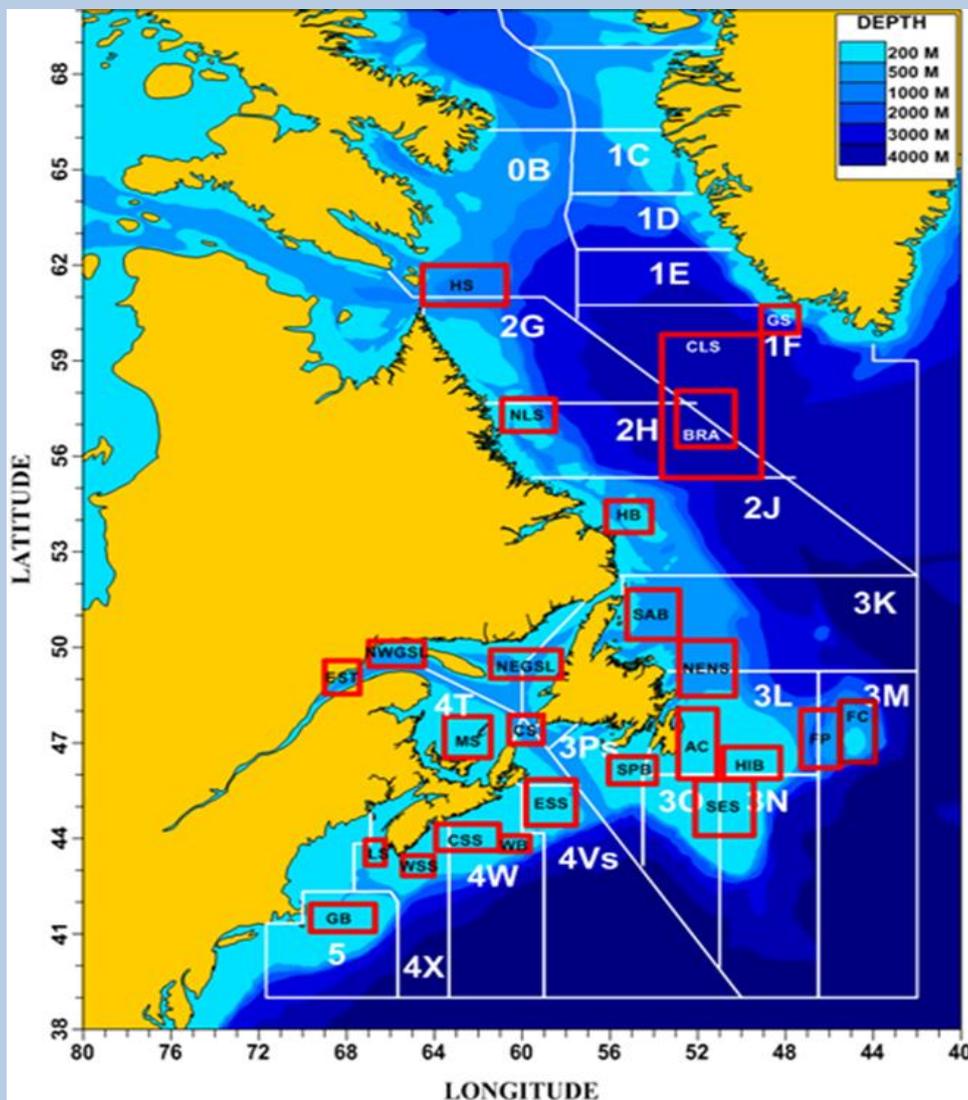


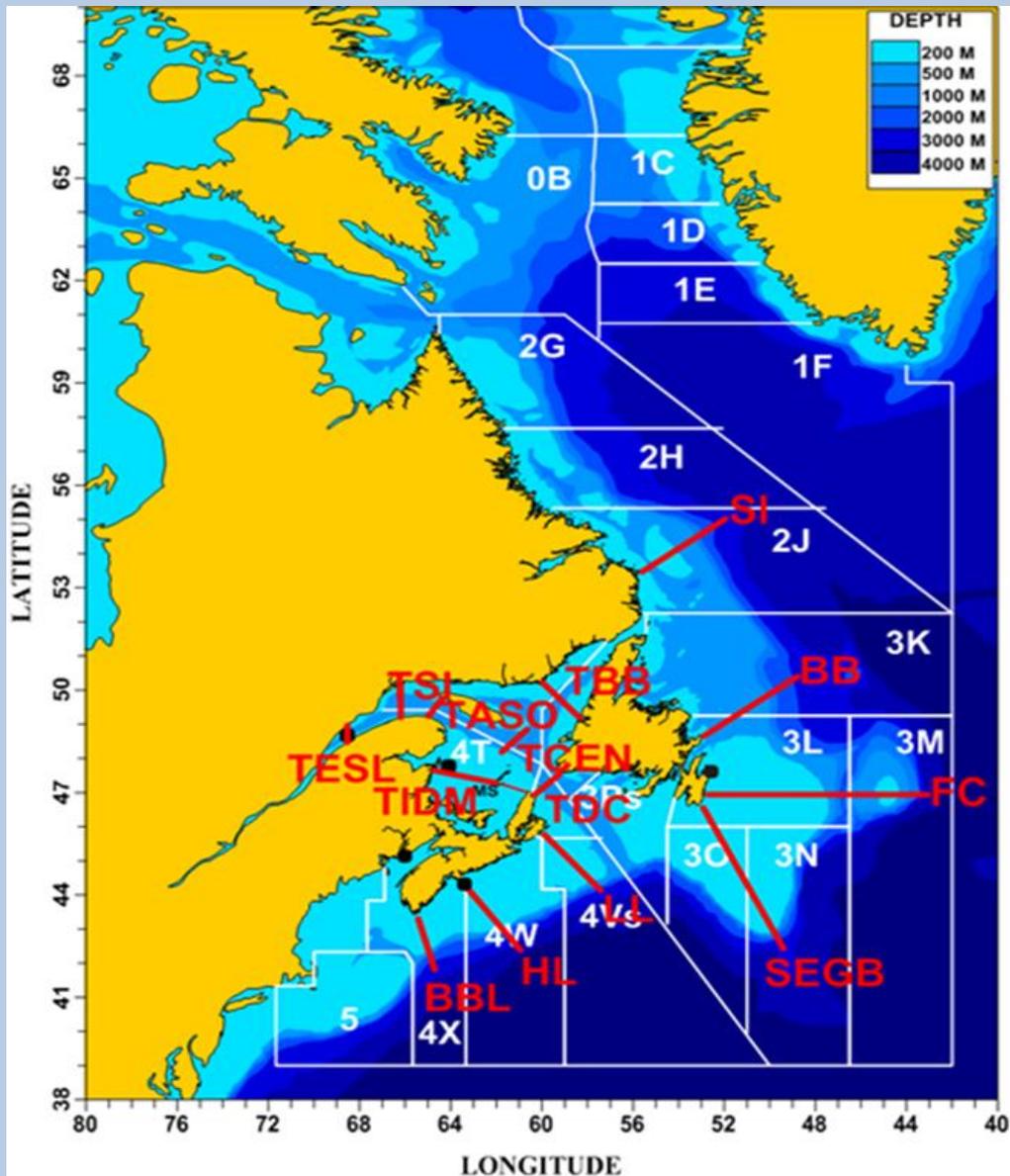
## The 2017 Ocean Climate Status Summary for NAFO S. A. 1-5, Biogeochemical Trends

**Biogeochemical Indicators within the NAFO Convention Area: Nitrate, Phytoplankton Metrics and Zooplankton Trends.**

**Map of the sub-regions from which satellite Ocean colour metrics (magnitude, amplitude, peak timing and duration of spring bloom) were derived.**



