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ABSTRACT

Hydrographic observations from 8 surveys spanning the Northeast US (NEUS) Continental Shelf are combined into a descriptive overview of the broadscale oceanographic conditions observed during 2013. Temperature and salinity observations are combined into bimonthly time periods to maximize both the spatial coverage of the data and its temporal resolution during the year. Maps of near-surface and near-bottom property distributions are presented for each bimonthly period, and time series of regional average properties are discussed for 5 geographic regions spanning the shelf: western Gulf of Maine, eastern Gulf of Maine, Georges Bank, and northern and southern Middle-Atlantic Bight (MAB). The entire NEUS Continental Shelf was generally warm in 2013 relative to the reference period (1977-1987), with warm conditions penetrating to the bottom over much of the region. The largest seasonal variability was observed in the southern MAB, where enhanced warming was observed during winter at both the surface and bottom, becoming anomalously cold during fall at the bottom. Similarly, an enhanced seasonal cycle of freshening was observed in the nearshore region along the length of the NEUS shelf, presumably a result of anomalous precipitation during spring and summer this year. Bottom waters in the MAB Cold Pool were warmer and the feature was smaller and centered further south than normal in 2013. Likewise, the Cold Intermediate Layer in the Gulf of Maine was warmer and saltier than average during the spring of 2013, presumably a consequence of the extremely warm ocean and atmosphere that dominated 2012 and the early part of 2013.

INTRODUCTION

The National Marine Fisheries Service's (NMFS) Northeast Fisheries Science Center (NEFSC) conducts multiple surveys on the Northeast US (NEUS) Continental Shelf each year in support of its ongoing mission to monitor the shelf ecosystem and assess how its components influence the distribution, abundance, and productivity of living marine resources. In support of this mission, the NEFSC's Oceanography Branch provides conductivity, temperature, and depth (CTD) instruments to all NEFSC cruises for the measurement of water column profiles of temperature and salinity. In addition to providing oceanographic context to specific field programs, these data contribute to a growing database of historical measurements that are used to monitor seasonal and interannual variability in the water properties on the northeast continental shelf.

Broadscale surveys sampling the shelf from Cape Hatteras, North Carolina into the Gulf of Maine are conducted up to 6 times per year during shelf-wide spring and fall bottom trawl surveys and typically on 4 dedicated seasonal Ecosystem Monitoring (EcoMon) surveys. Profiles of conductivity, temperature, and depth are collected at each station on these shelf-wide surveys. Observations are also collected on other more regionally focused NEFSC surveys, where station coverage varies depending on the objectives of the particular field program. During 2013, hydrographic data were collected on 8 individual NEFSC cruises, amounting to 1585 profiles of temperature and salinity (Table 1). Of these, only 2 surveys sampled the entire NEUS shelf. Here we present an annual summary of these observations, including surface and bottom distributions of temperature and salinity as well as their anomalies relative to a consistent reference period. In addition, regional average values of temperature and salinity and their anomalies are computed for 5 different regions of the shelf during 6 bimonthly periods. Finally, the volume and properties of the shelf water are examined for the Middle-Atlantic Bight (MAB) region.

DATA AND METHODS

The Oceanography Branch provides CTD instrumentation and support to all NEFSC programs requesting this service. Training in instrument maintenance and operation, including deployment, data acquisition, recovery, and preliminary processing, is provided as needed prior to sailing. On NEFSC surveys, CTD instruments are typically deployed in one of two modes:

(1) During a bongo net tow, a SBE-19+ SEACAT CTD instrument is mounted on the conducting wire above the bongo frame and data are collected as a double oblique profile with the ship steaming at approximately 2 knots. The sensors are not soaked at the surface prior to descent during bongo tows, rendering the upper 30 m or more of the downcast unreliable. For this reason, the upcast profile data are routinely processed as the primary data for each station.

(2) During a non-net cast, either a SBE-19+ SEACAT CTD is mounted vertically on the wire or a SBE-9+ is deployed on a rosette frame with a carousel water sampling system (SBE32) and up to 11 Niskin water-sampling bottles. In this configuration, the CTD is oriented so that the intake is exposed to new water as it is lowered, so the downcast profiles are routinely processed as the primary data for each station. The CTD sensors are soaked for 1 min at the surface prior to descent to allow for

equilibration and ensure that the circulation pump is powered on. In SBE-9+ deployments, water samples are often collected at discrete depths using the Niskin bottles. The water samples are collected on the upcast in order to avoid leakage and sample contamination, which can occur as the pressure increases with depth. The CTD package is stopped for 30 sec at each sample depth before a bottle is closed in order to allow the package wake to dissipate, the bottles to flush, and the surrounding water to equilibrate. The CTD remains stopped for another 10-15 sec after the bottle trip is confirmed to allow time for closure and to collect the CTD data appropriate for comparison to the water sample data. Water samples are processed for nutrients and carbonate chemistry, described elsewhere.

In 2013, hydrographic data were collected aboard the NOAA ships *Henry B. Bigelow*, *Gordon Gunter*, and *Okeanus Explorer* and the R/V *Hugo R. Sharp* using a combination of Seabird Electronics SBE-19+ SEACAT profilers and SBE 9/11 CTD units (Table 1). All raw CTD profile data were processed ashore, using standard Seabird Electronics software to produce 1-decibar averaged profiles in ascii-formatted files. Water samples were collected twice daily at sea during vertical casts. Following each cruise, these samples were analyzed using a Guildline AutoSal laboratory salinometer to provide quality control for the CTD salinity data. A salinity offset was applied to instrument data if the mean difference between the reference Autosal readings and the CTD values exceeded +/- 0.01 (a threshold chosen based on the expected instrument accuracy). Vertical density profiles were examined for inversions due to bad conductivity or temperature readings and/or sensor misalignment. Egregious cases were replaced with a flag value. The processed hydrographic data were loaded into ORACLE database tables and made publically available via anonymous ftp (ftp://ftp.nefsc.noaa.gov/pub/hydro). Cruise reports have been prepared for each survey listed in Table 1 and are available online (http://nefsc.noaa.gov/epd/oceanography/). Readers are referred to the individual cruise reports for notes, property maps, and aggregate data specific to a particular survey.

Here we aim to provide a descriptive overview of the hydrographic sampling that was conducted in 2013 and to characterize the broadscale oceanographic conditions that were observed. The processed CTD data have been sorted into six 2-month time bins to maximize both the spatial coverage of the data and its temporal resolution. Maps of near-surface and near-bottom temperature and salinity have been produced from profile data falling within each bimonthly period. Surface fields include the shallowest observed temperature/salinity at each station that is also in the upper 5 m of the water column, while bottom maps include the deepest observation at each station that also falls within 10 m of the reported water depth. Average values have been computed from the data within 5 subregions spanning the NEUS Continental Shelf to examine the spatial and temporal variability over broader areas of the shelf (Figure 1). Regional averages have been computed for the bimonthly binned fields (Tables 2 and 3) and for individual cruises (Appendix Tables 1-5).

Anomalies have been calculated at each station relative to a standard reference period (1977-1987) to characterize variability that is not related to seasonal forcing. During this period, the NMFS Marine Resources Monitoring and Prediction (MARMAP) program repeatedly occupied stations spanning the entire NEUS shelf so that an annual cycle could be constructed for water properties across all regions of the northeast shelf (Mountain et al. 2004; Mountain and Holzwarth 1989). The anomalies presented here are defined as the difference between the observed 2013 value at individual stations and the expected value for each location and time of year based on this reference period. Similarly, regional anomalies are the area-weighted average of these anomalies within a given domain. The methods used and an explanation of uncertainties is presented in Holzwarth and Mountain (1990).

Finally, we calculate the temperature, salinity, and volume of the shelf water in the MAB during 2013 and relate it to the conditions observed during the MARMAP reference period. Following Mountain (2003), the shelf water mass is defined as water within the upper 100 m having salinity less than 34. For each survey in 2013, the area of a subregion was apportioned among its stations by an inverse distance-squared weighting. The shelf water volume at a given station is the thickness of the shelf water at the station multiplied by its apportioned area, and the total shelf water volume within the subregion is the sum of these products for all stations within the region. Similarly, the average temperature and salinity was calculated in the shelf water layer at each station and multiplied by the total shelf water volume for that station. The sum of these products over all stations within a given subregion divided by the total shelf water volume for the region determines the volume-weighted average temperature and salinity. Anomalies in the property and volume of the shelf water mass are calculated relative to like variables derived from MARMAP hydrographic data, as described above. Hence, regional anomalies are computed as the mathematical difference between regional averages, *not* an average of the anomalies computed for a given subregion.

RESULTS

Table 1 provides a listing of the NEFSC cruises that collected hydrographic data in 2013. In total, 1585 profiles of temperature and salinity were collected, processed, and archived during the year. While the bimonthly binning of observations provides better spatial coverage compared with that of individual surveys, significant gaps remain in several of the bimonthly distribution maps shown in Figure 2a. This reflects the overall reduction in stations occupied in 2013 relative to previous years (Figure 2b). For instance, poor coverage in the MAB during August was a consequence of vessel schedule cuts that led to a truncation of the August EcoMon survey. Mechanical problems on the NOAA Ship *Gordon Gunter* led to lost sea days during the November EcoMon cruise and a loss of coverage in the southern MAB. Poor weather contributed to a loss of coverage in the eastern Gulf of Maine during the February EcoMon cruise. The gap in station coverage in the eastern Gulf of Maine during September-October results from a misalignment between this bimonthly period and the fall EcoMon survey that began in September, sampling first in the southern MAB. In several regions throughout the year, most notably in the eastern Gulf of Maine, large gaps in station coverage preclude the calculation of a true area-weighted regional average surface/bottom temperature and salinity (Tables 2 and 3; Figures 3 and 4). These cases are flagged in Tables 2 and 3 and the reader should keep them in mind when interpreting results.

Ocean temperatures across the NEUS shelf were generally warm throughout 2013 relative to the reference period (Figure 3). The largest variability was observed in the southern MAB, where enhanced warming was observed during winter at the surface and bottom, becoming anomalously cold during fall at the bottom. Elsewhere, warming was fairly uniform throughout the year (Figure 3). The distinct seasonal pattern of warming observed in this region, where waters are relatively shallow, implies that heat input at the surface has been efficiently redistributed vertically through local mixing processes. In the Gulf of Maine, where the waters are significantly deeper, bottom waters are largely insulated from atmospheric forcing, making it more likely that the warming here is driven by advection.

At the surface, anomalies enhanced the seasonal cycle of salinity during 2013, averaging saltier than normal in the winter and fresher than normal in the spring, particularly in the MAB (Figure 4). Near the bottom, waters were saltier than normal early in the year in the southern MAB and near normal elsewhere. Shelf water in the MAB is defined as waters having salinity less than 34 and the volume of this water mass was near normal in 2013 relative to the MARMAP period (Figure 5). This suggests that the shelf/slope front, a ubiquitous feature that marks the transition between colder/fresher shelf water onshore and warmer/saltier water offshore, was consistently located near the long-term average position.

Details related to the regional averages in Figures 3 and 4 are explored in surface and bottom property distribution maps (Figures 6-11). Maps of surface temperature reveal the seasonal cycle of warming and cooling over the region, with warmest temperatures observed at the surface beginning first in the south during early summer, followed by bottom waters near shore in the MAB and over Georges Bank, and finally at the surface in the Gulf of Maine (Figure 6-11a). Even though regional averages indicate warming over most of the region relative to the MARMAP reference period (Figure 3), the details of this warming vary from region to region. For example, strong warming is observed throughout the NEUS shelf region during January/February, with larger isolated anomalies found at the shelf edge extending onshore in the vicinity of Hudson Canyon and the Chesapeake Bay (Figure 6b). The enhanced warming is accompanied by elevated salinity, particularly along the axis of Hudson Canyon, where salinity anomalies exceed 1 salinity unit, indicative of a shoreward protrusion of slope water in this region. By May/June, surface cooling dominates the southern MAB, while warm conditions persist elsewhere (Figure 8b).

The regional average time series shows an enhanced seasonal cycle of freshening, particularly at the surface in the MAB (Figure 4). However, the anomaly maps indicate that beginning in May/June, bottom waters were anomalously fresh in the nearshore region along the length of the coast and throughout the western Gulf of Maine (Figure 8b). This near-bottom freshening persists through September/October in the nearshore region, spreading offshore to the mid-shelf in the MAB (Figure 10b).

Maps of near-bottom temperature show the seasonal formation of the cold pool in the MAB, with coldest temperatures observed during the May/June period (Figure 8a). The accompanying maps of near-bottom temperature anomaly suggest that the MAB Cold Pool was smaller, weaker, and centered further south than normal for this time of year (Figure 8b). The Cold Pool typically breaks down with the onset of vertical mixing induced by fall cooling and storm activity. In 2013, the Cold Pool had begun to weaken and warm by September/October (Figure 10a). While generally waters in the Cold Pool were warmer than normal in 2013, the coldest waters in the Cold Pool were located further south and the region of temperature minimum extended further onshore than previous years. This accounts for the extreme cold anomalies observed along the inshore edge of the Cold Pool minimum in Figure 10b.

Deep inflow through the Northeast Channel was warm and salty during 2013, with water mass characteristics typical of subtropical slopewater sources (Figures 12 and 13). Springtime temperature-salinity profiles indicate that the Cold Intermediate Layer in the Gulf of Maine, a mid-depth water mass formed seasonally as a product of convective mixing driven by winter cooling, was also warmer and saltier during 2013, near the upper limit of the historic range (Figure 14). Winter mixed layers during 2013 were twice as deep as those observed in 2012. The stratification of the water column at the beginning of winter (Taylor and Mountain 2009) and the intensity of atmospheric cooling are both important factors in determining the mixed layer depth, but in general deeper mixed layers imply strong winter convective mixing. Curiously, despite being deeper, the 2013 mixed layers were just as warm and even saltier than 2012, presumably a consequence of the extremely warm ocean conditions that were established in 2012 and persisted into 2013 (Figure 15). In general, deeper vertical mixing has greater potential to tap into nutrient rich slope water at depth and may result in a thicker intermediate layer during spring, both potentially having an impact on the timing and intensity of spring phytoplankton blooms.

Large-scale atmospheric and oceanic indicators for 2013 mirror the pattern of warming on the NEUS shelf inferred from hydrographic observations. Annual average surface air temperatures were warmer than average (1981-2010) over the entire Northwest Atlantic, with anomalies approaching 1°C along the NEUS shelf. Extreme warm anomalies blanketed the North American continent and much of the North Atlantic during winter (December-February), reflecting persistence of the atmospheric warming patterns observed in 2012 (Figure 16). However, by spring temperatures had begun to moderate and cooler than normal air temperatures had filled in over the southeastern US (Figure 16). Satellite-derived sea surface temperatures (SST) indicate that ocean warming was prevalent throughout the North Atlantic basin, particularly on the western shelf between Newfoundland and the northern MAB (Figure 17). While moderate relative to 2012, the average SST over the NEUS shelf remained at the upper end of the observed range (Figure 18).

According to Northeast Regional Climate Center records (http://www.nrcc.cornell.edu/), the monthly mean precipitation over the NEUS was below normal between January and April, followed by a relatively wet spring and summer (referenced to 1971-2000). Most notably, severe weather patterns over the NEUS in June led to anomalous precipitation levels (more than 3 inches above normal), making it the third wettest June since 1895. This enhanced precipitation may account for the anomalously fresh conditions observed in salinity anomaly maps between May and October (Figures 8 and 10b).

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Table 1. Listing of 2013 NOAA Northeast Fisheries Science Center cruises supported by the Oceanography Branch, where EcoMon refers to Ecosystem Monitoring Surveys and AMAPPS refers to the Atlantic Marine Assessment Program for Protected Species.

Cruise	Program	Dates	Region(s)[1]	Gear	Casts
PC1301	EcoMon	10 - 26 Feb	MAB, GB, W.GOM	SBE-19+/911+	139
HB1301	Spring Bottom Trawl	5 Mar – 9 May	Full Shelf	SBE-19+	392
GU1302	EcoMon	9 Jun - 23 Jun	MAB, GB, W.GOM	SBE-19+/911+	170
S11301	Scallop	28 Jun – 16 Jul	MAB, GB	SBE-911+	79
HB1303	AMAPPS	2 Jul - 18 Aug	Offshore, MAB, GB, MAB	SBE-19	242
EX1305	EcoMon	25 Aug - 4 Sep	GOM, GB	SBE-19+/911+	92
HB1304	Fall Bottom Trawl	7 Sep - 19 Nov	Full Shelf	SBE-19+	373
GU1305	EcoMon	14 - 24 Nov	Full Shelf	SBE-19+,911+	98

[1] Regional Abbreviation:
GOM=Gulf of Maine
GB=Georges Bank
MAB=Mid Atlantic Bight
SAB=South Atlantic Bight

Table 2. Bimonthly regional average surface and bottom temperature computed from CTD data collected during 2013 for 5 regions of the Northeast US Continental Shelf: Gulf of Maine east (GOME); Gulf of Maine west (GOMW); Georges Bank (GB); Middle Atlantic Bight north (MABN); and Middle Atlantic Bight south (MABS).

