Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

C S A S | ***S C C S***

Canadian Science Advisory Secretariat | **Secrétariat canadien de consultation scientifique**

Proceedings Series 2011/036 | **Compte rendu 2011/036**

Quebec, Newfoundland and Labrador, Maritimes and Gulf Regions | **Région du Québec, de Terre-Neuve et Labrador, des Maritimes et du Golfe**

Zonal Science Advisory Process on the 13th Annual meeting of the Atlantic Zone Monitoring Program (AZMP)

March 22 - 24, 2011
InterContinental Hotel
Montreal, Quebec

Meeting Chairperson:
Jacques A. Gagné

Processus consultatif scientifique zonal portant sur la 13e réunion annuelle du Programme de Monitorage de la Zone Atlantique (PMZA)

Du 22 au 24 mars 2011
Hôtel InterContinental
Montréal, Québec

Président de réunion :
Jacques A. Gagné

Maurice Lamontagne Institute
850, Route de la Mer, C.P. 1000
Mont-Joli, Quebec, G5H 3Z4

September 2011 | **Septembre 2011**

Foreword

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

Avant-propos

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

Proceedings Series 2011/036

Quebec, Newfoundland and Labrador, Maritimes and Gulf Regions
National Capital Region

Compte rendu 2011/036

Région du Québec, de Terre-Neuve et Labrador, des Maritimes et du Golfe
Région de la Capitale Nationale

Zonal Science Advisory Process on the 13th Annual meeting of the Atlantic Zone Monitoring Program (AZMP)

March 22 - 24, 2011
InterContinental Hotel,
Montreal, Quebec

Meeting Chairperson:
Jacques A. Gagné

Processus consultatif scientifique zonal portant sur la 13e réunion annuelle du Programme de Monitorage de la Zone Atlantique (PMZA)

Du 22 au 24 mars 2011
Hôtel InterContinental
Montréal, Québec

Président de réunion :
Jacques A. Gagné

Maurice Lamontagne Institute
850, Route de la Mer, C.P. 1000
Mont-Joli, Quebec, G5H 3Z4

September 2011

Septembre 2011

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

Published and available free from:
Une publication gratuite de :

Fisheries and Oceans Canada / Pêches et Océans Canada
Canadian Science Advisory Secretariat / Secrétariat canadien de consultation scientifique
200, rue Kent Street
Ottawa, Ontario
K1A 0E6

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

CSAS-SCCS@DFO-MPO.GC.CA

Correct citation for this publication:
On doit citer cette publication comme suit :

DFO. 2011. Zonal Science Advisory Process on the 13th Annual meeting of the Atlantic Zone Monitoring Program (AZMP) ; March 22-24, 2011. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2011/036.

TABLE OF CONTENTS

SUMMARY

The Atlantic Zone Monitoring Program (AZMP) was implemented in 1998 with the aim of collecting and analyzing the biological, chemical, and physical field data that are necessary to (1) characterize and understand the causes of oceanic variability at the seasonal, interannual, and decadal scales, (2) provide multidisciplinary data sets that can be used to establish relationships among the biological, chemical, and physical variables, and (3) provide adequate data to support the sound development of ocean activities. AZMP scientists meet annually to review the activities of the Program and assess business, operational and logistic issues that need regional/zonal intervention, or that must be brought to the attention of the DFO Atlantic Science Directors Committee. 2009 marked the 10th anniversary of ocean observation by AZMP. In March 2010 AZMP scientists initiated an effort to synthesize and integrate the oceanographic conditions observed in the Atlantic Zone since 2000, identify trends or changes, and provide a critical assessment of the information available. In 2011, they reconvened in Montreal from March 22 to 24 to discuss logistic and operational issues, review recent oceanographic conditions within the zone, update the plans for the integration and synthesis exercise, and finalize the workplan for the current year.

SOMMAIRE

Le Programme de monitorage de la zone atlantique (PMZA) a été mis en œuvre en 1998 afin de recueillir sur le terrain et analyser les données biologiques, chimiques et physiques nécessaires pour : 1) caractériser et comprendre les causes de la variabilité océanique à des échelles saisonnières, interannuelles et décennales; 2) constituer des ensembles de données multidisciplinaires qui peuvent servir à établir des relations entre les variables biologiques, chimiques, et physiques et 3) fournir des données adéquates pour assurer la développement soutenable de projets en milieu marin. Les scientifiques du PMZA se réunissent annuellement pour revoir les activités du Programme et identifier les enjeux relatifs à ses opérations et à la logistique qui requièrent une intervention régionale/zonale ou qui doivent être portés à la connaissance du Comité des directeurs des sciences de la zone atlantique du MPO. Le PMZA a complété sa première décennie d'observations océaniques en 2009. En mars 2010, les scientifiques du Programme entreprirent de synthétiser et d'intégrer les conditions océanographiques observées dans la zone atlantique depuis 2000, d'identifier les tendances ou les changements survenus et d'effectuer une évaluation critique de l’information disponible. Ils se sont réunis à nouveau à Montréal du 22 au 24 mars 2011 pour revoir les enjeux logistiques et opérationnels, discuter des conditions océanographiques récentes dans la zone, évaluer la progression des efforts de synthèse et d'intégration et finaliser le plan de travail pour l'année en cours.

SESSION 1 - BUSINESS ISSUES

22 MARCH 2011

AZMP REGIONAL ACTIVITY REPORTS (Rapporteur: M. Mitchell)

The regional representative for each of the three main regions delivering the AZMP presented a brief summary of activities and issues relevant to their specific region.

Newfoundland and Labrador Region

G. Maillet

Abstract

A total of 19 complete occupations were achieved at Station 27 along with 41 vertical CTD/XBT profiles in 2010. All months were sampled for CTD, plankton nets, and Niskin water sampling with the exception of January and February. The lack of winter sampling at Station 27 is due to the lack of available science platforms. All seasonal oceanographic surveys were completed in 2010 with good spatial coverage, although small portions of the main sections were not completed due to vessel delays and weather and equipment related issues. Processing of 2010 biochemical samples is nearing completion. The spring and fall multispecies along with single species assessment missions provided good spatial and temporal coverage across the Grand Banks, Newfoundland and Labrador Shelf in 2010. Occupations of our fixed station by ships of opportunity continue to provide important seasonal coverage in 2010. Some of the significant issues encountered during 2010 included CTD equipment and sensor failure and shortage of field personnel. Standardized quality checks and more timely data delivery to ISDM and data submissions to the national database (BioChem) need to be addressed. An urgent recommendation for replacement of field and laboratory equipment was made in order to ensure continuity of the monitoring program and efficient processing of biochemical samples. Continued funding pressures on the monitoring program due to increasing inflationary costs and branch tax on budgets do not permit equipment renewal, which may result in potential mission failures.

Québec region

L. Devine

Abstract

Very poor coverage of the Anticosti Gyre (AG) and Gaspé Current (GC) stations was achieved; there were only four dedicated sorties early in the year (Jan, Feb, March). In addition, AG was sampled during the helicopter survey (March), and both stations were sampled during the AZMP transect missions in June and in November. Ten sorties scheduled throughout the year were cancelled to save funds as a result of Science overtime funding issues. The stations were not sampled during the August multi-species survey. Good coverage was achieved, as usual, at the Rimouski station (Riki; 29 sorties from mid-March to the end of November).

All sections were adequately sampled during the dedicated June and November surveys.

Overall, the field sampling was worse than usual at the fixed stations, excellent at the Rimouski station and as good as usual for the spring and fall sampling of all transects.

Concerning the status of sample analysis for all AZMP stations (AG, GC, Riki; spring and fall surveys) it was reported that chlorophyll, nutrients, and zooplankton samples have been analyzed, quality controlled (QCed), and archived; phytoplankton samples have not been analyzed for lack of an expert taxonomist.

The report also presented a list of personnel directly involved in AZMP activities and gave an overview of other programs that provide additional data outside of the AZMP program (mackerel egg survey, toxic algae monitoring program, multi-species survey, thermograph network, zooplankton biomass, March helicopter survey, shipboard thermosalinograph, optical buoys).

Challenges for 2011 include improving fixed station sampling frequency and improving support for the phytoplankton program.

Maritimes region
J. Spry

Abstract

In the Maritimes region, the core programs include the fixed stations (Halifax-2, Prince-5, Shediac) and seasonal transects. Fixed stations were sampled with the same frequency as in recent years; although doing so at the Shediac station remains a logistical challenge. Transects were occupied in spring and fall of 2009 but only in the spring of 2010. A 2 month lay-up of the main platform, CCGS Hudson, resulted in our fall mission being completely cancelled such that any data we acquired (Halifax & Cabot lines) came from the Institut Maurice-Lamontage (IML) survey mission that departed from BIO later in the season than usual. Sample analysis was completed in timely fashion for the physical/chemical results but the biological (phytoplankton and zooplankton) results will not be available until the end of March 2011.

The core Maritimes programs are complemented by a set of other regional programs which are funded through other sources and provide additional spatial and temporal coverage and complementary measurements. These programs were all ongoing in 2009 & 2010 and include:

CPR – continuous plankton recorder,
Bioness Krill survey,
Labrador Sea mission,
AZOMP – off-shelf Halifax Line – joint mooring program,
Ecosystem trawl surveys,
Bedford Basin monitoring,
MVP – moving vessel profiler (towed body was lost during a 2010 survey),
LTTMP – long term temperature recorder program,
Seabird survey (Environment Canada, Canadian Wildlife Service (CWS)).

The Maritimes O & M budget was able to meet the essential day to day expenses of the 2010 fiscal year but the funding provided to AZMP has not increased since program inception in 1999 while costs have increased considerably. Equipment and instrumentation show significant signs of wear. Maintenance and upgrading will require other sources of funding.

Next fiscal year will bring significant challenges as funding pressures will likely impact our ability to continue provide the datasets and information required for advice.

Discussion

Much concern was expressed on the lack of resources to properly analyze the samples collected (e.g. phytoplankton, zooplankton). It was suggested that AZMP should consider incorporating newer technologies to facilitate these analyses. Such technologies include instruments such as *FlowCam* and plankton counters to obtain coarse level taxonomic identification. These instruments require a dedicated well trained operator and at present the program does not have the available personnel. Furthermore, these instruments do not provide the same detailed information as our current analysis. Before investing into these instruments, funds need to be identified to do an assessment of the value to AZMP of the data that can be obtained from these technologies.

A strategy needs to be identified very soon, as preserved phytoplankton samples have limited storage life. Already the Newfoundland and Labrador region has disposed of some earlier samples.

Finally, it was noted that the flow of profile data from the surveys is too often not as timely as it should be. The TESAC data from the surveys should be forwarded to ISDM much sooner after the missions than is currently done.

REMOTE SENSING UPDATE
C. Caverhill

Abstract

All of the remote sensing datasets provided by BIO are up to date, except Pathfinder Sea Surface Temperature (SST) which is available up to the end of 2009. There was a gap in MERIS data availability from October 22-27, 2010 during which the satellite's orbit was lowered in order to save fuel. This will extend the mission for three more years. The SeaWiFS ocean colour sensor stopped functioning on December 11, 2010, the end of a very successful mission which began August 1, 1997.

New accomplishments from BIO's remote sensing unit in 2010 include: porting of processing to Macintosh computers, availability of data in GEOTIFF format, anomaly maps for SST and chlorophyll, extended North Atlantic maps for SeaWiFS 4km data, and primary production maps updated to 2004. It should be noted that the image map projection has changed from Mercator to Cylindrical Equidistant.

A monitoring program in Bras d'Or Lakes was started in April 2009 as collaboration between Edward Horne, Cape Breton University (CBU) and the Unama'ki First Nation community. Two of the five stations are sampled monthly by either CBU or the Unama'ki, making every effort to coordinate sampling times with MERIS overflights. Sampling follows AZMP protocol and is done more frequently during spring bloom. A reduced sampling program at the other three stations is carried out by Edward Horne when possible. A time series plot of MERIS algal2 for 2010 shows a spring bloom peaking in late April.

BIO is subsetting MERIS FR (300 m resolution) data into various subregions of interest around Nova Scotia, Newfoundland and in the Gulf of St. Lawrence. Several ocean colour products are being produced and will be evaluated against *in situ* data, where available. Images and statistics will be available for each subregion, when the processing is finished.

A brief summary was given of the National Data Stream meeting which was held in Montreal on March 21, 2011. This is the last year of a four year Canadian Space Agency (CSA) Data Stream project which includes both SST and ocean colour. A summary of the first four years and a plan for the next 4-year proposal were outlined. SST data are now available for all Canadian waters on the St. Lawrence Global Observatory (SLGO) website http://slgo.ca/en/remotesensing/data.html. A proposal is being submitted to provide chlorophyll data with the same coverage as SST data on the SLGO website. A basic chlorophyll data set has been prepared as proof of concept. There are plans for the next four years to provide numerous ocean colour products, some valid for all Canadian waters and others at a finer resolution that will have region-specific products.

