

**MINUTES OF THE SIXTH ANNUAL MEETING OF THE
ATLANTIC ZONAL MONITORING PROGRAM
Crowne Plaza Hotel, Montreal
1-3 December 2003**

Participants :

Pepin, Pierre (Newfoundland/Chair)	Harrison, Glen (Maritimes)
Han, Guoqi (Newfoundland)	Mitchell, Michel (Maritimes/Rapporteur)
Therriault, Jean-Claude (Quebec)	Brian Petrie (Maritimes)
Alain Gagné (Quebec)	Frank, Ken (Maritimes)
Harvey, Michel (Quebec/Rapporteur)	Gregory, Doug (Maritimes)
Gilbert, Denis (Quebec/Rapporteur)	Chassé, Joël (Gulf/Maritimes/Rapporteur)
Ouellet, Patrick (Quebec)	Spry, Jeff (Maritimes)
Devine, Laure (Quebec)	Narayanan, Savi (MEDS)
Bernard, Pelchat (Quebec)	Schock, Cara-Lynn (MEDS/Rapporteur)
Ouellet, Mathieu (MEDS)	Guay, Claude (MEDS)

Agenda

Monday, 1-December-2003

AM session rapporteur: M. Mitchel

9:00 – 9:15 Welcome from the Chair
Acceptance of agenda
Appointment of Rapporteurs

9:15 – 9:35 AZMP Status Report Québec (Gagné)

9:35 – 9:55 AZMP Status Report Maritimes (Mitchel)

9:55 – 10:15 AZMP Status Report Newfoundland (Pepin)

10:15 – 10:30 BREAK

10:30 – 11:10 AZMP Status Report MEDS and AZMP Website (Schock/M. Ouellet)

11:10 – 11:30 Status of SST/SeaWiFS databases (Gregory)

11:30 – 11:50 AZMP Bulletin (Therriault)

12:00 – 13:30 LUNCH

PM session rapporteur: M. Harvey

13:30 – 14:30 Demonstration of BioChem (Guay)

14:30 – 15:00 Logistic Committee Status report (Mitchel)

15:00 – 15:30 BREAK

15:30 – 16:00 ESR of Physical Oceanographic Conditions in the Gulf of St. Lawrence
(Gilbert/Petrie/Chassé)

16:15 – 17:00 OVERVIEWS

Tuesday, 2-December-2003

AM session rapporteur: C. Schock

9:00 – 10:15 AZMP Review (Pepin)

10:15 – 10:30 BREAK

10:30 – 12:00 AZMP Review continued

12:00 – 13:30 LUNCH

PM session rapporteur: D. Gilbert

13:30 – 13:50 GOOS activities in the North Atlantic (Harrison)

13:50 – 14:20 Status of the remote sensing project Québec (Therriault)

14:20 – 14:50 Status of SeaWiFS data products and availability (Harrison)

14:50 – 15:15 BREAK

15:15 – 15:30 Sustainability of AZMP activities in Maritimes region (Harrison)

15:30 – 16:00 CPR – AZMP plankton comparison and suggested analyses (Frank)

16:00 – 16:30 Annual state of the zooplankton at the AZMP fixed stations: looking for a
multivariate index (Harvey)

16:30 – 17:00 Open discussion as required.

Wednesday, 3-December-2003

AM session rapporteur: J. Chassé

9:00 – 9:20 State of the environment in the Estuary and the Gulf of St. Lawrence in 2003:
preliminary results (Harvey)

9:20 – 9:40 State of the environment in the Martimes region (Spry)

9:40 – 10:00 State of the environment in the Newfoundland & Labrador region (Pepin)

10:00 – 10:20 Comparison of zooplankton catches using Bioness and AZMP nets during the
spring 2002 survey in the Gulf of St. Lawrence (Harvey)

9:40 – 10:10 Indices of the strength of the Labrador Current (Han)

10:20 – 10:40 BREAK

10:40 – 11:00 Oxygen in the NorthWest Atlantic, ARGO and the OPTODE sensor (Gilbert)

11:00 – 11:30 Issues arising

11:30 – 12:00 Schedule for next meeting / closing

Executive Summary

- All regions reported good results in the occupation of the fixed stations and oceanographic transects. As in previous years, there were important issues concerning the current availability of ship time, communication with CCG, and future reductions in the availability of platforms.
- AZMP has made efforts to increase the information content of routine reports by including information from other programs (e.g., Rimouski fixed station, Labrador Sea) and is looking toward others (e.g., Bedford Basin monitoring) to enhance our knowledge base.
- Despite the increased coverage afforded by AZMP activities, there remain some important gaps in coverage, particularly in the northern Gulf of St. Lawrence and off the coast of Labrador. Sample collection in winter is very limited. Even a modest increase in sampling would provide significant increase in knowledge in critical regions and times.
- Progress toward the implementation of the BIOCHEM database system has been good. Three major steps carried out during the year include: [1] move the database and tools to MEDS environment; [2] complete and enhance the existing tools; and [3] Develop and implement new functionalities. During the coming year, significant effort will be dedicated toward implementing the system in all regions.
- The meeting dedicated a large portion of the agenda to undertaking the review of AZMP activities. The results of the review are presented in a separate document (Final Report – The Atlantic Zone Monitoring Program: Review of 1998-2003). The key to making AZMP most effective for Canadians is to ensure that the program provides end-to-end production and interpretation. At this stage, the program has been heavily geared toward the collection of information and description of change in the Atlantic zone. However, greater emphasis will have to be placed on the interpretation and understanding of the processes that lead to change in marine ecosystems. To do so will require dedicated research effort that will require further investment by the department in order to achieve the greatest efficiency from the program.
- It is anticipated that AZMP (Maritimes) will play a role in the ecosystem monitoring in support of GOMA-GOOS. Currently, however, there is little monitoring in the Gulf of Maine carried out by AZMP-Maritimes nor are there resources to enhance their observation program. New resources or adjustments in current observations will have to be considered.
- As part of activities in the Quebec region, a network of oceanographic buoys (IML-4 (Rimouski), IML-6 (Shediac) and Banc Beaugé) is being developed to improve the validation of both SST and ocean color data. Buoy IML-4 was in operation for a second year in 2003. Construction of buoy IML-6 is complete and the instrument will be deployed in 2004. There is also effort being dedicated in Maritimes regions toward the development and implementation of the Seahorse system. The work from both these projects is highly relevant to AZMP but funded from other sources.
- The Maritimes remote sensing team has taken MODIS basic and advanced training and are currently tooling up to get these data online as a replacement for SeaWiFS.
- AZMP Maritimes has determined that the effort (basically, a human resources issue) going into sample collection/processing cannot be sustained under current and anticipated future resource scenarios nor is there a proper balance being achieved between collection and analysis. In the absence of a significant infusion of new

resources into AZMP-Maritimes (considered very unlikely), the coordinating committee has developed a number of options for reduction of sampling effort.

- Québec region are rationalizing cruises and decreasing the number of fixed sites. The biggest problem in the region is the availability of ship time. This will likely mean a reduction in the number of fixed stations or a relocation of some sites. In addition some adjustments will have to be made to the oceanographic surveys.

Minutes of the Meeting (1-3 December)

Welcome address

After a round table introduction, the Chairman (P. Pepin) welcomed the participants and pointed to the continued importance of this meeting in order to maintain a consistent and coordinated approach to the Atlantic Zone Monitoring Program (AZMP). The Chairman indicated that there was considerable work to be carried out during the course of the meeting, with particular emphasis being afforded to planning the five year review of AZMP activities as well as discussion of the results of the recent FOC-AZMP meeting in November.

Approval of the agenda

The agenda was approved without modification.

Appointment of rapporteurs

The Chair had contacted participants prior to the meeting to act as rapporteurs for each half-day session. The following individuals kindly agreed to take on the task:

Monday AM	Michel Mitchel
Monday PM	Michel Harvey
Tuesday AM	Cara Shock
Tuesday PM	Denis Gilbert
Wednesday AM	Joel Chassé

AZMP Status Report: Québec (Alain Gagné)

Highlights

- 12 outings accomplished so far in 2003 at the Gaspé Current and the Anticosti Gyre fixed stations (1 long sampling gap of 2 months in January-February, data gap of one month in May and one month in August). Was only able to realise 4 sorties have been done outings on opportunistic ship time offered by CG.
- Three monitoring surveys along the six AZMP standard sections of the Gulf of St. Lawrence were completed: one at the end of winter oceanographic condition (April 17 –24), one in the spring (June 7-17), and a final one in the fall (October 21– November 7).
- One new section (5 stations) located at the center of the Gulf was added and sampled during the fall survey.
- Chlorophyll, nutrients, zooplankton, and phytoplankton analyses are on schedule.
- The group is considering using the Rimouski station as an official fixed station. This station has a good coverage during summer and could possibly replace the CG station in the future.
- To provide more complete information (and avoid long data gap) at the fixed stations, it would be helpful to have a mooring moorings and buoys.
- Monitoring at a new fixed station located in the northeast Gulf would provide information from Belle-Isle Strait, as it was suggested in the initial proposal of AZMP. A mooring may be deployed in the coming year.

- For next year, we will merge AZMP fieldwork activities with other monitoring projects to reduce ship time and overtime requirements.

Discussion

How feasible it is to try merging the Spring survey with the mackerel survey was addressed as a concern. It was indicated that there would be adjustment in the timing of the surveys.

The report indicated that 29 different people worked on AZMP & related projects. It was clarified that there are only 8-9 PYs fully dedicated to AZMP, but that assistance on some aspects of the program come from other personnel within the region.

It was suggested that there seems to be an expansion of the Québec region AZMP program. J-C. Therriault indicated this was not the case: Québec region is rationalizing cruises and decreasing the number of fixed sites. The biggest problem in the region is the availability of ship time. A report has been produced by the Québec region and submitted to the chairman, where a rationale for reducing the fixed sites in the Gulf is presented. G. Harrison indicated Maritimes region is also trying to write a rationale on adjusting the sampling program to address sustainability and data quality issues as well as resolving the imbalance between analysis and fieldwork. The chairman decided this discussion should be deferred to later in the meeting.

