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Considerations for Marine Protected Area network planning on the Atlantic Coast of Nova Scotia with a focus on the identification of Ecologically and Biologically Significant Areas

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

Fisheries and Oceans Canada will lead Marine Protected Area (MPA) network planning in Canada's 13 bioregions, including the Scotian Shelf Bioregion. The technical aspects of MPA network planning in the Scotian Shelf Bioregion will take place in three planning areas: the Offshore Scotian Shelf, the Bay of Fundy, and the Atlantic Coast of Nova Scotia. The ecological data available for the Atlantic Coast Planning Area are generally patchy in their distribution compared to other parts of the bioregion. As a result, different data considerations and methodologies for identifying Ecologically and Biologically Significant Areas (EBSAs) and incorporating habitat representation in MPA planning will be required in the Atlantic Coast Planning Area. This research document was presented as a working paper at the Canadian Science Advisory Secretariat (CSAS) Regional Advisory Process (RAP) on MPA Network Planning in the Scotian Shelf Bioregion on March 5-7, 2012. The purpose of this document is to provide an overview of available data sets that may be useful in identifying and evaluating EBSAs against a draft set of MPA network objectives for the Atlantic Coast Planning Area. Data sets that could be used for EBSA identification and subsequent MPA network planning are identified and grouped into the following categories: the Inshore Ecosystem Project, Lobster Data, Marine Algae Data, Traditional Ecological Knowledge, Other Fish Data, and Environment Canada's Canadian Wildlife Services Key Marine Habitats for Migratory Birds Project. Data sets that are useful for incorporating representation into MPA network planning with some utility for EBSA identification are also highlighted. Finally, the identified data sets are evaluated in terms of readiness for use in MPA planning in the Atlantic Coast Planning Area. The authors recommended proceeding with coastal MPA network planning with data sets found to be "MPA network ready". It is also recommended that MPA network planning proceed in the short-term but remain flexible to allow for the incorporation of new knowledge and data as they become available.

Éléments à prendre en compte dans le cadre de la planification du réseau d'aires marines protégées sur la côte atlantique de la Nouvelle-Écosse axée sur l'identification des zones d'importance écologique et biologique

RÉSUMÉ

Pêches et Océans Canada mènera la planification du réseau d'aires marines protégées dans 13 biorégions du Canada, y compris la biorégion du plateau néo-écossais. Les aspects techniques de la planification du réseau d'aires marines protégées dans la biorégion du plateau néo-écossais concernent trois zones de planification, soit le large du plateau néo-écossais, la baie de Fundy et la côte atlantique de la Nouvelle-Écosse. Les données écologiques disponibles pour la zone de planification de la côte atlantique font généralement l'objet d'une répartition éparse en comparaison aux autres zones de la biorégion. Par conséquent, différentes considérations et méthodes liées aux données pour déterminer les zones d'importance écologique et biologique (ZIEB) et intégrer la représentation des habitats à la planification des aires marines protégées seront nécessaires pour la zone de planification de la côte atlantique. Ce document de recherche a été présenté à titre de document de travail dans le cadre du Processus de consultation régionale (PCR) du Secrétariat canadien de consultation scientifique (SCCS) sur la planification du réseau d'aires marines protégées dans la biorégion du plateau néo-écossais du 5 au 7 mars 2012. L'objectif du présent document est de fournir un aperçu des ensembles de données disponibles qui peuvent s'avérer utiles dans le cadre de l'identification et de l'évaluation des zones d'importance écologique et biologique d'après une ébauche des objectifs du réseau d'aires marines protégées pour la zone de planification de la côte atlantique. Les ensembles de données qui peuvent servir à déterminer les zones d'importance écologique et biologique et ensuite à planifier les réseaux d'aires marines protégées sont définis et regroupés dans les catégories suivantes : projet sur l'écosystème de la région côtière, données sur le homard, données sur les algues marines, connaissances écologiques traditionnelles, données sur les autres poissons et projet sur les habitats marins clés pour les oiseaux migrateurs du Service canadien de la faune d'Environnement Canada. Les ensembles de données qui sont utiles pour intégrer la représentation à la planification du réseau d'aires marines protégées et qui peuvent avoir une certaine utilité pour déterminer les zones d'importance écologique et biologique sont également mis en évidence. Enfin, les ensembles de données déterminés sont évalués sur le plan de la préparation à l'utilisation dans le cadre de la planification des aires marines protégées dans la zone de planification de la côte atlantique. Les auteurs recommandent de procéder à la planification du réseau d'aires marines protégées côtières à l'aide des ensembles de données qui sont prêts. Ils recommandent également que la planification du réseau d'aires marines protégées soit exécutée à court terme, mais qu'elle demeure flexible pour permettre l'intégration de nouvelles connaissances et données à mesure que ces dernières seront disponibles.

1.0 INTRODUCTION

Canada has committed to the establishment of a national network of Marine Protected Areas (MPA). Fisheries and Oceans Canada (DFO) will lead MPA network planning processes in Canada's 13 bioregions, including the Scotian Shelf Bioregion, which encompasses the Scotian Shelf, the Bay of Fundy and the Canadian portions of the Gulf of Maine and Georges Bank. The technical aspects of MPA network planning in the Scotian Shelf Bioregion will take place in three planning areas: Offshore Scotian Shelf, Bay of Fundy, and the Atlantic Coast of Nova Scotia. The Atlantic Coast Planning Area has differences in data availability and format compared to the Offshore and Bay of Fundy Planning Areas. Therefore, different methodologies for identifying Ecologically and Biologically Significant Areas (EBSAs) and incorporating representation will be required although the overall approach to MPA network planning will be consistent in all planning areas.

Considerable work has been done to identify ecological priority areas in support of integrated management and MPA network planning along the Atlantic Coast of Nova Scotia, including the identification of EBSAs through scientific expert opinion (Doherty and Horsman 2007) and the collection of ecological and human use information on 20 EBSAs that satisfy the criteria for establishing MPAs under the *Oceans Act* (Gromack *et al*. 2010).

This research document was presented as a working paper at the Canadian Science Advisory Secretariat (CSAS) Regional Advisory Process (RAP) on MPA Network Planning in the Scotian Shelf Bioregion on March 5-7, 2012, with the purpose of providing an overview of work completed to-date and to obtain input from meeting participants. The primary input sought at the meeting related to the data to be considered and the proposed approach for EBSA identification for the purpose of MPA network planning and broader integrated coastal and ocean management in the Atlantic Coast Planning Area. Feedback was also requested on a suite of initial conservation objectives for a network of MPAs along the Atlantic Coast. This document was revised to incorporate the advice provided at the RAP.

The following key questions were posed to participants for discussion:

1. Do you agree with the proposed approach for the identification and validation of EBSAs for the purpose of MPA network planning in the Atlantic Coast Planning Area?
2. Do you agree with the proposed conservation objectives for an MPA network in the Atlantic Coast Planning Area?
3. Are there any key data sets that have not been mentioned in this paper that should be used for EBSA identification on the Atlantic coast?
4. Do you agree with the use of these data to support the identification of EBSAs on the Atlantic coast?
5. What data limitations would prevent the use of the data presented for EBSA identification, provided it is the best (or only) available information?

2.0 WORK TO-DATE: EBSA IDENTIFICATION ON THE ATLANTIC COAST

Proposed EBSAs were identified for the offshore and inshore Scotian Shelf during the *Workshop on Inshore Ecosystems and Significant Areas of the Scotian Shelf* (DFO 2006a). The workshop involved participants from Fisheries and Oceans Canada's (DFO) Science Branch, DFO's Oceans, Habitat and Species at Risk Branch (now the Ecosystem Management Branch), scientists from other federal and provincial government departments, the Fishermen and Scientists Research Society (FSRS), academics, consultants, and environmental non-government organizations (Doherty and Horsman 2007). Forty-seven proposed EBSAs were identified using DFO's criteria for EBSA identification (DFO 2004). EBSAs were identified based

on the scientific expert opinion (SEO) of participants who were placed in working groups of five to seven individuals (Doherty and Horsman 2007). These proposed EBSAs are often referred to as “SEO EBSAs”. Sources of information to confirm the basis for EBSA identification were not provided during the workshop. This was the only effort to identify EBSAs along the Atlantic coast, however, the Inshore Ecosystem Project (IEP) was initiated to address the many data gaps along the Atlantic coast of Nova Scotia and to contribute to the identification of potential EBSAs (DFO 2007). Projects initiated under the IEP remain to be completed and some preliminary results suggest that they cannot provide a basis for identifying EBSAs (DFO 2007). More information on the IEP is presented in section 5.0.

Gromack *et al*. (2010) compiled ecological and human use information on 20 of the 47 proposed Atlantic coast EBSAs (Doherty and Horsman 2007) in support of MPA and broader conservation planning. The 20 areas were chosen based primarily on alignment with *Oceans Act* MPA criteria; however, sites that were also of interest to other government departments with a protected areas mandate were given higher priority. Ecological information was compiled based on international guidance including the Convention on Biological Diversity (CBD) *Scientific Criteria and Guidance for Identifying EBSAs and Designing Representative MPA Networks* (COP 9 Decision IX/20, Annexes I-III; CBD 2009). Although this work did not identify new EBSAs, it made a contribution to coastal MPA network planning through the identification of relevant data sources and gaps and by highlighting areas that may be of higher conservation value from an *Oceans Act* MPA perspective and potentially satisfy multiple CBD EBSA criteria.

3.0 PROPOSED APPROACH FOR EBSA IDENTIFICATION IN THE ATLANTIC COAST PLANNING AREA

In this research document, “EBSA identification” includes the validation of SEO EBSAs and the identification of new EBSAs using the CBD criteria for MPA network planning. The proposed process for doing this is described below.

The methods for identifying EBSAs on the Atlantic coast will differ from those used in the preliminary offshore MPA network analysis due to limited coast-wide ecological surveys. Offshore EBSA identification for the purpose of MPA network planning was a fully data-driven systematic approach that analysed nearly 100 data layers against specific conservation targets using *Marxan*, a conservation planning decision-support software (Horsman *et al.* 2011).