		SURFACE						BOTTOM					
Region	CD	#obs	Temp	Anomaly	SDV1	SDV2	Flag	#obs	Temp	Anomaly	SDV1	SDV2	Flag
							January-February						
GOME	52	5	6.12	1.17	0.45	4.89	1	4	8.37	1.85	0.48	6.84	1
GOMW	52	38	6.08	1.69	0.22	2.3	1	39	7.06	1.67	0.21	2.78	1
GB	50	23	6.54	1.49	0.23	2.03	1	21	6.3	1.22	0.23	2.56	1
MABN	50	25	6.89	1.63	0.25	1.46	0	23	6.96	1.51	0.27	1.71	0
MABS	43	42	8.57	2.5	0.21	1.68	0	43	8.37	2.42	0.21	1.33	0
							March-April						
GOME	112	22	5.87	0.37	0.2	1.88	1	21	7.86	0.88	0.21	1.62	1
GOMW	105	23	6.22	1.35	0.22	1.6	1	23	6.19	1.46	0.19	1.31	1
GB	104	67	6.56	1.21	0.13	0.69	0	56	6.71	1.17	0.16	0.66	0
MABN	90	51	6.19	1.4	0.18	0.65	0	44	6.25	0.52	0.23	1.09	0
MABS	82	94	7.17	0.75	0.14	1.33	0	77	7.62	1.65	0.17	1.2	0
							May-June						
GOME	132	5	7.47	0.69	0.43	5.05	1	5	8.13	0.84	0.41	3.47	1
GOMW	139	61	9.64	1.35	0.15	1.11	0	61	6.69	1.26	0.12	0.75	0
GB	163	18	12.49	1.59	0.27	2.89	1	15	10.24	1.51	0.26	3.38	1
MABN	167	37	15.68	0.82	0.22	1.58	0	35	9.88	2.2	0.26	1.69	0
MABS	171	85	19.05	-0.55	0.14	0.87	0	79	10.27	0.65	0.17	1.16	0
							July-August						
GOME	233	25	15.86	0.95	0.2	6.5	1	18	9.34	-0.17	0.23	5.08	1
GOMW	201	9	18.84	3.52	0.37	9.77	1	9	6.77	0.06	0.33	5.96	1
GB	217	83	17.58	2.31	0.12	2.51	0	59	11.84	0.69	0.15	1.76	0
MABN	213	27	18.94	1.29	0.25	2.32	1	18	11.83	1.18	0.29	2.68	1
MABS	199	51	23.3	0.89	0.19	1.28	1	18	10.97	0.55	0.32	2.43	1
							September-October						
GOME	244	3	14.4	1.8	0.59	7	1	3	9.97	1.49	0.57	6.44	1
GOMW	270	31	15.81	1.59	0.2	1.75	1	29	8.42	1.3	0.18	1.8	1
GB	296	43	14.96	0.66	0.17	1.12	0	34	13.5	0.9	0.2	1.17	0
MABN	270	55	19.03	0.88	0.18	1.15	0	46	12.62	0.61	0.23	1.59	0
MABS	258	90	22.83	0.77	0.14	1.1	0	75	12.35	-1.67	0.18	2.91	0
							November-December						
GOME	316	40	11.16	0.56	0.17	0.47	0	36	9.42	1.19	0.19	0.98	0
GOMW	318	60	10.69	0.62	0.14	0.51	0	56	8.44	1.19	0.12	0.88	0
GB	318	34	12.42	0.35	0.2	0.78	0	30	12.32	0.8	0.24	1.14	0
MABN	320	11	13.89	0.56	0.41	1.06	1	8	14.43	1.23	0.47	2.31	1
MABS	318	23	14.48	0.36	0.26	0.54	1	21	14.37	0.62	0.29	1.16	1

"Region", the geographic region of the northeast continental shelf: "CD", the calendar mid-date of all the stations within a region for a time period: "#obs", the number of observations included in each average: "Temp", the areal average temperature: "Anomaly", the areal average temperature anomalies: "SDV1",the standard deviation associated with the average temperature anomaly: "SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived: "Flag", a value of "1" indicates that a true areal average could not be calculated due to poor station coverage. The areal averages listed were derived from a simple average of the observations within the region.

Table 3. Bimonthly regional average surface and bottom salinity computed from CTD data collected during 2013 for 5 regions of the Northeast US Continental Shelf: Gulf of Maine east (GOME); Gulf of Maine west (GOMW); Georges Bank (GB); Middle Atlantic Bight north (MABN); and Middle Atlantic Bight south (MABS).

		SURFACE						BOTTOM					
Region	CD	#obs	Salt	Anomaly	SDV1	SDV2	Flag	#obs	Salt	Anomaly	SDV1	SDV2	Flag
							January-February						
GOME	52	5	33	0.11	0.32	1.88	1	4	34.04	0.16	0.27	2.29	1
GOMW	52	38	33.19	0.35	0.15	0.88	1	39	33.65	0.25	0.13	0.93	1
GB	50	23	33.4	0.36	0.14	0.73	1	21	33.39	0.28	0.14	0.81	1
MABN	50	25	33.62	0.46	0.17	0.5	0	23	33.73	0.28	0.17	0.53	0
MABS	43	42	33.92	0.52	0.16	0.58	0	43	34.02	0.52	0.13	0.42	0
							March-April						
GOME	112	22	32.45	-0.15	0.15	0.78	1	21	34.11	0.08	0.12	0.62	1
GOMW	105	23	32.96	0.13	0.14	0.68	1	23	33.24	0.04	0.11	0.5	1
GB	104	67	33.11	0.13	0.08	0.32	0	56	33.3	0.08	0.1	0.25	0
MABN	90	51	33.19	0.34	0.12	0.26	0	44	33.38	-0.1	0.13	0.39	0
MABS	82	94	33.53	0.52	0.1	0.81	0	77	33.9	0.5	0.11	0.51	0
							May-June						
GOME	132	5	32.26	-0.17	0.28	2.25	1	5	34.11	-0.17	0.21	1	1
GOMW	139	61	32.15	-0.02	0.1	0.49	0	61	33.2	-0.11	0.07	0.2	0
GB	163	18	32.92	0.05	0.15	0.68	1	15	33.03	0.09	0.16	0.91	1
MABN	167	37	32.51	0.19	0.14	0.38	0	35	33.43	0.31	0.16	0.47	0
MABS	171	85	32.12	0.2	0.11	0.76	0	79	33.26	0.08	0.1	0.38	0
							July-August						
GOME	233	25	32.45	0.01	0.13	1.41	1	18	33.84	0.19	0.13	1.13	1
GOMW	201	9	31.58	-0.36	0.22	2.13	1	9	32.78	-0.12	0.19	1.36	1
GB	217	83	32.56	-0.15	0.07	0.55	0	59	33.05	0.06	0.09	0.41	0
MABN	213	27	32.3	-0.33	0.15	0.87	1	18	32.67	-0.12	0.17	0.71	1
MABS	199	50	31.53	-0.44	0.14	0.68	1	18	33.4	0.41	0.2	0.66	1
							September-October						
GOME	244	3	32.64	0.22	0.44	2.53	1	3	33.62	0.06	0.37	1.65	1
GOMW	270	31	32.25	0.1	0.13	0.69	1	29	33.27	0.18	0.1	0.45	1
GB	296	43	32.79	-0.01	0.11	0.46	0	34	32.81	-0.11	0.12	0.31	0
MABN	270	55	32.88	0.23	0.12	0.54	0	46	33.02	-0.32	0.14	0.39	0
MABS	258	90	32.23	-0.02	0.11	0.65	0	75	32.98	-0.19	0.11	0.52	0
							November-December						
GOME	316	40	32.88	0.15	0.12	0.31	0	36	34.6	0.12	0.09	0.31	0
GOMW	318	60	32.89	0.13	0.09	0.18	0	56	33.82	0.17	0.08	0.23	0
GB	318	34	32.75	-0.05	0.12	0.23	0	30	33.12	0.04	0.14	0.4	0
MABN	320	11	33.29	0.07	0.26	0.54	1	8	33.89	0.13	0.26	0.62	1
MABS	318	23	33.22	0.45	0.2	0.32	1	21	33.17	0.23	0.18	0.29	1

"Region", the geographic region of the northeast continental shelf: "CD", the calendar mid-date of all the stations within a region for a time period: "#obs", the number of observations included in each average: "Salt", the areal average salinity: "Anomaly", the areal average salinity anomalies: "SDV1",the standard deviation associated with the average salinity anomaly:
"SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived:
"Flag", a value of "1" indicates that a true areal average could not be calculated due to poor station coverage. The areal averages listed were derived from a simple average of the observations within the region.

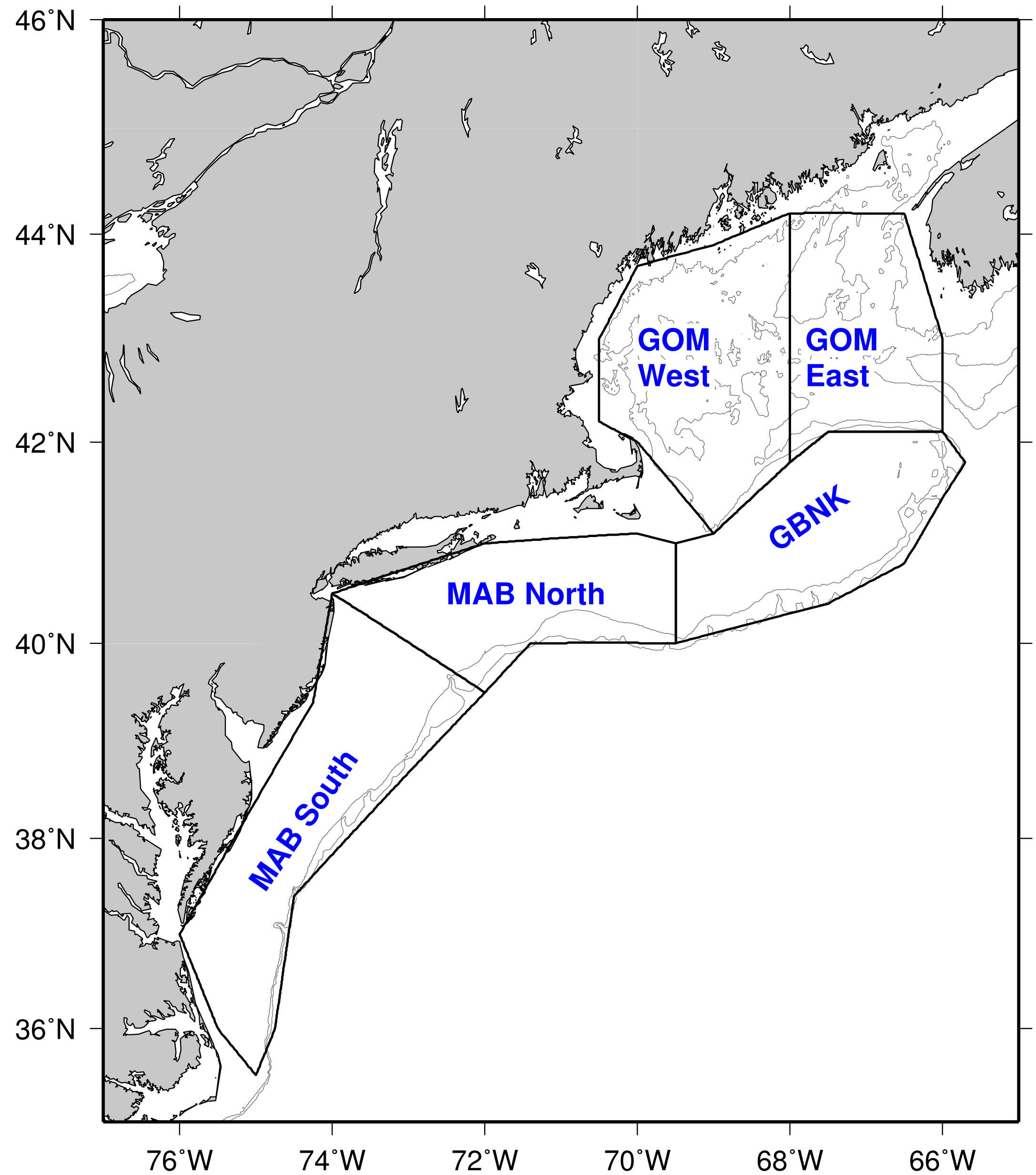

Figure 1. Regional designations used in the description of 2013 oceanographic conditions on the Northeast US Continental Shelf. The 100 m and 200 m isobaths are also shown. MAB = Middle Atlantic Bight; GBNK = Georges Bank; GOM = Gulf of Maine.

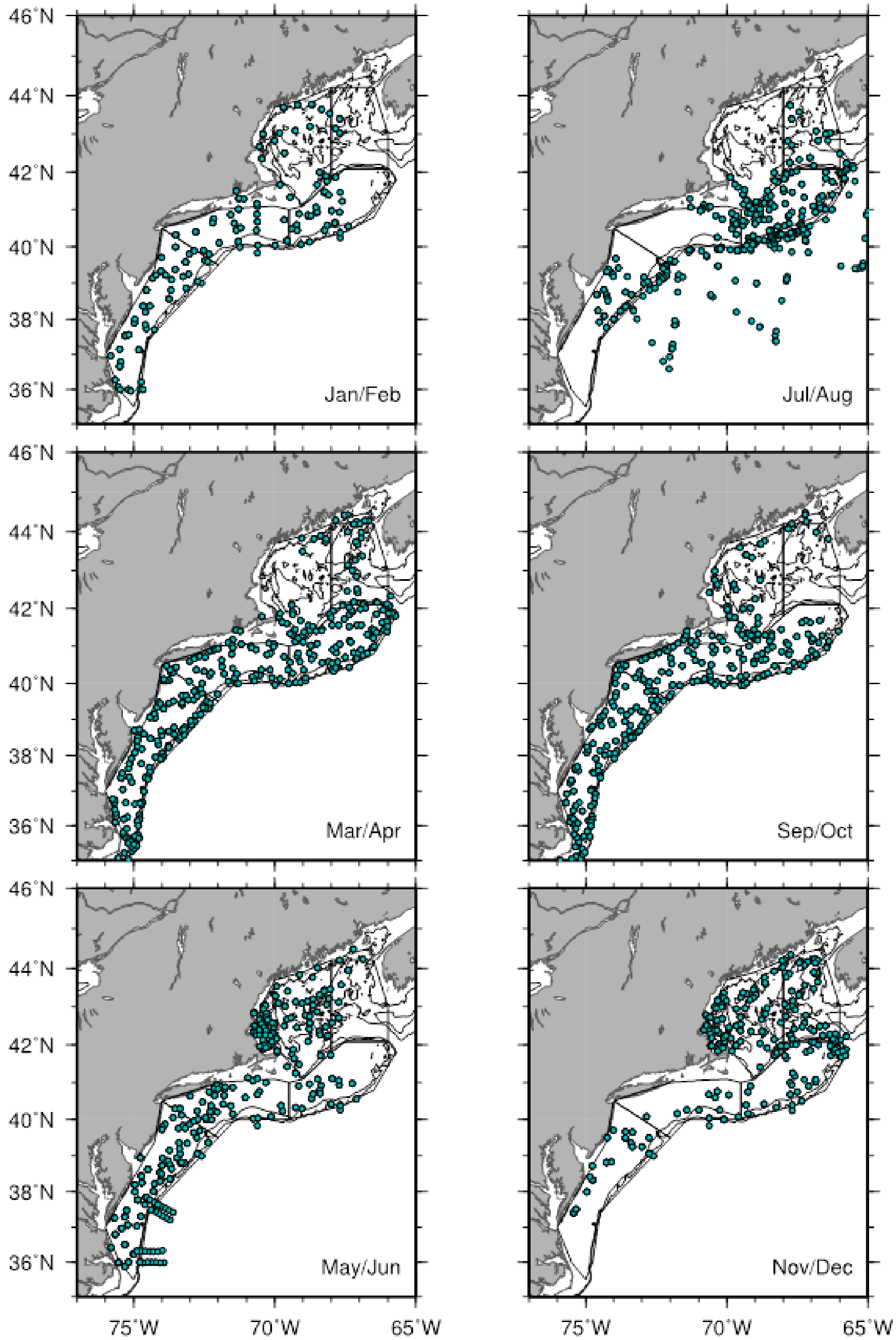

Figure 2a. Bimonthly distribution of hydrographic stations used in the description of 2013 oceanographic conditions on the Northeast US Continental Shelf. Regional boundaries used in the analysis are also shown. Contours correspond with the 100- and 200-m isobaths.

