

Spatial and temporal characteristics of water column and seabed sediment samples from Minas Basin, Bay of Fundy

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ABSTRACT

Zions, V.S., Law, B.A., O’Laughlin, C., Morrison, K.J., Drozdowski, A., Bugden, G.L., Horne, E. and Roach, S. 2017. Spatial and temporal characteristics of water column and seabed sediment samples from Minas Basin, Bay of Fundy. Can. Tech. Rep. Fish. Aquat. Sci. 3233: vi + 95.

Interest in tidal power extraction from the Upper Bay of Fundy has long been prevalent and has increased in recent years, however little data collection of suspended and bottom sediments has occurred in Minas Basin area since 1979. This study aims to provide a baseline of water column and seabed sediment characteristics of the Minas Basin and surrounding areas in the upper Bay of Fundy. Measurements were collected during summer, 5-14 June 2013, and winter, 19-22 March 2014, for seasonal comparisons. A conductivity, temperature and depth (CTD) instrument with rosette was deployed to examine temperature, salinity and turbidity. Water samples were collected for suspended particulate matter (SPM) concentration and nutrient analysis throughout the tidal cycle for approximately 12 hour intervals. Bottom sediments were collected for sediment grain size analysis. Profiles from the water column revealed that flow throughout Minas Basin is not always well mixed, and was often stratified. Suspended particulate matter concentrations revealed an order of magnitude difference seasonally throughout Minas Basin, although little difference was seen in the shallower Cobequid Bay. Seabed sediment grain size was compared to historical data and revealed finer sediment with the proportions of mud and sand increasing, and a corresponding decrease in the proportion of gravel.

RÉSUMÉ

Zions, V.S., Law, B.A., O’Laughlin, C., Morrison, K.J., Drozdowski, A., Bugden, G.L., Horne, E. and Roach, S. 2017. Spatial and temporal characteristics of water column and seabed sediment samples from Minas Basin, Bay of Fundy. Can. Tech. Rep. Fish. Aquat. Sci. 3233: vi + 95.

L'intérêt pour l'extraction d'énergie marémotrice de la partie supérieure de la baie de Fundy, qui se manifeste depuis longtemps, a augmenté au cours des dernières années; toutefois, depuis 1979, on a recueilli très peu de données sur les sédiments en suspension et sur le fond dans la région du bassin Minas. Cette étude vise à fournir des données de référence sur les caractéristiques de la colonne d'eau et des sédiments du fond marin du bassin Minas et des zones avoisinantes dans la partie supérieure de la baie de Fundy. On a pris des mesures pendant l'été, du 5 au 14 juin 2013, et en hiver, du 19 au 22 mars 2014, aux fins de comparaisons saisonnières. Un instrument de mesure de la conductivité, de la température et de la profondeur (CTP) muni d'une rosette a été déployé pour examiner la température, la salinité et la turbidité. Des échantillons d'eau ont été prélevés aux fins d'analyse de la concentration des matières particulaires en suspension et des éléments nutritifs, tout au long du cycle des marées à intervalles d'environ 12 heures. Des sédiments de fond ont été prélevés aux fins d'analyse de la granulométrie. Les profils de la colonne d'eau ont révélé que le débit dans l'ensemble du bassin n'est pas toujours bien mélangé, et était souvent stratifié. Les concentrations de sédiments en suspension ont révélé une différence d'ordre de grandeur saisonnière dans le bassin Minas, bien qu'on ait observé peu de différence dans les eaux moins profondes de la baie Cobequid. La granulométrie des sédiments du fond marin a été comparée aux données historiques et a révélé des sédiments plus fins ainsi qu'une proportion de vase et de sable à la hausse, et une baisse correspondante de la proportion de gravier.

INTRODUCTION

The Minas Basin is the most north-east part of the Bay of Fundy (Fig. 1) and is known for having the highest tides in the world. The highest tidal range ever recorded was measured in Minas Basin at 16.27 m and the area has an average tidal range of 12 m (Percy 2001). This extreme tidal system has been a focus for scientists, engineers, and industry due to the potential for energy extraction through the deployment of tidal turbines. The potential use of turbines however raises concern over possible change to the hydrodynamics and sediment dynamics (e.g. Wu *et al.* 2001, 2016) which may affect the natural environment, habitat and possibly commercial, recreational, and aboriginal fisheries.

The Upper Bay of Fundy and surrounding areas consist of a rich ecosystem home to many species (Bromley and Bleakney 1979). According to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) four species that inhabit Minas Basin are of concern; the striped bass and Inner Bay of Fundy salmon have been labeled as endangered and the American eel and Atlantic sturgeon are listed as threatened (www.cosewic.gc.ca). The Atlantic salmon spawns in fresh water tributary rivers from the Bay of Fundy and undergoes a feeding migration to the north Atlantic. Atlantic Sturgeon is of particular interest as it uses the intertidal mud flats and channels of the Minas Basin to feed. Pearson *et al.* (2007) showed that the Atlantic sturgeon favour tidal flats and banks of intertidal creeks composed of mostly silt and clay with a low (ie. approximately 10%) sand fraction. Changes to the hydrodynamics of the Minas Basin could drastically change the morphology of the coastal system.

The potential for human infrastructure to affect the natural environment has been demonstrated in the Bay of Fundy by the construction of causeways in the 1960's. van Proosdij *et al.* (2009) compared two causeways built in the Upper Bay of Fundy, the Petitcodiac River and Avon River, which experienced rapid sedimentation and infilling 1-2 km downstream of the structure in the year after construction. Differences in the morphology of the estuary, sediment composition, suspended sediment concentration and the position of the causeway in the estuary can all affect the amount of infilling that occurs. The mudflat in the Avon River did not prograde much beyond the initial 1-2 km of deposition whereas the Petitcodiac River continued to infill with sediment up to 21 km downstream of the causeway. The difference for the Avon River was the hydrodynamics of the connecting St. Croix River and its position within the estuary, compared to the lack of a second major fluvial input in the Petitcodiac River system. Because the equilibrium state of an estuary depends on the balance of hydrological, sedimentological and biological factors which control bottom shear stress, changes to one or more components will see change in the system until a new equilibrium is reached (eg. Bray *et al.* 1982; Wolanski *et al.* 2001; Tonis *et al.* 2002).

Early work to remotely characterize the suspended sediment concentration in Minas Basin predicted an order of magnitude difference between summer and winter months (Munday *et al.* 1979). Munday *et al.* (1979) used an automated multirate Landsat CCT MSS measurement of suspended sediment concentration to remotely predict sedimentation patterns. Their results had highest concentrations of suspended sediment occurring in the spring at approximately 60 mg L⁻¹ and lowest values occurring in the summer at 1-5 mg L⁻¹. Their work suggested that the spatial distribution of

sediment is not affected throughout the seasons, only the magnitude changes. The limitation of these predictions occurs in the methods of data collection. Satellite sensors can only characterize the sediment in the upper water column, and ground truthing methods in this study consisted of collecting surface water samples to compliment the satellite data. In order to calibrate sediment transport models and determine sediment budgets the suspended particulate matter (SPM) concentration must be determined throughout the entire water column.

The composition of bottom sediment throughout Minas Basin, including the Avon River, Cobequid Bay and Minas Passage, was extensively surveyed in 1979 (Long 1979). Long collected bottom sediment samples in an approximately 1-2 km spaced grid pattern throughout Minas Basin and characterized them for grain size and composition. Results from the grain size analysis revealed low concentrations of mud ($<63\ \mu\text{m}$), 0%-5% at most sampling locations throughout Minas Basin. Sand ($63\text{--}2000\ \mu\text{m}$) was the most abundant fraction; within the Avon River and Cobequid Bay areas the majority of samples contained 81%-100% sand. Cobble ($>2000\ \mu\text{m}$) varied in proportion throughout Minas Basin with the greatest concentrations of 66%-100% within Central Minas Basin and along the main axis of the Avon River. Gravel was the most abundant fraction in Minas Channel.

Little data collection on suspended and bottom sediments has occurred in Minas Basin since 1979. The focus of this technical report is to present the results of two field missions to the Minas Basin and surrounding area which aims to characterize water column properties and bottom sediment grain size. Summer sampling was conducted for 9 days from the Canadian Coast Guard Ship (C.C.G.S.) Hudson in June of 2013, and winter sampling was conducted for 5 days from the Dominion Victory in March of 2014. Measurements of temperature, salinity, and suspended particulate matter (SPM) from CTD casts, nutrient measurements from water samples and grain size data from bottom sediment samples are presented through a series of figures and tables. This data will be used to refine, build and validate hydrodynamic and sediment transport models for the Minas Basin system, with the goal to increase the predictive capacity of models to understand energy extraction related to tidal power.

METHODS

Study Site

Minas Basin is located at the head of the Bay of Fundy and protrudes into central Nova Scotia, Canada (Percy 2001). The Basin consists of 4 regions; Minas Channel, Central Minas Basin, the Southern Bight, and Cobequid Bay towards the east and innermost area of Minas basin (Fig. 1). Minas channel is located at the mouth of Minas Basin and is the inlet from the Bay of Fundy. It is 24 km wide and narrows to only 5 km at its easternmost point, called Minas Passage. The average depth through the channel at low tide is 25-50 m, but the central trench reaches 115 m in depth (Percy 2001). Minas Basin proper consists of the remaining three areas, which form an obtuse triangle, and is approximately 80 km long from Minas Passage to the tip of Cobequid Bay and approximately 29 km wide at the western edge down through the southern bight. Through the majority of Minas Basin proper the depth is less than 25

m at low tide, deepening toward the trough that protrudes from Minas Channel. The large tidal range of over 16 m causes the waterline to vary significantly through the tidal cycle. As the tide ebbs, sand and mud flats become exposed up to 5 km seaward, this intertidal zone comprises a third of Minas Basins' total area (Percy 2001). At the head of Cobequid Bay the Salmon and Shubenacadie rivers are the greatest input of fresh water, and in the Southern Bight the Kennetcook, St. Croix and Avon Rivers are dominant.

Water Sampling

Summer sample collection occurred June 5-14, 2013 from the C.C.G.S. Hudson (Hudson 2013-013 mission) and winter sampling occurred March 19-22, 2014 from the Dominion Victory (Dominion Victory 2014-901 mission). All timestamps were recorded in Greenwich Mean Time (GMT). Anchor station locations are shown in Figure 1b and listed in Table 1. Stations were occupied for approximately 13 hours to capture the entire tidal cycle. During the summer excursion all stations were occupied and stations ANC1, ANC3 and ANC4 were repeated on non-consecutive nights. During the winter excursion stations ANC1, ANC3 and ANC4 were occupied and ANC3 was repeated. During the anchor station sampling CTD casts were made approximately every two hours. Water samples were taken with 5 L Niskin bottles from a rosette attached to the CTD casts. Water was collected from 1 m, 5 m, 15 m below the surface and 1 m off the bottom. Water samples were subsampled for subsequent SPM concentration and nutrient measurements.

Water subsamples collected for SPM concentrations were processed using gravimetric measures (Winneberger *et al.* 1963; Sheldon 1972). A known volume of water was filtered through pre-weighed 8.0 μm 47 mm Millipore filters and then dried at less than 60°C for 24 hours. Concentrations of SPM were calculated in mg L^{-1} by dividing the sediment weight (initial filter weight subtracted from the sample laden filter weight) by the volume of water that was filtered.

Water samples collected at each depth during the summer and winter sampling periods were also subsampled for nutrient analysis. Subsamples were collected in duplicate in 100 mL vials and immediately frozen for preservation. Samples were analysed by the Nutrient Laboratory, Ocean Ecosystem Science Division of Department of Fisheries and Oceans Canada located at Bedford Institute of Oceanography (Dartmouth, NS). Samples were analyzed using colorimetric methods on a Seal Autoanalyzer III instrument according to standard nutrient methods. Nitrate and nitrite methods were adapted from Armstrong *et al.* (1967), phosphate analysis was adapted from Murphy and Riley (1962), silicate analysis adapted from Strickland and Parsons (1972), and ammonia analysis from Kerouel and Aminot (1997). Analysis of nitrate and nitrite phosphate, silicate and ammonia were reported in micromolar (μM) units.

A seabird SBE25 CTD (Fig. 2) was used to profile the entire water column throughout the tidal cycle, 13 hours, approximately every two hours. Suspended particulate matter concentrations were used to calibrate the OBS (Optical Back Scatter) data from CTD casts. Calibration was completed by plotting the OBS recorded turbidity (NTU) against the known concentration from SPM filter analysis (mg L^{-1}) (Fig.5). This regression was used to transform the OBS NTU data to mg L^{-1} . Profile plots of

temperature ($^{\circ}\text{C}$), salinity (PSU) and sediment concentration (mg L^{-1}) were made for each anchor station occupied. Data from the upward cast was used for these plots as a portion of the downward data was unusable near the surface, possibly due to bubbles on the sensors.

Current measurements were gathered using Teledyne RDI 300 kHz Sentinel ADCP moorings deployed at ANC2 and ANC3 for the duration of the summer 2013 sampling period. At ANC2 the ADCP was float mounted in a Streamlined Underwater Buoyancy System (SUBS) package with an acoustic release attached to a train wheel. At ANC3 the ADCP was deployed on a bottom mount frame with acoustic release. Both ADCP's were upward looking. Currents were plotted from bins with good data closest to the surface and bottom; ANC2 measurements from 8 m and 20 m above bottom, and ANC3 from 5 m and 15 m above bottom.

Bottom Sediments

Core samples were collected from C.C.G.S. Hudson (Fig. 4, Table 2) using a slow-corer (Bothner 1998; Law *et al.* 2008). The slow corer uses a hydraulically damped system and ~ 350 kg of weight to slowly drive a polycarbonate core barrel into the sediment. The slow rate of descent of the core barrel allows the sediment-water interface to remain intact. Upon recovery a poppet valve creates a seal on top of the core and a gasket spade plate swings into position once the core barrel clears the bottom to retain the sediment. Cores were subsampled into 2 cm layers for subsequent grain size analysis.

Bottom grab samples were collected during summer 2013 sampling period (Fig. 3). The small boat Packcat was lowered into the water from Hudson by crane for coastal shallow water operations (Fig. 4). Surficial sediment samples were collected with a Van Veen grab which is a 0.1 m^2 clam shell bucket. Each side of the bucket is attached to the end of a long lever and they are attached near the buckets like scissors. The sampler is set to trigger in an open position and is released when the sampler hits the bottom. Upon recovery the sampler closes, retaining a portion of sediment. Once on board the top 1 cm of the grab was sampled for subsequent grain size analysis from the top 1 cm across the top of the grab.

Grab samples were also collected using Video Grab (DFO 2007) from C.C.G.S Hudson during the 2013 sampling period in deeper water (Fig. 3). This sampler allows the operator to survey the sediment surface while collecting video and still images, and determine whether the location is suitable for grab sampling. The grab component is a 0.5 m^2 clam shell bucket that is electro-hydraulically triggered (DFO 2007). The video component views the bottom through the opened bucket showing 0.3 m^2 of the sea floor. Once a suitable site is located, the grab is lowered to collect a sample. As the bucket closes a retractable lid closes over the bucket to retain the sediment during recovery. Once on board a 250 mL pot of sediment was collected for subsequent grain size analysis.

Examination of video footage and still photos was completed via visual analysis, and included the reporting of relative proportions of various substrate types based on size class from the Wentworth scheme (Wentworth 1922) (Table 3). Two lasers mounted on the video grab, approximately 10 cm apart, projected onto the seafloor and were used to estimate the size of clasts observed in video footage collected. The Wentworth scheme was then used to classify substrate types into sand sized particles,

gravel, cobble, or boulder. For the purposes of this study, the term “gravel” will be used when referring to pebble and granule sized particles and the term “sand” includes very fine through coarse sands and mud. Particle roundness was also assessed using the methods of Wadell (1932) and Roussillon *et al.* (2009). This information, coupled with bathymetric data and seafloor imagery (Stewart 2009a, 2009b, 2009c), was used to create a regional map of spatially dominant substrate types. For characterization of video grab images the Minas Basin was divided into 4 geographic zones; Minas Channel, Minas Passage, Minas Basin east and Minas Basin west.

Sediment samples from cores, near shore grabs and video grabs were dried at 60°C in pre-weighed polystyrene weighing dishes. Once material was dry it was disaggregated using a mortar and pestle. A series of eight sieves were used to characterize the sediment distribution; 4 mm, 2 mm, 1 mm, 500 µm, 250 µm, 125 µm and 63 µm. Results are reported as the normalized weight percent for each sieve size. To compare grain size data with that collected in the initial Minas Basin study by Long (1979) sieve size classes were combined by weight to mud (<63µm), sand (63-2000 µm) and gravel (>2000 µm).

RESULTS

Station ANC1

Summer sampling at ANC1 took place over two tidal cycles; 7-8 June (Fig. 6) and 12-13 June 2013 (Fig. 7). For the first tidal cycle low tide occurred just before sampling began at 22:00 and high tide occurred mid-way through sampling at 04:00. Over the 12-13 June tidal cycle low tide occurred at 01:00 and high tide near the end of sampling at 07:15. Temperature varied from 9.3 °C to 11.8 °C with an average temperature of 10.2 °C for the two tidal cycles (Fig. 6a, 7a). Over the 7-8 June sampling, temperature was at its highest around low tide (22:47) with temperatures at the surface being higher than those at depth in the water column (Fig. 6a). As the tide flooded temperatures began to drop and were well mixed for samples taken around high tide (03:33, 05:00). As the tide began to ebb temperatures began to increase displaying a stratified water column once more with warmer water at the surface (06:14, 07:05). The second summer sampling period at ANC1 had a similar trend in temperature where the highest temperatures occurred around low tide (01:25) and then temperatures decreased to a well-mixed water column of lowest temperatures for the samples around high tide (06:28, 08:01) (Fig. 7a). Winter sampling at ANC1 took place from 21-22 March 2014 for one tidal cycle (Fig.8). High tide occurred at 20:30 and 8:30 during the sampling period, and low tide at 02:15. Temperature varied throughout the water column from -1.0 °C to -0.3 °C with an average temperature of -0.7 °C (Fig. 8a). Here there is a reverse in the tidal profiles compared to the summer sampling periods. In the winter the water column became more uniform as the tide ebbed, remaining well-mixed over a period of 4 hours (00:47-04:43), and temperatures increased as the tide flooded, with temperatures at depth slightly higher than at the surface. Figure 9 shows an image of the ice conditions present during the winter sampling period aboard Dominion Victory.

Summer ANC1 salinities ranged from 29.4 psu to 31.2 psu with an average of 30.6 psu (Fig. 6b, 7b) over the two sampling periods. Over both sampling periods, salinity increased as the tide flooded with salinities at depth greater than at the surface (Fig. 6b, 22:47, 00:10; Fig. 7b, 01:25, 02:50), and at high tide the water column was well mixed (Fig. 6b, 3:33, 05:00; Fig. 7b, 06:28, 08:01). During low tide, the ebb and flood profiles were stratified where surface waters had lower salinity than bottom waters. Winter sampling at ANC 1 had salinities range from 25.5 psu to 29.9 psu with an average of 28.1 psu (Fig. 8b). During winter profiles salinity also increased with the flooding tide and the profiles were stratified towards and at high tide with higher salinities at depth (06:46, 08:41). During the period around low tide (00:47-04:43) the water column was well mixed.

Summer profiles of SPM at ANC1 are plotted in Figures 6d and 7d. Suspended particulate matter concentration ranged from 2.3 mg L^{-1} to 6.7 mg L^{-1} with an average concentration of 3.2 mg L^{-1} . Profiles of SPM were most concentrated during low tide and decreased as the tide flooded with water from the outer Bay of Fundy. Individual profiles tended to have greater concentrations at depth in the water column (Fig. 6d, 00:10-07:05; Fig. 7d, 21:33-22:53, 04:15-08:01). During June 12-13 sampling (Fig. 7d) the three profiles taken around low tide (23:57-02:50) had a reversed trend, where SPM was greater at the surface compared to bottom waters. Winter profiles of SPM at ANC1 had much higher concentrations when compared to the summer profiles (Fig. 8d). Concentrations ranged from 18.0 mg L^{-1} to 73.6 mg L^{-1} with an average of 43.6 mg L^{-1} . Suspended particulate matter concentrations decreased as the tide flooded with some stratification in most profiles around high tide. At high tide when concentrations through the water column were lowest, concentrations at the surface were higher than at depth. Towards low tide the trend shifted to slightly higher concentrations at depth (00:47-04:43).

Nutrient samples collected from ANC1 in June 2013 are listed in Table 4. Nitrate ranged from $0.9 \text{ } \mu\text{M}$ to $2.5 \text{ } \mu\text{M}$ with an average of $1.7 \text{ } \mu\text{M}$ (Fig. 10a, 11a). Nitrite ranged from $0.1 \text{ } \mu\text{M}$ to $0.2 \text{ } \mu\text{M}$ with an average of $0.1 \text{ } \mu\text{M}$ (Fig. 10b, 11b). Phosphate ranged from $0.3 \text{ } \mu\text{M}$ to $0.6 \text{ } \mu\text{M}$ with an average of $0.5 \text{ } \mu\text{M}$ (Fig. 10c, 11c). Silicate ranged from $0.5 \text{ } \mu\text{M}$ to $1.5 \text{ } \mu\text{M}$ with an average of $1.0 \text{ } \mu\text{M}$ (Fig. 10d, 11d). Ammonia ranged from $0.7 \text{ } \mu\text{M}$ to $1.6 \text{ } \mu\text{M}$ with an average of $1.1 \text{ } \mu\text{M}$ (Fig. 10e, 11e). Nutrient samples collected from ANC1 in March 2014 are listed in Table 5. Nitrate ranged from $5.1 \text{ } \mu\text{M}$ to $11.5 \text{ } \mu\text{M}$ with an average of $9.4 \text{ } \mu\text{M}$ (Fig. 12a). Nitrite ranged from $0.3 \text{ } \mu\text{M}$ to $1.3 \text{ } \mu\text{M}$ with an average of $0.7 \text{ } \mu\text{M}$ (Fig. 12b). Phosphate ranged from $0.8 \text{ } \mu\text{M}$ to $4.9 \text{ } \mu\text{M}$ with an average of $1.5 \text{ } \mu\text{M}$ (Fig. 12c). Silicate ranged from $5.0 \text{ } \mu\text{M}$ to $13.9 \text{ } \mu\text{M}$ with an average of $10.1 \text{ } \mu\text{M}$ (Fig. 12d). Ammonia ranged from $1.0 \text{ } \mu\text{M}$ to $7.2 \text{ } \mu\text{M}$ with an average of $2.9 \text{ } \mu\text{M}$ (Fig. 12e).

Station ANC2

Current meter data collected from ANC2 during the summer 2013 sampling period are plotted in Figures 13-16. Top current speeds measured just below the surface were approximately 1.4 m s^{-1} during the flood tide and 1.75 m s^{-1} during the ebb (Fig. 13). Near bottom current speeds reached 1.3 m s^{-1} during the flood tide and 1.5 m s^{-1} during the ebb (Fig. 14). The tide moved in a tight tidal ellipse that oscillated in a north-west (ebb) to south-east (flood) direction (Fig. 15). The progressive vector plot reveals a particle would move, under constant tidal conditions, approximately 70 km west at the surface and approximately 40 km in a north north-westerly direction if released near bottom at ANC2 (Fig. 16).

Sampling at ANC2 took place in summer 2013 over one tidal cycle from 10-11 June (Fig. 17). Low tide occurred at 23:45 and high tide at 06:00 during the sampling period. Temperature ranged from 10.6 °C to 13.5 °C with average temperature of 12.3 °C (Fig. 17a). Temperatures increased towards low tide where they were well mixed from 22:25 to 02:59, and decreased as the tide flooded, becoming stratified with slightly higher temperatures at the surface compared to bottom waters.

Profiles of salinity at ANC2 are shown in Figure 17b. Salinities ranged from 27.0 psu to 30.4 psu with an average of 28.7 psu. Salinity increased with the flood tide (01:32-04:41) and decreased as the tide ebbed. Salinity profiles were generally well-mixed through the tidal cycle, and slightly stratified at high tide where surface waters were fresher than bottom waters.

Profiles of SPM at ANC2 are plotted in Figure 17d. Concentrations ranged from 4.4 mg L⁻¹ to 37.5 mg L⁻¹ with an average of 14.9 mg L⁻¹. Profiles were generally well mixed with concentrations decreasing as the tide flooded. An exception occurs at 1:32 as the tide started to flood. The profile is much more stratified, ranging from 15 mg L⁻¹ at the surface to over 35 mg L⁻¹ at depth, where other profiles at this station only varied by a few mg L⁻¹ throughout their profile.

Nutrient samples collected from ANC2 in June 2013 are listed in Table 4. Nitrate ranged from 1.1 µM to 3.5 µM with an average of 2.2 µM (Fig. 18a). Nitrite ranged from 0.1 µM to 0.5 µM with an average of 0.3 µM (Fig. 18b). Phosphate ranged from 0.4 µM to 0.9 µM with an average of 0.6 µM (Fig. 18c). Silicate ranged from 0.8 µM to 3.2 µM with an average of 1.6 µM (Fig. 18d). Ammonia ranged from 0.8 µM to 1.5 µM with an average of 1.0 µM (Fig. 18e).

Station ANC3

Current meter data collected from ANC3 during summer 2013 sampling period are plotted in Figures 19-22. Top current speeds measured below the surface were approximately 0.9 m s⁻¹ during the ebb tide and 1.2 m s⁻¹ during the flood tide (Fig. 19). Near bottom current speeds reached 0.6 m s⁻¹ during the ebb tide and 1 m s⁻¹ during the flood (Fig. 20). The tide moved in a tidal ellipse that oscillated in a roughly north (ebb tide) to south (flood tide) direction with westerly leanings as the tide ebbed (Fig. 21). The progressive vector plot of current residuals reveals a particle would move, under constant tidal conditions, approximately 80 km west at the surface and approximately 80 km in a south-west-west direction if released near bottom at ANC3 (Fig. 22).

Summer sampling at ANC3 took place over two tidal cycles from 6-7 June 2013 (Fig. 23) and 8-9 June 2013 (Fig. 24). For the first tidal cycle, high tide occurred at 03:00 and low tide occurred before and after sampling at 21:15 and 09:45. During the second tidal cycle, low tide occurred at 22:30 and high tide at 04:45. Temperatures ranged from 9.2 °C to 11.8 °C with an average temperature of 10.0 °C, over the two tidal cycles. On both days as the tide flooded temperatures decreased in a well-mixed pattern towards high tide (Fig. 23a, 00:24-03:06; Fig. 24a, 00:48-03:52). As the tide turned and began to ebb, temperatures increased again with profiles becoming more stratified; temperatures at the surface were greater than at depth by approximately 0.5 °C. An exception to this pattern occurred for one cast during the 8-9 June sampling series (Fig. 24a); one hour after low tide (23:27) the temperature profile was stratified with surface waters approximately 0.9 °C greater than at depth. Winter sampling at ANC3 also

took place over two tidal cycles on 19 March (Fig. 25a) and 20-21 March 2014 (Fig. 26a). On 19 March low tide occurred at 00:00 and high tide at 06:15. Sampling conducted 20-21 March saw low tide at 13:15 and 01:30, and high tide occurred at 19:30 and 07:45 during the 24 hour sampling period. Temperatures ranged from -0.8°C to 0.2°C with an average temperature of -0.2°C . Here the pattern of stratification is reversed from summer sampling profiles with highest temperatures seen during high tide. The stratified temperature profiles occur at low tide with a general trend of increasing temperatures towards high tide with a well-mixed water column. Around low tide stratified waters were characterized by warmer waters at depth (Fig. 25, 00:31, 10:53-12:49; Fig. 26a, 13:03, 01:46, 12:13).

