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St. Andrews Biological Station
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http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html

Canada

FOREWARD

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or misleading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

AVANT-PROPOS

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s'est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

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ABSTRACT

The Northeast Fisheries Science Center (NEFSC), National Marine Fisheries Service (NMFS) and Maritimes Region Science Branch, Fisheries and Oceans Canada (DFO) have periodically convened scientific discussion meetings to identify opportunities for collaboration that can lead to efficiencies, take advantage of synergy, and address mutual management concerns. The meeting convened during 10-12 April 2007 considered five themes, stock status / harvest advice, discard mortality, habitat, ecosystem status and monitoring infrastructure. Project proposals that offered benefits from collaboration were developed and recommended. In addition to these project proposals, Canada and USA will collaborate on joint assessments for eastern Georges Bank Atlantic cod, eastern Georges Bank haddock and Georges Bank yellowtail flounder scheduled for review by the Transboundary Resource Assessment Committee in June 2007.

RÉSUMÉ

Le Northeast Fisheries Science Center (NEFSC) du National Marine Fisheries Service (NMFS) et la direction des Sciences de Pêches et Océans Canada (MPO), Région des Maritimes tiennent régulièrement des réunions scientifiques pour étudier les possibilités de collaboration pouvant mener à des économies, tirer parti de la synergie entre les deux organismes et traiter de questions de gestion d'intérêt commun. La réunion qui a eu lieu du 10 au 12 avril 2007 portait sur cinq thèmes : l'état des stocks et la formulation d'un avis sur les captures, la mortalité due aux rejets, l'habitat, l'état de l'écosystème et l'infrastructure de surveillance. On y a présenté et recommandé des projets susceptibles de bénéficier d'une collaboration bilatérale. En plus de coopérer à ces projets, le Canada et les États-Unis procéderont ensemble aux évaluations des stocks de morue et d'aiglefin de l'est du banc Georges ainsi que de limande à queue jaune, qui seront examinées par le Comité d'évaluation des ressources transfrontalièrs en juin 2007.

INTRODUCTION

The Northeast Fisheries Science Center (NEFSC), National Marine Fisheries Service (NMFS) and Maritimes Region Science Branch, Fisheries and Oceans Canada (DFO) have periodically convened scientific discussion meetings. The purpose of these meetings is to identify opportunities for collaboration that can lead to efficiencies, take advantage of synergy, and address mutual management concerns. Traditional fisheries management has largely focused on conservation strategies for controlling exploitation of harvested species. While this aspect continues to command importance, there are emerging concerns about discards of harvested species, incidental mortality of non-harvested species, trophic implications and physical impacts on habitat. Also, there is a desire to have contextual and integrated indicators that provide overall synthesis of the state of the ecosystem. Accordingly, four themes were identified for these scientific discussions. A fifth theme was included, monitoring infrastructure, which has implications for all of the other themes. Plenary discussion considered how best to facilitate methodological development.

According to the following terms of reference, for each theme, consideration was given to monitoring requirements, coordination of research and development of analytical tools for determining the state of the associated performance indicators and for establishing reference points for the indicators.

1. ***Stock status and harvest advice***: Develop a science work plan, coordinated research plan and TRAC peer review schedule to address the requirements for future joint assessments and research initiatives on Atlantic mackerel, Atlantic halibut, spiny dogfish and pollock (and perhaps other stocks) in the Gulf of Maine area in support of conservation strategies that will maintain/enhance the productivity of harvested resources, and also:
   - keep fishing mortality moderate
   - promote positive biomass change when biomass is low
   - target % size/age/sex of capture to avoid wastage
   - distribute population component mortality in relation to component biomass

2. ***Discard mortality and trophic impacts***: Review respective science activities and develop collaborative research activities and scientific plans in support of discard mortality and trophic conservation strategies in the Gulf of Maine area which will:
   - quantify discarded catches for all harvested species
   - control incidental mortality for all non-harvested species
   - manage total removals taking into account system production capacity
   - account for consumption requirements of higher trophic levels

3. ***Habitat***: Review respective science activities and develop collaborative research activities and scientific plans in support of habitat conservation strategies in the Gulf of Maine area aimed at:
   - characterizing, classifying and evaluating fish and protected species habitat areas
   - assessing fishery (gear) impacts on the bottom habitats occupied by these species (including severity of gear impacts, quantification of amount of area fished, etc).

4. ***Ecosystem Status***: Review respective science activities and develop collaborative research activities and scientific plans with respect to providing an overall synthesis of the state of the ecosystem in the Gulf of Maine area:
   - which contextual indicators are informative

5. ***Monitoring Infrastructure***: Review adequacies of monitoring for requirements identified in the four themes above and develop collaborative research activities and scientific plans, taking note of newly available technologies, for:
   - biological survey monitoring
   - oceanographic survey monitoring
   - fisheries monitoring

Background presentations on the themes identified in the Agenda (Appendix I) were provided by Canadian and USA co-leads. Discussions, summarized in this report, occurred in both plenary and breakout groups. The breakout groups were also asked to develop project proposals for consideration. These were reviewed in plenary and are compiled in the Recommendation section of this report. The meeting was attended by 27 participants (Appendix II).

STOCK STATUS AND HARVEST ADVICE

Presentation Highlights (Paul Rago and Lou Van Eeckhaute)

The terms of reference for the stock status and harvest advice theme were to develop science work plans, coordinated research plans and a Transboundary Resource Assessment Committee (TRAC) peer review schedule for four species, Atlantic mackerel, Atlantic halibut, spiny dogfish and pollock in the Gulf of Maine (GoM) area to support conservation strategies to maintain/enhance productivity. This request came from the USA/Canada Transboundary Resource Management Steering Committee. Some background on the structure, function and administration of the TRAC which acts as the science arm of the Transboundary Management Guidance Committee (TMGC) was presented. The TMGC is a body for joint Canada/USA management of transboundary stocks. The four species of interest are all considered transboundary and migratory but it is not necessarily clear whether domestic conservation objectives are compromised by the absence of complementary management. Background information (i.e., distribution and migration, management unit, landings, indices and status) gleaned from Canadian and USA assessments, current issues and research requirements relevant to the four stocks were presented. Questions that need to be answered when considering Canadian/USA collaboration on these stocks include 1) would stock evaluation benefit from joint science? 2) is TRAC review needed? 3) is it worth the overhead to do joint research and/or joint assessments? and 4) would stocks benefit from consistent management?

Discussion

Most of the joint Canada/USA assessments, and in particular the TRAC reviews, have focused on stocks for which consistent management by the USA and Canada is well advanced. However, joint science may be beneficial even if the USA and Canada have not engaged in consistent management, as there may be efficiencies and a synergy attributable to the collaborative research. As the range of species being considered expands, it may be useful to establish and/or affirm the transboundary and migratory nature of those resources at an early stage. Of the species being considered for joint Canada/USA assessments, dogfish and mackerel are higher priorities relative to halibut and pollock.

