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NORTH-WEST ATLANTIC REGIONAL WORKSHOP
TO FACILITATE THE DESCRIPTION OF
ECOLOGICALLY OR BIOLOGICALLY
SIGNIFICANT MARINE AREAS
Montreal, 24 to 28 March 2014

REPORT OF THE NORTH-WEST ATLANTIC REGIONAL WORKSHOP TO FACILITATE THE DESCRIPTION OF ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS[1]

INTRODUCTION

1. At its tenth meeting, the Conference of the Parties to the Convention on Biological Diversity requested the Executive Secretary to work with Parties and other Governments as well as competent organizations and regional initiatives, such as the Food and Agriculture Organization of the United Nations (FAO), regional seas conventions and action plans, and, where appropriate, regional fisheries management organizations (RFMOs) to organize, including the setting of terms of reference, a series of regional workshops, with a primary objective to facilitate the description of ecologically or biologically significant marine areas through the application of scientific criteria in annex I of decision IX/20 as well as other relevant compatible and complementary nationally and intergovernmentally agreed scientific criteria, as well as the scientific guidance on the identification of marine areas beyond national jurisdiction, which meet the scientific criteria in annex I to decision IX/20 (paragraph 36 of decision X/29).

2. In the same decision, the Conference of the Parties requested that the Executive Secretary make available the scientific and technical data, and information and results collated through the workshops referred to above, to participating Parties, other Governments, intergovernmental agencies and the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) for their use according to their competencies.

3. Subsequently, the Conference of the Parties, at its eleventh meeting, requested the Executive Secretary to further collaborate with Parties, other Governments, competent organizations, and global and regional initiatives, such as the United Nations General Assembly Ad Hoc Working Group of the Whole on the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socio-Economic Aspects, the International Maritime Organization, the Food and Agriculture Organization of the United Nations, regional seas conventions and action plans, and, where appropriate, regional fisheries management organizations, with regard to fisheries management, and also including the participation of indigenous and local communities, to facilitate the description of areas that meet the

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[1] The designations employed and the presentation of material in this note do not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

criteria for EBSAs through the organization of additional regional or subregional workshops for the remaining regions or subregions where Parties wish workshops to be held, and for the further description of the areas already described where new information becomes available (paragraph 12 of decision XI/17).

4. Pursuant to the above requests and with financial support from the Government of Canada, the Secretariat convened the North-West Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs). The workshop was hosted by the Government of Canada and was held from 24 to 28 March 2014 in Montreal, Canada.

5. With the financial support of the Government of Canada, the CBD Secretariat commissioned a technical team to support their scientific and technical preparation for the workshop. The results of this technical preparation were made available in the meeting document providing data to inform the CBD North-West Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (UNEP/CBD/EBSA/WS/2014/2/2).

6. The meeting was attended by experts from Canada, United States of America, Northwest Atlantic Fisheries Organization, Global Ocean Biodiversity Initiative (GOBI) Secretariat, WWF, and Memorial University of Newfoundland (BirdLife International). An expert from the United Nations Environment Programme (UNEP) Mediterranean Action Plan for the Barcelona Convention Regional Activity Centre for Specially Protected Areas (RAC/SPA) attended the workshop as an observer so that the experience at this workshop could be shared at the forthcoming workshop in the Mediterranean region. The full list of participants is attached as annex I.

ITEM 1. OPENING OF THE MEETING

7. On behalf of the Government of Canada, as the host of the workshop, Mr. Patrice Simon, Acting Director General, Ecosystem Science Directorate, Fisheries and Oceans Canada, presented opening remarks. He welcomed participants to Montreal and thanked them for taking the time to participate in this important workshop and sharing their expertise. He also thanked the CBD Secretariat for convening the series of EBSA workshops all over the world and indicated that Canada was honoured to support these efforts by hosting this workshop. He noted that these workshops provided a significant contribution to the application of the ecosystem approach and the precautionary approach to the conservation and sustainable use of marine biodiversity. Mr. Simon pointed out that Canada had been a strong supporter of the EBSA process since its inception. Canada had made significant efforts to describe areas that meet the EBSA criteria in the majority of its domestic waters and had been an active participant in related work internationally, including the development of the CBD EBSA criteria. He explained that within Canada's exclusive economic zone (EEZ), the *Oceans Act*, which was based on the principles of sustainable development, integrated management and the precautionary approach, provided the legislative basis for oceans management. He noted that Canada had found the EBSA process to be an important tool that had provided a systematic approach and had brought consistency and scientific credibility to the identification of areas for risk-averse management. Furthermore, from a scientific perspective, the EBSA process helped understand gaps in scientific knowledge and therefore provided focus for future research. He noted that as a member State to the Northwest Atlantic Fisheries Organization (NAFO), Canada had also participated in the identification of vulnerable marine ecosystems, applying the deep-sea fisheries guidelines of the Food and Agriculture Organization of the United Nations (FAO). He wished participants a productive workshop and a pleasant stay in Montreal.

8. On behalf of the Secretariat of the Convention on Biological Diversity, Mr. Sarat Babu Gidda, Senior Programme Officer, welcomed participants and thanked them for participating in this workshop, the eighth regional EBSA workshop convened by the CBD Secretariat. He thanked the Government of Canada for hosting this workshop and for their kind financial support. He noted that the CBD process to facilitate the description of EBSAs benefited greatly from linkages to the work of other relevant organizations as well as experiences from national-level processes. In this regard, he highlighted the leadership of the Government of Canada in supporting the description of EBSAs through their

national-level EBSA process, which had provided valuable insights to the CBD EBSA process. He also emphasized the importance of collaboration with the Food and Agriculture Organization of the United Nations and its work on vulnerable marine ecosystems (VMEs), which complemented the ongoing work on EBSAs in building an improved understanding of marine ecosystems and facilitating the application of appropriate policy responses. Recognizing increasing global attention on the urgent need to effectively protect and preserve marine biodiversity, including in the ongoing United Nations Open Working Group on Sustainable Development Goals, he outlined the critical role of the regional EBSA workshops in describing ocean areas in need of special attention. He expressed his wish for successful deliberations of the workshop.

ITEM 2. ELECTION OF THE CO-CHAIRS, ADOPTION OF THE AGENDA AND ORGANIZATION OF WORK

9. After a brief explanation by the CBD Secretariat on procedures for electing the workshop chair, Mr. Jake Rice (Canada) was elected as the workshop chair, as offered by the hosting Government.

10. Participants were then invited to consider the provisional agenda (UNEP/CBD/EBSA/WS/2014/2/1) and the proposed organization of work, as contained in annex II to the annotations to the provisional agenda (UNEP/CBD/EBSA/WS/2014/2/1/Add.1), and adopted them without any amendments.

11. The workshop was organized in plenary sessions and break-out group sessions. The chair nominated the following rapporteurs for the plenary sessions, taking into consideration the expertise and experience of the workshop participants and in consultation with the CBD Secretariat:

- Agenda item 3 (workshop background, scope and output): Pat Halpin (Technical Support Team);
- Agenda item 4 (review of relevant scientific information): Kevin Friedland (United States of America);
- Agenda item 5 (description of of areas meeting the EBSA criteria): Break-out session subgroup coordinators were identified under later agenda items;
- Agenda item 6 (identification of gaps): David Johnson (GOBI).

ITEM 3. WORKSHOP BACKGROUND, SCOPE AND OUTPUT

12. Ms. Jihyun Lee (CBD Secretariat) provided an overview of the CBD EBSA process and highlighted the workshop objectives and expected outputs.

13. The workshop participants noted the following points regarding the guidance of the tenth and eleventh meetings of the Conference of the Parties on the regional workshop process as well as the potential contribution of scientific information produced by workshops:

(a) The Conference of the Parties to the Convention at its tenth meeting noted that the application of the scientific criteria in annex I of decision IX/20 for the identification of ecologically and biologically significant areas presents a tool which Parties and competent intergovernmental organizations may choose to use to progress towards the implementation of ecosystem approaches in relation to areas both within and beyond national jurisdiction, through the identification of areas and features of the marine environment that are important for conservation and sustainable use of marine and coastal biodiversity (paragraph 25 of decision X/29);

(b) The application of the EBSA criteria is a scientific and technical exercise, and the identification of EBSAs and the selection of conservation and management measures is a matter for States and competent intergovernmental organizations, in accordance with international law, including the United Nations Convention on the Law of the Sea (paragraph 26 of decision X/29);

(c) The EBSA description process is open-ended, and additional regional or subregional workshops may be organized when there is sufficient advancement in the availability of scientific information (paragraphs 9 and 12 of decision XI/17);

(d) The request by the Conference of the Parties, at its eleventh meeting, for Parties and other Governments, recalling paragraph 18 of decision IX/20 and paragraph 43 of decision X/29, to further provide for inclusion in the repository or information-sharing mechanism, as determined by submitting Parties or Governments, scientific and technical information and experience relating to the application of the criteria for EBSAs or other relevant compatible and complementary nationally and intergovernmentally agreed scientific criteria in areas within national jurisdiction before the twelfth meeting of the Conference of the Parties (paragraph 18 of decision XI/17);

(e) Each workshop is tasked with describing areas meeting the scientific criteria for EBSAs or other relevant criteria based on best available scientific information. As such, experts at the workshops are not expected to discuss any management issues, including threats to the areas; and

(f) The EBSA description process facilitates scientific collaboration and information-sharing at national, subregional and regional levels.

14. Mr. Jake Rice (Canada) delivered a presentation on the scientific criteria for EBSAs (annex I to decision IX/20, http://www.cbd.int/doc/decisions/cop-09/cop-09-dec-20-en.pdf) and the scientific guidance on the application of EBSA criteria, building upon the results of the Expert Workshop on Scientific and Technical Guidance on the Use of Biogeographic Classification Systems and Identification of Marine Areas beyond National Jurisdiction in Need of Protection (Ottawa, Canada, 29 September to 2 October 2009) (http://www.cbd.int/doc/meetings/mar/ebsa-np-01/other/ebsa-np-01-ewbcsima-01-02-en.pdf). He also shared experience from previous EBSA workshops in the North Pacific, North-East Atlantic, and Arctic.

15. The workshop then shared experiences in applying EBSA criteria or other similar criteria through national processes.

16. The workshop noted that Canada, through the *Oceans Act* (1997), was committed to maintaining biological diversity and productivity in the marine environment. A key component of this was to identify areas that were considered to be ecologically or biologically significant. Fisheries and Oceans Canada (DFO) had developed guidelines on the criteria that were to be used to identify EBSAs within Canada's waters and had undertaken a process to identify EBSAs in national waters. Five criteria were identified for consideration: uniqueness or rarity, aggregations, fitness consequences, naturalness and resiliency. Although these criteria differed from those used by the Convention, the considerations addressed by both sets of criteria were the same. The following presentations were provided on Canada's process for the identification of EBSAs in different regions:

(a) Mr. Garry Stenson (Canada) delivered a presentation on the identification of EBSAs in Newfoundland and Labrador;

(b) Ms. Ellen Kenchington (Canada) delivered a presentation on the identification of EBSAs in the Scotian Shelf Bioregion; and

(c) Mr. Denis Chabot (Canada) delivered a presentation on the identification of EBSAs in the Gulf of St. Lawrence.

17. Mr. Kevin Friedland (United States of America) provided a review of national-level scientific efforts in the United States relevant to the identification of EBSAs, in particular focusing on an analysis of North Atlantic spring phytoplankton blooms.

18. Mr. Javier Murillo (NAFO) presented details on the work of NAFO in the identification of vulnerable marine ecosystems in the region.

19. Mr. Michael Tetley (GOBI) delivered a presentation on knowledge and research on migratory species in the region of relevance to the description of EBSAs.

20. Mr. Pat Halpin (Technical Support Team) provided a regional overview of biogeographic information on open ocean water and deep-sea habitats and explained various considerations to be made in defining the geographic scope of the workshop, also noting the boundaries of the previous workshops in the North-East Atlantic, Arctic, Wider Caribbean and Western Mid-Atlantic, and South-Eastern Atlantic regions.

21. Summaries of the above presentations are provided in annex II.

22. Building upon information provided by thematic presentations under this agenda item, the workshop chair led a discussion on the geographic scope of the workshop. Experts from Parties and other Governments were first asked if there were any national processes for applying EBSA criteria or similar criteria within their respective countries and/or if they wished to have this workshop undertake description of EBSAs in their respective marine waters within national jurisdictions.

23. Experts from Canada and the United States of America requested that the workshop take note of national processes applying EBSA criteria and/or similar national processes for identifying marine areas of particular importance.

24. All the marine areas surrounding the "North-West Atlantic" had been considered by previous CBD regional EBSA workshops. Although this preceding work provided valuable context for this workshop, it posed some challenges in delineating the exact boundaries to be applied to the "North-West Atlantic" for the purposes of this workshop. After discussing on each case, it was agreed that:

(a) To the west, the boundary would be the EEZs of the United States and Canada;

(b) To the north, the Arctic Regional Workshop to Facilitate the Description of EBSAs (3 to 7 March 2014, Helsinki) had defined its geographic scope as including the entire area defined by the Arctic Council Working Group on Conservation of Arctic Flora and Fauna (CAFF) as "the Arctic" – an area extending down to waters between southern Labrador and West Greenland. For the northern boundary of the present workshop, it was agreed to use the point where the EEZs of Canada and Greenland (Kingdom of Denmark) meet. This means that both workshops had considered a small "finger" of ocean between Labrador and Greenland. This was not thought to present any risk of conflicting assessments, since the Arctic workshop had noted that it would be appropriate for features of this area of overlap to be evaluated in the North-West Atlantic workshop, in the context of the ecology of the North-West Atlantic Ocean. The present workshop further took note of the importance given by the Arctic workshop to sea ice as a feature to which the EBSA criteria should be applied. Noting that in the North-West Atlantic, sea ice and ice fronts occur almost exclusively in areas within national jurisdiction, the workshop concluded that it would be appropriate for those features to be considered by national processes. The workshop was informed that Canada had identified the southern edge of the seasonal pack ice off Newfoundland and Labrador as an EBSA in its national process;

(c) To the east, the Joint OSPAR/NEAFC/CBD Scientific Workshop on the Identification of Ecologically or Biologically Significant Marine Areas in the North-East Atlantic (Hyères, France, 8 and 9 September 2011) had defined a western boundary matching the western limit of the OSPAR Convention and NEAFC Regulatory areas, generally following 42 degrees W longitude. This boundary also delimited the area considered by ICES in its review of the report of the North-east Atlantic workshop (ICES Advice 2013 section 1.5.6.7). The present workshop accepted this boundary as the eastern boundary for its work. At this workshop, however, new information on occurrence and diversity of 20 seabird species in waters primarily to the east of this boundary was tabled. The treatment of this information and proposals for a way to advance the evaluation of areas in the central Atlantic Ocean important to seabirds using the EBSA criteria are presented in annex III;

(d) In the south-east, the previously unassessed area of the North-West Atlantic abuts the area considered at the South-Eastern Atlantic Regional Workshop to Facilitate the Description of EBSAs

(8 to 12 April 2013, Swakopmund, Namibia) to the east and the Wider Caribbean and Western Mid-Atlantic Regional Workshop to Facilitate the Description of EBSAs (Recife, Brazil, 28 February to 2 March 2012) to the south. It was noted that the previous regional workshops had not given in-depth consideration to benthic information from the areas where the three workshop regions meet. In particular, known or predicted hydrothermal vents in the vicinity of the mid-Atlantic Ridge were not assessed at these workshops. The present workshop noted that such vents are found or predicted to be scattered along the Mid-Atlantic Ridge from the Portuguese EEZ at the Azores well south into the South Atlantic, and that these vents should all be assessed relative to the EBSA criteria. An area containing a subset of those vents, bounded to the north by the OSPAR Maritime Area, and to the south by an area where known vents were inactive, was included in the workshop scope (see description of area no. 7 of the appendix to annex IV). The eastern boundary of this area was the boundary between the Wider Caribbean and Western Mid-Atlantic and the South-Eastern Atlantic regions. The western boundary was not set *a priori*, but the band of seabed to be considered was just wide enough to allow evaluation of benthic features associated with the centre of the Mid-Atlantic Ridge. Other ecological and physical features in the area of overlap with the previous EBSA regional workshops in the Wider Caribbean and Western Mid-Atlantic and the South-Eastern Atlantic regions were not assessed at this workshop; and

(e) To the south, the area to be considered by the North-West Atlantic workshop abuts the area already assessed at the Wider Caribbean and Western Mid-Atlantic regional workshop to facilitate the description of EBSAs (28 February to 2 March 2012, Recife, Brazil). Additional information, particularly on benthos and oceanographic features in the northern part of the area considered at the Recife workshop, was tabled at this workshop. After communication with participants in the previous workshop and experts in the Sargasso Sea (the major pelagic feature in the area of potential overlap), this workshop decided to extend its consideration of benthic features down to at least the southern boundary of the New England and Corner Rise seamount chains and clusters. The treatment of pelagic features in the area of overlap is discussed in annex III and the treatment of benthic features is discussed in area no. 6, in the appendix to annex IV.

25. The participants agreed to use the geographic scope of the workshop as illustrated in the map in annex V.

ITEM 4. REVIEW OF RELEVANT SCIENTIFIC DATA/INFORMATION/MAPS COMPILED AND SUBMITTED FOR THE WORKSHOP

26. For the consideration of this item, the workshop had before it two notes by the Executive Secretary: document UNEP/CBD/EBSA/WS/2014/2/2, containing data to inform the CBD North-West Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically significant Marine Areas, which was prepared in support of the workshop deliberations, and document UNEP/CBD/EBSA/WS/2014/2/3, containing a compilation of the submissions of scientific information to describe ecologically or biologically significant marine areas in the North-West Atlantic, submitted by Parties, other Governments and relevant organizations in response to the Secretariat's notification 2014-018 (Ref. no. SCBD/SAM/DC/JL/JA/JM/83129), dated 31 January 2014. The documents/references submitted prior to the workshop were made available for the information of workshop participants on the meeting website (http://www.cbd.int/doc/?meeting=EBSAWS-2014-02).

27. Mr. Pat Halpin provided a presentation entitled "Review of relevant scientific data/information/maps compiled to facilitate the description of EBSAs in the North-West Atlantic," based on document UNEP/CBD/EBSA/WS/2014/2/2. A summary of his presentation is provided in annex II.

28. The following presentations on scientific information in support of applying EBSA criteria in this region were also made:

(a) Labrador Sea Deep Winter Convection Area (by William Li, Canada);

(b) Seasonal Climatologies of Sea Surface Temperature, Chlorophyll a, and Daily Primary Production (by William Li, Canada);

(c) Mid-Atlantic Ridge Hydrothermal Vents during the North-West Atlantic EBSA Evaluation Process (by Ellen Kenchington, Canada);

(d) Marine Mammals in the North-West Atlantic (by Garry Stenson, Canada).

29. Summaries of the above presentations are provided in annex II.

30. Site-based submissions of scientific information on areas meeting EBSA criteria were presented by Ms. Lisa Speer (NRDC)/Mr. Brad Sewell (NRDC)/Mr. Peter Auster (University of Connecticut);[2] Mr. Michael Tetley (GOBI), incorporating information provided by WWF; and s. April Hedd Bird ife International emorial niversity). The information provided in these presentations was incorporated into the description of areas meeting the EBSA criteria by the break-out groups. Each presentation describing areas meeting the EBSA criteria provided an overview of the areas considered, the assessment of the area against the EBSA criteria, scientific data information available as well as other relevant information.

31. Summary of plenary discussion under this agenda item is described in annex III.

ITEM 5. DESCRIPTION OF AREAS MEETING EBSA CRITERIA THROUGH APPLICATION OF THE SCIENTIFIC CRITERIA AND OTHER RELEVANT COMPATIBLE AND COMPLEMENTARY NATIONALLY AND INTERGOVERNMENTALLY AGREED SCIENTIFIC CRITERIA

32. The meeting agreed that the four types of areas meeting the EBSA criteria described in the report of the North Pacific Regional Workshop to Facilitate the Description of EBSAs (Moscow, 25 February to 1 March 2013; http://www.cbd.int/doc/meetings/mar/ebsa-np-01/official/ebsa-np-01-04-en.pdf) might be useful in reporting on areas meeting the EBSA criteria in the North-West Atlantic as well. These were:

(a) ***Spatially stable features whose positions are known and individually resolved on the maps***. Examples include individual seamounts and feeding areas for sharks and seabirds. Such areas do not have to be used as important habitats all year round, nor does all the area have to be used every year. However, the feature(s) is entirely contained in the corresponding map polygons;

(b) ***Spatially stable features whose individual positions are known but a number of individual cases are being grouped***. Examples include a group of coastal areas, seamounts or seabird breeding sites where the location of each is known but a single polygon on the map and corresponding description encompasses all the members of the group. The grouping may be done because there may be insufficient knowledge to evaluate each separately or the information is basically the same for all members of the group, so one description can be applied to all group members;

(c) ***Spatially stable features whose individual positions are not known***. Examples include areas where coral or sponge concentrations are likely, based on, for example, modelling of suitable habitats, but information is insufficient to specify the locations of each individual concentration. Each such area may be represented by a single map polygon and description, but the entire area inside the polygon is not to be interpreted as filled with the feature(s) meeting the criteria. The narrative about these areas should stress the importance of getting better information on the spatial distribution of these features; and

(d) ***Features that are inherently not spatially fixed***. The position of this feature moves seasonally and among years. The map polygon for such a feature should include the full range occupied by the front (or other feature) during a typical year. However, the description and its narrative should describe seasonal movement of the key feature(s). The text for description should also make very clear that at any given time, the ecological importance usually is highest wherever the feature is located at that time and often decreases as distance from the feature increases. It may even be the case that at any given

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[2] Through a teleconference call.

time some parts of the total area contained in the polygon are ecologically little different from areas outside the polygon.

33. Correspondingly, each description for an area found to meet EBSA criteria includes clear statements about the degree to which the boundaries are fixed or mobile over time (at various scales, e.g., months, years), and how clearly the boundaries of the features can be specified with existing knowledge. The maps of the areas meeting EBSA criteria also use different symbols/colours to reflect the different types of EBSAs.

34. Countries bordering the North-West Atlantic Ocean that are represented by their experts at this workshop have national processes for identifying EBSAs, or for applying similar spatial criteria within their EEZs. The progress or results of these processes were reported to this workshop, as summarized in annex II, as background information. The experiences and the results of the Canadian EBSA process was useful in applying criteria and interpreting scientific information in marine areas beyond national jurisdiction (ABNJ), and for features such as subsea canyons. The features present in ABNJ were evaluated in the context of their representation and functions both within and beyond national jurisdiction (see annex III).

35. Following discussion of the information to be captured in the maps and EBSA descriptions, the workshop participants were then split into several break-out groups to address: (i) seamounts; (ii) the Southeast Shoal / Flemish Cap, Flemish Pass and Orphan Knoll; (iii) hydrothermal vents; (iv) the Labrador Sea deep convection area; (v) the transition zone front, (vi) seabird foraging areas to the east, which was also informed by information on seabird foraging on the Grand Banks and in the Labrador Sea; and (vii) canyons and the shelf edge.

36. Participants were assisted by the technical support team, including GIS operators, who assisted with access to and use and analysis of data and made hard/electronic copies of the maps available for the deliberations of the break-out group discussion.

37. During the break-out group discussions, participants worked on their descriptions of areas meeting EBSA criteria. They placed approximate boundaries of areas meeting EBSA criteria on maps provided by the technical support team as they were completed to keep track of opportunities to extend or merge areas and to identify areas that had yet to be considered.

38. Two of the breakout groups reported back that although they had discussed important ecological information, there was an insufficient basis for completing an EBSA description using the template, at least at the time of this workshop. In the case of the group considering the transition zone in the North-West Atlantic, it was concluded that there are identifiable oceanographic transition structures in the region that have some connection to important ecological features. However, the well-defined physical feature did not correlate well with selected biological features (e.g., tuna, turtles), and it was not possible to define a broader physical feature that would capture the ecological relationships well. The workshop encouraged further work to explore these relationships in more depth (see annex III, section B). In the case of the group considering migration corridors, particularly for marine mammals, it was agreed that there is presently insufficient information to support a full assessment of particular areas against the EBSA criteria. This situation is discussed further under agenda item 6 (see annex VI).

39. The results of the break-out groups were reported at the plenary for consideration. At this session, workshop participants reviewed the description of areas meeting EBSA criteria prepared by the break-out groups, using the templates provided by the CBD Secretariat, and considered them for inclusion in the final list of areas meeting EBSA criteria. During the review of the draft descriptions, it was agreed that there was insufficient information to evaluate the Newfoundland and Fogo seamounts relative to the EBSA criteria. The circumstances associated with these seamounts are discussed in annex III, and the information needs are discussed in annex VI.

40. The workshop participants agreed on descriptions of seven areas meeting EBSA criteria. They are listed in annex IV and described in its appendix. The map of described areas is contained in annex V.

ITEM 6. IDENTIFICATION OF GAPS AND NEEDS FOR FURTHER ELABORATION IN DESCRIBING AREAS MEETING EBSA CRITERIA, INCLUDING THE NEED FOR THE DEVELOPMENT OF SCIENTIFIC CAPACITY AND FUTURE SCIENTIFIC COLLABORATION

41. Building on the workshop deliberations, the workshop participants were invited to identify, through break-out group sessions and open plenary discussion, gaps and needs for further elaboration in describing areas meeting EBSA criteria, including the need to develop scientific capacity and future scientific collaboration.

42. The results of the plenary and subgroup discussions are compiled in annex VI.

ITEM 7. OTHER MATTERS

43. No other matters were discussed.

ITEM 8. ADOPTION OF THE REPORT

44. Participants considered and adopted the workshop report on the basis of a draft report prepared and presented by the chair with some changes.

45. Participants agreed that any additional scientific information and scientific references would be provided to the CBD Secretariat by workshop participants within two weeks of the closing of the workshop in order to further refine the description of areas meeting EBSA criteria contained in annex IV and its appendix.

ITEM 9. CLOSURE OF THE MEETING

46. In closing the workshop, the Executive Secretary of the Convention, Mr. Braulio de Souza Dias, congratulated the hard work by the workshop participants through excellent collaboration throughout the week. He expressed his great thanks to the Government of Canada for their generous financial support and warm hospitality in hosting the workshop. He highly commended the able leadership of workshop chair, excellent scientific and technical support by the technical support team, and all the rapporteurs who contributed to the report preparation. The workshop chair and participants expressed their sincere thanks to the Executive Secretary of the Convention for his support to the EBSA process and hosting the workshop at the Secretariat venue, and highly commended the efficient and effective servicing of the CBD Secretariat members and valuable scientific support by the technical support team.

47. The workshop was closed at 4 p.m. on Friday, 28 March 2014.

Annex I

LIST OF PARTICIPANTS

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Annex II

SUMMARY OF THEME PRESENTATIONS

Agenda item 3. Workshop background, scope and output

CBD's EBSA process, workshop objectives and expected outputs/outcome (by Jihyun Lee, CBD Secretariat)

Ms. Lee introduced the process for describing ecologically or biologically significant marine areas (EBSAs), beginning with the adoption of the EBSA criteria at the ninth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP 9) and the call by COP 10 for organizing a series of regional EBSA workshops. Ms. Lee explained that in accordance with the guidance provided by COP 11 the summary report of the first two EBSA workshops had already been submitted to the United Nations General Assembly (UNGA) and its relevant processes. She informed that the results of subsequent workshops, including the present one, would be submitted to the forthcoming SBSTTA-18 and COP-12 meetings. She indicated that this is the eighth regional workshop to take place thus far, which have involved almost 100 countries and 92 regional and international organizations, pointing out that thus far, these workshops have described 183 areas meeting the criteria. She then highlighted the potential benefits of the EBSA process in further strengthening the region's existing efforts toward marine biodiversity conservation goals, by facilitating scientific collaboration and increasing awareness.

Criteria and guidance for EBSAs: protection and use of special marine places (by Jake Rice, Canada)

Mr. Rice reviewed the seven criteria adopted by the Conference of the Parties to the Convention at its ninth meeting (decision IX/20) for the evaluation of ecologically or biologically significant marine areas. Mr. Rice first introduced the definition of each criterion, provided some context for their application, as well as some guidance on their use, as contained in annex I to that decision. He then summarized some of the lessons that have been learned about the application of the criteria, based on experience with their use in other CBD workshops and national processes. It was stressed that the criteria were designed to be applied individually with regard to their relative significance within the region under consideration, but results of the criteria application can be "layered" to build the full description of the ecological or biological significance of each area. He advised the participants that both the maps of areas meeting the criteria and the narrative associated with maps should clearly describe how strongly each area reflects the properties of each criterion, and how many criteria may be met in which way by each area.

Canada's work on the identification of ecologically or biologically significant areas (EBSAs) in Newfoundland and Labrador (by Garry Stenson, Canada)

Mr. Stenson explained that the Newfoundland region of Canada has undertaken two processes for the identification of EBSAs within their area. The first, carried out in 2007, addressed the Placentia Bay-Grand Banks Large Ocean Management Area (PBGB). The process was based primarily on a qualitative assessment of important areas by experts knowledgeable of the region. Following a peer review of the proposals, 11 EBSAs were identified, three of which overlapped with international waters. A second EBSA identification process was carried out in 2013 to examine the Newfoundland and Labrador Shelves Bioregion, which is bounded in the south by the PBGB and in the north by an Arctic area considered earlier. A steering committee comprising experts in oceanography, ecosystem structure and function, taxa-specific life histories and geographic information systems (GIS) guided this process by advising or aiding in the identification, collection, processing and analysis of data layers, as well as participating in the final selection of candidate EBSAs. The analysis relied on the use of GIS and was based on a synthesis of all available sources of information identified by the steering committee to be pertinent to the process. Inshore and offshore areas were treated separately due to the different data available. More than 170 biological and oceanographic data layers were examined to complete the analyses. Ninety-nine offshore layers were resampled using a 20 km x 20 km grid, and 75 coastal layers were reviewed at the scale of the available data. The grids with the greatest abundance (~top 10%) were identified and reviewed by species experts. Data from similar species were then grouped into conceptual layers, which were then overlaid to provide an indication of areas that had high diversity. A total of 15 EBSAs were identified within the study area. Three were primarily inshore coastal areas, seven were in offshore waters areas, and four had components of both inshore and offshore areas. The remaining EBSA, the southern extent of the pack ice, is transitory. The 14 static EBSAs represent approximately 31% of the total area examined.

Most EBSAs within the Newfoundland and Labrador Shelves Bioregion study area were identified based on the aggregation of one or, more frequently, several taxa in an area because few available data sets, even paired with expert knowledge, allowed for the assessment of life history events being undertaken by a species in a given area. It was assumed that aggregations are often linked to activities vital to fitness consequences – especially if appearing to be seasonally predictable across years. The distribution and diversity of deep-water habitats, such as abyssal plains, hydrothermal vents, methane hydrate and brine seeps, cold-water coral reefs, and deep-water canyons, and the biota they support were poorly inventoried for consideration in this type of analysis. Given the limitations of some of the available data in the bioregion, as well as changes in environmental and community structure observed in the ecosystem in recent times, the importance of revisiting EBSA delineations periodically as more information becomes available from scientific research, monitoring and traditional knowledge has been recognized in this process.

Canada's work on the identification of ecologically or biologically significant areas (EBSAs) in the Scotian Shelf Bioregion (by Ellen Kenchington, Canada)

Ms. Kenchington explained the process of EBSA identification within the Maritimes Region of Fisheries and Oceans Canada (DFO), where the DFO EBSA criteria were applied to the waters of the Scotian Shelf Biogeographic Zone. This larger zone was subdivided into three planning areas: Bay of Fundy, Atlantic Coast of Nova Scotia and Offshore Scotian Shelf. Each planning area had a different set of experts, different data sets and different jurisdictional issues. Consequently, the approach to identifying EBSAs differed in each. In the Bay of Fundy and Atlantic Coast of Nova Scotia, scientific expert opinion and local ecological knowledge, combined with a review of the literature, informed the process. In the Offshore Scotian Shelf, research vessel survey data and other data sources produced 145 data layers that were quantitatively assessed. The results of this work are documented in the literature and have been subjected to a peer-review process. The EBSAs will be considered in a broad range of oceans management and planning processes. "Profile" and risk assessments are to be completed for each EBSA to identify potential management needs.

Canada's work on the identification of ecologically or biologically significant areas (EBSAs) in the Estuary and Gulf of St. Lawrence in 2005-2007 (by Denis Chabot, Canada)

Mr. Chabot introduced the process used to identify EBSAs in the waters off the coast of Quebec in Canada. The process, which started in 2005, began with the identification of preliminary EBSAs for the Estuary and Gulf of St. Lawrence using expert opinion. Specialists in different thematic layers (i.e., physical processes, primary production, secondary production, meroplankton, benthic invertebrates, pelagic fishes, demersal fishes, marine mammals) were then identified to gather data, analyse the data, and identify important areas for each layer. A peer-review was held in December 2006 to examine each of the important areas for each thematic layer and decide how to identify EBSAs so that the most important areas of each layer were retained in the final EBSAs. It became evident that many areas were important for many thematic layers. Final EBSAs were obtained by overlaying areas for all thematic layers and selecting zones that were important for a majority of layers simultaneously. Boundaries were refined by taking into account physical parameters (e.g., bathymetry, circulation patterns, upwelling zones, circulation gyres, tidal amplitude) and by overlapping thematic layers after applying various filters (such as keeping only important areas that had high scores for one of the main dimensions (uniqueness, aggregation or consequences for fitness). A total of 10 EBSAs were identified, covering 31% of the entire estuary and Gulf of St. Lawrence, compared to 70% coverage for the preliminary EBSAs. Eighty percent of the final surface area of the EBSAs was contained within the preliminary EBSAs.

National-level efforts in the United States relevant to identifying EBSAs (by Kevin Friedland, United States of America)

Mr. Friedland presented an analysis of North Atlantic spring phytoplankton blooms based on change point statistics. Chlorophyll-a concentrations were derived from ocean-colour images taken by the Sea-viewing Wide Field of View (SeaWiFS) and Moderate Resolution Imaging Spectroradiometer (MODIS) sensors. The analysis used the level-3 processed data, at 9 km and eight-day spatial and temporal resolution, respectively. The spatial extent of the analysis was limited to 20-70^{o}N and 100^{o}W-30^{o}E over a 1 degree grid for the period 1998-2013. Blooms were detected using a sequential averaging algorithm called STARS or “sequential t-test analysis of regime shifts”. The method has been used in previous analyses of Georges Bank fall blooms and spring blooms in the North-West Atlantic. To limit the analysis to the detection of spring blooms, only data for the first half of the year were analysed. For each detected bloom, a suite of statistics was extracted to characterize bloom frequency, timing, and dimension. Bloom frequency was taken as the proportion of years in the time series (16 years) where a bloom could be detected. The highest frequencies were found in parts of the western Atlantic continental shelf, including the Grand Banks and West Greenland. Annual blooms tended to develop later in the year in the central and eastern Atlantic, which resulted in low spring bloom frequencies; blooms in these areas can be accurately described as summer blooms. Bloom start day was arrayed with latitude, with blooms in the southern Atlantic generally starting in February and in the North Atlantic as late as May to June. Spring bloom magnitude (mg m^{-3} 8-day) was defined as the sum of chlorophyll concentrations over the detected bloom period. Magnitudes were particularity high in coastal shelf seas areas, such as along West Greenland, the Grand Banks, and in the Gulf of Maine. The spring bloom is usually the dominant bloom feature in the production cycle of marine ecosystems. However, many areas of the North Atlantic have a secondary bloom that occurs in fall, and as mentioned above, the annual bloom cycle is dominated by a summer bloom in much of the central and eastern parts of the basin.

Defining and delineating Vulnerable Marine Ecosystems (VMEs) in the NAFO Regulatory Area (by Javier Murillo, Northwest Atlantic Fisheries Organization)

The presentation by Mr. Javier Murillo summarized the work of NAFO with regards to Vulnerable Marine Ecosystems (VMEs) in the NAFO Regulatory Area (NRA). The objective of this process has been the implementation of United Nations General Assembly Resolution 61/105 on sustainable fisheries. NAFO has applied the FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas in reviewing over 500 benthic taxa and identified those that meet the VME criteria. Fish, aquatic mammals and sea turtles were also reviewed, and a list of potential VME indicator species was also elaborated, but they require different management/conservation measures than benthic VME indicator species such as corals and sponges. For those highly aggregating benthic VME indicator taxa, such as sponges or sea pen corals, kernel density analysis was applied to quantitatively determine significant concentrations in the NRA. Species distribution models for some taxa to predict their distribution in under- or un-sampled areas and independent surveys to visually ground-truth the modelled outputs were also used. VME elements, that is topographical, hydrophysical or geological features that are associated with VME indicator species in a global context and have the potential to support VMEs, were also identified. Since 2006, closures to bottom fishing have been put in place to protect seamounts and significant concentrations of coral and sponges in the NRA. These boundaries will be reviewed in 2014 with new information available, and a decision will be made on future management measures. The boundaries of the existing closed areas in the NRA were drawn around locations of research vessel tows with high catches of VME indicators.

Building the knowledge base on migratory species in the North-West Atlantic (by Michael Tetley, Global Ocean Biodiversity Initiative)

In his presentation, Mr. Tetley explained that the North-West Atlantic represents a transition zone for highly migratory and mobile species diversity between tropical, temperate and subarctic groups of species. In particular, this is evident by the transition of cumulative overlapping IUCN Red List ranges of cetaceans, pinnipeds, sea turtles and sharks, tuna and billfishes when mapped across the region. Furthermore, information available highlights that the region contains key summer and wintering habitat for colonies in the region as well as Southern Hemisphere and Arctic migrants. Case studies on highly migratory mobile species were described to exemplify these specific species groups for areas beyond national jurisdiction. There is ongoing work for two global processes for the identification and standardized delivery of information on Important Bird Areas (IBAs) and Important Marine Mammal Areas (IMMAs). Marine IBAs have been developed using standardized procedures based on information from the Tracking Ocean Wanderers, IUCN Red List and Seabird Foraging Range databases. This information for the candidate and confirmed marine IBAs is now available via the online Marine e-Atlas. At the third International Marine Protected Area Congress (IMPAC3), in Marseille, France, in October 2013, the need for a standardized tool to assist with the compilation and delivery of marine mammal information was recognized. If developed, such a tool would need to complement and be comparable to other international processes, such as the IBA, EBSA and Key Biodiversity Areas (KBA). A process for developing IMMAs, therefore, is currently being pursued, led by the IUCN Joint SSC-WCPA Marine Mammal Protected Area Task Force (MMPATF), with a plan to test criteria at the third meeting of the International Committee on Marine Mammal Protected Areas (ICMMPA) in Adelaide, Australia, in November 2014.

Regional overview of biogeographic information on open-ocean water and deep-sea habitats and geographic scope of the workshop (by Pat Halpin, Jesse Cleary and Corrie Curtice, Technical Support Team)

This presentation provided biogeographic information for use by the workshop participants to define the workshop boundary. Considerations also include providing an extent contiguous with previous workshop boundaries, regions covered by concurrent national processes, and regional bodies active in the North-West Atlantic region.

Agenda item 4. Review of relevant scientific data/information/maps compiled and submitted for the workshop

Review of relevant scientific data/information/maps compiled to facilitate the description of EBSAs in the North-West Atlantic region (by Pat Halpin, Jesse Cleary, and Corrie Curtice, Technical Support Team)

This presentation reviewed the compilation of scientific data and information prepared for the workshop. The baseline data layers developed for this workshop closely follow the data types prepared for previous EBSA workshops, to provide consistency between regional efforts, along with many data specific to the North-West Atlantic region. More than 75 data layers were prepared for this workshop. The presentation covered three general types of data: (1) biogeographic data, (2) biological data, and (3) physical data. The biogeographic data focused on major biogeographic classification systems: Global Open Oceans and Deep Seabed (GOODS), Marine Ecoregions of the World (MEOW) and large marine areas (LMEs). The biological data portion of the presentation covered a variety of data sources to include data and statistical indices compiled by the Ocean Biogeographic Information System (OBIS). The physical data layers included bathymetric and physical substrate data, oceanographic features and remotely sensed data. Specific information on the data layers is provided in detail in the data report provided for the workshop as document UNEP/CBD/EBSA/WS/2014/2/2.

Labrador Sea deep winter convection area (by William Li, Canada)

In his presentation, Mr. Li explained that the Labrador Sea deep winter convection area is a unique oceanographic feature of the North-West Atlantic Ocean. It is one of the few areas of the global ocean where intermediate-depth water masses are formed through the convective sinking of dense surface water. Labrador Sea water (LSW), which is formed by winter convection, exports large quantities of fresh water, nutrients and dissolved gases (including carbon dioxide) from their formation region to the mid-depth layers of the ocean. Through mixing with deeper waters, LSW extends its influence to the Atlantic abyss, establishing the most effective transoceanic pathway for dissolved substances and small particles. In this subpolar gyre, overwintering pre-adult *Calanus finmarchicus* are dispersed over broad depth ranges between 200 and 2000 m. Here, these copepods are relatively safe from predators because they are dispersed at relatively low concentrations. Nevertheless, this zone represents a vast reservoir for *Calanus finmarchicus*, which can repopulate the adjacent shelves on an annual basis and downstream regions (e.g., Scotian Shelf, Gulf of Maine, Georges Bank) over longer time scales.

Seasonal climatologies of sea surface temperature, chlorophyll a, and daily primary production (by William Li, Canada)

Mr. Li presented seasonal climatologies of sea surface temperature (SST), chlorophyll *a* (CHL), and daily primary production (PP) for the North-West Atlantic. Seasons were defined as three-month periods for winter (JFM), spring (AMJ), summer (JAS), and autumn (OND). Climatologies for SST were constructed from global high resolution data (1982-2012) from AVHRR Pathfinder version 5.2. Climatologies for CHL were constructed from SeaWIFS data (1997-2010), and primary production was derived using the BIO model. Maps of the seasonal climatologies of CHL and PP contain rich and different information at various spatial scales that may be useful for locating areas of primary productivity that support the description of areas meeting the criteria for EBSAs.

Consideration of the Mid-Atlantic Ridge hydrothermal vents during the North-West Atlantic EBSA evaluation process (by Ellen Kenchington, Canada)

Ms. Kenchington presented an argument for including a set of hydrothermal vent fields in the EBSA evaluation process for the North-West Atlantic in response to the issue being raised during the first day of the meeting. She proposed consideration of the confirmed active Lost City, Broken Spur, Trans-Atlantic Geotraverse (TAG) and Snake Pit hydrothermal vent fields in the present exercise. It was proposed that those vent fields occurring further south (e.g., Logatchev, Ashadze) should not be evaluated by the workshop.

Marine mammals in the North-West Atlantic (by Garry Stenson, Canada)

Mr. Stenson presented information on movement patterns of different species of marine mammals in the region. In particular, he provided information on the movements of harp and hooded seals, which were studied using satellite telemetry. Tracking data have shown that harp seals are confined primarily to the Newfoundland and Labrador shelves within the Canadian EEZ, although some will traverse the Labrador Sea to the Greenland shelf to feed during the summer. During the winter, harp seals feed along the shelf edge out to the Nose of the Grand Banks but do not appear to go into the deep water areas of the Flemish Pass. Hooded seals tend to move along the shelf edge between Newfoundland and Baffin Bay. Satellite tracking data have been used to model habitat requirements and identify important areas for feeding. The Flemish Pass and slope around the Flemish Cap were identified as important diving areas for female hooded seals during the post-breeding period. Based upon sighting data, the Tail of the Grand Banks was identified as an important area for leatherback turtles. A wide variety of cetaceans also use the Grand Banks outside of the Canadian EEZ, particularly off the Nose of the Grand Banks, and along the Southeast Shoal. Mr. Stenson noted, however, that the distribution of animals based upon sightings is dependent upon effort and may not reflect the entire distribution. He also noted that the frequency of sightings might not reflect abundance since total effort is often unknown.

Annex III

SUMMARY OF PLENARY DISCUSSION ON REVIEW OF RELEVANT SCIENTIFIC DATA/INFORMATION/MAPS COMPILED AND SUBMITTED FOR THE WORKSHOP

A. Subsea canyons in the North-West Atlantic

1. Deepwater canyons are a striking feature of the continental margin off the east coast of the United States and Canada. There are over 113 canyons along the continental slope from northern Florida to northern Labrador (figure 1). Geologists have identified two different types of canyons based in the location of the canyon head, namely: (1) shelf-indenting canyons whose heads indent the continental shelf and banks, and (2) canyons sometimes called "gullies") whose heads are at a depth of 400 m or deeper and occur on the upper slope (Murillo et al. 2011). Mapping and classification of canyons into these categories has been undertaken for only part of the NAFO Regulatory Area.