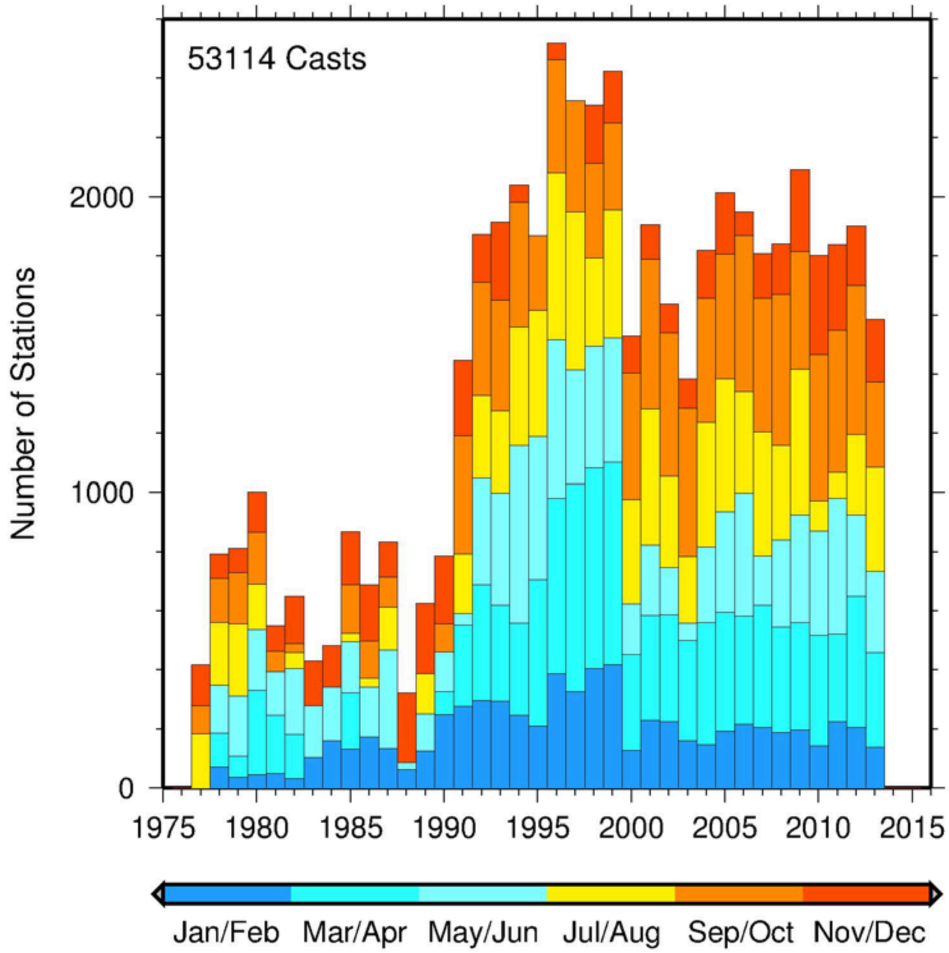

Figure 2b. Histogram of the number of hydrographic stations occupied on Northeast Fisheries Science Center surveys in a given year, color-coded by bimonthly period.

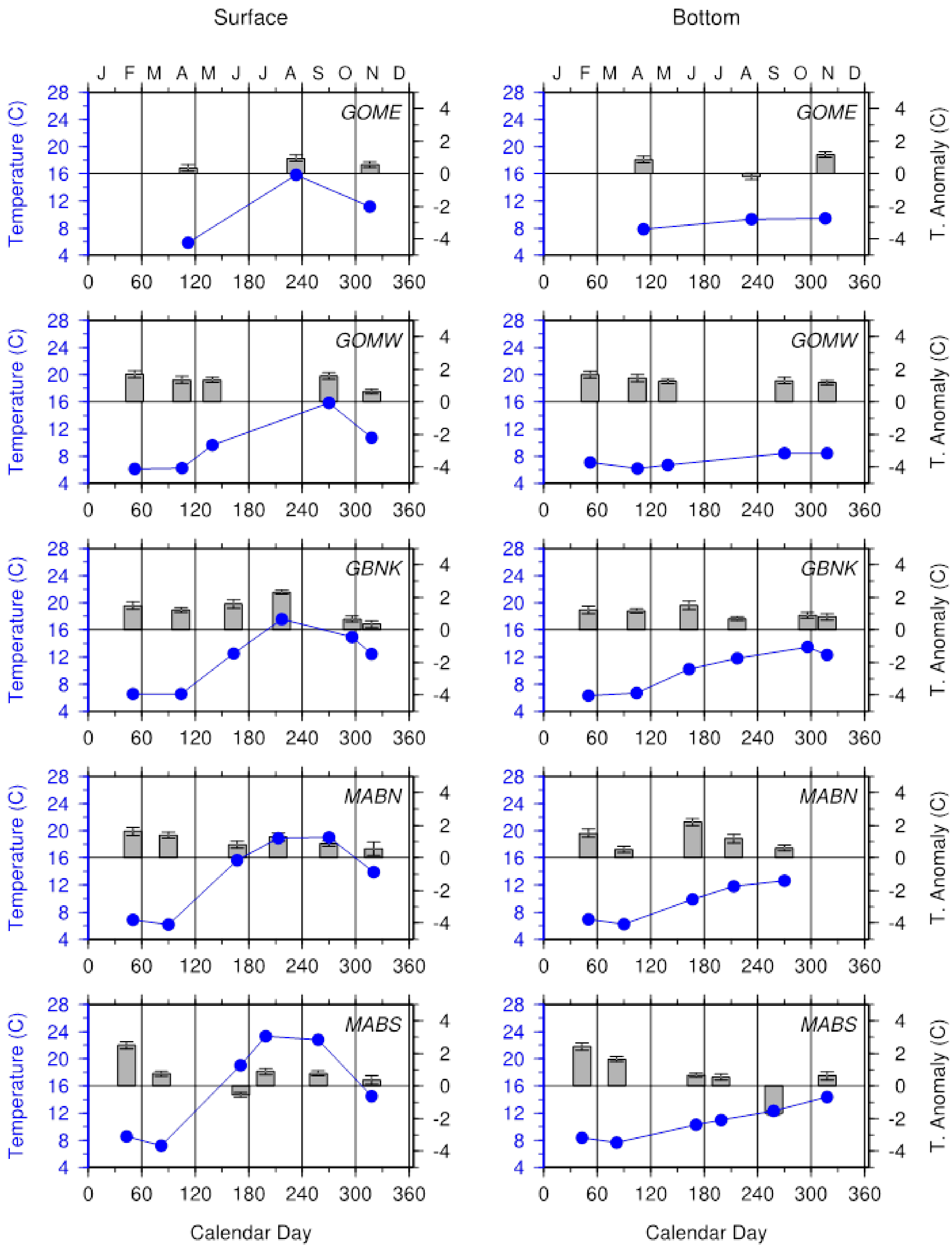

Figure 3. Time series of the 2013 regional surface (left) and bottom (right) temperatures (blue) and anomalies (bars) as a function of calendar day. Error bars are indicated for the anomaly estimates. GOME = Gulf of Maine east; GOMW = Gulf of Maine west; GBNK = Georges Bank; MABN = Middle Atlantic Bight north; MABS = Middle Atlantic Bight south.

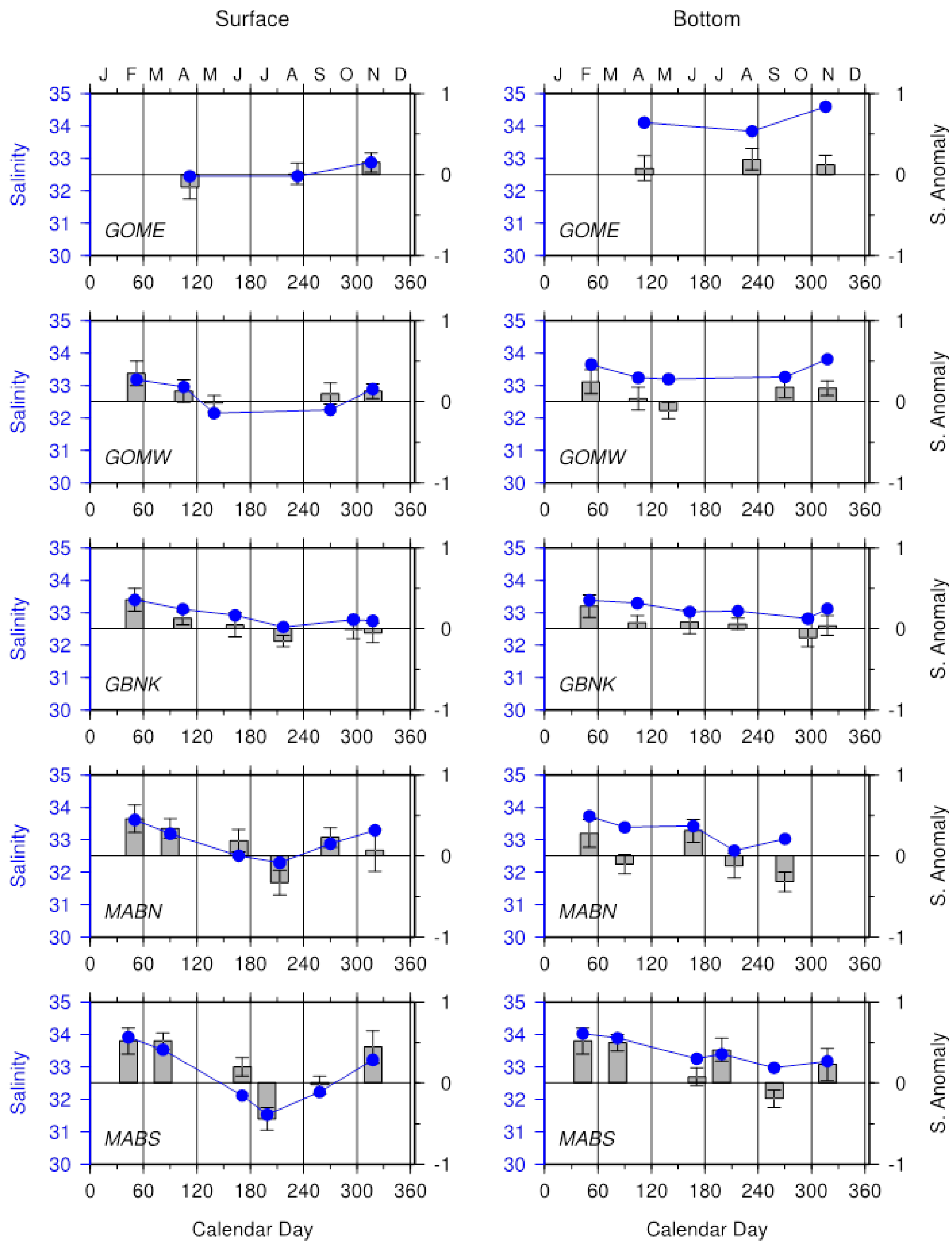

Figure 4. Time series of the 2013 regional surface (left) and bottom (right) salinities (blue) and anomalies (bars) as a function of calendar day. Error bars are indicated for the anomaly estimates. GOME = Gulf of Maine east; GOMW = Gulf of Maine west; GBNK = Georges Bank; MABN = Middle Atlantic Bight north; MABS = Middle Atlantic Bight south.

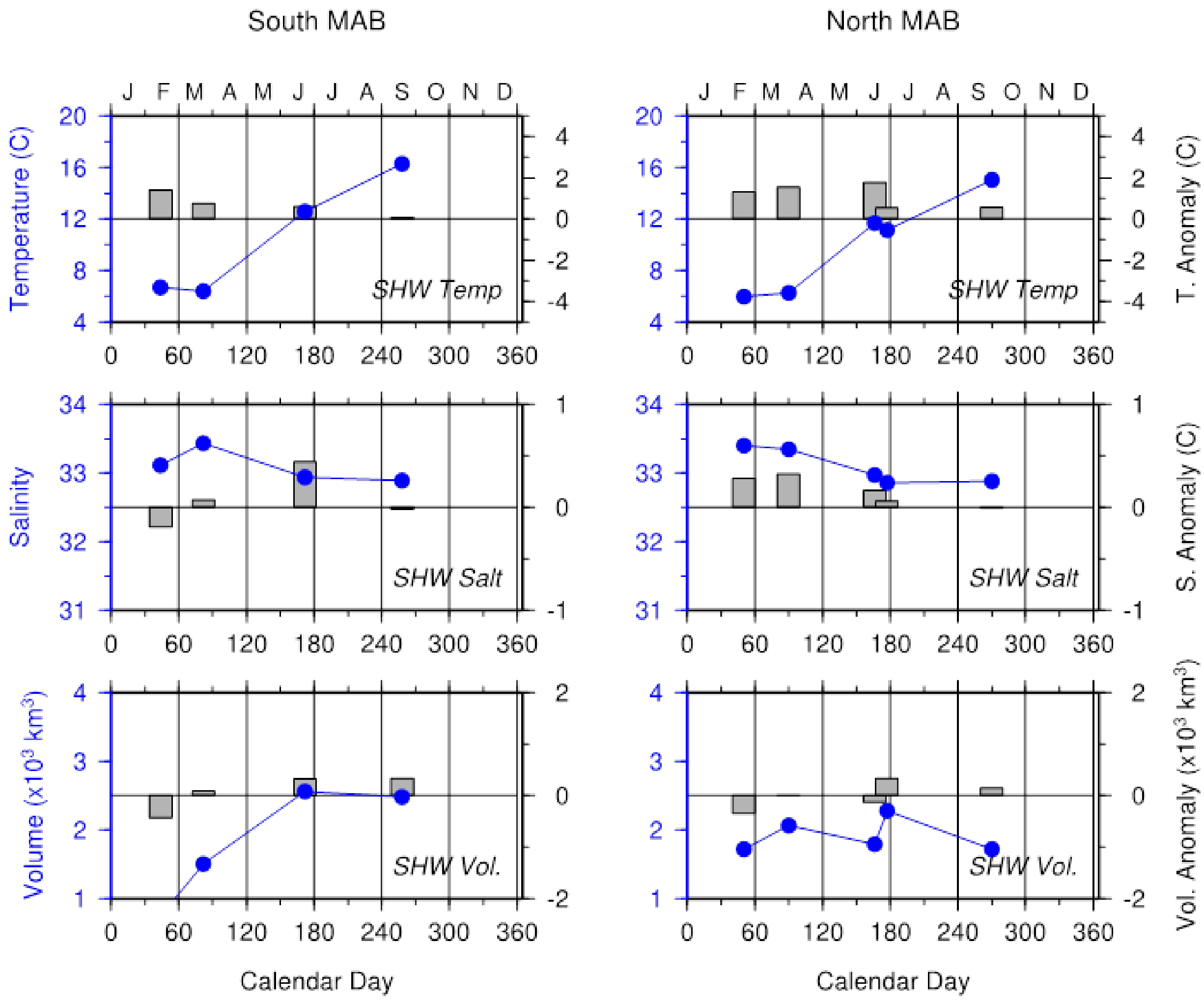

Figure 5. Time series of the 2013 regional shelf water (SHW) temperature, salinity, and volume as a function of calendar day shown in blue for the southern (left) and northern (right) Middle Atlantic Bight. The vertical bars show the corresponding shelf water anomalies.

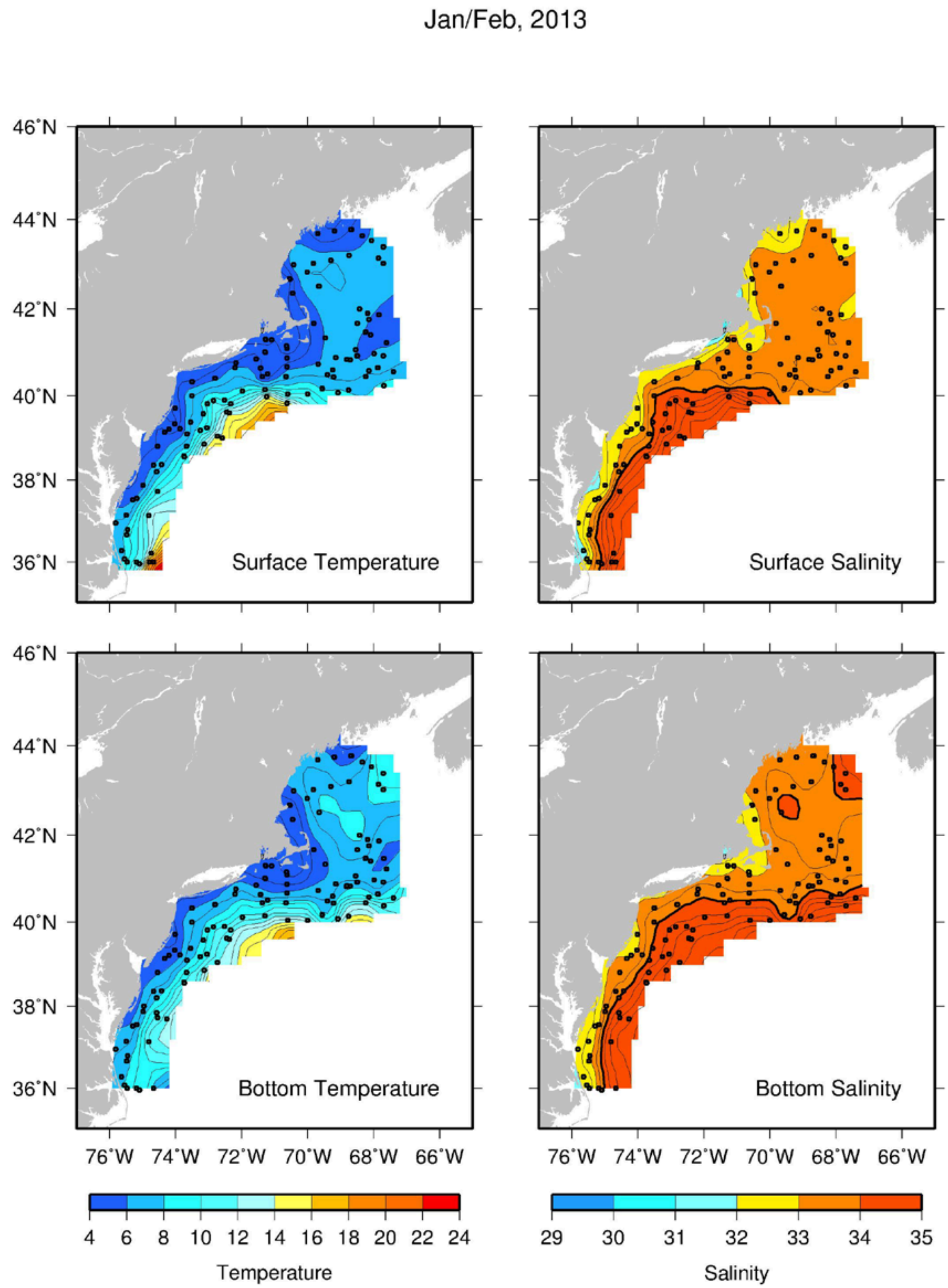

Figure 6a: Near-surface (top) and near-bottom (bottom) temperature (left) and salinity (right) distributions on the Northeast US Continental Shelf during January-February, 2013. Temperature and salinity are contoured in increments of 1ºC and 0.5, respectively. The 34 isohaline is denoted by the heavier contour.

