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# Ocean Productivity Trends in the Northwest Atlantic During 2012

by

G. Maillet<sup>2</sup>, G. Harrison<sup>1</sup>, C. Johnson<sup>1</sup> P. Pepin<sup>2</sup>, S. Plourde<sup>3</sup>, M. Starr<sup>3</sup>, B. Casault<sup>1</sup>, C. Caverhill<sup>1</sup>, H. Maass<sup>1</sup>, J. Spry<sup>1</sup>, S. Fraser<sup>2</sup>, C. Porter<sup>1</sup>, G. Redmond<sup>2</sup>, T. Shears<sup>2</sup>

<sup>1</sup>Fisheries and Oceans Canada, Bedford Institute of Oceanography, Box 1006, Dartmouth, NS, B2Y 4A2 <sup>2</sup>Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre, P.O. Box 5667, St. John's, Newfoundland, Canada, A1C 5X1

<sup>3</sup>Fisheries and Oceans Canada, 850 Route de la mer, C.P. 1000, Institut Maurice Lamontagne, Mont-Joli, Quebec, Canada G5H 3Z4

### Abstract

Biological and chemical variables collected in 2012 from coastal high frequency monitoring stations, semi-annual oceanographic transects, and ships of opportunity ranging from the Labrador-Newfoundland and Grand Banks Shelf (Subareas 2 and 3), extending west into the Gulf of St. Lawrence (Subarea 4) and further south along the Scotian Shelf and the Bay of Fundy (Subarea 4) and into the Gulf of Maine (Subarea 5) are presented and referenced to previous information from earlier periods when available. We review the information concerning the interannual variations in inventories of nitrate, chlorophyll a and indices of the spring bloom inferred from satellite ocean colour imagery, as well as the abundance of major taxa of zooplankton collected as part of the 2012 Atlantic Zone Monitoring Program (AZMP). In general, nitrate inventories in both the upper and lower water-column continue to remain below normal along the northern transects across the Labrador-Newfoundland Shelf and Grand Bank while above average levels are typical of the northwest Gulf of St. Lawrence and the Scotian Shelf transects and fixed stations in 2012. The annual trends in chlorophyll a inventories were below normal in 2011-2012 across the northern Subareas (2J to 3LM) in comparison to near-normal and above average levels in 2012 along the Gulf of St. Lawrence and Scotian Shelf transects and fixed stations. The magnitude of the spring bloom was below normal for most of the northern and southern Subareas with the exception of the Gulf of St. Lawrence which displayed positive anomalies in 2012. The timing indices (initiation, peak timing, and duration) of the spring production cycle generally tended to earlier and shorter cycles over the entire zone in 2012 with exceptions observed in the Gulf of St. Lawrence and in specific areas on the Scotian Shelf. Although many of the copepod abundance indices reached their highest levels in 2010-2011 in the northern Subareas, the anomaly time series indicated relatively weak secondary production throughout the northwest Atlantic in 2012. The non-copepod taxa increased substantially in 2012 along the Grand Bank and northeast Gulf of St. Lawrence fixed stations and transects.

### Introduction

We review biological and chemical oceanographic conditions on the Newfoundland and Labrador Shelves, Grand Bank, Gulf of St. Lawrence, Scotian Shelf, and in the Bay of Fundy and Gulf of Maine during 2012, and reference earlier periods when data are available. More frequent directed sampling from research vessels on oceanographic transects and ships of opportunity at coastal fixed stations by the Atlantic Zone Monitoring Program (AZMP<sup>1</sup>) and the completion of seasonal oceanographic surveys during 2012 provided good spatial and temporal series coverage of standard variables which affords a foundation for comparison with previous years. Additional details regarding biological and chemical oceanographic conditions on the Newfoundland and Labrador Shelf, Grand Banks, Gulf of St. Lawrence, Scotian Shelf, and the Gulf of Maine in 2012 and earlier years can be found in Pepin *et al.* (2013) and Johnson *et al.* (2012), Harvey and Devine (2009), Dufour et al. (2010).

### Methods

Collections of standard AZMP variables are based on sampling protocols outlined by Mitchell *et al.* (2002). Observations for 2012 and earlier years presented in this document are based on seasonal surveys conducted during the spring through the autumn (typically March through December). The coastal stations are typically sampled at twice monthly to monthly intervals during ice-free conditions. The location of the standard oceanographic transects and coastal stations are shown in Figure 1.

Phytoplankton biomass was estimated from ocean colour data collected by the Sea-viewing Wide Field-of-view Sensor (SeaWiFS; <u>http://seawifs.gsfc.nasa.gov/SEAWIFS.html</u>) and Moderate Resolution Imaging Spectroradiometer (MODIS) "Aqua" sensor (<u>http://modis.gsfc.nasa.gov/</u>). The SeaWiFS time series began in the September of 1997 and MODIS data stream began in July, 2002. Satellite data do not provide information on the vertical structure of chlorophyll *a* (chl*a*) in the water column but do provide highly resolved (~1.5 km) data on their geographical distribution in surface waters at the large scale. Two week composite images of chl*a* for the entire NW Atlantic (39-62.5° N Latitude 42-71° W Longitude) were routinely produced from SeaWiFS/MODIS data<sup>2</sup>. Basic statistics (mean, range, standard deviation, etc.) were extracted from the composites for selected sub-regions as shown in Figure 1. We constructed an ocean colour time series from 1998 to 2012 using data from both satellite sensors and averaging during the overlap period from 2002 to 2009.

Scorecard indices were developed as a method of summarizing the many variables used to represent the state of lower trophic levels. To simplify the information, the time-series of the annual estimate of inventory or abundance for each summary variable was standardized to a mean of zero (for the period 1999 – 2010) and unit standard deviation ([observation – mean]/SD). The standard deviation provides a measure of the variability of an index. The result of this standardization yields a series of anomalies. The scorecards serve to illustrate departures from the long term mean across the range of variables by colour coding anomalies as either being above/later than (red) or below/earlier than (blue) the long term average, with darkening shades serving to represent the increasing magnitude of that departure. The specific method used to compute the annual means is described further in Pepin *et al.* 2011 and Harrison *et al.* 2009. For the chemical-biological observations, the key variables selected were: (1) near surface (0-50 m) and deep (50-150 m) nitrate inventories, and (2) 0-100m integrated chla, satellite indices of background chla, chla biomass, initiation, peak timing and duration of the spring bloom (Zhai *et al.* 2011), and zooplankton abundance (*Calanus finmarchicus, Pseudocalanus spp.*, total copepods, and total non-copepod zooplankton) for the AZMP fixed stations and seasonal transects.

<sup>&</sup>lt;sup>1</sup> http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/azmp-pmza/index-eng.html

<sup>&</sup>lt;sup>2</sup> (http://www.bio.gc.ca/science/newtech-technouvelles/sensing-teledetection/index-eng.php)

# Annual Variability in Nutrient, Phytoplankton, and Zooplankton Conditions in NAFO Subareas

Based on the available data, the upper water-column nitrate inventories were generally below normal from the Labrador and Newfoundland (LAB-NL) Shelf (2J, 3K) and Grand Bank (GB; 3LM) extending down to the eastern and central Gulf of St. Lawrence (GSL), with near-normal to above average levels observed in the northwest GSL with mixed conditions across the Scotian Shelf (SS) in 2012 (Figure 2). The trend in anomalies of the deep nitrate inventories, a measure of what is available to fuel the base of the marine food chain in the subsequent year, were consistently negative across the northern Subareas including the LAB-NL Shelf and GB, while generally above normal across the GSL and SS in 2012. The chla inventories inferred from the dedicated seasonal oceanographic surveys, which provides an index of phytoplankton biomass throughout the water-column, were consistently below normal over much of the northern Subareas (2J to 3LNO) with variable levels throughout the GSL and SS Subareas in 2012 (Figure 2). In general, the annual anomaly trends in nitrate inventories in the upper 50m layer have remained below normal since 2009 across the northern Subareas (2J to 3LNO including the central and northeast GSL) in contrast to normal-to-above-average levels in 2012 along the northwest GSL and SS in recent years (Figure 3). The annual trends in deep nitrate inventories have remained well below normal during 2009-2012, particularly along the northern Subareas (2J-3LM). The annual deep nitrate inventories have recovered across much of the southern GB, GSL and SS regions in 2012 (Figure 3). The annual trends in chla inventories were below normal in 2011-2012 across the northern Subareas (2J to 3LM) in comparison to near-normal and above average levels in 2012 along the GSL and SS transects (Figure 4). Overall, large interannual and spatial variability in nitrate and chla inventories are apparent throughout the time series along with some regional similarities in certain years (Figure 3-4). We also examined the trends in composite summed anomalies across the LAB-NL Shelf, GB, GSL, and SS transects and fixed stations during the 14-year time series (Figure 5). The composite index for the upper water-column nitrate inventories exhibited an overall reduction from 2J to 4X with large amplitude changes and high interannual variability in the GSL Subareas. The composite trends were similar among the LAB-NL Shelf and GB but were mostly out of phase with the GSL and SS Subareas (Figure 5). Large year to year changes were also noted in the composite deep nitrate inventories across the GSL and SS in contrast to lower variability observed in the LAB-NL Shelf and GB Subareas. Large amplitude changes were also apparent in the composite inventories of chla in the GSL and SS Subareas in contrast to more limited variability for the LAB-NL Shelf and GB (Figure 5).

A number of different metrics derived from satellite imagery were examined to characterize the extent (background, magnitude and amplitude indices) and timing (initiation, peak timing, and duration) indices of the spring bloom. Background chl*a* levels were lower in 2012 with negative anomalies in the northern Subareas 0B-1F to 2H compared to positive values over the central and southern areas with the largest increases observed on the SS (Figure 6). The magnitude (chl*a* biomass) of the spring bloom was below normal for most of the northern and southern Subareas with the exception of the GSL which displayed positive anomalies. Although the overall magnitude of the spring bloom was weaker in northern Subareas, the amplitude of the spring bloom was higher the Hudson Strait and Labrador Sea (Figure 6). The amplitude of the spring bloom was mostly weaker across the GSL and SS in 2012 although some localized, large amplitude blooms were observed over the southern GSL and GB. The timing indices (initiation, peak timing, and duration) of the spring production cycle generally tended to earlier and shorter cycles in general over the entire zone in 2012 with exceptions observed in the GSL and in specific areas on the SS (Figure 6).

Significant coherent changes in enhanced background chl*a* levels have been observed in recent years over the LAB-NL Shelf extending southwards across the SS down to Georges Bank in Subarea 5 which has not been detected earlier in the 15-year anomaly time series (Figure 7). No coherent trends were detected in the magnitude of blooms across the Subareas except for lower production in the subarctic (0B-1F to 2H) ongoing since 2009 (Figure 8). No distinct trends were observed in the amplitude of the spring bloom other than for some general indication in higher frequency of large amplitude blooms in the later part of the time series (Figure 9). The initiation of the spring bloom, defined as 20 % of the peak amplitude, has shown some tendency to advance in time in recent years (a strong shift to earlier timing also occurred in 1999), most prominently in the GSL and GB Subareas along with some specific areas on the SS (Figure 10). The timing of the peak spring bloom revealed a coherent shift to earlier timing across most Subareas in 2010 and again in 2012 (Figure 11). The duration of the production cycle showed a large degree of variability in both the spatial and temporal scales with both large negative and positive anomalies during the 14-year time series (Figure 12). The duration of the spring bloom has been in decline in the Subarctic, GB, and SS Subareas in recent years with longer cycles in the GSL region, particularly in 2012.

We developed similar composite indices for each of the ocean colour metrics by summing all of the annual SeaWiFS/MODIS anomalies across the Petrie Boxes located in the subarctic, LAB-NL Shelf, GSL, GB, SS and Gulf of Maine (GoM) areas to evaluate trends during the 15-year series. The composite index for background chl*a* levels has remained relatively stable over the last decade (2000-2010) but as noted has sharply increased in recent years except for the subarctic Subareas (Figure 13). Chl*a* biomass has also remained stable during the last decade although interannual variability has increased somewhat during the later half of the time series (Figure 13). The amplitude (peak intensity) of the spring bloom has increased throughout the northwest Atlantic during the later half of the time series. The trends for the composite timing indices (initiation and peak timing) have progressively shifted to earlier timing since the start of the time series (Figure 13). The duration composite anomalies varied throughout the time series with no apparent overall trend but also show higher interannual variability during the later half of the time series (Figure 13).

The pattern of annual anomalies for the different functional zooplankton groups was highly variable across the northern and southern Subareas along with some limited regional coherence in 2012. The zooplankton abundance anomalies for small grazers - *Pseudocalanus spp*. were generally positive in northern areas on the southern LAB Shelf, across the GB and northeast GSL, in contrast to negative indices for the northwest GSL and SS transects and fixed stations (Figure 14). The abundance anomalies for large grazers - *Calanus finmarchicus* were below normal across most of the Subareas with the exception of the GB and northeast GSL (Figure 14). Reduction in total copepods characterized the northwest GSL and most of the SS Subareas and fixed stations while large positive anomalies were only observed on the GB Shelf along Subarea 3M (Figure 14). The non-copepod (mostly meroplankton and carnivorous zooplankton) taxa increased substantially in 2012 along the GB and northeast GSL fixed stations and transects, with variable levels throughout the GSL and SS Subareas (Figure 14).

Although many of the copepod abundance indices reached their highest levels in 2010-2011 in the northern Subareas, the anomaly time series indicated relatively weak secondary production throughout the northwest Atlantic in 2012 (Figure 15). We observed near-record levels of abundance of *Pseudocalanus spp*. during 2009-2011 in the northern Subareas while levels on the SS transects and fixed stations have remained substantially below normal since 2006 (Figure 15). The abundance anomalies of *Calanus finmarchicus* have remained well below normal since 2009 throughout the GSL and in particular, along the transects and fixed stations on the SS (Figure 15). No distinct trend has been detected in total copepod abundance anomalies except for the marginal increase in levels along the LAB-NL Shelf and GB since the start of the monitoring program in 1999. Total copepod abundance anomalies show high interannual variability throughout the GSL and SS Subareas during the time series (Figure 16). The noncopepod abundance anomalies have increased substantially along the GB transects and fixed station in recent years (Figure 16). The non-copepod anomaly index increased to the highest levels observed in the time series in 2011 over much of the GSL transects and fixed stations although declined in 2012 over much of this region and southwards over the SS Subarea (Figure 16).

