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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2014/020

Quebec Region

Proceedings of the regional peer review meeting for developing a marine protected area (MPA) network in the Estuary and Gulf of St. Lawrence – Validating the methodology for including ecological considerations into the future MPA network

24–25 September 2013
Mont-Joli, Quebec

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September 2014

Canada

Foreword

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

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280

Correct citation for this publication:

DFO. 2014. Proceedings of the regional peer review meeting for developing a marine protected area (MPA) network in the Estuary and Gulf of St. Lawrence – Validating the methodology for including ecological considerations into the future MPA network; 24–25 September 2013. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2014/020.

Aussi disponible en français :

MPO. 2014. Compte rendu de la revue par les pairs régionale sur l'établissement d'un réseau d'aires marines protégées (AMP) dans l'estuaire et le golfe du Saint-Laurent – Validation de la méthodologie pour l'intégration des considérations écologiques au futur réseau d'AMP; 24 et 25 septembre 2013. Secr. can. de consult. sci. du MPO, Compte rendu 2014/020.

SUMMARY

A workshop on the planning of the future marine protected area (MPA) network in the Estuary and Gulf of St. Lawrence was held on 24–25 September 2013 at the Maurice Lamontagne Institute in Mont-Joli. The meeting's objectives were to determine whether the ecological information layers selected would be able to meet the future MPA network's conservation objectives and whether the methods used were sufficient for identifying conservation targets to be used for exploring different network options and conducting the spatial analysis of data. Some 30 participants from the Institut des sciences de la mer de Rimouski, Fisheries and Oceans Canada, Environment Canada, Parks Canada, and the Pacific Marine Analysis & Research Association (PacMARA) heard presentations on the status of the MPA network project, discussed the methodology and available data, and prepared comments and recommendations following the discussions. This report highlights all the essential points formulated by the specialists attending this peer review, including the use of the Marxan tool, the best ecological information layers relating to the conservation objectives, and the methods used to set conservation targets and perform spatial analyses.

SOMMAIRE

Les 24 et 25 septembre 2013 se tenait à l'Institut Maurice-Lamontagne à Mont-Joli un atelier de travail sur la planification du futur réseau d'aires marines protégées (AMP) dans l'estuaire et le golfe du Saint-Laurent. Les objectifs de la rencontre étaient de valider si les couches de données écologiques retenues étaient adéquates pour répondre aux objectifs de conservation du futur réseau d'AMP et de valider si les méthodes utilisées étaient adéquates pour déterminer les cibles de conservation qui seront utilisées afin d'explorer différentes options quant à la conception du réseau et pour effectuer l'analyse spatiale des données. Une trentaine de participants de l'Institut des sciences de la mer de Rimouski, de Pêches et Océans Canada, d'Environnement Canada, de Parcs Canada et de la Pacific Marine Analysis & Research Association (PacMARA) ont assisté aux présentations sur l'état d'avancement du projet de réseau d'AMP, ont discuté de la méthodologie et des données disponibles et ont formulé des commentaires et recommandations suite aux discussions. Ce compte rendu souligne tous les points cruciaux formulés par les spécialistes présents lors de cette revue par les pairs, entre autres, sur l'utilisation de l'outil Marxan, sur les meilleures couches de données écologiques pour atteindre les objectifs de conservation et sur les méthodes utilisées pour déterminer les cibles de conservation et effectuer l'analyse spatiale.

INTRODUCTION

Marine protected area (MPA) networks play an important role in conserving marine biodiversity. The governments of Quebec and Canada recognize this and have made several national and international commitments related to the creation of such networks. Both levels of government decided to combine their efforts under the auspices of the St. Lawrence Action Plan (SLAP) 2011–2026 to plan this network. The MPA network's main goal is to provide long-term protection of marine biodiversity, ecosystem functions, and special natural features. Two secondary goals also support the approach: (1) to support the conservation and sustainable management of living marine resources and their habitats in order to preserve socio-economic values and related ecosystem services, and (2) to raise public awareness of the value of marine environments as well as the cultural and historical values associated with them.

A technical committee (TC) was created to produce the deliverables for this initiative. Its members are currently working on establishing a methodology to include the ecological considerations required for developing scenarios for a marine protected area network.