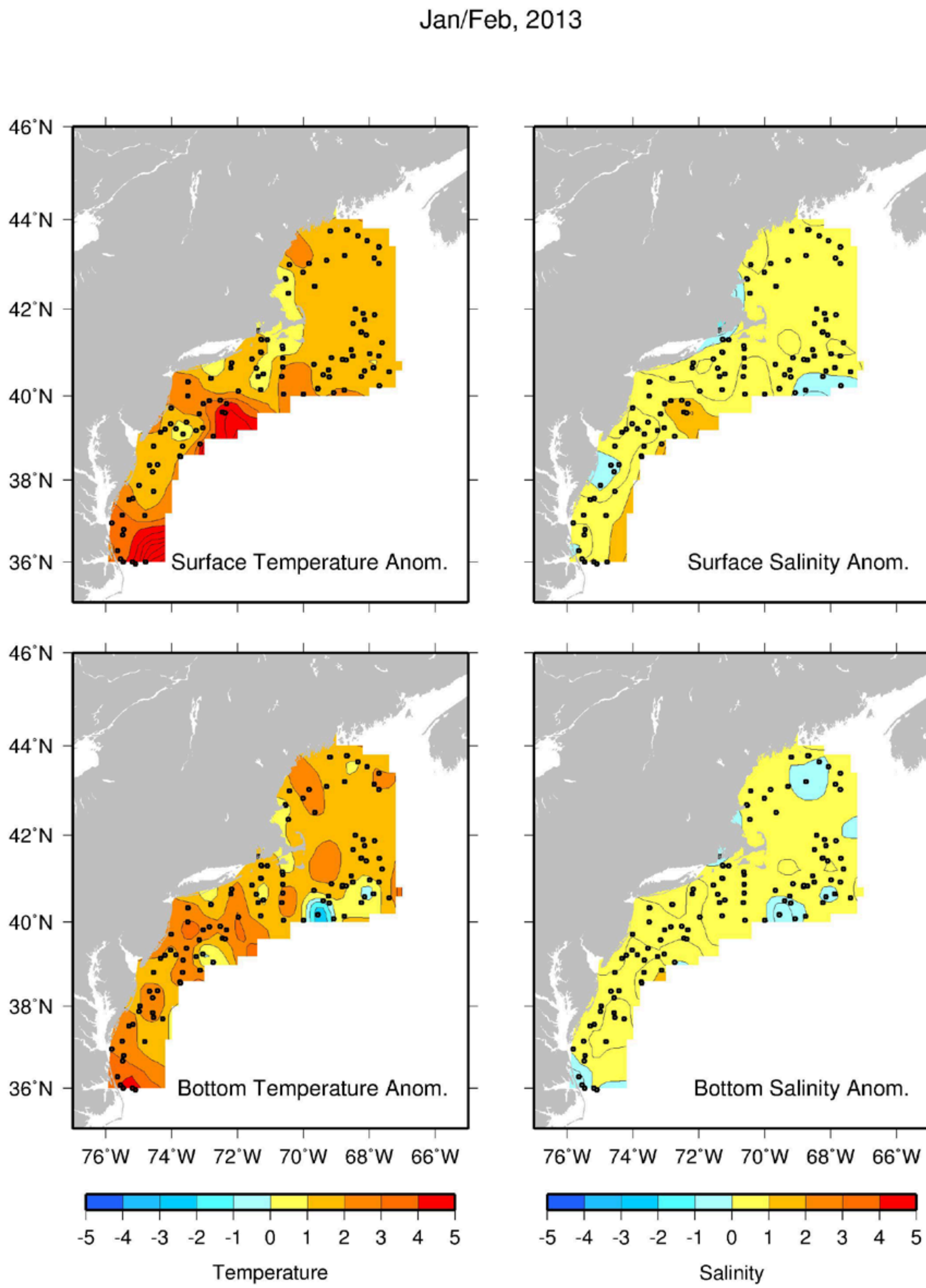

Figure 6b. Near-surface and near-bottom temperature anomaly (left) and salinity anomaly (right) distributions on the Northeast US Continental Shelf during January-February, 2013. Temperature and salinity anomaly are contoured in increments of 1ºC and 0.5, respectively.

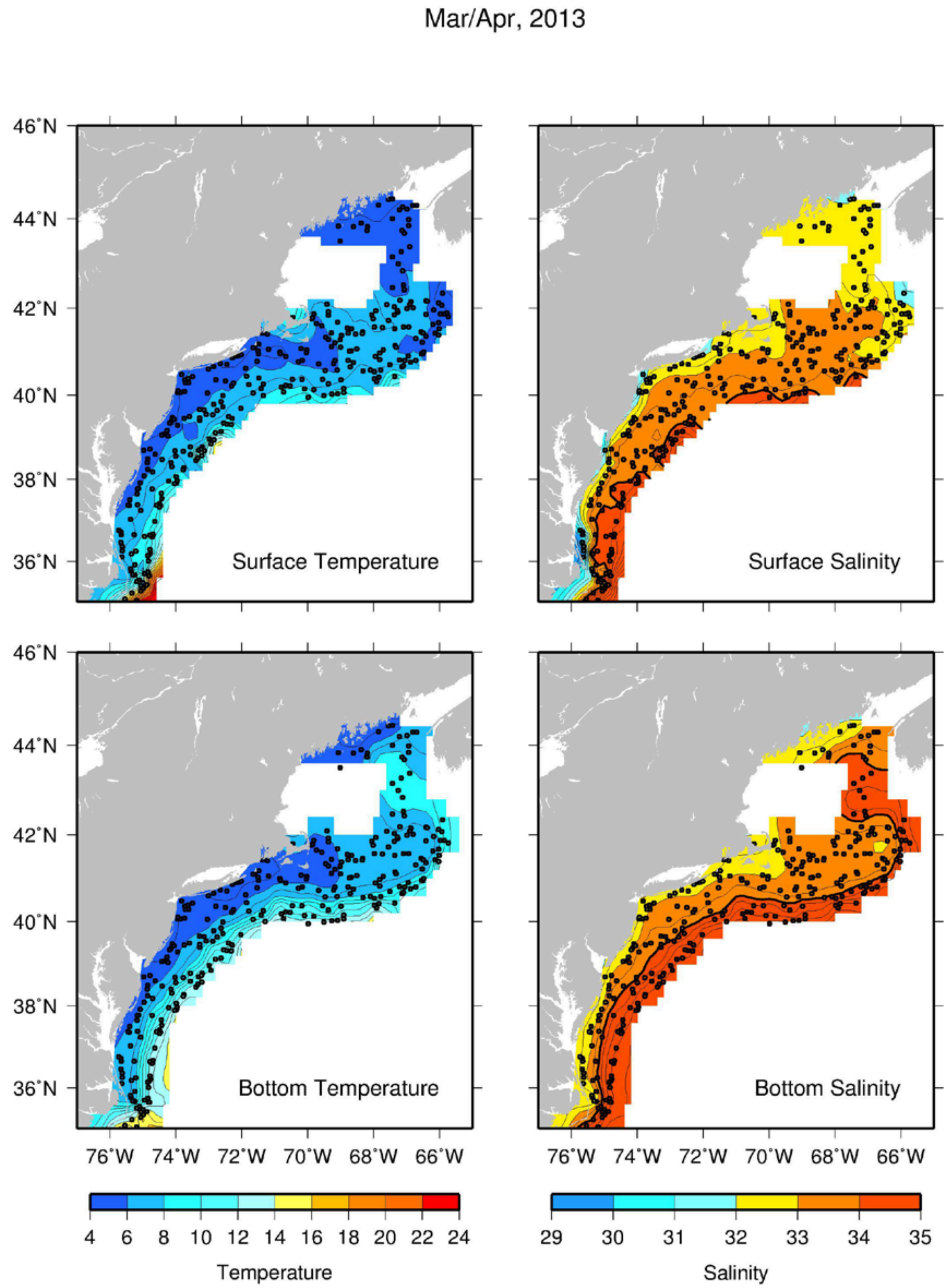

Figure 7a. Near-surface (top) and near-bottom (bottom) temperature (left) and salinity (right) distributions on the Northeast US Continental Shelf during March-April, 2013. Temperature and salinity are contoured in increments of 1ºC and 0.5, respectively. The 34 isohaline is denoted by the heavier contour.

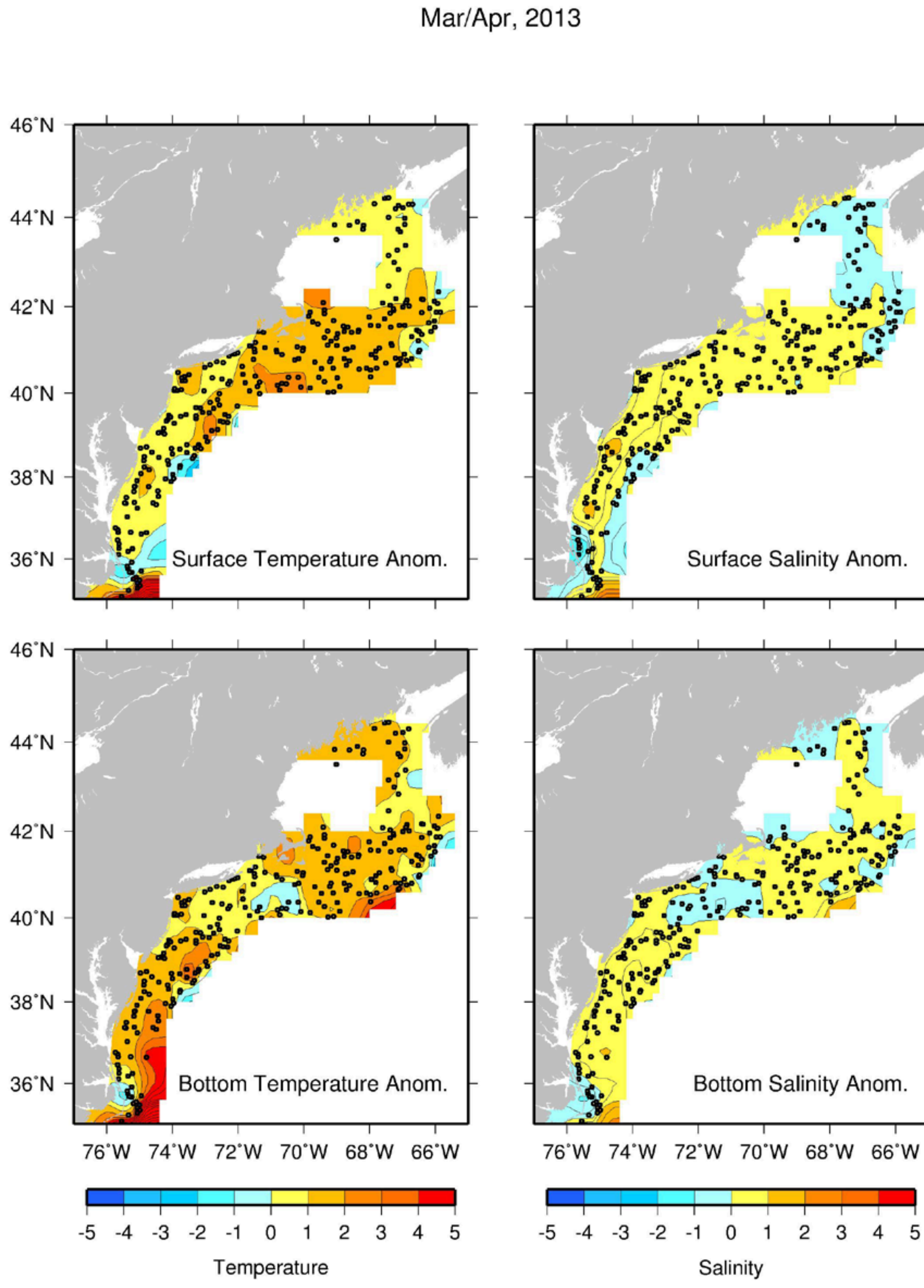

Figure 7b. Near-surface and near-bottom temperature anomaly (left) and salinity anomaly (right) distributions on the Northeast US Continental Shelf during March-April, 2013. Temperature and salinity anomaly are contoured in increments of 1ºC and 0.5, respectively.

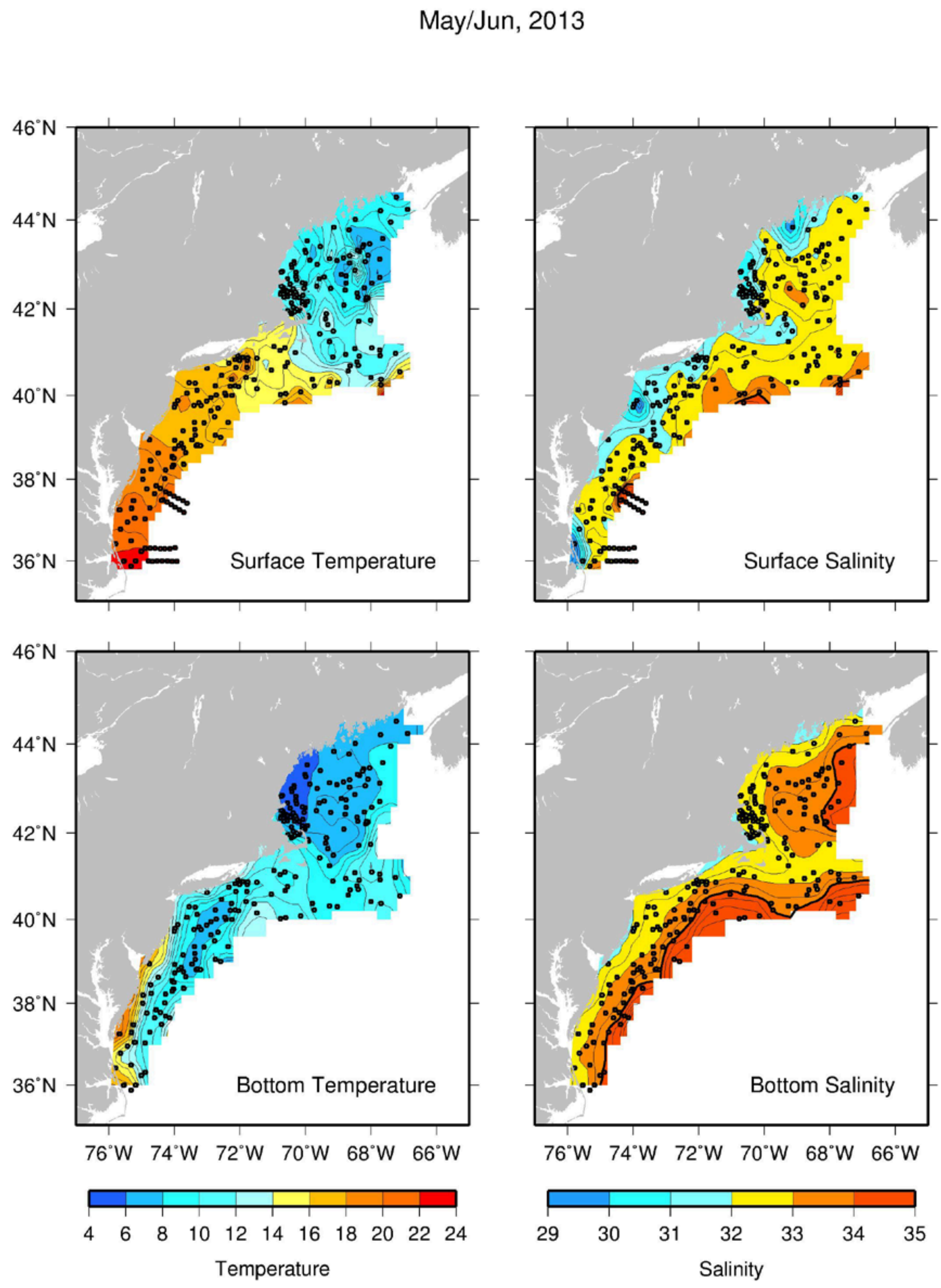

Figure 8a. Near-surface (top) and near-bottom (bottom) temperature (left) and salinity (right) distributions on the Northeast US Continental Shelf during May-June, 2013. Temperature and salinity are contoured in increments of 1ºC and 0.5, respectively. The 34 isohaline is denoted by the heavier contour.

