Fisheries and Oceans Canada Science | Pêches et Océans Canada Sciences

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Proceedings Series 2012/020

Compte rendu 2012/020

Maritimes Region

Région des Maritimes

Ecosystem Research Initiative (ERI) Synthesis: How can Ecosystem Research Initiative Results be Incorporated into Management Processes and Advice?

Synthèse de l'Initiative de recherche écosystémique (IRE) : Comment les résultats de l'Initiative de recherche écosystémique peuvent-ils être intégrés aux processus de gestion et aux avis ?

October 25 – 27, 2011
Dartmouth, Nova Scotia

25 – 27 octobre 2011
Dartmouth (Nouvelle-Écosse)

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July 2012

Juillet 2012

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings 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.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

ISSN 1701-1272 (Printed / Imprimé)
ISSN 1701-1280 (Online / En ligne)

Published and available free from:
Une publication gratuite de :

Fisheries and Oceans Canada / Pêches et Océans Canada
Canadian Science Advisory Secretariat / Secrétariat canadien de consultation scientifique
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Ottawa, Ontario
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Correct citation for this publication:
On doit citer cette publication comme suit :

DFO. 2012. Ecosystem Research Initiative (ERI) Synthesis: How can Ecosystem Research Initiative Results be Incorporated into Management Processes and Advice?; October 25 – 27, 2011. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2012/020.

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SUMMARY

A Maritimes Region Science Regional Advisory Process (RAP) was conducted on October 25-27, 2011, at the Mic Mac Amateur Aquatic Club in Dartmouth, Nova Scotia to conduct a workshop to answer the question: How can Ecosystem Research Initiative Results be Incorporated into Management Processes and Advice?

SOMMARIE

Un processus consultatif scientifique de la Région des Maritimes a été mené du 25 au 27 octobre 2011 au Mic Mac Amateur Aquatic Club à Dartmouth (Nouvelle-Écosse) pour organiser un atelier en vue de répondre à la question suivante : comment les résultats de l'Initiative de recherche écosystémique peuvent-ils être intégrés aux processus de gestion et aux avis?

BACKGROUND

Including the cumulative effects of human activities on fish populations, that act directly but also indirectly through alterations in the ecosystem, have been identified as a new component to include in fisheries and oceans management decision making. A number of decision making frameworks exist to include these effects. These include the Maritimes Region's ecosystem approaches to management (EAM) framework, Integrated Fisheries Management Plans (IFMP), and the requirement to identify threats and mitigative actions in Recovery Potential Assessments (RPA) for species at risk.

While oceanographic information has been a feature of some stock assessments as a result of the ecosystem approach to fish management its influence on management decisions has been limited. Cumulative effects of other human activities on fish populations have generally received less decision making attention than oceanographic effects.

This has occurred in part, because an analytical or risk framework for addressing oceanographic effects and the cumulative effects of non-fishing human activities on fish populations, which is analogous in approach to those estimating the effect of fishing on populations, has not been developed. The lack of programs or projects directed toward obtaining information on cumulative and ecosystem effects and their subsequent link to the fishery and oceans management processes have also been lacking.

The recent Ecosystem Research Initiatives in the Maritimes Region's ERI focused on the Gulf of Maine and had three components (see below) and had as one of its overarching objectives to include ecosystem considerations in the management process.

1. Influence of Climate Change on Oceanography and Ecosystems
2. Spatial patterns in benthic communities
3. Ecosystem modeling to quantify the impact of ecosystem interactions on ecosystem dynamics and species' harvest rates

OBJECTIVES

The objectives of this Workshop were to:

1. Identify the link between ERI results and fisheries management decisions.
2. Identify the link between ERI results and spatial planning decisions.
3. Identify how DFO will create more continuity in the scientific information needed for EAM decision making.

These proceedings report on the conclusions, discussions, and recommendations of the workshop that arose from addressing each of these objectives. The rapporteurs for this meeting were: Heath Stone, Sara Quigley, and Michelle Greenlaw. The subjects discussed had many sub-topics and the notes and summaries they provided were essential to a successful conclusion of these proceedings.

IDENTIFY THE LINK BETWEEN ERI RESULTS AND FISHERIES MANAGEMENT DECISIONS

D. Brickman: Circulation and Climate Change in the ERI Area

There has been a trend of increasing sea-surface temperature over the past decade. This is a result of large scale effects like the NAO/AMO and climate change and local effects (i.e. freshwater inflow from St. Lawrence and Saint John River).

The NAO has cyclic properties. Knowing the current position in the cycle allows tactical adjustments in management strategies to be considered.

The oceanography of the ERI region occurs within a transition zone that is influenced by the Gulf Stream and the Labrador Current. For management purposes, there is a need to understand the ecological response of the target species, some of which have a broad tolerance for changing environmental conditions while others are at the northern or southern limit of their geographic range.

C. Johnson: Climate Change and Lower Trophic Levels

Changes in the distribution and seasonal dynamics of zooplankton are important to the survival of fish larvae (i.e. match vs mismatch in terms of food availability). Lower salinities in the Gulf of Maine (GoM) in the 1990s resulted in changes to zooplankton communities and have contributed to differences in fish recruitment (i.e. better conditions for haddock compared to cod). Thus, there is a need to consider zooplankton dynamics for management purposes.

Calanus finmarchicus is at the lower end of its geographic range in the GoM and changes in its relative abundance due to interannual variability in advection would affect forage fish and various predator species.

