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Chairperson: Tana Worcester

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

Under the *Oceans Act*, Fisheries and Oceans Canada (DFO) is authorized to protect selected coastal and ocean areas through the establishment of Marine Protected Areas (MPAs), where the identification of an Area of Interest (AOI) is the first step in this process. The Fundian Channel-Browns Bank area was announced as an AOI on March 22, 2018. The Ecosystems Management Sector of DFO has requested DFO Science provide advice and supporting document(s) through this Canadian Science Advisory Secretariat (CSAS) regional peer review to inform the establishment of the Fundian Channel - Browns Bank AOI as an MPA. To achieve this objectives, meetings for the Regional Peer Review Process of the Biophysical and Ecological Overview of the Fundian Channel – Browns Bank Area of Interest were held November 27–29, 2018, with follow up meetings on December 19, 2018, and February 26, 2019. These meetings were intended to provide information on the key biophysical and ecological attributes of the area, especially as it pertains to potential conservation priorities and their linkages to other key ecosystem components and processes. The biophysical and ecological overview will assist in formulating and/or refining conservation objectives, delineating the proposed MPA boundary (and zones if required), and completing an ecological risk analysis to inform the development of the regulatory approach for the MPA. Participants in this meeting included DFO, other government agencies, First Nations and Indigenous groups and key stakeholders. This proceedings document includes a summary of the presentations and constitutes a record of the meeting discussions.

INTRODUCTION

The Government of Canada has agreed to a suite of international biodiversity conservation goals and targets (the Convention on Biological Diversity 2011–2020 Strategic Plan for Biodiversity’s Aichi Targets) and adopted complementary domestic 2020 Biodiversity Goals and Targets for Canada. Both international and domestic targets (Aichi Target 11 and Canada’s Target 1) call for the conservation of 10% of coastal and marine areas by 2020. An interim target of 5% protection by 2017, set by the Government of Canada, was achieved in the fall of 2017.

The designation of new Marine Protected Areas (MPAs) in Canadian waters has been identified as one part of the national strategy to meet these targets. Under the *Oceans Act*, Fisheries and Oceans Canada (DFO) is authorized to protect selected coastal and ocean areas through the establishment of MPAs, where the identification of an Area of Interest (AOI) is the first step in this process. The **Fundian Channel-Browns Bank** area was announced as an AOI on March 22, 2018. It was identified, in part, through an MPA network design analysis for the Scotian Shelf Bioregion that considered available ecological and economic information and associated design targets. Discussions with other government agencies, First Nations and Indigenous groups and key stakeholders also informed the selection of this AOI.

Within the context of the emerging MPA network, the Fundian Channel - Browns Bank AOI encompasses many of the conservation priorities that have been identified for the Scotian Shelf Bioregion (DFO 2018). In the AOI identification process, some of the most notable ecological features identified for this site were: significant concentrations of gorgonian corals; significant concentrations of sponges; areas of high diversity and productivity for fish and invertebrate species, including larvae; important foraging habitat for various seabird species; and distinctive oceanographic processes (e.g., upwelling) that create unique ecological conditions. This area also includes a migratory corridor to and from the Gulf of Maine and the Bay of Fundy and has been noted to include habitat for a variety of species of concern, i.e., listed under the *Species at Risk Act* (SARA) or assessed as Endangered, Threatened, or Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), including Atlantic Cod (Endangered – COSEWIC), Atlantic Wolffish (Special Concern – SARA), Cusk (Endangered – COSEWIC), Spiny Dogfish (Special Concern – COSEWIC), Smooth Skate (Special Concern – COSEWIC), Thorny Skate (Special Concern – COSEWIC), and White Hake (Threatened – COSEWIC). Within its proposed boundaries, this AOI contains a variety of habitats, including bank, basin, channel, shelf edge and upper slope.

The identification of AOIs is a first step in the assessment process that supports decisions toward formal MPA designations. Once an AOI is identified, documentation of additional information on the key biophysical and ecological attributes of the area is required, especially as it pertains to potential conservation priorities and their linkages to other key ecosystem components and processes. This review of available scientific knowledge provides details on these conservation priorities and may also serve to highlight additional important ecological features in the area. The biophysical and ecological overview will assist in formulating and/or refining conservation objectives, delineating the proposed MPA boundary (and zones if required), and completing an ecological risk analysis to inform the development of the regulatory approach for the MPA. The information contained within will also inform subsequent advice on monitoring protocols and strategies, identification of information gaps requiring further research, and the development of a management plan for the area.

Areas adjacent to the proposed AOI are considered in this exercise to capture the necessary breadth and scope of the various components of the ecosystem. This AOI includes two

geographically separate components. The western section is centered on Georges Basin while the larger eastern section encompasses the Fundian Channel (also known as the Northeast Channel) and part of Browns Bank. Given the geographic scale at which scientific information is collected and reported, the study area for this overview is the southwestern Scotian Shelf with specific focus on the Northeast Channel, Browns Bank, Georges Bank and Georges Basin, within and adjacent to the AOI boundaries.

The Ecosystems Management Sector of DFO has requested DFO Science provide advice and supporting document(s) through this Canadian Science Advisory Secretariat (CSAS) regional peer review to inform the establishment of the Fundian Channel - Browns Bank AOI as an MPA.

Meeting objectives were:

1. Evaluate, describe and map, where possible, the identified conservation priorities and other key biophysical and ecological features of the study area, including:
 - predominant and/or unique physical and biological oceanographic characteristics;
 - predominant, unique, and/or sensitive habitat features; and
 - ecologically, socially/culturally and/or commercially significant species; depleted species; and marine mammals, marine turtles, and marine birds.
2. Where appropriate, identify relevance of the study area to the life histories of species of interest, species distribution and abundance (and status and trends where available), and the local abiotic and biotic factors influencing these.
3. Identify known sensitivities, resilience, and recoverability of habitats and species of interest within the study area.
4. Identify key uncertainties and knowledge gaps as it pertains to the current understanding of the existing environment and species of interest within the study area, and recommend measures to address these gaps, where possible.
5. Where appropriate, based on the best available science, recommend the addition or removal of conservation priorities within the study area.

