# PROCEEDINGS OF THE NATIONAL CLIENT NEEDS WORKSHOP FOR THE AQUATIC CLIMATE CHANGE ADAPTATION SERVICES PROGRAM (ACCASP)

December 12-14, 2011 - Ottawa

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Fisheries and Oceans Canada
Ecosystems and Oceans
Science Sector

National Capital Region
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Ottawa, Ontario
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**Canadian Manuscript Report of Fisheries and Aquatic Sciences 2998E**

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# Proceedings of the Client Needs Workshop for the Aquatic Climate Change Adaptation Services Program (ACCASP) December 12-14, 2011 - Ottawa

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## CONTEXT

Ecosystems and Oceans Science Sector is launching a $16.5 million five-year climate change program funded by the $148.8 million Government of Canada climate change adaptation initiative announced by the Minister of the Environment in November 2011. The objective of the **Aquatic Climate Change Adaptation Services Program (ACCASP)** is to bring climate change considerations into the mainstream of decision-making in the delivery of programs and policies of the Department. The adaptation science program will be managed nationally by a secretariat in the Oceanography and Climate Branch and delivered regionally.

A national intra-departmental client needs workshop was held in Ottawa, December 12-14, 2011 to introduce DFO's internal client sectors to the ACCASP. These workshop proceedings are organised according to the workshop's agenda and capture summaries of the presentations and highlights of both plenary and breakout group discussions. The workshop presentations and related documents can be found on DFO's GCPedia Climate Change web page at the following link:
http://www.gcpedia.gc.ca/wiki/Climate_Change_at_Fisheries_and_Oceans_Canada#Resources

## OBJECTIVES

The objectives of the client needs workshop were to:

- Increase client programs' understanding of: the ACCASP, the relationship between ACCASP and the Department's Mandate, the Federal Adaptation Policy Framework, and the development of Large Basin Risk Assessments (LABRAs) in the context of changing climate, and;
- Identify client programs' needs with respect to climate change adaptation and risks, and setting priorities for science/policy work to be supported under the competitive facets of the ACCASP.

## 1. INTRODUCTORY SESSION

Helen Joseph, Director of Fisheries and Oceans' Oceanography and Climate Branch (Science Sector) welcomed participants to the Aquatic Climate Change Adaptation Services Program Client Needs Workshop (**Appendix 1**: Agenda). A total of 38 participants and invited speakers from DFO (Strategic Policy, Canadian Coast Guard, Small Craft Harbours, Ecosystems and Fisheries Management, Program Policy, Ecosystems, and Oceans Science) and from Environment Canada, University of Victoria, and Engineers Canada participated in the 2½ day-long meeting (**Appendix 2**). The workshop consisted of presentations, plenary discussions and breakout group discussions.

**PRESENTATION:**
**Overview of federal climate change impacts and adaptation activities**
**- Ryan Schwartz, Strategic Policy, Environment Canada (EC)**
*As the federal lead on horizontal adaptation policy, EC provided an overview of federal impacts and adaptation activities in Canada. The presentation included a brief history of this work within the federal government, including the most recent national-scale science assessments and work by the National Round Table on the Environment and the Economy. It summarized the origins and purpose of the Federal Adaptation Policy Framework (FAPF), and focused on how the FAPF establishes a clear role for the federal government with respect to adaptation. It also outlined federal adaptation programs approved in 2007 ($85.9 million over four years for six programs) and the suite of programs announced on November 8th, 2011 ($148.8 million over five years for ten programs). A brief overview of the general governance of these programs, as well as the communication and coordination of adaptation activities across the federal government were also provided.*

**DFO's ACCASP - Helen Joseph, Science, DFO**
H. Joseph described DFO's role within the FAPF and gave a broad overview of the allotment of ACCASP funds over the next five years. These ACCASP O&M funds will be spent within the department, and will be distributed to clients and science through both a competitive and non-competitive process. The themes for the competitive program will fit under the FAPF. Half of the funds initially requested for the first year of the program have been rolled over to the second year. The ACCASP will be managed nationally but delivered regionally, working from four Large Aquatic Basins (LABs): Atlantic, Pacific, Arctic and Freshwater. It will be important to keep close linkages with other federal departments that are also working on climate change issues to try and build on each other's initiatives.

**Discussion**

- Due to time constraints DFO is simultaneously working on different parts of a process (projections & trends, vulnerabilities and impacts and socio-economics) which could arguably benefit from being worked on sequentially.

- Recognition that there will be data and information gaps in the first five years of the ACCASP, but that we are building a longer term program that could address these gaps in the future. There was discussion on how to address these gaps in the short term.
- Recognition of the importance of integrating climate change adaptation considerations throughout DFO's activities and using outreach to promote DFO's role as a climate change adaptation department.

## 2. DFO AND CLIMATE CHANGE ADAPTATION- RISK BASED APPROACH

**PRESENTATION:**
**Climate Change: International and National Perspectives – Ken Denman, University of Victoria**

*The greenhouse effect maintains the temperature of the Earth warmer than it would otherwise be: incoming solar radiation (primarily at ultraviolet and visible wavelengths) reaches the Earth's surface, and is radiated back at longer wavelengths in the infrared (IR) bands; like a greenhouse, the atmosphere absorbs some of the IR. Since about 1800 (pre-industrial), humans have, through such activities as burning fossil fuels and producing cement, increased atmospheric concentrations of long-lived greenhouse gases, primarily carbon dioxide. Carbon dioxide in the atmosphere has increased from pre-industrial levels of about 285 parts per million (ppm) to about 390 ppm in 2011. This enhanced greenhouse effect has increased the global mean surface temperature by nearly 1°C. In the 1990s, atmospheric carbon dioxide grew about 1% per year, between 2000 and 2008 over 3% per year, and in 2010 by 5.9%. We thus expect warming to accelerate over the next few decades. The warming at high latitudes (greater than 60°) has increased and is projected to increase at 2-3 times the global average. Most global climate models also project an increase in winter precipitation over most of Canada. Average winter land surface temperature in Canada increased 2.8°C between 1948 and 2011.*