The TRAC process serves to inform the joint management process well. However, biological and ecological issues that impact fisheries management are not being confronted. It may be advantageous to nest relevant ecological research questions within the Terms of Reference for TRAC. Potential topics mentioned included changes in size at age across a range of

species in the Gulf of Maine area, habitat associations at different life stages and temporal shifts in spatial distribution patterns. Also, the environment may affect biological processes such as growth and recruitment, thereby impacting the reference points used in assessments. Review of research addressing ecological and biological issues may be particularly important as both Canada and the USA move towards an ecosystem approach to fisheries management. In Canada, Georges Bank has been proposed as a pilot area for an ecosystem approach to fisheries management. While there are many ecological research questions, care should be taken to identify those that are tractable and have relevance to improved management of ocean resources.

Both Canada and the USA are challenged to provide fisheries management advice for data poor stocks. In the USA, the recent re-authorization of the Magnuson-Stevens Fisheries Management Act requires annual catch limits to be developed for many data poor stocks by 2010-2011. A complicating factor for these data poor stocks is that stock structure is not well understood. A workshop on assessment methodology for data poor stocks may stimulate progress.

Stock status evaluation for species at risk poses special challenges. In the USA, NMFS conducts the stock status evaluation before a status determination is made. In Canada, while DFO may conduct a stock status evaluation, COSEWIC conducts their own stock status evaluation before they make a status determination. For transboundary resources, there are benefits to conducting a joint NMFS/DFO stock status evaluation to inform the status determination that follows in each country. Spiny dogfish needs immediate attention. In recognition of the requirement to assemble new information and of the benefits of having a DFO stock status evaluation available, COSEWIC has postponed their assessment of spiny dogfish. A joint NMFS/DFO assessment for spiny dogfish would be desirable. An associated concern for species at risk was the ‘unit’ for which status determination is made. In the USA, NMFS uses the conventional assessment stock units. In Canada, COSEWIC employs ‘ecologically sustainable units’ which may not align with assessment stock units or management units. The COSEWIC practice can present complications for regulatory purposes.

DISCARD MORTALITY

Presentation Highlights (Wendy Gabriel and Lei Harris)

At-sea observer programs are used by both Canada and the USA to monitor catch that is not landed. While the programs are fundamentally similar, implementation details vary to accommodate operational requirements. Coverage of fisheries in Canada has been dominated by ‘issue’ driven considerations. The program in the USA is more comprehensive with recent implementation of a Standardized By-catch Reporting Methodology (SBRM). The monitoring programs in Canada and USA were described along with some example results from representative analyses to serve as the background for discussion on opportunities for collaboration.

Discussion

Sample size requirements, design and allocation for observer programs

The adequacy of observer program sampling levels is often based on “rules of thumb.” USA protected species programs initially specified a target CV of 30% for estimates of marine mammal takes. This value has been propagated as a target for uncertainty in estimates of discarded fish (NMFS 2004). The actual effect of this target level on assessment uncertainty

will be unknown until contributions to uncertainty by other data components (e.g., variance in survey indices, landings at age, etc.) are quantified. Assessment accuracy may be more improved by reducing variance in other components of the assessment, rather than increasing observer coverage to meet a particular target level. Emerging ecosystem conservation objectives, however, may demand greater precision in discard estimates than do assessments.

High observer coverage levels may be appropriate for restricted duration as pilot studies. High intensity coverage would be appropriate to determine if specific fisheries (generally those with low by-catch rates) can be exempted from future observer coverage. Although overly precise estimates of minor quantities are undesirable in an assessment context, high intensity coverage rates (e.g., 100%) may be preferred by individual vessels to document negligible discarding for their vessel. This information would support their position that any fleet-wide discard quotas should not curtail individual operations. Intense sampling in multi-species fisheries can also be used to develop estimates of sampling requirements and associated accuracy for multiple species.

To investigate methods for allocating observer coverage over a range of multi-species fisheries or among strata within a fishery, or to improve coverage plans, the NEFSC Standardized By-catch Reporting Methodology (SBRM) tool (Rago et al. 2005, Wigley et al. 2006) may be useful in identifying gaps or excesses in observer sampling programs, given specified funding levels or target uncertainty levels. Lobster fisheries are poorly covered in both Canada and USA, although there are indications that by-catch of some groundfish species, e.g. cod and cusk, may be substantial as a result of the high effort in these fisheries. If a particular discarded species forces high coverage in a situation that could otherwise be accommodated with less coverage, perhaps mitigation measures should be considered to free up those coverage days. Although Canadian observer programs are not based on fixed levels of federal funding, the SBRM tool may provide advice on coverage levels which provide statistically adequate estimates of discards. In some cases, low levels of coverage may be adequate, and this will be important information for managers.

Survival rates of discarded individuals

Accurate estimates of the survival rate of discarded individuals will improve the accuracy of input data to both single species assessments and ecosystem energy budget models. Survival rates are highly variable, however, and it is unclear how effectively they can be quantified. Unless studies indicate otherwise, mortality of discards is assumed to be 100% when discards are included in Canadian assessments. From the U.S. assessment perspective, survival rates of discards are reflected in removal estimates whenever possible (e.g., striped bass, skates).

An inventory of techniques that provide estimates of survival of discards as well as a review of studies to date will ensure that the most current information is available for use when assessments incorporating estimates of discard are developed. Some studies may be on-going while others may be unpublished (Cape Cod Hook Fishermen's Association, S. Cadrin). Otherwise, no long-term studies are anticipated without significant new resources or industry partnering.

Estimation of discards, discard mortality or by-catch under data-poor conditions

One method for obtaining a rough estimate of discards when observer coverage is inadequate is to use survey data from the same time and area to estimate catch at length, and then apply gear selection ogives and regulated minimum sizes to simulate the commercial catch and discard process (e.g. Mayo et al. 1982, 1992). Relative fishing

mortality due to discards can be approximated and monitored over time by a ratio of (landings + discards)/survey index. Another useful metric might be the proportion of fishing mortality due to discards, discards/(landings + discards).

Knowledge of seasonal and spatial distributions of stocks (e.g., from survey data) can be combined with knowledge of seasonal and spatial distribution of fishery gear to determine overlap and thus potential for by-catch. In the case of Atlantic salmon, for example, it was determined that the timing and location of the mid-water trawl fishery did not coincide with the timing of smolt return, and so the potential for by-catch of smolts in the mid-water trawl fishery was negligible.

For rare or non-commercial species, species identification may be poor or aggregated at higher taxonomic levels. Discard of several skate species may be combined in a single observation, for example, requiring development of a prorating scheme for subsequent dis-aggregation to individual species.

Identifying "Observer Effects"

It is difficult to quantify the effect of the presence of an observer on fishing behavior. Most methods are one-sided tests: if analyses indicate large differences in attributes of observed vs. unobserved trips, it is possible that these are due to the observer's presence. The lack of a difference in any specific attribute does not mean that an effect is not present, however. A variety of tests are described in Rago et al. (2005) and Wigley et al. (2006). Effect of observer presence on high-grading may be evaluated by comparing price per pound from observed vs. unobserved trips. Another consideration when evaluating the effect of the presence of an observer is the difference between regulatory and non-regulatory discards. Although this issue is important, there are no long-term plans to address this issue further.

