Proceedings of the 'Coordinating Spatial Information for the Beaufort Sea' Workshop

Winnipeg, Manitoba
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by

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ABSTRACT

Brown, L., Bakelaar, C., and Lewin, A. 2013. Proceedings of the 'Coordinating Spatial Information for the Beaufort Sea' Workshop. Can. Manuscript Rep. Fish. Aquat. Sci. 3015: iv+18 p

For many years now, the concept of a central storage house for geospatial information has been regarded as a key step to improving decision making in the Beaufort Sea Large Ocean Management Area (LOMA), and facilitating the implementation of the Integrated Oceans Management Plan (IOMP). To date, this concept has not been realized because of two fundamental challenges, the first being the difficulties surrounding the logistics of developing and maintaining a central data server; the second being the difficult task of soliciting information from the spatial data holders.

The success of any geospatial tool relies on the quality of the underlying data. In order to create comprehensive geospatial decision support tools for regional planning purposes, data is often required from a variety of sources/organizations. Therefore, it is believed that improving data management and dissemination practices while uniting datasets in a platform using new technology will eliminate the burden on the tool developers who are seeking data and the data holders who will be solicited for information.

RÉSUMÉ

Brown, L., Bakelaar, C., and Lewin, A. 2009. Compte rendu de l'atelier de travail sur la «coordination de l'information spatiale pour la mer de Beaufort».. Can. Manuscript Rep. Fish. Aquat. Sci 3015: iv+18 p

Depuis de nombreuses années , la mise en place d'un entrepôt centralisé pour le stockage de données géospatiales est considérée comme une étape clé en vue d'améliorer la prise de décisions relatives à la zone étendue de gestion des océans (ZEGO) de la mer de Beaufort et de faciliter la mise en œuvre du Plan de gestion intégrée des océans (PGIO). Toutefois, jusqu'à aujourd'hui, la mise en place d'un tel entrepôt ne s'est jamais concrétisée en raison de deux difficultés fondamentales, à savoir la mise au point et l'entretien d'un serveur de données centralisé, et la sollicitation de renseignements auprès des détenteurs de données spatiales.

Le bon fonctionnement de tout outil géospatial dépend de la qualité des données qui le composent. Pour créer des outils géospatiaux de soutien à la prise de décision complets aux fins de planification régionale, il faut souvent recueillir des données provenant de différentes sources et de diverses organisations. Par conséquent, on croit qu'en améliorant la gestion des données et les pratiques de diffusion, et en regroupant les ensembles de données sur une plate-forme à l'aide d'une nouvelle technologie, on allégera la tâche des concepteurs d'outils qui seront à la recherche de données et des détenteurs de données que l'on sollicitera en vue de recueillir des renseignements.

INTRODUCTION / BACKGROUND

The Beaufort Sea Large Ocean Management Area (LOMA) is one of five priority areas identified for integrated ocean management planning by the Government of Canada. The Beaufort LOMA is approximately 1,107,694 km^2 and is located in the extreme northwestern corner of Canada (Figure 1). The LOMA includes the marine portion of the Inuvialuit Settlement Region (ISR) and works together with the six ISR communities on integrated management planning.

Integrated Management in the Beaufort Sea is a collaborative management and planning process led by the Oceans Programs Division of Fisheries and Oceans Canada (DFO Central and Arctic Region). The *Oceans Act* and its supporting policy, Canada's Oceans Strategy, affirm DFO's mandate as the lead federal authority for integrated oceans management and provide the national context for the Initiative. Therefore, a governance structure has been developed for the Beaufort Sea LOMA and consists of: 1.) the Regional Coordination Committee; 2.) the Beaufort Sea Partnership; 3.) four Working Groups and 4.) the Secretariat. The working groups are made up of members of the Beaufort Sea Partnership (BSP), which is comprised of a broad range of stakeholders from 53 organizations who are active in or have interest in the Beaufort Sea LOMA. This partnership led to the development of an Integrated Ocean Management Plan for the Beaufort Sea LOMA, which outlines a common vision for the LOMA. Within the plan, Goals, Objectives and Strategies were identified for each of the working groups. Numerous objectives in the Plan point towards the need to coordinate spatial data of the marine environment in order to implement Integrated Oceans Management and facilitate marine spatial planning.

Figure 1 – Beaufort Sea Large Ocean Management Area

The IOMP has numerous guiding principles, one of which is that 'decisions and recommendations are based on the best available information including Traditional Knowledge and Science'. The guiding principle identifies the need for a decision support tool that facilitates/enables decision makers to access data (especially spatial data) in a way that has been unavailable to date. The need for decision support tools has also been identified as a high priority by the Beaufort Sea Partnership Governance Working Group through the objective prioritization exercise in 2011. This type of tool requires a strong set of data to draw upon in order to conduct reliable analyses that will contribute to integrated regional planning and decision-making.

This need has been recognized in the past but has not been addressed because of two fundamental reasons:

1.) The inability of the Beaufort Sea Partnership to develop and maintain a server for spatial data

2.) The difficulty in soliciting information from data holders

Without a strong spatial data resource centre (also known as a data repository, data portal or data catalogue) decisions will continue to be made without the best information available; however, new technology and a common desire to share information makes the development of a spatial data sharing platform a real possibility for the future.

The Governance Working Group under the Beaufort Sea Partnership determined that the first step in making spatial information available was to host a workshop to bring together any and all interested parties from the Beaufort Sea Partnership, in particular member organizations that collect and/or use geospatial data as part of their regular operations.