2. Benthic habitat complexity is high in the canyons due to a combination of steep canyon walls, rocky outcrops, and sediments ranging from boulders to mud in patches that were formed or maintained in part by glacial processes and complex currents (Shepard 1973). These complex seafloor environments support diverse communities of organisms, including those dominated by corals, sponges and other fragile benthic species (Cooper et al. 1987; Hecker et al. 1980, 1983; Kelley et al. 2010; Gordon and Fenton 2001; Mortensen and Buhl-Mortensen 2005; Watling and Auster 2005). Cohesive sediments in most canyons support extensive burrows produced by crabs, tilefish, burrowing anemones and other species that function as habitat engineers (Cooper et al. 1987). Cold-seep communities have recently been discovered in at least four locations in submarine canyons on the east coast and on the continental slope (NOAA 2013 a, b, c, unpublished reference). The steep topography of the canyons creates currents and upwelling that in turn provide important feeding habitat for a variety of pelagic organisms above the canyons (Greene et al. 1988; Auster et al. 1992; Gowans and Whitehead 1995; Genin 2004). These types of geological and ecological features, separately and in combination, often result in moderate or high evaluations on several EBSA criteria.

3. Most deep-water canyons occur within the EEZs of the United States and Canada, with 15 major canyons in the EEZ of the United States, ranging in depth from roughly 200 m to 3500 m. As a result, this workshop only considered the few canyons in areas beyond national jurisdiction on the Tail of the Grand Banks and south of Flemish Cap (see the description of area no. 4 on the slopes of the Flemish Cap and Grand Banks in the appendix to annex IV). However, it is noted that the Canadian EBSA process identified much of the continental slope and specifically some canyons within its EEZ as meeting multiple EBSA criteria (Templeman 2007, DFO 2013, DFO in press). It is also noted that the Gully, the largest submarine canyon in the North Atlantic, is also the largest marine protected area in the Canadian Atlantic. The identification of these areas as EBSAs, and in one case a marine protected area, within Canadian jurisdiction, has the potential to foster coordinated actions to ensure that these canyon habitats receive enhanced protection.

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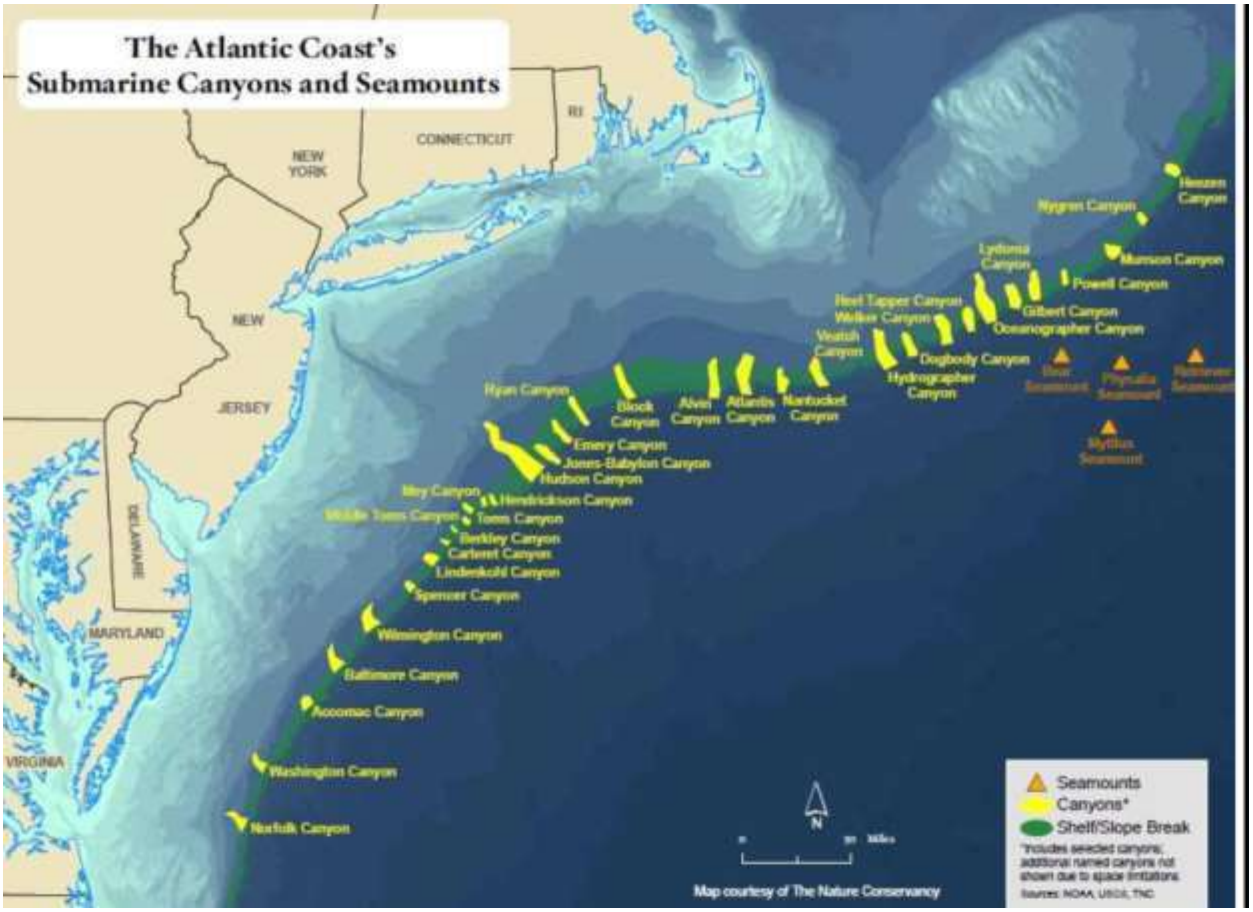

Figure 1. Submarine canyons and seamounts off the east coast of the United States and Canada.

B. Productivity transition area between tropical and temperate ocean provinces in the North-West Atlantic

4. The Gulf Stream and its associated fronts and eddies provide a complex and critical set of variably located marine habitats across a broad swath of the North-West Atlantic. For practical consideration, the area can be defined with a western extent along the southeast coast of the United States of America extending to approximately 51°W as an eastern extent. Further to the east, the Gulf Stream bifurcates and is characterized by significant latitudinal shifts in distribution. The centring spine of the area can be associated with the north wall of the Gulf Stream, which is a well-known descriptor of the northern frontal system of the Gulf Stream current (Taylor and Stephens 1998). For convenience, we refer to the region as the Gulf Stream Transition Zone (GSTZ).

5. The GSTZ is an oceanographic feature of special importance to the biology of many species in the North-West Atlantic. The fronts and eddies of the GSTZ serve to concentrate prey resources that are utilized by a range of pelagic species, including turtles, fishes, and marine mammals, many of which are endangered (Halliwell and Mooers 1979). As such, it is a highly productive area with a high degree of biological diversity. The GSTZ also serves as a migration corridor for bluefin tuna and loggerhead sea turtles.

6. Loggerhead turtles that begin life on North American nesting beaches enter the marine environment as neonates and soon begin a migration to the north and to the east. During their first year of life, many loggerheads complete a trans-Atlantic migration utilizing the Gulf Stream current for transport and the associated frontal systems. During some segments of their migration, vegetation in the form of sargassum seaweed (*Sargassum fluitans*) serves as nursery habitat (Musick and Limpus 1996). Other

species of sea turtles, such as leatherbacks, also utilize the GSTZ during feeding migrations (Ferraroli et al. 2004).

7. Large pelagic fish, including a suite of western Atlantic tuna species and swordfish, feed at frontal systems associated with the continental shelf break and the Gulf Stream. With warming summer conditions, bluefin tuna can be found along thermal and chlorophyll fronts of the GSTZ (Lawson et al. 2010), which provide part of the continuous set of habitats that bluefin tuna use to complete their trans-Atlantic migrations (Ulanski 2008). Swordfish, which have a similar diet, also concentrate along GSTZ fronts (Sedberry and Loefer 2001; Podestá et al., 1993). In recent studies of ocean sunfish, researchers observed a diving behaviour as the fish encountered the Gulf Stream front (Potter and Howell 2010), which the researchers believe is related to thermoregulation.

8. A number of marine mammals perform significant latitudinal migrations along the western boundary of the Atlantic basin, thus transiting and foraging in the GSTZ. Beaked and sperm whales have been found to orient themselves according to frontal structures along the shelf break and warm core ring structures of the Gulf Stream (Waring et al. 2001). The endangered right whale uses warm core rings formed within this GSTZ for orientation purposes (Mate et al. 1997). However, overall this region does not appear to be a principal habitat for marine mammals as compared to other taxonomic groups.

9. The workshop evaluated the GSTZ as a potential area meeting the EBSA criteria and felt that the relationship between living marine resources and the relative structure within the area posed a number of challenges. For example, a number of the species considered had associations with frontal structures of the GSTZ, but also showed associations with frontal structures aligned with the shelf break to the west and to the north, and also to frontal systems to the north beyond the influence of the Gulf Stream. Hence, there was a fundamental problem of assigning a consistent geographic description of this area. As this is one of the most studied regions of the world’s ocean, the workshop participants did not identify specific data deficiencies as the cause for this decision, but felt there was scope for more analyses using existing biological and oceanographic data to explore potential relationships more fully.

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C. Complementing the results of previous/ongoing regional EBSA workshops with additional scientific information

10. As part of the process for defining the geographic scope of the workshop, the meeting noted the opportunity to complement previous regional EBSA workshops, in cases when additional or new information was available to this workshop. A precedent for geographic overlap of the regional workshop areas has been established by previous workshops where, if appropriate and/or requested to do so, a subsequent workshop has considered an area that overlaps with an area that was considered by a previous workshop. This has not entailed reconsidering the specific assessments of any previous workshop, rather consideration of additional insight from complementary new information.

The Sargasso Sea area meeting EBSA criteria (as described in the Wider Caribbean and Western Mid-Atlantic regional workshop to facilitate the description of EBSAs, held in Recife, Brazil, 28 February to 2 March 2012)

11. Scientific information on seamounts, canyons, oceanography, and benthic and pelagic populations that was submitted to the present workshop extended into the geographic area considered by the Wider Caribbean and Western Mid-Atlantic Regional Workshop. Following plenary discussion among the workshop participants, including the technical support team, and an expert from the Government of Bermuda,[3] who had participated in the Recife workshop referred to above, as well as a representative of the Sargasso Sea Alliance,[4] this workshop agreed that the southern boundary of the present workshop should overlap with the northern part of the area considered by the Wider Caribbean and Western Mid-Atlantic workshop. The area of overlap covers the northern part of the Sargasso Sea, as described by the above Recife workshop as area no. 13 in its final report, document UNEP/CBD/SBSTTA/16/INF/7 (in the appendix to annex IV, page 107, available at http://www.cbd.int/doc/meetings/mar/rwebsa-wcar-01/official/rwebsa-wcar-01-sbstta-16-inf-07-en.pdf).

12. This decision was based on an understanding that the boundary of the above-mentioned "area no. 13: The Sargasso Sea" was determined primarily on the basis of long-term current climatology that classified its oceanographic features, such as geostrophic currents.[5] The decision on the northern boundary of this area did not draw upon any benthic data, although the importance of benthic features encompassed within the much larger area of the Sargasso Sea found to meet EBSA criteria were then acknowledged in the description of this area against the EBSA criteria in the appendix to annex IV of the above-mentioned workshop report.

13. The present workshop also noted lessons learned about the value of specificity in describing the spatial delineation and stability over time of areas meeting EBSA criteria, as set out in agenda item 5, paragraph 43 of the report of the North Pacific Regional Workshop to Facilitate the Description of EBSAs (http://www.cbd.int/doc/meetings/mar/ebsa-np-01/official/ebsa-np-01-04-en.pdf)and all subsequent regional workshops (refer to paragraph 32 under item 5 above). With reference to the four types of areas meeting the EBSA criteria, the Sargasso Sea can be recognized as being a pelagic feature that is inherently not spatially fixed, moving seasonally and annually. The guidance for the description of the four classes of EBSAs (as noted in paragraph 32, item 5, above and further described in the report of the North Pacific regional workshop to facilitate the description of EBSAs, Moscow, 25 February to 1 March 2013, available at http://www.cbd.int/doc/meetings/mar/ebsa-np-01/official/ebsa-np-01-04-en.pdf) states

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[3] Consulted through a teleconference call.

[4] Consulted through the teleconference call mentioned above.

[5] See Ardron, J., Halpin, P., Roberts, J., Cleary, J., Moffitt, M. and Donnelly, J. (2011) Where is the Sargasso Sea? A report submitted to the Sargasso Sea Alliance by Duke University Marine Geospatial Ecology Lab and Marine Conservation Institute. August 2011. 26 pp.

that "the map polygon for such a feature should include the full range occupied by the feature during a typical year". The present workshop complemented the information in the above-mentioned description of the Sargasso Sea area against EBSA criteria (area no. 13 in the appendix to annex VI of the Recife workshop report) by adding that the Sargasso Sea is a dynamic feature with "fluid boundaries". These boundaries are determined by a combination of dynamic oceanographic factors and aggregated mats of sargassum, also recognizing a combination of broad subfeatures of the "Sargasso Sea", including a central gyre, transition zone and Gulf Stream component. The variable and seasonally changing nature of its constituent parts means that the ecological extent and properties of the feature change over time and throughout its extent, but wherever it is located at a particular time, it is considered to meet several EBSA criteria. However, because of the variable size and position of the feature "the Sargasso Sea", it should be presented and discussed as a mobile and dynamic area meeting EBSA criteria.

14. In addition, this workshop evaluated the New England and the Corner Rise seamount chains as a separate feature from the pelagic components of the Sargasso Sea. The workshop concluded that these seamount chains meet several EBSA criteria in their own right, aside from any relationships that they may have with the pelagic features of the Sargasso Sea.

15. Finally, in addition to the areas meeting EBSA criteria described by this workshop, which overlap with the Sargasso Sea area from the above-mentioned Recife workshop, a spring bloom analysis for the North Atlantic that included information on the Sargasso Sea was presented to the workshop. The Sargasso Sea is a low production area that contains a north to south gradient of temperate to tropical waters. The northern edge of the Sargasso Sea has bloom frequencies approaching 0.8, indicating that, in most years, a spring bloom could be detected (figure 2). Moving north to south, bloom frequency declined to levels approaching 0.1, indicating spring blooms are not a prominent feature in the southern end of the region. Spring blooms in all parts of the Sargasso Sea are low magnitude blooms as compared to blooms occurring on continental shelf seas. In areas where spring blooms occur regularly, bloom magnitude was negatively correlated with bloom start, indicating that early blooms tended to be larger dimension blooms. This correlative trend was consistent with bloom dynamics observed elsewhere in the North Atlantic.

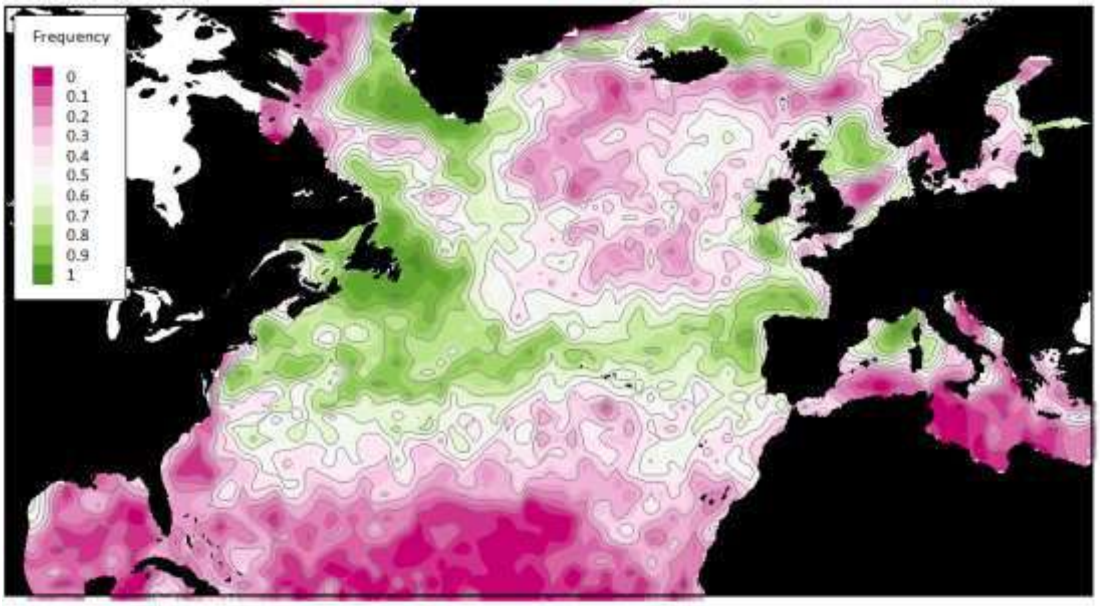

Figure 2. Spring bloom frequency in the North Atlantic detected using change point statistics for the period 1998-2013.

D. Seabird foraging areas

16. The workshop considered two proposals that evaluated areas relative to the EBSA criteria using information about the distribution and abundance of seabirds. The first of the areas, in the Labrador Sea, was evaluated with respect to the EBSA criteria (see area no. 2 of the appendix to annex IV). More than 95% of the area in the second proposal is in the central Atlantic, east of the boundary adopted for the scope of this workshop, and located in the region previously considered in the "Joint OSPAR/NEAFC/CBD Scientific Workshop on the Identification of Ecologically or Biologically Significant Marine Areas in the North-East Atlantic" and the subsequent peer review of that report by the International Council for the Exploration of the Sea (ICES).[6] The workshop noted that four areas had been identified in the North-East Atlantic workshop report as meeting EBSA criteria based on seabird foraging data, but peer review by ICES concluded that further scientific and technical analyses would be required before an assessment could be completed. At its Annual Commission meeting, OSPAR in 2013 concluded that "further work would be needed and could be the subject of a next submission from OSPAR NEAFC to CBD" (OSPAR 13/21/1 §4.40, OSPAR 13/21/1 Annex 7).

17. Taking into account both the mismatch of the geographic scope of the present workshop and the area in the second proposal, and the existence of an alternative process called for by the OSPAR Commission/NEAFC for considering seabird activity in the North-East Atlantic relative to the EBSA criteria, it was concluded that the second proposal would be more appropriately addressed in the ongoing process extending from the Joint OSPAR/NEAFC/CBD scientific workshop and subsequent ICES peer review. BirdLife International would be encouraged to liaise with the OSPAR Commission and NEAFC, and engage in that process. The workshop also noted that there were data gaps that need to be addressed (see annex VI).

18. Although this North-West Atlantic regional workshop did not conduct an evaluation of the second proposal, new information about the area covered by the proposal was considered (see box 1).

Box 1: Information provided by BirdLife International

The BirdLife submission and accompanying material presented at the workshop comprised tracking data from 960 individuals across 20 species, representing 47 populations of North Atlantic breeders and southern hemisphere migrants. This information was used to quantify the mesoscale diversity and relative abundance of seabirds within the region. These data revealed a hitherto undescribed usage hotspot in overlapping species diversity approximately 1,000,000 km^2 in extent in waters >3000 m deep between the Grand Banks and the Mid-Atlantic Ridge, south of the Charlie Gibbs Fracture Zone. This area was used during one or more key life history stages by over 17 species, including northern fulmars; Cory's, sooty, Manx, greater and Baroli's shearwaters; Fea's petrels; South Polar skuas and long-tailed jaegers; black-legged kittiwakes (Spitsbergen, Barents Sea and Norwegian Sea populations), Arctic terns and thick-billed murres. Despite variability within individuals, populations and species, 17 of the 20 species were present at some time and approximately 30% of species present in each season (range 10–59%); the hotspot persisted throughout the year, its location coinciding with the subpolar frontal zone. It was hypothesized that within this complex ecotone, currents topographically constrained by the Mid-Atlantic Ridge and Charlie Gibbs Fracture Zone cause intense mesoscale turbulence and large-scale habitat heterogeneity, leading to high diversity and, in some cases, abundance of seabirds. The hotspot is also used by other wide-ranging megafauna, including fin and blue whales, leatherback turtles and bluefin tuna, which are targeted by long-line fishing. Given the threat such activities pose, the area could be considered a suitable candidate area for potential risk-averse management measures, according to BirdLife International.

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[6] OSPAR/NEAFC special request on review of the results of the Joint OSPAR/NEAFC/CBD workshop on ecologically and biologically significant areas (EBSAs) (ICES Advice 2013 Section 1.5.6.5) and OSPAR/NEAFC special request on the review and reformulation of four EBSA proformas, ICES Advice Section 1.5.6.7.

19. In addition, the discussions prompted by the two seabird proposals contributed to better understanding of the nature of the information provided by BirdLife International (BLI) on Important Bird Areas (IBA) and zones of seabird diversity, relative to the EBSA criteria. Some points raised in those discussions should facilitate a more effective consideration of data on seabird occurrences and diversity in future EBSA or similar evaluation processes.

20. The first issue discussed was the nature of the information required by CBD regional EBSA workshops. Participants in this workshop noted that the EBSA regional workshops are expert processes and benefit from access to primary sources of information and technical details of analyses conducted in advance of workshops, to the greatest possible extent, as well as analyses and inferences done by other expert groups. Consequently, the workshop recommended that future submissions include, in addition to the outputs of research, other supporting contextual and meta-information. In addition, deliberations at regional EBSA workshops would be facilitated by the inclusion of analytical details underlying conclusions regarding areas to be included or excluded from proposals, such as smoothing parameters of kernel estimators and the sensitivity of areas included to those parameters. Such contextual and analytical information would help to make outputs more easily interpreted by workshop participants. Such a process would assist in the streamlined integration of seabird analyses into the work of assessing all relevant information against the EBSA criteria, and would support stronger proposals.

21. The second area of discussion relative to the future use of seabird information in the evaluation of areas potentially meeting EBSA criteria was the degree to which areas that meet BLI criteria for IBAs would also meet EBSA criteria. BLI has developed its own criteria and analytical approaches for identifying IBAs, and the workshop in no way questioned the appropriateness of the criteria or analytical methods that BLI uses for its own purposes. However, the intent of the EBSA process may not be the same as the intent of the IBA process. For seabird species not considered "at risk" by a competent authority, the seabird distributional information will often be most relevant to the "special importance for life history stages of species". In the original definition and guidance on the application of this criterion in annex I to CBD decision IX/20, the standard to be met is that these are "Areas that are required for a population to survive and thrive". This is intentionally a fairly high standard, most readily met when a large fraction of the population is aggregated in an area localized enough to be vulnerable to a single localized common threat – such as a breeding colony, restricted spawning ground, or constricted migration corridor for a population. This is consistent with the intent of focusing risk-averse spatial conservation management tools on those areas, as decided by relevant and competent authorities. As areas become larger, with greater dispersion of individuals within the areas and more alternatives available should a localized threat affect part of the larger area, the ranking on this criterion would decline.

22. There has not been a forum for comprehensive dialogue between the seabird specialist community and the wider community of experts engaged in the use of EBSA criteria and other similar criteria regarding the degree of consistency between the outcomes of BLI evaluations of areas against their criteria for IBAs and the outcomes of CBD and related evaluations of areas against EBSA criteria and other similar EBSA-like criteria. Such a dialogue might be a part of a process to consolidate experience and lessons learned from the first full geographic cycle of CBD regional workshops on EBSAs, including participants in those workshops, and in other similar national processes and processes by intergovernmental organizations, such as the work of the FAO and RFMOs on the identification of VMEs, and by non-governmental organizations, such as the work of BLI on IBAs. Although the 2009 CBD Expert Workshop on Scientific and Technical Guidance on the use of Biogeographic Classification Systems and Identification of Marine Areas beyond national jurisdiction in need of protection (Ottawa, Canada, from 29 September to 2 October 2009) concluded there were "no inherent incompatibilities" among the experiences available at the time with use of various EBSA and other similar criteria, this does not imply that the outcomes will be similar in all cases. Much experience has been gained since 2009, and it would be timely to consolidate lessons learned. Those lessons should also facilitate greater exchange of information and results among agencies and organizations involved in these highly complementary processes.

E. Newfoundland Seamounts and Fogo Seamounts.

23. The Newfoundland Seamounts, the Fogo Seamounts and Orphan Knoll were initially proposed as one grouped area potentially meeting the EBSA criteria (see annex VI for a map with these features identified). In reviewing the introduction and feature description, however, only limited bathymetric information of varying quality and limited geological sampling were available for the Newfoundland Seamounts and Fogo Seamounts, which proved insufficient to evaluate those seamounts with respect to the EBSA criteria. Consequently, the workshop agreed to remove those seamount groups from the evaluation and proceed only with an assessment of the Orphan Knoll, for which more information was available (area no. 3 in appendix to annex IV).

24. The workshop stressed that the limited availability of information did not imply that these seamount groups were not ecologically or biologically significant. When information is available, seamounts often are ranked moderate or high on several EBSA criteria. That could be the case for these seamounts, especially in light of the relative rarity of seamounts in the North-West Atlantic. However, the workshop recognized that in the short term, there is little incremental risk in deferring assessment of these seamounts against the EBSA criteria, since there are no known imminent threats, and most of the areas considered as part of the Newfoundland and Fogo Seamount chains are presently within two areas that have been closed to fishing by NAFO. However, this fishing moratorium will be reviewed in the coming year, so the degree of current protection might change. Hence, collection of at least basic ecological and oceanographic information on these seamounts is of particularly high priority. In addition, continuation of the NAFO moratorium until further information is available would help to manage threats from fishing, should these areas prove to be ecologically or biologically significant.

Annex IV

AREAS MEETING THE EBSA CRITERIA IN THE NORTH-WEST ATLANTIC AS AGREED BY THE WORKSHOP PLENARY

Area no.	Area meeting the EBSA criteria (See the detailed description of each area in the appendix to this annex)[7]
1	Labrador Sea Deep Convection Area
2	Seabird Foraging Zone in the Southern Labrador Sea
3	Orphan Knoll
4	Slopes of the Flemish Cap and Grand Banks
5	Southeast Shoal and Adjacent Areas on the Tail of the Grand Banks
6	New England and Corner Rise Seamount Chains
7	Hydrothermal Vent Fields

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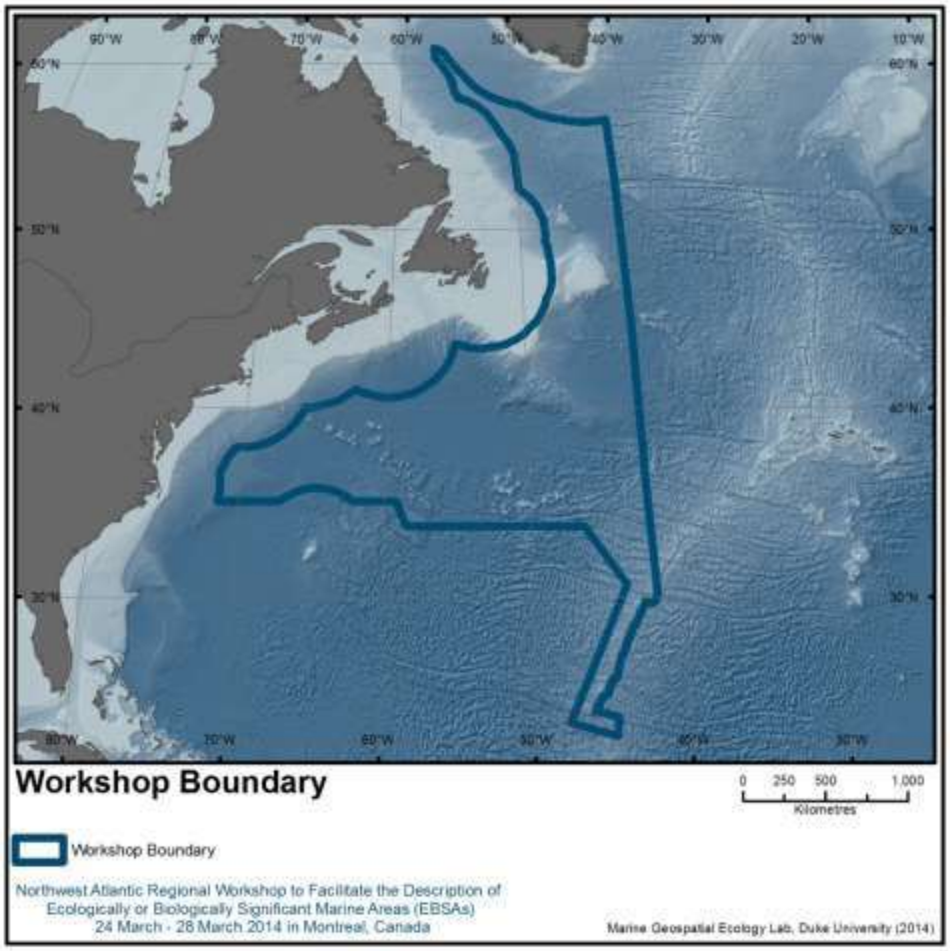
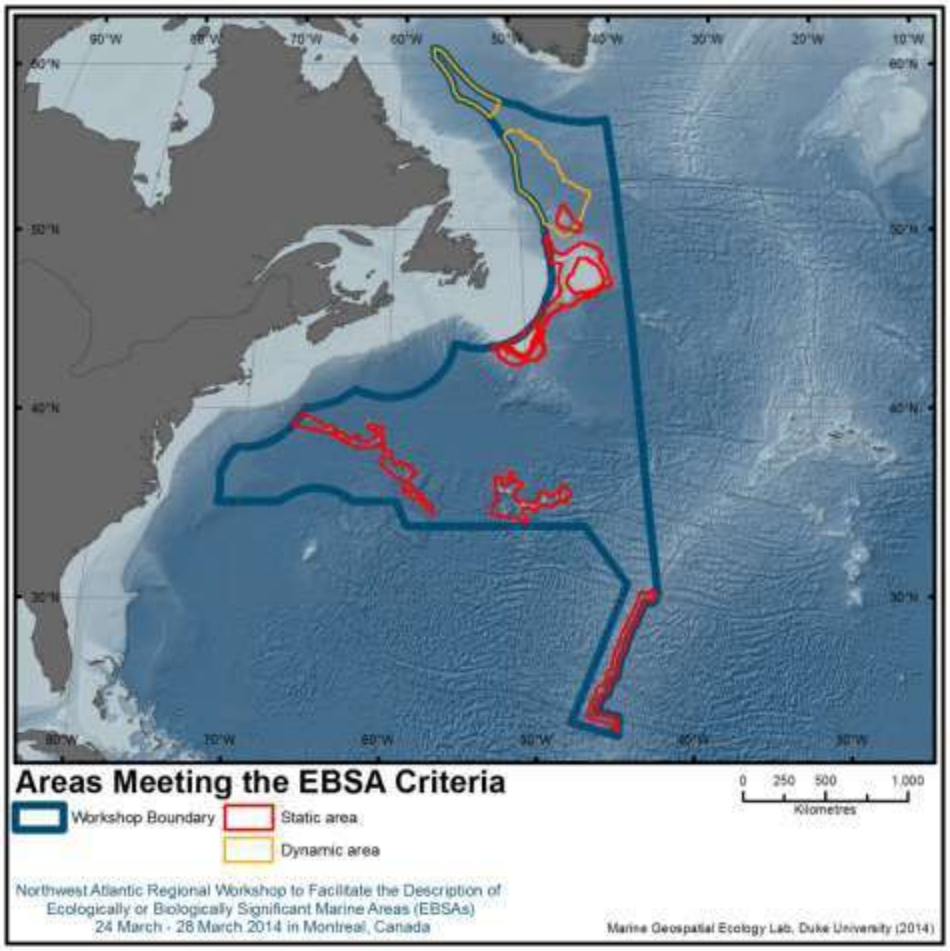
[7] The appendix to annex IV appears at the end of this document.

Annex V

MAP OF WORKSHOP'S GEOGRAPHIC SCOPE AND AREAS MEETING EBSA CRITERIA IN THE NORTH-WEST ATLANTIC AS AGREED BY THE WORKSHOP PLENARY



Map 1. Geographic scope of the workshop.



Areas Meeting the EBSA Criteria

Northwest Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs)
24 March - 28 March 2014 in Montreal, Canada

Marine Geospatial Ecology Lab, Duke University (2014)

Map 2. Areas meeting the EBSA criteria in the North-west Atlantic.

Annex VI

SUMMARY OF THE WORKSHOP DISCUSSION ON IDENTIFICATION OF GAPS AND NEEDS FOR FURTHER ELABORATION IN DESCRIBING ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS, INCLUDING THE NEED FOR THE DEVELOPMENT OF SCIENTIFIC CAPACITY AS WELL AS FUTURE SCIENTIFIC COLLABORATION

1. The North-West Atlantic is a relatively well-studied area compared to many of the world's oceans. However, the relative data richness of this area should be qualified by temporal and spatial data limitations. Many of the data are very seasonal, in some cases restricted to only one season, even for physical, biogeochemical and plankton variables. In preparation for this workshop, an extensive data collection process was undertaken, and a data report was developed. Biological, physical oceanographic and physiographic data were collected as well as data from global archives on biogeographic information. In addition, more specialized data sets and analyses specific to the North-West Atlantic region were also identified. Throughout this data collection process, a number of general data gaps were identified.

2. The most prominent data gaps involve the lack of consistent, region-wide surveys of biological data on marine species across taxa and trophic groups. Comparable surveys of biological data in the North-West Atlantic are sparse and often extremely limited in spatial extent and temporal representation. This especially applies to the abyssal plain, which is under-represented, with available biological data being more restricted to surface or shallow water regions in and around coastal areas.

3. Typically, as elsewhere, there is higher confidence in the coverage of physical oceanography data, while many deep-sea offshore habitats are under-studied and poorly inventoried. Little or no data are available for benthic communities on the slopes of the Flemish Cap below 2500 m. At a finer scale, some discrete geographical gaps were noted within the North-West Atlantic region, such as an absence of data in areas not accessible to groundfish surveys on the Flemish Cap.

4. Furthermore, the workshop did not have access to some existing fisheries survey data, collected by several countries, as this information is not covered by OBIS, the primary source of fisheries data for this workshop. Some data on seabed features from these surveys was available but no data on fish populations.

5. More specific data gaps were identified by workshop subgroups, as follows:

Seamount clusters

6. For the seamount clusters described by this workshop in areas 3 and 6 (appendix to annex IV), details of threatened, endangered and/or declining species were data gaps. It is likely that endemic populations and unique faunal assemblages are supported by these features. Clark et al. (2014) also note that productivity data are rarely available at the scale of individual seamounts, nor are robust estimates for biological diversity. Knowledge of benthic biota for the deeper seamounts, even those that are more studied, is sparse.

7. Two groups of North-West Atlantic seamounts in deep water beyond the continental slope were not described as areas meeting EBSA criteria on the grounds of insufficient data (see subsection E of annex III above). Similar to the Orphan Knoll, which lies to the north, these isolated seamount complexes are thought to have a high degree of naturalness, limited exploratory fishing and no commercial fishing impact (Thompson and Campanis 2007). They are likely to support endemic species and high biodiversity, but have yet to be surveyed. The workshop described these features as follows:

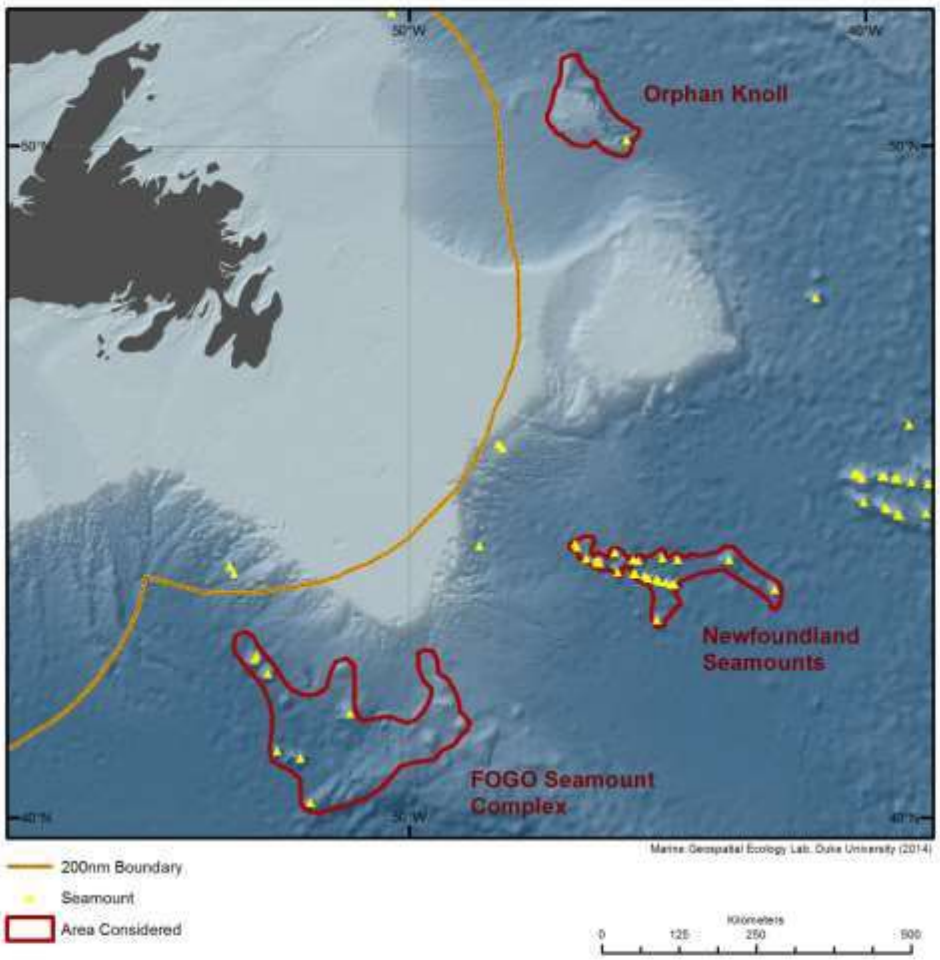
a. Fogo Seamounts

The Fogo Seamounts are located on oceanic crust in the central North Atlantic Ocean, south-west of the Grand Banks of Newfoundland, and form a broad zone of basaltic dormant volcanoes that parallels the transform margin. This zone is narrowest in the north-west and widens to 200 km in the south-east. This pattern differs from the narrow linear arrangement of a typical seamount channel, such as the New England Seamounts (Pe-Piper et al. 2007). The largest seamounts have official names (after the ships that came to the aid of the Titanic). Most of the seamounts are deeper than 2000 m.

b. Newfoundland Seamounts

Most of the information on the Newfoundland Seamounts is on the geology of the area (Sullivan and Keen 1977), but there is little information on the biota. Named seamounts include Shredder and Scruntion. Of the seamount peaks in this area, none are shallower than 2400 m, and most are deeper than 3500 m.

8. Maps showing both Fogo and Newfoundland seamounts (figure 1), and indicative feature boundaries of Fogo and Newfoundland seamounts (figures 2 and 3), which could provide a basis for future discussion against EBSA criteria, based on sufficient new information, are presented below. A relative dearth of information on seamount features in the North-West Atlantic, as compared to other ocean regions, provides a further incentive to address this information gap with urgency.



Marine Geospatial Ecology Lab, Duke University (2014)

Figure 1. Orphan Knoll, Newfoundland Seamounts and Fogo Seamount Complex.

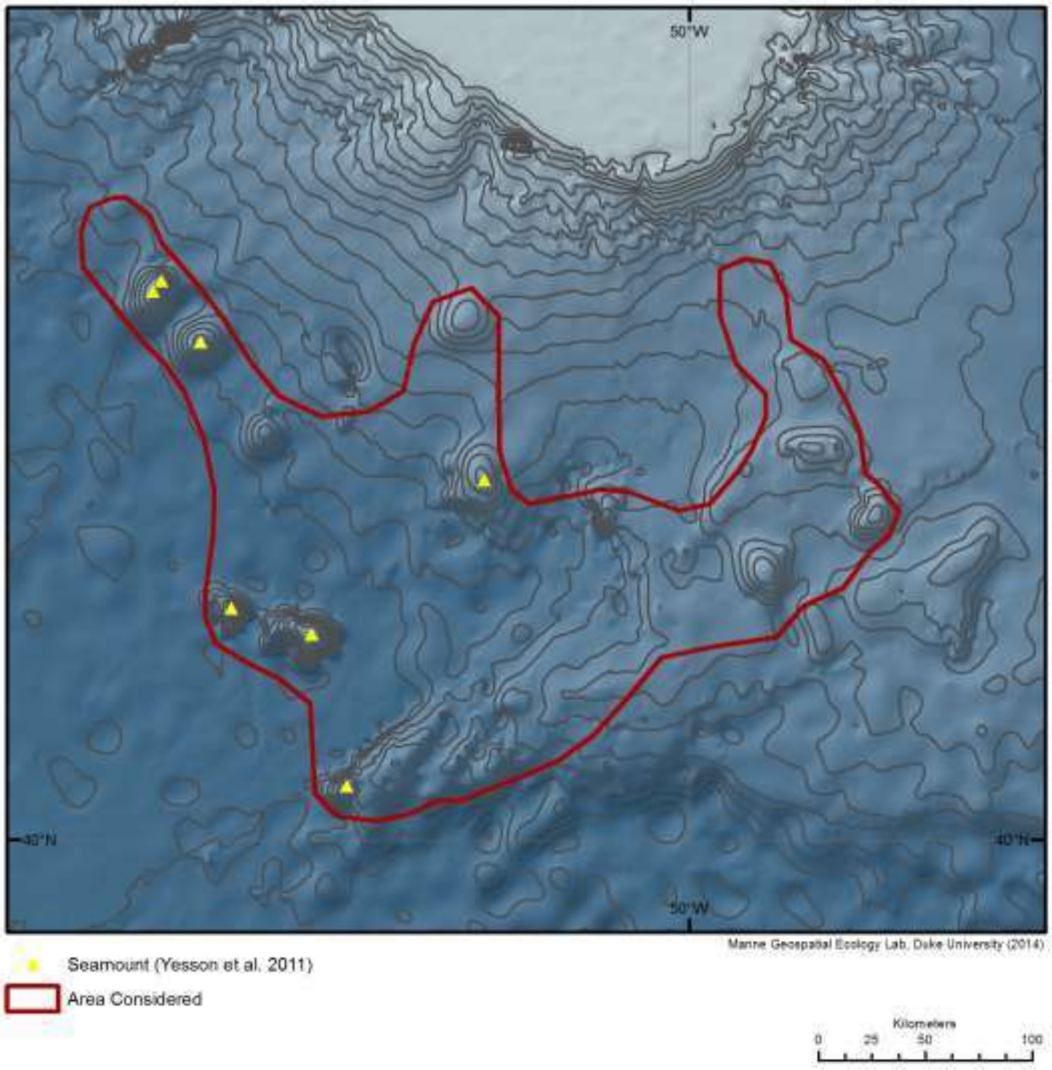


Figure 2. Area considered for the Fogo Seamount Complex.

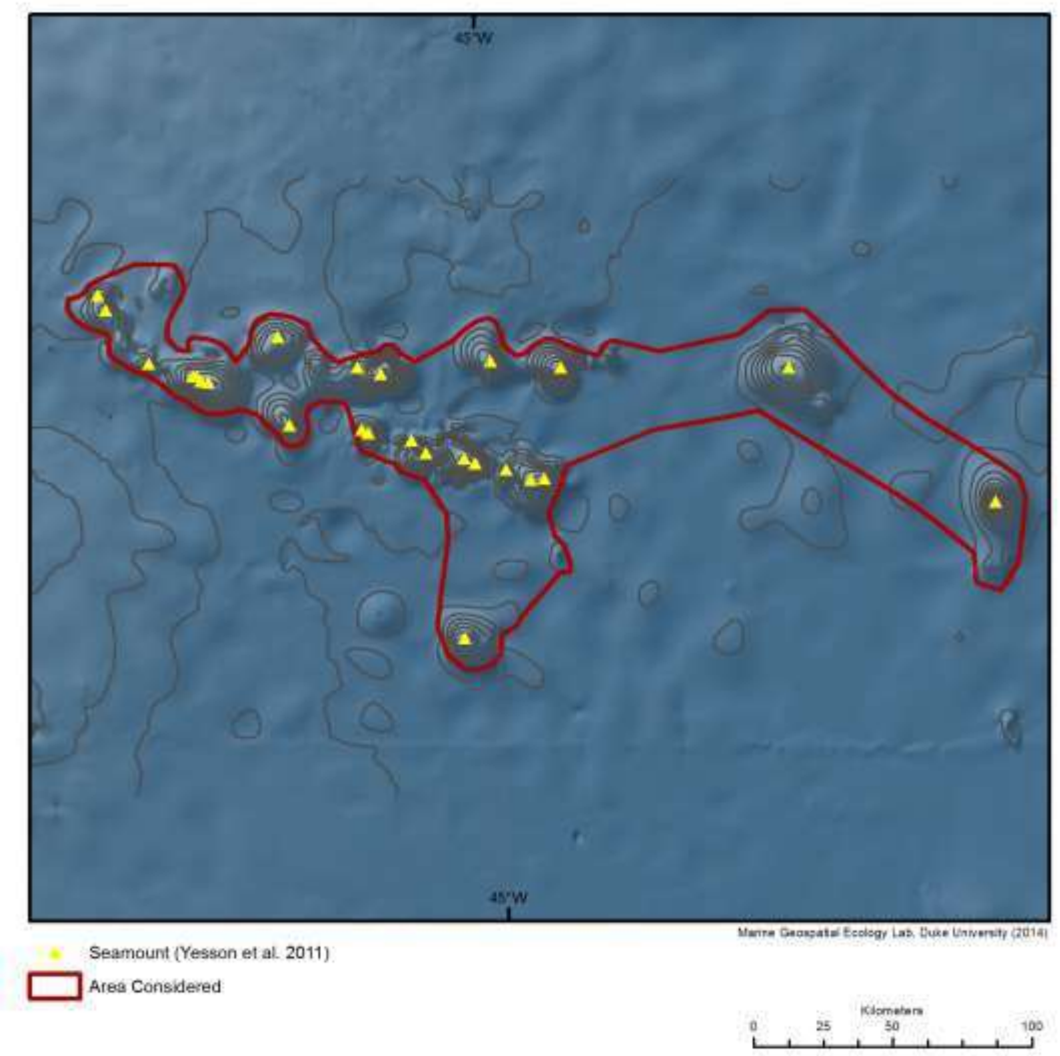


Figure 3. Area considered for the Newfoundland Seamounts.