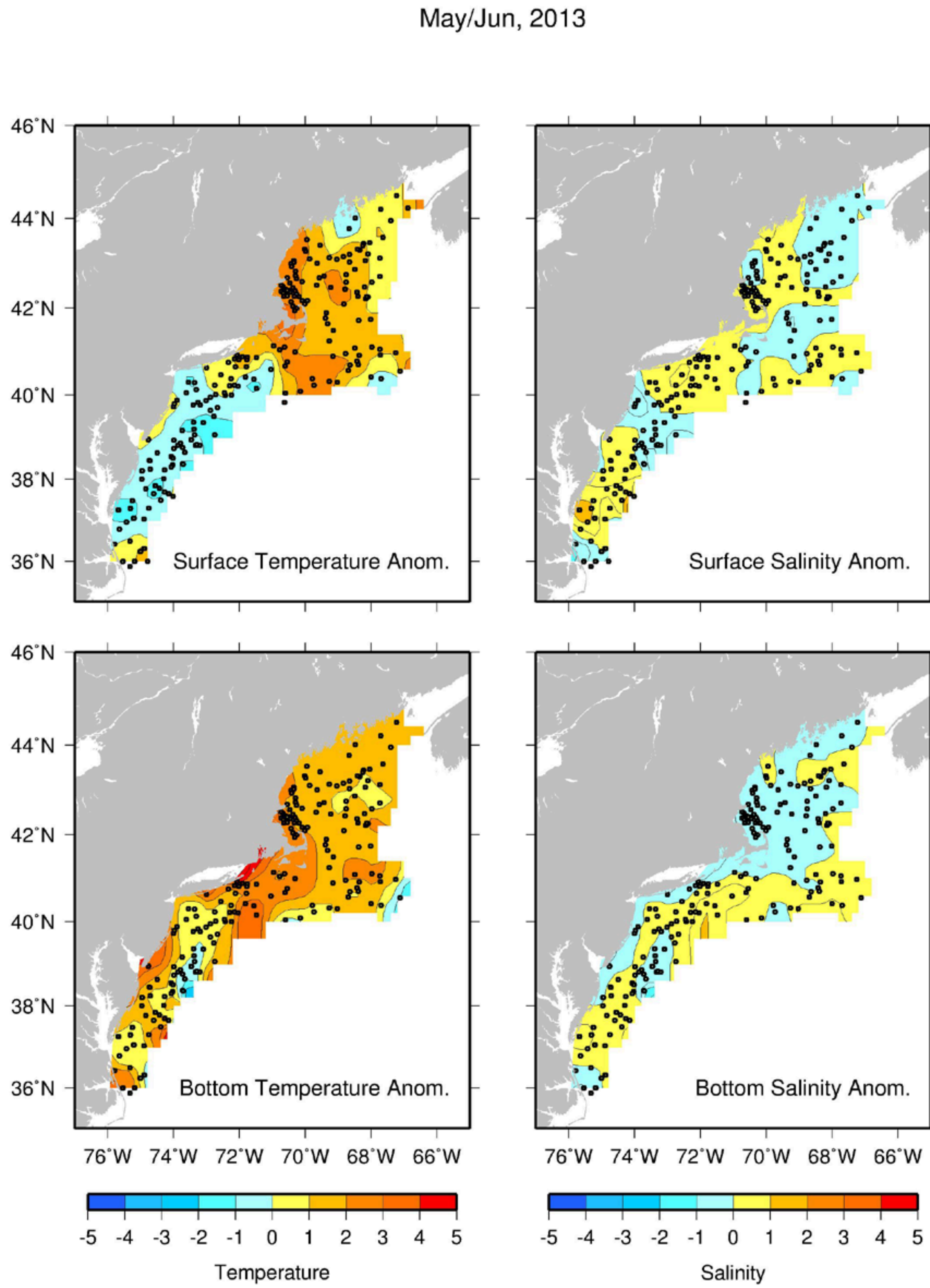

Figure 8b. Near-surface and near-bottom temperature anomaly (left) and salinity anomaly (right) distributions on the Northeast US Continental Shelf during May-June, 2013. Temperature and salinity anomaly are contoured in increments of 1ºC and 0.5, respectively.

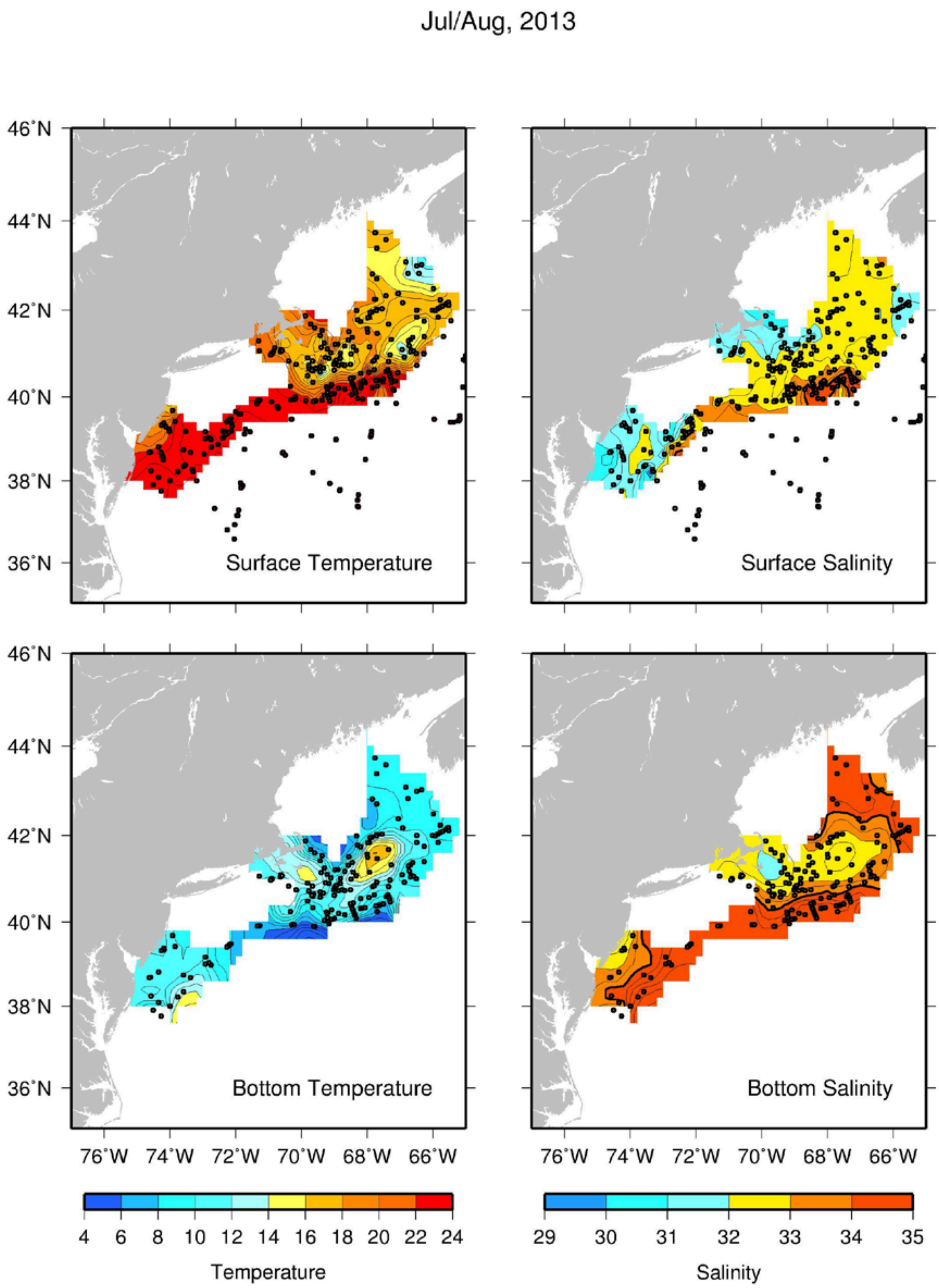

Figure 9a. Near-surface (top) and near-bottom (bottom) temperature (left) and salinity (right) distributions on the Northeast US Continental Shelf during July-August, 2013. Temperature and salinity are contoured in increments of 1ºC and 0.5, respectively. The 34 isohaline is denoted by the heavier contour.

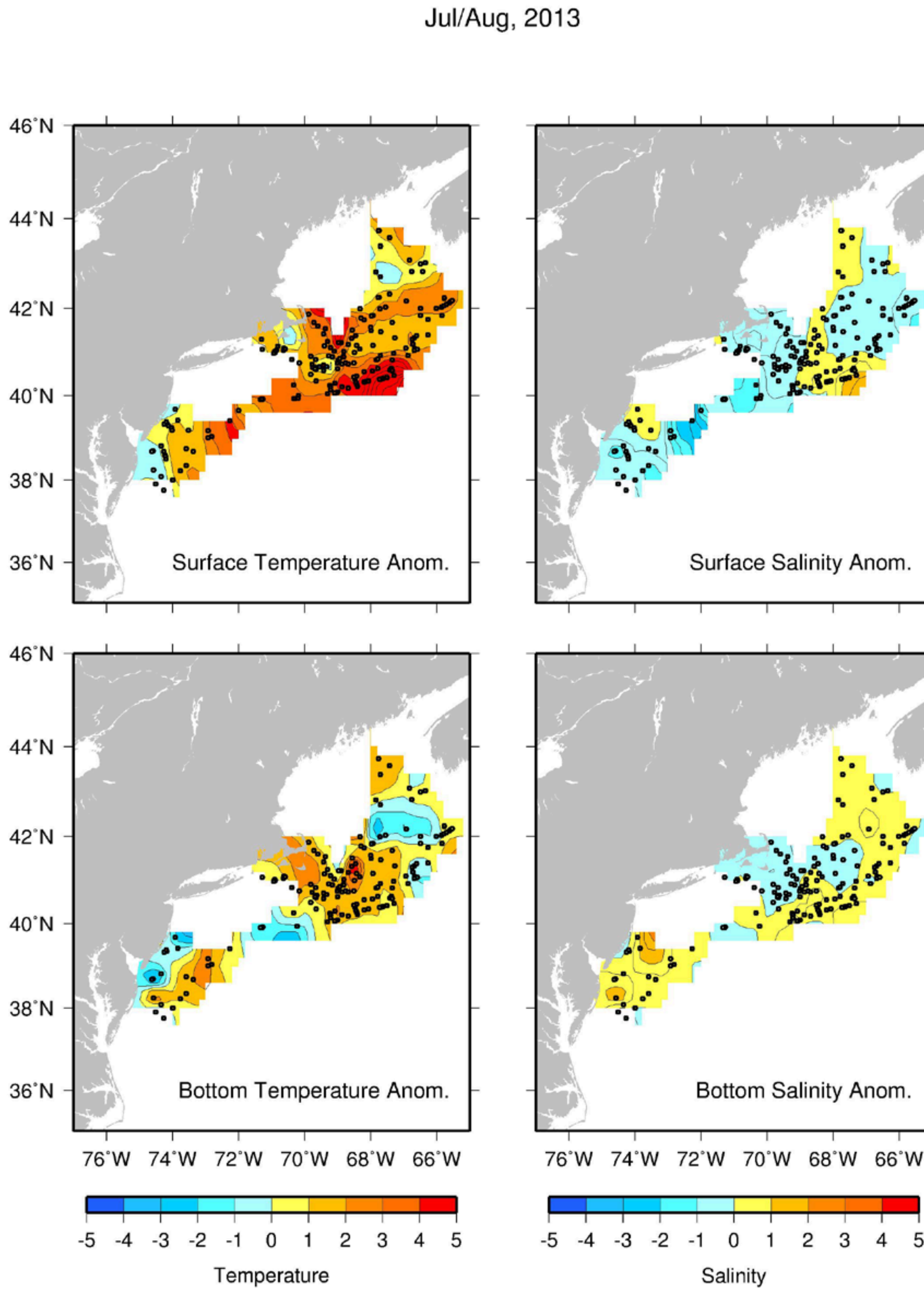

Figure 9b. Near-surface and near-bottom temperature anomaly (left) and salinity anomaly (right) distributions on the Northeast US Continental Shelf during July-August, 2013. Temperature and salinity anomaly are contoured in increments of 1ºC and 0.5, respectively.

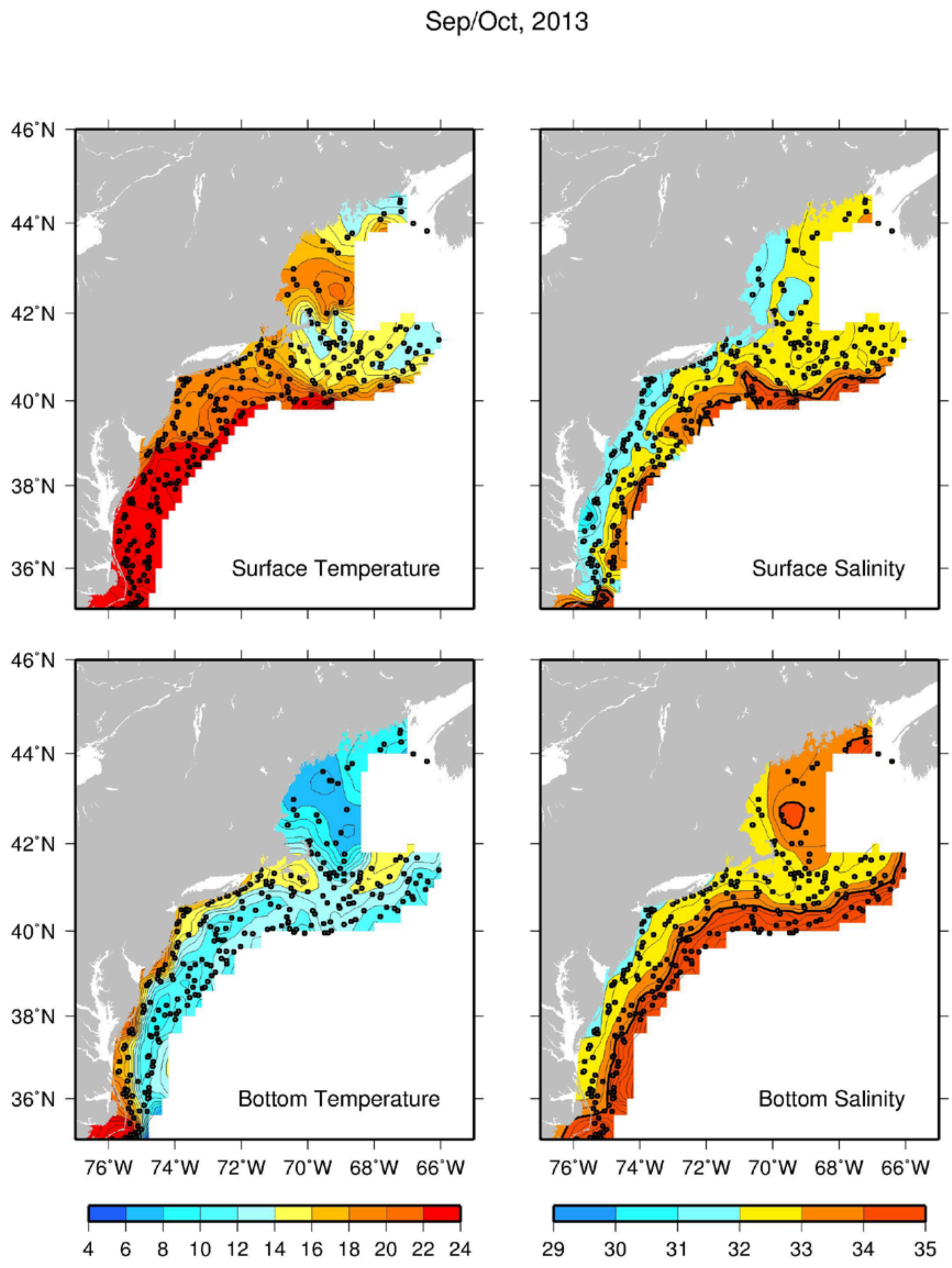

Figure 10a. Near-surface (top) and near-bottom (bottom) temperature (left) and salinity (right) distributions on the Northeast US Continental Shelf during September-October, 2013. Temperature and salinity are contoured in increments of 1ºC and 0.5, respectively. The 34 isohaline is denoted by the heavier contour.