The composite indices summing each of the zooplankton abundance indices across the LAB-NL Shelf, GB, GSL and SS Subareas revealed some contrasting patterns during the 14-year time series. The composite abundance anomalies for the small copepod *Pseudocalanus* spp. showed relatively stable levels on the LAB-NL Shelf and GB, a strong increasing trend over the GSL from 2000 to 2010, and a steady decline on the SS since 1999 (Figure 17). Composite abundance anomalies for the large copepod *Calanus finmarchicus* were also stable on the LAB-NL Shelf, GB and SS (until 2010), while large amplitude changes in anomalies were observed across the GSL Subareas (Figure 17). The composite anomalies for total copepods showed a steady trend on the LAB-NL Shelf and GB with record-high levels observed in recent years on the later Subarea with high interannual variability apparent over the GSL and SS Subareas (Figure 17). The composite values for the non-copepods showed relatively stable levels over the LAB-NL Shelf, GB and SS with much larger changes observed over the GSL Subarea (Figure 17).

Although the chemical and biological time series are becoming invaluable in detecting trends and changes in the lower trophic levels along both spatial and temporal scales, there remains considerable uncertainty in the estimates of nutrient inventories and overall abundance of phytoplankton and zooplankton. This uncertainty is related to variation in water masses, and the short life histories of phytoplankton and zooplankton along with their patchy distribution, and by the limited coverage of the NAFO Subareas by the environmental monitoring program.

## **Ocean Productivity Highlights**

- Nitrate inventories were generally below normal within the upper 50m in 2012 from the southern Labrador and Newfoundland Shelf, Grand Bank and northeast Gulf of St. Lawrence, with near-normal to above average levels in the northwest Gulf and mixed conditions across the Scotian Shelf.
- Deep inventories of nitrate (> 50m) that represent the main limiting nutrient for the subsequent year, were consistently negative in 2012 across the northern Subareas including the Labrador-Newfoundland Shelf and Grand Bank, while generally above normal across the Gulf of St. Lawrence and Scotian Shelf.
- Phytoplankton biomass inferred from chlorophyll *a* inventories were consistently below normal in 2012 over much of the northern Subareas (2J to 3LNO) with variable levels throughout the Gulf of St. Lawrence and Scotian Shelf Subareas.
- Overall, large interannual and spatial variability in nitrate and chlorophyll *a* inventories are apparent during the time series along with some regional similarities in certain years.
- Significant coherent changes in enhanced background chlorophyll *a* levels have been observed in recent years over the Labrador-Newfoundland Shelf extending southwards across the Scotian Shelf down to Georges Bank in Subarea 5 which has not been observed previously in the satellite imagery.
- No coherent trends were detected in the magnitude of blooms across the Subareas except for lower production in the subarctic Subareas ongoing since 2009.
- The amplitude (peak intensity) of the spring bloom has increased in frequency throughout the northwest Atlantic from 2006 onward.
- The satellite derived timing indices (initiation and peak timing) of the spring bloom have shown some tendency to advance (earlier) in recent years, most prominently in the Gulf of St. Lawrence and Grand Bank Subareas along with some specific areas on the Scotian Shelf.
- The duration of the spring bloom has been in decline in the Subarctic, Grand Bank, and Scotian Shelf Subareas in recent years with longer cycles in the Gulf of St. Lawrence, particularly in 2012.
- Although many of the copepod abundance indices reached their highest levels in 2010-2011 in the northern Subareas, the anomaly time series indicated relatively weak secondary production throughout the northwest Atlantic in 2012.
- The long-term trends in cumulative abundance anomalies for the small grazing copepod showed relatively stable levels on the Labrador-Newfoundland Shelf and Grand Bank, a strong increasing trend over the Gulf of St. Lawrence from 2000 to 2010, and an overall decline on the Scotian Shelf since 1999.
- Cumulative abundance anomalies for the large calanoid copepod and non-copepod taxa also revealed stable levels on the Labrador-Newfoundland Shelf, Grand Bank and Scotian Shelf, while higher variability was observed across the Gulf of St. Lawrence Subareas.
- The cumulative anomalies for total copepods showed a stable trend on the Labrador-Newfoundland Shelf and record-high levels on the Grand Bank and high interannual variability apparent over the Gulf of St. Lawrence and Scotian Shelf Subareas.

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#### References

Dufour, R., Benoît, H., Castonguay, M., Chassé, J., Devine, L., Galbraith, P., Harvey, M., Larouche, P., Lessard, S., Petrie, B., Savard, L., Savenkoff, C., St-Amand, L. and Starr, M. 2010. Ecosystem status and trends report: estuary and gulf of St. Lawrence ecozone. DFO Can. Sci. Advis. Sec. Res. Doc. 2010/030. v + 187 p.

Harrison, G., C. Johnson, E. Head, J. Spry, K. Pauley, H. Maass, M. Kennedy, C. Porter, and V. Soukhovtsev. 2009. Optical, chemical, and biological oceanographic conditions in the Maritimes Region in 2008. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/054. vi + 55 p.

Harvey, M. and Devine, L. 2009. Oceanographic conditions in the Estuary and the Gulf of St. Lawrence during 2008: zooplankton. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/083. vi + 54 p.

Johnson, C., G. Harrison, E. Head, J. Spry, K. Pauley, H. Maass, M. Kennedy, C. Porter, I. Yashayaeva, and B. Casault. 2012. Optical, Chemical, and Biological Oceanographic Conditions in the Maritimes Region in 2009 and 2010. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/012: iv + 64p.

Johnson, C., Harrison, G., Head, E., Casault, B., Spry, J., Porter, C., and Yashayaeva, I. 2012. Optical, chemical, and biological oceanographic conditions in the Maritimes Region in 2011. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/071. iv + 57 p.

Mitchell, M.R., G. Harrison, K. Pauley, A. Gagné, G. Maillet and P. Strain 2002. Atlantic Zone Monitoring Program Sampling Protocol. Canadian Technical Report of Hydrography and Ocean Sciences 223, 23 pp.

Pepin, P., Maillet, G., Fraser, S., Shears, T., and Redmond, G. 2011. Optical, chemical, and biological oceanographic conditions on the Newfoundland and Labrador Shelf during 2009 and 2010. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/074. iv + 45 p.

P. Pepin, G.L. Maillet, S. Fraser, T. Shears, and G. Redmond. 2013. Biological and Chemical Oceanographic conditions on the Newfoundland and Labrador Shelf during 2011-2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/XXX., (in progress).

Zhai, L., Platt, T., Tang, C., Sathyendranath, S., and Hernández Walls, R. 2011. Phytoplankton phenology on the Scotian Shelf. – ICES Journal of Marine Science, 68: 781–791.

Figure 1. Location of the NAFO Regulatory Areas (white boxes) and standard Atlantic Zone Monitoring Program (AZMP) fixed coastal stations (closed red squares) and oceanographic transects (red lines). The statistical subregions (Petrie Boxes) shown by the open red boxes (HS=Hudson Strait, GS=Greenland Shelf, CLS=central Labrador Sea, BRA=Bravo, NLS=northern Labrador Shelf, HB=Hamilton Bank (Seal Island), SAB=St. Anthony Basin, NENS=northeast Newfoundland Shelf, AC=Avalon Channel, CS=Cabot Strait, FP=Flemish Pass, HIB=Hibernia, SPB=St. Pierre Bank, SES=southeast Shoal, ESS=eastern Scotian Shelf, WB=Western Bank, CSS=central Scotian Shelf, WSS=western Scotian Shelf, LS=Lurcher Shoal, GB=Georges Bank.



Figure 2. Summary of nitrate (combined nitrate and nitrite which represents the principal limiting nutrient in the system) and chlorophyll *a* anomalies from different oceanographic transects and fixed stations from the Atlantic Zone Monitoring Program during 2012. The standardized anomalies are the differences between the annual average for a given year and the long-term mean (1999-2010) divided by the standard deviation. The nutrient and chlorophyll anomalies for transects were calculated using a general linear model using station, season, and year while the fixed stations only used season and year as inputs and were based on all available seasonal data. The NAFO Subareas are sorted by latitude from north (top) to south (bottom) regions. Data are missing for Shediac, Louisbourg and Browns Bank in 2012.



Figure 3. Time series of shallow (0-50m) and deep (50-150m) nitrate (combined nitrite and nitrate) inventory anomalies from different oceanographic transects and fixed stations (in bold) from the Atlantic Zone Monitoring Program during 1999-2012. The anomalies for transects were calculated using a general linear model using station, season, and year while the fixed stations only used season and year as inputs and were based on all available seasonal data. A grey cell indicates missing data; a blue cell indicates lower than normal levels and a red cell indicates higher than normal levels. More intense colours indicate larger anomalies. The numbers in the coloured cells are the differences in the annual average value from the long-term mean (1999-2010) divided by the standard deviation. The NAFO Subareas are sorted roughly by latitude from north (top) to south (bottom) regions.

Nitrate (0-50m)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Seal Island (2J)	-0.31	-0.22	0.16	0.60		1.78	0.41	-1.57	0.80	-1.75	0.00	0.11	-0.25	-0.53
Bonavista (3K)	-0.38	-0.63	-0.46	1.39	1.71	0.44	-0.07	-1.25	1.29	-0.31	-0.42	-1.31	-0.20	-0.40
Stn 27 (3L)		-0.08	1.77	-0.47	0.65	0.66	0.12	-0.82	0.67	0.18	-0.62	-2.06	-0.56	-1.47
Flemish Cap (3L, 3M)	0.06	-1.03	0.11	1.15	2.04	0.64	-0.62	0.04	0.47	-0.66	-0.58	-1.62	1.66	-0.76
SE Grand Banks (3LNO)	-0.13	-0.60	-0.16	0.26	2.48	0.80	-0.62	-1.06	0.77	0.03	-0.69	-1.08	-0.35	0.71
Northeast Gulf of St. Lawrence (4RS)	0.45	0.39	0.67	-0.08	1.82	-1.95	-0.69	-1.11	1.02	0.14	-0.14	-0.52	-0.92	-1.41
Centre Gulf of St.Lawrence (4ST)					1.25	-1.42	-0.42	0.07	1.11	0.51	0.21	-1.31	-2.32	-2.10
Southwest Anticosti (4ST)	0.66	-0.80	0.72	2.23	0.20	-0.67	-1.21	-1.00	0.07	0.84	-0.88	-0.15	-1.84	0.34
Anticosti Gyre (4S)	0.49	-0.12	-0.02	0.33	0.48	-0.71	-0.26	0.44	0.26	-0.25		-0.44	-1.17	-0.01
Northwest Gulf of St.Lawrence (4ST)	1.16	-0.64	1.27	1.56	0.86	-1.35	-1.20	-0.28	-0.94	0.16	-0.45	-0.15	-0.78	1.06
Rimouski (4T)	-0.35	0.61	0.07	1.13	-0.30	0.85	-0.29	0.00	-0.07	0.43	-0.44	-1.32	-0.62	-0.01
Lower St. Lawrence Estuary (4T)	2.60	0.09	0.02	0.97	-0.59	-0.58	0.47	-0.10	-0.88	-0.25	-0.85	-0.89	-0.46	0.21
Gaspé current (4T)	-0.11	-0.17	-0.38	0.63	0.29	0.09	0.08	0.30	-0.17	-0.28		-0.90	-1.68	0.64
Shediac (4T)	0.23	0.66	-0.32	0.16	0.16	0.55	-0.23	0.66	-1.15	-0.09	0.66	-1.16		
Îles-de-la-Madeleine (4T)	-1.82	1.28	-0.02	-0.02	-0.37	0.46	0.07	1.72	-0.35	0.58	0.00	-1.52	-1.26	-1.10
Cabot Strait (3Pn, 4Vn)	1.03	1.37	-0.32	1.78	-0.26	-1.58	-0.43	-0.12	-0.32	0.41	-0.26	-1.31	-2.02	-0.96
Cabot Strait (3Pn, 4Vn)	1.52	-1.57	-0.91	0.05	-1.09	-0.41	0.42	-0.07	1.04	1.27	0.16	-0.36	1.51	
Louisbourg (4Vs)	1.78	-0.69	-1.17	-1.97	0.48	-0.37	-0.28	0.65	0.93	0.59	0.02		0.38	
Halifax-2 (4W)	-2.18	1.16	1.25	-0.74	-0.19	0.09	-0.58	0.28	0.19	1.19	0.39	-0.87	-0.19	-2.73
Halifax (4W)	2.03	-0.82	0.14	-1.23	-0.68	-0.73	-0.30	0.11	-0.40	1.77	-0.31	0.41	0.94	1.68
Browns Bank (4X)	0.08	-0.58	-0.84	-0.91	0.67	-0.34	0.15	0.27	-1.78	1.98	1.17		0.74	
Prince-5 (4X)	-1.01	-0.49	-0.59	0.72	1.13	0.06	-0.88	1.44	-0.40	0.09	1.49	-1.54	-0.04	0.65
Nitrate (50-150m)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Seal Island (2J)	0.61	0.48	0.21	0.26		0.76	0.37	0.27	1.29	-2.10	-0.83	-1.32	-0.47	-1.60
Bonavista (3K)	0.72	0.52	-1.05	-0.04	0.82	0.65	0.31	0.63	0.92	-0.44	-0.54	-2.49	-1.53	-1.10
Stn 27 (3L)		1.56	0.36	0.34	-0.60	-0.47	0.13	-0.05	1.08	1.63	-0.73	-1.80	-0.93	-0.52
Flemish Cap (3L, 3M)	1.34	0.35	-0.66	-0.51	0.70	0.25	-0.20	1.74	0.15	-0.32	-0.83	-2.00	0.84	-1.34
SE Grand Banks (3LNO)	0.17	-1.56	-1.05	0.73	0.69	1.64	-0.69	0.99	0.17	0.31	-1.47	0.05	0.27	0.52
Northeast Gulf of St. Lawrence (4RS)	-2.58	-0.17	-0.05	0.48	1.08	-1.03	-0.06	0.93	0.72	0.13	-0.12	0.67	0.42	0.40
Centre Gulf of St.Lawrence (4ST)						-1.52	-0.28	1.19	0.69	0.31	0.68	-1.08	-0.91	-0.33
Southwest Anticosti (4ST)	-0.05	-1.53	0.20	1.36	0.89	-0.98	-1.00	1.01	-0.08	1.06	0.43	-1.31	-0.50	2.18
Anticosti Gyre (4S)	0.00	-1.06	-0.04	0.33	0.75	-0.47	-0.17	0.72	1.16	-0.14		-0.32	-1.08	-0.16
Northwest Gulf of St.Lawrence (4ST)	0.03	-1.39	0.73	1.24	0.95	-1.38	-0.87	0.68	-0.18	1.34	-1.07	-0.09	-0.50	1.09
Rimouski (4T)		-0.27	0.54	0.95	-0.68	-0.12	-0.26	0.61	0.67	-0.39	0.18	-1.18	-1.06	0.14
Lower St. Lawrence Estuary (4T)			1.04	1.56	0.18	-1.31		0.48	-0.04	-0.45	0.06	-1.52	-1.16	1.03
Gaspé current (4T)	-0.29	-0.48	-0.13	-0.10	0.27	0.64	0.37	0.44	0.52	-0.12			-0.20	0.77
Shediac (4T)	-0.15	1.01	0.17	0.67	-0.06	0.53	-0.17	0.61	-1.17	0.12	-0.09	-1.39		
Îles-de-la-Madeleine (4T)														
Cabot Strait (3Pn, 4Vn)	-1.07	1.90	-1.30	-0.01	0.27	-1.14	-0.62	1.51	-0.30	0.52	0.35	-0.10	-0.53	1.83
Cabot Strait (3Pn, 4Vn)	-0.02	1.73	-0.92	-0.72	-0.12	1.24	-0.68	0.11	-1.27	0.62	1.16	-1.13	-0.60	
Louisbourg (4Vs)	0.48	1.55	-1.28	-0.94	0.70	-0.61	0.45	0.37	-1.91	-0.11	0.39		-1.46	
Halifax-2 (4W)	-0.66	0.80	-0.83	0.15	1.49	-0.76	-1.06	1.71	-0.68	-0.30	1.03	-0.88	-1.14	2.36
Halifax (4W)	0.42	0.65	-0 14	-0.72	-0 10	-0.77	-1.98	0.46	-1 11	1.09	1.48	0.73	1.14	-0.31
Descuse Develo (AV)		0.00	0.14	0	0.10	0.77	1.50	0.10						
Browns Bank (4X)	-1.96	-0.21	0.12	-0.99	1.21	1. <u>13</u>	-0.45	0.23	-1.02	-0.09	0.91		-0.06	

