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Proceedings of the zonal peer review of the Twenty-second Annual Meeting of the Atlantic Zone Monitoring Program (AZMP)

Meeting dates: April 20-21, 2020
Location: Teleconference

Chairperson: Peter S. Galbraith
Editors: Jean-Luc Shaw and Peter S. Galbraith

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Canada

Foreword

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

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SUMMARY

The Atlantic Zone Monitoring Program (AZMP) was implemented in 1998 with the aim of collecting and analyzing the biological, chemical, and physical field data that are necessary to:

1. Characterize and understand the causes of oceanic variability at the seasonal, inter-annual, and decadal scales;
2. Provide multidisciplinary data sets that can be used to establish relationships among the biological, chemical, and physical variables; and
3. Provide adequate data to support the sound development of ocean activities.

AZMP scientists usually meet annually to review the activities of the Program and assess business, operational and logistic issues that need regional/zonal intervention, or that must be brought to the attention of the DFO Atlantic Science Directors' Committee. The year 2009 marked the 10th anniversary of ocean observation by AZMP. In March 2010, AZMP scientists initiated an effort to synthesize and integrate the oceanographic conditions observed in the Atlantic Zone since 1999, to identify trends or changes, and to provide a critical assessment of the information available. In 2014, the Atlantic Zone Offshore Monitoring Program (AZOMP) began providing an overview of the oceanographic conditions in the Labrador Sea. In 2019, aspects of ocean acidification were included. In 2020, the AZMP scientists reconvened by teleconference on April 20 and 21st with limited scope compared to last face-to-face annual meetings to review oceanographic conditions that prevailed in 2019 within the zone and draft a summary as a Science Advisory Report.

INTRODUCTION

The AZMP principal investigators, logistics and data management personnel usually meet once a year to discuss internal matters, resolve issues, present new results that may feed into eventual state of the ocean reporting, and lastly review the state of the ocean conditions that prevailed during the prior year and formulate a state of the ocean report. With the travel restrictions imposed with the COVID-19 pandemic, the face-to-face meeting that was scheduled to take place in Montreal on March 24–27, 2020 was cancelled. The terms of reference were then reduced in scope to only the review of the state of the ocean conditions that prevailed in 2019 and the drafting of a summary as a Science Advisory Report (SAR). A teleconference meeting was held April 20–21 to review material that was made available to the group one week earlier.

The SAR summarizes the information found within eight supported Research Documents, each detailing either the physical or the biochemical oceanography conditions in one of the Atlantic Zone regions: Scotian Shelf and Gulf of Maine, Gulf of St. Lawrence, Labrador and Newfoundland Shelf, and Labrador Sea.

Eight presentations were given of the supporting material, and a ninth presentation dealt with the impacts of a database error uncovered for Newfoundland and Labrador zooplankton biomass. Then, the SAR summary bullets were reviewed and modified one-by-one by the group. These had been initially drafted by Peter Galbraith (physical) and Pierre Pepin (biochemical), then reviewed and modified during a first round by the first authors of the AZMP Research Documents and finally made available to the group one week prior to the teleconference. The meeting was closed after a brief discussion of matters arising.

REVIEW OF PHYSICAL AND BIOGEOCHEMICAL CONDITIONS IN THE ATLANTIC ZONE

Rapporteur – Jean-Luc Shaw

PHYSICAL OCEANOGRAPHIC AND METEOROLOGICAL CONDITIONS ON THE SCOTIAN SHELF AND IN THE GULF OF MAINE DURING 2019 – DAVID HEBERT