Brain Petrie asked if it is likely that there will continue to be gaps in the winter as observed during the last 2 years. This is the result of the ice breakers not being available because of busy ice-breaking over the last 2 years. With the declining size of the CCG fleet, this is likely to continue unless we can find another solution. This problem will be explored over the next fiscal year.

The mackerel survey is done every 2 years. Patrick Ouellette indicated that historically, June is the preferred time.

It was asked if it would be possible to move the position of the transect in the central GSL. It was indicated the stations were selected based on sites that have been surveyed over a 20-year time period and in order to continue building on these long time series it would be best not to move the stations.

AZMP Status Report: Maritimes (Michel Mitchell)

Highlights

- Sampling was conducted at three fixed stations with a nominal interval of 2 weeks at all sites. Coverage at the Shediac Valley site is limited because of ice conditions. Most sorties at the Shediac Valley site are done on the SAR boat with excellent support from the boat crew. There were 21 sorties to Halifax Station 2, 17 to Prince 5 and 10 to the Shediac Valley.
- All stations along the 4 AZMP sections on the Scotian Shelf and Cabot Strait as well as other stations on the Shelf and Laurentian Channel were surveyed during the AZMP-dedicated fall cruise. The spring Hudson cruise was reduced in length by 12 days because of delays in completing the ship refit: as a result, only the basic AZMP sites were sampled and there was no time to survey the Cabot Strait line. Ice also prevented sampling the two innermost stations of the Louisbourg line.

- Again this year, Hydrographic, zooplankton and nutrient data were collected on the winter groundfish surveys on Georges Bank (Feb.) and the Eastern Scotian Shelf (March), the July Scotian Shelf/Bay of Fundy groundfish survey, and the September southern Gulf of St. Lawrence groundfish survey.
- The Halifax line was also surveyed during the Labrador Sea cruise (July 2003) and the NORWATE cruise (Dec 2003).
- Krill and zooplankton samples were collected with BIONESS in Roseway and Emerald Basins and in the Gully. The BIONESS tow cable is failing, but we were able to continue tows by using alternate conductors.
- The analysis of samples is progressing. Nutrient sample analysis has been delayed but should be completed in January.
- Maritimes regions continued to invest in technology development to improve the efficiency of the sampling program and quality of the field data:
 - ◆ A cell phone real-time data telemetry system was tested for the Seahorse profiler and modelling work has begun to provide a better understanding of the mooring behaviour with the aim of extending mooring survivability.
 - ◆ The Laser Optical Plankton Counter (LOPC) now provides usable zooplankton data and can be used to identify copepods. Efforts are under way to use LOPC data to produce ecosystem indices.
 - ◆ High spatial resolution profiles of CTD, fluorescence and zooplankton (LOPC) data were collected with the Moving Vessel Profiler (MVP) along the Halifax, Louisbourg and Cabot Strait lines.

Discussion

G. Harrison indicated that Maritimes region is facing a 5% budget cut. This is being applied to AZMP, including the CPR funding. We argued that the AZMP funds are held in Ottawa and transferred directly to regional coordinators to exclude the funds from regional cuts. This year it would appear that we will not be able to avoid these cuts and a precedent is being set. The tax on the CPR fund is a further problem because all these monies are expended to cover the cost of the contract and there are thus no funds available to provide for this tax. P. Pepin suggested that if the program funds are being reduced we should begin to reduce our deliverables.

G. Harrison indicated that the Bedford Basin has not been presented in this status report and should be included. The Bedford Basin program is a 30-year time series that should be routinely reported through AZMP. J.-C. Therriault indicated that Québec region will likely include other activities in the reporting.

G. Harrison also indicated that our RDS in the Maritimes would like to see a broader inclusion of monitoring activities in AZMP. AZMP is always mentioned as a contribution from Canada to GOOS. This discussion will be continued during Glen's presentation of GOOS activities.

AZMP Status Report: Newfoundland (Pierre Pepin)

Highlights

- Three dedicated surveys were carried out in the Spring (16 days; 161 oceanographic stations; 63 with chemical/biological sampling), Summer (17 days; 164 oceanographic

stations; 62 with chemical/biological sampling), and Fall (20 days; 161 oceanographic stations; 63 with chemical/biological sampling).

- Station 27 Occupations to mid-October 2003: 16 detailed sampling (Physical, chemical, biological data) plus 22 CTD Samplings.
- A total of 263 net-mounted CTD profiles were conducted during the April 2003 multi-species bottom trawl survey in NAFO Division 3P; A total of 574 net-mounted CTD profiles were conducted during the April-June 2003 multi-species bottom trawl survey in NAFO Divisions 3LNO.
- A total of 9 inshore thermographs were deployed and recovered during 2003 under the AZMP program with the assistance of various inshore fishers.
- We continued to have good success in the use of ships-of-opportunity in sampling Station 27.
- Timelines for processing of biological and chemical samples improving together with data transfers to MEDS.
- Quality assurance program fully implementation anticipated during 2003.
- Equipment needs renewal and benefits would be derived from investment in new technologies to reduce demands on personnel.
- Biological and Chemical group understaffed (100% of 1 Bi and 2 EG + 50% of 1 RES). Analyses and sea-going activities are pushing people to their limits of interest and tolerance.
- More than 80% of Physics group time spent on AZMP and related activities (station resource) – no new initiatives possible.
- Lack of a suitable coastal vessel and ships of opportunity continuing to result in gaps during winter and in parts of late summer/early fall.

Discussion

The ice extent limits how far it is possible to sample along the coast of Labrador.

There are 9 AZMP-funded thermograph sites, but no plans for any TS recorders.

Maritimes region would like to instrument the trawls on the MFD surveys as is done in Newfoundland and Labrador region. The Newfoundland region experience was discussed. Pierre indicated there are serious issues with the quality of the data. The trawl is a very rough environment for a CTD. Nfld are using a SeaBird SBE-19 CTD and always have to execute repairs because of physical damage to the instrumentation. It would require significant engineering to add any other sensors. There would likely be instrument survivability problems. The cylinder that houses the CTD would have to be completely re-designed to accommodate other sensors. During the trawl operation the CTD is the last item to be cared for. The technical operation personnel who deal with the samples are not well versed in dealing with the trawl CTD. Battery pack needs replacing every day.

B. Petrie remarked that there is no LTTMP site near the Avalon Peninsula. P. Pepin will bring this up as an issue to be addressed.

B. Petrie Brian also asked if it would be useful to have a thermistor chain at Stn27. Pierre indicated that there is good physical data at this station and what is really needed is more biology and chemistry. In fact, more information on nutrients and biology is required particularly in the winter months but there are no samples collected at that time.

AZMP Status Report: MEDS and AZMP web site (Cara Schock and Mathieu Ouellet)

This report summarizes the activities at MEDS during 2003 with regard to the AZMP program. During the year, E. Couture took a year assignment and her MEDS AZMP responsibilities were given to C. Schock.

Staffing and funding

Allocation		Expenditures	
AZMP	\$ 20 K (O&M)	Salary	\$ 30 K
Salary (MEDS)	\$ 30 K	Students at MEDS	\$ 30 K
Other (Science Data Management)	\$ 40 K	Computer supplies and software	\$ 20 K
		Travel + misc	\$ 10 K
TOTAL	\$ 90 K	TOTAL	\$ 90 K

Data Flow

This section summarizes a review of the data received at MEDS ***up to the end of October***. Data that were collected or sent after this time were not included in this report.

Annex 1 describes the outcome of comparisons that were made between reduced resolution profiles (TESACs) and full resolution profiles for the continuous data. Missing profiles of both types were determined and whether or not TESACs were received within 30 days for GTS distribution. Table 1 summarizes the number of individual profiles sampled at each Station. Table 2 shows the number of times each Section was sampled as a whole and therefore these numbers represent a group of individual profiles.

Continuous data appears to be flowing well. Most Stations have been sampled at least once a month. Of the data sent, MEDS has received all but one of the TESACs and just over one third of the full resolution profiles. Almost two-thirds of the TESACs were received within 30 days and distributed over the GTS (Table 1).

All Sections have been sampled at least twice except Seal Island which has been sampled once so far. Of the Section data sent, MEDS has received all but one of the TESAC groups and just over half of the full resolution profile data. Approximately three-quarters of the TESACs were distributed over the GTS (Table 2).

Discrete data does not appear to be flowing as timely as in past years. As of October 31, MEDS was not presenting any discrete data on the website. Reasons for delays are primarily two-fold: some regions send their data in one submission at the end of the year or the beginning of the next and there has been staff changes at MEDS which resulted in MEDS being less proactive. Efforts will be made to improve the data flow.

MEDS would like to emphasize the importance and value of sending TESAC and full resolution profile data in a timely manner. Recent profile data, whether reduced or full resolution, are extremely valuable in delayed mode QC procedures executed on Argo float data. Any profiles collected in the same area as profiles from Argo floats are used as a comparison to ensure Argo float sensors are working properly.

General summaries of the data flow by region are below.

IML:

Continuous:

(TESAC) Almost all received within 30 days (of collection)

(Full resolution) Usually most sent at end of the year

Discrete:

Nothing yet, usually sent at end of the year

GTS Distribution:

(stations) 92% received within 30 days

(sections) All received within 30 days

BIO:

Continuous:

(TESAC) Mostly within 30 days

(Full resolution) Within a few months

Discrete:

Nothing yet

GTS Distribution:

(stations) 66% received within 30 days

(sections) Almost all received within 30 days.

NAFC:

Continuous:

(TESAC) Some within 30 days, otherwise a couple of months

(Full resolution) One submission usually in March of the next year

Discrete:

Nothing yet for 2003, usually sent at end of the year

GTS Distribution:

(stations) 40% received within 30 days

(sections) Only a few received within 30 days

MEDS:

The Real Time data go through the MEDS Real Time processing system which takes place three times a week. Delays sometimes occur but are at most 5 days. Real Time data must be received within 30 days in order to be distributed on the GTS. However, since MEDS sometimes requires up to 5 days to process the data, to ensure GTS distribution the data should be received within 25 days. In any case, all TESAC data should be sent to MEDS regardless of meeting the 30-day limit. MEDS is the QC centre for all of the BATHY's and TESAC's worldwide, and ftp's or emails the archive update files to a number of data centres around the world. This data is used by many modelers and scientists who perform "near real-time" oceanography.