*In southern and eastern sea ice regions in Canada, summer ice area has been decreasing by 10-17% per decade over the last four decades. Dominant physical changes expected in mid- to high-latitude oceans over the next few decades are surface layer warming and freshening, shallowing of the winter mixed layer, increased stratification (reducing mixing of oxygen downwards and nutrients upwards), rising sea level and changes in wind patterns and storm tracks. Associated bio-chemical changes include reduced subsurface dissolved oxygen, increased carbon dioxide and acidity, and higher solar irradiance in a shallower upper ocean layer. Surface waters corrosive to aragonite, the mineral form of calcium carbonate in corals and other shellfish, are expected throughout the Arctic Ocean by 2050, and may reach as far south as Vancouver Island and Newfoundland by 2100. Marine ecosystems and fisheries foodwebs may change structure and productivity as species try to adapt to a changing climate by: migration/dispersion poleward, physiological acclimation to continue to function at higher temperatures, lower oxygen concentrations and higher acidity, changing phenology or seasonality, ecological adaptation, and for species with very*

*short generation times, possible evolutionary adaptation. Most adaptation studies are on single species for a single stressor. How whole ecosystems will change in response to multiple stressors will be complex, nonlinear and difficult to predict. In order to make projections on how risks to ecosystems will change, we need to "downscale" climate model projections to Canada's ocean ecosystems region by region, and try to assess which ecosystem components are at risk and how those risks/changes might affect harvestable marine resources.*

**Discussion**

- Discussed the potential need to quantitatively integrate feedback into projection models—current scenarios and projections are likely under- or over-estimating change due to the lack of integration of feedback mechanisms.
- Models are not designed to predict abrupt (threshold) changes, although from a policy perspective the rarer and catastrophic events may be of great importance.
- Projections are mostly based on physical, and not biological characteristics.

**PRESENTATION:**
**A Risk-Based Approach to Manage the Impacts of Climate Change in Canada's Aquatic Resources - Paul Lyon, Science, DFO**

*Risk is the combination of a hazardous event occurring, and the impact or consequence of that event. Climate Change poses a risk to DFO in its ability to deliver on its mandate. The 2005 National Climate Change Risk Assessment identified ecosystem and fisheries risks as well as those associated with safety and accessibility of waterways. In order to build resilience in the Department to climate change, risks need to be assessed in greater detail. The ACCASP''s risk-based approach seeks to assess impacts and vulnerabilities based on projected future states of Canada's aquatic resources. The initial assessments will focus on four Large Basin Assessments, which include Canada's three oceans and its inland waters.*

**PRESENTATION:**
**Climate Projections for DFO ACCASP – John Loder, Science, DFO**

*The occurrence of anthropogenic climate change associated with so-called "greenhouse gases" is now well-documented on global and, in some cases, continental and/or ocean-basin scales for many important climate variables. These include air and ocean temperature, precipitation, salinity, sea ice, sea level, snow cover, seasonal run-off and ocean acidity. However, its occurrence for many other variables and for the regional scales of relevance to DFO issues is less clear, in particular because of the strong natural variability in regional climate on inter-annual to multi-decadal time scales. In some cases, such as the summertime decline in sea ice extent in the Arctic, anthropogenic climate change is already well underway. In many other cases, it is unclear whether recent changes in important variables are due to natural or anthropogenic variability, and whether the lack of apparent recent changes in other*

*variables is due to offsetting natural and anthropogenic influences or to no anthropogenic influence. The availability of robust climate change projections on the relevant space and time scales will thus be an important challenge in ACCASP.*

*The comprehensive large-scale assessments by the Intergovernmental Panel on Climate Change (IPCC), together with downscaled projections, ongoing monitoring and new research, provide a basis for the gradual development of useful projections for ACCASP. Global and continental-scale projections for mid-century from the IPCC Fourth Assessment Report (AR4, 2007) and subsequent down-scaling activities, together with emerging results from the IPCC Fifth Assessment (AR5, 2013), will be a primary basis for projections on the "50 Year" time scale, for which the probabilistic projections from the ensemble average of model simulations are most relevant. Projections for the "Decadal" (over the next decade or so) time scale will be more difficult because of the greater relative importance of natural variability such as the Arctic, North Atlantic and Pacific Decadal Oscillations, and the limited deterministic predictability of these important coupled atmosphere-ocean natural variability modes. Projections for this time scale will need to rely heavily on recent observed variability and its interpretation in relation to potential natural and anthropogenic origins. In all cases, care and time will be required to ensure appropriate consideration of various uncertainties in the provision of robust projections for impacts and vulnerabilities assessments for input to adaptation planning. In most (perhaps all) cases, there is high potential for improved projections during the multi-year ACCASP.*

**Discussion**

- Several working groups on the IPCC are working on projections and other adaptations. The data and models used in the IPCC AR4 are publically available.
- Science operates in a realm of variability, uncertainty and probability. The client needs to be made aware of this, and needs to consider how this will affect their request for advice/tools.