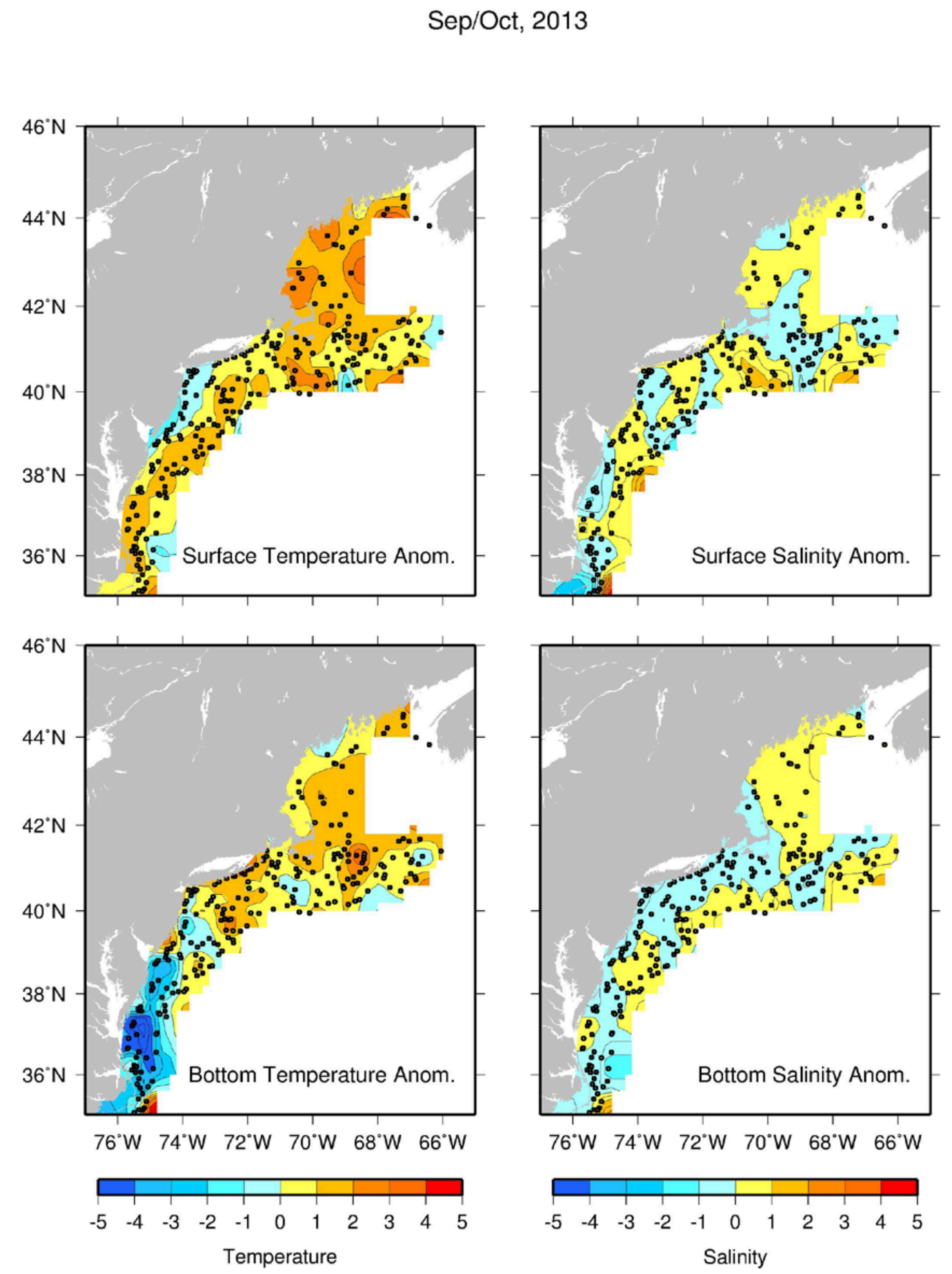

Figure 10b. Near-surface and near-bottom temperature anomaly (left) and salinity anomaly (right) distributions on the Northeast US Continental Shelf during September-October, 2013. Temperature and salinity anomaly are contoured in increments of 1ºC and 0.5, respectively.

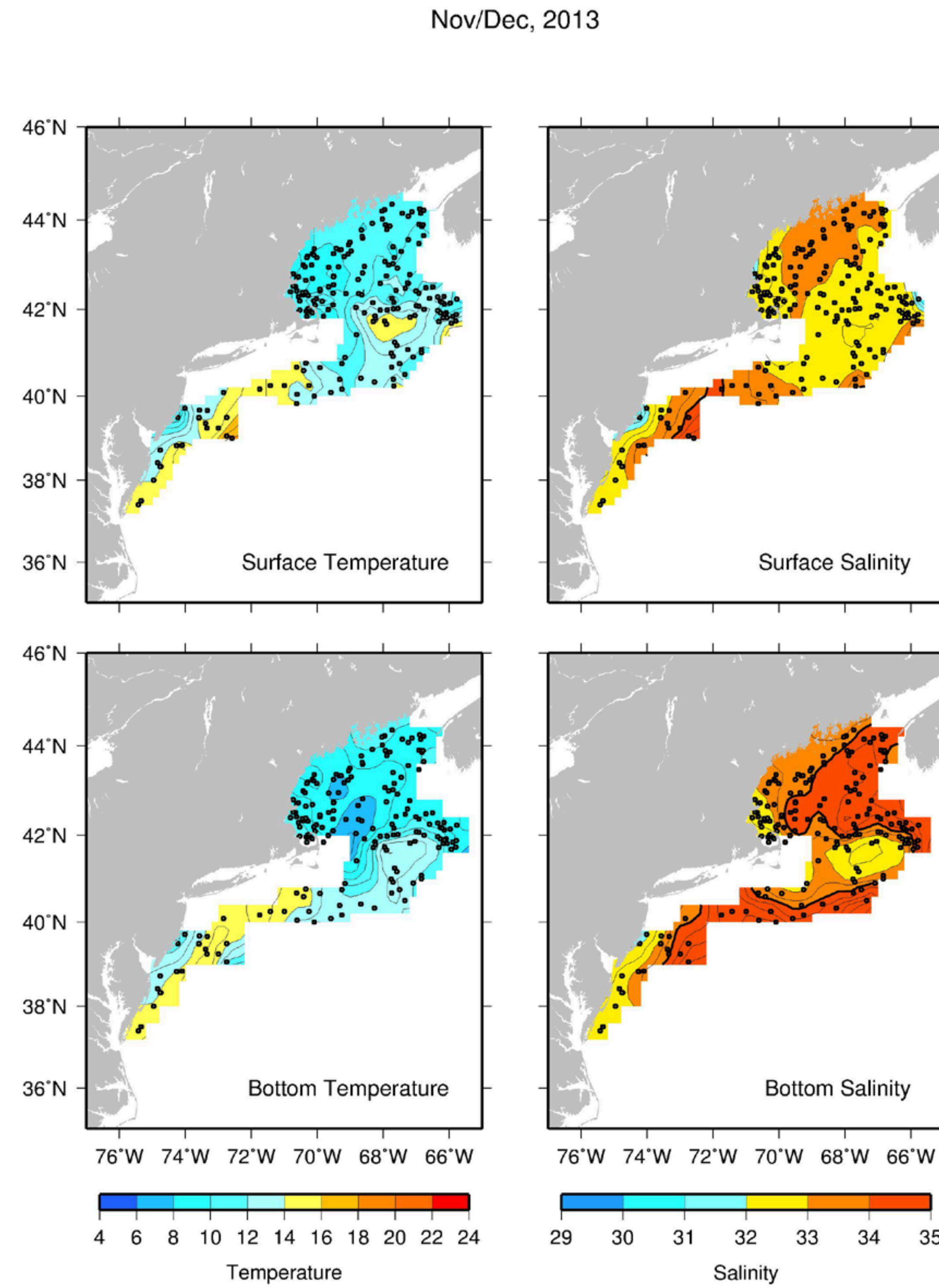

Figure 11a. Near-surface (top) and near-bottom (bottom) temperature (left) and salinity (right) distributions on the Northeast US Continental Shelf during November-December, 2013. Temperature and salinity are contoured in increments of 1ºC and 0.5, respectively. The 34 isohaline is denoted by the heavier contour.

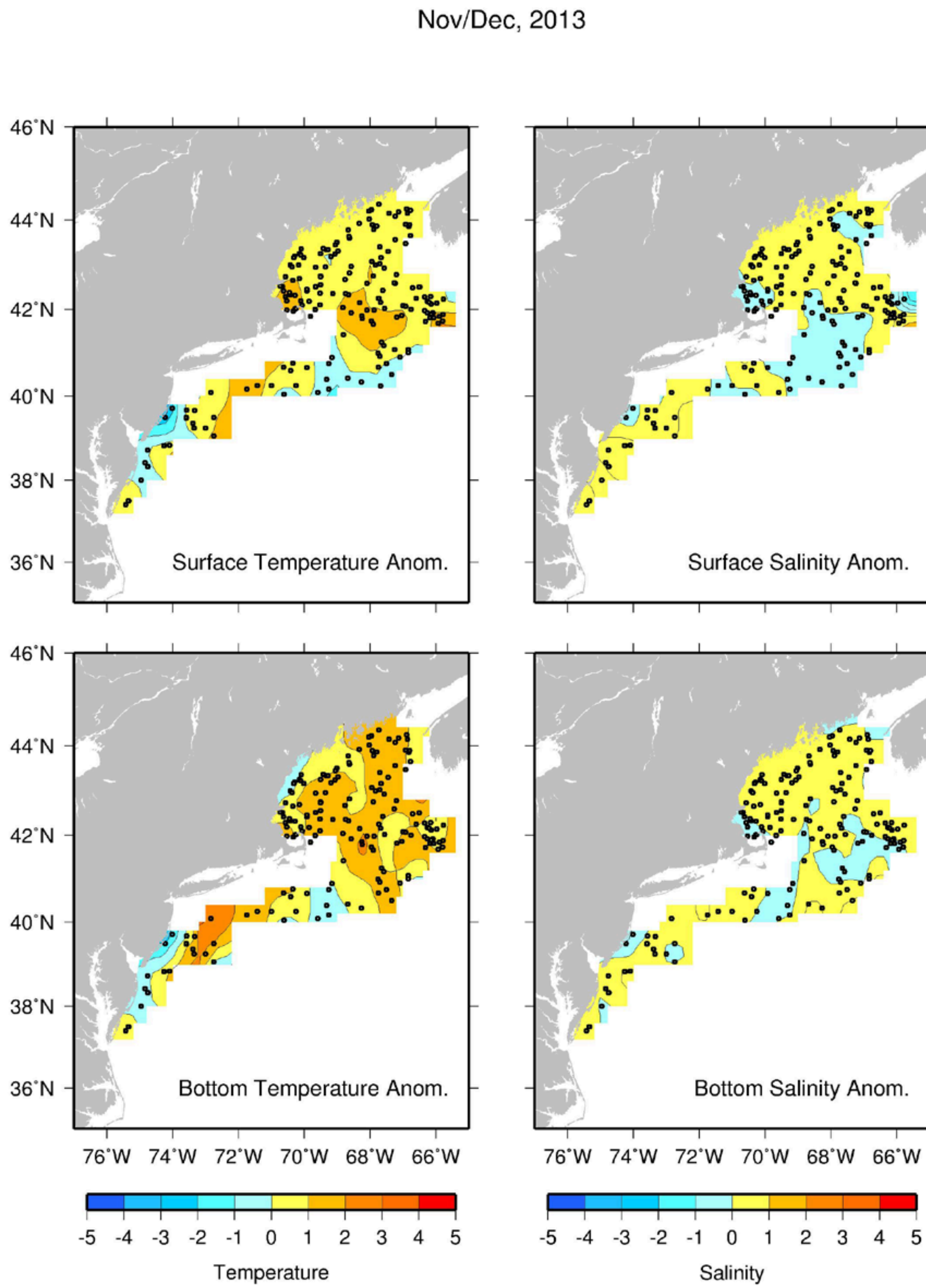

Figure 11b. Near-surface and near-bottom temperature anomaly (left) and salinity anomaly (right) distributions on the Northeast US Continental Shelf during November-December, 2013. Temperature and salinity anomaly are contoured in increments of 1ºC and 0.5, respectively.

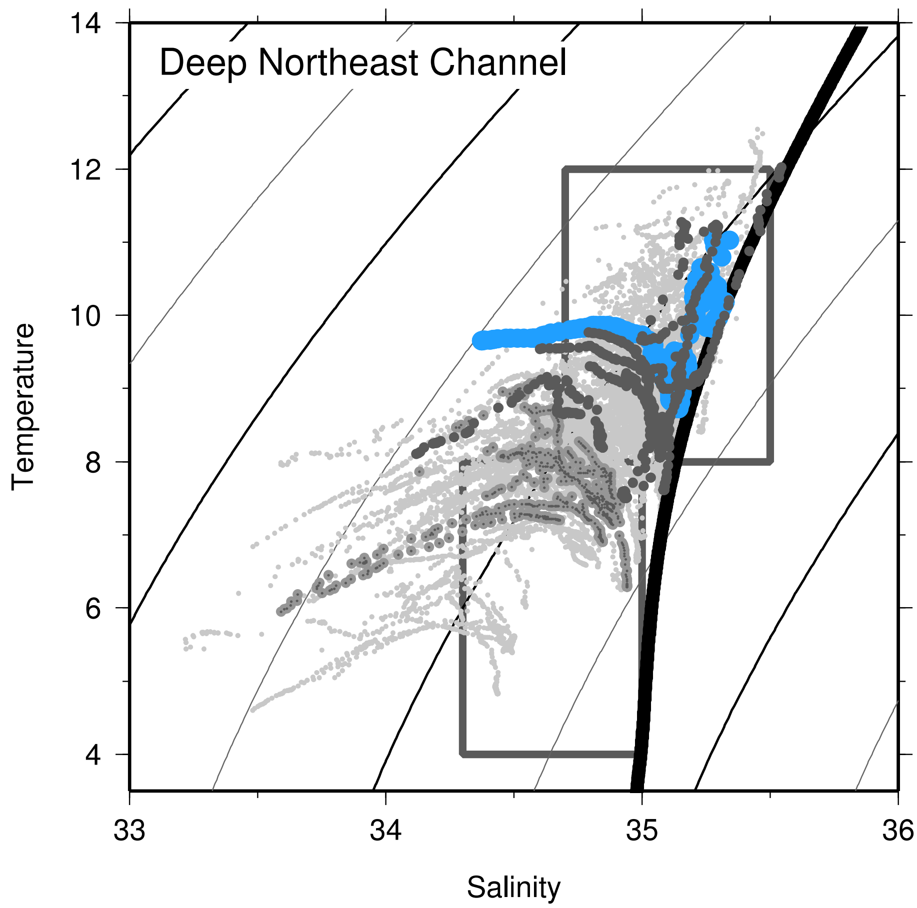

Figure 12. Temperature-salinity observations from the Northeast Channel (deeper than 150 m). Historical observations are shaded by year with lightest grey including all data between 1981-2010, medium grey limited to 2008 and darkest grey to 2012. The blue dots correspond to observations from November 2013. The grey boxes denote the typical T-S ranges for the two slope water sources, the cooler/fresher Labrador Slope Water and warmer/saltier Warm Slope Water. The heavy black curve represents the standard curve for North Atlantic Central Water (representing Gulf Stream water).

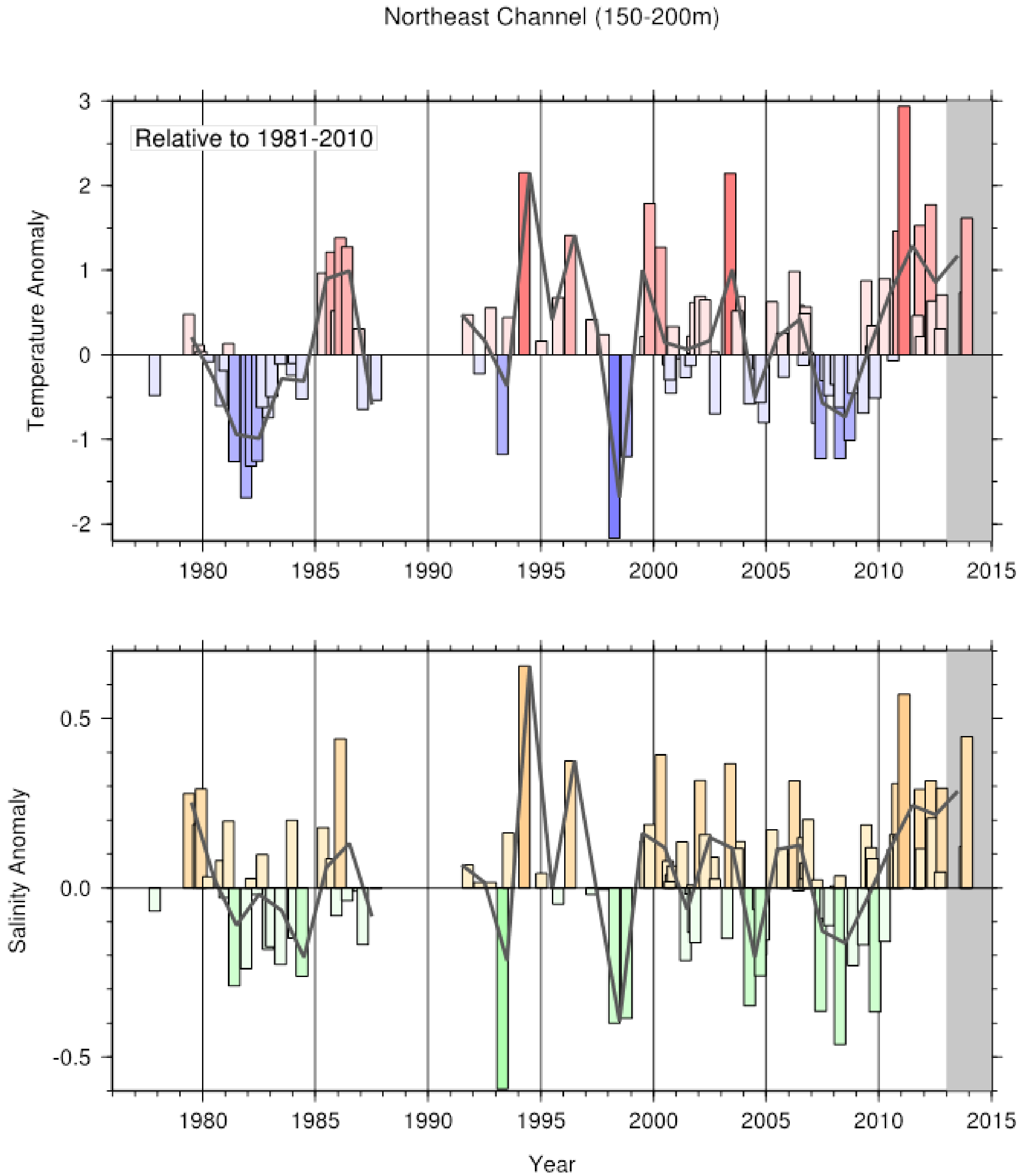

Figure 13. Time series of the regional volume-weighted average temperature (top) and salinity (bottom) anomaly between 150-200 m in the Northeast Channel. Anomalies are calculated relative to the annual cycle for the period 1981-2010. Annual average anomalies are shown by the gray curve. Bars representing 2013 anomalies used in the description of 2013 oceanographic conditions are highlighted by the gray shading. Positive anomalies correspond to warm/salty conditions.