Shelf edges and canyons

9. Annex III highlights both the general ecological significance of subsea canyons and the diversity of geological and ecological properties that they may have. Due to this diversity of properties among subsea canyons, effective conservation planning for the biodiversity of the canyons requires some knowledge of the characteristic of individual canyons. As presented in the description of area no. 4, Slopes of the Flemish Cap and Grand Banks (appendix to annex IV), there is presently insufficient information to even evaluate individual canyons relative to the EBSA criteria, and certainly insufficient information for case-specific threat assessments and design of conservation and management plans. More information on the structure, oceanographic processes, and associated biota is required to inform EBSA and other assessments, and for planning conservation and management of these important features.

Hydrothermal vents

10. The discovery of hydrothermal vents is ongoing, and new vents continue to be confirmed. Even in the area considered by the workshop, there is unconfirmed activity evidenced by plumes in the water column. Due to the difficulties and costs of exploring and studying hydrothermal vents at the Mid-Atlantic Ridge, there are gaps in knowledge that the scientific community are trying to fill, including

biomass studies, trends in biomass changes, relation of percentage cover, population size, habitat extent with physiological stages and life cycle of the species (ICES 2013). Studies on the dispersal of the key species, biogeography phenomena, and variability at different timescales are lacking.

Migratory corridors and marine mammals

11. The workshop noted a data gap generally with regard to migration corridors for marine mammals. The presence and known transient movement of some animals, such as humpback whales (*Megaptera novaeangliae)* from photo-identification studies, is well documented but whether they are restricted to particular areas or range more widely is not fully understood. Hooded seals (*Cystophora cristata*), for example, demonstrate considerable variability in their migration pathways to preferred foraging areas.

12. More specifically, it is known that some cetaceans migrate from wintering grounds in the Azores to highly productive foraging areas in the Labrador Sea and Greenlandic/Icelandic waters. In particular, the workshop noted the distinctive chlorophyll-a concentration on the Western Greenland Shelf as a proxy of the high productivity of this area and thus its value and importance to life-cycle stages. Interpretation of preliminary analysis for sei whale (*Balaenoptera borealis*), based on a limited sample of telemetry data drawn from the Azores (Pireto et al., 2012) and Labrador (Olsen et al. 2009), indicated the potential presence of a route between the Charlie Gibbs Fracture Zone and the Labrador Sea for this species. The limited data suggest the area is a critical corridor in part of a complex migration process of large baleen whales that can involve longitudinal movements between the two sides of the ocean basin in addition to expected latitudinal movements (Pireto et al. 2012, Silva et al. 2013). Sei whales are surface feeders (zooplankton and small fish) and prefer deep temperate waters.

13. The workshop recognized the eligibility of migratory corridors as features that may meet EBSA criteria. The data required are difficult to obtain and were not sufficiently comprehensive for the deliberations of this workshop. In the future, any such description should be supported by strong evidence of movements, for example from a suite of animals and/or supported by multiple studies. Data confidence of this nature was demonstrated in offshore EBSAs (Outer Shelf Saglek Bank, Labrador Marginal Trough) in the Newfoundland and Labrador Shelves Bioregion Study Area within Canadian national jurisdiction, resulting in the identification of national EBSAs for which migratory corridors are a significant factor (DFO 2013).

14. For the marine mammal migration data discussed above and the seabird foraging data discussed in annex III, data from the behaviour of tagged animals play a major role in inferences about functional significance of specific places in the sea. Tagging programmes that provide relatively long records of movements of individuals are often expensive and logistically demanding, so sample sizes are often limited, and results may have biases that may or may not be quantifiable. Although communities of specialists are developing standards for how such data can be used to infer use of areas in their area of specialization, groups of experts on various taxa have not converged on a common set of best practices. Coordinated efforts among groups working on different taxa to make best use of these data would facilitate getting greatest value from these information sources. Examples of new collaboration in this endeavour include coordination between seabird and mammal groups (see presentation by Tetley in annex II).

15. There is also an identified data gap for marine mammals along the Grand Banks in general due to the lack of sighting effort in seasons other than summer. Furthermore, due to the relative distribution of surveys being restricted to the shelf and slope, deeper water areas could also be considered a data gap for cetacean species.

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Seabird data gaps

16. The workshop noted a data gap in seasonal distributional information for some of the numerically important seabird species known to use the North-West Atlantic region. Knowledge of the locations of seabird breeding colonies is well understood; however, there are knowledge gaps with regards to marine habitat use, particularly for pelagic seabirds. While tracking technologies have provided greater geographical coverage and understanding of marine habitat use by seabirds, it is recognized that there are spatial and temporal data gaps for direct observations at sea.

17. Noteworthy gaps include year-round information for some of the auks (Atlantic puffin and dovekie), the procellariiformes each's storm-petrels and great shearwaters) and the gulls (great black-backed and herring gulls, in particular). Targeted tracking from breeding colonies could address these gaps. Data on seasonal seabird densities are also available through pelagic (vessel) surveys (Environment Canada; Gjerdrum et al. 2012), and development of analytical and modelling techniques to combine tracking and pelagic surveys data would substantially improve knowledge of seasonal area use by these taxa.

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Appendix to annex IV

DESCRIPTION OF AREAS MEETING EBSA CRITERIA IN THE NORTH-WEST ATLANTIC REGION AS AGREED BY THE WORKSHOP PLENARY

Area No. 1: Labrador Sea Deep Convection Area

Abstract

The Labrador Sea is a key component of the global ocean circulation system. It is the only site in the North-West Atlantic where deep winter convection serves to exchange surface waters with the deep ocean. In the convection process, seawater constituents, such as carbon dioxide, oxygen and organic carbon, are transported from surface to depth. This area also provides the mid-water overwintering refuge for pre-adult *Calanus finmarchicus*, which is a keystone species that seeds zooplankton populations on the Labrador Shelf and areas further downstream. Year-to-year variability in ocean-ice-atmosphere interaction leads to strong inter-annual variability in the intensity and extent of convection. However, in the long term, the ongoing warming and freshening of subpolar surface waters is likely to be a factor leading to weaker convection overall. Consequently, one may expect ecologically significant change in this area to be propagated through the ecosystems of the North-West Atlantic.

Introduction

The oceanographic features of open-ocean convection have been reviewed by Marshall and Schott (2009), here repeated verbatim:

> “The strong vertical density gradients of the thermocline of the ocean inhibit the vertical exchange of fluid and fluid properties between the surface and the abyss, insulating the deep ocean from variations in surface meteorology. However, in a few special regions characterized by weak stratification and, in winter, exposed to intense buoyancy loss to the atmosphere, violent and deep-reaching convection mixes surface waters to great depth, setting and maintaining the properties of the abyss. In the present climate, open-ocean deep convection occurs only in the Atlantic Ocean: the Labrador, Greenland, and Mediterranean Seas, and occasionally also in the Weddell Sea. Convection in these regions feeds the thermohaline circulation, the global meridional-overturning circulation of the ocean responsible for roughly half of the pole ward heat transport demanded of the atmosphere ocean system. Warm, salty water is drawn pole ward, becomes dense in polar seas, and then sinks to depth and flows equator ward. Water masses modified by deep convection in these small regions are tagged with temperature and salinity values characteristic of them (together with other tracers such as tritium from the atomic weapon tests and freons from industrial and household use), allowing them to be tracked far from their formation region.”

Oceanographic conditions and atmosphere-ice-ocean interactions in the Labrador Sea are of particular importance because this is the only area in the North-West Atlantic Ocean where intermediate-depth water masses are formed through the convective sinking of dense surface water. This transports carbon dioxide, oxygen and other important ocean properties to the lower limb of the ocean’s Meridional Overturning Circulation (MOC), sometimes referred to as the “global ocean conveyor belt”. It is a key region for the forcing and modification of the Labrador Current system (Yashayaev and Clarke 2008), which has a major influence on oceanographic and ecosystem conditions in extensive downstream areas.

Historical and contemporary oceanographic information on the Labrador Sea is maintained *inter alia* by Fisheries and Oceans Canada (DFO). The DFO Atlantic Zone Off-Shelf Monitoring Program (AZOMP) collects and analyzes physical, chemical and biological oceanographic observations from the continental slope and deeper waters of the North-West Atlantic. Its objective is to monitor variability in the ocean climate and plankton affecting regional climate and ecosystems off Atlantic Canada and the global climate system. The Labrador Sea Monitoring Program is the largest component of AZOMP; it maintains an observation programme on an oceanographic section across the Labrador Sea, referred to as the AR7W Line.

http://www.bio.gc.ca/science/monitoring-monitorage/azomp-pmzao/labrador/labrador-eng.php

Location

The Labrador Sea deep convection area is located in the central gyre of the deep oceanic basin in the Labrador Sea, an area transected by the World Ocean Circulation Experiment (WOCE) AR7W Line. The area is not fixed by geographic coordinates; instead it is delineated dynamically according to physical oceanographic properties. Normally, deep winter convection occurs over a large region whose spatial extent can be mapped by geo-referenced contours of the mixed layer depth (Våge et al. 2009). A contoured mixed layer depth of 600 m delineates a nominal convection zone that straddles across areas that are within and beyond national jurisdiction (figure 1). The area of the nominal convection zone that extends beyond national jurisdiction is an area meeting EBSA criteria, as shown in figure 2.

Feature description of the area

Annual reports of the state of the Labrador Sea are published in the Atlantic Zone Monitoring Program Bulletin (http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/publications-eng.html) and also in Research Documents of the NAFO Standing Committee on Fisheries Environment (http://www.nafo.int/publications/frames/publications.html). A brief summary is given here.

The Labrador Sea deep convection area is characterized by winter waters that almost always mix to depths greater than 200 m, and in some years, to 1600 m (figure 3). A mixed layer depth of about 600 m seems to delineate a nominal area representing recent normal conditions (figure 1).

In the central basin of the Labrador Sea, phytoplankton are broadly distributed across the region and exhibit their maximum biomass in May and June, sometimes exceeding levels of 5 mg chlorophyll m^{-3} (figure 4). The phytoplankton communities comprise a mixture of the major taxonomic groups common to boreal (Arctic) and temperate (Atlantic) waters, including predominantly nanoplanktonic (2–20 um) and microplanktonic (>20 um) diatoms, chrysophytes, dinoflagellates, prymnesiophytes, and flagellates. The smaller, less abundant picoplankton (<2 um), including *Synechococcus*, are also found here (Harrison et al. 2013). The diversity and productivity of phytoplankton in this area appear to be commensurate with subpolar communities elsewhere.

The mesozooplankton community comprises copepods (*Calanus finmarchicus*, *Euchaeta norvegica*, *Scolecithrocella minor)*, eupahusiids, pteropods, and amphipods. Diel migrants, which are confined to deep waters of the central basin, include ostracods, chaetognaths, and copepods such as *Metrida longa* and *Microcalanus* spp. (Head et al. 2003). One species of copepod, *Calanus finmarchicus*, dominates the mesozooplankton biomass throughout the central region of the Labrador Sea. For this reason, this species is the key link between phytoplankton and upper trophic levels. The abundance of this copepod is generally relatively low in spring and summer, with a low proportion of young stages, but certain years are exceptional when young stages are dominant and total abundance is relatively high.

In this subpolar gyre, overwintering pre-adult copepodite *C. finmarchicus* are dispersed over broad depth ranges between 200 and 2000 m, at relatively low concentrations (<60 m^{-3}): this renders them relatively safe from predators. The subpolar gyre represents a vast reservoir for *C. finmarchicus* (average concentration ~10,000 inds. m^{-2}, total area ~94 x 10^{10} m^2), which can repopulate the adjacent shelves on an annual basis, and downstream regions (e.g., Scotian Shelf, Gulf of Maine, Georges Bank) over longer time scales (Head and Pepin 2008).

Feature condition and future outlook of the proposed area

The Labrador Sea deep convection area exhibits strong inter-annual variation. The 1000 to 1500 m water layer has been warming since 2002, with temperature reversals in 2008 and 2012 only. However, in the long term, the ongoing warming of these waters (figure 5) is likely to be a factor leading to weaker convection overall. Among possible effects arising from weakened convection might be exacerbation of mid-water and deep water hypoxia in lower latitudes. Consequently, one may expect ecologically significant change in the convection area to be propagated through the ecosystems of the North-West Atlantic.

A striking trend in this area is the increase of the total inorganic carbon and concomitant decrease of pH. Arctic outflow and the local uptake of anthropogenic CO_2 in the deep convection region of the Labrador Sea are major controlling mechanisms of the state of ocean acidification in the North-West Atlantic. The abrador Sea is the site of a strong “solubility pump” — anthropogenic CO_2 sequestration from the atmosphere to the depths by chemical and physical processes. In the newly ventilated Labrador Sea, which ranges from 150 to 500 m deep for stations in the central part of the Labrador Basin, a time series from 1996 to 2012 shows that dissolved inorganic carbon has increased by 14 µmol kg over the past 16 years due to the local uptake of anthropogenic CO_2. As a result, pH has decreased by 0.05 units (in the total pH scale) during the same period (figure 6). The rate of pH decrease is 0.0029/year, which is higher than the global average of 0.002/year (Yashayaev et al. 2013). From a biogeochemical perspective, ocean acidification affects the capacity of seawater to remove CO_2 from the atmosphere. From a biological perspective, lower seawater pH may have an impact on various physiological functions: these include the formation of carbonate-based exoskeletons in some phytoplankton, zooplankton and benthic invertebrates, and the acid-base regulation in most invertebrates and fishes.

The ongoing DFO Labrador Sea Monitoring Program will serve as the backbone for a new Canadian research network initiative “Ventilation, Interactions and Transports Across the abrador Sea” (VITALS). This network addresses questions about how the deep ocean exchanges carbon dioxide, oxygen and heat with the atmosphere through the Labrador Sea. New observations and modelling will determine what controls these exchanges and how they interact with varying climate, in order to resolve the role of deep convection regions in the carbon cycle and Earth system. VITALS is a pan-Canadian initiative involving scientists from 11 Canadian universities as well as multiple federal government laboratories (Fisheries and Oceans Canada, as well as Environment Canada), industrial and foreign partners. The first research mission is planned for May 2014.

Assessment of the area against CBD EBSA criteria

CBD EBSA criteria (Annex I to decision IX/20)	**Description** (Annex I to decision IX/20)	**Ranking of criterion relevance** (please mark one column with an X)			
		No information	**Low**	**Medium**	**High**
Uniqueness or rarity	Area contains either (i) unique “the only one of its kind”), rare occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				X
Explanation for ranking The Labrador Sea Deep Convection Area is a unique oceanographic feature in the North-West Atlantic, being one of only three persistent areas in the world’s oceans where intermediate-depth water masses are formed through the convective sinking of dense surface water (Marshall and Schott 2009). The Labrador Sea is the coldest and freshest basin of the North-West Atlantic. Winter cooling in this sea produces Labrador Sea Water. This intermediate water plays an important role in the exchange of heat, freshwater, dissolved gases (including carbon dioxide and oxygen), and other substances between the atmosphere and the abyssal ocean, affecting the water masses and circulation (Yashayaev and Clarke 2008). As a crucial nexus in the global thermohaline circulation of ocean waters, the Labrador Sea Deep Convection Area exerts an effect on downstream ecosystems that is					

<table>
<tr><td colspan="6">disproportionately large in relation to its regional geographic spatial extent.</td></tr>
<tr><td>Special importance for life-history stages of species</td><td>Areas that are required for a population to survive and thrive.</td><td></td><td></td><td>X</td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
In this subpolar gyre, over-wintering pre-adult copepodite <i>Calanus finmarchicus</i> are dispersed over broad depth ranges between 200 and 2000 m at relatively low concentrations, rendering them relatively safe from predators. The subpolar gyre represents a vast reservoir for <i>C. finmarchicus</i>, which can repopulate the adjacent shelves on an annual basis, and downstream regions (e.g., Scotian Shelf, Gulf of Maine, Georges Bank) over longer time scales (Head and Pepin 2008). Many other mesozooplankton species that undergo daily migration require the large vertical excursion afforded by the great depths of the central Labrador basin (Head et al. 2003).</td></tr>
<tr><td>Importance for threatened, endangered or declining species and/or habitats</td><td>Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Information is not available on the possible importance of this area for threatened, endangered or declining species and/or habitats.</td></tr>
<tr><td>Vulnerability, fragility, sensitivity, or slow recovery</td><td>Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.</td><td></td><td></td><td>X</td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Seawater in this area is subject to increasing acidification (lower pH) arising from increasing concentration of dissolved inorganic carbon. The rate of acidification in this area is higher than the global average rate (Yashayaev et al. 2013). Species that require calcium carbonate to sustain life forms are sensitive to changes in pH and may be vulnerable to further seawater acidification. Weaker convection of oxygen-rich waters may exacerbate hypoxia in deeper layers downstream in the global thermohaline circulation.</td></tr>
<tr><td>Biological productivity</td><td>Area containing species, populations or communities with comparatively higher natural biological productivity.</td><td></td><td>X</td><td></td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Available information indicates that phytoplankton biomass and primary production are generally commensurate with other subpolar regions (Harrison et al. 2013).</td></tr>
<tr><td>Biological diversity</td><td>Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.</td><td></td><td>X</td><td></td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Available information indicates that phytoplankton and zooplankton diversities are generally commensurate with other subpolar regions (Harrison et al. 2013).</td></tr>
</table>

Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			X	
Explanation for ranking Effects of ocean warming and acidification may be evident (Yashayaev et al. 2013), as elsewhere.					

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Maps and Figures

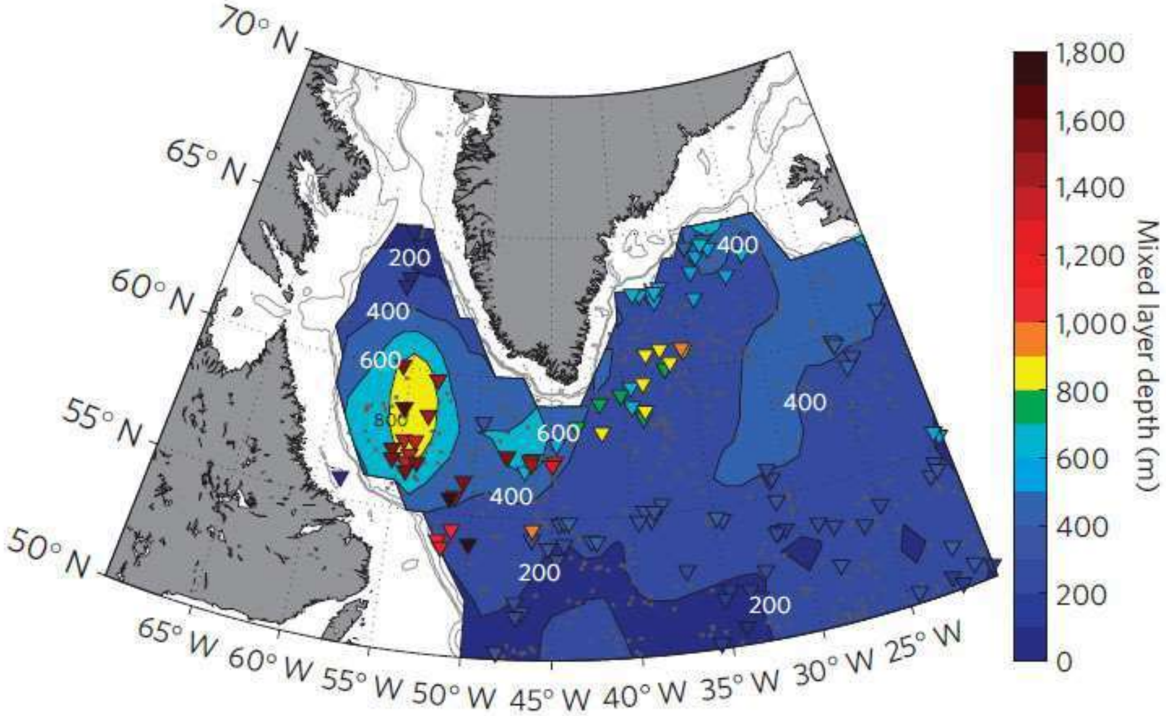

Figure 1. The Labrador Sea Deep Convection Area, as delineated by the 600 metre depth contour (cyan colour). Våge et al. 2009) describe the figure as follows: "Changes in wintertime mixed layer depth distribution. The February–April mixed layer depths from the winter of 2007–2008 (triangles) are contrasted with the average mixed layer depths for the period 2000–2007 (filled contours). Only mixed layers deeper than 80% of the maximum mixed layer depth recorded by each float were included. The crosses indicate the locations of the data points. The depth contours are 500, 1,000 and 2,000 m."

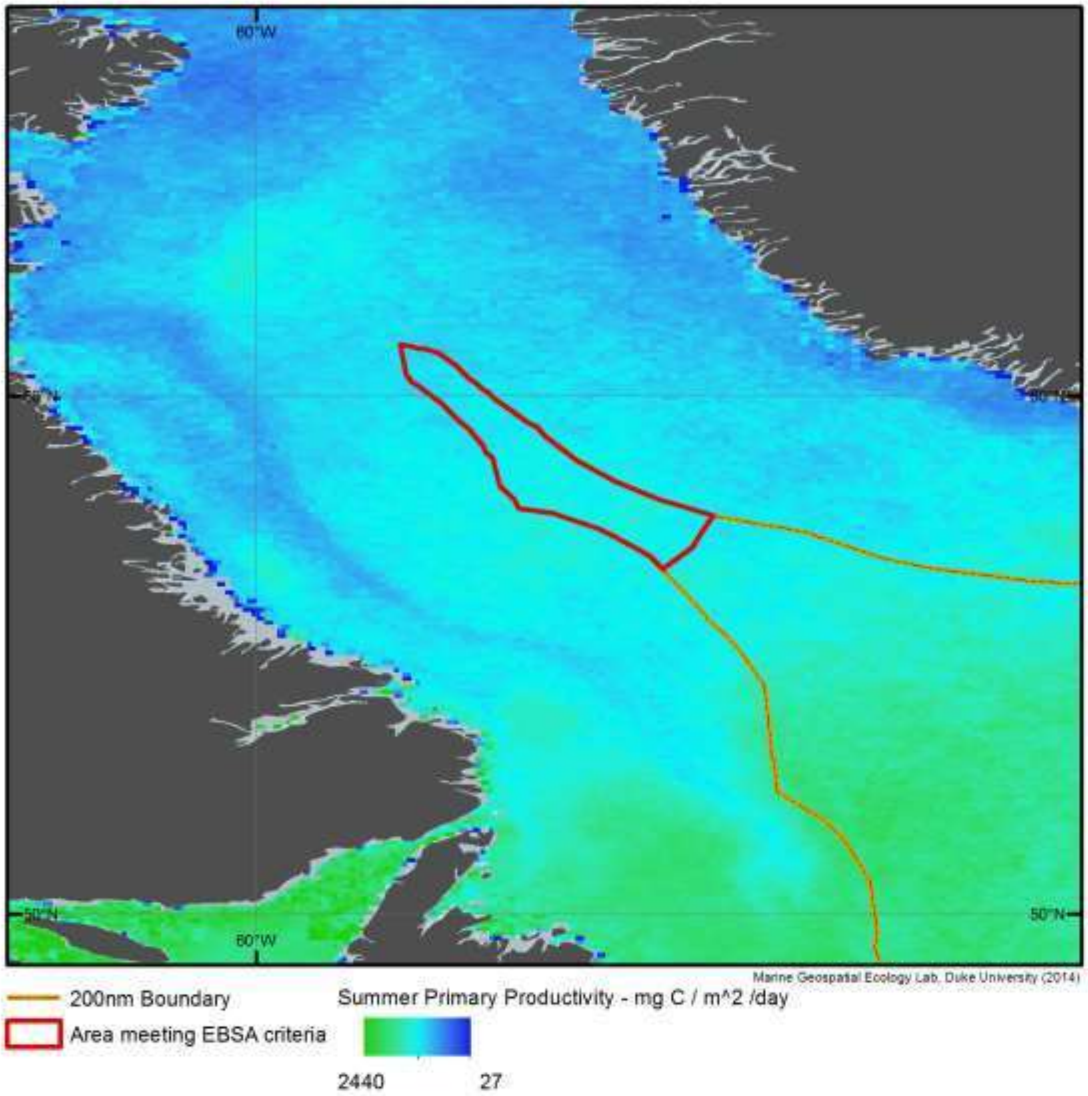

Figure 2. Map of the Labrador Sea deep convection zone within the area beyond national jurisdiction. Base image is daily primary production averaged over the summer months (July, August, September).

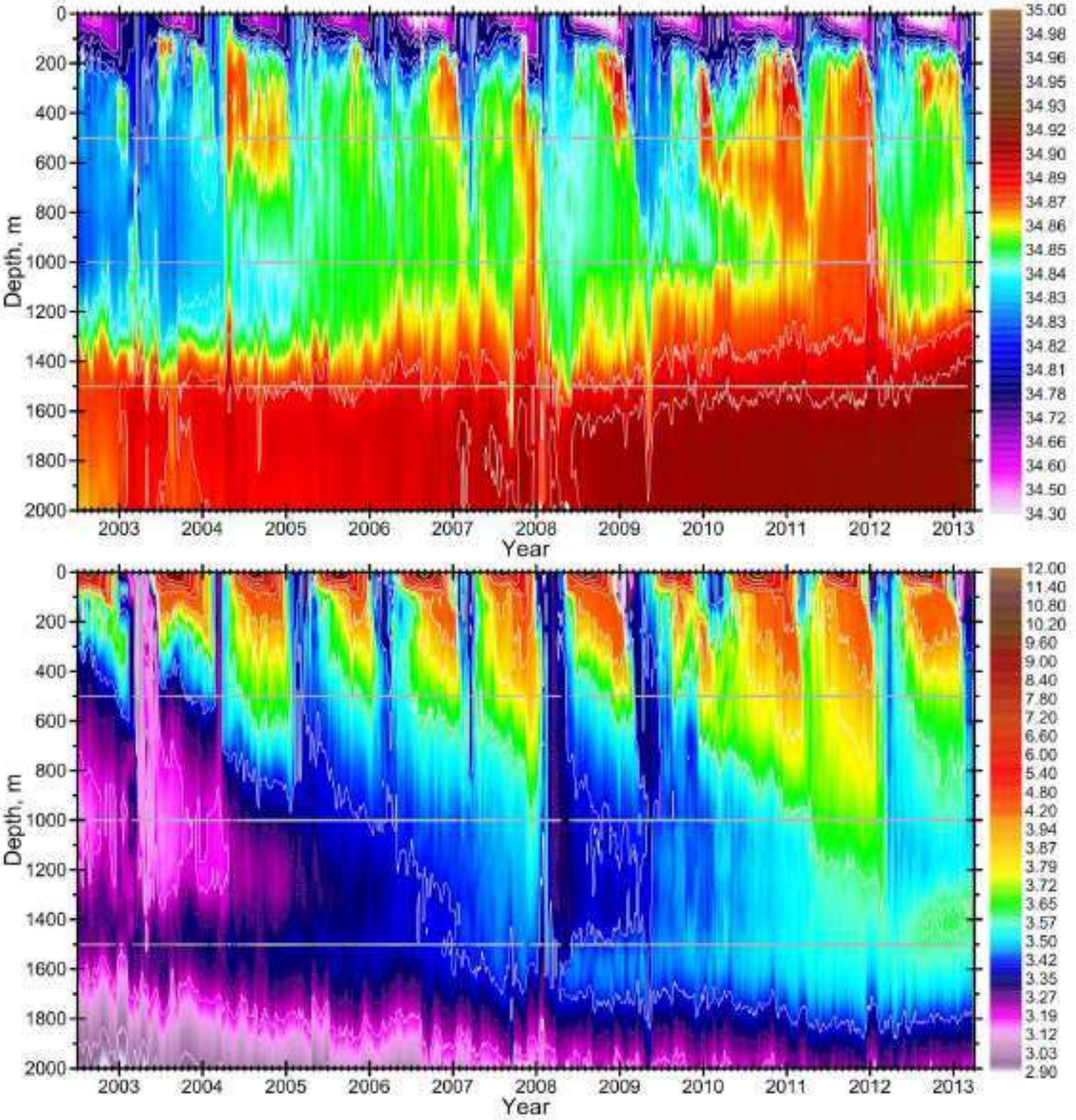

Figure 3. Salinity (top) and potential temperature (bottom) from Argo drifters in the Labrador Sea. The winter 2008 deep convection event is clearly evident to a depth of 1600 m, and 2012 winter deep convection reaches 1400 m. Convection was limited to a depth of about 200 m in the winters of 2010 and 2011 (Yashayaev et al. 2013).

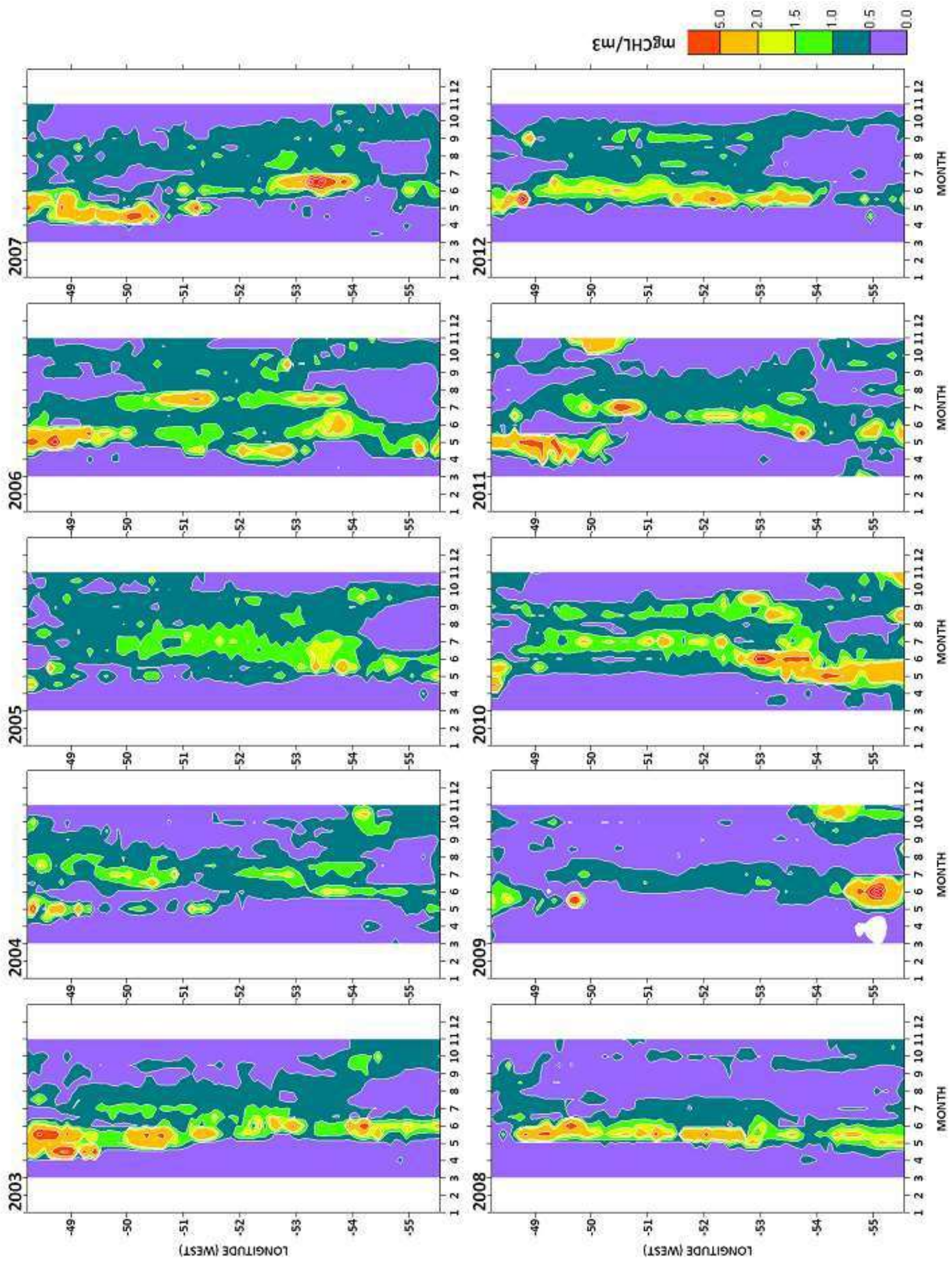

Figure 4. The concentration of sea surface chlorophyll *a* on AR7W transect estimated from remotely sensed ocean colour at two-week intervals from March to October spanning a 10-year time series, 2003-2012. For reference, the area of the nominal deep convection zone that extends beyond national jurisdiction (see figure 2) lies on AR7W transect between 51.26°W and 52.26°W.

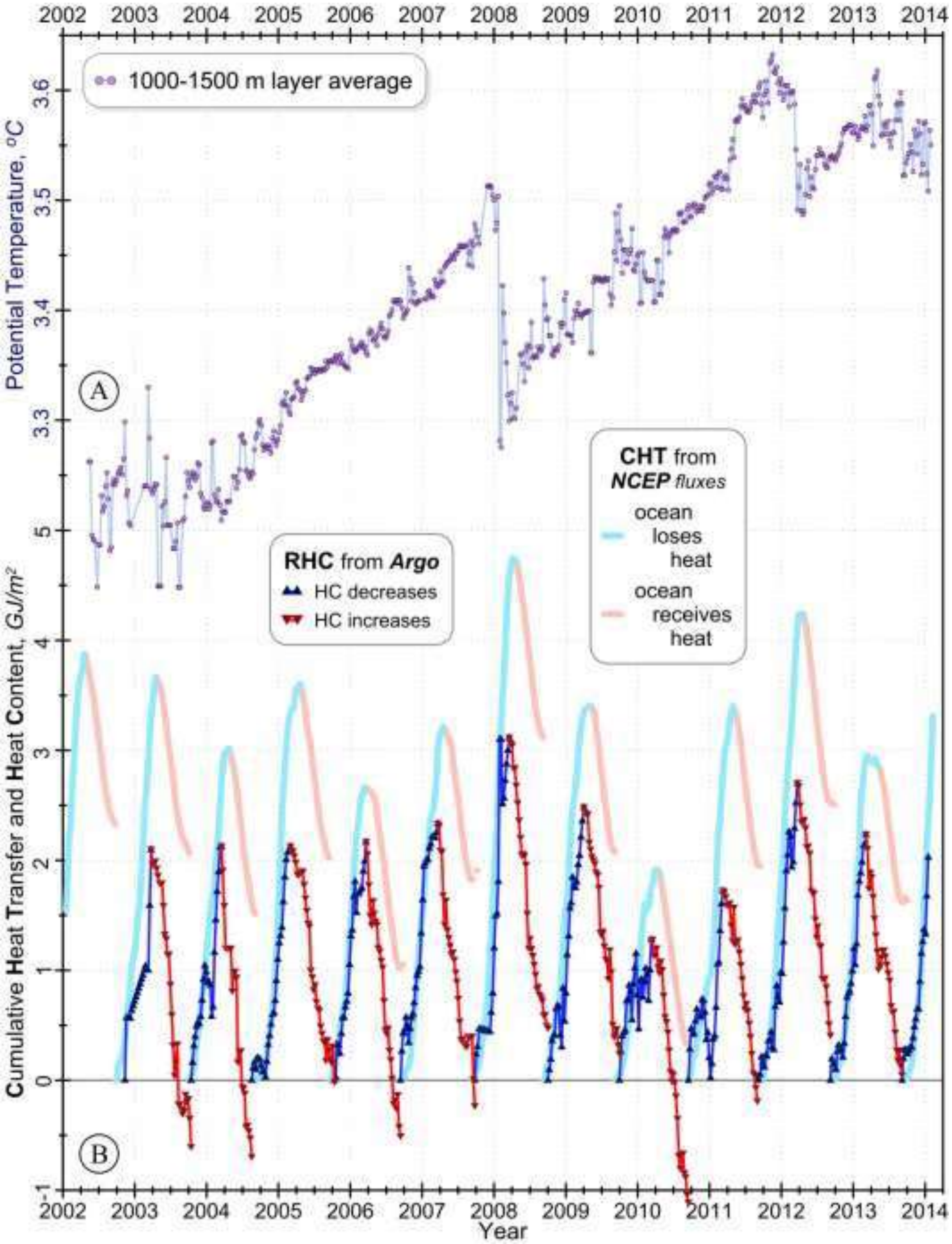

Figure 5. Potential temperature in the 1000-1500 m layer of the Labrador Sea derived from Argo floats and cumulative heat transfer using NCEP re-analysis and heat content from Argo floats. (A) Evolution of the 10-day running mean of the 1000–1500 m layer average temperatures from the Labrador Sea Argo profiles. (B) The annual cycles of cumulative heat transfer (CHT) through the surface from the NCEP data and Argo-based relative heat content (RHC) in the 10–1600 m layer in the Labrador Sea. The CHT curves start from zero at the time when persistent heat loss (from the ocean) starts each year. RHC is relative to the start of ocean cooling each year and reversed in sign to facilitate comparison with CHT (Yashayaev and Loder 2009).

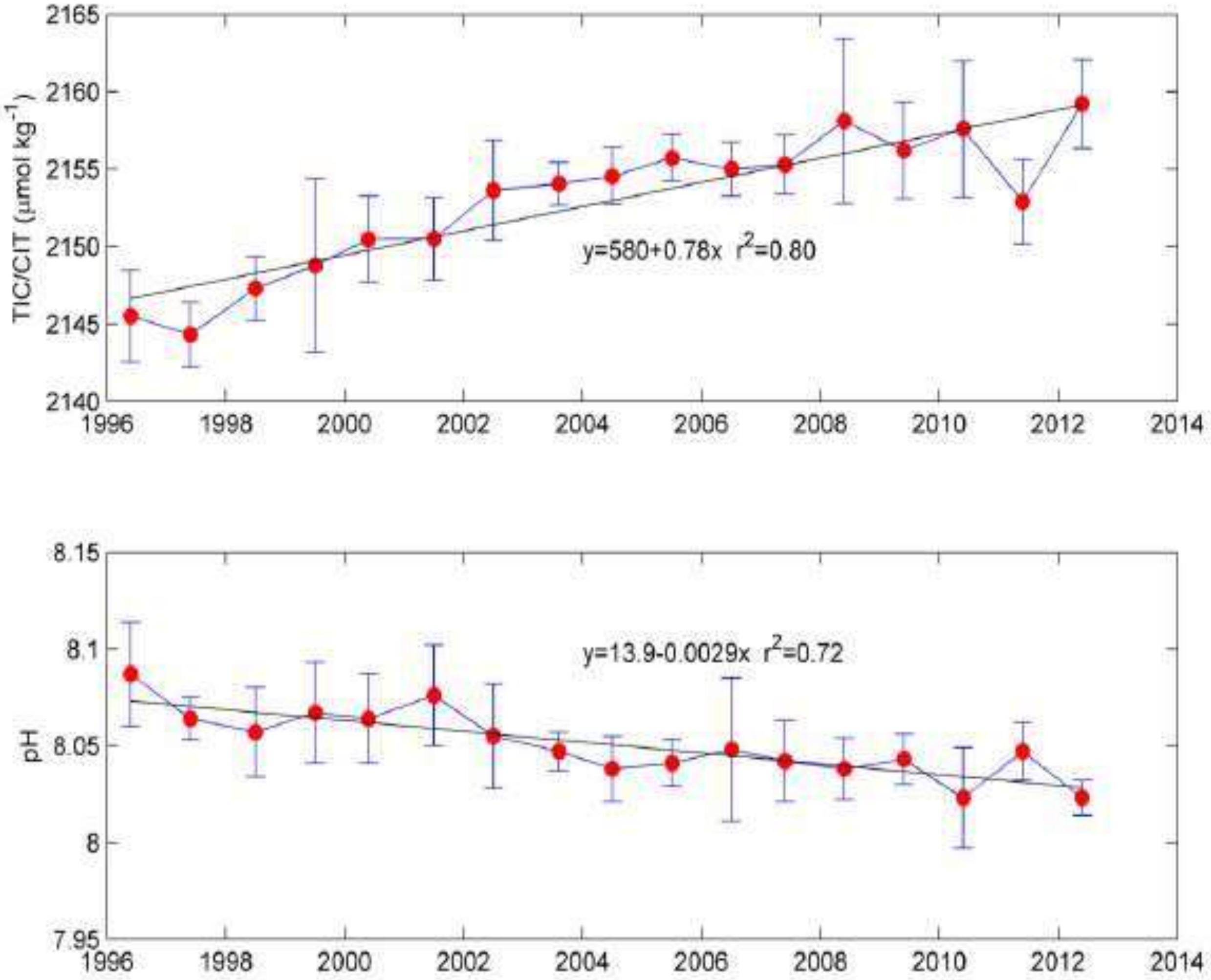

Figure 6. Time series of total inorganic carbon (TIC) and pH(top panel refers to TIC, bottom panel to pH) TIC and pH in in the 150–500 m depth range and corresponding regression lines for stations in the central part of the Labrador Basin for the period 1996–2012. In 2012, pH is a direct measurement because alkalinity measurements were not available due to an instrument failure (Yashayaev et al. 2013)

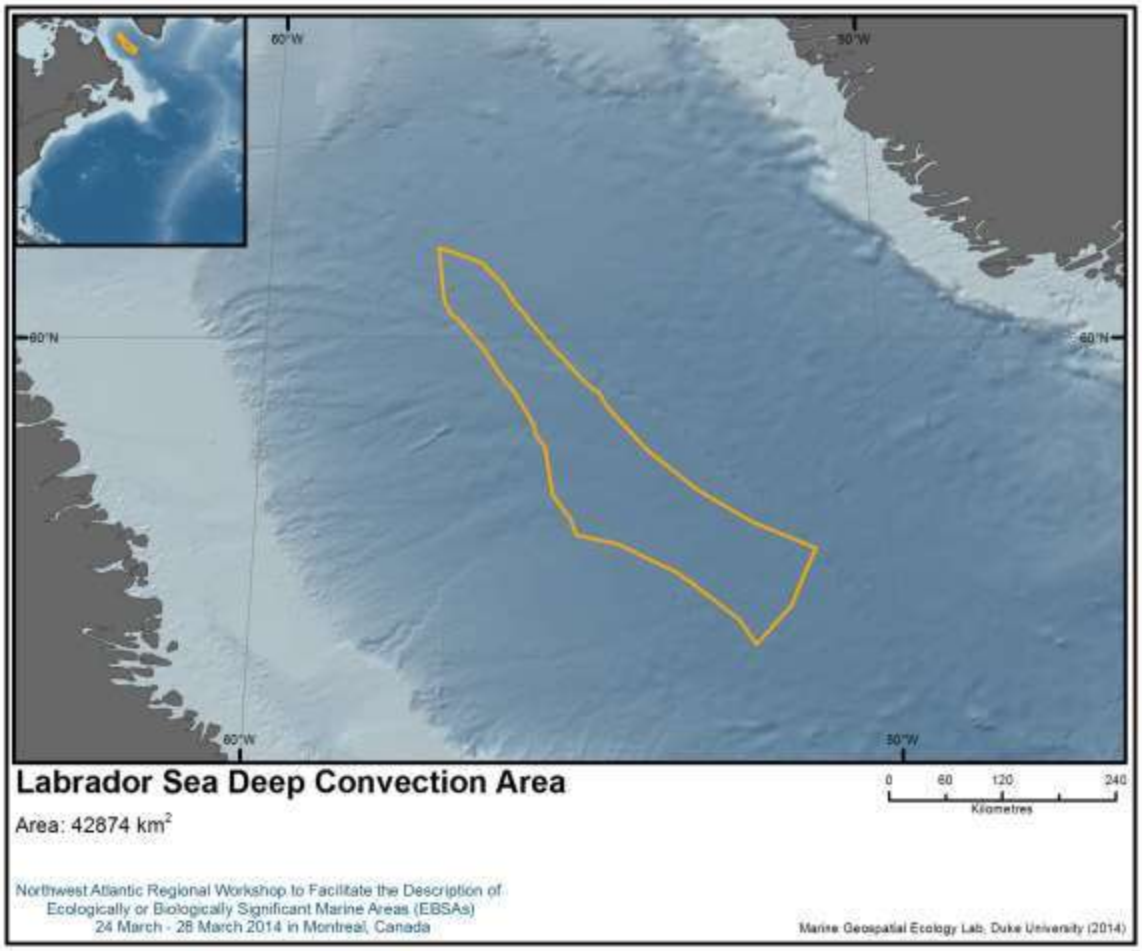

Figure 7. Area meeting the EBSA criteria.