**PRESENTATION:**

**Impact and adaptation issues and opportunities facing DFO sectors in response to climate change in the northern hemisphere – Kim Hyatt, Science, DFO**

*Climate impact and adaptation (CIA) issues are embedded within multiple domains of the human ecosystem. Climate change impacts register first in the atmosphere and hydrosphere. Impacts propagate geographically and temporally via complex biophysical processes influencing plant and animal populations and associated human socio-economic systems. CIA issues proliferate at numerous interfaces created between human populations and natural resources. Fisheries CIA issues are determined by properties of the biological resource and human systems composed of extractors, users and regulators. Signature effects of climate variation and change are readily apparent in fish and fisheries in freshwater and marine ecosystems throughout the northern hemisphere. Fisheries dependent, socio-economic systems involve a built environment composed of both "hard" (e.g. fishing fleet) and "soft" assets (e.g. decision support tools*

*and/or systems) of frequently unknown vulnerability and/or resilience. "Gap analysis" results from our own work suggest that 95 % of all fisheries CIA studies since 1970 have focused on impact rather than vulnerability and adaptation issues. Thus, the scope for fisheries to adapt to future climate change remains largely unknown. Moreover, broadly applicable synthesis work on CIA issues is principally restricted to the "physics, phytoplankton and fish" end of the response spectrum leaving risks for resource management systems and fisheries-dependent, socioeconomic systems largely unexplored. From a sectoral perspective, CVC issues involve complex interactions among: ecosystems and target species/resources (i.e. their behaviours, adaptive capacities and vulnerability), resource "regulators" (e.g. the behaviour and adaptive capacity of agencies, management boards etc…), resource stakeholders (e.g. the behaviour and adaptive capacity/vulnerability of water users or capture and culture fisheries). The complexity surrounding climate impact and adaptation issues suggests a need to adjust future research strategies to support interdisciplinary teams capable of reflecting a better balance of inputs from a broad range of fisheries sector participants (science, resource management, policy, industry and public interest groups). Accelerated development of integrated assessment models dealing with "fisheries sector" systems from "end-to-end" will be required to (1) explore limits on climate induced impacts and future vulnerability of DFO's sectoral clients, (2) identify opportunities for sector-specific, adaptation options and implementation tools to improve the Department's prospects to manage for favourable outcomes in the face of uncertainties about future climate change.*

**Discussion**

- Trying to project into the future based on historical record may be difficult due to direct anthropogenic influences on past ecosystems.
- Need to start thinking about how we can assist in aligning federal and provincial climate change adaptation activities/responses.
- Policies are set nationally but applied regionally. Will have to incorporate climate change adaptation considerations into policy by taking into account future climate variability and impacts across Canada, but all the while assessing how the different regions will be able to apply these national policy considerations.

**PRESENTATION:**

**Socio-Economic Analytic Support for Aquatic Climate Change Adaptation Services Program - David Collister, Economic Analysis & Statistics, DFO**

*The purpose of the presentation was to describe the socio-economic analytic support that Economic Analysis & Statistics (EAS) will be providing to ACCASP. In particular, EAS intends to provide analytic support under the overall direction of the ACCASP. Two key areas of support are expected to be: 1) analysis and advice on the socio-economic risks, impacts and cost benefits of climate change for DFO program activities; and 2) development of the socio-economic "evidential basis" for policies, strategic planning and legislative/regulatory activities that are recommended by the program. Short-term objectives of EAS will be to provide socio-economic analysis for the risk assessments of*

*the four Large Aquatic Basins that have been identified by ACCASP (work to be completed by March 31, 2012).*

**Discussion**

- The socio-economic (SE) climate change adaptation facet of the ACCASP will also be client-driven. Stakeholders and clients will be involved in program activity implementation and longer term program development.
- The ACCASP FTE assigned to each region will facilitate the engagement with, and communication between, other sectors in the regions. SE and Science will continue to liaise and work together. Each region could create a regional ACCASP team which would include a regional representative from each client sector, SE and Science. NL has already created such a team and is now looking at including external representatives (e.g., from the province).
- The ACCASP governance mechanism, currently under development, will ensure that SE work is embedded in the overall ACCASP framework. Management is likely to be interested in understanding the SE implications of CC adaptation, as guided by science.
- Suggested that a SE analysis on the opportunity cost (money, time, etc.) of CC adaptation activities should also be conducted. Instead of looking at the SE cost of events (e.g., the failure of the northern cod), look at the cost to the department of addressing these issues.
- Capacity is an issue, and we will need to prioritize ACCASP activities. Need to conduct activities that will affect policy but which will also engage managers, clients and people at the operational level. Clients will have to strategically consider the impact of the activities for which they are requesting funding. Need for ongoing dialogue between science and clients. Science must have a receptive client for the work they are proposing.

**PRESENTATION:**

**Ecosystems and Climate Adaptation – Jake Rice, Science, DFO**

*In the IPCC lexicon, "adaptation" is about how society had to modify social and economic pursuits, including their supporting infrastructures, in order to remain viable in the face of likely future environmental conditions. Dr. Rice's presentation began with a brief review of the types of ocean features likely to change under plausible future climate scenarios, and the types of activities humans conducted on or by the sea. It then focused in on the likely nodes of interaction between the two. It also highlighted some key contextual changes expected over the next four decades that will have a strong impact on adaptation options, including changes in human demography, likely societal choices made to mitigate future climate change, and the increased frequency and intensity of severe storms. Examples of how to work through the ocean science support that would be needed to inform adaptation options were presented both from the perspective of considering a single ecosystem feature (sea level rise) and tracing how it could impact social and economic undertakings, and from the perspective of a single human activity (energy production) and how climate change and measures to mitigate climate change could require adaptation. The activity of fishing and*

*aquaculture was examined in somewhat greater depth, because of its central position in departmental activities. Moreover, the treatment was placed in the context of global food security, and how humanity's needs are expected to change over the coming decades. In this context, three questions about adaptation were posed:*

1. *What species will be available (or grow well) at a particular place (static industry);*
2. *Where will the fleet have to move to find (grows well) the species it prefers (mobile);*
3. *How productive will the stock be where it is being fished?*

*The ocean science needed for each of the questions was explored with a different analytical approach—the first with Ecological Niche Analysis, the second with a Community Dynamics approach, and the last with an Ecological Processes approach. The strengths and weaknesses of each approach were illustrated and the conditions that would influence using one or the others were discussed. The value of having a clear policy and management question to guide the planning of appropriate science initiatives was stressed and illustrated. At the same time, it was demonstrated that science needs to be proactively ahead of demands from management, in order to increase the ability of the policy sector to pose the right questions at the right times.*

**Discussion**

- There are significant future domestic threats associated with not planning now for future global scenarios – we need to plan for when resources become globally sparse.
- It is not part of DFO's culture to make policies that will cost society. Open dialogue between science, clients, the public and policy makers is critical to incorporate CC adaptation issues in policy/decision making as quickly as possible.