Mitigating the effects of discard and by-catch

The consideration of gear modification or closed area implementation to mitigate discard mortality is a management decision. The quantitative analyses to evaluate the effectiveness of the proposed mitigation measures will likely fall to assessment scientists, however. There is a long-term need to exchange and evaluate methodologies to quantify effects of time area closures. Examples of closures to reduce by-catch include those for cod and haddock, with attendant supporting analyses (e.g., DFO 2003). Post-hoc evaluation of the effectiveness of these closures is also warranted. Frameworks to evaluate effects of gear modifications are poorly developed at this point, and are unlikely to be addressed without new resources.

DFO. 2003. Cod on the Southern Scotian Shelf and Bay of Fundy (Div. 4X/5Y). DFO Sci. Stock Status Report 2003/050.

Mayo, R. K., L. O'Brien and N. Buxton. 1992. Discard estimates of American plaice, Hippoglossoides platessoides, in the Gulf of Maine northern shrimp fishery and the Gulf of Maine-Georges Bank large mesh otter trawl fishery. Appendix to NEFSC 1992 Report of the Fourteenth Northeast Regional Stock Assessment Workshop (14th SAW). U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 92-07: 140 p.

Mayo, R.K., A.M. Lange, S.A. Murawski, M.P. Sissenwine, and B.E. Brown. 1982. Estimation of discards in mixed trawl fisheries off the Northeast Coast of the United States, based on bottom trawl survey catches. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Lab. Ref. Doc. 81-18.

National Marine Fisheries Service. 2004. Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs.

Rago, P.J., S.E. Wigley, and M.J. Fogarty. 2005. NEFSC bycatch estimation methodology: allocation, precision and accuracy. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc 05-09. August, 2005.

Wigley, S.E., P.J. Rago, K.A. Sosebee, and D.L. Palka. 2006. The analytic component to the standardized bycatch reporting methodology ominibus amendment: Sampling design, and estimation of precision and accuracy. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 06-022: 135 p.

HABITAT

Presentation Highlights (Tana Worcester and Bob Reid)

Habitat-related activities of DFO and NEFSC overlapped with other ongoing activities – e.g. in the USA, describing the northeast marine ecosystem for Ecosystem Approach to Fisheries, and characterizing large marine ecosystems worldwide; and in Canada, the Integrated Oceans Management Initiatives (such as Eastern Scotian Shelf Integrated Management (ESSIM), the proposed Gulf of Maine Ecosystem Overview and Assessment Report). The Monitoring Infrastructure theme also includes a habitat component.

The Habitat Theme terms of reference included describing activities in habitat characterization, classification and evaluation, and assessing gear impacts (severity and quantifying area fished).

Characterization

In Canada, the Discovery Corridor initiative is describing habitats and associated species from inshore waters to 6,000m depths, and is developing new techniques and collaborations. Multibeam mapping is ongoing under the Gulf of Maine Mapping Initiative (GOMMI). In Canada, multibeam is combined with geological and biological data to produce high-resolution habitat maps, with applications such as reducing habitat fished by increasing the efficiency of scallop harvesting. The USA hopes to opportunistically map more areas, with one possibility being a swath across Cape Cod Bay (MA); this or other mapped areas could serve as a “Research Corridor”. NEFSC is forming a Habitat Characterization Group to lead in conducting inshore and offshore benthic habitat surveys and studying habitat structure, function, sensitivity and resilience.

Classification

The Kostylev “Habitat Template” model was described. It organizes physical data into two axes: natural disturbance (e. g., bathymetry, currents, sediment type) and scope for growth (nutrient and oxygen availability, temperature). It may be of value as a predictive model, to fill in gaps in data-poor areas, and as a consistent way of describing benthic habitat across the Region. The model may help to identify areas sensitive to human impacts, and to predict recoverability of impacted areas. It could be useful in designating Essential Fish Habitat (EFH) and Marine Protected Areas (MPA), in seabed engineering, and in climate effects projections. Also briefly discussed were a finer-scale habitat classification scheme for the northeastern North America region (Valentine et al. 2005), and the DeAlteris-Fogarty “Conceptual habitat impact model”. One opportunity for collaboration on habitat classification will be within the CA/USA Habitat Working Group.

Evaluation

In the USA, analysis of the value of habitats to resource species leads to designation of Essential Fish Habitat and Habitat Areas of Particular Concern (HAPC). In Canada, Ecologically and Biologically Significant Areas are identified based on uniqueness, aggregation, and fitness consequences. The ESSIM consultation for identifying significant areas and species on the Scotian Shelf was described. First a group of people knowledgeable about the area identified parts of it believed to be significant. Biological survey data were then examined for confirmation of the experts' opinion. For species, an Ecopath model was used to investigate the strength of trophic linkages, as a measure of ecological significance.

Gear Impacts

Three major experimental studies of habitat impacts of otter trawling in the region, and one study of hydraulic clam dredge impacts have been conducted in Canada. In 2006 a national peer review of effects of trawling and dredging was conducted. Prioritization of effects of other gear types is ongoing. There have been about a dozen USA gear effect studies in the Gulf of Maine, including one comparing fish and benthic assemblages just inside and outside the three large closed areas, and a study with sampling since 1994 in and near the HAPC on northeast Georges Bank. In that area, the USA and Canada are now collaborating on a study of distribution and impacts of an invasive sea squirt which has not yet been found in Canadian waters. NEFSC may be also be required to conduct a peer review of gear effects studies (for which the Canadian review would be very helpful), and a risk analysis and assessment of gear effects may be undertaken. Both countries are using the Vessel Monitoring System to estimate amounts of area fished; in northeast US waters, an analysis of fishing effort was also made based on fishers' trip reports and clammers' logbooks, for 1995-2001.

Valentine, P.C., B.J. Todd, and V.E. Kostylev. 2005. Classification of marine sublittoral habitats, with application to the northeastern North America region; pp. 183-200. *In*: Barnes, P.W., and J.P. Thomas. Benthic Habitats and the Effects of Fishing. American Fisheries Society Symposium 41: 890 p.

Discussion

This is an area where the two agencies would want to do collaborative work to establish common definitions and approaches to characterize habitat. Progress has been hampered by lack of specificity for the task. While particular features can be mapped, management interest involves sensitivity to disturbance and ability to recover from disturbance. These aspects require interpretation of the mapped features. One view was to proceed with mapping features while another view held that understanding which features could be used and how these would be used to evaluate sensitivity and recoverability was a prerequisite before embarking on mapping. The matter is further complicated by ambiguous use of the term 'habitat'. Habitat has been used to denote areas characterized by particular physical benthic structures as well as areas where a certain species of fish is found in abundance. While these two definitions may be correlated, they are not synonymous. In the USA, use of tiers to classify habitat has further blurred the situation.