Summer profiles of salinity at ANC3 ranged from 23.0 psu to 31.2 psu with an average of 30.8 psu. Salinity increased with the flooding tide on both sampling days at ANC3 (Fig. 23b; 24b). As the tide ebbed profiles were slightly stratified with less than 0.5 psu differences from surface to bottom waters. As the tide flooded, and at high tide the profiles became well mixed. An exception occurred on the second day of sampling at 23:27 (Fig. 24b). Here there was a distinct parcel of fresh water that entered the system at the surface. This may be explained by fluvial input from the Avon River. Winter profiles at ANC3 were measured in a wider range with lower salinities observed when compared to the summer months. Salinities ranged from 28.7 psu to 30.9 psu with an average of 30.2 psu (Fig. 25b; 26b). Winter salinity profiles were more stratified than summer profiles with up to 1 psu difference between surface and bottom waters, although at high tide profiles were well-mixed for both days. During the winter salinities were greatest at high tide and decreased as the tide ebbed. During the ebb tide of 19 March at 08:35 (Fig. 25b), there was a pronounced decrease in salinity at the surface. This coincided with a decrease in temperatures at the surface (Fig. 25a).

Summer profiles of SPM at ANC3 ranged from 2.4 mg L^{-1} to 5 mg L^{-1} with an average of 3.2 mg L^{-1} (Fig. 23d; 24d). There was no clear variation in concentration through the tidal cycle although each individual profile was irregular through the water column. Winter profiles at ANC3 ranged from 6.9 mg L^{-1} to 27.5 mg L^{-1} with an average of 12.6 mg L^{-1} (Fig. 25d; 26d). Winter profiles had a clear advancement with the tide. As the tide flooded and at high tide, concentrations decreased and the profiles had a well-mixed shape. Towards low tide, concentrations increased and the profiles became more stratified top to bottom. Interestingly, on each day of sampling at this station casts done approximately 15 hours apart had similar profiles towards low tide (Fig. 25d, 02:46 and 14:55; Fig. 26d, 13:30 and 01:46, 15:16 and 03:42, 17:16 and 05:39, 23:53 and 12:13).

Nutrient samples collected from ANC3 in June 2013 are listed in Table 4. Nitrate ranged from $0.6\text{ }\mu\text{M}$ to $2.1\text{ }\mu\text{M}$ with an average of $1.4\text{ }\mu\text{M}$ (Fig. 27a, 28a). Nitrite ranged from $0.1\text{ }\mu\text{M}$ to $0.2\text{ }\mu\text{M}$ with an average of $0.1\text{ }\mu\text{M}$ (Fig. 27b, 28b). Phosphate ranged from $0.3\text{ }\mu\text{M}$ to $0.6\text{ }\mu\text{M}$ with an average of $0.4\text{ }\mu\text{M}$ (Fig. 27c, 28c). Silicate ranged from $0.5\text{ }\mu\text{M}$ to $2.4\text{ }\mu\text{M}$ with an average of $0.9\text{ }\mu\text{M}$ (Fig. 27d, 28d). Ammonia ranged from $0.5\text{ }\mu\text{M}$ to $1.7\text{ }\mu\text{M}$ with an average of $1.1\text{ }\mu\text{M}$ (Fig. 27e, 28e). Nutrient samples collected from ANC3 in March 2014 are listed in Table 5. Nitrate ranged from $4.1\text{ }\mu\text{M}$ to $10.2\text{ }\mu\text{M}$ with an average of $7.6\text{ }\mu\text{M}$ (Fig. 29a, 30a). Nitrite ranged from $0.2\text{ }\mu\text{M}$ to $0.5\text{ }\mu\text{M}$ with an average of $0.3\text{ }\mu\text{M}$ (Fig. 29b, 30b). Phosphate ranged from $0.6\text{ }\mu\text{M}$ to $1.2\text{ }\mu\text{M}$ with an average of $0.9\text{ }\mu\text{M}$ (Fig. 29c, 30c). Silicate ranged from $3.6\text{ }\mu\text{M}$ to $9.6\text{ }\mu\text{M}$ with an average of $6.6\text{ }\mu\text{M}$ (Fig. 29d, 30d). Ammonia ranged from $0.7\text{ }\mu\text{M}$ to $2.3\text{ }\mu\text{M}$ with an average of $1.1\text{ }\mu\text{M}$ (Fig. 29e, 30e).

Station ANC4

Summer sampling at ANC4 took place over two tidal cycles, on 10 June (Fig. 31) and 11-12 June 2013 (Fig. 32). During 10 June sampling high tide occurred at 05:15. During 11-12 tidal cycle low tide occurred at 00:30 and high tide at 06:30. Temperatures ranged from 12.6°C to 14.4°C with an average temperature of 13.7°C (Fig. 31a; 32a). Profile patterns through the tidal cycle were similar for each day sampled. Most profiles were well mixed through the tidal cycle where waters became warmer as the tide ebbed. Surface waters showed stratification for a couple of profiles on each day while the tide ebbed (Fig. 31a, 01:29, 07:23; Fig. 32a, 21:43). As the tide flooded temperatures decreased with lowest temperatures observed around high tide. Winter sampling at ANC4 took place from 19-20 March 2014 where low tide occurred at 00:45 and high tide at 07:00. Temperatures ranged from -1.3°C to -1.0°C with an average temperature of -1.2°C (Fig. 33). Although temperatures didn't vary greatly throughout the tidal cycle, less than 0.3°C, individual casts were stratified through the water column (Fig. 33a, 18:59, 21:14, 01:44) with surface waters warmer than at depth. The general trend was a decrease in temperature as the tide flooded.

Summer profiles of salinity at ANC4 ranged from 23.6 psu to 28.1 psu with an average of 26.3 psu (Fig. 31b; 32b). Profiles were generally well mixed with salinities increasing with the flood tide. There was a slight freshening of the surface waters around low tide (Fig. 31b, 00:08, 01:29; Fig. 32b, 23:45, 01:27). Winter salinities (Fig. 33b) ranged from 21.4 psu to 27.3 psu with an average of 25.6 psu. Salinity decreased as the tide ebbed and then increased again when the tide flooded. All profiles were well-mixed except at the lowest water sampled (01:44), one hour after low tide, where salinity at the surface was approximately 2 psu lower than at the bottom. This coincided with increased temperatures (Fig. 33a, 01:44) at the surface.

Summer profiles of SPM at ANC4 ranged from 13.2 mg L⁻¹ to 195.4 mg L⁻¹ with an average of 67.8 mg L⁻¹ (Fig. 31d; 32d). Profiles tended to increase in concentration and became more stratified as the tide ebbed with greater concentrations at depth. At high tide the water column was well-mixed on each sampling day. Noteworthy, is a similar profile from each day that was collected just after low tide (Fig. 31d, 03:18; Fig. 32d, 01:27). The difference in concentration from surface to bottom was greatest at this time and shows a bottom layer where concentrations were constant. Winter profiles of SPM at ANC4 (Fig. 33d) ranged from 61.0 mg L⁻¹ to 186.7 mg L⁻¹ with an average of 102.4 mg L⁻¹. SPM in the water also increased as the tide ebbed, although most profiles were well mixed. An exception occurred at 01:44, the lowest point of the tide sampled, which was stratified. Concentrations at the surface started at approximately 12 mg L⁻¹ and increased to 186 mg L⁻¹ just 5 m below the surface and remained constant to the bottom. This profile resembles those collected in the summer months at the same point in the tide, just after low water (Fig. 31d, 03:18; Fig. 32d, 01:27).

Nutrient samples collected from ANC4 in June 2013 are listed in Table 4. Nitrate ranged from 2.5 µM to 8.5 µM with an average of 4.8 µM (Fig. 34a, 35a). Nitrite ranged from 0.2 µM to 1.9 µM with an average of 0.8 µM (Fig. 34b, 35b). Phosphate ranged from 0.6 µM to 4.7 µM with an average of 1.5 µM (Fig. 34c, 35c). Silicate ranged from 1.6 µM to 12.3 µM with an average of 5.5 µM (Fig. 34d, 35d). Ammonia ranged from 1.1 µM to 2.1 µM with an average of 1.3 µM (Fig. 34e, 35e). Nutrient samples

collected from ANC4 in March 2014 are listed in Table 5. Nitrate ranged from 5.8 μM to 12.2 μM with an average of 10.4 μM (Fig. 36a). Nitrite ranged from 0.8 μM to 4.5 μM with an average of 2.0 μM (Fig. 36b). Phosphate ranged from 1.2 μM to 4.9 μM with an average of 2.7 μM (Fig. 36c). Silicate ranged from 6.7 μM to 18.1 μM with an average of 13.7 μM (Fig. 36d). Ammonia ranged from 1.9 μM to 5.1 μM with an average of 3.2 μM (Fig. 36e).

Station ANC5

Sampling at ANC5 took place over one tidal cycle on 5 June 2013 (Fig. 37). High tide occurred at 01:30, just before sampling began (01:41). Temperatures ranged from 7.3°C to 7.9°C with an average temperature of 7.5°C (Fig. 37a). As the tide ebbed temperatures increased, where warmest temperatures occurred at the lowest water sampled. Around high tide (01:41) and the sampling after (03:44), the middle portion of the water column (15-50 m) had slightly warmer temperatures than at depth and at the surface. As the tide continued to ebb profiles became more stratified top to bottom with warmer waters at the surface (05:20, 06:38).

Salinities at ANC5 ranged from 31.5 psu to 31.7 psu with an average of 31.6 psu (Fig. 37b). Salinity was highest in the profile sampled near high tide, at 01:41. As the tide ebbed profiles became fresher and more stratified with bottom waters more saline than those at the surface (03:44-06:38). There was also a distinct shift in salinity between 15-50 m depth, as there was in temperature, for the profile sampled at 01:41. This band of fresher water became less prevalent as the tide ebbed.

Summer profiles of SPM at ANC5 are plotted in Figure 37d. Suspended particulate matter concentrations ranged from 2.0 mg L^{-1} to 4.6 mg L^{-1} with an average 2.7 mg L^{-1} . Concentrations increased as the tide ebbed with the highest concentrations sampled at 06:38, an hour and a half before lowest water (08:00). Individual profiles were stratified with bottom waters more concentrated than those at the surface, and each profile appeared noisy with measurements oscillating by approximately 0.25 mg L^{-1} down the water column.

Nutrient samples collected from ANC5 in June 2013 are listed in Table 4. Nitrate ranged from 1.6 μM to 3.6 μM with an average of 2.7 μM (Fig. 38a). Nitrite ranged from 0.1 μM to 0.1 μM with an average of 0.1 μM (Fig. 38b). Phosphate ranged from 0.5 μM to 0.6 μM with an average of 0.6 μM (Fig. 38c). Silicate ranged from 1.1 μM to 1.7 μM with an average of 1.5 μM (Fig. 38d). Ammonia ranged from 1.7 μM to 2.2 μM with an average of 2.0 μM (Fig. 38e).

Station SC4

Sampling at SC4 took place over one tidal cycle from 13-14 June 2013. Low tide occurred at 01:45 and high tide at 08:00 during the tidal cycle. Temperatures ranged from 8.4°C to 9.5°C with an average temperature of 9.1°C (Fig. 39a). At SC4 as the tide ebbed there was an increase in temperature where greatest temperatures occurred around low tide (01:16). Around high tide the profiles were stratified with temperatures at the surface greater than at depth (21:43-22:56, 05:07-08:20).

Salinity profiles at SC4 are plotted in Figure 39b. Salinities ranged from 31.1 psu to 31.5 psu with an average of 31.3 psu. Salinities generally decreased with the ebbing tide and profiles were well-mixed around low tide (23:57-04:00). Around high tide, which occurred at 19:45 and 8:00, profiles were stratified where surface waters were fresher than at depth. The difference between surface and bottom waters was approximately 0.1 psu at 22:59 and 06:12, and differed by approximately 0.2 psu at 21:43 and 05:07.

Summer profiles of SPM at SC4 are plotted in Figure 39d. Concentrations ranged from 2.5 mg L⁻¹ to 3.5 mg L⁻¹ with an average of 3.1 mg L⁻¹. Because of the variation within each profile over such a small range of values the general progression of the tide is not as clearly defined. Some casts have a slightly stratified shape where concentrations at the bottom were greater than at the surface (21:43, 05:07) but the majority of profiles were well-mixed despite the minute variation throughout the water column (01:16, 06:12, 08:20).

Nutrient samples collected from SC4 in June 2013 are listed in Table 4. Nitrate ranged from 0.3 µM to 3.6 µM with an average of 1.9 µM (Fig. 40a). Nitrite ranged from 0.1 µM to 0.4 µM with an average of 0.2 µM (Fig. 40b). Phosphate ranged from 0.5 µM to 1.2 µM with an average of 0.6 µM (Fig. 40c). Silicate ranged from 1.1 µM to 1.9 µM with an average of 1.6 µM (Fig. 40d). Ammonia ranged from 1.2 µM to 2.0 µM with an average of 1.5 µM (Fig. 40e).

Grain Size

Bottom sediment was collected and analysed for grain size throughout Minas Basin, including shallower intertidal areas, during the summer Hudson 2013-013 excursion (Fig. 4). Sediment grain size data is expressed as percent weight of the total sample for the eight sieve size classes. Grain size data from near shore grabs are listed in Table 6, slow-core data is listed in Table 7, and video grab grain size data is listed in Table 8. Sediment samples from deeper water locations were collected from C.C.G.S. Hudson, and samples from shallower water locations were collected from the small boat Packcat.

Grain size data from the Hudson 2013-013 cruise was compared to the Long (1979) grain size data for changes in sediment composition. Figures 41-43 show percent composition of mud (<63 µm), sand (63-2000 µm) and gravel (>2000 µm) (Long 1979). The Long 1979 study revealed a low percentage of mud throughout Minas Basin with most stations comprising between 0-5 %. Samples with higher proportions of mud occurred in the intertidal zone along the coast of Cobequid Bay and into the Southern Bight, towards the Avon River, and a few stations within Central Minas Basin. The composition of sand (Fig. 42) was most concentrated within Cobequid Bay and the Southern Bight where most samples were composed of 81-100% sand. Within Central Minas Basin the sand content was quite variable. In Cobequid Bay, the Southern Bight and along the coast in the intertidal zones, the sand content tends to be higher than in central Minas Basin and Minas Passage. Gravel (Fig. 43) was most prevalent in central Minas Basin and Minas Passage, as well as through the central channel of the Southern Bight towards the Avon River.

Plots of the analysis of samples collected during the Hudson 2013-013 cruise for mud ($<63\ \mu\text{m}$), sand ($63\text{-}2000\ \mu\text{m}$) and gravel ($>2000\ \mu\text{m}$) are shown in Figures 44, 45, and 46 respectfully. Kingsport tidal-flat complex area of study is shown as an area of greater resolution because of the abundance of samples concentrated there. The proportion of mud in samples collected in 2013 is much more uniform throughout Minas Basin compared to the plots from 1979 data, ranging from 0-5 % at most stations and increasing to 6-25 % at a few locations along the coast. In the Kingsport area samples varied more than those in central Minas Basin with samples composed of up to 41-65 % mud. The proportion of sand (Fig. 45) in samples from this study is also high with the majority of samples composed of 66-100 % sand, as did all of the samples collected from Kingsport marsh. The proportion of gravel (Fig. 46) in samples from 2013 is greatest in central Minas Basin with most samples composed of $> 66\%$. Towards the coast line and upstream in Cobequid Bay and the Southern Bight the proportion of gravel decreased. On Kingsport flat the proportion of gravel was mostly 0-5 % and increased to 6-25 % in a few samples.

The change in grain size composition between the initial study by Long (1979) to the Hudson 2013-013 cruise is illustrated in Figure 47. Negative change is depicted in yellow for each plot and increases are shown in brown (A. mud), orange (B. sand) and grey (C. gravel). Plots of both mud and sand show a general increase in the proportions of these components throughout Minas Basin, and as should be expected there is a corresponding decrease in the proportion of gravel. The greatest increase in the mud fraction is localized in the Southern Bight towards the Avon River, where sand also tended to increase. Sand was also seen to increase in proportion in central Minas Basin, however towards the mouth of Minas Passage sand decreased. These samples at the mouth of Minas Passage mostly saw a large increase in gravel, and a slight increase in mud proportions.

Video Grabs

Analysis of video grab footage was completed as part of the B.Sc. thesis of K. Morrison (2014) at Acadia University. The Basin was divided into a four zones analysis for video and still images from video grab; 1- Minas Channel, 2- Minas Passage, 3- Minas Basin west and 4- Minas Basin east (Fig. 48). Locations sampled with video grab are shown in Figure 3. A total of 21 grab samples, 91 videos, and 1022 still photos from the June 2013, Hudson 2013-013 cruise were included in the examination of geological and biological features. Seafloor substrate was variable within the Minas Basin, Minas Passage, and Minas Channel. The most commonly occurring size class of loose seafloor substrate was gravel, typically falling between 1.0 cm and 6.5 cm. Sand was common in Scots Bay (Minas Channel), Cobequid Bay, and outer Minas Channel. Boulders and scoured bedrock were typical of the Minas Passage. Clasts observed were subrounded to rounded, as expected from the strong tidal influence in the region (Wadell 1932; Svenson *et al.* 2009).

In the eastern Minas Basin (Fig. 48, zone 4), 52 % of sediment observed was classified as fine gravel (Fig. 49). The next largest component was sand, accounting for 40 % of any given field of view in video and photo footage, with the remainder of substrate being cobble (8 %). Two boulders were observed in this zone. Sand dominated the substrate at stations further east into Cobequid Bay (Fig. 49,

50d, 51). Zone three (Fig. 48), the central/western Minas Basin and the shallower regions near to the Avon river estuary, infrequently featured boulders (three instances) in video and still footage, and on average, contained 52 % gravel (Fig. 49). Sand and cobble accounted for 27 % and 21 % of the surficial substrates, respectively (Fig. 49, 51). The Minas Passage (Fig. 48, zone 2) was the most unique zone in terms of seafloor substrate. Video footage revealed that more than half of the bottom substrate within this zone featured boulders and exposed bedrock (21 % and 40 %, respectively) (Fig. 49). Amongst boulder fields and ridges of scoured bedrock, loose surficial material was observed, comprising the remaining 39 % of sediment observed (Fig. 50b, 51). Scoured bedrock regions are volcanic in origin, found amongst sedimentary bedrock covered or partially covered with boulder, cobble, and other loose clasts. Within Minas Channel (Fig. 48, zone 1), sand was the most prominent substrate type (42 %) and dominated the seafloor of Scots Bay. Elsewhere in Minas Channel, gravel (43 %) and cobbles (15 %) were common (Fig. 49, 50a, 51). Relative proportion of substrate types at sampling stations was assessed and polygons linking areas with similar percentages of substrate types, and the same dominant substrate type, were connected using polygons in ArcGIS (Fig. 51). In areas where sampling stations were widely spaced, available bathymetric data was used to fill in knowledge gaps.

DISCUSSION

The macro tidal range, average current of 1.5 m s^{-1} (Fig.13-14; 19-20), and minimal fresh water inputs to Minas Basin have led to the assumption that Minas Basin is generally well-mixed (Dryer 2001; Greenberg 1984). And though this stands true around high tide, during the ebb and flood of the tide profiles of salinity and temperature are more indicative of a partially mixed estuary. In June warm fresh waters were replaced by cold saline waters from the outer Bay of Fundy as the tide flooded as was seen at stations ANC1 (Fig. 6; 7), ANC2 (Fig. 17) and ANC3 (Fig. 23; 24). In Cobequid Bay, station ANC4 (Fig. 31; 32), waters were warmer and fresher than the central Minas Basin stations, and had profiles that more closely resembled a well-mixed estuary throughout the tidal cycle. The shallower waters in Cobequid bay would allow for greater turbulent mixing through the water column and a greater influence of fresh waters from the Salmon and Shubenacadie Rivers, which are located at the head of Cobequid Bay (Daborn and Pennachetti 1979).

Winter sampling concentrated in central Minas Basin ANC1 (Fig. 8) and the Southern Bight ANC3 (Fig. 25; 26), revealed a general trend of cold fresh water at low tide that was replaced with warmer salt water as the tide flooded. Profiles from Cobequid Bay, station ANC4 (Fig. 33) showed a reverse trend of temperature with warmer fresh water at low tide replaced with colder more saline water as the tide flooded. Stratification was much more variable throughout the tidal cycle during winter sampling. At ANC1 (Fig. 8) profiles of salinity and temperature were well-mixed around low tide and were stratified around high tide. At ANC3 (Fig. 25; 26), located near the mouth of the Southern Bight, well-mixed profiles occurred at high tide, and became stratified as the tide ebbed with colder fresher water at the surface. Cold fresh water sourced from the Avon, St. Croix and Kennetcook Rivers, which are the largest fresh water inputs to the southern bight, would contribute to this trend in the winter. Another contributing factor to the much colder and fresher waters during winter months could be the

abundance of ice that was often seen floating through the system (Gordon and Desplanque 1983). During the 2014 sampling period ice was observed during the ebb of every tide in the form of drift ice and dislodged shorefast ice from tidal rivers, mudflats and channels (Fig. 9).

Profiles of suspended sediment collected in June 2013 depicted stratified water column with greater concentrations near bottom at all six anchor stations, with a general trend of increasing concentrations as the tides ebbed. The difference in concentration from surface to bottom waters was large, in some cases reaching 150 mg L^{-1} (Fig. 31d). The abundance of particles observed near bottom in the Minas Basin leads to a greater occurrence of flocculation, the aggregation of suspended single grains into larger floc particles (Kranck 1980; Kranck and Milligan 1991). Flocculation occurs at low and high slack tide when velocities approach zero (Fig. 13-14; 19-20). As large particles settle out of suspension at a greater rate than smaller particles, according to Stokes law, this would lead to increased deposition (Law *et al.* 2013; O’Laughlin *et al.* 2014). Walker *et al.* (1981) also observed variable but high SPM concentrations during the ebb and flood of the tide with considerably lower concentrations during high and low slack. Mulligan *et al.* (2013) created a model to test the effects of changing hydrodynamics in the Minas Basin system as a result of potential tidal power instalments. They found a potential for 71% decrease in suspended sediment concentration from near-maximum tidal power extraction in Minas Passage. This would lead to increased deposition of sediment on tidal flats and in channels of the Southern Bight and Cobequid Bay.

Winter profiles of SPM from ANC1 (Fig. 8d) and ANC3 (Fig. 25d; 26d) show an increase by an order of magnitude throughout the tidal cycle when compared to summer months. At ANC4 in Cobequid Bay there was less variation in SPM between summer and winter profiles. In these shallower waters wave mixing, turbulence and biological activities have a great effect on the turbidity of the water column (Amos and Long 1980; Greenberg and Amos 1983). There is also a physical sill stretching across the mouth of Cobequid bay which may constrain sediment from being transported out into central Minas Basin. Tao *et al.* (2014) observed an order of magnitude increase in SPM values, derived from MERIS satellite images, throughout Minas Basin when comparing summer (July-August) to late winter (February-March). They found the greatest annual variation occurred in central areas of Minas Basin where water depths were greatest, and less variation in the shallows.

Bottom sediments collected throughout Minas Basin in 2013 show some change in proportion of mud, sand and gravel when compared to samples collected by Long (1979). It appears that the top 2 cm layer of sediments collected for this study was finer than what was reported by Long (Fig. 47) in most areas of Minas Basin. The area at the mouth of Minas Passage is the only location where the proportion of gravel increased substantially. This is due to the removal of finer materials by high tidal current speeds through the Minas Passage (Amos and Long 1980; Greenberg and Amos 1983). In Minas proper sediment became sandier and in the Southern Bight mud and sand increased. These areas have on average lower current speeds ($\sim 1 \text{ m s}^{-1}$) that allow the finer sediment fractions to settle out of suspension and be deposited on mud flats. Differences observe over the 35 year period may also be attributed to sediment grab techniques, and the depth to which the sediment sample was collected. During this study the top 0-2 cm of sediment was reserved for grain size analysis. If during the Long

(1979) study a deeper portion of the sediment was collected, proportionally coarser sediment may have been the result.

Extensive mud flats comprise a third of the total area of the Minas Basin, half of which are located in Cobequid Bay and the rest throughout the Southern Bight and Minas proper (Percy 2001). These flats become exposed twice daily which allows the sediment to be warmed by the sun's rays. A transfer of thermal energy to incoming tidal waters then occurs. Daborn and Pennachetti (1979) observed noticeably warmer waters as the tide flooded in later afternoon when compared to a flooding tide overnight or early in the morning. The intertidal mud flats are also a large source of suspended sediment as the tide ebbs. Daborn and Pennachetti (1979) observed a strong gradient of SPM from the mouth of the Cornwallis River in the Southern Bight at 100 mg L^{-1} to the centre of Minas proper at 10 mg L^{-1} .

Geological and biological elements observed in video grab samples taken in Minas Channel, Minas Passage, and Minas Basin were similar to prior observations (Amos and Long 1980; Brylinsky 2008; Stewart 2009a, 2009b, 2009c). Not surprisingly, success in grab sampling in Minas Passage was low due to the high flow regime and lack of abundant loose surficial sediment. Differences in grain size between the four geographic zones can be attributed to the hydrodynamics of each zone, with smaller particles accumulating in areas of lower energy (Svenson *et al.* 2009). Regions of high current velocities often have little loose, fine grained material and are generally devoid of clasts small enough to be carried away with each tidal cycle. Sand and gravel were present in Scots Bay, the southern portion of the Minas Passage and the inner Minas Basin. Accumulation of fine sediments in the southern Minas Passage is likely the result of a large eddy that forms on the flood tide along the Blomidon Peninsula (Karsten *et al.* 2008) and the general clockwise flow of currents in the Southern Bight.

Nutrients collected during summer and winter were variable throughout the water column at most stations sampled with no clear progression with the progressing tide. An exception was seen in Cobequid Bay, ANC4 (Fig. 34-36), in June and March. Here samples clearly became more concentrated with the ebbing tide, and though most profiles were stratified, there was no overall pattern to the stratification. This clearly defined tidal signal in Cobequid bay can be attributed to the shallow waters, and extensive mud flats. Between seasons an order of magnitude difference was observed in nitrate and silicate concentrations (Fig. 10-12; 27-30; 34-36). Petrie and Yeats (2000) also observed seasonal differences in nitrate and silicate in the Scotian Shelf-Gulf of Maine region. Their study observed nitrate and silicate concentrations that increased in fall through winter (max $\sim 11 \text{ } \mu\text{M}$), followed by rapid decrease in late winter coinciding with the spring bloom, and remained low ($\sim 3 \text{ } \mu\text{M}$) throughout the spring and summer. Petrie and Yeats (2000) also observed phosphate levels in the region and found no significant difference between seasons as was observed in this study.

This study was conducted to provide a 2013-2014 baseline of the physical environment, water column and seabed sediment, in the Minas Basin and area to assist the validity of predictive models concerning tidal power extraction in Minas Passage. A numerical model created by Wu *et al.* (2011) focused on the tidally controlled transport patterns of sediment in Minas Basin. The model looked at

bed load component from modeled shear stress and observed bottom grain size data, and suspended sediment component from modeled current velocities and remote imaging of suspended sediment surface concentrations. Their results revealed a general transport of bed load towards the centre of Minas Basin from the eastern shore and westward from Minas Channel and Passage. In Cobequid Bay bed load was transported eastward to the head of The Bay. Suspended sediment transport was shown to follow the tidal currents, generally transporting eastward during the flood tide and westward during the ebb. Two eddies are also apparent; one moving clockwise near the mouth of the southern bight, and another that moves anti-clockwise in Scots Bay located in the south-eastern portion of Minas Channel. The authors then used their model to examine the effect that tidal power extraction would have on hydrodynamics and sediment dynamics (Wu *et al.* 2016). Their results indicate that there would be increased erosion of the bed in the Minas Passage, and greater deposition of sand in the Southern Bight. Suspended sediment concentrations followed a similar pattern to bed load showing decreased transport from Minas Channel into Central Minas Basin, and increased concentrations in the Southern Bight with a total transport of $2690 \text{ m}^3 \text{ y}^{-1}$ of sediment to the area. The modelling study of Ashall *et al.* (2016) using the ADCP current and waves, and suspended sediment data from this study also predicted deposition in the Southern Bight and Cobequid Bay due to decreases in SPM but were dependant on the total energy extracted from the system.