The meeting Chair, Tana Worcester, requested that meeting participants introduce themselves (Appendix 1). The Chair thanked participants for attending this regional peer review process and provided a brief overview of the CSAS science advisory process, inviting participants to review the meeting Terms of Reference (Appendix 2) and Agenda (Appendix 3). To guide discussion, a working paper was provided to meeting participants in advance of the meeting. The chair indicated that a Science Advisory Report (SAR) would be produced from the meeting, as well as a Proceedings document that would constitute the record of meeting discussions.

The Chair also emphasized that the intention of the meeting was to come to a shared understanding of the ecosystem in the study area. Discussion of whether or not the area should become an MPA was considered to be outside the scope of the meeting. Additionally, characterization of the human uses of the area will also take place through other processes.

PRESENTATIONS AND DISCUSSION

All presentations were based on material included in the working paper provided in advance of the meeting, entitled *Biophysical and Ecological Overview of the Fundian Channel-Browns Bank Area of Interest (AOI)*.

SELECTING THE FUNDIAN CHANNEL-BROWNS BANK AOI AND NEXT STEPS

Presenters: D. Fenton and M. King, DFO Ecosystems Management

Rapporteurs: E. Will and J. Ford

Summary

M. King outlined the national targets for MPAs and the national and regional progress to date to meet them. The intermediate goal to have 5% of Canada's coastal and marine areas under effective protection by 2017 has been met nationally and regionally. The Fundian Channel-Browns Bank AOI is one of two proposed Oceans Act MPAs that are currently in the process of being evaluated as potential contributions to the 10% by 2020 target. M. King noted that while these targets are still relevant, the Departmental focus at this time is to work through a good process to develop these MPAs, which may extend beyond 2020.

The full process, from site selection to designation for the Fundian Channel - Browns Bank AOI as an Oceans Act MPA, was reviewed. It was noted that this site fills a geographic gap in the emerging MPA network for the Maritimes Region, and there is no large-scale MPA in the Western Scotian Shelf. The site was identified as having high ecological value, as well as relatively low overlap with most fisheries, and it partially coincided with existing closed areas (for fishing as well as oil and gas). Adjustments to the proposed boundaries for the AOI emerged from a consultative process with the fishing industry and the Province of Nova Scotia. Feedback was also sought from First Nations well in advance of the AOI announcement.

Following this review of the biophysical and ecological information, next steps identified were to assess the potential risk of human activities to the ecosystem, design the proposed MPA (including conservation objectives, boundaries and zoning), and then move into the legal MPA designation process. Consultation will take place during all of these steps in the process. It was noted that it may be possible to prioritize research activities to address some of the key gaps identified through this biophysical and ecological overview.

Discussion

Fishing industry representatives indicated that, while they were engaged in the site selection process, the existing proposal does not fully reflect the input provided by industry. It was also noted that not all industry sectors participated in the working group. It was noted that the site proposal and the establishment process has not been fully endorsed by the Province of Nova Scotia.

The chair asked that meeting participants who questioned the description of the establishment process work with DFO Oceans staff to develop a slide that more fully described the process.

GEOLOGY OF THE FUNDIAN CHANNEL – BROWNS BANK AOI

Presenter: B. Todd, Natural Resources Canada

Rapporteurs: E. Will

Summary

The AOI boundary captures a wide variety of representative geological surfaces. The Fundian Channel is a major, shelf-crossing trough, and the only other similar trough in the Maritimes Region is the Laurentian Channel. Seabed geology within the boundaries of the AOI is typical of much of the Scotian Shelf with thin deposits of glacially-derived muds, sands, and gravels that overlie an eroded sedimentary bedrock surface. Sediments generally reflect oceanographic processes with muddy substrates preserved in the deeper portions of the AOI, whereas sand and gravel deposits on the shallower Browns Bank portion are frequently disturbed and redistributed by both tidal currents and storm waves. At a coarse scale, the geology of this area

is a persistent feature as it looks much the same as it did 20,000 years ago. The geology ultimately influences habitat type, which is why it is important to include in this overview.

Discussion

Much of the discussion centered on whether the AOI covers an area that is unique in its geology. While the surficial geology is not unique, the combination of the shelf-crossing trough combined with the interesting oceanographic factors make this site regionally unique, if not nationally. Some participants commented that we do not need to establish that the AOI is unique in every respect.

There are gaps in multi-beam data in the AOI, so it was suggested that future work could fill in these gaps. In addition, there would be value in new multi-beam data collection overlapping with some areas where there was work in the past in order to identify any changes and ensure continuity in the data.

MARINE BIRDS

Presenters: K. Allard and C. Gjerdrum, Canadian Wildlife Service

Rapporteurs: E. Will and J. Ford

Summary

K. Allard noted that Eastern Canada is considered to be a globally important area for seabirds. The AOI overlaps with Ecologically and Biologically Significant Areas that were identified for marine birds, and some portions overlap with “important areas” identified for many marine birds and foraging groups on the Scotian Shelf (defined as where species’ linear densities derived from at-sea surveys fall within the top 10% of counts, as calculated for the entire Scotian Shelf bioregion from 1965–1992 and 2006–present), summarized in Table 9 in the working paper. The AOI is outside of the foraging range of most breeding colonies of seabirds, although it is within the foraging area for Leach’s Storm-Petrels and contains important areas for that species.

Discussion

It was noted that, for many species, the largest concentration of important habitat in the Western Scotian Shelf was on Georges Bank, to the West of the AOI. There is some evidence in the seabird data of changes in habitat use over time, which may change the use of the AOI over time, but the type of change is likely to be different by species and foraging group. It was noted that, while this area was not selected primarily due to its importance to seabirds, there would likely be benefits to seabirds that use the area if an MPA was established. However, it would not be possible to evaluate the degree of future benefits to seabird populations, particularly given the multiple pressures faced by these species.

