petrel, *Procellaria cinerea*, presence and areas of foraging as described in EBSAs with a) breeding and feeding sites (Halpin et al. 2009), and b) relative densities of OBIS-SEAMAP recorded locations (Appendix C) (Riede 2004). Densities are described using quintiles.

Wandering albatross

34. Wandering albatross are distributed within the Southern Ocean with breeding sites on small remote islands, but were not mentioned to reproduce in any EBSA descriptions (Figure 13a) (Halpin et al. 2009). An EBSA workshop has not yet been convened for the circumpolar Southern Ocean region, so inclusions of wandering albatross in EBSA reports are restricted to southern regions of the South Pacific, East Atlantic and South Indian Ocean workshop regions. All seven EBSAs mentioning wandering albatross fell within their feeding extent (Riede 2004, BirdLife International and NatureServe 2013), three of which mentioning foraging in their descriptions (Figure 13a). The extent considered by the EBSA process did not encompass their feeding area's southern boundary, where there were high densities of recorded locations in the southern Atlantic Ocean off Argentina and some presence in the southern Indian Ocean (Figure 13b) (Riede 2004). However, these areas contained numerous protected areas and IBAs, specifically off of Uruguay and Argentina, but none directly south of Prince Edward Island in the southern Indian Ocean (Halpin et al. 2009). Also, two EBSAs located south of Australia that were described with wandering albatrosses as a principal role did not overlap with many OBIS-SEAMAP locations (Birdlife International 2013, IUCN and UNEP-WCMC 2014). However, other EBSAs that did not include wandering albatross in their descriptions in the southern Indian and Atlantic Oceans did encompass areas of relatively high densities of recorded locations and breeding sites (Figure 13b) (Halpin et al. 2009).

a)



b)

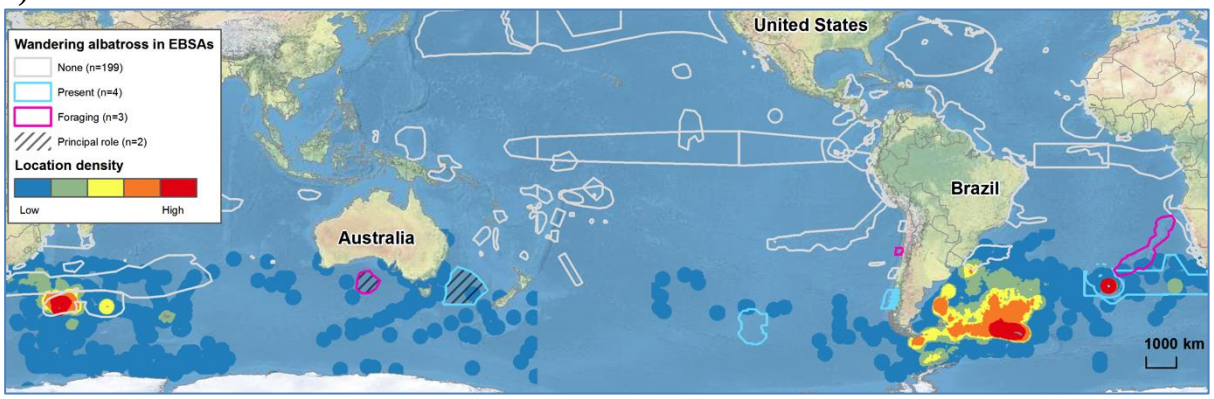
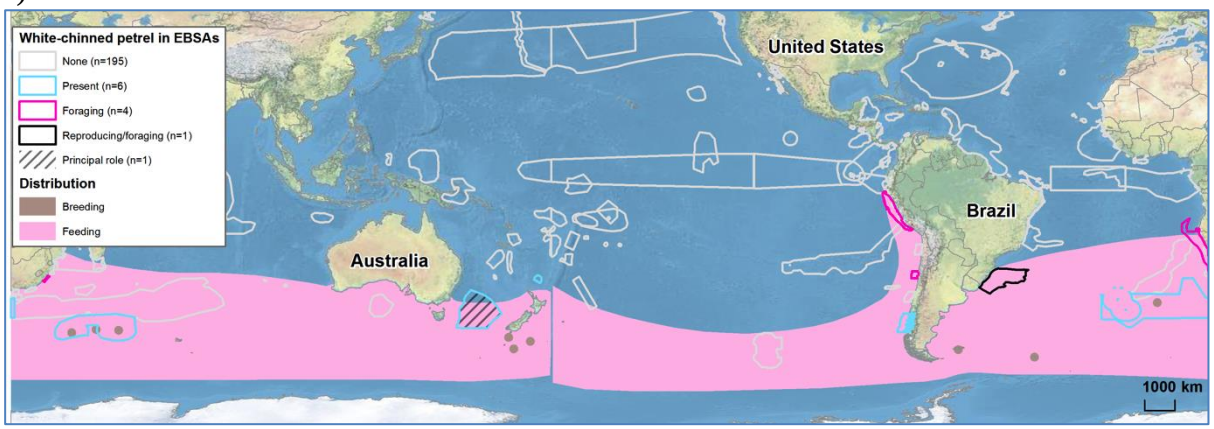


Figure 13. Wandering albatross, *Diomedea exulans*, presence and areas of foraging as described in EBSAs with a) breeding and feeding sites (Halpin et al. 2009), and b) relative densities of OBIS-SEAMAP recorded locations (Appendix C) (Riede 2004). Densities are described using quintiles.

White-chinned petrel

35. The white-chinned petrel resides in the southern ocean and has a circumpolar distribution (Halpin et al. 2009) and was mentioned in only 11 EBSAs within their feeding and nesting range (Figure 14a). The one EBSA in the southwest Atlantic (Southern Brazilian Sea) that mentioned white-chinned petrels reproducing did not overlap known breeding areas or recorded locations (Figure 14a) (Riede 2004, BirdLife International and NatureServe 2013). However, EBSAs did overlap with some breeding sites in the southern Indian and southwest Atlantic Oceans, where it was mentioned in the description that they were present. As with the other seabirds highlighted previously, the extent considered by the EBSA process covered only part of the white-chinned petrel distribution, with high densities of recorded locations in the southern Indian and southwest Atlantic Oceans south of the extent (Figure 14b). There was also limited coverage of protected areas and IBAs in areas outside the considered extent by the EBSA process and presence of the seabirds. White-chinned petrels were a principal role in one EBSA in the south Pacific (South Tasman Sea), which did not overlap with breeding or any locations recorded in OBIS-SEAMAP (Riede 2004, Halpin et al. 2009).

a)



b)

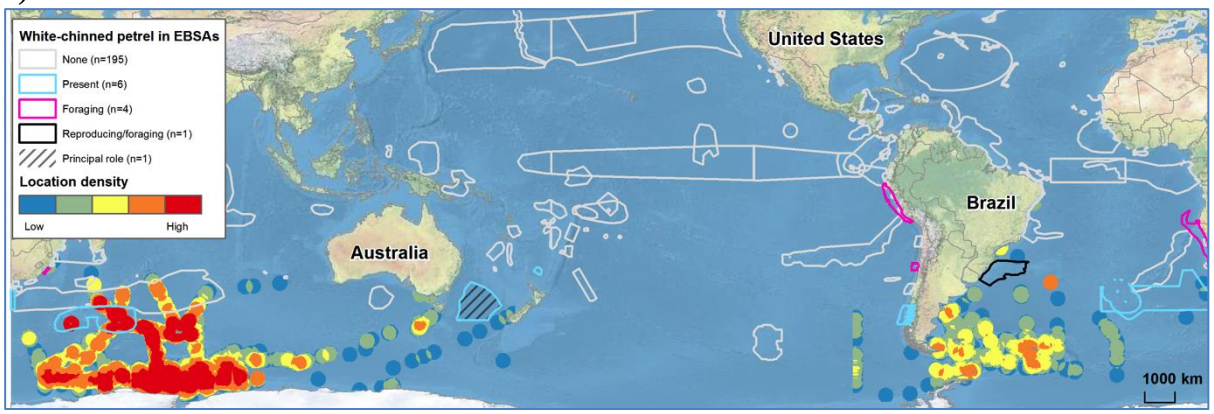


Figure 14. White-chinned petrel, *Procellaria aequinoctialis*, presence and areas of foraging and foraging / reproducing as described in EBSAs with a) breeding and feeding sites (Halpin et al. 2009), and b) relative densities of OBIS-SEAMAP recorded locations (Appendix C) (Riede 2004). Densities are described using quintiles.

36. The preliminary six case studies showed that a number of EBSAs overlapped with high densities of known locations, areas highly used by migratory species, and other marine areas delineated for conservation or a particular concern. Conservation instruments and

programs already in place within or near described EBSAs usually were included in descriptions to help put the area in context. These included national, regional, and international agreements that have previously recognized the importance of the marine ecology and / or biology of the area, varying in focus and scope. Most often mentioned were the presence of Birdlife defined IBAs (n = 49 mentioned within EBSA descriptions) and Ramsar Convention on Wetlands' sites (Ramsar sites, n = 18). In addition, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) sites (world heritage for humanity sites, man and biosphere reserves), national marine areas of protection (i.e., reserves, marine parks, etc.) were included in descriptions to emphasize habitat features and biological resources. Furthermore, data used to inform the Arctic workshop included results from previous activities that have assessed the region to identify important marine areas under similar criteria (Halpin et al. 2009). Although areas defined under different conservation instruments were designated because of criteria separate from the EBSA process, they often shared the EBSA focus of identifying important areas because of their ecology or biology and can benefit marine migratory species by helping to select potential areas for conservation. The case studies showed that some of these areas filled the gaps where the EBSA process was not considered, but where migratory species were present.

Discussion

Review of scientific data and information from the EBSA process

37. The CBD process for identifying EBSAs collated the most current, available datasets and can initiate discussions on information needs, applications, and best data management practices for improvements on the knowledge of migratory species. Data were compiled and used as a baseline of biological and environmental characteristics within the region, with the additional data presented by individual countries participating in the workshops captured within the regional workshop reports, to identify EBSAs. The information within the compiled data reports (i.e., DFO 2011) and workshop reports (Dunstan and Fuller 2011, 2012, Halpin et al. 2012a, Halpin et al. 2012b, Dunstan and Fuller 2013, Halpin et al. 2013a, Halpin et al. 2013b, Halpin et al. 2014a, Halpin et al. 2014b) have highlighted the most current knowledge and helped with determining critical gaps and needs for migratory species. Although there were many data sources, the compilation was not exhaustive and was mostly limited by public data availability and resources in time. Overall, migratory species data came from sightings (structured surveys and opportunistic sightings), telemetry tags, modeled habitat and density distributions, nesting sites / colonies, and species status under specific management instruments.

38. While reviewing each of the nine regional workshop reports, it was apparent that EBSA descriptions varied in the amount of information and detail included on migratory species, which may be the result of many factors. Although different experts contributed to the reports, some inherent variations can be attributed to the unintentional evolution of EBSA workshop methods and process over time. The high dependence on participant knowledge, expertise, and differing degrees of reliance on outside references (i.e., OBIS database, on-going current research), inferred common knowledge (i.e., unique, endemic, or rare species), or identification of organisms to general taxa categories instead of species level (i.e., seabirds) were also major sources of variation. For example, if descriptions included "cetaceans" or "seabirds" but did not identify the species, no assumption could be made about whether they were a migratory species listed under the CMS or their conservation

status. However, despite the fact that the outputs of the EBSA process were not intended for rigorous analyses in relation to migratory species, regional reports were still found to be useful tools for assessing migratory species' roles within and across regions. These results can serve as a point of reference for identifying areas of importance to migratory species.

39. Each regional EBSA workshop was constrained by the focus and expertise of the participants at the workshop. This likely had a strong influence on the availability of scientific data and information and the marine taxa included in the EBSA descriptions. Much of the text within the CBD EBSA documents referenced marine mammals, seabirds, sea turtles, and fish, with relatively less emphasis on migratory sharks and rays. This may be due to the lack of participant expertise on these taxa, along with relatively little information on sharks and rays included in compiled data reports used to facilitate each regional workshop. However, some of the final workshop reports reflected that sharks and rays still factored as contributors to justify EBSA criteria rankings.

Migratory species data role in the description of EBSAs

40. In general, migratory species data contributed to the description of EBSAs on two different levels and was evaluated with a broad and detailed approach. Approximately 10% of all EBSAs were described with migratory species as the principal justification because they support the life history requirements and / or were a globally unique location for a particular migratory species. Approximately 80% of all EBSAs were described with migratory species, particularly sea turtles, large cetaceans, and seabirds. Detailed analysis showed that although some EBSAs may not have been defined primarily to support migratory species, they cite a large number of CMS listed migratory species as present, using the areas for reproduction, or using the areas to forage.

41. Migratory species data have contributed to the justification of multiple criteria to describe EBSAs, especially for species-level criteria (2 and 3). All principal EBSAs ranked criterion 2 (special importance for life-history stages of species) and criterion 3 (the importance for threatened, endangered or declining species and / or habitats) as "high" or "some," showing that migratory species data heavily influenced these species-level criteria. Justifications for ranking an EBSA as "high" for the special importance and importance for particular species of concern criteria usually included mentioning physical features and species that depended highly upon the resources within the area, such as critical habitat for migratory species. In addition, EBSAs that had migratory species as any role in the descriptions were more often found to have "high" and "some" rankings for criteria related to biological productivity (criterion 5), and biological diversity (criterion 6). Conversely, EBSA descriptions where migratory species played a contributory or no role were more likely to rank criterion 7 (naturalness) as "high" or "some." Naturalness rankings were most often justified as an inverse of human activity, with the mention of migratory species that may be affected. Consequently, EBSAs may be more "natural" (ranked higher) without migratory species mentioned within the criterion because the presence of migratory species and other resources were relatively unknown in the area.