A workshop was held to bring together stakeholders, other government departments, co-management groups and data holders for the purpose of discussing and determining how to share spatial data for the Beaufort Sea LOMA. It also addressed technical issues such as functionality requirements for a spatial data resource center and long-term sustainability of this project. The workshop was timely in that numerous organizations and stakeholders are in the preliminary stages of developing geospatial tools because they also require geospatial data to meet their business needs.

PRESENTATIONS

Opening Remarks: Steve Newton - DFO, Oceans Programs, C&A Region

Steve Newton, Oceans Division Manager, Central and Arctic Region welcomed participants to the workshop. The broader context of the workshop was discussed including the role of the Oceans Program, the Beaufort Sea LOMA and the IOMP. The purpose of the workshop was put into the context of the IOMP priorities and current ongoing related initiatives in the Beaufort Sea.

Coordinating Geospatial Information in the Beaufort Sea: Leah Brown – DFO, Oceans Programs, C&A Region

Leah Brown discussed the reasons for having a workshop to look at developing a spatial data sharing platform for the Beaufort Sea Large Ocean Management Area. The workshop objectives were reviewed:

- To highlight ongoing and potential geospatial initiatives for the Beaufort Sea

- To determine the requirements and functionality needed to overcome the current barriers to data sharing
- To decide on the 'best options' for sharing and coordinating spatial information for the Beaufort Sea
- To develop a roadmap for the 'best options' and create a recommendation for the RCC

Arctic Spatial Data Infrastructure - a Conversation: Cameron Wilson – Natural Resources Canada (NRCan), Ottawa

Cameron Wilson highlighted the international and national context of discovering, sharing and integrating spatial information via Spatial Data Infrastructures. The Arctic Spatial Data Infrastructure has domestic and international implementations.

The International Arctic Spatial Data Infrastructure (Arctic SDI) is led by 8 national Mapping agencies with linkages to Arctic Council. Canada will be chairing Arctic Council in 2013-2015 with the theme "Development for the People of the North". After which, the United States will be the chair for two years. It is anticipated that Arctic SDI will be chaired by Canada (NRCan lead) in order to facilitate co-ordination with Arctic Council during Canada's tenure as chair (CanNor/DFAIT leads).

Canada's domestic Arctic Spatial Data Infrastructure (ASDI) is the northern component of the Canadian Geospatial Data Infrastructure (CGDI). The pillars of CGDI include authoritative data, access standards (Web Services Architecture), supportive policy and governance. The CGDI pillars complement and enhance the Government of Canada's (TBS lead) Open Government, "open data, open information, open dialogue", and Information Management policies.

The Canadian ASDI study produced a comprehensive account of initiatives to establish a baseline of existing information. The study also produced recommendations for opportunities for future pilot projects. The results of the study were based on a comprehensive review of 180 documents and numerous interviews. The results can be summarized as follows:

- There are widespread needs for geospatial information to meet the Government of Canada's Arctic policy priorities.
- While data currently exist to meet these needs, efforts in geospatial data production are fragmented, standards are rarely employed, and access to available data is difficult.
- There is interest in the Canadian ASDI initiative within the user community, and there appears to be reasonable prospects for partnering to make it happen.
- Development of the Canadian ASDI will need to address a number of key challenges, including: complexity in terms of data needs; applications and business drivers; heterogeneity in available data quality, coverage, scale, etc.. Barriers to data sharing include: existing portal structures, internal policies, the project nature of the many datasets, and dependence on other initiatives to move forward.
- The best chances for success will be to adopt a much more focused approach, with emphasis on a few priority datasets linked to the needs of a priority group of stakeholders and applications.

Canadian ASDI is based on the governance of the Federal Committee on Geomatics and Earth Observation (FCGEO). The FCGEO DFO representative is Jody Thomas (DFO-MPO ; Deputy Commissioner, Operations; DCO-DCO) and DFO representatives are encouraged to convene. The policies and technologies under development by FCGEO's Federal Geospatial Platform (FGP) are symbiotic with ASDI architecture, standards and data. The Federal Geospatial Platform co-ordinates with Shared Service Canada (SSC) on emerging Federal Cloud (SaaS) and server consolidation initiatives. The Arctic SDI is based on principals which include the partnership model; ensuring integration and

linkages with other northern agencies, incremental development, and leveraging existing data, infrastructure and resources across multiple agencies.

Summary of Presentation

Products / Services:	Software Used	Standards	Application to BSP	More Information
• Arctic SDI Study o Baseline status of Arctic Data o Recommendations for Arctic SDI • Strategic policy and partnership development • Data and Standards use cases	Standards based connections between software & data environments	• ISO TC-211 19115 Metadata std • Open Geospatial Consortium specs (WMS, WFS, WCS, WPS, etc.) • Other defacto or domain specific stds.	• Government of Canada enterprise level IM/IT • Can help prioritize data, access & interoperability • Designed to work in heterogeneous, multi-jurisdictional environments	http://www.gcpedia.gc.ca (Note: hyperlink takes you to correct page in GCPedia)

Marine Cadastre - The Role of NRCan: José M'Bala – NRCan, Ottawa

The Surveyor General Branch's (SGB) mandate is derived from the Canada Lands Surveys Act which stipulates that the Surveyor General, subject to the direction of the Minister, has the management of surveys under this Act and the custody of all the original plans, journals, field notes and other papers connected with those surveys.