Figure 4. Time series of chlorophyll *a* (0-100m) inventory anomalies from different oceanographic transects and fixed stations (in bold) from the Atlantic Zone Monitoring Program during 1999-2012. The anomalies for transects were calculated using a general linear model using station, season, and year while the fixed stations only used season and year as inputs and were based on all available seasonal data. A grey cell indicates missing data; a blue cell indicates lower than normal levels and a red cell indicates higher than normal levels. More intense colours indicate larger anomalies. The numbers in the coloured cells are the differences in the annual average value from the long-term mean (1999-2010) divided by the standard deviation. The NAFO Subareas are sorted roughly by latitude from north (top) to south (bottom) regions.

Chlorophyll a (0-100m)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Seal Island (2J)		0.66	1.91	0.72	-1.00	-0.36	0.26	0.70	-1.27	-1.21	0.33	-0.73	-1.51	-1.43
Bonavista (3K)		0.56	0.02	-1.77	-1.46	0.78	-0.05	0.53	1.16	-1.01	1.06	0.20	2.39	-1.59
Stn 27 (3L)	3.10	-0.19	-0.12	0.11	-0.35	-0.28	-0.47	-0.43	-0.09	-0.65	-0.09	-0.54	-0.76	-0.96
Flemish Cap (3L, 3M)		0.34	-0.09	-1.01	-2.00	0.08	1.48	-0.51	0.56	-0.40	1.37	0.17	-3.76	-1.72
SE Grand Banks (3LNO)		-1.50	0.79	0.04	-0.98	0.02	1.06	-0.46	1.18	-1.29	1.32	-0.18	-2.58	-1.16
Northeast Gulf of St. Lawrence (4RS)	-0.87	-0.54	-0.80	1.72	0.15	2.20	-0.72	-0.90	0.08	0.10	-0.38	-0.03	-0.03	0.21
Centre Gulf of St.Lawrence (4ST)						-1.22	-1.04	-0.91	0.14	1.21	0.53	-0.05	-1.25	-0.65
Southwest Anticosti (4ST)	-0.66	-1.06	-0.93	2.55	-0.08	0.28	0.57	0.30	-0.75	0.73	-0.59	-0.36	-0.64	-0.06
Anticosti Gyre (4S)	0.36	-0.46	0.24	0.13	-0.27	0.39	-0.09	-0.30	0.18	0.14		0.13	-0.57	-0.15
Northwest Gulf of St.Lawrence (4ST)	-0.49	-1.80	-0.36	1.80	-0.10	0.93	-0.38	-0.01	0.00	1.48	-0.96	-0.12	-0.62	0.17
Rimouski (4T)	1.71	-0.23	0.04	-0.26	0.48	-0.76	-0.41	-0.47	0.50	-0.89	0.24	0.02	-0.28	0.55
Lower St. Lawrence Estuary (4T)	-1.01	-1.16	1.16	-0.53	1.93	-0.49	-0.94	-0.56	1.33	-0.08	0.23	0.14	-0.08	0.28
Gaspé current (4T)	0.66	0.03	-0.07	-0.16	-0.18	-0.42	-0.03	-0.01	0.12	-0.21		0.37	0.28	-0.07
Shediac (4T)	-0.44	-0.70	-0.26	1.13	0.23	-0.46	-0.56	-0.13	0.46	0.60	0.14	-0.25		
Îles-de-la-Madeleine (4T)	-0.54	-1.48	-0.74	0.89	0.34	-0.24	0.05	-0.23	-0.39	2.52	-0.56	0.38	-0.57	-0.29
Cabot Strait (3Pn, 4Vn)	1.51	-1.08	-0.08	2.35	-0.49	-0.74	-0.92	0.14	-0.07	-0.59	0.08	-0.12	-0.66	-0.57
Cabot Strait (3Pn, 4Vn)	0.85	0.99	-0.75	2.42	-0.04	-0.39	-0.72	-1.25	-0.09	-0.40	0.07	-0.68	1.05	
Louisbourg (4Vs)	1.05	0.45	-0.43	0.74	1.85	-0.35	-0.29	-1.47	-0.03	-0.21	0.40		1.69	
Halifax-2 (4W)	2.58	0.75	0.48	-0.23	0.37	-0.56	-0.54	-1.15	-0.82	-0.86	-0.10	0.07	1.20	0.76
Halifax (4W)	-0.49	0.44	-0.47	-1.08	0.37	-0.49	0.23	-2.14	1.65	0.73	0.38	0.86	0.59	-0.83
Browns Bank (4X)	1.20	-0.52	0.10	-1.26	1.93	-1.28	-0.87	-0.63	0.92	0.07	0.54		-1.21	
Prince-5 (4X)	1.38	1.68	0.56	0.19	-0.58	0.21	-0.82	-1.23	-0.47	-1.07	-0.90	1.07	-0.50	1.14

Figure 5. Composite sums of annual anomalies across Labrador and the northeast Newfoundland (LAB-NL) Shelf, Grand Bank (GB), Gulf of St. Lawrence (GSL), Scotian Shelf and Bay of Fundy (SS-BoF) transects and fixed stations for shallow (0-50m) and deep (50-150m) nitrate and chlorophyll *a* inventories during 1999-2012.



Figure 6. Summary of annual ocean colour anomalies from Sea-viewing Wide Field-of-view Sensor (SeaWiFS) and Moderate Resolution Imaging Spectroradiometer (MODIS) "Aqua" sensor imagery across the different statistical sub-regions during 2012. The top panels show the extent of the spring production cycle while the bottom panels indicate the different timing indices. The standardized anomalies are the differences between the annual average for a given year and the long-term mean (1998-2010) divided by the standard deviation. The ocean colour anomalies for Petrie Boxes were calculated using a general linear model using month and year as inputs and were based on all available seasonal data. The NAFO Subareas are sorted from northern (top) to southern (bottom) regions. Negative anomalies for the timing indices (initiation, peak timing, and duration) indicate earlier/shorter blooms while positive anomalies indicate the reverse.



Figure 7. Annual anomalies of background chlorophyll *a* (before and after spring bloom) derived from SeaWiFS and MODIS "Aqua" sensor imagery across the different NAFO Subareas extending from Georges Bank to the Hudson Strait during 1998-2012. The background chlorophyll *a* anomalies for the different Petrie Boxes were calculated using a general linear model using station, season, and year as inputs and were based on all available seasonal data. Blue cells indicate lower than normal levels and red cells indicate higher than normal levels. More intense colours indicate larger standardized anomalies. The numbers in the coloured cells are the differences from the long-term mean (1998-2010) divided by the standard deviation for that time period.

				Backgr	ound Cl	nlorophy	/II a Lev	vels (An	nual An	omalies	)				
Petrie Box	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenland Shelf (1F)	-0.68	0.61	-0.34	0.29	-0.19	2.58	-1.20	-0.59	-0.78	0.51	-0.35	0.93	-0.80	0.86	0.39
Hudson Strait (0B, 2G)	-0.54	0.20	-0.54	-0.47	-0.44	-0.54	3.08	1.24	0.64	-0.54	-0.54	-0.27	-0.54	-0.22	-0.54
Central Labrador Sea (2GH,1F)	-0.51	0.08	0.18	-0.31	2.05	-0.67	0.69	-0.52	-0.88	-0.87	0.07	1.83	-1.15	-5.72	-1.91
Bravo (2GH,1F)	0.06	0.83	-0.11	-0.17	1.01	-0.27	0.32	-0.37	-2.90	0.18	0.75	0.93	-0.26	-0.26	-0.90
Northern Labrador Shelf (2H)	-0.07	-0.02	-0.05	1.26	-1.57	-0.37	1.54	-0.19	1.42	-0.39	0.78	-1.30	-1.07	0.97	-0.93
Hamilton Bank (2J)	0.48	-0.61	-0.99	0.03	-0.59	-0.21	1.63	-0.66	-0.13	-0.96	-0.96	-0.53	0.61	2.51	0.37
St. Anthony Basin (3K)	-0.41	-0.34	-0.34	0.02	0.71	0.95	-0.51	-0.26	-0.45	-0.18	-1.28	2.92	-0.34	0.54	-1.01
Northeast Newfoundland Shelf (3KL)	0.28	-1.17	0.50	0.10	0.36	-1.06	0.03	-0.33	-0.41	-0.99	-1.40	-0.30	0.63	2.29	1.46
Northeast Gulf of St. Lawrence (4RS)	-0.10	0.49	-0.65	-0.67	-0.56	-0.96	-0.66	-0.73	-0.27	0.21	0.12	-0.36	1.70	2.73	-0.28
Northwest Gulf of St. Lawrence (4S)	-0.24	-0.25	-0.61	-0.21	-0.26	-1.14	0.01	0.31	-0.30	-0.13	-0.22	-0.10	3.14	0.80	-0.38
GSL Estuary (4T)	-0.19	-0.63	-0.98	0.84	-0.33	-1.06	-0.05	0.49	0.29	-0.29	-0.26	-0.61	2.80	1.89	1.46
Magdalen Shallows (4T)	0.25	0.56	-0.40	-1.21	-0.81	-0.02	-0.67	-1.30	1.29	1.56	0.94	-1.14	0.95	3.06	0.12
Cabot Strait (3Pn, 4Vn)	0.99	1.02	-0.24	-1.03	-1.20	-0.94	-0.99	-0.58	0.12	0.24	-0.35	0.29	0.96	2.37	-0.66
Avalon Channel (3L)	-0.37	-0.12	-0.33	-1.04	-0.42	-0.87	-0.74	-0.81	-0.21	-0.08	-0.10	-0.10	2.04	2.40	0.74
Hibernia (3L)	-0.15	-0.69	-0.31	-0.44	0.33	0.62	-0.75	-0.56	-0.02	-0.39	-1.05	-0.54	1.35	2.90	-0.30
Flemish Pass (3LM)	-0.22	0.49	0.68	-0.48	1.26	-1.19	-1.18	0.62	-1.14	-0.11	-1.65	-0.51	1.24	1.01	1.17
St. Pierre Bank (3Ps)	-0.42	0.78	-0.36	-0.82	0.35	-1.07	-0.75	-0.46	0.04	-0.56	-0.54	-1.01	1.24	2.42	1.16
Southeast Shoal (3NO)	-0.99	-1.07	-0.85	-0.46	0.41	0.71	-0.57	-0.68	-0.46	-0.48	1.74	2.40	-0.01	0.48	-0.17
Eastern Scotian Shelf (4Vs)	-0.30	0.10	-0.10	-0.65	-1.38	-0.69	-0.12	-0.51	-0.09	-0.74	1.13	2.50	0.85	1.30	3.89
Western Bank (4W)	0.21	-2.15	0.07	0.01	0.01	-0.60	0.46	0.14	0.33	2.32	-0.16	0.40	-1.04	0.31	0.41
Central Scotian Shelf (4W)	-0.51	0.05	0.13	-0.67	-1.01	-1.51	0.42	-0.84	0.06	0.13	0.00	1.66	2.08	2.08	3.79
Western Scotian Shelf (4X)	-0.29	0.76	-0.49	-1.12	-0.03	-1.27	-0.39	-0.38	1.59	-1.05	-0.20	1.13	1.74	0.83	1.32
Lurcher Shoal (4X)	0.78	1.00	-0.76	0.37	-0.99	-0.18	-0.30	0.68	0.52	1.64	-1.57	-1.59	0.40	-1.15	1.21
Georges Bank (5Ze)	-0.16	1.23	-0.17	0.48	-0.61	-1.63	1.46	-0.28	0.27	1.64	-1.00	-1.08	-0.15	-0.76	1.33

Figure 8. Annual anomalies of the magnitude (integrated area) of the spring bloom derived from SeaWiFS and MODIS "Aqua" sensor imagery across the different NAFO Subareas extending from Georges Bank to the Hudson Strait during 1998-2012. The magnitude anomalies for the different Petrie Boxes were calculated using a general linear model using station, season, and year as inputs and were based on all available seasonal data. Blue cells indicate lower than normal levels and red cells indicate higher than normal levels. More intense colours indicate larger standardized anomalies. The numbers in the coloured cells are the differences from the long-term mean (1998-2010) divided by the standard deviation for that time period.