EBSA identification in the Atlantic Coast Planning Area will be based on the CBD criteria outlined in Annex 1 of COP 9, Decision IX/20 (CBD 2009). The twenty SEO EBSAs highlighted and described by Gromack *et al.* (2010) were endorsed for consideration in the bioregional MPA network design phase (DFO 2012). It was recommended that the remaining 27 EBSAs that were identified by Doherty and Horsman (2007), but not described by Gromack et al. (2010), be re-evaluated against the CBD EBSA criteria to ensure priority areas for conservation for other federal and provincial government departments are not overlooked. This re-evaluation will be done using data sets identified in this research document and expert opinion.

The concept of ecosystem or habitat representation is a required criterion for effective MPA networks. Thus, networks of MPAs should be designed to protect certain EBSAs and representative examples of all major ecosystem or habitat types. To consider representation in the process, a suitable habitat classification system must be adopted or developed. Greenlaw *et al.* (2013) provide more detail on the proposed habitat classification systems that will be used in the coastal planning area.

4.0 CONSERVATION OBJECTIVES FOR THE ATLANTIC COAST PLANNING AREA

Draft conservation objectives for the Scotian Shelf Bioregion were presented in Westhead *et al.* (2012) based on guidance provided by the CBD. Conservation objectives are intended to be hierarchal, with higher-level conservation objectives (see below) set for the Bioregion as a whole (Westhead *et al.* 2012) and more specific conservation objectives or targets that outline the species, habitats and other features the network will aim to protect in each Planning Area. Although planning-area-specific conservation objectives were suggested for the Atlantic Coast Planning Area, only the following high-level, bioregional-scale objectives were agreed upon at the RAP (bolded below).

It was recognized that planning area-specific conservation objectives may be required and should be developed in consultation with others, along with specific (quantitative) conservation targets to ensure objectives are measurable and achievable (DFO 2012). Quantitative conservation targets were set for the preliminary MPA network analysis for the Offshore Planning Area (Horsman *et al.* 2011). Given the lack of detailed ecological data for the Atlantic Coast Planning Area, fewer and, in some cases, more general conservation objectives or targets should be set. Example conversation objectives for the Atlantic Coast Planning Area are presented under each bioregional-scale conservation objective.

Criteria for meeting conservation objectives 1 and 2 were identified by the Coastal Protected Areas of Nova Scotia (CPANS) Working Group[1] based on CBD EBSA criteria. These criteria were used to develop example conservation objectives. These criteria are presented briefly below, with more details provided in Appendix A and B (Canadian Wildlife Service draft priority bird species):

1. **Protect Ecologically or Biologically Significant Areas and other special natural features in the Scotian Shelf Bioregion that benefit from long-term, year-round, spatial management, including:**
    a. Areas with unique or rare ecological functions, processes or natural features on an international, national, regional, or sub-regional scale
    b. Areas of special importance for the life history stages of species
    c. Vulnerable species, habitats, and features
    d. Areas of high biological diversity
    e. Areas of high biological productivity
    f. Areas of high naturalness
2. **Protect representative examples of all marine ecosystem and habitat types in the Scotian Shelf Bioregion based on coastline, coastal subtidal, and offshore classifications, along with their associated biodiversity and ecological processes (DFO 2012).**

This research document examines the data sets that may be useful in evaluating individual EBSAs (the remaining 27 not presented in Gromack *et al.* 2010) against the proposed Atlantic Coast Planning Area objectives. The ecosystem and habitat classification data required for meeting objective 2 are not discussed in this research document. Greenlaw *et al.* (2013) developed a physiographic coastline classification and work is underway to classify coastal

[1] Further information on CPANS is available in Gromack *et al.* (2010), page 13.

subtidal habitats[2].There are some considerations regarding data sets for the identification of unique areas and vulnerable species, habitats, and features:

- **Unique areas:** Ecologically or biologically unique areas may be identified through the examination of data sets that are considered under other EBSA criteria such as areas of importance for lifecycle stages of species. For example, there may be only one spawning area for a particular species within the Bioregion. Physiographically or oceanographically unique areas may be identified through coastal classification (*e.g.*, Greenlaw *et al.* 2013) or through further quantitative analyses. Some unique inlets (in terms of expected productivity and diversity) are identified in the inlet classification of Greenlaw (2009). Unique areas were identified in Doherty and Horsman (2007) by scientific expert opinion and it is recommended that this assessment be used to identify EBSAs that meet this criterion.
- **Vulnerable species, habitats, and features:** Fewer structurally vulnerable species and habitats have been described in temperate coastal environments in comparison to the offshore where certain cold-water coral and sponge species can form dense aggregations or reefs (Campbell and Simms 2009). Coastal species, habitats, and features are generally more exposed to anthropogenic influences due to a much higher degree of human activity in the coastal zone (CBCL Limited 2009). Eelgrass and sponges are the only vulnerable species identified in the subtidal coastal zone. Eelgrass is determined to be vulnerable due to evidence of extensive declines in coastal areas of the Atlantic coast (Sharp *et al.* 2007) and sponges are considered to be a structurally vulnerable species and should be prioritized for protection. However, no significant sponge aggregations have been identified in the Atlantic Coast Planning Area. Vulnerability should be incorporated into the MPA network planning analysis in terms of assigning a higher weight to the protection of eelgrass and sponges.

5.0 ATLANTIC COAST DATA SETS FOR MPA NETWORK PLANNING

This section describes the regional coastal data sets that may support EBSA identification for MPA network planning in the Atlantic Coast Planning Area (section 5.1). Data sets that may contribute to both EBSA and representation conservation objectives are also described (section 5.2). Many of these data sets can be used to identify areas that meet multiple bioregional conservation objectives. Appendix C provides a summary of all data sets. In addition, data sets are evaluated according to their compatibility, or readiness, for use in coastal MPA network planning.

The best available information will be used in planning a network of MPAs in the Scotian Shelf Bioregion and this will involve the use of site-specific, as well as regional data. Although peer-reviewed data is the best data source, some of the best available information is found in grey literature, unpublished government and non-government databases and Local or Traditional Ecological Knowledge (LEK or TEK).

Regional-scale data allows for comparison between sites to understand relative distributions of species, habitats, and features within the Bioregion. Due to few regional data sets on the Atlantic coast, smaller scale or site specific information will be used to identify areas of known

[2] For further information on coastal subtidal habitat classification in the Scotian Shelf Bioregion, please contact Michelle Greenlaw by mail at mailing address: Fisheries and Oceans Canada, Coastal Ecosystem Science Division, St. Andrews Biological Station, 531 Brandy Cove Road, St. Andrews, NB, E5B 2L9, or by email at email address: Michelle.Greenlaw@dfo-mpo.gc.ca).

ecological significance. For example, there is a large amount of information within the Bras d'Or Lakes that shows it is an area of significance for many species, such as American eel and herring.

The following considerations should be taken into account before using each data set:

- Compared to the Offshore Planning Area, a small number of coastal sites have been scientifically surveyed, which makes it difficult to determine the relative importance of an area;
- Detailed site-specific data (*e.g.*, focused on an individual bay or estuary) can still be used to identify EBSAs but do not shed light on the relative importance of an area;
- Regional-scale data sets (*i.e.*, those that span much of the Planning Area) are ideal as they can provide an indication of the relative importance of an area within the Planning Area;
- Coarse or low spatial resolution regional-scale data are of limited use in identifying fine-scale EBSAs (*e.g.*, data summarized by Lobster Fishing Area would be too coarse);
- Data sets with a limited time series are less reliable due to the dynamic nature of coastal and marine ecosystems;
- Many high quality regional coastal data are outdated and should be used with caution; and
- Seasonal shifts or other temporal effects are often not accounted for in the survey data that exist.

Additional considerations and/or constraints regarding data in the Atlantic Coast Planning Area include resource availability to analyse or collect data (funding and human resources) and data access or use issues.

The data sets below were grouped into the following categories based on similarities: the Inshore Ecosystem Project (IEP), Lobster Data, Marine Algae Data, TEK, Other Fish Data, and the CWS Key Marine Habitats for Migratory Birds Project. Data sets that are useful for incorporating representation into MPA network planning with some utility for EBSA identification are also described.

5.1 Atlantic Coast Data Sets for EBSA Identification

5.1.1 Inshore Ecosystem Project (IEP)

The IEP was a joint project between DFO and the FSRS that was funded under Phase I of Canada's Oceans Action Plan (DFO 2007). The study area of the IEP was from Cape Sable Island to Cape North, Cape Breton, the shoreline was the inshore limit and the seaward limit was approximately 100 m depth or 12 nautical miles (DFO 2007). There were eight research initiatives as part of this project:

1. Workshop on inshore ecosystems and significant areas of the Scotian Shelf (DFO 2006a; Doherty and Horsman 2007);
2. Analysis of DFO databases and data archiving;
3. Monitoring of environmental and oceanographic data;
4. Grey seal pup survey;
5. At-sea catch analysis (den Heyer *et al.* 2010);
6. Fishery-independent research;
7. Video of bottom habitat using URCHIN (Underwater Reconnaissance and Coastal Habitat Inventory; Strong and Lawton 2004); and
8. Local Ecological Knowledge (LEK) Survey of commercial fishermen.

A workshop was held on March 19-20, 2007, to begin the synthesis of the results of the eight projects and to discuss if they could be used to identify or refine EBSAs. The findings are documented in a CSAS proceedings document, *DFO/FSRS Inshore Ecosystem Project Data Synthesis Workshop* (DFO 2007). The analysis and synthesis is not complete for all of these projects, but some of the results may be very useful for MPA planning. Each of these research initiatives is described briefly below in consideration for use in EBSA identification and broader MPA network planning.