There is a need to develop useful indices of zooplankton community variability for application to the precautionary approach. Currently, the Atlantic Zonal Monitoring Program (AZMP) is reports annually on these indices and research documents are expanding in scope At present, only oceanographic effects on zooplankton dynamics are being considered and not anthropogenic effects. Feedback from fisheries scientists and managers on additional information required in these reports is needed.

One example of additional information would be to have zooplankton information by size category. One of the current problems with zooplankton data is that several different collection methods are used for sampling. Improved data structures and communication would help to make advances in this topic.

N. Shackell: What to Expect When You're Expecting Climate Change

The coincidence between the current warm NAO phase and climate change the high variability in current environmental conditions is adding to the uncertainty to investigations on the direct effects on productivity.

Warmer water favours smaller phytoplankton cells (pico-plankton) but food webs based on these are less productive. As stratification increases with increasing water temperatures, important forage species like *C. finmarchicus* usually decline in abundance. Increased stratification also impedes vertical mixing and disrupt trophic interactions.

Overfishing has resulted in a loss of genetic diversity and has reduced population adaptability, particularly for those species which are less resilient to climate change. As the proportion of spawning stock biomass decreases, recruitment becomes more variable. Therefore, high F increases susceptibility to climate change.

At present we do not have an ecosystem survey for monitoring benthic systems (i.e. no analog to the bottom trawl survey) which makes for a large gap in the available data on benthic communities. There is also a requirement to develop a standardized zooplankton survey as well.

There is a need to identify EAM strategic reference points which incorporate information on zooplankton size structure and species composition. The role of stratification, water masses (Gulf Stream *vs* Labrador Current) and zooplankton abundance match/mis-match (with larval fish production) also need to be considered.

A. Bundy: Multi-species Interactions

Multi-species virtual population analysis (MSVPA) or ecosystem modelling approaches usually result in an increase in natural mortality (M) and a decline in maximum sustainable yield (MSY) compared to single species population models. This is largely because the multi-species/ecosystem model approaches include a series of predators in the calculations.

Environmental drivers and predators have the same effect at reducing MSY (theoretically) by affecting the intrinsic rate of increase. With the surplus production and Ecopath with Ecosim (EwE) models, these factors add more terms that generally reduce the intrinsic rate of increase. The extent to which the intrinsic increase rate is reduced depends on how these factors enter the model (i.e. multiplicative versus additive).

In terms of sensitivity analyses for the ecosystem models, Monte Carlo simulations can be performed to examine uncertainty various assumption produce but this analysis has not been done yet. However, ecosystem model robustness has been demonstrated through their use by other countries.

It is not clear at this point just how much consideration should be given to these models, especially with regard to reduced MSY. So far, the emphasis has been on a comparative approach across models. At this point more work is required before these types of models can be applied for management purposes.

We can explore MSVPA with predators and environmental covariates and examine how different the results are compared to single-species virtual population analysis (SSVPA). We know that a fundamental feature is that aggregate MSY estimates are lower than the single species estimates. These results could be used as upper and lower bounds for a value of MSY somewhere in between.

It was suggested that catch and biomass trends could be used in production modelling to better understand what the “MSY bounds” are. A framework could be planned for the review of production model approaches across a wide range of species as a first step in a process to determine the bounds on MSY. Production models with different assumptions could also be used as “operating models” in the MSE context.

It was noted that these are equilibrium based concepts and it may not be possible to meet this assumption, an aspect will have to be examined.

N. Shackell: Spatial Distribution – Management, Sea Cucumber

When we know nothing about a species how can it be exploited in a sustainable way? The FAO approach to this problem would be to create permanent marine reserves. The DFO approach would be to protect a large segment of the population until more information becomes available. Science would need to determine the spatial structure of the population and where connectivity occurs. In the sea cucumber case, patch quality is very important since it is linked to other patches by larval drift. Fertilization success increases with the density of spawners.

Based on relative abundance distribution maps (i.e. from the RV survey), the high density areas could be closed to commercial fishing operations since these are the areas which contribute most to the population in terms of recruitment. If only one area can be protected, then it should be the one with the highest density. It will also be necessary to determine how long it takes for individual areas to be replenished after they have been fished commercially. The downside to this approach is that there would be increased bottom impact from fishing gear in the marginal areas if the high density areas are always closed, hence the need to strike a balance between high and low density areas.

Currently there are 6-8 areas which are open for directed commercial fishing operations which comprise a mix of high and low density components.

S. Smith: Spatial Distribution – Management, Scallop Habitat

Limit reference point (LRP) and Upper stock reference point USR) based on 40% and 80% of the biomass that corresponds to maximum sustainable yield (B_{MSY}), respectively, evolved from studies on groundfish stocks on Canada's west coast. For sea scallops, productivity is site based - some areas are more productive than others. Limit reference points do not work well for scallops because productivity is based on recruitment pulses.

The spatial impacts of scallop fisheries generally progress through a series of stages as defined by Caddy. Initially, catch rates are highest in the productive areas, effort is low and the fishery tends to occur over a small geographic area. As abundance/catch rates decline, the fishery spreads out geographically, more areas are fished and effort increases. Eventually, catch rates become too low to support the costs of fishing operations (i.e. fuel costs).