					Magnitu	ude of S	pring B	loom (A	nnual A	nomalie	es)				
Petrie Box	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenland Shelf (1F)	-0.01	0.75	-0.47	1.69	0.89	0.22	-0.92	-1.14	1.09	0.86	-1.49	-0.98	-0.50	0.27	-0.45
Hudson Strait (0B, 2G)	-0.81	0.38	-0.65	0.24	0.39	-0.62	0.92	0.84	2.46	-0.87	0.97	-0.41	-1.09	-0.91	-0.84
Central Labrador Sea (2GH,1F)	-0.36	-0.99	-1.23	0.64	-0.62	1.94	0.58	-0.11	0.83	0.65	0.87	-1.43	-0.76	3.92	-0.66
Bravo (2GH,1F)	-0.49	-0.40	-0.62	0.02	-0.28	0.11	0.62	-0.16	3.06	-0.52	0.09	-0.79	-0.65	-0.64	-0.17
Northern Labrador Shelf (2H)	0.13	0.04	-0.52	0.77	-0.98	0.78	-0.68	-0.01	0.34	-0.74	2.95	0.08	-1.03	-0.54	-0.60
Hamilton Bank (2J)	-0.28	1.13	-1.11	1.06	-0.72	-0.66	-1.06	-0.21	1.14	-1.45	0.70	1.22	1.30	-1.03	-0.03
St. Anthony Basin (3K)	-0.15	0.32	-0.75	0.05	0.73	-1.71	-0.36	-0.61	-0.13	-0.48	2.83	0.36	-0.49	0.77	-0.37
Northeast Newfoundland Shelf (3KL)	-0.18	0.00	0.33	-1.20	-0.14	-0.37	-0.74	-0.78	1.16	-0.05	-0.75	1.60	-0.35	2.38	-0.91
Northeast Gulf of St. Lawrence (4RS)	1.98	-0.70	-1.43	0.11	-0.76	0.49	0.76	-1.77	1.00	0.04	-0.94	-0.18	0.95	0.02	0.44
Northwest Gulf of St. Lawrence (4S)	0.30	-0.03	-0.55	0.81	-0.48	-0.03	1.49	0.92	1.15	-0.65	0.36	-1.22	-2.07	-1.30	2.84
GSL Estuary (4T)	-0.26	1.47	-1.24	0.74	-0.45	-0.10	-0.80	2.16	-0.17	0.24	-1.18	-0.77	0.35	-1.10	0.91
Magdalen Shallows (4T)	-0.82	-0.92	0.08	-0.71	1.26	0.31	-0.46	1.98	-0.80	0.74	-1.60	0.47	0.47	0.27	1.60
Cabot Strait (3Pn, 4Vn)	1.04	0.44	-0.14	-0.83	0.07	0.36	-0.59	-1.25	2.06	0.09	-1.35	-0.36	-1.13	0.00	1.58
Avalon Channel (3L)	-1.56	-0.71	-0.65	-0.27	0.26	-0.15	-0.40	-0.78	0.22	0.42	-0.16	1.41	2.51	0.70	-0.81
Hibernia (3L)	-0.48	2.27	-0.65	-0.89	-0.08	-1.29	1.03	-1.04	-0.06	-0.05	1.50	0.72	-0.26	0.13	-0.85
Flemish Pass (3LM)	-1.26	-0.16	0.11	-0.97	2.01	-0.41	0.23	0.77	-0.18	-0.03	-0.95	1.52	1.17	-1.29	-0.58
St. Pierre Bank (3Ps)	-1.03	-0.46	-1.42	1.58	-0.53	-0.74	-0.17	0.05	0.32	-0.37	-1.20	1.88	0.53	0.24	1.33
Southeast Shoal (3NO)	-0.36	0.56	-1.56	0.03	1.38	-0.55	-0.82	-1.00	-0.12	-0.78	2.03	1.13	0.27	0.65	-0.86
Eastern Scotian Shelf (4Vs)	0.81	-0.94	-0.03	-1.45	0.35	0.96	-0.60	-1.03	0.47	1.91	0.88	-1.07	-0.25	0.99	1.13
Western Bank (4W)	-0.51	2.99	-0.61	-0.39	-0.42	0.01	-0.27	-0.72	-0.54	0.39	-0.77	0.18	0.66	1.48	-0.53
Central Scotian Shelf (4W)	-1.44	-0.12	0.53	-0.99	0.10	0.77	1.11	-1.46	0.07	1.52	0.58	0.60	-1.29	-0.74	-1.51
Western Scotian Shelf (4X)	-1.09	-0.70	-1.41	-0.29	0.49	1.56	0.04	-1.46	1.35	1.22	0.22	0.26	-0.19	-0.69	-0.14
Lurcher Shoal (4X)	-0.99	-0.40	-0.13	0.13	0.39	-0.53	0.64	-0.92	-0.54	-0.92	0.14	2.81	0.31	1.37	-0.54
Georges Bank (5Ze)	-1.15	-0.57	-0.47	0.00	0.36	0.85	-0.77	-0.62	-0.34	-0.32	0.05	2.84	0.14	1.30	-0.69

Figure 9. Annual anomalies of the amplitude of the spring bloom derived from SeaWiFS and MODIS "Aqua" sensor imagery across the different NAFO Subareas extending from Georges Bank to the Hudson Strait during 1998-2012. The amplitude anomalies for the different Petrie Boxes were calculated using a general linear model using station, season, and year as inputs and were based on all available seasonal data. Blue cells indicate lower than normal levels and red cells indicate higher than normal levels. More intense colours indicate larger standardized anomalies. The numbers in the coloured cells are the differences from the long-term mean (1998-2010) divided by the standard deviation for that time period.

					Amplitt	Ide of S	pring Bi	ioom (A	nnuai A	nomaile	s)				
Petrie Box	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenland Shelf (1F)	0.04	1.12	-0.58	2.11	0.05	0.72	-0.74	-0.56	0.93	0.20	-1.17	-1.07	-1.05	0.45	-0.55
Hudson Strait (0B, 2G)	-0.80	0.01	-0.25	0.16	-0.52	-0.43	-0.73	-0.33	-0.48	1.87	0.42	1.22	-1.05	-1.16	2.08
Central Labrador Sea (2GH,1F)	-0.17	-0.80	-0.41	-0.21	0.67	-0.13	-0.33	-0.36	-0.29	-0.08	3.13	-0.63	-0.38	-0.13	0.55
Bravo (2GH,1F)	-0.77	-0.79	-0.57	-0.47	0.01	-0.34	-0.51	-0.54	-0.14	1.39	2.53	-0.68	0.88	0.86	1.14
Northern Labrador Shelf (2H)	-0.36	0.02	-0.20	-0.43	-0.40	-0.14	-0.47	0.77	-0.26	-0.73	0.02	3.37	-0.63	-0.04	-0.52
Hamilton Bank (2J)	-0.73	1.42	-1.00	-0.63	-0.96	0.49	-0.94	-0.67	0.51	-0.78	2.31	0.14	1.11	-0.33	0.07
St. Anthony Basin (3K)	-0.64	0.36	-0.87	0.64	1.52	-0.05	-0.84	-1.20	-0.31	-0.49	1.37	0.47	-0.95	1.91	-0.91
Northeast Newfoundland Shelf (3KL)	-0.46	-0.56	-0.04	-0.92	0.30	-0.32	-0.61	-0.31	1.38	-0.34	-0.66	-0.05	0.20	3.01	-0.62
Northeast Gulf of St. Lawrence (4RS)	0.97	-0.41	-1.10	-0.07	-1.14	-0.99	0.43	-0.90	2.04	0.45	-0.72	0.16	1.17	1.09	-0.98
Northwest Gulf of St. Lawrence (4S)	-0.04	-0.27	-0.67	0.20	0.43	-0.48	-0.14	3.00	-0.38	-0.43	0.47	-0.85	-0.84	-0.85	-0.29
GSL Estuary (4T)	-0.09	0.82	0.15	0.20	0.34	0.00	-0.86	-0.26	-1.03	-0.27	2.75	-1.12	-0.63	-0.64	-0.68
Magdalen Shallows (4T)	-0.39	-1.16	-1.31	-1.08	0.80	0.28	0.32	-0.58	1.96	0.89	-0.88	1.01	0.15	0.95	2.03
Cabot Strait (3Pn, 4Vn)	0.21	0.19	-0.05	-0.33	-0.41	0.02	-0.39	-0.77	0.47	3.37	-0.76	-0.38	-0.69	-0.16	-0.31
Avalon Channel (3L)	-1.10	-0.75	-0.60	-0.84	-0.71	-0.13	-0.78	-1.06	0.44	0.97	-0.08	0.93	2.38	1.07	0.27
Hibernia (3L)	-0.65	1.69	-0.84	-0.90	-0.70	-1.23	0.10	-0.93	0.29	0.14	2.17	0.40	0.20	0.93	-0.67
Flemish Pass (3LM)	-0.97	-0.17	-0.47	-1.48	1.89	-0.33	-1.12	0.74	-0.15	1.09	0.19	0.50	-1.13	-0.12	1.53
St. Pierre Bank (3Ps)	-0.54	0.33	-0.87	0.97	-0.71	-0.38	-0.43	1.78	0.43	-0.42	-1.14	-0.31	-0.69	-0.37	2.35
Southeast Shoal (3NO)	-0.83	0.00	-1.05	0.25	0.99	-0.34	-0.81	-1.09	2.25	-0.25	1.60	-0.08	0.69	-0.94	-0.39
Eastern Scotian Shelf (4Vs)	0.49	-0.59	-0.30	-0.48	0.21	2.89	-0.52	-0.92	0.58	0.10	-0.36	-1.04	-0.07	0.61	0.60
Western Bank (4W)	-0.44	0.07	-0.68	-0.38	-0.18	0.19	0.09	-0.48	-0.27	3.16	-0.80	0.10	-0.39	1.15	-0.20
Central Scotian Shelf (4W)	-0.54	-0.42	-0.08	-0.57	-0.16	-0.08	3.25	-0.25	-0.38	0.14	-0.34	-0.10	-0.49	-0.35	-0.13
Western Scotian Shelf (4X)	-1.14	-0.72	-1.07	0.24	0.98	0.88	-0.11	-1.12	2.16	0.53	-0.96	0.01	0.31	-0.99	-1.07
Lurcher Shoal (4X)	-1.08	-0.64	0.28	1.65	-0.51	-0.20	1.40	-1.12	-0.17	-0.63	-0.10	1.80	-0.69	2.42	-0.10
Georges Bank (5Ze)	-1.25	-1.20	0.30	0.58	-1.08	1.33	1.81	-0.16	-0.20	-0.80	-0.77	0.71	0.72	1.19	-0.77

Figure 10. Annual anomalies of the initiation of the spring bloom derived from SeaWiFS and MODIS "Aqua" sensor imagery across the different NAFO Subareas extending from Georges Bank to the Hudson Strait during 1998-2012. The initiation anomalies for the different Petrie Boxes were calculated using a general linear model using station, season, and year as inputs and were based on all available seasonal data. Blue cells indicate lower than normal levels and red cells indicate higher than normal levels. More intense colours indicate larger standardized anomalies. The numbers in the coloured cells are the differences from the long-term mean (1998-2010) divided by the standard deviation for that time period.

					Initiatio	n of Sp	ring Blo	om (An	nual An	omalies	)				
Petrie Box	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenland Shelf (1F)	0.81	1.71	-0.02	0.72	-0.79	0.74	-0.56	-0.98	-0.22	-0.32	0.48	0.59	-2.18	-0.19	0.06
Hudson Strait (0B, 2G)	0.07	0.37	0.86	0.29	-0.12	0.22	-1.36	-1.06	-2.30	1.22	-0.30	1.70	0.40	-0.22	0.22
Central Labrador Sea (2GH,1F)	-0.32	-1.04	1.41	-0.34	1.65	-1.50	0.00	0.43	-1.13	-1.04	0.71	0.67	0.50	-3.50	0.63
Bravo (2GH,1F)	-0.17	-0.31	0.58	-0.08	0.72	-0.25	-1.30	0.02	-2.45	0.87	0.25	0.79	1.35	1.27	0.27
Northern Labrador Shelf (2H)	-0.47	0.02	0.34	-0.83	1.02	-0.80	-0.05	-0.05	-0.55	2.49		0.74	0.34	-0.07	-0.11
Hamilton Bank (2J)	-1.14	0.47	0.94	-0.58	1.28	1.33	-0.36	-1.05	-1.82	1.42	-0.27	0.61	-0.64	0.37	-0.56
St. Anthony Basin (3K)	-0.60	-0.68	-0.36	0.19	0.15	2.30	0.22	-0.30	-0.21	0.42	-1.96	-1.37	0.74	0.83	0.63
Northeast Newfoundland Shelf (3KL)	-0.69	-1.83	-0.07	1.37	1.59	1.12	0.65	-0.11	-0.44	0.00	0.45	-1.68	-0.71	0.57	-0.21
Northeast Gulf of St. Lawrence (4RS)	-1.17	0.04	1.21	-0.07	0.14	1.96	-0.21	0.19	-0.35	0.30	0.31	-0.72	-1.50	1.36	-1.51
Northwest Gulf of St. Lawrence (4S)	-1.29	0.29	0.40	-0.39	0.63	0.20	0.02	-0.85	-1.34	-0.10	0.03	-0.23	2.63	-0.71	-2.18
GSL Estuary (4T)	-0.03	-0.71	0.79	-0.68	1.71	0.19	0.79	-0.50	-0.90	-0.14	1.71	-0.70	-1.53	-0.03	-1.85
Magdalen Shallows (4T)	0.59	-0.81	-0.57	0.80	-0.71	0.37	0.82	-2.00	0.98	0.06	1.27	0.57	-1.36	0.81	-0.92
Cabot Strait (3Pn, 4Vn)	-0.61	-1.00	-0.03	1.31	-0.39	0.63	0.62	0.19	-0.63	1.04	1.35	0.25	-1.61	0.74	-1.85
Avalon Channel (3L)	0.09	-1.18	-0.39	-0.01	-0.74	2.09	-0.73	-1.87	0.77	0.67	1.18	-0.43	-0.50	0.70	0.35
Hibernia (3L)	0.44	-1.01	-1.36	0.80	0.54	-0.18	-1.15	0.47	0.68	0.55	1.65	-0.88	-1.66	1.19	-0.08
Flemish Pass (3LM)	-0.07	-1.24	0.06	-0.13	1.44	2.03	-1.12	-0.31	-0.94	0.55	0.55	-0.26	-1.65	0.67	0.43
St. Pierre Bank (3Ps)	0.35	1.32	0.16	0.55	0.01	1.28	0.20	0.32	0.41	-0.01	-0.05	-0.91	-2.94	-0.60	-0.09
Southeast Shoal (3NO)	-0.28	-0.38	-0.02	0.63	0.59	1.40	0.59	-0.19	0.79	0.92	0.54	-1.92	-0.72	-2.16	0.21
Eastern Scotian Shelf (4Vs)	0.01	-1.00	0.19	2.31	0.24	1.29	0.61	-0.93	-0.11	-1.01	-0.80	0.19	-0.99	0.10	-1.56
Western Bank (4W)	0.31	-2.75	0.53	0.15	0.47	0.36	0.50	0.47	0.17	0.87	0.37	0.06	-1.52	-0.55	0.44
Central Scotian Shelf (4W)	-0.64	-1.78	1.42	-1.22	0.35	0.61	1.41	0.69	-0.78	0.50	-0.62	0.61	-0.58	0.79	0.50
Western Scotian Shelf (4X)	-0.97	-1.74	1.42	1.68	-0.13	0.53	0.49	0.10	0.00	-0.04	-1.60	0.28	-0.02	0.16	-5.69
Lurcher Shoal (4X)	0.81	-1.10	-0.23	1.15	-0.78	0.64	0.33	0.37	0.37	1.19	0.08	-0.42	-2.40	0.28	0.45
Georges Bank (5Ze)	0.64	-1.77	-0.56	1.13	-1.48	0.37	1.38	0.86	-0.14	-0.13	-0.30	-0.94	0.93	-0.02	0.20

Figure 11. Annual anomalies of the peak timing of the spring bloom derived from SeaWiFS and MODIS "Aqua" sensor imagery across the different NAFO Subareas extending from Georges Bank to the Hudson Strait during 1998-2012. The peak timing anomalies for the different Petrie Boxes were calculated using a general linear model using station, season, and year as inputs and were based on all available seasonal data. Blue cells indicate lower than normal levels and red cells indicate higher than normal levels. More intense colours indicate larger standardized anomalies. The numbers in the coloured cells are the differences from the long-term mean (1998-2010) divided by the standard deviation for that time period.