The remote sensing unit at BIO had a very successful year, with a lot of accomplishments. This was only possible because of CSA funding which was used to hire casual employees.

Discussion

The SST climatology is based on the period starting in 1999. An alternative would be to use data starting in 1997 as is done with other physical data sets. It was noted that other biological climatologies are based on the period starting in 1999 when the program started, and that adding two years would not add much information. It was therefore decided to continue using the period starting in 1999.

There are little resources for further development. It will be possible to continue generating standard products, but any new development is strictly dependant on new funding. It would be possible to merge the SeaWiFS and MODIS data sets but this has not yet been initiated. Similarly, creating a diatom index would be a useful product, but new resources are required.

STATUS OF AZMP FIELD AND LABORATORY RESOURCES (Rapporteur: M. Mitchell)

A main element of the AZMP is the observation program. Quality observations are key to the success of this program. Ocean observations continue to rely on *in situ* measurements of key variables carried out by expert personnel using specialized instrumentation and equipment on research vessels. The AZMP was implemented over a decade ago as a minimal program to achieve ambitious goals. The program has been successful, but has never received any funding increase to offset inflationary operation costs. Consequently, the program is now suffering from the inability to properly maintain equipment and the risk of failure to delivering some key components.

Equipment

There has been little funding available to maintain and replace the field and laboratory equipment required by the AZMP. Recent major capital projects have provided some funding to the DFO regions, but AZMP had limited success in applying these projects to its needs in light of competitions for the funds. In particular, the Newfoundland and Labrador region AZMP did not obtain any equipment from these projects. Consequently, much of the current AZMP equipment is in need of significant maintenance or replacement.

Furthermore, the program has found it difficult to carry out the analysis of some of the samples collected as a result of funding pressures and as a result of loss of expertise. A potential solution is to adapt technologies that would facilitate the analysis of samples. Instruments such as the *FlowCam*, and the *Laser Optical Plankton Counter* might provide information of value and

reduce the need for detailed analysis of all samples. An assessment of the value of these data needs to be carried out.

An important driver for these issues is that the AZMP baseline budget has not increased in over 10 years of the program. Different regions have addressed the budgetary shortfall by abandoning complementary programs or by reducing the number of surveys carried out. All regions have seriously limited upgrade and maintenance of equipment, such that equipment is frequently failing. Pressure is such that we will need to identify a consistent approach to choose activities that are no longer carried out. This will have serious impact on the program, as AZMP was designed as a "minimal program" at the onset.

These financial issues must be flagged to senior management. The AZMP Chair will report to relevant DGs, and specifically the DG of OS-CHS will be fully briefed.

It was decided to identify and evaluate the condition of all existing equipment and instrumentation (field and laboratory) required for AZMP in all regions. Consideration will also be given to new instruments that could facilitate the analysis of AZMP samples. The AZMP logistics committee will provide the list of equipment and recommend to the Permanent Management and Coordination Committee (PMCC) what could be achieved through upgrading equipment and what will require replacement. The PMCC will consult DFO HQ to seek support for the development of an Investment Summary Note (ISN) specific for the AZMP. If the ISN is supported, the logistic committee will prepare the appropriate documents, including consideration of equipment life cycle management.

Although it has not been feasible to date to extensively share equipment among regions (issues of scheduling, equipment damage or loss, etc), options for increased equipment sharing will be identified and evaluated by the logistics committee.

Specific action items for the Logistics committee:

- The AZMP logistics committee will review and update the list of AZMP equipment needs and submit a revised list to the PMCC. The Logistics committee will also evaluate what could be achieved through renewal with new equipment or through the upgrading of older equipment.
- To facilitate the acquisition of equipment when funds become available, the committee will identify providers with whom NMSOs should be established.
- This information should be provided to the PMCC by end of June 2011.

Personnel

Personnel requirements and the loss of expertise were also discussed. During this 1st decade of the program, AZMP has become increasingly vulnerable to the loss of field and other personnel through retirements and the difficulty in staffing as a result of budgetary restrictions. The Newfoundland and Labrador region has already faced situations where it had difficulties staffing field programs.

Specialists are difficult to hire. If using new technology is identified as a solution to the AZMP field operations and sample processing problems, it will be important to consider the expertise required to operate and maintain this technology.

Data management is increasingly becoming a significant issue. With staff reductions in all regions, the personnel to process, quality control and archive the datasets is often insufficient resulting in significant backlogs.

It is recognized that personnel issues are regional, and each region's management will have to resolve these. Senior management needs to be made aware of the AZMP HR challenges in order to encourage regions to give priority to AZMP needs.

Vessels

Finally, vessel issues were noted as a major concern to the AZMP. The program faced significant vessel problems this fiscal year, in particular the loss of the complete Maritimes region fall program as a result of the breakdown of CCGS Hudson. Being primarily an observation program, AZMP must rely on the appropriate vessel support from CCG. The PMCC will raise this issue to senior management following the federal budget announcement.

AZMP is concerned with the vessel replacement plan: both the offshore trawlers and the oceanographic vessel are key to the delivery of our program. Senior management must ensure DFO continues to have access to the vessel resources that will allow us to collect the information required to address the issue we will face in the decades to come.

DATA ACQUISITION AND MANAGEMENT (Rapporteur: P. Galbraith)

Data flow from regions to ISDM / Update on bottle archive migration / AZMP website improvements
M. Ouellet

Summary: See Appendix 4 for complete annual report from ISDM.

Discussion

Regarding TESAC, summary profiles are not all being sent within 30 days; the NL region representatives are surprised because they thought they had been all sent in time from their region.

It was asked whether a script is available to chief scientists for producing the TESAC files. Such scripts currently exist at IML, BIO and NAFC. ISDM will compile a list of existing scripts / programs and make them available to scientists who currently do not have access to them.

Recently, full-resolution CTD profiles from BIO have been missing at ISDM. BIO has been notified of the data flow interruption and is currently working on re-establishing it. The problem was mostly due to retirements and personnel replacement issues.

It was asked whether charts of data flow through the BIO data shop exist. Each survey is handled a bit differently. (This topic came up for discussion in greater detail in later presentations).

The exchange of data between ISDM with the World Data Centre (WDC) for Oceanography happens once a year through ISDM's submission to Global Temperature-Salinity Profile Program (GTSPP; http://www.nodc.noaa.gov/GTSPP/overview/aboutGTSPP.html). Some data managers from the United States National Oceanographic Data Center (US NODC; http://www.nodc.noaa.gov/General/NODC-About/NODC-overview.html) would want exchanges to happen four times a year, namely for BioChem data. It was asked why the WDC-Oceanography did not get the data from BioChem whenever needed. The answer was that international agreements have been set up in the past and are still implemented: the

Management Policy for Scientific Data states that ISDM is to serve as the primary point of contact for international data exchanges, except in certain cases (with approval from ADM Science/Oceans). ISDM will be examining all possibilities, such as establishing a routine connection between BioChem and the WDC-Oceanography, or including the BioChem bottle data in the yearly submission to GTSPP (which is eventually submitted to WDC-Oceanography).

Report on action items from 2010 (including in particular a discussion on CTD and bottle QA / QC procedures)
M. Ouellet

Summary

IML has a documented quality control (QC) system which is similar to the one used at ISDM. BIO and NAFC have no documented QC system, and the QC that they do does not include information captured in fields. For now, ISDM controls CTD and submitted-to-ISDM* bottle (*not through BioChem) profiles for regions that have no QC system in place. The quality control is reflected in Q_PARM flags (depth, parameter specific) and QCF$/QCP$ codes (profile specific); the latter are analogous to IML's QCFF codes. ISDM does not change Q_PARM flags set by IML in IML profiles, but recalculates the QCFF and store it in QCF$. This will be addressed in 2011-2012.

ISDM does not have a procedure to extract non-quality controlled data from BioChem, quality control it, and store it back in BioChem. ISDM believes that all regions should QC their data before loading them in BioChem, using a BioChem flagging scheme. IML is already doing it.

Discussion

Quebec offered that bottle QC for the Gulf region could be done by IML as well as CTD data.

It was asked why coarse (5 degree) and seasonal Levitus climatology was still used for QC at ISDM. ISDM management is unwilling to commit resources to modify the old quality control system, and is not yet ready to implement a new QC system. It is however working at stipulating a quality control policy. The IML data management people do not want to adopt a new scheme, but alternatively it was stated that it would be possible to add a regional climatology for the Gulf upstream to the Levitus atlas.

There was a general agreement that quality flags should stay at zero until they are tested against a documented quality control method with a climatology.

There was concern that everybody was doing quality control on the same data. Mathieu replied that quality control performed at NAFC and BIO is not documented and does not result in setting quality flags, plus a further quality control performed at ISDM proved beneficial to both NAFC and BIO data, both on the data and metadata (position/time). It was asked if that still involved a major investment of time to do these tests multiple times. Mathieu replied that the tests performed at ISDM are not the same tests that are performed at NAFC (for instance), so until a standard QC method is followed in all regions, ISDM will keep doing the QC of the data that has gone through no QC or through undocumented QC. A NL region representative stated that region should not use sparse resources to QC data that will be QC'ed again.

BIO hired someone to look at the ISDM Fortran and IML Matlab QC code in order to adapt it to their region; it looks feasible. Mathieu replied that a module approach could be used (e.g. coastline, T and S climatology) and everyone could then be using the same code. There was

agreement that interregional discussion needs to take place to harmonize this. Every region agreed to try the Matlab quality control software developed by IML. It was suggested that data management people meet this week to discuss a plan of action to harmonize QC procedures. Such harmonization might save personnel time at ISDM over upcoming years.

Given the deadline under which most AZMP members wanted to see this plan implemented, Mathieu did not encourage waiting to request funds from the National Science Data Management Committee (NSDMC) before beginning the work.

Consensus: bottle data should be QC'ed before they are uploaded; however, zooplankton data can be uploaded not QC'ed.

A major issue for users is not being sure that all data are there e.g. CTD and zooplankton for every station. Getting the cruise report helps, but they are not of consistent completeness. It was suggested that a standard format be produced for data managers. Laure Devine said that she had made one up.

Action item**:** implement a template for core AZMP data (and extras) such that they can be tracked through analysis, quality-control, all the way to the archive.

Does BioChem need a new paradigm? Group discussion to address problem of regional participation in BioChem
L. Devine

Summary and discussion

More than ten years into the program there is still inconsistent regional participation in BioChem. It was proposed that ISDM take the lead in becoming a sort of centre of excellence for QC and data loading, but this idea was discouraged by ISDM because personnel in that group already have a surcharge of work. It was decided that the data management subcommittee would meet and come up with an action plan to move this issue forward. The action plan will be presented on Thursday morning (24 March).

It was suggested to have simple procedures to follow rather than a central group to handle all data for all users, which is not realistic; for example some sort of procedure manual from BIO for phytoplankton data.

It was suggested to use a Matlab-based executable to process standard-format bottle files from the code used at IML.

Joe Craig will likely be the contact for QC issues in NL region.

What is the zonal view about how VDC should be used?
M. Kennedy

Summary

Do you submit standard queries to BioChem? Does your analysis require extensive post-processing of BioChem output? Perhaps the VDC can offer a solution.

The Virtual Data Centre (VDC) http://marvdc.bio.dfo.ca/pls/vdc/mwmfdweb.splash is a DFO intranet website that was initially developed by the Maritimes Marine Fish Division to facilitate access to data stored in Oracle databases. This integrated science user orientated facility is a data retrieval and analysis tool that greatly enhances research productivity by enabling diverse and disparate data sets to appear in common/familiar forms at a central location. The VDC is now recognized within the DFO Science data management community as a national activity.

It is now possible to access a view of the BioChem database through the VDC (this view is updated daily). Users may construct their own SQL queries and not be confined to the output format of the existing BioChem Query Application output format. In addition, it is possible to perform calculations on the data using SQL, S-Plus and R routines. Data may be output in spreadsheet format. Graphs and maps may also be generated. The mapping permits multi-dimensional drill-down into the selected data, providing multiple plot generation (including movies) and categorization of the selected data by the factor variables defined in the SQL query. These queries and associated products may be restricted or shared regionally thus facilitating a standardized product and reducing the amount of programming effort.

The VDC also enables linkage of BioChem tables to other Oracle databases. One example is that users may wish to link their BioChem species names to the Canadian Register of Marine Species (CaRMS). Linkage to CaRMS will facilitate grouping of taxonomic names according to the accepted scientific name and the latest classification hierarchy.