The remainder of the presentation focused on McCall's Basin Hypothesis as it relates to the ERI program. There are different population models for different habitat types which express MSY as a density. There is a need to balance fishing in productive areas with minimizing the impact of fishing gear on the bottom. Focusing fishing operations on less productive areas results in these areas being fished harder which can disrupt marginal habitats for scallops as well as impact other species in the benthic community.

One approach is to set MSY based on suitable habitat/high density areas and remove the tonnage from these areas based on MSY reference points. The high production area would get a rest when the fishery occurs in other less productive areas, but overall the catch would never exceed the productivity reference points of the high density area. When density in the high productivity area approaches that of other areas, that density would be the LRP.

The catch rates in each area could be monitored using at-sea observers who would instruct the captain to move to another area if the catch rate falls below a certain threshold. The LRP would be based on catch rate density (i.e. 40 kg/hr). The reference points would be based on the density of the most productive area(s).

S. Quigley: Bycatch Policy

Over the years management measures and fishing practices in Canada have evolved to try to improve the selectivity of fishing. Nevertheless, some amount of incidental fishing mortality is unavoidable. The Department is in the process of developing a policy under the Sustainable Fisheries Framework that will address systematically the management of bycatch in Canadian fisheries, both retained and discarded. The objectives of the current draft of the policy include minimizing risks of fisheries causing serious or irreversible harm to bycatch and discard species, and accounting for total catch. Assuming these or similar objectives form part of the final policy, Resource Management may request scientific advice on the following: estimates of incidental mortality from fishing; impacts of fisheries on bycatch populations and ecosystems; management strategies that minimize risks from fisheries of serious or irreversible harm to bycatch populations and ecosystems; and measures that reduce incidental mortality in fisheries. Importantly, Resource Management may also request advice on conservation priorities, as well as on methodologies for establishing conservation priorities, in all of these areas. In the near term, prioritization of management activity will be guided by work carried out to characterize discards in the region's commercial fisheries and related analyses.
Some data sources to explore are:

1. The additional Species-at-Risk (SAR) bycatch data from Observer Program monitoring
2. Each assessment group should provide an analysis of bycatch for the fishery/species that they are working on.
3. There is also a need to create a bycatch database for various fisheries from the ISDB.

C. DiBacco: Ecosystem Response of the Atlantic Sea Scallop

The overall goals of this research project were to better understand (i) how large-scale physical and biological forcing on Georges Bank (GB) and in the Gulf of Maine affects Atlantic sea scallop (*Placopecten magellanicus*) reproductive seasonality, and (ii) how resultant temporal and spatial variability in larval production influences larval dispersal and connectivity among commercially exploited scallop beds on GB, including the northeast peak (NEP), southern flank (SF), and great south channel (GSC) stocks.

Finally, this study also questions the assumption that longer planktonic larval durations equate to lower survivorship, an expectation based largely on the assumption that planktonic larval mortality rates were comparable between fall and spring spawning seasons. Research presented shows that mortality of planktonic organisms is typically reduced by lower spring temperatures, which may help better explain the adaptive significance of spring spawned larvae in the life history of GB scallops.

GENERAL GROUP DISCUSSION COMMENTS FROM DAY 1 (OCT. 25TH)

- It is appropriate to use the current management process and work with them. Science staff and resource managers will need to work together to develop strategies that are robust to scientific uncertainties and gaps. Use the Management Strategy Evaluation (MSE) approach to explore future scenarios under different assumptions and develop new expertise in modelling using MSE

- Use various species attributes (i.e. size composition, maturity, condition) to try to determine what is affecting them besides the fishery (i.e. environmental effects).

- There is a need to identify gaps in data and the resolution of the scale of the data.

- There are differing expectations of what should occur in stock assessments (i.e. industry has questions they would like to see addressed). How can changes in environmental conditions affect productivity? What is the best way to deal with bycatch? It would be useful to have the questions well in advance to have the time to work towards an answer and have a method for prioritizing these questions.

- For AZMP, are there ways in which the program can provide more products and reports for other users? Initially the AZMP provided information of the state of the environment (physical, chemical, oceanographic) in a general sense, but this could be expanded upon.

- There is a requirement for accessible databases that others can use in their analyses.

- We can build environmental variability into our assessments but problems occur when we project forward based on relationships which we think exist into the future. How climate change will affect the scallop fishery is one question but the questions are often one's related to why growth has changed or why recruitment is poor.

IDENTIFY THE LINK BETWEEN ERI RESULTS AND SPATIAL PLANNING DECISIONS. ERI RAP SYNTHESIS: CONCLUSIONS FROM DISCUSSION OF PAPER ON ERI CONTRIBUTIONS TO MPA NETWORK PLANNING (AND SBA POLICY)

Theoretical Contributions

Discussions supported statements in the working paper that, at a theoretical level, the greatest contribution from the ERI to the design of the Marine Protected Area (MPA) Network would be in helping to identify EBSAs, representative areas, and replicate areas. Discussions also supported statements in the working paper that ERI results could, in theory, help with reviewing and evaluating the effectiveness of the Network. Generally, however, it was acknowledged that a significant amount of additional work would first be required.

Identifying EBSAs

The ERI helped DFO Science gain experience in using different approaches to habitat mapping, approaches that involved using acoustic remote sensing techniques coupled with *in situ* sampling. Generally speaking, this experience will help Science provide guidance on identifying EBSAs (as well as mapping representative areas, designing boundaries, and evaluating protected areas).