Potential contribution of the scientific data and information within EBSA descriptions

42. All six migratory species used as case studies were widely distributed with migratory ranges that include marine areas both within and beyond national jurisdiction Like many other marine migratory species, there is incomplete knowledge on global migration corridors

and oversimplified areas available of known uses (CBD 2012a, 2012b, 2013, 2014a, 2014b, 2014c, 2014d, 2014e, 2014f). For example, cosmopolitan leatherback sea turtles show some consistent post-nesting migratory patterns in the Pacific (e.g., CAFF 2001, Kurvits et al. 2011), but migratory corridors have been difficult to delineate in the Atlantic (Shillinger et al. 2008, Benson et al. 2011). Information on the movements of leatherback sea turtles and other relatively well-known migratory species may be available for various populations from recent telemetry tag data, but globally comprehensive corridors and important areas throughout species' life cycles are still unavailable at this time. Understanding how species stay connected among key sites is essential for identifying areas critical for the connectivity of migratory species conservation networks. Therefore, this study utilized all available high quality georeferenced data (i.e., sightings, nesting sites, and telemetry data) for constructing the complete picture on habitat use to better assess the EBSAs' potential contribution to connectivity in conservation networks. Although not ideal, this method for piecing together the life history and habitat needs of migratory species has been demonstrated to be the most feasible (Ferraroli et al. 2004). Greater data availability on migratory movements, corridors, and high areas of use is required for more informed planning of the connectivity within ecological networks in the future.

43. The databases used as a foundation for knowledge in this study did not contain all available data for migratory species and were not representative of global distribution (Fujioka et al. 2014), but they were useful tools as an example of the state of knowledge so that comparisons could be made with information within the EBSA descriptions. Certain EBSAs were described to meet the defined criteria because specific migratory species were present, or used the area to feed and / or reproduce. However, these EBSAs did not always overlap with information from other databases. Therefore, the large number of CMS listed migratory species cited as present or using the areas for reproduction and foraging contributed to the general knowledge of their distribution and habitat needs. Regional knowledge that has contributed to describing these EBSAs and was not included in global databases such as GROMS, OBIS-SEAMAP, and SWOT should be made available so that any gaps in knowledge may be filled. In addition, there were many instances where high densities of observations occurred in areas that have not been considered by the EBSA process. There are future plans for workshops in the south Asian Seas and north Indian Ocean regions, in areas where EBSAs were not considered previously, but gaps remain. Areas that are important to migratory species in areas that were not considered, and will not be considered in the future (i.e., EEZs of some countries, Southern Ocean, northeast Atlantic) by the EBSA process, will need to come from other mechanisms.

44. Most marine conservation instruments have not focused on ABNJ, and it has been recognized that better international initiatives need to be in place to address increased human use of these zones (Kot et al. 2010, Williams et al. 2014). Existing conservation instruments mentioned within the EBSA descriptions related to migratory species (e.g., IBAs, Ramsar sites, UNESCO sites) may be limited in scope (i.e., regional, certain ecosystem type and / or taxa, or narrow criteria) and legal obligation (i.e., none, or consist vague terminology). However, information gathered for these instruments, along with the CBD EBSA process and other important marine areas identified with similar but different criteria (i.e., Food and Agriculture's vulnerable marine ecosystems [VME], International Maritime Organization's particular sensitive sea areas [PSSA], etc.) can work together to benefit migratory species and their habitats in a large extent. Outside of these areas, progress still needs to be made for their conservation and sustainable use.

Conclusion

45. This review found that marine migratory species provide a useful basis to further review the potential contribution of the scientific data and information used to describe EBSAs for the development of ecological networks and the promotion of connectivity by exploring whether this data and information could contribute to identifying areas meeting the needs of marine migratory species which use multiple habitats throughout the stages of their life history and across their migration range.

46. This review focused on two distinctly different components concerning the relationship of marine migratory species and EBSAs. The first component of the assessment was focused on determining how marine migratory species have factored in the description of EBSAs. In this case, migratory species played a principal role in the description of approximately 10% of EBSAs and a contributory role in approximately 80% of EBSAs. These findings highlighted the significant roles migratory species data played in the description of EBSAs to date. This review found that a subset of the scientific criteria applied to describe EBSAs were particularly relevant to marine migratory species, namely 'special importance of life history stages of species', 'importance for threatened, endangered or declining species and/or habitats', 'vulnerability, fragility, sensitivity or slow recovery' and 'biological productivity'. This review also found that data and information provided for the description of EBSAs was useful for identifying important areas for marine migratory species.

47. The second component of the assessment focused on the use of preliminary case studies on cetaceans, seabirds and marine turtles, to explore the potential for the scientific data and information describing EBSAs to contribute to the conservation of migratory species in marine areas within and beyond the limits of national jurisdiction, particularly with respect to ecological networks and connectivity. In order to begin addressing this question, migratory species most commonly mentioned within the EBSA workshop reports were selected as case studies to assess the distribution of EBSA sites versus the distributional range of these species. This second component of the assessment identified regional trends in the coverage of the distributional ranges of species, but also highlights significant gaps in current knowledge of the usage patterns of these species.

48. The findings of these case studies underscore the need for significantly more research in the spatial and temporal distributions of marine migratory species, even for many of the most well known species considered for the case studies. Specifically, the different roles CMS listed migratory marine mammal, seabird, sea turtle, shark and ray species have in the description of individual EBSAs, along with the different numbers of migratory species mentioned, ways migratory species were used to justify particular criteria, or how a site was described to be used by migratory species, can all have implications for the conservation and management priorities of CMS listed migratory species. In addition, these results suggested that most EBSAs could be important in meeting the needs of migratory marine species and contribute to the connectivity of ecological networks for these species. At the same time, it was clear that such networks require further consideration within areas already examined by the EBSA process, along with areas outside of the current extent considered by the EBSA process or recognized by other criteria.

49. Incomplete knowledge of the distribution of many migratory species and areas critical

to their life history stages remains a significant challenge to conservation planning. Improvements to the global knowledge of migratory species, particularly with regard to migratory corridors and overall distributions, can be made if the regional knowledge contributed to describing these EBSAs were also included in global databases and made easily available so that any gaps in knowledge may be filled for more informed marine assessments. While the EBSA process has improved the state of knowledge with the use of regional and globally available datasets, it also has not been an exhaustive or systematic process. At the regional level, capacity to compile all migratory species information to determine true gaps in knowledge is needed, while a more comprehensive process for including any available migratory species information is necessary at a global level.

50. Increased regional capacity to allow for better availability of regional taxonomic expertise for the EBSA process is a necessary first step toward a better understanding of how migratory species can benefit from describing EBSAs. The EBSA process and CBD EBSA data repository can be refined and updated when further capacity and data are developed. In addition, global databases that house biodiversity information are essential to regional processes such as the description of EBSAs. In general, future improvements to the global knowledge of migratory species with the greater availability of data from regional taxonomic expertise can support more robust conservation planning for migratory species in the future.

51. The current EBSA process has described a number of individual areas that are important for specific life history stages of migratory marine species. The data and information that was acquired in this process and the description of these individual sites will be directly useful in more comprehensive assessments of connectivity and ecological networks. The data and information used to describe EBSAs may contribute as some of the potential building blocks in the assessment of future marine ecological networks.

52. Because the current implementation of the EBSA process does not explicitly consider ecological networks and connectivity, this process has not been fully effective in identifying important networks for marine migratory species at this time. However, Annex II of the COP9 decision IX/20 outlines further guidance for the additional description of EBSAs as they relate to ecological networks. This second annex of the EBSA guidance describes additional criteria such as “representativity” and “connectedness” that could be directly relevant to marine migratory species. A future inclusion of the Annex II criteria or similar criteria in the EBSA process could provide a more robust framework for more fully associating EBSAs and ecological networks for marine migratory species.

References

Ban, N. C., N. J. Bax, K. M. Gjerde, R. Devillers, D. C. Dunn, P. K. Dunstan, A. J. Hobday, S. M. Maxwell, D. M. Kaplan, R. L. Pressey, J. A. Ardron, E. T. Game, and P. N. Halpin. 2014a. Systematic conservation planning: A better recipe for managing the high seas for biodiversity conservation and sustainable use. Conservation Letters **7**:41-54.

Ban, N. C., S. M. Maxwell, D. C. Dunn, A. J. Hobday, N. J. Bax, J. Ardron, K. M. Gjerde, E. T. Game, R. Devillers, D. M. Kaplan, P. K. Dunstan, P. N. Halpin, and R. L. Pressey. 2014b. Better integration of sectoral planning and management approaches for the interlinked ecology of the open oceans. Marine Policy **49**:127-136.

Benson, S. R., T. Eguchi, D. G. Foley, K. A. Forney, H. Bailey, C. Hitipeuw, B. P. Samber, R. F. Tapilatu, V. Rei, P. Ramohia, J. Pita, and P. H. Dutton. 2011. Large-scale movements and high-use areas of western Pacific leatherback turtles, *Dermochelys coriacea*. Ecosphere **2**:1-27.

Birdlife International. 2013. Marine important bird areas: Site networks for seabird conservation. Available at: http://www.birdlife.org/datazone/marine. (Accessed: July 14, 2014). Birdlife International, Cambridge, UK.

BirdLife International, and NatureServe. 2013. Bird species distribution maps of the world. BirdLife International, Cambridge, UK and NatureServe, Arlington, VA, US.

Boyer, T. P., O. K. Baranova, M. Biddle, D. R. Johnson, A. V. Mishonov, C. Paver, D. Seidov, and M. Zweng. 2012. Arctic regional climatology. Available at: http://www.nodc.noaa.gov/OC5/regional_climate/arctic (Accessed: February 17, 2014). Regional Climatology Team, National Oceanographic Data Center, National Oceanic and Atmospheric Administration.

CAFF. 2001. CAFF Map No. 35 - Migration routes of the humpback whale. Image. Available at: http://library.arcticportal.org/1367 (Accessed: Septemer 24, 2014). Arctic Council Conservation of Arctic Flora and Fauna Working Group (CAFF), Arctic Portal Library, Akureyri, Iceland.

CBD. 1997. Jakarta mandate on marine and coastal biological diversity. First meeting of experts, Jakarta, Indonesia 7 to 10 March 1997. UNEP/CBD/JM/Expert/I/2. Convention on Biological Diversity (CBD), Montreal, Canada.

CBD. 2007. Expert workshop on ecological criteria and biogeographic classification systems for marine areas in need of protection. Azores, Portugal, 2-4 October 2007. UNEP/CBD/EWS.MPA/1/2. Convention on Biological Diversity (CBD), Montreal, Canada.

CBD. 2010. DecisionX/29. Available at: http://www.cbd.int/decisions/cop/?m=cop-10 (Accessed: September 24, 2014). Convention on Biological Diversity (CBD), Montreal, Canada.

CBD. 2012a. Report of the western south Pacific regional workshop to facilitate the description of ecologically or biologically significant marine areas. 22 - 25 November 2011, Nadi, Fiji. UNEP/CBD/SBSTTA/16/INF/6. Convention on Biological Diversity (CBD), Montreal, Canada.

CBD. 2012b. Report of the wider Caribbean and western mid-Atlantic regional workshop to facilitate the description of ecologically or biologically significant marine areas. 28 February -2 March 2012, Recife, Brazil, UNEP/CBD/SBSTTA/16/INF/7. Convention on Biological Diversity (CBD), Montreal, Canada.

CBD. 2013. Report of the eastern tropical and temperate Pacific regional workshop to facilitate the description of ecologically or biologically significant marine areas. 28 - 31 August 2012, Galapagos Islands, Ecuador, UNEP/CBD/RW/EBSA/ETTP.

Convention on Biological Diversity (CBD), Montreal, Canada.
CBD. 2014a. Report of the Arctic regional workshop to facilitate the description of ecologically or biologically significant marine areas. 3 - 7 March 2014, Helsinki, Finland, UNEP/CBD/EBSA/WS/2014/1/5. Convention on Biological Diversity (CBD), Montreal, Canada.
CBD. 2014b. Report of the Mediterranean regional workshop to facilitate the description of ecologically or biologically significant marine areas. 7 - 11 April 2014, Málaga, Spain, UNEP/CBD/EBSA/WS/2014/3/4. Convention on Biological Diversity (CBD), Montreal, Canada.
CBD. 2014c. Report of the north Pacific regional workshop to facilitate the description of ecologically or biologically significant marine areas. 25 Feburary - 1 March 2013, Moscow, Russia. UNEP/CBD/RW/EBSA/NP/4. Convention on Biological Diversity (CBD), Montreal, Canada.
CBD. 2014d. Report of the north-west Atlantic regional workshop to facilitate the description of ecologically or biologically significant marine areas. 24 - 28 March 2014, Montreal, Canada, UNEP/CBD/EBSA/WS/2014/2/4. Convention on Biological Diversity (CBD), Montreal, Canada.
CBD. 2014e. Report of the south-eastern Atlantic regional workshop to facilitate the description of ecologically or biologically significant marine areas. 8 - 12 April 2013, Swakopmund, Namibia, UNEP/CBD/RW/EBSA/SEA/1/4. Convention on Biological Diversity (CBD), Montreal, Canada.
CBD. 2014f. Report of the southern Indian Ocean regional workshop to facilitate the description of ecologically or biologically significant marine areas. 31 July - 3 August 2012, Flic en Flac, Mauritius, UNEP/CBD/RW/EBSA/SIO/1/4. Convention on Biological Diversity (CBD), Montreal, Canada.
CBD Secretariat. 2005. Handbook of the Convention on Biological Diversity including its Cartagena Protocol on biosafety, 3rd edition. Convention on Biological Diversity (CBD), Montreal, Canada.
CMS. 2013. CMS introduction. Available at: http://www.cms.int/en/legalinstrument/cms (Accessed: September 9, 2014). Convention on the Conservation of Migratory Species of Wild Animals, Bonn, Germany.
Dearden, P., and K. N. Topelko. 2005. Establishing criteria for the identification of ecologically and biologically significant areas on the high seas. Background paper for the CBD expert workshop on ecological criteria and biogeographic classification systems for marine areas in need of protection. Prepared for Fisheries and Oceans Canada. Marine Protected Areas Research Group, University of Victoria, Victoria, CA.
DFO. 2011. Identification of ecologically and biologically significant areas (EBSA) in the Canadian Arctic. Canadian Department of Fish and Oceans Science Advisory Secretariat Science Advisory Report 2011/055. Canadian Department of Fish and Oceans (DFO), Ottawa, CA.
Dow, W. E., K. L. Eckert, M. Palmer, and P. Kramer. 2007. An atlas of sea turtle nesting habitat for the wider Caribbean region. WIDECAST Technical Report No. 6. The Wider Caribbean Sea Turtle Conservation Network and The Nature Conservancy, Beaufort, NC.
Dunn, D. C., J. Ardron, N. Bax, P. Bernal, J. Cleary, I. Cresswell, B. Donnelly, P. Dunstan, K. Gjerde, D. Johnson, K. Kaschner, B. Lascelles, J. Rice, H. von Nordheim, L. Wood, and P. N. Halpin. 2014. The Convention on Biological Diversity's ecologically or biologically significant areas: Origins, development, and current status. Marine Policy **49**:137-145.