Discussion

It was asked if computer programming skills were required to use it. No, the fish stock-assessment people use it, but it is extendable through SQL for those who want to do so.

Asked whether the VDC is easy to use, a user around the table contributed that VDC is easier than BioChem, and that VDC has access to BioChem data (Data are updated every night from BioChem).

The VDC is a good place for processing standardized operations such as integrated chlorophyll, which can be an advantage to users.

The capability of uploading data (or updating data) automatically via FTP was requested.

VDC is well-supported and allows sharing of scripts.

Is there an AZMP view on VDC? The NL region wants documentation and simple query examples. A Maritimes region representative says that the bottleneck is having data actually in the databases rather than a specific access system. They do not want support staff to spend time writing code for VDC since they invested a lot of time already supporting another system.

Inconsistencies in taxonomic resolution is currently leading to errors preventing a year's worth of zooplankton data from IML from loading.

Action item: a tutorial directed at AZMP users will be created on how to use the VDC.

International data management commitments (ITIS, OBIS, WoRMS) related to biological and chemical data, and how these commitments contribute to AZMP
M. Kennedy

Summary

An overview of data flow, standards and international initiatives was presented. Datasets collected by primary investigators as part of the AZMP program flow from the region to ISDM archives and content is made accessible by ISDM on the AZMP web page, as illustrated below.

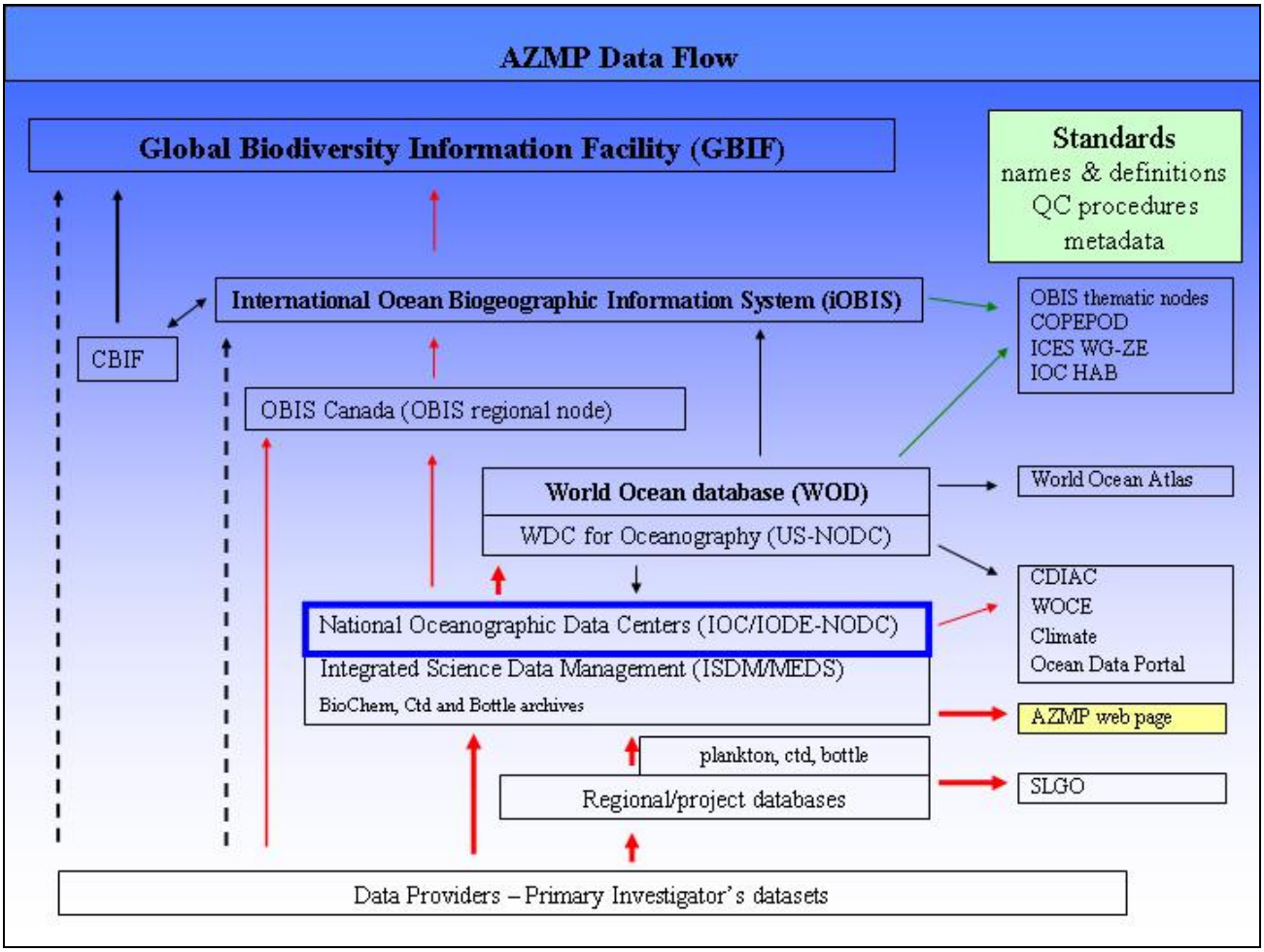

Figure 1. AZMP data flow diagram. A few links associated with AZMP data management that are displayed on the data flow diagram are provided in Annex 5.

Behind the scenes, AZMP data are being shared with other groups. DFO as a member of the IOC and IODE maintains a national oceanographic data centre (NODC) and contributes data to the World Data Center for Oceanography. In other words ISDM contributes data to the US-NODC's Global Temperature and Salinity Profile Project and World Ocean databases. In

addition, biogeographic data flow from ISDM (BioChem) to OBIS and atmospheric data to CDIAC.

AZMP PIs participate in many international initiatives and working groups such as ICES the working group for zooplankton ecology, the IOC harmful algal bloom program and WOCE. Contributions to these initiatives should be done through either the Canadian NODC or through the world data centre (WOD or OBIS) but this requires timely flow of quality controlled data.

Implementation of proper data flow should result in the following benefits:

- Lessen the burden on the PI; the data will be discoverable and accessible elsewhere and the outsider users do not initially need to contact the PI. Terms of use agreements will promote proper citation of the data and recommend collaboration with the PI if particular datasets constitute a major component of the study.
- One original copy of the data and subsequent versions identified. At each level in the data processing documentation related to QC checks will be recorded.
- Metadata pages for the various levels/versions of the datasets will increase accessibility and discovery of the data.
- Quality controlled data will contribute to global initiatives such as climatologies in the World Ocean Database Atlas, zooplankton time series in ICES, global biodiversity indices in OBIS, and species depth distribution patterns in the Encyclopaedia of Life, etc.
- Participation with and contributions to global programs and initiatives such as the IODE, GE-BICH, ICES, WOD and OBIS have benefits including access to datasets collected by other sources in our area of interest (repatriated data) and access to tools and products used by these initiatives such as area definitions, taxon matching, images, checklists, vocabularies and QC methodologies and standards.

AZMP is encouraged to share its knowledge related to data management of oceanographic data. An excellent venue for this information exchange is through the IODE supported Ocean Teacher program (http://classroom.oceanteacher.org/).

Discussion: no discussion took place.

SESSION 2

REVIEW OF 2009 AND/OR 2010 ENVIRONMENTAL CONDITIONS IN THE NORTHWEST ATLANTIC

PHYSICAL ENVIRONMENT (Rapporteur: C. Caverhill, *: presenter)

Climate Conditions in the Northwest Atlantic during 2010

E. Colbourne, J. Craig, C. Fitzpatrick, D. Senciall, P. Stead, and W. Bailey*

Abstract

The North Atlantic Oscillation index for 2010 was at a record low and as a consequence, outflow of arctic air masses to the Northwest Atlantic was much weaker than normal. This resulted in a broad-scale warming throughout the Northwest Atlantic from West Greenland to Baffin Island to Newfoundland relative to 2009. Air temperatures were above normal by 2-3 standard deviations (SD) and at a record high at some northern sites on Baffin Island and the Labrador Coast. Sea-

ice extent and duration on the Newfoundland and Labrador Shelf decreased in 2010 for the 16th consecutive year, with the January-June average reaching a record low. As a result of these and other factors, local water temperatures on the Newfoundland and Labrador Shelf warmed compared to 2009 and were above normal in most areas. Salinities on the NL Shelf were lower than normal throughout most of the 1990s, increased to above normal during most of the past decade but decreased to fresher-than-normal conditions in many areas in 2010. At Station 27 off St. John's, the annual depth-averaged water temperature increased to 2 SD above normal, the second highest on record. Annual surface and bottom temperatures at Station 27 were also above normal by 0.6°C (1 SD) and 0.64°C (1.7 SD) respectively. Bottom temperatures at Station 27 were slightly below normal in 2009. The area of the Cold-Intermediate-Layer (CIL) water mass with temperatures <0°C on the eastern Newfoundland Shelf during 2010 was below normal by 0.6 SD off Bonavista and 1 SD off Seal Island Labrador. Average temperatures conditions along sections off eastern Newfoundland and southern Labrador were above normal while salinities were generally below normal. Spring bottom temperatures in NAFO Divs. 3Ps and 3LNO during 2010 were above normal by up to 1 SD and as a result the area of the bottom habitat covered by water <0°C was significantly below normal. During the fall bottom temperatures in 2J were at a record high value, almost 2 SD above normal and 3K and 3LNO they were >1 SD above normal. The volume of CIL water on the NL shelf during the fall was below normal (3rd lowest since 1980) for the 16th consecutive year. A composite climate index derived from 27 meteorological, ice and ocean temperature and salinity time series shows a peak in 2006, a declining trend in 2007-09 and a sharp increase in 2010 to the 2nd highest in 61 years, indicating warmer than normal conditions throughout the area.

Reference

Colbourne, E. B., Craig, J., Fitzpatrick, C., Senciall, D., Stead, P. and Bailey, W. 2010. An assessment of the physical oceanographic environment on the Newfoundland and Labrador Shelf during 2010. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/Draft.

Discussion

Different scientists have different methods for calculating standard deviation for physical variables. For example, it is sometimes calculated from daily means and other times from monthly means. A standard method should be chosen and adhered to for consistency.

It was asked how the inshore & offshore branches of the Labrador Current were distinguished. The offshore current is stronger and larger, especially in terms of transport. Geostrophic transport calculations do not always work because the assumption of a level of no motion may be invalid. Different methods such as satellite altimetry can be used to improve transport calculations. On the Scotian Shelf, the transport around the tail of the Grand Banks is very important, as is cross-shelf transport. The inshore Labrador Current enters the Gulf of St. Lawrence. It affects both the Scotian Shelf and the Gulf of Maine, sometime resulting in regime shifting in the Gulf of Maine.

The inshore and offshore currents may vary independently but there is some suggestion that they are coherent on seasonal time scales.

Warm and fresh conditions often occur together but there are exceptions. There is evidence in the time series of de-coupling, so you have to look at both temperature and salinity. The degree of association depends on the mechanism driving the changes. Cumulative values smooth out the differences.

Physical oceanographic conditions in the Gulf of St. Lawrence in 2010

P. Galbraith

Abstract

An overview of physical oceanographic conditions in the Gulf of St. Lawrence in 2010 is presented. Air temperatures reached record highs when averaged from January to March, from October through December, as well as annually. The monthly averaged freshwater runoff measured at Québec City was normal overall in 2010 but was usually high during winter and fall, and the spring freshet was almost absent. These unusual conditions led to the warmest winter surface mixed layer recorded in 15 years, but the record highs did not persist into the summer CIL which was only warmer than normal. Very warm waters occupied Cabot Strait in June at 250 m, the depth of the temperature maximum, and there is a hint that the top portion of this water mass was sampled during the March survey. The warm deep waters were still present in Cabot Strait in August as well as in November and should circulate up to the estuary in the coming three years.

New products were shown. These include new bottom temperature maps from which timeseries of bottom surface areas occupied by various temperature ranges are calculated for each of the eight regions of the Gulf. A hydrological model was used to generate monthly runoff for 78 rivers in the Gulf of St. Lawrence since 1948, and the rivers were summed over each of the regions of the Gulf and shown as anomalies for the past two years. Modeled averaged currents are also included for the first time, over three depth ranges (0-20m, 20-100m, 100m-bottom) and four seasons. Monthly transports across sections were also calculated since 2006 and displayed as anomalies.

Discussion

There is interest in the transport estimates across sections. When asked if there are estimates of outflow onto the Scotian Shelf from the Gulf of St. Lawrence, it was stated that an index going back to 1991 will be shown in a later talk.

It was suggested to split the model to estimate east and west flow through Cabot Strait (Note: this has since been done and will appear in the Res. Doc.).