Area No. 2: Seabird Foraging Zone in the Southern Labrador Sea

Abstract

The waters off Newfoundland and Labrador support globally significant populations of marine vertebrates, including an estimated 40 million seabirds annually. A number of recent tracking studies highlight the importance of the southern Labrador Sea, in particular, as foraging habitat for seabirds, including over-wintering black-legged kittiwakes (*Rissa tridactyla*) thick-billed murres (*uria lombia*) and, and breeding each's storm-petrels (*Oceanodroma leucorhoa*). This habitat spans the Orphan Basin in the south to 56°N, covering continental shelf, slope and adjacent offshore waters. While the habitat supporting these seabirds spans the Canadian EEZ and adjacent area beyond national jurisdiction, this description represents the portion located within the pelagic zone, where core foraging and wintering areas for the three seabird species, representing 20 populations, intersect.

Introduction

The waters off Newfoundland and Labrador support globally significant populations of marine vertebrates, including an estimated 40 million seabirds annually (Barrett et al. 2006). Local and Arctic breeding auks (common murre, *Uria aalge*, thick-billed murre, *Uria lombia*, and dovekie, *Alle alle*) and black-legged kittiwakes (*Rissa tridactyla*) over-winter in the region, and globally significant populations of auks (common murre and Atlantic puffin, *Fratercula arctica*) and each's storm-petrels (*Oceanodroma leucorhoa*) breed in the area during summer. Millions of *Puffinus* shearwaters also migrate from colonies in the Southern Hemisphere to become the main avian consumers of fish in summer (Barrett et al. 2006). A number of recent tracking studies highlight the importance of the southern Labrador Sea, in particular, as foraging habitat for seabirds (Fort et al. 2012, McFarlane Tranquilla et al. 2013, Hedd et al. unpublished data). Foraging habitat spans the Orphan Basin in the south to 56°N, covering continental shelf, slope and adjacent offshore waters. This area meeting EBSA criteria represents the portion in pelagic waters where the core foraging and wintering areas for three seabird species intersect. A portion of this area has been proposed as a marine Important Bird Area by BirdLife International due to its importance for over-wintering black-legged kittiwakes.

Location

The area is located in the southern portion of the Labrador Sea, north-east of Newfoundland. The identified seabird habitats span the Canadian EEZ and adjacent pelagic waters, but the area described as meeting the EBSA criteria is restricted to the pelagic portion. It includes the area used by black-legged kittiwakes (known to include some threatened populations) and at least one of the other two tracked seabird species (thick-billed murre and each's storm-petrel; figures 1 and 2). The seabirds utilizing the area feed between the surface and 200 m in depth. The specific areas used by each seabird species are likely to vary seasonally and inter-annually so the area defined by their joint occurrence will be dynamic in nature.

Feature description of the area

The waters off Newfoundland and Labrador provide important year-round foraging habitat for seabirds (Barrett et al. 2006). A recent study of year-round tracking for black-legged kittiwakes from 18 breeding colonies throughout the North Atlantic, which together represent ~25% of the biogeographic population, found a high degree of mixing and spatial overlap of populations during the winter period (Fredericksen et al. 2012). The authors estimated that 80% of 4.5 million adult kittiwakes breeding in the Atlantic wintered west of the mid-Atlantic ridge, with many populations concentrating over the Newfoundland and Labrador shelf (Fredericksen et al. 2012; see figure 3). The importance of the area for kittiwakes has been confirmed through pelagic (vessel) surveys, with high densities observed in winter over the shelf and along the shelf-edge off north-east Newfoundland (Fifield et al. 2009). Areas beyond the shelf-edge, however, have been poorly covered. The concentrated winter occurrence of much of the North Atlantic population of black-legged kittiwake was cause for concern for Fredericksen et al. (2012), as while the population is large, there have been widespread declines in the last decade, and the species is regionally Red-Listed in Norway, the Faroe Islands and Greenland (Kingdom of Denmark) (Fredericksen, 2010). Reasons for population declines are only partly understood (involving food shortages and poor breeding success), but in some areas declines appear to be linked to increasing ocean temperatures (Fredericksen et al. 2004).

Year-round tracking of thick-billed murre from five eastern Canadian colonies (together representing ~35% of the eastern Canadian population) has also highlighted Orphan Basin, the Labrador Shelf and adjacent portions of the Labrador Sea as important winter habitat (McFarlane Tranquilla et al. 2013; figure 2). Birds from all colonies used these areas to varying degrees, with Orphan Basin and areas in the south being particularly important for Minarets and Gannet Island birds, and the Labrador Shelf and adjacent portions of the Labrador Sea being important for birds originating from colonies in Hudson Bay (Coats and Digges Islands). Scaled to colony size (figure 5), the birds breeding at the large Digges Island colony, followed by Coats and Minarets, account for many of the birds estimated to be present in the proposed region during winter.

The southern portion of the region, offshore of the Orphan Basin, also provides important summer foraging habitat for the world's largest population of each's storm-petrel (*Oceanodroma leucorhoa)* (3.5 million pairs, ~75% of the eastern Canadian population; Sklepkovych & Montevecchi 1989) at Baccalieu Island, Newfoundland (figure 6; Hedd et al., unpublished data). These petrels specialize on myctophid fishes, mesopelagic species widespread in waters deeper than 300 m (Nafpaktitus et al. 1977), which is consistent with the highly pelagic nature of the birds. There is concern for each's storm-petrels, given that a number of locally significant colonies have declined substantially over the past two decades (Robertson et al. 2006; S. Wilhelm et al., Environment Canada, unpublished data). While the cause(s) of population declines are unknown, several potential cumulative drivers, including ongoing marine ecosystem change (Buren et al. 2014), increased predation by large gulls *Larus* spp. (Stenhouse & Montevecchi 1999, Stenhouse et al. 2000), attraction to and mortality in association with offshore oil activities (Wiese et al. 2001, Ellis et al. 2013) and high levels of contaminants in eggs (Burgess & Braune 2001) warrant further investigation. The population trend for the colony at Baccalieu is unknown, but it was surveyed in 2013.

Winter productivity in the region of the Labrador Sea used by thick-billed murres from the Minarets colony, in particular, was high relative to the surrounding regions (figure 5). Productivity at other times of year did not appear to differ in or outside the area used.

The factors causing the variability in seabird foraging are not well understood. Therefore, in practice it will not be possible to track the changing boundaries of this area meeting EBSA criteria in real time. However, as knowledge of seabird foraging improves, it may become possible to identify reasonable covariates that can be used to delineate the boundaries of this area more precisely and in time frames that can inform management.

Feature condition and future outlook of the area

Seabirds are long-lived (several decades) and slow reproducing, making them susceptible to negative impacts from marine threats. Accidental by-catch in gillnet, longline and trawl fisheries is a risk for several species (Piatt et al., 1984; Benjamins et al., 2008; Ellis et al., 2013). In continental shelf regions adjacent to the described area, there has been a history of heavy fisheries exploitation, which could be a threat to seabird populations present. Although mortality caused by pollution from chronic and episodic oil spills, and collisions with lights and flares on offshore vessels and platforms can be problematic, the area described is situated mainly in the pelagic zone, including the Orphan Basin, where there is ongoing oil and gas exploration and development (Montevecchi, 2007; Ellis et al., 2013).

Assessment of the area against CBD EBSA criteria

<table>
<tr><th rowspan="2">CBD EBSA criteria (Annex I to decision IX/20)</th><th rowspan="2">Description (Annex I to decision IX/20)</th><th colspan="4">Ranking of criterion relevance (please mark one column with an X)</th></tr>
<tr><th>No information</th><th>Low</th><th>Medium</th><th>High</th></tr>
<tr><td>Uniqueness or rarity</td><td>Area contains either i) unique “the only one of its kind”), rare occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.</td><td></td><td></td><td>X</td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
The aggregation of birds from a large number of widely dispersed colonies (black-legged kittiwake) in the North-East and North-West Atlantic to a prescribed area during winter is rare, but occurs in the Labrador Sea (Fifield et al. 2009, Fredericksen et al. 2012).</td></tr>
<tr><td>Special importance for life-history stages of species</td><td>Areas that are required for a population to survive and thrive.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
This area represents an intersection of important foraging and wintering habitat for three seabird species from 20 breeding colonies in the North-East and North-West Atlantic (Fredericksen et al. 2012, McFarlane Tranquilla et al. 2013). It provides critical wintering habitat for black-legged kittiwakes (representing ~25% of the biogeographic population), where a high degree of population mixing and overlap occur (Fredericksen et al. 2012). It is also an important wintering site for eastern Canadian populations of thick-billed murre (representing ~35% of the eastern Canadian population) and is used by each’s storm-petrels from the world’s largest colony while foraging during the incubation period.</td></tr>
<tr><td>Importance for threatened, endangered or declining species and/or habitats</td><td>Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.</td><td></td><td></td><td>X</td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
There is regional concern for black-legged kittiwakes, which have declined in the North-East Atlantic over the past couple of decades and appear on Red Lists of multiple countries (Fredericksen et al. 2010). The populations tracked to the area described represent ~25% of the North-East Atlantic population. each’s storm-petrels in Newfoundland and Labrador have also declined substantially at a number of locally significant colonies in the past 15 years (Robertson et al. 2006, S. Wilhelm et al., Environment Canada, unpublished data). The population tracked to the described area represent ~75% of the eastern Canadian population. Both species, however, are classified as Least Concern globally by IUCN.</td></tr>
<tr><td>Vulnerability, fragility, sensitivity, or slow recovery</td><td>Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.</td><td></td><td></td><td>X</td><td></td></tr>
</table>

Explanation for ranking Seabirds are long lived (several decades) and slow reproducing, making them susceptible to negative impacts from marine threats. Accidental by-catch in gillnet, longline and trawl fisheries is a risk for several species (Piatt et al., 1984; Benjamins et al., 2008; Ellis et al., 2013). The continental shelf region adjacent to the described area has a history of heavy fisheries exploitation and as such could be a threat to seabird populations present. Mortality caused by pollution from chronic and episodic oil spills, and collisions with lights and flares on offshore vessels and platforms can be problematic (Montevecchi, 2007; Ellis et al., 2013). The region described is situated mainly in pelagic areas, which includes the Orphan Basin, where there is ongoing oil and gas exploration and development.					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.			X	
Explanation for ranking Higher patches of primary productivity are seen in portions of the described area during winter, but these were not consistent throughout study area or through time (figure 5).					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.			X	
Explanation for ranking Important habitat for three species of seabirds; multiple colonies for two of the species (five tracked populations of thick-billed murre, McFarlane Tranquilla et al. 2013; 14 of 18 populations of black-legged kittiwake Fredericksen et al. 2012).					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			X	
Explanation for ranking The site is in the pelagic zone, which likely means it has lower anthropogenic influence than adjacent shelf areas. Fishing, however, has occurred over the continental shelf adjacent to the area for hundreds of years, and there are expanding oil exploration and extraction activities to the south on and in the vicinity of the Grand Banks and Orphan Basin.					

Sharing experiences and information applying other criteria (Optional)

Other criteria	**Description**	**Ranking of criterion relevance** (please mark one column with an X)			
		Don't Know	**Low**	**Medium**	**High**
Add relevant criteria	BirdLife International Important Bird Area			X	
Explanation for ranking					
The site qualifies as an IBA for the black-legged kittiwake.					

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Maps and Figures

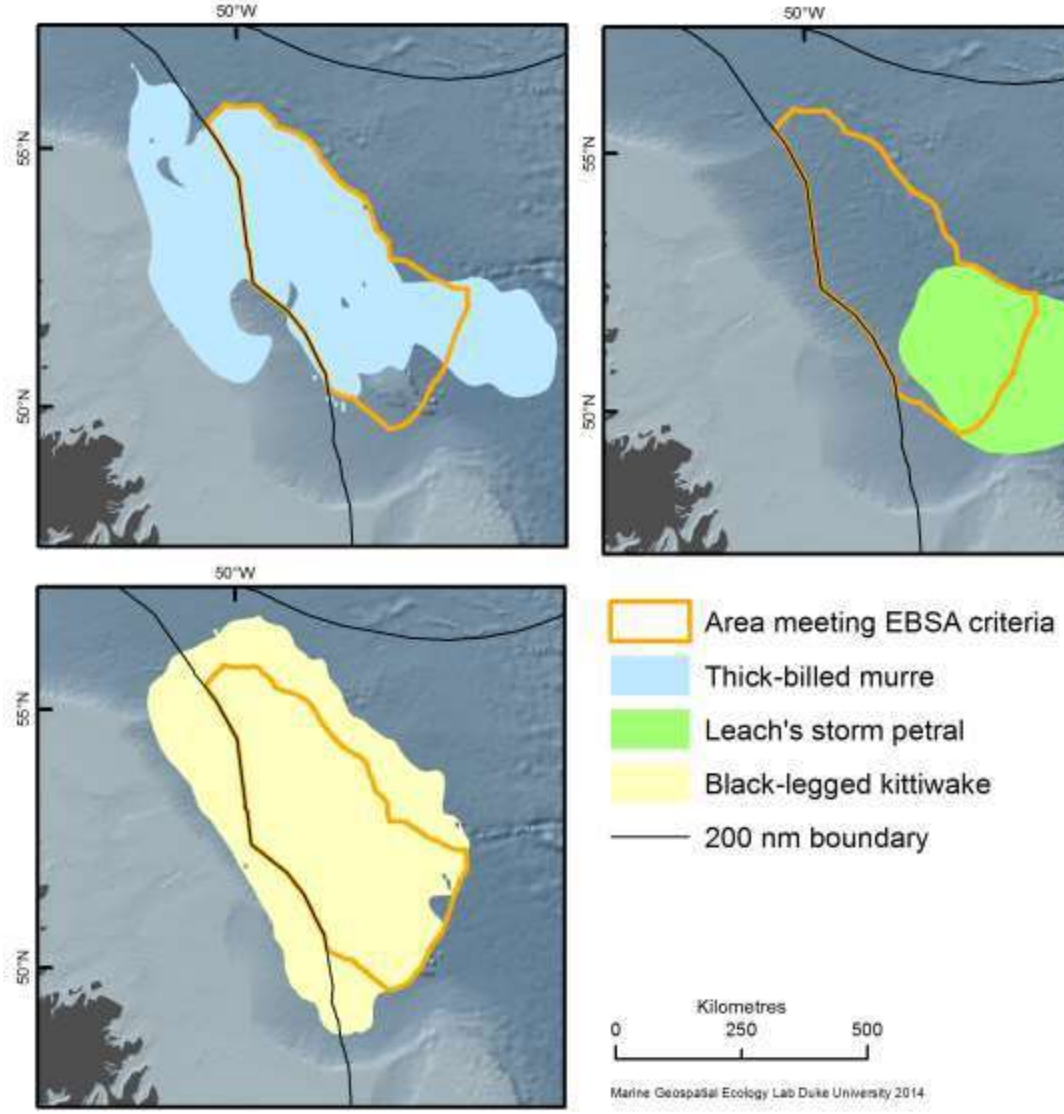

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Figure 1. Boundary of the described area overlaid on the primary individual data layers used to define its extent. Black-legged kittiwake data represent a proposed marine Important Bird Area, based on data from 14 colonies in the North-East Atlantic (Fredericksen et al. 2012), accessed and analyzed by BirdLife International. Thick-billed murre data are winter hotspots for three eastern Canadian Arctic colonies combined (see figure 5, Coats, Digges and Minarets; McFarlane Tranquilla et al. 2013) and were analyzed and assessed by BirdLife International. Foraging areas of each's storm-petrel from Baccalieu Island, Newfoundland (figure 7) are represented by a 50% kernel density contour (A. Hedd, unpublished data).

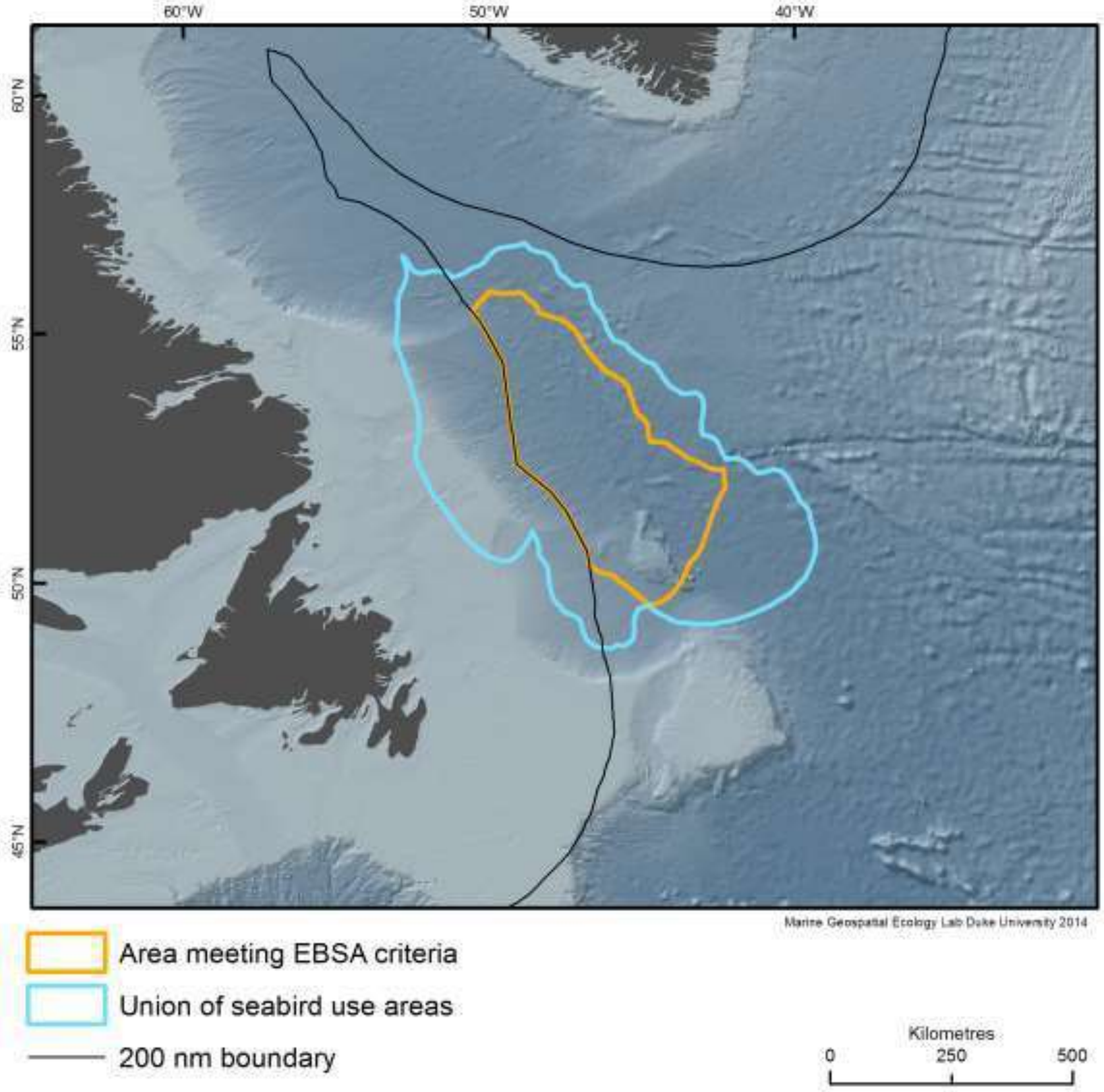

Figure 2. Area meeting the EBSA criteria (yellow) depicted agagainst the wider area used collectively by three species (blue): The area in blue encompasses the union of foraging and over-wintering areas of black-legged kittiwakes, thick-billed murres and each's storm-petrels; the area in yellow represents the intersection of habitat for black-legged kittiwakes and one of the other tracked species in waters beyond national jurisdiction.

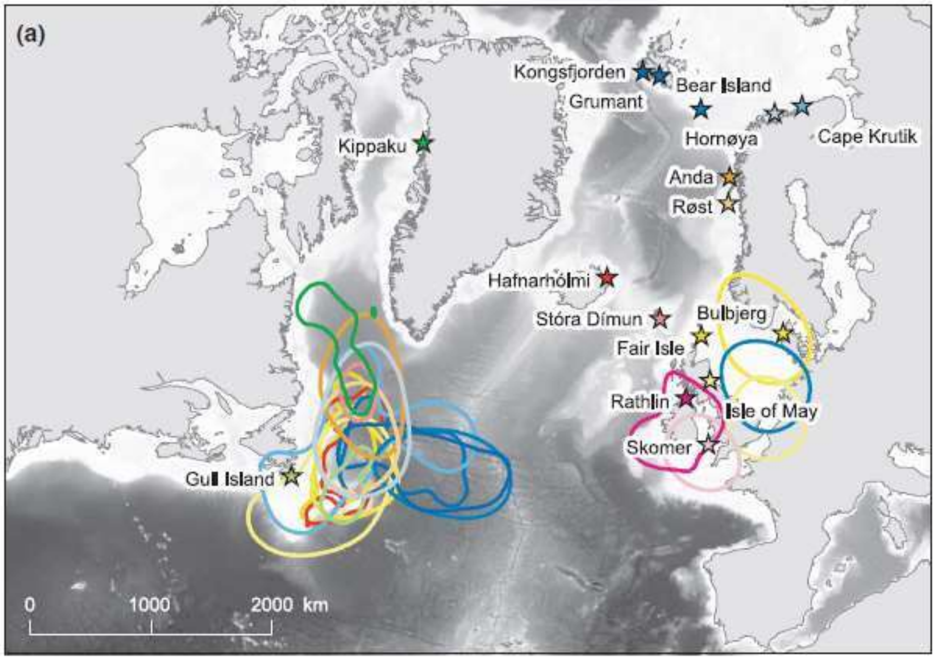

Figure 3. Areas used by black-legged kittiwakes wintering in the North Atlantic. Shown are 50% density kernels for December 2009, with kernel colour matching that of the star used to indicate the colony tagging location.

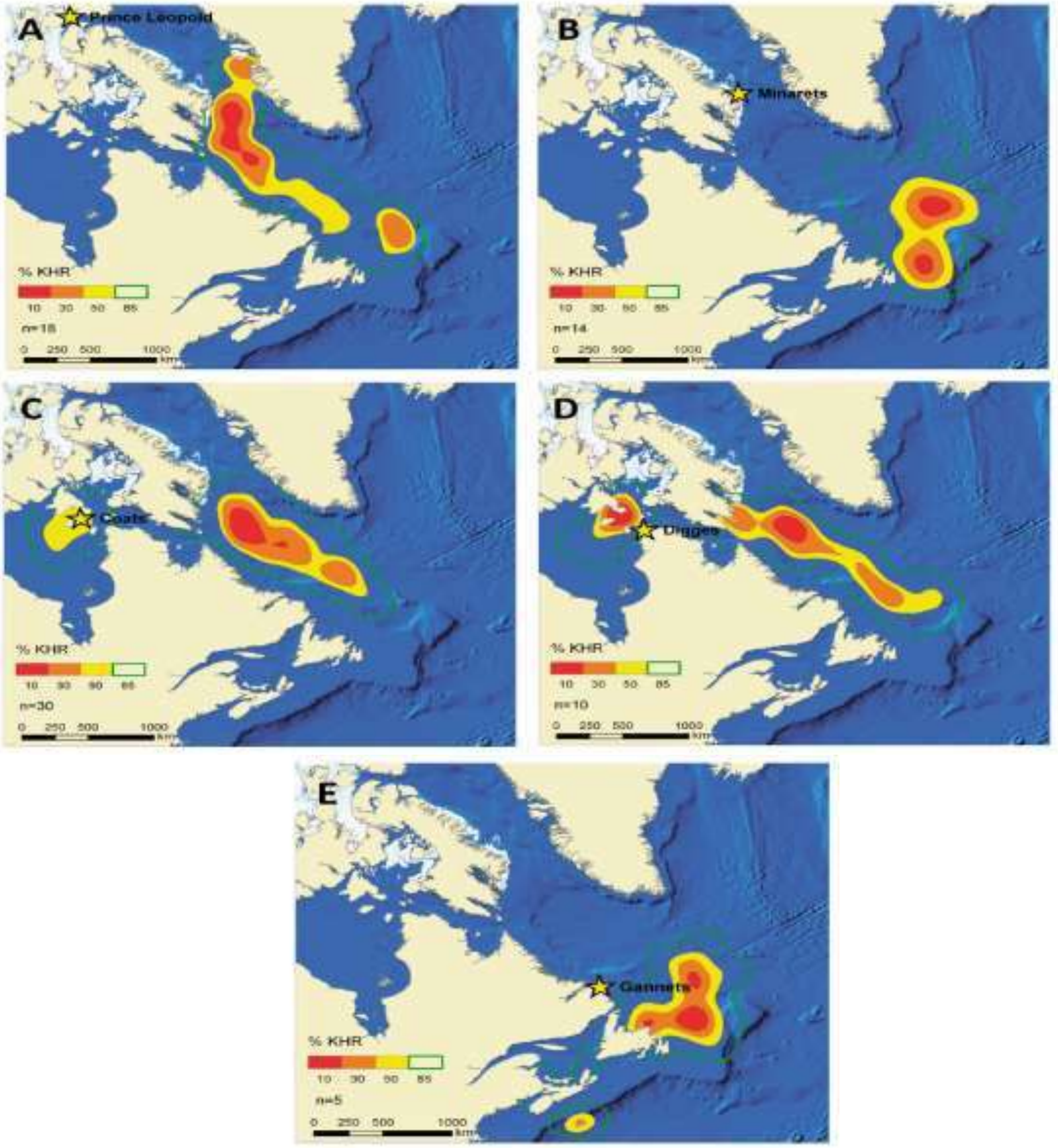

Figure 4. Winter distribution (November-February) of thick-billed murres from five colonies in eastern Canada (McFarlane Tranquilla et al. 2013), using kernel density contours (KHR).

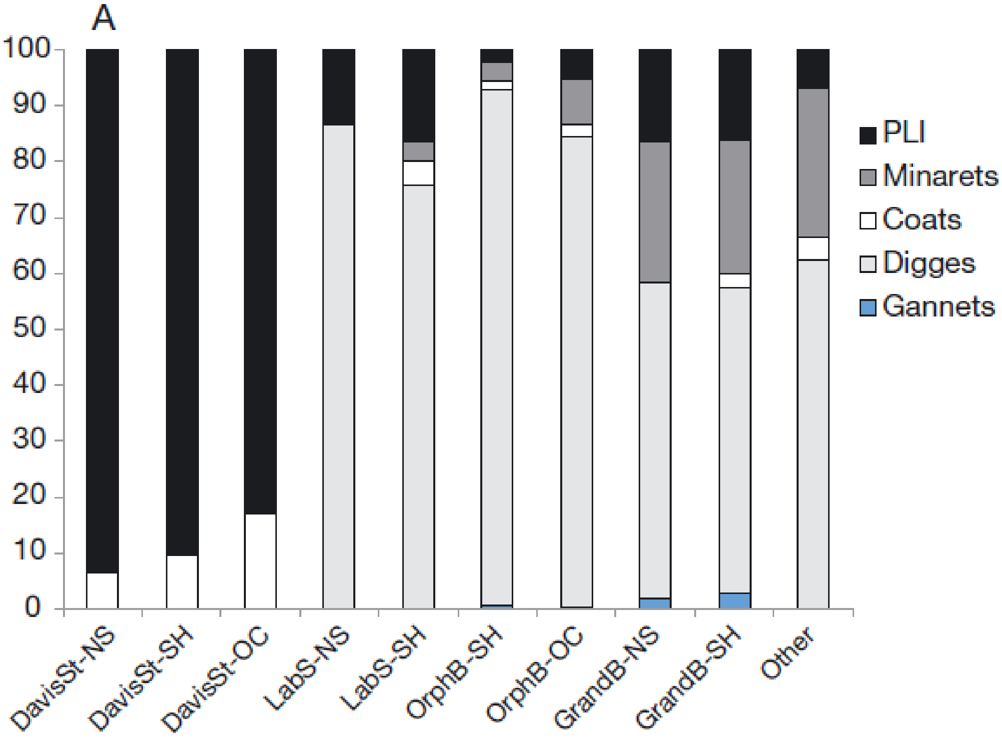

Figure 5. Composition (%) by subregions (NS=nearshore, SH=shelf, OC=oceanic, LabS=Labrador Sea, OrphB=Orphan Basin, GrandB=Grand Banks) of different populations of thick-billed murre, based on proportional use of subregions scaled to population size. Labrador Sea and Orphan Basin are the areas relevant to the described area (McFarlane Tranquilla et al. 2013).

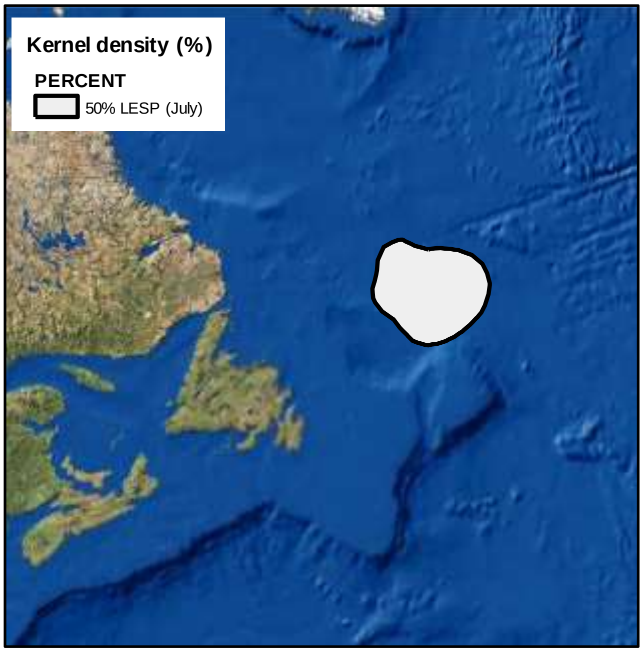

Figure 6. Areas used by each's storm-petrel foraging from Baccalieu Island, Newfoundland during the incubation period, July 2013. Data were collected using geolocators.The 50% kernel density contour is shown.

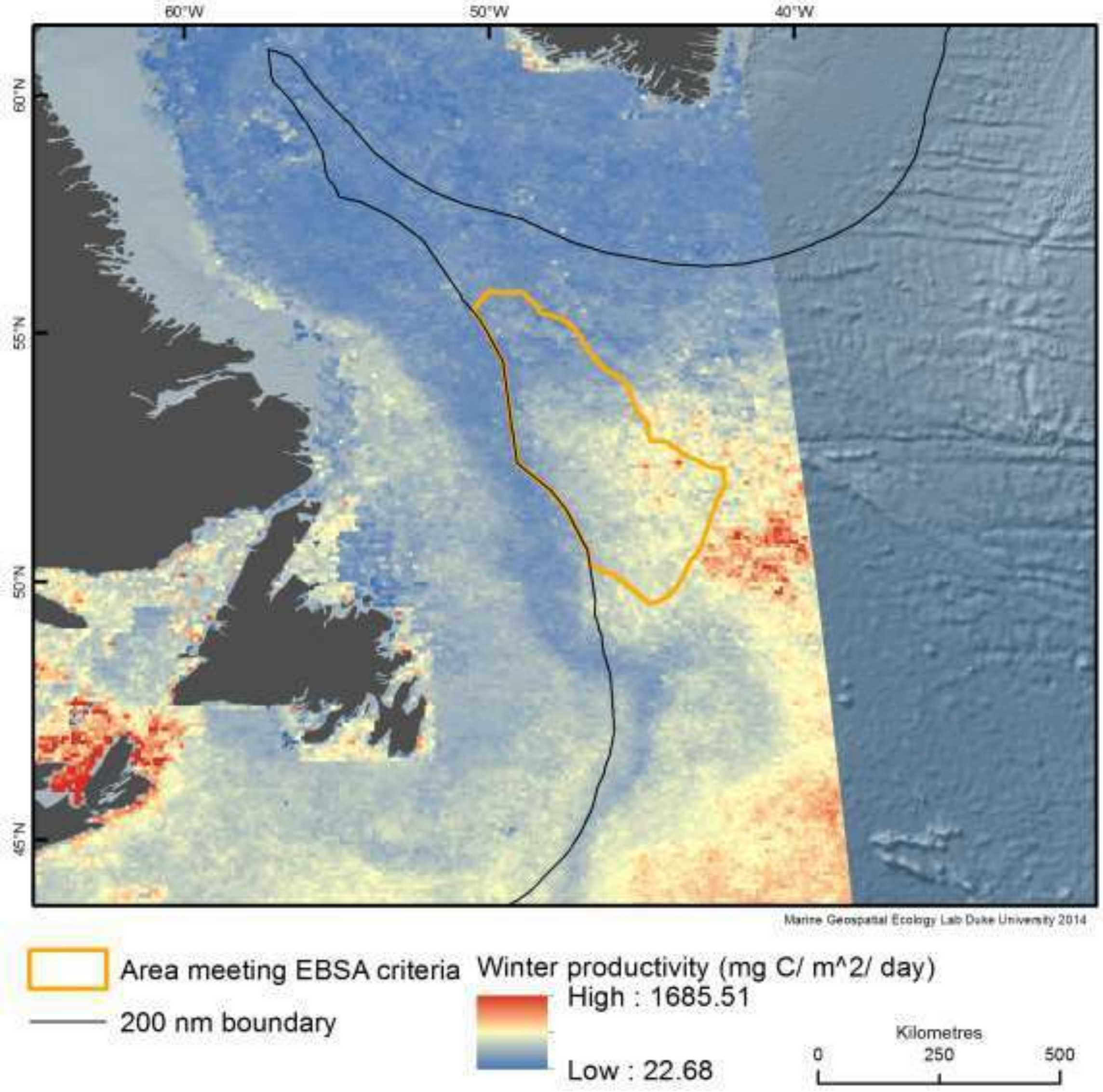

Figure 7. The described area is overlaid on winter primary productivity, depicting relatively higher productivity in the south-east corner and in relation to adjoining areas of the shelf-edge.

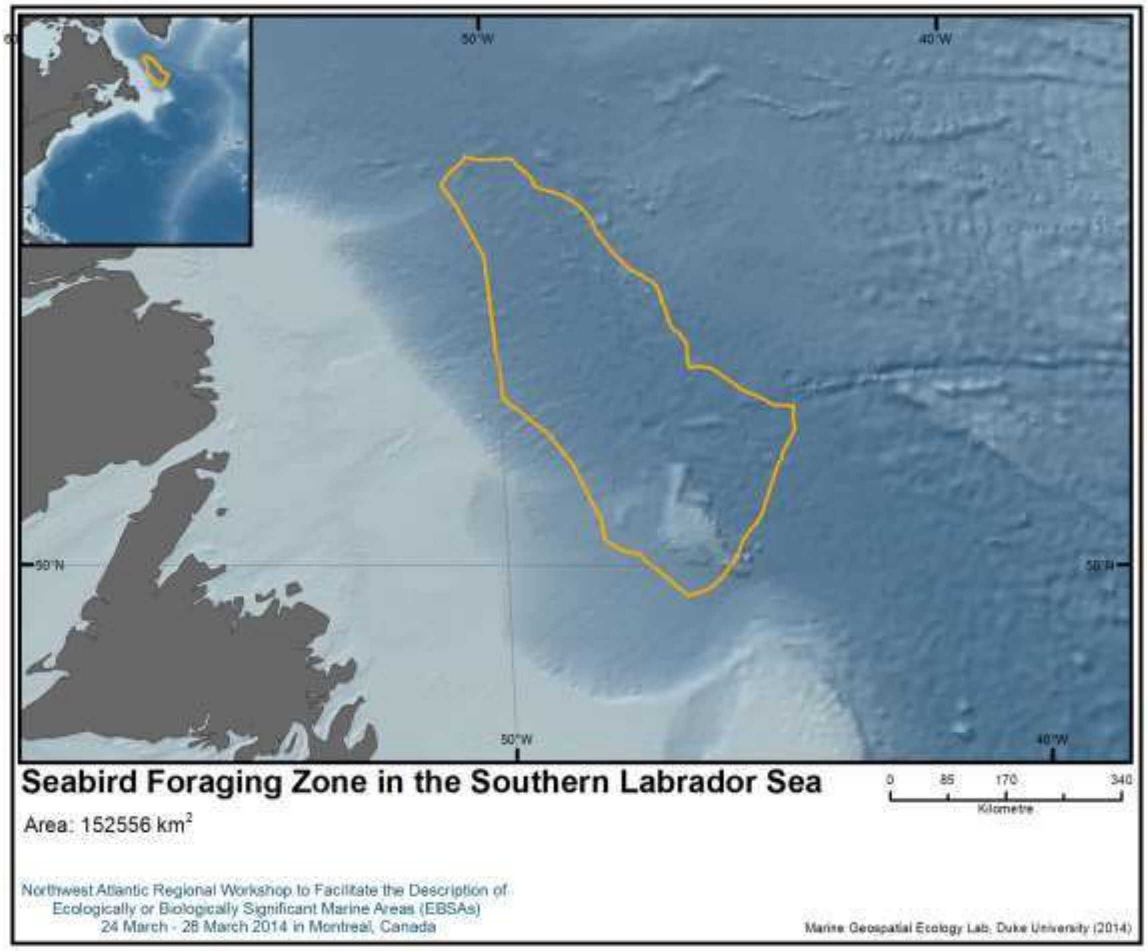

Figure 8. Area meeting the EBSA criteria. The area represents the intersection of core foraging and over-wintering zones for three seabird species (of which 20 colonies are represented) that congregate in the area.

Rights and permissions

Seabird tracking data has been generously provided by Laura McFarlane Tranquilla, Bill Montevecchi, Tony Gaston, April Hedd, Morten Frederiksen, Tycho Anker-Nilssen, Rob Barrett, Bergur Olsen, Maria Bogdanova, Børge Moe, Thierry Boulinier, Francis Daunt, Deryk Shaw, Geir Helge Systad, David Grémillet, Hallvard Strøm, Harald Steen, Jacob Gonzalez-Solis, Svein-Håkon Lorentsen, Lorraine Chivers, Mark Mallory, Mark Newell, Olivier Chastel, Signe Christensen-Dalsgaard, Thorkell Lindberg Thórarinsson, Tony Gaston, and Yuri Krasnov.

Area No. 3: Orphan Knoll

Abstract

The Orphan Knoll provides an island of hard substratum and uniquely complex habitats that rise from the seafloor from the surrounding deep, soft sediments of Orphan Basin. Owing to their isolation, seamounts tend to support endemic populations and unique faunal assemblages. Although Orphan Knoll is close to the adjacent continental slopes, it is much deeper and appears to have a distinctive fauna. Fragile and long-lived corals and sponges have been observed on Orphan Knoll during underwater camera and video surveys. A Taylor Cone circulation has been identified, providing a mechanism for retention of larvae over the feature.

Introduction

A knoll is similar to a seamount in that it is a mountain arising abruptly from the sea floor; however, a knoll is less than 1000 m in height. Some deep-sea fishes aggregate on seamounts and knolls to feed and/or spawn, while others are only loosely associated with them (Morato et al. 2004). Filter-feeding invertebrates — including corals and sponges — are often found attached to the hard substrates associated with these features (Clark et al. 2006) and the Food and Agriculture Organization (FAO) International Guidelines for the Management of Deep-sea Fisheries in the High Seas (FAO 2009) identifies summits and flanks of seamounts, guyots, banks, knolls and hills as areas likely to contain vulnerable marine ecosystems. Species found on seamounts and knolls also display a relatively high degree of endemism.

The topography of seamounts and knolls evokes interactions with ocean circulation, leading to potential biological responses. Isopycnal doming due to the formation of Taylor Cones brings deeper nutrient-rich water to shallower depth. This process may generate stratification over the seamount, which may stabilize the water masses, promoting retention of eggs and larvae and productivity. Asymmetric flow acceleration governs sediment distribution and influences benthic communities. Taylor cone circulation can also advect organic material onto seamounts/knolls, enhancing food supply (cf. Pitcher et al. 2007).

Orphan Knoll is one of a number of seamounts and knolls in the area. Orphan Knoll rises to a depth of 1800 m from the surface (Kulka et al. 2007). The general location of Orphan Knoll is illustrated in figure 1 relative to the Flemish Cap.

Location

Orphan Knoll is an irregularly shaped feature with one named seamount adjacent to the south-east (Orphan Seamount indicated in yellow on figure 2). Boundaries were drawn around Orphan Knoll and the small seamount to encompass both features. The 4000 m depth contour was followed to the east, and the 3000 m depth contour was followed to the south and the north-west. To the south-east the boundary connected the 3000 m and 4000 m contours to encompass a small feature near the later. To the west, the depth contours were followed (approx. 2750 m) to capture the slope of the Orphan Knoll between the 3000 m contours to the north and south (figure 2).

Feature description of the area

Orphan Knoll is a single peak reaching to 1800 m from the surface (figure 2). The Orphan Basin–Orphan Knoll region is biologically rich and complex, and strongly influenced by local processes and advection (Enachescu 2004, Greenan et al. 2010). The combination of the gyre around the Flemish Cap (see area no. 4) and Taylor Cones associated with the Orphan Knoll provides a mechanism that may provide some isolation of biota between these features, but this has only been partially documented.

Within the Knoll, mounds are found at depths between 1800 and 2300 m, creating heterogeneous habitats. For example, Einarsson Mound is 1500-2000 m wide and 300 m tall, and Nader Mound is between 400-800 m wide and 300 m tall Enachescu 2004). Enachescu 2004) proposed “a mixed organic/inorganic origin for those mounds, which implies the existence of deep, cold-water marine organisms feeding from either hydrocarbon rich vents or hydrothermal fluids rising through deep-seated faults at the water bottom.”

Canada has undertaken physical, chemical and biological oceanographic research on Orphan Knoll, which supports isolation of this feature from the nearby adjacent continental shelves. *In situ* evidence includes data from hydrographic surveys, near bottom current meters and a compilation of data from Argo floats in the region. A 2010 expedition with ROPOS, a tethered submersible, identified coral and sponges (figure 3). Although this work has not yet been fully analyzed, preliminary findings identify the area as having a unique fauna compared to the adjacent continental slopes. A theoretical calculation of a blocking parameter also strongly suggests the presence of a Taylor Cone above the seamount, which would enhance retention of water, and hence of eggs and larvae, over this topographic feature (Greenan et al. 2010). Retention promotes the creation of a distinct benthic fauna at the genetic and community levels.

Greenan et al. (2010) conducted an investigation of the oceanographic and lower trophic level biology in the region over Orphan Knoll and is quoted here verbatim: “Physical properties indicate that mid-depth waters above Orphan Knoll are in a boundary region between outflow from the Labrador Sea (subpolar gyre) and northward flow of the North Atlantic Current (subtropical gyre). Near-bottom current measurements provide evidence for anti-cyclonic (clockwise) circulation around the knoll. A west-east gradient in nutrients was observed and is likely related to water mass differences between Orphan Basin and the region east of Orphan Knoll. The saturation state of seawater on the Orphan Knoll sediment surfaces is less than 1.2 and, therefore, organisms with shells and skeletons composed of aragonite and calcite with high magnesium content (more soluble than aragonite) may be affected by ocean acidification. The saturation state of seawater with respect to $CaCO_3$ and the ecosystem response need to be monitored closely. Chlorophyll, small phytoplankton and bacteria in the Orphan Basin-Orphan Knoll region in the spring of 2008 and 2009 showed strong spatial and inter-annual variability, reflecting the complex physical dynamics and growth conditions in the region. Bacterial abundance appeared to be elevated on the summit of the knoll compared to surrounding waters at the same depth, but the persistence of this feature is not known. Zooplankton abundance was significantly greater in the region in 2009 relative to the preceding year, but no enhancement relative to the surrounding region was observed over Orphan Knoll. Overall, we have little evidence at this point that Orphan Knoll enhances the lower trophic level biology in the water column above the knoll; however, near-bottom anti-cyclonic circulation could have important implications for benthic community...”

Feature condition and future outlook of the area

Seamount ecosystems are sensitive to anthropogenic disturbance because the fishes and invertebrates the comprise are mostly slow growing, long-lived (decades to centuries), late to mature, and experience low natural mortality (Morato et al. 2004, Stocks 2004). Scientific studies indicate that seamount summits and upper slopes can provide refugia for cold-water stony corals from ocean acidification as they lie in shallower waters with a higher aragonite saturation horizon (Tittensor et al. 2010, Rowden et al. 2010). There is no evidence of demersal fishing on Orphan Knoll (Kulka et al. 2007). Oil and gas exploratory drilling has occurred on Orphan Knoll and in Orphan Basin (Smee et al. 2003).