Much attention has been given to a model that comprehensively classifies all areas with respect to natural disturbance and scope for growth. There has been a disparate message, with suggestions that the model is ready to be used now yet funding is being requested for further development of the model before it can be applied. What products could managers be afforded today and what resources are needed for further development? Some ground

truthing exercises have suggested that the model would be enhanced by recognizing frontal features. Other approaches have focused on identification of 'special' areas. One complication with this latter approach is that when all the 'special' areas are overlaid, they tend to encompass the vast majority of the entire area. A third alternative to comprehensive habitat classification or 'special' area classification is scenario analysis. This latter approach involves incorporating the nature of the human activity disturbance from the outset and is often considered in a risk analysis context.

While the broad conservation objective for habitat is to preserve habitat features, this has not yet been translated into practical and implementable management strategies. Management tools such as closed areas and gear specifications are being promoted in the absence of clear specification of how performance can be measured and of reference points for any performance indicators. Further, performance measurement must deal with prevailing views that environmental regimes are shifting, thereby bringing about habitat change independent of human activity. Closed areas are generally not completely closed to exploitation, usually only trawling and dredging, and without comprehensive risk analyses, the result may simply be redistribution of effort. There was also ambiguity about whether habitat concerns were primarily associated with the functional role of habitat towards contribution to productivity rather than preserving features *per se*. There may be a conflict in objectives if disturbance of habitat features enhanced productivity. Can the precautionary approach and risk assessment be applied to the current state of knowledge about habitat conservation?

The following were considered important issues where collaborative work could prove beneficial in developing a common understanding of patterns by capitalizing on the synergy from pooling resources.

Habitat Template
- Focus on disturbance axis.
- Further ground-truthing required to address issues raised.
- Add something to depict oceanographic fronts (horizontal gradients).
- Explore other approaches to characterizing spatial patterns of benthic communities.

Closed Areas
- What can we learn about recovery of benthic habitats from existing closed areas?
- How are protected areas helping us to achieve conservation objectives?
- How does benthic structure / complexity influence productivity of different components of the ecosystem?

Sampling
- Is there information we could collect on the RV surveys that would inform habitat characterization?
- Are there specific invertebrates that we should be sampling?
- Are there indicator species, other metrics?
- Develop necessary identification keys.

ECOSYSTEM STATUS

Presentation Highlights (Mike Fogarty and Bob O'Boyle)

Joint Canada/USA Ecosystem Overview Report Proposal (Mike Fogarty)

Implementation of an Ecosystem Approach to Management of marine resources has now been strongly advocated in a number of international and national settings and development of this general approach has been accorded high priority in both Canada and the United States. In 2005, representatives of Fisheries and Oceans Canada approached the Canada-US Steering Committee to explore the feasibility of developing a joint Canada-U.S Ecosystem Overview and Assessment Report for the Gulf of Maine. The Steering Committee established an *ad hoc* Oceans Working Group to consider options for the development of such a report, with the directive that the report would focus on waters outside the coastal zone and on living marine resources, in keeping with the remit of the Steering Committee.

At a meeting of the Oceans Working Group in April 2006, it was agreed that a feasibility analysis for the development of an Ecosystem Overview Report (EOR) should be undertaken immediately. Plans for preparation of a scoping document to be developed under contract with funds supplied by DFO were established. It was further decided that for the purposes of the planning exercise, the EOR would be modeled after a similar project for the Eastern Scotian Shelf (Zwanenburg et al. 2006). The scoping document was completed and presented to the Oceans Working Group in March 2007 (Parker et. al. 2007). On the basis of this scoping exercise, it was determined that a rich information base exists for this extensively studied system and that preparation of a joint EOR would be both feasible and desirable. Following the structure of the Eastern Scotian Shelf Report, the major report sections would include (1) Introduction, (2) Ecological Management Considerations, (3) Physical and Oceanographic Setting, (4) Major Ecosystem Components, (5) Human Impacts and (6) Integrating Concepts. This basic structure will be further tailored to the specific requirements for the Gulf of Maine report.

It was determined that the Gulf of Maine EOR would be developed by a team of Canadian and US Scientists with co-leads for each major section of the report. The report will be targeted for a broad scientific audience and interested stakeholder groups.

Parker, M., P. Wells, and D.Walmsley. 2007. Developing a Gulf of Maine ecosystem overview report: A scoping exercise to identify key review literature and considerations for report production. Report to the Department of Fisheries and Oceans Canada.

Zwanenburg, K.C.T., A. Bundy, P. Strain, W.D. Bowen, H. Breeze, S.E. Campana, C. Hannah, E. Head, and D. Gordon. 2006. Implications of ecosystem dynamics for the integrated management of the Eastern Scotian Shelf. Can. Tech. Rep. Fish. Aquat. Sci. 2652: 91 p.

Canadian Initiatives on Ecosystem Status Reporting relevant to Gulf of Maine (Bob O'Boyle)

State of the physical, chemical and biological oceanography reports for large regions of Canada's east coast (e.g. Labrador Shelf, Gulf of St. Lawrence, Scotian Shelf) have been produced since the mid-1990s. In 2003, the first Ecosystem Status Report (ESR) for Atlantic Canada, which focused on the Eastern Scotian Shelf, was produced. In 2007, the Atlantic Science Directors' Committee requested the Fisheries Oceanography Committee (FOC) to develop a national framework for future ESRs. This would report on ecosystem health at the

Large Ocean Management Area (LOMA) and Coastal Management Area (CMA) level, include ecological indicators linked to decisions on integrated management and allow comparison of Canada's performance on an ecosystem approach to management (EAM) with similar initiatives elsewhere. These reports would be biannual or less frequent.

Two types of ESR are possible: one similar to that for the Eastern Scotian Shelf which characterized temporal changes in ecosystem structure and function and another which would be the reporting component of integrated management, including evaluation of performance towards achievement of stated conservation objectives and monitoring of cumulative impacts across and within ocean industry sectors (e.g. fisheries, oil and gas). FOC discussed the merits of each type of report and agreed with the need for the latter but there was not consensus on whether or not it was the appropriate body to produce this type of report.

The presentation then provided an overview of DFO's implementation of an EAM which has evolved since 1998 in a similar fashion to efforts elsewhere (e.g. Australia, Norway, Iceland). So far, five LOMAs have been defined for Canada's three oceans, including that on the Eastern Scotian Shelf. There has been discussion on extending the southern boundary of Eastern Scotian Shelf to encompass the entire Scotian Shelf but not Bay of Fundy, which has implications for any northern boundary for EAM in the Gulf of Maine. DFO is using a hierarchical objectives structure – from national conceptual at the top to sector operational at the bottom – to facilitate EAM development in each of these LOMAs. The 2001 national conservation objectives designed to address biodiversity, productivity and habitat issues have been recently enhanced with more specific wording. Articulation of these objectives within each LOMA has involved compilation of an Ecosystem Overview and Assessment Report with both a description of the ecosystem and key threats to it. The benefits of developing models of ecosystem structure and function as part of this process were highlighted as was risk analyses to identify those ecosystem components most at risk from human impacts. It was noted that the ESSIM initiative has focused on stakeholder engagement to define the conceptual objectives for the area but these are still stated at a high level. Considerable progress in engaging the fishing sector in EAM has been made through evaluation of existing fishing management plans against an initial set of conservation objectives.