It was asked if the CIL minimum temperature and volume were recreated every single year or whether there was multi-year memory in the system. The CIL curves seem to often respond over several years in a cumulative manner. Peter agreed but also said the only memory could really be in the fall pre-conditioning phase since the winter mixed layer is mixed each year, resetting the CIL for the forthcoming summer. He noted that the November 2009 cruise showed the surface mixed layer to be usually warm and thick. The winter mixed layer conditions are well correlated to winter air temperature, but the pre-existing conditions must also be very important.

Does the warm, deep water in Cabot Strait reflect changes in the slope water? Is this analogous to changes observed on the slope? To answer this question, it is necessary to look further upstream, i.e. at BIO data to see what is happening outside the Gulf of St. Lawrence. Newfoundland data are too sparse to help with clarification, but BIO takes measurements on the Grand Banks. It could be possible to combine data from both regions to address this question. The strength of the Labrador Current and position of the Gulf Stream could also be contributors.

Physical, Chemical and Biological Conditions in the Labrador Sea 2010

B. Greenan

Abstract

The Arctic Oscillation (AO) and North Atlantic Oscillation (NAO) indices for the 2010 Jan-Feb-Mar (JFM) period were record lows in the time series going back to 1950. The NCEP reanalysis of surface air temperature for this period indicated much warmer than normal conditions with an anomaly of greater than 10°C in the northern Labrador Sea during the winter period. The anomalies were smaller for the spring and summer periods, but were again observed to be greater than 10°C (centered in the Foxe Basin area) in the fall period. Sea surface temperature (SST) anomalies were also positive in 2010 reaching values of greater than 3°C in the summer period. Labrador Shelf ice extent was below normal in Jan-Feb and near normal in Mar 2010 (reference period: 1979-2000). Sea ice conditions on the southern Labrador/Newfoundland shelf were well below normal in the winter 2010.

The annual AZOMP survey of the AR7W Line in the Labrador Sea took place on CCGS Hudson during the period of 16-31 May 2010. This survey also included sampling of the Extended Halifax Line (XHL) to monitor variability on the Scotian Rise in the deep western boundary flows of the NW Atlantic and to obtain additional information on oceanographic and lower-trophic-level variability of the Slope Water affecting the Scotian and adjacent shelves.

Physical oceanography measurements along AR7W indicate that the winter convection in the central basin of the Labrador Sea was very limited in 2010 due to the above normal air temperatures in the winter period. This was a significant change from the previous two winters during which convection reached depths of 1500 m (2008) and 1000 m (2009). The lack of winter convection was also confirmed from Argo drifter profiles in the Labrador Sea during the winter 2010.

Total inorganic carbon (TIC) and pH in the 150–500 m depth range for stations in the central part of the Labrador Basin has been monitored over the period 1996–2010. TIC shows an upward trend ($r^2 = 0.9$) during this period, while pH has decreased from 8.08 to 8.02 ($r^2 = 0.74$). The failure of oxygen titration instrumentation during the cruise has delayed the analysis and QC of the data which was collected in 2010.

Systematic biological measurements have been made along the AR7/W line since 1994 and include major components of the lower trophic level (bacteria, phytoplankton and zooplankton abundance or biomass) metabolic rates (bacterial and phytoplankton productivity and respiration on occasion) and total biogenic carbon. All biological components exhibit high interannual variability. Weak trends have been seen in strongly co-varying phytoplankton and bacteria levels, i.e. decrease of ~10% per year in the Labrador Shelf/slope region and increase of about the same magnitude on the Greenland Shelf/slope region; however, no significant long term trends has been noted in the central Labrador Basin over the 15 years of observations. Bi-weekly imagery of ocean colour showed that in 2010, the major phytoplankton bloom was earlier than normal (by 2-4 weeks) on the Greenland shelf. No long term trends were seen in total zooplankton abundance or abundance of the dominant species, *Calanus finmarchicus*, although years with high numbers and large proportions of young stages were associated with warm temperatures and early phytoplankton blooms.

Discussion

It was noted during the presentation that the BIO O_2 system failed during the cruise, leaving no validation data for the IML O_2 system that was being tested. It was suggested that the O_2 sensor on the CTD (Seabird 43) could be calibrated with a few filtrations and the data then could be used to compare with the IML O_2 system.

It is not possible to monitor physical properties (temperature & salinity) for the AR7W transect using only Argo data. Argo measurements only go to 1500-2000m and it is necessary to look at deep flow for climate studies. There is a plan for a long-term international study to look at overturning circulation and Argo data could be used for transects down to about 1500m. There is talk of deploying floats to 4000m but that would cut the float life in half. The community is more concerned with global coverage. Large-scale ocean modelers have tried using and not using Argo floats in deep ocean circulation studies and these studies indicated that Argo contributed significantly to improving the model simulations.

The observed trend in decreasing pH is due to increased CO_2 in the atmosphere. This increases the flux of CO_2 into the upper ocean and a chemical reaction decreases pH.

BIOGEOCHEMICAL ENVIRONMENT (Rapporteur: L. Devine, *: presenter)

Optical, chemical, and biological oceanographic conditions on the Newfoundland and Labrador Shelf during 2009 and 2010

P. Pepin, G. Maillet, S. Fraser, T. Shears and G. Redmond*

Abstract

We review seasonal and interannual variations in the concentrations of major nutrients, chlorophyll *a*, as well as the abundance of major taxa of zooplankton measured from Station 27 and along standard transects of the Atlantic Zone Monitoring Program (AZMP) in 2009 and 2010. Across the region, annual nitrate inventories (shallow and deep) have declined since 2008 and appear to be continuing to decrease in 2010. Chlorophyll concentrations in 2009 were at their highest levels since the start of AZMP activities in the region but returned to near normal values in 2010. In 2009 and 2010, the principal zooplankton indices indicated that abundance was generally higher than average, with densities reaching their highest levels in 2010 along many of the oceanographic sections. The indices of inventories and abundances across trophic levels (nutrients, phytoplankton and zooplankton) generally exhibit weak associations (i.e. correlations) between adjacent trophic levels. There was no single environmental variable that demonstrated a widely consistent pattern of correlation with either nutrient inventories, phytoplankton abundance or with the wide diversity of zooplankton taxa. This may be the result that over the last decade the physical environment of the Newfoundland Shelf showed the lowest overall variability relative to previous decades going back to 1950.

Discussion

There was discussion about the relative abundances of warm- and cold-water zooplankton zooplankton species, with warm-water ones being less abundant and cold-water species more abundant despite increased water temperature (maybe problems during development?). It was suggested that advection might be the vector for this phenomenon, and that study areas must be chosen carefully to resolve the issue. CPR (continuous plankton recorder) data, which might be used to resolve this question, do not show the same trend as data from ring nets since the CPR samples the surface only (~ 7 m). In addition, the changing location of CPR tows can

influence the apparent temporal trends. For example, CPR tows from the near-shore and off-shore eastern Scotian Shelf would sample different communities. It was also noted that the long-lasting and early 2010 bloom did not necessarily lead to a larger overall magnitude. It would be interesting to see long-term trends in chlorophyll.

Biogeochemical conditions in the Estuary and Gulf of St. Lawrence during 2009 and 2010

M. Starr, L. St-Amand, P. Galbraith, S. Lessard, L. Devine, J. Spry and G. Harrison*

Abstract

We reviewed information concerning the spatial and temporal variations in the concentrations of chlorophyll a, nitrates, and silicates as well as the abundance of the major taxa of phytoplankton measured at four AZMP fixed stations (Rimouski, Anticosti Gyre, Gaspé Current and Shediac Valley) and seven sections crossing the Estuary and Gulf of St. Lawrence. We concentrated on conditions prevailing in 2009 and 2010 but also compared those observations with previous information from the 1999-2008 period and over the longer-term, where applicable.

Spring-summer phytoplankton biomass observed at Station Rimouski in the lower St. Lawrence Estuary during 2009 and 2010 were close to the 1999-2010 average. Dates of the onset of the spring phytoplankton bloom in 2009 and 2010 were also close to normal. In 2009, diatoms/flagellates and diatoms/dinoflagellates ratios continued to decrease – a trend initiated since the last decade. This shift from diatom dominance before 2004 to dominance by dinoflagellates/flagellates in recent years could have potential consequences on food web dynamics and biogeochemical cycles. Such shifts are usually attributed to changes in water stratification and/or eutrophication.

Overall, the nutrient inventories in late winter, spring and fall in 2010 were much lower compared to 2009 and the 1999-2010 average in most regions of the Gulf of St. Lawrence. In parallel, ocean color imagery shows that the seasonality of the spring bloom was relatively close to the "normal" in 2009 but the bloom occurred much earlier in 2010. The much earlier spring phytoplankton bloom in 2010 may explain the strong negative anomalies in surface nutrient concentrations in late winter and afterward.

Surface chlorophyll levels in spring, summer and fall 2010 were below normal in most regions of the Gulf of St. Lawrence while those in winter were well above normal. In contrast, all indices computed from MODIS composites indicate that phytoplankton biomass and timing of the bloom in 2009 were overall relatively close to the average in most regions of the Gulf of St. Lawrence.

Discussion

The point was raised about how much of the MODIS (satellite; ocean colour) data are used for averages considering ice coverage; it was suggested that an ice index be created, although it was also pointed out that there has been little ice during the past decade. These MODIS data include information on the percentage of pixels available, so calculations could be made. It would be interesting to note bloom onset as related to ice breakup. The question was raised whether the bloom was correlated with nitrate concentration and salinity at the head of the Laurentian Channel, to investigate the role of tidal mixing. The speaker will check this point for the 2009–2010 data.

Optical and biogeochemical conditions on the Scotian Shelf and in the Gulf of Maine during 2009 and 2010

J. Spry

Abstract

For Maritimes region, 2010 was an interesting year with many similarities to that other unusual year at the start of AZMP sampling in 1999. Several inconsistencies were observed in our sampling data that made explaining the seasonal evolution a challenge. Questions were raised but served to highlight the somewhat complex biological response to physical and environmental forcing.

Fixed station (HL2 and Prince 5) data were mostly discussed, but other sources of information like transect surveys and remote sensing imagery confirmed our observations. Nutrient inventories at the fixed stations were quite similar, being above normal in 2009 and well below normal in 2010. In contrast, chlorophyll anomaly levels were slightly above normal in 2009 and at the mean in 2010. Most striking was the timing and the duration of the spring bloom at HL2 and the contrast between the two stations. The spring bloom at HL2 appeared to have one of the earliest starts and to be of the shortest duration on record with not especially high chlorophyll values. Satellite images indicated the bloom was already well underway in the first half of March. The lowest NAO index on record and the lowest ice cover in the Gulf of St. Lawrence must have been factors in the 2010 conditions since we are in effect 'downstream' in the Atlantic flow. Transect survey measurements suggest in fact that the bloom maximum may have been missed by our sampling, but if that is the case, it was of very short duration. Prince 5 in the Bay of Fundy appeared to operate in the opposite fashion, with the bloom being late to start but once underway continued at a high level through an extended summer period.

Phytoplankton cell counts were quite low at HL2 in 2010, but community structure appeared unchanged. Zooplankton biomass and *Calanus finmarchicus* abundance were reduced at HL2 in both 2009 and 2010.

There is evidence to suggest enhanced flow of offshore water onto the Scotian Shelf in 2010, but it is not clear if it is primarily 'Labrador Slope' water or 'Warm Slope' (Atlantic) water. Some water mass anomalies were observed on the shelf that could serve to confirm this.

Finally, another interesting point is the suggestion that young-of-the-year (<10 cm) cod and haddock were more abundant in 2010. A very strong year class was observed after the early bloom conditions of 1999 as well.

Discussion

It was noted that surface to bottom temperatures all increased from 0.5°C to 4°C across the region according to SST data, and ice cover is down. Everything is warmer than normal across this region.

Monitoring the Labrador Current transport by combining satellite with AZMP observations

G. Han, K. Ohashi, N. Chen, P. Myers, N. Nunes and J. Fischer*

Abstract

Monitoring and understanding of Labrador Current variability is important because it is intimately linked to the meridional overturning circulation and the marine ecosystem off northeast North America. By combining satellite altimetry with conductivity-temperature-depth (CTD) data we analyze the Labrador Current variability over 1993–2004. The analysis shows a decline of the surface-to-bottom transport of current by 6.3 ± 1.5 Sv (1 Sv =106 m^3 s^{-1}) in the 1990s (significant at the 99% confidence level) and a likely partial rebound of 3.2 ± 1.7 Sv in the early 2000s (significant at the 89% confidence level only). The inferred multiyear changes in the Labrador Current transport seem to be primarily barotropic and positively correlated (at the 99% level) with the North Atlantic Oscillation at zero lag, implying a fast response of the regional circulation to the atmospheric forcing variability. The results compare favourably with direct current measurements and recent model-based findings on the multi-year variability of the subpolar gyre and its underlying mechanisms. The study demonstrates the feasibility of combining altimetry and CTD data for assessing the climatic variability of the Labrador Current, by eliminating the uncertainty associated with the level of no motion in the commonly used geostrophic calculation.