## 3. INTERNAL DFO CLIENT/STAKEHOLDER SCIENCE NEEDS FOR ADAPTATION

**PRESENTATION:**

**Initial Client Engagement Meeting- Maritimes Region – Glen Harrison, Science, DFO**

*The initial meeting between regional sector clients and Science was held on Friday, 9 December, 2011, at Bedford Institute of Oceanography (BIO). The meeting was organized and facilitated by Maritime Policy and Economics, Jennifer Mullane and was well attended; participants from fifteen programs areas representing all regional sectors participated in the two-hour overview and discussion. The objectives of this meeting were to: (i) raise awareness of ACCASP in the region, (ii) provide a primer on adaptation, (iii) provide an overview of the program goals and initial planning steps, and (iv) get initial feedback from the participants on climate changes issues from their sector perspective. Clients were also provided a series of questions to help focus their issues with regard to science information needed for decision-making. It was clear from responses to the program outline and comments during the meeting that there is, broadly, a good understanding of climate change and the potential impacts it will have on the Department's operations, despite the fact that few were aware of the 2005*

*Climate Risk Assessment. For some sectors (e.g., CCG, SCH), climate change awareness and operational considerations are already being discussed. For other sectors (e.g., resource management) the impacts of climate change are less certain and the operational considerations are just beginning. A number of the questions posed to the ACCASP planning team centred on pragmatic issues such as funding levels and opportunities for collaboration in research and adaptation tool development. Concern was expressed about how adaptation tools developed under the program would be implemented and the implications of "main-streaming" climate change adaptation into sector operations. One suggestion raised with regard to the development of background information for the Atlantic Basin Risk Assessment scheduled for fall 2012 was that, in addition to reports on climate change trends and projections (T&P) and impacts and vulnerabilities (I&V), perhaps a client issues document should also be produced to help focus the risk assessment. The meeting wrapped up with the ACCASP team reiterating the importance of client input in setting priorities for the program and the expectations of sectors playing a significant role in the basin risk assessment and in the development of ACCASP as planning moves forward. Further client engagement is planned for later in the fiscal year.*

**Discussion**

- These types of regional workshops are critical for engaging and working with the clients.

## 4. CLIMATE CHANGE ADAPTATION NEEDS OF DFO PROGRAMS

**PRESENTATION:**
**Canadian Coast Guard – Seyi Okuribido-Malcolm, Canadian Coast Guard (CCG), DFO**

*Climate change has a direct, real and cascading impact for Canadian Coast Guard programs and services. Warming temperatures in the Arctic have led to the permanent melting of sea ice, extending the navigational season and increasing the volume of vessel traffic. However, diminishing ice in the Arctic does not eliminate or reduce the risk factors associated with Arctic transit. As such, CCG has conducted risk assessments for each of its core programs; these assessments enable the CCG to identify and evaluate risk factors associated with increased storm surges and sea level rises to better monitor the impacts of climate change on its infrastructure and on the delivery of its services. To respond to the evolving nature of the demand for CCG programs and services in the Arctic brought about by climate change, the CCG is continuously assessing its services, infrastructure, and crisis response capacity and capability to ensure that Arctic marine corridors are safe and accessible.*

**Discussion**

- CCG would like a full climate change risk assessment to be conducted on CCG operations, activities, policies, etc. (e.g., search and rescue models, purchase of ice breakers, and safe navigation in the Arctic where charts are not electronic).

- Forecasted water levels in both the marine and freshwater environments are of increasing importance to foreign vessels in order to determine the volume of allowable cargo safe to load before entering Canadian waters.
- As melting ice increases vessel traffic in the North, CCG will have to enhance its emergency response capabilities and marine infrastructure in the Arctic to ensure safe and secure waterways.
- CCG will need to work with other sectors and other departments such as Transport Canada and Natural Resources Canada to develop a comprehensive strategy to address climate change.

**PRESENTATION:**

**Aquaculture Management – Mandy Mielke, Program Policy, DFO**

*Aquaculture is in the preliminary stages of investigating climate change and potential means for adaptation as they relate to the sector. However, climate change presents both opportunity and challenge for the sector (internally to DFO and externally to all stakeholders). Opportunities may exist to increase the adaptable nature of aquaculture management activities, proactive planning and to promote the development of appropriate technologies. Challenges arise where efforts to invest time, effort and resources are competing with other existing externalities of concern that are affecting the aquaculture sector. By targeting focus, knowledge of climate change impacts on the sector could easily be broadened in a relatively short timeframe through state of knowledge reporting, risk analysis and coordination within the Department for those groups with responsibilities tied to aquaculture activities. Several opportunities for DFO's aquaculture branches and the ACCASP program to further the Department's understanding of climate change impacts and adaptation needs as they relate to aquaculture in Canada have been identified for future interaction.*

**Discussion**

- The two main climate change adaptation considerations for aquaculture are:
    1. *Alternative species* – developmental strategies are being worked on mainly from a diversification perspective. Climate change could likely factor into decisions as priorities are set depending on the conditions where aquaculture is, could be and must be present;
    2. *Changing sight/location of species* – regional differences in social licenses and density of aquaculture activities will be a factor.
- There may be an opportunity to revisit the ocean acidification work being done on the East Coast whose funding wasn't originally open to include aquaculture - *potential link with on-going work on the West Coast of Canada*
- Although adaptation in the aquaculture sector has historically occurred locally, we may need to start looking at climate change adaptation on a larger scale. Industry is aware of the need for assessing future costs associated with climate change (e.g., moving infrastructure, farming new species, etc.), although there are limited resources (time, money and personnel) available to put towards this issue with many other high priority issues at hand for the sector.