This has led the SGB to focus on its main activities:

- Survey Regulation
- Cadastral Information Management
- Survey Contract Management Services
- Advice & Consultation Services

The SGB of NRCan believes that the establishment of an integrated multi-purpose cadastral infrastructure framework is the foundation for integrated management in the offshore. A marine cadastre for Canada's oceans could be a core element for the integrated management of the marine region and for the sustainable development of ocean resources and the realization of their full value.

The increasing human activities in the ocean space (protection of some marine areas, navigation, pipelines and cables, conservation areas, oil and gas, aquaculture, fishing, renewable energy projects, mining, etc.) requires an integrated approach to balance competing demands. The common unifying element to these various management regimes is the geospatial component, which is key to a Marine

Cadastre. The cadastral data will be a layer in the CGDI (Canadian Geospatial Data Infrastructure) as are bathymetry, hydrography, natural habitat, etc.

The marine cadastre is to be understood as an inventory of:

- The all-recognized rights
- The extent of interests, and
- The rights holders

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• Multi-purpose Cadastre • Cadastre GIS layer	software independent	• Canadian Geospatial Data Infrastructure	• Utilize existing layers • Multi-purpose cadastre model	http://www.nrcan.gc.ca/earth-sciences/geography-boundary/boundary/modernization-cadastral-systems/11129

Marine Cadastre Complexity of Jurisdictions and Rights : Kian Fadaie – CHS, Ottawa

Kian Fadaie discussed the complexities of a Marine Cadastre and spatial data infrastructure while touching on the roles of both DFO and the Canadian Hydrographic Service (CHS). She discussed the potential for a marine cadastre in the Beaufort Sea, as well as future directions for the program.

A marine cadastre is basically a marine information system in which the primary information held relates to rights and interests (along with related restrictions and responsibilities) to marine spatial extent. A multipurpose marine cadastre, on the other hand, is supported by SDI and also includes: boundary delineation, the identity of entities with statutory consent (i.e. those assigning rights & interests), scientific and other information (e.g. geology, hydrography, biology etc.), and marine-related information that has boundary implications.

Kian Fadaie discussed the technical requirements for a Marine SDI, and the fundamental data sets that would be required. She identified the role of DFO and gave examples of the various types of data collected by CHS and how it is used.

CHS is involved in the development of a strategic plan and roadmap for Canada's Arctic SDI and Marine Cadastre component, the objectives of which are to:

- Establish initiatives that could leverage a Canadian Arctic SDI including the marine cadastre component.
- Establish geospatial information requirements and gaps.
- Provide key elements of a strategic framework.
- Develop a roadmap; and
- Provide recommendations for pilot projects

A Marine Cadastre in the Beaufort Sea would provide an integrated view of geospatial data regarding off-shore oil rights and the complexities of uses, changing conditions and multiple rights. The Marine Cadastre could evaluate cost and benefits, impacts, challenges, risks and opportunities while facilitating partnerships and maintaining the Territorial Sea Baseline (article 76). This would require a governance

structure, vision, infrastructure, resources (not only monetary but human resources as well) and standards.

CHS will continue to research topics related to the Marine Cadastre by addressing questions such as: 'What systems are out there?' and 'what data is out there?'. In addition, CHS will maintain their involvement in the various national geomatics groups and initiatives.

Questions Comments and Responses

- Although the Department of Fisheries and Oceans charges for access to their marine charts, there are agreements with other departments for restricted use at no charge.
- Historically, the Arctic has always been a lower priority area to update charting because of the relatively little marine traffic and vessel accidents. CHS is now changing their level of practice because of the increased priority of the Arctic for the Federal Government.

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• Planning and research for SDI and Marine Cadastre • Committee representation	CARIS	• Canadian Geospatial Data Infrastructure • ISO19115 (Chart Metadata)	• Data awareness • Information regarding legal boundaries	http://www.nrcan.gc.ca/earth-sciences/geography-boundary/boundary/modernization-cadastral-systems/11129

GNWT Tools: Rick Wind – GNWT, Yellowknife

Rick Wind gave a presentation on behalf of the Government of North West Territories (GNWT) highlighting the functionality of their Geoportal initiative. The Geoportal is an information repository which has a search and share tool that allows users to both access data and reports as well as contribute by uploading research and monitoring information. The GNWT has partnered with Aboriginal Affairs and Northern Development Canada (AANDC) to create a portal that was not completely federally run. The metadata portal allows users to seek out information on a specific topic and access it by linking to it, if a link is available. However, recipients of funding from the GNWT have are obligated to submit their findings to the portal for sharing. The focus of the portal is on cumulative effects and tracking, which aligns with the BSP objectives. It is unique in that it is user driven.

Questions Comments and Responses

- The majority of the portal holds data from government and researchers. Industry is cautious to share any information that may give up a competitive advantage. The GNWT is currently working on expanding their audience.
- It is believed that the Government has around 4,500 data portals right now. In the next couple years they want to shrink to 500 portals in anticipation of saving millions of dollars.
- A geomatics center is going to be established in the near future in Inuvik.