Some participants asked what percentage of the top decile (i.e., the “important areas”) on the Scotian Shelf was within the AOI, or for another a way to quantitatively describe the importance of this area to seabirds, relative to the rest of the shelf. There was agreement that the assessment team should look at how to best characterize this. There was also a request for more detailed information about the distribution of seabird observations within the site itself, and for a clearer distinction between the importance of the AOI itself versus the surrounding area.

The concept of using birds as ecosystem indicators for monitoring purposes was mentioned, in the context of large-scale ecosystem change. While this idea may have merit, it was commented that trends in these indirect indicators may be difficult to interpret, and that not all species would be useful as indicators.

BENTHIC COMMUNITIES

Presenters: A. Metaxas, Dalhousie University

Rapporteurs: E. Will

Summary

A. Metaxas outlined research on the distribution and abundance of corals and sponges in the study area. More complex substrate is associated with increased species diversity, and the existing AOI boundary is expected to capture a large diversity of benthic species and benthic features. There is generally a lower diversity moving into the Gulf of Maine. Based on nearby areas, the maximum abundance of corals was found around 500–600 m depth, and that would be expected to be similar in the AOI, although Bubblegum corals were found at 1500 m depth in the Northeast Channel. In general, benthic sampling that has been done supports protecting areas outside of the Northeast Channel Coral Conservation Area for corals and sponges.

While large corals are relatively well studied, more information is needed on other species, including sponges.

Ocean acidification was identified as a potential concern for these species, but deepwater corals would not likely be impacted by projected temperature increases in the short term.

Discussion

It was suggested that more information on the important role corals and sponges play as biogenic habitat be included in the working paper and the Science Advisory Report. In addition, a map showing all the surveys for corals that have taken place in this area, and where corals and sponges have been observed, was requested.

PHYSICAL OCEANOGRAPHY

Presenters: H. Shen, DFO Science

Rapporteurs: E. Will

Summary

The physical oceanography of the AOI is influenced by the dominant southwest flowing oceanographic current on the Scotian Shelf, the generally cyclonic flow in the Gulf of Maine, and gyres influenced by the diverse bathymetry of the area.

A key oceanographic feature of the AOI is the persistence of internal waves caused by the topography and dominant circulation patterns of the area. Internal waves disrupt the pycnocline, so are an important driver of nutrient transport, and they are a constant feature of the AOI. Zooplankton distribution follows internal waves, which can influence patterns of distribution of other species (e.g., sand lance).

Discussion

There was discussion about how internal waves and resulting patterns in zooplankton might influence the food chain and effect distribution of fish, whales, and seabirds. Impacts seem likely, but this is not well understood.

CHEMICAL OCEANOGRAPHY AND PLANKTON

Presenters: N. Jeffery, DFO Science

Rapporteurs: E. Will

Summary

A summary of the chemical oceanography of the study area and plankton communities was provided. In terms of the chemistry, it was noted that the Northeast Channel plays an important role for nutrient transport in and out of the Gulf of Maine. Changes in nutrients levels for this area (nitrates and phosphates) have shown positive anomalies relative to long-term baseline in the last decade; it remains unclear what the ecological implications of this change are.

Patterns of phytoplankton abundances are similar inside and outside of the AOI, following seasonal trends. A large spike of copepods was observed in AOI in 2008, but the overall zooplankton biomass has declined since 2009 based on Continuous Plankton Recorder data.

The AOI is considered an area of relatively high scope for growth within the Maritimes Region, as described in Kostylev and Hannah (2007). With respect to future changes, the AOI is projected to warm faster than the Scotian Shelf average by a quarter of a degree.

Discussion

There was considerable interest in characterizing what can be said about how the environment is changing and is expected to change, and what that might mean in terms of a protected area. Climate change, in particular, will increase uncertainty, particularly in terms of changing species distribution. A participant noted that one approach to establishing protected areas in the face of change and uncertainty is to focus on enduring features that will likely have continued ecological importance, and this location fits with that approach.

How to design MPAs with the expectation of environmental change, especially climate change, is an area of active research both academically and within the Department. It was suggested that a national CSAS process on this topic might be useful.

BENTHIC INVERTEBRATES AND GROUND FISH

Presenters: N. Jeffrey, DFO Science

Rapporteurs: E. Will

Summary

The Northeast Channel has been identified as an area of consistently high fish and invertebrate diversity, suggesting this ecosystem is both productive and resilient to disturbance and change (e.g., Ward-Paige and Bundy 2016). Similarly, Browns Bank was also characterized by high invertebrate richness and evenness relative to other areas on the Scotian Shelf. Overlapping with these areas of high diversity, in addition to George's Basin and a portion of the continental shelf break, the AOI covers a diversity of habitat types and, correspondingly, has a high aggregate invertebrate diversity. The deeper parts of the site have been shown to have high concentrations of sponges, seapens, and gorgonian corals.

The DFO Summary Research Vessel (RV) Survey was the primary source of data reviewed for benthic invertebrates and groundfish. In addition to being an area of consistently high diversity, portions of the AOI have been identified as consistently important areas ("hotspots") for some groundfish species over time, based on Horsman and Shackell (2009). A persistent area of high juvenile Halibut abundance was identified within the AOI (e.g., Boudreau et al. 2017), which is one of two hotspots in the Maritimes Region. In addition, this area is considered to be habitat for a variety of depleted groundfish, including Redfish, Atlantic Cod, Atlantic Wolffish, Cusk, Roundnose Grenadier, Spiny Dogfish, Smooth Skate, Thorny Skate, and White Hake.

Discussion

There was agreement that fisheries management information (quotas, management plans) should be removed from the working paper unless they add important context. Much of the discussion on this section related to the use of the RV survey to describe invertebrate

distribution and diversity. Results from 2017 were a focus due to an increased taxonomic focus on invertebrates. There was agreement that the RV survey is a useful index for some invertebrate species over a particular time period, and is appropriate to use in the document, as long as it is clear what information is and is not collected, and how this has changed over time.

A participant noted that while LFA 40 (the majority of which falls within the AOI boundaries) is a longstanding conservation measure intended to protect lobster, there is no clear basis to say whether or not it has been effective. Lobster abundance has increased throughout the Region, but the role of LFA 40 is undetermined.