Identifying Representative Areas

Experience under the ERI with surrogate approaches to mapping species distribution and abundance could help identify representative areas at the bioregional scale. One project, for instance, examined how well physical habitat variables function as surrogates. Another project involved using Gradient Forest, a method for representative planning in the absence of detailed biological assemblage data. Gradient Forest could help identify which physical factors are the most appropriate within the bioregion for determining species diversity and distribution patterns.

Identifying Replicate Areas

ERI work on benthic habitat modelling could provide useful techniques for determining the set of features contained within particular areas and how replication of features might be constrained by boundaries.

Reviewing and Evaluating Effectiveness

Baseline maps could be produced of habitat, species and community characteristics. Subsequent biological surveys could then be designed to examine whether or not habitat occupation of particular species or community characteristics change over time.

Immediate Contributions and Next Steps

It was generally concluded that the focus needed to shift from small, discrete projects to consideration of broader frameworks and applications. The following next steps were proposed.

- Management should clarify how EBSAs are being used beyond network planning.

- Management should also develop a framework for determining how features and objectives will be prioritized within network planning

- Use should be made of linkages that have been developed with international work on network planning (e.g., ICES working groups, universities).

- Science needs to define what its role will be in providing advice to support spatial planning and should identify what essential data it will collect and what products it will offer and should include ways of matching up of biotic and abiotic data. Identifying what baseline level of expertise, systems, data, etc, the Department needs to maintain will help the Department take advantage of funds when they become available.

- Science also needs to prioritize incremental requests for data collection and products, and Science should consider what might be done within baseline activities/data to accommodate new requests (e.g., adding a benthic component to trawl survey design).

- Science should identify what environmental surveys are important for supporting main activities. For example, satellite data (sea surface temperature, chlorophyll, etc.) are required for ecosystem models and analyses of primary production.

- Different divisions within Science need to discuss ways of creating access into databases and need to identify what routine outputs and intermediate products it will offer. Also, feedback needs to be provided on how data is being used and when it is found to be useful.

- Both Management and Science need to find ways of mainstreaming climate change considerations (particularly in light of the new Federal Adaptation Policy Framework).

- In addition, work should be done to define indicators of climate change impacts on abiotic and biotic features. A triage approach could be adopted, for example: do we see any evidence of drivers and, if so, do we include a vector in a stock recruit model?

- Elements of Theme 1 and Theme 3 could be brought into network planning.

IDENTIFY HOW DFO WILL CREATE MORE CONTINUITY IN THE SCIENTIFIC INFORMATION NEEDED FOR EAM DECISION MAKING

Ecosystem Approach Past to Future Presentation

Over the past few decades, a need has emerged for ocean regulators to embrace a broader approach to management that recognizes the complexities of marine ecosystems, confounding negative effects of incompatible management decisions, and the role of humans as agents and recipients of change. This is reinforced by the increase in degraded marine ecosystems and ocean user conflicts observed throughout the world. In Fisheries and Oceans Canada , Maritimes Region, a major change initiative is underway that is bringing together the various Departmental sectors in the region to develop a mutual path forward for incorporating an ecosystem approach into their daily operations: founded on an ecosystem approach and integrated approach to management. An ecosystem approach to management is management that places the ecosystem in the forefront whereby its thresholds of change beyond natural variation determine the nature in which a collection of human activities should be managed, so that the ecosystem remains within its natural range. Integrated management is the coordinated management between ocean regulators, sectors, and stakeholders of all human activities in a management area, so that human-ecosystem and human-human interactions can be anticipated, supported, prevented, or mitigated.

In 2001, a national workshop was held with DFO scientists and managers to discuss a path forward for achieving an ecosystem approach (the workshop is commonly referred to as 'Dunsmuir I' – see Jamieson and O'Boyle, 2001). The workshop proposed three policy objectives for achieving an ecosystem approach: 1) productivity objective – conserve enough components and functions so that an ecosystem can play its historic role; 2) biodiversity objective – conserve enough components and functions to maintain the natural resiliency of an ecosystem; and 3) habitat objective – conserve physical and chemical properties, so as not to negatively affect ecosystem components and functions. The objectives were viewed as starting points for characterizing marine ecosystems throughout Canada regardless of their complexity or location. At that time, Canada's oceans were being organized into large ocean management areas (LOMA) for planning and management purposes. It was envisioned that an ecosystem overview and assessment process would be used to build understanding of each LOMA, including the connections to human activities. The idea was to "unpack" the ecosystem objectives into site-specific, operational level conservation objectives that would guide management of the pressures confronting each unique LOMA.

Tim Hall – EAM Framework Presentation

The EAM framework was created in attempt to bring coordination and clarity to how the department was thinking about the ecosystem considerations into management decisions. A major change initiative developed the framework, to guide science input and research and management actions. There was representation from most of the operational sectors with an emphasis initially on the links between science and fishery management. The framework is now trying to be applied on a broader basis.

The framework organizes information about pressures impacting ecosystem attributes and activities contributing to pressures. The framework is helpful in that it can identify gaps in monitoring, or in contributions of advice.

Future of the EAM Framework

We need to think more about cumulative effects. We currently have a version of the framework that's been put forward to senior managers. Nationally, we are starting to compare our regional framework with a national framework that is being developed. Possibilities include applying the framework for MPA planning on St. Ann's Bank and to determine how we work with other departments.
The benefits of the framework are that it requires good horizontal governance and cooperation. In talks about the EAM framework recently there was a continued and renewed interest to apply the principles on a much broader basis.

