Fall 2011 Update: Annual Condition of the Northeast Shelf Ecosystem

Produced by the Ecosystem Dynamics and Assessment Branch

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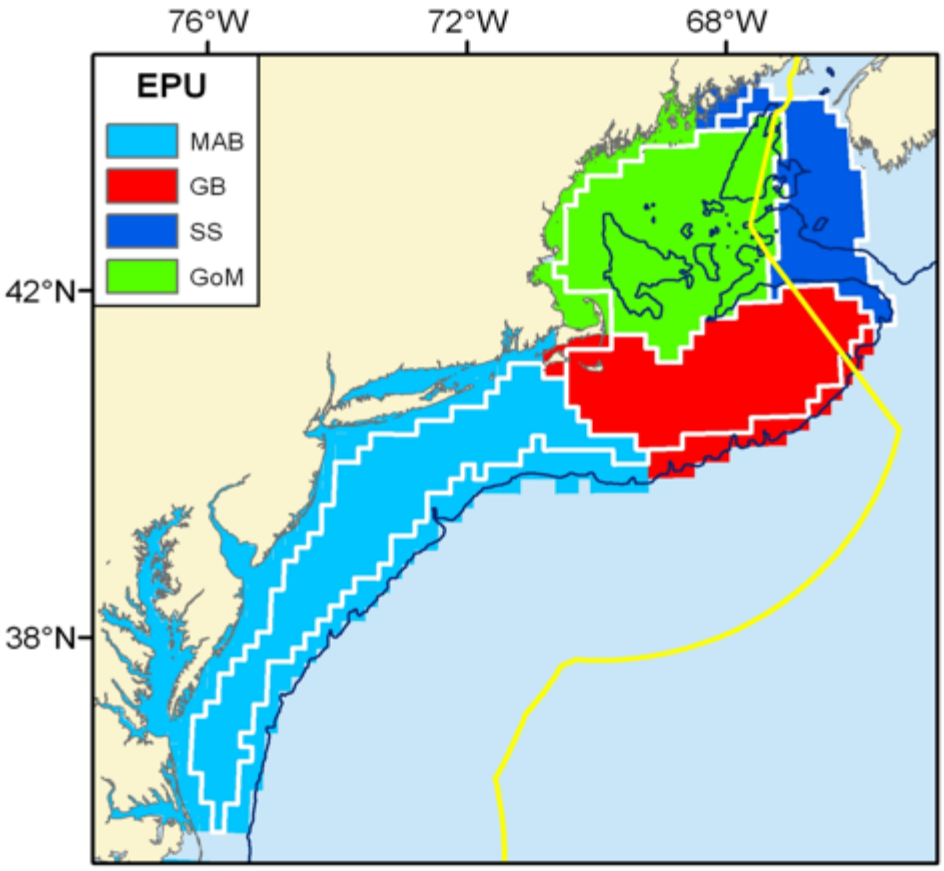
Fall 2011 Update: Summary of Conditions of the Northeast Shelf Ecosystem

Summary

- Sea surface temperature (SST) in the Northeast Shelf Large Marine Ecosystem during the first half of 2011 was moderate during winter, but increased to exceptionally high levels by June (see Data Sources for changes in methods used to calculate ecosystem indices).
- The 2011 spring bloom was a short duration high intensity bloom involving most of the shelf waters. In recent years, an intense spring bloom developed in the Massachusetts Bay/Nantucket Shoals area, however this was not the case in 2011. The spring bloom was well developed in the Southern New England and eastern Georges Bank areas and below average in Massachusetts Bay/Nantucket Shoals.
- The spring phytoplankton blooms associated with the Gulf of Maine, Georges Bank and the Middle Atlantic Bight usually initiates in sequence, with earlier blooms from south to north. In 2011, the spring bloom started at the same time throughout the ecosystem and was only differentiated by bloom duration in different sub-regions.
- Zooplankton biomass on the Northeast Shelf was extremely low in 2010, declining to levels not seen in over two decades.