The Delayed Mode data processing is done usually within a week of reception.

Once QC'd the data is immediately updated into the archives. The website to access the data is updated monthly.

Data Access

MEDS has been involved with two projects associated with access to data. The BIOCHEM database will store all biological and chemical data in the Northwest Atlantic and the Standards

project, which is supported under major capital funding for ZMP, addresses the issue of standardizing procedures to facilitate easier exchange and management of data and information.

BIOCHEM

Until recently the development of the BioChem database was led by the Maritimes Region. The current focus has been to migrate it to MEDS as a national application accessible from all regions. The nationalization of BioChem is a three-step process:

1. Move the database and tools to MEDS environment.
2. Complete and enhance the existing tools.
3. Develop and implement new functionalities

As part of the first step MEDS has done the following:

- installed and configured an Oracle 8i (8.1.7 release 3) database on a production server and an Oracle 9i (9.2.0 release 2) database on a development server
- successfully migrated a production and development BioChem instance from BIO
- migrated, tested and ran an Oracle 9i Application Server (AS), the oracle infrastructure server, Internet Application Server and an Oracle 6 and 9i Forms server in order to run the web applications locally at MEDS
- configured the Oracle Forms services, the forms can now be run from MEDS BioChem production server
- the web applications point to both production and development BioChem servers at MEDS
- modified the BioChem Data Manager Utility to work against MEDS BioChem servers

The migration is complete. The Edit and Query forms are fully accessible through the intranet and internet, many tools for accessing, editing and inputting data have been implemented, and user accounts have been set up for access from all regions.

The second step involved:

- The web Tools developed by BIO now work for both Production and Development BioChem databases on the Intranet.
- Accounts have been created for each region with a temporary password on both the Production and Development BioChem databases.
- The BioChem Data Manager utility has been converted to edit both discrete and plankton data in both local and national databases and in the production and development national database as well.
- The utility was transferred to BIO for review. BIO has provided feedback and MEDS is currently finishing work on this utility.
- MEDS has written User Documentation for the installation of the MS Access Data Manager Utility as well as documentation to install the Java drivers needed on the client for the web modules of BioChem (Edit and Query modules).
- Both the development and production servers address information for the national BioChem has been added to the national tnsname that is propagated to the regions.
- The production database server has been moved to a secure location where it can be kept on 24/7 and properly backed up on a regular basis.
- MEDS is currently working on providing scripts to each region to allow them to load their discrete and plankton data into BioChem.

Discussion groups were formed in order to tackle the issues surrounding developing and implementing new functionality. The following are some of the discussions currently taking place:

- An online query database will need to be created and the requirements for this database defined.

- A list of products and queries will need to be provided as a first step.
- Quality control specifications will need to be defined.
- What is a duplicate and how are they dealt with?
- The question of appending to a cruise is also closely tied to duplicates.
- MEDS needs to upgrade the national BioChem to the current version 7.

Standards project

At present, all regions of DFO have their own techniques for processing, storing and exchanging data with each other. Dealing with many different formats can be time-consuming and difficult to manage. To address this issue, a project to standardize all aspects of data and information management and exchange procedures has been initiated under the National Science Data Management Project, through cooperation between MEDS and the regions. This project will initially focus on ocean profile data and expand to other data types once experience is acquired. The objective is to reduce the problems associated with format handling and more importantly standardize the data and information content. This will help to improve the effectiveness of managing the diverse types of data within DFO Science.

The major aspects of this project are:

- Review existing practices (formats, contents, QC procedures, duplicates management, version control, exchange procedures)
- Review of standards emerging from SSF XML project.
- Agreement on standards
- Develop implementation plans for mapping or conversion of existing archives and procedures to the agreed standards
- Carry out implementation

An initial review of existing practices is near completion and can be viewed online at http://www.meds-sdmm.dfo-mpo.gc.ca/meds/Prog_Int/standards/.

AZMP Website

Updates and modifications achieved in 2003

The website format and content were reviewed to assess the changes required to ensure that all the content is up-to-date. This included a review of all the graphs and data from 1999 to present. The following summarizes the status and the actions taken, as well as, other additions made throughout the year.

Hydrographic Section

- Modified Gaspé station page to only report the data taken at the actual Gaspé Current station as recommended at last year's meeting. We now no longer report the data taken in its vicinity by a private scientific group located in Sainte-Anne-des-Monts.
- A new application to search and download Hydrographic data has been completed and added to the website.

Climate Indices

- Most climate indices were updated for 2002 following Roger Pettipas' annual submission.
- The St. Lawrence River freshwater runoff series has been updated by retrieving data from the St. Lawrence Observatory. The Physical Modelling Section of IML maintains this series. It was agreed that MEDS will update the series from their website on a yearly basis. A link to the St. Lawrence Observatory has been added to the AZMP website in the Climate Indices section.
- Some indices which are no longer available for updating and were labelled as such on the website. Those indices are :
 - ◆ Hudson Bay Freshwater Runoff: The data that we display were obtained from a report (Loucks & Smith 1995) which stops in 1992.
 - ◆ Saint John River: Environment Canada, from whom we got the data for Saint John River at Mactaquac, have stopped monitoring the site since December 1999. A provincial department (NB Power) is now monitoring it and Roger Pettipas (BIO) has recently inquired to them for updates. Until we hear back from them, the web site will keep specifying that the data stopped in December 1999 and is no longer updated.
- Gulf Stream and Shelf/Slope Front Positions are no longer updated at longitudes 50°W to 54°W. These positions are digitized at BIO from maps sent by Jennifer Clark, an independent oceanographer. Since 1996, the maps no longer cover the area from 50°W to 54°W. A note has been added to the website.
- Indices that show seasonal cycles (*NAO index*, *East Coast Offshore Hydrographic Stations*, *Coastal SST*, *Drainage Basins*) had the period of computation of their seasonal cycle updated when possible. The previous period of computation of seasonal cycles was 1961 to 1990. It has been changed to 1971 to 2000 for series that extend beyond 2000.

Plankton Section

- Zooplankton plots from 1999-2002 at all stations were added. Mesh size is also now specified on the web pages since some 1999 data were acquired using a slightly different mesh size (158 µm) than the standard size defined in the protocol (202 µm).
- Phytoplankton plots at all stations were updated (2000-2002).
- MEDS have been generating the latest plankton graphs out of data provided to us from the regions. We have developed the ability to generate the plankton graphs very quickly, in a compliant format and in a manner which ensures homogeneity across different regions and years.

Sea Levels Section

- The Halifax station 00490 has been out of service since October 2003. Text has been added to the website to indicate this. Data could be taken from a nearby station (00491) as a replacement.
- De-tided and 4-day low-passed filtered water levels have been added to the hourly water levels.
- Graphs of monthly means and monthly level anomalies have been created and are now displayed. They are updated monthly.

- In the *Monthly Means Reports*, NaN values have been added to account for missing data, keeping the columns 'straight' for anyone who wants to import the data in Matlab or Excel.
- Water level series 4 years old and younger have been made continuous hourly by filling missing data with NaNs.

Meteorological Section

In 2003, an agreement was reached whereby Environment Canada will provide meteorological data relevant to AZMP to MEDS twice a year at no cost.

- A meteorological section comprising data sent to us by Environment Canada's Meteorological Service has been implemented on the AZMP website. Meteorological data can now be accessed free of charge through the website.
- With suggestions from regions, the data ensemble we have gathered so far contains:
 - ◆ Hourly Weather at 18 stations (cloud amount, wind speed/direction, etc.)
 - ◆ Hourly Rainfall at 7 stations
 - ◆ Hourly Solar Radiation at 17 stations.
- The data are updated biannually through requests made from MEDS to EC. Scientists from the regions are still encouraged to express their stations and variables of predilection. The Meteorological Service has been very efficient in sending us inventories of their stations and answering our requests in a short amount of time.
- Locations from all Atlantic Provinces, Québec and Nunavut are covered.

Other Sections

- The Publications listed in 2002 bulletin were added to the Publications section.
- GOOS link was added to Links section.
- The Documents section was updated with the Meeting Minutes from the last two meetings.
- Making the AZMP web site Common Look and Feel (CLF) compliant. This task is well underway and has progressed significantly this year.

Items listed as Action Items at 2002 meeting and not yet delivered:

These items were listed as Action Items from last year's meeting and have not yet been received by MEDS.

- Description of climate indices
- List of databases available from data managers. This came from a discussion at last year's meeting concerning a query tool that would lead clients to the locations of links to desired Atlantic data.

AGENDA FOR NEXT YEAR

1. Website

The following is a list of items MEDS will start undertaking soon and will contact some scientists in the regions for feedback when appropriate. Some of these items were mentioned at last year's meeting but were delayed due to lack of time and a change in resources at MEDS.

Climate Indices section:

- We would like to redesign this page and reorganize the twelve (12) indices into different categories for better presentation. For instance, Ice Coverage and Iceberg Count could be grouped into a category named Ice. Air Temperature, Wind observations and NAO in a category named Atmospheric data, etc. This could make the list of twelve indices easier to browse through.
- It might be worth discussing whether the water level monthly means graphs should remain in the water level section or be moved to climate indices section. They show trends and seasonal cycles.
- We will add more indices descriptions, especially in relation to the source of the data and the frequency of update. There are some Climate Indices where the source is not indicated clearly. We have remedied some of them and will continue to do so.
- A new climate index called *Depth Layer Average Temperatures in Gulf of St. Lawrence* has been sent to us lately by Denis Gilbert. With his collaboration MEDS has produced a graph showing the evolution of this index. Its place in the Climate Indices section has yet to be found but will be added soon.
- We have been considering adding runoff from Saguenay River to the Drainage Basin section. This could be accomplished by using data from Environment Canada's HYDAT CD and its yearly updates. We would have to decide which station to use (1-centrale de Chute-à-Caron, 2-centrale de Shipshaw, 3-centrale de L'Isle-Maligne).