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• Data Portal	ESRI ArcGIS Server	• ISO19115 (Metadata) • WMS	• Data Catalogue and Portal technology • Funding model	http://www.geomatics.gov.nt.ca/data.aspx?node=data

ArcGIS Online: Sarah Garner/Scott Labonte – ESRI, Winnipeg

Esri is a global brand with more than one million users around the world. Sarah Garner and Scott Labonte, from Esri Canada, spoke about the functionality of the ArcGIS software and gave a demonstration. First, Scott Labonte gave a background on the company and highlighted its usefulness for facilitating the dissemination of spatial information.

With the ArcGIS Online program users are able to work and collaborate with numerous organizations. It is a simple to use technology that allows multiple users, mobile devices, desktop environment and a web browser. It uses cloud-based technology which eliminates the need for one organization or individual to manage the data. For cases like the Arctic where individuals or organizations may be reluctant to share data because of the inability to control how it will be used, security measures can be put in place to ensure the data is used only for its intended purpose. Tools are designed around spatial data and can make the application relevant to your organization.

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• Cloud-based collaborative content system	ESRI ArcGIS Online	Determined by user	• multi-agency • cloud- based technology • easy-to-use	http://www.arcgis.com/home/

Beaufort Sea Regional Environmental Assessment: Tara Paull – AANDC, Ottawa

Tara Paull, Northern Petroleum and Mineral Resources Branch, Aboriginal Affairs and Northern Development Canada, is the chair of the Beaufort Sea Regional Environmental Assessment (BREA) Information Management Working Group. She spoke about the Information Management working group, linkages to this project, challenges and next steps. After a brief overview of the oil and gas leases in the Beaufort Sea, the goals and objectives of the BREA project were discussed.

Tara Paull described the Information Management working group's objectives, work with the Polar Data Catalogue, the BREA website and data. The BREA website is a 'one-stop-shop' for all BREA-related information. It provides links to BREA metadata, data, and publications. The Polar Data Catalogue houses BREA metadata and data,. The PDC is a good example of a tool for sharing metadata and data. Although there are a number of tools and technological solutions currently available for sharing spatial information, the challenges exist in: data management, finding a common place to share information, reluctance to share information, and poor understanding of the technology. It was suggested that more education and information on data management and sharing is needed as well as the willingness and resources to implement existing technologies.

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• BREA website • Polar Data Catalogue (metadata and data)	Unknown	FGDC (Metadata) (Note: PDC is moving toward implementing ISO standards)	• Metadata catalogue (PDC) • Data warehouse (PDC) • Data Policy • Contains data required by partners • Similar challenges for data sharing	www.BeaufortREA.ca http://www.polardata.ca/

Geospatial Information in Support of Oceans Management: Léa Olsen – DFO, Ottawa

On behalf of the Oceans Policy and Planning Branch, Ottawa, Léa Olsen presented an assessment of geospatial information for Oceans Management. The current context of oceans management was discussed and an East Coast example was highlighted to show the use of geospatial information in oceans management.

Numerous maps were shown including: marine conservation measures, fisheries intensity and distribution, marine shipping intensity, emerging marine economic activities and aquaculture sites. These layers were then overlaid to highlight the potential conflicts between ocean users. The resulting map emphasized the need for geospatial analysis in decision making. Existing internal and external platforms for sharing spatial information and decision making were discussed along with the use of risk assessments as a tool for aiding decision making.

From a national perspective, the requirements for moving forward with spatial data sharing include an integration of datasets, the delineation of a spatial framework, a data validation process, and the development of best practices for data analysis, visualization and metadata. Best practices/methodologies for tools to delineate areas and for modeling and forecasting is also a requirement. The next steps for the National Oceans Policy and Planning Branch include a workshop in January 2013, which will seek to identify requirements for Ocean Management and planning needs over the next five years. Results from that workshop will feed into a national geomatics strategy document that will issue recommendations for meeting these requirements in support of oceans management.

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• Using geospatial information for decision making • Joint Oceans and Science (DFO) Workshop	ESRI (by data custodians)		• DFO support of oceans management • Information on data sharing resulting from the workshop	http://www.dfo-mpo.gc.ca/oceans/oceans-eng.htm

Geospatial Applications for Environmental Assessment and Oil Spill Preparedness in the Arctic: Jason Duffe – Environment Canada, Ottawa

Jason Duffe of Environment Canada spoke to the group about the work that his geomatics lab has been undertaking to develop of geospatial applications. The geomatics lab focuses on remote sensing, desktop GIS, mobile GIS and web mapping applications. Such web-based geospatial applications include: The

Northern Data Discovery Portal, Field Work/Project Planning, Emergency Response Applications, the BREA toolkit and The Beaufort Sensitivity Atlas.

The Northern Discovery GeoPortal allows scientists, decision makers and policy analysts to access a wide range of data via the web. Users of this portal do not have to be GIS-literate to display, explore and analyze different datasets. The geomatics group has taken an interactive approach to fieldwork by allowing real-time geospatial tracking of field studies. They are also working with the BREA Information Management working group to develop a BREA toolkit which will aid government, industry, Aboriginal groups, resource managers and public stakeholders in better understanding the geographic distribution of areas which are sensitive for environmental and socio-economic reasons in the face of economic development.

In addition, the toolkit will facilitate the exploration and visualization of data, the sharing and distribution of data, and the visualization of interactions between biological or socio-economic variables with economic development. It was acknowledged that although there are few technical limitations to sharing spatial data, issues such as coordination, adherence to standards and interoperability still need to be considered. It was recommended that data be stored, managed and updated by the responsible organizations and maximize use of existing data hubs such as the GNWT and the Government of Nunavut.