Discussion

Participants wondered how rapidly the data presented was available, i.e., if it could be an operational product. The answer was that the index could be rapidly calculated for the Labrador Sea because the trials were already done, but for other areas it would take more time. There was speculation for 2010 that the low NAO would lead to high current speeds, but the opposite was found. This needs further investigation. It was proposed that this index be added to the scorecard, but it was noted that the scorecard is getting somewhat unwieldy. Indexes need to be reviewed to choose the most appropriate. It was suggested again that zooplankton community changes might be related to transport. There are many factors involved with transport: buoyancy forcing, wind variability, barotropic changes… Large-scale differences are related to NAO wind stress, deep convection, and Gulf Stream shifts. It was questioned whether more water on the Labrador coast leads to more water passing through Belle Isle Strait. This is an interesting question that will be investigated.

Continuous Plankton Recorder monitoring of plankton on the Canadian continental shelf and in the sub-polar gyre

*E.J.H. Head and P. Pepin**

Abstract

In this report we consider the monthly 2009 values compared with decadal monthly averages since 1957. There were numerous “missing months” between the eastern Scotian Shelf and the Newfoundland Shelf in the summer, because the shipping line changed the route to go through the Strait of Belle Isle instead of going to St John’s. The western Scotian Shelf (WSS) was (apparently) sampled using another ship. Because of this change in route, most of the reporting was for the WSS and an area representative of the sub-polar gyre. Levels of diatoms and the PCI [phytoplankton colour index] were relatively low on the Scotian Shelf in January and February 2009, with values similar to average values for the 1960s and 1970s, but lower than

those for the 1990s and 2000s. This seems to be linked to reduced stratification in the previous year. Diatom and PCI levels elsewhere were unchanged. Dinoflagellate levels were relatively high west of 40°N and relatively low east of 40°N, with seasonal differences in the timing of the changes. *Calanus finmarchicus* levels were unchanged everywhere, but *C. glacialis* and *C. hyperboreus* abundances dropped to vanishingly low levels on the Scotian Shelf and reduced levels on the Newfoundland Shelf. The abundances of small copepods and copepod nauplii declined everywhere. Macroplankton levels showed no obvious changes anywhere. The abundances of acid-sensitive phytoplankton and microzooplankton groups were unchanged, but pteropod levels were relatively low in the sub-polar gyre.

Discussion

It was questioned whether the logistic issues relating to dedicated vessels have been addressed. Different ships of opportunity have been proposed, but the set-up costs are not trivial, and this could prove to be a serious problem. Anything on ships of opportunity are troublesome because changes in ship tracks lead to noisy data. Some participants wondered if it was worth reporting on CPR data considering the strong variability seen in the data. The answer was that 5–10 year average differences may be useful and the long time series is valuable, especially for ocean colour and certain zooplankton taxa. It was suggested that decadal trends be compared to oceanographic conditions to look for links. It was questioned whether CPR vessels were equipped with temperature and salinity sensors. The answer was that when present, temperature was usually good, but salinity not so good (calibration issues).

GENERAL DISCUSSION

1. **How to calculate standard deviations for the scorecards for biological variables in order to harmonize the regional methods?**

   The discussion began about how scorecard anomalies were calculated. The explanation left many participants confused. It was noted that anomalies reported by Environment Canada are not calculated in the same way.

   Action item: it was decided that those calculating the anomalies contact one another and agree on how this will be done and document it for the next time this question arises (M. Ouellet to lead; participation of P. Galbraith, R. Pettipas, D. Hebert and E. Colbourne).

   The biological scorecards include abundance indices for zooplankton. Newfoundland indices use a GLM which takes into account year, month, and seasonal effects, to fill in missing values. It was noted that interannual variability in the NL indices are much lower than those from other regions, perhaps because equivalent indices are not being compared. It would be of great interest to see whether the NL indices calculated using data from another region would give different results. Maybe the differences observed are real, but the methods need to be compared to be sure. NL needs to use the GLM method because there are many data gaps that need to be filled with model results.

   Action item: NL will try this exercise using Maritimes' data (P. Pepin to lead and C. Johnson to provide data).

2. **How to combine the physical and biogeochemical scorecards?**

The answer to this question depends on what question is actually being asked. It was suggested that the last decade be concentrated on to see how the physical variables relate to the others. It was suggested that a hypothesis-based synthesis be used, e.g., how does transport affect the Scotian Shelf? We need to form questions that will lead to themes and help us explore how to combine indices. It may be possible to link long-term scorecard tendencies in physical variables with short-term scorecard results for biogeochemical variables. It would be useful to integrate metrics of all the data that we have available over the whole region. An exercise should be undertaken to try to reduce the number of indices to get rid of highly correlated ones. However, some participants thought that leaving many related indices to emphasize an overall trend was a good idea.

Action item: it was proposed that composite indices for the different sections be developed with the aim of calculating anomalies (P. Pepin to lead).

It was mentioned that it is important to use AZMP data to address research questions, but that funding is not focused on this and there is rather a more *ad hoc* use. A summary inventory of the available data needs to be made available to show the importance of the program. There is increasing pressure to show linkages between AZMP and stock assessment, but drawing conclusions over several trophic levels is not easy.

A general point was raised to wrap up Session 2: why have we not made more progress on the integration and synthesis work? It was emphatically stated by one participant that this is largely because the data are not in the database, and that much effort must be expended to identify the data, request them from different people, and then deal with the variable formats and QC levels. That the data get to the database is the first and most important task. This must be done in a way that is coordinated across regions, and this is the biggest challenge. The data management subcommittee will meet for discussion and submit a plan before the close of the meeting tomorrow.

SESSION 3

OCEAN OBSERVATION AND MODELING

23 MARCH 2011 (Rapporteur: N. Shackle, *: presenter)

A 20 YEAR LONG ICE-OCEAN NUMERICAL HINDCAST FOR THE GULF OF ST. LAWRENCE, SCOTIAN SHELF AND GULF OF MAINE

*D. Brickman, A. Drozdowski and J. Chassé**

Abstract

Two simulations were carried out using the NEMO-OPA modeling system for the Gulf of St. Lawrence, Scotian Shelf and Gulf of Maine (GSL-SS-GOM). First, a 2005-2010 hindcast with the ocean forced by the CMC GEM atmospheric model was used to investigate seasonal circulation and transports. The modeling system also takes account of the 78 main rivers entering the domain. The simulation shows that the modeling system is accurately representing the seasonal cycle of temperature, salinity and ice as well as local features like the Anticosti

gyre, recirculation over Western Bank (Scotian shelf) and the counter-clockwise circulation in the Gulf of Maine. Transport climatology and anomalies were generated for the period 2006-2010. The circulation patterns and transports from the hindcast are now included in the State of the Gulf of St. Lawrence CSAS document (Galbraith et al, 2011).

Second, a 1990-2010 ice-ocean numerical hindcast for the shelf seas of Maritime Canada was performed using a version of the NEMO-OPA circulation model forced by NCEP atmospheric variables. The run allows analysis of long term model trends, and also provides a "climatology" for model variables, thus allowing a given year to be analyzed from an anomaly point of view. Analyses focused on AZMP sections and fixed stations.

The model ice volume 1990-2010 compared favourably with data, as did its hindcast of the spatial pattern for 2010. Model CIL volumes (Aug-Sep and "winter", 1990-2010) show a high correlation between CILs and ice volumes and between the GSL and SS CILs (0.75-0.80). The SS CIL was not correlated with the outflow through Cabot Strait, indicating that the CIL volumes are locally determined. Annual and seasonal areal average model bottom temperature was computed for 7 regions, and analyzed to determine any trends. Increasing bottom temperatures (1990-2010) were found throughout the GSL, and onto the eastern SS. However, the trend did not persist in the central SS and west into the Gulf of Maine. Model stratification time series (50m-0m, 1990-2010) were computed for a number of fixed stations. Weak increasing trends were found for all stations. Correlation between stratification and river input series were significant for stations that (roughly) followed the pattern of outflow from the GSL onto the SS.

In general the model did a good job simulating the AZMP T&S section data for 2010.

For 2010, anomalies (from the long term model mean) of velocity and T&S were computed for various AZMP sections. The annual cycle of nearshore transport of the NS current at AZMP sections from Cabot Strait to Cape Sable Island was computed for 2010 and compared to the long term model average. The transport through CS was generally within 1 std of the average, Halifax was found to be generally higher than average in 2010, while the flows at Louisbourg and CSI were more variable than the norm.

Results were also presented from a 2010 model run on a domain that included the Newfoundland Shelf and thus covered the entire Atlantic Canada AZMP domain. This model may the basis for further development in regards of assimilating AZMP data and providing missing environmental information.

Discussion

The main questions about the model were:

1. Whether there was a problem with the model because it did not account for advection of ice from the Strait of Belle Isle?
   The Speaker noted that the model was able to reproduce 0 ice in 2010, and that the researchers believe that the ice is formed locally. However, it is a good suggestion (to think about ice advected from the Strait of Belle Isle), and that may be why the correlation between the data and the model is not perfect. It was suggested that ice charts would help with the issue.
2. Whether there was a problem with the transect line off of Cape Sable Island because it seemed to cross Brown's Bank?
   The Speaker said he would check with the main author, but pointed out that he himself had drawn the lines, and that when one checks the main authors slide, the CSI line did not cross Browns Bank.

3. What are the authors using to drive upstream boundaries?
   The speaker explained that Belle Isle and east shelf break were involved, and the seasonal cycle used to modify flow in. In other words, the model accounts for what comes in. The remark was made that it is always a challenging issue with open boundary conditions, and that NL people can help with that as they use the same model. The speaker replied that the main author had used the NL model, and found it was not as good as assuming open boundary conditions. It was agreed that some international projects are using *ad hoc* ways. The speaker concluded that it depends on where you are looking, but within the Gulf of St. Lawrence, deeper and deeper, the conditions are determined internally.

USING AN OCEAN FORECAST SYSTEM FOR THE NORTH WEST ATLANTIC TO SUPPLEMENT BOTTOM TEMPERATURE SAMPLING
F. Davidson

Abstract

Model output from the NEMO ocean model constrained by data assimilation is used to gain a better understanding of the implications of the space and time scales of the AZMP sampling program. In particular comparisons are done between fall bottom temperature data collected from random stratified tows over a 3 month period with instantaneous and mean snap shots of the model output at the AZMP sampling locations. Differences between model output and AZMP observations are discussed to show case ocean forecast strengths and weaknesses. The talk then focuses on contributions ocean models and data assimilation can make to the AZMP program.

Discussion

The main questions/comments about the model were:
1. Whether the NL region wanted to do a reanalysis?
   The speaker responded they would like to redo analyses at the basin and regional scale because they do not like to transfer between models; so it is a lot simpler if one works on the same grid.
2. Whether there are plans to include freshwater?
   The speaker replied they would like to include freshwater. It was noted that boundary conditions affect what happens on the shelf, and that it will be good to expand inputs into the model. Emphasis should be placed on getting shelf system right. The speaker assured the audience that the larger domain will allow them more representation with the data assimilation.
3. Whether the Canadian archipelago would be able to be resolved using the larger grid?
   The speaker said it will be 4km resolution. They are happy with the 12km now, but will do more downscaling; right now the priority is to get the 12km running well.
4. The use of multi-species survey data should be developed so that it would be useful to scale error from the model to the errors in surveys. That is, instead of expressing them as degree C difference, express them as interannual % std deviations (not in units of C).
   The speaker and audience agreed that it was a very good point and would put things in perspective.
5. The forecasting needs clarification. How come error is 3-4 degrees but in real world it does not change that fast. The error seems to be generated by the model?
   The speaker said that the model may be generating some of that error. Using the model in the 12km version, the assimilation state is more acceptable to model than the 4km. It was suggested that perhaps it is better to have no data to force the model. The speaker agreed that in some cases, that is a good idea and that they would have to run a hindcast, using

climatology as the benchmark. It was pointed out that it is quite hard to match the climatology. The speaker said that this is why they use persistence as a benchmark in forecasting models to tell how errors are growing.

6. There was some discussion on how different models (GLORYS Mercator CNOOFS) reconcile with each other, and how well they predict observations as taken by multi-species trawl surveys in the fall.