SUMMARY

Sample collection was conducted in the Minas Basin in the summer of 2013 and the winter of 2014 to determine spatial and temporal characteristics of water column and seabed sediment samples. Profiles of the water column were collected by CTD casts throughout the water column at six locations throughout Minas Basin and Minas Channel. Profiles revealed that the water column throughout Minas Basin is not always well mixed. During the summer sampling, temperature ranged from 7.25°C to 14.4°C , salinity from 23.57 psu to 31.67 psu and SPM concentrations from 1.54 mg L^{-1} to 192.67 mg L^{-1} . Winter CTD casts revealed temperatures from -1.25°C to 0.18°C , salinities from 21.39 psu to 30.88 psu and SPM from 6.91 mg L^{-1} to 186.71 mg L^{-1} . There was an order of magnitude difference in SPM concentration measured throughout Minas Basin from summer to winter, and stratification was seen in both seasons with higher concentrations of SPM near the bottom. Cobequid Bay however had similar suspended sediment measured in summer and winter. A physical sill at the mouth of Cobequid Bay likely constrains suspended sediment from being transported into central Minas Basin and maintains high SPM concentration over seasons. Bottom sediment samples collected in June 2013 were compared with the results from Long's (1979) grain size study of Minas Basin and show a different pattern. The top 2 cm of bottom sediment was finer than Long (1979) reported, as there was a general increase in the proportion of mud and sand throughout Minas Basin and a corresponding decrease in the proportion of gravel. Future work should focus on determining the processes that contribute to the patterns of suspended and bottom sediment distributions. Analysing water column grain size and flocculation dynamics from tripod data collected during Hudson 2013-13 and Dominion Victory 2014-901 missions will add to our understanding of the Minas Basin system. This data set will be required for the calibration of

hydrographic and sediment transport models. With the development of more accurate models and better predictive capabilities of the Minas Basin system, more confidence can be placed in future plans for tidal power energy extraction.

ACKNOWLEDGEMENTS

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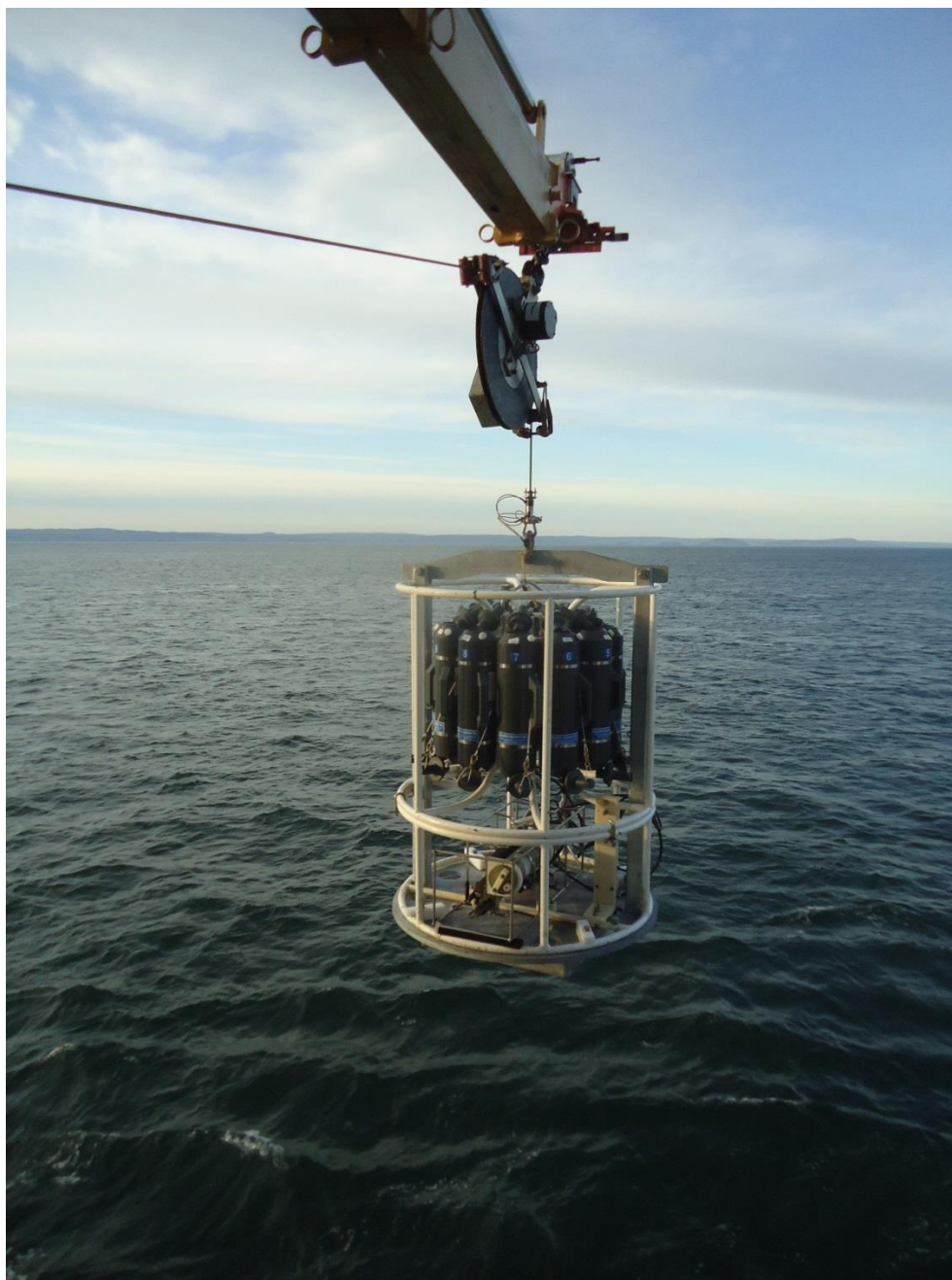


Figure 2. Seabird SBE25 CTD with rosette used to profile the water column every 2 hours throughout the tidal cycle. Additional weights were added to the bottom of the CTD to encourage a vertical decent to the bottom through the high velocity currents in the Minas Basin.

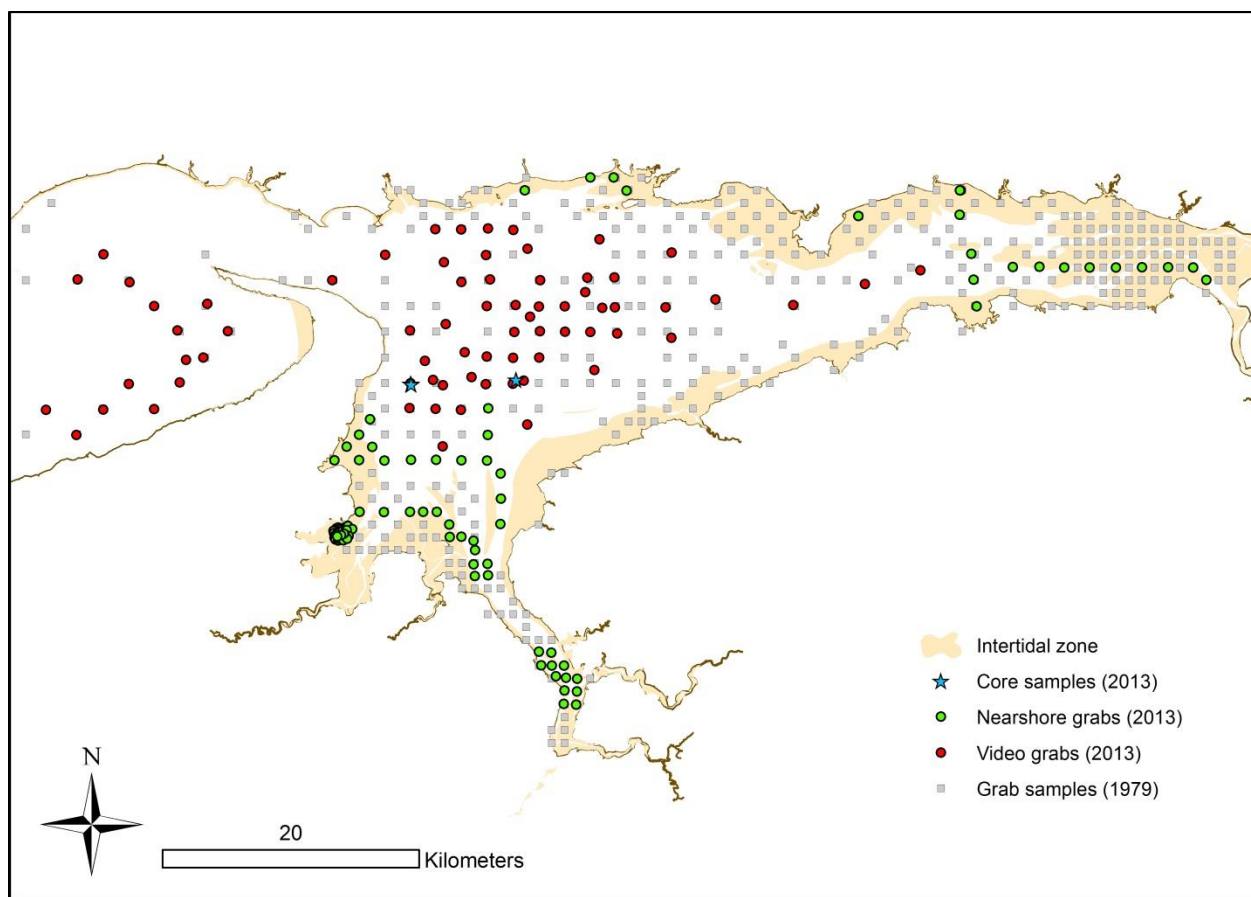


Figure 3. Grab station locations throughout Minas Basin during Hudson 2013-013 cruise. Locations sampled by Long (1979) are also depicted.



Figure 4. The small boat Packcat was lowered into the water from C.C.G.S. Hudson by crane for coastal shallow water operations.

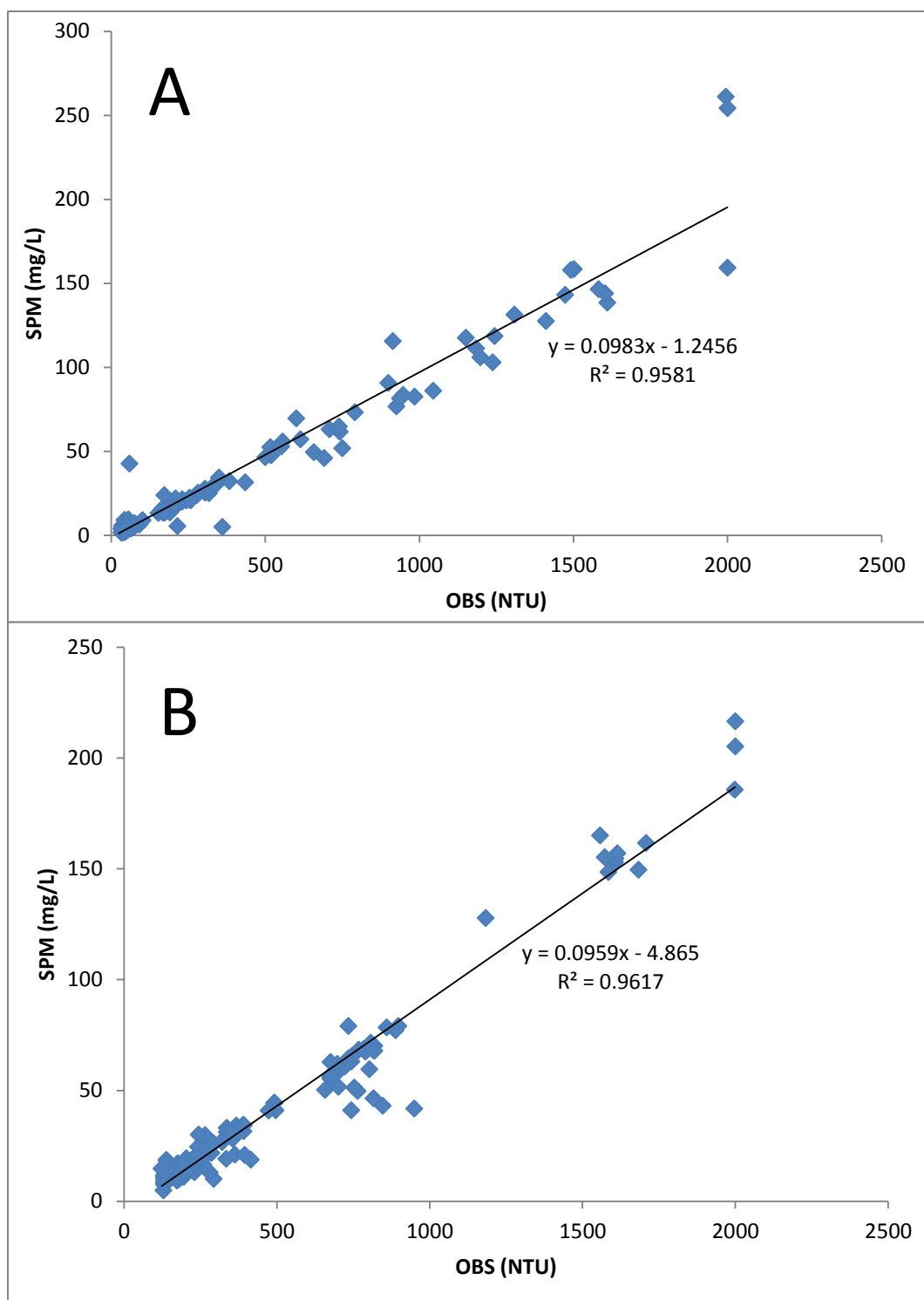


Figure 5. Linear regression of SPM (mg L^{-1}) from bottle casts and OBS data recorded by CTD cast. Panel A data is from Hudson 2013-013 sampling period and panel B from Dominion Victory 2014-901.

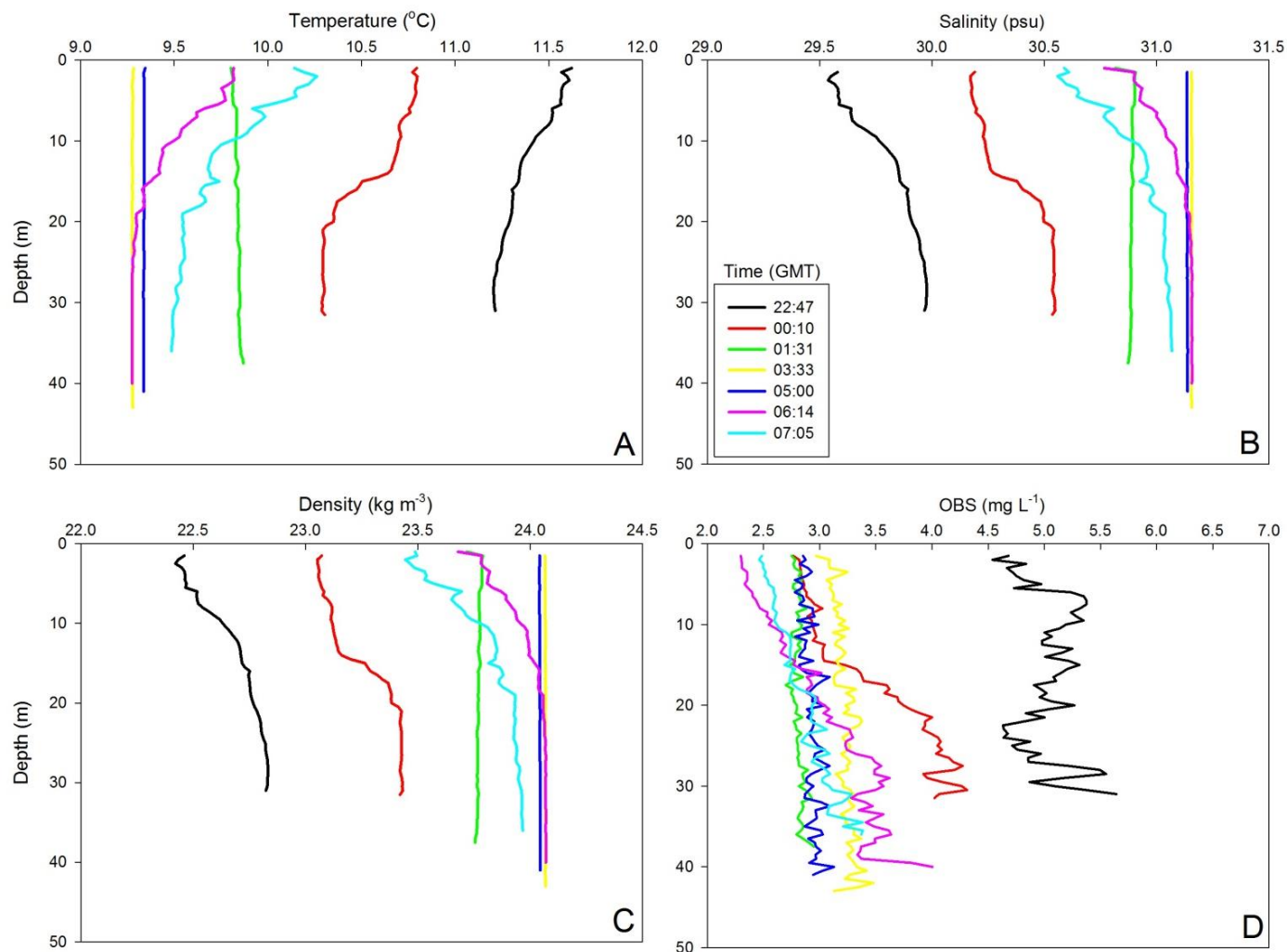


Figure 6. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC1 summer sampling collected 7-8 June 2013. Low tide occurred at 22:00 GMT and high tide at 4:00 GMT during the sampling period.

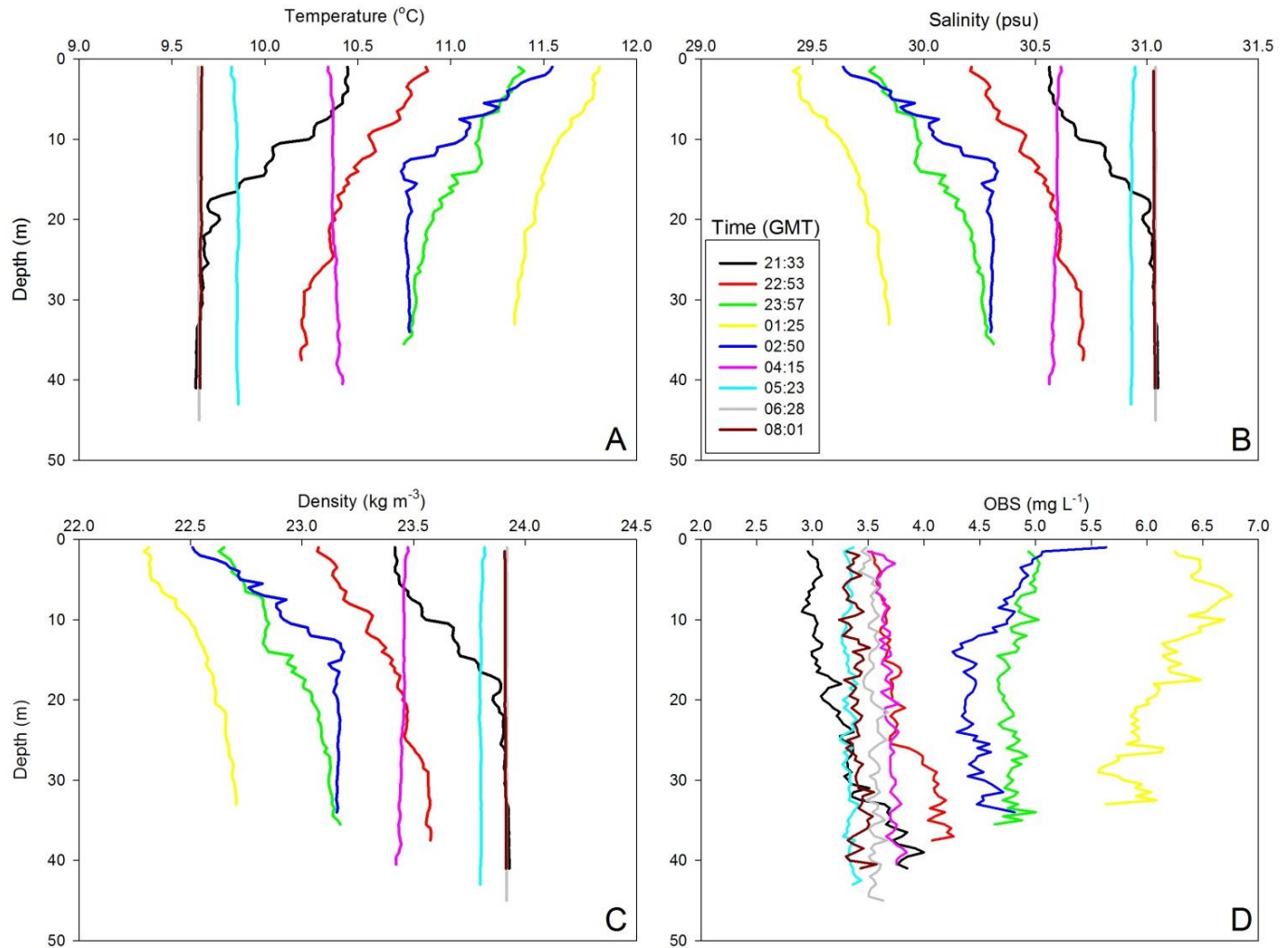


Figure 7. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC1 summer sampling collected 12-13 June 2013. Low tide occurred at 1:00 GMT and high tide at 7:15 GMT during the sampling period.

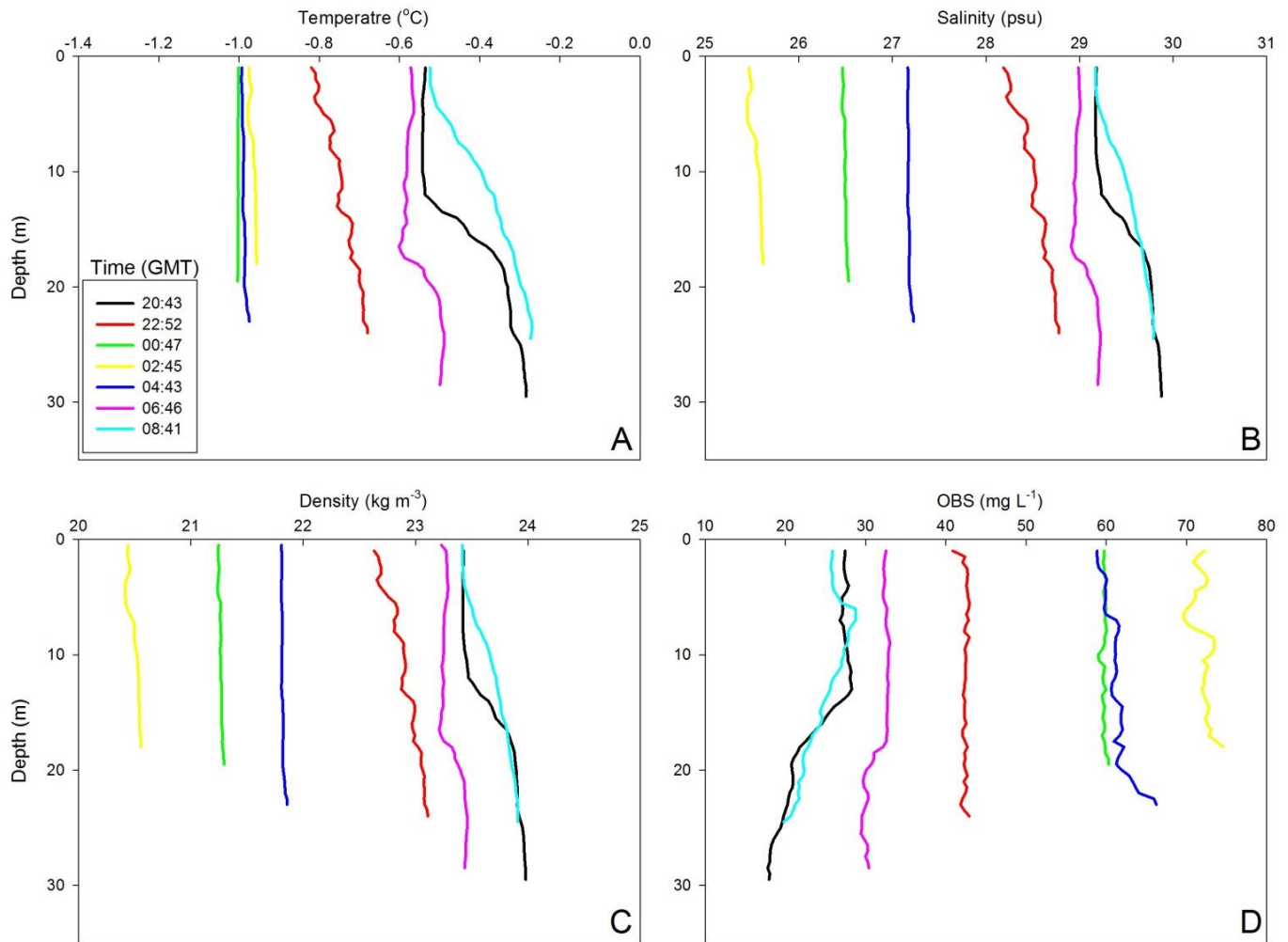


Figure 8. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC1 winter sampling collected 21-22 March 2014. Low tide occurred at 2:15 GMT and high tide at 20:30 GMT and 8:30 GMT during the sampling period.

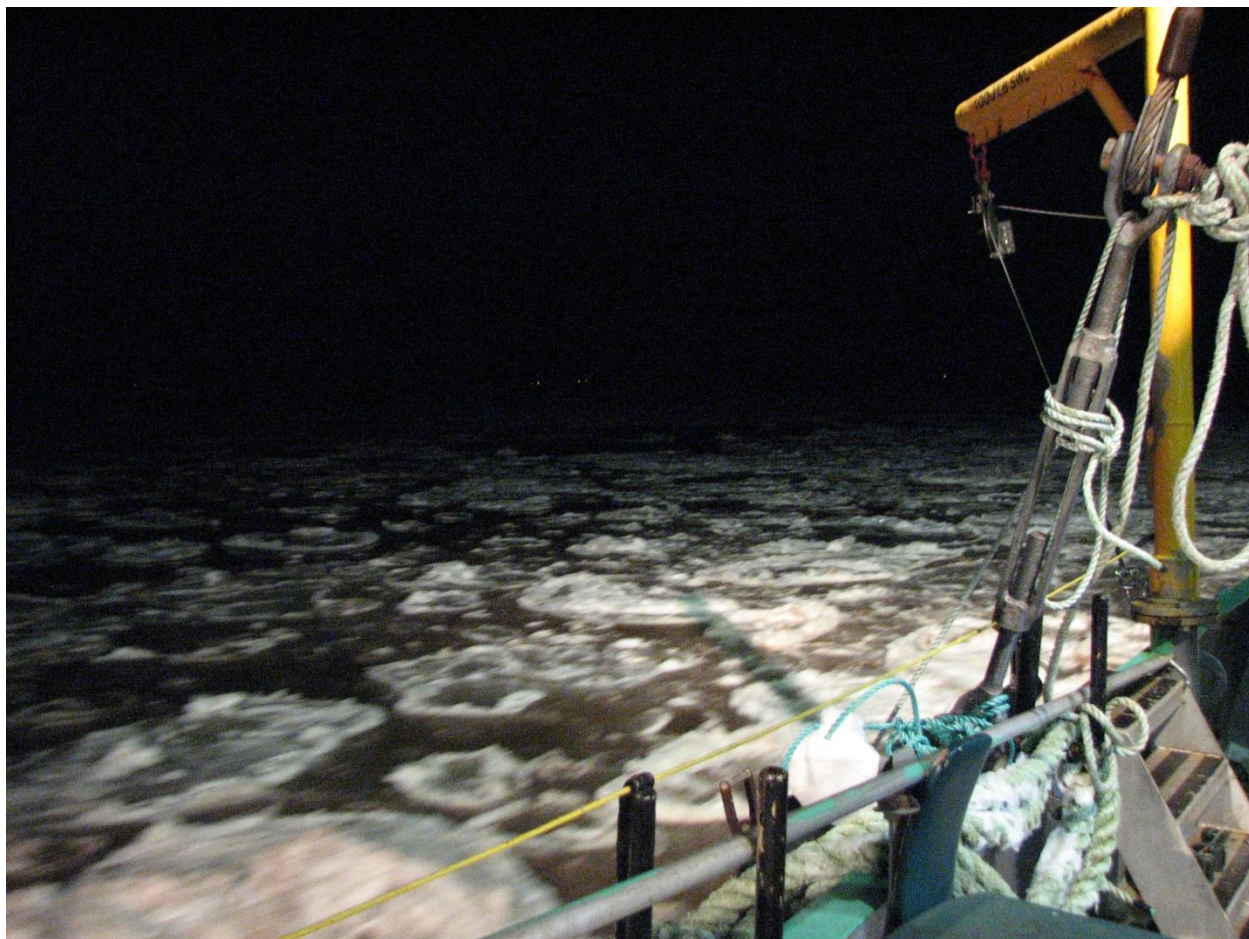


Figure 9. Picture of ice conditions encountered during Dominion Victory 2014-901 mission to Minas Basin, Bay of Fundy.