The methodology developed by the committee must be validated by scientists. The ecological characteristics (information layers) and methods (including parameterization) used to conduct the spatial analysis must also be evaluated. DFO's Oceans Management, which co-chairs the technical committee with Quebec's Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP), hoped to obtain answers to specific questions on these matters.

The specific purpose of this meeting was to answer the following questions:

1) Are the selected ecological data layers sufficient to meet the future MPA network's conservation objectives?
2) Are the methods used sufficient to determine conservation targets and to conduct a spatial analysis of the data?

These proceedings include the main points of the presentations, summarize the proposed adjustments and common suggestions, and reformulate remarks in the form of highlights and recommendations. This document will guide future analyses and ensure effective follow-up on recommendations.

CONTEXT

Meeting chairperson Denis Gilbert welcomed the participants. He gave them the opportunity to introduce themselves (Appendix 1) and stated the general guidelines to be followed for the workshop to run smoothly. He focused on the need for the fair and respectful right to speak and on the effort to reach a consensus. He added that all participants must limit themselves to the terms of reference (Appendix 2) and to good scientific practices. After this introduction, the presentations began according to the agenda (Appendix 3).

MARINE PROTECTED AREA NETWORK PLANNING (G. CANTIN)

Guy Cantin provided context for the marine protected area network planning project. He emphasized the importance of adopting a common terminology and harmonizing the federal and provincial approaches. He took the opportunity to remind everyone of the study area's geographical limits. He also stressed the eventual enlargement of the study area to include the Gulf of St. Lawrence bioregion.

Following this presentation, the participants made a few comments. In particular, mention was made of a national peer review on the formulation of conservation objectives for MPA networks, which was held in 2012. The meeting determined that strategic and operational objectives should be identified and that they should be used as the basis for developing MPA network monitoring indicators. However, the technical committee has no plans to set operational objectives. It is focusing instead on developing the network's monitoring indicators on the basis of conservation targets attributed to ecological features.

MARXAN TOOL PRESENTATION (J. ARDRON, N. SERRA, AND H. COLEMAN)

The PacMARA team followed with a presentation on systematic conservation planning and one of the tools that could be used, Marxan. The team first presented a general overview of Marxan's usefulness and its role in an MPA network's planning process. Marxan is a spatial planning tool that strives to attain all conservation targets while minimizing the total cost and generating different solutions. Then the team summarized the tool's advantages and limitations and gave a synopsis of misconceptions and lessons learned with respect to Marxan. They also discussed the way to work with stakeholders and partners during the planning of an MPA network and the use of the Marxan tool. Lastly, they presented and explained Marxan's technical aspects.

After the presentation, the tool was discussed, focusing on some of the technical aspects and, in particular, on the quality of available data and the sensitivity of analyses. Marxan is a flexible tool that supports decision making and facilitates the effort to find solutions. To improve results, it was recommended that Marxan be used, that the proposed solutions be validated with help from stakeholders, and that the next rounds of analyses be adjusted on the basis of comments made. This procedure should be repeated several times until an acceptable solution is found. Marxan offers solutions that are adapted to each of a specific project's problems and objectives. It does not give a final answer but helps to guide discussions toward an answer that is more plausible based on the available data.

IDENTIFICATION OF ECOLOGICALLY AND BIOLOGICALLY SIGNIFICANT AREAS IN THE ESTUARY AND GULF OF ST. LAWRENCE: 2006–2007 EXERCISE (C. SAVENKOFF)

Claude Savenkoff presented a summary of the 2006–2007 exercise, which identified ecologically and biologically significant areas (EBSAs) in the Estuary and Gulf of St. Lawrence. He clearly presented the goals of this exercise and the approach taken. He also summarized the observations and recommendations drawn from the work that was done, among which he specifically mentioned the following:

- Clear establishment of what constitutes a data layer and the weight that should be assigned to each one;
- Representation of data – for this exercise, only the spatial scale was considered in the analysis (the temporal and vertical [depth] scales were not dealt with directly);
- Several large regions were poorly sampled (coastal areas were not included in the analyses because the data were not easily accessible during the allotted period of time);
- Integration was based on the attributes (dimensions) of significant areas (no common database);
- Topography layer and physical oceanography – use of a different method to identify significant areas.