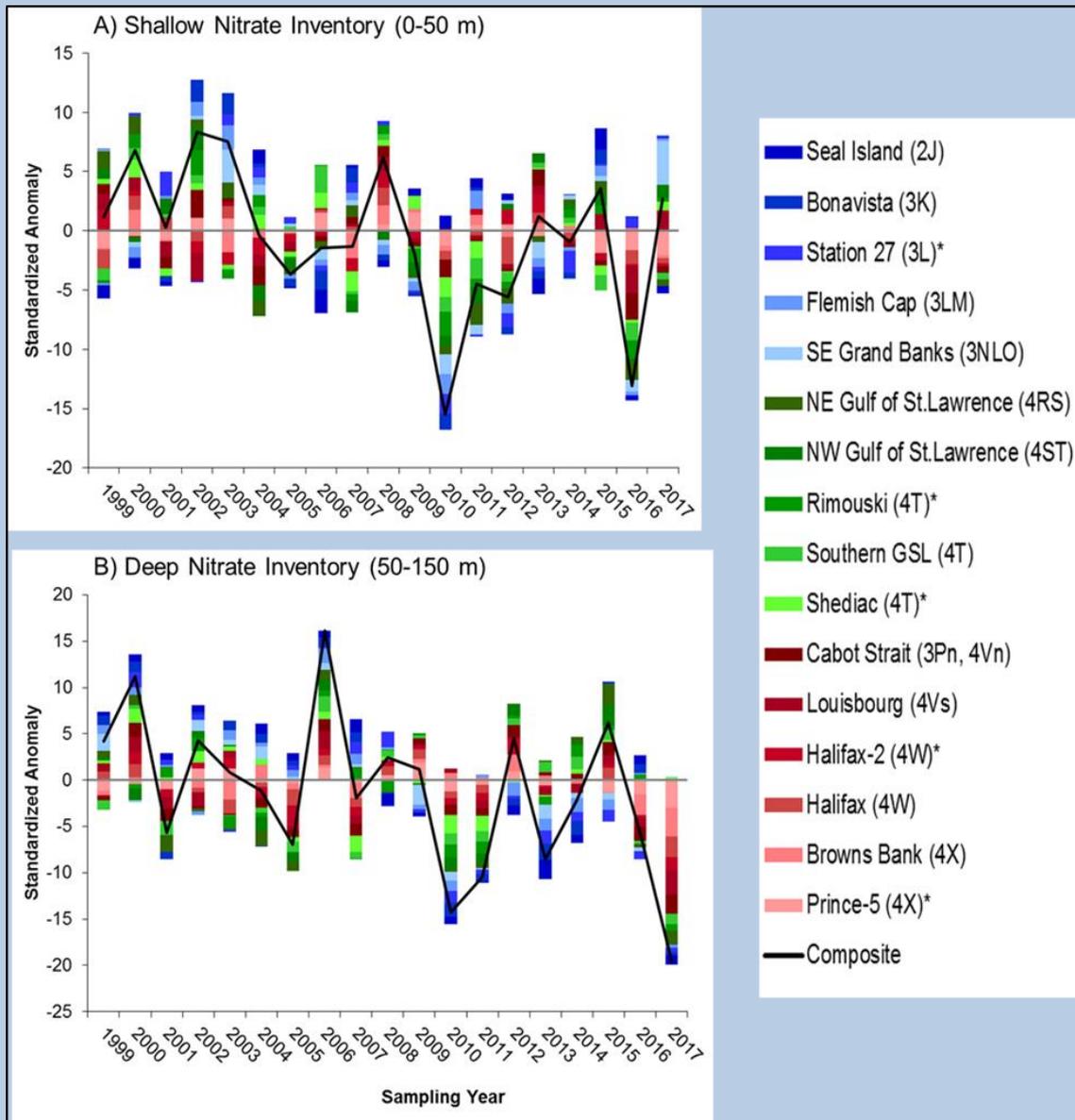
Location Map of primary Atlantic Zone Monitoring Program (AZMP) sections (red lines) from which chemical (nitrate) and biological (chlorophyll *a* and zooplankton) data were collected. High frequency sampling stations are show as the **black dots**.