**PRESENTATION:**
**Fisheries and Aboriginal Policy – Marc Clemens, Program Policy, DFO**
*The risks due to climate change could affect all program elements and are not limited to the risks identified in DFO's 2005 Risk Assessment Report. Furthermore, understanding extreme events, not just average future projections, is likely key in the development of future DFO policies. To manage the risk we first need to recognize the overarching challenges—how to incorporate uncertainty, how to maintain a balance between stability and flexibility in our management system. We then need to identify our priorities – what new tools/information are needed, where our vulnerabilities are (e.g., stocks or areas), and how we prioritise them. The next step is to obtain the best information possible, in order to then finally factor risks into existing decision processes, such as the Integrated Fisheries Management Plans.*

*To effectively adapt to the future impacts of climatic change, it will be essential to involve fisheries stakeholders through outreach and by including them in monitoring efforts. Although managing fisheries at an ecosystem scale may give more resilience to fisherman and the industry, historically fisheries have been set up as specialised, often isolated, fishery units. A diversification of fishermen portfolios may help manage the longer-term risk in the context of changing climate.*

**Discussion**

- Science can help Fisheries Management move towards a proactive approach through outreach and education of fish harvesters. If we want ACCASP to have an impact we have to communicate it with the fisheries by helping management talk about: 1) impact of climate change on fish stocks (quotas), and 2) management plans.
- There is a disconnect between the model projections and the time scales which will allow fisheries management to make decisions.

**PRESENTATION:**
**Small Craft Harbours – Donna Jean Kilpatrick, Small Craft Harbours (SCH), DFO**
*SCH owns and maintains a national system of commercial fishing harbours to provide commercial fish harvesters and other harbour users with safe and accessible facilities. The presentation began with an overview of the location, types and number of SCH assets, and an explanation as to how and why they are potentially vulnerable to climate change impacts including rising sea levels, reduced formation of shorefast ice and extreme weather events such as storm or tidal surges, hurricanes, and ice impacts. These events appear to be increasing in frequency, severity, and financial impact.*

*Towards taking a proactive approach to incorporate climate change considerations into the management of its infrastructure SCH contracted Cameron Consulting Inc.in 2010 and AMEC in 2011 to perform a literature search of the possible impacts of climate change on SCH infrastructure. The presentation outlined the results of this work which included a series of maps (Cameron Consulting) dealing with various predicted climate changes in Canada and a report (AMEC) summarizing the existing literature on possible*

*climate change effects to harbour infrastructure. The AMEC report also describes three potential approaches to adapt SCH infrastructure to these changes—i.e., protect, accommodate, and/or retreat—and outlines decisional processes that may help SCH determine under what circumstances each approach could be applied.*

*For SCH, the expected climate change effects will be both direct and indirect. The most predictable significant direct effects include rising sea level, coastal erosion, changing wind directions and the increased severity and frequency of extreme weather events (storms). Indirect effects may include climate-driven changes to fish stocks and fishing patterns.*

**Discussion**

- The Cameron Consulting and AMEC work was an initial step for SCH in attempting to predict climate change vulnerabilities with respect to assets and infrastructure. Some additional regional or local studies may be required. Also before investing in infrastructure adaptation measures, information on the indirect effects of a changing climate, such as possible changes to fish stocks and fishing patterns should be considered. SCH will need to rely on the expertise of other DFO sectors (Science, Fisheries Management) for information on these indirect effects.
- The AMEC report was just recently completed and will be available shortly to the department.
- SCH has minimal infrastructure in the Arctic, and therefore the AMEC report did not include a consideration of climate changes in the Arctic. However, increased navigability of Arctic marine waters and expansion transportation networks may result in increased demands for SCH infrastructure in the Arctic in the future.

**PRESENTATION:**
**Oceans Management - Danna Campbell, Program Policy, DFO**
*The ecological impacts resulting from climate change will create uncertainty and increase complexity for oceans management. At the same time, socio-economic opportunities arising from climate change will lead to changes in the distribution and intensity of human activities in the marine environment. Effectively managing oceans under these conditions will require a greater understanding of the potential direct and cumulative ecological and socio-economic impacts of these activities. We also need to comprehend how properties of populations, habitats and ecosystems increase the resilience of marine systems to the impacts of climate change, so that we can develop measures to protect these components. Knowledge and data are not the only requirements. Assessment tools (e.g., Ecologically and Biologically Significant Aarea identification, Pathways of Effects models, geospatial mapping of ecosystem data and human uses, futures analysis) are also needed to support the identification of high-risk areas that require management action.*

**Discussion**

- Oceans Management will prioritize the list of activities presented in D. Campbell's talk. Looking for commonalities between sectors will allow for more projects to be completed.
- Oceans Management wants to start fostering adaptive management and developing flexible management tools. This requires updating evergreen data to allow management activities to adapt through time.

**PRESENTATION:**

**Climate Change Adaptation to Engineering and Infrastructure - David Lapp, Engineers Canada**

*Engineers Canada is a national organization for the engineering profession in Canada. It is currently conducting a National Engineering Vulnerability Study to: 1) assess the risks of destruction, disruption or deterioration of civil infrastructure due to changing climatic conditions; 2) understand climate change and account for it in the design and retrofitting of Canadian public infrastructure; and 3) develop or revise policies, standards and tools to guide professional engineers in their day-to-day practices. In the course of this study, a total of 17 local infrastructure climate risk assessment case studies (out of a total of 23) have been completed. A Public Infrastructure Engineering Vulnerability Committee (PIEVC) Engineering Protocol was used in these analyses, focussing on the principles of vulnerability and resiliency and requiring the input of local knowledge and experience. Adaptation of infrastructure is not necessarily a complex problem, but is one of great magnitude. It will be critical to incorporate adaptation considerations in plans to address infrastructure deficits and to tie adaptation planning to infrastructure life cycles. This will also require developing new adaptation tools and knowledgeable people to use them.*

**Discussion**

- Engineering Perspective Adaptation is currently working on a climate change adaptation project with Natural Resources Canada (NRCan).
- They use the same methods, but with different set parameters, to address soft vs hard infrastructure.
- DFO should be a part of the PIEVC For every project undertaken by PIEVC, there is a project advisory committee that includes expert scientists and representatives from the affected municipality. This is a form of peer-reviewing for the project.
- The list of PIEVC projects and final reports are publically available online.