A proposed outline of an ESR was presented which included sections on managed activities, status of impacted ecosystem components (and thus performance towards conservation objectives), oceanographic and ecological properties (including contextual indicators linked to conservation objectives) and a synthesis on ecosystem health. Brief outlines of each section were then provided. It was emphasized that while an extensive list of contextual indicators were available, only the subset of these linked to the conservation objectives would be reported on. Recent work by Mathratta and Link (2007) could provide a basis for contextual indicators on fish communities. The synthesis section would include the LOMA level suite of indicators / reference points for ecosystem health linked to sector based EAM performance and influences of large scale processes such as climate change on ecosystem structure and function.

Methratta, E., and J.S. Link. 2006. Evaluation of quantitative indicators for marine fish communities. Ecological Indicators 6: 575–588.

Discussion

The ecosystem approach to fisheries management aims to broaden the scope of conservation objectives and to take cumulative effects into account. Embarking on an ecosystem approach involves a large investment in resources and time and may introduce an additional regulatory burden. Pay-off in terms of improved management may be difficult to demonstrate. Additional fishery monitoring for the ecosystem approach will require buy-in from fishermen. The broad array of indicators being produced, all of which may not be equally important and many without associated reference points of what is unacceptable, has the potential to obfuscate rather than facilitate improved management unless the message is structured. Evaluating cumulative effects will involve threat analyses and better integration of economic and social considerations. In Canada, socio-economic effects are starting to be considered for recovery potential assessments of species at risk. In the USA, the potential for new management measures to result in a change of the social and economic status-quo must be evaluated. Evaluation should be possible in a practical time frame so that emerging threats do not supersede the evaluation. Development of a template or framework with specific management strategies for achieving the objectives and associated indicators to measure performance can organize the planning process and integrate the plethora of policies, making tradeoffs explicit and providing a tool for consultation with stakeholders.

Various types of reports about the state of the ecosystem may be produced, depending on the audience and purpose. The intent of a broad overview report is to synthesize a description of the ecosystem and make it available to stakeholders as background for setting objectives. Some ecosystem status reports have presented a comprehensive evaluation of the changing states of a wide range of ecosystem components. For management of specific sector activities, a report with the performance indicators relevant to that sector may be more effective.

The nature and suite of indicators used in a report will reflect the purpose of the report. For a management report, including many contextual indicators without careful rationalization could detract from the main purpose of providing decision support on conservation consequences of alternative options. Contextual indicators, if used and explained properly, could elucidate the causes for change in performance or system resilience and ultimately lead to adjustment of reference points.

Determining a single spatial scale upon which to base an ecosystem approach is challenging. While large ocean management areas are being designated, there is recognition of finer scale eco-regions within them. In the USA, work has distinguished Georges Bank, eastern Gulf of Maine and western Gulf of Maine as regions within the broader Gulf of Maine Area. In Canada, national directives may preclude the designation of the Gulf of Maine as a distinct ocean management area. It may be necessary to develop complementary and/or nesting approaches for determining a suitable spatial scale for collaborative projects.

There was affirmation of collaboration on the compilation of an Ecosystem Overview Report (EOR) for the Gulf of Maine as presented by M. Fogarty in the plenary session. This collaboration would have as its broad goal the development of a common and consistent basis of scientific information and understanding for Gulf of Maine EAM efforts in both countries. It was clarified that the report would 1) be similar in scope to that of Zwanenburg et. al., 2006 and 2) provide a broad view of the ecosystem components and key processes in the Gulf of Maine but not including the threats and human use analysis. A report of about 100 pages in length was envisioned. The information compiled for the NMFS website was considered a good start for this report.

There was some discussion on the spatial scope of the report. It was confirmed that it would include the inner Gulf of Maine, Georges Bank, Bay of Fundy and Western Scotian Shelf. It was recognized that the substructure in the area should be addressed in the report. While this aspect was not discussed in detail, it was felt that it may be useful to consider separate subsections for each of these areas.

The extent to which modeling efforts would be reported was discussed. Scientists in both countries have been undertaking ecosystem modeling efforts. It was agreed that collaboration on these efforts should be continued. It was not felt that a separate proposal was required for this but rather that this could be included in the EOR proposal. In the latter, it was considered valuable to include a conceptual model of the Gulf of Maine ecosystem which would assist identification of the key ecosystem components and processes.

There was discussion on a proposal related to conservation observations. Specifically, would an audit of activities in both countries to evaluate progress towards EAM be useful? This had been mentioned as an initiative at a recent workshop at the University of New Hampshire. This stimulated discussion on the need to identify key impacted ecosystem components through formal risk analysis. There are a number of possible risk analyses approaches available (qualitative through to quantitative) that it might be useful to jointly explore. The Integrated Ecosystem Assessment of NMFS is to include aspects of this. Overall, while these were considered important, it was felt that they could be included in the EOR proposal.

Zwanenburg, K.C.T., A. Bundy, P. Strain, W.D. Bowen, H. Breeze, S.E. Campana, C. Hannah, E. Head, and D. Gordon. 2006. Implications of ecosystem dynamics for the integrated management of the Eastern Scotian Shelf. Can. Tech. Rep. Fish. Aquat. Sci. 2652: 91 p.

MONITORING INFRASTRUCTURE

Presentation Highlights (Russell Brown and Don Clark)

NMFS monitors transboundary stocks, ecosystems and fisheries through three key monitoring programs: a landings sampling program, an observer program, and a series of fishery independent bottom trawl surveys. The landings or port sampling program samples commercial landings in eleven key U.S. ports from Maine through North Carolina. Length and age composition sampling are stratified by stock area, region/port, time and commercial market category. Sampling effort allocation is made in conjunction with stock assessment biologists. Key challenges for characterizing fisheries landings include sampling trips that fish in multiples areas inside and outside the zone of bi-national interest and the development of better mechanisms for predicting when and where landings will occur. The potential effectiveness of sampling effort could be enhanced through the development of a cooperative sampling program with commercial fishery dealers similar to programs already in place in Canada.

NMFS administers a large and active fishery observer program to monitor catch on commercial vessels in a variety of fisheries. Discarding practices are dynamic in response to fishery management actions including trip limits and closed area access. Interaction between the scientific program and fishery management systems is effective; however, sampling allocation is also at times constrained or directed by legal action. Observer program effectiveness can continue to be enhance through better communication and coordination among management and stockholder groups.