In 2019, mean annual air temperature anomalies ranged from -0.4°C (-0.6 SD) below climatology to near normal for most stations except for Boston which is above normal, +1.2°C (+1.7 SD). Satellite-based sea surface temperature (SST) annual anomalies ranged from -0.8°C (-1.4 SD) in NAFO Division 4Vn to +0.1°C (+0.2 SD) in the eastern Gulf of Maine/Bay of Fundy. Long-term coastal monitoring sites at St. Andrews (New Brunswick) and Halifax (Nova Scotia) recorded annual SST anomalies of +0.4°C (+0.6 SD) and +0.1°C (+0.2 SD), respectively. At other selected sites across the region, annual water temperature anomalies were positive: +1.6°C (+4.8 SD) for Cabot Strait at 200-300 metre (m) depth range (the largest anomaly; four of the last five years were the warmest in the record); -0.2°C (-0.3 SD) for Misaine Bank at 100 m; +1.8°C (+2.2 SD) for Emerald Basin at 250 m (the largest anomaly; last six years were the warmest in the record); +1.7°C (+3.2 SD) for Georges Basin at 200 m (the second warmest), near normal conditions for eastern Georges Bank at 50 m and +0.3°C (+0.4 SD) for Lurcher Shoals at 50 m. The average bottom temperature anomaly in Northwest Atlantic Fisheries Organization (NAFO) Division 4Vn was +1.0°C (+2.4 SD), the second warmest in the record. Divisions 4Vs, 4W and 4X were +0.8°C (+1.2 SD), +0.9°C (+1.2 SD) and +1.2°C (+1.6 SD), respectively. Stratification in 2019 was significantly greater than in 2018 due to the surface freshening had a greater effect than the surface cooling. Since 1948, the stratification has slowly been increasing on the Scotian Shelf due mainly to half freshening and half warming of the

surface waters. A composite index, consisting of 22 ocean temperature time series from surface to bottom across the region, indicated that 2018 was the 14th warmest of 50 years of observations (2012 was the warmest), with an averaged normalized anomaly of +0.9 SD relative to the 1981–2010 period.

Discussion summary:

Concerns were raised about naming a metric which includes conditions on the Scotian slope and shelf the “Labrador Current index”.

It was noted that reporting a 5-year running mean of SST could mislead readers to believe that annual means are not important, as they are only one year. The speaker counters that the purpose of the 5-year running average is to show low-frequency variability and trends and does not minimize annual results; it is a climate vs weather argument.

Sparse coverage of the winter groundfish survey over the Gulf of Maine and Scotian Shelf is due to recurring harsh working conditions in winter near George’s Bank. There are discussions with the US National Oceanic and Atmospheric Administration (NOAA) to pool resources and hopefully get better coverage.

BIOGEOCHEMICAL CONDITIONS ON THE SCOTIAN SHELF AND IN EASTERN GULF OF MAINE IN 2019 – BENOIT CASAULT

Ocean nutrient and plankton conditions on the Scotian Shelf and in the eastern Gulf of Maine were assessed in the context of mainly warmer ocean temperatures and increasing stratification observed in the last decade. Deep nutrient inventories in 2019 were lower than normal over most of the region, continuing the pattern of the last four (for nitrate) to seven (for phosphate and silicate) years. Anomalies for the three deep nutrients were positive or near zero on Cabot Strait in 2019 and were associated with record high water temperatures in the 100–300 m layer observed in spring. The spring phytoplankton bloom, as observed from remote sensing, was highly consistent across the Scotian Shelf with respect to its initiation (normal on eastern but slightly delayed on central and western subareas), its duration (shorter on all three subareas), and the timing of the peak intensity which occurred within one week across the whole area. Observations in 2019 provide additional evidence of a persistent change in the phytoplankton community with lower abundance of diatoms and dinoflagellates, especially in summer and fall, as observed at Halifax-2. Zooplankton biomass and *Calanus finmarchicus* abundance continued to be mainly lower than normal, while non-copepods and warm offshore copepods (*O. atlantica* especially) abundance was mainly high. Anomalies for Arctic *Calanus* and *Pseudocalanus* spp. abundance switched from mainly negative in recent years to mainly positive in 2019. Conversely, anomalies for warm shelf copepods abundance went from mainly positive in 2018 to near zero or mainly negative in 2019. These shifts in anomalies might be associated with the absence of fall sampling on the sections and the deficient sampling at Halifax-2 during late summer and fall in 2019.

Discussion summary:

It is important to use separate climatologies specific to the different remote sensing satellites, be it SeaWiFS, Modis or VIIRS.

Doubt was expressed about emphasizing the fall bloom at Halifax-2 station. It appears in the *in situ* time-depth plot of chlorophyll-a concentrations but not so much in the plot of the 0–100 m integrated chlorophyll index. The appearance of this important fall bloom may be caused by interpolation artifacts due to limited sampling.