Data Sources



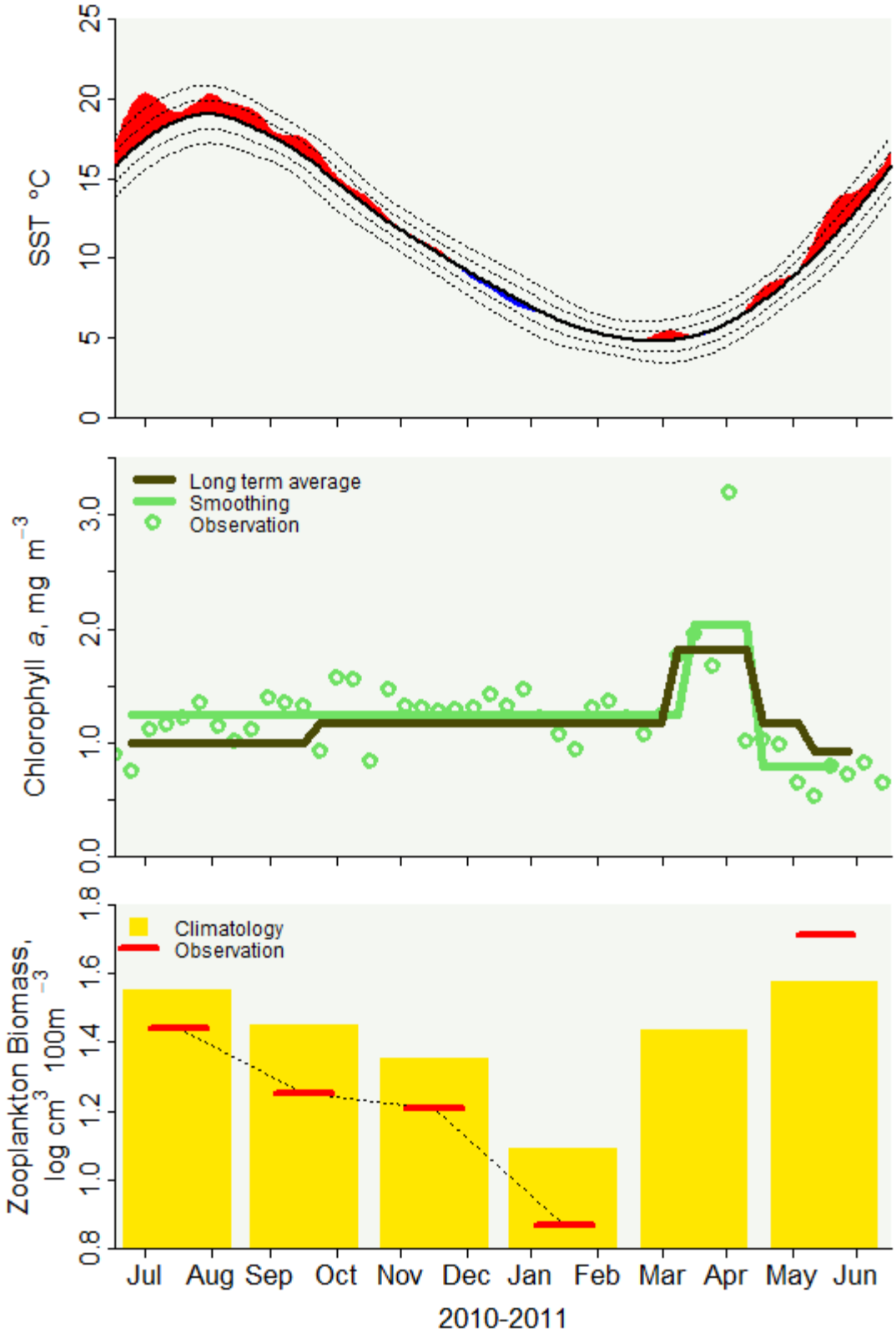
The Advisory assessment has been revised and is now based on a new set of ecosystem sub-area boundaries (see figure, MAB – Mid-Atlantic Bight; GB – Georges Bank; SS – Scotian Shelf; GoM – Gulf of Maine). As such, sea surface temperature and chlorophyll indices will vary to some degree from previous assessments.