Dunstan, P., and M. Fuller. 2011. Data to inform the CBD western south Pacific regional workshop to facilitate the description of ecologically or biologically significant marine areas. Fiji, 22-25 November 2011. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/RW/EBSA/WSPAC/1/2. CSIRO Marine and Atmospheric Research, Hobart, Tasmania, AU.

Dunstan, P., and M. Fuller. 2012. Data to inform the CBD southern Indian Ocean regional workshop to facilitate the description of ecologically or biologically significant marine areas. Flic en Flac, Mauritius, 31 July to 3 August 2012. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/RW/EBSA/SIO/1/2. CSIRO Marine and Atmospheric Research, Hobart, Tasmania, AU.

Dunstan, P., and M. Fuller. 2013. Data to inform the CBD south east Atlantic regional workshop to facilitate the description of ecologically or biologically significant marine areas. Swakopmund, Namibia, 8-12 April 2013. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/RW/EBSA/SEA/1/3. CSIRO Marine and Atmospheric Research, Hobart, Tasmania, AU.

ESRI. 2014. ArcGIS Desktop: Release 10.2. Environmental Systems Research Institute (ESRI), Redlands, CA.

FAO. 2006. Management of demersal fisheries resources of the southern Indian Ocean. FAO Fisheries Circular No. 1020. Food and Agriculture Organization (FAO), Rome, Italy.

Ferraroli, S., J. Y. Georges, P. Gaspar, and Y. Le Maho. 2004. Endangered species - Where leatherback turtles meet fisheries. Nature **429**:521-522.

Fujioka, E., C. Y. Kot, B. P. Wallace, B. D. Best, J. Moxley, J. Cleary, B. Donnelly, and P. N. Halpin. 2014. Data integration for conservation: Leveraging multiple data types to advance ecological assessments and habitat modeling for marine megavertebrates using OBIS-SEAMAP. Ecological Informatics **20**:13-26.

Goote, M. M. 1997. The Jakarta Mandate on marine and coastal biological diversity. The International Journal of Marine and Coastal Law **12**:377-389.

Halpin, P., J. Cleary, C. Curtice, and B. Donnelly. 2012b. Data to inform the CBD wider Caribbean and western mid-Atlantic regional workshop to facilitate the description of ecologically or biologically significant marine areas. Recife, Brazil, 28 February – 2 March 2012. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/RW/EBSA/WCAR/1/2. Marine Geospatial Ecology Lab, Duke University, Durham, NC.

Halpin, P., J. Cleary, C. Curtice, and B. Donnelly. 2013a. Data to inform the CBD workshop to facilitate the description of ecologically or biologically significant marine areas in the northwest Atlantic. Montreal, Canada, 24-28 March 2014. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/EBSA/WS/2014/2/2. Marine Geospatial Ecology Lab, Duke University, Durham, NC.

Halpin, P., J. Cleary, C. Curtice, and B. Donnelly. 2014a. Data to inform the CBD workshop to facilitate the description of ecologically or biologically significant marine areas in the Arctic. Helsinki, Finalnd, 3 - 7 March 2014. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment

Programme, Convention of Biological Diversity UNEP/CBD/EBSA/WS/2014/1/3. Marine Geospatial Ecology Lab, Duke University, Durham, NC.
Halpin, P., J. Cleary, C. Curtice, B. Donnelly, D. Dunn, E. Klein, and J. Roberts. 2012a. Data to inform the CBD eastern tropical and temperate Pacific regional workshop to facilitate the description of ecologically or biologically significant marine areas. Galápagos Islands, Ecuador, 28 to 31 August 2012. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/EBSA/ETTP/1/3. Mrine Geospatial Ecology Lab, Duke University, Durham, NC.
Halpin, P., J. Cleary, C. Curtice, B. Donnelly, D. Dunn, and J. Roberts. 2013b. Data to inform the CBD workshop to facilitate the description of ecologically or biologically significant marine areas in the North Pacific. Moscow, Russia, 25 February – 1 March 2013. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/RW/EBSA/NP/1/3. Marine Geospatial Ecology Lab, Duke University, Durham, NC.
Halpin, P., J. Cleary, C. Curtice, B. Donnelly, D. Dunn, and J. Roberts. 2014b. Data to inform the CBD Mediterranean regional workshop to facilitate the description of ecologically or biologically significant marine areas (EBSAs). Málaga, Spain, 7-11 April 2014. Prepared for the Secretariat of the Convention of Biological Diversity (SCBD). United Nations Environment Programme, Convention of Biological Diversity UNEP/CBD/EBSA/WS/2014/3/3. Marine Geospatial Ecology Lab, Duke University, Durham, NC.
Halpin, P. N., A. J. Read, E. Fujioka, B. D. Best, B. Donnelly, L. J. Hazen, C. Kot, K. Urian, E. LaBrecque, A. Dimatteo, J. Cleary, C. Good, L. B. Crowder, and K. D. Hyrenbach. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. Oceanography **22**:104-115.
Hazen, E. L., S. Jorgensen, R. R. Rykaczewski, S. J. Bograd, D. G. Foley, I. D. Jonsen, S. A. Shaffer, J. P. Dunne, D. P. Costa, L. B. Crowder, and B. A. Block. 2013. Predicted habitat shifts of Pacific top predators in a changing climate. Nature Climate Change **3**:234-238.
Humphries, G. R. W., and F. Huettmann. 2014. Putting models to a good use: a rapid assessment of Arctic seabird biodiversity indicates potential conflicts with shipping lanes and human activity. Diversity and Distributions **20**:478-490.
IUCN. 2014. The IUCN red list of threatened species. Version 2014.1. Available at: http://www.iucnredlist.org. (Accessed: July 21, 2014). International Union for Conservation of Nature (IUCN), Cambridge, UK.
IUCN, and UNEP-WCMC. 2014. The world database on protected areas (WDPA). Available at: http://www.protectedplanet.net (Accessed: September 11, 2014). International Union for Conservation of Nature (IUCN), United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC), Cambridge, UK.
Kot, C. Y., A. DiMatteo, E. Fujioka, B. Wallace, B. Hutchinson, J. Cleary, P. Halpin, and R. Mast. 2014. The State of the World's Sea Turtles online database: Data provided by the SWOT team and hosted on OBIS-SEAMAP. Available at: http://seamap.env.duke.edu/swot (Accessed: August 22, 2014). Oceanic Society, Conservation International, IUCN Marine Turtle Specialist Group (MTSG), and Marine Geospatial Ecology Lab, Duke University, Durham, NC.
Kot, C. Y., E. Fujioka, L. J. Hazen, B. D. Best, A. J. Read, and P. N. Halpin. 2010. Spatio-temporal gap analysis of OBIS-SEAMAP project data: Assessment and way forward. PLoS ONE **5**:e12990.

Kurvits, T., C. Nellemann, B. Alfthan, A. Kühl, P. Prokosch, M. Virtue, and J. F. Skaalvik, editors. 2011. Living Planet: Connected Planet – Preventing the End of the World's Wildlife Migrations through Ecological Networks. A Rapid Response Assessment. United Nations Environment Programme, GRID-Arendal. http://www.grida.no.

Marra, P. P., D. Hunter, and A. M. Perrault. 2011. Migratory connectivity and the conservation of migratory animals. Environmental Law **41**.

Merrie, A., D. C. Dunn, M. Metian, A. M. Boustany, Y. Takei, Y. Ota, V. Christensen, P. N. Halpin, and H. Österblom. 2014. Human use trends and potential surprise in the global marine common. Global Environmental Change **27**:19-31.

OBIS. 2014. Data from the ocean biogeographic information system (OBIS). Available at: http://www.iobis.org (Accessed: January 20, 2014). Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization, Oostende, Belgium.

Reeves, R. R., T. D. Smith, E. A. Josephson, P. J. Clapham, and G. Woolmer. 2004. Historical observations of humpback and blue whales in the North Atlantic Ocean: Clues to migratory routes and possibly additional feeding grounds. Marine Mammal Science **20**:774-786.

Riede, K. 2004. Global register of migratory species - from global to regional scales. Final Report of the R&D Projekt 808 05 081. Federal Agency for Nature Conservation in Germany, Bonn, Germany.

Shillinger, G. L., D. M. Palacios, H. Bailey, S. J. Bograd, A. M. Swithenbank, P. Gaspar, B. P. Wallace, J. R. Spotila, F. V. Paladino, R. Piedra, S. A. Eckert, and B. A. Block. 2008. Persistent leatherback turtle migrations present opportunities for conservation. PLoS Biol **6**:e171.

Shillinger, G. L., A. M. Swithenbank, S. J. Bograd, H. Bailey, M. R. Castelton, B. P. Wallace, J. R. Spotila, F. V. Paladino, R. Piedra, and B. A. Block. 2010. Identification of high-use internesting habitats for eastern Pacific leatherback turtles: Role of the environment and implications for conservation. Endangered Species Research **10**:215-232.

SWOT. 2006. Burning issues in sea turtle conservation...leatherback sea turtles of the world. SWOT report volume I. State of the World's Sea Turtles (SWOT), Washington, DC.

SWOT. 2007. A global glimpse of loggerhead nesting. SWOT report volume II. State of the World's Sea Turtles (SWOT), Arlington, VA.

SWOT. 2008. Where the hawksbills are. SWOT report volume III. State of the World's Sea Turtles (SWOT), Arlington, VA.

SWOT. 2009. Discovering the flatback: Australia's own sea turtle. SWOT report volume IV. State of the World's Sea Turtles (SWOT), Arlington, VA.

SWOT. 2010. Kemp's and olive ridleys: Small turtles, big secrets. SWOT report volume V. State of the World's Sea Turtles (SWOT), Arlington, VA.

SWOT. 2011. The green turtle: The most valuable reptile in the world. SWOT report volume VI. State of the World's Sea Turtles (SWOT), Arlington, VA.

SWOT. 2012. The world's most (and least) threatened sea turtles. SWOT report volume VII. State of the World's Sea Turtles (SWOT), Arlington, VA.

SWOT. 2013. Persuasion: The case for saving sea turtles. SWOT report volume VIII. State of the World's Sea Turtles (SWOT), Ross, CA.

SWOT. 2014. Are we succeeding? How trends in turtle conservation are shaping the future. SWOT report volume IX. State of the World's Sea Turtles (SWOT), Ross, CA.

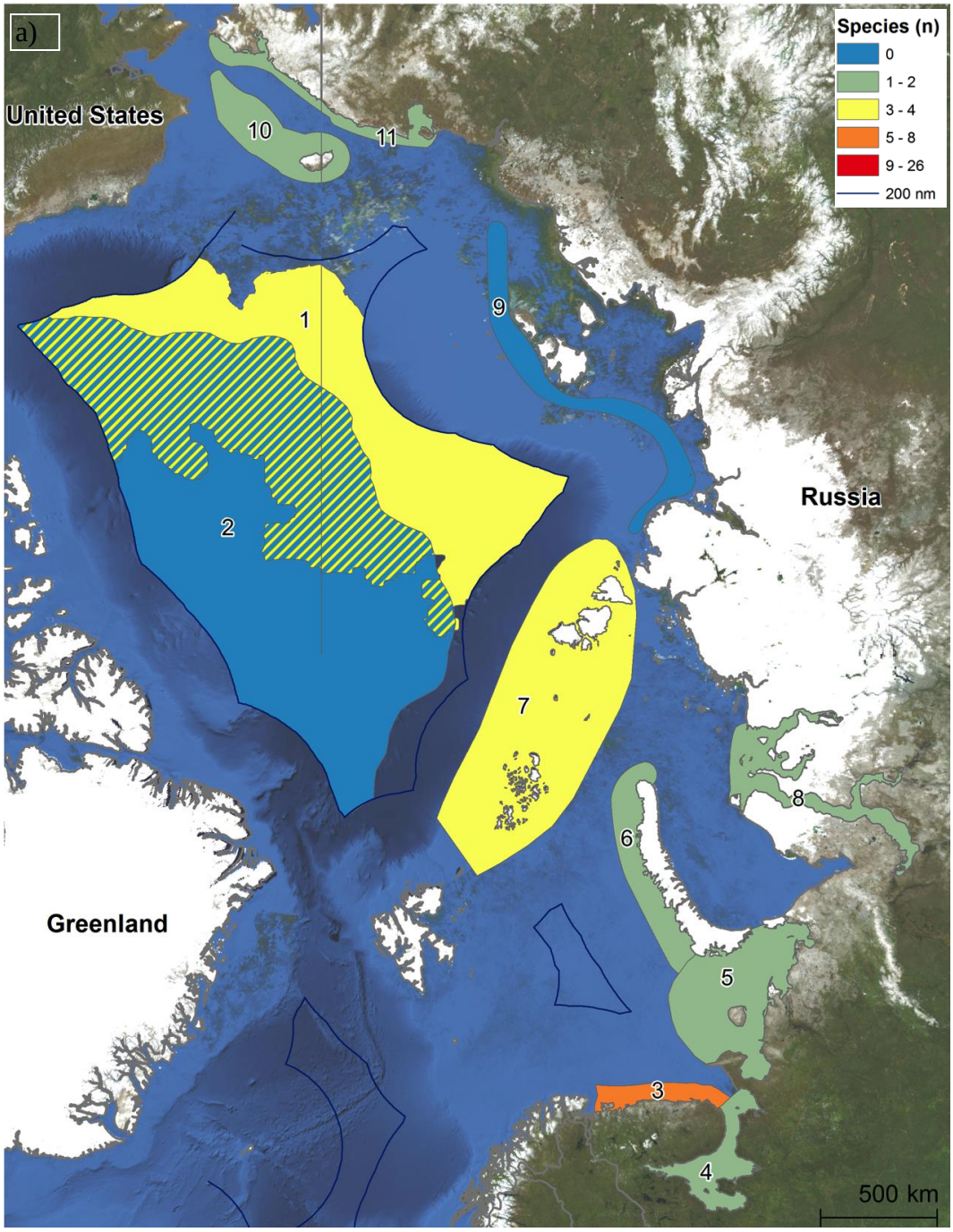
Townsend, C. H. 1931. Where the nineteenth century whaler made his catch. Bulletin of the New York Zoological Society **34**:173-178.