NMFS conducts three seasonal bottom trawl surveys that produce valuable inputs including times series indices of abundance and biomass for stock assessment and management use. These surveys have been effective at detecting broadscale changes in species abundance, distribution and ecosystem level dynamics. NOAA will soon replace the primary survey vessel (RV Albatross IV) with a new modern research vessel (FSV Henry B. Bigelow) with greatly enhanced capabilities. Concurrent with the change in research vessels, the Northeast Fisheries Science Center (NEFSC) intends to introduce a number of other changes in survey methodology including a significant upgrade to the bottom trawl system, the consolidation of the three seasonal surveys (Winter, Spring and Autumn) into two primary surveys (Spring and Autumn) and changes to sampling protocols. New bottom trawl gear was designed through an inclusive advisory panel process that incorporated the expertise of gear designers, commercial fishery stakeholders, fishery management specialists, and academic personnel with expertise in gear and survey conduct. These changes are being made based on information provided through a 2003 peer review of NEFSC survey protocols and recommendations contained in reports by the ICES Study Group on Trawl Survey Standardisation. Each future seasonal survey will reserve 10% of the total survey effort to be dynamically allocated to address short term resource information needs or survey standardization issues. A large scale calibration experiment that includes both shadow surveys and site specific experiments is planned for 2007 and 2008 to evaluate changes in catchability between surveys and to estimate calibration coefficients to allow for comparability between current and future surveys.

A review was presented of geographic coverage and sampling protocols for annual DFO bottom trawl surveys in the Maritimes Region. Issues highlighted for discussion included a proposal for a synoptic east coast survey, the geographic range covered by the DFO 5Z survey in U.S. water, the potential for harmonizing data collection software and guides, recent initiative to increase the sampling of invertebrates, survey quality assurance procedures and plans for a vessel change in 2011.

Discussion

Surveys conducted by DFO and NMFS are typically broad scale monitoring programs. They have been widely used to evaluate the productivity of harvested resources. These surveys may not be best suited to address issues for some species of interest in localized environments. In the USA, state surveys may augment the national programs, e.g. the Massachusetts survey provides a valuable juvenile cod index from coastal areas that are difficult to sample with larger boats due to shallow depth and presence of fixed gear. Partnering may be also used advantageously to address some of these immediate problems (not monitoring programs), e.g. evaluating efficacy of closed areas or sampling rocky areas. In the USA, partnering with industry has not been employed for monitoring programs because of insecurity about long term commitment. In Canada, industry and DFO have undertaken joint monitoring programs.

While both DFO and NMFS conduct surveys with a broad geographic range, there is no survey which extends from the Scotian Shelf through the Gulf of Maine. A survey with coverage over this range would assist with the understanding of broadly distributed and highly migratory species. Given the scale of distribution for species like mackerel, pollock, dogfish and white hake, a cooperative approach to surveying would be required to provide indices which span the geographic range. One of the new ecosystem challenges is whether surveys can be stitched together to detect large scale changes, e.g. changes in biogeographic range. While this could also be addressed through a synoptic survey, there

are other ways to achieve comparability, e.g. overlap in surveys, and having multiple indices for overlap areas can proffer other benefits.

With emerging concerns about biodiversity and habitat, surveys are being challenged to provide information on these issues. The challenge will be to adjust protocols in order to address these needs without jeopardizing the quality of the traditional information. On DFO surveys, hydrographic monitoring has expanded over the years and vertical plankton tows were introduced in 1999 for about 15% of sets, selected to represent the whole area. One of the new ecosystem challenges is whether surveys can be stitched together to detect large scale changes, e.g. changes in biogeographic range.

Design of vessel/gear calibration experiments and analysis methodology of results from these experiments is a potential area for profitable collaboration. NMFS is planning calibration experiments between the Albatross and the Bigelow over a 15 month span that will encompass 3 shadow surveys and 3 other surveys in areas of high species abundance. The gear was designed to use two sweeps. An immediate outstanding issue is whether a common sweep will be used for the entire survey or whether different sweeps, better suited, to each area, will be used in the north and the south. Given that NMFS is engaged in a major change in survey trawl, it was recognized as beneficial for the continuity of the survey indices that the geographically overlapping DFO surveys will be continuing with no change in trawl.

The introduction of a new vessel offers the opportunity to review and refine protocols. Comparison of protocols and sharing experience could assist in designing more robust practices. Some areas that could be examined include warp to depth ratios and direction of tow protocols. Some protocols interact, e.g. direction of tow, maintaining depth, maintaining speed over ground, maintaining speed through water and bottom contact are all interconnected, and judgment is required to determine practical compromises.

RECOMMENDATIONS

The following project proposals were recommended. All were considered to have merit and they are not presented in any order of priority. Several projects address issues related to more than one of the themes discussed. Workshops to address methodological issues arising from these projects are encouraged.

In addition to these project proposals, Canada and USA will collaborate on joint assessments for eastern Georges Bank Atlantic cod, eastern Georges Bank haddock and Georges Bank yellowtail flounder scheduled for review by TRAC in June 2007. It may be advantageous to investigate the possibility of synchronizing the 2008 TRAC review for these resources with the 2008 GARM III review. It would be wise to ensure that the eastern Georges Bank Atlantic cod and haddock assessments conducted for TRAC are consistent with the Georges Bank wide assessments conducted for GARM III. It is also expected that Canada and USA will collaborate on a joint herring assessment in April/May 2009.

Title:	**Mackerel Stock Status**
Description:	Mackerel joint benchmark assessment
Rationale:	Requested by Canada/US Steering Committee
Benefits:	Consistent science approach for exploited transboundary stock.
Principals:	Bill Overholtz and Francois Gregoire
Timeframe:	Principal investigators to develop workplan for Sept. 2007 steering committee meeting.
Review:	TRAC reviews of data in summer/fall 2009 and benchmark/assessment in Dec 2009.
Deliverables:	Draft TOR for Can/US Steering Committee TRAC Reference Documents, status reports, proceedings
Discussion:	Research recommendations from SARC and DFO assessment.

Title:	**Spiny Dogfish Stock Status**
Description:	Spiny dogfish joint benchmark assessment.
Rationale:	Requested by Canada/US Steering Committee
Benefits:	Consistent science approach for exploited transboundary stock.
Principals:	Kathy Sosebee and Steve Campana
Timeframe:	Principal investigators to develop workplan for Sept. 2007 steering committee meeting.
Review:	TRAC reviews of data in Dec 2008 and benchmark/assessment in Mar 2009. Schedule needs to be confirmed by principal investigators.
Deliverables:	Draft TOR for Can/US Steering Committee TRAC Reference Documents, status reports, proceedings
Discussion:	Coordinate US with results of Canadian research project. Research recommendations from SARC and DFO assessment.

Title:	**Atlantic Halibut Stock Status**
Description:	Reciprocal participation in Canadian and US assessment processes.
Rationale:	Assessments in both countries are limited by data.
Benefits:	Better use of existing information on landings, data, and tagging
Principals:	Laurel Col, Kurtis Trzcinski and Shelley Armsworthy
Timeframe:	In accord with the assessment review meetings.
Review:	GARM review in Aug. 2008 and RAP benchmark/assessment review winter 2007/2008.
Deliverables:	Contribution to peer review of domestic products.
Discussion:	Joint benchmark not warranted at this time. Future collaboration dependent on outcomes of assessment meetings.