Analysis of DFO Databases and Data Archiving

The objectives of this analysis were to describe the distribution and abundance trends of inshore species in the IEP study area and explore differences between inshore and offshore areas (DFO 2007). The DFO summer research survey, industry surveys, and commercial landings were examined; the DFO observer database contains minimal inshore data and was not examined (DFO 2007). The DFO Summer Research Vessel (RV) Survey does not include the Atlantic Coast Planning Area and therefore cannot be used in MPA network planning for the inshore area. The three industry surveys examined may be useful in MPA network planning: 4X Individual Transferable Quota (ITQ), 4VsW Sentinel, and the 4Vn Sentinel (DFO 2007). The commercial landings analysis focused on fisheries that occur in both inshore and offshore areas. The industry and commercial landings databases are described below with considerations for MPA network planning within the Atlantic Coast Planning Area:

- The **ITQ survey** has been conducted since 1995 and uses otter trawl gear with rockhopper footgear with 31 out of 187 stations located inshore area, primarily in the Bay of Fundy and German Bank areas (DFO 2007) and is, therefore, outside of the Atlantic Coast Planning Area; however, it may be useful in the Offshore Scotian Shelf and Bay of Fundy Planning Areas.
- The **4VsW Sentinel Survey** is a collaborative initiative between DFO and industry through the FSRS that has been ongoing since 1995 to develop indices of fish abundance and to monitor local distributions, spawning locations, and size structure of fish populations, among many other objectives (FSRS 2011a). Surveys are done using longline gear from commercial fishing vessels in several stations in the 4VsW area. Numerous data are recorded on target and non-target species (FSRS 2011a). This data set may be useful in identifying areas of importance for potential ecologically significant species (ESS) (DFO 2006b) in the inshore (spawning areas and areas of high relative abundance) and may also be useful in identifying areas of high biodiversity within 4VsW. The data require further analysis and mapping of results prior to integrating it into MPA network planning.
- The **4Vn Sentinel Survey** is a longline survey conducted by industry since 1994 (Lambert 1995) but was discontinued in 2006. The primary objective of the survey was to provide an index of abundance of 4Vn cod. The survey uses a stratified random sampling design, similar to DFO's RV survey. The survey area is divided into three strata based on depth (<55 m, 55-91 m, 92-183 m). Count and total weight estimates are recorded for all species, including discards (Lambert 1995). These results could be applied to EBSA identification in the same way as those of the 4VsW Sentinel Survey and should be integrated with the 4VsW results for better coverage of the Atlantic Coast Planning Area.
- **DFO's commercial database** provides detailed positional information (latitude and longitude) for commercial fisheries since 1990 (DFO 2007). However, most inshore commercial species that are widespread across the Atlantic Coast Planning Area are not reported at these fine scales within the database (lobster, soft-shell clam, eel, elver, bait fisheries, etc.) (DFO 2007). The commercial database could be used to (a) identify areas

of importance for commercial fishing sectors for the integration of socio-economics into the MPA network analysis and (b) inform the selection of areas that meet conservation objectives where data is otherwise absent. The commercial database could be used to identify areas of importance (areas of relatively high abundance, spawning areas, and potential nursery areas) for potential ESS, namely herring, cod, pollock, spiny dogfish (through analysis of by-catch), and sea urchins.

Monitoring of Environmental and Oceanographic Data

Oceanographic data can be used in MPA network planning to characterize representative environments (see Greenlaw *et al.* 2013) and to identify oceanographically unique areas. In the IEP workshop proceedings (DFO 2007), there was no indication that unique areas emerged from an analysis of the FSRS oceanographic gauges. It was suggested that stratifying the data analysis to the nearshore (10-15 m from shore), midshore, and offshore may help identify longitudinal gradients and also significant areas (DFO 2007). FSRS gauges collect data on surface and bottom temperature and water column CTD (FSRS 2011b) through the Lobster Recruitment Index Project and the Nearshore Temperature Monitoring Project.

Grey Seal Pup Survey

This survey is described by Lidgard (DFO 2007) and involved interviews with the fishing industry to identify grey seal breeding areas followed by validation through aerial surveys. These data could be used to identify important areas for grey seal. There was poor correlation between the fishing industry interview results and the aerial surveys identifying grey seal breeding colonies (DFO 2007), however, aerial survey results should be used for EBSA identification until more evidence can be collected on the potential breeding sites identified through the industry survey.

At-Sea Catch Analysis

One objective of the At-sea Catch Analysis was to provide data on the distribution and abundance of non-target species that are not normally recorded in commercial fisheries (den Heyer *et al.* 2010). Information on target and non-target species was recorded on one longline trip and 41 lobster fishing trips. The longline fishing trip occurred offshore from the Chezzetcook area only (den Heyer *et al.* 2010). It, therefore, cannot easily be used for EBSA identification as there are no other sites for comparison, unless it can be integrated with other data sets such as the Sentinel Surveys. The lobster trips occurred widely throughout the Atlantic Coast Planning Area (except for Lobster Bay) (den Heyer *et al.* 2010) and these data could easily be analysed to identify areas of relatively high abundance for potential ESS.

Data limitations include the selectivity of the gear in catching certain species, especially since more than 90% of the overall catch in both weight and number was the target species (den Heyer *et al.* 2010), however, it is recommended that these data be further analysed to identify areas containing relatively high abundance of potential ESS and areas of high species diversity.

Fishery-Independent Survey

The fishery-independent survey was conducted at ten sites along the Atlantic coast: Mira Bay, Gabarus Bay, St. Peters/Isle Madame, Country Harbour, Ship Harbour, Chezzetcook, St. Margaret's Bay, LaHave, Port Mouton, and Port LaTour (DFO 2007). The objectives of the survey were to develop inshore base-line data; identify and map the distribution of plants, benthic invertebrates, and fish along the coast of Nova Scotia; explore latitudinal and inshore/offshore differences; capture marine biodiversity and habitat association; and identify potential EBSAs (DFO 2007). The survey involved two sampling designs at each site, transect sampling aboard a chartered fishing vessel and close-shore sampling from land and the DFO Boston Whaler, and used six types of sampling gear (DFO 2007). Although the results of the survey have not been fully analysed, they are likely to support the identification of areas that

meet the coastal MPA network objectives for biodiversity and important areas for certain species including areas of relatively high species abundance, spawning areas, and potential nursery areas. Rock crab was one of the top four species caught by weight and was suggested as a possible ESS due to its important trophodynamic role as both predator and prey (DFO 2007).

URCHIN (Underwater Reconnaissance and Coastal Habitat Inventory) Survey

The objective of the URCHIN survey was to define species distribution and habitat associations using underwater video of the seafloor within the IEP study area. Six bays were surveyed: Mira Bay, Ship Harbour, St. Margaret's Bay, LaHave, Port Mouton, and Port LaTour (DFO 2007; den Heyer 2007). Several video transects were taken within each bay on soft (sand or mud) and hard (rock or gravel) sites to record numbers of fish and invertebrates, marine plant coverage, and substrate type. Data analysis is not yet complete (DFO 2007; den Heyer 2007). Although there are limitations with these data due to the limited number of survey locations, comparisons could still be made between the six locations to identify areas of relatively high abundance of potential ESS, areas of high biodiversity, and areas of high primary productivity (based on coverage of marine plants). By comparing with other data sets (*e.g.*, LEK data and fisheries-independent survey), these results may be further corroborated and justified for use in MPA planning. Preliminary analysis of URCHIN data in Port LaTour showed differences in species abundance and composition with differences in exposure (DFO 2007; den Heyer 2007).

LEK Survey of Commercial Fishermen

The objective of the LEK survey was to map fishermen's local knowledge of the distribution, seasonal changes in abundance, and life history and habitat associations of fish, invertebrates, birds, mammals, and macrophytes based on fishing histories and practices in the inshore ecosystem within nine sites in the IEP study area (DFO 2007; DFO/FSRS 2009). Preliminary results of the LEK survey show the number of significant areas (spawning, nursery, high abundance, unique, diversity, and pristine areas) identified for each survey site (DFO/FSRS 2009). Although this data set has the potential to contribute to the identification of EBSAs, the results have not yet been fully analysed due to resource limitations (this work is in progress). Until the data set has been fully analysed it would be premature to use it to identify EBSAs (A. Bundy, DFO Maritimes, pers. comm. 2012).

5.1.2 Lobster Data

Lobster Recruitment Index Project

The FSRS has conducted this project since 1999. During the regular commercial season, fishermen use standardized lobster traps designed to capture undersize lobsters in their regular fishing grounds. The fishermen can then record information on lobster size (with a special measuring gauge), whether or not they are berried females, tagged or v-notched lobsters, and bottom temperature (FSRS 2011c). The project has great regional coverage with participants from LFAs 27-35 and over 180 fishermen in total, setting traps every 5-30 km along the coast (FSRS 2011c). These data are being used in DFO stock assessments (FSRS 2011d). This may be a useful data set for EBSA identification, assisting in the identification of important areas for lobster, including areas of relatively high abundance of lobsters and important spawning areas (areas of high abundance of berried females). The data would need to be analysed at the scale of individual fishermen (sampling locations) to be of most use for EBSA identification.

LFA 33 Commercial Trap Sampling Project

As part of the Lobster Recruitment Index Project, participants in LFA 33 have also agreed to record lobster catch information from three of their own commercial traps (S. Scott-Tibbetts, DFO Maritimes, pers. comm. 2012). This part of the Recruitment Project began in 2002. These

data give an idea of the catch differences between the standardized recruitment trap and the regular commercial trap. For the most part, the fishermen fish the six traps (for LFA 33) in the same area to make the data more comparable (S. Scott-Tibbetts, DFO Maritimes, pers. comm. 2012).

Lobster Collector Project

The Lobster Collector Project is a collaborative initiative between DFO and the FSRS with funding assistance from the Nova Scotia Department of Fisheries and Aquaculture and the DFO Laroque fund (until 2011) (FSRS 2011d). The objective is to quantify newly settled, young-of-year (YOY) lobster. Initiated in Canada in 2007 (Tremblay 2007), the project is linked with a long-term settlement index originated in the U.S. (Wahle et al. 2010). The passive collectors are made of wire mesh and filled with cobbles and are deployed across a range of depths within locations with varying oceanographic conditions (Wahle et al. 2010). The geographic extent of the project is from Rhode Island to Newfoundland and the sampling locations have changed from year to year beginning at various locations within Lobster Bay, Sambro, and Canso (Wahle et al. 2010). In 2010, 377 collectors were deployed in St. Mary's Bay, Lobster Bay, Port Mouton, False Bay and Canso/Whitehead (the Guysborough County Inshore Fishermen's Association deployed the Canso/Whitehead collectors) (FSRS 2011d). In addition to catching YOY lobsters, the collectors caught a wide variety of other species (FSRS 2009), making these data useful for identifying important nursery areas for lobster, as well as areas of high biodiversity for use in EBSA identification, although more sampling sites would result in greater data confidence.