## Trends in Nitrate Concentration

Time series of (A) shallow (0-50m) and (B) deep (50m-150m) nitrate (combined nitrite and nitrate) inventory anomalies from different oceanographic sections and high frequency sampling stations from the AZMP during 1999-2017.

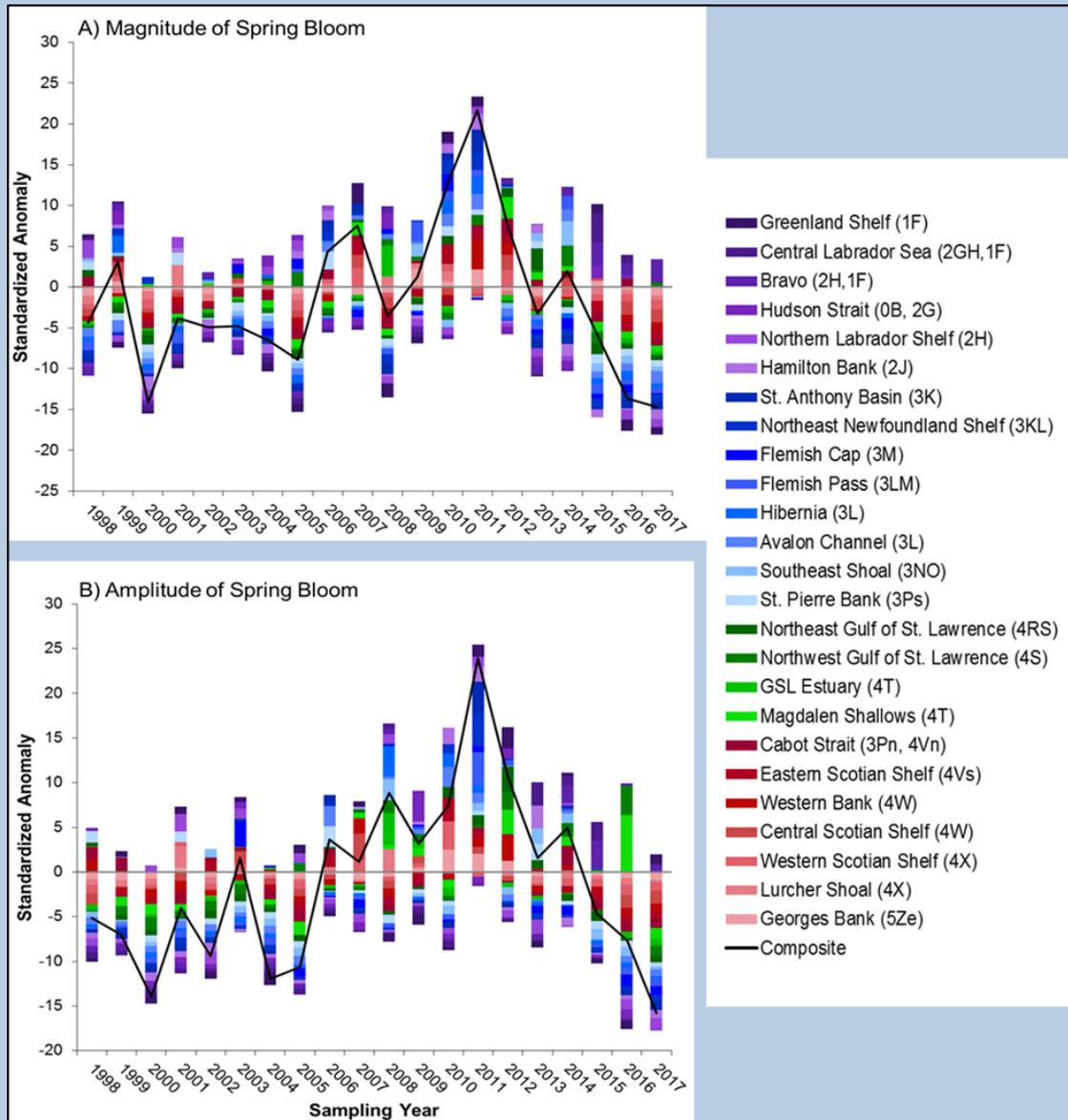
General decreasing trend in nitrate concentration since 1999 with a record low in the deep Nitrate inventory in 2017.