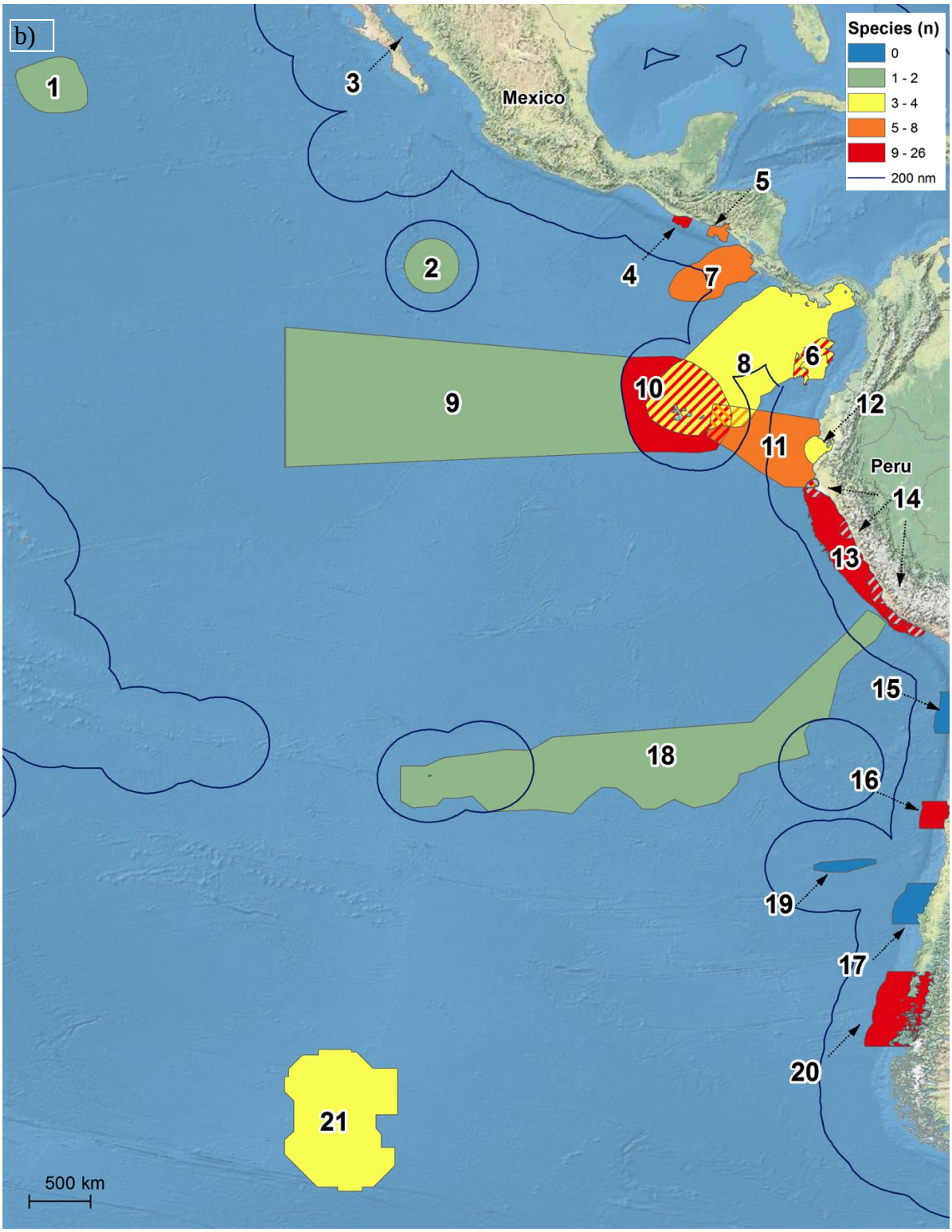
Townsend, C. H. 1935. The distribution of certain whales as shown by logbook records of

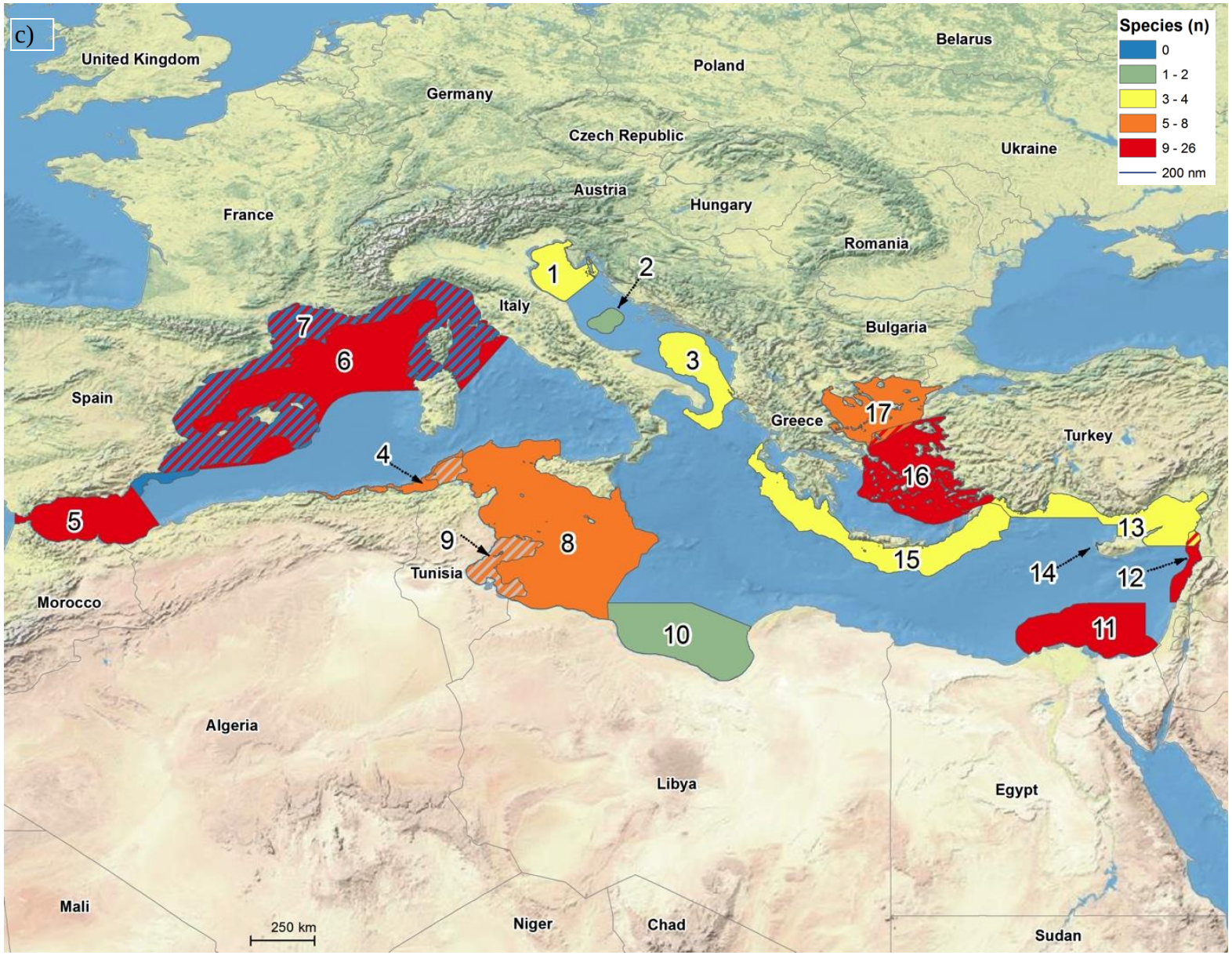
American whaleships. Zoologica **19**:1-50.
Vanden Berghe, E., editor. 2007. The ocean biogeographic information system: Web pages. Available at: http://www.iobis.org (Accessed: August 3, 2012).
Wallace, B. P., A. D. DiMatteo, B. J. Hurley, E. M. Finkbeiner, A. B. Bolten, M. Y. Chaloupka, B. J. Hutchinson, F. A. Abreu-Grobois, D. Amorocho, K. A. Bjorndal, J. Bourjea, B. W. Bowen, R. B. Dueñas, P. Casale, B. C. Choudhury, A. Costa, P. H. Dutton, A. Fallabrino, A. Girard, M. Girondot, M. H. Godfrey, M. Hamann, M. López-Mendilaharsu, M. A. Marcovaldi, J. A. Mortimer, J. A. Musick, R. Nel, N. J. Pilcher, J. A. Seminoff, S. Troëng, B. Witherington, and R. B. Mast. 2010. Regional management units for marine turtles: A novel framework for prioritizing conservation and research across multiple scales. PLoS ONE **5**:e15465.
Warner, R. M. 2014. Conserving marine biodiversity in the global marine commons: Co-evolution and interaction with the law of the sea. Frontiers in Marine Science **1**.
Williams, R., J. Grand, S. K. Hooker, S. T. Buckland, R. R. Reeves, L. Rojas-Bracho, D. Sandilands, and K. Kaschner. 2014. Prioritizing global marine mammal habitats using density maps in place of range maps. Ecography **37**:212-220.
Willis, K. J., E. S. Jeffers, C. Tovar, P. R. Long, N. Caithness, M. G. D. Smit, R. Hagemann, C. Collin-Hansen, and J. Weissenberger. 2012. Determining the ecological value of landscapes beyond protected areas. Biological Conservation **147**:3-12.