Discussion

A preliminary analysis of how CSAS advice has contributed to attributes of the EAM framework was presented by Tana Worcester.

[Note: totals won't add up to 100% since advisory reports often dealt with multiple topics. These are the numbers of SARs and SSRs (number in brackets) that dealt with a particular issue and then that number over 133 (as a percentage). Also, this was a very rough look at reports completed by skimming the bullets and personal memory of the meeting. The objective was to get a rough feel and the numbers would change upon more detailed review.]

1. *Total Number of Science Advisory Reports (SARs) and Science Special Responses (SSRs) reviewed = 133 (2006-2011)*
2. *"State of …" Reports (10) 8%*
3. *Productivity (95) 73%*
    a. Keep fishing mortality moderate (66) 50%
        i. Promote positive biomass change when biomass is low (18) 15%
        ii. Manage discards of all harvested species (14) 10%
    b. Allow sufficient escapement from exploitation of spawning biomass (7) 5%
    c. Limit disturbing activities (12) 10%
    d. Control alteration of nutrient concentrations affecting primary productivity (0)
    e. --- Issues not in framework: disease, genetic interactions, fish health (3) <5%
4. *Biodiversity (17) 15%*
    a. Control incidental mortality for all non-harvested species (17) 15%
    b. Minimize unintended transmission of invasive species (0)
    c. Distribute population component mortality in relation to component biomass (0 that used this explicitly to protect biodiversity)
5. *Habitat (30) 23%*
    a. Manage areas disturbed of bottom habitat (18) 15%
    b. Limit introduction of pollutants in habitat (16) 12%
    c. Minimize deaths from structures/equipment/lost gear (0)
    d. Control noise and light disturbance (5) <5%
    e. --- Issues not in framework: restoration and protection of freshwater habitat, removal of barriers (4) <5%

Discussion occurred on Werther these statistics would have lined up so well with attributes from the EAM framework had the framework not been created? The response indicated that habitat would not have been so prevalent and would not have been in stock assessments specifically. EAM is about building a bigger approach, it doesn't tell us about how the EAM implementation is going.

It should be viewed as a gap analysis to think about how we might incorporate more of this information into our work. We haven't had a CSAS process on whether the attributes are appropriate for the community. If we're looking to operationalize this we should we have a peer review process on it. Walking through the CEA process would be useful in exploring how the attributes fit into a variety of management decisions.

There has been an increase in reporting on bycatch, but it is not always clear that the information if useful or used in making decisions. Requirements for stock assessments could be developed during the terms of reference stage of the process. The by-catch of other species may be useful for identifying biological hotspots, connectivity, and interactions not just removals. An online database of bycatch would make this more accessible.

Are there regional databases we can contribute to? With the Canadian Healthy Oceans Network project we want to make this data available to people like DFO. DFO doesn't come to data holders outside DFO. CHONE is willing to contribute the data. Action for DFO managers is to move forward on those things. Make data products more accessible. If we want to promote making products from scallop to be more accessible for say Claudio, then we should have that happen. Message to managers, help us figure that out.

<u>Resource Management Perspective</u>

The value in sitting down for 3 days and having this discussion is to expose individual products that might have had less exposure to a broad audience and to promote things that come up constantly. How you take the work that has been generated and build it into existing management systems or changing them is a different group of people. You can't do that with this size group or its composition. Everyone here is a provider of information or a technique and the next step is to have those people in the room that control people and budgets. There should be a steering process to incorporate ecosystem information and to think about those things to make changes to management processes. Section work plans or branch work plans should incorporate these things. In this day and age it means that other things are not going to get accomplished. Multiyear reviews are the reality of things and we need to develop an approach to implement this consideration taking into account there will be less frequent assessments. These things are running at the same time, the work this group should develop a set of recommendations and the management group should implement this set of recommendations.

A group like this would let us harmonize the approaches. We need to wrap up one phase of this meeting to suggest things and make some choices. All branches of decision making and data collection and analysis should be included.

Discussion about gaps in the information from science that needs to be implemented into the EAM framework Habitat related attributes and reference points have been a sizable gap. Policies were developed to deal with that. We should be working towards reference points on a broader scale. Maybe we'll get at this through MPA network planning.

There are things that happen in the world in a decadal time frame, we need to be aware of these things in the long term. It's not going to flow directly into management; it's going to flow into the broader more strategic decisions. It's not going to affect choices that we make this year.

The other thing to build into this is a triage of the stocks that we do manage, because the attention on some of the stocks is going to be higher. For example, sea cucumber, requires a different set of tools and information to be collected.

If we were to develop a standardized terms of reference for stock assessment and Oceans management decision it would build a triage process into the terms of reference and would add ecological terms of reference into standard operating protocol.