PHYSICAL OCEANOGRAPHIC CONDITIONS IN THE GULF OF ST. LAWRENCE DURING 2019 – PETER GALBRAITH

The annual average freshwater runoffs of the St. Lawrence River measured at Québec City and its combination with rivers flowing into the Estuary (RIVSUM II) were at their highest level since 1976. Sea ice maximum volume was near normal, but the winter mixed layer volume was at a record high aided by the second largest inflow since 1997 of Labrador Shelf Water. The August cold intermediate layer (CIL) and the seasonally averaged minimum temperature index were near normal. Surface water temperatures were at a record low in September, but this was caused by strong vertical mixing from tropical storm Dorian rather than from heat loss to the atmosphere. The May to November average was below normal, but the warmest month of the year, August, was above normal. Deep water temperatures have been increasing overall in the Gulf since 2009, with inward advection from Cabot Strait. Gulf-wide average temperatures at 150 and 200 m are lower than the 2015 record highs but remain above normal at 3.3°C (+0.8°C, +1.6 SD) and 5.5°C (+1.0°C, +2.4 SD). New series record highs (since 1915) were set at 250 and 300 m, at 6.3°C (+1.0°C, +3.8 SD) and 6.5°C (+1.0°C, +6.6 SD) respectively. Bottom area covered by waters warmer than 6°C remained high in Anticosti Channel and Esquiman Channel and were at record highs in the northwest Gulf and Central Gulf.

Discussion summary: No discussion.

BIOGEOCHEMICAL CONDITIONS IN THE GULF OF ST. LAWRENCE IN 2019 – MARJOLAINE BLAIS ET AL. PRESENTED BY STÉPHANE PLOURDE

Nitrates inventories in the surface (0–50 m) and mid-layer (50–150 m) were below or near normal in the Gulf of St. Lawrence in 2019. In the Eastern Gulf, they were near normal in deep waters for the first time since 2012. Strong positive anomalies were recorded for vertically integrated phytoplankton biomass during fall. Since 2013, chlorophyll-*a* annual anomalies have been mostly positive in Eastern and Southern Gulf. Annually averaged surface chlorophyll-*a* was below normal throughout the Gulf. The start of the bloom varied between normal to late in the Eastern Gulf. Bloom duration, magnitude and amplitude were generally below normal across the region. Zooplankton biomass was above normal in the Western Gulf (including Rimouski station) and below normal elsewhere. Below normal zooplankton biomass are generally observed since 2014. *C. finmarchicus* abundance was generally near normal across the region, but noticeably below normal in the Eastern Gulf. *Pseudocalanus* spp. and non copepod abundances were above normal in most regions, a pattern observed in most years and regions since around 2010.

Discussion summary:

High values of silicates in 2019 were likely due to larger than average river runoff.

PHYSICAL OCEANOGRAPHIC CONDITIONS ON THE NEWFOUNDLAND AND LABRADOR SHELVES – FRÉDÉRIC CYR

The winter North Atlantic Oscillation (NAO) index, a key indicator of the direction and intensity of the winter wind field patterns over the Northwest Atlantic was positive for a 6th consecutive year (since 2012, only 2013 was negative). The large majority of the environmental parameters were however close to normal. The sea ice volume across the Newfoundland and Labrador shelf was slightly below normal, characterized by a large negative anomaly in March-April and an early retreat on the Newfoundland shelf. A large number of icebergs (1515) drifted south of 48°N, the 7th highest number since 1900. Annual sea surface temperature across the NW Atlantic was about normal, but characterized with slightly warmer than normal temperature in the north and

colder than normal temperature in the south, especially during the first half of the year. Observations from the summer AZMP oceanographic survey indicate that after a predominance of colder than average conditions since 2012, the volume of the cold intermediate layer (CIL, <0°C) reduced along Bonavista and Flemish Cap section in 2019 (CIL along Seal Island section was normal this year but was reduced in 2018). The spatially averaged bottom temperature in 3LNOPs during the spring was close to normal, except along the slopes of the Grand Banks where it was above normal. For the fall, bottom temperature in 2HJ3KLNO was also above normal, especially in 2J (+1.1 SD) and 3K (+1.0 SD). The Labrador Current transport index along the Labrador and northern Newfoundland slope in 2019 was back to normal after the 2018 record high since the beginning of the time series that started in 1993. The NL climate index was normal in 2019.