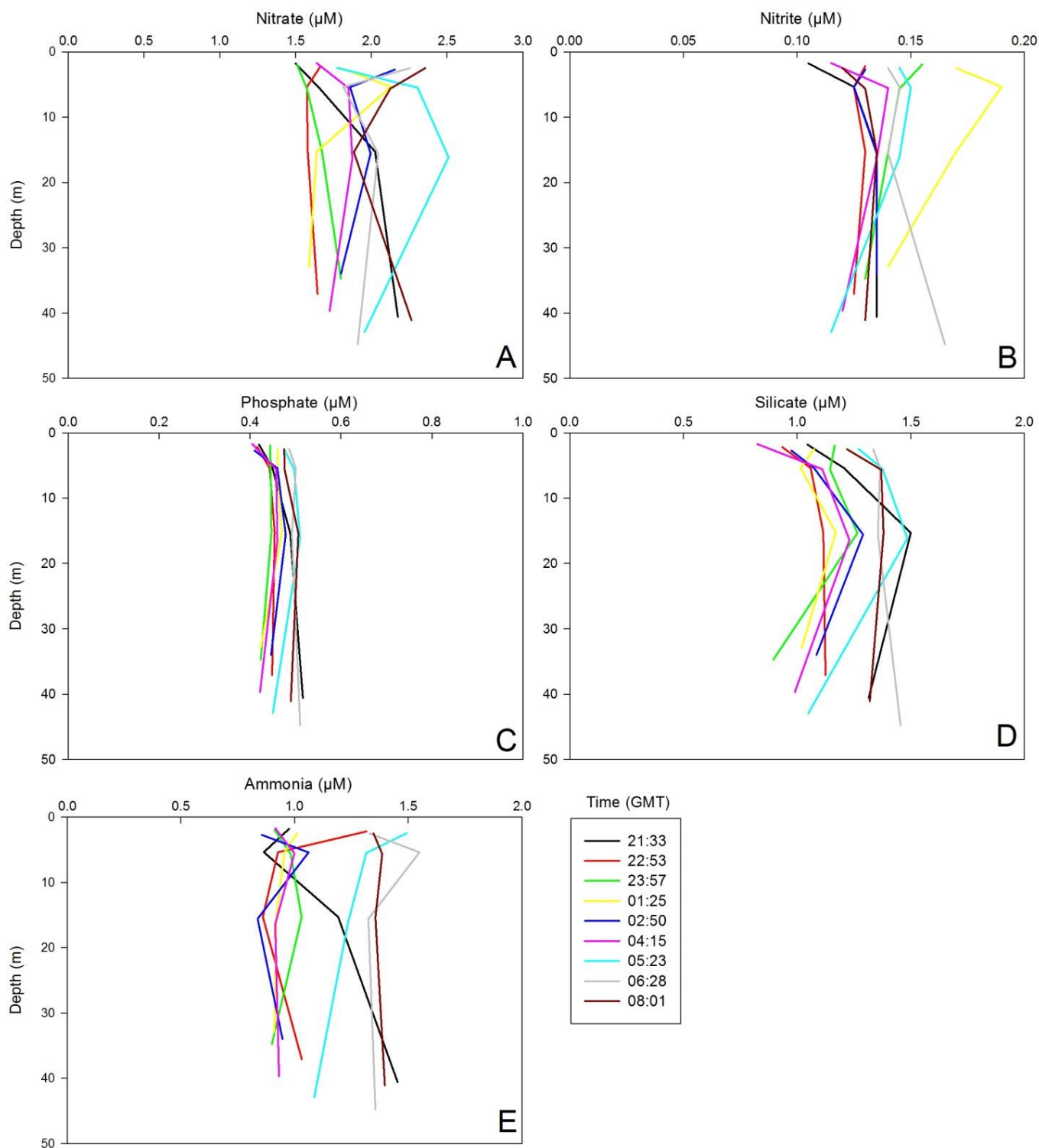


Figure 10. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC1 summer sampling collected 7-8 June 2013. Low tide occurred at 22:00 GMT and high tide at 4:00 GMT during the sampling period.

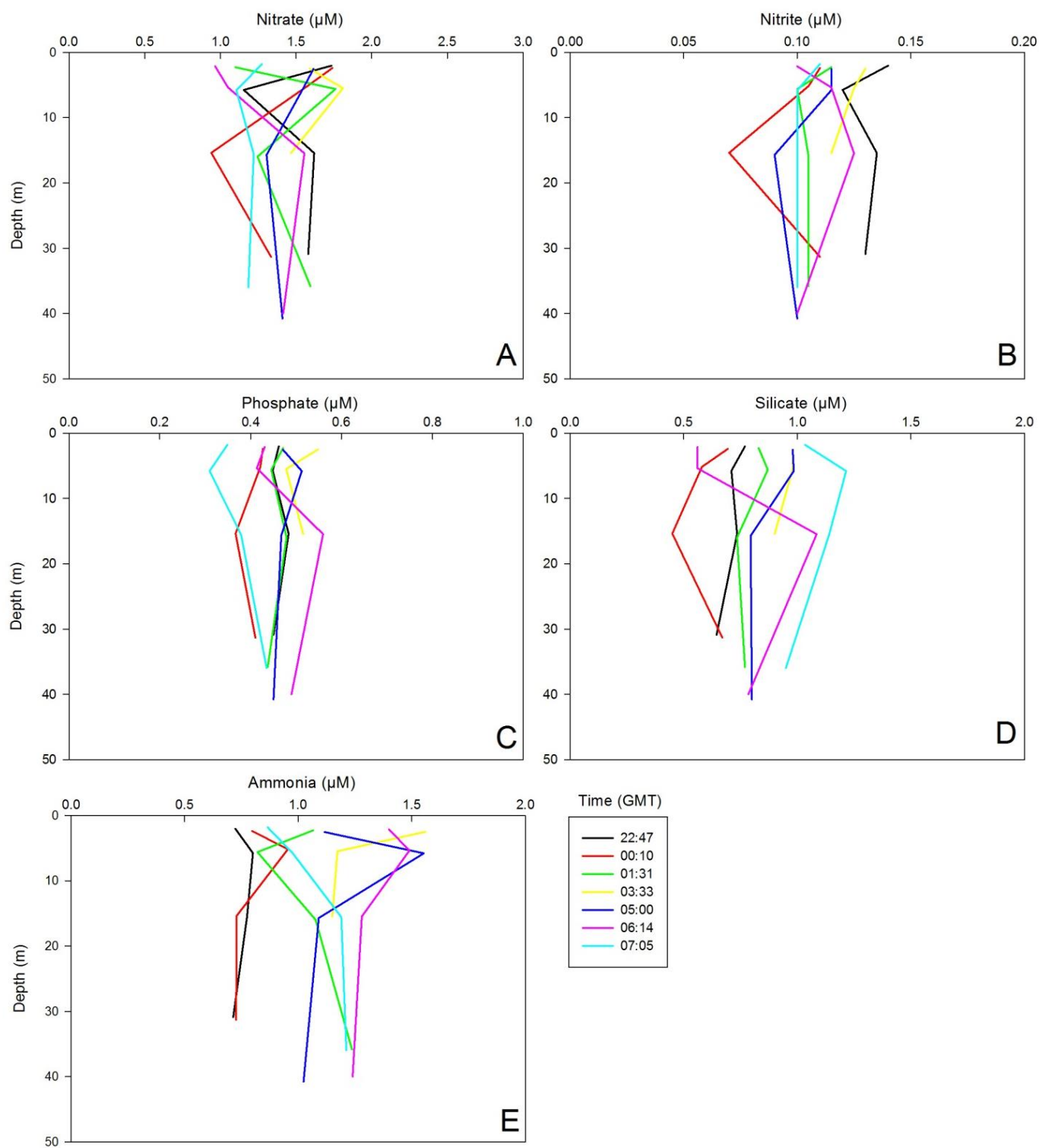


Figure 11. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC1 summer sampling collected 12-13 June 2013. Low tide occurred at 1:00 GMT and high tide at 7:15 GMT during the sampling period.

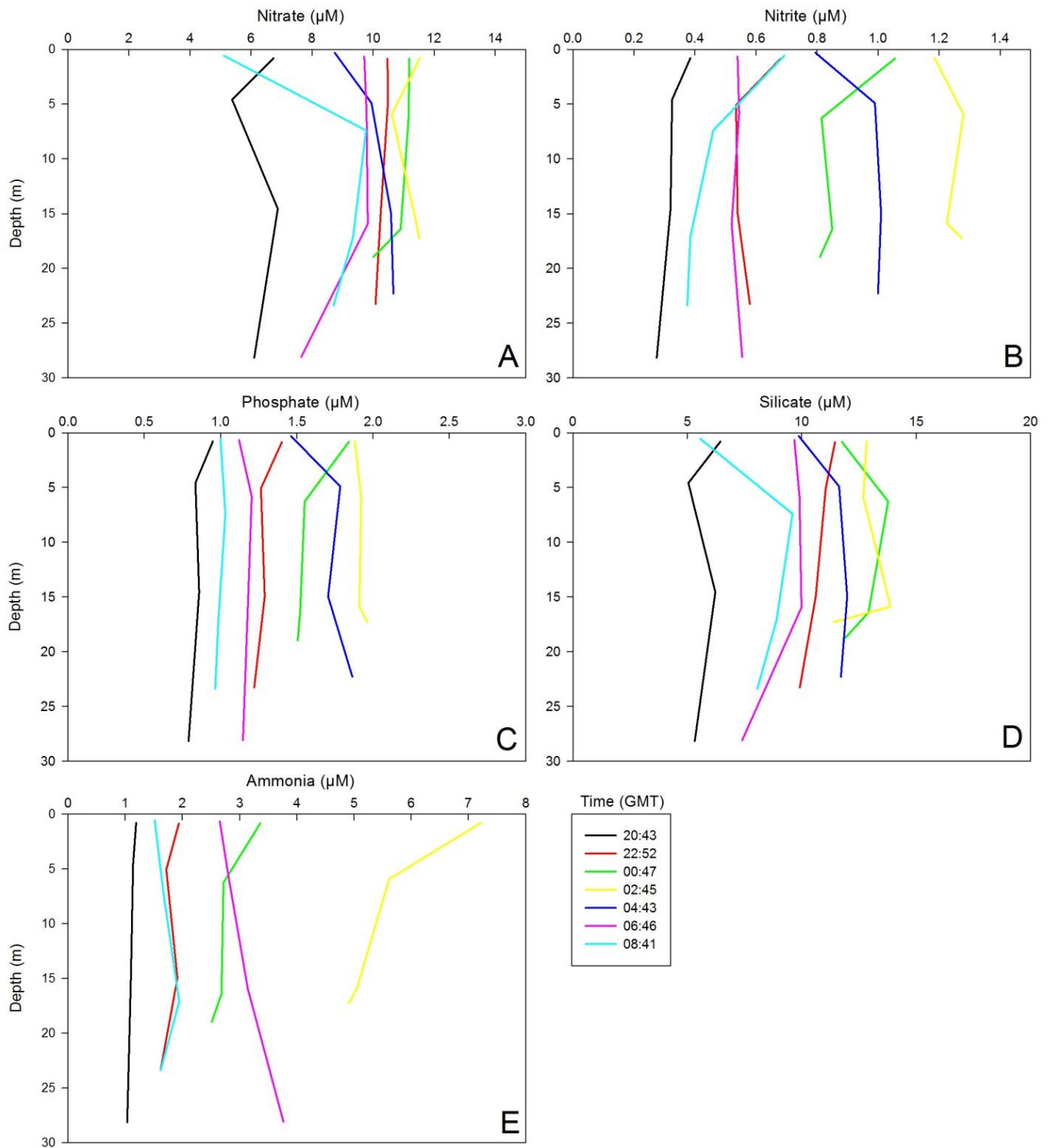


Figure 12. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC1 winter sampling collected 21-22 March 2014. Low tide occurred at 2:15 GMT and high tide at 20:30 GMT and 8:30 GMT during the sampling period.

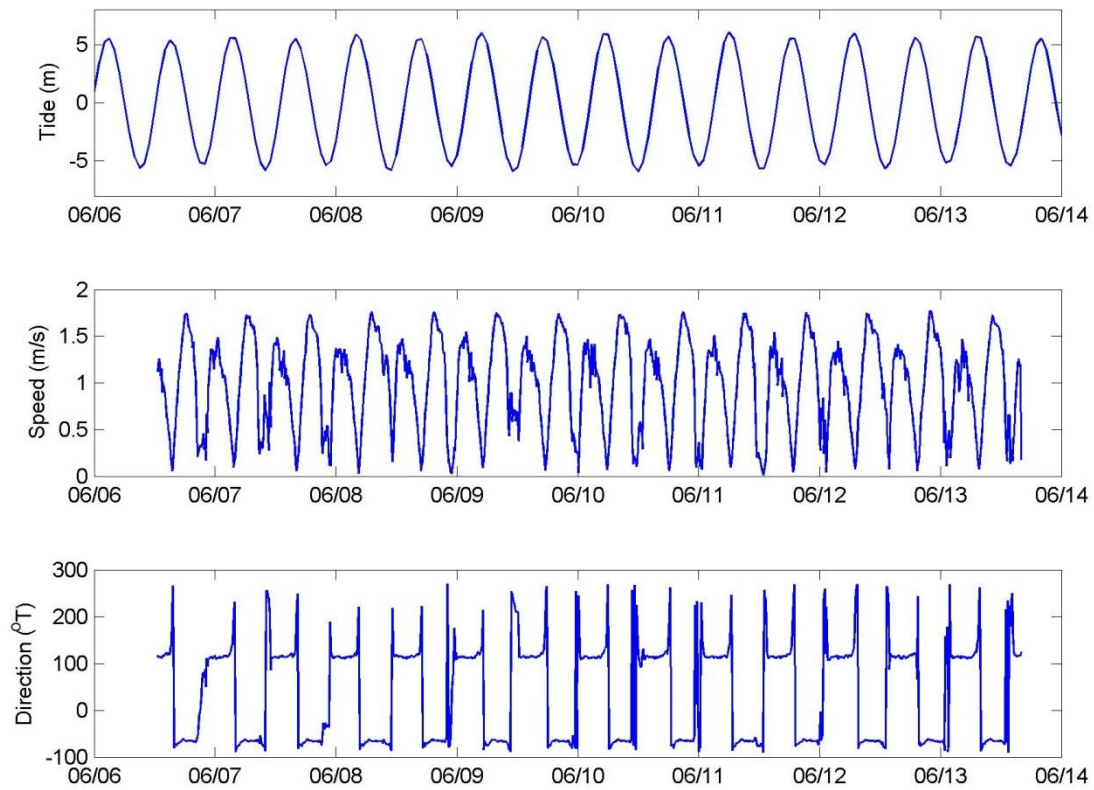


Figure 13. Tidal height (m), speed (m s^{-1}), and direction ($^{\circ}\text{T}$) from Teledyne RDI 300 kHz Sentinel ADCP located at ANC2 during June 2013 sampling period. Plots depict measurements from 20 m above bottom. The x-axis of time is given as month/day.

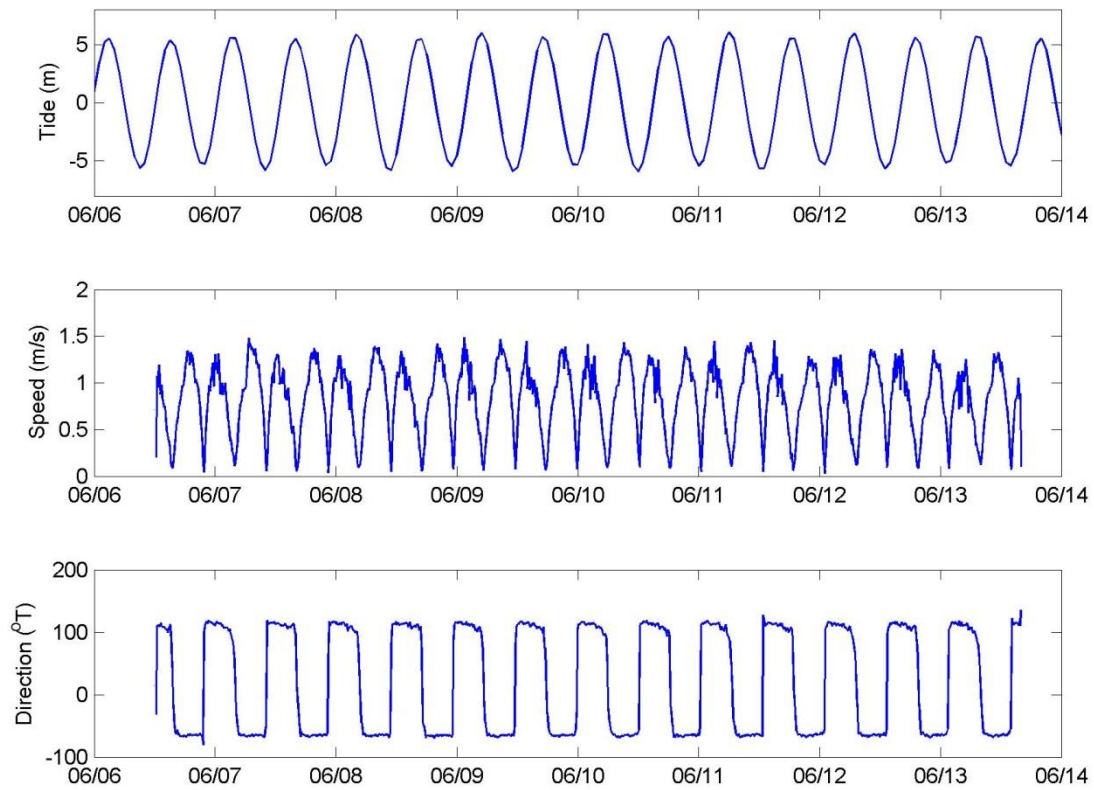


Figure 14. Tidal height (m), speed (m s^{-1}), and direction ($^{\circ}\text{T}$) from Teledyne RDI 300 kHz Sentinel ADCP located at ANC2 during June 2013 sampling period. Plots depict measurements from 8 m above bottom. The x-axis of time is given as month/day.

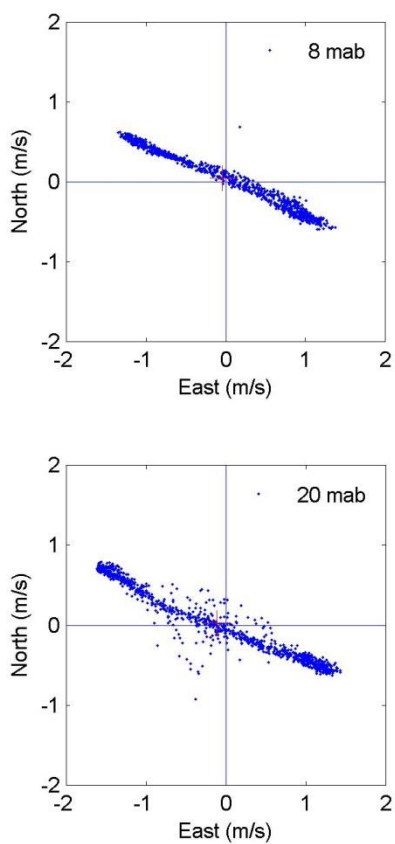


Figure 15. Scatter plot of u (North) and v (East) components of velocity from Teledyne RDI 300 kHz Sentinel ADCP current meter located at ANC2 during June 2013 sampling period. Current measurements plotted from measurements 8 m (top panel) and 20 m (bottom panel) above bottom.

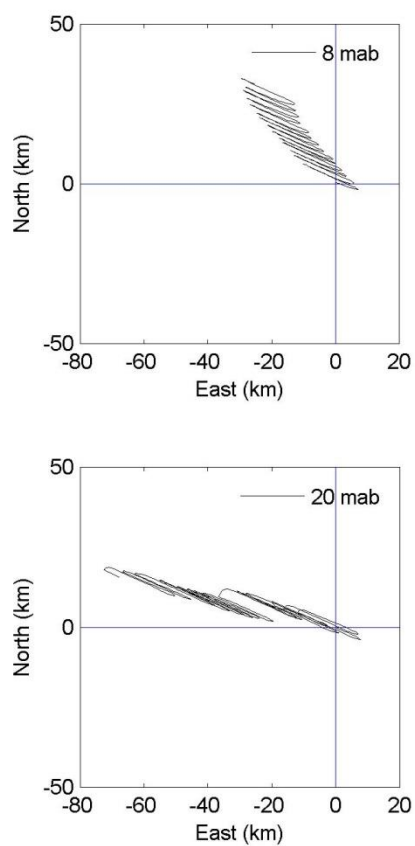


Figure 16. Progressive vector plot from Teledyne RDI 300 kHz Sentinel ADCP current meter located at ANC2 during June 2013 sampling period. Current measurements analysed from 8 m (top panel) and 20 m (bottom panel) above bottom.

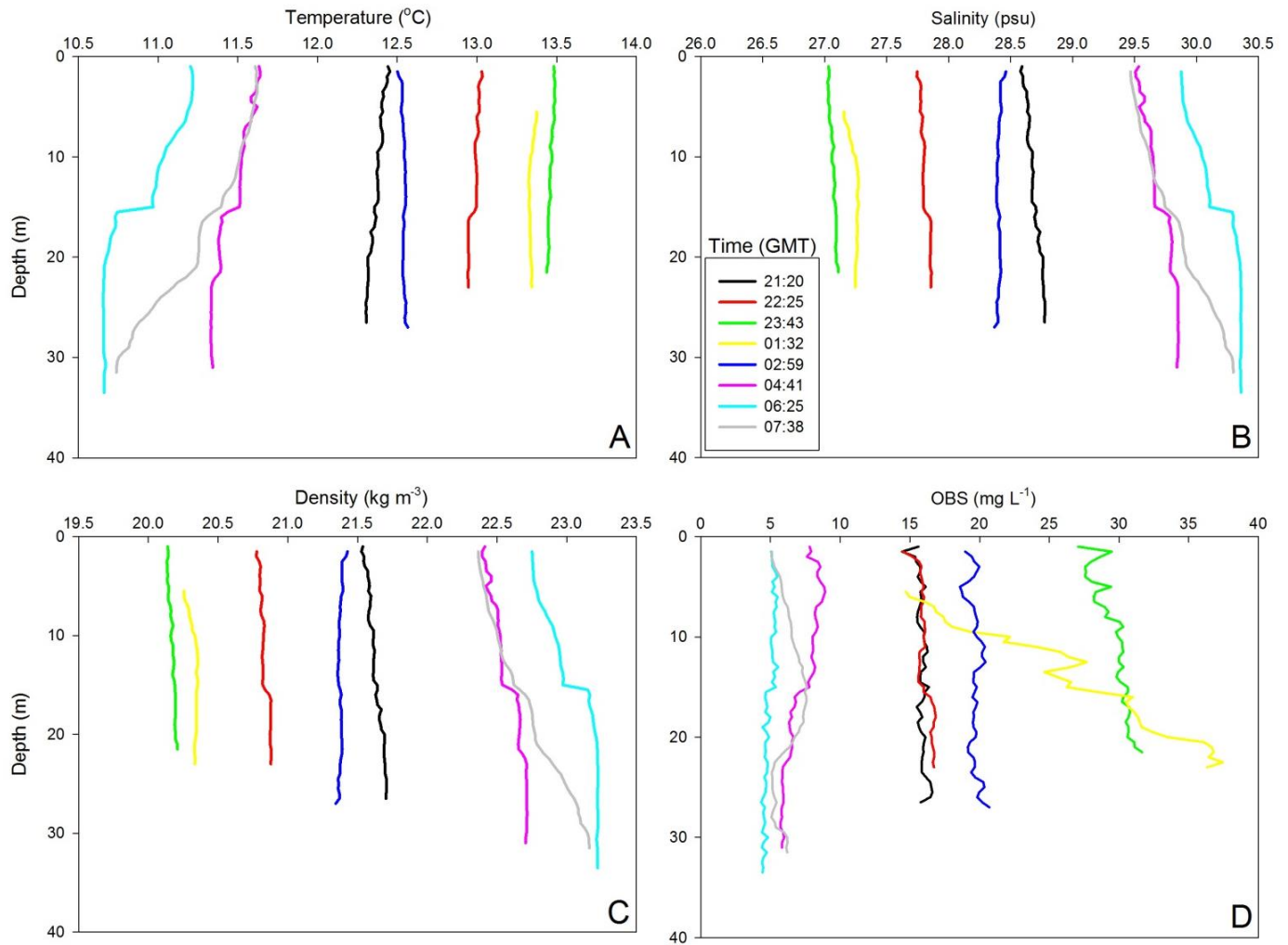


Figure 17. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC2 summer sampling collected 10-11 June 2013. Low tide occurred at 23:45 GMT and high tide at 6:00 GMT during the sampling period.

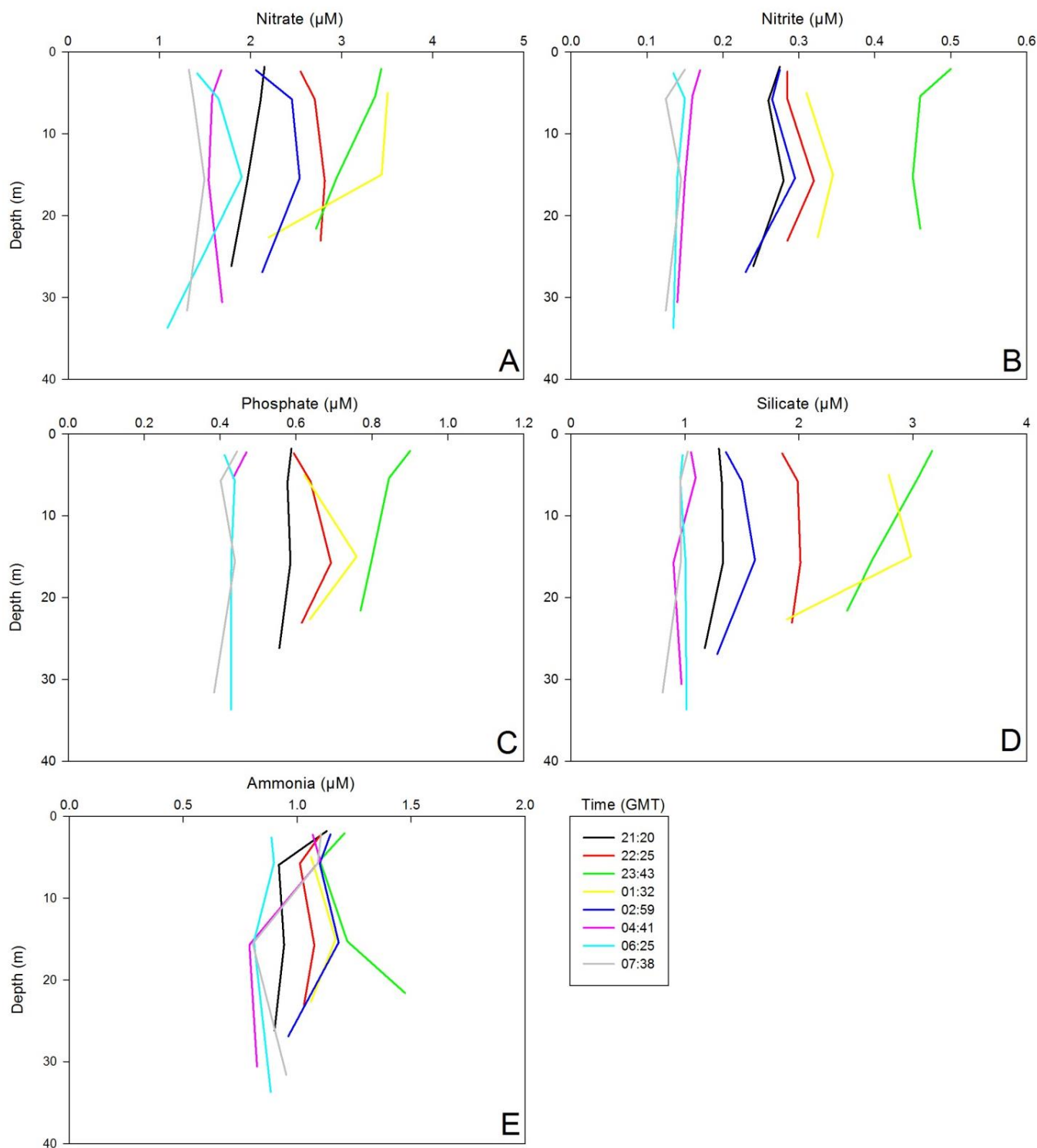


Figure 18. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC2 summer sampling collected 10-11 June 2013. Low tide occurred at 23:45 GMT and high tide at 6:00 GMT during the sampling period.