At-Sea Lobster Sampling

At-sea sampling of the commercial lobster fishery has been supported by DFO by opportunity and to answer specific questions in the last 15 years; there is no ongoing spatially extensive at-sea sampling program (J. Tremblay, DFO Maritimes, pers. comm. 2012). Standard protocols are the counting, measuring and sexing of lobsters in a defined number of traps. From 2008 to 2010 there was extensive geographic at-sea sampling resulting from *Species at Risk Act* (SARA) funding (J. Tremblay, DFO Maritimes, pers. comm. 2012). The objective for this was to evaluate the by-catch in lobster traps. These data are described in Tremblay *et al.* (2011) for the area from northeast Cape Breton to Shelburne County. As part of the Eastern Shore Fishermen's Protective Association's research strategy, the FSRS has increased the amount of sea sampling done over the Eastern Shore in 2011 in particular and will continue to do so over the next two years. This is a separate project from the SARA funded work, but all of the data are added to the Crustacean Research Information System (CRIS) (S. Scott-Tibbetts, DFO Maritimes, pers. comm. 2012).

Lobster Connectivity Project

The newly formed Lobster Node of the Canadian Capture Fisheries Research Network (CCFRN) is working on a project to answer questions about stock structure and lobster connectivity among LFAs, beginning in 2011 (FSRS 2011e). Information will be collected on berried females at 50-75 km intervals along the Atlantic coast from Newfoundland to the Gulf of Maine (FSRS 2011e). This data will be fed into oceanographic models that will predict lobster settlement, followed by ground-truthing (FSRS 2011e). In addition to this focus on understanding larval transport and retention, there is a genetic component that will evaluate population structure. Although all of this work is in early stages, as more data become available it is a very valuable data set that can be used to identify important nursery and spawning (berried female) areas for lobster, which not only meets EBSA-related MPA network objectives but also addresses the CBD criteria for ensuring connectivity between network sites.

LFA 34 Berried Female Lobster Project

In 2007, fishermen in LFA 34 were asked to record information on their catches of berried females. They used a specially designed gauge and separated the lobsters into three broad size range groups (small < 91 mm, medium 91-120 mm, and large > 120 mm) (S. Scott-Tibbetts, DFO Maritimes, pers. comm. 2012). Along with recording the berried females, the fishermen would record the number of trap hauls and indicated which grid number they fished. The maximum number of participants was 19, which did not cover all grid squares in LFA 34 (S. Scott-Tibbetts, DFO Maritimes, pers. comm. 2012). These data covered only a small area of the Atlantic Coast Planning Area and does not enable comparative analysis across the Bioregion, however, they could be integrated with other berried female data sets such as the At-sea Lobster Sampling Project and the Lobster Connectivity Project for better integration in EBSA identification.

Lobster Landings Data and Catch/Effort Data

Lobster landings data are available at a variety of scales in the Maritimes Region: LFA (largest scale), Statistical District (mid-scale), and Grid Squares (smallest scale). Grid square reporting, along with daily catch and effort, became a requirement for LFAs 27-33 in 2005, however, reporting levels were low for the first year and not considered reliable until 2008. Grid square reporting in LFA 34 began in 1998 and these data are considered reliable (S. Scott-Tibbetts, DFO Maritimes, pers. comm. 2012). For a time series of more than 20 years, landings data are the only available proxy for lobster abundance.

For abundance estimates in more recent years, catch per unit effort (CPUE) can be used as a more accurate abundance index (Tremblay et al. 2011; DFO 2011a). CPUE is measured by the number or weight of lobsters per trap haul. CPUE data is likely to provide the best estimate of relative abundance and may be useful for MPA network planning. Effort data (*e.g.*, number of trap hauls per grid) may also be useful, however, much discussion with industry on the conservation objectives of the MPA network and the use of these data is required before they could be integrated. As discussed above regarding the DFO commercial fisheries landings database for other fisheries, lobster CPUE (or landings) will be extremely useful to identify areas of importance for commercial fishing sectors and for the integration of socio-economics into the MPA network analysis.

5.1.3 Marine Algae Data

Macroalgae and Sea Urchin Dive Transects by DFO Science

Transect surveys of macroalgae conducted by Moore and Miller (1983) and Moore *et al.* (1986) were used to describe macrophytes in each area in relation to large scale sea urchin mortality. Percent macroalgae coverage was visually estimated and recorded. Species were recorded in decreasing order and sea urchin density per square metre was visually estimated (Moore and Miller 1983). Eighty-one transects were taken every 16 km of shoreline from Medway Harbour to Cape Sable Island in 1982 (Moore and Miller 1983) and 59 transects were taken for the rest of the Atlantic coast in 1984-1985 using the same methodology (Moore *et al.* 1986). These data could be quantitatively analysed to identify areas of high diversity and density of kelp. They could be interpolated over larger areas based on more recent substrate data analysed (M. Greenlaw, DFO Maritimes, pers. comm. 2013), however, these data are very outdated and kelp bed abundance and location can change with environmental conditions.

Industry Macroalgae Data

Species harvested commercially in Nova Scotia include rockweed (*Ascophyllum nodosum*), Irish moss (*Chrondus chrispus*), dulse (*Palmaria palmate*), and kelp (*Laminaria sp.*) (NSDFA 2009). Rockweed and Irish moss are the primary commercial species in Nova Scotia and rockweed is

the only species for which widespread harvesting information is available (J. Huston, NSDFA, pers. comm. 2012). Biomass estimates for macroalgae are primarily obtained for commercial harvesting interests. Recent Irish moss biomass estimates are available from Pennant Point to Port Medway and were obtained using remote sensing and ground-truthing (Sharp *et al.* 2008). Rockweed harvesting information is available for the entire South Shore from St. Mary's Bay to Halifax and the Bay of Fundy where much of the coastline is leased to companies for rockweed harvesting (NSDFA 2009). Lease areas are divided into over 200 sectors where harvested quantities are reported to the Nova Scotia Department of Fisheries and Aquaculture (Sharp *et al.* 2007; NSDFA 2009). Leaseholders do annual assessments of the biomass on their leases, but this ranges from detailed, quantifiable science by larger companies to qualitative estimates by smaller leaseholders (J. Huston, NSDFA, pers. comm. 2012).

If analysed and portrayed spatially by sector, these data could be very useful in identifying important areas for rockweed to achieve ecological MPA network objectives. Optimally, landings should be coupled with biomass estimates from industry to improve data accuracy. The commercial data could also be used to integrate socio-economic considerations into the MPA network analysis. Science related to the impact of the harvest on the overall biomass and habitat structure should also be examined (J. Huston, NSDFA, pers. comm. 2012).

Academic Macroalgae Data

Academia represents a significant source of macroalgae data for the Atlantic Coast of Nova Scotia. Macroalgae related academic research in this area has focused on a range of topics, including biomass and distribution, the stability of kelp beds, the relationship between certain macroalgae and other species, and effects of invasive species on native kelps (*e.g.*, Sharp and Carter 1986; Johnson and Mann 1988; Balch and Scheibling 2000; Watanabe *et al.* 2010). The findings of this research and the data collected could be used to help identify and describe EBSAs along the Atlantic Coast of Nova Scotia.

5.1.4 Traditional Ecological Knowledge (TEK)

Coastal Resources Mapping Project

The Coastal Resources Mapping Project was conducted from 1993 to 1997 through informal partnership arrangements between DFO, other government agencies, and coastal communities. The main objective of the community based coastal resource mapping project was to collect TEK and combine it with relevant government information, to create a comprehensive inventory of coastal resources for the community to manage (DFO, unpublished manuscript[3]). A variety of human use information and some ecological and physiographic information was collected on CHS charts and coastal 1:10,000 base maps within all counties across Nova Scotia for use by the communities involved and by DFO for coastal zone management (DFO, unpublished manuscript).

The final compilation of data does not include individual written data records so may be considered as a data limitation. There is a possibility for minor inconsistencies in data collection methods and data portrayal across different counties for the databases that are common throughout the mapping projects (*i.e.*, groundfish fisheries, pelagic fisheries, diadromous fisheries, fish traps, invertebrates, marine mammals, marine plants, shoreline types, geology, ocean dumping, aquaculture, fish processing plants, lobster pounds). Other databases which the community defined as important may have inconsistent collection methods, and these

[3] DFO. Unpublished manuscript. Community Based Coastal Resources Mapping Manual. Habitat Management Division, Maritimes Region.

issues reduce the confidence in the results. There is an unknown total number of participants in each county, however, there was validation of the data by several community members across each county. These data could be used to provide species distribution information where data are otherwise lacking. Much of it is point data representing species presence without an associated area which can be difficult to use for EBSA identification. Data that need to have accurate up-to-date status, such as shellfish closures and aquaculture sites would need to be re-collected. These data should be re-validated and integrated with the more recently collected Fishing Industry LEK Survey when that analysis is complete. This information could be used to incorporate socio-economic information into the MPA network analysis.

TEK Survey of Spawning and Nursery Areas

Declining groundfish stocks were a driver for this project that involved interviews with 89 fishermen from various gear sectors across DFO's Maritimes Region from 1995-1997 to identify spawning and nursery areas for groundfish (Benham and Trippel, unpublished manuscript[4]). Although groundfish were the targeted species, spawning and nursery areas were identified for several other species, however, information for these others is very limited. Most interviews took place with one interviewee at a time and a few interviews had several interviewees present. Comparisons between these results and those of the Fishing Industry LEK Survey could increase the confidence in these data for use in EBSA identification. A secondary objective of this work was to identify current and historical fishing areas and the types of gear used to describe trends in fish distribution, size, and numbers. This information could be useful to identify historical fishing areas for the socio-economic analysis for MPA planning. Information on this part of the study was not available to the author at the time of writing.

5.1.5 Other Fish Data

Herring Spawning Surveys

In the coastal Nova Scotia spawning component of the fishery, which is a herring roe fishery using gillnet, the fishing industry has participated in sampling and surveying since the fishery developed in 1996 (DFO 2011b). Surveys are conducted in known spawning areas where harvesting takes place every year. Little Hope Island/Port Mouton Area, Halifax/Eastern Shore area, Glace Bay, Lobster Bay, and the Bras d'Or Lakes are commonly known herring spawning areas (Gromack *et al.* 2010). The Bras d'Or Lakes are closed to fishing and have not been surveyed since 2000 (DFO 2011b). These known spawning areas could be used in the MPA network analysis to achieve conservation objectives of protecting spawning areas for herring, while also ensuring socio-economic impacts to the fishing industry are minimized.

Juvenile Fish Assemblages and Relationships to Physical Features

O'Connor (2008) examined coastal fish assemblages and the physical features of nearshore ecosystems from twenty bays between Chedabucto Bay to the Bay of Fundy using a beach seine to sample juvenile fish. Results predicted that smaller bays have higher juvenile fish species diversity than larger bays (O'Connor 2008). In addition to using the data to identify areas of high biodiversity, it could also be used to identify nursery areas for herring and other species.