					Peak Ti	ming of	Spring	Bloom	(Annual	Anoma	lies)				
Petrie Box	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenland Shelf (1F)	0.85	1.72	0.12	0.51	-0.37	0.43	-0.92	-1.97	-0.36	0.00	0.00	1.19	-1.20	-0.50	0.19
Hudson Strait (0B, 2G)	-0.51	0.84	0.80	0.18	0.94	-0.46	0.05	-1.16	-0.44	0.42	-0.71	2.15	0.19	-0.19	-2.09
Central Labrador Sea (2GH,1F)	-1.24	-0.21	1.28	0.19	0.86	-0.59	1.30	1.17	-0.59	-1.60	-1.21	0.33	0.33	-1.73	-0.95
Bravo (2GH,1F)	0.86	1.41	0.13	0.43	0.02	-0.66	-0.10	0.56	-0.05	-0.94	-2.64	0.40	0.58	0.37	-2.33
Northern Labrador Shelf (2H)	-0.38	-0.06	0.19	-0.40	0.89	-0.66	-0.23	-0.39	-0.47	3.09	-1.45	0.37	0.10	-0.38	-0.23
Hamilton Bank (2J)	-0.50	-0.12	1.23	0.86	1.86	0.43	-0.07	-0.48	-1.78	0.91	-1.15	0.80	-0.97	-0.20	-0.82
St. Anthony Basin (3K)	-0.34	-0.84	-1.24	-0.03	0.14	0.94	0.71	0.00	-0.20	0.27	-1.26	-1.92	1.31	1.03	1.43
Northeast Newfoundland Shelf (3KL)	-0.38	-1.23	0.20	1.49	1.41	1.34	0.73	-0.86	-1.06	0.40	0.60	-0.35	-1.67	0.05	-0.69
Northeast Gulf of St. Lawrence (4RS)	-0.94	-0.17	0.97	-0.15	0.79	2.72	-0.31	-0.25	-0.83	-0.15	0.17	-0.85	-1.50	0.44	0.08
Northwest Gulf of St. Lawrence (4S)	-1.44	0.41	0.82	-0.40	0.07	0.64	0.80	-1.82	-0.47	-0.22	-0.30	-0.15	2.05	-0.80	-0.57
GSL Estuary (4T)	-0.64	-0.71	-0.92	-0.68	1.24	-0.20	0.81	2.49	0.20	0.17	-0.18	-0.68	-0.89	-1.30	-0.18
Magdalen Shallows (4T)	0.19	-1.80	0.77	1.28	-0.71	0.64	0.62	-0.32	0.14	0.11	0.48	0.70	-2.08	0.97	-1.56
Cabot Strait (3Pn, 4Vn)	-0.75	-1.52	-0.35	1.19	0.06	0.71	0.64	0.43	-0.62	0.30	1.51	0.37	-2.06	0.87	-0.78
Avalon Channel (3L)	0.02	-1.23	-0.52	1.17	0.45	2.33	-0.15	-0.97	0.39	0.03	1.13	-0.87	-1.28	0.14	-0.64
Hibernia (3L)	0.78	-0.96	-0.73	0.92	1.88	0.10	-0.32	0.22	0.13	0.16	1.04	-0.79	-2.30	0.37	-0.48
Flemish Pass (3LM)	-0.27	-1.73	0.25	1.25	1.19	2.12	0.20	-0.78	-1.39	-0.18	-0.20	-0.31	0.52	-0.09	-0.59
St. Pierre Bank (3Ps)	0.02	1.08	-0.20	0.57	0.38	1.43	0.45	-0.71	0.13	-0.05	0.75	0.37	-2.74	-0.43	-1.06
Southeast Shoal (3NO)	0.22	-0.37	-0.83	0.59	0.78	1.73	0.85	0.05	0.13	0.77	0.66	-2.13	-1.53	-0.67	-0.25
Eastern Scotian Shelf (4Vs)	-0.08	-1.67	0.43	1.86	0.18	0.70	0.71	-0.95	-0.49	-0.17	0.19	0.88	-1.60	0.04	-2.01
Western Bank (4W)	0.24	-2.57	1.31	0.00	0.43	0.46	0.50	-0.01	-0.59	0.97	0.41	0.08	-1.23	-1.42	0.10
Central Scotian Shelf (4W)	-0.56	-2.18	2.02	0.55	0.07	0.69	0.48	-0.18	-0.61	0.27	-0.23	0.65	-0.96	1.03	-0.76
Western Scotian Shelf (4X)	-0.55	-2.21	1.26	1.53	-0.71	0.70	0.55	-0.48	-0.61	0.07	0.72	0.33	-0.60	1.11	-4.41
Lurcher Shoal (4X)	0.03	-2.03	-1.28	1.31	1.08	0.37	0.10	0.54	-0.31	0.76	0.60	0.19	-1.36	0.07	-0.19
Georges Bank (5Ze)	-0.35	-1.94	-1.87	1.12	1.00	0.21	0.72	0.43	-0.79	0.03	0.50	0.09	0.86	-0.04	-0.27

Figure 12. Annual anomalies of the duration of the spring bloom derived from SeaWiFS and MODIS "Aqua" sensor imagery across the different NAFO Subareas extending from Georges Bank to the Hudson Strait during 1998-2012. The duration anomalies for the different Petrie Boxes were calculated using a general linear model using station, season, and year as inputs and were based on all available seasonal data. Blue cells indicate lower than normal levels and red cells indicate higher than normal levels. More intense colours indicate larger standardized anomalies. The numbers in the coloured cells are the differences from the long-term mean (1998-2010) divided by the standard deviation for that time period.

					Duratio	n of Spi	ing Blo	om (Ani	nual And	omalies					
Petrie Box	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Greenland Shelf (1F)	-0.25	-0.62	0.24	-0.62	0.98	-0.78	-0.39	-1.26	-0.14	0.63	-0.97	0.76	2.42	-0.45	0.18
Hudson Strait (0B, 2G)	-0.32	-0.04	-0.62	-0.25	0.57	-0.47	1.58	0.68	2.44	-1.21	0.02	-0.95	-0.37	0.16	-1.22
Central Labrador Sea (2GH,1F)	-0.45	1.14	-0.87	0.55	-1.46	1.45	0.88	0.27	0.99	0.20	-1.69	-0.60	-0.39	3.14	-1.41
Bravo (2GH,1F)	0.41	0.71	-0.51	0.21	-0.67	0.04	1.20	0.15	2.30	-1.10	-1.02	-0.63	-1.10	-1.09	-0.95
Northern Labrador Shelf (2H)	0.47	-0.20	-0.53	1.47	-0.88	0.77	-0.40	-0.76	0.51	-0.04	2.50	-1.28	-0.72	-0.69	-0.21
Hamilton Bank (2J)	0.86	-0.87	0.57	2.20	1.06	-1.27	0.42	0.77	-0.15	-0.64	-1.41	0.38	-0.60	-0.85	-0.47
St. Anthony Basin (3K)	0.62	0.19	-0.81	-0.36	-0.11	-2.85	0.45	0.52	0.13	-0.41	1.89	0.14	0.26	-0.23	0.58
Northeast Newfoundland Shelf (3KL)	0.70	1.55	0.40	-0.36	-0.87	-0.14	-0.15	-0.97	-0.67	0.56	0.03	2.47	-1.04	-0.92	-0.56
Northeast Gulf of St. Lawrence (4RS)	-0.13	-0.35	0.12	-0.17	1.17	2.16	-0.27	-0.67	-0.98	-0.64	-0.11	-0.55	-0.65	-0.97	2.05
Northwest Gulf of St. Lawrence (4S)	0.03	0.15	0.63	0.07	-1.09	0.71	1.32	-1.45	1.78	-0.18	-0.57	0.18	-1.57	0.00	3.23
GSL Estuary (4T)	-0.39	0.21	-1.35	0.20	-0.81	-0.31	-0.22	2.08	0.98	0.24	-1.73	0.21	0.86	-0.81	1.63
Magdalen Shallows (4T)	-0.65	-0.30	1.34	-0.08	0.40	0.00	-0.62	2.42	-1.19	0.01	-1.32	-0.22	0.21	-0.33	0.04
Cabot Strait (3Pn, 4Vn)	0.06	-0.41	-0.56	-0.87	0.98	-0.17	-0.27	0.33	0.33	-1.83	-0.39	0.09	0.03	-0.14	2.82
Avalon Channel (3L)	-0.11	0.30	-0.04	1.45	1.70	-0.36	0.93	1.69	-0.72	-0.99	-0.44	-0.41	-0.80	-0.90	-1.32
Hibernia (3L)	0.56	0.06	1.00	0.21	2.22	0.46	1.34	-0.39	-0.89	-0.64	-0.97	0.13	-1.10	-1.33	-0.67
Flemish Pass (3LM)	-0.18	-0.26	0.17	1.38	-0.49	-0.26	1.49	-0.41	-0.28	-0.81	-0.83	0.00	2.43	-0.86	-1.09
St. Pierre Bank (3Ps)	-0.58	-0.99	-0.51	-0.28	0.44	-0.51	0.20	-1.38	-0.55	-0.05	0.98	1.99	1.80	0.52	-1.09
Southeast Shoal (3NO)	0.74	0.23	-0.93	-0.41	-0.11	-0.39	-0.03	0.39	-1.20	-0.69	-0.16	0.83	-0.55	2.95	-0.66
Eastern Scotian Shelf (4Vs)	-0.12	-0.54	0.27	-1.60	-0.18	-1.37	-0.11	0.34	-0.51	1.62	1.76	0.90	-0.45	-0.12	0.01
Western Bank (4W)	-0.34	2.70	-0.09	-0.22	-0.46	-0.28	-0.48	-0.69	-0.56	-0.78	-0.33	-0.05	1.59	0.07	-0.60
Central Scotian Shelf (4W)	0.49	0.84	-0.45	2.23	-0.47	-0.34	-1.68	-1.16	0.65	-0.52	0.72	-0.37	0.06	-0.31	-1.36
Western Scotian Shelf (4X)	0.75	0.03	-0.61	-0.66	-0.59	0.02	-0.08	-0.65	-0.67	0.12	3.00	-0.04	-0.63	0.99	3.11
Lurcher Shoal (4X)	-1.01	0.24	-0.43	-0.72	1.60	-0.60	-0.36	-0.16	-0.64	-1.07	0.24	0.64	2.27	-0.32	-0.68
Georges Bank (5Ze)	-1.00	0.64	-0.72	-0.49	2.43	-0.28	-1.07	-0.69	-0.42	0.17	0.71	1.15	-0.45	-0.01	-0.44

Figure 13. Composite (sum of anomalies) annual anomalies across the Sub-Arctic (Greenland Shelf, Hudson Strait, Central Labrador Sea, Bravo); Labrador and Newfoundland Shelf (Northern Labrador Shelf, Hamilton Bank, St. Anthony Basin, northeast Newfoundland Shelf); Gulf of St. Lawrence (NE and NW Gulf of St. Lawrence, Estuary, and Magdalen Shallows) and Scotian Shelf and Gulf of Maine (Eastern-Central-Western Scotian Shelf, Western Bank, Lurcher Shoal, Georges Bank) for satellite ocean colour indices during 1998-2012.



Figure 14. Summary of zooplankton abundance anomalies from different oceanographic transects and fixed stations from the Atlantic Zone Monitoring Program during 2012. The zooplankton abundance anomalies for transects were calculated using a general linear model using station, season, and year while the fixed stations only used season and year as inputs and were based on all available seasonal data. The NAFO Subareas are sorted by latitude from the southern Labrador Shelf - 2J (top) to southern Scotian Shelf - 4X (bottom). Data are missing for Shediac, Louisbourg, Cabot Strait (Maritimes) and Browns Bank in 2012.



Figure 15. Time series of dominant copepods *Pseudocalanus spp*. (top panel), and *Calanus finmarchicus* (lower panel) abundance anomalies from different oceanographic transects and fixed stations from the Atlantic Zone Monitoring Program during 1999-2012. The copepod abundance anomalies for transects were calculated using a general linear model using station, season, and year while the fixed stations only used season and year as inputs and were based on all available seasonal data. A grey cell indicates missing data; a blue cell indicates lower than normal levels and a red cell indicates higher than normal levels. More intense colours indicate larger anomalies. The numbers in the coloured cells are the differences from the long-term mean (1999-2010) divided by the standard deviation. The NAFO Subareas are sorted by latitude from north (top) to south (bottom) Subareas.