Jason Link – External reviewer discussion and wrap-up.
Small presentation on his observations from the meeting

1. Group Hugs are good, sometimes.
   Because of different organizational structure, jargon, and world views there is a lot of value having people together. To have people trying to talk together in a-typical RAP process to talk about these types of decisions. Impressed by the degrees of professionalism and non-arguing. No resource battles and arm wrestling. Sincere legitimate interest in learning what other groups are doing in the
2. Less is more especially when there is less.
   We are all probably going to have to re-tool what we do. I am seeing it around the world. Economies are shrinking, and we're having to do more with less resources. We can't just be business as usual. We need more simple but robust approaches. Fewer stock assessments and ecosystem assessments. Fewer expectations. There is some efficiencies that could be gained here with pulling data together to get more overall views of things.
3. Smackdown in science: reductionism vs. holism.
   Scientific training and tendency is to bore down in detail vs. at some level users suggest to pull it together that we don't need all that detail.
   Debate is raging internationally. As scientists we tend to think reductionally, but we have the limits of not weighing the trade-offs. This is where the smackdown comes from.
4. Management measure won't change, but perspective of how they are applied probably should.
   Maybe we need to have an F_{MSY} for an aggregate group of species. Marine spatial planning, MPAs, we need to put all those data layers on the table at the same time. Management tools for all the sectors, how can they be applied should be thought about at a higher level to look at things differently. Baltic Sea example of where this is trying to happen.
   With MPA planning, and fisheries issues. Why would you not coordinate MPA planning and fisheries resource issues to try and protect a certain portion of stocks that are having issues to try and kill two birds with one stone.
5. Some tensions are healthy but others may not be.
   Tension between science and management. Scientists want to be reductionist, managers want to be practical. Also known as a reference point right now. Embracing this tension can lead to perspectives and views that lead to the management and science having different views, for the better. Ocean use sectors are beginning to complete EAM, integrated management.
   The potential offshore energy in parts of the US and North Sea tends to trump everything economically processes move really fast and these tensions can derail things.
6. Ride the wave of obvious hot button issues.
   For example, climate change and Glen Harrison's presentation. If climate is what Ottawa wants to fund then we're doing climate research. Species trade-offs, forage topic and marine spatial planning and decision support is ramping up. Trying to come up with threshold indicators for system levels is ramping up. The invasive species is hot button too. Look at climate change for ocean acidification and we need to build products, and these products could be applied a lot more broadly in the end.
7. Infrastructural considerations not to overlook, some of them include feedback to monitoring and some include database management systems. Get those up to speed

and surveys and the database management are the easiest targets when it comes to budget crunches over time it is more cost effective to just maintain as you go. Not unique to this region.

Single specie vs. Multi-species MSY: Six models that we've developed to calculate these "methods?" They all have caveats and different assumptions. Setting ceiling and floors, at the system level is one approach. There is only so much production that you can have in an area. Trophic level, species assemblages. Capitalizing on that overall production limit to set the cap on the removal from fisheries. Still looking at single species to set the floors. The sum of individual single species is always lower than the cap. The individual species are going up and down, and it's always going to be stable if you manage in this respect.

Riding the wave of obvious hot button issues is risky. It's a strategy, but it's not of interest to the individual and if you're not interested don't touch it. Address the terms of reference for the issue but build in a lot of other work to leverage the other work that you need to get done. The surveys should be critical and key and the selling job and value are incumbent on us to remind folks of that at every opportunity that we get.

CHAIR SUMMARY

HIGHLIGHTS OF DISCUSSION

<u>Objectives for Meeting</u>

The objectives of this RAP synthesis process were to:

1. Identify the link between current management decision making frameworks and ERI results.
2. Identify how specific ERI results will influence short- and long term fishery and oceans management decisions.
3. Identify future ERI program direction to improve links to fishery and oceans management.

<u>Fisheries Management Discussion</u>

<u>Current Management Frameworks – Fisheries Management</u>

1. Ecosystem approach to management (EAM)
2. Precautionary Approach and reference points
3. Integrated Fisheries Management Plans
4. Advice on these through CSAS process

<u>Working Environment</u>

1. Fewer resources
2. Do the best with what we can

<u>Key Elements for Advice</u>

1. Reference points for elements we cannot directly manage but need to understand their strategic effects (environmental effects)
2. Strategic reference points – long term (multi-species MSY)
3. Tactical – short term reference points (reference points based on habitat suitability)

Monitoring (Additional)

1. Ecosystem survey incorporates inverts
2. Standardized zooplankton survey and reporting related to strategic considerations
3. CHS surveys – consistent sounders for backscatter
4. Determination of diet sampling in surveys
5. Implications for fishery data: Spatial location, By-catch, CPUE
6. Scientific work by fishing industry

Current Processes Amenable to These Considerations

1. RAP, RPA
2. Rebuilding plans
3. Reference points - PA

Frameworks Needed

1. Resiliency as defined for strategic FM decisions: fecundity, pop abundance, environmental trends or cycle.
2. Multi-species models to estimate MSY
3. Fishing and non-fishing effects on reduced size-at-age (haddock on GB example) relates to resiliency
4. Cumulative effects

MPA Network Discussion

Current Management Frameworks – MPA Network

1. International Frameworks
2. Canadian Biodiversity guidelines
3. EBSAs, Representation. Connectivity, Replication

Management Framework Aspects Needing Additional Definition

1. Ecosystem approach to management (EAM)
2. Sensitive Benthic Area Policy
3. Integrated Fisheries Management Plans
4. Advice on these through CSAS process

Working Environment

1. Fewer resources
2. Do the best with what we can
3. Relatively new so start up costs need to be considered

Key Elements for Advice

1. Data layers
2. Habitat suitability models
3. Integrating analyses

Monitoring (at least)

1. Remote sensing at BIO
2. AZMP
3. CHS data –consistent sounders for backscatter
4. Ecosystem surveys
5. Groundtruthing - Obtained using optical sampling on Ecosystem surveys
6. Special surveys
7. Fishing industry opportunities

a. Fishing industry surveys (optical sampling)
b. Role of OLEX

Main Recommendation

Management Work Planning Group (Science Division Managers, Canadian Science Advisory Secretariat (CSAS), Directors Fishery Management , Aquaculture Management, Spatial planning, Species-at-Risk).