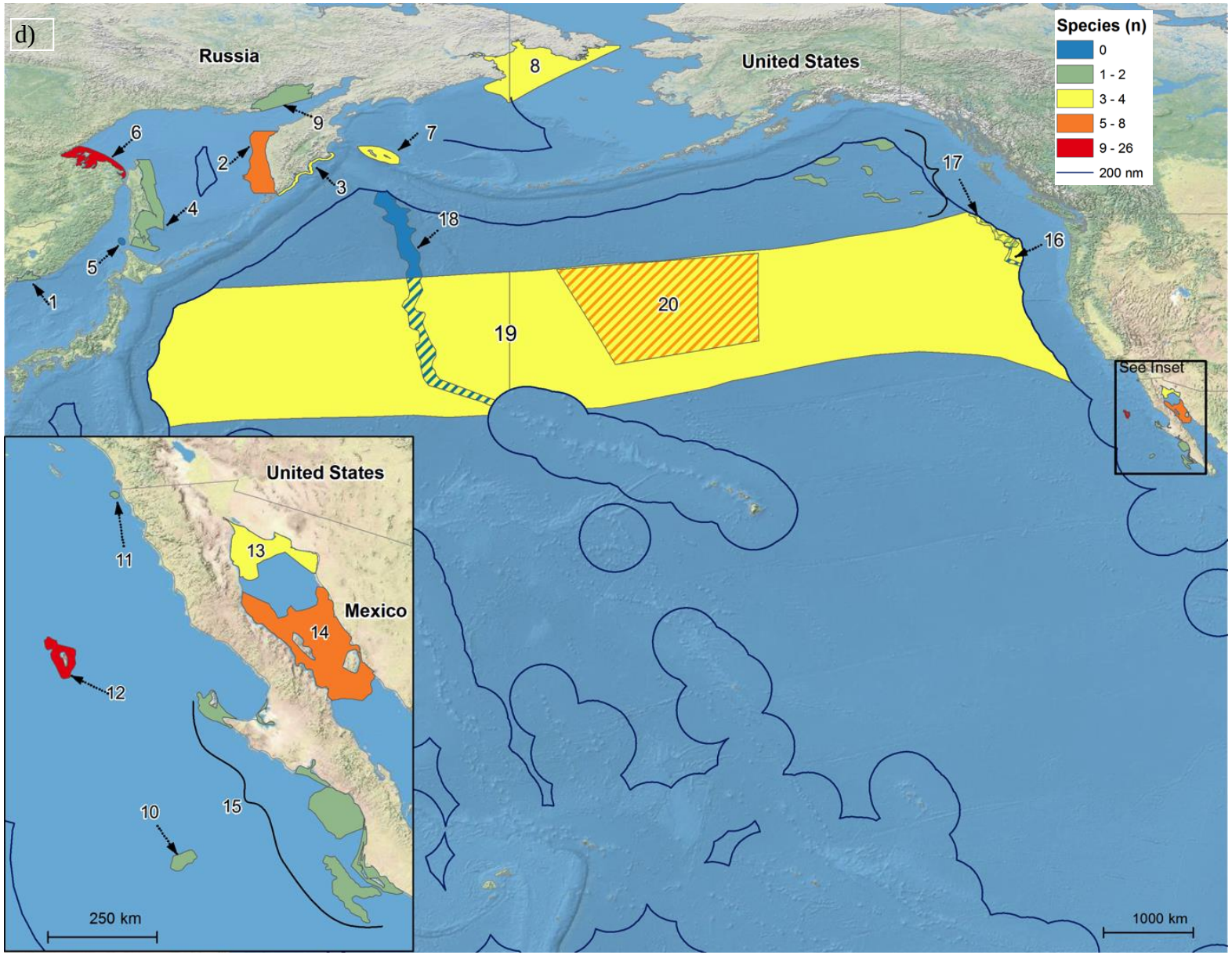
Appendices

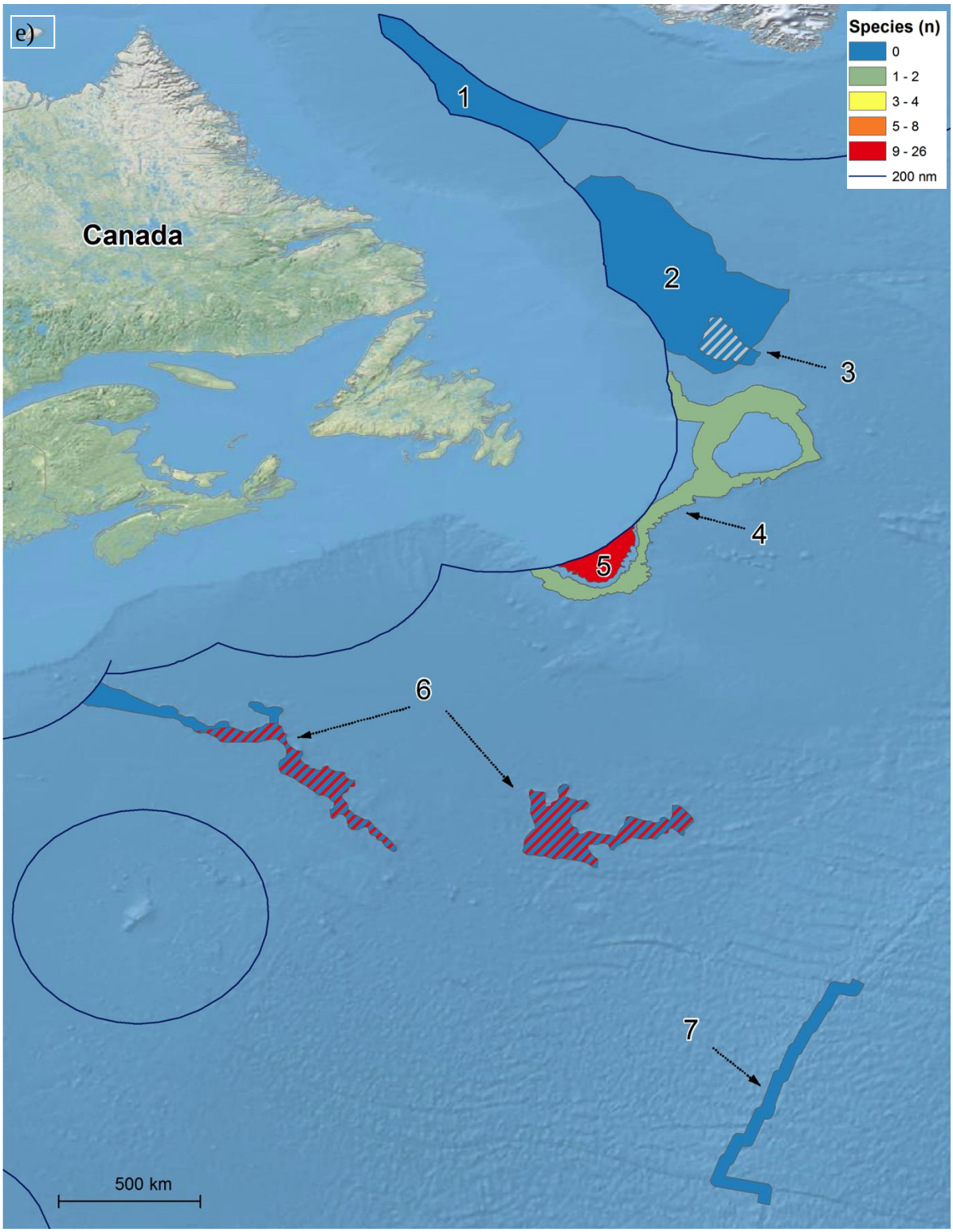
Appendix A. The number of migratory species mentioned in each EBSA description for the a) Arctic, b) Eastern Tropical and Temperate Pacific, c) Mediterranean, d) North Pacific, e) Northwest Atlantic, f) South East Atlantic, g) Southern Indian Ocean, h) Wider Caribbean and Western Mid-Atlantic, and i) Western South Pacific regions. EBSA number refers to the area number listed within the original CBD regional workshop reports. Hatched areas are where two or more EBSAs overlap; EBSAs overlapping with the same values are shown with grey hatching. (Data sources: land and ocean features - Natural Earth, U.S. National Park Service, except for panel a – Blue Marble Next Generation, NASA; country borders - VMap0, National Geospatial Intelligence Agency; EBSA borders - CBD and Marine Geospatial Ecology Lab, Duke University; 200 nm - Flanders Marine Institute Marine Regions.)



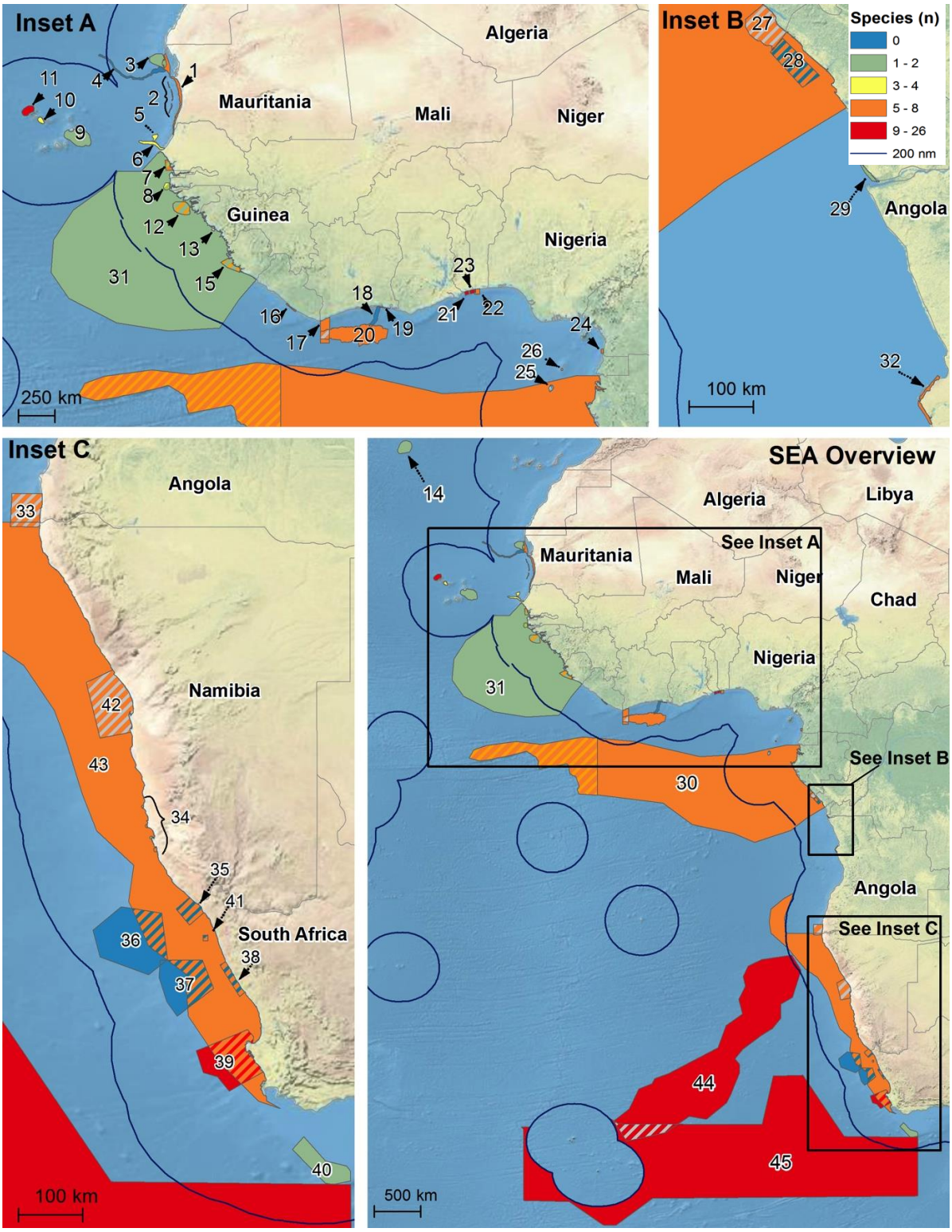

b)
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
Mexico
Peru
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
500 km

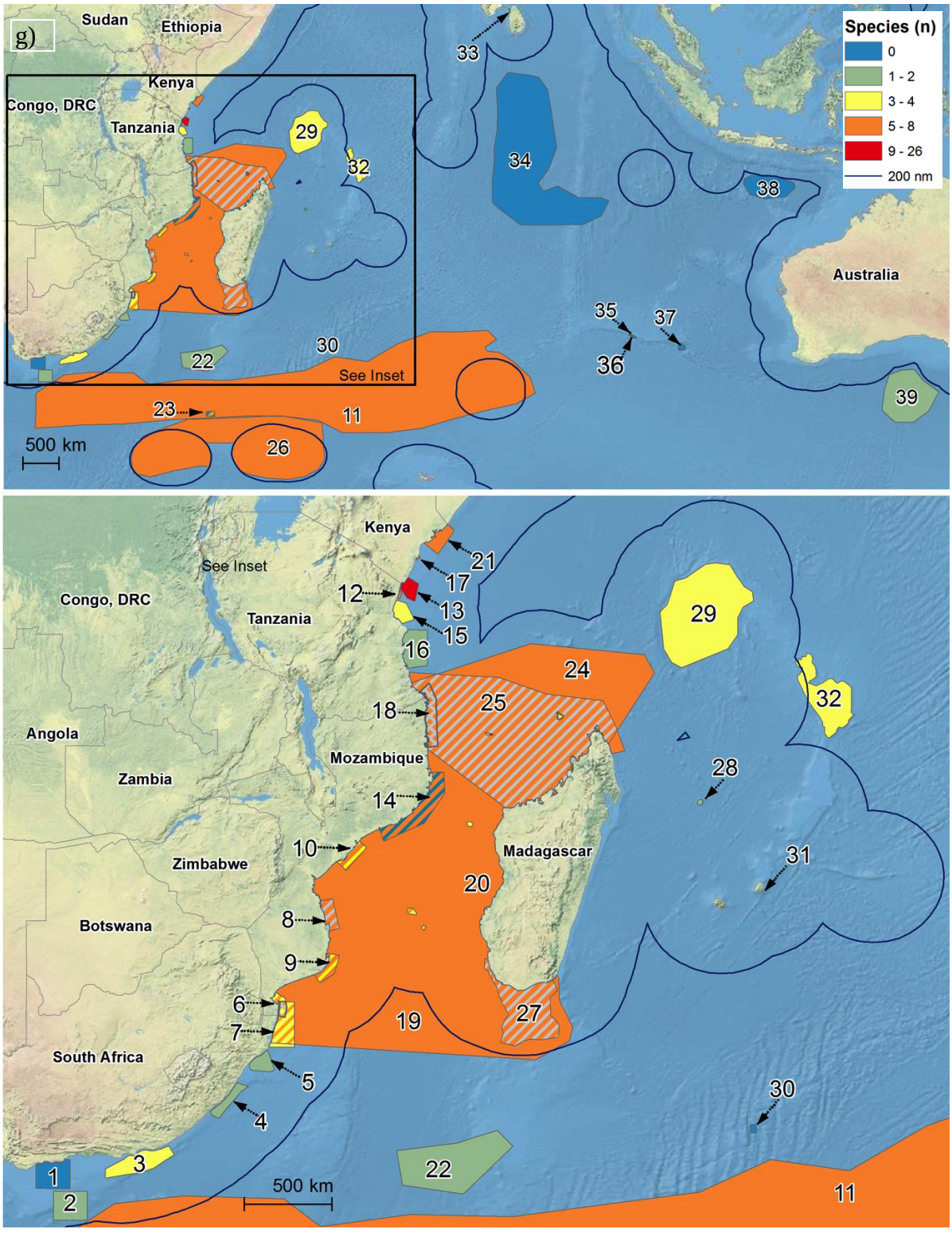

c)
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
United Kingdom
Belarus
Poland
Germany
Czech Republic
Ukraine
Austria
Hungary
France
Romania
Italy
Bulgaria
Spain
Greece
Turkey
Tunisia
Morocco
Algeria
Libya
Egypt
Mali
Niger
Chad
Sudan
250 km
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

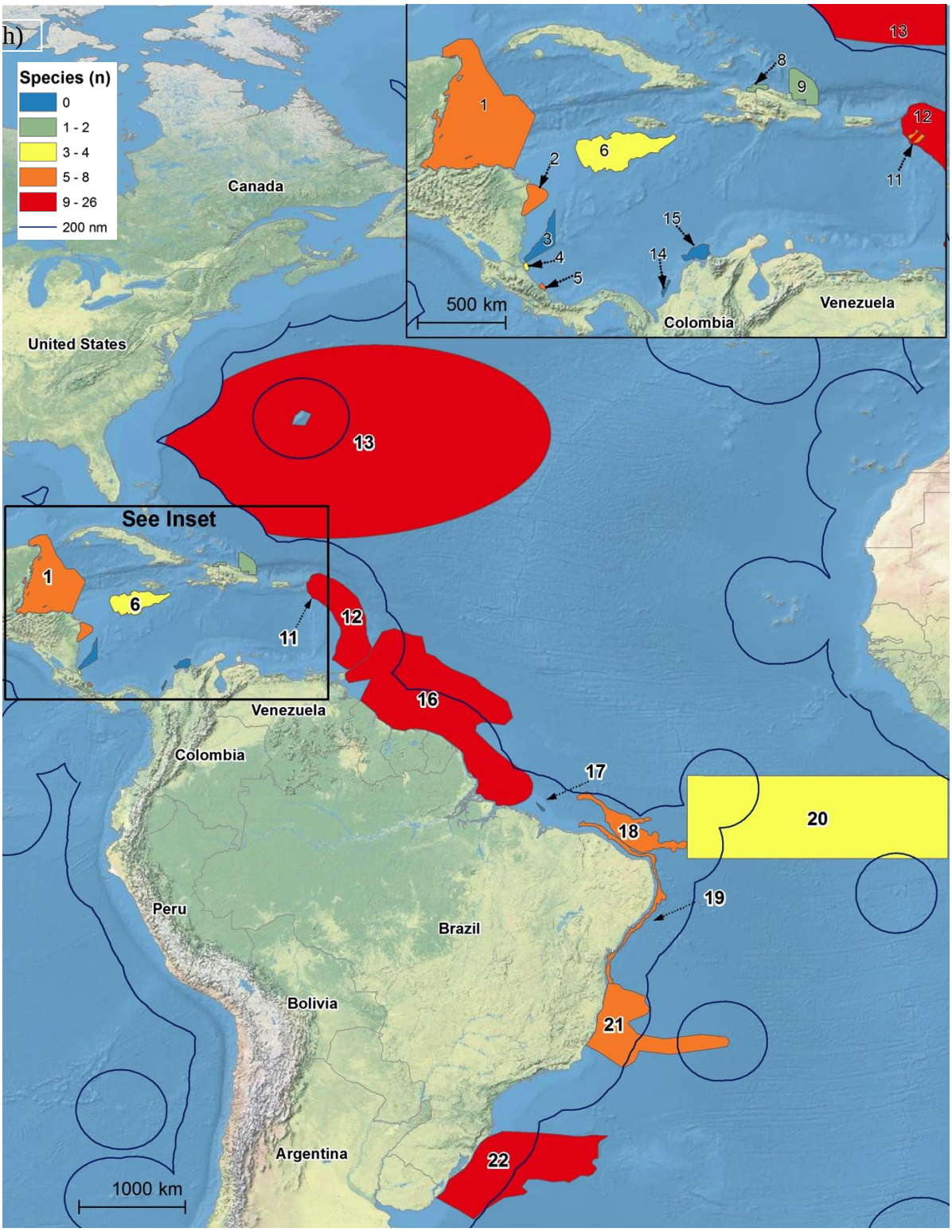

d)
Russia
United States
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
See Inset
United States
Mexico
250 km
1000 km