SST was derived by compositing data from three sources: the Advanced Very-High Resolution Radiometer onboard the Polar Orbiting Environmental Satellite (AVHRR-POES); the MODIS Terra sensor; and the MODIS Aqua sensor. The data represent the surface ocean temperature, not the temperature of the entire water column.

Synoptic views of surface concentrations of chlorophyll *a* were derived from the Sea-viewing Wide Field of View Sensor (SeaWiFS) and the Moderate Resolution Imaging Spectroradiomater on the Aqua satellite (MODIS-Aqua). Data from these ocean color sensors were obtained from the NASA Ocean Biology Processing Group. The data sources were combined to represent trends in chlorophyll *a* during 2009. Chlorophyll *a* is considered a proxy of phytoplankton biomass present in the near-surface water

Zooplankton biomass was derived from shipboard surveys of the U.S. Northeast Shelf ecosystem. Zooplankton provide the link from primary producers to higher trophic levels. From 1977-1987, the MArine Resources Monitoring, Assessment, & Prediction (MARMAP) program conducted intensive surveys from Cape Hatteras, North Carolina to Nova Scotia. These efforts continued at a reduced level through the 1990s and are ongoing today as the Ecosystem Monitoring program (EcoMon). Currently, 30 plankton samples are taken 6 times a year in each of four ecosystem subareas: Middle Atlantic Bight, Southern New England, Georges Bank, and the Gulf of Maine (resulting in approximately 720 zooplankton biomass samples annually). Zooplankton are identified to the lowest taxonomic level possible, resulting in taxon specific data on abundance and distribution.