Pseudocalanus spp.	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Seal Island (2J)	-0.11	-0.50	0.29	-0.95	0.25	-0.48	-1.06	1.03	2.32	0.16	-0.94	0.38	0.46	2.62
Bonavista (3K)	-1.14	-1.82	1.33	0.12	0.71	0.16	-0.95	0.84	-0.40	0.02	1.13	1.79	-0.48	-0.04
Stn 27 (3L)	-0.55	1.22	0.58	0.76	0.54	-1.90	-0.02	-0.63	0.81	-1.66	2.24	1.14	0.45	0.16
Flemish Cap (3L, 3M)	0.20	1.70	-0.22	1.82	-0.42	-0.68	-1.46	0.25	-0.78	-0.52	0.10	1.97	-1.61	-0.50
SE Grand Banks (3LNO)	-2.43	1.17	0.58	0.86	-0.55	0.06	0.74	-0.47	0.50	-0.55	0.08	0.67	1.30	0.35
NE Gulf of St. Lawrence (4RS)		-1.04	-1.12	-1.10	-0.86	-0.31	0.15	0.15	0.18	1.40	1.70	0.83	1.29	0.62
Centre GSL (4ST)					-1.29	-0.40	-1.59	0.65	0.04	0.80	0.90	0.88	4.06	1.34
Southwest Anticosti (4ST)		-0.84	-1.34	-0.76	-0.97	-0.47	-0.50	0.88	1.44	0.54	0.58	1.44	1.72	-0.63
Anticosti Gyre (4S)	-0.90	-0.97	-0.89	-0.92	-0.82	0.14	-0.13	-0.17	0.39	0.79	1.74	1.75	0.71	-0.38
NW Gulf of St.Lawrence (4ST)		-0.82	-1.01	-0.87	-1.00	-0.31	-0.42	0.54	0.70	0.00	1.16	2.03	0.29	-0.65
Rimouski (4T)							-1.04	-0.78	0.69	-0.54	0.08	1.59	1.78	-0.93
St. Lawrence Estuary (4T)		-0.64	-1.16	-1.15	-0.92	1.25	-0.64	1.45	1.21	-0.27	0.21	0.66	0.08	-0.80
Gaspé current (4T)	-0.75	-0.67	-0.88	-0.86	-0.73	-0.57	-0.34	-0.14	0.45	0.99	1.50	2.01	0.58	-0.57
Shediac (4T)	1.35	-0.84	1.93	-0.20	-0.10	-0.94	0.43	-1.49	-0.79	-0.29	0.13	0.82	0.99	
Magdalen Shallows (4T)		-1.06	-0.43	-1.24	-0.79	-0.67	-0.20	1.17	-0.12	0.45	1.11	1.80	0.90	0.39
Cabot Strait (3Pn, 4Vn)		-0.72	-1.33	-1.22	-0.90	0.07	0.84	0.83	-0.41	0.82	0.25	1.76	1.42	-0.15
Cabot Strait (3Pn, 4Vn)	0.94	-1.41	-0.52		2.07	-0.20	-0.40	-0.61	-0.11	0.61	-1.08	0.69	-1.33	
Louisbourg (4Vs)	2.35	-1.17	0.61	1.15	0.11	-0.62	-0.83	0.04	-0.45	0.27	-0.84		-0.98	
Halifax-2 (4W)	1.54	0.45	0.05	-0.26	1.00	1.02	0.28	-1.79	-1.30	0.47	-0.56	-0.89	-1.67	-1.96
Halifax (4W)	1.27	0.81	0.85	0.84	0.82	-0.32	0.26	-2.01	-1.20	-0.04	-0.32	-0.94	-1.21	-0.26
Browns Bank (4X)	1.21	-0.02	2.04	-0.33	1.47	-0.71	-0.69	-0.52	-0.86	-0.23	-0.97		-1.16	
Prince-5 (4X)	0.31	0.51	2.16	0.21	-0.05	-0.69	-0.87	-1.13	-0.35	0.75	-1.52	0.67	-0.88	-0.80
	1	-											-	
Calanus finmarchicus	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Calanus finmarchicus</b> Seal Island (2J)	<b>1999</b> -0.38	<b>2000</b> -1.89	<b>2001</b> -0.90	<b>2002</b> -0.19	<b>2003</b> 0.12	<b>2004</b>	<b>2005</b>	<b>2006</b> 0.69	<b>2007</b> 0.78	<b>2008</b> -0.38	<b>2009</b> -0.59	<b>2010</b> 0.24	<b>2011</b> 0.12	<b>2012</b> 0.25
<b>Calanus finmarchicus</b> Seal Island (2J) Bonavista (3K)	<b>1999</b> -0.38 -1.53	<b>2000</b> -1.89 -2.05	<b>2001</b> -0.90 0.01	<b>2002</b> -0.19 -0.05	<b>2003</b> 0.12 0.45	<b>2004</b> 1.58 0.76	<b>2005</b> 1.16 0.05	2006 0.69 1.51	<b>2007</b> 0.78 0.33	<b>2008</b> -0.38 -0.01	2009 -0.59 0.53	<b>2010</b> 0.24 1.36	<b>2011</b> 0.12 -0.50	<b>2012</b> 0.25 -0.31
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L)	<b>1999</b> -0.38 <b>-1.53</b> 1.79	<b>2000</b> -1.89 -2.05 0.48	2001 -0.90 0.01 -0.03	2002 -0.19 -0.05 0.66	2003 0.12 0.45 -0.26	<b>2004</b> 1.58 0.76 -1.57	<b>2005</b> 1.16 0.05 -0.39	2006 0.69 1.51 -0.67	2007 0.78 0.33 -0.62	<b>2008</b> -0.38 -0.01 -5.47	2009 -0.59 0.53 0.21	<b>2010</b> 0.24 1.36 2.17	<b>2011</b> 0.12 -0.50 0.73	<b>2012</b> 0.25 -0.31 -1.09
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M)	<b>1999</b> -0.38 -1.53 1.79 -1.36	2000 -1.89 -2.05 0.48 -2.21	2001 -0.90 0.01 -0.03 0.88	2002 -0.19 -0.05 0.66 0.87	2003 0.12 0.45 -0.26 -0.38	<b>2004</b> 1.58 0.76 -1.57 0.01	2005 1.16 0.05 -0.39 0.46	2006 0.69 1.51 -0.67 1.12	2007 0.78 0.33 -0.62 0.21	2008 -0.38 -0.01 -5.47 0.21	2009 -0.59 0.53 0.21 0.18	2010 0.24 1.36 2.17 1.37	<b>2011</b> 0.12 -0.50 0.73 0.68	<b>2012</b> 0.25 -0.31 -1.09 1.11
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO)	1999 -0.38 -1.53 1.79 -1.36 -2.27	2000 -1.89 -2.05 0.48 -2.21 -1.72	2001 -0.90 0.01 -0.03 0.88 0.46	2002 -0.19 -0.05 0.66 0.87 0.50	2003 0.12 0.45 -0.26 -0.38 0.49	<b>2004</b> 1.58 0.76 -1.57 0.01 0.46	2005 1.16 0.05 -0.39 0.46 0.73	2006 0.69 1.51 -0.67 1.12 0.27	<b>2007</b> 0.78 0.33 -0.62 0.21 0.45	2008 -0.38 -0.01 -5.47 0.21 0.32	2009 -0.59 0.53 0.21 0.18 0.31	2010 0.24 1.36 2.17 1.37 0.65	2011 0.12 -0.50 0.73 0.68 0.80	<b>2012</b> 0.25 -0.31 -1.09 1.11 0.32
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS)	1999 -0.38 -1.53 1.79 -1.36 -2.27	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38	2001 -0.90 0.01 -0.03 0.88 0.46 0.13	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84	<b>2004</b> 1.58 0.76 -1.57 0.01 0.46 1.10	2005 1.16 0.05 -0.39 0.46 0.73 -0.06	2006 0.69 1.51 -0.67 1.12 0.27 -1.21	2007 0.78 0.33 -0.62 0.21 0.45 1.08	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03	2009 -0.59 0.53 0.21 0.18 0.31 -0.72	2010 0.24 1.36 2.17 1.37 0.65 -0.55	2011 0.12 -0.50 0.73 0.68 0.80 -0.28	2012 0.25 -0.31 -1.09 1.11 0.32 0.49
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST)	1999 -0.38 -1.53 1.79 -1.36 -2.27	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38	2001 -0.90 0.01 -0.03 0.88 0.46 0.13	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST)	1999 -0.38 -1.53 1.79 -1.36 -2.27	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66	<b>2012</b> 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)	1999 -0.38 -1.53 1.79 -1.36 -2.27	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.19	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60 -0.60 -0.50 -0.53	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.62	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.94	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72
Calanus finmarchicus Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St.Lawrence (4ST)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.97 0.03	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60 -0.50 -0.50 -0.83 -0.80	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.32 -0.86	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.74 -0.74	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4RST)         Rimouski (4T)         St.Lawrence (4T)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.97 0.03	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60 -0.50 -0.50 -0.83 -0.80	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.71	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4RS)         Rimouski (4T)         St. Lawrence Estuary (4T)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.97 0.03 -0.07 0.03	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60 -0.50 -0.50 -0.83 -0.80 0.16	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 0.04	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.06	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Charlie (4T)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.19 -0.97 0.03 -0.07 -0.07 -0.54	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26 -0.26 -0.76 -0.76 -0.56	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.60 -0.83 -0.80 0.16 -0.03	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 0.04 0.04	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.19 -0.97	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67 1.19	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 1.21	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23 -1.09	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St. Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Vanded Schellwup (4T)	<b>1999</b> -0.38 -1.53 -1.36 -2.27 -1.12 -0.41 -0.41 -0.61	2000 -1.89 -2.05 -0.48 -2.21 -1.72 -0.38 -0.19 -0.97 -0.97 -0.97 -0.03	2001 -0.90 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26 -0.26 -0.76 -0.76 -0.76 -0.31	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.60 -0.83 -0.80 0.16 -0.03 -0.52	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 0.04 0.12 1.27 0.24	2005 1.16 0.05 -0.39 0.46 0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.19 -0.97 -0.36	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12 0.04	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67 1.19 -0.14	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 <b>1.21</b> -1.00	2010 0.24 1.36 2.17 1.37 0.655 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23 -1.09 -0.89	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28	<b>2012</b> 0.25 -0.31 -1.09 -0.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St. Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Magdalen Shallows (4T)         Cabet Strip (2De, 4)(z)	<b>1999</b> -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.61	2000 -1.89 -2.05 -0.48 -2.21 -1.72 -0.38 -0.19 -0.97 -0.97 -0.97 -0.03 -0.07 -0.54 -0.20 -1.39	2001 -0.90 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26 -0.26 -0.76 -0.76 -0.31 0.55 0.21	2002 -0.19 -0.05 0.60 -0.60 -0.50 -0.83 -0.80 0.16 -0.03 -0.52 0.52	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58 0.00 0.27	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 0.04 0.12 1.27 0.22 1.27	2005 1.16 0.05 -0.39 0.46 0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.19 -0.97 -0.36 -1.01 -0.53	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12 0.04 0.22	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67 1.19 -0.14 0.15	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 1.21 -1.00 -0.78	2010 0.24 1.36 2.17 1.37 0.655 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23 -1.09 -0.89 -0.89	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 -1.28 -0.44	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37 -0.37 -0.46 0.46 -0.37
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Magdalen Shallows (4T)         Cabot Strait (3Pn, 4Vn)         Cabot Strait (4P)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.61	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.97 -0.97 -0.03 -0.07 -0.07 -0.54 -0.20 -1.39	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26 -0.26 -0.76 -1.56 -0.31 0.555 -0.31	2002 -0.19 -0.05 0.66 0.87 0.50 -0.60 -0.50 -0.83 -0.80 -0.80 -0.33 -0.52 0.85 0.14	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58 0.00 -0.27	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 0.04 0.12 1.27 0.22 1.27 0.22	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.97 -0.36 -1.01 -0.55	2006 0.69 1.51 -0.67 -1.12 0.27 -1.21 -0.45 2.73 0.58 2.055 -0.09 -0.20 0.12 0.04 0.80 0.55	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67 1.19 -0.14 0.15 -0.36	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81 -0.43	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 1.21 -1.00 -0.78 -1.02	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.94 -0.87 -0.91 -1.23 -1.09 -0.89 -1.21 -1.28	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 -1.48 0.11	<b>2012</b> 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.67 -0.56 -1.02 0.37
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St. Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Magdalen Shallows (4T)         Cabot Strait (3Pn, 4Vn)         Lawrence (4N)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.61	2000 -1.89 -2.05 0.48 -2.21 -1.72 -0.38 -0.19 -0.97 -0.97 -0.07 -0.54 -0.20 -1.39 1.80 -1.15	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.06 -0.26 -0.76 -0.26 -0.76 -0.31 0.55 -0.31 -0.31	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.60 -0.83 -0.80 0.16 -0.03 -0.52 0.85 0.14	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58 0.00 -0.27 1.552	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 0.04 0.12 1.27 0.22 1.72 -0.18 -0.50	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.97 -0.36 -1.01 -0.55 0.10 0.55	2006 0.69 1.51 -0.67 -1.22 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12 0.04 0.80 0.55 -0.33	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67 1.19 -0.14 0.15 -0.36 0.90	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81 -0.43 -0.43	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.069 1.21 -1.00 -0.78 -1.02 -1.24	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.94 -0.87 -0.91 -1.23 -1.09 -0.89 -1.21 -1.28 0.53	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 -1.48 0.11 -2.95 -1.92 -1.48 -	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.56 -1.02 0.37
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Cabot Strait (3Pn, 4Vn)         Louisbourg (4Vs)         Helifar 2 (4Vb)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.41 -0.61 1.45 1.38	2000 -1.89 -2.05 0.48 -2.21 -0.79 -0.97 0.03 -0.07 -0.54 -0.20 -1.39 1.80 -1.15 -1.07	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.066 -0.26 -0.26 -0.76 -0.76 -0.71 0.55 -0.31 -1.11 -0.84	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.50 -0.83 -0.80 0.16 -0.03 -0.52 0.85 0.14	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58 0.00 -0.27 1.52 -1.12	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 1.35 -0.02 1.27 0.22 1.72 -0.18 -0.17 0.22	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.97 -0.36 -1.01 -0.55 0.10 -0.55 0.10 -0.55 0.10	2006 0.69 1.51 -0.67 1.12 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.04 0.04 0.02 0.04 0.03 0.55 -0.33 -0.33	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.055 1.19 1.75 2.67 1.19 -0.14 0.15 -0.36 0.90 -0.59	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81 -0.43 -0.50 1.044	2009 -0.59 0.53 0.21 -0.50 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 1.21 -1.00 -0.78 -1.02 -1.24	2010 0.24 1.36 2.17 1.37 0.65 -0.94 -0.53 -0.94 -0.53 -0.91 -1.23 -1.09 -0.89 -1.21 -1.28 0.53	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.81 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 -1.48 0.11 -2.95 -1.48	<b>2012</b> 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37 0.46 -0.82
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Cabot Strait (3Pn, 4Vn)         Louisbourg (4Vs)         Halifax-2 (4W)         Halifax-2 (4W)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.41 -0.61 -1.45 1.38 0.86	2000 -1.89 -2.05 0.48 -2.21 -0.79 -0.97 0.03 -0.97 -0.97 -0.07 -0.54 -0.20 -1.39 -1.55 -1.00 0.73	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.066 -0.26 -0.76 -0.76 -0.31 0.555 -0.31 -1.11 -0.84 1.76	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.50 -0.50 -0.83 -0.80 -0.52 0.16 -0.03 -0.52 0.85 0.14	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58 0.00 0-0.27 1.52 -1.11 0.38	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 -0.32 -0.02 -0.32 -0.02 -0.32 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.02 -0.03 -0.04 -0.04 -0.04 -0.05 -0.04 -0.05	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.53 -0.27 -0.92 -1.00 -0.19 -0.97 -0.36 -1.01 -0.55 0.10 -0.61 -0.55 -0.10 -0.51 -0.55 -0.10 -0.55 -0.55 -0.10 -0.55 -	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12 0.04 0.80 0.55 -0.33 -0.33 -0.33 -0.33	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.87 0.05 1.19 1.75 2.67 1.19 -0.14 0.15 -0.36 0.90 -0.59 -0.26	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81 -0.43 -0.50 1.04 1.04	2009 -0.59 0.53 0.21 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 1.21 -1.00 -0.78 -1.02 -1.24 -0.53 -1.56	2010 0.24 1.36 2.17 1.37 0.65 -0.94 -0.53 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23 -1.09 -0.89 -1.21 -1.28 0.53	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 0.11 -2.95 -1.08 -1.48 0.11	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37 -0.56 -1.02 0.46 -0.82
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Magdalen Shallows (4T)         Cabot Strait (3Pn, 4Vn)         Louisbourg (4Vs)         Halifax-2 (4W)         Halifax (4W)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.41 -0.61 -1.45 1.38 0.86 1.83 0.86	2000 -1.89 -2.05 0.48 -2.21 -0.72 -0.79 -0.97 -0	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.066 -0.26 -0.76 -0.31 0.55 -0.31 0.55 -0.31 -1.11 -0.84 1.76 -0.84	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.50 -0.50 -0.50 -0.83 -0.80 -0.52 0.85 0.85 0.14 -0.25 -0.25 -0.25	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.28 1.00 0.41 1.73 2.58 0.00 -0.27 1.52 -1.11 0.38 0.17	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 -0.32 -0.02 -0.32 -0.02 -0.32 -0.02 -0.32 -0.02 -0.02 -0.35 -0.02 -0.03 -0.02 -0.03 -0.03 -0.03 -0.03 -0.03 -0.03 -0.03 -0.03 -0.04 -0.03 -0.03 -0.04 -0	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.97 -0.36 -1.01 -0.55 0.100 -0.61 -1.15 0.70 0.27 -0.61 -0.51 -0.73 -0.62 -0.61 -0.51 -0.73 -0.61 -0.51 -0.73 -0.61 -0.51 -0.52 -0.92 -1.00 -0.51 -0.52 -0.92 -1.00 -0.51 -0.55 -0.01 -0.55 -0.027 -0.92 -1.00 -0.55 -0.01 -0.55 -0.01 -0.55 -0.027 -0.92 -1.00 -0.55 -0.01 -0.55 -0.01 -0.55 -0.01 -0.55 -0.05	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12 0.04 0.80 0.55 -0.33 -0.33 -0.33 -0.83 0.49	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.05 1.19 -0.75 -0.36 0.90 -0.59 -0.26 -1.33	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81 -0.43 -0.50 1.04 1.04	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.06 -0.69 1.21 -1.00 -0.72 -0.53 -1.56 1.24 -0.53 -1.56	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23 -1.09 -0.89 -1.21 -1.28 0.53	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 -1.48 0.11 -2.95 -1.08 -2.56 -1.05 -1.05	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37 0.46 -0.82 -3.57 -1.83
Calanus finmarchicus         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St.Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Cabot Strait (3Pn, 4Vn)         Louisbourg (4Vs)         Halifax-2 (4W)         Browns Bank (4X)         Prince-5 (4X)	1999 -0.38 -1.53 1.79 -1.36 -2.27 -1.12 -0.41 -0.41 -0.61 -1.45 1.38 0.86 1.83 -0.10	2000 -1.89 -2.05 0.48 -2.21 -0.78 -0.19 -0.97 0.03 -0.97 -0.54 -0.07 -0.54 -0.20 -1.39 1.80 -1.15 -1.00 0.73 -0.28 -1.10	2001 -0.90 0.01 -0.03 0.88 0.46 0.13 -0.62 0.066 -0.26 -0.26 -0.31 0.55 -0.31 0.55 -0.31 1.1.11 -0.84 1.76 -0.16 0.71	2002 -0.19 -0.05 0.66 0.87 -0.50 -0.50 -0.50 -0.50 -0.83 -0.80 -0.52 0.85 -0.52 0.85 -0.25 -1.59 0.64 -1.59	2003 0.12 0.45 -0.26 -0.38 0.49 -0.84 1.94 -0.01 2.288 1.00 0.41 1.73 2.58 0.00 -0.27 1.52 -1.11 0.38 0.17 1.52	2004 1.58 0.76 -1.57 0.01 0.46 1.10 -0.50 -0.32 1.35 -0.02 1.35 -0.02 1.27 0.22 1.72 -0.18 -0.17 -0.89 -0.96 -0.96 -0.07 0.02	2005 1.16 0.05 -0.39 0.46 0.73 -0.06 -0.61 -0.53 -0.27 -0.92 -1.00 -0.19 -0.36 -1.01 -0.55 0.10 -0.61 -1.15 0.70 -0.88 -0.29 -0.98	2006 0.69 1.51 -0.67 1.12 0.27 -1.21 -0.45 2.73 0.58 2.05 -0.09 -0.20 0.12 0.04 0.80 0.55 5-0.33 -0.33 -0.33 -0.33 0.49	2007 0.78 0.33 -0.62 0.21 0.45 1.08 1.12 0.05 1.19 -0.14 0.15 -0.36 0.90 -0.59 -0.26 -1.33 -1.06	2008 -0.38 -0.01 -5.47 0.21 0.32 2.03 -0.05 -0.27 -0.08 -0.57 0.31 -0.12 0.22 0.13 1.81 -0.43 -0.50 1.04 1.04 0.066 1.05	2009 -0.59 0.53 0.21 0.18 0.31 -0.72 -0.50 -0.62 -0.32 -0.86 -0.069 1.21 -1.00 -0.78 -1.02 -1.24 -0.53 -1.56 1.24 0.70	2010 0.24 1.36 2.17 1.37 0.65 -0.55 -0.94 -0.53 -0.74 -0.87 -0.91 -1.23 -1.09 -0.89 -1.21 -1.28 0.53	2011 0.12 -0.50 0.73 0.68 0.80 -0.28 -0.66 -1.66 -0.71 -0.65 -1.09 -0.78 -1.28 -1.48 0.11 -2.95 -1.08 -2.56 -1.05 -1.09 -2.56 -1.05 -1.09 -2.56 -1.09 -2.44 -2.55 -1.08 -2.55 -1.09 -2.55 -1.08 -2.55 -1.09 -2.55 -1.08 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.09 -2.55 -1.08 -2.55 -1.09 -2.55 -1.08 -2.55 -1.09 -2.55 -1.08 -2.55 -1.08 -2.55 -1.05 -	2012 0.25 -0.31 -1.09 1.11 0.32 0.49 -0.03 -0.21 -0.72 -0.67 -0.56 -1.02 0.37 -0.56 -1.02 0.37 -0.46 -0.82