Plankton Section:

- We now encourage the regions to send us their zooplankton and phytoplankton abundance data at AZMP sections, in any format readily available. MEDS will process the data quickly to generate plankton graphs that are fully web compliant. Compliance requires that both unilingual English and unilingual French graphs must be created, and it has been known to be an inconvenience in some regions. From now on MEDS will take care of it.
- We will contact the Region(s) responsible for CPR graphs to update with 2001 and 2002 data.

Water Levels Section:

- Data from station 00491, located near the Halifax water level station (00490) which was just discontinued in October, will be added to the web site as a replacement.

Hydrographic Section:

- Scientists will be consulted on the question of whether to now include the variables that are measured less frequently (such as turbidity for instance) on the website.
- Add a map of spatial representativeness contours (Ouellet, Petrie & Chassé, 2003) around AZMP stations and sections as suggested in last year's AZMP meeting report.

Remote Sensing Section:

- Add paragraph descriptions about OSL and BIO Remote Sensing links.

Links Section:

- Add link and description of link to CMEP (Center for Marine Environmental Prediction), since they carry, so far, three observing programs in the same region as AZMP. Add descriptions to other links listed on the site as well.

2. Data Flow

In order to be more proactive and ensure a continuous data flow, MEDS will send inventory lists to BIO, IML, and NAFC on a regular basis. These lists will describe what we have received in a certain time frame and will help keep everyone up to date.

3. Standards

The following aspects of the standards project will be addressed by MEDS together with the other regions:

- Formats: elements considered essential by scientists from all regions have yet to be determined for the choice of a common CTD and bottle formats.
- QC software: there needs to be a comparison between different DFO regions' QC procedures (set of tests, flags.). A comparison of climatologies is underway at MEDS in order to nest them and to compare data to the highest resolution one available. Work for a better bathymetry (the current 5 minutes bathymetry is weak near shelves) is also underway and will be carried on during next year.
- Duplicates: need to determine the proper actions to take when duplicates are found but profiles have slightly different times, or the same variable was sampled by two different instruments.
- Data dictionary: need to compare the mapping of MEDS codes to everyone else's or ensure that they use the same codes with a master list kept somewhere.
- Timely and complete archives: there will be discussions about the exchange practice as it currently exists between MEDS and regions.

4. BioChem

Develop and implement new functionality for the BioChem database. Refer to Step 3 of the BioChem section described previously.

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Annex 1

Continuous Data				
STATION	# of SAMPLES	# of full resolution profiles	# of TESACs (reduced resolution)	TESACs RECEIVED WITHIN 30 DAYS
Anticosti	12	5	12	11
<u>Gaspé</u>	14	7	13	12
Prince 5	15	13	15	11
<u>Shediac</u>	5	4	5	5
Stn2	18	6	18	9
Stn27	35	0	35	14

Table 1

Continuous Data				
SECTION	# of times SAMPLED (# of groups)	# of groups of full resolution profiles	# of groups of TESACs (reduced resolution)	# of TESAC groups RECEIVED WITHIN 30 DAYS
Anticosti	2	2	2	2
Bonavista	2	0	2	0
Bonne Bay	2	2	2	2
Browns Bank	2	0	2	1
Cabot Strait	4	3	3	3
Estuary	4	3	4	4
Flemish Cap	2	0	2	0
Halifax	3	0	3	3
Louisbourg	2	0	2	1
Magdalen Is.	3	3	3	3
Seal Island	1	0	1	0
Sept-Iles	5	5	5	5
SE Grand Banks	2	1	2	1

Table 2

Discussion

It was noted that there seems to be very little discrete data available on the MEDS web site compared to what is known to have been collected. MEDS should review their discrete data holding to ensure all the data that have been sent are included. An FTP site should be set up where the regions can upload their data as they become available: this will make it easier to determine what data have been sent to MEDS.

The discrete data table shows “no entry” for many dates where there are only CTD data (no samples). It would be useful to link to the biological and nutrient data, the CTD data that were collected with these. This would provide information that is important in interpreting the discrete data and would address the issue of “no entries” in the discrete data table.

There are still issues with data return from the fixed sites. This is not a problem with data from major cruises. These data should be shared through an FTP site: as with discrete data, it would make it easier to determine what data have been sent to MEDS. It was also indicated that for the

fixed sites, the IGOSS data and the high resolutions are usually sent to MEDS at the same time as these data are processed very soon after being collected. Because MEDS data are also forwarded to other sites, it was requested that regions should continue to send both the IGOSS and the high-resolution data to MEDS.

On the plankton section of the web site, plots are available but the data cannot currently be downloaded. It was suggested that the actual data be made available also. MEDS now has the ability to generate the plots from the data. It was therefore decided that all regions should send the data used to generate the plots and MEDS would produce the plots and make available the associated data.

The list of climate indices is growing. Mathieu suggested the links to these indices could be grouped by topics. All felt this was a good idea and should be implemented.

Freshwater runoff from Hudson Bay was produced only to 1992. MEDS can generate the time series from 1992 but the data will have to be reprocessed. It was decided MEDS should not redo all the calculations from scratch for all the data. Mathieu Ouellet should contact François Saucier to obtain directions as to how to proceed and ensure the consistency of the calculation for pre-1992 and post-1992 data.

At last year's meeting there were discussions of the spatial representation for the various sites. Maps showing the spatial representation of the information have now been produced. These should be included on the web site as well as the complete PDF report and a subset of this report for general information. The amplitude and phase information made available by pixel for the region would also be a useful feature. This could be achieved by making the database of SST harmonics available by pixels.

Summary of action items:

1. MEDS to review their discrete data to verify the collection includes all data already sent by the regions. Data should be made available through an FTP site. **Action: Cara Schock**
2. CTD data collected with biological and nutrient data should be included in the "discrete data" link of the web page. **Action: Cara Schock**
3. MEDS to consider constructing global solar radiation semi-monthly plots (1997 ff) as data allow: long-term mean, current state and anomalies. **Action: Mathieu Ouellet**
4. Actual data used to generate the plot in the "plankton section" should be available on the site. Regions are to send to MEDS the data they use to produce the plots. **Action: Cara Schock to contact regional coordinators for action.**
5. Put TS data with the discrete data for examination of $\text{NO}_3 = f(T,S)$ - Make sure BIOCHEM fields are filled if they can. **Action: Cara Schock**
6. Fixed stations: regions are to continue sending to MEDS both IGOSS and high-resolution data. **Action: Cara Schock to contact regional coordinators for action.**
7. Climate indices: the indices should be grouped by topics as suggested by Mathieu Ouellet. **Action: Mathieu Ouellet**
8. Hudson Bay freshwater runoff from 1992: MEDS should not recalculate from scratch. Mathieu Ouellet to contact François Saucier to obtain direction on how to proceed; ensure consistency of calculation pre- and post-1992 data. **Action: Mathieu Ouellet**
9. Map of spatial representation of information should be included on the web site. The complete PDF report should be added and a subset of the document is to be included for general information. **Action: Mathieu Ouellet.**

10. Database of SST harmonics available by pixel for Atlantic Canadian Region: capability of generating plots also. **Action: Mathieu Ouellet**

AZMP Data Management Report: Maritimes Region (Doug Gregory)

BioChem Application Development

A workshop to discuss the transfer of BioChem to MEDS was held at BIO in February. Release 7 of the database was signed off by Maritimes Informatics July 15, 2003, which completed Maritimes development commitments to BioChem. The application software has been transferred to MEDS.

Data Processing

Biological / Chemical (BioChem)

Discrete samples – Processing is up-to-date for chlorophyll, oxygen and salinity for fixed stations, ZMP and MFD cruises. Kennedy now has the data and it will be entered into BioChem in early December. Nutrient analysis has been slower than usual. We have the fixed stations to July and Halifax Line from a July Hudson cruise to Labrador Sea.

Zooplankton (200u) - Species abundance, wet, dry weights for fixed stations are in BioChem up to Aug/03 as well as species abundance, wet, dry weights for ZMP lines for HUD2003005. Partial processing (wet and dry weights, large bugs) have also been completed for 2003-002/003 (MFD), 2003-036/042 (MFD), and 2003-038 (Hfx Line / Lab Sea).

Phytoplankton – species abundance for all fixed stations 1999 - Nov 2003 are complete and will be put into BioChem. There are no counts for any of the ZMP lines taken on BOS, non-BOS and MFD cruises

CTD

The protocol is to submit fixed station IGOSS and ODF data to MEDS within 30 days. All other ZMP related cruise data (groundfish survey and ZMP spring/fall cruises) follow the normal process stream and are submitted to MEDS when released by the scientist (not to exceed 2 years).

The processing status of ZMP cruises/stations and submission to MEDS is attached. We are keeping up with the processing, but in many cases failing to meet the 30-day target for fixed stations.

Databases

SST Database

The addition of Pathfinder data to the SST database was completed early in 2003. Version 4.1 data loaded for 1985-1999 and Version 4.1 interim is available for January – June 2003. The database application was modified to permit selection based on data quality.

The application performed 120 queries by 22 users during 2003,

With the addition of Pathfinder data this year, the database is becoming very large (~55 million records, up from 5 million for MCSST) with a growth rate of about 3 million records/yr. We will have to look at some sort of partitioning before too long.

Climate Database

Updates are done on a monthly basis. About 15,000 new profiles were added this year, about the same as the previous year (13,000). The application performed 900⁺ queries by 50⁺ users during 2003, unchanged from the previous year.

A major upgrade to Climate under the GeoConnections project is currently in progress and is scheduled for completion this fiscal year.

SeaWiFS Database

No further work has been done on this project pending receipt of data from BOS. If we do decide to proceed we may have to do a re-think. SeaWiFS will be very much larger than SST, and it is causing us problems. We should look at the spatial indexing CHS uses with their large bathymetric databases.

Coastal Temperature Database

CTS is our first database application to be re-designed under the GeoConnections project. The new application returns results on line and has a much-improved selection of products. Four hundred and twenty three deployments were added this past year including SABS (1995-2001), Gulf (1995-2000), Nfld (1999-2002), and Maritimes (2000-2002).