Spring Conditions

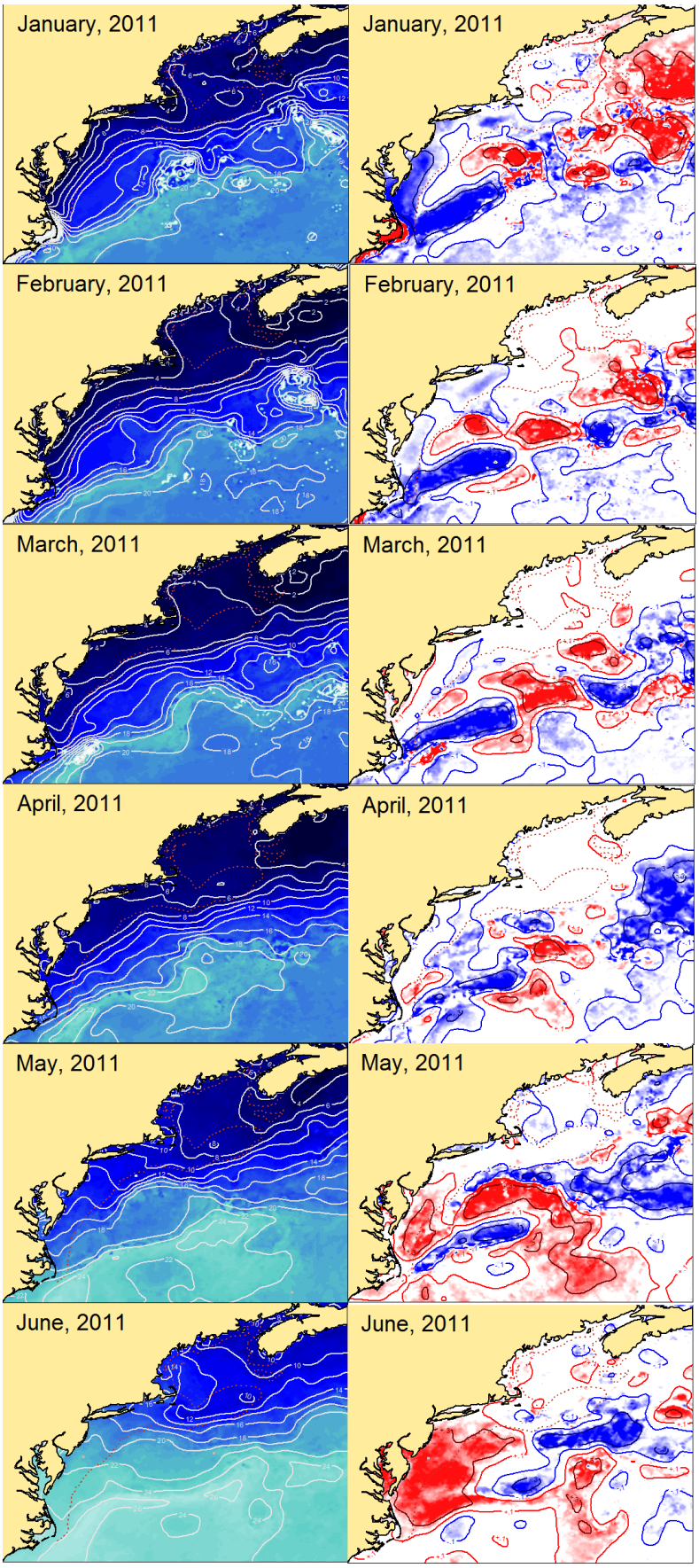


Surface temperature and chlorophyll biomass values are shown from July 2010 to June 2011. The Northeast Shelf Large Marine Ecosystem experienced above average sea surface

temperatures during summer into fall of 2010, moderating to average temperature through the winter and well into spring. The shelf began to warm to above average temperatures during early summer 2011. The chlorophyll conditions associated with summer and fall of last year were above average, but not significantly above the baseline to produce a detectable fall bloom. The spring bloom developed slightly later than usual and was of shorter duration than blooms in previous years. Zooplankton biomass levels were generally well below average for most of the preceding year with an indication of a rebound to higher levels during the May-June period of 2011.