Questions Comments and Responses

A barrier to making the data available is policy and mandate. There is often no process for disseminating the data. Also, data is often not properly validated which makes it hard to get approvals to share. Some groups and individuals fear that their data will be ‘stolen’ or misunderstood.

Summary of Presentation

Products:	Software Used	Standards	Application to BSP	More Information
• Geoportal • BREA toolkit: data visualization and interactions	ESRI: ArcGIS Server	Tool dependent	• Data access model • Custom tools design for specific types of users	http://www.ec.gc.ca/scitech/default.asp?lang=En&n=F97AE834-1&xsl=scitechprofile&xml=F97AE834-A762-47A6-A2D9-9C397FD72F37&formid=E0AACF1E-B953-4C28-B84A-BA8869C1DC58

Beaufort Sea Atlas: Chris Harrison – IRC, Inuvik

Chris Harrison with the Inuvialuit Regional Corporation (IRC) in Inuvik highlighted the IRC’s involvement and interest in geospatial information sharing. He gave a background on the joint secretariat co-management body, the IRC and the Inuvialuit Final Agreement. In May 2012, a report funded by DFO was completed and made recommendations for future GIS work in the Inuvialuit Settlement Region (ISR).

In September 2012, the group submitted a proposal for funding to advance and integrate a GNWT and AANDC GIS application. This project aims to coordinate geospatial information through the IRC via a customized application for the ISR, working with GIS developers to make GIS available at the local level. It will promote knowledge at the local level and strengthen Inuvialuit participation. Next steps for the IRC include a literature review, cataloguing information, identifying user needs, identifying technical requirements and developing operational plans. Priorities for the application include:

- Customized to meet the user needs;

- Useable by non-GIS users;
- Limited access for secure information, and;
- The integration of science and Traditional Knowledge (TK).

Following this, the application would then be tested with the users prior to final deployment.

Summary of Presentation

Products:	Application to BSP	Geospatial tool guidance	More Information
• preliminary research for geospatial application development	• similar approach and needs	• User needs assessment required • Focus on science and TK • Usable by non-experts • Access controls	http://www.daair.gov.nt.ca/_live/pages/wpPages/Inuvialuit_Regional_Corporation.aspx

Decision Support Tools for Integrated Oceans Management Planning : Dan Slavik – WWF, Inuvik

Dan Slavik with World Wildlife Fund (WWF) Canada spoke to the group about decision support tools in the context of user needs, specific needs of the BSP and decision support tool functionality. After a brief overview of the results from the Spatial Tools for Arctic Mapping and Planning (STAMP) User Needs Assessment, Dan Slavik discussed the objectives of the Beaufort Sea Partnership as they relate to Decision Support Tools (DSTs). PacMARA in conjunction with the Center for Ocean Solutions produced a Decision Guide for selecting decision support tools for marine spatial planning. The document can be found at http://pacmara.org/decision-support-tool-guide. The functionality of decision support tools in relation to the generic steps of marine spatial planning were discussed and it was noted that in some cases more than one tool may be required.

Marxan with Zones and InVEST are two examples of decision support tools that can facilitate decision making in two uniquely different ways. Marxan with Zones is software designed to help marine planners with conservation planning. Using a number of data layers, Marxan will generate spatial MPA systems that achieve particular biodiversity and representation goals with reasonable optimality. InVEST, on the other hand, is a family of tools to map and value the goods and services from nature which are essential for sustaining and fulfilling human life. The tools allow users to work closely with stakeholders to ensure their needs and concerns are captured in the decision making process and allows for the analysis of the trade-offs between management plans. Additionally, users can compare land and marine environments in one tool. To close the presentation, it was noted that without an effective stakeholder process, decision support tools cannot be used to their full potential.

Summary of Presentation

Products:	Geospatial tool guidance	Application to BSP	More Information
• Decision Support tools for user needs	• Marxan with zones for marine reserve design • InVEST a suite of tools for mapping ecosystem goods and services • Collaboration with Alaskan based decision support tools	• For consideration post platform development	http://pacmara.org/decision-support-tool-guide

Sea Sketch: Evan Paul – University of California, California

Evan Paul, form the University of California, presented remotely on their decision support tool called Sea Sketch. It was explained how Sea Sketch evolved out of a previous decision support tool called Marine Map which was used for designing marine reserve systems in California. The McClintock Lab is now expanding on this tool with Sea Sketch. They are working collaboratively with Esri to sync technologies. Using Sea Sketch, anyone with a web browser and internet connection may design management plans, including MPAs, transportation zones, renewable energy sites and more. A demo of Sea Sketch was the given to highlight the usability of the program and the expansive functionality. Sea Sketch allows users to:

- Initiate a project by defining a study region.
- Upload map layers from existing web services.
- Define "sketch classes" such as prospective marine protected areas, transportation zones or renewable energy sites.
- Author sketches and receive automated feedback on those designs, such as the ecological value or the potential economic impacts of a marine protected area, and;
- Share sketches and discuss them with other users in a map-based chat forum.