The application was used 60 times by 14 users during 2003,

Monitoring Cruises Status CTD		
Cruise	Date	Details
Fixed Stations sent to MEDS		
<u>Stn 2</u>	<u>Nov 24,2003</u>	<u>28 files</u>
<u>Prince 5</u>	<u>Nov 13,2003</u>	<u>14 files</u>
<u>Shediac</u>	<u>Oct 14,2003</u>	<u>7 files</u>
Cruises sent		
NED2002051	April 24,2003	Fall Gulf Survey, Sept. 4/02- Sept. 28/02 Tom Hurlbut 175 files
NED2002067	April 24,2003	Fall Pelagic Herring Survey Oct. 23/02-Nov. 01/02 M. Power, 12 files
SWA2002916	Nov 24/03	Halifax Line May 4/02-May 6/02 7 files
Processed, not sent		
NED2002062		Western Sable Bank Oct. 3/02-Oct. 9/02 Edgar Dalley 55 files completed March 7/03
NED2003002		George's Bank Survey Feb. 17/03-Feb.27/03 L. Van Euckhaute 36 files completed April 10/03
NED2003003		2003 4VW Spring Cruise March 4/03-March 20/03 Bill MacEachern 105 files completed June 4/03
NED2003036		2003 Summer Survey July 2/03-July 18/03 Joe Hunt 146 files
NED2003042		AZMP Monitoring Cruise July 21/03-July 31/03

Monitoring Cruises Status CTD		
Cruise	Date	Details
		Paul Fanning 75 files
Not Processed		
HUD2003005		Apr. 12,2003-Apr. 19,2003
HUD2003021		May 21,2003-May 29,2003
HUD2003067		Oct. 19,2003-Oct. 31,2003
HUD2003072		Nov. 1,2003-Nov. 13,2003

Discussion

The SST database data are obtained from NOAA and are updated 2-3 times per year.

G. Harrison indicated the remote sensing data are constantly being updated with new processing as algorithms are improved and updated. For SeaWiFS, this reprocessing will end with the end of the SeaWiFS program. In 1-2 months, the final product from SeaWiFS will be made available. This is a 5-year data set and there is a large amount of very good data.

AZMP Bulletin (Jean-Claude Therriault)

Jean-Claude indicated no draft bulletin was available at this time because the submissions from authors have arrived much later than last year. He has received some drafts but the 12 proposed articles are not yet all submitted. The bulletin will be longer this year - perhaps 36 pages. The main difficulty he faces this year is that articles are being submitted so late. It was suggested that the length of future articles be limited to 1-2 pages: this would reduce the workload on authors and limit the size of the bulletin. This will be considered for next year. The deadline for submission will also be earlier.

Jean-Claude requested that meeting attendees provide him topics for next year's bulletin and that these be discussed on the last day of the meeting.

Demonstration of BioChem (Claude Guay)

The topic of this presentation was the BioChem nationalization project. A working group was formed at the Science Data Management meeting 2002 and after review it was decided that the best option was to migrate BioChem to MEDS so it can become a national resource accessible from all regions. The BioChem database development until recently was led by the Maritimes Region; the current focus has been to migrate it to MEDS as a national application accessible from all regions. The nationalisation of BioChem is a three-step process: 1) move the BioChem database and tools in MEDS environment, 2) complete and enhance the existing tools, 3) develop and implement new functionality.

Until now:

- We have installed and configured an Oracle 8i database on a production server and an Oracle 9i database on a development server,
- We migrated, tested and ran an Oracle 9i Application Server (AS), the oracle infrastructure server, Internet Application Server and an Oracle 6 and 9i Forms server in order to run the web applications locally at MEDS,
- We have configured the Oracle Forms services and are now able to run the forms from our BioChem production server,

- The web Tools developed by BIO now work for both Production and Development BioChem databases on the Intranet,
- Accounts have been created for each region with a temporary password on both the Production and Development BioChem databases,
- The BioChem Data Manager utility has been converted to edit both discrete and plankton data in both local and national databases and in the production and development national database as well,
- We have written User Documentation for the installation of the MS Access Data Manager Utility and documentation to install the Java drivers needed on the client for the web modules of BioChem (Edit and Query modules).
- Both the development and production servers address information for the national BioChem has been added to the national tnsname that is propagated to the regions.
- The production database server has been moved to a secure location it can be kept on 24/7 and properly backed up on a regular basis.
- MEDS is currently working on providing loading scripts for each region for their discrete and plankton data to be loaded in BioChem.

Discussion: Discussion on this agenda item was very short but no major issues or concerns were voiced. The implementation of the database will be the source for discussion at the next meeting.

Logistic Committee Status Report. (Michel Mitchell)

On behalf of the logistic subcommittee Michel Mitchell presented 2 issues: (1) the concern over the maintenance and replacement of equipment required to carry out the AZMP program; and (2) a proposed plan for the inter-comparison of zooplankton sample analysis methods between regions.

Equipment Maintenance and Replacement

At the start of the AZMP in 1999, each region began their respective monitoring programs largely through the use of existing oceanographic instrumentation and associated gear. In order to ensure that all regions followed standard protocols in the collection and measurement of physical, chemical, and biological variables, additional oceanographic sensors and equipment was purchased by the various regions.

At present, all of the regions provide access to oceanographic equipment to other science programs which sometimes results in conflicts with users and equipment being in short-supply for AZMP missions. This condition varies across the different regions. In order to ensure the continuity and maintenance of the AZMP sampling program each region must be equipped with the standard oceanographic equipment including:

<p>Field Equipment</p> <ul style="list-style-type: none"> ➤ CTD SBE911 <ul style="list-style-type: none"> ▪ Fluorometer ▪ Oxygen probe ▪ PAR sensor ▪ Rosette system and Niskin Bottles ▪ Altimeter ➤ Oxygen meters ➤ Ring Nets, cod ends 	<p>Automated systems</p> <ul style="list-style-type: none"> ➤ Shipboard surface water monitoring systems (ground-truth satellite data) ➤ Thermosalinograph ➤ ADCP and multi-frequency acoustics systems
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<p>Small Vessels</p> <ul style="list-style-type: none"> ➤ CTD SBE25, Niskin bottles ➤ Portable winch 	<p>Laboratory Analysis Equipment</p> <ul style="list-style-type: none"> ➤ Nutrient analyzer ➤ Fluorometer ➤ Winkler O₂ titration system
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This equipment must be maintained, calibrated, and replaced when no-longer serviceable.

More frequent sampling of the AZMP coastal fixed stations has been achieved through the use of ships of opportunity. Cooperation of multi-species and other research missions together with AZMP missions has resulted in increased frequency of collection of all standard measures at the fixed coastal stations. A portable mini-rosette (non-conducting cable with auto-fire modules) CTD SBE25 systems, including a small winch, must be available for ship-of-opportunity occupations of the fixed coastal stations to ensure that all physical, chemical, and biological variables are being measured and collected when vessels are in transit. The use of automated shipboard monitoring systems for near surface oceanographic conditions will permit greater confidence and ground-truthing of satellite remote sensing data.

Reliance on the shared equipment pool is at present being utilized in some regions to avoid user conflicts and replace any short-term loss of oceanographic instrumentation and sensors until such time that repairs or replacement can be made. At present, some of the shared equipment and oceanographic sensors available in all regions is reaching it's expected life span and will need to be replaced shortly to ensure that sufficient equipment is available to meet the needs of the AZMP and supported science and environment programs. The committee suggests that efforts be directed into exploring the option of group purchases of new technology instrumentation that will improve the efficiency and cost-effectiveness of the AZMP in the coming years.

In the near future, we hope to establish the capability of continuous monitoring of several biological, chemical, and physical variables from moored installations (**ML buoy, Seahorse profiler**) or using remotely-operated instruments deployed from permanent bottom-moored platforms or surface buoys at the fixed sites. In addition, some research vessels are being outfitted with oceanographic equipment (**thermosalinographs, moving vessel profiler, trawl instrumentation**) for continuous near-surface monitoring and profiling of physical-biological variables. Efforts should continue to be directed at developing and improving these technologies and outfitting the main ships of opportunity with these automated systems and additional sensors for monitoring of meteorological, chemical, and biological variables which will result in additional efficiencies and cost savings for the AZMP. This combination of comprehensive sampling from research vessels coupled with the remotely-collected, high-frequency data, should greatly enhance our understanding of periodic, seasonal, and interannual variability in oceanographic conditions in the Northwest Atlantic which is one of the main objectives of the AZMP.

Failure to properly maintain, calibrate and replace oceanographic instrumentation and outfit our vessels and fixed stations with automated systems will result in the loss in continuity of time series data upon which our environmental overviews and state of the ocean conditions depend and will reduce our capability of monitoring relevant oceanographic conditions at appropriate temporal and spatial scales in the northwest Atlantic. The opportunity to collect information over a broad geographic region by outfitting ship's of opportunity with automated sensor systems represents an enormous cost savings over our conventional dedicated surveys to acquire this information.

Recommendations:

1. Accommodate the need for equipment maintenance and replacement
2. Invest more in new technologies and make use of the new technologies
3. Consider the option of group (zone) purchasing of equipment and technology

Zooplankton Sample Analysis Comparison

Zooplankton abundance and species distribution are key AZMP variables. Samples are collected via vertical plankton net tow, and are later analyzed under the microscope. Shortly after the implementation of the AZMP, a protocol was developed to ensure a consistent approach to the analysis of the collected zooplankton samples. The protocol is aimed at ensuring there is a standard analysis process for consistency between regions and for the long-term reliability of the data set.

The current analysis includes:

1. Splitting the original sample;
2. Concentrating the animals into one volume. This is the final split (**aliquot 2**);
3. Extracting a small aliquots from the final split
 - (a) To count and identify a minimum of 200 organisms (the volume of this **aliquot 1** is recorded); and
 - (b) To take additional aliquot until approximately 100 *Calanus spp* have been identified and staged (the volume of this additional aliquot 1 is recorded).