Some Objectives:
1. Develop processes that support the interaction necessary to provide science to support the management processes of these sectors in a harmonized manner.
2. RAP Synthesis supports spatial and regional assessments
3. Data bases of intermediate products
4. Standardized terms of reference for RAPS
5. Will include a triage to stocks we manage - Attention will be higher than others
6. Link between Framework and Assessments for tactical decision making
7. Role of spatial or regional RAP syntheses in frameworks and assessments for tactics
8. Develop work plan that Integrates EAM into multi-year assessment planning for Fisheries Management, Spatial planning, Aquaculture and others

Fisheries Management Objectives:
1. Science information on climate, phytoplankton, zooplankton and other environmental factors that are not directly managed into the long-term management process – reference points around attributes.
2. Factors that are managed but affect strategic decisions (MSY multi-species, recruitment – long-term references that will be influenced by management decisions, 5 – 20 year decisions)
3. Factors that are managed but affect tactical decision.(Habitat suitability, short 1 – 5 year decisions)

Spatial Planning Objectives:
1. Identify overlap in management processes between Spatial planning and Fisheries Management
2. Identify which of these can be included in RAP syntheses and which in frameworks and assessments

Aquaculture Objectives:
1. Identify overlap in management processes among Aquaculture, Spatial planning and Fisheries Management
2. Identify which of these can be included in RAP syntheses and which in frameworks and assessments

SUMMARY OF COMMENTS AROUND THREE MAIN NEXT STEPS IDENTIFIED AT THE END OF THE MEETING

1. **Management Work Planning**
   a. Develop requirements for science products as part of work planning with rationale for other sectors
   b. Assess how requests fit into long-term strategies, better use of EAM framework – could be used to develop standard terms of reference for RAPS

c. Standardized terms of reference would help find and utilize common threads in science advice needed.
d. Need a method for responding to long-term requests – EAM working group could help provide input on these
e. Coordination to avoid duplication – all sector involvement is needed to use the EAM framework as basis for management process.
f. EAM framework does not make sense to other sectors, organize in process oriented fashion would make it more applicable to other sectors.
g. Take EAM framework outside working group to get feedback on implementation in other sectors
h. Setting 3-5 year horizon of planning that would include academics, would position us well.
i. Coordinated work planning considering staff and budgets with regional priorities on subjects such as bycatch is needed. One sector's product depends on input from other sector. Recognize the snowball effect on each other. Coordinated approach to IFMP plan enhancement section for example.
j. EAM working group could be used to further that multi-sectoral approach using FM examples.
k. Cannot put load on a few experts, maintain their balance. Include biologists and tech in meeting, not just scientists.
l. Implement culture to provide advice over broad spectrum
m. Keep expertise up to date
n. To operationalize EAM a feedback loop from management is very important.
o. Oceans needs to be more involved in work plan for prioritizing issues for science for work planning.
p. A liaison with Fishermen is needed to help introduce these ideas to them. Economic climate is changing for them and this approach is complicating their economic issues.
q. Need a case study, IFMPs to do this (herring)

2. Data Requirements

a. Geo spatial data requirements need to come to agreement on ecological data layers to be used for planning and on-line presentations to the public.
b. AZMP reporting requirements would depend on derived variables and information needed by other groups – data bases for these products would need to be developed.
c. Centralized repository for data steams and toolkits for EAM. Integrating data sources from various streams from data made accessible in easy formats would encourage innovation.

3. RAP Synthesis (Spatial or Regional RAPs)

a. Need fewer meetings but those larger in scope. Many meetings are narrow in scope and there is redundancy between meetings.
b. Ecosystem (spatial) assessments are needed
c. Ecosystem modeling for fishery, MSY – multi-species yield could be used to develop bounds on MSY from single species to multi-speies.
d. Need to look at strategies and tactics on broader spatial scale
e. Upcoming MPA network framework is an opportunity to explore spatial based policy approaches
f. Produce science relevant to society, time span of 3-4 year planning.
g. Regional conference on Maritimes Region ecosystem that would look at all trophic levels, general oceans and FM sector issues. Develop during work planning, could set the foundation for Regional RAP synthesis processes.

h. Network MPA RAP, very timely and will provide clarity and methods to reduced duplication of effort by clarifying management process for MPAs and how to use EBSAs in EAM framework.
i. The spatial component is a way of involving the Canadian Public as a stakeholder.
j. Reference points for groundfish with respect to changes in NAO and AMO need to be examined.

RECOMMENDATIONS FOR PUBLICATIONS FROM THE MEETING

Working papers 2 and 3 are stand-alone research documents. Paper 1 a collection of papers a stand-alone would require a voice to put it all together.

Access to presentations. Eri folder. R:\Shared\RAP Synthesis\RAP Synthesis Presentations

EPILOGUE

Response to Recommendation 1: A management work planning group was formed to identify CSAS requests for the coming 2012-2013 year. Additional meetings of this group are planned.