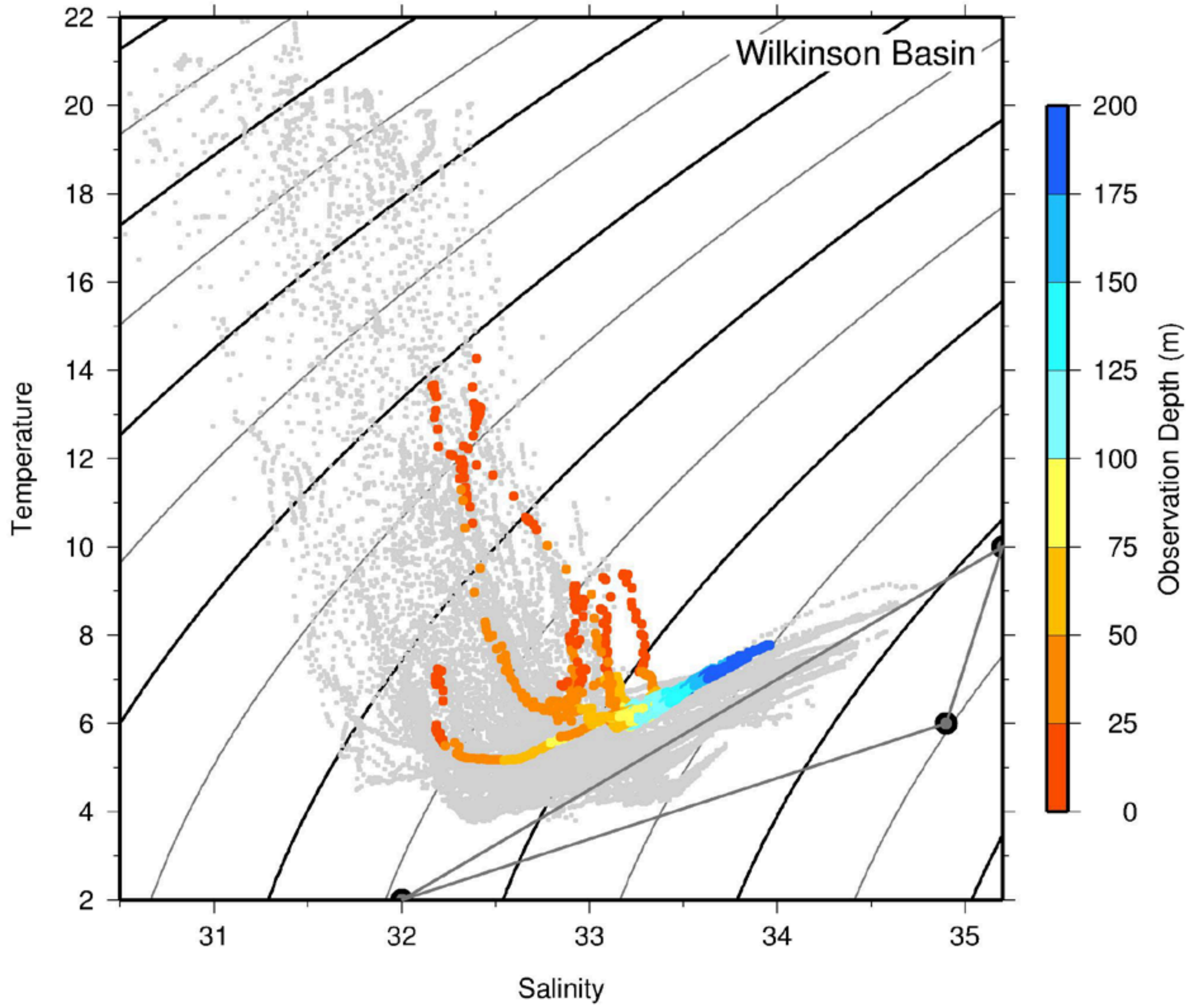

Figure 14. Temperature-salinity from observations in Wilkinson Basin, which is the westernmost deep basin in the Gulf of Maine. Historical observations collected between 1981-2010 are shown in grey. Colored dots were occupied in May 2013 and are color-coded by observation depth. The T-S properties of the three dominant sources to the Gulf of Maine are shown by the mixing triangle, representing cold/fresh Scotian Shelf Water, warmer/saltier Labrador Slope Water and warmest/saltiest Warm Slope Water. The temperature minimum characterizing Cold Intermediate Water is located at the elbow in the T-S curves.

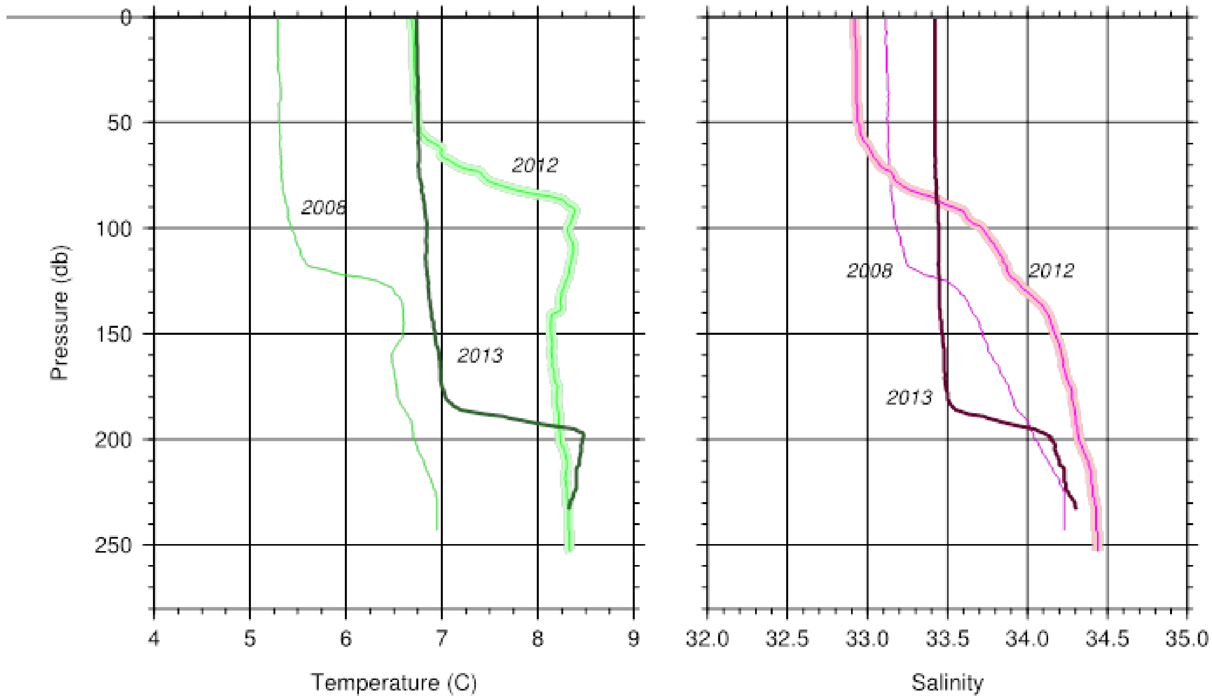

Figure 15. Profiles of temperature (left) and salinity (right) collected in February at a standard station in Wilkinson Basin (the westernmost deep basin in the Gulf of Maine). Heavier lines show the average 2013 profile compared with profiles from 2008 (thin) and 2012 (thicker). The winter mixed layer is characterized by the homogenization of properties extending from the surface to varying depths. The lower limit of these mixed layers, where profiles of temperature and salinity change abruptly from uniformly low to higher values, corresponds with the depth to which vertical mixing penetrates during a given winter.

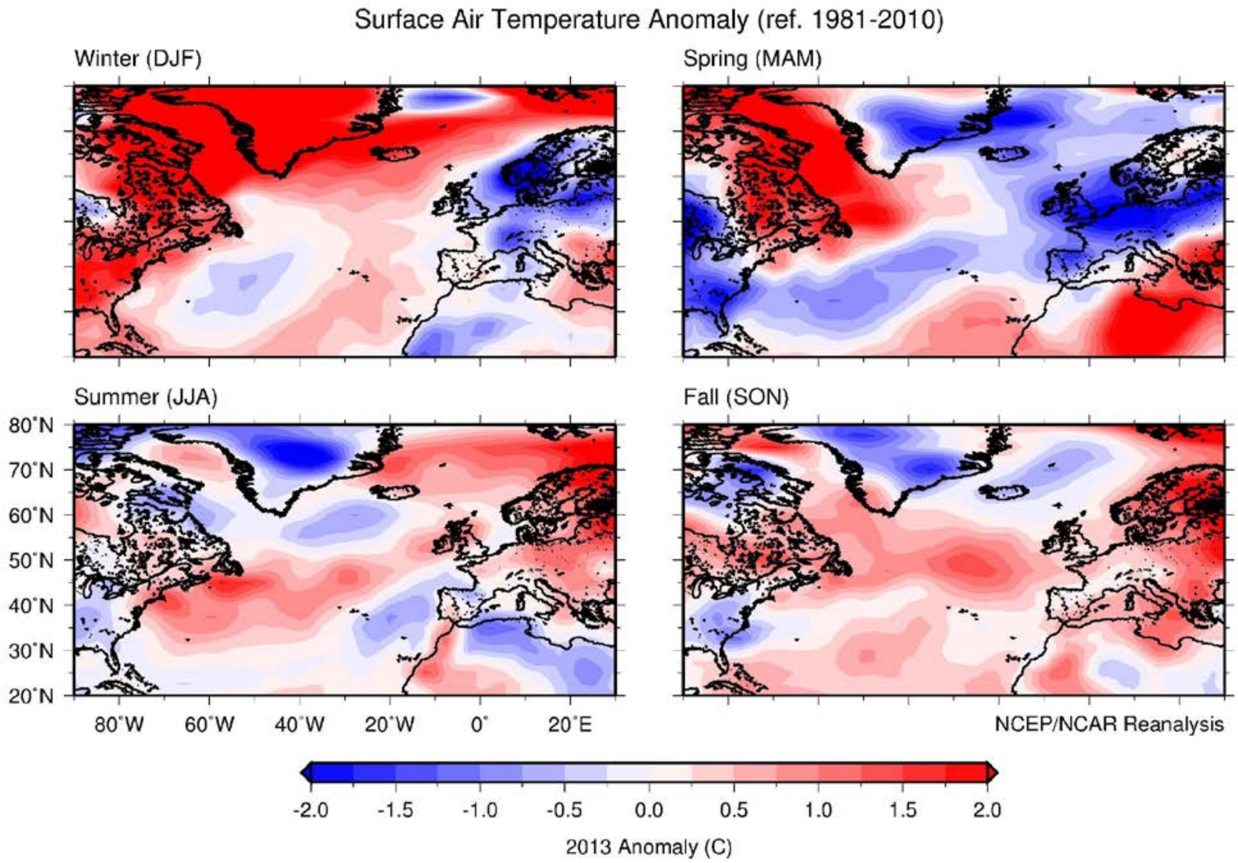

Figure 16. Surface air temperature anomaly from NCEP Reanalysis product (NOAA/OAR/ESRL/PSD, http://www.esrl.oaa.gov/psd) for winter (Dec-Feb), spring (Mar-May), summer (Jun-Aug) and fall (Sep-Nov) on the Northeast US Continental Shelf. Positive anomalies correspond to warming in 2013 relative to the reference period (1981-2010).

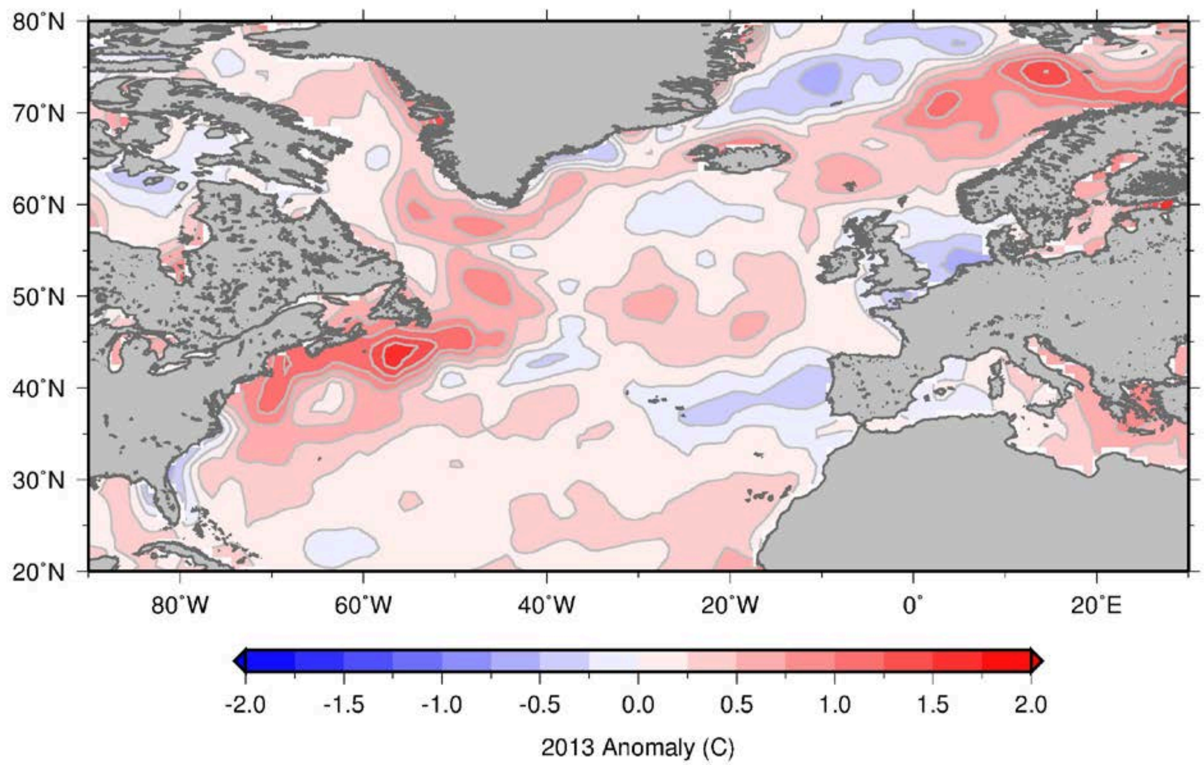

Figure 17. Annual mean sea surface temperature (SST) anomaly derived from NOAA's Optimum Interpolation (OI) SST product (NOAA/OAR/ESRL/PSD, http://www.esrl.oaa.gov/psd) on the Northeast US Continental Shelf. Positive anomalies correspond to warming in 2013 relative to the reference period (1981-2010).