Past experience has shown that even with a defined protocol there is a danger of biased sample analysis. For example, it was determined that the Huntsman analysis of the SSIP samples (1979-1982) only recognized a very limited number of species. Prior to incorporating these data in BIOCHEM, the SSIP samples had to be re-analyzed. To ensure AZMP did not face a similar problem and that each region's analysis produced comparable results, it was decided to conduct an inter-comparison of the analysis methods from each region.

Such an exercise was begun this year, but after review it was felt the process would not allow us to draw quantitative conclusions. It was therefore decided to revise the comparison process. The ultimate goal is to ensure that the zooplankton analysis results are not biased from one region to another because of a systematic difference in the way the analysis is actually executed. This inter-comparison exercise is not intended to evaluate the potential error introduced by the process of collecting samples with plankton nets.

We identified 2 primary questions to address:

1. Does each person recognize and identify organisms as being the same organisms identified by the other persons doing the analysis? This is a basically an evaluation of the actual species identification process.
2. How does the final splitting procedure, as executed in each region, influence the resulting species distribution? This is an analysis of the species count error.

The proposed comparison exercise is a two step procedure.

Step 1

Goal: evaluation of the species identification and counting process in each region

Procedure: Count and identify all the animals in a same final aliquots which will be circulated to each of the regions.

Table 1. Example of Species identification	
Identification	Count
Calanus finmarchicus f	20
Calanus finmarchicus m	6
Calanus finmarchicus V	156
Calanus finmarchicus IV	43
Calanus glacialis f	2
Calanus glacialis V	0
Calanus glacialis IV	1
Calanus hyperboreus IV	7
Calanus hyperboreus III	1
Metridia longa	1
Metridia lucens	3
Microcalanus sp	4
Oithona similis	188
Pseudocalanus sp	29
Scolecithricella minor	2
Temora longicornis	1
Damaged or exoskeletons	3
Small unidentified	16
copepod nauplii	2
Cyphonaute larvae	1
TOTAL	486

1. Representative small aliquots are to be prepared – each region might prepare 2 small aliquots;
2. Every individual animal is to be identified and counted;
3. A table is produced listing the species identified and the counts of each, similar to the example of table 1.
4. The complete aliquot is returned to its vial and sent to the next AZMP region where the same analysis is to be done.

In an ideal world, we would expect that each person would have recognized the same list of species, and would count the same number of specimen of each species.

Step 2

Goal: proper sub-sampling and counting method

Procedure: Analyze the final split (aliquot 2) according to the AZMP protocol.

1. Count all the animals in a small aliquot until a total of approximately 200 animals are counted and identified;
2. Extract further aliquots to count *Calanus* until a total of at least 150 *Calanus* have been counted.
3. The complete aliquot is returned to its bottle and sent to the next AZMP region for the same analysis.

We would expect variation between the results of the analysts to fit within the error illustrated in the figure 1 generated from a table presented in Postel *et al* (2000).

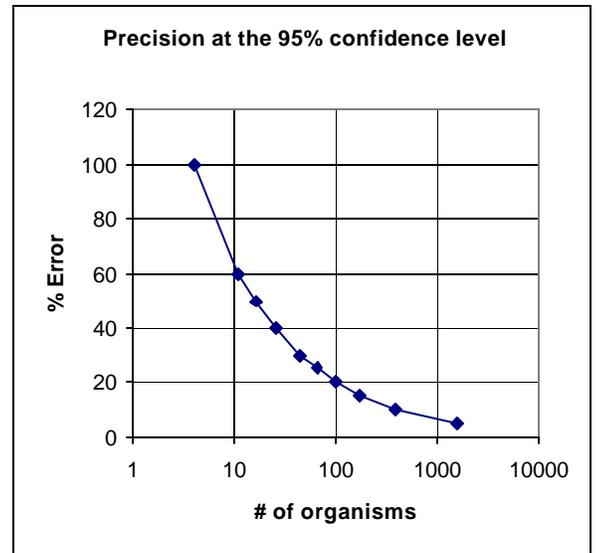


Figure 1. Precision ($\pm\%$) at the 95% confidence level for different number of specimen counted.

This proposed plan for this exercise will be reviewed and discussed among the regions with the intention of executing the exercise next year and presenting preliminary results of the inter-comparison at the next AZMP annual meeting.

References

Postel, L., Fock, H., Hagen, W. (2000) Biomass and abundance. In "ICES Zooplankton Methodology Manual" Harris, R.P., Webe, P.H., Lenz, J., Skjoldal, H.R., Huntley, M. (eds.) Chapter 4, page 151.

ESR of physical Oceanographic Conditions in the Gulf of St. Lawrence. **(Denis Gilbert/ Brian Petri/ Joel Chassé)**

Prior to K. Drinkwater's departure for Norway, a number of climate time series from the Gulf of St. Lawrence were routinely sent to Denis Gilbert for inclusion in his ESR, or simply for inclusion in the PowerPoint presentation that Denis makes each year to IML fisheries biologists in the context of regional stock assessments. These climate time series include the bottom area with temperatures less than 0°C or less than 1°C in both the southern and northern Gulf of St. Lawrence as determined from optimal interpolation maps, time series of ice extent, duration and volume, time series of air temperature at the Magdalen Islands, etc.

Discussion: Discussion on this agenda item focussed on the implications of Ken's departure on the continued delivery of these Gulf of St. Lawrence climate time series. B. Petrie pointed out that

since most of these time series were produced by either R. Pettipas or L. Petrie in previous years, and since those two individuals are still DFO employees, the climate time series they produced in the past would be updated as usual and made available to D. Gilbert. Brian also proposed that the various climate indices could be put on the OSD and/or the MEDS AZMP website so they would be more generally available.

There was also a short discussion on the fate of all the CSAS ESR's and Res. Docs. which K. Drinkwater used to produce. B. Petrie said he would personally become responsible for producing a Res. Doc. on the meteorological and sea ice conditions for the entire Atlantic Zone, and a Res.Doc./ESR pair of documents on the physical oceanographic conditions of the Scotian Shelf/Gulf of Maine. There was some uncertainty about the future of the ESR or Res. Doc. on ocean climate conditions relevant to snow crab in the southern Gulf of St. Lawrence. J. Chassé will probably become responsible for the production of a modified version of this document that would be relevant to several fish/invertebrate species in addition to snow crab, possibly starting in 2005 with a document describing the 2004 ocean climate conditions and with some support from L. Petrie and R. Pettipas. Finally, D. Brickman will replace K. Drinkwater for the Scotian Shelf/Gulf of Maine RAP presentation that usually takes place in late summer.

Review of AZMP activities 1998-2003

The meeting dedicated a large portion of the agenda to undertaking the review of AZMP activities. The results of the review are presented in a separate document (Final Report – The Atlantic Zone Monitoring Program: Review of 1998-2003).

As per the initial proposal for the program, one of the major tasks for the Sixth Annual Meeting of the AZMP was to undertake a five year review of the activities, accomplishments and challenges during the period 1998-2003.

The Chair started the discussion with an outline of the general format of the review, which was based principally on the agenda items approved by the Atlantic Science Directors as part of the outcome of the Minutes of the Fifth Annual Meeting of the AZMP, held in December of 2002. The AZMP committee agreed that a single document, preceeded with an executive summary, should form the basis of the review. The general format was to state the question under each section, which is to be immediately followed by the conclusion(s) and recommendation(s) emerging from the analysis and discussion of the issue(s).

One of the issues discussed involved the need for an external review of AZMP activities. The Chair indicated that the external review had been done as part of the FOC workshop held earlier in the fall of 2003. Furthermore, the Atlantic Science Directors had agreed that the AZMP review should be conducted principally by the active members of the program.

In order to achieve maximum impact in the presentation of the AZMP review to the Atlantic Science Directors, the committee felt that it would be effective for the Chair to consider making a live presentation of the results instead of a teleconference as is normally the case. The Chair agreed but indicated that this would also depend on the Atlantic Science Directors. Presentation of the program review should focus on:

- Highlights of the program
- Achievements made to date
- Understanding that has been gained through program activities
- Issues requiring further research that should be identified as science priorities

The key to making AZMP most effective for Canadians is to ensure that the program provides end-to-end production and interpretation. At this stage, the program has been heavily geared

toward the collection of information and description of change in the Atlantic zone. However, greater emphasis will have to be placed on the interpretation and understanding of the processes that lead to change in marine ecosystems. To do so will require dedicated research effort that will require further investment by the department in order to achieve the greatest efficiency from the program.

GOOS Activities in the North Atlantic (Harrison)

Two GOOS developments during 2003 of relevance to AZMP were highlighted. (1) The Design Plan for the Coastal Ocean Observation Panel of the Global Ocean Observing System (COOP-GOOS) was completed in 2003 and the implementation planning begun. The development of regional pilot projects has been considered a major strategic approach to the implementation of GOOS globally. For the North Atlantic, the implementation of GOOS is being directed by the ICES-IOC Steering Group on GOOS (SGGOOS). The 2003 meeting of SGGOOS took place in Nantes, France (IFREMER) in April, and among the topics discussed were plans for the development of GOOS pilot projects in the North Atlantic. In the eastern Atlantic, the North Sea Ecosystem Pilot Project (NORSEPP) was discussed. In the western Atlantic, plans for a joint Canada/US pilot project in the Gulf of Maine (GOMA-GOOS) were introduced. (2) A planning group for the Gulf of Maine GOOS pilot project (GOMA-GOOS) has been recruited (representatives from DFO on the Canadian side and NMFS on the US side) and a draft planning document has been completed. The objectives of GOMA-GOOS are to:

- Evaluate the observation and monitoring system, and its coordination, of the Gulf of Maine Area (NAFO Div 4X-5) in relation to diverse indicators required for 'integrated management', with particular emphasis on fisheries
- Develop an information support system for management
- Undertake research on the inter-relationships of indicators of diversity, productivity and habitat
- Develop a seasonal forecast model of the Gulf of Maine and adjacent marine areas. Incorporate oceanographic models for the Gulf of Maine Area into climate change models of the North Atlantic

In order to move the planning and implementation of GOMA-GOOS forward, four working groups have been established:

- Ecosystem Status and Indicators WG
- Monitoring & Data Gaps WG
- Data Integration WG
- Climate Change WG
- GOMMI WG (already exists)

As a first step, a workshop will be held in winter 2004 to review the ecosystem-level objectives of each country and develop an objectives hierarchy with associated indicators that would subsequently guide the activities of the working groups.