He succinctly presented the exercise's conclusions:

- The exercise helped to attain the objectives, but it also pointed out certain research needs (zones with data gaps) and the necessity to consider seasonal and interannual variations in the analyses;
- Redoing all analyses would be appropriate, considering the new data that were not available when the analyses were done;
- The delineation of EBSAs must not be considered to be strict and definitive.

REVIEW OF DATA LAYERS SELECTED FOR ANALYSIS (J.-C. BRÊTHES)

Jean-Claude Brêthes reviewed the various data layers that are available for completing the work. He began his presentation with the goal and then discussed the objectives and the ecological features. Next, he presented the data selection criteria, the aspects linked to representativeness, and several elements related to EBSAs. He made additional comments on EBSAs and other special elements that deserve consideration. He ended with a summary of ecological features and related them to the conservation objectives.

Following this presentation, participants returned to the questions found in the terms of reference. Comments directly related to these questions are reported in the section below directly dealing with these questions. The main points discussed after this presentation were as follows:

- The deadline for providing additional data to be used in the next analyses (ideally, late-November);
- Precisions concerning the data to be included for primary production;
- Chlorophyll a: The use of a new model for evaluating chlorophyll a offers greater precision and increases the area off southern Newfoundland. There was a question about whether using the annual average masks this data layer too much. It was also noted that chlorophyll a does not necessarily correspond to areas with strong primary production. Since this production is at the base of the food chain, it should probably be included in a data layer;
- Disparity in coverage between data layers;
- Inclusion of data layers for coastal environments (marshes, macroalga, eelgrasses, etc.);
- Coastal areas seem to be presented less often than other ecological features. However, the absence of certain data layers does not mean that they cannot be integrated later or that the unique or missing ecological feature is not protected. Existing layers such as marshes or coastal landscapes could offset this lack. Furthermore, these gaps could be offset by the future integration of additional data layers with those that are already available for the southern Gulf's eelgrass and marshes;
- Low number of data layers included for representing benthos in relation to other ecological components;
- Representation of physical surface data and absence of data layer for deeper areas;
- Inclusion of persistent features in the system and how to integrate aspects linked to climate change into the definition of the marine protected area network;
- Selection criteria for inclusion of data, including representativeness;

- The redundancy that may occur between the ecological terms of reference produced by Quebec and the megahabitat map produced by Jean-Denis Dutil's team[1];
- Availability of data outside the region covered by Quebec (west coast of Newfoundland and Southern Gulf).

PRESENTATION OF THE METHODOLOGY FOR DETERMINING AREAS OF ECOLOGICAL INTEREST – CONSERVATION TARGETS (D. DORION)

Danielle Dorion presented the conservation targets identified as part of this exercise. The targets were generally defined as a percentage associated with each ecological feature in order to arrive at a quantifiable target for completing spatial analyses using the Marxan tool. She presented minimum targets based mainly on international considerations and the criteria used for assigning higher targets to certain ecological features. Three conservation scenarios corresponding to different levels of protection (low, medium, and high) were used, showing how conservation targets can help explore different network scenario options. Finally, she presented a visual example of the effect of changing a target.

A discussion was held following this presentation, the main points of which can be found in the "Conservation Target Scenarios" section later in the report.

PRESENTATION OF THE METHODOLOGY FOR DETERMINING AREAS OF ECOLOGICAL INTEREST – SPATIAL ANALYSIS (G. FAILLE)

Geneviève Faille presented the methodology for determining areas of ecological interest and focused on spatial analysis. She summarized the choices to be made prior to the analyses (study grid, coastal adjustment, number of replicates). She also discussed the Marxan tool and the various parameterizations made, particularly with respect to the number of iterations and repetitions chosen, the boundary length modifier (BLM), and the species penalty factor (SPF). She concluded with the presentation of a few preliminary results obtained by varying different parameters and discussed the sensitivity tests that need to be done as well as the next steps.

Following this presentation, certain important technical aspects of the Marxan tool were reviewed, notably the coastal adjustment, the connectivity aspect, the sensitivity analyses, and the BLM parameter.

- It was specified that the coastal adjustment is done according to the percentage of the cell that covers the coast.
- Some participants questioned the integration of connectivity into the results. This aspect was not planned for this phase of the exercise. Furthermore, the BLM, which affects the spatial distribution of solutions by promoting aggregation or fragmentation according to the parameterization of the tool being used, is not used to ensure the network's connectivity. When the BLM value is higher, the chosen areas will be more aggregated (larger) and less numerous, and vice versa. It is also possible to assign a different boundary length to the units in coastal environments as compared to offshore units in order to have a lower aggregation in coastal environments.