Discussion summary:

It was pointed out that it would be nice to have more altimetric sections of the Labrador current between the tail of the Grand Banks and the Laurentian Channel in order to better understand the fate of Labrador Current Water on the Scotian Shelf and south of Newfoundland. It was pointed out that this would however not affect the Labrador Current index which is currently reported. Concerns were again raised about the Labrador Current index's name implying Labrador Current Water south of Newfoundland when this is in contradiction with temperature and salinity values measured there, even if some previous publications call that water a "Labrador Current extension". Consensus was found that calling it the Shelf Break Current was much safer. Concerns were also raised that the reported climate index would be better to exclude atmospheric forcing parameters such as the NAO in the context of a state of the ocean report, though including them in a climate index was though by some to be more useful from an operational standpoint.

BIOGEOCHEMICAL OCEANOGRAPHIC CONDITIONS ON THE NEWFOUNDLAND AND LABRADOR SHELF AND THE GRAND BANKS – DAVID BÉLANGER

Satellite ocean colour observations indicate that the amplitude and magnitude of the 2019 spring phytoplankton production was below normal across the region despite earlier and longer-lasting blooms compared to 2014-2017. However, in-situ observation showed that both nitrate (50–150 m) chlorophyll (0–100 m) concentrations remained mostly near or above normal across the region for a third consecutive year. The abundance (individuals m^{-2}) of copepod and non-copepod zooplankton continued above normal on the Grand Bank (Station 27) and Southern Labrador (Seal Island section) in 2019. The overall increase in zooplankton abundance over the 21-year time series was mainly driven by an increase in the small *Pseudocalanus* spp. and *Oithona* spp. copepods while the abundance of large, energy-rich *Calanus finmarchicus* copepods have remained mostly below normal since 2014. Total zooplankton biomass has decreased to near normal in 2019 after three consecutive years of above normal levels.

Discussion summary:

Sampling quality issues to be resolved were raised. Data not yet analyzed at Station 27 between June and September may later affect biomass index results because this is the period when *Calanus finmarchicus* is most abundant and when the spring cohort is developing to its late stages. For uniformity with the rest of the SAR figures, shading around a time series should represent plus or minus one standard deviation about the climatology. It was decided that zooplankton abundance scorecard boxes for the Bonavista Bay, Flemish Cap and Southeast Grand Bank sections would likely to be modified by analysis of the fall data should be marked as missing data.

METEOROLOGICAL, SEA ICE, AND PHYSICAL OCEANOGRAPHIC CONDITIONS IN THE LABRADOR SEA DURING 2019 – IGOR YASHAYAEV

In the Labrador Sea, wintertime surface heat losses result in the formation of dense waters that play an important role in ventilating the deep ocean and driving the global ocean overturning circulation. In the winters since 2015, the central Labrador Sea (the coldest and freshest North Atlantic basin south of the Greenland-Iceland-Scotland Ridge) experienced above-normal (2015–16 and 2016–17) and near-normal (2017–18 and 2018–19) surface heat losses. The recent reduction in the seasonal cooling of the Labrador Sea contrasts the situation in 2014–15 with the highest winter heat loss since 1993-94. The winter (Dec–Mar) NAO index was moderately positive in 2018–19. However, atmospheric circulation associated with a low atmospheric pressure anomaly in the Labrador Sea in winter resulted in above-normal air temperatures in the northern and central Labrador Sea. Sea surface temperatures were near-normal in winter and above-normal in spring. Sea ice extent anomalies in winter and spring were generally negative, except for a near-normal winter anomaly on the central Labrador Shelf. With respect to annually averaged temperature anomaly values, in 2018, the upper 100 m layer of the central Labrador Sea was the coldest since 2000. However, between 2018 and 2019, this layer warmed by 0.5°C. The intermediate, 200–2000 m, layer was cooling between 2011 (the layer's warmest year since 1972) and 2018. This cooling trend can be associated with persistent deepening of winter convection over the same time period. The key factor that has contributed to the recurrent deepening of convective mixing in the three winters following the winter of 2014–15 was not as much air-sea heat exchange as it was the water column preconditioning caused by convective mixing in the previous years. Such multiyear persistence of deepening winter convection (eventually exceeding 2000 m in depth) has resulted in the most voluminous, densest and deepest formation of Labrador Sea Water since 1994. In the winter of 2018–2019 the situation has however changed with winter convection not generally exceeding 1200 m and the intermediate layer warming slightly but enough to reverse the seawater density trend. Between 2018 and 2019, the annual mean intermediate layer density reduced by 0.007 kg/m^3. Overall, the changes in the depth of winter convection and intermediate layer properties between these years imply that the effect of the water column preconditioning on winter convection has weakened since 2018. Bedford Institute of Oceanography North Atlantic model simulations suggest that the transport of the Labrador Current decreased between 1995 and 2014, but has since increased slightly. The AMOC from this model demonstrates a general weakening trend since mid-1990s, and continuing weakening in recent years is present in this model hindcast.