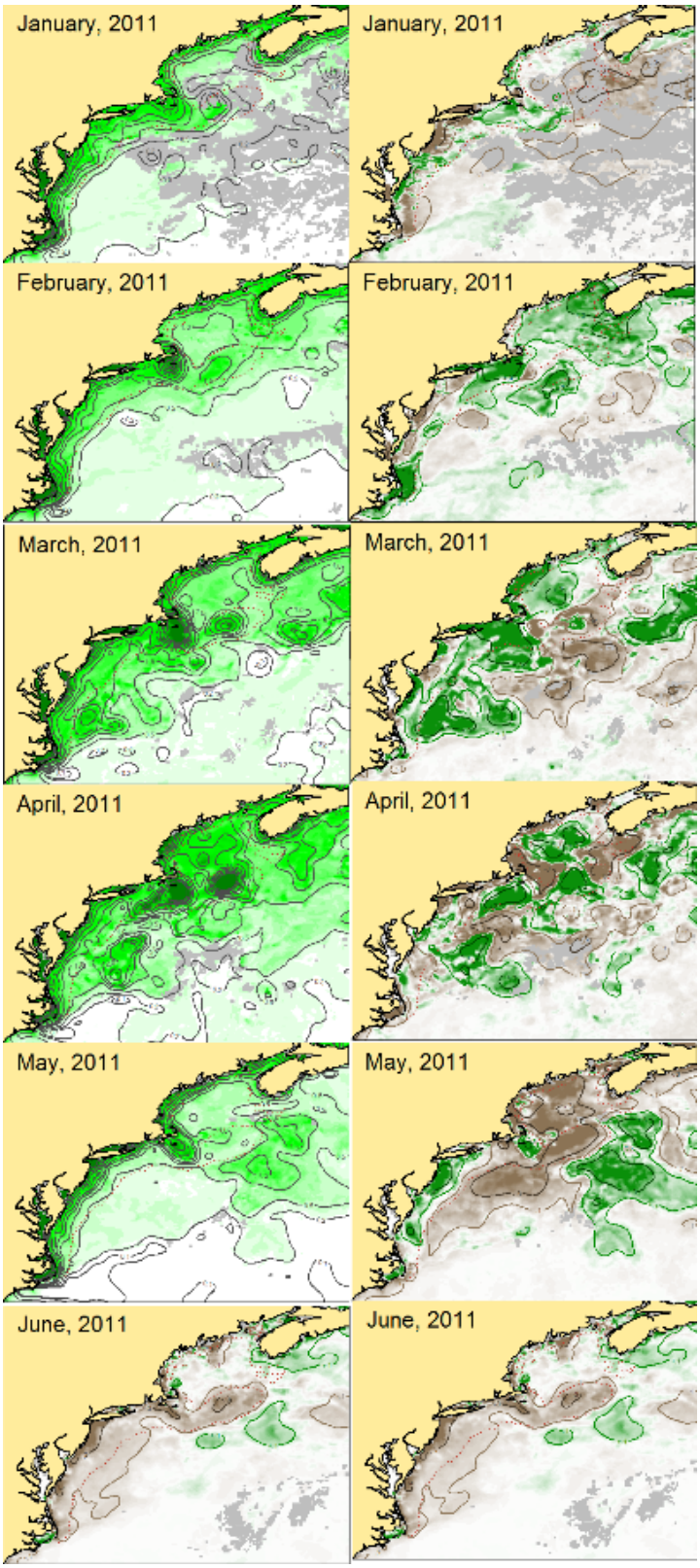
Sea Surface Temperature Distribution

The progression of spring sea surface temperatures for the months of January through June are shown in the interactive figure below. SSTs appear as progressive shades of cyan to blue in the left hand icons. Anomalies of SST, those tending to exceed plus or minus one quarter of a standard deviation of the overall SST for the field, are in the right hand set of icons. This type of anomaly tends to highlight high SSTs in an area, the red shades, and low SSTs in an area, the blue shades. The shelf was generally at average temperature for much of the first part of the year with the exception of some cool conditions during January off the Virginian and Carolina capes. Significant warming developed in the same area by May into June.