With respect to groundfish, there was agreement that the document was relatively comprehensive; the main gap identified was that the Halibut survey would be more appropriate for characterizing the distribution of Halibut and Cusk. The persistent hotspot analysis conducted by Horsman and Shackell (2009) was identified as a useful addition to the working paper, and it could be included as a supplement with comments on any changes in the spatial distribution of hotspots relative to the AOI since the method was last reviewed/applied.

There was discussion surrounding the significance of the noted juvenile Halibut hotspot, and whether or not this should be considered a conservation priority. In particular, the utility of the RV survey for understanding Halibut distribution was raised, as well as the appropriateness of identifying a conservation priority for a commercial species that has been increasing in abundance. Other participants felt that there could be long-term benefits for the species and the fishery to protecting this spot for juvenile Halibut, which has remained a hotspot in periods of high and low Halibut abundance (Boudreau et al. 2017).

There was agreement that the AOI supports relatively high concentrations of Wolffish, Cusk and Redfish. It was noted by one meeting participant that the fishing industry has observed more frequent and abundant catches of Cusk in 4X recently. There was agreement to remove Roundnose Grenadier as a conservation priority given the limited information available. An overall lack of information about the species composition of the deep-water portion of the site was noted and this was identified as a future research priority.

LARGE PELAGIC FISHES

Presenter: K. Gillespie, DFO Science

Rapporteurs: C. Schram and J Ford.

Summary

Data sources for large pelagic fishes are much more limited than for other fish species, with scientific surveys limited to a survey for Porbeagle Shark undertaken by DFO in 2006, 2007, and 2017. Accordingly, most information about the use of the area by large pelagic fishes comes from fishery-dependent data, including fishery logbooks and at-sea observers. Many large pelagic fishes like Tunas and Swordfish follow the Gulf Stream, following along the shelf break, including through the AOI. Most of these species are highly migratory, and there are no records of spawning in Canadian waters, including in the AOI. The biology, range and movement, biomass trends, and conservation status of commercial large pelagic fishes that are known to occur in the AOI, including Albacore, Bigeye, Bluefin, Skipjack and Yellowfin Tunas, Mahi Mahi, Swordfish, and Blue and White Marlin were outlined. The biology and conservation status of common shark species that are known to use the AOI, or that are likely to use the AOI, were also reviewed, including Blue, Porbeagle, Shortfin Mako, and White Sharks. For all these species, the AOI constitutes a small portion of the species range and the magnitude of movement through the AOI is likely dependent on temperature patterns and prey availability. Bluefin Tuna and Swordfish are the most commonly encountered large pelagic fish in the AOI.

The most notable section of the AOI relating to large pelagic fishes is the “Hell Hole” area at the entrance to the Northeast Channel within the AOI, between Browns Bank and Georges Bank. This area has been seasonally closed to large pelagic fishing (July 1 to November 30) since 2003 in order to reduce the bycatch of Bluefin Tuna by longliners. Occasional openings have occurred, including in 2018, to test whether bluefin tuna bycatch levels remain high.

Discussion

For Bluefin Tuna, an index of abundance based on catch from NAFO areas 4XVW, including the AOI, is reported to the International Commission for the Conservation of Atlantic Tunas (ICCAT) and informs the Bluefin Tuna stock assessment model. It was suggested that this information be incorporated into this AOI overview.

It was noted that the information on large pelagic fishes was presented at a larger spatial scale than some of the other species. Information that is available for these species is fishery-dependent, and catch per unit effort standardization and analysis had not yet been completed, so spatial distribution of landings data was not included in the working paper. More detailed information about the occurrence of large pelagic species in the study area was requested, and landings information for large pelagic species in the AOI was recommended for inclusion in the working paper. It was also commented that the swordfish harpoon fishery focuses on a different part of the site than the longline fishery, so information from both fleets would be informative. There was agreement that fishery-based information about distribution of large pelagic fish in the AOI should be presented for the site in lieu of any fishery independent data sources.

SEALS, SEA TURTLES, AND MIGRATORY SPECIES

Presenter: S. Heaslip, DFO Science
Rapporteurs: C. Schram and J. Ford
Summary

An overview of the biology of common seal species on the Western Scotian Shelf was provided. Given the known distribution, movement patterns, and habitat preferences of grey seals, they are the most likely seal species to utilize the AOI for foraging and travelling. Satellite tagging indicates that male grey seals from Sable Island forage in this area, as part of their large foraging areas, and seem more likely to use the AOI than females. Sea turtle distribution on the Scotian Shelf has largely been characterized based on tagging data, although other fishery-based information and sightings data also exists. Loggerhead and leatherback turtles have been observed in the AOI. Important habitat for Leatherback Turtles in Canadian waters has been identified south of the AOI, and although this area does not overlap with the AOI boundaries, it is within 10 nm of the southern boundary (DFO 2011). An update of important habitat for Leatherback Turtles is scheduled for early 2019. At-sea observer records of Leatherback Turtles (presence only, not assessed for any bias in observer coverage) were noted within the AOI, with most records were further offshore. Loggerhead Turtles are known to follow thermally dynamic waters along the shelf break, including along the southern edge of the AOI.

In general, many groups of pelagic species, including small and large pelagic fishes, diadromous fishes, marine mammals, sea turtles, and seabirds use the area as part of migratory life-history patterns. Movements through the AOI have been described for Basking Sharks. It was noted that climate change may change patterns of use by migratory species.

Discussion

A participant noted that there are no records of Leatherback Turtle mortality attributed to the pelagic longline fleet, and it was recommended that it would be more appropriate to consider turtles to be vulnerable to fishing than to characterize fishing as a threat. The potential to use

sightings data, fishery-based information, and data from satellite tags (used to assess post-release mortality) to further characterize use of the AOI by sea turtles was discussed. It was concluded that this should be captured as an area for potential future study.