This tool focuses on collaboration and partnership..
Summary of Presentation

Products:	Geospatial tool guidance	Application to BSP	More Information
• SeaSketch	SeaSketch allows users to: • Load, view and manipulate geospatial data • Collaborate online • Develop spatial plans	• Potential stakeholder engagement tool	http://www.seasketch.org/

The Alaskan Experience: Darcy Dugan – Alaska Ocean Observing System, Anchorage Alaska

Darcy Dugan, with the Alaska Ocean Observing System (AOOS), did a remote presentation on AOOS's web based data products. The presentation started with a description of the AOOS, their mandate and philosophy. This was followed by a demonstration of three maps/tools including a real-time sensor map, the Cook Inlet response tool and the research assets map. The Cook Inlet Response Tool is a data integration and visualization product designed to assist responders. It uses GIS spatial data layers, real time observations, modeled nowcast/forecasts for winds, waves and ocean circulation and 'ShoreZone' video imagery. Spatial Tools for Arctic Mapping and Planning (STAMP) is NOAA funded, interactive data tool to improve access and usability of Arctic data specifically for the Northern Bering and Chukchi Seas. The tool will include real-time data, biological data, forecasts, satellite imagery, physical characteristic and human use areas. The tool is designed for resource managers and planners, members of the public who want to provide input into decision making, and people interested in the Alaskan marine environment. STAMP is different from other data synthesis projects in that it integrates different data types, is designed to serve multiple types of users, captures changes over time, includes climate change projections and is web-accessible. Although STAMP is still in the development phase, a number of issues have been flagged for consideration including:

- The need to be cognizant about the technical capacity of agencies and partners.

- Issues among scientists with data sharing (even publicly funded data).
- Interoperability.

Darcy Dugan expressed an interest on behalf of STAMP to collaborate with the BSP through sharing Canadian/American data, sharing code and or expanding on research assets maps to include Canadian instruments.

Questions Comments and Responses

Darcy Dugan expressed a keenness to collaborate with the BSP through sharing datasets, tools and programs.

Summary of Presentation

Products:	Geospatial tool guidance	Application to BSP	More Information
• STAMP • Tool kit - real-time sensor map, Cook Inlet response tool and the research assets map	• Alaska has numerous tools for spatial resource management • Similar issues to data sharing • Integration of different data types and web-accessibility is key • Open to collaborating with the BSP	• Potential data collaboration via WMS • STAMP development plan	• http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma/arctic-erma.html • http://www.aoos.org/ • http://www.aoos.org/stamp/

BREAKOUT GROUPS
Introduction

Prior to the breakout groups, and due to the discussions during the presentations, the purpose of the breakout groups was reviewed. The discussion identified the questions the breakout groups should be addressing. The requirements/functionality of a spatial data sharing platform to meet the needs of the user group – the BSP– was discussed in detail.

The primary goal of this workshop was to decide how to make spatial information available for visualization and thus address the majority of decision making needs. The breakout groups identified barriers and opportunities to achieving this ambitious goal and proposed a roadmap for a pilot project for the Beaufort Sea. This roadmap would be shared with the Regional Coordination Committee for final approval in March, 2013.

Breakout Session One : Identifying barriers and opportunities to data sharing

The purpose of the first breakout session was to identify the barriers and opportunities to sharing spatial information for the Beaufort Sea. The room was divided into two breakout groups to discuss the pertinent issues. A participant from each group recorded the conversation and the key points. After the breakout group discussions, each group presented their findings to the larger group. The groups presented a comprehensive list of the main barriers (Table 1) to sharing spatial information for the Beaufort Sea and the potential strategies (Table 2) to overcoming these barriers.

Table 1. **Summary of barriers to sharing spatial information for the Beaufort Sea**

Barriers	Description of Barrier
Organizational compliance	If sharing spatial information is not part of an organization's priorities, it can be hard to acquire and share information at the ground level.
Lack of human resources	Time and effort is required to start the process of sharing spatial information, and as such human resources need to be allocated to the task.
Lack of awareness	Decision makers within the organizations holding data are not always aware of the importance of sharing spatial information.
Data quality	An example of poor data quality is the relatively few peer-review processes in place to vet spatial information.
Lack of metadata standards	Metadata standards provide a consistent approach to providing information about the data itself. Without this information data can be misused and/or under used.
Lack of an enterprise approach	Organizations that don't have an enterprise approach to organizing their GIS data often lack data integration and standards limiting the ability to acquire information.
Undiscoverable data	Situations exist where in-house data is collected but not shared with the larger group of stakeholders lack of engagement or lack of a collaborative governance process.

Table 2. **Strategies for overcoming data-sharing barriers**

Strategy	Description of Strategy
Identify which data sets are consumable	Determine and record which data sets are accessible via Web Mapping Services (WMS) or other accessible formats.
Conduct a pilot project	The purpose of which would be to: 1.) Show what is possible with a web-based platform. 2.) Identify more specific barriers to data sharing as well as potential solutions.
Increase communication and collaboration among stakeholders	Increasing the level of engagement regarding data sharing is a fundamental first step.
Place the data sharing responsibility on the organizations.	Foster data management practices within organizations to improve access to datasets that are relevant to multiple stakeholders.

To summarize, the results from the first breakout session highlighted the need for a clearly defined pilot project. Concern was expressed that a pilot would not lead to continued development of the initiative; therefore, it is critical that the pilot is scalable and facilitates future development. The pilot project should provide detailed requirements, feasibility, options and costs, based on a BSP user-case scenario. Considering the fact that not all information will be available right away, the pilot project will assess the feasibility of accessing and making available desirable data from various government departments of non-government organizations. The aim of the pilot will not be to explicitly address, with analysis tools, decision making processes within the Beaufort Seal but, rather, to make information available to aid in the decision making processes.