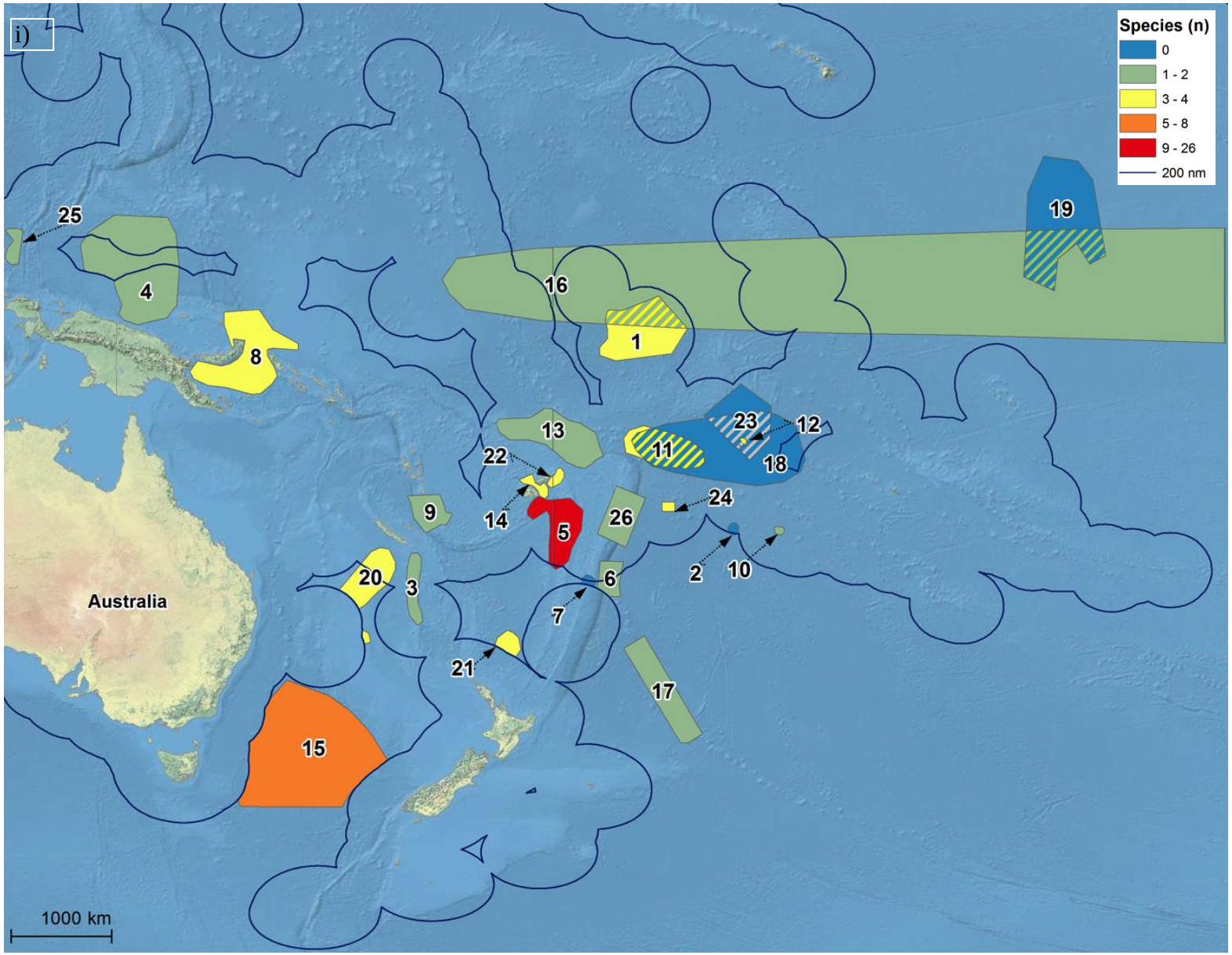

e)
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
Canada
1
2
3
4
5
6
7
500 km

f)

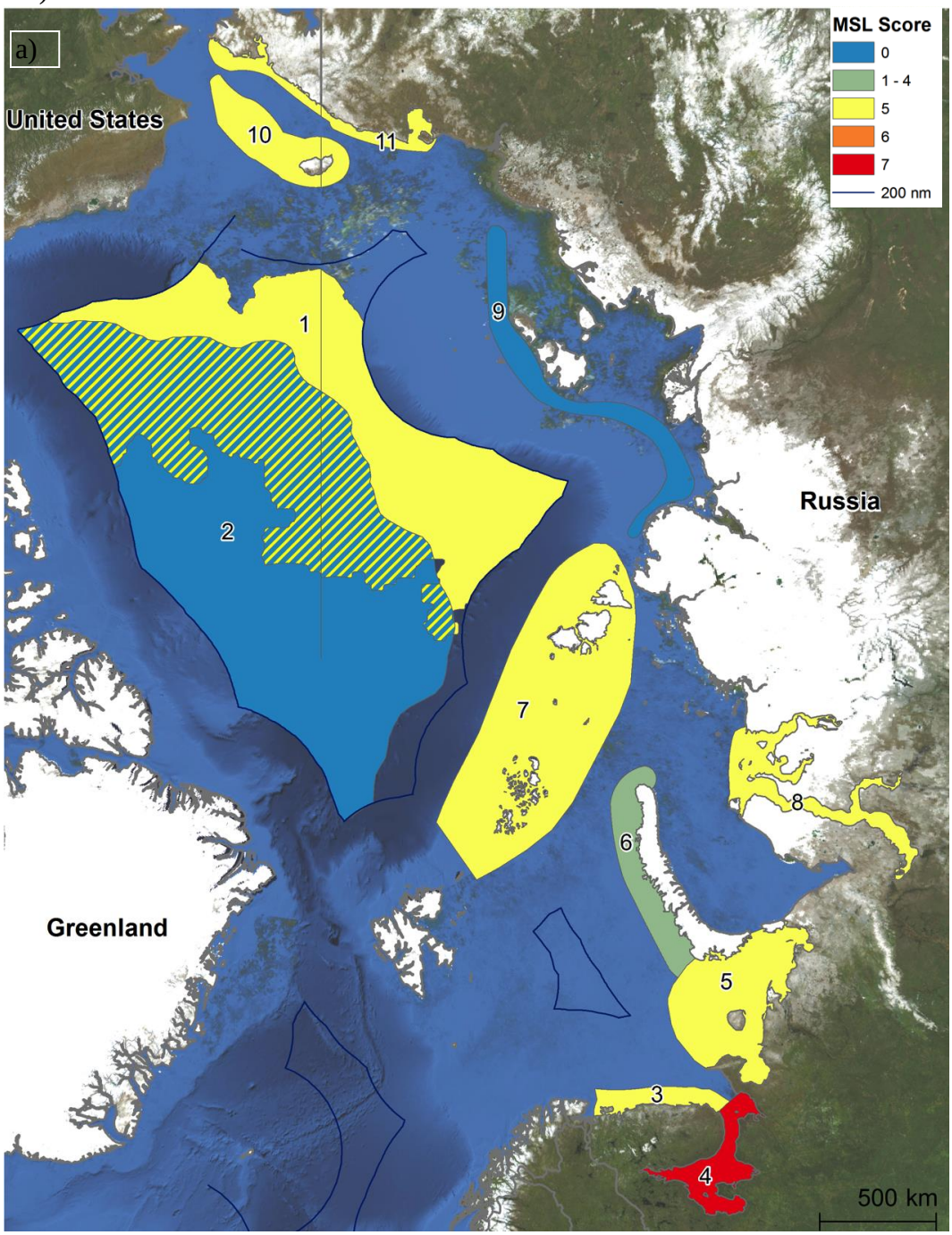

Inset A
Algeria
Mauritania
Mali
Niger
Guinea
Nigeria
250 km
Inset B
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
Angola
100 km
Inset C
Angola
Namibia
South Africa
100 km
SEA Overview
Algeria
Libya
Mauritania
Mali
Niger
Chad
Nigeria
See Inset A
See Inset B
See Inset C
Angola
500 km

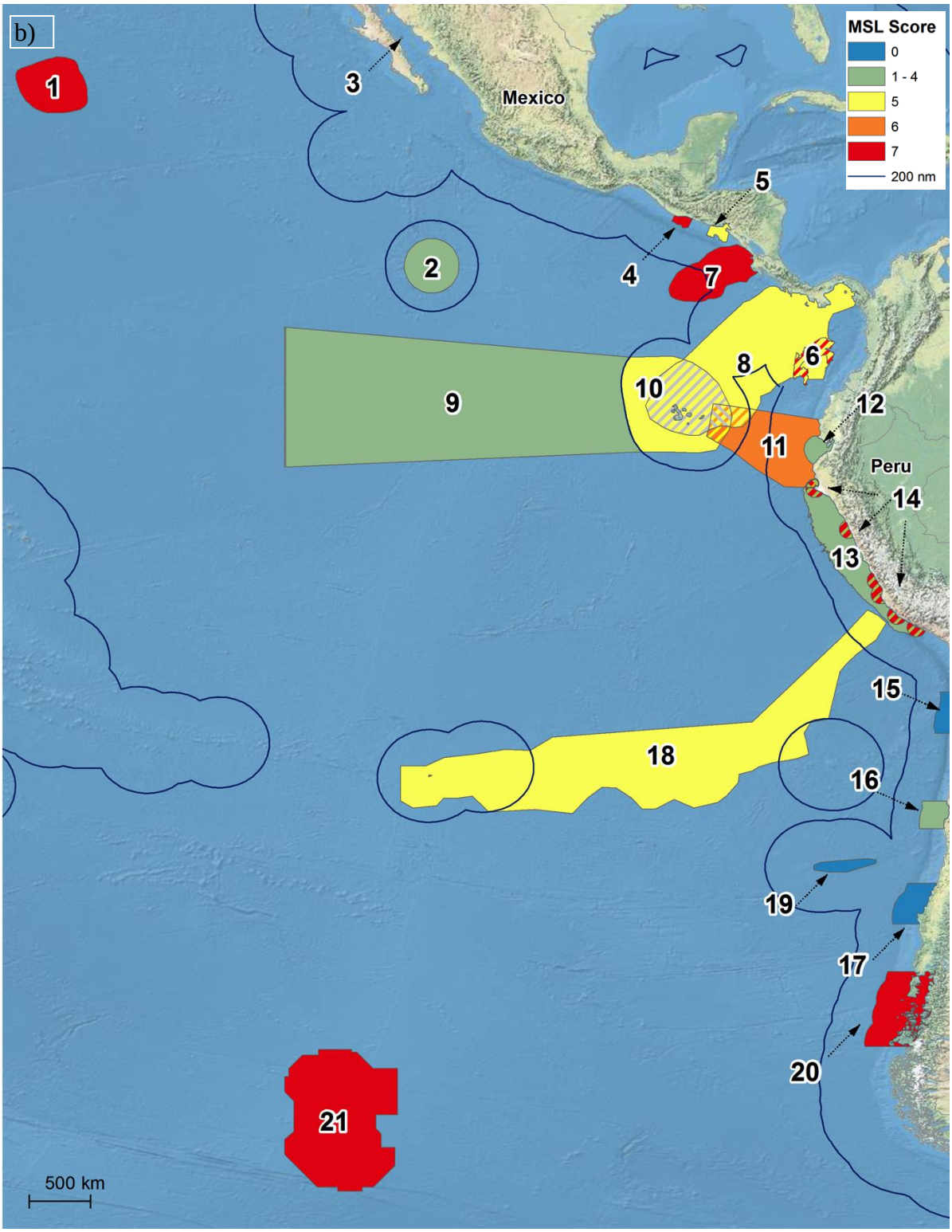

g)
Sudan
Ethiopia
Kenya
Congo, DRC
Tanzania
Australia
See Inset
500 km
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
Angola
Zambia
Zimbabwe
Botswana
South Africa
Mozambique
Madagascar