CETACEANS

Presenters: E. Marotte, DFO Oceans

Rapporteurs: C. Schram and J. Ford

Summary

No comprehensive systematic studies on the occurrence or distribution of cetaceans in the Fundian Channel-Brown's Bank area have been conducted to date, and cetacean abundance has not been estimated for this area. Current understanding of cetacean presence on the Scotian Shelf, including the AOI, is based on information from a variety of sources including sightings data from both opportunistic encounters and dedicated surveys. Both these types of sightings data exist for the area that encompasses the Fundian Channel - Browns Bank AOI, although the majority have not been corrected for effort. They, therefore, only provide a basic understanding of cetacean presence in this area and cannot be used to infer trends in occurrence or abundance over different spatial and temporal scales. The analysis presented was largely informed by these sightings data, collected from three different databases. Overall, the AOI was characterized as an area frequented by a variety of species, but little could be said about patterns of occurrence or the relative importance of the area to cetaceans. Additional information consulted after the first day of the meeting showed that the AOI could be important foraging habitat for Blue Whales and represent suitable habitat for other species, particularly Beaked Whales.

Discussion

Questions arose regarding the significance of using fisheries observer data. Since fisheries observers sometimes note whale observations but are not required to do so, it is not clear whether a lack of whale sightings reported by observers reflects absence of whales or not.

There was discussion about the appropriateness of considering the use of this area as a migration corridor or migratory area as a conservation priority; currently, there is relatively little information about the use of this area by cetaceans. However, cetaceans experts present considered it likely that the area is used by multiple species and that it would be reasonable and precautionary to include them based on habitat suitability models and what we know about cetacean movement in the area.

Further discussion was had about the types of information used to characterize cetacean presence in the AOI. The group suggested that additional information sources be included in the analysis in order to provide a more comprehensive overview of cetacean occurrence, including results from previous habitat suitability modeling efforts for Blue Whales and Northern Bottlenose Whales. These were subsequently consulted and a more refined description of the AOI's importance to cetaceans was developed as a result, with Blue Whale foraging habitat and Beaked Whale habitat emerging as possible conservation objectives. Cetacean use of the AOI was flagged as an area for future research.

KNOWLEDGE GAPS AND ECOSYSTEM SYNTHESIS

This presentation was tabled in order to allow more time to discuss conservation priorities, and participants were asked to review this section of the working paper. Knowledge gaps were flagged during the previous presentations. Throughout the meeting, how to adequately capture the potential for future ecosystem changes was a subject of considerable discussion. There was

agreement that we should reflect existing research on potential future change (e.g., ocean acidification and warming) to the extent possible, but how this will impact future management of the area is outside the scope of the current science review.

CONSERVATION PRIORITIES

Presenters: S. Heaslip and N. Jeffery, DFO Science

Rapporteurs: E. Will and J. Ford

Summary

The conservation priorities outlined in the working paper were reviewed:

1. Significant concentrations of deep-water corals;
2. Significant concentrations of sponges, including records of the Russian Hat Sponge;
3. Important habitat for juvenile Atlantic Halibut;
4. Habitat for a variety of depleted groundfish, including Redfish, Atlantic Cod, Atlantic Wolffish, Cusk, Roundnose Grenadier, Spiny Dogfish, Smooth Skate, Thorny Skate, and White Hake;
5. Large pelagic animals, including sea turtles, cetaceans, and sharks, that migrate through the AOI;
6. Feeding areas for large pelagic fishes, sea turtles, pinnipeds, and cetaceans, and migratory corridor from southern to temperate waters (and vice versa) and for offshelf/onshelf waters including the Bay of Fundy and Scotian Shelf; and
7. Foraging ground for most functional guilds of marine birds, including species listed by SARA and the International Union for the Conservation of Nature.

Discussion

There was agreement that deepwater corals are an appropriate conservation priority for this site, although it was noted that more information about their distribution within and around the site would be valuable, particularly outside the Northeast Coral Conservation Area. Concentrations of sponges and sea pens were also noted as appropriate conservation priorities, although better understanding of the distribution of sponge species would help future discussions on MPA management. With respect to fish, there was agreement to remove Roundnose Grenadier as a conservation priority, but for some other species there was request to see more information about previous hotspot analyses (*sensu* Horsman and Shackell 2009) and about the importance of the AOI versus other parts of the shelf. For Atlantic Cod, there was agreement that the AOI would be better characterized as a representative area rather than an important area, although Brown's Bank is known to be an important spawning area for Cod.

REVIEW OF DISCUSSIONS AND CONCLUSIONS

IDENTIFYING AREAS OF CONSENSUS AND KEY DATA GAPS

The Chair reviewed draft consensus statements from the first two meeting days. Those statements and some additional considerations that were raised are summarized in this section. In general, there was agreement that *the Biophysical and Ecological Overview of the Fundian Channel – Brown's Bank Area of Interest* provided a high level summary of available information on the physical, chemical and biological characteristics of the site, with gaps identified below.

Context – A suggestion was made that the process be characterized in a more general way, e.g., that this is science information and advice to inform the next steps in the MPA establishment process, but the outcome of that process has not yet been determined.

Physical Setting - Characterization of the physical setting (geology, chemical, and physical oceanography) is appropriate, with minor corrections (as discussed at the meeting, and submitted by reviewers). Some modifications that were agreed to included adding any information on acidification that has been observed on the Scotian Shelf to date. The importance of distinguishing between trends and variability was discussed. There was also agreement to add something on the acoustic environment, particularly the potential sources and effects of human-generated sounds in the marine environment, and any information available for the study area, to the extent possible.

Some suggestions for future characterizations of the site included capturing any information on archaeological artifacts in the area, a complete data inventory of coral and sponge research that has been done in the area, and the impact of changing freshwater inputs on variability and uncertainty.

Biological Oceanography (overall) - Characterization of the biological oceanography (description of surveys, plankton, benthic habitats and communities, invertebrates, fish, cetaceans, seals, sea turtles, marine birds) is generally appropriate (captures major trends and patterns), with some critical gaps identified:

Large Pelagic Fishes - The description of large pelagic species was not adequately specific to the AOI. It was noted that the Hell Hole catch per unit index for Bluefin Tuna that Canada brings to the International Commission for the Conservation of Atlantic Tunas (ICCAT) should be included. Fishery information is the main source of information about large pelagic fish in this area, and efforts should be made to include it.