The pilot project will be two-tiered in that it will focus on the technical aspects of a data delivery system and review the governance aspects of controlling data accessibility. A major outcome of the pilot will be to test the ability to manage the data flow and to show potential for an online delivery system. In addition, it

will highlight challenges and opportunities for future development and determine a concrete way to move the initiative forward.

Breakout Session Two: Developing a Roadmap

The purpose of the second breakout session was to use the information from the first breakout session to clearly define a roadmap for a pilot project which would deliver a web-service-based solution for data discovery, sharing, access and integration for the Beaufort Sea Partnership. Again, the larger group was split into two breakout groups to discuss and define a 'roadmap'. Once completed, the breakout groups presented their findings to each other. Not surprisingly, both groups had very similar roadmaps with similar criteria for the delivery system. After Group One presented their roadmap Group Two simply presented some of their ideas which could fill in the gaps. A plenary discussion followed to confirm the aspects of each breakout group which would contribute to the final roadmap and proposal for the RCC.

The recommended pilot project will consider the following factors:

1.) Storage. The pilot should evaluate the criteria for storage solutions for data holders that are not currently storing their information in an accessible manner.
2.) Traditional Knowledge. The importance of making Traditional Knowledge accessible was highlighted as a key feature of this platform.
3.) Web Services. This pilot should use web mapping services to discover, share and access spatial data via the web.
4.) Metadata standards. Standards for metadata are required to ensure the data is properly understood by its users. Data quality, source, use constraints, and other information is documented in a format that is easily integrated into spatial platforms (web or desktop). Metadata will allow users to search the database of spatial information for specific criteria.
5.) Usability. The interface of the pilot should be simple and user friendly, allowing both technical and non-technical users to access the information they require.
6.) Branding. Once developed, the pilot and its utility will need to be communicated to potential users.
7.) Administrative control. The pilot project should consider that not all data will be open to the public. Access controls should be in place to ensure secure datasets are shared only with the identified users. This type of access control will give users the comfort of contributing their data, knowing that it will not be accessed by everyone unless they chose to make it available.
8.) Cost. The development and maintenance costs of the system must be considered and kept as low as practically possible.
9.) Federal Committee on Geospatial and Earth Observation. The Government of Canada is currently working on developing a platform with similar objectives to the pilot project described above. It will be important to make sure that the development of this platform is aligned with the Canadian Government's platform to ensure interoperability.

A fundamental outcome of the pilot project is to make information available while building capacity within individual organizations to manage and maintain their data. The strategies to do this include:

1. Develop Best Practices for sharing information
2. Establishing data sharing agreements or Memorandums of Understandings when required
3. Resourcing special projects for essential data that is currently inaccessible

In addition to a pilot project, two fundamental aspects of a sustainable and operational delivery system were recommended for the near future. First, conduct a user needs assessment to look at the requirements of the delivery system that will facilitate current decision making processes in the Beaufort

Sea LOMA. A user needs assessment would be done by canvassing members of the BSP who are currently responsible for making decisions. Second, undertake a data inventory and assessment to categorize and document the state of existing spatial data. This assessment will include an evaluation of the data according to the (1) data quality, (2) accessibility and (3) compatibility.

(1) Data quality reviews will examine the source, date, peer-review process and metadata.

(2) Data access can be appraised by determining the availability of metadata, online access, cost, licence agreements, service level agreements, and frequency of updates.

(3) Compatibility refers to the ability of data to be in more than one place at a time and its interoperability which requires consistent design, format and metadata.

To summarize the breakout session, Group One recommended ArcGIS online and Group Two suggested Environment Canada's geospatial tool (http://geomatics.nwrc.carleton.ca) as a delivery model for the pilot project. It was acknowledged that the tool would need to enable organizations to take responsibility for their data. Both groups agreed with the delivery model shown in Figure 1, which shows the flow of data from the data holders to the users. The proof of success will be an indication of an improved decision making process, and there will need to be a way to measure this. Traditional Knowledge will be a key part of this project as enabling access to this important source of information will greatly improve the efficiency of making decisions.