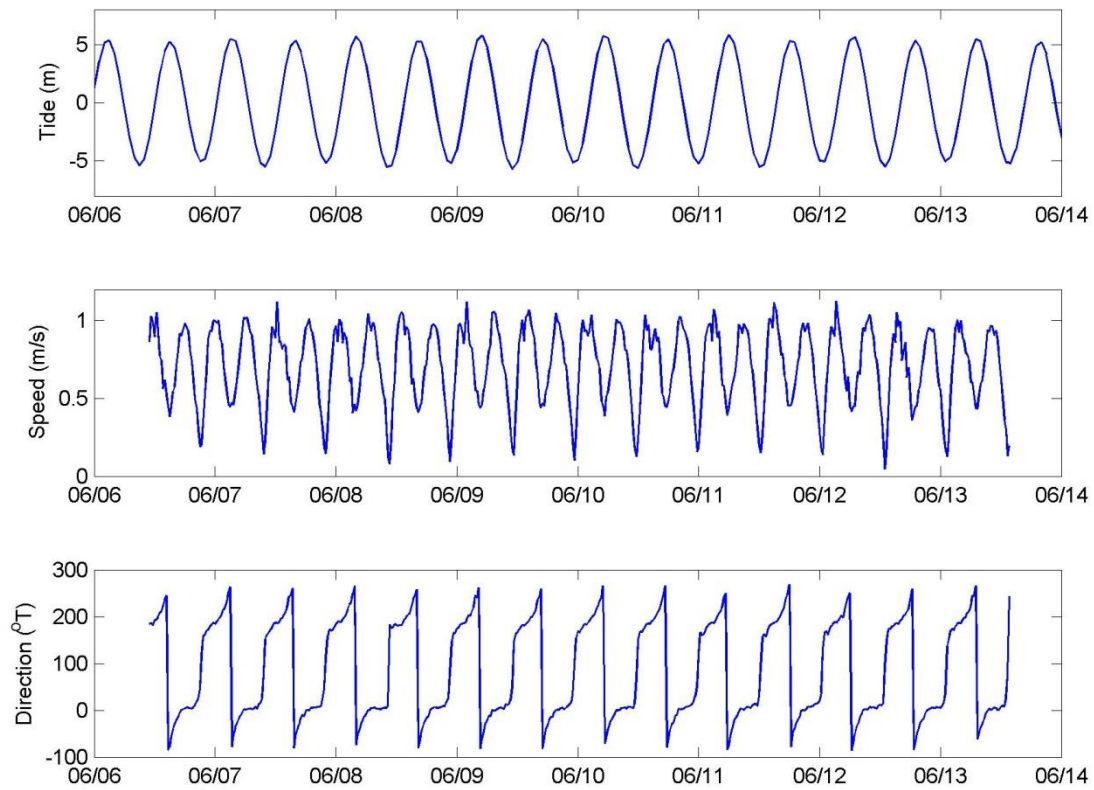


Figure 19. Tidal height (m), speed (m s^{-1}), and direction ($^{\circ}\text{T}$) from Teledyne RDI 300 kHz Sentinel ADCP located at ANC3 during June 2013 sampling period. Current measurements analysed 15 m above bottom. The x-axis of time is given as month/day.

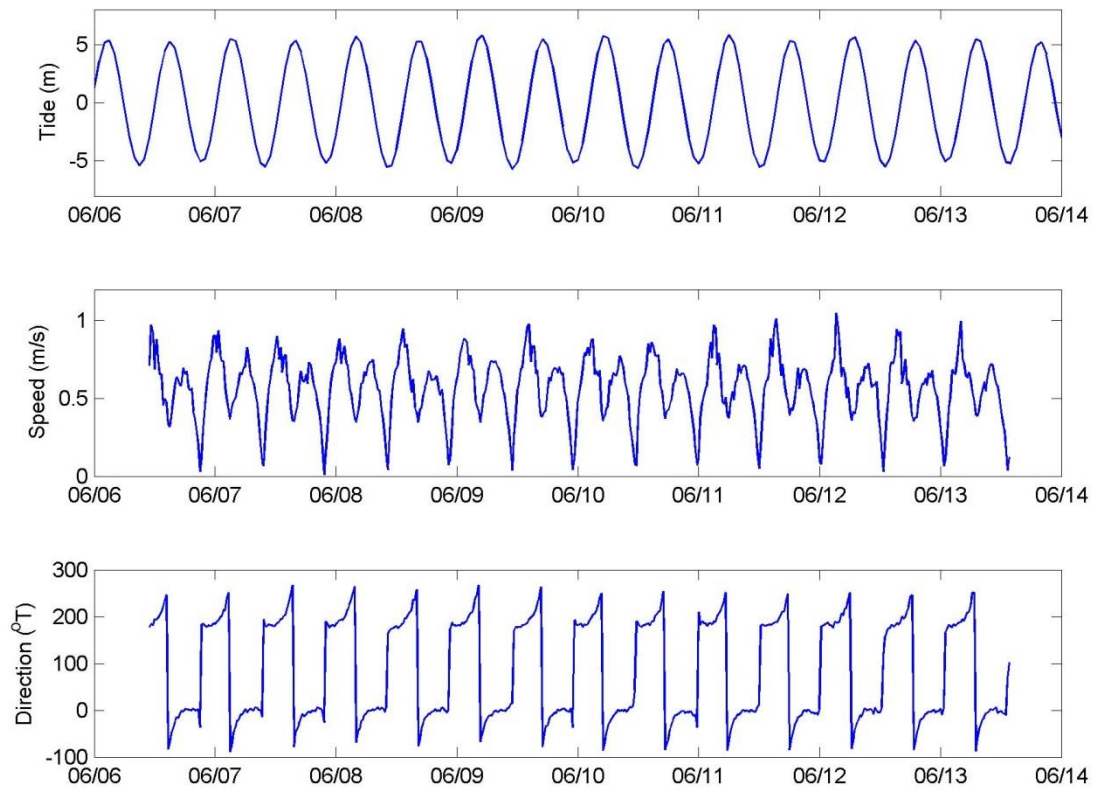


Figure 20. Tidal height (m), speed (m s^{-1}), and direction ($^{\circ}\text{T}$) from Teledyne RDI 300 kHz Sentinel ADCP located at ANC3 during June 2013 sampling period. Current measurements analysed 5 m above bottom. The x-axis of time is given as month/day.

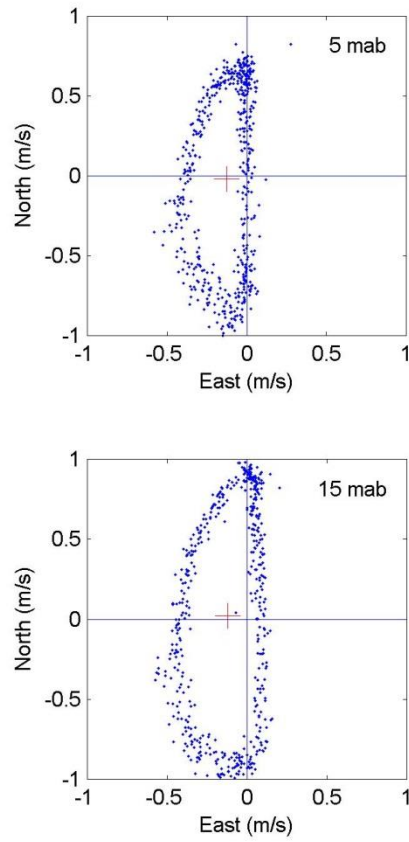


Figure 21. Scatter plot of u (North) and v (East) components of velocity from Teledyne RDI 300 kHz Sentinel ADCP current meter located at ANC3 during June 2013 sampling period. Current measurements analysed for 5 m (top panel) and 15 m (bottom panel) above bottom.

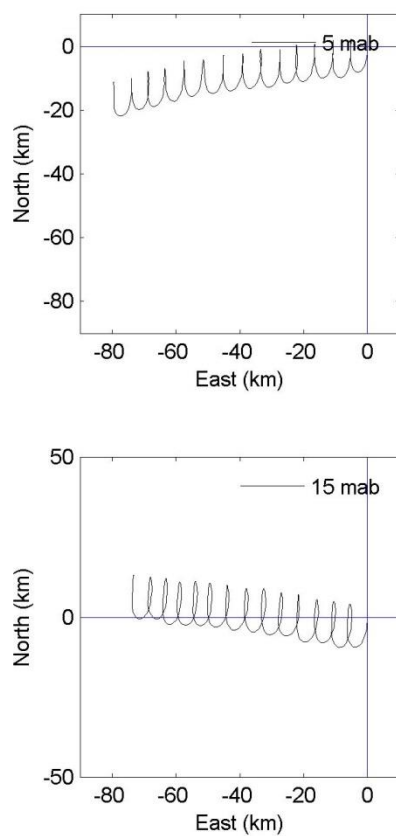


Figure 22. Progressive vector plot from Teledyne RDI 300 kHz Sentinel ADCP current meter located at ANC3 during June 2013 sampling period. Current measurements analysed for 5 m (top panel) and 15 m (bottom panel) above bottom.

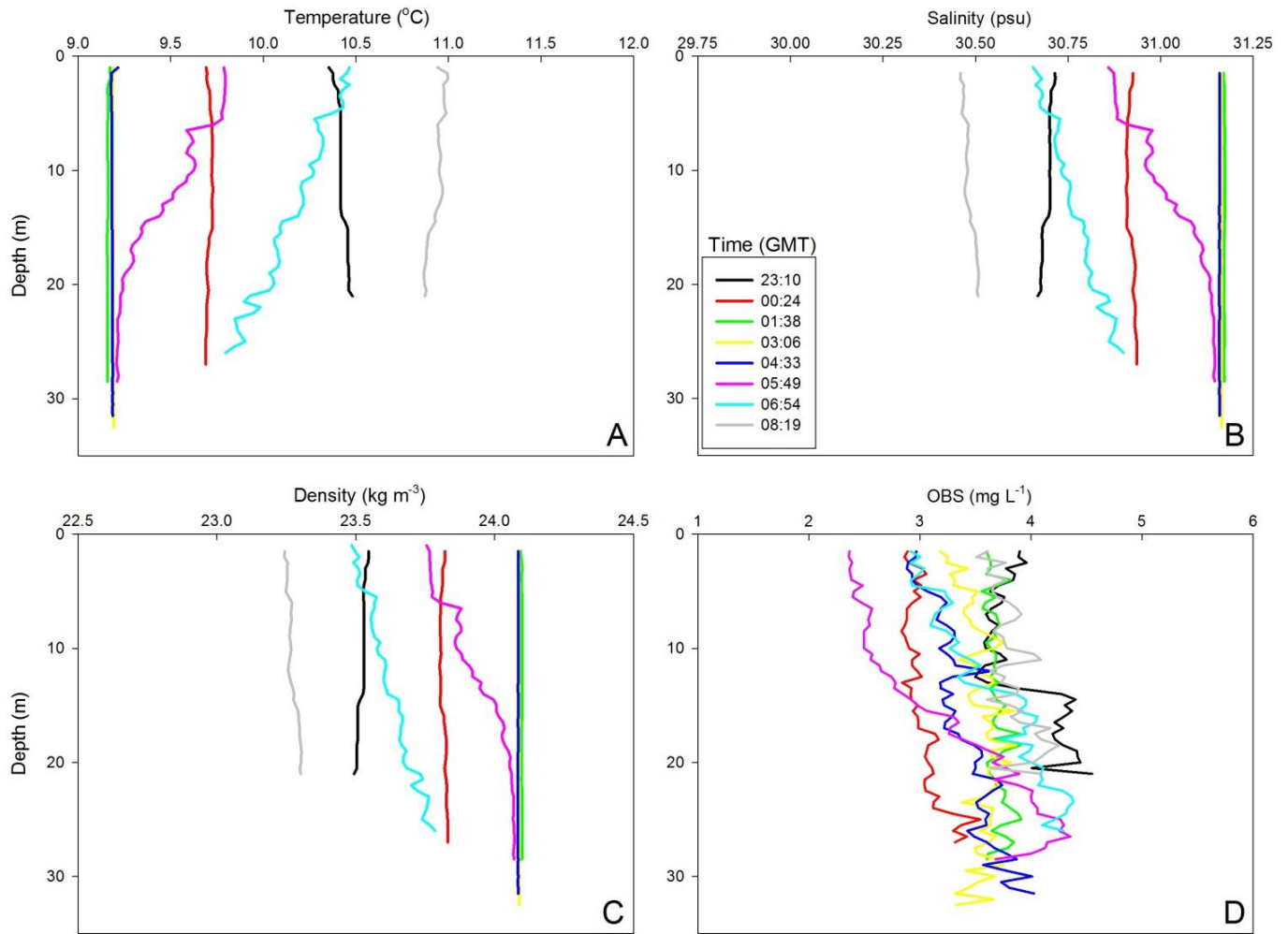


Figure 23. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC3 summer sampling collected 6-7 June 2013. Low tide occurred at 21:15 GMT and 9:45 GMT, before and after the sampling period. High tide occurred at 3:00 GMT during the sampling period.

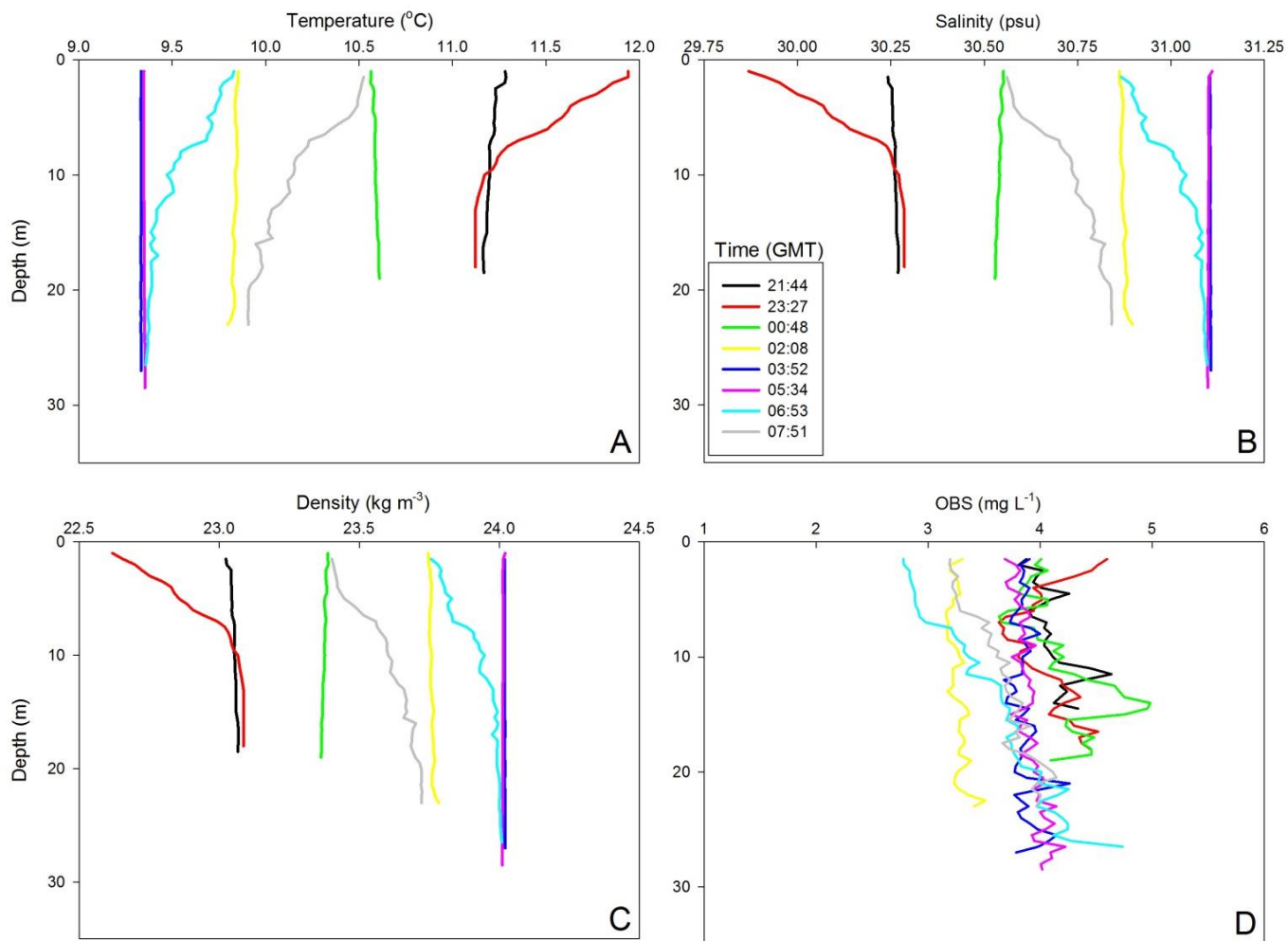


Figure 24. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC3 summer sampling collected 8-9 June 2013. Low tide occurred at 22:30 GMT and high tide at 4:45 GMT during the sampling period.

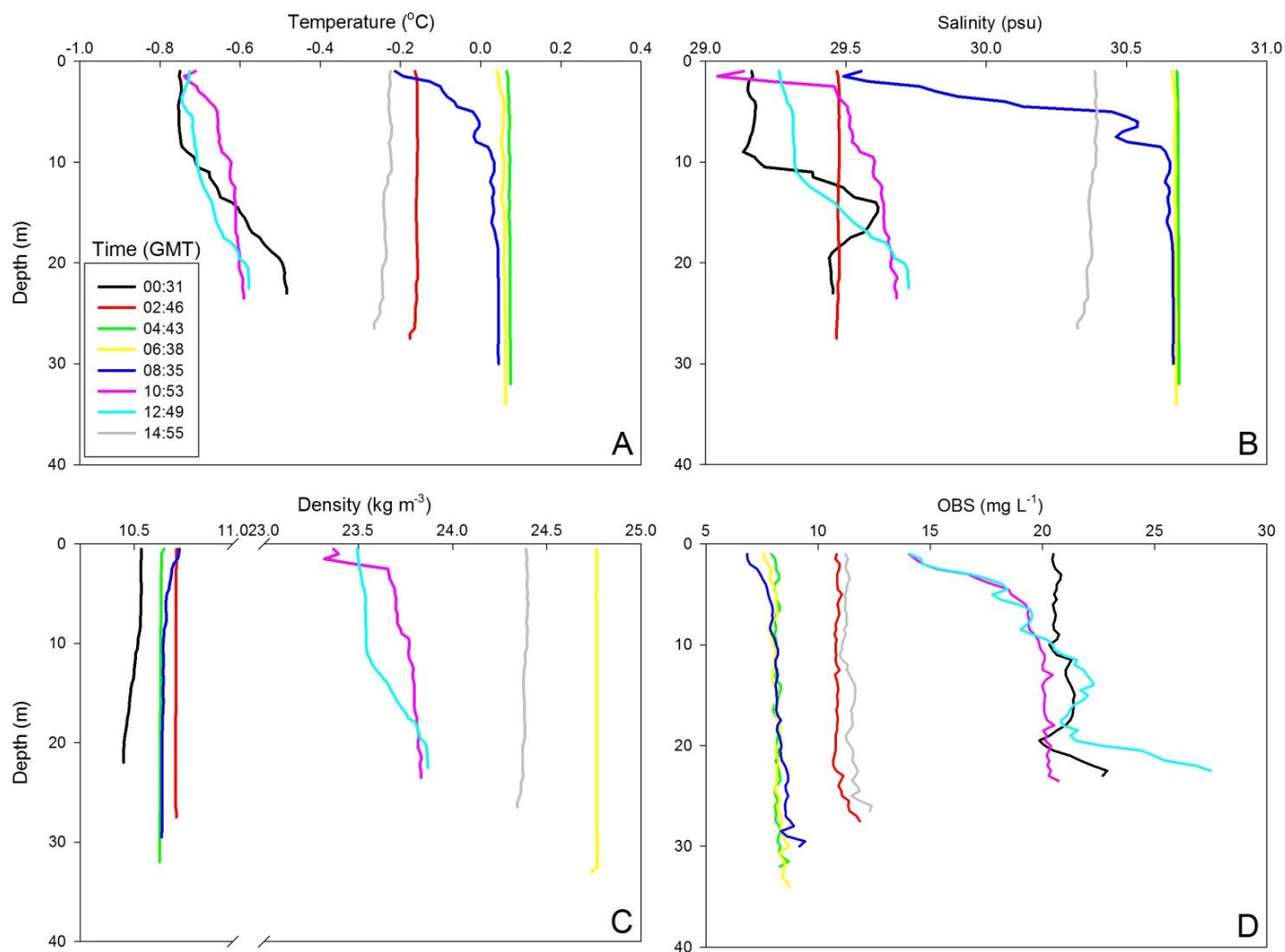


Figure 25. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC3 winter sampling collected 19 March 2014. Low tide occurred at 0:00 GMT and 12:30 GMT, and high tide at 6:15 GMT during the sampling period.

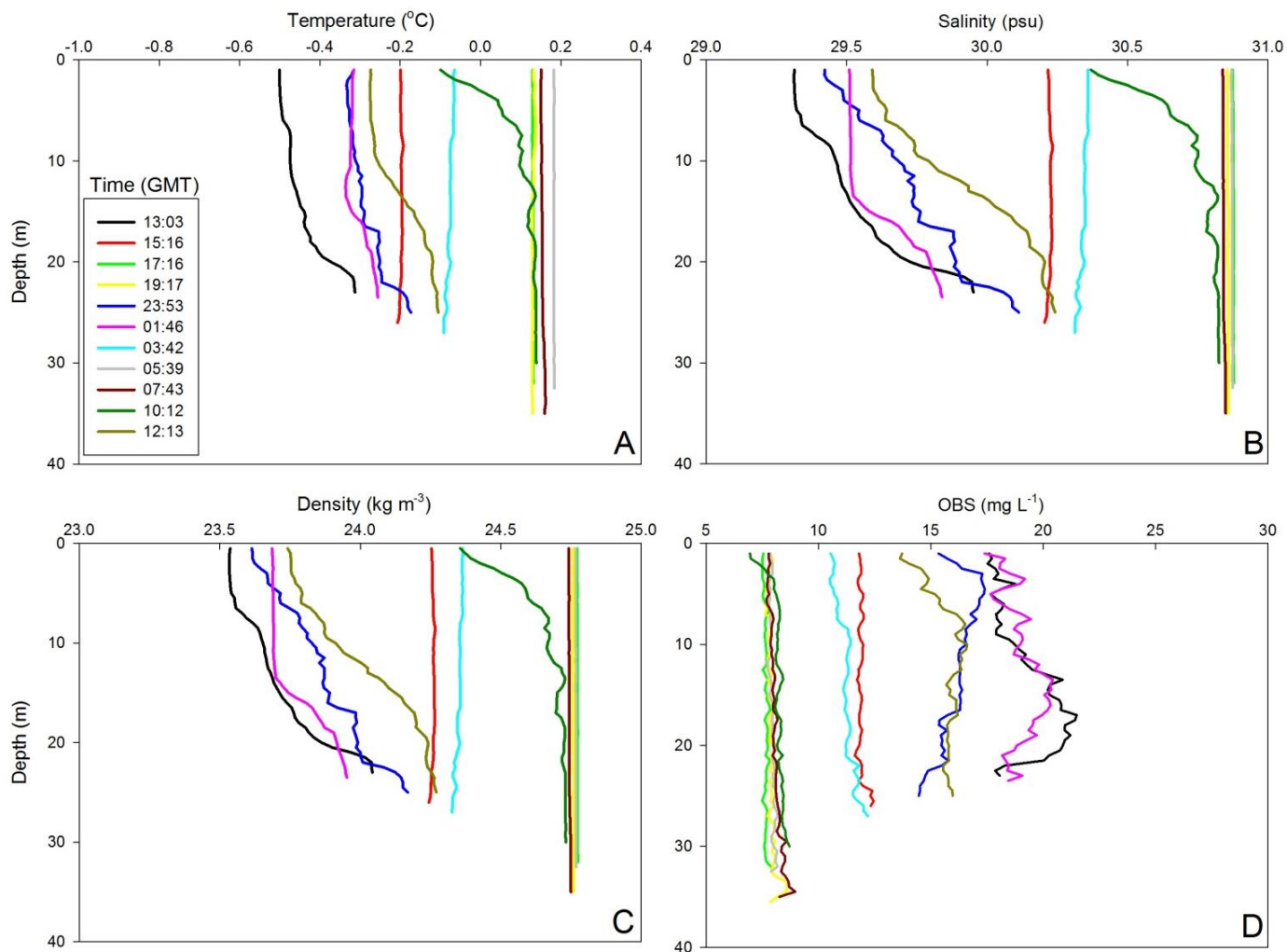


Figure 26. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC3 winter sampling collected 20-21 March 2014. Low tide occurred at 13:15 and 1:30 GMT, and high tide at 19:30 and 7:45 GMT during the sampling period.