Title:	**Pollock stock structure across Can/USA boundary**
Description:	Develop a research plan to explore potential techniques for investigating stock structure, including techniques for tagging adult pollock and genetic analysis, and review previous stock structure studies.
Rationale:	Substantial Canadian and USA fisheries near international boundary in 4X5Y area. Mixing across Can/USA boundary needs to be determined.
Benefits:	Better understanding of extent of mixing across Can/USA boundary.
Principals:	Heath Stone and Ralph Mayo.
Timeframe:	Principal investigators to develop research plan for Sept. 2007 or April 2008 steering committee meeting.
Review:	Dependent on feasibility of projects.
Deliverables:	Research plan conditional on feasibility of tagging adult pollock and justification for stocks structure.
Discussion:	Tagging studies deliver results several years into the future. Genetic analyses may be a more timely approach.

Title:	**Application of Standardized By-catch Reporting Methodology (SBRM) sampling allocation algorithm**
Description:	Develop facility with current SBRM sampling allocation algorithms for potential application in Canadian multi-fleet mixed species fisheries
Rationale:	Analytic tools to allocate observer coverage by fishery sectors/components will improve statistical efficiency of observer deployments, either to achieve target CV levels or to obtain maximum information from limited funding.
Benefits:	USA scientists have developed analytic tools to evaluate effects of alternate schedules of observer coverage on variance of bycatch estimates.
Principals:	Susan Wigley, Lei Harris, Mark Showell
Timeframe:	Within next two years
Review:	DFO internal evaluation
Deliverables:	SBRM-type allocation model for Canadian fisheries
Discussion:	

Title:	**Review literature and studies of survival rates of discard**
Description:	Develop a comprehensive review of available data on survival rates of discarded species (fish, marine mammals, sea turtles)
Rationale:	Estimates of survival rates of discards will improve accuracy of assessment inputs, ecosystem energy budgets, and quantify human-induced mortality of species at risk.
Benefits:	USA and Canadian scientists have independently accumulated literature and studies on survival of discards. Some work is unpublished therefore difficult to find. Collaboration will result in a more comprehensive review.
Principals:	NE Fisheries Observer Personnel, Lei Harris/John Neilson?
Timeframe:	2008 GARM
Review:	Internal technical report reviews
Deliverables:	Technical reports
Discussion:	

Title:	**Characterizing Spatial Patterns of Benthos**
Description:	Develop a research plan to test different approaches to describing/predicting the spatial patterns of benthic communities using Georges Bank as a pilot.
Rationale:	Current habitat template may not be adequate for all purposes. Would be useful to explore other techniques, approaches and models. While we may not fully understand habitat function, it is still important to be able to map distribution. However, understanding of habitat function will inform mapping, particularly in terms of defining scale.
Benefits:	Common understanding of patterns, and opportunities for shared resources and expertise.
Principals:	USA Habitat Characterization Group, Steve Smith, Peter Lawton. Involvement of academics, including Page Valentine and Vlad Kostylev.
Timeframe:	Principal investigators to develop terms of reference and/or funding proposals within 12 months. Bring proposal to Can/USA Habitat Subcommittee.
Review:	
Deliverables:	Technical reports.
Discussion:	Scope still to be determined, e.g., Georges Bank plus a few deep basins, a coastal component, areas with oil & gas potential, and/or areas within discovery corridor.

Title:	**Investigation of Closed Areas**
Description:	Develop a research plan to use closed areas as an opportunity to study resilience and recovery of benthic habitats. Use existing and new monitoring data from these areas to explore a variety of concepts and to test models.
Rationale:	May help us to better understand impacts of fishing activity, though areas are still open to some activity (e.g., fixed gear & traps).
Benefits:	USA has more closed areas to study than Canada (in Gulf of Maine).
Principals:	USA Habitat Characterization Group, Claudio diBacco, Melissa Wong, Jeremy Collie.
Timeframe:	Principal investigators to develop terms of reference and/or funding proposals within 6 months. Bring proposal to Can/USA Habitat Subcommittee.
Review:	
Deliverables:	Technical reports.
Discussion:	Some analysis has already been conducted. Potential opportunities for funding related to Marine Protected Areas. Chose experimental design carefully. Some areas are closed for purposes other than benthic recovery, some may not have pre-closure information.

Title:	**Spatial analysis of by-catch in relation to habitat**
Description:	Examine relationship between habitat and fisheries catch of target and non-target species (compare to survey data) using spatial analytical tools.
Rationale:	Improved knowledge of habitat distribution may help to minimize by-catch.
Benefits:	Potential mitigation tool for by-catch.
Principals:	USA Habitat Characterization Group, Chad Keith, Lei Harris
Timeframe:	Dependent on progress of habitat mapping. No immediate action required.
Review:	
Deliverables:	Technical reports.
Discussion:	Relationship to risk assessment.

Title:	**Ecosystem Overview Report for the Gulf of Maine**
Description:	Develop a collaborative Canada-USA Ecosystem Overview Report describing the state of knowledge of the structure of the Gulf of Maine ecosystem, including development of a conceptual model for the Gulf of Maine and the specification of a risk assessment framework.
Rationale:	Development of an ecosystem approach to management of marine resources has been accorded high priority in both Canada and the United States. The proposed project would provide the requisite background information for consideration of management goals for the Gulf of Maine in an ecosystem context.
Benefits:	Both Canada and the USA have made substantial investments in understanding ecosystem processes in the Gulf of Maine and their potential implications for management. Combining the resources, scientific expertise and information bases of the two countries will allow efficient development of an ecosystem overview report capitalizing on this investment.
Principals:	Rob Stephenson and Mike Fogarty
Timeframe:	Finalize report structure and contributors (1.5 months) Assemble draft report (12 months)
Review:	Submit to peer review July 2008
Deliverables:	Ecosystem Overview Report (~100 pages) Summary report for broad audience (~15 pages) Web-based products
Discussion:	This project has been vetted through the Canada-USA Steering Committee

Title:	**Shipboard Data Acquisition Systems for Fisheries Independent Surveys**
Description:	Shipboard data acquisition systems are integral to the efficient and accurate collection of station, environmental and biological data and can contribute to rapid data turnaround for stock assessment and management use.
Rationale:	Advancements in shipboard data acquisition systems are needed to ensure the efficient use of research vessel time and scientific personnel contributions during the conduct of research vessel operations.
Benefits:	Efficient shipboard data acquisition systems have several advantages related to improvement in data quality, error checking, partial mitigation for the maintenance of field institutional knowledge and rapid data turnaround once the cruise is completed.
Principals:	Nancy McHugh & Paul Kostovick (USA) Don Clark, Jim Gale & Tom Hurlbut (Canada)
Timeframe:	FSCS 2.0 is currently under development in the U.S. Information exchange would occur during 2007-2009 with the goal of implementation of updated systems on the new Canadian research vessel (upon arrival), the FSV Henry Bigelow in Spring 2009, and the FSV Pisces if/when vessel is allocated for use in the northeastern U.S.
Review:	Work would not necessarily be peer reviewed.
Deliverables:	Operational shipboard hardware/software systems that are customized for specific survey use.
Discussion:	