Response to recommendation 2: An ERI RAP Synthesis Data Management Committee was formed and has met and prepared a submission of the Science Branch Management Committee

APPENDIX 1. Terms of Reference.

TERMS OF REFERENCE

Maritimes Regional Workshop

Ecosystem Research Initiative (ERI) Synthesis: How can Ecosystem Research Initiative Results be Incorporated into Management Processes and Advice?

MicMac Amateur Aquatic Club
192 Prince Albert Road
Dartmouth, Nova Scotia

October 25-27, 2011

Chairperson: Ross Claytor

Context

Including the cumulative effects of human activities on fish populations, that act directly but also indirectly through alterations in the ecosystem, have been identified as a new component to include in fisheries and oceans management decision making. A number of decision making frameworks exist to include these effects. These include the Maritimes Region's ecosystem approaches to management (EAM) framework, Integrated Fisheries Management Plans (IFMP), and the requirement to identify threats and mitigative actions in Recovery Potential Assessments (RPA) for species at risk.

While oceanographic information has been a feature of some stock assessments as a result of the ecosystem approach to fish management its influence on management decisions has been limited. Cumulative effects of other human activities on fish populations have generally received less decision making attention than oceanographic effects.

This has occurred in part, because an analytical or risk framework for addressing oceanographic effects and the cumulative effects of non-fishing human activities on fish populations, which is analogous in approach to those estimating the effect of fishing on populations, has not been developed. The lack of programs or projects directed toward obtaining information on cumulative and ecosystem effects and their subsequent link to the fishery and oceans management processes have also been lacking. The recent ERI has as one of its overarching objectives to include ecosystem considerations in the management process.

The Maritimes Region's ERI focused on the Gulf of Maine and had three components:

4. **Influence of Climate Change on Oceanography and Ecosystems**
5. **Spatial patterns in benthic communities**
6. **Ecosystem modeling to quantify the impact of ecosystem interactions on ecosystem dynamics and species' harvest rates**

Objectives

The objectives of this Workshop are to:

1. Identify the link between ERI results and fisheries management decisions.

2. Identify the link between ERI results and spatial planning decisions.
3. Identify how DFO will create more continuity in the scientific information needed for EAM decision making.

Outputs

CSAS Proceedings
CSAS Research document(s)

Participation

DFO Fisheries Management
DFO Oceans
DFO Science
DFO Policy and Economics
Academics
Non-government

APPENDIX 2. Agenda.

Maritimes Region Workshop

Ecosystem Research Initiative: (ERI) Synthesis:
How can Ecosystem Research Initiative Results be Incorporated into Management Processes and Advice?

Mic Mac Amateur Aquatic Club
Dartmouth, Nova Scotia
October 25 – 27, 2011

Chairperson: Ross Claytor

DRAFT AGENDA

Tuesday, October 25th

Time	**Topic**
9:00 – 9:15	Introductions
9:15 – 10:30	ERI results and fisheries management decisions: Reference points – Preamble, Climate change, mulit-species interations, LRP to maintain spatial distribution
10:30 – 10:45	Break
10:45 – 12:00	ERI results and fisheries management decisions: Bycatch – Preamble, Oceanographic information, Ecosystem modelling
12:00 – 1:00	Lunch – not provided
1:00 – 2:30	ERI results and fisheries management decisions: How do we think things will change over time – Spatial and temporal scales, analysis of scallop reproductive indices, EAM attributes
2:30 – 2:45	Break
2:45 – 4:30	Discussion – Conclusions, GAPS, Research direction
4:30 – 5:00	Wrap-up

Wednesday, October 26th

Time	**Topic**
9:00 – 9:15	Review of Day 1 – plan for Day 2
9:15 – 10:30	ERI and spatial planning: Background, Methods paper on approaches to spatial questions of scale and purpose

10:30 – 10:45	Break
10:45 – 12:00	ERI and spatial planning: MPA network questions, ERI and identifying EBSAs, MPA selection
12:00 – 1:00	Lunch
1:00 – 2:30	ERI and spatial planning: MPA selection
2:30 – 2:45	Break
2:45 – 4:00	ERI and spatial planning: Models developed in GoM that can be used elsewhere, SARA and habitat, How will things change over time
4:00 - 5:00	Discussion– Conclusions, GAPS, Research direction
5:00 – 5:30	Concluding remarks

Thursday, October 27th

Time	Topic
9:00 – 9:15	Review of Day 2, plan for Day 3
9:15 – 10:30	Harmonizing science – EAM and ERI: Introduction, EAM described, Science context
10:30 – 10:45	Break
10:45 – 12:00	Management context, Recommendations (Part 1)
12:00 – 1:00	Lunch
1:00 – 2:00	Management context, Recommendations (Part 2)
2:00 – 2:45	Discussion– Conclusions, GAPS, Finalize recommendations
2:45 – 3:00	Break
3:00 – 3:30	Discussion– Conclusions, GAPS, Finalize recommendations
3:30 – 4:00	Conclusions of EAM, ERI
4:00 – 4:30	Concluding remarks and summary of next steps

APPENDIX 3. List of Participants.

Maritimes Region Workshop

Ecosystem Research Initiative: (ERI) Synthesis:
How can Ecosystem Research Initiative Results be Incorporated into Management Processes and Advice?

Mic Mac Amateur Aquatic Club
Dartmouth, Nova Scotia
October 25 – 27, 2011

LIST OF PARTICIPANTS

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