USING AZMP DATA TO VALIDATE AN OCEAN CIRCULATION MODEL

G. Han, Z. Ma, B. deYoung, M. Foreman and N. Chen*

Abstract:

Ocean currents and associated hydrographic conditions are important to the transport and survival of marine eggs and larvae. A good example of this is the impact of the Labrador Current and its variability on the Newfoundland Shelf ecosystem. Nevertheless, there are few ocean models that both adequately resolve the cross-shelf structure of the Labrador Current and that are sufficiently evaluated against *in situ* observations at synoptic and seasonal scales. We present a three-dimensional, high-resolution, prognostic, nonlinear circulation model, the finite volume coastal ocean model (FVCOM) for the Grand Banks of Newfoundland. The FVCOM uses unstructured grid in the horizontal and thus allows efficient and effective use of grid resolution to resolve coastal- and shelf-scale features. The model results are evaluated against temperature and salinity observations and vessel-mounted ADCP from the Atlantic Zone Monitoring Program. The hindcasts for spring-summer 1999 show reasonable skills in reproducing currents (a velocity difference ratio of 0.68 at the Flemish Cap transect), temperature (a root-mean-square (RMS) accuracy of 2 ^{o}C) and salinities (an RMS accuracy of 0.5 psu) at Station 27. We will continue to calibrate and validate the FVCOM model using the AZMP and other data and hope that the model results will in turn help optimize the monitoring program and address ecosystem issues in coastal and shelf waters of Newfoundland.

Discussion: None.

PROGRESS IN 3D OCEAN-BIOGEOCHEMICAL (NPZD-O_2-PH) MODELING FOR THE EASTERN CANADIAN SHELF

D. Lavoie, M. Starr, J. Chassé and D. Brickman*

Abstract

In this presentation we show the evolution of the development of a bio-physical modeling capacity for the Atlantic zone that started in the Quebec Region in the early 2000s with the POSE project, a collaboration between MLI and ISMER. With the creation of COMDA, a zonal collaboration developed between different DFO centers of the east coast (MLI, GFC, BIO), and the biogeochemical model was coupled to a new physical model covering a larger region (GSS4, which includes the Scotian Shelf). New sub-models were added (oxygen and carbonates) to study emergent problems (hypoxia and acidification). The ultimate goal of the regional collaboration is to couple this new biogeochemical model to a third circulation model, NEMO, also covering the Gulf of Maine, which is used in regional downscaling climate change studies (GFC, BIO), to forecast future changes in environmental conditions (primary production, hypoxia, pH). The final coupling is underway and being made possible with funds from the DFO climate change initiative (CCSI).

Discussion

The main questions about the model were:

1. Whether there was any way this model could be used to see how interannual variations in phytoplankton production propagate through to the zooplankton. The rationale behind this approach is to see if observed interannual variations in zooplankton biomass are similar to interannual variations in simulated phytoplankton production. The latter would thus give a good measure of the amount of energy that can propagate through to secondary producers? The speaker said that it is a possibility. However, timing issues might also be important. For example, does an early peak result in a larger bloom?
2. Whether AZMP data could be used to enhance climatology or validate the model?
   The speaker said there are two aspects, initial conditions and validation of results. They use the climatology to get monthly forcings at the boundaries, and then validate the simulations by comparing data and model results at the sampling sites and for the same dates.
3. There was some discussion about how the BGCM-NEMO model reproduces phytoplankton blooms.
   The speaker reminded the audience that the coupling of the biogeochemical model to NEMO is not completed. For example, it was mentioned that the nitrate climatological fields need to be built; right now the same nitrate vertical profile is used over the whole domain and spatial and vertical interpolation needs to be done to represent the spatial variations. It was also mentioned that it might be possible to move to a larger domain, including the Newfoundland shelf, in the future (D. Brickman is actually implementing NEMO on this larger domain); several agreed that having a common domain would further enhance the modeling.

GENERAL DISCUSSION

How can ocean observation and modeling be better coupled and how can AZMP and ocean modeling better support each other?

Better formatted data are available and NetCDF could be made available. As well, anomaly maps would be easier to put on the AZMP website. It was suggested that datasets at HQ would be good so that every region would use common datasets, not necessarily in the near future but at some point.

Action item: M. Ouellet will make NetCDF available at HQ.

AZMP and modeling could be used in climate change adaptation programs (if funded). One component is to develop tools for regional use. The AZMP scorecards could also be used in the climate change adaptation initiative if they do go forward with funding. The assembly was reminded that there are two aspects to modeling, research that allows us to learn (e.g. how is energy propagated through the system) and validation for forecasting. It was stated that we should get the physics and chemistry perfect first, and then add the biology. However, we do have some understanding in the biological aspect of models; for instance, the relationship between nitrate and phytoplankton is quite good. Nobody disagreed.

Taxonomic names and groupings could be part of data management.

Somebody wondered when the AZMP group would be satisfied with the model before it would be used by the group? An answer is if we were to see similar metrics as to those used in the observations, e.g. the transport at various stations. It is important that the models provide things like “transport “ that are not measured in the AZMP. This is a multiple

stage process; as the model improves, those metrics should start to converge. Indeed! AZMP focuses on seasonal and interannual variability, but there must be metrics where the model performs well and that we could use. Many processes are locally driven; in these cases the model can work much better. The model could also be used for casting scenarios e.g. what would happen if freshwater flow was reduced by .5. Modelers like to link large scale drivers to the biology. Another suggestion was made to look at the physics and model outcome at fixed sites. The model can also do reverse particle tracking to find out where they come from.

Fixed stations have a seasonal cycle; it would be interesting to look at time scale between sites e.g. how fast water travels from one site to the other. The BIO modeling team will also look at spatial correlation scales to find out how connected these indices are. Someone asked whether scorecards could be generated for the indices? Yes, this is possible except that we are limited by resources. This year, it was decided to include model results in the Gulf Res. Doc. There was general consensus that incorporating them into the AZMP report was a good idea, but should be thought out further within regions.

Action item: regions to discuss whether model indices should be incorporated into AZMP reports.

Some DFO scientists participated to a discussion about operational oceanography during a DFO workshop in early March 2011; some stated that model development and monitoring programs were currently decoupled in DFO. Perhaps AZMP could help alleviate the problem. This decoupling cannot be generalized; one only needs to point around the table to demonstrate otherwise. It would be good to better join forces however when asking for funding; it should better stated observations are the first stage because if there were no data, there would be no modeling. But In European operational oceanography groups, they do not fund the collection of data, only the modeling. In a perfect world though, there would be resources to sample more locations, but since resources are lacking, modeling could be used to identify locations from where large signals are coming. For instance, models are used to validate atmospheric observations in EC. It was stated that we do not have to get rid of redundant sites; we need redundant sites to identify significant ones.

Action item: continue to invite modelers.

SESSION 4

MATTERS ARISING

24 MARCH 2011 (Rapporteur: J. Craig, *: presenter)

RESEARCH DOCUMENT REVIEW, SARS AND THE BULLETIN

Session 4 was called to order by the chairman at 8:40 AM with the AZMP Bulletin, Research Documents and SARS on the agenda. Research documents contain the information in the SARs, but it may be desirable to retain the latter because they contribute to visibility and public awareness of the AZMP in a concise and accessible manner. However these must be translated, creating extra work and it might be better to have the SAR included as main points on the research document per an existing template.

Review of the drafts is currently done by exchanging them between the regional laboratories and this should continue.

Several changes to the AZMP Bulletin were discussed including a new cover page design which should reflect issues that are distinctive from year to year. Also, it is important to emphasize the main aim of AZMP on the cover page, to retain the « AZMP Bulletin PMZA » banner, but to include "Ocean Monitoring" or something similar to make it more attractive to potential readers outside the AZMP. The matter of reducing costs was discussed with a near-consensus that hard copies should no longer be printed and only electronic ones distributed. This would save printing costs but not production costs which were the greater. A central e-mailing list should be developed to avoid duplicate messages. A mechanism should be in place that allows people to subscribe and unsubscribe to receive the Bulletin. Several suggestions were made on how to increase the visibility of the Bulletin including announcements in ”In the Loop / Au courant”. It is desirable to get a performance measure of the program, for example, use Google Analytics (http://www.google.com/analytics/) to see who is downloading the Bulletin and data from the website.

Other suggestions were to add a section on the website publication list for publications of non-AZMP authors using AZMP data and to include a prominent “how to cite AZMP data” reference on the website that people can cut and paste to their publications, for example from OBIS:

> http://www.nbii.gov/portal/server.pt/community/marine_data_%28obis-usa%29/791/policies_and_disclaimer/5196

The Sea Surface Temperature (SST) and Ocean Colour (OCDB) data bases were identified as being in need of citations.

Action item: a full Bulletin will not be compiled before spring 2012, but members feel that the environmental review for 2010 should be released in electronic format as a “mini-bulletin” in fall 2011.

DATA MANAGEMENT AND QUALITY CONTROL

Discussion concerning data management focused first on the basics such as initial data inventory and status of data flow, noting that the Data Management (DM) subcommittee suggested that regions look into requiring that mission reports be submitted after missions are completed. A copy should be forwarded to concerned data management personnel. This report can act as a first-level inventory of collected data.

Action item: regional data managers are to design and populate tables that are accessible to all AZMP members on the Virtual Data Centre (VDC) website. These tables will indicate, by region, what data were collected, whether the samples are analyzed, quality controlled, archived and dates where applicable.

There was consensus that quality control of bottle and CTD data needs to become a priority. The DM subcommittee is to draw up a comparison table of quality control (QC) tests done by ISDM, IML, and World Ocean Database (US NODC) and decide on a minimum set of QC tests to be run on data. When QC flags are associated with data, users will know exactly what tests were performed.

Action item: IML is to make available their Matlab procedures for CTD and bottle QC. Regions may modify the procedures somewhat to tailor tests to their different sampling areas of interest

for example, land mask maps, bathymetries, T, S, sigma-t, and nutrient climatologies. Matlab expertise exists in all regions, but IML and ISDM are both available if questions arise.

Quality controlled CTD files will still be sent to ISDM for archiving. Quality controlled bottle data will be archived in BioChem but still sent to ISDM until migration of the ISAM "bottle archive" database is complete. IML will make available their Matlab procedures to load bottle and plankton data to BioChem. These procedures check over the dataset for any "illegal" entries that cause errors when loading to BioChem tables.

Action item: IML will make available their Matlab procedures to load bottle and plankton data to BioChem.

The Maritimes region is currently loading the NAFC zooplankton data and will have a documented guide available by mid April 2011. BIO also has loading procedures for NAFC bottle data available.

Action item: Dedicated data managers must be identified in each region to undertake data management, be responsible for quality control, data loading, and other AZMP data management issues that arise.

ZOOPLANKTON SYNTHESIS PROGRESS AND COORDINATION WITH THE ICES WORKING GROUP ON THE NORTH ATLANTIC REGIONAL SEAS (WGNARS)

C. Johnson, P. Pepin and M. Harvey*

Abstract

Zooplankton communities on the Northwest Atlantic shelf can be influenced by variability in large-scale environmental forcing. The objective of the zooplankton synthesis project is to evaluate how climate signals propagate through lower trophic levels on the NW Atlantic Shelf system, and to identify coherent changes in zooplankton communities, abundance of key species, or phenology across the NW Atlantic Shelf zone. Much of the synthesis work to date has involved compiling, processing, and checking multiple data types from the regions and developing environmental and zooplankton metrics. Following data assembly, fixed station data will be used to evaluate the validity of comparing the semi-annual broadscale surveys from the different regions, given the different seasonal timing of sampling, and interannual variability patterns in metrics from surveys in different regions will be compared with one another and with environmental variability. An example was presented of Arctic *Calanus* spp. On the inshore Scotian Shelf, these species are expatriates from the Gulf of St. Lawrence. We found weak, lagged, positive correlations in Arctic *Calanus* spp. abundance anomalies between Halifax-2 and the Anticosti Gyre (5 mo. lag) and Gaspé Current (8 mo. lag) stations and a weak negative correlation between Halifax-2 and the Shediac station (0-3 mo.). The abundance of this species at Halifax-2 was also related to cold spring-summer surface and bottom temperatures and a low NAO index. While the mechanistic links driving these relationships require further study, these observations are not inconsistent with transport variability from the GSL driving Arctic *Calanus* spp. abundance at Halifax-2, and they provide evidence for climate signal propagation into the zooplankton community of the NW Atlantic. The next steps for the synthesis project will include completion of the zooplankton and environmental data compilation and incorporation of more efficient analytic tools to evaluate patterns. This project contributes to development of an Integrated Ecosystem Assessment by the ICES WGNARS, and funding is being sought to coordinate analyses with US WGNARS members.