## 5. CLIMATE CHANGE ADAPTATION

**PRESENTATION:**

**Adaptation 101[1] – Paul Lyon, Science, DFO**

*Adaptation is an "adjustment in natural or human systems in response to actual or expected climate stimuli or their effects which moderates harm or exploits beneficial*

*opportunities (Intergovernmental Panel on Climate Change)". As mitigation efforts fail, adaptation has become more urgent. Adaptive responses are built on models that identify trends and current impacts, yet acknowledge the inadequacies and uncertainty of the science. The scope of adaptation is broad with multiple risks, involves multiple sectors, and is significant at a number of levels (local, regional, strategic). Mainstreaming factors climate risks into ongoing activities and builds a community of practice for which science has a major role (science for adaptation and science of adaptation). Risk analysis and assessments help to articulate risk. Risk considers the probability of an event occurring and its consequences. From the analysis, decision makers are in a better position to define strategies and identify gaps in knowledge and tools that support an adaptive approach to deal with climate change.*

*[1]A summary of the presentation, ADAPTATION TO THE IMPACTS OF CLIMATE CHANGE, originally presented by Dr. Ian Burton for DFO's Climate Dialogue Series (January 29, 2010)*

## BREAK-OUT GROUPS AND PLENARY DISCUSSION - 1

Groups were tasked with discussing **potential climate change adaptation tools and pilot projects**, **the delivery and content of the competitive call for proposals**, and the **messaging** for the ACCASP initiatives. Highlights of this discussion were:

### COMPETITIVE FUNDING ENVELOPES

- Adaptation tools and pilot project proposals should follow a multidisciplinary approach, and include multidisciplinary working teams. We want the work to be relevant to more than one client/user—how one ecological question can serve multiple clients and linkages.
- When designing a project, evaluate if there is a continuum of policy and management processes already in place, in which this one proposed element is the missing climate change link/consideration. For example, look at what is missing in the chain in the fisheries stocking decision process.
    - Projects needs to fit into the continuum that eventually leads to management action—"end to end".
- Given the timeframe, proposals should build upon existing tools and information, further supporting the "missing link" in the end-to-end chain approach.
- Focus on projects that are applicable to many different scales (in time and in space).
- Tools proposed at the workshop touched on all three of DFO's strategic outcomes.
- Coastal zones are being recognised as transitional zones and important for our infrastructure. We should talk to NRCan as they are doing a coastal zone assessment. However, their geographic interpretation of coastal zone does not physically overlap with DFO's.
- Arctic was raised as an important area where we know the least but where changes will be the most significant.
- Fair bit of discussion on mapping (literature search and then mapping).

    - Should we be considering geospatial data management and presentation as part of this program?
- On one hand we want to understand what climate change is doing to the system; on the other hand we want to know how to adapt to it.
- Since the impacts of climate change are cumulative, our approach could also be cumulative—think of dealing with a number of problems at once.
- Look at leveraging projects by working off of what is already going on, providing more funding, and speeding up the process. Picking low hanging fruit will help us get early results.
    - Leveraging should be in the criteria (working with NRcan, EC, Health Canada, NGOs, provinces, etc.)

**POLICY and PROGRAMS**

- Recognition of putting the idea of climate change into policy and program infrastructure (Habitat, Species At Risk, EBSA, Marine Protected Areas, networks, etc.). Most effective to do this as the policy is being renewed or developed.
- The issue we have with the current program configuration is that the process by which science will provide advice to the sectors—advice that will ultimately influence policy and management—is very slow. Meanwhile, other policy processes are underway that are in need of some faster insertion of climate change considerations. There needs to be a consistent integration of climate change adaptation consideration in ongoing policy development.
- Need to brainstorm on what different policies are currently being prepared/renewed.

**COMMUNICATION**

- Need to communicate, reach out and build up our constituency both internally at DFO, between F/P/T partners, and the general public. Communication and dialogue were common threads discussed at the workshop:
    - Need to communicate inside the department, cross-sectorally and up to senior management;
    - Involvement of stakeholders; and
    - Work required with corporate communications to see what we can say regarding climate change adaptation.
- When presenting Science and SE analyses to client sectors, we need to acknowledge and explain uncertainty. The overarching message, however, is that **things will change**—we see trends in certain directions, we don't know exactly how this will play out, but we do know that the environment will be different.
- The group further discussed the need for outreach material, which could be partially fulfilled by the design of an external ACCASP website.

**PROGRAM (ACCASP)**

- Good recognition of mainstreaming climate change adaptation, aligning our program to the Program Activities Architecture (PAA), the idea of alignment.

- Need some early results, “quick hits”..
- Nobody sees this as a five-year sunsetting program—considering long-term objectives will allow us to plan further into the future.

## 6. NEXT STEPS-MAINSTREAMING ADAPTATION

### BREAK OUT GROUPS AND PLENARY DISCUSSION - 2

Groups were tasked with discussing **priority themes** for the 2012-2013 ACCASP competitive call for both ecosystems and infrastructure, and with continuing the discussion on potential **climate change adaptation tools**.

**ADAPTATION TOOLS**

- Examples: geospatial tools; tools that integrate cumulative impacts; cost/benefit analysis tools; numerical tools for assessing ecosystem primary productivity and production of fish populations; tools for integrating climate change considerations into fish management plans and all other program areas (could develop a framework to guide this integration); standardized thematic mapping for each sector that could be overlapped to show the overall vulnerability of areas; tools that focus on extracting climate change adaptation-related data from already existing observation networks; strategic policy exploration tools and models.
- Tools may need to be designed to address the extreme scenarios, and not just for the projected mean.