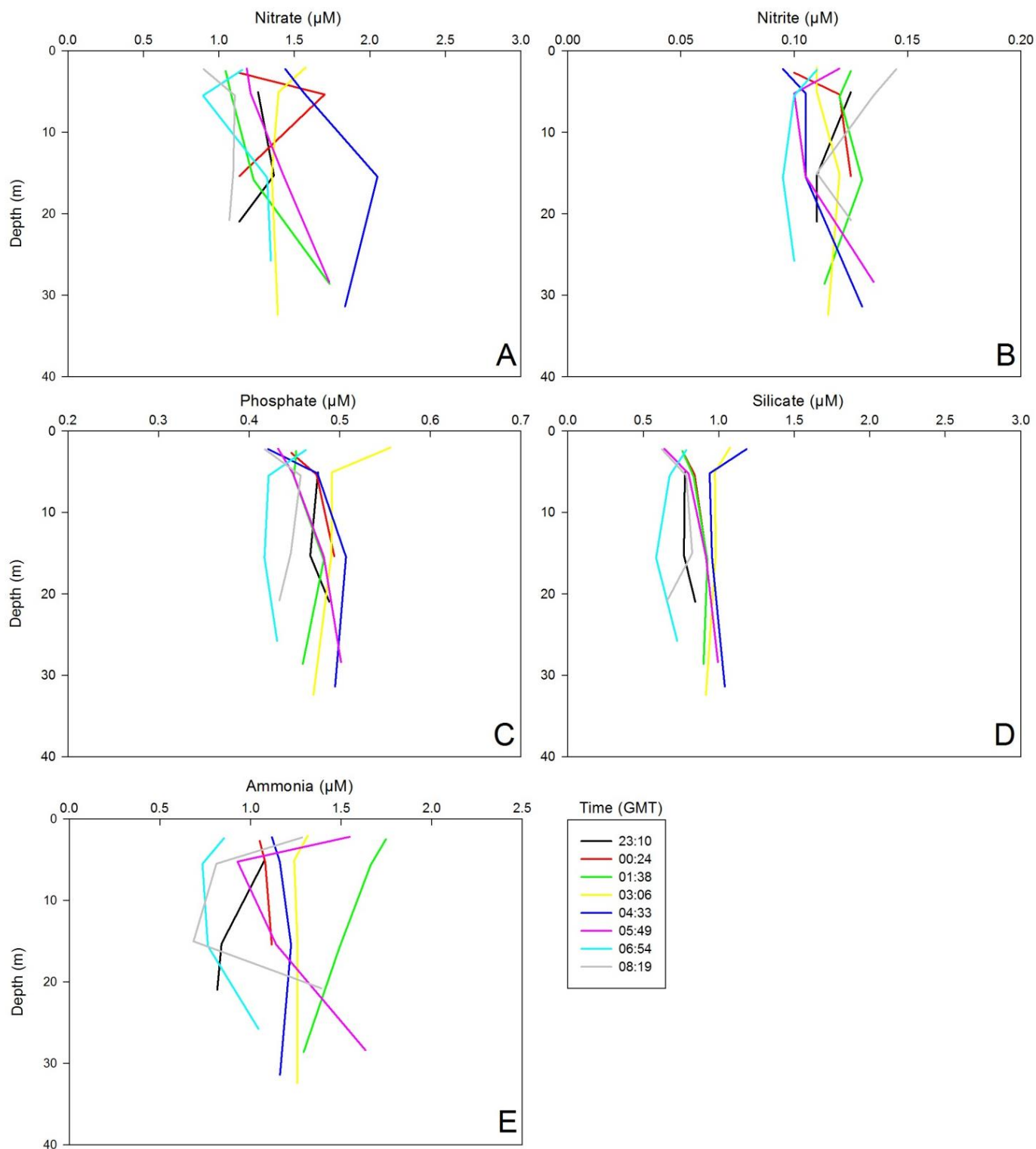


Figure 27. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC3 summer sampling collected 6-7 June 2013. Low tide occurred at 21:15 GMT and 9:45 GMT, before and after the sampling period. High tide occurred at 3:00 GMT during the sampling period.

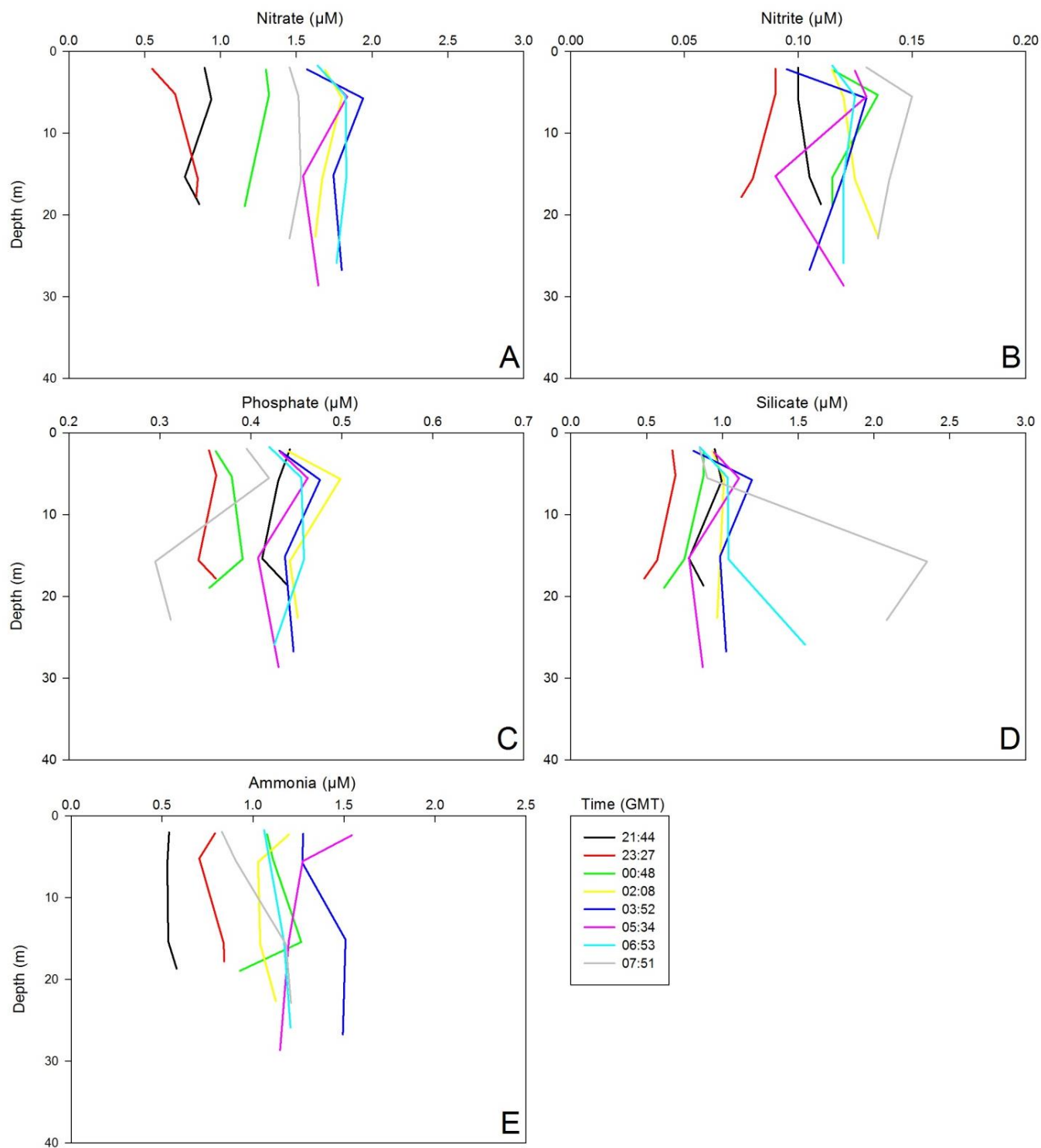


Figure 28. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC3 summer sampling collected 8-9 June 2013. Low tide occurred at 22:30 GMT and high tide at 4:45 GMT during the sampling period.

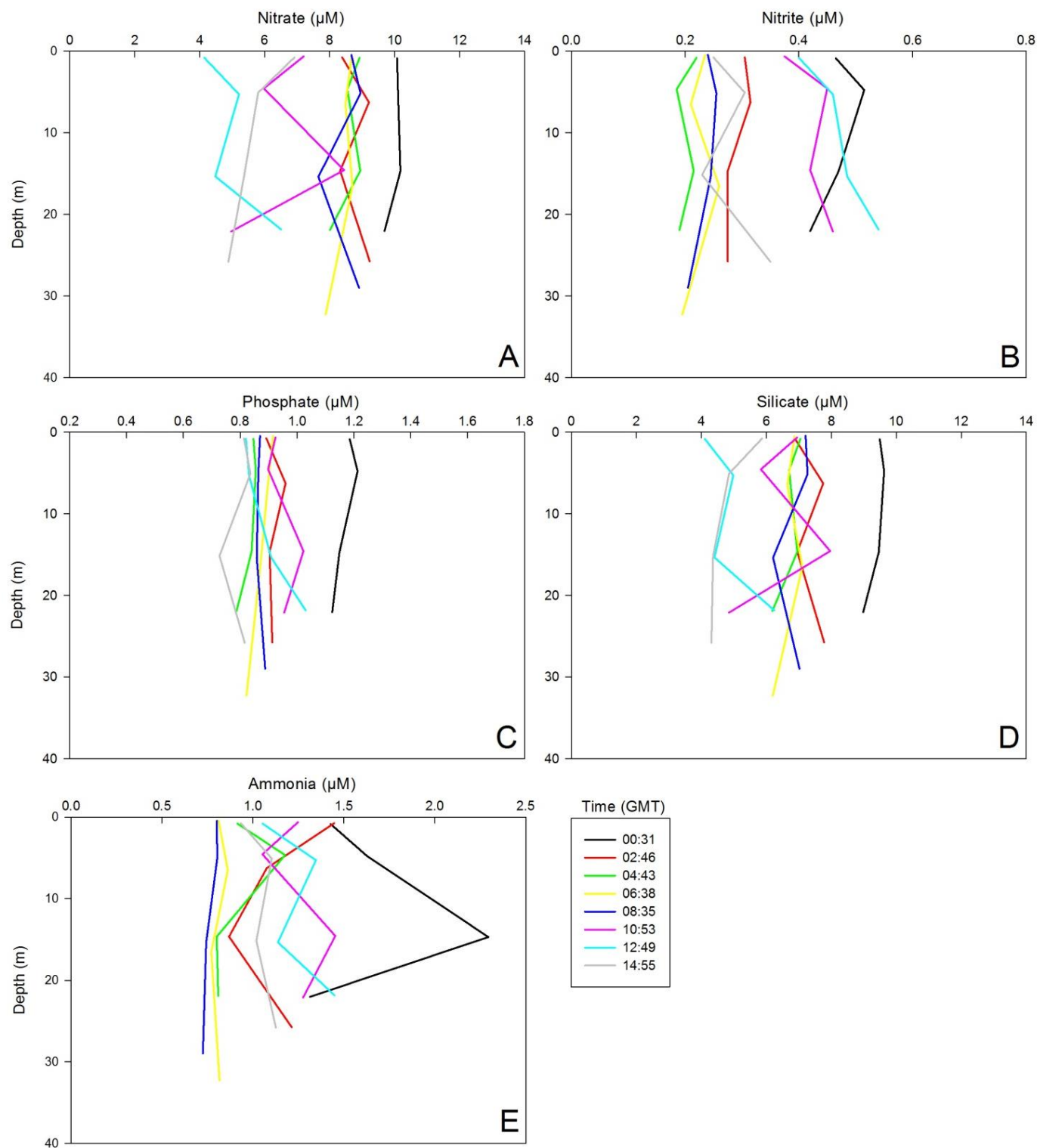


Figure 29. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC3 winter sampling collected 19 March 2014. Low tide occurred at 0:00 GMT and 12:30 GMT, and high tide at 6:15 GMT during the sampling period.

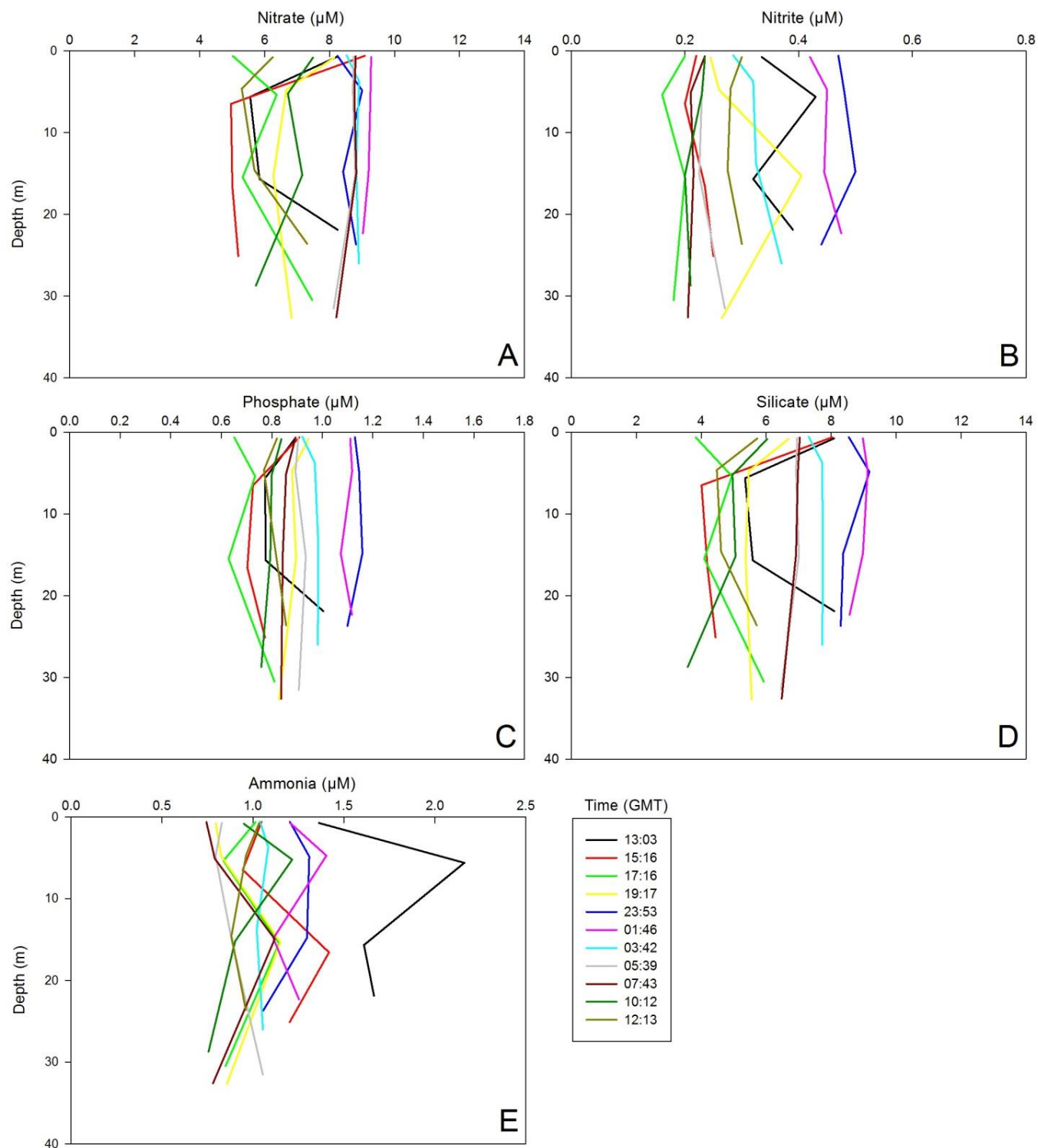


Figure 30. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC3 winter sampling collected 20-21 March 2014. Low tide occurred at 13:15 and 1:30 GMT, and high tide at 19:30 and 7:45 GMT during the sampling period.

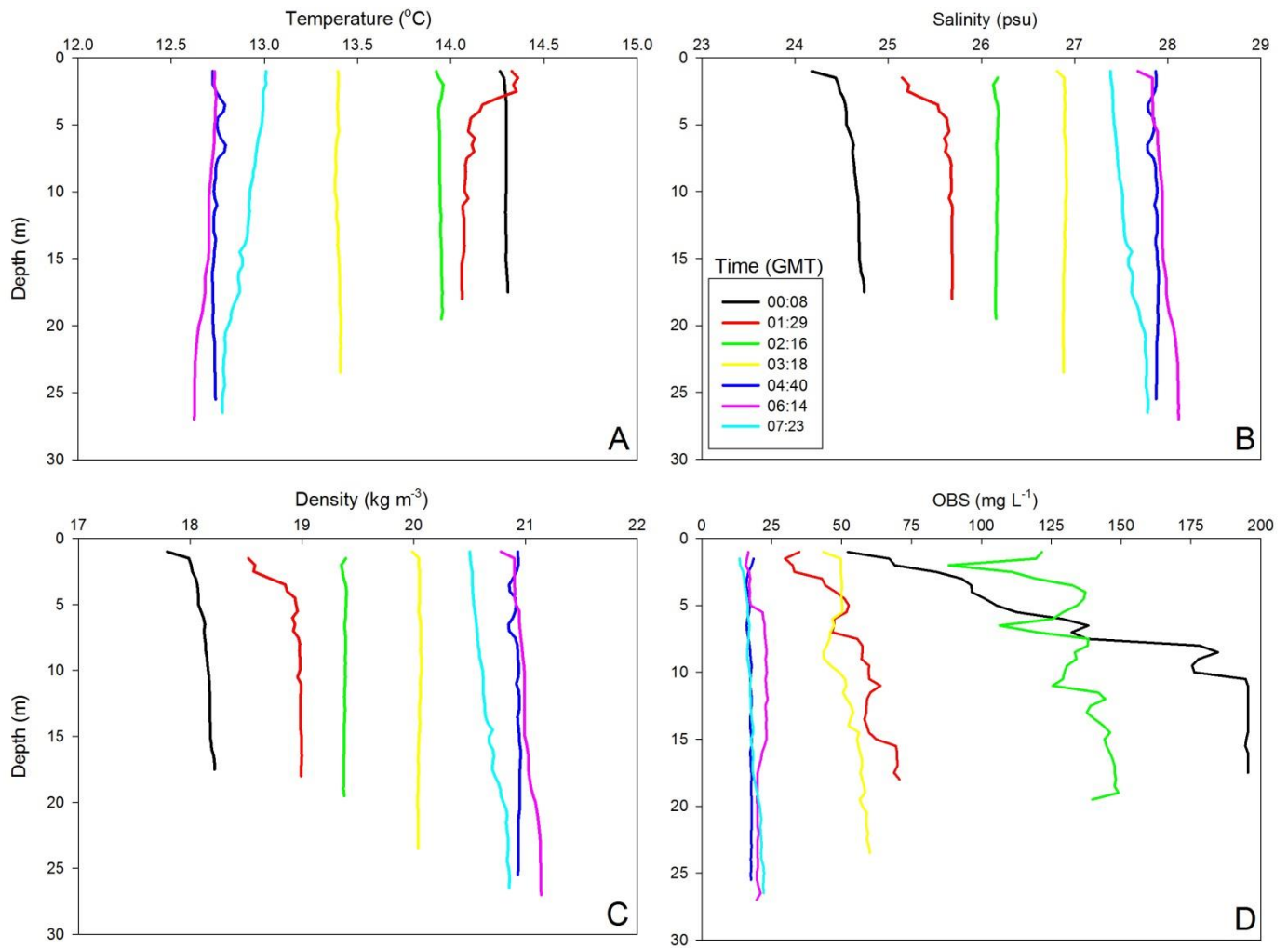


Figure 31. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC4 summer sampling collected 10 June 2013. Low tide occurred at 23:15 GMT just before sampling began and high tide at 5:15 GMT during the sampling period.

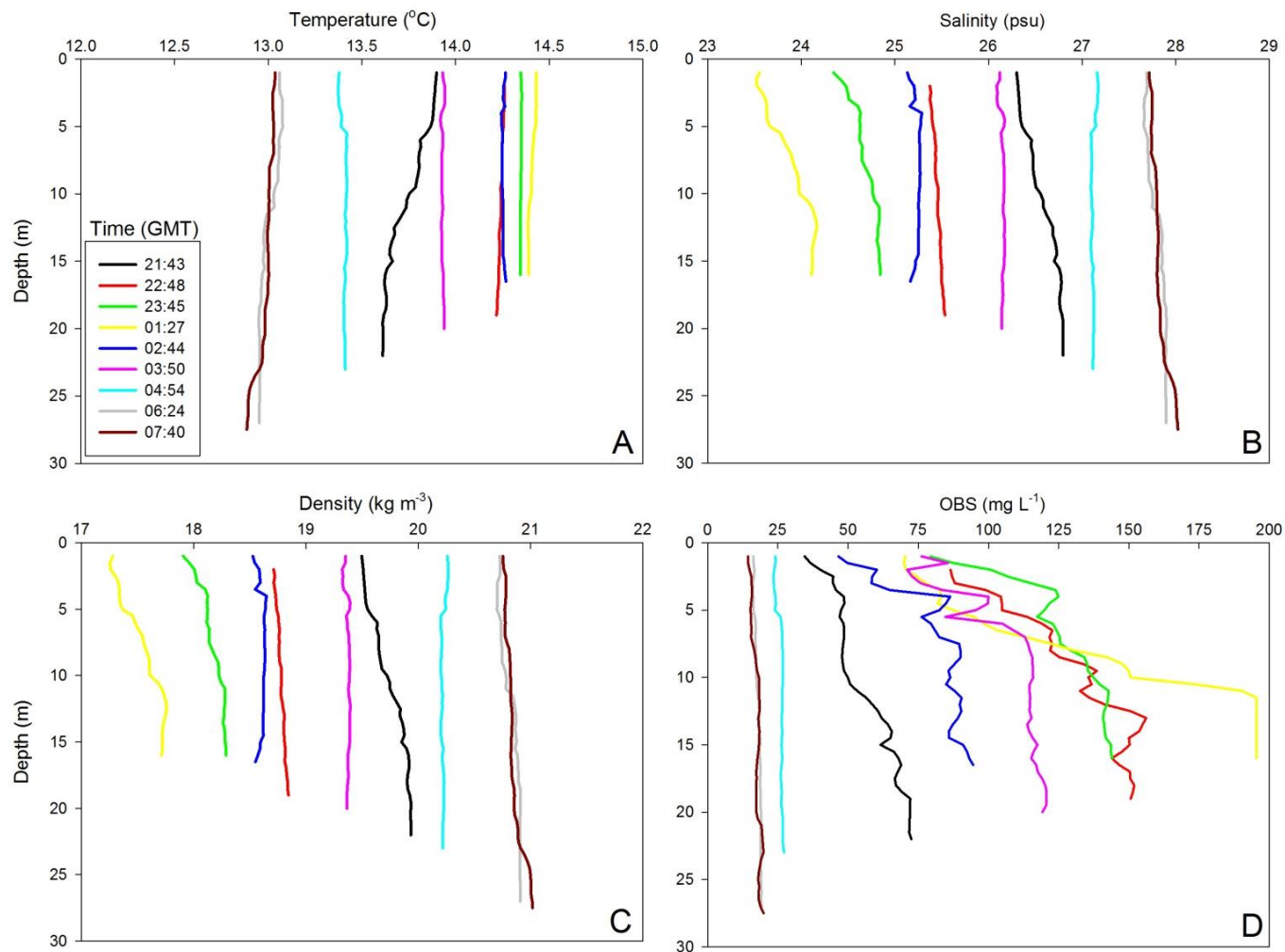


Figure 32. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC4 summer sampling collected 11-12 June 2013. Low tide occurred at 0:30 GMT and high tide at 6:30 GMT during the sampling period.

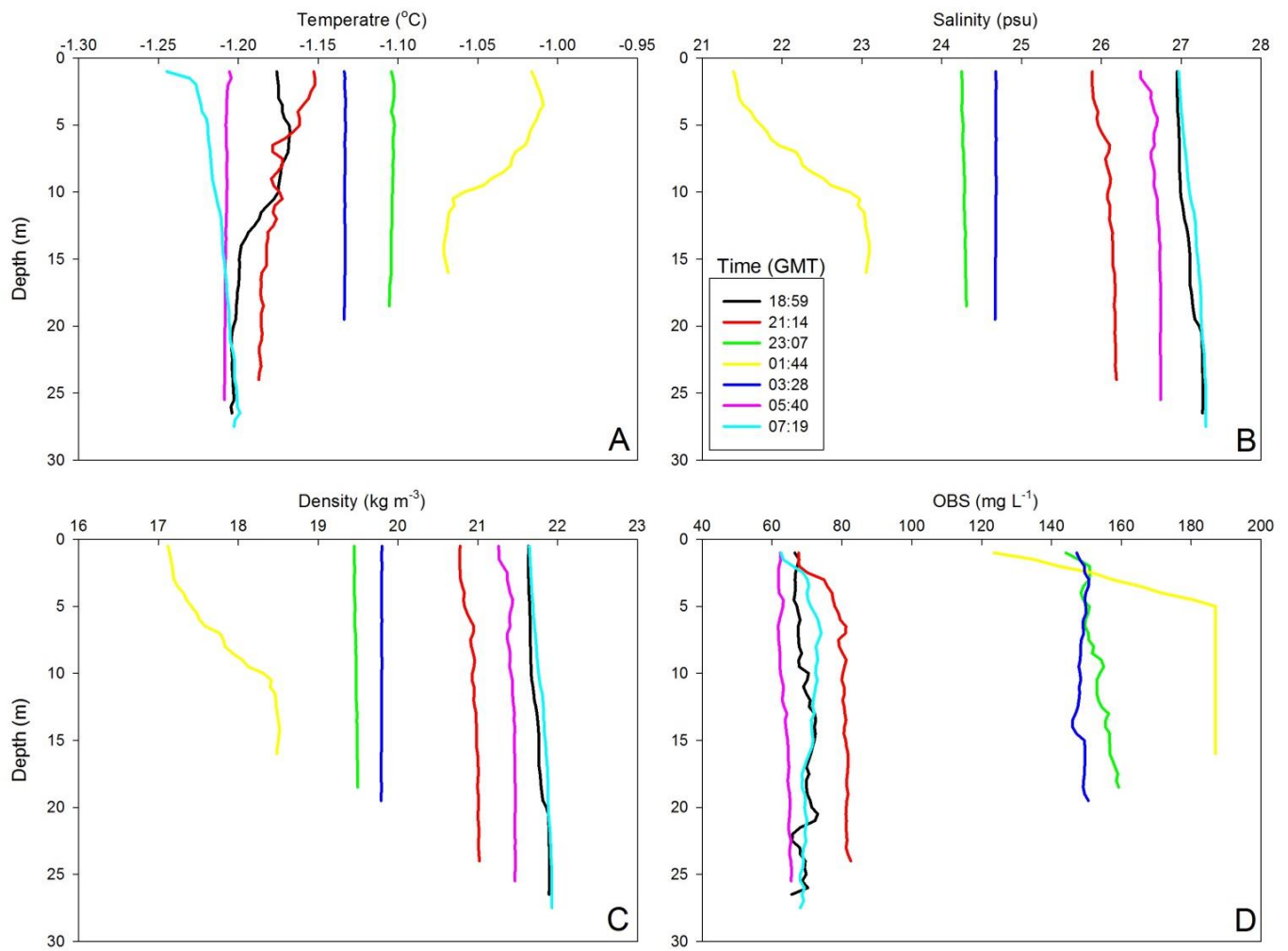


Figure 33. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC4 winter sampling collected 19-20 March 2014. Low tide occurred at 0:45 GMT and high tide at 18:30 and 7:00 GMT during the sampling period.

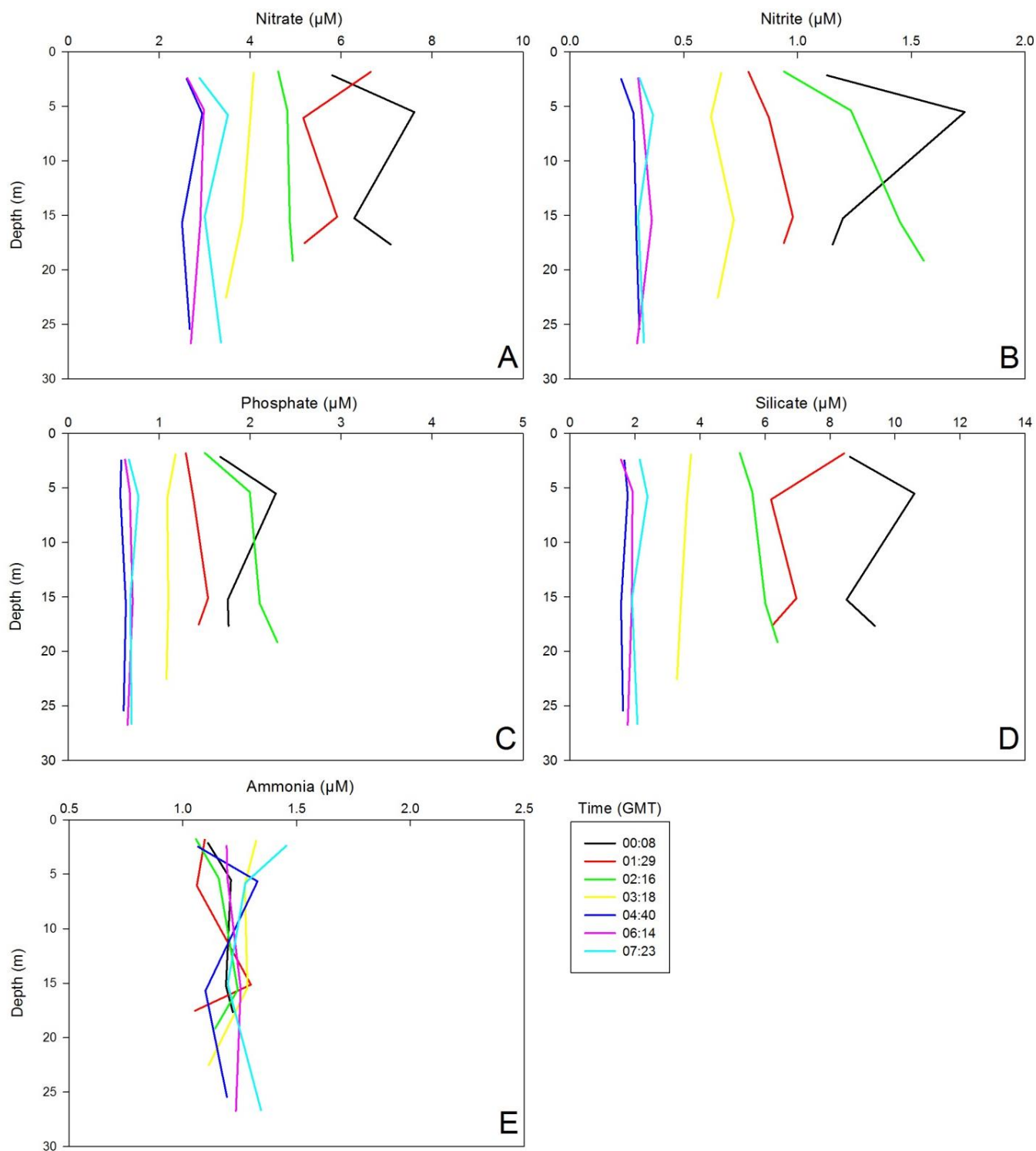


Figure 34. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC4 summer sampling collected 10 June 2013. Low tide occurred at 23:15 GMT just before sampling began, and high tide at 5:15 GMT during the sampling period.