[4] A.A. Benham and E.A. Trippel. Draft Manuscript Report. Mapping Fishermen's Knowledge of Groundfish and Herring Spawning and Nursery Areas in the Bay of Fundy and Gulf of Maine. DFO Maritimes, St. Andrews Biological Station, NB.

5.1.6 Canadian Wildlife Service (CWS) Key Marine Habitats for Migratory Birds Project

Due to the significant contribution of birds to marine biodiversity and productivity, areas of importance for birds will be identified through the MPA network planning analysis in collaboration with CWS. As part of its wildlife monitoring programs, CWS launched the Key Marine Habitats for Migratory Birds on Eastern Canada's Atlantic Coast project (Gromack *et al.* 2010) which is considered a key project for EBSA identification. The goal of this project is to identify key sites, according to marine habitat type, from intertidal salt marshes, mudflats, beaches and rocky shorelines, and eelgrass beds, to and including offshore areas (Gromack *et al.* 2010). This project compiles and analyses existing data on bird distribution and abundance to map the aforementioned key habitats for a number of bird species and species groups.

Where there were gaps in Environment Canada species or habitat data, other large non-governmental data sources were used for this project. Although other smaller data sets held by provincial governments and academic institutions exist, accommodating the challenges of limited geographic scope and differing methodologies, as well as summarizing results within our maps, exceeded the scope of this data compilation exercise. Still, many opportunities exist to fill certain gaps at smaller spatial scales, via inclusion of species-specific avian data sets, consultation of published and unpublished reports, and communication with researchers, wildlife managers and habitat specialists, as well as the broader ornithological community. The following is a description of all nearshore data sets used in this project, excluding those outside the Scotian Shelf/Bay of Fundy Bioregion.

Coastal Waterfowl Database (CWS Atlantic Region)

These data originate from aerial surveys of geese, dabbling ducks, bay ducks and sea ducks within coastal waters of Atlantic Canada. Although individual birds generally are identified by species, species can be grouped into subfamilies (herein referred to as 'guilds') based on ecological similarities. This approach largely eliminates issues associated with misidentification of similar species within guilds that are difficult to distinguish from the air. This database also acts as a repository for provincially gathered waterfowl data (following the same protocols). Records include counts of birds of each species observed within ‘waterfowl block’ polygons during each survey visit. Coastal waterfowl block polygons were established at the beginning of the monitoring program and have remained fixed across years. Polygon sizes differ geographically, are irregularly shaped, and reflect prominent coastline features that separate coastal segments, bays and estuaries. This potential source of bias should be considered in assessing their relative value. Incidental records of species other than waterfowl appear in this database.

COEISDS Database – Common Eider and Sea Duck Surveys (CWS Quebec/Atlantic Regions)

This data set focuses on distribution and abundance of sea ducks within both Atlantic Canadian and Quebec coastal waters. Here also, individual birds and flocks are recorded geospatially (*i.e.*, with their respective latitudinal and longitudinal coordinates) as opposed to within survey block polygons. Surveys do not cover the entire coastline in a given year, although almost the entire northwest Atlantic coastline has been surveyed since inception.

Piping Plover Survey Database (CWS Quebec and Atlantic Regions)

This database contains results of two survey types. 1) The Index Count encompasses the maximum number of pairs and singles observed during a nine-day standard count period (exact timing determined annually) in early June. This count is effectively a ‘snapshot’ of the Atlantic region’s population during a brief period to avoid or at least minimize double counting. Its goal is to count both breeding pairs and unpaired adults. Certain beaches may be visited several times

during the period, enabling observers multiple opportunities to determine the maximum number of pairs and singles at a given locale. Pairs include birds seen together, whereas single birds in the presence of nests or young are tallied separately from other unpaired birds. 2) The Year-end Count is most often used by investigators and encompasses the total number of pairs (breeding and non-breeding) and singles documented on a beach throughout the breeding season. Surveys that document the presence of a single plover or pair on a beach consistently over a period of at least two weeks are included in the Year-end Count. Single adults or pairs observed on a beach for less than two weeks are defined as transient individuals and are reported as such, minimizing double counting of plovers that move between beaches during the breeding season.

ACSS Database – Atlantic Canada Shorebird Survey (CWS Atlantic Region)

The ACSS database was developed from the Maritimes Shorebird Survey (MSS) initiative, during which surveys were undertaken at a limited number of sites by Canadian Wildlife Service employees. The ACSS now enlists the help of skilled volunteer contributors from throughout the Atlantic region, including Newfoundland and Labrador. Surveys typically occur during spring, summer and fall periods. More recently, the ACSS contains winter survey data for Purple Sandpiper overwintering sites. Point data generated from site-specific surveys contain information on species and numbers observed.

As the ACSS is opportunistic in nature, relying on the availability and participation of volunteer contributors, coverage is not complete, temporally or spatially. As such, sites lacking data suggest elevated levels of shorebird use should not be assumed to be unimportant.

ARCD – Atlantic Region Colony Database (CWS Atlantic Region)

The Atlantic Region Colony Database holds records of individual colony counts for known colony locations in Atlantic Canada. Counts, associated with spatial coordinates, are obtained for each species present on the colony. Although some, typically larger, colonies are inventoried annually, most are visited less frequently.

5.2 COASTAL DATA SETS FOR REPRESENTATION AND EBSA IDENTIFICATION

The primary data layers proposed for incorporation of habitat or ecosystem representation into MPA network planning in the Atlantic Coast Planning Area are the recently created physiographic coastline classification (Greenlaw *et al.* 2013), and work now being conducted to complete a physiographic subtidal classification (M. Greenlaw, DFO Maritimes, pers. comm.) These data layers will not be further described in this research document.

5.2.1 Inlet Classification

Coastal inlets from St. Mary's Bay to Chedabucto Bay were classified by Greenlaw (2009) to predict biological community types and alpha and beta-diversity patterns. This work involves using geophysical information to identify representative habitat types where actual biogeographic information is limited or absent (Greenlaw 2009; Greenlaw *et al.* 2011) and aims to address the ad-hoc selection of MPAs by enabling the incorporation of representation into MPA network design in coastal Nova Scotia. Seventeen inlet types were initially identified by Greenlaw (2009) followed by a cluster analysis to consolidate more similar inlets into eleven classes to facilitate conservation planning (Greenlaw *et al.* 2011). The inlet classification can provide a valuable data set for setting representation goals and objectives for a coastal conservation areas network; however, it covers only a portion of the Atlantic Coast Planning Area. Expansion to the rest of the planning area would require much additional work that is not likely to occur in the short term. The classification could be used to meet EBSA-related objectives of biodiversity and productivity through a prioritization of inlets that was done by

Greenlaw *et al.* (2011) and could be used in this way for MPA network planning in the short-term.

5.2.2 Nova Scotia Department of Natural Resources (NSDNR) Wetland Inventory

The NSDNR Wetland Inventory provides information on coastal ecosystems at fine scales along Nova Scotia's coastline including dunes, beaches, estuarine and marine flats, coastal saline ponds, rocky ledges and reefs, high and low salt-marshes, and eelgrass beds (NSDNR 2000). Data were derived by the visual interpretation and digitizing of 1:10,000 scale aerial photography taken during the late 1980s and 1990s (NSDNR 2000). DNR does not consider the delineation of marine features (*i.e.*, estuarine and marine flats, rocky reefs, and eelgrass beds) to be accurate because aerial photos were collected without regard for the stage of tides, and photos were not corrected below the high water mark (R. Milton, NSDNR, pers. comm. 2011 and S. Basquill, NSDNR, pers. comm. 2012). The inventory is being updated and the coastline corrected with recent aerial photography for changes in sensitive physical features (*e.g.*, dunes, barrier beaches, coastal saline ponds). The update does not delineate marine features. Despite marine limitations, archived DNR aerial photos have been used by Sharp *et al.* (2007) to demonstrate reductions in eelgrass beds in coastal areas (Sinclair 2012). The original inventory can at least be used to identify presence/absence of marine features (R. Milton, NSDNR, pers. comm. 2011) to address conservation objectives for representation and EBSA-related objectives where eelgrass and salt marshes are highly productive ecosystems and eelgrass is considered ESS (DFO 2009).

5.2.3 The Canadian Wildlife Service Maritimes Wetland Inventory (MWI) Atlas Series

The Wetland Inventory Atlas was derived from the Canadian Wildlife Service (CWS) Maritime Coastal Habitat Inventory Database and the Maritime Freshwater Database. It can be used to identify the location and relative importance of freshwater and coastal wetlands in Nova Scotia, New Brunswick and Prince Edward Island. The Atlases are a series of 1:50 000 topographic maps that identify and describe the freshwater wetlands and coastal habitats of each province. The MWI for Nova Scotia was based primarily on colour air photos taken during 1974 to 1978 at a scale of 1:10 000. Supplemental photos used were taken during 1969, 1970 and 1973 at a scale of 1:15 840, as well as 1: 20 000 scale photos taken during 1981 (Hanson and Calkins 1996).

The Atlases show all coastal habitats and freshwater wetlands in terms of their classification, size and evaluation score, and provide the watershed boundaries and list of all vegetative classes found for each freshwater wetland. The Atlas series (hardcopy) may be viewed at the Canadian Wildlife Service in Sackville, New Brunswick, or at any of the agencies listed in Hanson and Calkins (1996).

The NSDNR Wetland Database and CWS MWI are the only regional data sources for eelgrass distribution, other than LEK studies that are described below. Site-specific studies for eelgrass have been conducted and should be integrated with regional data sets where possible. Examples are surveys done in Port Joli and Musquodoboit Harbour by NSDNR using satellite imagery and ground-truthing (unpublished data) and transects in the Bras d'Or Lakes and other areas using the sidescan sonar and video (the Towfish) (Vandermeulen 2007).

5.2.4 Environment Canada (EC) Shoreline Classification and Pre-Spill Database (EC EPOD [Environmental Protection Operations Division] Quebec and Atlantic Regions)

The objective of the Shoreline Classification and Pre-Spill Database is to provide decision support for spill response management teams. Data acquired via various tools including low-altitude videotape, aerial photography, and pre-existing mapping material, are summarized by shoreline segment. Data define sections of shoreline with uniform alongshore character.