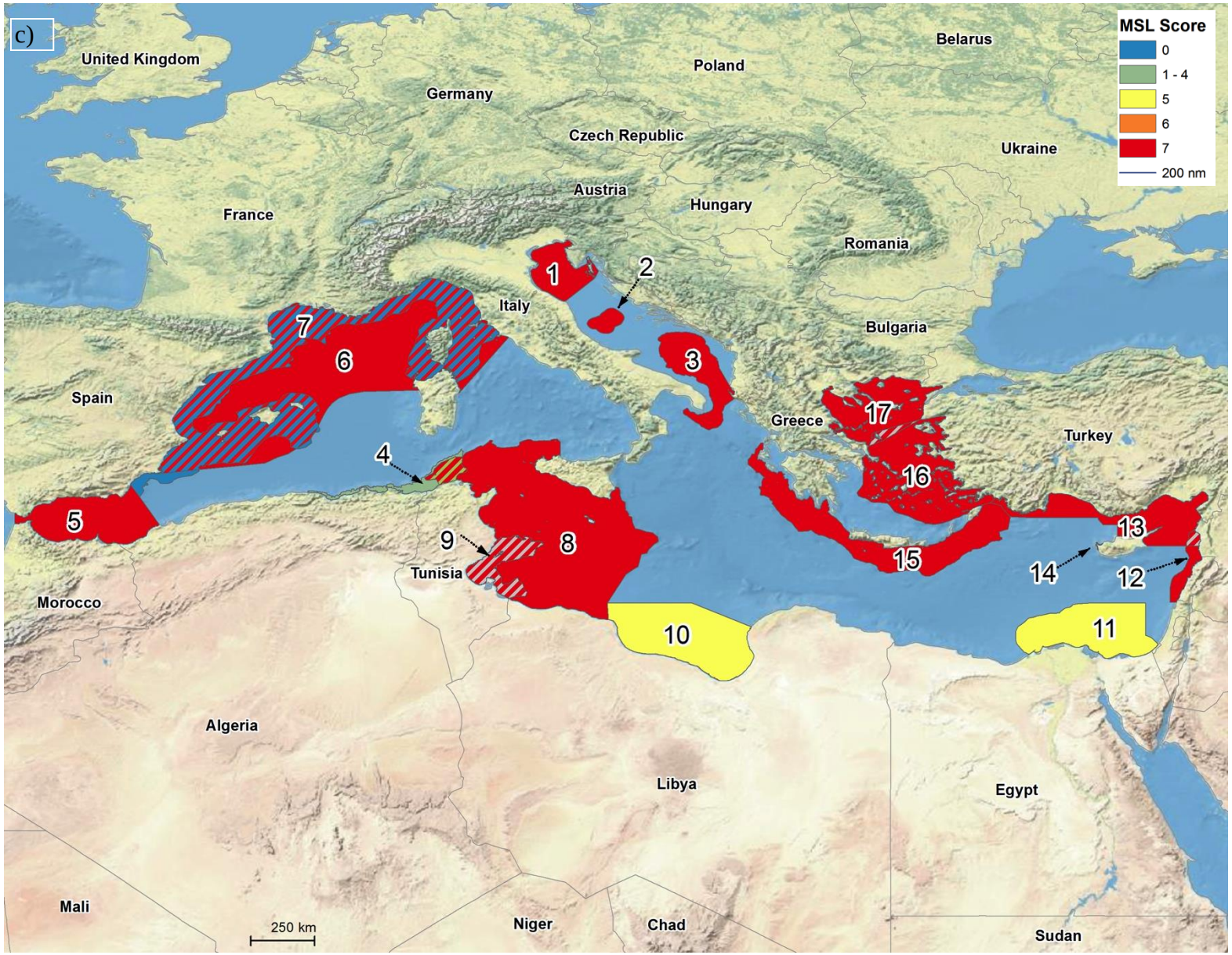

h)
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
Canada
United States
See Inset
Venezuela
Colombia
Peru
Brazil
Bolivia
Argentina
1000 km
500 km
Colombia
Venezuela
1
2
3
4
5
6
8
9
11
12
13
14
15
16
17
18
19
20
21
22

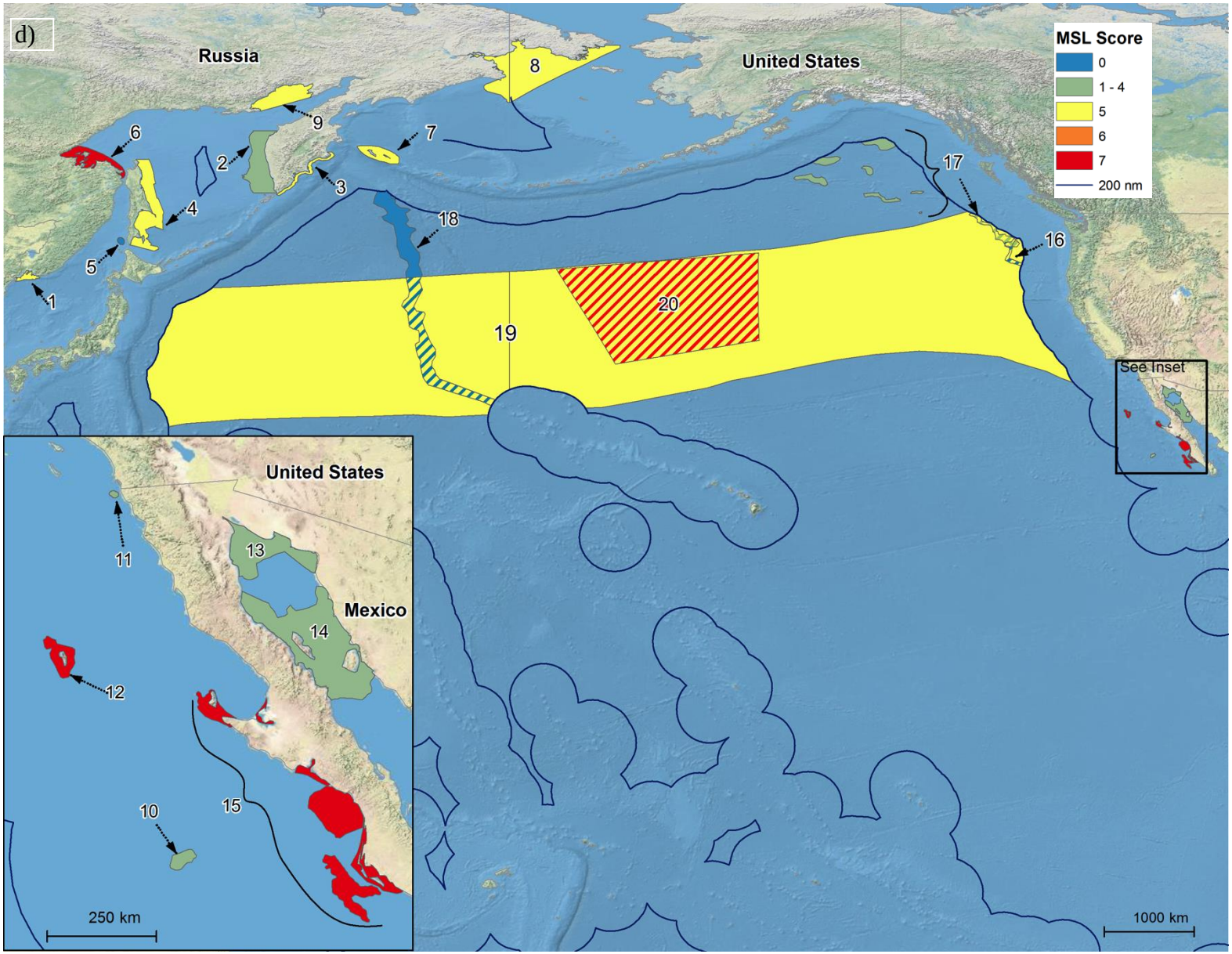

i)
Species (n)
0
1 - 2
3 - 4
5 - 8
9 - 26
200 nm
Australia
1000 km
25
4
8
16
1
19
13
22
14
9
5
26
23
12
11
18
24
2
10
6
7
20
3
21
17
15

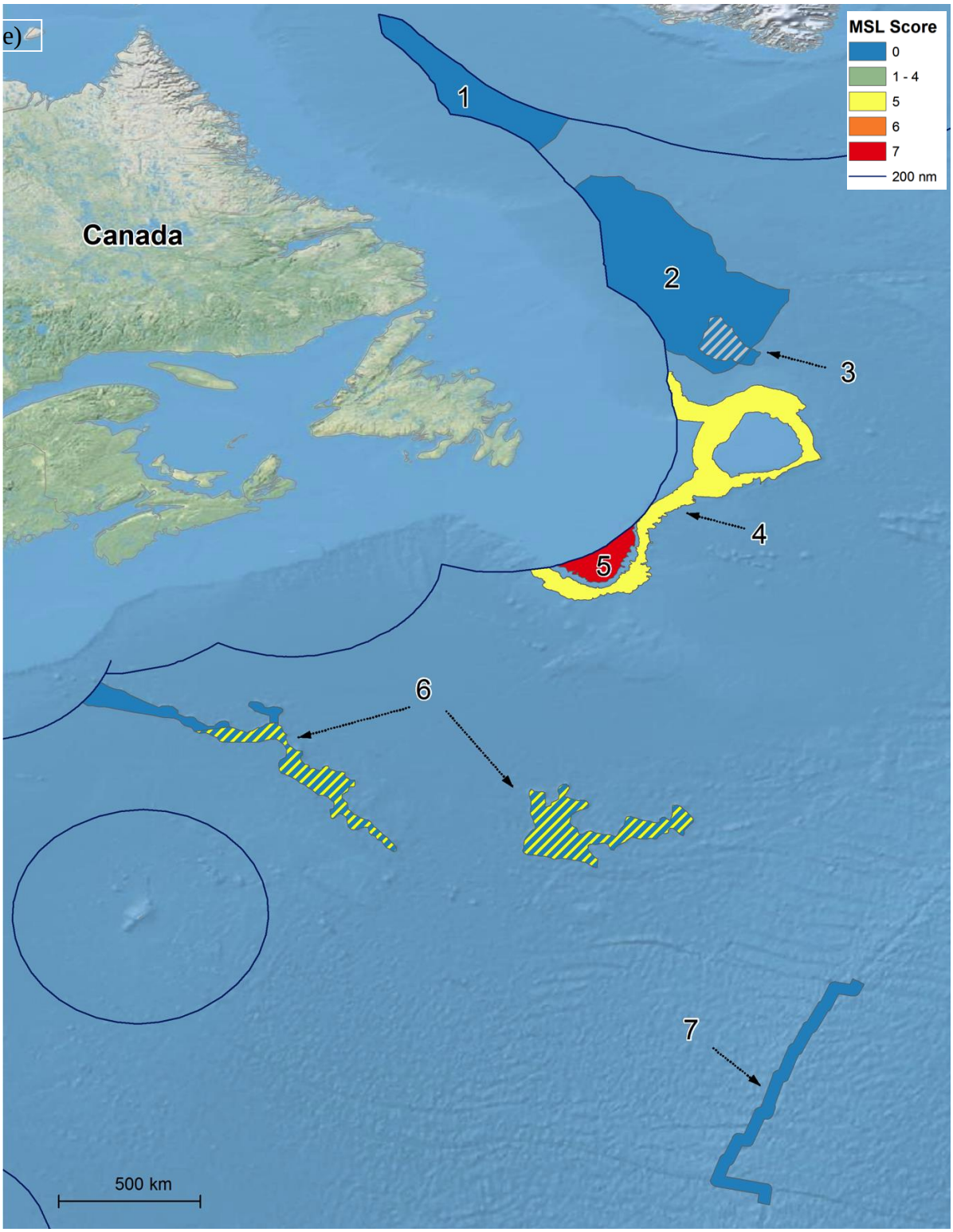
Appendix B. The migratory species level (MSL) score for each EBSA description for the a) Arctic, b) Eastern Tropical and Temperate Pacific, c) Mediterranean, d) North Pacific, e) Northwest Atlantic, f) South East Atlantic, g) Southern Indian Ocean, h) Wider Caribbean and Western Mid-Atlantic, and i) Western South Pacific regions. EBSA number refers to the area number listed within the original CBD regional workshop reports. Hatched areas are where two or more EBSAs overlap; EBSAs overlapping with the same values are shown with grey hatching. (Data sources: land and ocean features - Natural Earth, U.S. National Park Service, except for panel a – Blue Marble Next Generation, NASA; country borders - VMap0, National Geospatial Intelligence Agency; EBSA borders - CBD and Marine Geospatial Ecology Lab, Duke University; 200 nm - Flanders Marine Institute Marine Regions.)



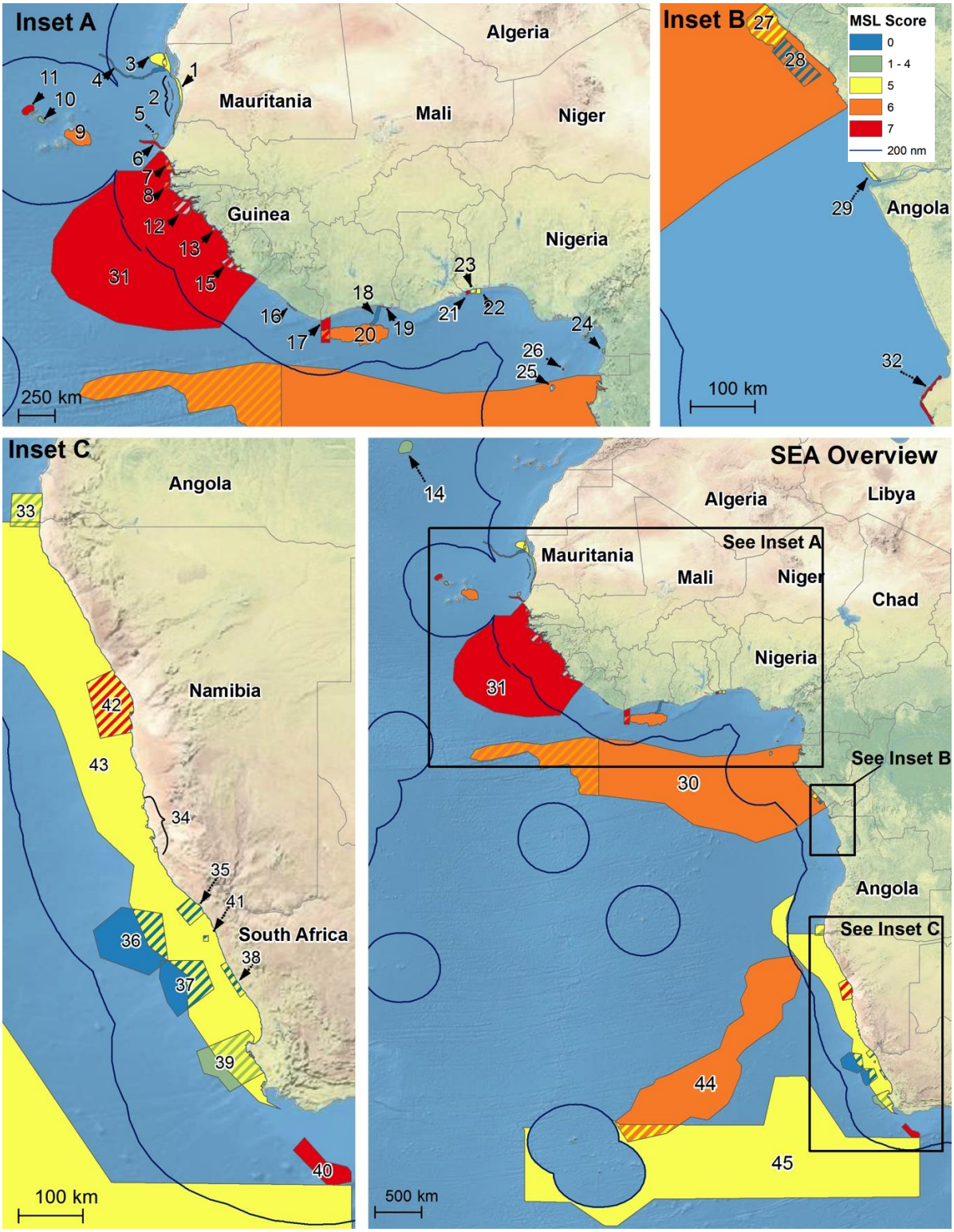

b)
MSL Score
0
1 - 4
5
6
7
200 nm
Mexico
Peru
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
500 km