It is anticipated that AZMP (Maritimes) will play a role in the ecosystem monitoring in support of GOMA-GOOS. Currently, however, there is little monitoring in the Gulf of Maine carried out by AZMP-Maritimes nor are there resources to enhance their observation program. New resources or adjustments in current observations will have to be considered.

Discussion

D. Gregory asked whether there is any relationship between GOMA-GOOS and GOMOOS ? Answer is Yes and No. GOMOOS is not measuring any of the living resources whereas GOMA-GOOS proposes to do so.

M. Mitchell questioned whether there would be any new DFO funding once DFO agrees to join GOMA-GOOS. He is afraid that if we buy into GOMA-GOOS without new funding, this may eventually have a negative impact on our ability to continue our current AZMP activities. G. Harrison acknowledges there may indeed be no new DFO funding for GOMA-GOOS.

D. Gregory wants to know how GOOS is related to the recent Earth Observing System workshop recently held in Washington D.C. S. Narayanan answered that Environment Canada minister David Anderson is Canada's representative on this EOS construct. Some text pertaining to this EOS workshop appears in Glen's text on AZMP-GOOS in the 5-year AZMP review.

AZMP remote sensing activities at MLI (Larouche)

The Maurice Lamontagne Institute Remote Sensing laboratory has been operating a NOAA-AVHRR reception facility since 1994. This station is also capable of receiving SeaWiFS images. IML receives, archive and process images to generate a suite of products aiming at a variety of users (support research cruises, scientific projects, general public, etc). IML also operates a second reception facility in Resolute Bay, allowing a complete view of the Arctic. This station is co-managed with the Arctic Weather Center (Environment Canada).

The sea surface temperatures generated from NOAA satellites are available for 8 regions: Estuary and Gulf of St. Lawrence, Scotian Shelf, NW Atlantic, Hudson Bay, Baffin Sea, Arctic Ocean, North Water, and Beaufort Sea. Maps are generated for every overpass (4-12 per day), and we also calculate weekly and bi-monthly means. Products are available as either JPEG maps or HDF data files at <ftp://eole.gc.dfo.ca>. We also generate SST time series at specific AZMP locations and sites of offshore thermographs to compare with in situ measurements and evaluate the precision of satellite estimated SSTs. In 2003-04, we completed major system modifications by adding a back-up processor and upgrading our RAID disk array. We also rebuilt our product database as part of a major reprocessing of all MLI images acquired since 1994. The web site development is still ongoing as part of the St. Lawrence Observatory and should be available by year's end. (Now available at : <http://www.osl.gc.ca/teledetection/jsp/recent.jsp?lg=en>)

As part of the laboratory's research activities of the remote sensing laboratory, IML is also putting in place a network of oceanographic buoys (IML-4 [Rimouski], IML-6 [Shediac] and Banc Beaugé) to improve the validation of both SST and ocean color data. The year 2003 was the second operational year for the IML-4 buoy. We just completed the construction of the IML-6 buoy which is now ready for deployment in early 2004.

Discussion

G. Harrison requests that an email be sent to all AZMP members to advertise the FTP address where people will be able to download the JPG and HDF files (see above).

J. Chassé asked whether there is any difference between the SST images produced by P. Larouche and those produced by the BIO group. D. Gilbert answered that P. Larouche's SST composites images are based on a greater number of NOAA satellites, but he is not sure about possible differences in SST algorithms. One other difference is IML's extended geographic

coverage made possible by the Resolute Bay receiving station that allows SST measurements of Baffin Bay and the Beaufort Sea as well, for example.

Status of SeaWiFS data products and availability (Harrison)

The SeaWiFS ocean colour data we have been getting at no cost since September 1997 will end on 20 December 2003. SeaWiFS will remain operational but accessibility to the data from ORBIMAGE will be by licensing only. For DFO, the annual fee would apparently be on the order of \$100K US! This is a prohibitive cost and as a consequence, the Maritimes remote-sensing team is transitioning to the Moderate Resolution Imaging Spectroradiometer (MODIS) products that are being made available at no cost from NASA by FTP/web access.

MODIS has 36 spectral bands and spatial resolution of 0.25, 0.5 and 1.0 km with global coverage every 1-2 days. There are two MODIS satellites in orbit ("Terra" launched in December 1999 and "Aqua" launched in May 2002). The MODIS team produces some 44 standard data products of which PAR, SST, water-leaving radiances and chlorophyll a pigment concentration are of most interest to AZMP. Perhaps a downside of this new satellite ocean colour system has to do with data management – approximately 6 gigabytes of data will come in daily, just for the level-2 processed products for the NW Atlantic!

Because of the transition to MODIS and reprocessing problems with both the current SeaWiFS and NOAA-SST products Maritimes Region processes, the bi-weekly composites (SST and colour) and regional statistics for the NW Atlantic are not available yet. However, it is anticipated that the full record of SeaWiFS and NOAA-SST (September 1997-December 2003) will be available within a month.

The Maritimes remote sensing team has taken MODIS basic and advanced training and are currently tooling up to get these data online as a replacement for SeaWiFS within the next three months (MODIS data commencing in July 2000 will be available). At present, they are doing extensive inter-comparison tests between NOAA and MODIS SST data and will do the same for SeaWiFS and MODIS ocean colour as soon as the MODIS colour data are verified ready. Bi-weekly composites of SST (from NOAA and MODIS) will be produced as in the past as well as MODIS colour. Regional statistics will also be produced as previously. Composite images of NOAA and MODIS SST for the NW Atlantic in October, 2003 were shown as illustration of the comparability (and differences) in the two data products.

The report was concluded with a few SST and SeaWiFS images from the Scotian Shelf in spring showing the cold conditions and large spring bloom in 2003 compared with 2002. Based on the SeaWiFS data, the 2003 spring bloom, particularly on the western shelf, exhibited the highest maximum chlorophyll concentrations of the 5-year data record.

Discussion

P. Pepin asked when the SeaWiFS products for polygons will be ready. G. Harrison answered they will probably be ready by the end of December 2003.

Sustainability of AZMP activities in Maritimes region (Harrison)

The AZMP-Maritimes coordinating committee felt the occasion of the 5year program review provided the appropriate context for a close scrutiny of the sustainability of the regional program, particularly in light of mounting pressures on overtime, ship usage, loss/re-direction of A-base support and the need for a better balance between sample collection/processing and data analysis/interpretation.

AZMP Maritimes has determined that the effort (basically, a human resources issue) going into sample collection/processing cannot be sustained under current and anticipated future resource scenarios nor is there a proper balance being achieved between collection and analysis. In the absence of a significant infusion of new resources into AZMP-Maritimes (considered very unlikely), the coordinating committee has developed a number of options for reduction of sampling effort based on the following considerations: (1) What was the sampling identified in the original AZMP proposal as a regional commitment? (2) What is the scientific value of the sampling (or what will we lose if we eliminate it)? (3) What are the 'political' implications of elimination of sampling, i.e., will there be strong objections from AZMP colleagues from other regions, DFO managers, or other potential end-users? An additional guiding principle is to suggest, where possible, alternatives to conventional human-based sampling to collect the observational data, i.e., is a technology fix feasible?

Scenarios for effort-reduction at the Maritimes' three fixed stations, the two (spring and fall) section surveys and the four groundfish surveys were outlined and feedback from the other AZMP regions solicited. Instrumented (CTD, fluorometer, LOPC, NO₃-probe) groundfish trawls, for example, are technically feasible and have proven useful in the Newfoundland region and may address some of the human resource issues in the Maritimes region if implemented.

Discussion

S. Narayanan asked whether prioritization of field activities is actually threatening CTD data collection on groundfish surveys. G. Harrison answered that some people make the argument that dropping hydrography from the groundfish cruise can shorten a 28 day cruise to a 26 day cruise, thus saving two days of ship time.

D. Gilbert argues that in terms of AZMP priorities, the fixed station at Shediac should not be dropped because it is part of the program's core measurements. Moreover, the IML-6 instrumented buoy will start being deployed at the Shediac station beginning in summer 2004. BIO should instead reduce or drop its bottom nutrients measurements on the groundfish surveys. G. Harrison replied that from a groundfish habitat point of view, the ability to map bottom oxygen is viewed as an important issue. P. Pepin then suggested that it might be possible to put an oxygen sensor mounted on a trawl to reliably measure bottom oxygen. Getting reliable vertical oxygen profiles could be more problematic though. The way water flows within the tubing protecting the CTD-O₂ probe can certainly affect the sensors' response.

G. Harrison suggested that one possibility for reduced sampling is to drop the Cabot Strait section as there presently is an overlap with the Quebec Region sampling. Furthermore, due to financial pressures, St. Andrews staff have recently reduced their sampling effort from bi-weekly to monthly sampling at the Prince 5 station.

Net Plankton data: recent use and future possible application (K. Frank, B. Petrie)

Annual abundance estimates of selected groups of phytoplankton and zooplankton from the Continuous Plankton Recorder (CPR) have been used in the recent evaluation of the eastern Scotian Shelf ecosystem (DFO 2003). Recent trends in the CPR data are consistent with a top-down effect from one trophic level to the next starting with reduced predation on pelagic fish species associated with the collapse of groundfish, and intensive consumption by pelagic fish on zooplankton leading to relatively high levels of phytoplankton. The success of this recent application of CPR data has led to a deeper examination of the utility of this data to other questions concerning assessment of changes in community structure and its potential to quantify biodiversity. We focused our evaluation on zooplankton from two geographic areas along the E-line: the eastern Scotian Shelf (ESS) and southern Newfoundland (SN). Analysis of net plankton from historical collections and during AZMP was also undertaken for the ESS. Briefly, we found

utilizing 90 and 72 unique categories (mixture of species, genera, family types) derived from CPR for the ESS and SN regions respectively, that distinct changes in community structure had occurred. On the ESS, three distinct community types were evident with the greatest separation occurring before and after 1992. The most recent period was dominated by *Calanus glacialis*, *Centropages typicus*, *Oithona* sp., Decapoda, Coelenterata, Bryozoans and Larvacea. The time series of decapods larvae was found to coincide remarkably well with the commercial landings of snow crab after accounting for an average age of recruitment of 8 years. Community structure in the SN was distinct in two time periods, before and after 1992; however, the categories contributing to the differences were not the same as observed on the ESS, particularly with respect to decapod larvae. The net plankton data from the eastern Scotian Shelf collected before and during AZMP using 200-243 micron mesh nets (comparable to CPR mesh) using different gear types and deployment methods resulted in identification of close to 400 unique categories. There was generally good agreement between these collections and CPR with AZMP providing much higher taxonomic resolution of the dynamics of the component species. Collectively, the data bases we examined hold potential for indicators of water mass types that should eventually be evaluated in association with T-S properties, population dynamics of selected species, indicators of structural/functional changes in continental shelf ecosystems, monitoring and evaluating changes in biodiversity, development of biomass size spectra (from fish to phytoplankton) and for assessing changes in benthic macroinvertebrate abundance.