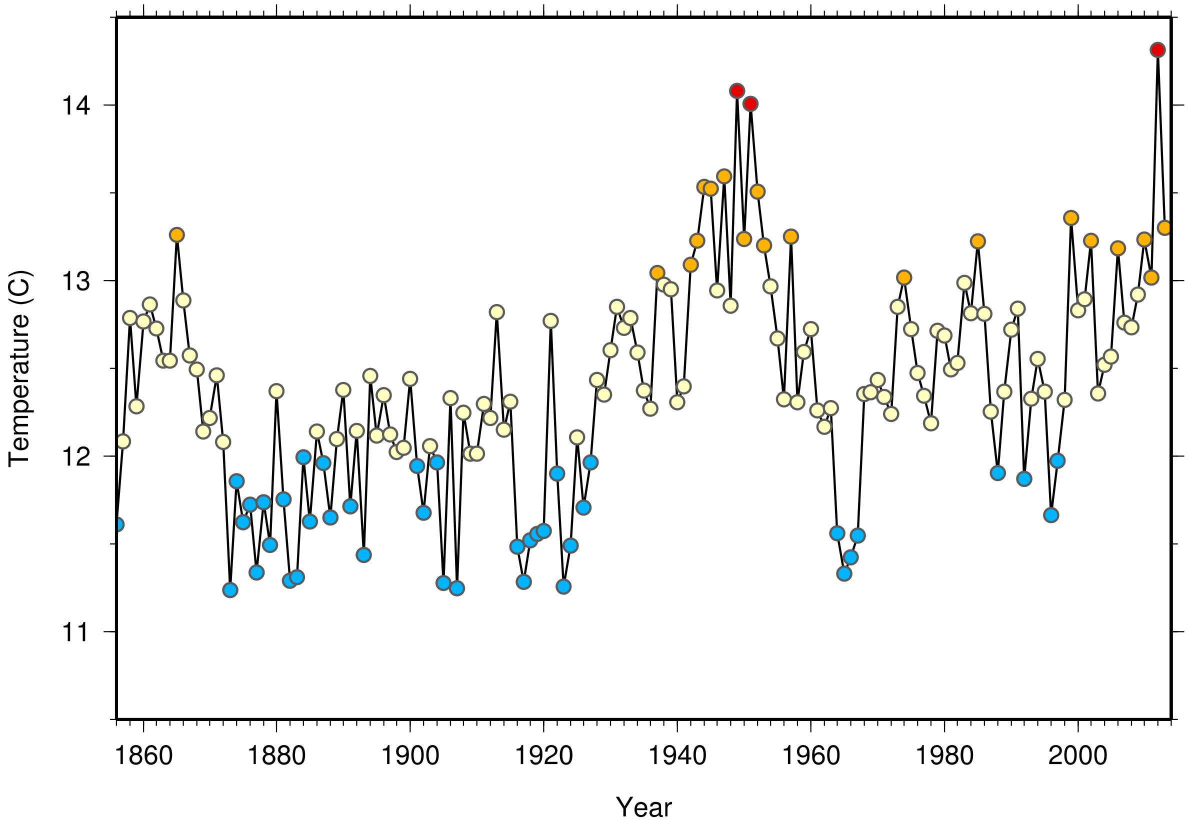

Figure 18. Regional average sea surface temperature for the Northeast US Continental Shelf region calculated from NOAA's extended reconstructed sea surface temperature product (NOAA/OAR/ESRL/PSD, http://www.esrl.oaa.gov/psd).

APPENDIX

Table A1. Regional average temperature and salinity calculated from hydrographic observations collected by individual Northeast Fisheries Science Center surveys in the eastern Gulf of Maine (boundary defined in Figure 1.) Average values incorporating less than 10 observations are shown in gray.

Gulf of Maine East

Cruise	CD	#obs	Surface Temp	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Temp	Anomaly	SDV1	SDV2	Flag
PC1301	52	5	6.12	1.17	0.45	4.89	1	4	8.37	1.85	0.48	6.84	1
HB1301	113	26	6.00	0.45	0.19	1.85	1	25	7.90	0.87	0.19	1.49	1
S11301	195	5	16.15	2.74	0.42	9.62	1	5	8.86	-2.52	0.42	9.39	1
GU1302	165	1	10.60	0.38	0.87		1	1	8.23	0.93	0.95		1
HB1303													
EX1305	242	20	15.18	0.88	0.20	1.41	0	14	9.45	0.69	0.24	1.47	0
HB1304	311	29	11.59	0.57	0.21	0.50	0	29	9.41	1.11	0.21	1.04	0
GU1305	327	14	10.44	0.48	0.29	1.30	1	9	9.32	1.31	0.33	1.34	1

Cruise	CD	#obs	Surface Salinity	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Salinity	Anomaly	SDV1	SDV2	Flag
PC1301	52	5	33.00	0.11	0.32	1.88	1	4	34.04	0.16	0.27	2.29	1
HB1301	113	26	32.42	-0.17	0.13	0.79	1	25	34.11	0.03	0.11	0.55	1
S11301	195	5	32.13	-0.41	0.25	2.14	1	5	32.78	0.08	0.25	2.20	1
GU1302	165	1	32.27	0.09	0.58		1	1	34.16	-0.01	0.46		1
HB1303													
EX1305	242	20	32.54	0.06	0.15	0.36	0	14	34.26	0.20	0.13	0.43	0
HB1304	311	29	32.86	0.12	0.14	0.21	0	29	34.57	0.12	0.10	0.34	0
GU1305	327	14	32.92	0.27	0.20	0.41	1	9	34.61	0.08	0.15	0.65	1

"Cruise", the code name for a cruise:
CD, the calendar mid-date of all the stations within a region for that cruise:
"#obs", the number of observations included in each average:
"Temp", the areal average temperature: "Salt", the areal average salinity:
Anomaly, the areal average temperature or salinity anomaly:
"SDV1",the standard deviation associated with the average temperature or salinity anomaly:
"SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived:
Flag, a value of "1" indicates that a true areal average could not be calculated due to poor station coverage.
The areal averages listed were derived from a simple average of the observations within the region.

Table A2. Regional average temperature and salinity calculated from hydrographic observations collected by individual Northeast Fisheries Science Center surveys in the western Gulf of Maine (boundary defined in Figure 1.) Average values incorporating less than 10 observations are shown in gray.

Gulf of Maine West

Cruise	CD	#obs	Surface Temp	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Temp	Anomaly	SDV1	SDV2	Flag
PC1301	52	38	6.08	1.69	0.22	2.30	1	39	7.06	1.67	0.21	2.78	1
HB1301	119	65	7.56	1.62	0.14	0.85	0	65	6.36	1.24	0.12	0.64	0
S11301	196	8	18.89	3.83	0.39	5.10	1	8	6.63	-0.15	0.35	4.93	1
GU1302	165	20	12.49	0.51	0.24	2.66	1	20	6.79	1.29	0.21	2.82	1
HB1303													
EX1305	244	18	17.66	1.56	0.23	1.09	0	16	8.43	1.28	0.21	0.93	0
HB1304	313	53	11.22	0.76	0.14	0.63	0	51	8.58	1.21	0.13	1.09	0
GU1305	326	18	9.78	0.46	0.27	0.97	1	16	8.45	1.11	0.23	0.82	1

Cruise	CD	#obs	Surface Salinity	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Salinity	Anomaly	SDV1	SDV2	Flag
PC1301	52	38	33.19	0.35	0.15	0.88	1	39	33.65	0.25	0.13	0.93	1
HB1301	119	65	32.53	0.09	0.09	0.37	0	65	33.26	-0.09	0.07	0.21	0
S11301	196	8	31.50	-0.42	0.24	1.14	1	8	32.60	-0.17	0.20	1.17	1
GU1302	165	20	31.54	-0.26	0.16	0.97	1	20	33.01	-0.06	0.12	0.79	1
HB1303													
EX1305	244	18	32.14	0.09	0.15	0.24	0	16	33.64	0.21	0.12	0.27	0
HB1304	313	53	32.82	0.11	0.09	0.18	0	51	33.78	0.19	0.08	0.22	0
GU1305	326	18	32.89	0.16	0.18	0.29	1	16	33.46	0.11	0.14	0.39	1

"Cruise", the code name for a cruise:
CD, the calendar mid-date of all the stations within a region for that cruise:
"#obs", the number of observations included in each average:
"Temp", the areal average temperature: "Salt", the areal average salinity:
Anomaly, the areal average temperature or salinity anomaly:
"SDV1",the standard deviation associated with the average temperature or salinity anomaly:
"SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived:
Flag, a value of "1" indicates that a true areal average could not be calculated due to poor station coverage.
The areal averages listed were derived from a simple average of the observations within the region.

Table A3. Regional average temperature and salinity calculated from hydrographic observations collected by individual Northeast Fisheries Science Center surveys in the Georges Bank area (boundary defined in Figure 1.) Average values incorporating less than 10 observations are shown in gray.

Georges Bank

Cruise	CD	#obs	Surface Temp	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Temp	Anomaly	SDV1	SDV2	Flag
PC1301	50	23	6.54	1.49	0.23	2.03	1	21	6.30	1.22	0.23	2.56	1
HB1301	104	67	6.56	1.21	0.13	0.69	0	56	6.71	1.17	0.16	0.65	0
S11301	188	29	15.31	2.32	0.20	2.33	1	27	10.37	1.03	0.21	2.39	1
GU1302	163	18	12.49	1.59	0.27	2.42	1	15	10.24	1.51	0.26	3.02	1
HB1303	206	37	23.02	5.04	0.25	3.30	1	6	11.35	1.92	0.54	4.99	1
EX1305	239	29	17.73	1.56	0.19	1.31	0	26	13.25	0.47	0.21	1.58	0
HB1304	297	55	14.80	0.70	0.14	0.96	0	46	13.14	0.84	0.17	1.26	0
GU1305	323	22	11.81	0.15	0.23	0.69	0	18	11.88	0.56	0.27	0.59	0

Cruise	CD	#obs	Surface Salinity	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Salinity	Anomaly	SDV1	SDV2	Flag
PC1301	50	23	33.40	0.36	0.14	0.73	1	21	33.39	0.28	0.14	0.81	1
HB1301	104	67	33.11	0.13	0.08	0.32	0	56	33.30	0.08	0.09	0.25	0
S11301	188	29	32.47	-0.14	0.11	0.53	1	27	32.98	0.01	0.12	0.60	1
GU1302	163	18	32.92	0.05	0.15	0.77	1	15	33.03	0.09	0.16	0.84	1
HB1303	206	37	33.40	0.11	0.15	1.18	1	6	34.16	0.60	0.32	1.55	1
EX1305	239	29	32.56	-0.16	0.12	0.40	0	26	32.68	-0.14	0.12	0.40	0
HB1304	297	55	32.81	0.02	0.08	0.39	0	46	32.90	-0.07	0.10	0.41	0
GU1305	323	22	32.79	-0.02	0.14	0.20	0	18	33.13	0.06	0.16	0.29	0

"Cruise", the code name for a cruise:
CD, the calendar mid-date of all the stations within a region for that cruise:
"#obs", the number of observations included in each average:
"Temp", the areal average temperature: "Salt", the areal average salinity:
Anomaly, the areal average temperature or salinity anomaly:
"SDV1",the standard deviation associated with the average temperature or salinity anomaly:
"SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived:
Flag, a value of "1" indicates that a true areal average could not be calculated due to poor station coverage.
The areal averages listed were derived from a simple average of the observations within the region.

Table A4. Regional average temperature and salinity calculated from hydrographic observations collected by individual Northeast Fisheries Science Center surveys in the northern Middle Atlantic Bight (boundary defined in Figure 1.) Average values incorporating less than 10 observations are shown in gray.

Northern Mid Atlantic Bight

Cruise	CD	#obs	Surface Temp	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Temp	Anomaly	SDV1	SDV2	Flag
PC1301	50	25	6.89	1.63	0.25	1.46	0	23	6.96	1.51	0.27	1.71	0
HB1301	90	51	6.19	1.40	0.18	0.65	0	44	6.25	0.52	0.23	1.09	0
S11301	176	18	17.36	1.21	0.29	1.58	1	18	8.62	1.11	0.29	1.30	1
GU1302	165	22	15.26	0.58	0.26	1.62	0	20	10.39	2.61	0.30	1.90	0
HB1303	213	20	19.62	1.09	0.29	2.58	1	11	11.48	0.92	0.35	3.29	1
EX1305	239	5	18.12	1.63	0.53	1.51	1	5	14.42	2.20	0.54	1.19	1
HB1304	270	54	19.01	0.87	0.18	1.16	0	45	12.62	0.62	0.23	1.63	0
GU1305	320	11	13.89	0.56	0.41	1.06	1	8	14.43	1.23	0.47	2.31	1

Cruise	CD	#obs	Surface Salinity	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Salinity	Anomaly	SDV1	SDV2	Flag
PC1301	50	25	33.62	0.46	0.17	0.50	0	23	33.73	0.28	0.17	0.53	0
HB1301	90	51	33.19	0.34	0.12	0.26	0	44	33.38	-0.10	0.13	0.39	0
S11301	176	18	32.04	0.21	0.20	0.53	1	18	33.10	0.16	0.17	0.49	1
GU1302	165	22	32.51	0.15	0.17	0.55	0	20	33.43	0.30	0.18	0.56	0
HB1303	213	20	32.30	-0.41	0.18	1.02	1	11	32.77	-0.01	0.22	0.88	1
EX1305	239	5	32.09	-0.18	0.31	0.28	1	5	32.27	-0.36	0.32	0.32	1
HB1304	270	54	32.88	0.23	0.12	0.54	0	45	33.02	-0.32	0.14	0.40	0
GU1305	320	11	33.29	0.07	0.26	0.54	1	8	33.89	0.13	0.26	0.62	1

"Cruise", the code name for a cruise:
CD, the calendar mid-date of all the stations within a region for that cruise:
"#obs", the number of observations included in each average:
"Temp", the areal average temperature: "Salt", the areal average salinity:
Anomaly, the areal average temperature or salinity anomaly:
"SDV1",the standard deviation associated with the average temperature or salinity anomaly:
"SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived:
Flag, a value of "1" indicates that a true areal average could not be calculated due to poor station coverage.
The areal averages listed were derived from a simple average of the observations within the region.

Table A5. Regional average temperature and salinity calculated from hydrographic observations collected by individual Northeast Fisheries Science Center surveys in the southern Middle Atlantic Bight (boundary defined in Figure 1.) Average values incorporating less than 10 observations are shown in gray.

Southern Mid Atlantic Bight

Cruise	CD	#obs	Surface Temp	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Temp	Anomaly	SDV1	SDV2	Flag
PC1301	43	42	8.57	2.50	0.21	1.68	0	43	8.37	2.42	0.21	1.33	0
HB1301	82	94	7.17	0.75	0.14	1.33	0	77	7.62	1.65	0.17	1.20	0
S11301	169	20	18.03	-0.64	0.29	0.48	1	20	7.90	0.33	0.31	0.77	1
GU1302	171	65	19.05	-0.58	0.16	0.96	0	59	10.44	0.69	0.19	1.33	0
HB1303	199	51	23.30	0.89	0.19	1.28	1	18	10.97	0.55	0.32	2.43	1
EX1305													
HB1304	258	90	22.83	0.77	0.14	1.10	0	75	12.35	-1.67	0.18	2.91	0
GU1305	318	23	14.48	0.36	0.26	0.54	1	21	14.37	0.62	0.29	1.16	1

Cruise	CD	#obs	Surface Salinity	Anomaly	SDV1	SDV2	Flag	#obs	Bottom Salinity	Anomaly	SDV1	SDV2	Flag
PC1301	43	42	33.92	0.52	0.16	0.58	0	43	34.02	0.52	0.13	0.42	0
HB1301	82	94	33.53	0.52	0.10	0.81	0	77	33.90	0.50	0.11	0.51	0
S11301	169	20	32.10	-0.03	0.21	0.30	1	20	33.35	0.01	0.18	0.37	1
GU1302	171	65	32.15	0.24	0.12	0.84	0	59	33.23	0.09	0.12	0.40	0
HB1303	199	50	31.53	-0.44	0.14	0.68	1	18	33.40	0.41	0.20	0.66	1
EX1305													
HB1304	258	90	32.23	-0.02	0.11	0.65	0	75	32.98	-0.19	0.11	0.52	0
GU1305	318	23	33.22	0.45	0.20	0.32	1	21	33.17	0.23	0.18	0.29	1

"Cruise", the code name for a cruise:
CD, the calendar mid-date of all the stations within a region for that cruise:
"#obs", the number of observations included in each average:
"Temp", the areal average temperature: "Salt", the areal average salinity:
Anomaly, the areal average temperature or salinity anomaly:
"SDV1",the standard deviation associated with the average temperature or salinity anomaly:
"SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived:
Flag, a value of "1" indicates that a true areal average could not be calculated due to poor station coverage.
The areal averages listed were derived from a simple average of the observations within the region.

Table A6. Temperature, salinity and volume of the shelf water in the Middle Atlantic Bight during 2013. The shelf water is defined as water within the upper 100 meters having salinity less than 34. MABN = Middle Atlantic Bight north; MABS = Middle Atlantic Bight south.

CD	Temp	Temp. Anomaly	Salt	Salt Anomaly	SHW Temp	SHW T. Anom	SHW Salt	SHW S. Anom	SHW Volume	SHW Vol. Anomaly
					MABN					
50	7.54	1.73	33.82	0.34	5.95	1.32	33.40	0.28	1720.79	-343.32
90	6.86	1.12	33.54	0.23	6.25	1.54	33.34	0.32	2063.31	1.84
166	11.84	1.33	33.51	0.28	11.67	1.76	32.97	0.16	1793.33	-136.22
177	11.14	-0.02	32.86	-0.40	11.14	0.54	32.86	0.06	2282.62	340.61
270	15.65	0.75	33.54	-0.08	15.06	0.58	32.88	-0.01	1720.11	153.69
					MABS					
44	10.03	1.52	34.56	0.42	6.67	1.40	33.11	-0.19	760.36	-427.35
82	8.79	0.85	34.25	0.36	6.37	0.77	33.43	0.07	1504.06	93.78
172	12.70	0.13	33.31	0.07	12.58	0.59	32.94	0.44	2557.77	328.75
258	16.22	-0.21	33.48	0.00	16.28	0.07	32.89	-0.02	2481.70	332.07

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