[1] Dutil, J. D., Proulx, S., Chouinard, P.-M., and Borcard. D. 2011. A hierarchical classification of the seabed based on physiographic and oceanographic features in the St. Lawrence. Can. Tech. Rep. Fish. Aquat. Sci. 2916: vii + 72 p.

- When it comes time to integrate connectivity into the network, the location of different interrelated areas must be taken into account. In fact, a problem could arise if a downstream area is chosen that depends on another area located further upstream that itself is not part of the network.
- To optimize parameter settings, the suggestion was made to plot a graph of the percentage of targets reached on the basis of the cumulative area necessary (number of planning units). This will help determine whether these percentages of targets reached require a high percentage of the area necessary for meeting all of the conservation objectives.
- Some participants also wondered if the number of data layers attributed to a certain type of ecological feature could bias the Marxan analysis, e.g., 15 data layers on birds. Many fish species not meeting the selection criteria were rejected. A subsequent sensitivity analysis could assess the effect that a specific data layer has on the results. For example, by removing all the layers related to species at risk, we could observe how these layers influence the analysis.

Before moving on to the workshop's specific questions, regions were asked to explain the different approaches they have used to plan MPA networks. Newfoundland and Labrador region is currently working on the Newfoundland and Labrador Shelf bioregion, which is divided into six ecological units. Its approach involves overlaying different data layers to reveal "hot spots" for the future protection of its territory. Because of the multiple activities in the coastal area, several use conflicts may arise. Therefore, consultation with users is extremely important for establishing its MPA network. Unlike Newfoundland, the Maritimes, Arctic, and Pacific regions plan to use the Marxan tool to develop their MPA networks.

After these presentations, specific workshop questions were addressed.

FIRST QUESTION: ARE THE SELECTED ECOLOGICAL DATA LAYERS SUFFICIENT TO MEET THE FUTURE MPA NETWORK'S CONSERVATION OBJECTIVES?

To date, 69 data layers corresponding to ecological features have been selected. Of these 69 layers, 39 cover the entire Gulf and the other 30 cover only the area covered by the SLAP. These data layers meet 10 of the future MPA network's conservation objectives. During the workshop, a few participants suggested replacing or adding certain data seen as being more relevant and supplementing the data sets once they become available for the regions outside the SLAP area. However, some participants in attendance were concerned about the very tight deadline for submitting the final data layers (end of November 2013). While it is imperfect, the spatial analysis of these layers can be done using the adaptive management principle. Thus nothing in the near future will prevent the technical committee from doing a subsequent analysis with new or refreshed data layers. A good opportunity to do this would be when the socio-economic data are processed.

a) Data selection criteria

The data selection criteria must lead to the attainment of the conservation objectives. These criteria include representativeness and the EBSAs. Four additional data layers were selected for the representativeness objective: MDDEFP's ecological reference framework, Environment Canada's coastal landscape map, and the maps of coastal and epipelagic habitats and megahabitats developed by Jean-Denis Dutil's team. For the EBSAs, eight layers representing the following aspects were evaluated by the technical committee: physical oceanography and topography, primary production, secondary production, meroplankton, benthic invertebrates,

pelagic fish, demersal fish, and marine mammals. Some of these layers were selected (secondary production, meroplankton, and pelagic fish); source data used to determine EBSAs were used for others while for some still other types of integrator data (indices) or by-species data were used instead. The technical committee also selected other ecological features, namely species at risk, corals, and sponges. Finally, other special elements were targeted to complete the list of ecological features, namely potential ecologically significant species (ESSs) and other significant species or habitats (e.g., plant communities, birds).

In all cases, the selected layers had to meet additional criteria such as the data's quality, availability, and spatial coverage.