Sharks – Characterization of the area as a migration “corridor” was questioned, and there was agreement that this is one of multiple routes that could be used by sharks for migration. There was a suggestion that shark tagging information could also be reviewed for this area.

Groundfish - It was suggested that the focus could be on the more recent time period and the most common species in the area, and that the DFO-Industry Halibut longline survey would be the best index of abundance for Halibut and Cusk. It was agreed that there was too much information on fisheries in the document for the intended purpose.

Cetaceans - The potential for duplicate records was raised, and there was agreement that this should be reviewed with an eye to minimizing any duplicate cetacean records. Some additional citations for Blue Whales and other listed species were suggested.

Seabirds - It was agreed that the overall characterization was useful and appropriate. It was also suggested that the information could be simplified a little, and it would help to clarify when significant concentrations were seen within the AOI versus in its vicinity. It was also recommended that functional guilds would be a better area of focus than individual species.

Other - Overall, it was agreed that the characterization of the deep water parts of the site is necessarily limited and largely based on information from other similar areas, due to a lack of information from the study area. This should be noted as a key gap and area for future research.

Some suggestions of additions for future consideration (but not this process) included a more complete description of smaller plankton, inclusion of the scallop survey information and scallop

habitat suitability modelling on Brown's Bank, acoustic data on cetacean distribution, and a general description of deep-sea (shelf-slope) ecosystems.

IMPACT OF CHANGING ECOSYSTEM CONDITIONS

The potential impact of changing ecosystem conditions (e.g., increasing temperatures, shifting zooplankton communities, shifting right whale distribution) on the future species composition of the AOI was of concern to many meeting participants. Concerns were raised about the potential of changing environmental conditions to change the distribution or prevalence of identified conservation priorities. Another concern expressed by some fishing industry participants was that ecosystem changes may increase the importance of this area to fisheries in the future, and that a protected area designed to minimize impact on fisheries today may inhibit future access.

Suggestions were made to incorporate predictive modelling (i.e., models that attempt to predict future change in distributions), where these exist. A CSAS process to look in more detail at the impact of changing ecosystem conditions on MPAs, and the role of MPAs in moderating impact (enhancing resiliency) was encouraged.

CONSERVATION PRIORITIES DISCUSSION

Given some of the considerations above, there was agreement that conclusions about conservation priorities could not be made at the meeting. The meeting chair and assessment team agreed to compile the key additional information that was requested, as well as feedback from meeting participants about conservation priorities and data gaps. A follow-up meeting to review this information and draw conclusions about conservation priorities would be arranged.

CONSERVATION PRIORITIES DISCUSSION (PART 2): DECEMBER 19, 2018

Bedford Institute of Oceanography, Dartmouth

Summary

T. Worcester began the meeting by reviewing the meeting Terms of Reference (Appendix 2), as well as additional national context regarding MPA networks and previous guidance related to conservation priorities. In particular, there is National Guidance on Conservation Priorities (DFO 2007) and multiple examples within the Maritimes Region and from other regions of how conservation priorities were identified and described.

A table, the final draft of which is included in the Science Advisory Report for this meeting (DFO 2020), was presented for review, which included a list of the proposed conservation priorities, and whether there was evidence of these met agreed to representation, species-based (i.e., depleted or at-risk species), and EBSA criteria. The available evidence was also discussed and categorized (high = historical and recent records from within AOI, including imagery or physical samples; medium = historical evidence, modeled suitable habitat, or sparse records from within AOI; low = inferred from nearby survey sites or from literature with no physical samples or modeling). A recommendation for many of the conservation priority was discussed and agreed to. While significant progress was made at this meeting, discussion and/or agreement on a few conservation priorities were not completed (e.g., Halibut, Lobster, representation of habitat types and associated fish and invertebrate communities, migratory habitat for Pelagics), and another meeting was planned.

CONSERVATION PRIORITIES DISCUSSION (PART 3): FEBRUARY 26, 2019

Bedford Institute of Oceanography, Dartmouth

T. Worcester began the meeting by reminding participants of the Terms of Reference (Appendix 2) for this science peer review, and the progress that had been made to date.

A presentation was made on the remaining conservation priorities for discussion, including the spatial datasets and other information available to inform the discussion:

- Persistent habitat for juvenile Atlantic Halibut.
- Reproductive hotspot for American Lobster.
- Representation of habitat types, including basin, bank, deep water slope and channel, and associated representative fish and invertebrate communities.
- Migratory habitat between southern to temperate waters and on/off shelf movements.
- Feeding area for large pelagic fish, such as tunas.
- Suitable habitat for Sowerby's beaked whale.
- Suitable habitat for other whales.
- Feeding habitat for turtles.

Discussion continued on the table of conservation priorities, and the final draft of the consensus determinations of the meeting are included in the SAR (DFO 2020). Consensus was reached on most of the proposed conservation priorities. However, while the majority view was that there was sufficient information to recommend persistent habitat for juvenile Atlantic Halibut as a conservation priority for this AOI (in particular, that this feature is persistent and there is overlap between it and the proposed AOI boundary), there was ongoing disagreement about recommending it as a conservation priority. It was agreed to reflect this lack of agreement, including where there was agreement and where there was not, in the SAR.