## Trends in the Intensity of the Spring Bloom across the NAFO Convention Area

Annual anomaly time series for the magnitude and amplitude of the spring bloom derived from weekly composites of satellite imagery across the different NAFO Subareas.

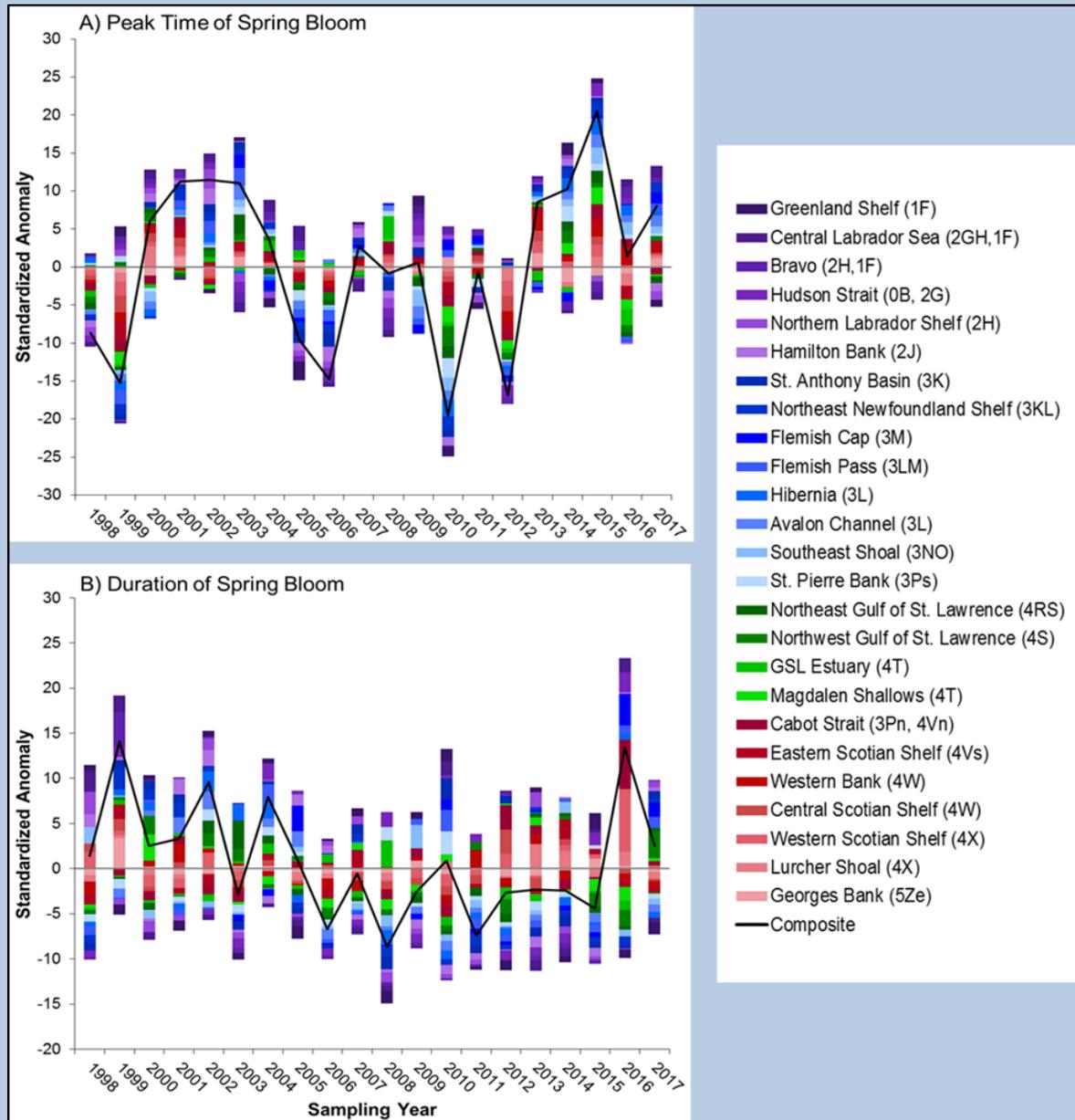
Decreasing trend in the intensity of the spring bloom since 2010 with a record low observed in 2017.