Description of the shore zone is presented within one of four distinct database templates: 1) Shore Zone Character, 2) Shoreline Protection, 3) Shoreline Treatment, and 4) Summary of Response and Requirements. Templates contain a total of 143 different attributes unique for each shoreline segment. The Shore Zone Character template describes information such as shoreline material/type, nearshore environment, longshore current, oil traps, and potential behaviour, and resources at risk. The shoreline material/type is further subdivided into five distinct categories: lower inter-tidal material, lower inter-tidal form, shoreline type (area located between the high and low tide mark), backshore material, and backshore form. The shoreline type is a description of that area of the shore zone where oil is most likely to be stranded, and the coastal character is described since this is the area in which backshore operations will stage and deploy resources. This data set was used in the physiographic coastline classification (Greenlaw *et al.* 2013) and also contains some wetland and salt marsh delineation which may be useful for EBSA identification.

Appendix C summarizes each of the data sets described above.

The data sets described above can also be grouped according to their current compatibility (*i.e.*, readiness) for network planning over both the short and long term, in consideration of the data limitations and considerations described earlier. Data sets are grouped into the following categories (Table 1):

1. MPA network ready (*i.e.*, ready for immediate use).
2. Some analysis required (available for MPA planning in short term, approximately 6 to 12 months).
3. More extensive analysis required (will integrate into MPA planning over longer term, approximately 2 years).
4. Needs further consideration for use in MPA network planning.

Table 1. Data readiness for planning an MPA network in the Atlantic Coast Planning Area.

1. MPA Network Ready	2. Some Analysis	3. Extensive Analysis	4. Further Considerations
• Coastline classification • Inlet classification • DNR Wetland Inventory • CWS Maritime Wetland Inventory • Fishery-independent survey (preliminary results) • TEK survey of spawning/nursery areas (Trippel) • Herring spawning surveys • CWS Key Marine Habitat for Migratory Birds Project	• Subtidal classification • Fishery-independent survey (preliminary results) • At-sea catch analysis • 4VsW and 4Vn sentinel surveys • DFO commercial fisheries database • Lobster commercial landings data • At-sea lobster sampling • Industry macroalgae data • Coastal resources mapping data • Juvenile fish assemblage	• Fishing industry LEK survey • URCHIN • Lobster collector project • Lobster connectivity project • Macroalgae and sea urchin dive transects by DFO Science	• Grey seal pup survey • Lobster collector project • LFA 34 berried female project • EC shoreline classification data • Coastal and shallow subtidal research conducted by regional Universities

6.0 DATA GAPS AND RECOMMENDATIONS

Data gaps are identified through the IEP proceedings (DFO 2007) and in Gromack *et al.* (2010). Some of these data gaps are being addressed through IEP initiatives including the Fishery-Independent Survey and Fishing Industry LEK study which are both still undergoing analysis. Extensive regional surveys for the inshore remain costly in terms of time and resources, particularly because information becomes outdated quickly as environmental conditions cause changes to ecological, biological, and physical features in both coastal and offshore environments. LEK surveys require significant resources (mainly human resources) but are a more cost-effective means of obtaining regional data, provided there is high confidence in the data. LEK surveys also involve stakeholders at early stages in the MPA planning process.

The author recommended proceeding with coastal MPA network planning with data sets on the "MPA network ready" list and prioritizing data sets on the "some analysis required" list for short term integration into MPA network planning as funding and human resources allow. Over the long term, data sets on the latter two lists may be incorporated into MPA network planning, including potential future studies on climate change and connectivity.

Collection of new data and information should be focused within areas of known significance, when there is opportunity for collaboration or where there is stakeholder support for a MPA designation or other conservation measures.

Meeting participants generally agreed with the author's recommendations, however, they suggested that sufficient information exists to proceed with MPA network planning on the Atlantic coast using existing data and endorsed the 20 EBSAs presented in Gromack *et al.* (2010) for consideration in the bioregional MPA network design phase (DFO 2012). Participants recommended that the remaining 27 EBSAs (of the original 47) be re-evaluated against the CBD EBSA criteria, using expert knowledge and available regional information, to ensure potential priority areas for conservation for other departments (Environment Canada, Parks Canada, and the Nova Scotia Government) have not been overlooked (DFO 2012). Expert

opinion and LEK was highly valued by meeting participants and there was strong support that the MPA network should include areas that are repeatedly identified for their ecological significance. It was recommended that a final list of EBSAs for consideration in the MPA network should be developed and refined through ongoing discussions among federal and provincial partners and consultation with Aboriginal groups and stakeholders.

Based on these recommendations, MPA network planning can proceed within a reasonable timeline but must remain flexible for the incorporation of new knowledge and data as they become available. In addition to addressing data gaps, DFO's Oceans and Coastal Management Division (OCMD) and Science Branch should work in collaboration to move MPA network planning forward within the Atlantic Coast Planning Area by providing further input on conservation objectives and working together to identify and validate EBSAs and incorporate representation into MPA network planning. Socio-economic data collection and mapping is considered a priority for broader integrated management initiatives, including MPA planning, and OCMD is working to address this through a variety of human use mapping initiatives. This is a key step in the MPA network planning process that will occur in collaboration with others.

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APPENDIX A: OVERARCHING CONSERVATION OBJECTIVES FOR THE SCOTIAN SHELF/BAY OF FUNDY BIOREGION AND EXAMPLE CONSERVATION OBJECTIVES FOR THE ATLANTIC COAST PLANNING AREA

Conservation objectives 1 and 2 were initially drafted based on the Convention on Biological Diversity (CBD) criteria for designing ecologically coherent networks of MPAs and adapted and agreed upon at the CSAS RAP on MPA Network Planning (DFO 2012). Agreement was not reached on the more detailed planning area-specific objectives. As a result, the conservation objectives presented below should be viewed as examples of the types of objectives that could ultimately be set for the Atlantic Coast Planning Area. The planning-area specific objectives were developed by the Oceans and Coastal Management Division (OCMD), with significant input from the Coastal Protected Areas of Nova Scotia (CPANS) Working Group. CPANS is a federal-provincial working group that works collaboratively to address issues of coastal conservation. Specific targets will eventually be identified for each conservation objective.

1. **Protect Ecologically or Biologically Significant Areas and other special natural features in the Scotian Shelf Bioregion that benefit from long-term, year-round, spatial management.**

   a) Areas with unique or rare ecological functions, processes or natural features on an international, national, regional, or sub-regional scale
   Example conservation objective:
   - Protect a portion of known unique areas
     Examples of unique areas:
   - Nesting cliffs
   - Islands with seaward extensions
   - Areas with unique physical and oceanographic attributes, for example:
     - Lobster Bay
     - Bras d'Or Lakes
     - Eastern Shore Islands Archipelago
   - The only available areas (within the bioregion) for important life cycle stages of species (*e.g.*, protect the only known spawning area for species X).

   b) Areas of special importance for the life history stages of species
   Example conservation objective:
   - Protect a portion of known important habitats* for species[5]
     *Important habitats:
     - Spawning and breeding areas
     - Nursery and nesting areas
     - Feeding and foraging areas
     - Over-wintering areas
     - Staging areas

[5]Priority coastal species may be developed to allow for the development of specific conservation targets. Priority species may include species that are dependent on coastal habitats for important lifecycle stages, Ecologically Significant Species, species that are listed in the *Species at Risk Act* (SARA) or by the Committee on the Status of Endangered Wildlife in Canada (COSWEIC), and others. Examples include herring (potential ESS), eelgrass (confirmed ESS, DFO 2009), and Atlantic cod (endangered, COSEWIC). A draft list of priority bird species have been identified by the Canadian Wildlife Service (CWS) and are found in Appendix B.

- Migration stop-over areas
- Migration corridors and bottlenecks
- Aggregations for reasons unknown
- Areas that contain a high percentage of the overall population of a particular species

c) Vulnerable species, habitats and features
Example conservation objectives:
- Protect known areas of aggregating sponges
- Protect dense and extensive eelgrass beds, saltmarshes, and dunes

d) Areas of high biological diversity
Example conservation objective:
- Protect areas of particularly high species richness/diversity

e) Areas of high biological productivity
Example conservation objectives:
- Protect dense and extensive eelgrass beds
- Protect dense and extensive salt marshes
- Protect areas with dense or extensive marine algae
- Protect areas of localized upwelling
- Protect bird colonies (an indicator for productivity)

f) Areas of high naturalness (highly intact areas)
Example conservation objective:
- Protect areas adjacent to terrestrial or inter-tidal protected areas
  Examples of highly intact areas:
- Areas with low levels of current or planned coastal development (residential, commercial)
- Areas with no adjacent industrial development
- Areas adjacent to land with good land-use, where Municipal Planning Strategies, Land-Use By-laws, or other measures are in place.
- Areas that do not contain permanent shellfish harvesting closures

2. **Protect representative examples of all marine ecosystem and habitat types in the Scotian Shelf Bioregion based on coastline, coastal subtidal, and offshore classifications, along with their associated biodiversity and ecological processes**

   Example conservation objectives:

   - Protect more than one example of each subtidal coastal class
   - Protect more than one example of each “coastline sub-segment”
   - Protect more than one example of each “coastal inlet”
   - Protect more than one example of each “coastal landform or habitat type” (*e.g.*, dunes, sandy beaches, estuaries, marine flats, etc.)

APPENDIX B: CANADIAN WILDLIFE SERVICE (CWS) SPECIES ASSESSMENT TO IDENTIFY PRIORITY SPECIES

EC CWS Bird Conservation Plans (including Marine Biogeographic Unit Plans) identify “priority species” from all regularly occurring bird species in each planning unit. The priority species approach allows management attention and limited resources to focus on those species with particular conservation importance, ecological significance and/or management need. The species assessment processes used are derived from standard assessment protocols developed by the four major bird conservation initiatives.