The Northwest Atlantic Fisheries Organization (NAFO) has closed an area over most of Orphan Knoll to protect vulnerable marine ecosystems (VMEs) in accordance with United Nations General Assembly resolution 61/105 (table 1 below; NAFO 2009).

Assessment of the area against CBD EBSA criteria

CBD EBSA criteria (Annex I to decision IX/20)	**Description** (Annex I to decision IX/20)	**Ranking of criterion relevance** (please mark one column with an X)			
		No information	**Low**	**Medium**	**High**
Uniqueness or rarity	Area contains either i) unique “the only one of its kind”), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or				X

	distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				
Explanation for ranking Orphan Knoll is a pocket of hard substratum amidst the soft sediments of Orphan Basin. It is the only knoll in the Orphan Basin. Although it is located near the continental slope, it is much deeper and has a distinctive fauna. A Taylor Cone operating over the knoll promotes uniqueness and rarity through retention of eggs and larvae, creating potential for genetic isolation and distinct faunal assemblages (Greenan et al. 2010).					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.	X			
Explanation for ranking The information is not available to evaluate this criterion although mechanisms promoting endemism have been identified, and endemic species would require this area for completion of their life histories.					
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.	X			
Explanation for ranking The information was not available to evaluate fully this criterion. Scientific studies indicate that the summits and upper slopes of seamount can provide refugia for cold-water stony corals from ocean acidification as they lie in shallower waters with a higher aragonite saturation horizon (Tittensor et al. 2010, Rowden et al. 2010). This will have increasing importance to the life histories of cold-water corals in future.					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				X
Explanation for ranking Cold-water corals and sponges have been observed on Orphan Knoll with underwater cameras. Corals and sponges are known to be vulnerable, fragile and sensitive, exhibit slow recovery and growth rates, and are long-lived (cf. FAO 2009). To the extent that populations on Orphan Knoll are found to be endemic, the oceanographic isolating mechanisms would also mean that re-colonization of populations on the Knoll from adjacent populations would be less likely, making both fish and invertebrate populations more vulnerable to local impacts.					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.		X		
Explanation for ranking There is little evidence at this point that Orphan Knoll enhances the lower trophic level biology in the water column above the knoll (Greenan et al. 2010).					
Biological	Area contains comparatively higher diversity				X

diversity	of ecosystems, habitats, communities, or species, or has higher genetic diversity.				
Explanation for ranking Limited observations (DFO personal communication) show high benthic diversity on Orphan Knoll compared with the surrounding Orphan Basin. In general, seamounts can support high biodiversity (Pitcher et al. 2007).					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.				X
Explanation for ranking There is no evidence of demersal fishing on Orphan Knoll (Kulka et al. 2007) and the oil and gas exploration was localized and limited to one site (Smee et al. 2003).					

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Relevant databases

The Seamount Catalog is a digital archive for bathymetric seamount maps that can be viewed and downloaded in various formats. This catalog contains morphological data, sample information, related grid and multibeam data files, as well as user-contributed files that all can be downloaded. Currently this catalogue contains more than 1,800 seamounts from all the oceans. http://earthref.org/SC/.

Maps, Figures and Tables

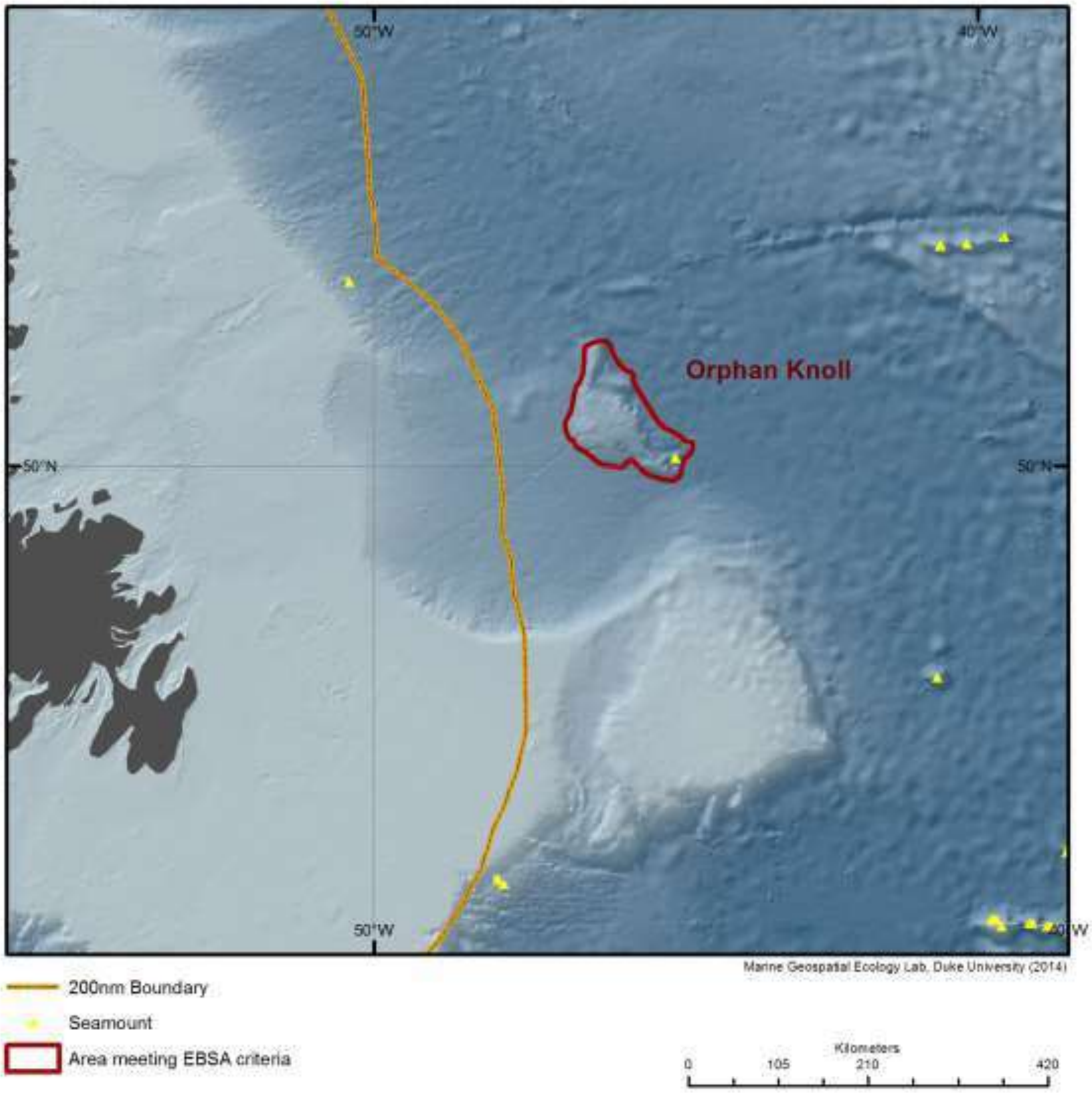
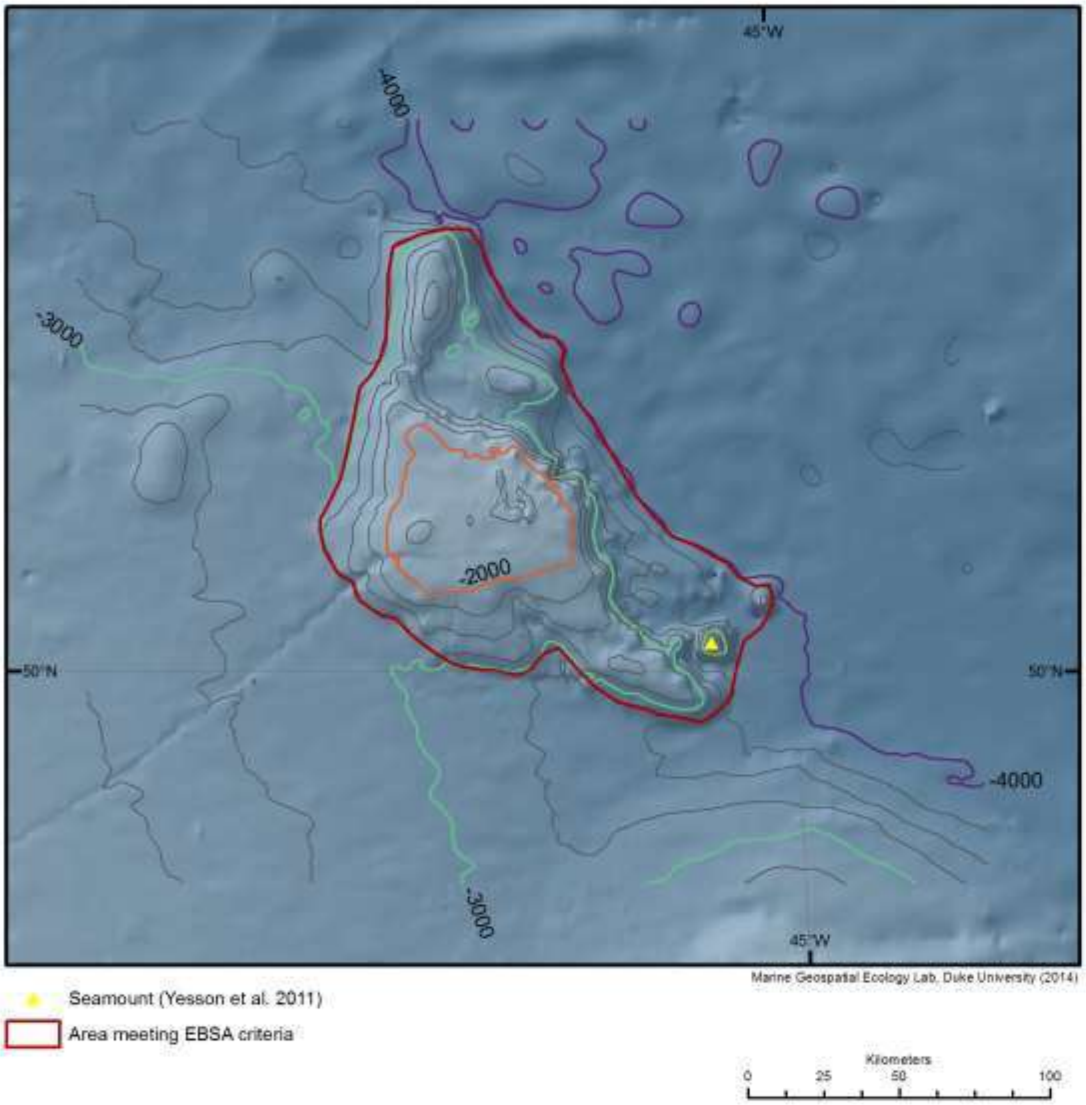


Figure 1. Boundaries of the Orphan Knoll illustrating its position relative to the nearby continental slopes.



Marine Geospatial Ecology Lab, Duke University (2014)

Figure 2. The Orphan Knoll.

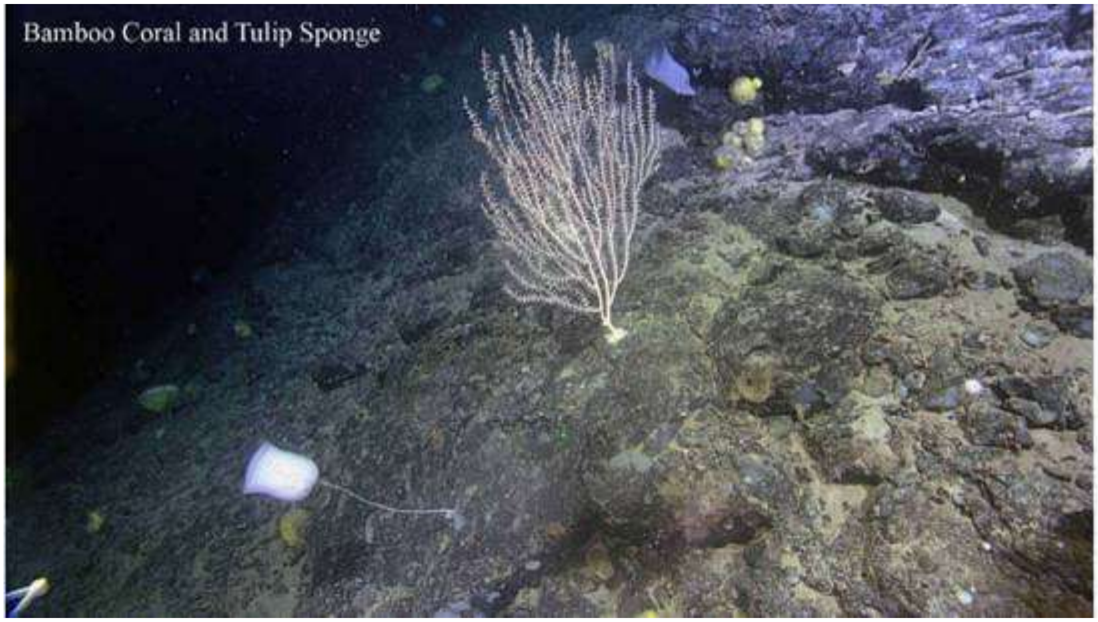


Figure 3. Corals and sponges on the Orphan Knoll (© DFO/ROPOS).

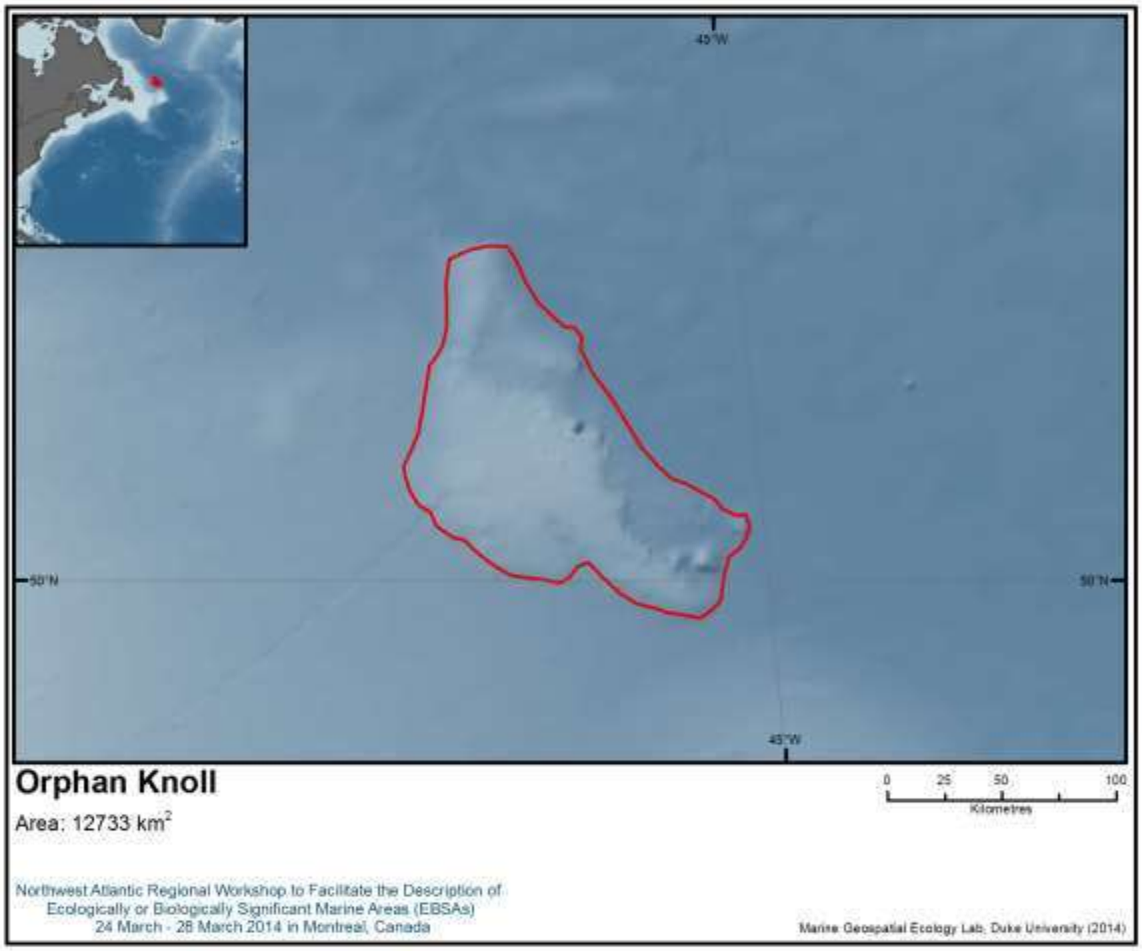
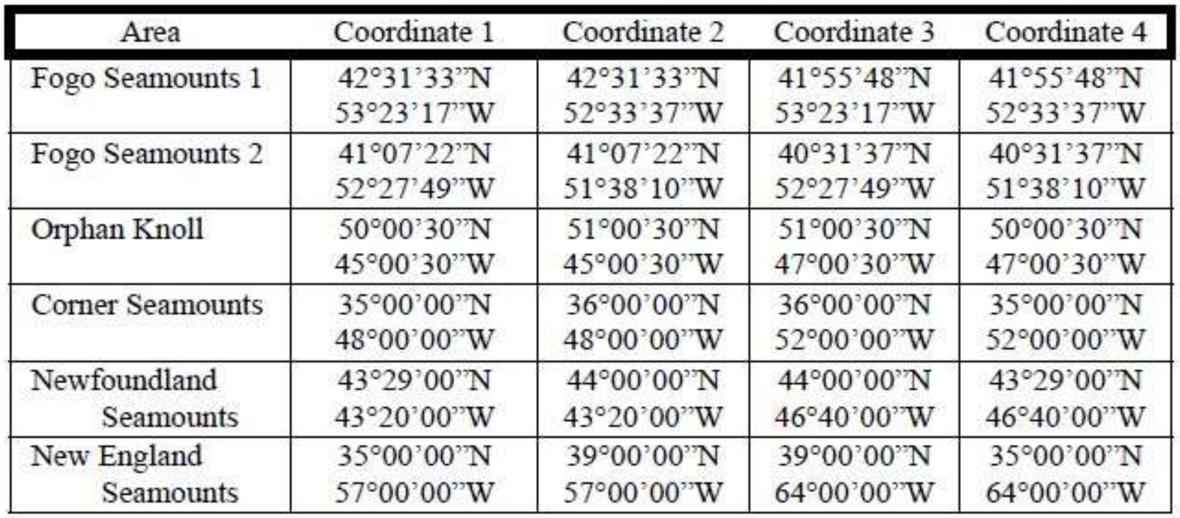


Figure 4. The area meeting the EBSA criteria.

Table 1. NAFO seamount areas protected from bottom fishing in January 2007 and 2008 (NAFO CEM 2009).



Area	Coordinate 1	Coordinate 2	Coordinate 3	Coordinate 4
Fogo Seamounts 1	42°31’33”N 53°23’17”W	42°31’33”N 52°33’37”W	41°55’48”N 53°23’17”W	41°55’48”N 52°33’37”W
Fogo Seamounts 2	41°07’22”N 52°27’49”W	41°07’22”N 51°38’10”W	40°31’37”N 52°27’49”W	40°31’37”N 51°38’10”W
Orphan Knoll	50°00’30”N 45°00’30”W	51°00’30”N 45°00’30”W	51°00’30”N 47°00’30”W	50°00’30”N 47°00’30”W
Corner Seamounts	35°00’00”N 48°00’00”W	36°00’00”N 48°00’00”W	36°00’00”N 52°00’00”W	35°00’00”N 52°00’00”W
Newfoundland Seamounts	43°29’00”N 43°20’00”W	44°00’00”N 43°20’00”W	44°00’00”N 46°40’00”W	43°29’00”N 46°40’00”W
New England Seamounts	35°00’00”N 57°00’00”W	39°00’00”N 57°00’00”W	39°00’00”N 64°00’00”W	35°00’00”N 64°00’00”W

Area No. 4: Slopes of the Flemish Cap and Grand Banks

Abstract

The slopes of the Flemish Cap and Grand Banks of Newfoundland contain most of the aggregations of indicator taxa for vulnerable marine ecosystems identified in international waters of the Northwest Atlantic Fisheries Organization (NAFO) Regulatory Area. This area also includes all the current NAFO closures to protect corals and sponges in their Regulatory Area as well as a component of the Greenland halibut fishery grounds in international waters. It is also the habitat of a number of threatened and listed species. A high biodiversity of marine taxa are found within the boundary of the area described as meeting the EBSA criteria.

Introduction

The Flemish Cap is a plateau with a radius of approximately 200 km at the 500 m isobath, with a depth of less than 150 m at its centre. It is situated east of the Grand Banks of Newfoundland and separated from it by the approximately 1200-m-deep Flemish Pass. The Newfoundland Grand Banks is on the Canadian continental shelf and is almost entirely within the Canadian EEZ. The areas outside the Canadian EEZ are known as the Nose and Tail of the Grand Banks.

The water mass around this area comprises mainly two sources: the Labrador Current Slope water, with temperatures between 3 and 4ºC and salinities between 34 and 35‰, flowing from the north and the North Atlantic Current water, with temperatures >4ºC and salinities >34.8‰, flowing from the south (Colbourne & Foote 2000). At the Flemish Pass, the Labrador Current bifurcates with the major branch flowing southward to the south-eastern slope of the Grand Banks; meanwhile, the side branch circulates clockwise around Flemish Cap (Stein 2007). Around the Tail of the Banks the Labrador Current and the Gulf Stream meet, giving rise to the North Atlantic Current (NAC) and the NAC front (Gil et al. 2004). Most of the area meeting EBSA criteria is influenced by the deep Labrador Current. The 3000-m isobath is often considered the offshore limit of the deep Labrador Current (Cuny et al. 2005).

The Northwest Atlantic Fisheries Organization (NAFO) is in charge of the management and conservation of most of the fishery resources on waters outside the EEZs (Regulatory Area) in the North-West Atlantic Ocean. The area described corresponds to the 3LMNO divisions of the NAFO Regulatory Area (NRA) between 600 and 2500 m depth. This area includes the main Greenland halibut (*Reinhardtius hippoglossoides*) fishing grounds in international waters, with the highest concentration of fishing effort seen along the continental slope on the north-east side of the Flemish Cap and a smaller concentration along the southern end of the Flemish Pass and around the Tail of the Banks (Campanis et al. 2008).

Spanish/EU and Canadian research vessel (RV) bottom-trawl surveys sample most of this area annually, but only down to 1500 m (Durán Muñoz et al. 2007; Healey et al. 2012). The main objective of these surveys is to produce abundance and biomass indices for the main demersal species, and to determine the demographic structure of their populations, although other scientific goals, such as the collection of information on the spatial and bathymetric distribution of megabenthic invertebrate species, are also addressed.

Data from RV bottom-trawl surveys have been used by NAFO to identify and delineate vulnerable marine ecosystems (VMEs) in their Regulatory Area. A kernel density analysis was applied to different VME indicator taxa, complemented with species distribution modeling for under- or un-sampled areas. Physical VME elements that are topographical, hydro-physical or geological features known to support vulnerable species, communities, or habitats have also been identified in the area. The area described includes all the aggregations identified for sponge and coral VME indicator taxa, all of the NAFO closures to protect corals and sponges, as well as the VME indicator elements within the region of the Flemish Cap and Grand Banks slopes and other VME indicative taxa identified, such as crinoids and cerianthids. Because of the specificity of the criteria, a number of small areas were identified by NAFO that together cover most of the slope. The area meeting EBSA criteria, defined by the zone between specific bathymetric contours (600-2500 m) was chosen to best encompass these features.

Species distribution models for sponge grounds and different coral taxa have been recently developed for the area described (Knudby et al. 2013a, Knudby et al. 2013b). The models have a spatial extent of the NRA (Divs. 3LMNO) to 2500 m depth and show prediction surfaces with clearly defined areas of high occurrence probability for all the taxa considered.

Location

The area is delimited by the 600 m and 2500 m bathymetric contours along the 3LMNO NAFO divisions and lies beyond the limit of the Canadian EEZ (figure 1). However, the entire Beothuk Knoll is included, even though its shallower depth is less than 500 m, because it is considered a VME element by NAFO. The part of the Flemish Cap above 600 m was considered but due to the absence of sponge grounds or any aggregation of any VME indicator taxa or VME elements, this part was not included in the area described as meeting the EBSA criteria.

Feature description of the area

Deep-sea sponge grounds and corals are important components of deep-water ecosystems. They increase habitat complexity (Tissot et al. 2006; Buhl-Mortensen et al. 2010), enhancing biodiversity (Bett & Rice 1992; Klitgaard 1995; Buhl-Mortensen & Mortensen 2005; Beazley et al. 2013) and providing feeding and spawning sites (Herrnkind et al. 1997; Freese & Wing 2003; Ryer et al. 2004; Mortensen et al. 2005; Etnoyer & Warrenchuk 2007; Amsler et al. 2009). The structural characteristics, slow growth rates and long-lived nature of these organisms (Hoppe 1988; Leys & Lauzon 1998; Stone & Wing 2001; Risk et al. 2002; Klitgaard & Tendal 2004) make them very vulnerable to perturbations, particularly to the mechanical impacts of bottom fishing activities (Freese 2001; Koslow et al. 2001; Krieger 2001; Hall-Spencer et al. 2002; Wassenberg et al. 2002; Heifetz et al. 2009), and they can take decades or longer to recover (if they do) if they are removed or damaged(Jones 1992; Andrews et al. 2002; Roberts et al. 2006; Althaus et al. 2009; Sherwood & Edinger, 2009). These habitats are qualified as Vulnerable Marine Ecosystems in relation to high seas fisheries, according to criteria developed by FAO (FAO 2009).

Geodia-dominated sponge grounds form a linear band following depth contours on the continental slopes in the NRA. Five areas with significant sponge concentrations have been identified based on RV surveys (Kenchington et al. 2011): a narrow band between 700 and 1470 m depth on the north-east slope of the Grand Banks, between the Nose and the Tail of the Banks; the south-eastern corner of the Beothuk Knoll between 1000 and 1400 m depth; the south-eastern corner of the slope of Flemish Cap between 950 and 1330 m depth; the eastern slope of the Flemish Cap in a band from north to south-east between 1050 and 1350 m depth; and lastly, the north slope of the Flemish Cap and Flemish Pass in one area known as Sackville Spur, between 1250 and 1450 m depth. Results from the use of species distribution models confirm the presence of sponge grounds in the described area and increase the spatial extent to unsampled areas such as south of Flemish Cap and at water depths down to 2500 m (Knudby et al. 2013a).

Sea pen distribution is easily discernable as a horseshoe around Flemish Cap and a narrow band hugging the slope on the south-east edge of the Grand Banks and above the 3O NAFO closure, which extends from Canadian waters to international waters on the southern edge of the Grand Banks (Kenchington et al. 2011). Sea pen fields in the NRA are concentrated in shallower water than the sponge grounds, between 600 and 1200 m depth. Large gorgonian coral aggregations are mainly on the Flemish Pass and on the southern slope of Flemish Cap between 600 and 1400 m depth. Results from species distribution models increase the spatial extent to water depths down to 2500 m with high probability on the south-east of Flemish Cap (Knudby et al. 2013b). Small gorgonian aggregations are recorded on the slope of the Grand Banks between 600 and 1400 m depth.

The area meeting EBSA criteria includes all the sponge grounds and all the deep sea coral aggregations known in the area, as well as other VME indicator species, such as cerianthids and crinoids and the VME elements within the region of the Flemish Cap and Grand Banks slopes as deeper part of the canyons, steep flanks and knolls identified as VMEs by NAFO in the area. Available publications, reports and NAFO Scientific Council Research (SCR) documents have been used to draw the boundaries of the area, together with recent models extended to deeper areas where no data were available (Knudby et al. 2013a, Knudby et al. 2013b).

Slopes make up a small proportion of the North-West Atlantic reference zone but are particularly productive compared to plains and sometimes shelves. A recent RV longline survey has shown that there were high abundances of many species of fish in this area, including the Greenland halibut and the roughhead grenadier (*Macrourus berglax*), as well as the armed grenadier (*Nematonurus armatus*), blue antimora (*Antimora rostrata*), smalleyed rabbitfish (*Hydrolagus affinis*) and black dogfish (*Centroscyllium fabricii*) (Murua and De Cárdenas 2005). Similar slopes have been extensively surveyed within Canada's EEZ and characterized by high productivity and diversity of fish and invertebrates (including many commercial species). Canada identified many EBSAs within its EEZ that encompassed slopes, such as the Northeast Shelf and Slope area (Templeman 2007), the Outer Shelf Nain Bank, Labrador Slope and Orphan Spur (DFO 2013).

The described area represents important habitat for the threatened northern and spotted wolffishes (*Anarhichus denticulatus* and *A. minor)* listed by Canada's Species at Risk Act–SARA), the highest densities of both species in NAFO areas 3LMNO are found on the slopes of the Tail of the Grand Banks and of Flemish Cap (figures 3 and 4) (Simpson et al. 2013). Protection of northern wolffish habitat is one of the measures recommended to reverse the declining trend of this species (Kulka et al. 2008). The area is used by another threatened (SARA listing) species, the northern bottlenose whale (*Hyperoodon ampullatus*) (Lawson and Gosselin 2009). This species has a very specialized diet consisting of *Gonatus* squid (COSEWIC 2011). This squid was the main prey of Greenland halibut (*Reinhardtius hippoglossoides*) in neighbouring waters of similar depth, which suggests that these bathypelagic squid are particularly abundant in this area (Dawe et al. 1998). This is also an area where Cuvier's and Sowerby's beaked whales have been located. Although neither are listed by COSEWIC, beaked whales are considered highly sensitive to seismic exploration (Cox et al. 2006).

Other, not threatened, top predators select the area to feed over other slopes in NAFO areas 3KLMNO, suggesting that the described area offers attractive prey patches. Post-breeding female hooded seal (*Cystophora cristata*) come to the area (Andersen et al. 2013) and their diet in NAFO area 3M contains more *Gonatus* squid than hooded seals feeding elsewhere (Hammill and Stenson 2000). The little auk (*Alle alle*) is a marine bird with a wide breeding distribution in the North Atlantic. Tracking data show that the described area encompasses most of the wintering area defined from tracking data for birds from two out of four breeding colonies that were investigated (Fort et al. 2013). It is also a non-breeding hotspot for Great Skua from colonies in Iceland and Norway (Magnusdottir et al. 2012).

Two types of canyons based in the location of the canyon head have been identified along the slope of the Grand Banks and south of Flemish Cap, namely: (1) shelf indenting canyons whose heads indent the shelf of the Grand Banks and (2) canyons whose heads are at > 400 m water depth and occur on the upper slope (Murillo et al. 2011) Although canyons are generally associated with relatively higher benthic diversity and often higher productivity than adjacent slope areas, the specific canyons in the area meeting EBSA criteria have not been thoroughly sampled so their exact boundaries are not tracked by the boundaries of this area.

Feature condition and future outlook of the area

The area includes all the current NAFO closures to protect corals and sponges and the international fishery grounds for Greenland halibut. The boundaries of the current closures will be reviewed at a later date in 2014 (NAFO 2014).

Some of the areas inside the area described, mainly on rough bottoms, including within canyons, steep flanks and below 1500 m depth, have likely been little fished or affected by any other human activity (NAFO 2008).

NAFO is working on the Significant Adverse Impacts in support of the reassessment of NAFO bottom-fishing activities required in 2016, specifically an assessment of the risk associated with such activities on known and predicted VME species and elements in the NRA.

Oil and gas activities in the Flemish Pass, as well as those on the wider Grand Banks, can pose additional threats to the species found in the described area (C-NLOPB 2014). Oil and gas activities could include disturbance and injury of mammals and seabirds by anthropogenic noise (Cox et al. 2006), oil spills and associated increase in vessel traffic. Exploration and development activities can impact VME indicator taxa when they overlap in the slope areas such as the Flemish Pass.

Assessment of the area against CBD EBSA criteria

CBD EBSA criteria (Annex I to decision IX/20)	**Description** (Annex I to decision IX/20)	**Ranking of criterion relevance** (please mark one column with an X)			
		No information	**Low**	**Medium**	**High**
Uniqueness or rarity	Area contains either i) unique "the only one of its kind"), rare occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				X
Explanation for ranking This is the only known area in international waters of the North-West Atlantic where sponge grounds and sea pen concentrations have been identified (Knudby et al. 2013a, Knudby et al. 2013b). A sponge new to science has been recently described from the slope of Flemish Cap and Flemish Pass (Murillo *et al.* 2013) This species may be restricted to the described area, although a firm conclusion cannot be drawn until more extensive sampling is undertaken.					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.			**X**	
Explanation for ranking Areas with high coral and sponge density are known to provide shelter and places for feeding and reproduction for other invertebrates and fish (Herrnkind et al. 1997; Freese and Wing 2003; Ryer et al. 2004; Mortensen et al., 2005; Etnoyer and Warrenchuk, 2007; Amsler et al. 2009).					
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.				**X**
Explanation for ranking The described area is used by the northern bottlenose whale (Lawson & Gosselin 2009), which is listed as endangered by Canada's Species at Risk Act SARA). The northern and spotted wolffish (*Anarhichas denticulatus* and *A. minor*), both found in the area, are two species that are threatened in the North-West Atlantic (Kulka et al. 2008). Protection of their habitat is					

one of the measures recommended to reverse their declining trend (Kulka et al. 2008). Deep-sea sponge aggregations, sea pen communities and coral gardens are included on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR 2008).					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				**X**
Explanation for ranking Deep-sea corals and large sponges are very vulnerable to perturbations, particularly to the mechanical impacts of bottom fishing activities when their range overlaps with trawl grounds. These species can take decades or centuries to recover if they are removed (Jones 1992; Andrews et al. 2002; Roberts et al. 2006; Althaus et al. 2009; Sherwood & Edinger 2009).					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.			X	
Explanation for ranking Slopes make up a small proportion of the North-West Atlantic reference zone but are particularly productive compared to shelves and plains. Neighbouring continental slopes off Newfoundland and Labrador were found to be highly productive and led Canada to identify several EBSAs encompassing these slopes within its EEZ (Templeman 2007; DFO 2013). Many fish species are abundant within the area meeting EBSA criteria, which attracts many top predators, such as whales, pinnipeds, seabirds (Lawson and Gosselin 2009; Fort et al. 2013; Magnusdottir et al. 2012; Andersen et al. 2013).					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				**X**
Explanation for ranking The structural habitat created by sponge grounds and deep sea corals is known to increase the number and complexity of microhabitats, enhancing biodiversity (Bett and Rice 1992; Klitgaard 1995; Buhl-Mortensen and Mortensen, 2005; Beazley et al. 2013). The described area is diverse and productive compared with the abyssal plains surrounding it, but not more so than the neighbouring Grand Banks.					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			**X**	
Explanation for ranking Some of the areas, mainly on rough bottoms, including within canyons and below 1500 m depth, have likely been little fished or affected by any other human activity (NAFO 2008).					

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Maps and Figures

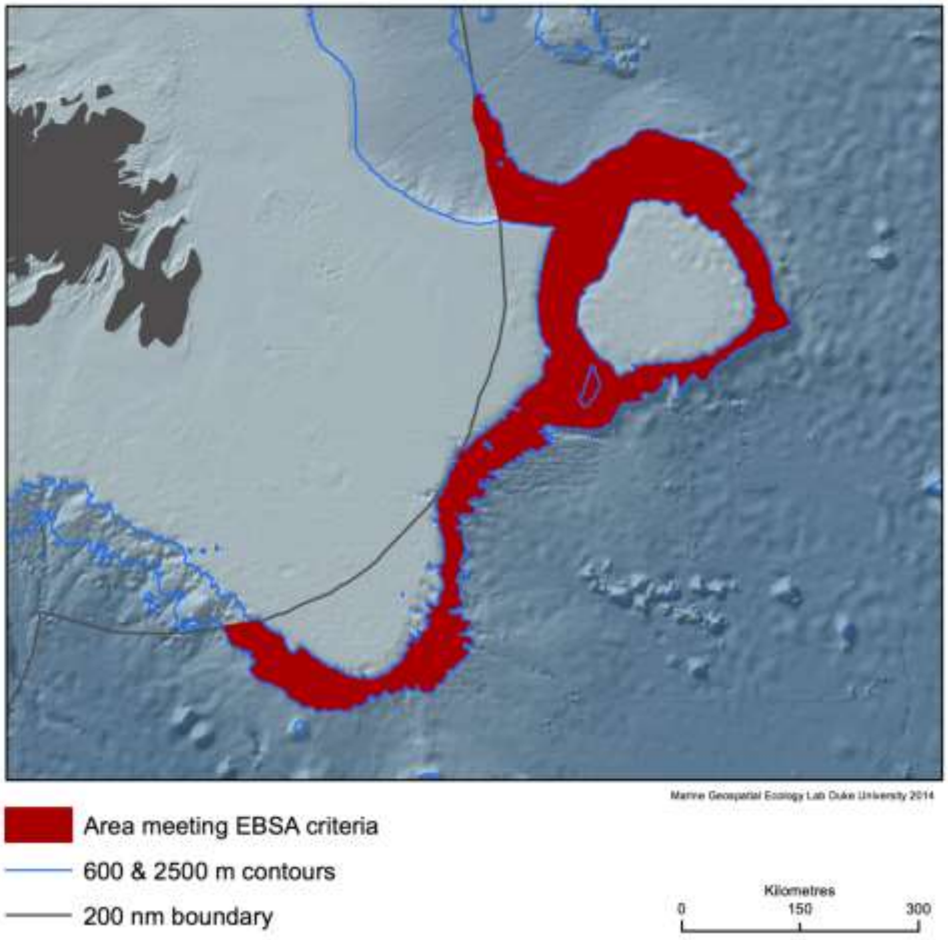

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Figure 1. The Flemish Cap and Grand Banks Slope. Area is bounded by the 600 – 2500 m contours, which contain the representative features contained within the VME elements assessed (please see figure 2).

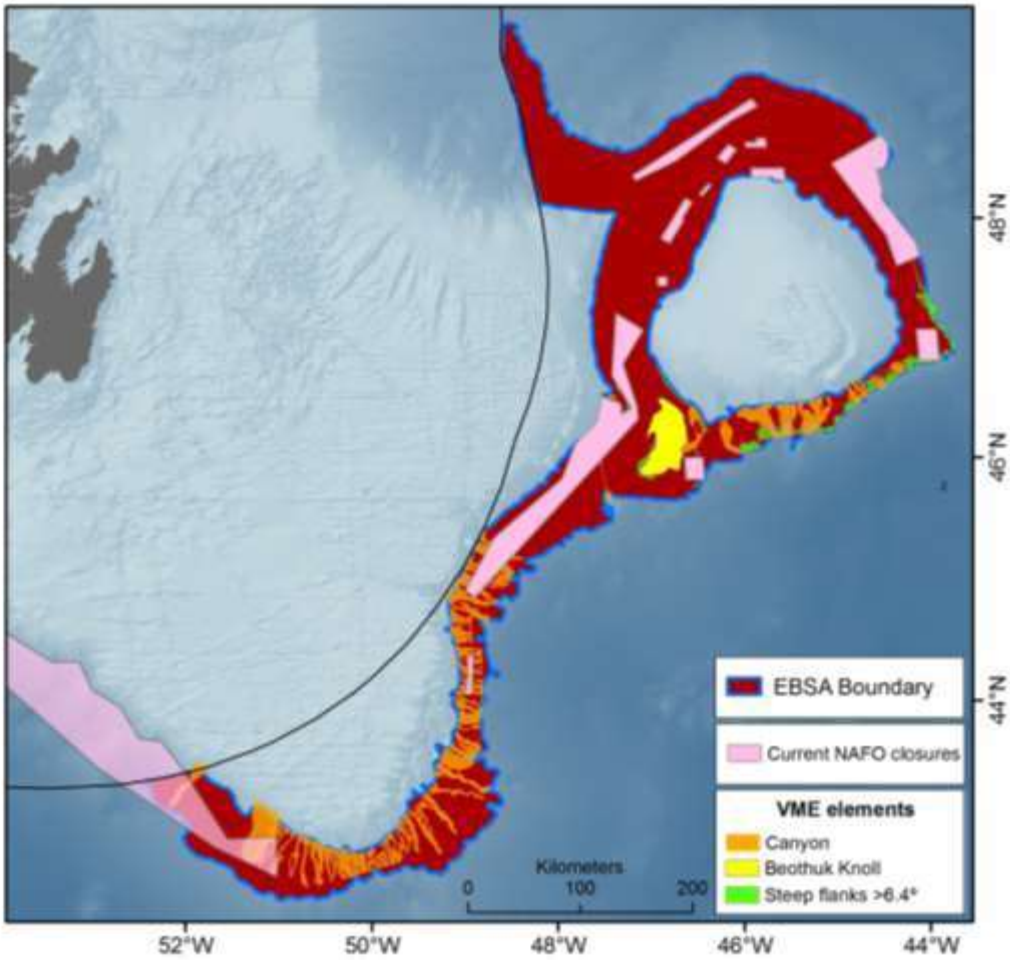

Figure 2. Boundary of the area meeting EBSA criteria overlaid to all current NAFO closures to protect corals and sponges, together with the NAFO VME elements within the region of the Flemish Cap and Grand Banks slopes.

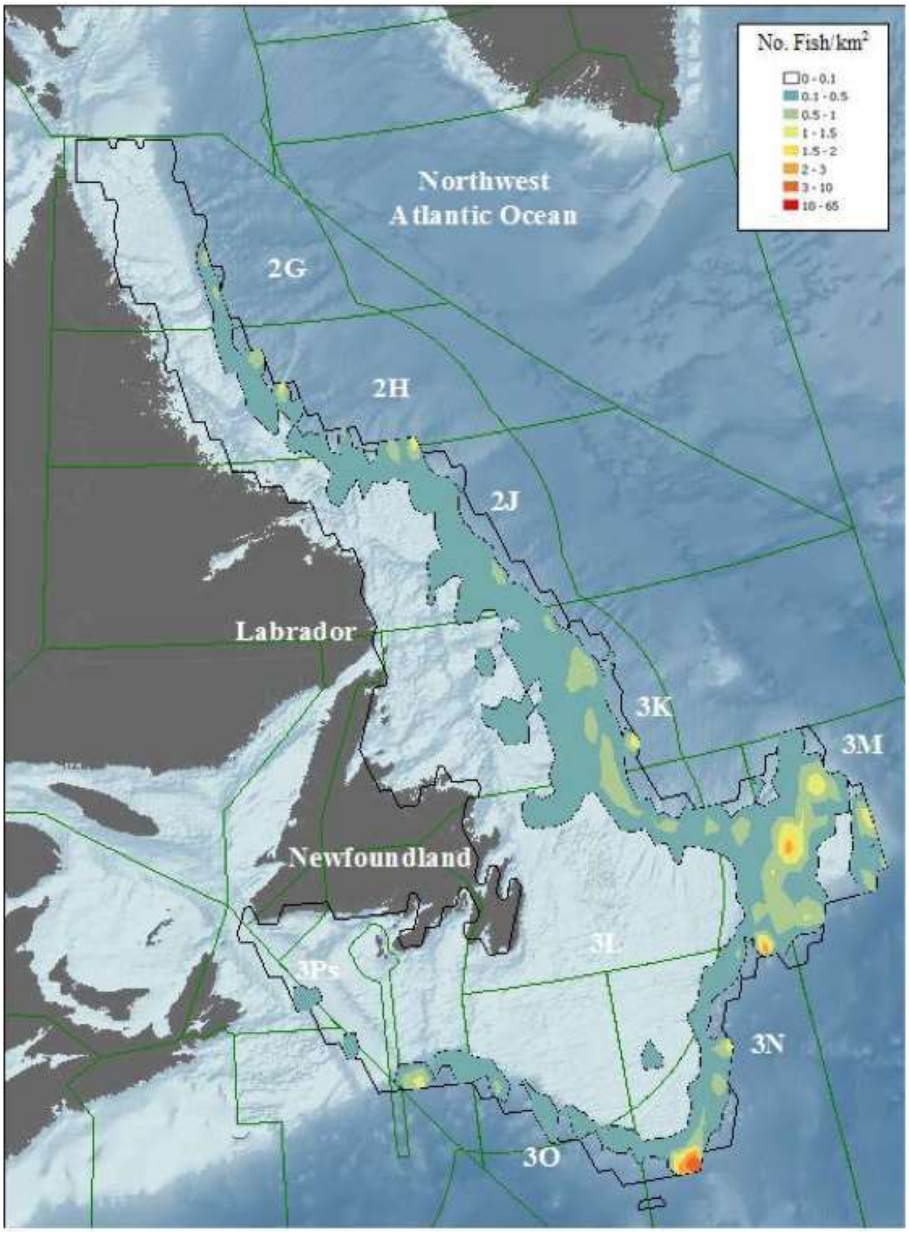

Figure 3. Kernel density surface map of northern wolffish during the spring and fall RV bottom-trawl surveys (1995-2012) (from Simpson et al. 2013).