- Some participants wondered about the choices that were made. They asked why some data layers were included while others were not. For example, the technical committee included information on lobster because it had not been taken into account in the information on invertebrates in the EBSA exercise. At the same time, fish were chosen because they were on species-at-risk lists. A recommendation was made to modify the working paper to better clarify the choices that the technical committee made on the basis of the criteria used.
- Selection: At least forty data layers were eliminated during the selection phase. Such a removal could be explained by non-existent, incomplete, or too-limited data, etc., and was based on previously defined criteria. However, this exercise was still difficult and some participants questioned the removal of certain data layers. For example, the data layer on macroalga was eliminated because they covered only a portion of the study area. On the other hand, the layer for Barrow's goldeneye, a species that is well documented and concentrated in only a few places, was accepted. There may also be a scale issue—in other words, a species that is essential on a regional level is not necessarily essential with respect to the entire Gulf. The integration of such layers might significantly direct the analysis result.
- Climate change: Some participants wondered about the way data related to climate change were integrated, e.g., the forecasting of a gradual, long-term rise in surface water temperature. Additional discussions will have to be held to address these questions. To validate and improve the approach, investigating what is done elsewhere with respect to this issue (adaptation, species' resilience, representativeness, etc.) and consulting the document produced by Brock et al. (2012)[2] was suggested.

b) Data quality

One of Marxan's weaknesses is that it does not discriminate between the absence of data and a true zero in the data series. To try to correct for this bias, choices were made to select the most complete data possible, but biases may still exist.

When a data layer is known to include lower quality data, the importance of this layer can be reduced by lowering the conservation target's value or by modifying the SPF. In general, setting a lower SPF for less reliable data is advisable. These data will therefore have less impact on the analysis.

[2] Brock, R.J., Kenchington, E., and Martínez-Arroyo, A. (editors). 2012. Scientific Guidelines for Designing Resilient Marine Protected Area Networks in a Changing Climate. Commission for Environmental Cooperation. Montreal, Canada. 95 pp.

c) Selection of data for representativeness

As mentioned earlier, the data layers selected for representativeness include the ecological reference framework (ERF), the coastal landscape map, and the maps of coastal and epipelagic habitats and megahabitats. All these data layers are complementary.

With respect to the ERF, some participants questioned the positioning of certain boundaries defining the areas in Level 3, which includes 17 physiographic units. Areas in the ERF are delineated according to bathymetry, the type of substrate, and steep slope areas. The outlines are based on these three factors. The purpose of using this layer is to force Marxan to choose areas within these zones to ensure better representativeness of the entire study area.

Because there appears to have been a duplication of information stemming from the use of the ERF and the megahabitat information layer, some participants suspected that there was a bias in the analysis results. Even if there is apparent redundancy, the data's complementarity could justify their use, particularly if the conservation objectives were attained. To address these questions, there was a suggestion to check the results of the Marxan analyses with and without the ERF data layer to demonstrate the relevance of using these data. The use of ERF Level 2 (composed of five natural regions) rather than Level 3 could also be evaluated.

Care must be taken with the coastal and epipelagic habitat data layer because—unlike the megahabitat layer—it was not the subject of an in-depth interpretation to make connections between the ecological and biological processes and the various kinds of habitats defined. However, some participants noted that there seem to be correspondences between certain types of habitats and oceanographic features such as the Labrador Current, etc. More in-depth analyses are required. Finally, new data could also be added in the future, particularly from the Gulf Region, which could alter the final results.

d) Availability of other data from the Gulf that could meet conservation objectives

This section essentially presents all the discussions held on the different types of data available for the entire region. It is also crucial to obtain the metadata with all new data sets that will be transmitted to the technical committee after the meeting.

Bioregion:

- In terms of the ecosystem and planning the future MPA network, efforts are being made to work as much as possible in the Estuary and the Gulf of St. Lawrence bioregion. Although the technical committee's work was originally undertaken on the SLAP scale, the assembly agreed to expand the exercise to cover the entire bioregion.

Availability of data in the other regions:

- The Newfoundland region already provided data during the EBSA process. Other data from the coastal area may be made available by the government of Newfoundland.
- The Gulf Region should be able to complete the coastal and epipelagic habitat database (30 m to the bottom). Data on eelgrasses, marshes, and lobster are also available to complete the data from Quebec.

Other data:

- Some data on invertebrates are available from Quebec Region and could be integrated into the database. This should improve the representativeness of benthos, given that the EBSA study only includes 2% of all invertebrates in the Estuary and Gulf of St. Lawrence.
- Primary production simulations are underway and will be available soon.