Discussion summary:

Interest in predicting convection depth in the Labrador Sea was mentioned and whether recursive filters could be applied. This is currently being done using filtering of the heat flux time series and can offer predictions up to two years in the future.

BIOGEOCHEMICAL CONDITIONS IN THE LABRADOR SEA (AZOMP) IN 2019 – MARC RINGUETTE

In 2019, the AR7W line, divided into three main regions (Labrador Sea, LS; Central Labrador Sea, CLS; and Greenland Shelf, GS) was sampled in June, one of the few years since 1995 as sampling is usually performed in May. In the context of a time series, the interplay between the seasonality and the interannual variability consequently becomes challenging to disentangle. A delayed spring bloom on the Labrador Shelf and in the Central Labrador Sea may have contributed to changes in the seasonality. Following mild winter convective mixing, the chemical and biological indicators of the Labrador Sea and adjacent shelves have shifted closer to the long-term average after a 5-year period which were generally lower than the average.

Increasing concentration of dissolved inorganic carbon and decreasing pH have continued the same monotonic trend that extends back to the beginning of the monitoring program in the mid-90's. While the mean concentration of chlorofluorocarbon (CFC-12) over the in the 150 – 500 m depth range of the central basin has remained stable, the accompanying concentration of Sulfur hexafluoride (SF_6) has been increasing steadily since measurements began in 2011, reflecting the atmospheric history of these two anthropogenic gasses. In the top 100m all nutrients concentrations were around the average, with the exception of silicate in the Central Labrador Sea which was above average, as a result of seasonal drawdown of nutrients by primary producers. Deep nutrients exhibited inter-annual variations, except for silicate concentration in the CLS, which remained lower than average since 2008, except in 2014. Phytoplankton, as indicated by chlorophyll-*a* concentration and HPLC derived pigments were below the 1999–2015 average in all three regions (LS, CLS, and GS). Mesozooplankton analysis was restricted to the Labrador Shelf and Central Labrador Sea regions. Abundance of *Calanus finmarchicus* was higher than average on the Labrador Shelf, mostly due to recruitment and/or additional sampling on the shelf. Smaller taxa, on the contrary, were consistently higher than average in abundance, while Hyperiid and Euphausiids followed the general trend towards lower abundance than average.

Discussion summary:

The index developed by Erica Head should be presented with the abundance scorecards as it helps appreciate the effects of cruise timing relative to the bloom. Concerns were raised that these results should be presented as missing because of interpretation difficulties related to cruise timing around the bloom. As a solution, it was proposed that the time series be divided into early bloom sampling and late bloom sampling to clarify interpretation. It was considered to use the 15 – 100 m surface temperature presented by Igor instead of a different 0 – 100 m number for homogeneity of the SAR, but this presents difficulties because of difference in ocean conditions between the Labrador Sea and waters of the Greenland and Labrador shelves.

ZOOPLANKTON BIOMASS ANOMALY REVIEW FOR THE NEWFOUNDLAND AND LABRADOR REGION – DAVID BÉLANGER

Errors had been found in archiving zooplankton biomass data file for the 2013–2018 period. Between 2015 and 2018, biomass measured from subsamples (1/2 sample) were not multiplied by two (× 2) to get corrected estimates for the whole samples. In addition, biomass from 205 samples collected between 2013 and 2015 was found not to have been included in the database. Here the corrected annual and seasonal anomaly time series (1999–2019) for zooplankton biomass (dry weight m^{-2}) is presented for each of the four main AZMP oceanographic sections in the NL region (Seal Island, Bonavista Bay, Flemish Cap, Southeast Grand Bank) and at the high-frequency sampling station (Station 27) and compared with results previously obtained with non-corrected biomass and/or missing data. As expected, corrected dry weights resulted in marked increases in annual anomaly values for 2015-2018 but had little impacts on annual anomalies outside that period or on the seasonal anomalies over the entire time series. Missing samples had little impacts on both annual and seasonal anomalies. The corrected anomaly time series showed an overall trend of increasing zooplankton biomass throughout the region since 2014 with above normal levels observed for all oceanographic sections in 2018.