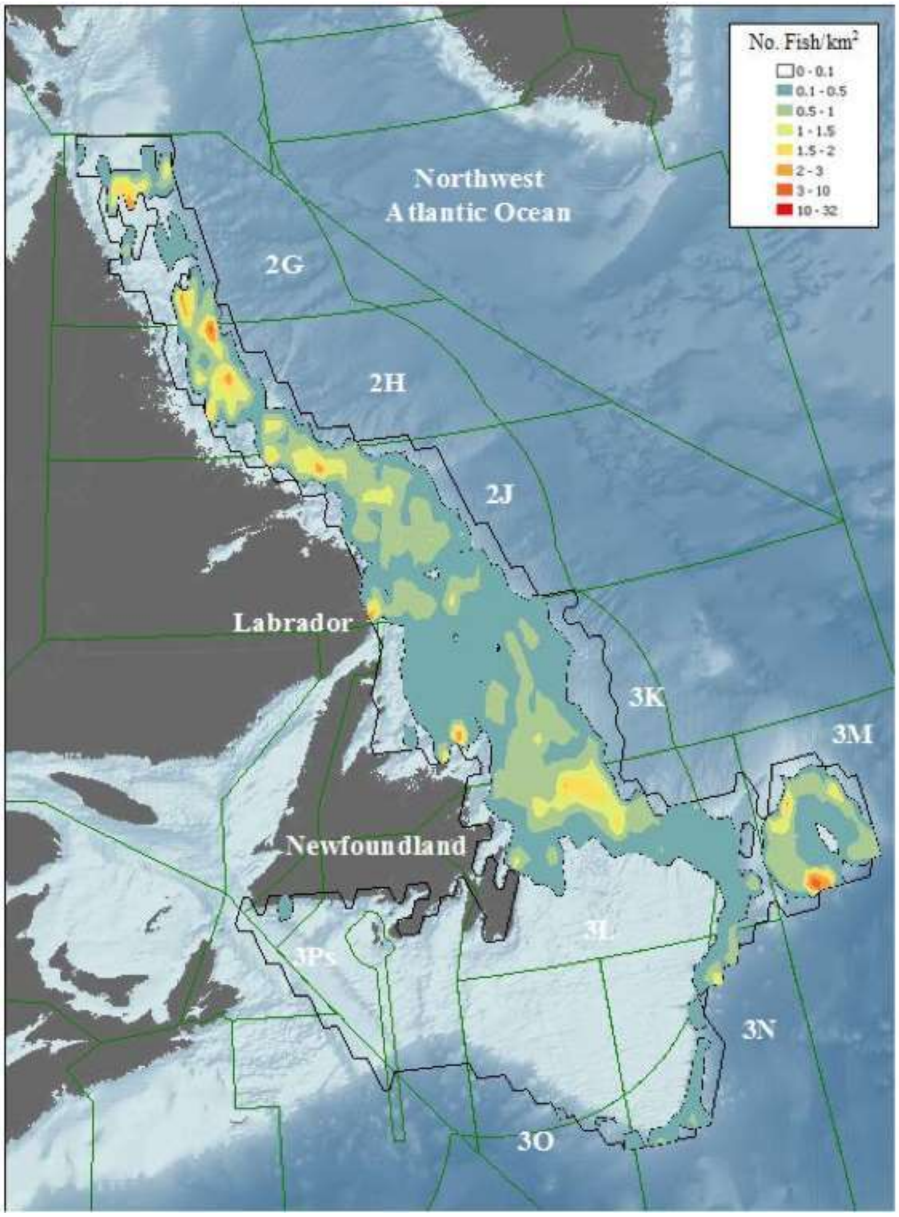

Figure 4. Kernel density surface map of spotted wolffish during the spring and fall RV bottom-trawl surveys (1995-2012) (from Simpson et al. 2013).

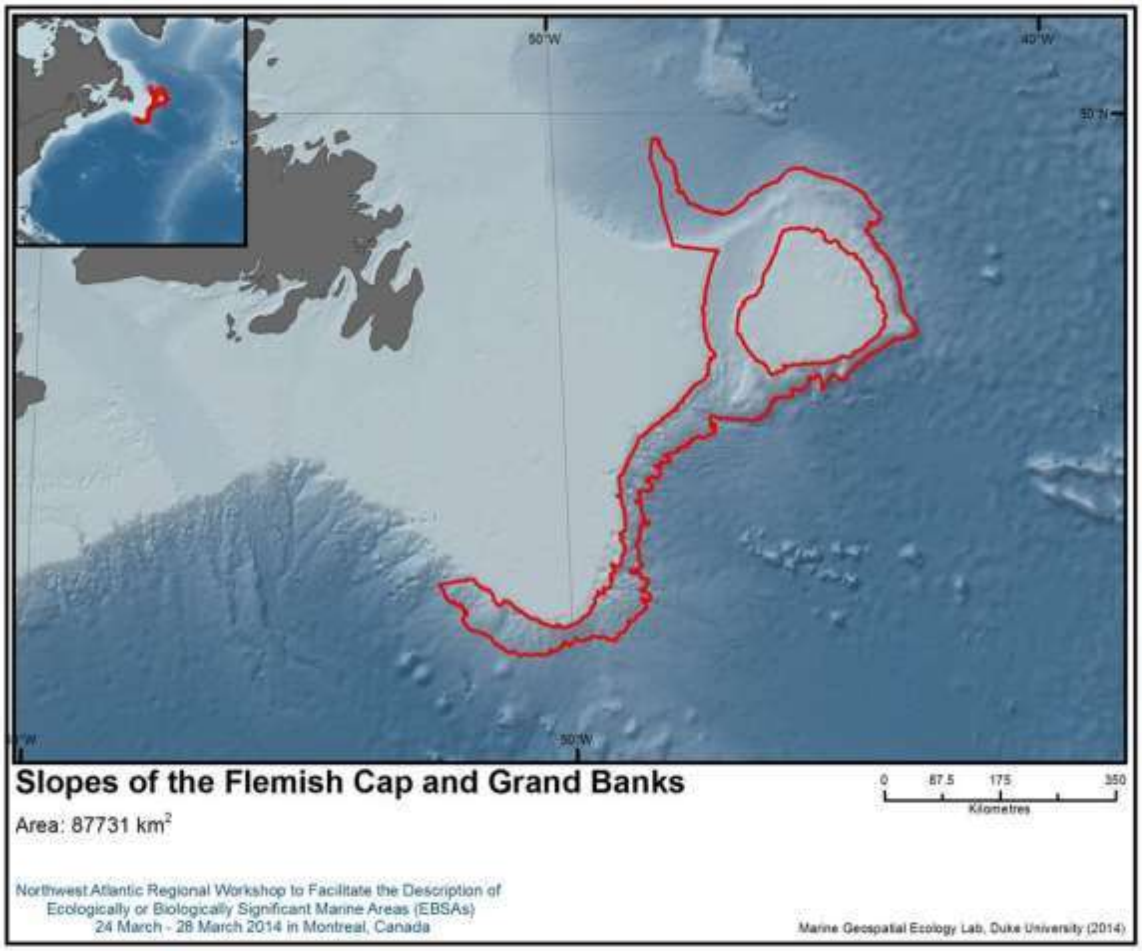

Figure 5. Area meeting the EBSA criteria.

Area No. 5: Southeast Shoal and Adjacent Areas on the Tail of the Grand Banks

Abstract

The Southeast Shoal and adjacent areas referred to as the "Tail of the Grand Banks") is a highly productive ecosystem that has sustained a dynamic web of marine life for centuries. The Southeast Shoal is an ancient beach relic that provides a shallow, relatively warm, sandy habitat with a unique offshore capelin-spawning ground. The area also supports a nursery ground for yellowtail flounder, as well spawning areas for depleted American plaice, depleted Atlantic cod and striped wolffish (listed as a species of special concern by Canada's federal Species at Risk Act – SARA). Unique populations of blue mussels and wedge clams are also found here. Due to the presence of abundant forage fish, the "Tail" is an important feeding area for a number of cetaceans, including humpback and fin whales, and is frequented by large numbers of seabirds, including species that travel over 15,000 km from breeding sites in the South Atlantic to feed in the area during the non-breeding season.

Introduction

The Southeast Shoal and adjacent area on the Tail of the Grand Banks constitute a highly productive ecosystem that has sustained a dynamic web of marine life for centuries. The area (east of 51^{o} W and south of 45^{o}N) has been identified as an EBSA by Fisheries and Oceans Canada (DFO) (Templeman, 2007), extending to the edge of the Grand Banks of Newfoundland, Canada. The area extends from the 200 nm EEZ in the area of the southern Grand Banks to the 100 m contour of the shelf.

The area is defined by several distinct physical and geographical characteristics. The most significant is the Southeast Shoal, an ancient beach relic that provides a unique shallow (< 90 m) offshore sandy plateau. Bottom water temperatures on the shoal are amongst the warmest on the Grand Banks of Newfoundland (Loder, 1991; Fuller and Myers 2004; Templeman, 2007). Many species of mollusks, fish, birds and marine mammals congregate in this area to spawn and/or feed. The Southeast Shoal provides a unique offshore spawning area for capelin (Fuller and Myers, 2004). Northern sand lance are also abundant on the Southeast Shoal (Mowbray, pers. com). Abundant forage fish, such as capelin and sand lance, are important prey for a large variety of predators, including cod, seals, whales and seabirds (Lavigne, 1996).

The area described is also known for being the only nursery habitat for yellowtail flounder in the region, as well as historical nursery ground for American plaice (Walsh et al., 2004). Nursery areas for flatfish are known to play a crucial role in determining population size (Walsh et al., 2004).

A number of species of whales occur on the Grand Banks with regular frequency and are most commonly observed during summer months when prey species are most abundant. These include baleen whales, such as the humpback whale, blue whale, fin whale, sei whale and the minke whale (Templeman & Davis, 2006, Lawson and Gosselin 2009). Odontocetes, such as harbor porpoise, Atlantic white-sided dolphins, long-finned pilot whales and beaked whales, are also present with regular frequency. Most whales are reported during the summer but this is likely due to the lack of sighting effort during other seasons in this area (Templeman & Davis, 2006; Stenson et al., 2011).

The Tail of the Grand Banks also provides critical habitat for a large number of seabirds (Barrett et al., 2006). Globally significant concentrations of thick-billed murres, common murres and dovekies overwinter here, while southern hemisphere shearwaters and storm-petrels enter the area during the summer (Brown, 1986; Barrett et al., 2006; Hedd et al., 2011; Montevecchi et al., 2012; McFarlane Tranquilla et al., 2013; Fort et al., 2013). This is also an important feeding area for local breeding populations, including both the world's largest colony of each's storm-petrels and the largest common murre colony in North America (Sklepkovych & Montevecchi, 1989; Chardine et al., 2003). Black-legged kittiwakes, puffins and gannets all feed in this area during part of the year (Montevecchi et al., 2011; Frederikson et al., 2012). The influx of migratory shearwater species, which travel over 15,000 km from breeding sites in the South Atlantic to feed in the area during summer, and the winter occupancy of

Arctic-breeding auks make the site one of the most important in the North Atlantic for seabirds. The site is recognized as an Important Bird Area by BirdLife International.

Location

The area is located at the southern portion of the Grand Banks, south-east of Newfoundland. The area extends from the 200nm (Canadian EEZ) to the 100 m contour. This area is contiguous with an area within the Canadian EEZ that was identified as an EBSA (Templeman, 2007) in the Canadian EBSA process (paragraph 16, item 3 of this report). Please see figure 1 for a map of the area described.

Feature description of the area

The Wisconsin glaciation and corresponding sea level variations played a fundamental role in the geology of the Grand Banks, including the Southeast Shoal and surrounding area (Shaw, 2006). Slatt (1977) has noted that the Grand Banks were above sea level 18,000 years ago. Shaw (2006) affirms that the Southest Shoal was an offshore island for a period of time as it was the last area to become submerged after transgression. Fuller and Myers (2004) noted the two bivalve species – wedge clam and blue mussel – along with the spawning grounds for capelin, constitute evidence of relict populations of past beach habitat (Hutcheson and Stewart, 1994).

The southern Grand Banks, the Southeast Shoal in particular, has been identified as an area of high whale concentration (Whitehead & Glass, 1985b). The presence of whales can be attributed to an abundance of prey, particularly capelin, which has been recognized as an important food source. However, given that the capelin stock in the 3NO region has been substantially lower in recent decades (Buren et al., 2014), feeding may have shifted toward sand lance and their larvae. Sightings of cetaceans have been recorded throughout the year with highest abundance during late summer (Templeman & Davis, 2006). Many species of marine mammals appear seasonally on the southern Grand Banks. Blue whales, sperm whales, humpbacks, fin whales, minke whales, killer whale, harbor porpoises, bottlenose dolphin, white-beaked dolphins and short beaked common dolphins have all been sighted in the area (Coughlan, 2002).

Humpback whales are common on the Southeast Shoal during June and July and are known to feed on the spawning capelin stock present (Fuller & Myers, 2004). This population of whales is considered to be a discrete segment of the Newfoundland-Labrador feeding stock due to its summer feeding grounds on the Southeast Shoal and winter feeding/breeding areas in the West Indies, particularly in the waters off Puerto Rico (Whitehead & Glass, 1985b). It has been estimated that 900 humpbacks visit the Southeast Shoal, or roughly 15-30% of the North-West Atlantic population once estimated at 3000-6000 animals. More recent estimates consider the population total to be closer to 10,500 (Fuller & Myers, 2004). Large numbers in the Southeast Shoal area indicate that the area is a significantly important habitat area for this population (Fuller & Myers, 2004).

Recent tracking and pelagic surveys confirm the southern Grand Banks region as important habitat for wintering auks (including common and thick-billed murres and dovekies; Brown, 1986; Hedd et al., 2011; Fort et al., 2013; McFarlane Tranquilla et al., 2013) and black-legged kittiwakes (Frederikson et al., 2012). Populations of common murres from Funk Island the species' largest breeding site in North America), Gull Island and the Gannet Islands winter locally in offshore regions of the northern and southern Grand Banks. Some populations of Arctic-breeding thick-billed murres, including colonies from the Minarets (Baffin Island) and the Gannet Islands, Labrador also utilize the southern Grand Banks in winter (Montevecchi et al., 2012; McFarlane Tranquilla et al., 2013). A recent study tracking black-legged kittiwakes from colonies in both the North-East and North-West Atlantic identified the Grand Banks as an important wintering area (Frederikson et al., 2012). Pelagic surveys confirm the importance of the region for murres (Hedd et al., 2011), dovekies and kittiwakes (Brown 1986; Environment Canada, unpublished data).

Migrant *Puffinus* shearwaters from the southern hemisphere are the primary avian consumers of fish within the Grand Banks ecosystem in summer (Hedd et al., 2012). Great shearwater tracked from Tristan da Cunha in the South Atlantic travel 15000 km to spend the non-breeding season feeding in the Bay of

Fundy and over the Grand Banks (Ronconi et al. 2010). Sooty shearwaters from the South Atlantic tracked with geolocators also spend the non-breeding season in the northern hemisphere, travelling northwards 15,000 km to move into shallow, warm continental shelf waters of the eastern Canadian Grand Banks in mid-June and reside there until moving south again in late August to mid-September (Hedd et al., 2012; figure 5).

In addition, the area adjacent to the Southeast Shoal also contains benthic communities, which include significant concentrations of VME indicator species (i.e., bryozoans and sea squirts) (NAFO SC 2013). Erect bryozoans form ramified structures that can be ecologically important in providing substrata for epizoans and hiding places for motile organisms, such as ophiuroids and small fish (NAFO SCS doc 11/22). Two species of large sea squirt were identified on the Tail of the Grand Banks, in the adjacent area to the Southeast Shoal (NAFO SCS 11/22; NAFO SC 2013). Some species of sea squirts (*Boltenia ovifera*) are known to support invertebrate fauna attached to the stems and holdfasts (NAFO SCS doc. 11/22). More detailed descriptions of the ecological functions of these VME indicator taxa is found at Murillo et al. (2011).

Feature condition and future outlook of the area

There has been some improvement in the abundance of fish in the area but many populations remain at low levels (NAFO, 2013).

All cetaceans and seabirds are long-lived (measurable in decades) and slow reproducing, making them susceptible to negative impacts from marine threats. Possible threats to cetaceans in the region are ship traffic, fishing gear entanglement, and seismic surveys (Fuller & Myers, 2004; Fisheries and Oceans Canada, 2005). For seabirds, accidental by-catch in gillnet, longline and trawl fisheries is a risk for several species (Piatt et al., 1984; Benjamins et al., 2008; Ellis et al., 2013). Mortality caused by pollution from chronic and episodic oil spills and collisions with lights and flares on offshore vessels and platforms is also a very real risk (Montevecchi, 2007; Ellis et al., 2013). The area is heavily fished and as such could be a threat to the fish populations present. The Southeast Shoal has been listed as a vulnerable marine ecosystem (VME) by the Northwest Atlantic Fisheries Organization (NAFO, FC 14/1).

There are several bottom trawl surveys conducted in the area each year by Canadian and Spanish research vessels. In addition there is a Canadian oceanographic research survey in the area each year. Data on the presence and abundance of cetaceans are collected using acoustic recorders and sighting surveys.

Assessment of the area against CBD EBSA criteria

CBD EBSA criteria (Annex I to decision IX/20)	**Description** (Annex I to decision IX/20)	**Ranking of criterion relevance** (please mark one column with an X)			
		No information	**Low**	**Medium**	**High**
Uniqueness or rarity	Area contains either i) unique “the only one of its kind”), rare occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				**X**

Explanation for ranking

The Southeast Shoal is unique in that it is the only shallow sandy offshore shoal on the Grand Banks (Fuller and Myers 2004; Templeman 2007).

The Southeast Shoal has amongst the warmest bottom water temperatures on the Grand Banks (Loder, 1991, Fuller and Myers 2004, Templeman, 2007).

The Southeast Shoal is the only known offshore spawning site for Capelin (Fuller and Myers 2004;

<table>
<tr><td colspan="6">Templeman, 2007).
The Southeast Shoal was the last part of the Grand Banks to be deglaciated (Shaw 2006). As a result, relict populations of blue mussel, wedge clam and capelin associated with beach habitats from the last glacial advance remain in the area. The two bivalve species are typically found in inshore areas, and capelin normally spawn on beaches so all of these populations are unique (Fuller and Myers 2004; Templeman 2007).</td></tr>
<tr><td>Special importance for life-history stages of species</td><td>Areas that are required for a population to survive and thrive.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Offshore spawning capelin may be a genetically separate population and therefore the Southeast Shoal could be considered an exclusive spawning area that is vital to the fitness of the population (Templeman 2007)
The Southeast Shoal contains foraging habitat for a large variety of cetaceans, including humpbacks (~15-30% of the Northwest Atlantic Population), which winter in the West Indies in the waters off Puerto Rico.
Critical feeding grounds for seabirds breeding on Newfoundland colonies. Key stop off point for common murre chicks departing the colony. Primary North Atlantic feeding area for sooty and great shearwater during the nonbreeding season, when birds travel 15,000 km from the South Atlantic groups. Primary wintering areas for auks from the Arctic and Newfoundland and Labrador regions.
The Southeast Shoal and the adjacent area provides nursery habitat for yellowtail flounder, American plaice (Walsh et al., 2004) and Atlantic cod (Templeman 2007).
The Southeast Shoal contains the highest benthic biomass on the Grand Banks (Walsh et al. 2001, Templeman 2007).</td></tr>
<tr><td>Importance for threatened, endangered or declining species and/or habitats</td><td>Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Sooty shearwater is listed as Near Threatened on the IUCN Red List.
Considered to be a habitat for species of baleen whales, such as fin whales, whose global status is assessed as Endangered on the IUCN Red List, as well as classified as special concern under the Canadian Species at Risk Act (SARA, 2003)SARA (.
Habitat for striped wolffish (status: special concern under the Canadian Species at Risk Act (SARA, 2003)).
In addition, the area is a nursery ground for American plaice (Walsh et al., 2004), which has been assessed by COSEWIC as meeting the threatened status (COSEWIC 2009). This is also consistent with NAFO's assessment that the stock is below the reference points and is under NAFO moratorium since 1994.</td></tr>
<tr><td>Vulnerability, fragility, sensitivity, or</td><td>Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to</td><td></td><td></td><td>X</td><td></td></tr>
</table>

slow recovery	degradation or depletion by human activity or by natural events) or with slow recovery.				
Explanation for ranking A naturally dynamic environment, with open access to larger oceanic areas. Cetaceans, particularly large whales, such as blue and humpback whales, and seabirds are long-lived and slow to reproduce. As a shallow shoal, the sandy bottom habitat that dominates the area is subject to regular physical disturbance by wave action from storms. So, the habitat itself is naturally dynamic and less sensitive to disturbance. However, the ecosystem and many of its components have been severely altered by fishing, which has altered community and ecosystem structure. For example, haddock and Atlantic cod were once abundant in this area, but both species have been severely depleted by fishing and are therefore are not fulfilling the same role in the ecosystem as they did in the past (Templeman 2007). A significant concentration of bryozoans (VME indicator species) is found on the Tail of the Grand Banks outside the Southeast Shoal feature, while a significant concentration of sea squirts (VME indicator species) is found on the shoal (NAFO SC 2013). The relict concentration of blue mussels found on the shoal is also vulnerable to bottom-fishing activities.					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.				x
Explanation for ranking There is a large spring phytoplankton bloom on the southern Grand Banks, followed by summer blooms in zooplankton, both of which provide food for other species and the basis for a diverse ecosystem. Due to the presence of the shallow sandy habitat present on the shoal of the bank, a system of high productivity supporting many trophic levels supports a high degree of biological productivity, including fish, seabirds and mammals.					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X
Explanation for ranking The area has a high diversity of species, from phytoplankton to commercially important fish (e.g., capelin, sand lance, cod, yellowtail founder, American plaice, skate) (Templeman 2007, Walsh 2004), to cetaceans (e.g., humpback, blue, fin, sei and minke whales, as well as long-finned pilot whales and beaked whales, harbor porpoise, Atlantic white-sided dolphins (Templeman and Davis 2006; Lawson and Gosselin 2009; Stenson et al. 2011) and seabirds (Hedd et al. 2012), as well as benthic species such as sea squirts and bryozoans (NAFO SC 2013). Several species and populations warrant special consideration due to their current status in relation to past abundance or as unique populations.					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.		X		
Fishing has been extensive in this area, and the benthic species in the areas adjacent to the Southeast Shoal are vulnerable to bottom fishing.					

Sharing experiences and information applying other criteria (Optional)

Other Criteria	**Description**	**Ranking of criterion relevance** (please mark one column with an X)			
		Don't Know	**Low**	**Medium**	**High**
Add relevant criteria	BirdLife International Important Bird Areas				X

Explanation for ranking

The site qualifies as an IBA for a number of the breeding and wintering species.

The Southeast Shoal has been described as a VME indicator element by NAFO based on the capelin spawning ground (NAFO Conservation and Enforcement Measures 2014). Significant concentrations of VME indicator species (i.e., bryozoans and sea squirts) are also found in the area (NAFO SC 2013).

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Maps and Figures

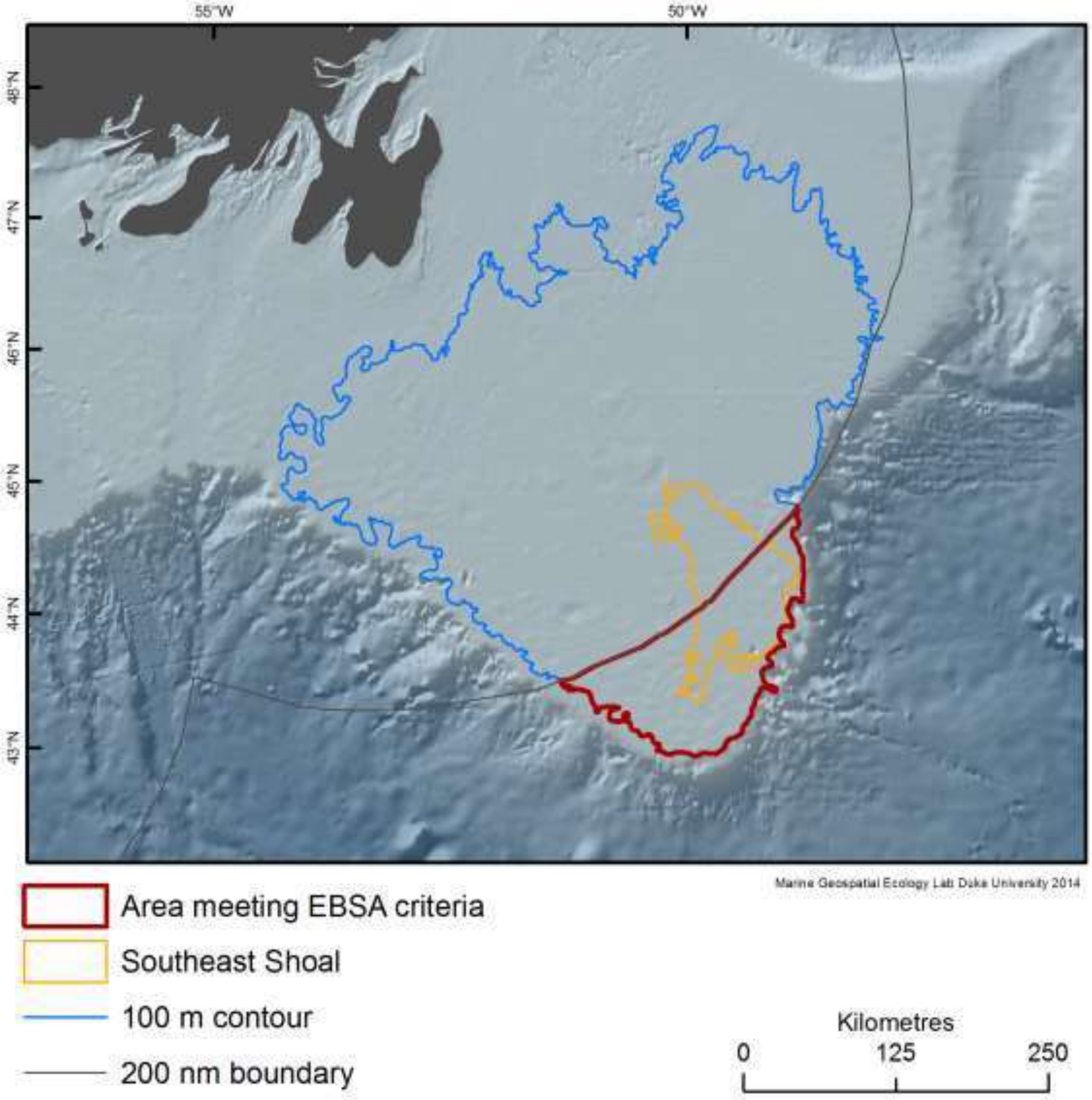

Figure 1. Location of the Southeast Shoal and Adjacent Areas of the Tail of the Grand Banks.

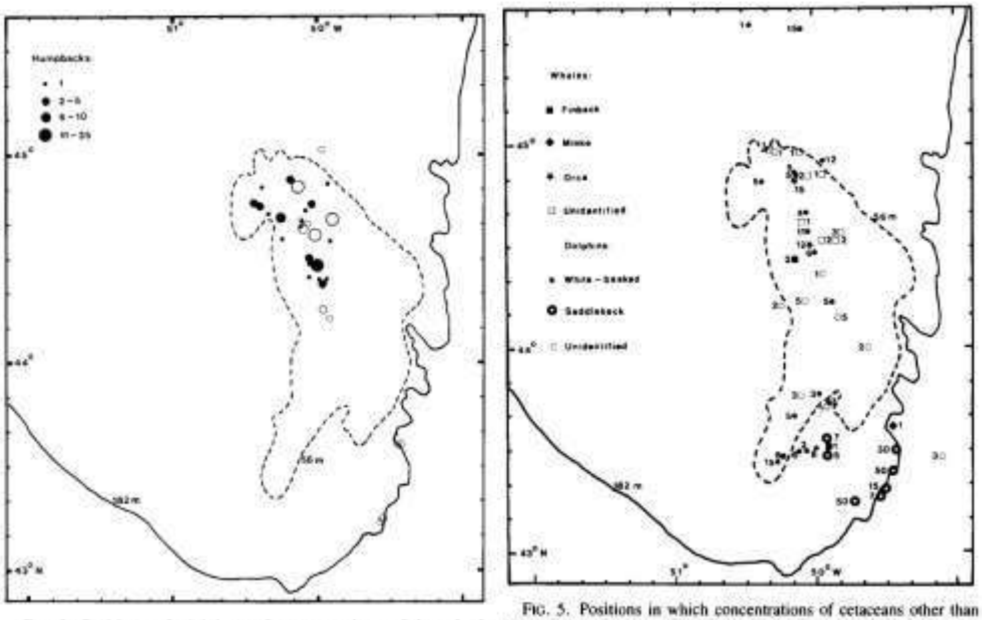

FIG. 3. Positions of sightings of concentrations of humpback whales on the Southeast Shoal while not on transect in 1982 (●) and 1983 (○).

FIG. 5. Positions in which concentrations of cetaceans other than humpback whales were sighted on the Southeast Shoal while not on transect in 1982 and 1983. The numbers of animals sighted in each concentration is given beside each symbol.

Figure 2. Sighting positions of humpback (left) and other cetaceans (right) on the Southeast Shoal of the Grand Banks (reproduced from Whitehead & Glass, 1985a).

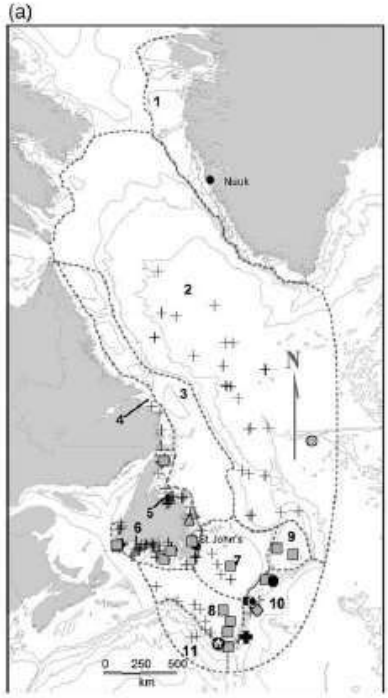

Figure 3. Spring (April – June) locations of sets and catches of marine mammals during DFO experimental salmon fishery operations. The 200, 1000, 2000, 3000, 4000, 5000, 6000, 7000, and 8000-m isobaths are indicated. Some sets involved multiple animals or 1 species (Stenson et al., 2011).

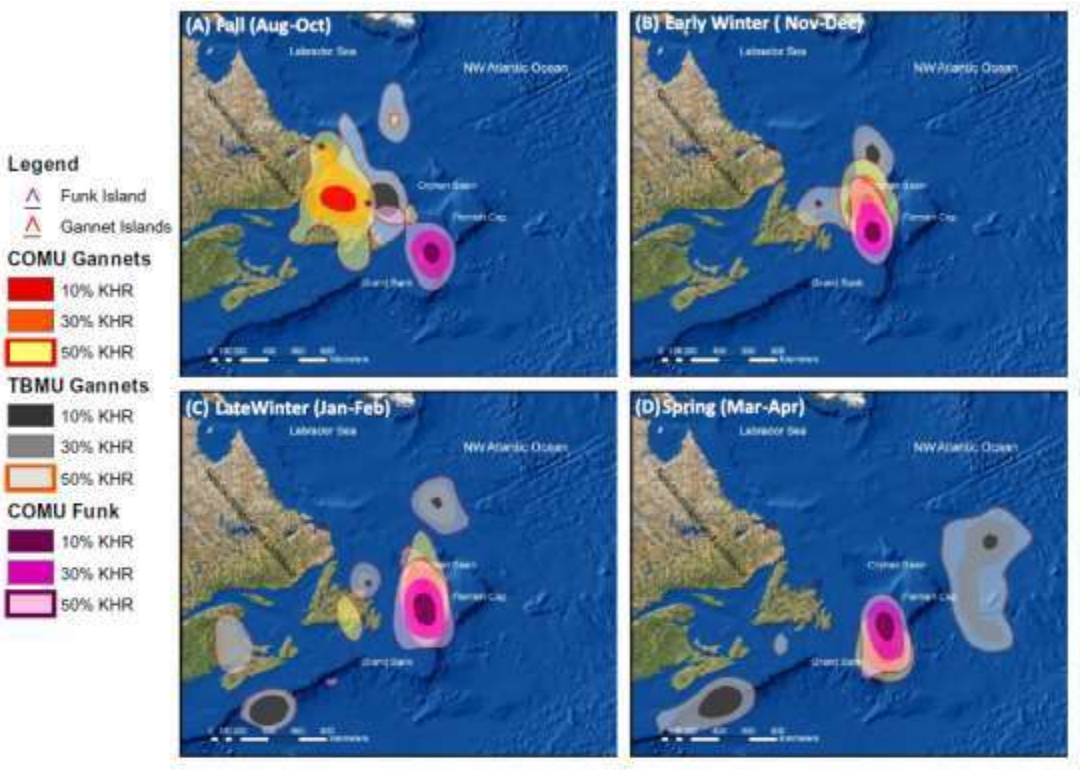

Figure 4. Seasonal distribution of common murres (COMU) and thick-billed (TBMU) murres obtained from tracking birds from the Gannet Islands (both species), Labrador and Funk Island, Newfoundland (Montevecchi et al., 2012).

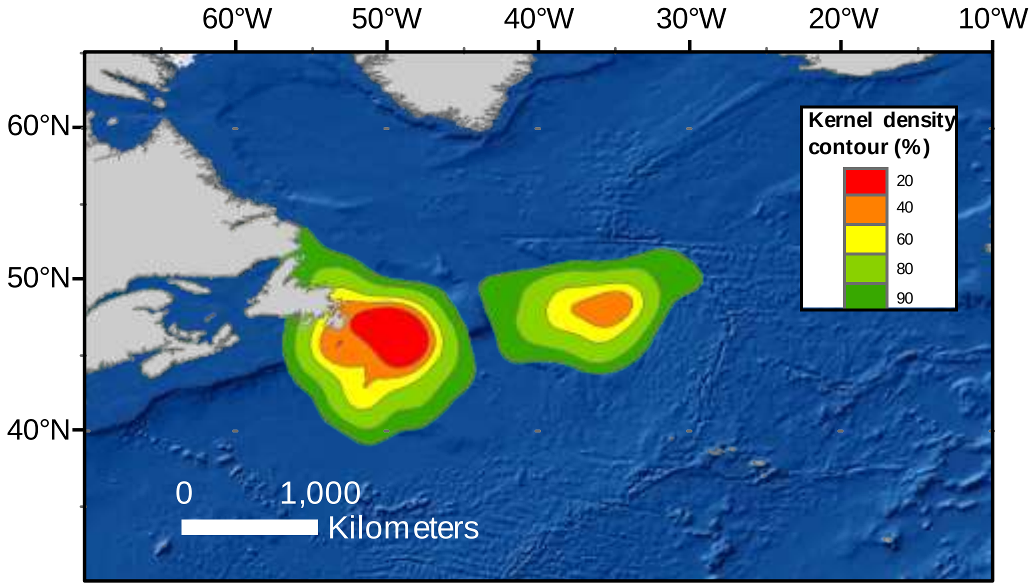

Figure 5. Nonbreeding distribution of sooty shearwaters from South Atlantic populations during their non-breeding period (Hedd et al., 2012).

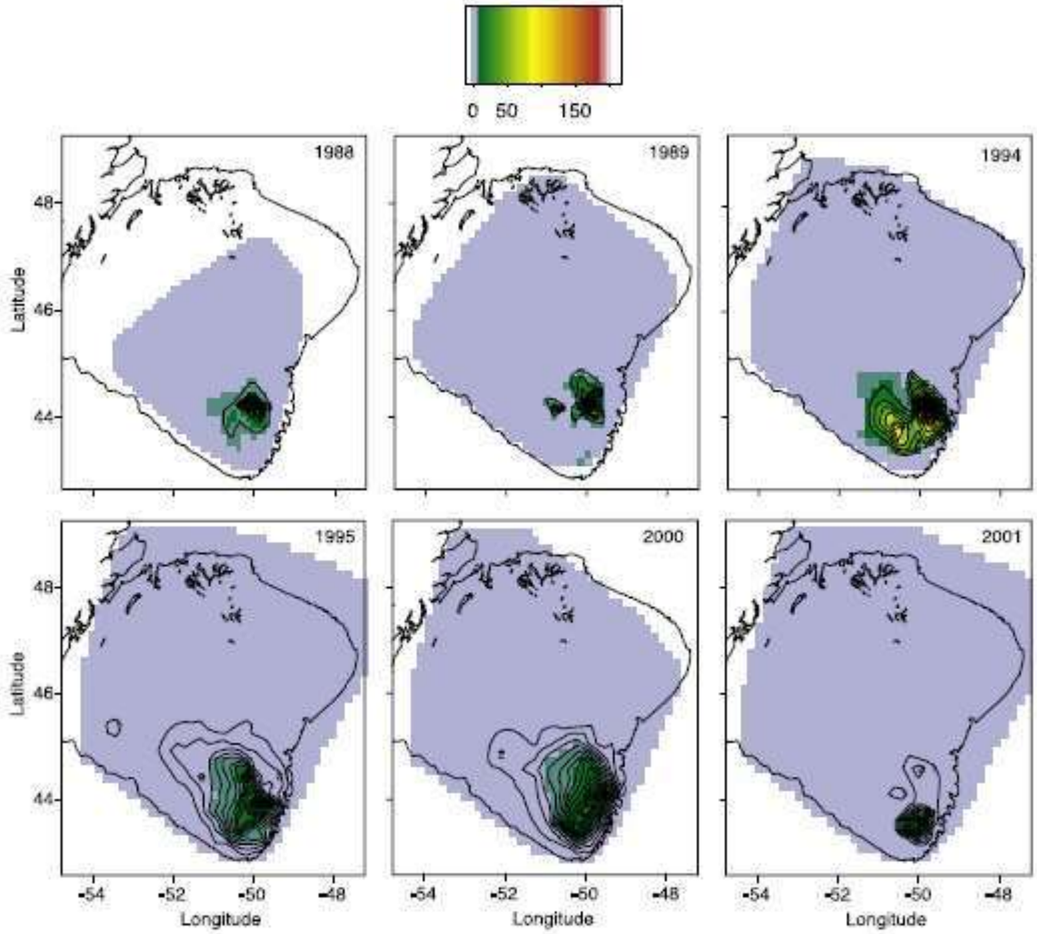

Figure 6. Contour plots (catch in numbers) showing the spatial distribution of age 1 y yellowtail flounder in annual surveys of the Grand Banks from 1988–2001 based on the generalized additive model. The blue represents the area covered in the survey (Walsh et al. 2004).

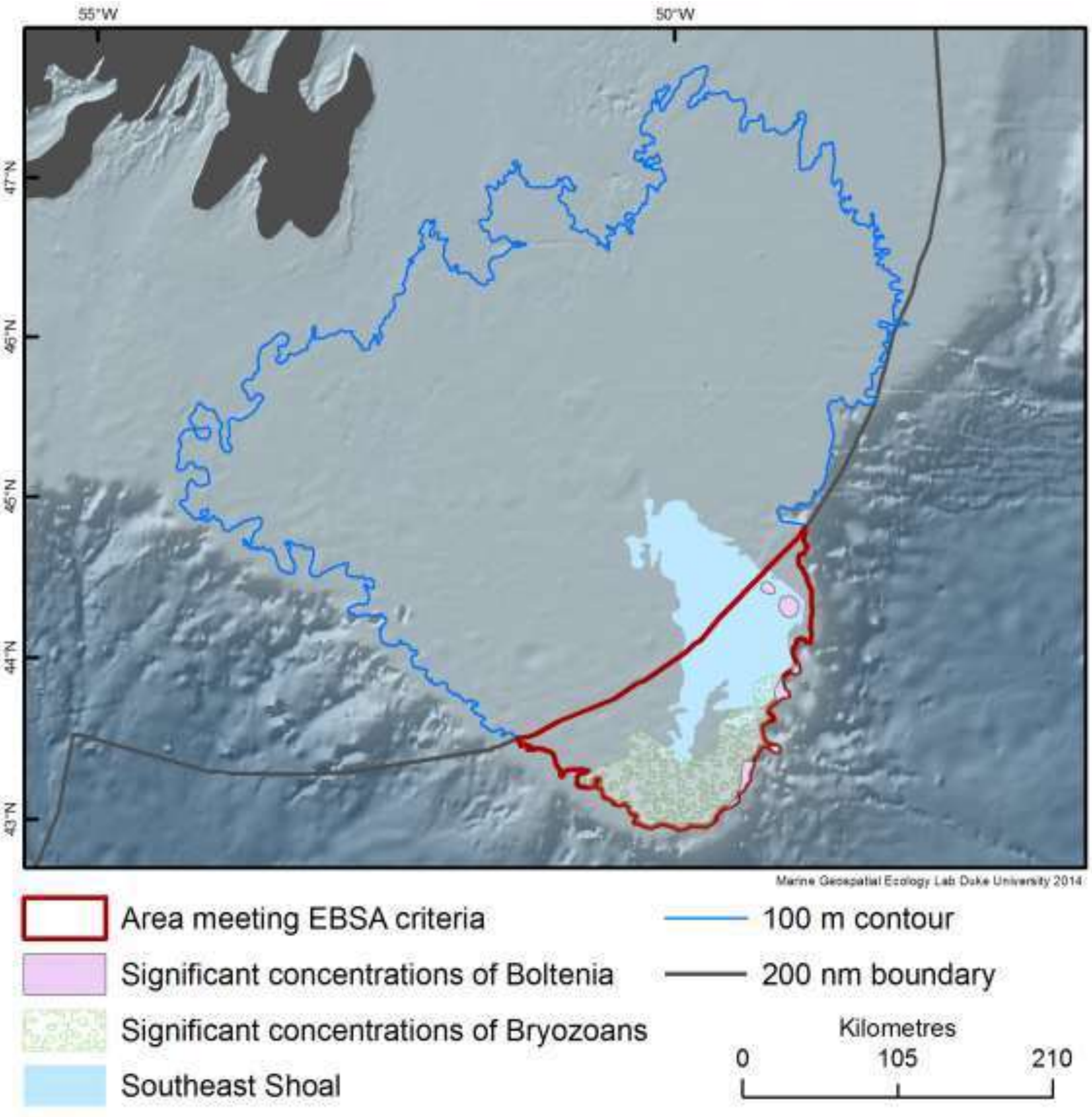

Figure 7. Significant concentrations of bryozoans and stalked tunicates (*Boltenia ovifera*), both VME indicators, present in the area meeting EBSA criteria for the Tail of the Grand Banks.

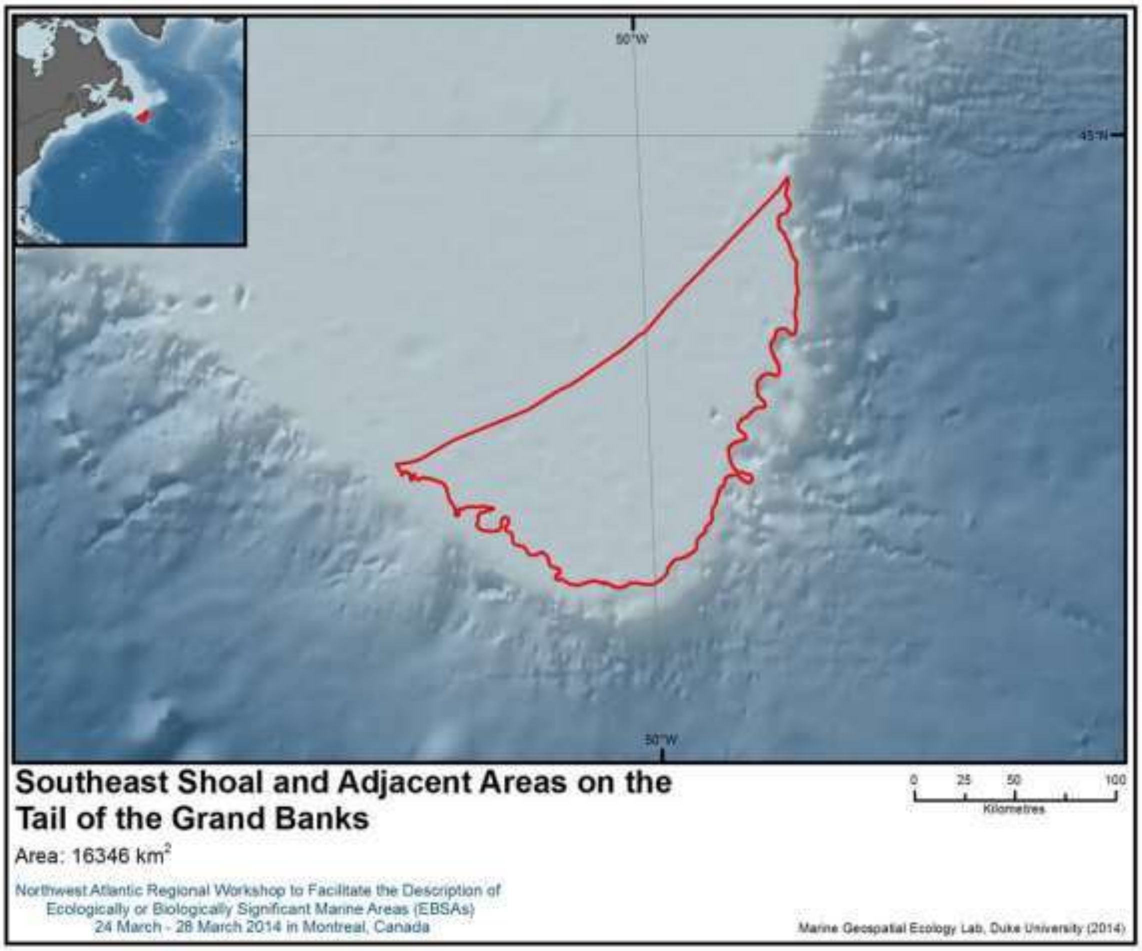

Figure 8. Area meeting the EBSA criteria.