**PRIORITY THEMES**

- **Impact adaptation response of natural ecosystem themes**
  - Adapting to changes in ecosystem capacity and productivity, at the whole-system, population, or species level. Linkages of proposed activities to other initiatives/sectoral activity is key.
  - Address both cumulative effects (“death by a thousand cuts”) and catastrophic events; these two scenarios need to be considered for climate change adaptation.
  - Bring the ecosystem/biological models being developed by DFO along with the physical models.
  - Recovery plans for SARA and rebuilding plans for commercial species not under SARA.
  - Front-end approach: review and evaluate worldwide aquatic ecosystem climate change adaptation tools.
- **Impact and adaptation of human systems themes**
  - Adapting to future impacts of climate change on the structure of human systems (hard and soft human related infrastructure). Although this is usually assessed by Socio-Economics, Science will have to contribute.
  - Sectors all have hard (docks, buildings, etc.) and soft (policy, best practices,etc.) infrastructure, which will need to adapt.

- SCH concerned about the impacts on infrastructure of the rise in sea level and storm surges, and will continue ongoing climate change adaptation work already underway, while maintaining linkages with NRCan and engineers.

**TUTORIAL ON THE USE AND CONTENT OF GCPEDIA-ACCASP SITE** *(added to agenda)-*

The GCPEDIA site contains documents and hyperlinks to ACCASP relevant information. **Documents and presentations from this client workshop are posted on the GCPEDIA-ACCASP site:**

http://www.gcpedia.gc.ca/wiki/Climate_Change_at_Fisheries_and_Oceans_Canada#Resources

The site can only be accessed internally or through the use of VPN. To upload onto this site or to contribute to the text you will need to register as a member. See the registration how-to guide at the following link:
http://www.gcpedia.gc.ca/wiki/NRCan_wiki_user_guide

For help with this site, please contact Matthew Surch (Matthew.Surch@dfo-mpo.gc.ca).

**UPDATE ON UPCOMING REGIONAL ACCASP MEETINGS**

- **Pacific** (Robin Brown): in February 2012, plan to have an internal meeting.
- **Central and Arctic:** two, maybe three workshops: Arctic workshop by end of fiscal (Jim Reist), freshwater workshop in Burlington in Jan/Feb 2012 (Susan Doka), with possibly a second freshwater workshop in the Prairies.
- **Quebec** (Michel Gilbert): one-day meeting on Jan 12, 2012. Client sector will have to prepare beforehand a list of priorities and theme issues on climate change adaptation.
- **Gulf** (Marc Lanteigne): single meeting with internal clients on January 30th in Moncton. Will want to consult Quebec, NL and Maritimes to ensure consistency of approach between regional workshops.
- **Maritimes** (Glen Harrison): already had their initial meeting. Will share the information from this workshop with the clients. Deciding if there will be another meeting, or bilats/trilats.
- **Newfoundland-Labrador** (Atef Mansour): will have a meeting with internal and external clients, date to be determined, likely February 2012.

The group agreed that a template ACCASP overview presentation could be sent to the regions for their workshops. National Secretariat coordinators will likely be present at each regional meeting.

Will need to work on developing a standardised outline for the two science documents produced for each the LABRA (Projections and Trends; and Impacts, Vulnerabilities and Opportunities documents) to ensure consistency in information generated – need to coordinate between basins to obtain a standard product at the end of the LABRA. This will facilitate the development of a national overview.

**COMPETITIVE CALL TIMELINE:**

1. Call sent out mid/end January 2012
2. Proposal submission deadline end Feb/early March
3. Funds awarded by end of March 2012

**CLOSING PRESENTATION: ADM LECTURE SERIES**

**Highlight from the long term monitoring in the Northwest Passage with Implications for a new Arctic ice/ocean observatory – Jim Hamilton, Science, DFO.**

*Thirteen years of moored measurements in eastern Barrow Strait have allowed us to establish the magnitude and variability of freshwater transport through this important Arctic gateway, and to explore what drives the variability. The data have also allowed us to see how inter-annual variability in ice conditions and zooplankton abundance are linked to water column temperature and salinity. These results suggest that it is possible to predict seasonal features of the ice cover and zooplankton population, if key parameters are measured in real time.*

*A prototype real time data delivery system was deployed in Barrow Strait last summer and is presently providing bi-hourly oceanographic data in real time. This modest real time observatory will be described, as will its potential as a useful tool for marine operators and ecosystem managers working in the changing Arctic marine environment.*

# APPENDIX 1 AGENDA

**CLIENT NEEDS WORKSHOP**
**AQUATIC CLIMATE CHANGE ADAPTATION SERVICES PROGRAM (ACCASP)**

**Les Saisons Boardroom, Westin Hotel**
**December 12 – 14**

## Monday December 12, 2011

| | | |
|---|---|---|
| 09:30 – 10:00 | Arrival and registration | |

**1. Introductory Session (chaired by Helen Joseph)**

| | | |
|---|---|---|
| 10:00 – 10:45 | Opening Comments | Helen Joseph |
| 10:45 – 11:15 | Roundtable introductions | |
| 11:15 - 11:45 | Renewal of Federal Adaptation Program – EC perspective | Ryan Schwartz |
| 11:45 – noon | DFO's Aquatic Climate Change Program | Helen Joseph |
| Noon – 1:15 | **Lunch (not provided)** | |