## Trends in the Timing and Duration of the Spring Bloom across the NAFO Convention Area

Annual anomaly time series for the time of maximum intensity and the duration of the spring bloom derived from weekly composites of Satellite imagery across the different NAFO Subareas.

Peak timing shows high variability since 1998 with a delayed bloom during the past several years.

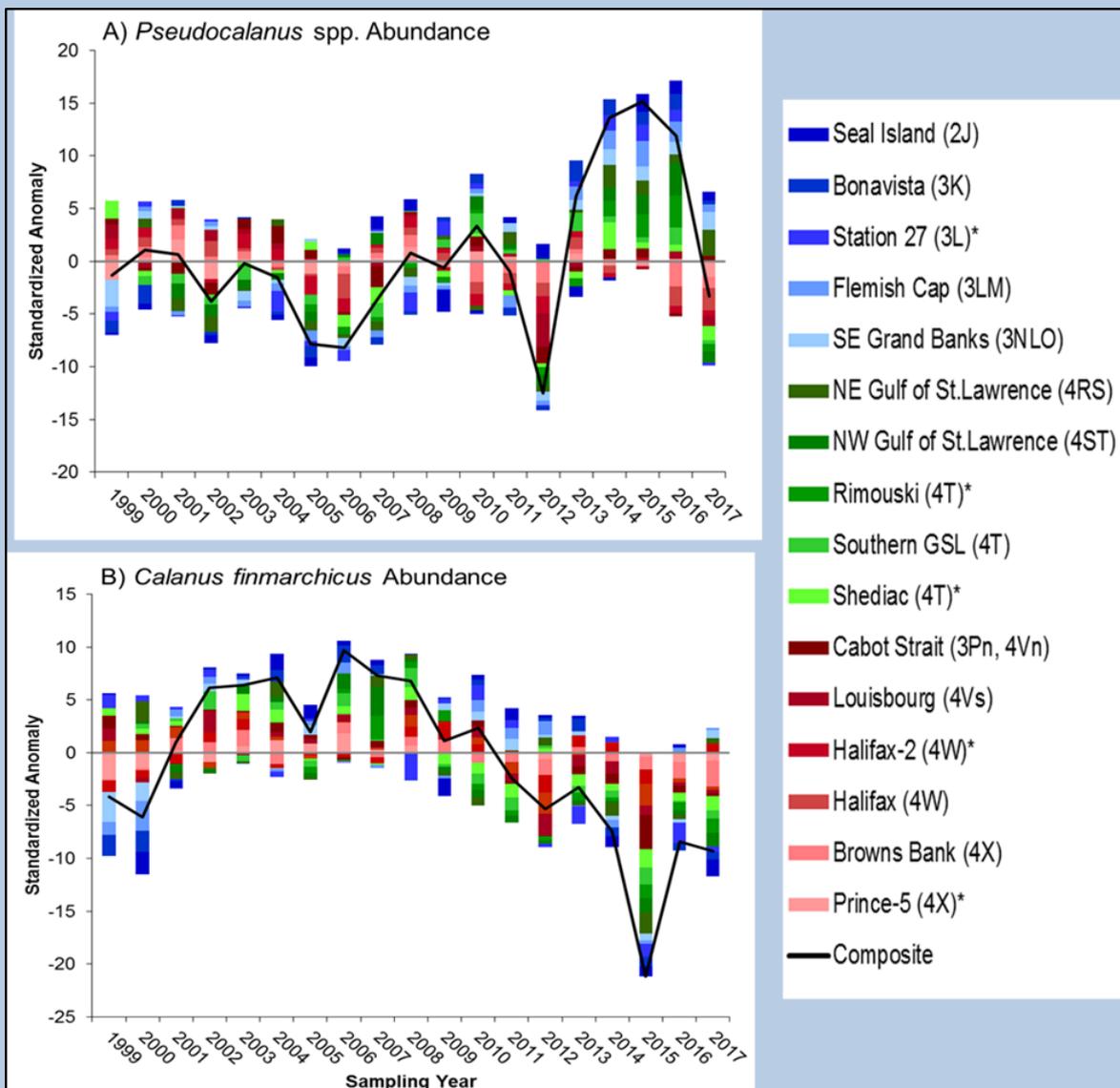


## Trends in the dominant copepods from NAFO Subareas 2-4

Time series of dominant