- The layer related to meroplankton does not include recent data. Replacing them for the analysis process was suggested.
- Birds: The Canadian Wildlife Service (Quebec and Atlantic regions) have data covering all of Eastern Canada. The pelagic bird data currently in use cover the entire Gulf while data on colonies are limited to the SLAP territory. However, data for the Gulf will also be available. The PIRA program includes recent data that show for the first time the relative abundance of pelagic birds in Eastern Canada; these data are now available, and Environment Canada will transfer them to the technical committee. Separating pelagic birds according to their diet—piscivore or planktivore—to improve the interpretation of Marxan results was also suggested.
- The data layers linked to physical oceanography are essentially data that reflect processes observed at the surface (0–30 metres). Certain data selections will also be redundant. The specialists recommended including the physical processes linked to greater depths (30 m or more). Furthermore, the Mécatina Trough should have been identified on one of the maps produced during the preliminary analysis because of its importance. This region might have been underestimated in the analyses due to the low fishing effort.
- Other types of data, such as the biodiversity index and eventually the EBSAs in coastal environments once they are defined, could also be included in the database.
- The possibility of integrating the data from climate change simulations into the database must be explored.

SECOND QUESTION: ARE THE METHODS USED SUFFICIENT TO DETERMINE CONSERVATION TARGETS AND TO CONDUCT THE SPATIAL ANALYSIS OF THE DATA?

Due to the short period of time available, it was difficult to determine whether the methods used to set the conservation targets and to conduct the spatial analysis of data were sufficient. Nevertheless, participants agreed that these were reasonable methods within which the targets and several parameters can be adjusted to optimize the analysis. The effect of varying one or many parameters is complex, which prevented some participants from commenting on the relevance of using these methods.

For their part, the members of the technical committee were confident in the Marxan tool. This tool is extensively used elsewhere in the world for planning conservation area networks. The use of this tool will inform decision making when the MPA network is planned. It is therefore essential to systematically fine-tune this process with comments and suggestions made by users and scientists.

Conservation targets

a) Target scenarios used to conduct the spatial analysis of the data

Conservation targets represent the percentage of an ecological feature to be protected in an MPA network (e.g., percentage of an area for a specific species' reproduction). Therefore, the setting of conservation targets is a crucial step in the Marxan analysis. It quantifies and measures the attainment of the network's results by exploring different scenarios. The starting point for assigning the percentage of a target is based on work done at the national and international levels.

- Three sets of target options were developed to facilitate exploratory Marxan analysis. The 10% conservation target is in line with commitments to the Convention on Biological

Diversity (CBD) for the protection of marine and coastal environments but is not based on ecological criteria. On the international level, it is accepted that a target of 20 to 30% coverage can satisfy the objectives for protecting commercial species.

- Higher targets were set for species at risk and for some specific ecological features such as corals and sponges.
- It is also possible to set targets by subregion for certain ecological features, but this exercise should be limited to certain specific features due to the complexity of the analyses. This could be particularly useful when certain data sets are incomplete.

b) Criteria for determining targets

There were few comments on this subject. The criteria used for setting higher targets for certain features must be well documented to ensure transparency of the results.

c) Relevance of using proportional targets for habitats

For habitats such as megahabitats, coastal and epipelagic habitats, and coastal landscapes, the use of base targets (10, 20, and 30%) can lead to an overrepresentation of more common habitats, thus covering a larger area, as a result of the Marxan analyses. To correct this, the Marxan Good Practices Handbook proposes assigning proportional targets to each habitat making up these data layers, i.e., calculating targets according to the proportion of these habitats in the environment. These proportional targets are calculated by normalizing the spatial data using a square-root transformation, then by generally adjusting the representativeness targets to scale according to the square root of the ratio comparing the representativeness data's area to the total area.

The assembly seemed to accept the appropriateness of using this approach in some situations. It could result in a slightly different selection of areas. Moreover, this method should foster the users' greater acceptance of the MPA network during consultations.

Spatial analysis

A few additional comments were made about spatial analysis.

If critical areas were not apparent after the analysis, they can be incorporated in part or in full into the solution at a later date. The Marxan results are only a basis for planning the network.