Discussion

It was noted that the runoff at Québec City was highly (negatively) correlated with the salinity at Rimouski fixed station, but not with the salinity at Prince 5 fixed station. However, the salinity at Prince 5 was significantly (positively) correlated with the salinity at Rimouski. This seemed to suggest a coherent precipitation pattern eastward of Québec City not entirely captured by the Québec City runoff index but encompassing both hydrographic basins that flow in the St. Lawrence Estuary and Bay of Fundy, affecting near shore salinity. Also, it seemed that there had been an abrupt increase in water levels at the three selected Scotian Shelf gauges on the AZMP website starting in early 2010. January and December 2010 were the two months with highest monthly averaged water levels at North Sydney, Halifax and Yarmouth in more than 40 years. The same is still true when the seasonal cycle is removed. The graphs can be seen on the AZMP website.

Decorrelation scales will help with expectations about where signals will propagate. Particle tracking will give time scales of connection between stations. The autocorrelation of physical variables was suggested as sources of information on spatial connectivity between the stations.

SYNTHESIS AND INTEGRATION IN 2011-2012

A round table discussion was held on other synthesis initiatives that had not been mentioned thus far at the meeting. These included modeling efforts, the use of satellite data, making new products from satellite data, using one and three dimensional models and empirical methods to link the biology and physics such as dynamic factor and neural network analysis.

There is a need to develop a more coordinated and cohesive approach to synthesis; however people are already overburdened which limits their capacity to contribute. It was suggested last year that the Permanent Management Committee may provide direction on coordination towards a more regional then zonal approach of synthesising the annual and seasonal patterns in all the data.

The matter of timely importation of data into BioChem was discussed with deficiencies in manpower and resources being significant issues at all labs.

Modeling initiatives will continue to be an important component of the AZMP.

Available data formats will include NetCDF.

FIELD AND LABORATORY EQUIPMENT RENEWAL

The equipment at all laboratories is at or near the end of its life cycle. There were many instances of when efforts have been taken to repair aging instrumentation when it should have been replaced. This was to accommodate budget cuts. There has been no increase in the operating budget since the inception of the AZMP in 1999. Additionally, the AZMP has been further burdened by regional taxes from which it must be made exempt. The logistic subcommittee should prepare an Investment Summary Note (ISN) which replaces the Capital Project Summary Note (CPSN) specific to the AZMP.

Vessel difficulties continue to be significant issues. Reliable vessel support is essential for observation programs and fleet renewal is a concern.

The lack of specialized personnel required to use new technology such as phytoplankton analysis also creates major problems. The use of regional standing offers was discussed along with the rules behind sharing standing orders between regions.

These points must be made to senior management. Jacques Gagné is to report to Dave Gillis and Paul Lyon is to brief Helen Joseph and Savi Narayanan.

Action items identified for the AZMP Logistics committee:

- Update and revise the latest list of AZMP equipment requirement; evaluate what can be achieved through renewal/upgrading of existing equipment and provide equipment list to Permanent Management Committee for review by 31 May 2011.
- Review previous CPSNs (Lab Modernization, Monitoring Equipment) and recommend options to Permanent Management Committee.
- Identify relevant NMSOs currently available and NMSOs gaps; set up new NMSOs for the appropriate suppliers.

THEME SESSION FOR 2012

Potential ideas for a theme session for next year were discussed such as summary indicators for the environmental state, physical and ecosystem indicators and proxies. Operational oceanography and the search for common trends and the influence of the environment, defining ecosystems, and conceptual models and how this could lead to useful indicators were discussed. There is a need for input from the biologists as well.

SCHEDULING THE NEXT MEETING:

The next Annual General meeting of the AZMP was scheduled for 20-22 March 2012. Breakout groups could meet on Monday afternoon. The venue was to be kept open as an option, bearing in mind costs and facilities.

END OF MEETING

At 12:05 PM, Session 4 and the AGM concluded with the chair offering his thanks to the participants.

APPENDICES / ANNEXES

1 - **Terms of reference / Cadre de référence de la revue**

Thirteenth Annual Meeting of the Atlantic Zone Monitoring Program (AZMP)
Zonal Advisory meeting

March 22-24, 2011
Montreal, QC

Chairperson: Jacques A. Gagné

Context

The Atlantic Zone Monitoring Program (AZMP) was implemented in 1998 with the aim of collecting and analyzing the biological, chemical, and physical field data that are necessary to (1) characterize and understand the causes of oceanic variability at the seasonal, interannual, and decadal scales, (2) provide multidisciplinary data sets that can be used to establish relationships among the biological, chemical, and physical variables, and (3) provide adequate data to support the sound development of ocean activities.

The program sampling strategy is based on (1) seasonal and opportunistic sampling along sections to quantify the oceanographic variability in the Canadian NW Atlantic shelf region, (2) higher-frequency temporal sampling at more accessible fixed sites to monitor the shorter time scale dynamics in representative areas, (3) fish survey and remote sensing data to provide broader spatial coverage and a context to interpret other data, and (4) data from other existing monitoring programs such as CPR (Continuous Plankton Recorder) lines, sea level network, nearshore long-term temperature monitoring, toxic algae monitoring, or from other external organizations (e.g., winds and air temperatures from Environment Canada) to complement AZMP data.

The collected data are edited and archived in databases managed by DFO's Integrated Science Data Management (ISDM) Branch.

Objectives

1 Review the activities of the Atlantic Zone Monitoring Program during 2010 and assess business, operational and logistic issues that need regional/zonal intervention, or that need to be brought to the attention of the DFO Atlantic Science Directors Committee.
2 Synthesize and integrate the biological, chemical and physical oceanographic conditions observed in the Atlantic Zone since 1998, identify trends or changes if they occur, and provide a critical assessment of the information available. Review progresses made since March 2010 and plan work for next year.

Expected publications

CSAS Research Document (6)
CSAS Proceedings

Participants

Participants include DFO Science staff and collaborators as well as representatives from Environment Canada.

Treizième réunion annuelle du Programme de Monitorage de la Zone Atlantique (PMZA)
Réunion zonale d'avis scientifiques

Du 22 au 24 mars 2011
Montréal, QC

Président de la réunion : Jacques A. Gagné

Contexte

Le Programme de monitorage de la zone atlantique (PMZA) a été mis en oeuvre en 1998 afin que l'on puisse recueillir sur le terrain et analyser les données biologiques, chimiques et physiques nécessaires pour : 1) caractériser et comprendre les causes de la variabilité océanique à des échelles saisonnières, interannuelles et décennales; 2) constituer des ensembles de données multidisciplinaires qui peuvent servir à établir des relations entre les variables biologiques, chimiques, et physiques; 3) fournir des données adéquates pour soutenir l'exécution d'activités marines.

La stratégie d'échantillonnage du programme est fondée sur : 1) un échantillonnage saisonnier et opportuniste le long de sections afin de quantifier la variabilité océanographique dans la région du plateau continental canadien de l'Atlantique Nord-Ouest; 2) un échantillonnage temporel plus fréquent de stations fixes plus accessibles afin que l'on puisse assurer un suivi de la dynamique océanique sur une échelle temporelle moins grande dans des zones représentatives; 3) des données de relevés de poissons et de télédétection afin que l'on dispose d'une couverture spatiale et d'un contexte plus vastes pour interpréter d'autres données; 4) des données d'autres programmes de surveillance, comme les transects des EPC (enregistreurs de plancton en continu), le réseau de suivi du niveau de la mer, la surveillance des températures des eaux côtières à long terme, la surveillance des algues toxiques, ou des données d'organisations externes (p. ex., les données de vents et de températures de l'air d'Environnement Canada) à titre de complément aux données du PMZA.

Les données recueillies sont éditées et archivées dans des bases de données régies par la Direction de la gestion des données scientifiques intégrées (GDSI) du MPO.

Objectifs

1. Procéder à l'examen des activités du Programme de monitorage de la zone atlantique en 2010 et évaluer les enjeux relatifs aux activités, aux opérations et à la logistique qui doivent faire l'objet d'une intervention régionale/zonale ou qui doivent être portés à la connaissance du Comité des directeurs des sciences de la zone atlantique du MPO.
2. Synthétiser et intégrer les conditions océanographiques biologiques, chimiques et physiques observées dans la zone atlantique depuis 1998, relever les tendances ou les changements survenus et effectuer une évaluation critique de l'information disponible. Revoir les progrès réalisés depuis mars 2010 et planifier le programme de la prochaine année.

Publications prévues

Document de recherche du SCCS (6)
Compte rendu du SCCS

Participants

Les participants incluent des employés et des collaborateurs du secteur des Sciences du MPO ainsi que des représentants d'Environnement Canada.

2 - 13th Annual meeting of the Atlantic Zone Monitoring Program
22 - 24 March 2011

InterContinental Montréal, 360 rue Saint-Antoine Ouest, Montréal
Salle St-Laurent

Tuesday - Session 1 - Business issues

AZMP Business Meeting (Rapporteur: M. Mitchell)

- 9:00 - 9:10: **J.A. Gagné**: Welcome/ introduction. Acceptance of agenda.
- 9:10 - 9:45: **E. Colbourne, L. Devine, J. Spry**: Regional activity reports.
- 9:45 - 10:00: **C. Caverhill**: Remote sensing.
- 10:00 - 10:30: Break.
- 10:30 - 12:00: Status of AZMP field and laboratory equipment (discussion).
- 12:00 - 13:20: Lunch.

Data acquisition and management (Rapporteur: P. Galbraith)

- 13:20 - 13:40: **M. Ouellet**: Data flow from regions to ISDM / Update on bottle archive migration / AZMP website improvements.
- 13:40 - 14:00: **M. Ouellet**: Report on action items from 2010 (including in particular a discussion on CTD and bottle QA / QC procedures).
- 14:00 - 14:20: **L. Devine** (discussion): Does BioChem need a new paradigm? Group discussion to address problem of regional participation in BioChem.
- 14:20 - 14:40: **M. Kennedy**: What is the zonal view about how VDC should be used?
- 14:40 - 15:00: **M. Kennedy:** International data management commitments (ITIS, OBIS, WoRMS) related to biological and chemical data, and how these commitments contribute to AZMP.
- 15:00 - 15:30: Break.

Session 2

Review of 2009 and/or 2010 environmental conditions in the Northwest Atlantic

Physical Environment (Rapporteur: C. Caverhill)

- 15:30 - 15:50: **E. Colbourne**: Physical oceanographic conditions on the Newfoundland and Labrador Shelves during 2009 and 2010.
- 15:50 - 16:10: **P. Galbraith**: Physical oceanographic conditions in the Gulf of St. Lawrence in 2010.
- 16:10 - 16:30: **B. Greenan**: Physical oceanographic and meteorological conditions on the Scotian Shelf and in the Gulf of Maine during 2009 and 2010.
- 16:30 - 16:50: **B. Greenan**: 2010 physical, chemical and biological conditions in the Labrador Sea (AZOMP).
- 16:50: Wrap-up and end of day 1.

Wednesday AM - Session 2 continues

Biogeochemical Environment (Rapporteur: L. Devine)

- 8:30 - 8:50: **P. Pepin**: Biogeochemical conditions on the Newfoundland and Labrador Shelves during 2009 and 2010.
- 8:50 - 9:10: **M. Starr**: Biogeochemical conditions in the Gulf of St. Lawrence during 2009 and 2010.
- 9:10 - 9:30: **C. Johnson**: Optical, biogeochemical conditions on the Scotian Shelf and in the Gulf of Maine during 2009 and 2010.
- 9:30 - 9:50: **G. Han**: Combining satellite and CTD observations to monitoring the Labrador Current.
- 9:50 - 10:30: Break.
- 10:30 - 12:00 Discussion on :
  - How to calculate standard deviations for the scorecards for biological variables in order to harmonize the regional methods?
  - How to combine the physical and biogeochemical scorecards?
- 12:00 - 13:30: Lunch.

Wednesday PM - Session 3 - Ocean observation and modeling (Rapporteur: N. Shackell)

- 13:30 - 15:00:
  - **D. Brickman, A. Drozdowski and J. Chassé**: A 20 year long ice-ocean numerical hindcast for the Gulf of St. Lawrence, Scotian Shelf and Gulf of Maine.
  - **F. Davidson**: Using an ocean forecast system for the North West Atlantic to supplement bottom temperature sampling.
  - **D. Lavoie, M. Starr, J. Chassé and D. Brickman**: Progress in 3D ocean-biogeochemical (NPZD-O_2-pH) modeling for the eastern Canadian shelf.
- 15:00 - 15:30: Break.
- 15:30 - 17:00:
  - How can ocean observation and modeling be better coupled?
  - How can AZMP and ocean modeling better support each other?
- 17:00: Wrap-up and end of day 2.