REFERENCES CITED

- Boudreau, S.A., Shackell, N.L., Carson, S., and den Heyer, C.E. 2017. Connectivity, persistence, and loss of high abundance areas of a recovering marine fish population in the Northwest Atlantic Ocean. *Ecol Evol* 7(22): 9739–9749.
- DFO. 2011. [Using Satellite Tracking Data to Define Important Habitat for Leatherback Turtles in Atlantic Canada](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/036.
- DFO. 2020. [Biophysical and Ecological Overview of the Fundian Channel – Browns Bank Area of Interest \(AOI\)](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2020/034.
- DFO. 2018. [Design Strategies for a Network of Marine Protected Areas in the Scotian Shelf Bioregion](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/006.
- Horsman, T., and Shackell, N. 2009. Atlas of important habitat for key fish species of the Scotian Shelf, Canada. Can. Tech. Rep. Fish. Aquat. Sci. 2835: viii + 82 p.
- Jeffery, N.W., Heaslip, S.G., and Stanley, R.R.E. (Eds.). 2023. [Biophysical and Ecological Overview of the Fundian Channel-Browns Bank Area of Interest \(AOI\)](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2023/058. xxix + 302 p.
- Kostylev, V.E., and Hannah, C.G. 2007. Process-driven characterization and mapping of seabed habitats. Mapping the Seafloor for Habitat Characterization: Geological Association of Canada, Special Paper 47: 171–184.

Ward-Paige, C.A., and Bundy, A. 2016. [Mapping Biodiversity on the Scotian Shelf and in the Bay of Fundy](#). DFO Can. Sci. Advis. Sec. Res. Doc. 2016/006. v + 90 p.

APPENDIX 1: MEETING PARTICIPANTS

Name	Affiliation	Participation		
		Nov	Dec	Feb
Allard, Karel	Environment and Climate Change Canada, Canadian Wildlife Service	X	-	-
Atkinson, Troy	NS Swordfishermen's Association	X	X	X
Boudreau, Cyril	NS Fisheries	-	X	-
Bowlby, Heather	DFO Maritimes Science	X	X	X
Boyce, Daniel	Dalhousie University	X	-	-
Boyd, Catherine	Clearwater Seafoods	X	-	-
Turlo, Colleen	Oceans North	-	X	-
Cook, Adam	DFO Maritimes Science	-	-	X
Dalton, Alex	DFO Maritimes Science	-	-	X
Fenton, Derek	DFO Maritimes Oceans	X	X	X
Fuller, Susanna	Oceans North	X	-	-
Gillespie, Kyle	DFO Maritimes Science	X	-	-
Gjerdrum, Carina	Environment and Climate Change Canada, Canadian Wildlife Service	X	X	-
Gomez, Catalina	DFO Maritimes Science	X	X	X
Heaslip, Susan	DFO Maritimes Science	X	X	X
Jeffery, Nick	DFO Maritimes Science	X	X	X
Keith, David	DFO Maritimes Science	X	-	-
King, Marty	DFO Maritimes Oceans	X	X	X
Lacharite, Myriam	Nova Scotia Community College	X	-	-
Lang, Shelley	DFO Maritimes Science	X	-	X
MacDonald, Elizabeth	Canada-NS Offshore Petroleum Board (CNSOPB)	X	-	-
Marotte, Emma	DFO Maritimes Oceans	-	-	X
Maxwell, Judith	Scotia-Fundy Inshore Fishermen's Assn. (SFIFA)	X	-	-
Metaxas, Anna	Dalhousie University / Oceanography	X	X	-
Mitchell, Vanessa	Maritime Aboriginal Peoples Council	X	-	-
Regnier-McKellar, Catriona	DFO Maritimes Science	X	-	-
Sark, Roger	Maliseet Nation Conservation Council	X	-	-
Schram, Catherine	DFO National Headquarters	X	-	-
Shackell, Nancy	DFO Maritimes Science	X	-	X
Shen, Hui	DFO Maritimes Science	X	-	-

Name	Affiliation	Participation		
		Nov	Dec	Feb
Stanley, Ryan	DFO Maritimes Science	X	X	X
Thomson, Jordy	Ecology Action Centre	X	-	-
Todd, Brian	Natural Resources Canada	X	-	-
Underwood, Jonathan	DFO Maritimes, Management	X	X	-
Vance, Alexandra	OCEANA	X	X	X
Vascotto, Kris	Atlantic Halibut Council / Groundfish Enterprise Allocation Council (GEAC) / Vascotto Resource Services Inc.	X	X	X
Whitman, Bill	NS Dept. Fisheries & Aquaculture (NSDAF)	X	-	X
Will, Elise	DFO Maritimes Oceans	X	-	-
Worcester, Tana (chair)	DFO Maritimes Science, Centre for Science Advice	X	X	X

APPENDIX 2: TERMS OF REFERENCE

Biophysical and Ecological Overview of the Fundian Channel-Browns Bank Area of Interest

Regional Peer Review Process – Maritimes Region

November 27–29, 2018

Dartmouth, Nova Scotia

Context

The Government of Canada has agreed to a suite of international biodiversity conservation goals and targets (the Convention on Biological Diversity 2011–2020 Strategic Plan for Biodiversity’s Aichi Targets) and adopted complementary domestic 2020 Biodiversity Goals and Targets for Canada. Both international and domestic targets (Aichi Target 11 and Canada’s Target 1) call for the conservation of 10% of coastal and marine areas by 2020. Further, to highlight these targets as a priority, the Government of Canada identified an interim target of 5% protection by 2017, which was achieved in the fall of 2017.

The designation of new Marine Protected Areas (MPAs) in Canadian waters has been identified as one part of the national strategy to meet these targets. Under the *Oceans Act*, Fisheries and Oceans Canada (DFO) is authorized to protect selected coastal and ocean areas through the establishment of MPAs, where the identification of an Area of Interest (AOI) is the first step in this process. The **Fundian Channel-Browns Bank** area was announced as an AOI on March 22, 2018. It was identified, in part, through an MPA network design analysis for the Scotian Shelf Bioregion that considered available ecological and economic information. Discussions with other government agencies, First Nations and Indigenous groups and key stakeholders also informed the selection of this AOI.