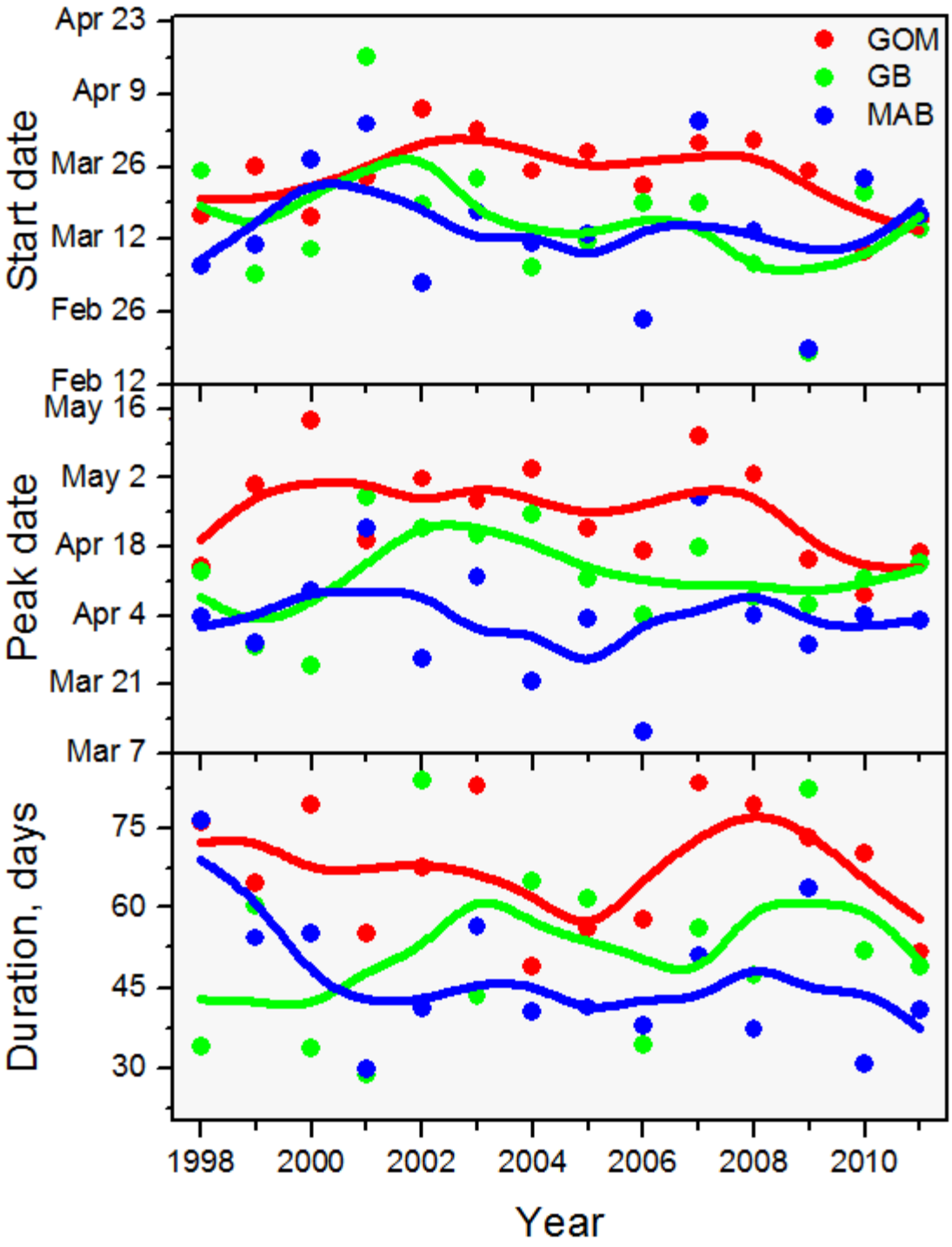

January, 2011
January, 2011
February, 2011
February, 2011
March, 2011
March, 2011
April, 2011
April, 2011
May, 2011
May, 2011
June, 2011
June, 2011

Chlorophyll Distribution

The progression of spring chlorophyll concentrations for the months of January through June are shown in the interactive figure below. Chlorophyll concentrations appear as progressive shades of green in the left hand icons. Anomalies of chlorophyll concentration, those tending to exceed plus or minus one quarter of a standard deviation of the overall concentration for the field, are in the right hand set of icons. This type of anomaly tends to highlight strong blooms in an area, the green shades, and weak blooms in an area, the brown shades. The exceptional phytoplankton bloom in the contiguous region of Massachusetts Bay and Nantucket Shoals, evidenced in recent years, did not develop in 2011. Instead, the spring bloom tended to peak in the Southern New England and eastern Georges Bank areas. Chlorophyll concentrations were generally at average levels by the beginning of the summer.