Rights and permissions

Seabird tracking data has been generously provided by Laura McFarlane Tranquilla, Bill Montevecchi, Tony Gaston, April Hedd, Robert Ronconi, Jacob Gonzales-Solis, Maria Dias, Paulo Catry, and Jose Granadeiro. Underlying procellariiforme data are housed at www.seabirdtracking.org and has been analysed by BirdLife International. Future requests to use these data should be directed to seabirds@birdlife.org in the first instance.

Area No. 6: New England and Corner Rise Seamount Chains

Abstract

The New England and Corner Rise seamounts are rare islands of hard substratum and uniquely complex habitats that rise from the deep sea into shallow water, in one case to less than 200 m from the surface. Owing to their isolation, seamounts tend to support endemic populations and unique faunal assemblages. Both the New England and Corner Rise seamount chains host complex coral and sponge communities, including numerous endemic species. Benthic diversity is very high relative to the surrounding abyssal areas. Seamount slopes and deeper summit environments (greater than 2000 m from the surface) currently remain free of any direct impacts of human activities, although some of the shallower seamounts have been commercially fished.

Introduction

A seamount is often defined as a mountain arising abruptly from the sea floor to heights of 1000 m or higher, that is either flat-topped or peaked and occurs as discrete peaks or in linear or random groupings that do not reach sea level (or they would become islands) (Neuendorf et al. 2005). Some deep-sea fishes aggregate on seamounts to feed and/or spawn, while others are more generally associated with seamounts (Morato et al. 2004). They are known as areas of high pelagic biodiversity (Morato et al. 2010). Filter-feeding invertebrates — including corals and sponges — are often found attached to the hard substrates associated with these features (Clark et al. 2006) and the Food and Agriculture Organization (FAO) International Guidelines for the Management of Deep-sea Fisheries in the High Seas (FAO 2009) identify seamounts as areas likely to contain vulnerable marine ecosystems. Seamount species also display a relatively high degree of endemism. A recent survey identified approximately 14,000 seamounts globally (Kitchingman et al. 2007).

The topography of seamounts evokes interactions with ocean circulation, with potential biological responses. Isopycnal doming due to the formation of Taylor Cones brings deeper nutrient-rich water to shallower depth. This may extend into the euphotic zone of shallower seamounts, where the nutrient inputs can locally increase primary production. This process may also generate stratification over the seamount, which may stabilize the water masses, promoting retention of eggs and larvae, thereby creating potential for genetic isolation and distinct faunal assemblages. Asymmetric flow acceleration governs sediment distribution and influences benthic communities. Taylor Cone circulation can also advect organic material onto seamounts, enhancing food supply (cf. Pitcher et al. 2007).

Several distinct seamount chains can be found in the North-West Atlantic along with a few isolated knolls, which are smaller, more rounded seamounts. The majority of these features are located in deep water, well beyond the continental slope, with the prominent groupings including the New England Seamounts, the Corner Rise Seamounts, and the Newfoundland Seamounts. Other seamounts and knolls in the area include the Fogo Seamounts, Orphan Knoll and Beothuk Knoll and Muir Seamount (figure 1, in part). Of the 43 seamounts identified in these areas, only four have peaks at depths less than 1800 m (Kulka et al. 2007a). Shank (2010) notes that one of the longest seamount tracks in the Atlantic Ocean is formed by the New England – Corner Rise Seamount system. This hotspot, referred to as the "New England hotspot" Shank 2010), is more than 3000-km-long. A pause in volcanism 83 million years ago is responsible for the present day spatial gap between these two chains (Shank 2010). Due to their common origin these two seamount chains are herein considered together.

Named seamounts within the New England Seamount chain include: Allegheny Seamount, Asterias Seamount, Balanus Seamount, Bear Seamount, Buell Seamount, Gerda Seamount, Gilliss Seamount, Gosnold Seamount, Gregg Seamount, Hodgson Seamount, Kelvin Seamount, Kiwi Seamount, Manning Seamount, Michael Seamount, Mytilus Seamount, Nashville Seamount, Panulirus Seamount, Picket Seamount, Physalia Seamount, Rehoboth Seamount, Retriever Seamount, San Pablo Seamount, Sheldrake Seamount and Vogel Seamount.

Named seamounts within the Corner Rise Seamount chain include: Bean Seamount, Caloosahatchee Seamount with Milne-Edwards Peak, Verrill Peak, Castle Rock Seamount, Corner Seamount with Goode Peak and Kukenthal Peak, Justus Seamount, MacGregor Seamount, Rockaway Seamount and Yakutat Seamount.

Location

Boundaries were drawn around the named seamounts in each of the New England (figure 2) and Corner Rise (figure 3, 4) Seamount chains. Two polygons were drawn, given the large distance of about 300 km between them where there are no seamounts (figure 1) due to a pause in volcanism 83 million years ago (Shank 2010). The New England Seamounts feature extends into the EEZ of the United States of America but the area described here is entirely beyond national jurisdiction.

Feature description of the area

Information on the ecology and species associated with the New England and Corner Rise Seamounts was quite limited until recently (Kulka et al. 2007b), and the literature is growing. Complex coral and sponge communities, including numerous endemic species, which provide habitat for diverse invertebrate communities that are highly dependent on them, are found on both the New England and Corner Rise seamount chains (Shank 2010, Pante and Watling 2012, Simpson and Watling 2011, Watling et al. 2011). Kulka et al. (2007a) reviewed the available information on the occurrence of cold-water corals on seamounts in this area. Corals have been documented on the New England (Moore et al. 2001, Watling et al. 2011) and Corner Rise Seamounts (Kulka et al. 2007a, Waller et al. 2007, Watling et al. 2011) but information on detailed distribution is lacking. Waller et al. (2007) explored five of the Corner Rise Seamounts using an ROV and documented pristine coral areas as well as "dramatic evidence of large-scale trawling damage" on the summits of Kukenthal peak and Yukutat Seamount figure 4). Murillo et al. 2008) described the occurrence of structure forming corals and "extremely rough bottom" on two New England Seamounts based on the results of an experimental trawl survey during 2004. Less coral was encountered on the Corner Rise Seamounts (7% of sets contained coral) in that survey.

Shank (2010) notes that these seamounts are now the focus of intense ecological and evolutionary studies arising from targeted research over the past decade. Over 270 morphospecies have been observed from underwater camera surveys within this region. Approximately 75 morphotypes are unique to the Corner Rise and 60 unique to the New England Seamounts (Cho 2008), indicating distinct faunas. Interestingly, a variety of commensal invertebrates are revealing differing levels of specificity to their host corals, ranging from "facultative" to "obligate" osher and Watling 2009, Shank 2010). For example, the galatheid *Uroptychus* has been observed only on the antipatharian *Parantipathes* sp., and the ophiuroid *Ophiocreas oedipus* only on the coral *Metallogorgia melanotrichos* (figure 5). The population genetics of some groups illustrate that isolating mechanisms on seamounts within the larger ocean basin exist and can lead to evolutionary change and potentially speciation. For example, a complex picture has arisen from studies of *Paramuricea* collected from 16 locations across the North-West Atlantic (New England and Corner Rise seamounts, submarine canyons along the continental margin of North America, and deep basins in the Gulf of Maine) at depths between 200 and 2200 m. Among 89 colonies sampled, genetic data show that there are at least four genotypes corresponding to three or four species (Thoma et al. 2009). Two of these are evolutionarily older lineages, and the other two are more recently derived and closely related. All types were found on at least some seamounts, but only one type was found on the continental margin (canyons and Gulf of Maine). Another type was absent from the four easternmost locations in the Corner Rise Seamounts, and a third was absent from the two westernmost locations (Bear and Retriever seamounts). A similarly complex picture emerges with four ophiuroid seastars that occur as commensals on corals (Cho and Shank 2010). Here, there was species-specific genetic differentiation based both on seamount region and depth, indicating that links to host species as well as mechanisms that are critical to connectivity are required for conservation of fauna with such tightly linked interactions.

Vinnichenko (1997) described the deep-sea fishes encountered during periodic Soviet Union/Russian research and commercial activities on the Corner Rise Seamounts since the mid-1970s where alfonsino

(*Beryx splendens*) was the most abundant species in the catches. Several other fishes were taken in commercial quantities while a diverse fish fauna, species not of economic importance, was also documented. Very little fishing took place on these seamounts over the following decade.

Duran et al. (2005) summarized the catches of deep-sea fish species in an experimental trawl survey of several of the New England and Corner Rise eamounts in 2004. Alfonsino was also the main species caught on the Corner Rise Seamounts during this survey (Duran et al. 2005, Murillo et al. 2008). This species appears to aggregate near certain seamounts, making it vulnerable to exploitation, but they are relatively fast-growing and not long-lived (10-15 years) and thus do not possess the biological traits typical of many other deep-sea species. Other fishes that were caught in significant amounts during the 2004 survey are slow-growing and long-lived. Cardinal fish (*Epigonus telescopus*), for example, are considered highly vulnerable (http://www.fishbase.org/Summary/SpeciesSummary.php?id=2508). González-Costas and Lorenzo (2007) identified Kukenthal Peak and, more generally, the western portion of the Corner Rise, as areas of high fish species diversity and abundance compared to other parts of the Corner Rise Seamounts based on catches collected between 2005 and 2007. The most abundant species encountered were alfonsino, black scabbardfish (*Aphanopus carbo*), and wreckfish (*Polyprion americanus*). Auster et al. (2005, 2010) described demersal and semi-demersal species from both New England and Corner Rise Seamounts either as habitat generalists, fine-grained sediment specialists, basalt habitat specialists, or ecotone specialists based on foraging tactics in seamount habitats. Based on encounter rates in video surveys from underwater vehicles, it appears that Corner Rise has a more diverse fish community (Auster et al. 2010). False boarfish, *Neocyttus helgae*, has a significant association with coral habitats, using both octocorals and basalt depressions as flow refuges (Moore et al. 2008). This species also appears to exhibit territorial defense and often occurs in pairs, much like butterfly fishes on shallow coral reefs (Moore et al. 2008).

Seamounts are used as feeding areas for transient marine mammals as well (Kaschner 2007). Beaked whales leave marks in fine grained sediments when chasing prey to the seafloor, and evidence of their presence has been observed from seafloor imagery at the summits of seamounts in both the Corner Rise and New England groups (Auster and Watling 2010).

Clark et al. (2014) have suggested thresholds for assessing EBSA criteria for seamounts, one of which identifies peaks that reach into the photic zone (< 200 m) as being a criterion for uniqueness and rarity. MacGregor Seamount in the Corner Rise complex meets this criterion (figure 4).

Feature condition and future outlook of the area

Seamount ecosystems are sensitive to anthropogenic disturbance because the fishes and invertebrates associated with them are mostly slow-growing, long-lived, late to mature, and experience low natural mortality (Morato et al. 2004, Stocks 2004). Scientific studies indicate that the summits and upper slopes of seamounts can provide refugia for cold-water stony corals from ocean acidification as they lie in shallower waters with a higher aragonite saturation horizon (Tittensor et al. 2010, Rowden et al. 2010).

Fisheries (using bottom trawl and mid-water trawl) on the Corner Rise Seamounts for splendid alfonsino took place on a regular basis from 1976 to 1996 (Vinnichenko 1997), with total fish removals between 1976 and 1995 exceeding 19000 tonnes (alfonsino being the most abundant species in the catch). This fishing effort was followed by a nine-year hiatus and started again in 2004. Catches for this fishery ranged from about 50 to 1200 tonnes, and effort ranged from four to 50 days. In recent years this fishery has generally been small (catches of 302 tonnes in 2012). By-catch of vulnerable species, such as small-tooth sand tiger shark (listed as vulnerable under the IUCN Red List for Threatened Species) has been identified in the current fishery.

The Northwest Atlantic Fisheries Organization (NAFO) closed four areas of seamounts to protect VMEs in accordance with the United Nations General Assembly Resolution 61/105 to protect vulnerable marine ecosystems, including large areas of the New England and Corner Rise Seamount chains (some of which fall outside of the NAFO Convention Area) (table 1).

In 2007, two New England Seamounts (Bear and Retriever) within the national waters of the United States of America were recognized as Habitat Areas of Particular Concern (HAPC) by the New England and Mid-Atlantic fishery management councils. Despite the lack of commercial fishing activities, the councils are developing management measures that could protect the two seamounts from deep-sea bottom trawling in the future (Stiles et al. 2007).

The Report of the Wider Caribbean and Western Mid-Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (UNEP/CBD/SBSTTA/16/INF/7), which was considered by the eleventh meeting of the Conference of the Parties (COP 11) in 2012, expressly refers to the Corner Rise Seamount chain as home to specialized, fragile, diverse and endemic communities. The workshop report makes a number of references to the Corner Rise Seamounts as well as the New England Seamounts, including reference to the NAFO closures. It specifically discusses the need for monitoring to document recovery of these areas in the NAFO closed areas.

With respect to planned research activities, the US NOAA ship *Okeanos Explorer* completed a New England Seamount Chain exploration in June 2013 (NOAA, http://oceanexplorer.noaa.gov/okeanos/explorations/ex1303/welcome.html). A similar cruise is tentatively planned for 2014.

Assessment of the area against CBD EBSA criteria

<table>
<tr><th rowspan="2">CBD EBSA criteria
(Annex I to decision IX/20)</th><th rowspan="2">Description
(Annex I to decision IX/20)</th><th colspan="4">Ranking of criterion relevance
(please mark one column with an X)</th></tr>
<tr><th>No information</th><th>Low</th><th>Medium</th><th>High</th></tr>
<tr><td>Uniqueness or rarity</td><td>Area contains either i) unique "the only one of its kind"), rare occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
The seamounts of the area meeting EBSA criteria are rare islands of hard substratum and uniquely complex habitats that rise into bathyal and epi-pelagic depths. These seamount features are otherwise surrounded by vast areas of abyssal sediments. Owing to their isolation, seamounts, tend to support endemic populations and unique faunal assemblages (Pitcher et al. 2007). Both the New England and Corner Rise seamount chains have numerous endemic species (Cho 2008) and demonstrate genetic isolation within and among seamount chains (Cho and Shank 2010). One new genus from the New England Seamounts has recently been described by Watling and France (2011).

Within the New England and Corner Rise seamount chains the MacGregor seamount is unique in that it extends into the photic zone.</td></tr>
<tr><td>Special importance for life-history stages of species</td><td>Areas that are required for a population to survive and thrive.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
The canyons and seamounts provide virtually the only hard substrate habitat in the epi-pelagic and bathyal depths of the North-West Atlantic for deep-water corals, sponges and other benthic species. The chain of seamounts here collectively provides a series of spatially structured features that form a broad corridor that may facilitate gene flow among populations of deep-sea and pelagic fauna, and provide</td></tr>
</table>

nursery or feeding opportunities for migratory species (Pitcher et al. 2001). Scientific studies indicate that the summits and upper slopes of seamounts can provide refugia from ocean acidification for cold-water stony corals as they lie in shallower waters with a higher aragonite saturation horizon (Tittensor et al. 2010, Rowden et al. 2010). This will have increasing importance to the life histories of cold-water corals in future.					
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.	X			
Explanation for ranking No data were presented on threatened and endangered species/habitats to enable evaluation of this criterion.					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.			X	
Explanation for ranking Fauna associated with seamounts are vulnerable to disturbance (Pitcher et al. 2007). Orders of corals and sponge communities are known to be vulnerable, fragile, and sensitive, exhibit slow recovery and growth rates, and are long-lived. Many fish species on seamounts aggregate and are locally restricted. These species can be quickly depleted by fisheries (Morato et al. 2004). The Sargasso Sea Summary Report considered by COP 11 has also highlighted the high vulnerability of the Corner Rise Seamounts and the New England Seamounts.					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.	X			
Explanation for ranking The productivity of these areas has not been systematically assessed.					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X
Explanation for ranking Benthic diversity is very high on the Corner Rise and New England seamount chains, where there are numerous endemic and novel species of coral (Simpson and Watling 2011, Panteand Watling 2012). Over 270 benthic morphospecies have been observed from underwater camera surveys within this region (Cho 2008).					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.			X	
Explanation for ranking Seamount slopes and deeper summit environments (greater than 2000 m) have not yet been directly impacted by human activities (Kulka et al. 2007a). Some seamounts have been commercially fished (Vinnichenko 1997).					

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Relevant databases

The Seamount Catalog is a digital archive for bathymetric seamount maps that can be viewed and downloaded in various formats. This catalog contains morphological data, sample information, related grid and multibeam data files, as well as user-contributed files that all can be downloaded. Currently this catalog contains more than 1,800 seamounts from all the oceans.
http://earthref.org/SC/

Maps, Figures and Tables

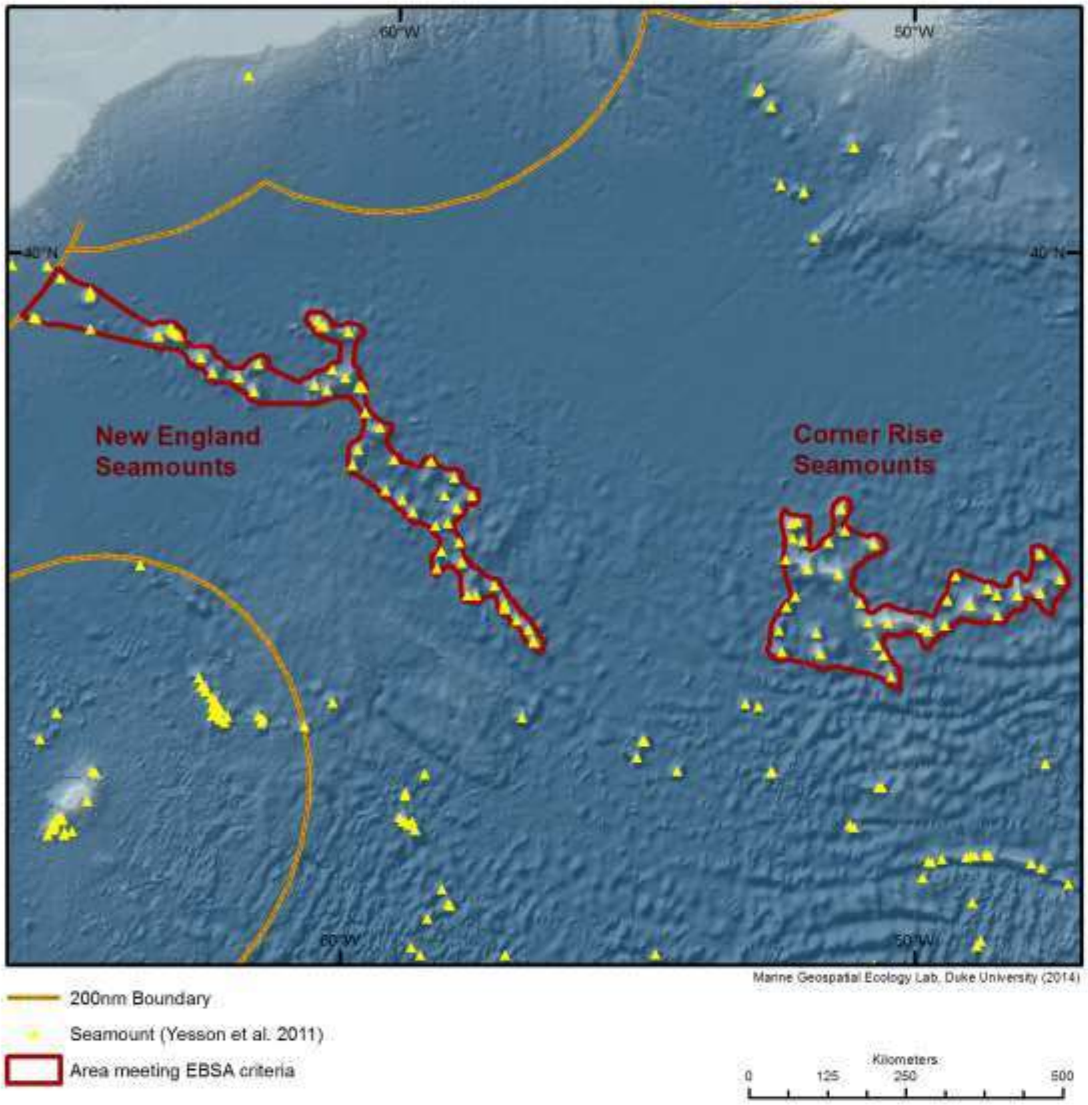


Figure 1. The location of the areas on the New England and Corner Rise Seamount chains in relation to the EEZs of Bermuda, Canada and the United States of America and other seamounts described in Yesson et al. (2011) (yellow triangles).

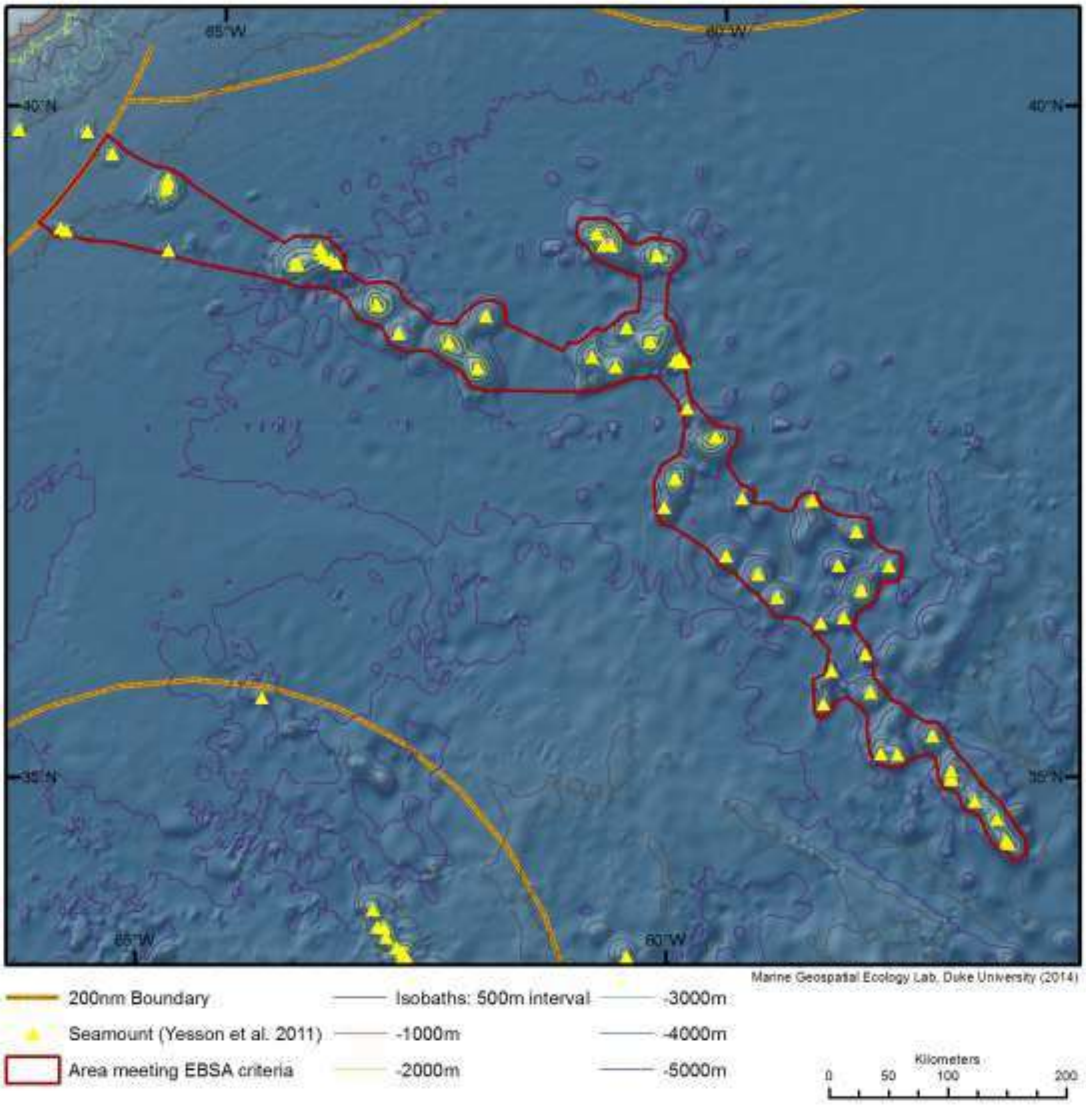


Figure 2. Boundaries for the area meeting EBSA criteria for the New England Seamount chain in relation to the EEZs of Bermuda, Canada and the United States of America and other seamounts described in Yesson et al. (2011) (yellow triangles).

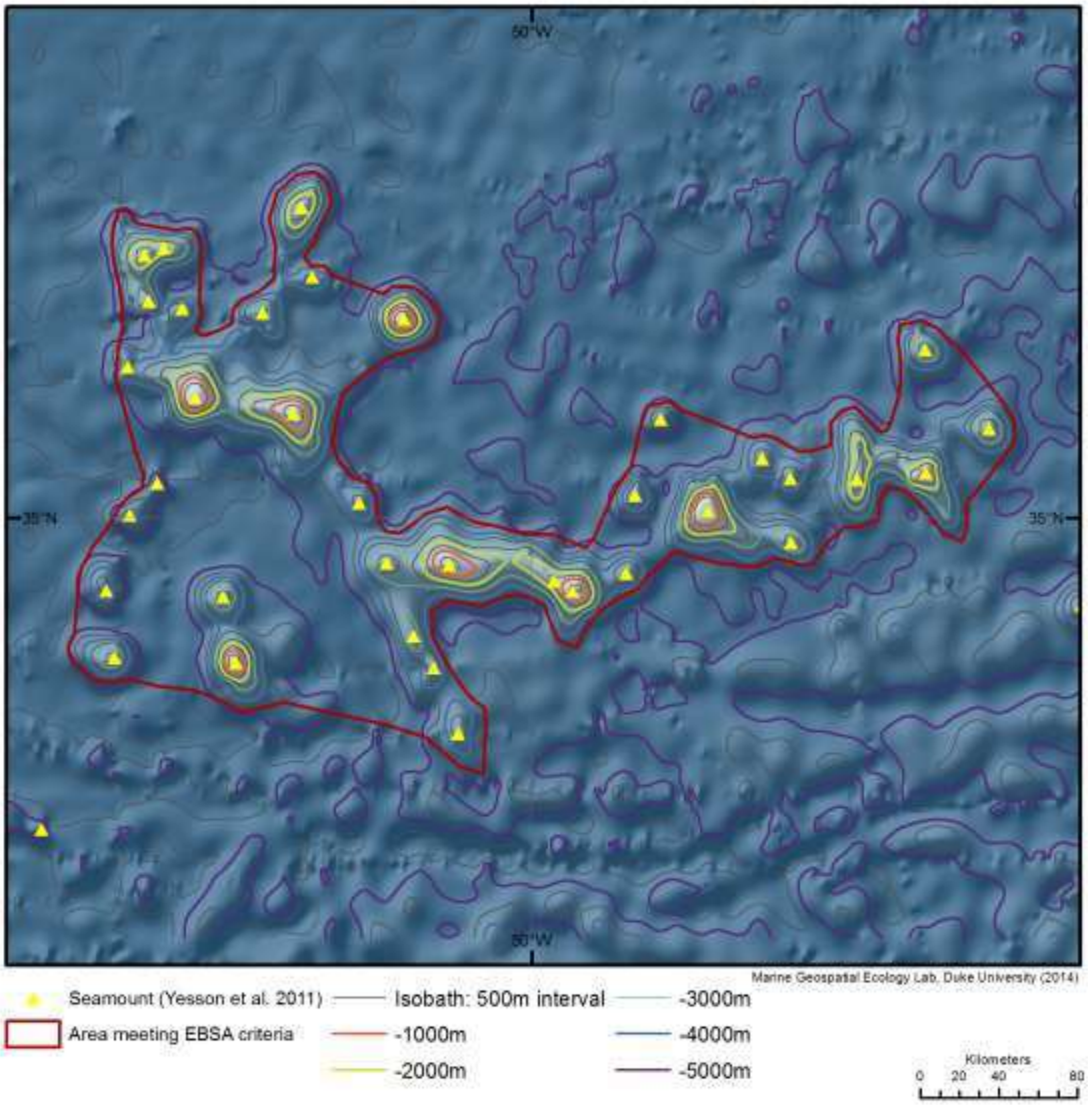


Figure 3. Boundaries for the Corner Rise Seamount chain and other seamounts described in Yesson et al. (2011) (yellow triangles), which meet the EBSA criteria.

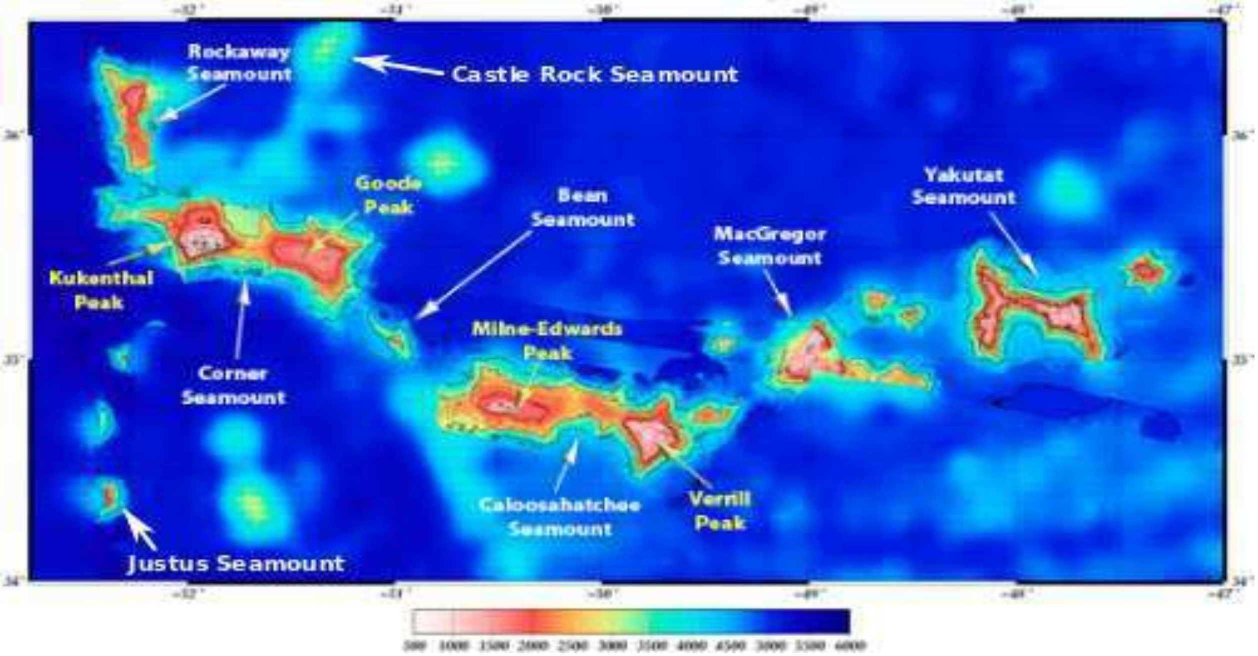


Figure 4. The Corner Rise Seamounts (Downloaded from http://en.wikipedia.org/wiki/Corner_Rise_Seamounts).

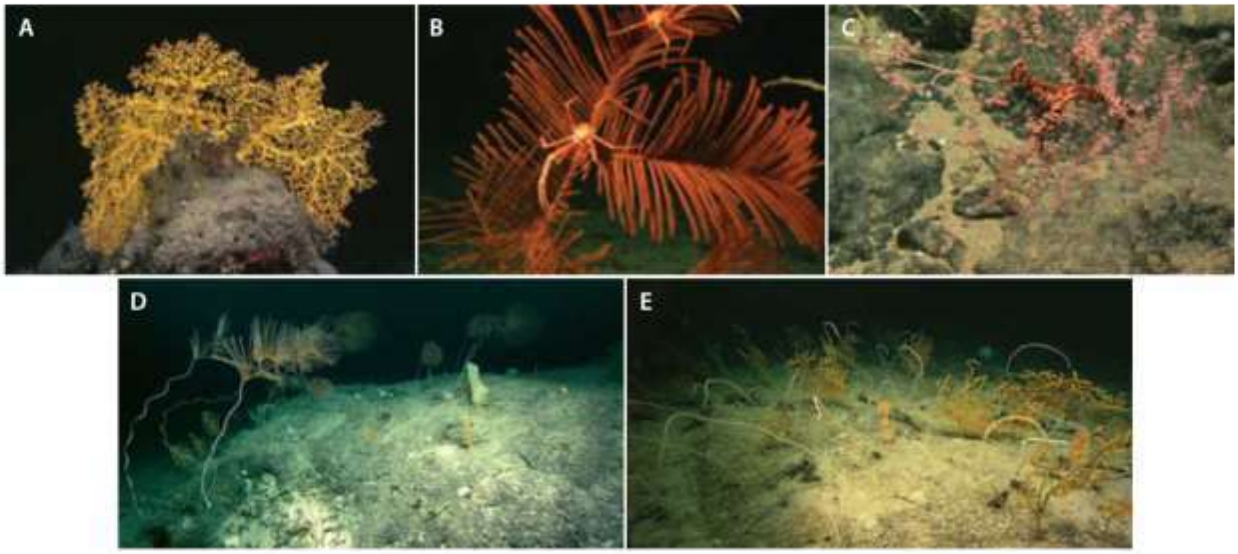
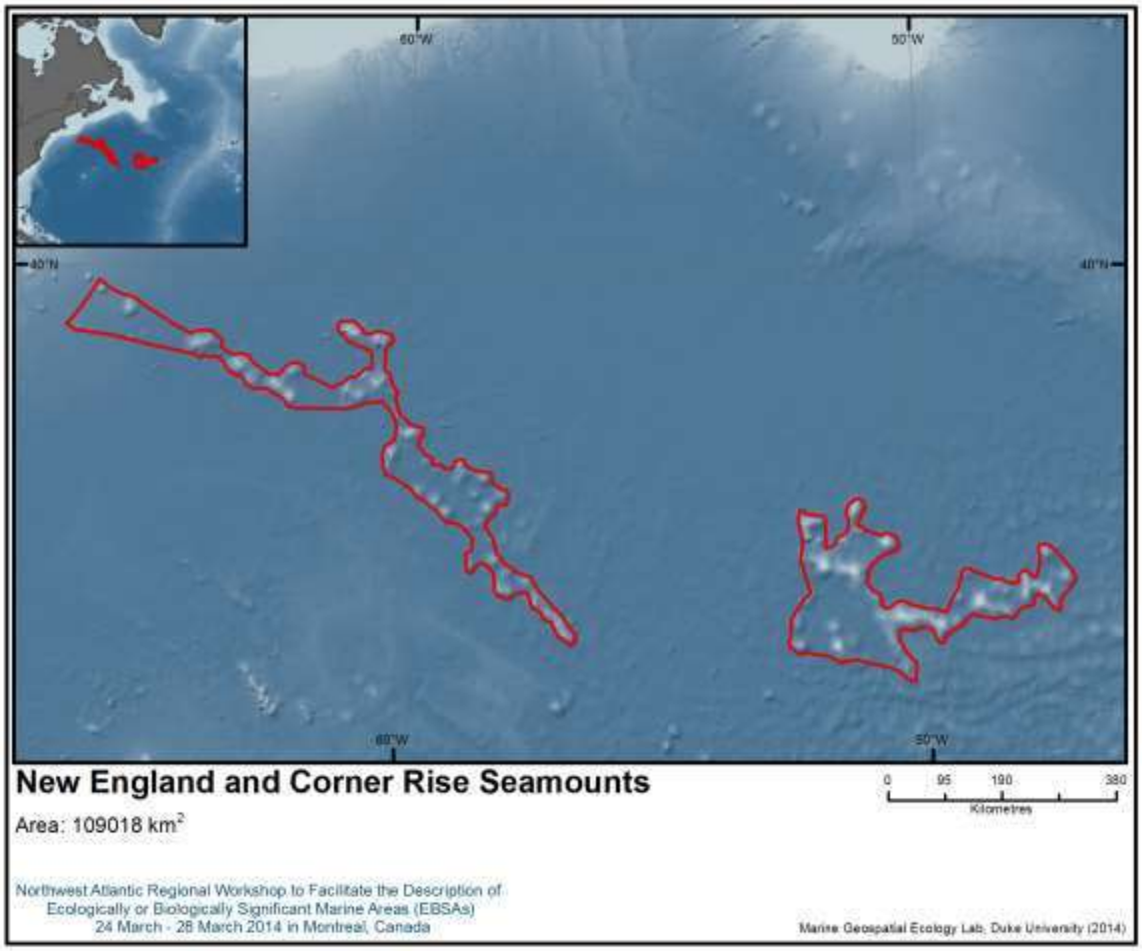


Figure 5. Characteristic features of the New England and Corner Rise seamounts. Habitat-forming coral ecosystems support diverse invertebrate associations on the New England and Corner Rise seamounts, including (a) ophiuroids, shrimp, hydroids, and galatheid crabs associated with the scleractinian *Enallopsammia* on Lyman Seamount (1450 m), (b) chyrostylid crabs on the antipatharian *Plumapathes* on Kükenthal Seamount (915 m), (c) *Ophinocreas oedipus* ophiuroid wrapped around the coral *Metallogorgia melanotrichos*, (d) spiraling *Iridogorgia* corals along with *Metalogorgia* corals and sponges living on an outcrop on the Corner Rise Seamounts, and (e) a soft coral community of *Paramuricea* sp., *Calyptrophora* sp., and *Chrysogorgia* sp. from Corner Seamount (1220 m) (from Shank 2010).



New England and Corner Rise Seamounts

Area: 109018 km^2

Northwest Atlantic Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs)
24 March - 28 March 2014 in Montreal, Canada

Marine Geospatial Ecology Lab, Duke University (2014)

Figure 6. Area meeting the EBSA criteria.

Table 1. NAFO seamount areas protected from bottom fishing in January 2007 and 2008 (NAFO CEM 2009).

Area	Coordinate 1	Coordinate 2	Coordinate 3	Coordinate 4
Fogo Seamounts 1	42°31’33”N 53°23’17”W	42°31’33”N 52°33’37”W	41°55’48”N 53°23’17”W	41°55’48”N 52°33’37”W
Fogo Seamounts 2	41°07’22”N 52°27’49”W	41°07’22”N 51°38’10”W	40°31’37”N 52°27’49”W	40°31’37”N 51°38’10”W
Orphan Knoll	50°00’30”N 45°00’30”W	51°00’30”N 45°00’30”W	51°00’30”N 47°00’30”W	50°00’30”N 47°00’30”W
Corner Seamounts	35°00’00”N 48°00’00”W	36°00’00”N 48°00’00”W	36°00’00”N 52°00’00”W	35°00’00”N 52°00’00”W
Newfoundland Seamounts	43°29’00”N 43°20’00”W	44°00’00”N 43°20’00”W	44°00’00”N 46°40’00”W	43°29’00”N 46°40’00”W
New England Seamounts	35°00’00”N 57°00’00”W	39°00’00”N 57°00’00”W	39°00’00”N 64°00’00”W	35°00’00”N 64°00’00”W

Area No. 7: Hydrothermal Vent Fields

Abstract

Hydrothermal vents are unique habitats dominated by temperatures much warmer than those of the surrounding deep-sea and characterized by a sulphur-rich chemistry. A small number of endemic taxa are adapted to these otherwise inhospitable environments and can occur at high density and biomass. This area follows the Mid-Atlantic Ridge (MAR) from the Lost City vent fields and includes the confirmed active Broken Spur and Trans-Atlantic Geotraverse (TAG) vents. The Lost City vent field is estimated to have been active for more than 30,000 years and has unique characteristics, being a low temperature vent with high alkalinity. The entire feature is located beyond national jurisdiction.

Introduction

Hydrothermal vents occur on mid-oceanic ridges, back-arc basins, volcanic arcs and active seamounts, and play an important role in transferring mass and energy from the crust and mantle to the oceans. The hot, reducing, metal-rich, magnesium- and sulphate-poor hydrothermal fluids that exit “black smoker” and “white smoker” chimneys are formed through interactions of seawater with oceanic crust. Hydrothermal plumes form above sites of venting and ultimately disperse laterally (figure 1). Hydrothermal fluids are enriched in several key tracers (e.g., Mn, Fe, CH_4, H_2, ^3He) relative to typical oceanic deep waters, allowing for their detection at significant distances away from hydrothermal vent sites (Baker et al. 1995). These interactions modify the composition of oceanic crust, affect ocean chemistry, form metal-rich deposits (possible analogs to ore deposits present on land), and provide energy sources for biological communities in the deep sea, which are important even after the vents become inactive. Specifically, hydrothermal circulation has proven to be an important sink for Mg and a source for other elements such as Fe, Mn, Li, Rb, and Cs (Von Damm et al. 1985).

In the North Atlantic, hydrothermal vents lie along the Mid-Atlantic Ridge (MAR). While some have been visually surveyed and studied, several remain unconfirmed and are inferred based on detection of a chemical signature from the plume in the overlying water column (table 1). The actual number of hydrothermal vents and locations remains unknown both in the North Atlantic and elsewhere (ICES 2013). About 350 vent fields have been identified in the world’s oceans to date.

Hydrothermal vents are habitats dominated by temperatures much warmer than those of the surrounding deep-sea and characterized by a chemistry that is highly toxic (sulphur-rich) to most life. A number of endemic taxa are adapted to these otherwise inhospitable environments and can occur at high density and biomass. Globally there are about 600 species that have been described from hydrothermal vent areas. Many of the invertebrates among them are species that host chemoautotrophic bacteria as epi- or endosymbionts, and are endemic to the vents (Desbruyères et al. 2006). Bacharty et al. (2009) delineate six major hydrothermal provinces based on faunal composition, although there is considerable variation within each. For example, Fabri et al. (2011) have shown that the North Atlantic vent fauna of Logatchev, Ashadze, Snake Pit, Trans-Atlantic Geotraverse (TAG) and Broken Spur cluster together with 50% similarity and are distinctive from those of Lucky Strike, Rainbow and Menez Gwen to the north on the Azorean Plateau, although all belong to a single biogeographic province (Bacharty et al. 2009). These vent communities are dependent on chemosynthetic production of microbial biomass, which on the MAR has been found to occur in warm water emissions, loosely rock-attached flocculent material, dense morphologically diverse bacterial mats covering the surfaces of polymetal sulphide deposits, and filamentous microbes on the carapaces of shrimp (Wirsen et al. 2012). The bacterial mats on polymetal sulphide surfaces contained unicellular and filamentous bacteriathat appeared to use as their chemolithotrophic electron or energy source either dissolved reduced minerals from vent emissions, mainly sulphur compounds, or solid metal sulphide deposits, mainly pyrite. Thus, the transformation of geothermal energy at the massive polymetal sulphide deposits of the MAR is likely based on the lithoautotrophic oxidation of soluble sulphides and pyrites into microbial biomass (Wirsen et al. 2012). Primary production based on chemosynthesis forms the basis of the food web associated with hydrothermal vents.

The North Atlantic hydrothermal vents south of the Azores were not considered in previous CBD EBSA workshops. The South-Eastern Atlantic Regional EBSA Workshop noted that the Mid-Atlantic Ridge (MAR) is the major mid-ocean geomorphological feature, with diverse habitats including numerous seamounts, fractures, and slopes (http://www.cbd.int/doc/?meeting=EBSA-SEA-01). The biodiversity information from this feature remains limited and insufficient to assess whether the MAR as a whole or specific sub-areas should be described as EBSAs. However, that workshop also noted that more specific areas associated with the MAR have been documented, e.g., recently discovered MAR hydrothermal vent sites (3-7° S, the hottest reported to date, with temperatures up to 407°C).