Within the context of the emerging MPA network, the Fundian Channel-Browns Bank AOI encompasses many of the conservation priorities that have been identified for the Scotian Shelf Bioregion (DFO 2018). Some of the most notable ecological features for this site are: significant concentrations of gorgonian corals (e.g., bubblegum coral); significant concentrations of sponges; areas of high diversity and productivity for fish and invertebrate species, including larvae; important foraging habitat for various seabird species; and distinctive oceanographic processes, such as upwelling that creates unique ecological conditions. This area also includes a migratory corridor to and from the Gulf of Maine and has been noted to include habitat for a variety of species of concern including Atlantic cod (Endangered – COSEWIC), Atlantic wolffish (Special Concern – SARA), cusk (Endangered – COSEWIC), spiny dogfish (Special Concern – COSEWIC), smooth skate (Special Concern – COSEWIC), thorny skate (Special Concern – COSEWIC), and white hake (Threatened – COSEWIC). Another defining ecological characteristic of this AOI is the wide range of habitats it spans, including bank, basin, channel, shelf edge and upper slope habitats.

The identification of MPA AOIs is a first step in the assessment process that supports decisions toward formal MPA designations. Once an AOI is identified, more detailed information on the key biophysical and ecological attributes of the area is required, especially as it pertains to potential conservation priorities and their linkages to other key ecosystem components and processes. A review of available scientific knowledge will provide details on these conservation priorities and may also serve to highlight additional important ecological features in the area. The biophysical and ecological overview will assist in formulating and/or refining conservation objectives, delineating the proposed MPA boundary (and zones if required), and completing an ecological risk analysis to inform the development of the regulatory approach for the MPA. The information contained within will also inform subsequent advice on monitoring protocols and

strategies, identification of information gaps requiring further research, and the development of a management plan for the area.

Areas adjacent to the proposed AOI may need to be considered in this exercise to capture the necessary breadth and scope of the various components of the ecosystem. This AOI includes two geographically separate components. The western section is centered on Georges Basin while the larger eastern section encompasses the Fundian Channel (also known as the Northeast Channel) and part of Browns Bank. Given the geographic scale at which scientific information is collected and reported, the study for this overview is the southwestern Scotian Shelf with specific focus on the Northeast Channel, Browns Bank, Georges Bank and Georges Basin, within a buffer of the AOI boundaries.

The Ecosystems Management Sector of DFO has requested DFO Science provide advice and supporting document(s) through this Canadian Science Advisory Secretariat Regional Peer Review to inform the establishment of the Fundian Channel-Browns Bank AOI as an MPA. The Ecosystems Management Sector will be conducting consultations concerning the MPA establishment process in 2018 and 2019.

Objectives

The working paper(s) will be reviewed and provide the basis for discussion and advice on the specific objectives outlined below:

1. Evaluate, describe and map, where possible, the identified conservation priorities and other key biophysical and ecological features of the study area, including:
 - predominant and/or unique physical and biological oceanographic characteristics;
 - predominant, unique, and/or sensitive habitat features; and
 - ecologically, socially/culturally and/or commercially significant species; depleted species; and marine mammals, marine turtles, and marine birds.

Where appropriate, identify relevance of the study area to the life histories of species of interest, species distribution and abundance (and status and trends where available), and the local abiotic and biotic factors influencing these.

2. Identify known sensitivities, resilience, and recoverability of habitats and species of interest within the study area.
3. Identify key uncertainties and knowledge gaps as it pertains to the current understanding of the existing environment and species of interest within the study area, and recommend measures to address these gaps, where possible.
4. Where appropriate, based on the best available science, recommend the addition or removal of conservation priorities within the study area.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document(s)

Expected Participation

- Fisheries and Oceans Canada (Science, Fisheries Management, and Ecosystem Management)

-
- Canadian Wildlife Service
 - Province of Nova Scotia
 - Environmental Non-Government Organizations
 - Academic researchers
 - Indigenous communities/organizations
 - Fishing associations
 - Other invited experts

References

DFO. 2018. [Design Strategies for a Network of Marine Protected Areas in the Scotian Shelf Bioregion](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2018/006.

APPENDIX 3: AGENDA

Biophysical and Ecological Overview of the Fundian Channel – Browns Bank Area of Interest (AOI)

Regional Peer Review – Maritimes Region

27–29 November 2018
Mic Mac Amateur Aquatic Club
192 Prince Albert Road
Dartmouth, Nova Scotia
Chairperson: Tana Worcester

DRAFT AGENDA

DAY 1 (Tuesday, November 27, 2018)

Time	Topic	Leads
09:00–09:10	Welcome and Introductions	Chair
09:10–09:30	Selecting the Fundian Channel-Browns Bank AOI and Next Steps	D. Fenton/M. King
09:30–10:15	Geology of the Fundian Channel	B. Todd
10:15–11:00	Marine Birds	K. Allard/CWS
11:00–11:15	Break (Coffee/tea provided)	
11:15–12:30	Benthic Communities	A. Metaxas
12:30–13:30	Lunch (Not provided)	
13:30–14:15	Physical Oceanography	H. Shen
14:15–15:00	Chemical Oceanography and Plankton	N. Jeffery
15:00–15:15	Break (Hospitality not provided)	
15:15–16:30	Benthic Invertebrates and Groundfish	N. Jeffery

DAY 2 (Wednesday, November 28, 2018)

Time	Topic	Leads
09:00–09:15	Welcome and recap	Chair
09:15–10:45	Large Pelagics, Seals, Sea Turtles, and Migratory Species	S. Heaslip/ K. Gillespie
10:45–11:00	Break (Coffee/tea provided)	
11:00–12:00	Cetaceans	E. Marotte
12:00–13:00	Lunch (Not provided)	
13:00–14:30	Knowledge Gaps and Ecosystem Synthesis	S. Heaslip/ N. Jeffery

Time	Topic	Leads
14:30–15:00	Conservation Priorities Discussion	S. Heaslip/ N. Jeffery
15:00–15:15	Break (<i>Hospitality not provided</i>)	
15:15–16:30	Continue Conservation Priorities & Discussion	S. Heaslip/ N. Jeffery

DAY 3 (Thursday, November 29, 2018)

Time	Topic	Leads
09:00–09:15	Welcome and recap	Chair
09:15–10:30	Science Advisory Report (SAR) writing	S. Heaslip
10:30–10:45	Break (<i>Coffee/tea provided</i>)	
10:45–12:00	Wrap-up SAR and final discussion	S. Heaslip/Chair