Figure 16. Time series of total copepod (top panel) and non-copepod (lower panel) abundance anomalies from different oceanographic transects and fixed stations from the Atlantic Zone Monitoring Program during 1999-2012. The zooplankton abundance anomalies for transects were calculated using a general linear model using station, season, and year while the fixed stations only used season and year as inputs and were based on all available seasonal data. A grey cell indicates missing data; a blue cell indicates lower than normal levels and a red cell indicates higher than normal levels. More intense colours indicate larger anomalies. The numbers in the coloured cells are the differences from the long-term mean (1999-2010) divided by the standard deviation. The NAFO Subareas are sorted by latitude from north (top) to south (bottom) Subareas.

Copepods	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Seal Island (2J)	-0.82	-1.81	-0.81	0.04	0.38	1.41	1.16	1.20	0.19	-0.38	-0.56	0.03	0.04	0.00
Bonavista (3K)	-1.73	-1.61	-0.27	-0.60	0.57	0.45	-0.25	1.36	0.65	0.49	0.94	1.21	0.13	-0.39
Stn 27 (3L)	-0.40	1.00	-0.26	1.25	0.69	-1.32	0.39	-1.36	1.15	-1.39	3.71	2.18	2.19	-0.56
Flemish Cap (3L, 3M)	-1.67	-1.31	0.23	-0.29	-0.85	-0.47	0.73	1.53	0.55	0.68	0.88	2.75	0.42	1.83
SE Grand Banks (3LNO)	-2.49	0.46	-0.94	0.06	0.02	0.23	1.08	-0.25	0.79	0.15	0.89	1.04	1.57	0.38
NE Gulf of St. Lawrence (4RS)		-1.16	-0.42	0.56	-0.65	2.32	-0.61	-1.00	-0.13	0.67	0.67	-0.25	0.73	0.45
Centre GSL (4ST)					2.24	0.11	-1.27	-0.42	-0.05	-0.33	-0.01	-0.27	0.56	0.36
Southwest Anticosti (4ST)		-0.70	-0.22	0.08	-0.96	-0.09	-0.85	2.68	0.63	0.08	-0.41	-0.26	-0.48	-0.50
Anticosti Gyre (4S)	-0.76	-1.50	1.48	-1.46	-0.29	1.15	-0.37	-0.20	-0.34	1.29	0.45	0.54	0.21	-0.28
NW Gulf of St.Lawrence (4ST)		-0.56	1.58	-0.75	-1.11	0.40	-1.66	1.44	0.39	0.04	-0.22	0.45	-0.38	-1.17
Rimouski (4T)							-1.06	-0.87	1.73	-0.08	0.32	-0.05	1.83	0.05
St. Lawrence Estuary (4T)		-0.56	0.43	-0.77	-1.18	1.25	0.36	-0.28	2.19	-0.23	-0.28	-0.92	-1.17	-1.45
Gaspé current (4T)	-0.67	-1.21	-0.41	-1.09	0.11	0.03	-0.80	-0.32	0.14	1.86	1.76	0.60	1.30	-1.07
Shediac (4T)	0.99	-0.62	0.10	-0.53	0.92	-0.62	-0.54	-1.02	0.93	2.05	-1.22	-0.44	-0.84	
Magdalen Shallows (4T)		-1.82	1.24	1.17	-0.26	-0.40	-1.39	0.75	-0.58	0.77	0.26	0.27	0.19	0.53
Cabot Strait (3Pn, 4Vn)		-0.46	-1.46	1.67	-0.05	1.18	-0.91	0.36	-1.26	0.83	-0.28	0.38	1.37	-1.37
Cabot Strait (3Pn, 4Vn)	1.32	-1.33	-1.03		1.18	0.29	0.22	-1.00	-0.38	-0.02	-0.75	1.49	-1.72	
Louisbourg (4Vs)	2.68	-0.78	0.19	-0.93	0.32	-0.64	0.03	0.21	-0.83	0.62	-0.82		-0.97	
Halifax-2 (4W)	1.87	0.94	0.69	-1.43	0.03	0.14	0.65	-1.00	-1.40	-0.25	0.46	-0.69	-0.90	-1.36
Halifax (4W)	2.13	0.92	0.13	-0.83	-0.37	-1.32	1.19	-0.60	-0.44	-0.64	0.48	-0.65	-1.03	-0.69
Browns Bank (4X)	1.28	1.37	0.45	0.13	1.29	-1.30	-0.53	-0.24	-1.07	0.52	-0.55		-1.52	
Prince-5 (4X)	-0.11	1.21	1.56	-0.78	0.50	-0.25	-1.28	0.72	-1.06	-0.38	-1.24	1.10	-0.82	0.81
	-		-				-			-				
Non-copepods	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Non-copepods Seal Island (2J)	<b>1999</b> -1.40	<b>2000</b> -0.64	<b>2001</b> -0.12	<b>2002</b>	<b>2003</b>	<b>2004</b> 1.15	<b>2005</b>	<b>2006</b> 1.94	<b>2007</b> 0.12	<b>2008</b> -1.08	<b>2009</b> -0.23	<b>2010</b> 0.03	<b>2011</b> -0.03	<b>2012</b> 0.45
Non-copepods Seal Island (2J) Bonavista (3K)	<b>1999</b> -1.40 -1.45	<b>2000</b> -0.64 <b>-1.78</b>	<b>2001</b> -0.12 0.32	<b>2002</b> -0.62 0.20	<b>2003</b> -0.06 0.36	<b>2004</b> 1.15 -0.27	<b>2005</b> 0.95 -0.08	<b>2006</b> 1.94 1.70	<b>2007</b> 0.12 0.07	<b>2008</b> -1.08 -0.25	2009 -0.23 1.18	<b>2010</b> 0.03 1.20	<b>2011</b> -0.03 -0.32	<b>2012</b> 0.45 0.15
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L)	<b>1999</b> -1.40 -1.45 -1.79	2000 -0.64 -1.78 1.27	2001 -0.12 0.32 -0.09	2002 -0.62 0.20 0.60	2003 -0.06 0.36 0.61	<b>2004</b> 1.15 -0.27 0.03	2005 0.95 -0.08 0.47	2006 1.94 1.70 -1.10	2007 0.12 0.07 0.21	2008 -1.08 -0.25 -1.99	2009 -0.23 1.18 -0.82	2010 0.03 1.20 0.97	<b>2011</b> -0.03 -0.32 <b>0.85</b>	<b>2012</b> 0.45 0.15 2.86
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M)	<b>1999</b> -1.40 -1.45 -1.79 -2.31	<b>2000</b> -0.64 -1.78 1.27 0.47	2001 -0.12 0.32 -0.09 0.75	2002 -0.62 0.20 0.60 1.19	2003 -0.06 0.36 0.61 -0.79	<b>2004</b> 1.15 -0.27 0.03 -0.90	2005 0.95 -0.08 0.47 0.24	2006 1.94 1.70 -1.10 0.69	2007 0.12 0.07 0.21 -0.26	2008 -1.08 -0.25 -1.99 0.53	2009 -0.23 1.18 -0.82 0.38	2010 0.03 1.20 0.97 3.24	2011 -0.03 -0.32 0.85 1.03	2012 0.45 0.15 2.86 3.69
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO)	<b>1999</b> -1.40 -1.45 -1.79 -2.31 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52	2001 -0.12 0.32 -0.09 0.75 0.42	2002 -0.62 0.20 0.60 1.19 0.25	2003 -0.06 0.36 0.61 -0.79 0.10	2004 1.15 -0.27 0.03 -0.90 -0.24	2005 0.95 -0.08 0.47 0.24 0.67	2006 1.94 1.70 -1.10 0.69 0.08	2007 0.12 0.07 0.21 -0.26 -0.33	2008 -1.08 -0.25 -1.99 0.53 0.05	2009 -0.23 1.18 -0.82 0.38 0.09	<b>2010</b> 0.03 1.20 0.97 3.24 1.32	2011 -0.03 -0.32 0.85 1.03 0.61	2012 0.45 0.15 2.86 3.69 2.19
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS)	1999 -1.40 -1.45 -1.79 -2.31 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52 1.26	2001 -0.12 0.32 -0.09 0.75 0.42 -1.97	2002 -0.62 0.20 0.60 1.19 0.25 0.31	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07	2005 0.95 -0.08 0.47 0.24 0.67 0.77	2006 1.94 1.70 -1.10 0.69 0.08 1.34	2007 0.12 0.07 0.21 -0.26 -0.33 0.04	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02	2009 -0.23 1.18 -0.82 0.38 0.09 0.05	2010 0.03 1.20 0.97 3.24 1.32 -0.60	2011 -0.03 -0.32 0.85 1.03 0.61 6.83	2012 0.45 0.15 2.86 3.69 2.19 0.86
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST)	1999 -1.40 -1.45 -1.79 -2.31 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52 1.26	2001 -0.12 -0.09 0.75 0.42 -1.97	2002 -0.62 0.20 0.60 1.19 0.25 0.31	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST)	1999 -1.40 -1.45 -1.79 -2.31 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83	2002 -0.62 0.20 0.60 1.19 0.25 0.31	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95	2003 -0.06 0.36 -0.79 0.10 -1.29 -1.53 -0.74 -0.93	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St.Lawrence (4ST)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.09	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72	2005 0.955 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T)	1999 -1.40 -1.45 -1.79 -2.31 -2.61	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.09	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.89	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.32	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.84 -0.48 -1.03
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 0.74	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68	2001 -0.12 0.32 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.09	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.89 -0.56	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48 -1.03 -0.41
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 0.74 0.74	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68	2001 -0.12 0.32 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74 -0.58 -0.63	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.09	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.89 -0.56 -0.77	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10 -0.14	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87 1.66	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18 0.22	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08 -0.57	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48 -1.03 -0.41 -0.18
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68 -0.40 0.37 -0.93	2001 -0.12 0.32 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.83 -1.20 -0.90 -0.55 -1.05 0.43	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74 -0.58 -0.58 -0.53 -0.34	2003 -0.06 0.36 0.61 -0.79 0.10 -1.53 -0.74 -0.93 -0.09 0.47 -0.33 -0.33 -0.24	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99 -0.78	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.07 -0.63 -0.38 -0.59 -0.89 -0.56 -0.77 1.04	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.83 1.02 2.33 -0.66 -0.10 -0.14 0.25	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87 1.66 0.28	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34	2009 -0.23 1.18 -0.82 0.09 0.05 -0.53 -0.53 -0.53 -0.53 -0.24 0.32 -0.18 0.22 -0.18	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.871 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.88 -1.03 -0.41 -0.18
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St.Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T) Magdalen Shallows (4T)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 0.74 0.74 0.09 1.70	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68 -0.40 0.37 -0.93 -0.87	2001 -0.12 0.32 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.68 -0.95 -0.74 -0.58 -0.63 -0.34 -0.34	2003 -0.06 0.36 0.61 -0.79 0.10 -1.53 -0.74 -0.93 -0.09 0.47 -0.33 -0.24 -0.33	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99 -0.78 -0.87	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.89 -0.56 -0.77 1.04	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.80 1.80 1.80 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87 1.66 0.28 0.12	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17	2009 -0.23 1.18 -0.82 0.09 0.055 -0.53 -0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18 0.22 -1.21	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54 2.42	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.871 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.20	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48 -1.03 -0.41 -0.18