Consequently, the group of 10 vent fields north of 23°N were selected from a list of 22 hydrothermal vent sites located between the Azores exclusive economic zone (EEZ) and above 14°N (InterRidge Vents Database v. 3.2) (figure 2). These included four sites with confirmed activity (Lost City, Broken Spur, TAG and Snake Pit), two sites where activity was inferred from the chemistry of plumes in the water column, as well as four inactive sites at depths ranging from approximately 800 m to 3900 m (table 1). Inactive sites were considered since the characteristics that make them ecologically important (compared to the surrounding areas) remain (mineral deposits) and they support unique ecosystems. The Rainbow vent field and nearby SAMAR 1 were not considered as they fall within the OSPAR Maritime Area (figure 3) and so could be evaluated under the ongoing EBSA identification process for the North-East Atlantic. The 10 vents south of Snake Pit at 23°22′ N latitude were not considered as all but one were inactive or had only inferred activity. The workshop acknowledged the data gap identified by the South-Eastern Atlantic EBSA Workshop and also recommended that the MAR and associated other hydrothermal vent fields such as Logatchev and the newly discovered Ashadze-1at 12° 58'N (Fabri et al. 2011) be considered in future.

Location

The area follows the MAR from the Lost City vent fields at 30.125°N 42.1183°W to the Snake Pit vent fields at 23.3683°N 44.95°W. The entire feature is located beyond national jurisdiction (figure 4). Vents along the broad (5-10 km wide) axial rift valley of the MAR are often bounded across axis by steep and faulted valley walls that rise 1000-2000 m above the valley floor and along axis by frequent transform-fault offsets (Baker et al. 1995). The height of rise of buoyant hydrothermal plumes is nearly always less than the bounding heights of the MAR rift valley. Consequently, hydrothermal plumes are often trapped and transported within the axial valley. These bathymetric characteristics allow easy detection of hydrothermal tracers within a particular segment of the MAR, but make precise location difficult along the axis. Plume mapping on the MAR has typically covered a greater linear distance at significantly less detail than similar studies in the eastern Pacific (Baker et al. 1995). Consequently the full linear extent of the MAR between the Lost City and Snake Pit vent fields was included within the area meeting EBSA criteria, given that the precise locations of the inferred sites are not known and that new vents are still being discovered at a rapid rate.

The bathymetry along the MAR is highly irregular and difficult to use for establishing a depth-based outer boundary to the area. The MAR axial valley was demarcated for the reasons indicated above, and a boundary of 20 km either side of it used to establish the area meeting EBSA criteria, including the distance north and south of the Lost City vent fields and the Snake Pit vent fields respectively (figure 4). Plume mapping on the Juan de Fuca Ridge off British Columbia, Canada on the Axial Volcano has shown that the plume from the summit is traceable for tens of kilometres (Baker et al. 1995). Refinement of the boundaries here would require detailed study of the spatial extent of the plume influence, which would reflect local topographic and hydrological conditions. However, the 20 km boundary either side of the mid-point of the axial valley of the MAR will capture the Lost City off-axis location.

Feature description of the area

Lost City Vent Field

The Lost City Vent Field is an extensive hydrothermal field at 30°N near the eastern intersection of the Mid-Atlantic Ridge and the Atlantis fracture zone first discovered in 2000 (Kelley et al. 2007). Four vents are identified from the area: IMAX, Poseidon, Seeps and Nature (InterRidge Vents Database v. 3.2; http://vents-data.interridge.org/ventfield/lost-city). This vent field is globally unique (Kelley et al. 2007) and different from all other known sea-floor hydrothermal fields in that it is located on 1.5-Myr-old crust, nearly 15 km from the spreading axis, and may be driven by the heat of exothermic serpentinization reactions between sea water and peridotite, which lead to formation of heat, hydrogen, and methane (Kelley et al. 2005, Boetius 2005 but see Allen and Seyfried 2004). Kelley et al. (2007) describe it as having "a combination of extreme conditions never before seen in the marine environment". It is located on a dome-like massif (the Atlantis Massif; Kelley et al. 2007; figure 5) and is dominated by steep-sided white carbonate chimneys reaching to 60 m in height (Boetius 2005; figure 6). The vent fluids are relatively cool (40-91°C) and alkaline (pH 9.0-9.8), supporting dense microbial communities that include anaerobic thermophiles. The vent field is estimated to have been active for more than 30,000 years, exceeding the known longevity of black-smoker-type hydrothermal vents by two orders of magnitude (Früh-Green et al. 2003).

Broken Spur Vent Field

The Broken Spur Vent Field, located at 29°10'N on the MAR, is formed by five hydrothermal vents: Bogdanov, Saracen's Head a black smoker), Spire, Wasp's Nest, White ushroom InterRidge Vents Database v. 3.2; http://vents-data.interridge.org/ventfield). Hydrothermal activity at the Broken Spur vent field has been on the order of several thousand years. It is relatively isolated, being the only vent field between 27° to 30°N (Baker and German 2004). Hydrothermal activity within the Broken Spur vent field is controlled by a combination of recent volcanic and tectonic activity, similar to the vents at Menez Gwen, Lucky Strike, and Snake Pit (Baker and German 2004). The field can be subdivided into the eastern valley and a western plateau. Three sulphide mounds, with high-temperature fluid vents (365°C), and two weathered sulphide mounds, with low-temperature fluid seeps, are aligned across an axial summit trench (geological term: graben) that lies along the crest of a ridge within the axial valley floor. The largest high-temperature venting sulphide mound, which is up to 40 m high, lies in the centre of this trench (Murton et al. 1995). Two further and smaller high-temperature sulphide mounds are located to the east and west of the larger mound. All three high-temperature venting mounds lie on an axis that strikes 115°, orthogonal to the trend of the axial summit trench and ridge. The fauna colonizing the vents are distinct from those found at other hydrothermal sites on the MAR (Murton et al. 1995). A new species of bresiliid shrimp, and a new genus of brittle star have been found, along with other fauna, in an ecosystem that is otherwise similar to those found at high-temperature hydrothermal sites elsewhere on the Mid-Atlantic Ridge (Murton et al. 1995, Fabri et al. 2010). Copley et al. (1997) noted the lack of swarms of shrimp at this site compared to TAG and Snake Pit. Microbial chemosynthetic production of organic carbon near the hydrothermal vent is comparable to primary production in the euphotic layer. Fe, Zn, Ca, Si, Ba and P are enriched in particulate matter in comparison to the background (Lukashin et al. 2010).

Trans-Atlantic Geotraverse (TAG) Hydrothermal Vent Field

The Trans-Atlantic Geotraverse (TAG) Hydrothermal Field is located on the base of the median valley wall of the MAR crest, near latitude 26°N at 3670 m. It was the first high-temperature (369°C) vent field discovered on the MAR. Seven vents are associated with this black smoker complex: Alvin zone, Daibutsu, Kremlin, Mir zone, ODP 957M, ODP 957D and Shimmering Mound (InterRidge Vents Database v. 3.2; http://vents-data.interridge.org/ventfield). TAG is located within a larger hydrothermal field that extends over an area of at least 5 km x 5 km and consists of presently active low- and high-temperature zones, as well as a number of relict deposits (InterRidge Vents Database v. 3.2; http://vents-data.interridge.org/ventfield). Black-smoker fluids are extremely concentrated and forcefully exit from a central black-smoker complex to form a large, buoyant black plume (Rona et al. 1986). The large size results in part from significant seawater entrainment into the mound, which triggers precipitation of anhydrite, chalcopyrite, and pyrite within the mound, and remobilization of metals (Edmond et al. 1995). The hydrothermal activity has been cyclic, multi-stage, and episodic. Low-temperature hydrothermal venting stages intervene between the short high-temperature stages and produce stratiform deposits of layered and earthy manganese oxide, iron oxide, hydroxide, and silicate. Shell hash, possibly derived from vent clams in various stages of dissolution, are identified on bottom photographs. Massive swarms of bresiliid shrimp are associated with the hydrothermal chimneys (Gebruk et al. 1993).

Snake Pit Hydrothermal Vent Field

The Snake Pit hydrothermal site lies on the axis of the AR at 23°22′ N latitude, about 30 km south of the Kane Transform Intersection. Active “black smoker” vents and a surrounding field of hydrothermal sediment occur at the crest of a laterally extensive neovolcanic ridge. The Snake Pit vents are located on a local peak of a volcanic ridge at a depth of 3500 m. The vent field includes four vents — Moose, Beehive, Fir Tree and Nail (InterRidge Vents Database v. 3.2; http://vents-data.interridge.org/ventfield/snake-pit) — is at least 600 m long and up to 200 m wide and is covered by a thick blanket of greenish to yellow-orange hydrothermal sediment. Both active and extinct vents are perched along the crests of steep-sided sulfide mounds that reach heights of over 40 m. High-temperature (366°C) fluids are vented from black smoker chimneys, and low-temperature (226°C) fluids seep from sulphide domes (Karson and Brown 1989). Abundant shrimps occur around the chimneys (figure 7), whilst the vent fauna consists of anemones, worm tubes, large gastropods, bivalves, crabs, and zoarcid fishes (Grassle et al. 1986, Mevel et al. 1989).

Feature condition and future outlook of the area

In 2010, an international workshop sponsored by the International Seabed Authority (ISA) was held to formulate general guidelines for the conservation of vent and seep ecosystems at regional and global scales, and establish a research agenda that aimed at improving existing plans for the spatial management of vent ecosystems. At this workshop, human activities associated with non-ecological services of vents were identified, as were the different levels of impact on vent ecosystems. A number of anthropogenic pressures arising from indirect commercial activities, such as shipping, cable laying and waste disposal, may impact upon vents. An expert judgment approach gathered the opinions of scientists to estimate the levels of impact of activities on the structure and function in chemosynthetic ecosystems below 250 m (Van Dover et al. 2011). Taking into account the overall intensity of direct impacts, the persistence of impacts, and the likelihood of an activity, the most severe threats to natural ecosystem structure and function at vents are currently the extractive industries (minerals). The TAG and Snake Pit vent fields fall within the exploration license area granted by ISA to the French Research Institute for Exploitation of the Sea (IFREMER) (figure 8).

Damage to vent structures can lead to irreversible changes to the thermal and chemical properties of the surrounding water column. Given that vent ecosystems rely on vent fluids and gases for production, and that many taxa inhabit the structures formed by venting, any damage to the vent structures can lead to significant mortality through crushing (Tunnicliffe et al. 1990), loss of available habitat, or the loss of localized communities. Hydrothermal vents form relatively small structures and have communities that are highly localized and are therefore vulnerable to disturbances on local scales. The spatial structure and distinct community structure of fauna associated with vents may themselves be vulnerable to introduction of novel vent taxa (e.g., during scientific surveys in multiple vent fields). It should also be noted, however, that ISA contractors are obliged to gather environmental data during their exploration phase and to nominate reserve areas in the event of exploitation (e.g., ISA Technical Study No. 9; Regulations on Prospecting and Exploration for Polymetallic Sulphides in the Area ISBA/16/A/12/Rev.1; and Recommendations for the Guidance of contractors for the assessment of possible environmental impacts arising from marine minerals in the Area ISBA/19/LTC/8).

Assessment of the area against CBD EBSA criteria

<table>
<tr><th rowspan="2">CBD EBSA criteria (Annex I to decision IX/20)</th><th rowspan="2">Description (Annex I to decision IX/20)</th><th colspan="4">Ranking of criterion relevance (please mark one column with an X)</th></tr>
<tr><th>No information</th><th>Low</th><th>Medium</th><th>High</th></tr>
<tr><td>Uniqueness or rarity</td><td>Area contains either i) unique “the only one of its kind”), rare occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
The hydrothermal vents associated with the area are regionally unique and globally rare. Venting produces unique chemical and mineral characteristics on the surrounding seabed, which are different from surrounding areas. There is a high level of endemism associated with the vents; some species are capable of chemosynthesis based on sulphur/sulphides released by the vents (Grebuk et al. 1993, Desbruyères et al. 2006, Bacharty et al. 2009).
The Lost City vent field is different from all other known sea-floor hydrothermal fields in that it is located on 1.5-million-year--old crust and may be driven by the heat of exothermic serpentinization reactions between sea water and peridotite (Kelley et al. 2007). It is both cool and alkaline relative to the other vent fields in the area meeting EBSA criteria and wider area and uniquely situated nearly 15 km from the spreading axis of the Mid-Atlantic Ridge. The vent field is estimated to have been active for more than 30,000 years, exceeding the known longevity of black-smoker-type hydrothermal vents by two orders of magnitude (Früh-Green et al. 2003).</td></tr>
<tr><td>Special importance for life-history stages of species</td><td>Areas that are required for a population to survive and thrive.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Fauna associated with hydrothermal vents depend on the thermal and chemical properties of the water column associated with the vents (Wirsen et al. 2012). Primary production based on chemosynthesis forms the basis of the food web associated with hydrothermal vents.</td></tr>
<tr><td>Importance for threatened, endangered or declining species and/or habitats</td><td>Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.</td><td>X</td><td></td><td></td><td></td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
The vents have yet to be examined with respect to the conservation status of individual species.</td></tr>
<tr><td>Vulnerability, fragility, sensitivity, or slow recovery</td><td>Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i></td></tr>
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<tr><td colspan="6">Damage to vent structures can lead to irreversible changes to the thermal and chemical properties of the surrounding water column. Given that vent ecosystems rely on vent fluids and gases for production, and that many taxa inhabit the structures formed by venting, any damage to the vent structures can lead to significant mortality through crushing (Tunnicliffe et al. 1990), loss of available habitat, or the loss of localized communities.
Hydrothermal vents form relatively small structures and have communities that are highly localized and are therefore vulnerable to disturbances on local scales.
The spatial structure and distinct community structure of fauna associated with vents may themselves be vulnerable to introduction of novel vent taxa (e.g., during scientific surveys in multiple vent fields).</td></tr>
<tr><td>Biological productivity</td><td>Area containing species, populations or communities with comparatively higher natural biological productivity.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Active vents support dense populations of microbes, molluscs and tube worms. Dense swarms of shrimp are associated with chimneys at Trans-Atlantic Geotraverse (TAG) and Snake Pit (Gebruk et al. 1993).
Microbial chemosynthetic production of organic carbon near the Broken Spur hydrothermal vent is comparable to primary production in the euphotic layer, which is considered to be very high for deep sea environments. In the absence of active venting, productivity would be significantly lower in local areas at similar depths and latitudes, as the food web structure and productivity depend on chemosynthesis (Grassle et al. 1986, Mevel et al. 1989).Vents are not as productive as some coastal and shelf areas.</td></tr>
<tr><td>Biological diversity</td><td>Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
In the absence of active venting, species diversity would be significantly lower in the localized vent fields, as food web structure and productivity depend on chemosynthesis (Grassle et al. 1986, Mevel et al. 1989).</td></tr>
<tr><td>Naturalness</td><td>Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6"><i>Explanation for ranking</i>
Some of the vent fields have been subject to scientific and other surveys, subject to the ISA regulatory regime, but compared to exploratory mining, such impacts are expected to be low.</td></tr>
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Maps, Figures and Tables

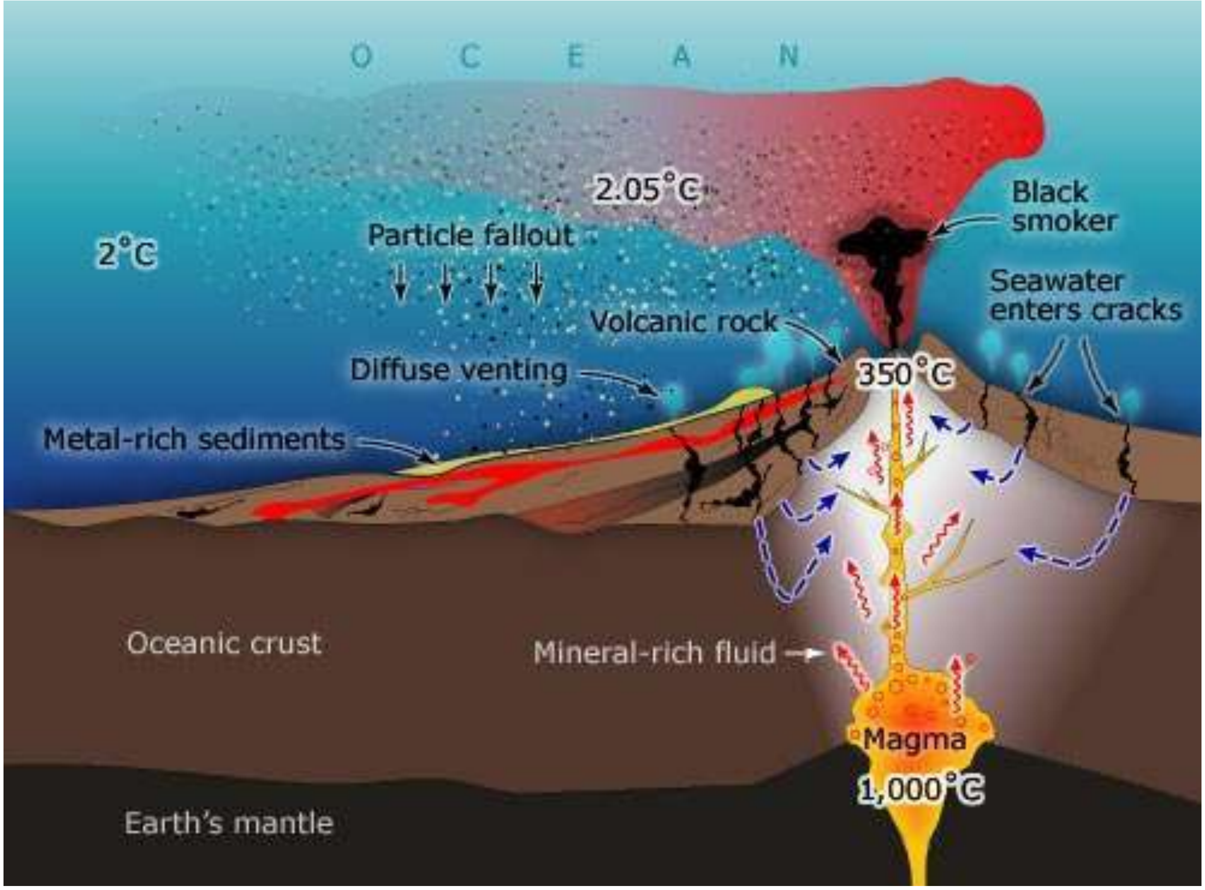

Figure 1. Deep-sea vent biogeochemical cycle (downloaded from http://en.wikipedia.org/wiki/Hydrothermal_vent).

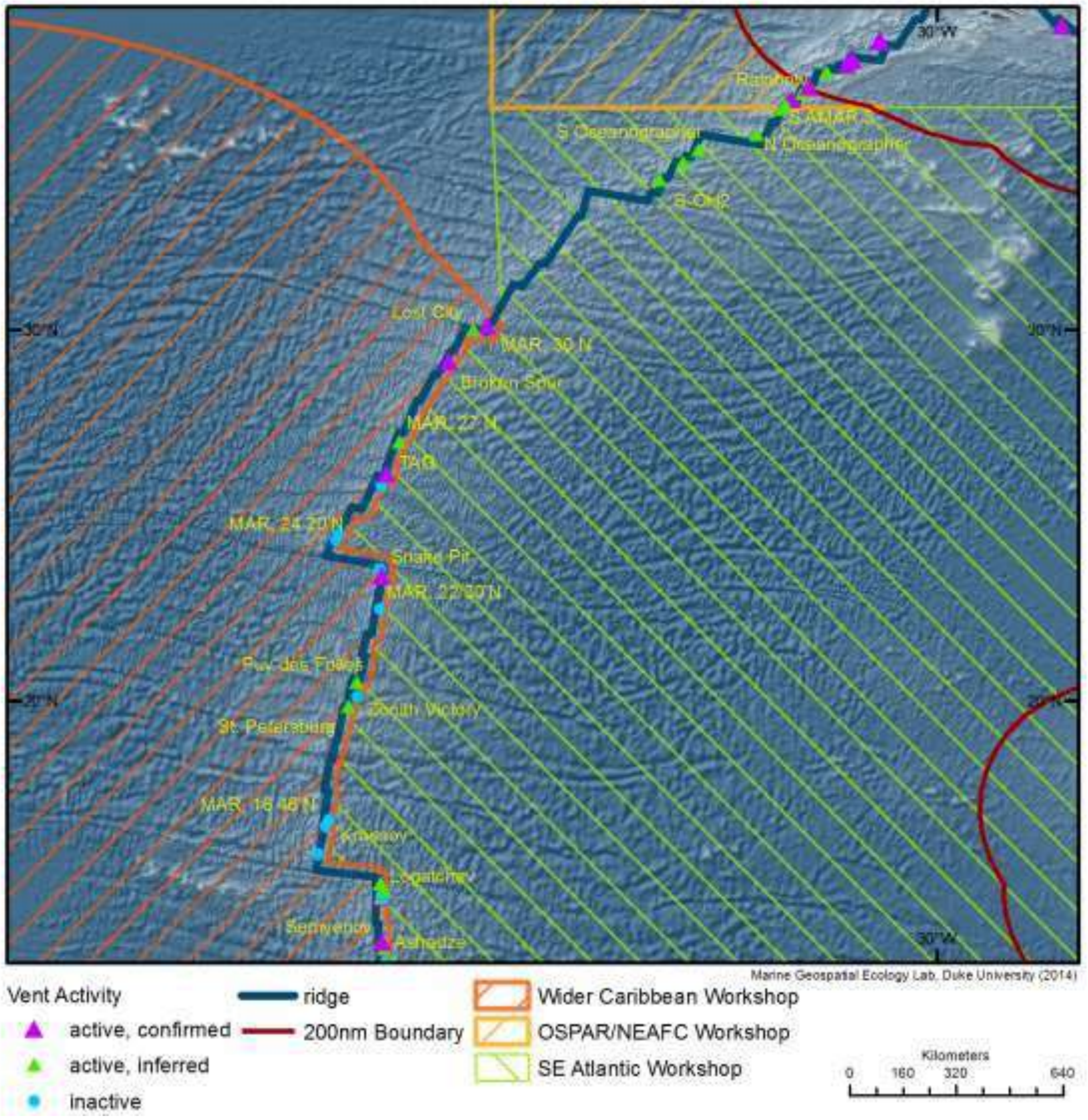

Figure 2. Map of all vents considered during the preliminary selection of EBSA extent. The areas considered by the OSPAR/NEAFC, Wider Caribbean and Western Mid-Atlantic, and South-Eastern Atlantic EBSA workshops illustrate the position of the Mid-Atlantic Ridge on the boundary of the latter two workshops.

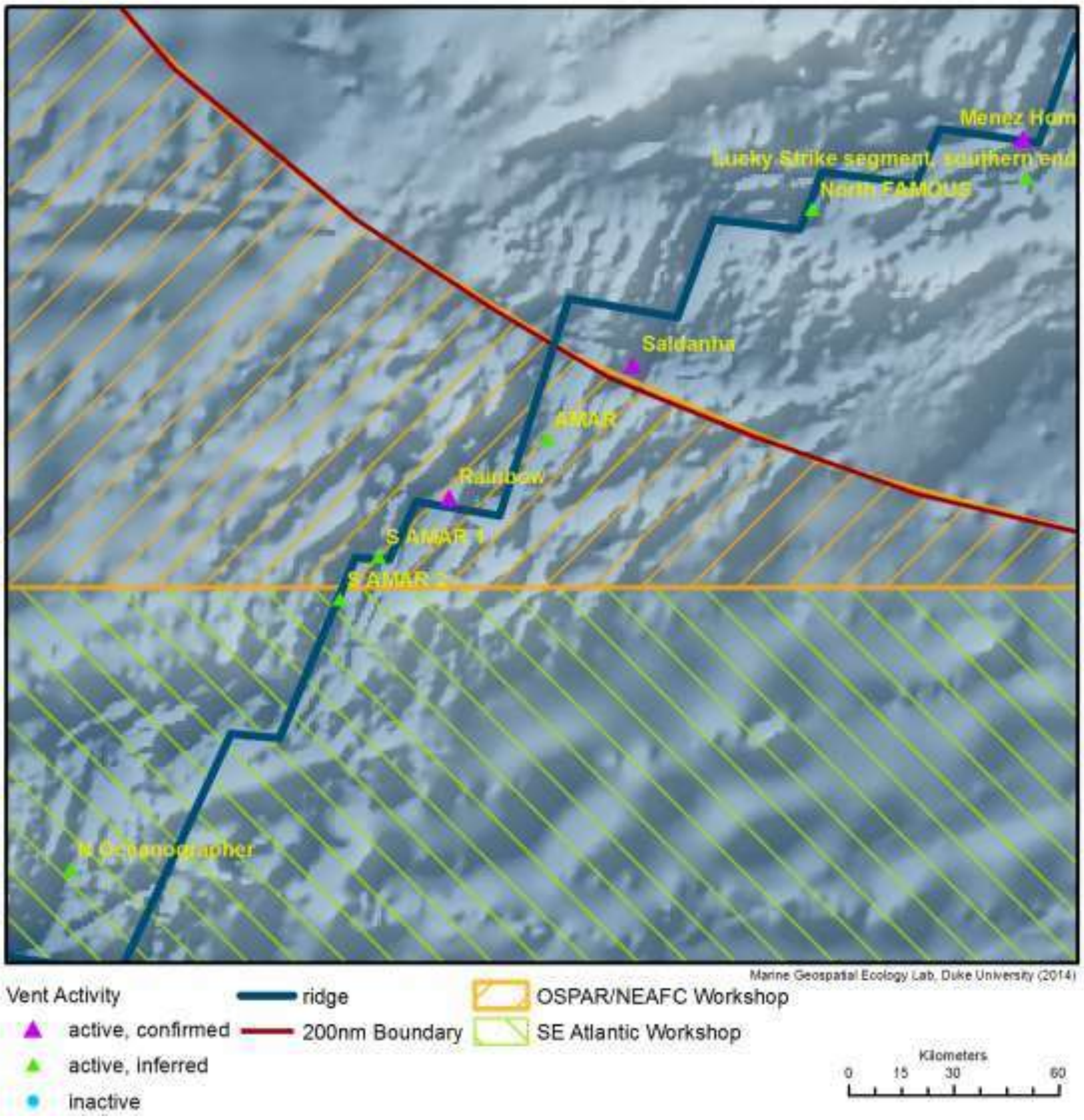

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Figure 3. Close-up map of the vents positioned within the EEZ of the Azores and the OSPAR/NEAFC area.

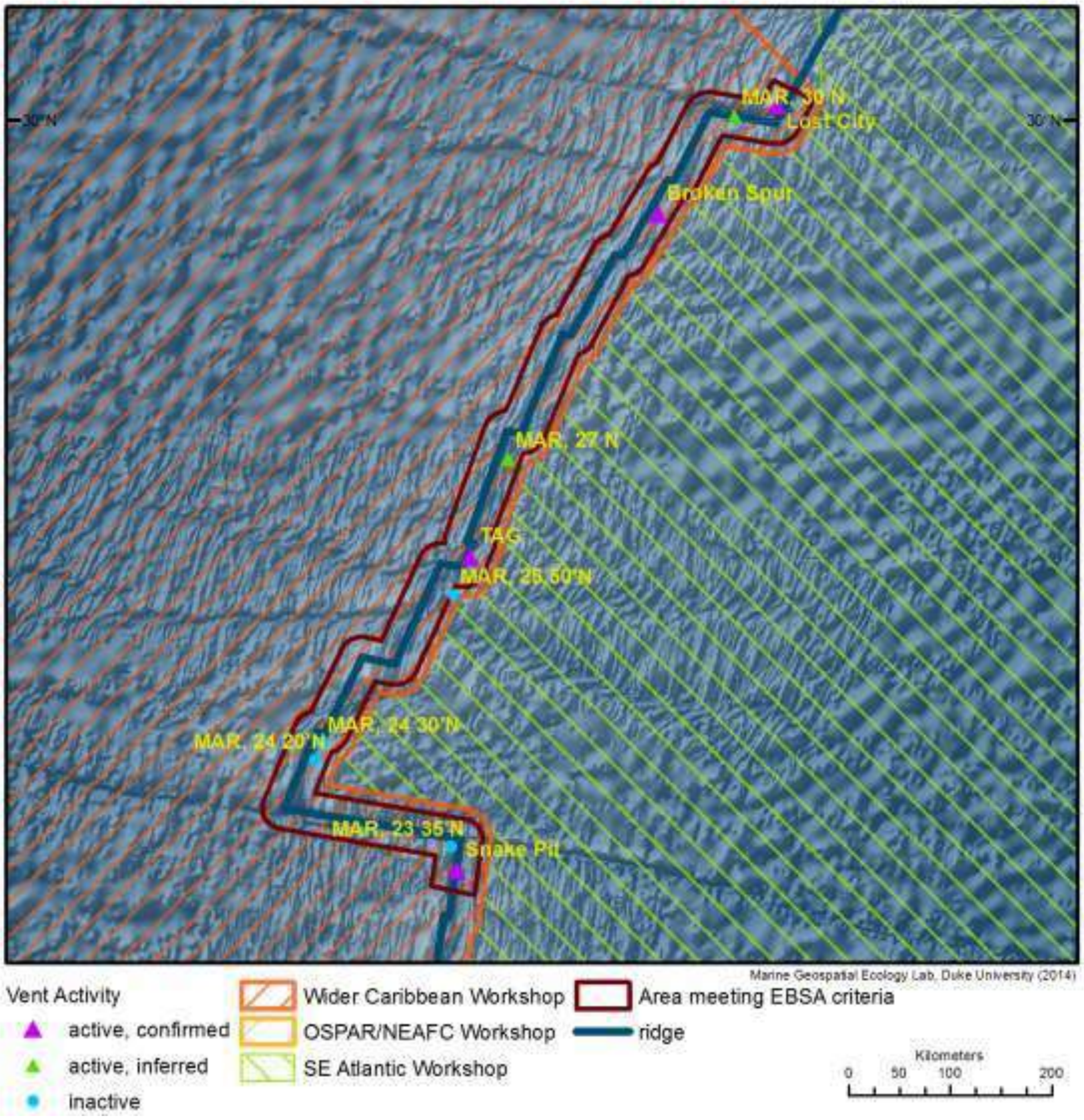

Figure 4. The boundary for hydrothermal vent fields relative to the Mid-Atlantic Ridge (MAR). The four confirmed, active vents (Snake Pit, Broken Spur, Trans-Atlantic Geotraverse (TAG) and Lost City) are indicated.

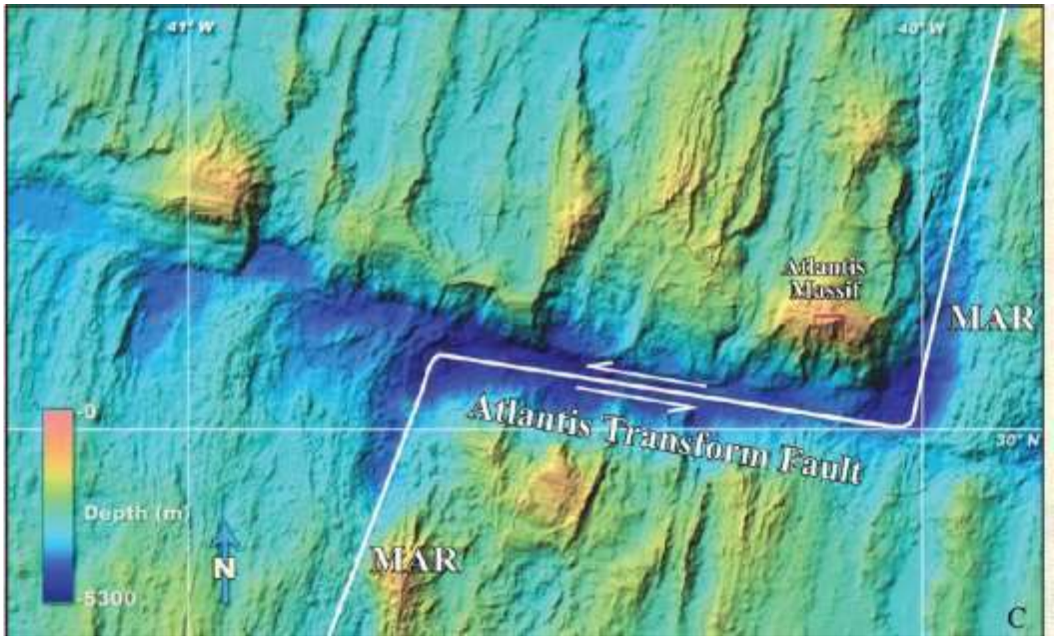

Figure 5. Location of the Lost City hydrothermal vent fields (red box) on the Atlantis Massif west of the Mid-Atlantic Ridge and north of the Atlantis Transform Fault (from Kelley et al. 2007).

Figure 6. The carbonate structures at the Lost City vent field include these spires stretching 90 feet tall. The white, sinuous spine is freshly deposited carbonate material. Added digitally to this image are the remotely operated vehicles Hercules and Argus, which were used to explore the hydrothermal vent field during an expedition. (Photo courtesy Kelley, U of Washington, IFE, URI-IAO, NOAA and downloaded from http://www.whoi.edu/page.do?pid=39137&tid=441&cid=61532&ct=61&article=36806)

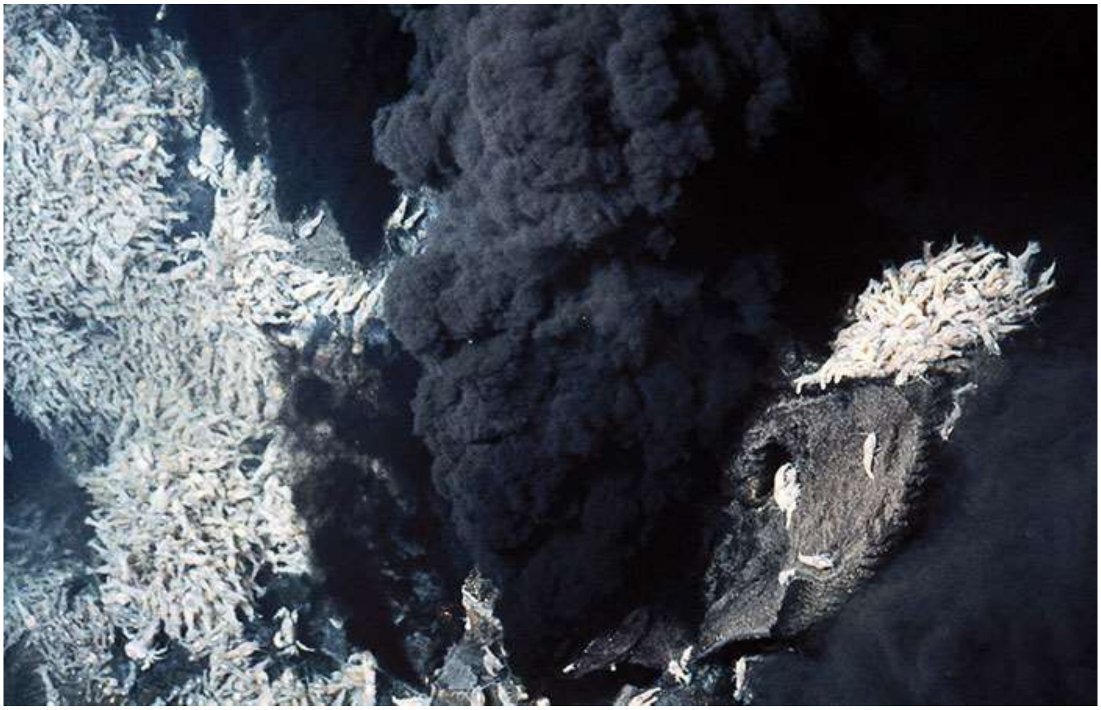

Figure 7. Thousands of shrimp (*Rimicaris exoculata*) crowd around a black smoker at the Snake Pit hydrothermal vent field on the Mid-Atlantic Ridge. (Photo downloaded from http://www.whoi.edu/oceanus/viewArticle.do?id=143909)

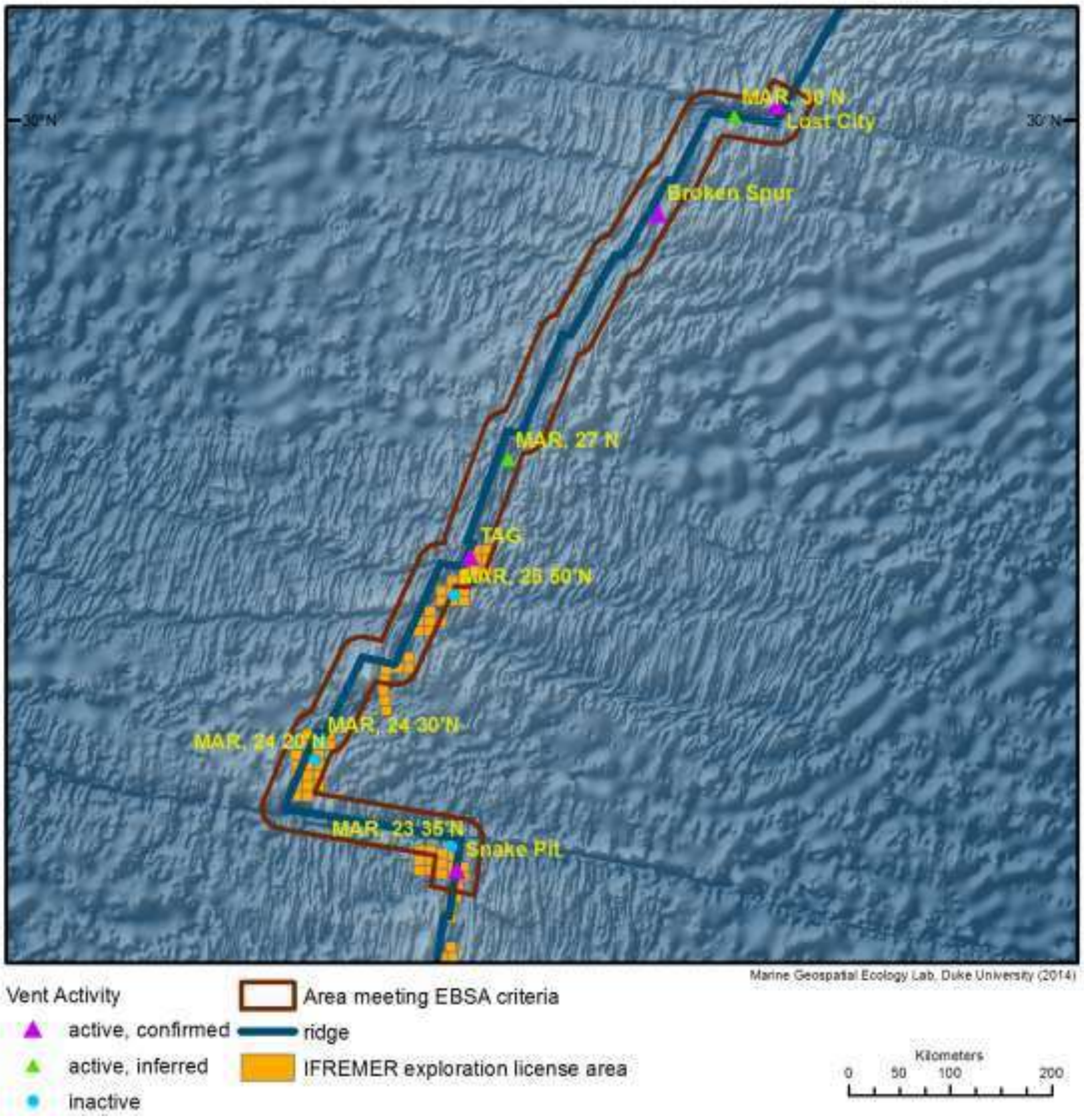

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Figure 8. Location of IFREMER mineral exploration licenses issued by the International Seabed Authority relative to the area meeting EBSA criteria and hydrothermal vent locations.

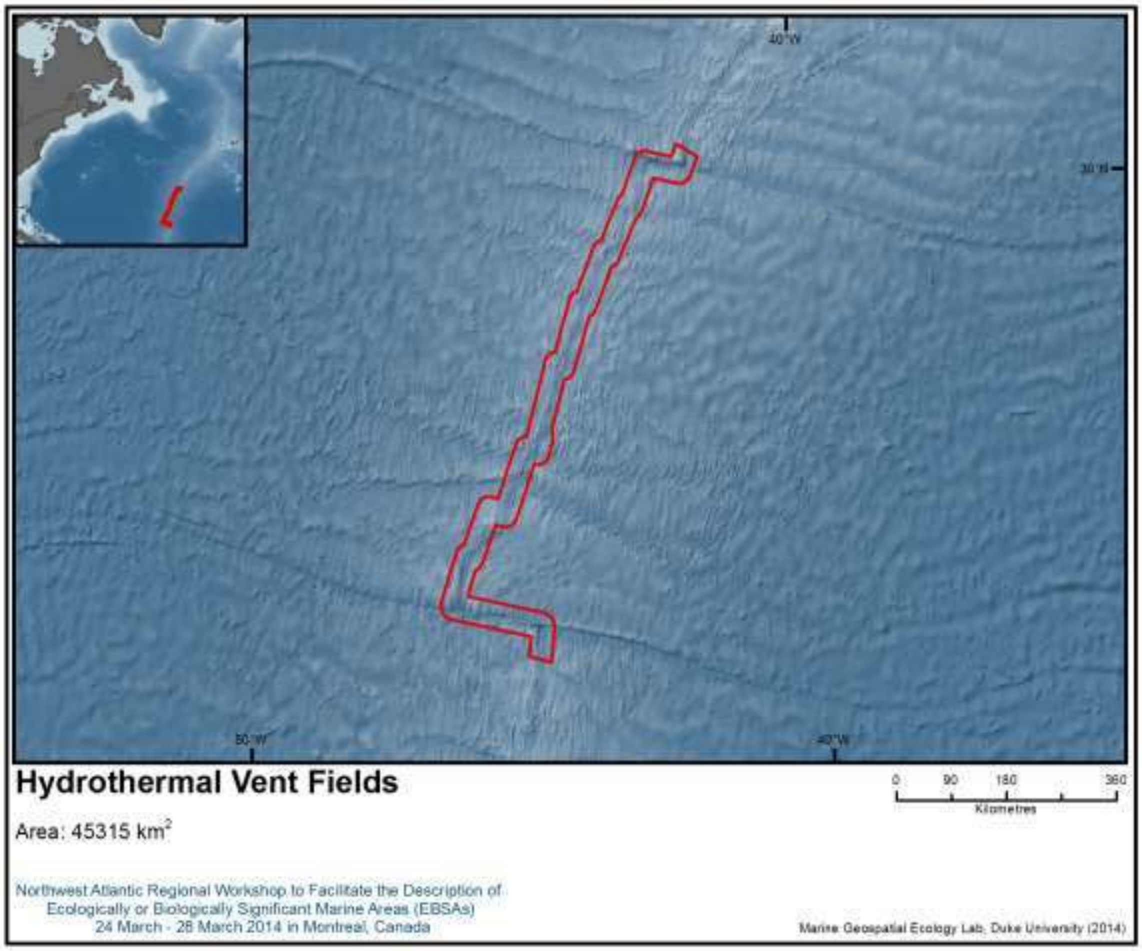

Figure 9. Area meeting the EBSA criteria.

Table 1. Location and activity level of known hydrothermal vent sites between the Azores EEZ and 14°N.

NAME	ACTIVITY	LATITUDE	LONGITUDE	DEPTH (M)
Rainbow	active, confirmed	36.23	-33.902	2320
S AMAR 1	active, inferred	36.083	-34.083	2630
Lost City	active, confirmed	30.125	-42.1183	800
MAR, 30 N	active, inferred	30.0333	-42.5	3400
Broken Spur	active, confirmed	29.17	-43.1717	3100
MAR, 27 N	active, inferred	27	-44.5	2900
TAG	active, confirmed	26.1367	-44.8267	3670
MAR, 25 50'N	inactive	25.8083	-44.9833	3000
MAR, 24 30'N	inactive	24.5	-46.1533	3900
MAR, 24 20'N	inactive	24.35	-46.2	3200
MAR, 23 35'N	inactive	23.5833	-45	3500
Snake Pit	active, confirmed	23.3683	-44.95	3500
MAR, 22 30'N	inactive	22.5	-45.005	2800
Puy des Folles	active, inferred	20.5083	-45.6417	2000
Zenith-Victory	inactive	20.1292	-45.6225	2390
St. Petersburg	active, inferred	19.8666	-45.8666	3400
MAR, 16 46'N	inactive	16.795	-46.38	3300
Krasnov	inactive	16.64	-46.475	3900
MAR, 15 50'N	inactive	15.8667	-46.6667	3000
MAR, south of 15 20'N fracture zone	active, inferred	15.0833	-45	3000
MAR, 14 54'N	active, inferred	14.92	-44.9	3500
Logatchev	active, confirmed	14.752	-44.9785	3050