Title:	**Shipboard Data Collection Tools to Improve Organism Identification and Maturity Determination**
Description:	The diversity of fish taxonomy encountered during typical fishery independent surveys and increased interests in ecosystem applications and biodiversity issues emphasize the importance of accurate fish identification. In addition, both countries desire to achieve improvements in the enumeration of non-commercial invertebrate species, but recognize the challenges of achieving and maintaining shipboard invertebrate identification expertise. There is a need to define a reasonable set of invertebrate identification and enumeration objectives that are achievable.
Rationale:	The diversity of fish and invertebrate taxonomy encountered during typical fishery independent surveys and increased interests in ecosystem applications and biodiversity issues emphasize the importance of accurate fish identification.
Benefits:	Implementation of onboard visual tools will result in the improvement of species identification and maturity determinations made during fishery independent surveys.
Principals:	Peter Chase & Richard McBride (USA) Don Clark, Tom Hurlbut (Canada) Jack Pearce (to identify), Kevin MacIssac
Timeframe:	The U.S. recently developed and implemented a shipboard intranet system available on monitors at sampling stations to improve the consistency and accuracy of shipboard biological determinations. The countries will initiate an exchange and review of existing products with the objective of completing a review and identifying additional enhancements and products by June 2008.
Review:	The nature of the project entails that this is a bi-national review of the materials currently used to teach and guide shipboard biological determinations.
Deliverables:	Enhanced intranet tools for shipboard implementation. Digital picture collections of maturity stages of commercially important species and target non-commercial invertebrate species.
Discussion:	

Title	**Synoptic Bottom Trawl Survey: Cape Hatteras to Cape North**
Description	Develop a proposal for a synoptic survey from Cape Hatteras to Cape North using consistent sampling gear and protocols and incorporating gear monitoring in determining validity of tow.
Rationale	Provide ecosystem monitoring and indices of abundance for transboundary stocks in the Gulf of Maine - Scotian Shelf area.
Benefits	Synoptic coverage following a consistent sampling design and stratification will provide information on trends in species composition, abundance and distribution throughout the region. Development of a synoptic survey effort will provide significant benefits to our understanding of broadly distributed and highly migratory species (e.g., Atlantic mackerel, spiny dogfish) and distributional shifts in response to climatic factors.
Principals	Don Clark (Canada) Russell Brown (U.S.)
Timeframe	Synoptic survey plan development by Fall 2008, possible implementation with the introduction of the new Canadian research vessel in 2009-2011
Review	Can-USA (some aspects potentially at ICES)
Deliverables	Proposed design for a joint survey of the Scotian Shelf and Gulf of Maine. This will include stratification, sampling protocols, geographic coverage and quality assurance practices to be employed in the survey. Procedures and equipment for gear mensuration, especially bottom contact time, are necessary to ensure comparability.
Discussion	Current surveys do not allow for clear interpretation of distribution and abundance throughout the region. A coordinated survey would provide clear indices required for Gulf of Maine species such as Atlantic mackerel, pollock, white hake, redfish, spiny dogfish and monkfish. This survey could be used for unambiguous monitoring of trends in the ecosystem. Given the large geographic range of the sample area, the duration of such a survey may be longer than any standard surveys now conducted. Thus spatial differences could be confounded with seasonal movements of species. Accomplishing the survey in a shorter period of time would require multiple vessels and the attendant issues of inter-vessel calibration.

Title:	**Geographic Coverage, Stratification and Station Allocation Procedures for Fishery Independent Bottom Trawl Surveys in 5Z and 4X**
Description:	Both Canada and the U.S. conduct survey activities in both Canadian and U.S. waters of 5Z and 4X. Canada is contemplating additional survey effort in area 4X, possibly in the spring in coordination with existing U.S. multispecies bottom trawling survey efforts. Canada is contemplating a reduction in sampling effort in the western Georges Bank area and an extension of the depth range currently sampling within 5Z. The U.S. is contemplating a reduction in sampling effort in the German Bank and Lurchers Shoals areas of 4X. A comprehensive review of the depth range and geographic coverage of transboundary surveys is warranted.
Rationale:	Coordination of stratification and sampling allocation efforts could result in improved aerial coverage and enhanced ability to coordinate and compare survey results. Ensure that the range covered during surveys is appropriate for providing informative indices of biomass and abundance. Provide ecological monitoring for the Eastern Atlantic slope and deep water areas.
Benefits:	Ensure that the range covered during surveys is appropriate for providing informative indices for commercially and ecologically important species. Provide ecological monitoring for the Eastern Atlantic slope and deep water areas. Implementation of common stratification designs and coordinated sampling allocation have the potential to improve survey performance relative to stock assessment and ecosystem modeling uses.
Principals:	Don Clark, Glen Harrison (Canada) Russell Brown, John Galbraith, Michael Vecchione (USA)
Timeframe:	Work on this issue needs to occur during late 2007 and 2008. Stratification and sampling allocations procedures need to be in place for new U.S. surveys by December 2008. The U.S. has established a working group to examine stratification and sampling allocation issues. These discussion concerning stratification and allocation issues in 5Z, 5Y and 4X should occur through a bi-national meeting or workshop.
Review:	The U.S. is likely to initiate a peer review focused on the experimental design (likely to remain stratified random), stratification and sampling allocation during 2008.
Deliverables:	Proposed geographic coverage for transboundary surveys, including GIS coverage of stratification to be used in 5Z and 4X. Sampling allocation definitions relative to newly defined stratification. Proposal for a deep water survey which will provide monitoring off the shelf edge on a less than annual basis (every 3-5 years).
Discussion:	No clearly defined rationale is available for determining the geographic coverage of transboundary surveys. Ecological monitoring does not extend off the shelf edge. Some monitoring of this region is needed.

APPENDICES

APPENDIX I: AGENDA

Tues. 10 Apr.		
13:00	Welcome	Stephenson Gabriel, Gavaris
	• Plenary, background on Themes	
13:30	- Stock status and harvesting advice	Rago, Van Eeckhaute
15:00	- Discard mortality and trophic impacts	Gabriel, Harris
16:30	• Plenary, discussion	Gabriel, Gavaris
Wed. 11 Apr.		
08:30	• Plenary, discussion	Gabriel, Gavaris
	• Background on Themes (continued)	
09:00	- Habitat	Reid, Worcester
10:00	- Ecosystem status	Fogarty, O'Boyle
11:00	- Monitoring infrastructure	Brown, Clark
13:00	• Plenary, review breakout instructions	Gabriel, Gavaris
13:30	• Breakout into Themes	
Thur. 12 Apr.		
	• Plenary, reports from breakouts	
09:30	- Stock status and harvesting advice	Rago, Van Eeckhaute
10:00	- Discard Mortality and trophic impacts	Gabriel, Harris
10:30	- Habitat.	Reid, Worcester
11:00	- Ecosystem status	Fogarty, O'Boyle
11:30	- Monitoring Infrastructure	Brown, Clark
13:00	• Plenary, discussion of breakout recommendations	Gabriel, Gavaris
15:30	• Plenary, formulate and review meeting recommendations	Gabriel, Gavaris

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