The objective assessment identifies vulnerable species according to five biological factors (population size, breeding and non-breeding distribution, population trend, breeding and non-breeding threats, and regional density and abundance) at the continental, BCR (Bird Conservation Region), or planning unit scale. Other species can be included on the priority list for additional reasons:

- Species that are identified in the four national/continental bird conservation plans as conservation priorities;
- Species that are widely distributed and abundant are considered “stewardship” species that typify the national or regional avifauna because they have a large proportion of their range and/or continental population in the planning unit; many of these species have some conservation concern, while others may not require specific conservation effort at this time; all should have long-term monitoring in place;
- Priority waterfowl species that are at their desired population objectives but that require ongoing management because of their socio-economic importance as game species;
- Species assessed by COSEWIC as Special Concern, Threatened, or Endangered; and any provincially/territorially listed species not already identified through the species assessment;
- Other species of identified concern in the BCR planning unit, such as those considered “sensitive” or more vulnerable by the General Status Ranking process may be included when warranted (*e.g.*, those species contribute new conservation issues to the plan); and
- Overabundant species that require management to reduce their populations.

The purpose of the prioritization exercise is to focus implementation efforts on the issues of greatest significance for our Canadian avifauna. As with any priority-setting exercise, some important species may be excluded, but the issues of importance to any excluded species are usually captured by addressing the threats identified for species that are included on the priority list. Figure 1 and Table 1 outline the number of priority species in NB MBU (Marine Biogeographic Unit) 11 by pillar group, Table 2 indicates the reasons for priority status.

In NB MBU 11, a species was considered as “regularly occurring” within the MBU and assessed for priority status if there were 10 or more records in the past ten years, occurring every year or almost every year. Records were obtained from Partners in Flight, preliminary data from the Maritimes Breeding Bird Atlas (http://www.mba-aom.ca/english/index.html), the Atlantic Canada Shorebird Surveys database (CWS-AR), the Atlantic Colonial Seabird Bird Database (CWS-AR), ebird Canada (http://ebird.org/content/canada), the Atlantic Coastal Blocks database (CWS-AR), the Eastern Canada Seabirds at Sea database (ECSAS - 2006 - present) and PIROP (1966-1992). Federally or provincially listed species were also considered, even if there were fewer than ten records. See Appendix 3: NB MBU 11 Species prioritisation methods for details of priority species assessment. In NB MBU 11, the priority species list is dominated by waterbirds (18 species), but also includes shorebirds (15 species) and waterfowl (11 species). However, nearly 50% of all shorebirds are priority species, compared to 35% of waterbirds and 37% of waterfowl. 11% of the priority species are considered at risk, either federally or provincially.

Table B1. Priority species in open water: nearshore and offshore environments in New Brunswick MBU 11 (Bay of Fundy only) and Nova Scotia MBU 11 (Scotian Shelf, including the Bay of Fundy) and their reasoning for priority status.

Priority species	Regional habitat sub-class	Important Bird Features	Representative Group/Guild	Reason for priority status						
				At Risk	CC	RC	SRC	S	NAWMP	TWG
American Black Duck	Nearshore Waters	shallow sheltered areas	Dabbling ducks		Yes				Yes	
Green-winged Teal (NB)	Nearshore Waters	sheltered bays	Dabbling ducks						Yes	
Common Eider	Nearshore Waters	abundant vegetation on shallow slope	Seaducks		Yes				Yes	
Harlequin Duck	Nearshore Waters	rocky coastline, exposed headlands, and subtidal ledges; often associated with offshore islands	Seaducks	Yes	Yes					
Surf Scoter	Nearshore Waters	sandy, cobble or rocky substrate (<10 m depth)	Seaducks		Yes					
Black Scoter (NB)	Nearshore Waters	sandy, cobble, or boulder substrate, 5-6 m depth, mollusk beds	Seaducks		Yes				Yes	
White-winged Scoter	Nearshore Waters		Seaducks		Yes					
Long-tailed Duck	Nearshore Waters & Continental Shelf	protected bays with steep slopes and shorelines with gradual shelves	Seaducks		Yes					
Common Goldeneye	Nearshore Waters	sandy, cobble, rocky, or boulder substrate with abundant prey	Seaducks		Yes				Yes	
Barrow's Goldeneye	Nearshore Waters	rocky coasts, rockweed, sheltered bays	Seaducks	Yes	Yes					
Red-throated Loon	Nearshore Waters & Continental Shelf		Loons+grebes		Yes	Yes				
Common Loon	Nearshore Waters	bays and nearshore coastal areas	Loons+grebes		Yes	Yes				
Horned Grebe	Nearshore Waters	sheltered areas between islands far from land (10-20 m depth)	Loons+grebes	Yes	Yes					
Red-necked Grebe	Nearshore Waters		Loons+grebes		Yes	Yes				
Cory's Shearwater (NS)	Continental Shelf & Oceanic Waters		Seabird, shearwaters		Yes					
Great Shearwater	Nearshore Waters & Continental Shelf	fronts/upwellings	Seabird, shearwaters		Yes			Yes		

Priority species	Regional habitat sub-class	Important Bird Features	Representative Group/Guild	Reason for priority status						
				At Risk	CC	RC	SRC	S	NAWMP	TWG
Sooty Shearwater	Nearshore Waters & Continental Shelf	upwellings/fronts	Seabird, shearwaters		Yes					
Manx Shearwater	Nearshore Waters & Continental Shelf	fronts/upwellings	Seabird, shearwaters		Yes					
Leach's Storm-Petrel	Continental Shelf	upwellings	Seabird, storm-petrel			Yes		Yes		
Great Cormorant	Nearshore Waters	sheltered bays with nearby perching sites	Cormorants		Yes					
Red-necked Phalarope	Nearshore Waters & Continental Shelf	shelfbreaks, upwellings, fronts	Shorebird, phalaropes		Yes					
Red Phalarope	Nearshore Waters & Continental Shelf	near upwellings, where Euphausiids are present	Shorebird, phalaropes		Yes					
Black-legged Kittiwake	Nearshore Waters & Continental Shelf	upwellings/fronts	Seabird, small gulls					Yes		
Ivory Gull	Continental Shelf	in association with pack ice	Seabird, small gulls	Yes	Yes	Yes				
Bonaparte's Gull	Nearshore Waters		Seabird, small gulls		Yes					
Roseate Tern	Nearshore Waters	shallow water	Terns	Yes	Yes					
Common Tern	Nearshore Waters	clear water for foraging	Terns		Yes	Yes				
Arctic Tern (NB)	Nearshore Waters	Open waters where prey available within 50 cm of surface (BNA)	Terns		Yes					Yes (NB)
Great Skua (NS)	Continental Shelf & Oceanic Waters	upwellings	Seabird, stercs		Yes					
South Polar Skua (NS)	Continental Shelf & Oceanic Waters		Seabird, stercs		Yes					
Dovekie	Nearshore Waters & Continental Shelf	shelf edge, upwellings	Seabird, Dovekie		Yes					
Common Murre	Nearshore Waters & Continental Shelf		Seabird/Large Alcid		Yes					
Thick-billed Murre	Nearshore Waters & Continental Shelf	upwellings/fronts	Seabird/Large Alcid		Yes					
Razorbill	Nearshore Waters & Continental Shelf		Seabird/Large Alcid		Yes					

Note: **At Risk**: the species is listed as either Endangered, Threatened or Special Concern by COSEWIC or provincially (NB); **CC**: the species meets conservation concern criteria for its pillar group; **RC**: the species meets regional conservation concern criteria, **SRC**: the species meets sub-regional conservation concern criteria, **S**: the species meets stewardship criteria for its pillar group; **NAWMP**: the species has NAWMP priority of Moderate-High or High; **TWG**: species added by the NB Technical Working Group.

* Population objectives (Recovery objective) for certain waterfowl defer to the NB-EHJV management plan.

** Population objectives (Recovery objective) for Species at Risk defer to Species at Risk recovery strategies.

Table B2. Priority species in intertidal, coastline, and coastal nesting habitats in New Brunswick MBU 11 (Bay of Fundy) and Nova Scotia MBU 11 (Scotian Shelf, including Bay of Fundy) and the reasoning for priority status.

Priority species	Regional habitat sub-class	Important Bird Features	Representative Group/Guide	Reason for priority status						
				At Risk	CC	RC	SRC	S	NAWMP	TWG
Canada Goose NAP	Saltmarshes, Mudflats & Estuaries		Geese		Yes		Yes (NS)		Yes	
Canada Goose AFRP	Saltmarshes, Mudflats & Estuaries		Geese		Yes		Yes (NS)			
American Black Duck	Saltmarshes & Estuaries		Dabbling ducks		Yes		Yes (NS)		Yes	
Green-winged Teal (NB)	Saltmarshes	coastal marshes with heavy vegetation and muddy bottoms	Dabbling ducks						Yes	
Common Eider	Islands & Rocky Shorelines	access to freshwater, abundant seaweed & prey, vegetated or rocky, prefers no livestock or predators	Seaducks		Yes				Yes	
Common Goldeneye	Estuaries	adequate prey abundance	Seaducks		Yes				Yes	
Barrow's Goldeneye	Estuaries		Seaducks	Yes	Yes					
Red-throated Loon	Estuaries				Yes	Yes (NS)				
Common Loon	Estuaries				Yes					
Horned Grebe	Estuaries	protected		Yes	Yes					
Red-necked Grebe	Estuaries				Yes					
Leach's Storm-Petrel	Islands	vegetated islands with soft soil for digging burrows or rock crevices for nest sites, no livestock	Seabirds		Yes					
Black-bellied Plover	Mudflats, Sandflats, Estuaries & Saltmarshes	in channels	Shorebirds		Yes					
Piping Plover	Sandflats		Shorebirds	Yes	Yes					
Solitary Sandpiper	Estuaries		Shorebirds		Yes					
Willet	Saltmarshes & Bare Areas		Shorebirds			Yes				
Lesser Yellowlegs	Mudflats, Estuaries & Saltmarshes		Shorebirds		Yes					
Whimbrel	Sandflats, Estuaries & Saltmarshes		Shorebirds		Yes					

Priority species	Regional habitat sub-class	Important Bird Features	Representative Group/Guide	Reason for priority status						
				At Risk	CC	RC	SRC	S	NAWMP	TWG
Hudsonian Godwit	Mudflats, Sandflats, Estuaries & Saltmarshes		Shorebirds		Yes					
Red Knot	Mudflats, Sandflats & Saltmarshes		Shorebirds	Yes	Yes					
Sanderling	Sandflats & Estuaries		Shorebirds		Yes					
Semipalmated Sandpiper	Mudflats		Shorebirds		Yes					
Least Sandpiper	Mudflats, Sandflats & Estuaries		Shorebirds		Yes					
Purple Sandpiper	Rocky Shoreline	exposed to wave action	Shorebirds					Yes		
Dunlin	Mudflats, Sandflats & Estuaries		Shorebirds		Yes					
Red-necked Phalarope	Estuaries		Seabirds, shorebirds		Yes					
Black-legged Kittiwake	Islands	free from predators	Seabirds, small gulls					Yes		
Bonaparte's Gull	Estuaries		Seabirds, small gulls		Yes					
Roseate Tern	Islands	cover for nests and chicks	Terns	Yes	Yes					
Common Tern	Islands, Estuaries & Saltmarshes	vegetation or other cover for chicks	Terns		Yes	Yes				
Arctic Tern (NB)	Islands	sparsely vegetated shores of small islands; avoid islands with shrubs or other woody vegetation, and nest where the vegetation is short or sparse at the time the nest site is chosen; other tern sp. present	Terns		Yes					Yes
Common Murre	Islands	cliffs	Seabirds, alcids		Yes					
Razorbill	Islands	cliffs	Seabirds, alcids		Yes					

Table B3. Priority species that use intertidal, coastline, and coastal nesting habitats in New Brunswick BCR 14 and Nova Scotia BCR 14 and their reasoning for priority status.