copepods *Pseudocalanus* spp. and *Calanus finmarchicus* abundance anomalies from standard AZMP Sections from 1999-2017.

The abundance anomaly time series for the small grazing copepod (*Pseudocalanus* spp.) shows a record low in 2012 before rapidly increasing to a record high in 2015.

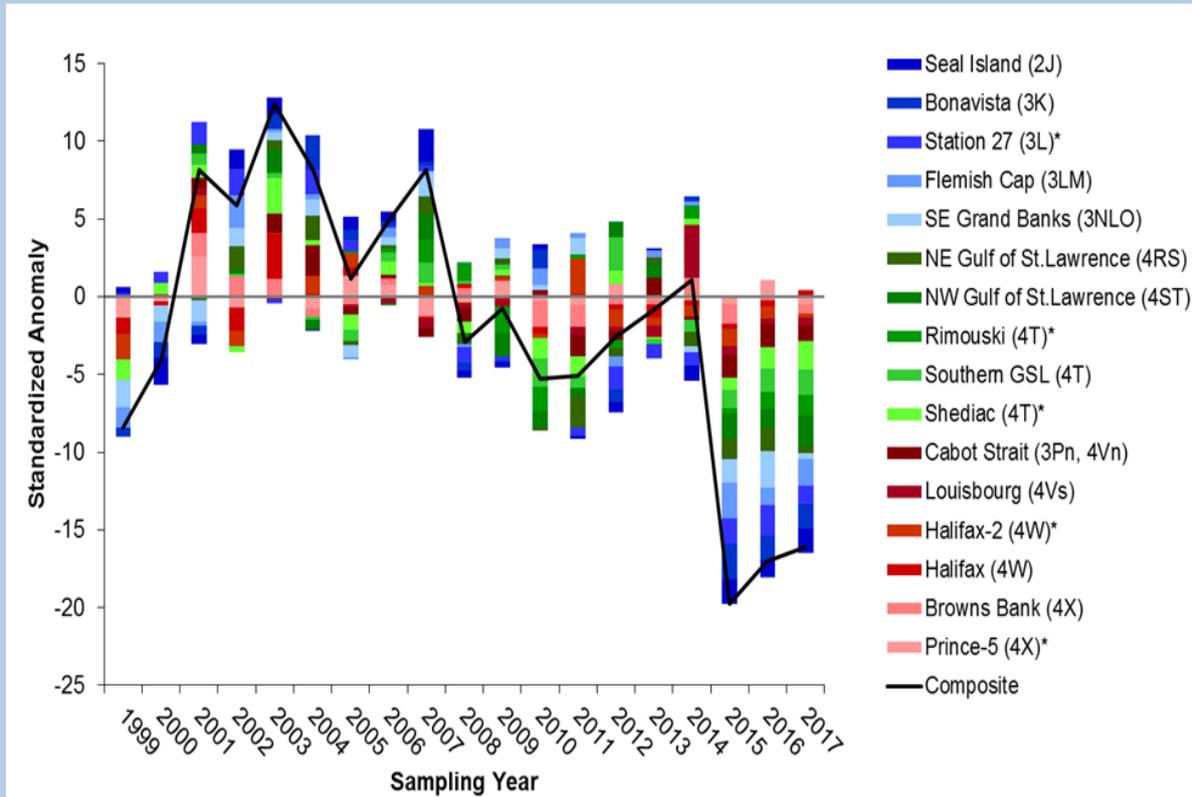
*Calanus finmarchicus* showed a positive trend from the beginning of the monitoring program to a record-high in 2006 followed by a general decline to a record low in 2015.