Concerning the size of the selected areas, it was suggested that the minimum size of an area selected by Marxan should be larger than the tidal current's horizontal measurement for pelagic species in order to keep these species from disappearing from the selected area with each tidal cycle. This minimum size could be determined by a simulation.

a) Choice of study grid

Most participants agreed on using the study grid from Jean-Denis Dutil's work on megahabitats. This grid includes cells for an area measuring 6.25 km^2 and covers the Estuary and the Gulf of St. Lawrence.

b) Adjustments of external cells to minimize bias in the spatial analysis

The proposed adjustment appeared to be adequate for preventing bias in favour of or against the coastal environment cells. PacMARA experts also suggested that it might be interesting to consider putting a buffer zone above the coastline for very shallow depths.

c) Number of replicates

The number of replicates could be determined by a risk assessment. On the international level, three replicates is a common recommendation. The technical committee will decide whether to use two or three replicates. To prevent replicates from being located next to each other, it would certainly be preferable to set a minimum distance between two replicates or even to consider the ecological feature at issue. It is also possible to go by region on the basis of ERF Level 2.

d) Criteria used to set penalties

Every time Marxan performs an analysis, it calculates the cost of the solution offered. The cost equation includes three terms: 1) the cost associated with the planning unit (here, set at one), 2) the SPF (penalty for not reaching all the targets), and 3) the BLM (influences the solution's level of aggregation). When all the targets are attained, the second parameter drops to zero.

The pertinence of the equation's three terms generated some questions. Participants felt that the graphic representation of these three terms could be used to better weight these parameters.

CONCLUSION

The two days of the meeting addressed the meeting's objectives and provided guidance for continuation of the analysis process. The participants' recommendations will clarify the technical committee's choices and refine the Marxan adjustment, thanks in part to the suggestions regarding the sensitivity analyses.

The technical committee's next step will be to contact the participants who identified new data that will be available in each of the regions in the coming months and then to collect these data to complete the database. An effort must be made to properly document these data by including metadata. The working paper will also be updated on the basis of the comments received. Once all the data have been received and validated, new Marxan analyses can be done to obtain the first scenarios for the MPA network that integrate all the data. Only later can socio-economic data be included.

To finalize the approach to finding a final solution that satisfies everyone, a second workshop is planned for 2015–2016. This second meeting will assess the results of the spatial analysis of data that integrated ecological and socio-economic considerations and will ensure that areas of great ecological value are included in the scenarios proposed for planning the MPA network and that the selected scenarios sufficiently meet conservation objectives.

APPENDIX

APPENDIX 1- PARTICIPANT LIST

Name	Affiliation
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Lewis, Sara	DFO – Science, Newfoundland and Labrador
McKindsey, Chris	DFO – Science, Quebec
McQuinn, Ian	DFO – Science, Quebec*
Mercier, Francine	Parks Canada – Quebec*
Mitchell, Jessica	DFO – Oceans Management, Ottawa
Ouellette, Marc	DFO – Science, Gulf
Park, Laura	DFO – Oceans Management, Newfoundland and Labrador
Pelletier, Émilien	ISMER
Pereira, Selma	DFO – Oceans Management, Quebec
Plourde, Stéphane	DFO – Science, Quebec
Robitaille, Daniel	EC/SCF – Quebec*
Savenkoff, Claude	DFO – Science, Quebec
Serra, Norma	PacMARA (by phone)
Turcotte, Anne	DFO – Oceans Management, Gulf

* Member of the technical committee for the establishment of an MPA network in the Estuary and Gulf of St. Lawrence.

** Former member of the technical committee for the establishment of an MPA network in the Estuary and Gulf of St. Lawrence.

APPENDIX 2- TERMS OF REFERENCE

Developing a marine protected area (MPA) network in the Estuary and Gulf of St. Lawrence - Validating the methodology for including ecological considerations in the future MPA network

Regional Peer Review – Quebec Region

September 24 and 25, 2013
Mont-Joli, Quebec

Chairperson : Denis Gilbert

Context

The numerous national and international commitments made by the governments of Quebec and Canada relating to the creation of marine protected area (MPA) networks show how important these networks are in conserving marine biodiversity. Both levels of government have decided to combine their efforts under the auspices of the St. Lawrence Action Plan 2011–2026 (SLAP) to plan this network. The main goal of this network will be to provide long-term protection of marine biodiversity, ecosystem functions and natural characteristics of the marine environment.

A technical committee was created to produce the deliverables for this initiative. Its members are currently working on establishing a methodology to include the ecological considerations required to develop scenarios for an MPA network.