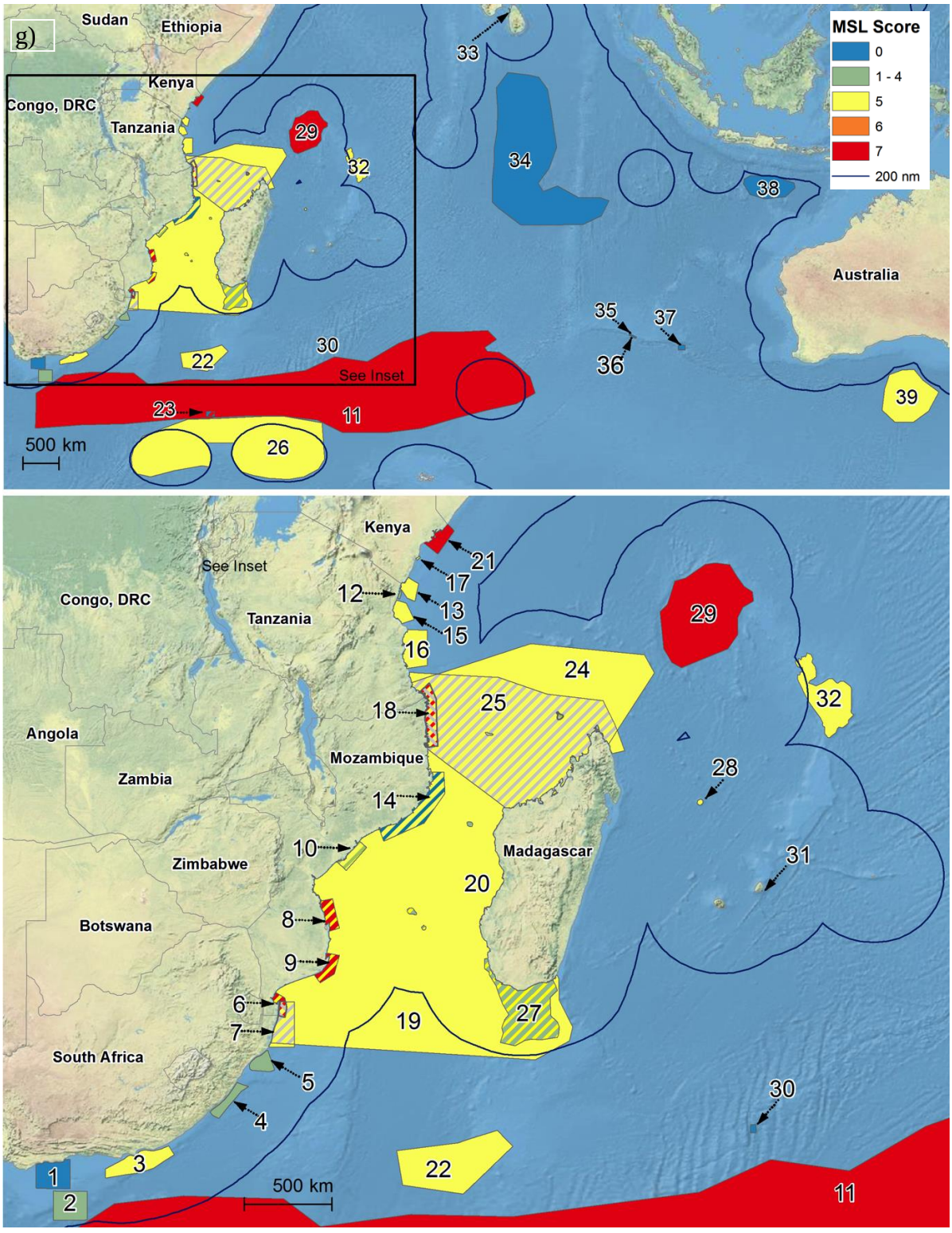

c)
MSL Score
0
1 - 4
5
6
7
200 nm
United Kingdom
Belarus
Poland
Germany
Czech Republic
Ukraine
Austria
Hungary
France
Romania
Italy
Bulgaria
Spain
Greece
Turkey
Tunisia
Morocco
Algeria
Libya
Egypt
Mali
Niger
Chad
Sudan
250 km
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17

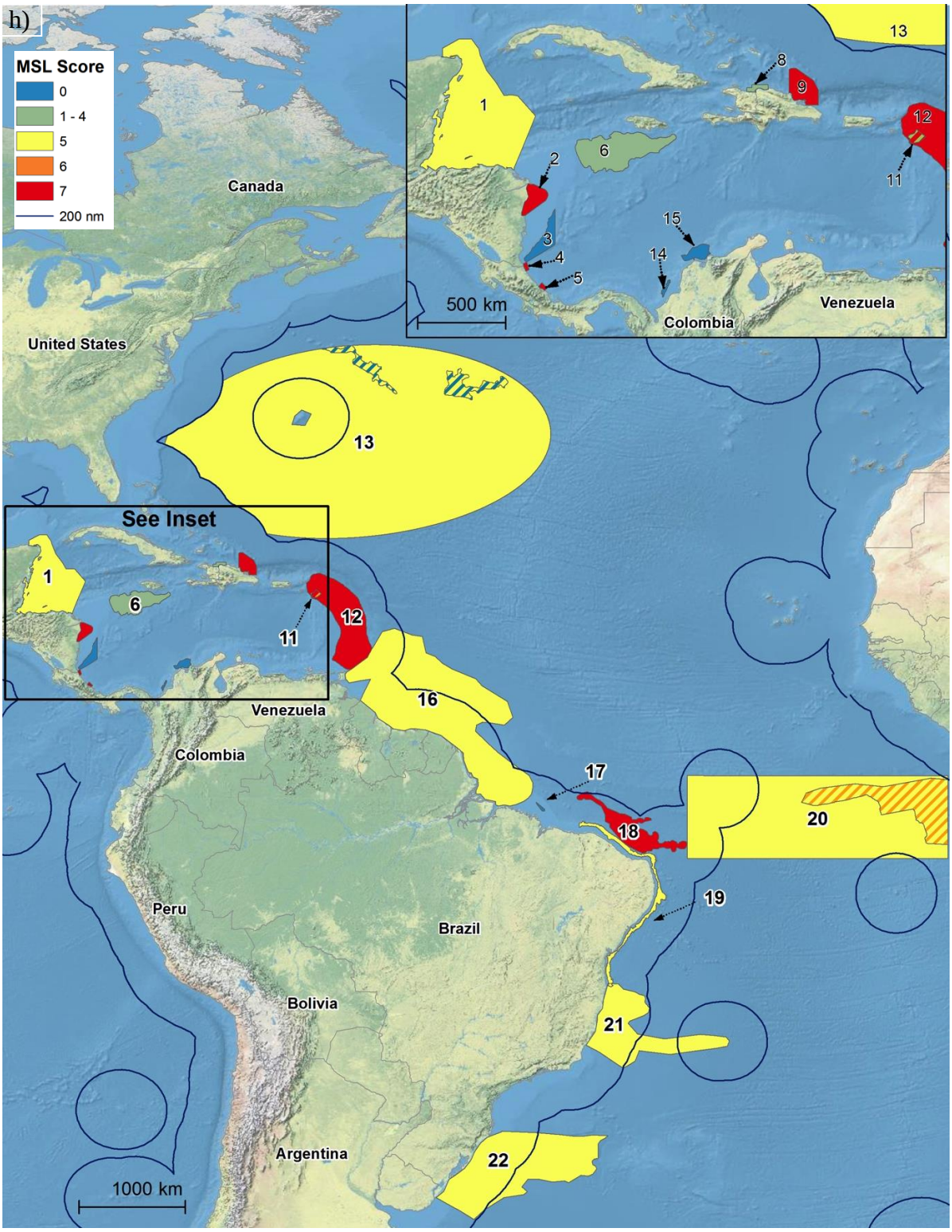

d)
Russia
United States
MSL Score
0
1 - 4
5
6
7
200 nm
See Inset
United States
Mexico
250 km
1000 km
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

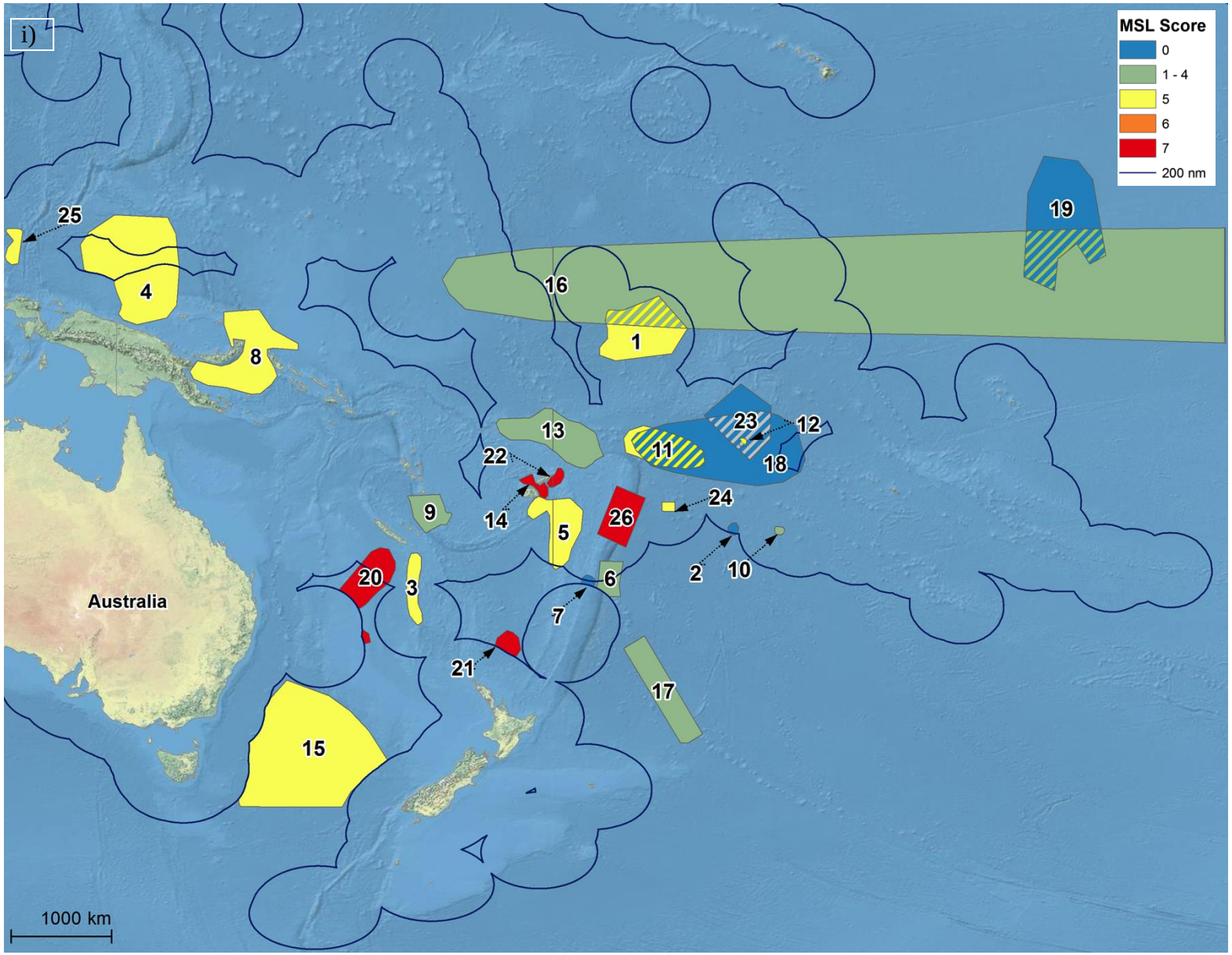

e)
MSL Score
0
1 - 4
5
6
7
200 nm
Canada
1
2
3
4
5
6
7
500 km

f)


Inset A
Algeria
Mauritania
Mali
Niger
Guinea
Nigeria
250 km
Inset B
MSL Score
0
1 - 4
5
6
7
200 nm
Angola
100 km
Inset C
Angola
Namibia
South Africa
100 km
SEA Overview
Algeria
Libya
Mauritania
See Inset A
Mali
Niger
Chad
Nigeria
See Inset B
Angola
See Inset C
500 km


g)
Sudan
Ethiopia
Kenya
Congo, DRC
Tanzania
Australia
See Inset
500 km
MSL Score
0
1 - 4
5
6
7
200 nm
Angola
Zambia
Zimbabwe
Botswana
South Africa
Mozambique
Madagascar


h)
MSL Score
0
1 - 4
5
6
7
200 nm
Canada
United States
13
See Inset
1
6
11
12
16
Venezuela
Colombia
17
18
20
19
Peru
Brazil
Bolivia
21
Argentina
22
1000 km
500 km
Venezuela
Colombia
1
2
3
4
5
6
8
9
11
12
13
14
15


i)
MSL Score
0
1 - 4
5
6
7
200 nm
Australia
1000 km
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

Appendix C. Summary of OBIS-SEAMAP datasets used as a foundation of recorded locations for select migratory species, downloaded August 22, 2014 (Halpin et al. 2009). The number of records refers to a unique species, time, date, and geographic location per dataset; years refer to range of years data were collected, with some years within the range lacking data. For a total list of datasets and data providers, please see website listed for each species.

Common name	Species	Datasets	Records	Years	Website
Humpback whale	*Megaptera novaeangliae*	187	29380	1901-2014	http://seamap.env.duke.edu/species/180530
Leatherback sea turtle	*Dermochelys coriacea*	111	16310	1756-2014	http://seamap.env.duke.edu/species/173843
Pediunker / grey petrel	*Procellaria cinerea*	4	63	1896-2006	http://seamap.env.duke.edu/species/562470
Wandering albatross	*Diomedea exulans*	10	20028	1901-2008	http://seamap.env.duke.edu/species/174525
Green sea turtle	*Chelonia mydas*	96	68517	1758-2014	http://seamap.env.duke.edu/species/173833
White-chinned petrel	*Procellaria aequinoctialis*	8	2952	1915-2007	http://seamap.env.duke.edu/species/174610