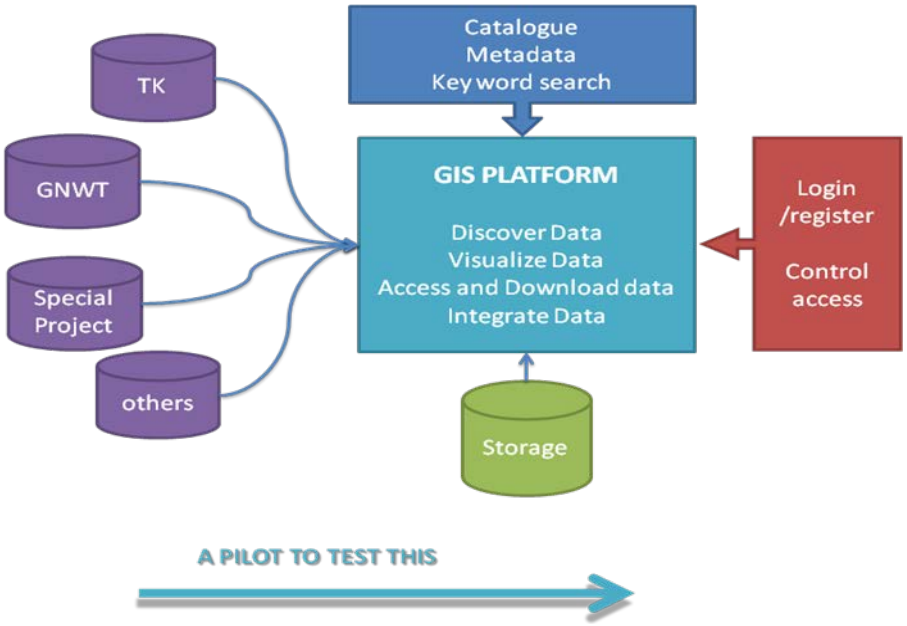

Figure 2. Pilot project for a spatial data delivery system

The next step will be to create a two page summary of the pilot project and take it to the RCC for approval. The pilot project will include: 1.) the development of a framework or best practices required for making inaccessible data accessible and 2.) a web-based map visualization platform.

ROADMAP

Phase 1

1. Using the criteria and functionality required for the platform clearly map out options for implementing the pilot project (ArcGIS online; An Expansion of Environment Canada's BREA data access system; or an independently developed system).
2. Present the options to the RCC in March 2013 for decision.
3. Form a Beaufort Sea Geomatics Task Group to help guide the pilot project.

Phase 2

4. Identify acritical integrated management question where the availability of a spatial data sharing platform would improve the decision making process.
5. Begin drafting and using Best Practices for sharing spatial information.
6. Identify the key data sets needed to answer this question (determine which are accessible in the required format and which are not).
7. Develop platform and make the currently accessible data available.

Phase 3

8. Of the key data sets that are not accessible (in the required format), collaborate with the organizations holding the data to make the data available.
9. Develop Best Practices and lessons learned for making the data accessible and determine level of effort.

Phase 4

10. When inaccessible data becomes available, incorporate it into the platform.
11. Educate the BSP on the use of the system.

CONCLUSIONS

The result of this workshop is a recommendation to the RCC to conduct a pilot project. The purpose of the pilot is to create and test (1) a framework and best practices for making inaccessible data accessible and (2) a web-based map visualization platform for decision support. The pilot will be developed by addressing a specific integrated management decision relevant to the Beaufort Sea Partnership. It will focus on data sharing and making inaccessible data available, as well as enabling data holders to maintain control of and share their information. The group of experts that attended the workshop acknowledged the need to ensure linkages to the numerous ongoing geospatial initiatives in the Beaufort Sea and to continue to work with the Beaufort Sea Partnership to assess user needs and functional requirements.

The meeting was successful in:

- Developing relationships between partners interested in sharing geospatial information about the Beaufort Sea.
- Understanding the main barriers to sharing spatial information.
- Gaining agreement on the functionality and requirements of a data sharing platform.
- Identifying Traditional Knowledge as a key layer and information source for decision making.
- Increasing awareness of Arctic spatial sharing initiatives (e.g. EC, GNWT), and;
- Developing a “roadmap” for a pilot project to share geospatial information in the Beaufort Sea LOMA.

The next step is to prepare a recommendation for the RCC in a face-to-face meeting in March 2013, based on the results of this workshop. Following approval from the RCC, it is recommended to conduct a one-year pilot project using a web based platform to share geospatial information in the Beaufort Sea.

ANNEX 1

Recommended Geospatial Data Sets to Include in Final Data Sharing Platform

Data / Information	Source
Ice coverage and type	EC – Ice Service and CCRS
Marine mammals: presence, feeding, movement, avoidance	DFO, Academic
Fish populations, timing, breeding cycles	DFO, HTC, FJMC
Bottom habitat	NRCan, CHS
Depth, bathymetry (20-600m)	CHS, NRCan, ArcticNet
Oceanography / currents	
Water turbidity / transparency	
Impact of noise	
Temperature	
Community statistics and Traditional Knowledge	
Vessel traffic	TC
Harbour impacts (traffic, fuel storage) and effects on people and environment.	
Polar Bears	EC
MPA's	DFO, Parks, EC, NWT, YG
Socially and Culturally Important Areas	
CEAA registry data	CEAA
Polynyas	Canadian Ice Services
Mineral listings	NWT
Oil and Gas leases	AANDC
Community Conservation Plans	Joint Secretariat
Arctic Marine Workshop	DFO
Ecologically and Biologically Significant Areas	DFO

ANNEX 2

Meeting Participants

Organization	Participant	Role
Fisheries and Oceans Canada	Steve Newton	Presenter
	Carolyn Bakelaar	Participant
	Andrew Lewin	Participant
	Lèa Olsen	Presenter
	Tamara Grant	Notes
	Scott Coffen-Smout	Participant
	Sergio Ieropoli	Participant
Canadian Hydrographic Services	Kian Fadaie	
Inuvialuit Regional Corporation	Chris Harrison	
Natural Resources Canada	Cameron Wilson	Presenter
	Jose M'Bala	
Government of the Northwest Territories	Rick Wind	Presenter
ESRI (this is not an acronym)	Sarah Garner	Presenter
Fisheries Joint Management Committee	Burton Ayles	Participant
Aboriginal and Northern Development Canada	Tara Paull	Presenter
Environment Canada	Jason Duffe	Presenter
World Wildlife Fund	Dan Slavik	Participant
Transport Canada	Wasif Kamal	Participant
National Energy Board	Justina Krynski	Participant
Alaska Ocean Observing System	Darcy Dugan	Presenter
University of Santa Barbra	Evan Paul	Presenter