The methodology that has been developed must be validated by scientists. The ecological characteristics (data layers) and methods (including parametering) used to conduct the spatial analysis must be evaluated. DFO Oceans Management, which co-chairs the technical committee, would like to have specific answers on these aspects (Appendix 1).

There is also an interest in working in the Gulf of St. Lawrence bioregion. Seeing as this bioregion spans three DFO regions, experts from the Newfoundland and Labrador, Gulf and Quebec regions must participate.

Objectives

The purpose of the meeting is to answer the following questions:

1) Are the ecological data layers selected sufficient to meet the conservation objectives for the future MPA network?
2) Are the methods used sufficient to determine conservation targets and to conduct a spatial analysis of the data?

A second peer review meeting to complete this initiative is scheduled for 2014-2015. During this meeting, experts will evaluate the results of the spatial analysis of the data that included the ecological and socio-economic considerations. Scientists will be asked to comment on the results of the analysis from an ecological perspective by answering the following questions:

1) Are areas of great ecological value missing from the proposed scenarios to plan the MPA network?
2) Do these scenarios sufficiently meet conservation objectives?

Given that the planning exercise for the MPA network could also be expanded to include the Estuary and the Gulf of St. Lawrence bioregion, this second meeting could be subject to a zonal peer review.

Expected publications

- Proceedings

Participation

- Fisheries and Oceans Canada (DFO) Oceans Management and Regional Science Branch; Quebec, Gulf, Maritimes and Newfoundland and Labrador regions
- Parks Canada
- Environment Canada (Canadian Wildlife Service)
- Quebec government
- Academia

Reference work

TC-CCMPA. 2013. Planning a network of marine protected areas in the Estuary and Gulf of St. Lawrence. Methodology for the analysis of ecological data. Working document. 51 p. + Appendices.

Terms of Reference - Appendix 1. Specific points to evaluate during the peer review

Question 1. Are the ecological data layers selected sufficient to meet the conservation objectives for the future MPA network?

a. Data selection criteria
b. Quality of selected data
c. Choice of data selected for representativity
d. Availability of other data from the Gulf that could meet conservation objectives

Question 2. Are the methods used sufficient to determine conservation targets and to conduct a spatial analysis of the data?

a. Conservation targets
    - Target scenarios used to conduct the spatial analysis of the data
    - Criteria for determining targets
    - Relevance of using proportional targets for habitats
b. Spatial analysis
    - Choice of the study grid
    - Adjustments from external cells to minimize bias in the spatial analysis
    - Number of replicates (minimally sufficient?)
    - Criteria for adjusting penalties

APPENDIX 3- AGENDA

Developing a marine protected area (MPA) network – Methodology validation for integrating ecological considerations into the future MPA network

Maurice Lamontagne Institute
Mont-Joli, Quebec
Room A582 and A582A

Tuesday, 24 September 2013

9:00 a.m.	Welcoming remarks, meeting objectives, and agenda (D. Gilbert)
9:15 a.m.	Planning a Marine Protected Area Network (G. Cantin)
10:00 a.m.	Break
10:15 a.m.	Marxan tool presentation (J. Ardron, N. Serra, and H. Coleman)
12:00 p.m.	Lunch
1:00 p.m.	Identification of Ecologically and Biologically Significant Areas (EBSA) in the Estuary and Gulf of St. Lawrence: 2006–2007 Exercise (C. Savenkoff)
1:20 p.m.	Reviewing data layers for analysis (J-C. Brêthes)
2:20 p.m.	Discussion on data layers (all)
3:00 p.m.	Break
3:15 p.m.	Discussion on data layers (continued) (all)
4:15 p.m.	Review and end of first day

Wednesday, 25 September 2013

9:00 a.m.	Presentation on the methodology for determining areas of interest from an ecological perspective – conservation targets (D. Dorion)
9:45 a.m.	Discussion on conservation targets (all)
10:15 a.m	Break
10:30 a.m.	Discussion on conservation targets (continued) (all)
11:00 a.m.	Presentation on the methodology for determining areas of interest from an ecological perspective – spatial analysis (G. Faille)
12:00 p.m.	Lunch
1:00 p.m.	Discussion on spatial analyses (all)
3:00 p.m.	Break
3:15 p.m.	Discussion on spatial analyses (continued) (all)
4:00 p.m.	Review, highlights, and adjournment