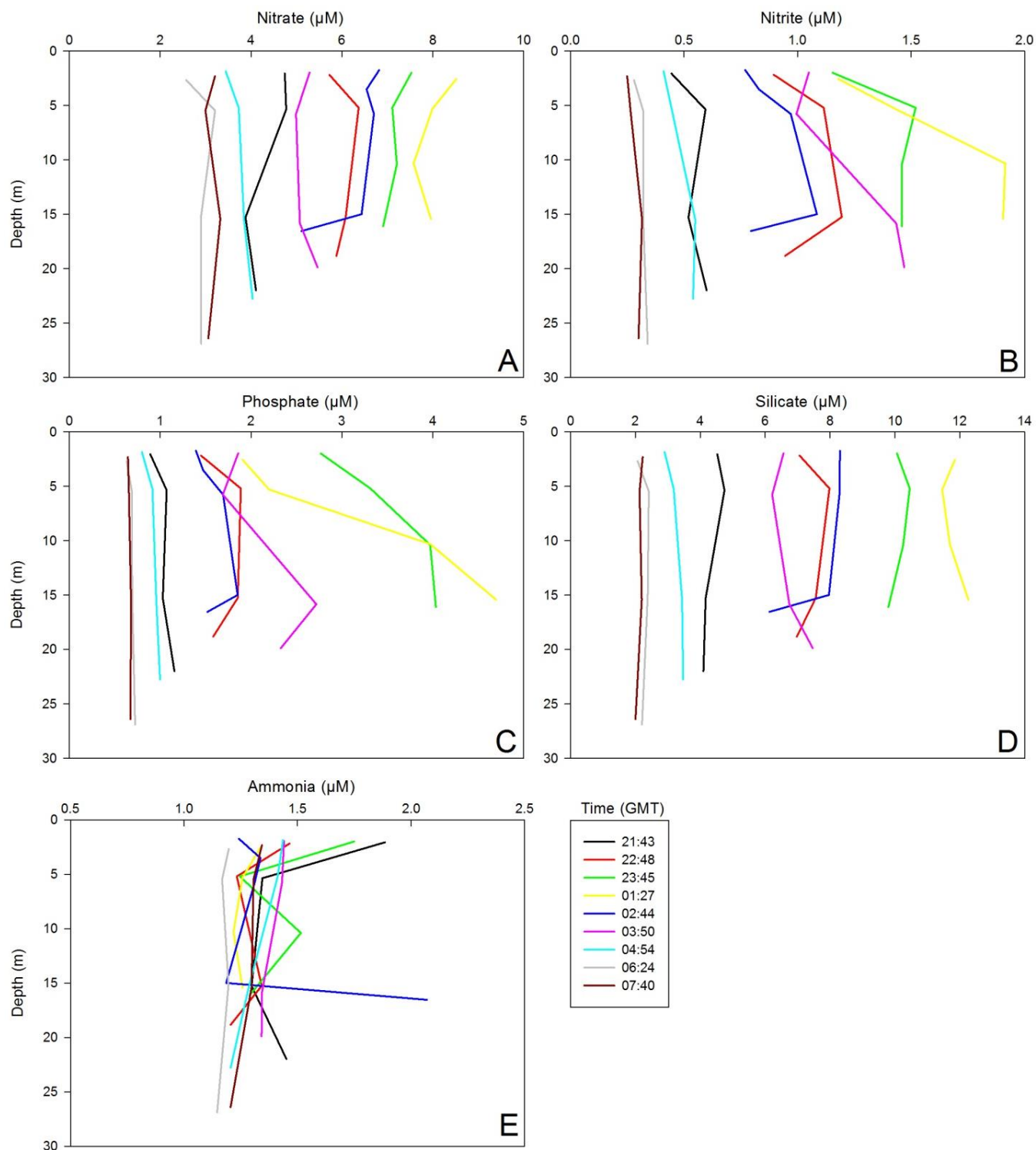


Figure 35. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC4 summer sampling collected 11-12 June 2013. Low tide occurred at 0:30 GMT and high tide at 6:30 GMT during the sampling period.

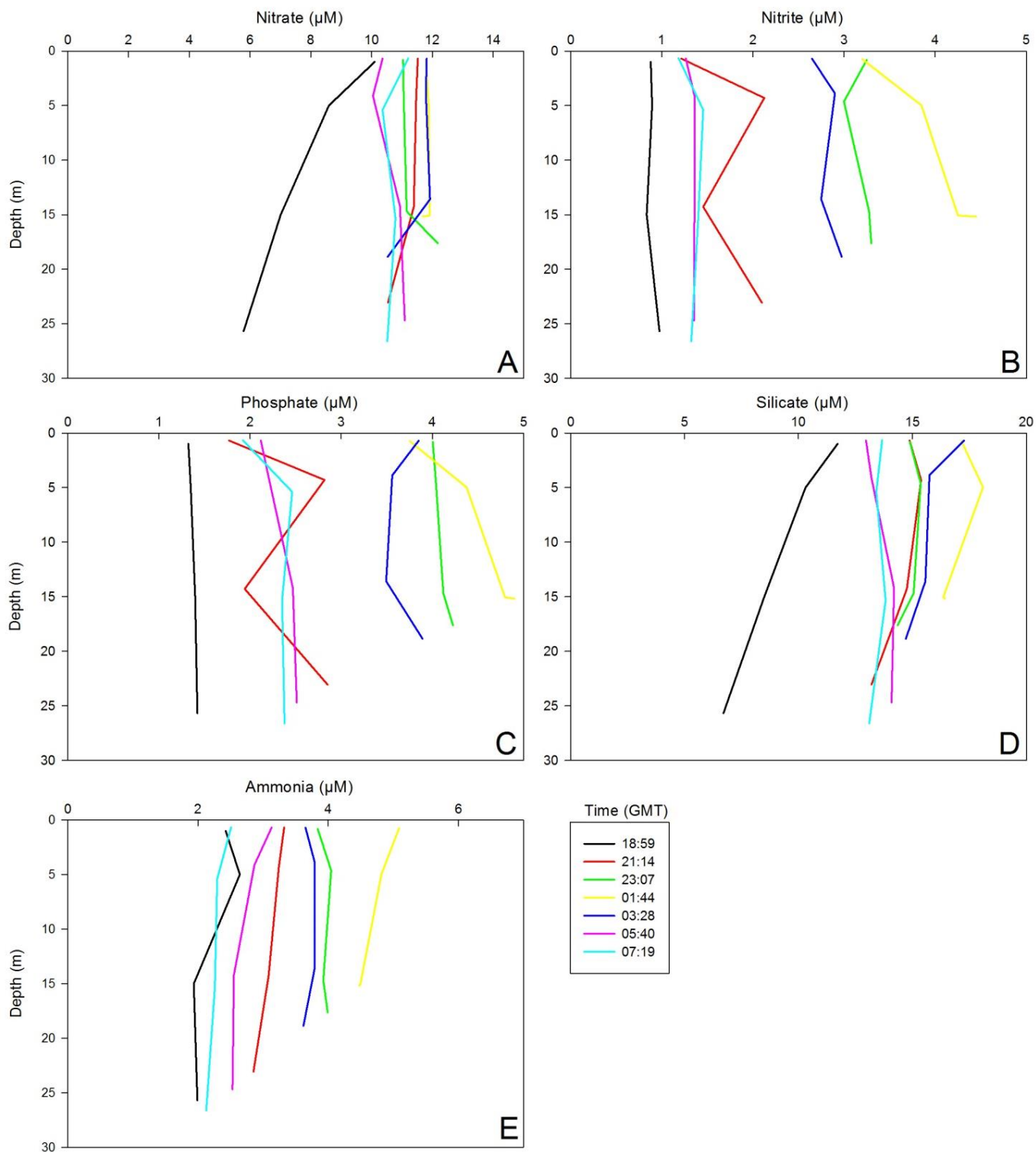


Figure 36. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC4 winter sampling collected 19-20 March 2014. Low tide occurred at 0:45 GMT and high tide at 18:30 and 7:00 GMT during the sampling period.

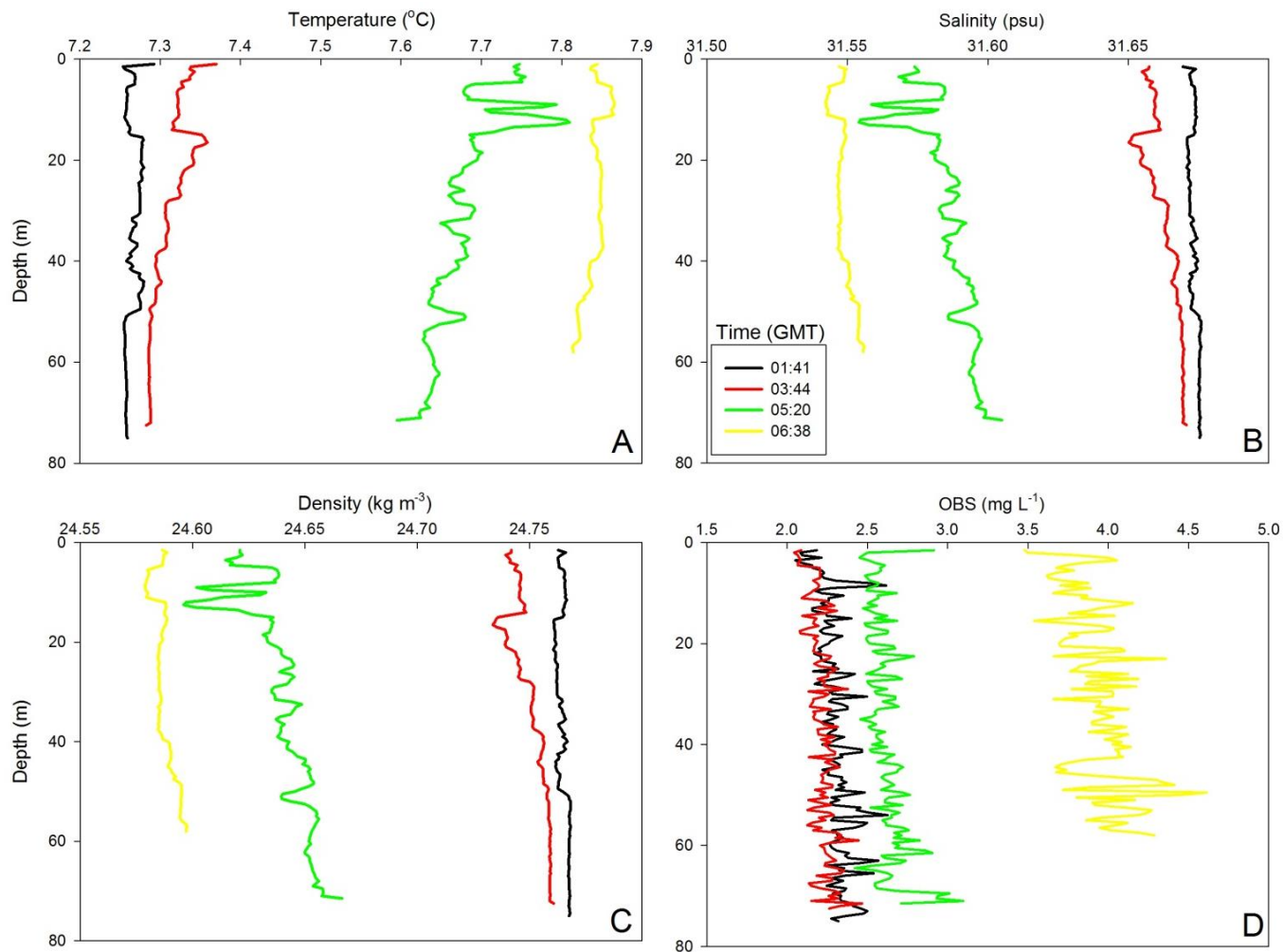


Figure 37. Temperature (A), salinity (B), density (C) and OBS (D) profiles from ANC5 summer sampling collected 5 June 2013. High tide occurred at 1:30 GMT during the sampling period.

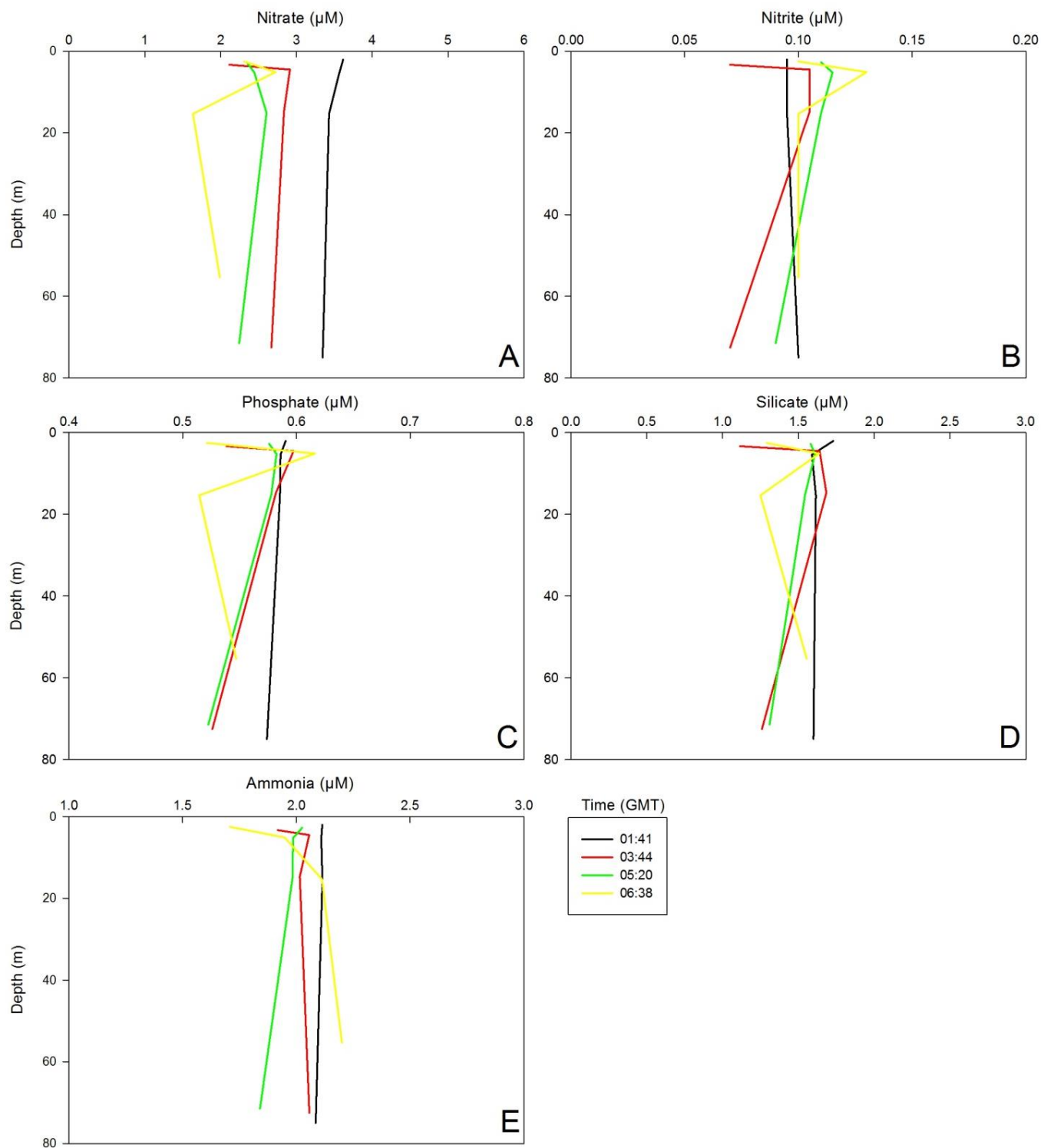


Figure 38. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) profiles from ANC5 summer sampling collected 5 June 2013. High tide occurred at 1:30 GMT during the sampling period.

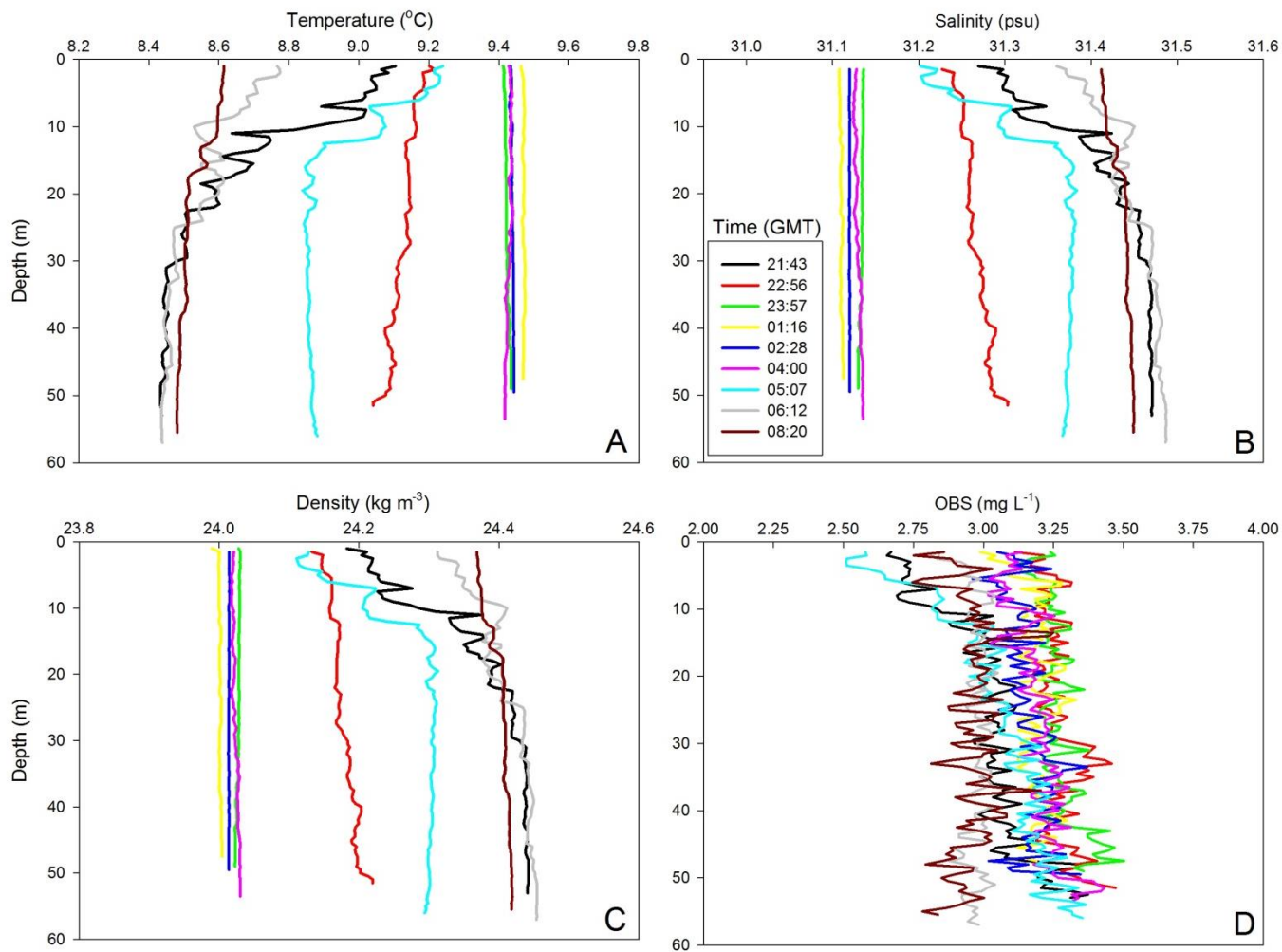


Figure 39. Temperature (A), salinity (B), density (C) and OBS (D) profiles from SC4 summer sampling collected 13-14 June 2013. Low tide occurred at 1:45 GMT and high tide at 8:00 GMT during the sampling period.

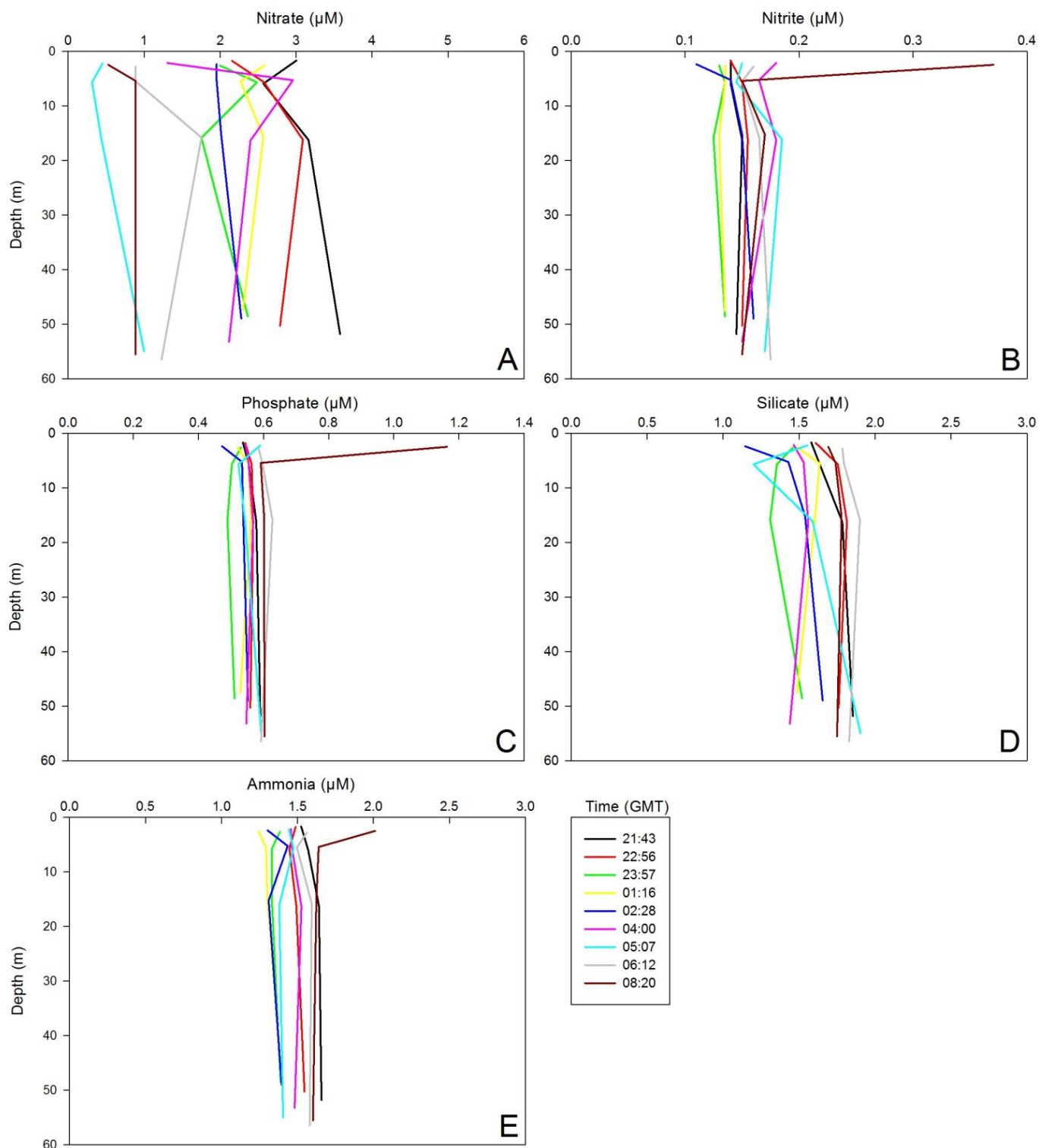


Figure 40. Nitrate (A), nitrite (B), phosphate (C), silicate (D) and ammonia (E) from SC4 summer sampling collected 13-14 June 2013. Low tide occurred at 1:45 GMT and high tide at 8:00 GMT during the sampling period.

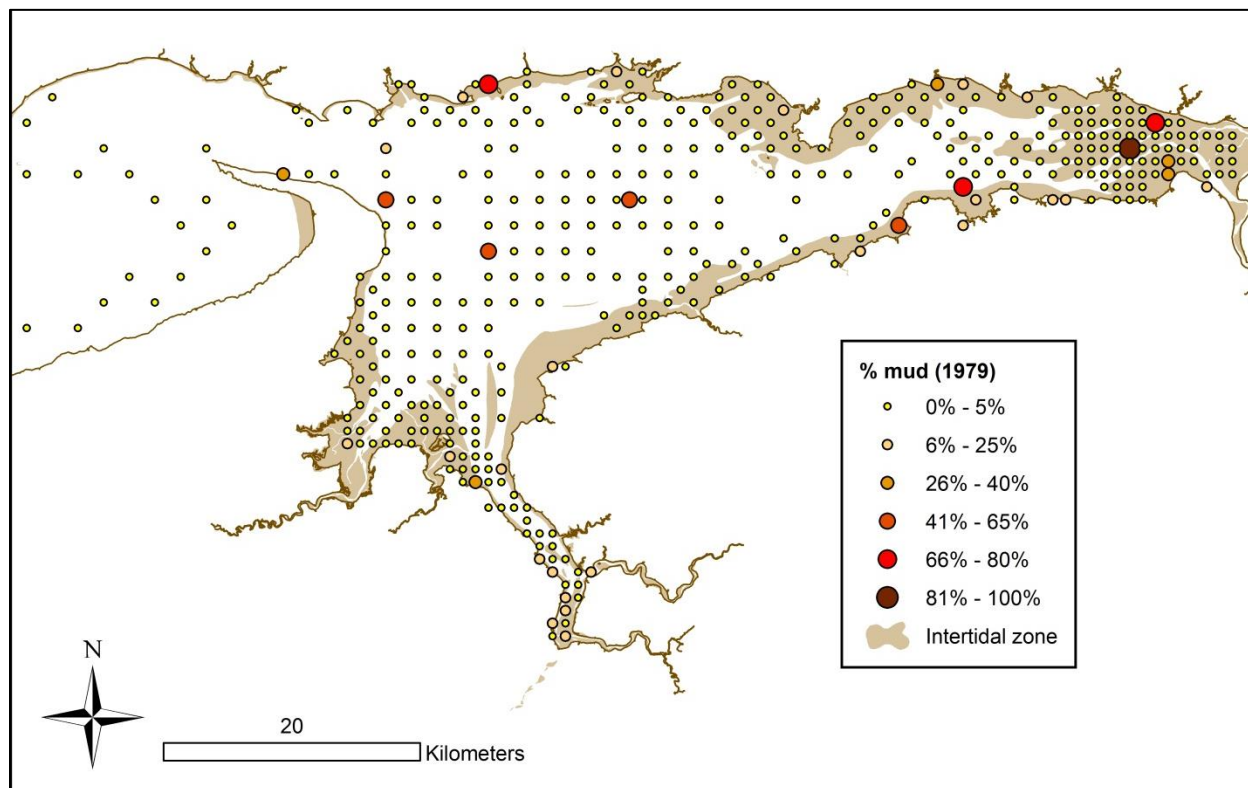


Figure 41. Percent composition of mud (<63 μm) in samples collected by Long (1979) throughout Minas Basin, NS.