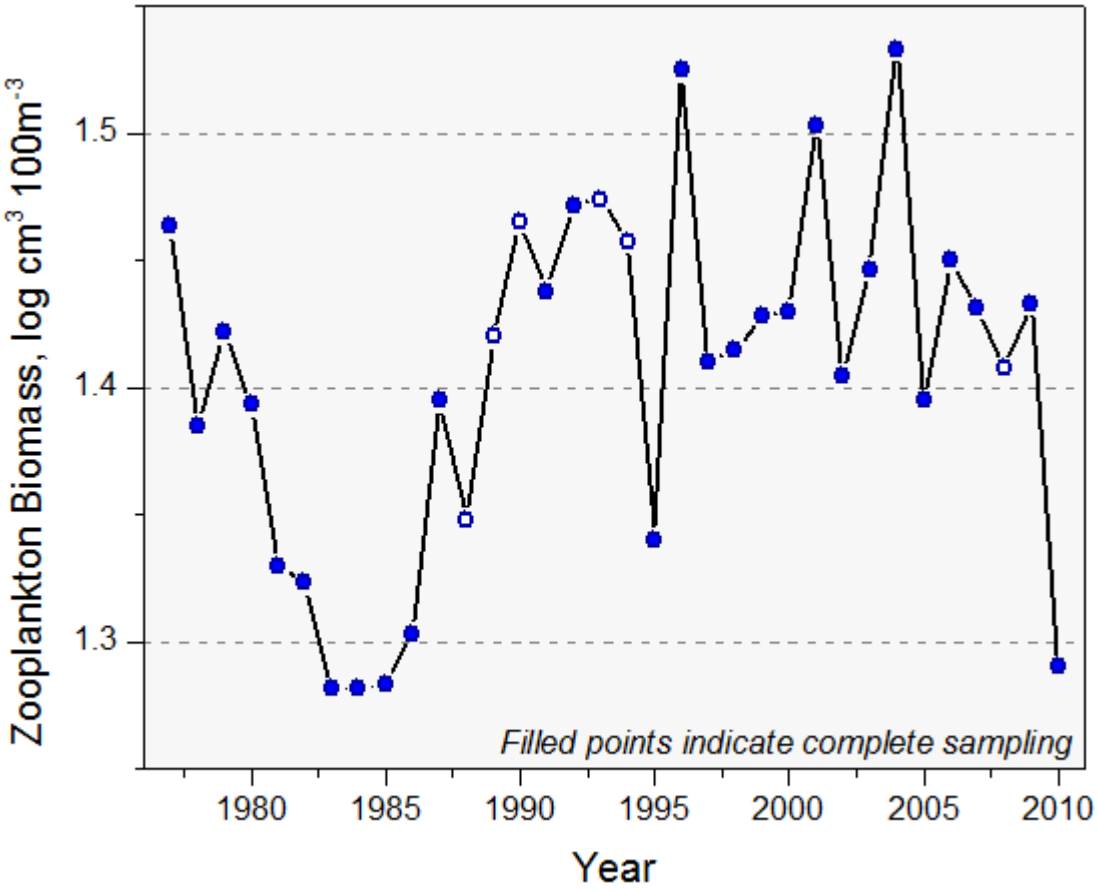


Spring Bloom Timing



The spring bloom typically starts earlier in the more southern segments of the Northeast Shelf LME. In 2011, our analysis of bloom start date suggests that the spring bloom essentially started at the same time throughout the shelf, around March 15. The peak date of the bloom was earlier in the Middle Atlantic Bight at April 2, whereas the bloom peaked in the Gulf of Maine and on Georges Bank almost two weeks later. This delay reflects spring bloom duration which tends to be longer in the Gulf of Maine and on Georges Bank; in 2011, the bloom lasted 50 days in the Gulf of Maine compared to 40 days in the Middle Atlantic Bight.

Low Zooplankton Populations



After approximately 20 years of relatively high zooplankton biovolumes, estimates for 2010 and the first part of 2011 were below the long-term average. The recent decrease was most pronounced in the Gulf of Maine and least pronounced in the Mid-Atlantic indicating regional differences. The low values in the Gulf of Maine are remarkable and similar to the low values observed in the first half of the 1980's. The implied decreases in secondary production could impact overall system productivity depending on how long these low values persist.