Discussion summary:

The GLM approach in Newfoundland was adopted to compensate for problems due to missing data. Results from this presentation were thought to show that this approach allowed adequate representation of the seasonal and annual cycles as long as enough data was available to

implement it. Consensus was reached that this SAR's bullets should address the large change in the presented biomass trend since the last SAR.

REVIEW OF SCIENCE ADVISORY REPORT SUMMARY POINTS

The group reviewed the summary bullets of the SAR, which had been made available a week earlier, in the context in the material presented over the course of the meeting. Minor adjustments were made.

It was also decided to renormalize each biological "zonal index" that appear in Figures 12, 14 and 15 of the SAR. Since they are constructed as the average of all normalized anomalies in a given year, the combination of positive and negative anomalies often leads to anomalies that are much closer to zero, washing out the appearance of the time series. Applying a renormalization restores contrast.

MATTERS ARISING

The current climatological period used in AZMP reports is 1981–2010 for physical conditions and 1999–2015 for biological conditions. While there is an immediate advance for biologists to switch to 1999–2020 in next year's reports, the physical principal investigators decided to look into what other organizations (e.g. ICES, NOAA) will be doing before deciding to switch to 1991–2020. It would be desirable for both physical and biological reporting to switch at the same time.

There are several delays in the publishing of Research Documents, mostly associated with translation delays in the Maritimes Region. For example, their biochemical report on condition during 2017 was submitted to CSAS on September 26 2018, but has only recently been assigned the number 2020/002 and appears to still be in translation. As it stands, some reports from other regions for conditions in 2019 will most likely be published before this report on 2017 conditions.

There was discussion of holding a mid-year meeting in fall 2020, allowing the presentation of the material that was meant to be shared at this meeting during the scientific workshop. Everyone sees the benefit, and a call for volunteers to organize one will be made later.

The next annual meeting will be held at the Delta Hotel in Montréal from Tuesday March 22 to Friday March 26 2021, although it is a possibility to end the meeting Thursday if the agenda is light.

APPENDIX 1 – TERMS OF REFERENCE

Twenty-second Annual Meeting of the Atlantic Zone Monitoring Program (AZMP)

Zonal Peer Review Meeting – Québec, Newfoundland and Labrador, Maritimes and Gulf Regions

April 20-21, 2020
Teleconference

Chairperson: Peter Galbraith

Context

The Atlantic Zone Monitoring Program (AZMP) was implemented in 1998 with the aim of collecting and analyzing the biological, chemical, and physical field data that are necessary to:

1. Characterize and understand the causes of oceanic variability at the seasonal, interannual, and decadal scales;
2. Provide multidisciplinary data sets that can be used to establish relationships among the biological, chemical, and physical variables; and
3. Provide adequate data to support the sound development of ocean activities.

The program sampling strategy is based on:

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

Objectives

1. Assess the biological, chemical and physical oceanographic conditions since 1999 through a peer review of the outcomes of monitoring activities in the four Atlantic regions.
2. Synthesize the multidisciplinary information gathered over the course of the program.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Documents

Expected Participation

- DFO Ecosystems and Oceans Science
- Environment and Climate Change Canada
- University Partners

APPENDIX 2 – LIST OF MEETING PARTICIPANTS

Name	Affiliation
Bélanger, David	DFO, Science – Newfoundland and Labrador Region
Brickman, David	DFO, Science – Maritimes Region
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Johnson. Catherine	DFO, Science – Maritimes Region
Lambert, Nicolas	DFO, Science – Gulf Region
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Lewis, Sara	DFO, Science – Newfoundland and Labrador Region
Pepin, Pierre	DFO, Science – Newfoundland and Labrador Region
Plourde, Stéphane	DFO, Science – Quebec Region
Riche, Olivier	DFO, Science – Quebec Region
Ringuette, Marc	DFO, Science – Maritimes Region
Shaw, Jean-Luc	DFO, Science – Quebec Region
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