Priority Species	Regional Habitat Sub-Class	Important Bird Features	Representative Group/Guide	Reason for Priority Status						
				At Risk	CC	RC	SRC	S	NAWMP	TWG
Mallard	Saltmarshes & Estuaries		Dabbling ducks		Yes				Yes	
American Bittern	Saltmarsh	Tall emergent vegetation with aquatic bed vegetation	Marsh birds, herons		Yes	Yes				
Bald Eagle	Mature forest	Near water, relatively unpopulated, deciduous or coniferous, with large nest/perching trees	Raptors	Yes (NB)				Yes		
Peregrine Falcon	Beaches	Shorebirds	Raptors	Yes	Yes			Yes (NS)		
Yellow Rail (NB)	Saltmarsh	Prefers richer types of herbaceous vegetation, and elsewhere *carex*	Marsh birds, rails	Yes	Yes					
Sora	Saltmarsh	Migration	Marsh birds, rails		Yes					
American Golden-Plover	Beaches	Shoreline	Shorebirds		Yes					
Piping Plover	Beaches	Sparse vegetation and wrack, white sand or medium cobble beach but not rocky	Shorebirds	Yes	Yes	Yes (NS)				
Killdeer	Beaches		Shorebirds		Yes					
Spotted Sandpiper	Beaches	Beaches and barrier beaches	Shorebirds		Yes					
Whimbrel	Beaches and heathlands	Coastal heathlands	Shorebirds		Yes					
Common Tern	Beaches	Sand, gravel and scattered vegetation for hiding chicks	Seabirds		Yes	Yes				
Short-eared Owl	Saltmarsh		Owls	Yes	Yes					
Common Nighthawk	Beaches		Nightjars	Yes	Yes					
Bank Swallow	Banks and bluffs	Cut banks/cliffs with soft sandy soil	Swallows							Yes
Bobolink (NS)	Saltmarsh		Sparrows	Yes	Yes	Yes	Yes			

APPENDIX C: SUMMARY OF DATA SETS FOR MPA NETWORK PLANNING IN THE ATLANTIC COAST PLANNING AREA

Data set/layer	Description	Data Originator/Developer	Geographic extent
EBSAs			
Grey seal pup survey, DFO/FSRS Inshore Ecosystem Project (IEP)	Verbal interviews with fishing industry followed by aerial surveys	Damian Lidgard, Population Ecology Division, DFO Science	Cape North to Yarmouth
Fishery Independent Survey (IEP)	10 sites sampled with two sampling methods: transect and parallel sampling. 6 types of sampling gear used.	Alida Bundy, Population Ecology Division, DFO Science (project lead)	10 sites from Cape Sable Island to Cape North (LWM to 100 m depth or 12nm distance from shore)
At Sea Catch Analysis (IEP)	Information on target and non-target species distribution and abundance recorded on 1 longline trip and 41 lobster fishing trips	Nell den Heyer, Population Ecology Division, DFO Science (project lead), data collected by FSRS technicians	Cape Sable Island to Cape North (LWM to 92 m depth or 12 nm)
Fishing industry LEK study (IEP)	2-tiered survey of fishermen to spatially identify species distributions and EBSAs among other ecological information.	Alida Bundy, Population Ecology Division, DFO Science (project lead)	9 sites within Atlantic coast planning area
URCHIN (IEP)	Underwater video transects of bottom habitat to identify species abundance and habitat associations.	Nell den Heyer, Population Ecology Division, DFO Science (project lead)	6 bays in Atlantic coast planning area
4VsW Sentinel Survey	Longline surveys of target and non-target species using commercial fishing vessels in various stations throughout 4VsW	FSRS	4VsW
4Vn Sentinel Survey	Same as 4VsW	Industry	4Vn
DFO Commercial Fisheries Database	Landings data for most commercial fisheries in the Maritimes Region (some inshore fisheries not included)	DFO	Maritimes Region
Lobster Recruitment Project Index	Specialized traps used to capture undersized lobster. Information collected on size, berried females, tagged or v-notched lobsters, and bottom temperature.	Lobster fishermen (FSRS members) collect data, FSRS analyses	LFAs 27-35
Lobster Collector Project	Passive lobster collectors used to quantify YOY lobster; other species also recorded.	FSRS and DFO; John Tremblay, DFO Science (project lead)	Rhode Island to Newfoundland
At-sea Lobster Sampling	Size, sex of lobsters retained by traps during commercial fishing; some by-catch species data for some years	DFO; CRIS database	LFAs 27-41

Data set/layer	Description	Data Originator/Developer	Geographic extent
LFA 33 Commercial Trap Sampling Project	Extension of the Lobster Recruitment project, collecting lobster information from a small number of commercial traps	Lobster fishermen	LFA 33 (some data from LFA 34, 31A and 32)
LFA 34 Berried Female Lobster Project	LFA 34 fishermen collected size information on berried lobsters from their catch		LFA 34
Lobster Connectivity Project	Quantifying berried females along Atlantic coast and feeding into oceanographic models to determine lobster settlement patterns.	Lobster Node of the CCFRN - collaboration with FSRS and DFO	Gulf of Maine to Newfoundland
Lobster Commercial Landings Data	Landings data is available by LFA, Statistical District, and grid square. Grid square landings or CPUE are the most useful for MPA network planning.	Commercial lobster fisheries report landings by grid square.	Maritimes Region
Macroalgae and Sea Urchin Dive Transects by DFO Science	Dive transects taken every 16 km along Atlantic coast, estimated percent cover of macroalgae and urchin density	DFO Science (Bob Miller)	Atlantic Coast of NS from Cape Sable Island to Bay St. Lawrence.
Industry Macroalgae Data (Rockweed)	Rockweed landings reported to NSDFA by industry	Industry surveys and reporting, data stored by NSDFA and DFO Science	Inner Bay of Fundy to Halifax
Coastal Resources Mapping (TEK)	TEK collected through interviews with community members	DFO Oceans and Coastal Management Division (formerly the Habitat Management Division)	Maritimes Region
TEK Survey of Spawning and Nursery Areas	Identification of spawning and nursery areas for herring and groundfish through interviews with 89 fishermen.	Ed Trippel and A. Benham, DFO Science	Maritimes Region
Herring Spawning Surveys	Industry participation in sampling and surveying known coastal spawning areas	Industry, data stored by DFO	Atlantic Coast (Lobster Bay to Cape North)
Juvenile fish assemblages	Sampled 20 bays with a beach seine to determine juvenile assemblage association with physical features.	Beach seine data collected by Shannon O'Connor for MSc thesis	20 bays from the Bay of Fundy to Chedabucto Bay
CWS Key Marine Habitats for Migratory Birds Project Data			
Coastal Waterfowl Database	Replicated aerial surveys; broadly waterbird focused	Environment Canada (Atlantic office); Active contact Bruce Pollard	Coastal zone of Atlantic Canada
COEISDS Database – Common Eider and Sea Duck Surveys	Replicated aerial surveys; Common Eider and seaduck focused	Environment Canada (Atlantic and Quebec offices); Active contacts Scott Gilliland and Christine Lepage	Coastal zone of Atlantic Canada

Data set/layer	Description	Data Originator/Developer	Geographic extent
Piping Plover Survey Database	Systematic ground surveys by CWS and ENGO staff	Environment Canada (Atlantic office); Active contact Jen Rock	Atlantic Canada
ACSS Database – Atlantic Canada Shorebird Survey	Opportunistic ground surveys by staff and volunteers; shorebird focused	Environment Canada (Atlantic office); Active contact Julie Paquet	Coastal zone of Atlantic Canada
ARCD – Atlantic Region Colony Database	Seabird colony locations in Atlantic Canada	Environment Canada (Atlantic office); Active contacts Sabina Wilhelm and Carina Gjerdrum	Atlantic Canada
Representation			
Subtidal coastal classification	Delineation of areas with similar oceanographic and physical characteristics.	DFO Science (Michelle Greenlaw)	Maritimes Region, LWM – 100 m depth
Physiographic coastline classification	Delineation of areas of the coastline with similar oceanographic and physical characteristics.	Coastal Classification Working Group (DFO, NRCan, NS DNR, NS Environment, Dalhousie University)	Maritimes Region, backshore - LWM
Inlet Classification	Geophysical classification of NS inlets to assess habitat and predict biodiversity for MPA planning	Analysis by M. Greenlaw (MSc thesis)	St. Mary's Bay to Chedabucto Bay
NS DNR Wetlands and Coastal Habitats Inventory (2000)	Delineation of wetlands and coastal habitat types based on interpretation of aerial photos. Features include: salt marshes (high and low), flooded flats, saline ponds, dunes, beaches (type of beach not indicated), marine and estuarine flats, and eelgrass beds.	NS DNR Renewable Resources Branch (Wildlife Division)	Nova Scotia
Canadian Wildlife Service (CWS) Maritime Wetland Inventory (MWI)	Location of wetland habitats; saltmarshes, sandy beaches, mudflats, eelgrass beds	CWS (Hanson and Calkins 1996)	Maritimes Provinces
EC Shoreline Classification and Pre-Spill Database	Shoreline classification developed for oil spill response. Includes substrate information and some wetland distribution.	Environment Canada (Atlantic office); Active contact Anthony Pouw	Atlantic Canada (Labrador incomplete)