## Zooplankton Biomass

Time series of zooplankton (copepods and non-copepods) biomass anomalies from different oceanographic sections and high frequency sampling stations from the AZMP during 1999-2017.

Zooplankton biomass shows a general declining trend since 2003 with record low values in the past 3 years.



## Highlights for 2017

- **Nitrate inventories in the upper (0-50 m) water-column were near normal in 2017, compared to the 1999-2015 climatology throughout the NW Atlantic with the exception of larger positive and negative anomalies on the SE Grand Bank (3LNO) and in the Bay of Fundy (4X), respectively.**
- **Deeper (50-150 m) nitrate inventories were near normal throughout the surveyed area in 2017 except in the Cabot Strait and on the Scotian Shelf (3P4VWX) where deep nitrate concentrations continued well below normal for a second consecutive year.**
- **Chlorophyll-a standing stock was below normal on the Grand Bank (3LNMO) and the eastern Scotian Shelf (4VW), above normal in the southern GSL (4T), and near normal in other NAFO divisions.**
- **Chlorophyll-a biomass was positively correlated with shallow nitrate concentrations at a zonal scale (NAFO Subareas 2, 3, 4), and positively correlated with 1-year lag deep nitrate concentrations at the regional scale on the NL Shelf (2J3KLMNO) suggesting regulation of phytoplankton production through nitrate availability across the NW Atlantic.**
- **Spring bloom phytoplankton magnitude (total production) and amplitude on the eastern Canadian Shelf (NAFO Subarea 2-5) in 2017 continued below the long-term climatology for a third consecutive year.**
- **Spring bloom peak timing was delayed compared to the long-term climatology in the Labrador Sea as well as on the Grand Bank and the Scotian Shelf, but earlier than normal on the West Greenland and Labrador (1F2HJ) shelves, as well as in the northern GSL (4RS) and the Cabot Strait.**
- **Zooplankton abundance in Subarea 2-4 (both copepods and non-copepods) showed a general decline in 2017, especially in the GSL, compared to the record-high values for the time series observed in 2016.**
- **Zooplankton biomass in 2017 remained well below normal across the surveyed area for a third consecutive year since the time series record-low observed in 2015.**
- **The general trends in *Pseudocalanus* spp. abundance reflected the pattern of change in total copepod abundance, whereas abundance of the larger copepod *Calanus finmarchicus* generally tracked the pattern of change in zooplankton biomass.**

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**References:**

*D. Bélanger, G. Maillet, P. Pepin<sup>1</sup>, B. Casault, C. Johnson, S. Plourde, P.S. Galbraith, L. Devine, M. Scarratt, M. Blais, E. Head, C. Caverhill, E. Devred, J. Spry, A. Cogswell, L. St-Amand, S. Fraser, G. Doyle, A. Robar, J. Higdon, J. Holden, C. Porter, E. Colbourne.*

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