Discussion

G. Harrison asked whether some species have strong influences in the 90's and was there something similar in the 70's? The authors responded that there was no real answer for now but that such questions could be addressed in the future. G. Harrison commented that it is very interesting that the CPR data could show the kind of patterns described. CPR data shows consistency with the net data for the main species.

Annual state of the zooplankton at the AZMP fixed stations: looking for a multivariate index. (Michel Harvey)

The motivation for the work is based on the fact that no correlation between variables could be found in the univariate sense. The software PRIMER is used to do the multivariate analysis at the Gaspé Current (GC) and Anticosti Gyre (AG) stations. 65 groups were discriminated in the matrix. The analysis is done over 4 years of data. Multi-dimensional scaling permits the description of the similarities in the samples (sampling). A seasonal variability is seen in the Gaspé Current (GC). The highest contributions have been determined (mean abundance). The variability between the samples was much higher in 2002 (GC). Simulations were performed to look at the sensitivity of the analysis on the abundance of different species and their seasonal variability. There were no significant interannual variations of the zooplankton biomasses and abundances between 1999 and 2002 at both stations (GC, AG) and no relationships between the univariate zooplankton indices and the environmental indices (chl. a, onset of the bloom, % of Labrador Shelf water, CIL core temperature) except for the total abundance of zooplankton and the chl. a at the Gaspé Current station. The multivariate analysis showed significant interannual variations in the zooplankton community structure and abundance at both stations (GC and AG). In the GC, this variability was due to the variation in abundance of the opposite stages of 2 small copepod species (*O. similis* and *Pseudocalanus* spp.) and 1 large copepod species (*C. finmarchicus* CIV and CV). On the other hand, in the AG the variability was due to the variation in abundance of the copepodite stages of 3 small copepod species (*O. similis*, *Pseudocalanus* spp., and *Microcalanus pusillius*) and 1 large copepod species (*C. hyperboreus* CIV and CV). The MVDISP index seems to have some potential to evaluate the annual state of the zooplankton at the AZMP fixed stations. This index varied as a function of both the abundance of the different taxa and the presence and/or their absences, including the copepodite stages. It also varied as a function of the chlorophyll a and 2 physical environmental factors (% of Labrador Shelf water entering the GSL and the CIL core temperature index), suggesting that both primary production

and the circulation play important roles in the control of the zooplankton community structure and abundance at both AZMP fixed stations in the GSL. More analysis should be done to better understand how the index is affected by 1) changes in the abundance of some species and/or development stages, and 2) by change in the seasonality of the community structure (reproduction period). Longer time series are needed to evaluate the real potential of the MVDISP index.

Discussion

D. Gilbert commented that one should be careful with correlation with only four points. P. Pepin commented that there were similarities between the analyses of the data at the two stations. B. Petrie suggested that a principal component analysis would be interesting to carry out for comparative purposes. He also wondered if there is a way to quantify the error bar on the index, possibly using bootstrapping.

Comparison of zooplankton catches using BIONESS and AZMP nets during the spring 2002 survey in the Gulf of St. Lawrence. (Michel Harvey)

A comparison study was undertaken during the spring of 2002 to estimate the differences in catches using a BIONESS as opposed to AZMP usual nets. 42 stations along six transects were occupied. Samples from the BIONESS (1 m² opening, 202 µm) were compared with samples from 2 nets: 1) a vertical tow from bottom to surface (0.75 m ring net, 202µm) and 2) an oblique tow from the bottom to surface (same net). Sorting, identification, enumeration, and wet weight measurement of all macrozooplankton species including euphausiids (krill), mysids, chaetognaths, amphipods, and jellies, and wet weight measurements of the mesozooplankton were performed. Results show that there were no significant differences in both the mesozooplankton and the macrozooplankton biomasses sampled with the ring net and the BIONESS, both equipped with 202 µm net mesh size, along the 6 AZMP transects of the GSL in Spring 2002. There were no significant differences of the macrozooplankton abundance sampled with the ring net and the BIONESS along the 6 AZMP transects of the GSL in spring 2002. However, the proportion of euphausiids and hyperiid amphipods were higher in the BIONESS samples at stations where they were abundant (> 15 ind/m²) (LSLE and TASO). The dominant macrozooplankton groups varied in each region of the GSL: 1) the euphausiids dominated in the LSLLE and the Gaspé Current, 2) the cnidarians and the ctenophora dominated in the NW GSL, and 3) the chaetognatha and the hyperiid amphipods dominated in the northern and the southern GSL.

Indices of the strength of the Labrador Current. (Guoqi Han)

The equatorward flowing Labrador Current exhibits strong seasonal and interannual variations and is believed to have significant impacts on the physical, chemical and biological properties on the entire Atlantic Canadian Shelf. Previous work in using satellite altimetry to observe major tidal constituents and seasonal and interannual sea level variations over the continental shelf/slope and along the coast was reviewed. Studies of seasonal and interannual changes of slope currents and rotational currents of Gulf Stream warm-core rings from satellite altimetry were also discussed. With satellite altimetry's ability demonstrated, the methods of deriving the Labrador Current volume fluxes were outlined. Mean currents are coming from models (finite-element). Model currents are interpolated on T/P tracks. The actual current could be greater with the along-track component. Variability is larger as one goes southward. Unit-depth seasonal-mean volume fluxes were calculated between the 200- and 3000-m isobaths for the Labrador, Newfoundland and Scotian Slopes from 1992-2002. The seasonal cycle of the Labrador Current transport is clearly evident, stronger in fall/winter and weaker in spring/summer. On the interannual scale, the Labrador Current intensified off Labrador in 1995/96, off Newfoundland in 96/97 and off Nova Scotia in 1997/98. There are indications that a Labrador Current pulse is traveling southward and

would affect the entire Newfoundland Shelf. There is a different pattern near the coast compared to the slope. Altimetry-derived current shows the patterns of the Gulf stream rings. Future work includes the derivation of the total volume transport by combining satellite altimetry with hydrographic data, calculation of heat fluxes from satellite sea surface temperature observations and chlorophyll-a fluxes from space-observed ocean color data. The results will be presented online and updated promptly.

Discussion

D. Gilbert asked whether there is any possibility to derive the current around the Louisbourg line using altimetry data. G. Han replied this would be possible if there are T/P sections in the vicinity of the line.

Oxygen in the Northwest Atlantic, ARGO and the OPTODE sensor (Denis Gilbert)

A major reduction of dissolved oxygen concentration (from 130 μM to 65 μM) in the bottom waters of the Lower St. Lawrence Estuary (LSLE) has occurred from the 1930s to the 1990s. The oxygen levels in the bottom waters of the LSLE are now so low (17% saturation) that they no longer represent a suitable habitat for cod. Other fish and invertebrate species of commercial importance in the LSLE are presumably approaching their own tolerance threshold to hypoxia, giving us reasons to worry about the present low oxygen conditions.

In an initial effort to understand the causes of this two-fold reduction in oxygen levels, we examined the role of changes in conservative water mass properties (T & S) in the deep waters of the Laurentian Channel. This exercise revealed a $\sim 2^\circ\text{C}$ warming in the bottom waters of the LSLE from the 1930s to the 1990s. This warming was also observed at 250 m depth in the Cabot Strait region and at the mouth of the Laurentian Channel, some 400 km south of Nova Scotia and Newfoundland. A warming of this magnitude implies that the proportion of Labrador Current Water in the makeup of waters entering the mouth of the Laurentian Channel has significantly decreased in recent decades compared with the 1930s. If we look at temperature, salinity and oxygen values in the Northwest Atlantic on a potential density surface (27.25 kg m^{-3}) characteristic of the bottom waters of the LSLE, we can see that the Labrador Current Water (LCW) has a much higher oxygen content than waters to the south of the Gulf Stream, in the North Atlantic Central Water (NACW). But how much do we know about the variability of oxygen concentrations in the LCW and the NACW? Present sources of data relying on ships are rather spotty. They may allow interdecadal comparisons in the oxygen levels of the LCW and NACW, but are insufficient to characterize the oxygen variability in these waters at the seasonal or annual time scales in most places. More frequent measurements of oxygen in the LCW and in the NACW would certainly be desirable.

A broad-scale global array of temperature/salinity profiling floats, known as Argo (<http://www.argo.ucsd.edu>), offers us a unique opportunity to vastly increase the collection of vertical oxygen profiles in the world ocean, including the Northwest Atlantic. A new oxygen sensor known as the OPTODE, developed by Aanderaa Instruments (<http://www.aanderaa.com>), shows remarkable long-term stability in calibration, is not sensitive to biological fouling, and also has a well-documented pressure dependence. The OPTODE sensor is based on the effect of dynamic luminescence quenching (lifetime based) by molecular oxygen. Webb Research Corporation is now capable of supplying APEX floats with the Optode sensor fully integrated into the system, and initial field trials have yielded good quality oxygen data. Howard Freeland of the Institute of Ocean Sciences has recently included the possibility of buying APEX floats equipped with the OPTODE on the next standing offer agreement for the purchase of such floats by Canada.