Thursday AM - Session 4 (Rapporteur: J. Craig)

- 8:30 - 10:00: Res. Doc. review, SARs and the Bulletin.
- 10:00 - 10:30: Break.
- 10:30 - 12:00: Ten-year synthesis and integration work.
  - **C. Johnson**: Zooplankton synthesis progress and coordination with ICES WGNARS.
  - Synthesis and integration in 2011-2012.
- 12:00 - 12:30: Matters arising, theme session for 2012 and scheduling of next meeting.
- 12:30: End of meeting.

3 - **Participant List / Liste des participants**

Name / Nom	**Affiliation / Affiliation**
Caverhill, Carla	BIO, Dartmouth
Greenan, Blair	BIO, Dartmouth
Horne, Ed	BIO, Dartmouth
Johnson, Catherine	BIO, Dartmouth
Kennedy, Mary	BIO, Dartmouth
Mitchell, Michel	BIO, Dartmouth
Shackell, Nancy	BIO, Dartmouth
Spry, Jeff	BIO, Dartmouth
Chassé, Joël	GFC, Moncton
Devine, Laure	IML, Mont-Joli
Gagné, Jacques A. (chair)	IML, Mont-Joli
Galbraith, Peter	IML, Mont-Joli
Larouche, Pierre	IML, Mont-Joli
Lavoie, Diane	IML, Mont-Joli
Starr, Michel	IML, Mont-Joli
Ouellet, Mathieu	ISDM, NCR, Ottawa
Lyon, Paul	NCR, Ottawa
Craig, Joe	NAFC, St. John's
Davidson, Fraser	NAFC, St. John's
Han, Guogi	NAFC, St. John's
Maillet, Gary	NAFC, St. John's
Mansour, Atef A.H.	NAFC, St. John's
Pepin, Pierre	NAFC, St. John's
McCurdy, Paul	SABS, St. Andrews

4 - **ISDM Annual Report**

1. Data Flow

1.1 Real-Time Requirements

The real-time requirement of GTSPP is that low-resolution messages (TESAC) of CTD profiles get transmitted within 30 days of their observation date on the GTS.

In 2010 the rate of occupations for which a TESAC message was sent to the GTS within 30 days decreased compared to 2009. Overall, 57% of CTD profiles sampled at fixed stations and 52% of CTD profiles sampled in fixed sections' polygons were transmitted on the GTS within 30 days. Among NAFC occupations, the rate of profiles which met the real-time requirement varied greatly, between 100% for Flemish Cap section to 15% for Station 27.

The Shamook, Needler and Pandalus ships failed the requirement more than 50% of the time.

Outside of AZMP, TESACs from 2010 profiles along A7RW, extended Halifax line, Orphan Basin/Knoll & Laurentian Fan survey were not sent until discovered in 2011.

1.2 CTD Profiles (full resolution)

77 cruises containing AZMP CTD data were processed or updated by ISDM in 2010-2011 (prior to the meeting), including 19 cruises from 2010 and 27 cruises from 2009.

The 2010 submission of NAFC CTD data to ISDM had not been made at the time of the meeting, therefore the ISDM archive contains no CTD sampled within the fixed stations and sections located on the Grand Banks or Newfoundland or Labrador shelves.

There was also an interruption in exchange of CTD data from BIO to ISDM. At the time of the meeting, the amount of missing full resolution 2010 CTD profiles from BIO was 97% (compared to estimated number of AZMP occupations).

Most IML CTD profiles have been received. This year IML started processing CTD profiles sampled by the Gulf Region.

Most problems at ISDM with processing CTD data are caused by inconsistencies or new fields in ODF files, and by the fact that there is no machine readable field to pick the best sensors in ODF files when data from multiple sensors are present.

1.3 Bottle data

52 cruises containing AZMP bottle data were processed or updated by ISDM in 2010-2011 (prior to the meeting), including 17 cruises from 2010 and 7 cruises from 2009.

The 2010 submission of NAFC bottle data to ISDM has been made and the data has been ingested.

BIO bottle data are now extracted from BioChem to be featured on the website. There were however no 2010 BIO bottle data loaded in BioChem at the time of the meeting.

IML bottle data is being loaded in BioChem and sent to ISDM Bottle Archive. All 2010 bottle data were sent to ISDM in a timely manner.

The AZMP web site has incomplete data for years 2008 and earlier. ISDM will resume reminding data centers about missing profiles on a best-effort basis in decreasing chronological order.

2. Bottle Archive Migration

   Bottle data from BioChem is now visible on AZMP website. ISDM is pursuing efforts to migrate their Bottle Archive to BioChem. Efforts done in 2010-2011 were to edit standard and reference tables and identify historical cruises with incomplete metadata information. The migration is ongoing, but on a best-effort basis.

3. Website Improvements

   Work on the application extracting zooplankton data from BioChem to generate website products is underway, on a best-effort basis.

   A survey on the AZMP CSV file format was conducted during the year and revealed a need for minor changes to the CSV format, which will be implemented in 2011-2012.

4. Other AZMP-related activities.

   - ISDM generated two scorecards for the 2009 Bulletin Environmental Review.
   - The Bulletins were moved from the Document section to the Publication section.
   - Two staff are currently training to update Climate Indices and Meteorological Data sections, which were updated last year.
   - The website has been updated as usual.
   - ISDM has been monitoring the data flow of AZMP related data.

5 - **AZMP Data Flow Links and Acronyms**

CaRMS – the Canadian Register of Marine Species http://www.marinespecies.org/carms/.

- In spring 2009, the Canadian National Science Data Management Committee created a national activity with the mandate to promote the use of taxonomic standards within the Science Branch of DFO and to develop and implement best-practice procedures for the quality control of biological names used by DFO. One of the objectives of this project was to compile and manage an authoritative list of species occurring in geographical areas of interest to Canadian scientists and to establish a standard reference for aquatic (marine, estuarine and freshwater) biodiversity research, conservation and sustainable management (CaRMS).

CBIF Canadian Biodiversity Information Facility http://www.cbif.gc.ca/home_e.php.

- As a member of the GBIF Canada is exploring new ways to improve the organization, exchange, correlation, and availability of primary data on biological species of interest to Canadians. By enhancing access to these data, CBIF provides a valuable resource that supports a wide range of social and economic decisions including efforts to conserve our biodiversity in healthy ecosystems, use our biological resources in sustainable ways, and monitor and control pests and diseases.

CDIAC – Carbon Dioxide Information Analysis Center cdiac.ornl.gov/.

- The WDC for Atmospheric Trace Gases, Oakridge is operated by, and collocated with, the Carbon Dioxide Information Analysis Center (CDIAC), sponsored by the U.S. Department of Energy's Environmental Sciences Division. CDIAC holds data on emissions of radiatively active trace gases and their concentrations in the atmosphere, oceans, and the biosphere.

COPEPOD - The Coastal & Oceanic Plankton Ecology, Production & Observation Database http://www.st.nmfs.noaa.gov/plankton/products/index.html.

- COPEPOD strives to provide easy access to quality plankton data and prepared data products. An Interactive Atlas is also available, highlighting data coverage by major plankton groups.
- Every 2-3 years, a printed publication is created to summarize the full plankton database content and coverage and also presents the new methods or analysis applied to the database and data products. COPEPOD-2007 introduced an advanced data quality control method for plankton data.

CSAS – Canadian Science Advisory Secretariat.

GBIF – Global Biodiversity Information Facility http://www.gbif.org/.

- GBIF enables free and open access to biodiversity data online. We're an international government-initiated and funded initiative focused on making biodiversity data available to all and anyone, for scientific research, conservation and sustainable development.

GCMD – NASA's Global Change Master Directory http://gcmd.nasa.gov/Aboutus/index.html.

- The project mission is to assist researchers, policy makers, and the public in the discovery of and access to data, related services, and ancillary information (which includes descriptions of instruments and platforms) relevant to global change and Earth science research. See the GCMD AZMP metadata page.

GE-BICH - IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices http://sites.google.com/site/gebichwiki/.

- The GE is a working group formed by the International Oceanographic Data and Information Exchange (IODE) programme of the Intergovernmental Oceanographic Commission (IOC) (see the GE-BICH page on the IODE website for more information).

- The GE addresses issues related to the management and exchange of biological and chemical data collected in the world's oceans. Recent work has focused on the development of vocabularies (names and authoritative definitions) and on QC procedures.

ICES WGZE - ICES Working Group on Zooplankton Ecology http://www.wgze.net/.

- WGZE monitors zooplankton sampling activities in the North Atlantic region, including comparative analyses of zooplankton time series (from national monitoring programs) in relation to climate variability, and reviews new zooplankton sampling and analysis technologies. The WGZE group also organizes taxonomic and laboratory workshops, zooplankton symposia, and joint meetings with other scientific groups within and outside ICES for comparison of plankton ecology between regions.

IOC-HAB – Harmful Algal Bloom http://ioc-unesco.org/hab/.

- The goal of HAB is to foster the effective management of, and scientific research on, harmful algal blooms in order to understand their causes, predict their occurrences, and mitigate their effects. There are three major divisions: educational; scientific, and operational.

IODE - International Oceanographic Data and Information Exchange http://www.iode.org/.

- The IODE programme of the Intergovernmental Oceanographic Commission (IOC) of UNESCO was established in 1961. Its purpose is to enhance marine research, exploitation and development, by facilitating the exchange of oceanographic data and information between participating Member States, and by meeting the needs of users for data and information products.

ISDM - Integrated Science Data Management http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/index-eng.html.

- ISDM formerly Marine Environmental Data Services (MEDS) was established in 1968 to coordinate the processing and archival of physical oceanographic data. Data management, archival and dissemination of physical oceanographic data and data products on national and international scales is still a key component of ISDM mandate, however it has since been broadened to include chemical and biological oceanography.
- The Canadian primary area of interest is 35 to 90 degrees N latitude and 40 to 180 degrees W longitude but for some specialized data types and programmes the area of interest is global.
- The ISDM web site will soon have a quicklink to a DFO science standards page.

OBIS Ocean Biogreographic information System http://iobis.org/about/index.

- Adopted as a program by the IOC under the IODE in 2010.
- The Ocean Biogeographic information System (OBIS) seeks to absorb, integrate, and assess isolated datasets into a larger, more comprehensive pictures of life in our oceans. The system hopes to stimulate research about our oceans to generate new hypotheses concerning evolutionary processes, species distributions, and roles of organisms in marine systems on a global scale. The abstract maps that OBIS generates are maps that contribute to the ‘big picture’ of our oceans: a comprehensive, collaborative, world-wide view of our oceans.
- OBIS provides a portal or gateway to many datasets containing information on where and when marine species have been recorded. The datasets are integrated so you can search them all seamlessly by species name, higher taxonomic level, geographic area, depth, and time; and then map and find environmental data related to the locations.
- Go to Search Data and select OBIS Canada and the view the AZMP Maritimes region collection.
- OBIS Canada is the Canadian regional node http://www.marinebiodiversity.ca/OBISCanada.

ODP – Ocean Data Portal http://www.oceandataportal.org/.

- The Ocean Data Portal aims at providing seamless access to collections and inventories of marine data from the NODCs (National Oceanographic Data Centres) of the IODE network and allows for the discovery, evaluation (through visualization and metadata review) and access to data via web services.

Res. Doc. – CSAS Research Document.

SAR – CSAS Science Advisory Report.

US-NODC - NOAA National Oceanographic Data Center http://www.nodc.noaa.gov/.

- The mission of the NODC is to provide scientific stewardship of marine data and information. The NODC manages and operates the World Data Center (WDC) for Oceanography, Silver Spring, Maryland.
- The WDC is one component of a global network of discipline subcenters that facilitate international exchange of scientific data. In accordance with principles set forth by ICSU, WDC for Oceanography acquires, catalogues, and archives data, publications, and data inventory forms and makes them available to requesters in the international scientific community. Oceanographic data contributed to the WDC become automatically available to scientific investigators in any country.
- The World Ocean Atlas 2009 (WOA09), produced by the WDC, is a set of objectively analyzed (1° grid) climatological fields of *in situ* temperature, salinity, dissolved oxygen, Apparent Oxygen Utilization (AOU), percent oxygen saturation, phosphate, silicate, and nitrate at standard depth levels for annual, seasonal, and monthly compositing periods for the World Ocean. It also includes associated statistical fields of observed oceanographic profile data interpolated to standard depth levels on both 1° and 5° grids.

WoRMS – World Register of Marine Species http://www.marinespecies.org/.

- The aim of WoRMS is to provide an authoritative and comprehensive list of names of marine organisms, including information on synonymy. While highest priority goes to valid names, other names in use are included so that this register can serve as a guide to interpret taxonomic literature.