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St.Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T) Magdalen Shallows (4T) Cabot Strait (3Pn, 4Vn)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.61 -2.74 -2.77 -2.74 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.777 -2.7777 -2.7777 -2.7777 -2.7777 -2.7777 -2.7777 -2.777777 -2.7777777777	2000 -0.64 -1.78 1.27 0.47 -0.57 -0.24 -0.68 -0.40 0.37 -0.93 -0.87 -0.93	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05 -1.42	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74 -0.58 -0.58 -0.63 -0.34 -0.21 -1.01	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.09 -0.47 -0.33 -1.24 -0.73 -0.80	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99 -0.51 -0.99 -0.78 -0.87 0.15	2005 0.95 -0.08 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.59 -0.56 -0.77 1.04 0.92 1.93	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15 0.89	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87 0.28 0.28 0.12 0.90	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17 -0.07	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18 -0.12 0.22 -1.21 0.24 0.20	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54 2.42 0.18	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.20 2.76	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48 -0.48 -0.48 -0.41 -0.41 -0.18 -0.18 -0.86
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St.Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T) Magdalen Shallows (4T) Cabot Strait (3Pn, 4Vn) Cabot Strait (3Pn, 4Vn)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 0.74 0.74 0.09 1.70	2000 -0.64 -1.78 1.27 0.47 -0.57 -0.24 -0.68 -0.40 0.37 -0.40 0.37 -0.93 -0.87 -0.96 -0.98	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05 -1.42 -0.77	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74 -0.58 -0.63 -0.34 -0.34 -0.21 -1.01	2003 -0.06 0.36 0.10 -1.29 -1.53 -0.74 -0.93 -0.09 -0.47 -0.33 -1.24 -0.73 -0.80 0.48	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99 -0.78 -0.78 -0.87 0.15 1.46	2005 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.89 -0.56 -0.77 1.04 0.92 1.93 -0.64	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.33 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15 0.89 0.21	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87 1.66 0.28 0.12 0.90 -1.28	2008 -1.08 -0.25 -1.99 0.53 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17 -0.07 -0.54	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18 0.22 -1.21 0.24 0.20 -0.53	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54 2.42 0.18 1.46	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.270 2.276 0.65	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48 -1.03 -0.41 -0.18 -0.18 -0.86
Non-copepods         Seal Island (2J)         Bonavista (3K)         Stn 27 (3L)         Flemish Cap (3L, 3M)         SE Grand Banks (3LNO)         NE Gulf of St. Lawrence (4RS)         Centre GSL (4ST)         Southwest Anticosti (4ST)         Anticosti Gyre (4S)         NW Gulf of St. Lawrence (4ST)         Rimouski (4T)         St. Lawrence Estuary (4T)         Gaspé current (4T)         Shediac (4T)         Magdalen Shallows (4T)         Cabot Strait (3Pn, 4Vn)         Louisbourg (4Vs)	1999 -1.40 -1.45 -1.79 -2.31 -2.61 0.74 0.09 1.70 	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68 -0.93 -0.96 -0.98 -0.98	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05 -1.42 -0.77 1.72	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.68 -0.95 -0.74 -0.58 -0.63 -0.34 -0.21 -1.01	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.09 0.47 -0.33 -1.24 -0.73 -0.80 0.48 -0.98	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -0.72 -0.51 -0.99 -0.78 -0.78 -0.78 -0.87 0.15 1.46 -0.28	2005 0.955 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.38 -0.59 -0.59 -0.59 -0.56 -0.77 1.04 0.92 1.93 -0.64 0.00	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15 0.89 0.21 1.42	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.55 1.52 1.33 1.14 2.87 1.66 0.28 0.12 0.90 0.90 -1.28	2008 -1.08 -0.25 -1.99 0.53 0.05 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17 -0.07 -0.54	2009 -0.23 1.18 -0.82 0.05 -0.05 -0.05 -0.02 1.31 -0.24 0.22 -1.21 0.24 0.20 -0.53 -0.90	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54 2.42 0.18 1.46	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.276 0.65 0.25	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.84 -0.48 -1.03 -0.41 -0.18 <b>1.89</b> -0.86
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T) Magdalen Shallows (4T) Cabot Strait (3Pn, 4Vn) Cabot Strait (3Pn, 4Vn) Louisbourg (4Vs) Halifax-2 (4W)	1999 -1.40 -1.45 -7.79 -2.31 -2.61 0.74 0.74 0.09 1.70 1.14 0.73 2.77	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.68 -0.40 0.37 -0.93 -0.93 -0.98 -0.99 0.30	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05 -1.42 -0.77 1.72 -0.09	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74 -0.58 -0.74 -0.58 -0.34 -0.34 -0.21 -1.01 -0.63 -0.93	2003 -0.06 0.36 0.61 -0.79 -1.53 -0.74 -0.93 -0.99 0.47 -0.33 -1.24 -0.73 -0.80 0.48 -0.98 -0.26	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99 -0.78 -0.78 -0.78 -0.75 1.46 -0.28 0.22	2005 0.955 -0.08 0.47 0.24 0.67 0.08 -0.63 -0.38 -0.59 -0.89 -0.56 -0.77 1.04 0.92 1.93 -0.64 0.00 0.59	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15 0.89 0.21 1.42 -0.57	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.55 1.33 1.14 2.87 1.66 0.28 0.12 0.98 0.12 0.997 -0.94	2008 -1.08 -0.25 -1.99 0.53 0.05 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17 -0.07 -0.54 0.60 -0.01	2009 -0.23 1.18 -0.82 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18 0.22 -1.21 0.24 0.20 0.053 -0.90 -0.31	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54 2.42 0.18 1.46	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.20 2.20 2.20 2.20 5.05 0.25 1.19	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.41 -0.41 -0.18 -0.86 -0.86
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T) Magdalen Shallows (4T) Cabot Strait (3Pn, 4Vn) Cabot Strait (3Pn, 4Vn) Cabot Strait (3Pn, 4Vn) Louisbourg (4Vs) Halifax-2 (4W)	1999 -1.40 -1.45 -7.79 -2.31 -2.61 	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.57 -0.24 -0.68 -0.93 -0.93 -0.93 -0.93 -0.98 -0.99 0.30 0.61	2001 -0.12 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05 -1.42 -0.77 1.72 -0.09 -0.68	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.63 -0.34 -0.34 -0.21 -1.01 0.63 -0.93 -0.93 -0.13	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.33 -0.74 -0.33 -0.80 0.47 -0.33 -1.24 -0.73 -0.80 0.48 -0.26 0.25	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -0.72 -0.51 -0.99 -0.78 -0.78 -0.87 0.15 1.46 -0.28 0.22 -0.44	2005 0.955 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.58 -0.59 -0.89 -0.56 -0.77 1.04 0.92 1.93 -0.64 0.59 0.87	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15 0.89 0.21 1.42 -0.57 -0.91	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.52 1.52 1.33 1.14 2.87 1.66 0.28 0.12 0.90 -1.28 -0.97 -0.94 -0.81	2008 -1.08 -0.25 -1.99 0.53 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17 -0.07 -0.54 0.60 -0.01	2009 -0.23 1.18 -0.82 0.05 -0.53 -0.02 1.31 -0.24 0.32 -0.18 0.22 -1.21 0.24 0.24 0.20 -0.53 -0.93 -0.93	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.61 0.08 -0.57 -0.54 2.42 0.18 1.46 -0.77 -0.89	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.20 2.76 0.65 0.25 0.25 1.19 -0.33	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.84 -0.48 -0.41 -0.18 -0.86 -0.86 -0.25 -0.02
Non-copepods Seal Island (2J) Bonavista (3K) Stn 27 (3L) Flemish Cap (3L, 3M) SE Grand Banks (3LNO) NE Gulf of St. Lawrence (4RS) Centre GSL (4ST) Southwest Anticosti (4ST) Anticosti Gyre (4S) NW Gulf of St. Lawrence (4ST) Rimouski (4T) St. Lawrence Estuary (4T) Gaspé current (4T) Shediac (4T) Magdalen Shallows (4T) Cabot Strait (3Pn, 4Vn) Cobot Strait (3Pn, 4Vn) Louisbourg (4Vs) Halifax-2 (4W) Browns Bank (4X)	1999 -1.40 -1.45 -7.79 -2.31 -2.61 	2000 -0.64 -1.78 1.27 0.47 1.52 1.26 -0.57 -0.24 -0.40 0.37 -0.93 -0.87 -0.96 -0.98 -0.99 0.300 0.61	2001 -0.12 0.32 -0.09 0.75 0.42 -1.97 -0.83 -1.20 -0.90 -0.55 -1.05 0.43 -1.05 -1.42 -0.77 1.72 -0.09 -0.68 -0.54	2002 -0.62 0.20 0.60 1.19 0.25 0.31 -0.68 -0.95 -0.74 -0.58 -0.63 -0.34 -0.21 -1.01 -0.63 -0.93 -0.13 -0.38	2003 -0.06 0.36 0.61 -0.79 0.10 -1.29 -1.53 -0.74 -0.93 -0.93 -0.93 -0.23 -1.24 -0.73 -0.80 0.48 -0.98 -0.25 1.42	2004 1.15 -0.27 0.03 -0.90 -0.24 0.07 -0.54 -0.69 -1.03 -0.72 -0.51 -0.99 -0.78 -0.51 -0.99 -0.78 -0.87 0.15 1.46 -0.28 0.22 -0.44 -1.03	2005 0.95 -0.08 0.47 0.24 0.67 0.77 0.08 -0.63 -0.59 -0.59 -0.59 -0.59 -0.59 -0.59 -0.59 -0.56 -0.77 1.04 0.92 1.93 -0.64 0.00 0.59 0.87 0.64 0.00	2006 1.94 1.70 -1.10 0.69 0.08 1.34 1.80 1.13 1.02 2.33 -0.66 -0.10 -0.14 0.25 -0.15 0.89 0.21 1.42 -0.57 -0.91 -0.97	2007 0.12 0.07 0.21 -0.26 -0.33 0.04 0.86 1.85 1.52 1.33 1.14 2.87 1.66 0.28 0.12 0.90 -1.28 -0.97 -0.94 -0.81 -0.96	2008 -1.08 -0.25 -1.99 0.53 0.05 0.02 0.12 1.51 0.75 0.17 -1.04 -0.38 2.13 1.34 0.17 -0.07 -0.54 0.60 -0.01 0.25 0.16	2009 -0.23 1.18 -0.82 0.38 0.09 0.05 -0.53 -0.02 1.31 -0.24 0.22 -0.18 0.22 -1.21 0.24 0.20 -0.53 -0.90 -0.53 -0.90 -0.51 -0.64 -0.64	2010 0.03 1.20 0.97 3.24 1.32 -0.60 -0.26 -0.34 -0.61 0.12 1.13 -0.08 -0.57 -0.54 2.42 0.18 1.46 -0.77 -0.89	2011 -0.03 -0.32 0.85 1.03 0.61 6.83 3.71 1.61 0.95 1.45 2.61 -0.23 1.97 -0.06 2.20 2.76 0.65 0.25 1.19 -0.33 -1.28	2012 0.45 0.15 2.86 3.69 2.19 0.86 -0.21 0.34 -0.48 -0.48 -1.03 -0.41 -0.18 1.89 -0.86 0.25 -0.02

Figure 17. Composite sums of annual anomalies across the Labrador and Newfoundland Shelf (LAB-NL Shelf), Grand Bank, Gulf of St. Lawrence, and Scotian Shelf Subareas for the different functional zooplankton abundance indices during 1999-2012.