**2. DFO and Climate Change Adaptation – Risk Based Approach (chaired by Marie-Claude Fortin)**

| | | |
|---|---|---|
| 01:15 – 02:00 | *Climate Change - International and National Perspectives* | Expert Speaker: Ken Denman |
| 02:00 – 02:45 | Risk-based Approach<br>- National Climate Change Risk Assessment<br>- Large Basin Assessments | Paul Lyon |
| 02:45 - 03:15 | 1) Climate Projections and Trends Analysis | John Loder/<br>Mike Foreman |
| 03:15 – 03:30 | **Break** | |
| 03:30 – 04:00 | 2) Impacts, Vulnerabilities and Opportunities | Kim Hyatt |
| 04:00 – 04:30 | 3) Socio-Economics | David Collister |
| 04:30 – 04:45 | Daily Summary | Helen Joseph |

## Tuesday December 13, 2011

| | | |
|---|---|---|
| 08:30 – 09:15 | *Ecosystems and Climate Adaptation* | Expert speaker: Jake Rice |

**3. Internal DFO Client/Stakeholder Science Needs for Adaptation (chaired by Ann McMillan):**

| | | |
|---|---|---|
| 09:15 – 09:30 | Linking DFO Activities to the Changing Climate | Ann McMillan |
| 09:30 – 09:45 | Initial Regional Engagement Meeting – Maritimes | Glen Harrison |
| 09:45 – 10:10 | **Break** | |

**4. Climate Change Adaptation Needs of DFO Programs**:
Note that the agenda will be finalized Friday, Dec 9 depending on which presentations come in and which groups indicate they will speak.

| | | |
|---|---|---|
| 10:10 – 10:30 | Canadian Coast Guard | Seyi Okuribido-Malcolm |
| 10:30 – 10:50 | Aquaculture Management | Mandy Mielke<br>Allistair Struthers |
| 10:50 – 11:10 | Fisheries and Aboriginal Policy | Mike Hogg-Marc Clemens |
| 11:10 – 11:30 | Small Craft Harbours | Donna Jean Kilpatrick |
| 11:30 – 11:50 | Oceans Management | Danna Campbell |
| 11:50 – 01:00 | **Lunch (not provided)** | |

**5. Climate Change Adaptation: (chaired by Karen Davison):**

| | | |
|---|---|---|
| 01:00 – 01:15 | Adaptation 101 | Paul Lyon |
| 01:15 – 01:45 | *Climate Change Adaptation to Engineering and Infrastructure* | Expert Speaker: David Lapp |
| 01:45 – 03:30 | Small group breakouts to discuss<br>- how do we mainstream climate change adaptation into program decision-making, policy development and planning. | |
| 03:30 – 04:00 | **Break** | |
| 04:00 – 04:45 | Report back to plenary | |
| 04:45 – 05:00 | Daily summary | Helen Joseph |

## Wednesday December 14, 2011

**6. Next Steps, Mainstreaming Adaptation (chaired by Paul Lyon):**

| | | |
|---|---|---|
| 08:30 – 08:45 | Summary of where we are | Paul Lyon |
| 08:45 – 09:30 | Small group discussion – Adaptation tool development and Pilot projects: possible priorities? | |
| 09:30 – 10:15 | Reports from break out sessions | |
| 10:15 – 10:45 | **Break** | |
| 10:45 – 11:00 | Science response and closing remarks | Helen Joseph |

## *ADM Lecture*
## *Les Saisons Boardroom*

| | | |
|---|---|---|
| *11:00 – noon* | *The Arctic – filling the information gaps* | *Jim Hamilton* |

# APPENDIX 2- PARTICIPANT LIST

| | | |
|---|---|---|
| **Strategic Policy Sector** | | |
| 1 | Pierre Pascal Duquette | Strategic Policy and Planning |
| 2 | Matt Surch | Foresight |
| 3 | Marc Vachon | Legislative & Intergovernmental Affairs |
| 4 | David Collister | Economic Policy |
| **Canadian Coast Guard** | | |
| 5 | Tanya Faure | CCG |
| 6 | Seyi Okuribido-Malcolm | Program Strategies |
| 7 | Ian Gillis | Program Planning and Integration |
| 8 | Patrick Fraser | Environmental Response |
| **Small Craft Harbours** | | |
| 9 | Donna Jean Kilpatrick | SCH |
| 10 | Mike Wallace | SCH |
| **Ecosystems and Fisheries Management** | | |
| 11 | Amanda Mielke | Program Policy |
| 12 | Mike Hogg | Fisheries & Aquaculture Management |
| **Program Policy** | | |
| 13 | Marc Clemens | Fisheries & Aboriginal Policy |
| 14 | Danna Campbell | Oceans Program Policy |
| 15 | Lisa Robichaud | Habitat Management Operations |
| 16 | Kaija Metzulas | Species at Risk Program Policy |
| **Invited Speakers** | | |
| 17 | Ken Denman | University of Victoria |
| 18 | Jake Rice | ESD |
| 19 | David Lapp | Engineers Canada |
| 20 | Ryan Schwartz | Environment Canada, Strategic Policy |
| **Ecosystem and Oceans Science** | | |
| 21 | Helen Joseph | National Capital Region |
| 22 | Paul Lyon | National Capital Region |
| 23 | Ann McMillan | National Capital Region |
| 24 | Georgine Pastershank | National Capital Region |
| 25 | Karen Davison | National Capital Region |
| 26 | Marie-Claude Fortin | National Capital Region |
| 27 | Robin Brown | Pacific |
| 28 | Kim Hyatt | Pacific |
| 29 | Jim Reist | Central and Arctic |
| 30 | Susan Doka | Central and Arctic |
| 31 | Michel Gilbert | Quebec |
| 32 | John Loder | Maritimes |
| 33 | Glen Harrison | Maritimes |

| Ecosystem and Oceans Science (ctd) | | |
|---|---|---|
| 34 | Atef Mansour | Newfoundland Labrador |
| 35 | Pierre Pepin | Newfoundland Labrador |
| 36 | Gouqi Han | Newfoundland Labrador |
| 37 | Kian Fadaie | National Capital Region |
| 38 | Charles Hannah | Maritimes |