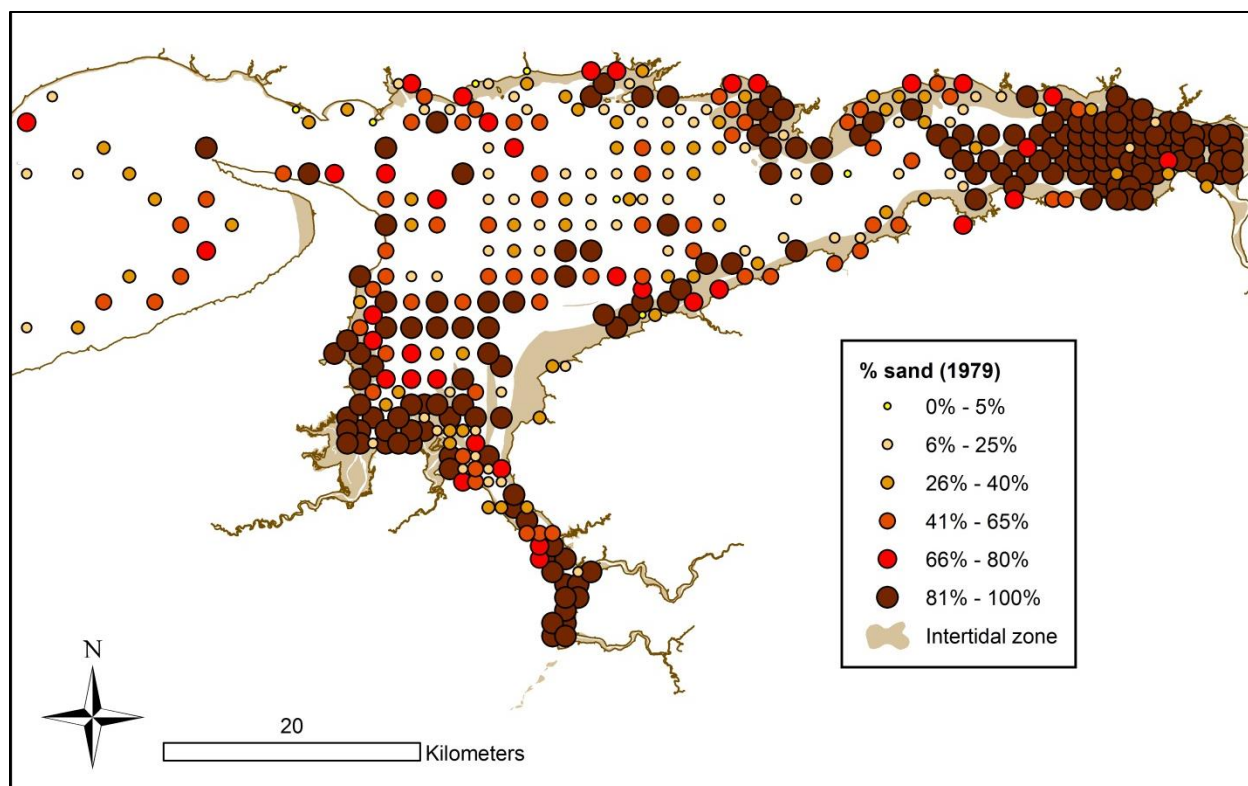


Figure 42. Percent composition of sand (63-2000 μm) in samples collected by Long (1979) throughout Minas Basin, NS.

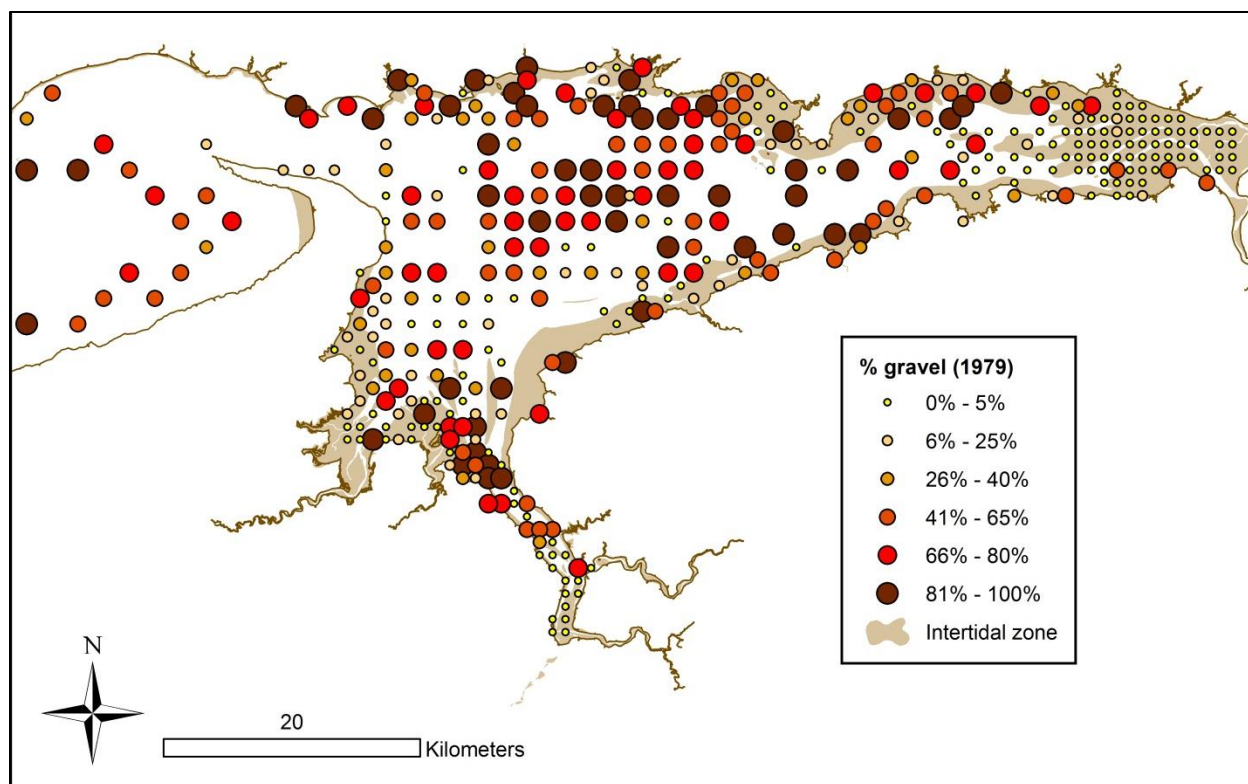


Figure 43. Percent composition of gravel (>2000 µm) in samples collected by Long (1979) throughout Minas Basin, NS.

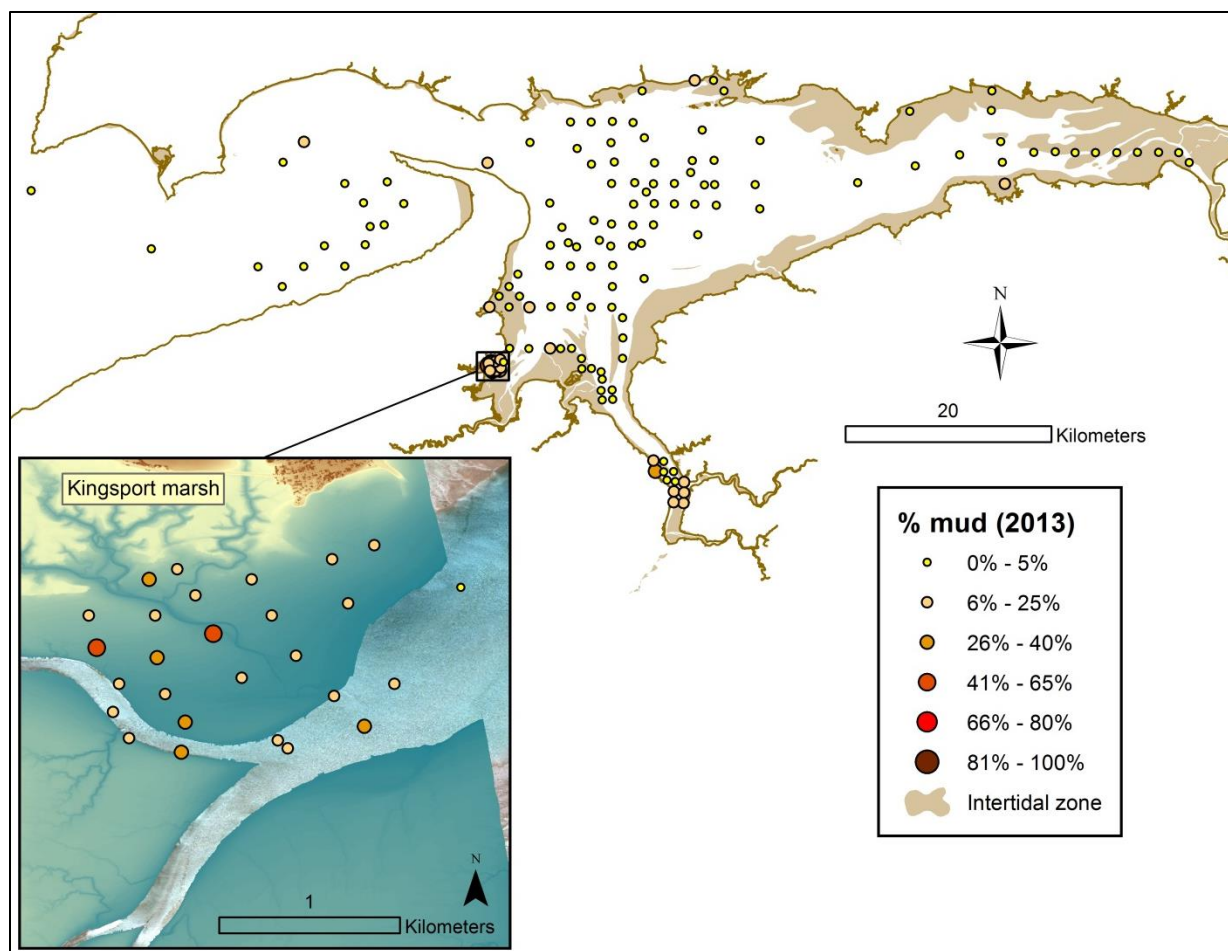


Figure 44. Percent composition of mud (<63 μm) in samples collected during the Hudson 2013-013 cruise throughout Minas Basin, NS.

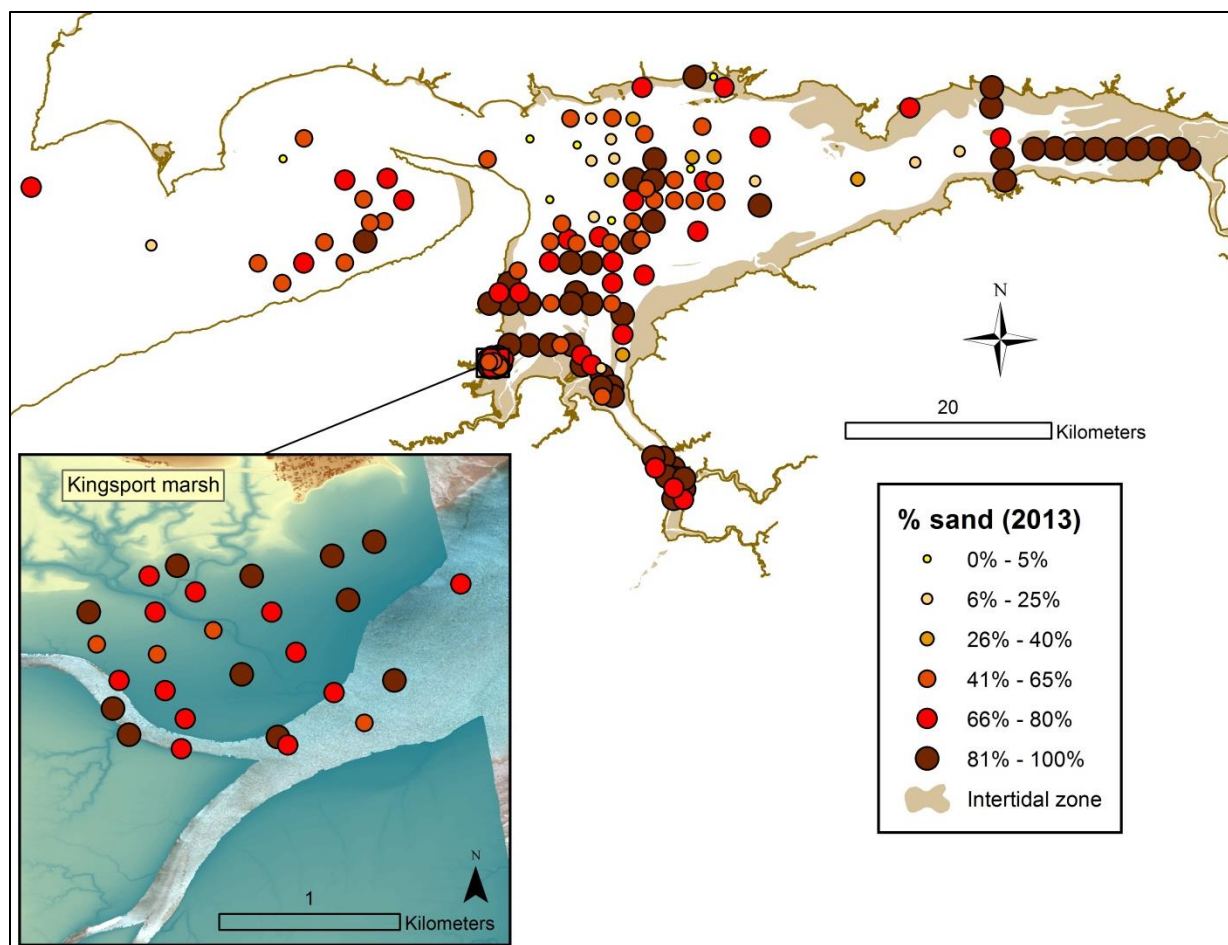


Figure 45. Percent composition of sand (63-2000 µm) in samples collected during the Hudson 2013-013 cruise throughout Minas Basin, NS.

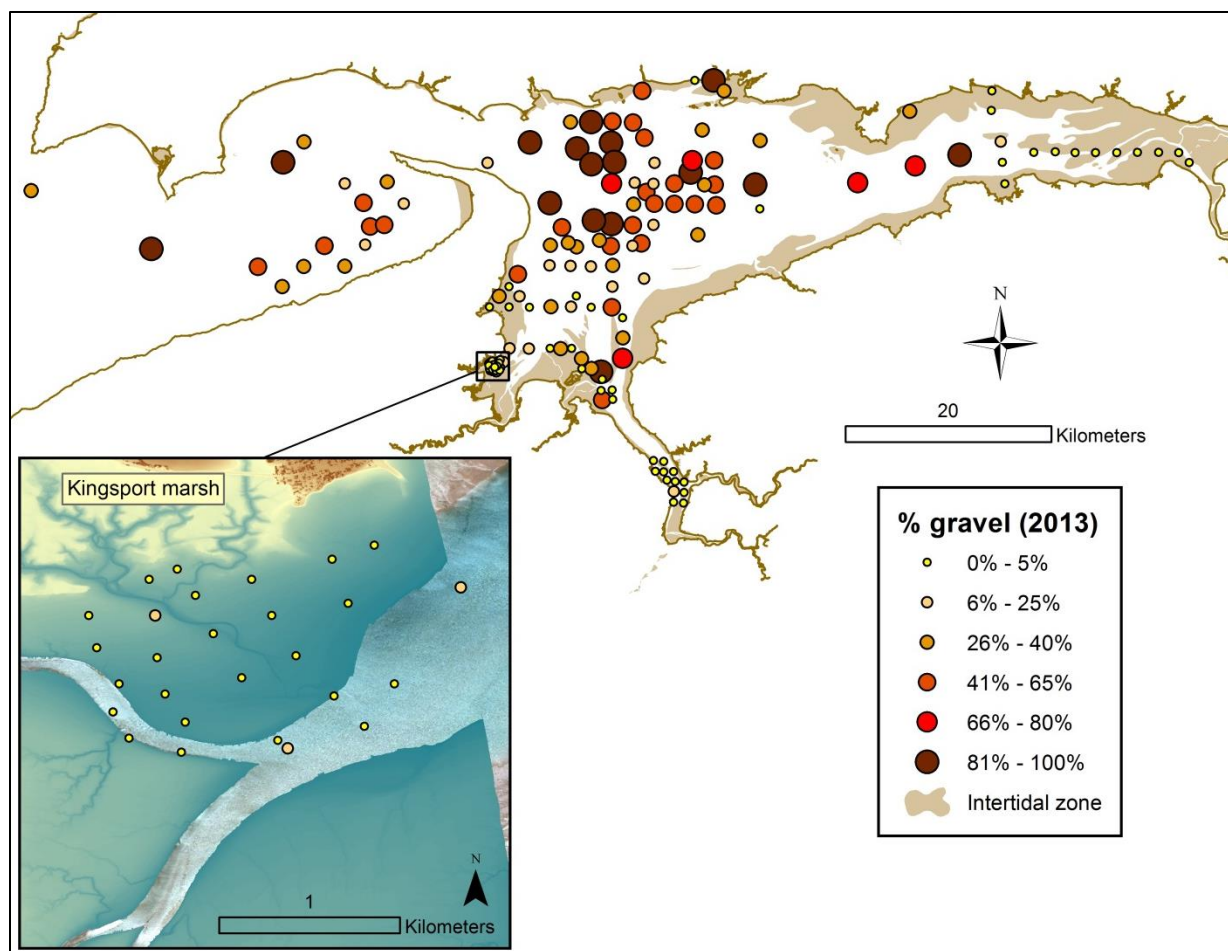


Figure 46. Percent composition of gravel (>2000 µm) in samples collected during the Hudson 2013-013 cruise throughout Minas Basin, NS.

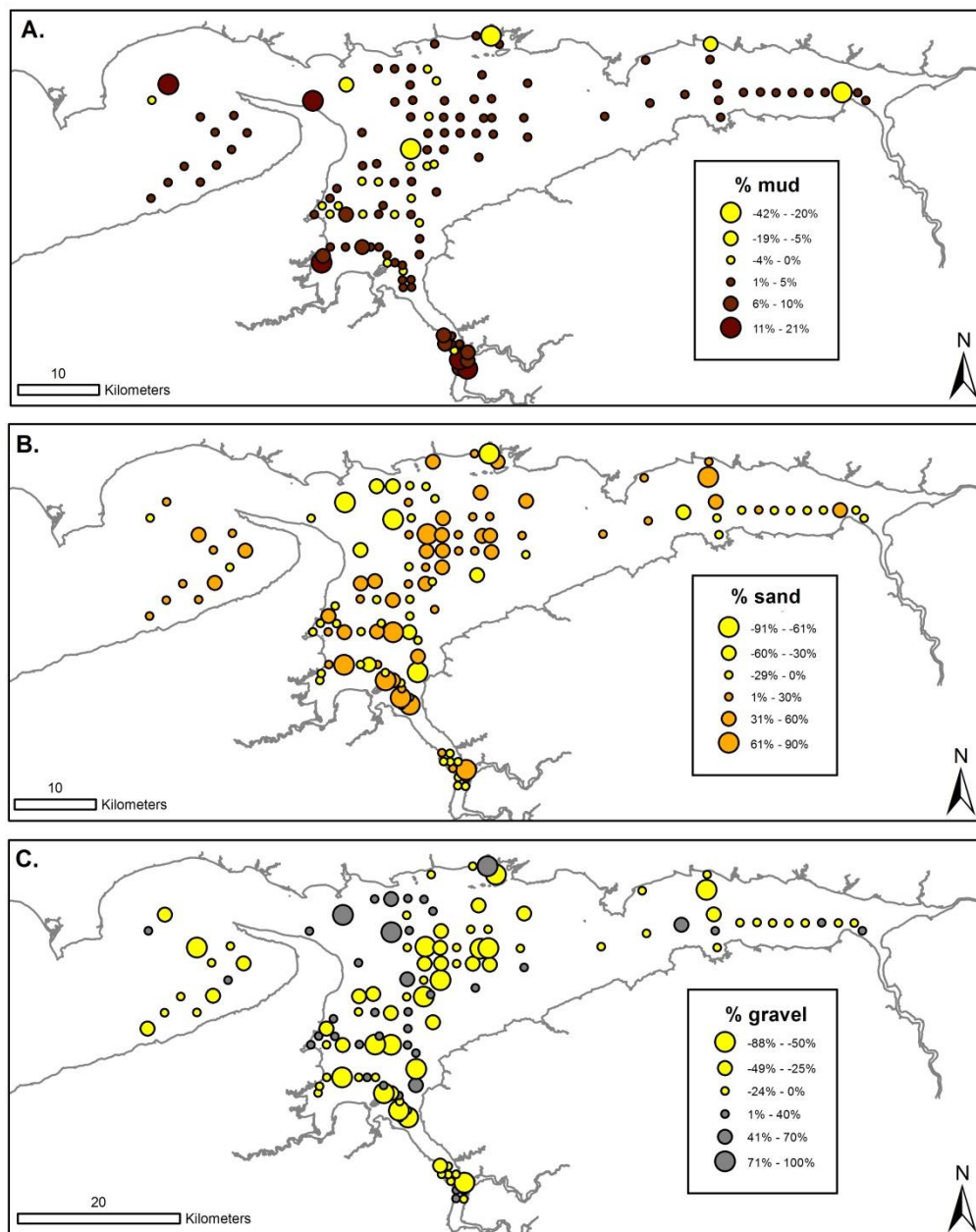


Figure 47. Change in sediment composition from results of Long (1979) to samples collected during the Hudson 2013-013 cruise throughout Minas Basin, NS. Negative change is shown in yellow, reflecting a decrease in in that sediment component of varying magnitude. Positive change indicates an increase in that component and is shown in brown (A. mud), orange (B. sand) and grey (C. gravel).

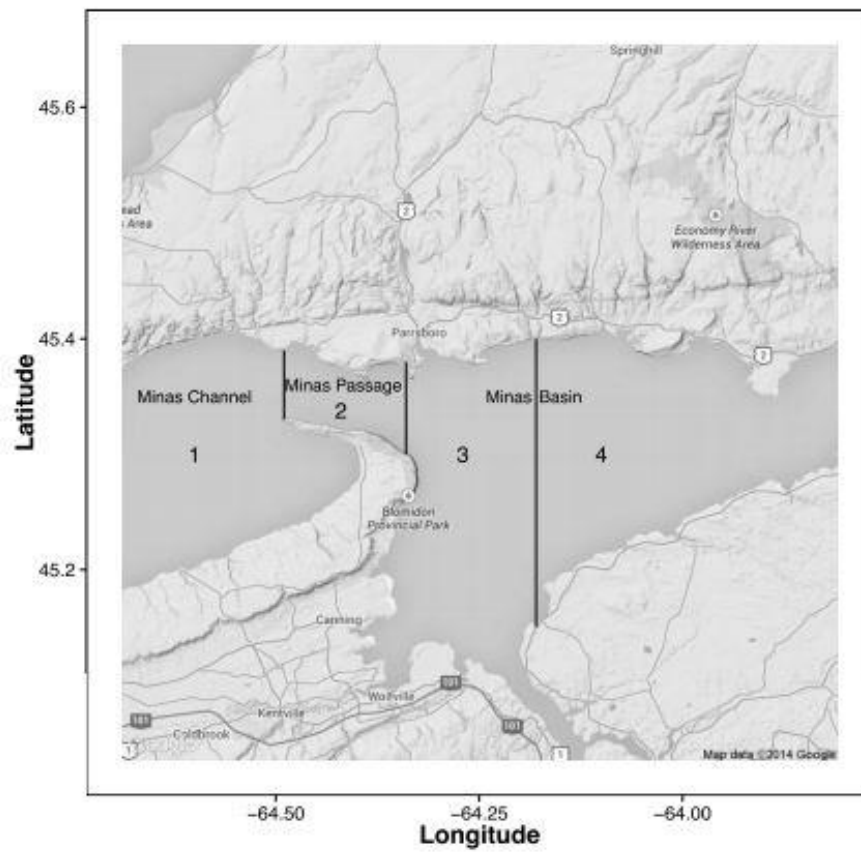


Figure 48. Four geographic zones of the upper Bay of Fundy used for comparison of bottom types from video grab samples and image analysis; 1-Minas Channel, 2-Minas Passage, 3-Minas Basin east, and 4-Minas Basin west.

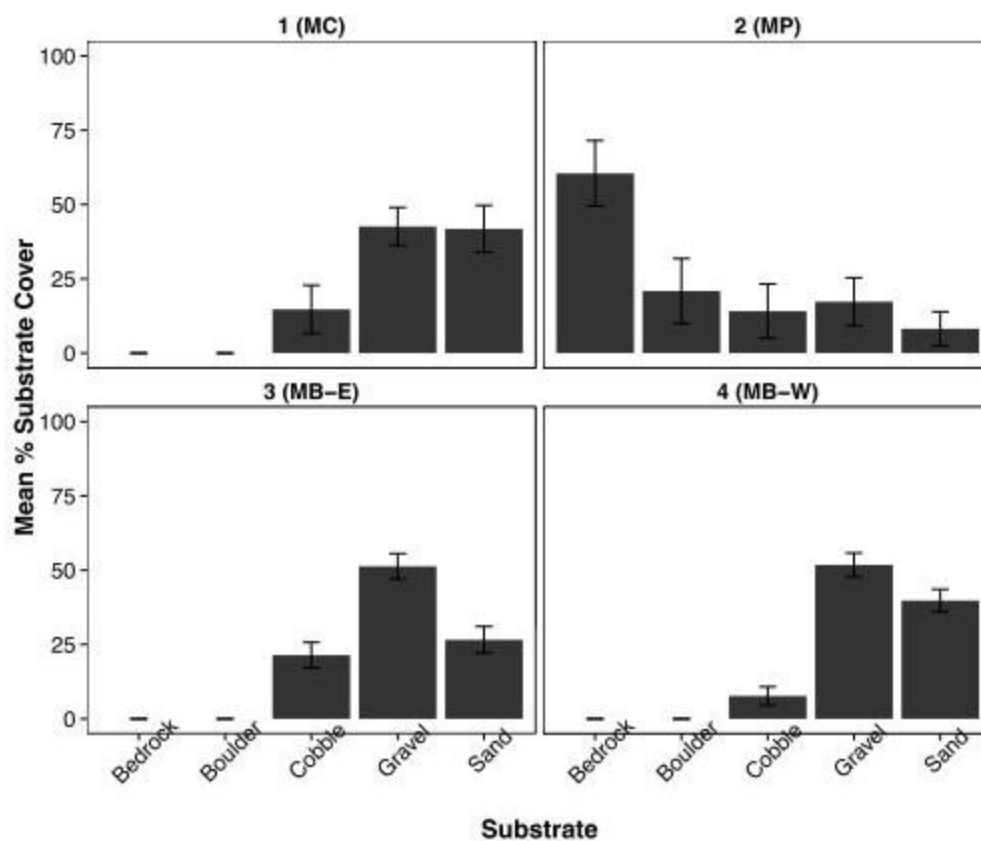


Figure 49. Mean percent substrate cover (bedrock, boulder, cobble, gravel, sand) and standard error for upper Bay of Fundy zones ; 1-Minas Channel, 2-Minas Passage, 3-Minas Basin east, and 4-Minas Basin west.

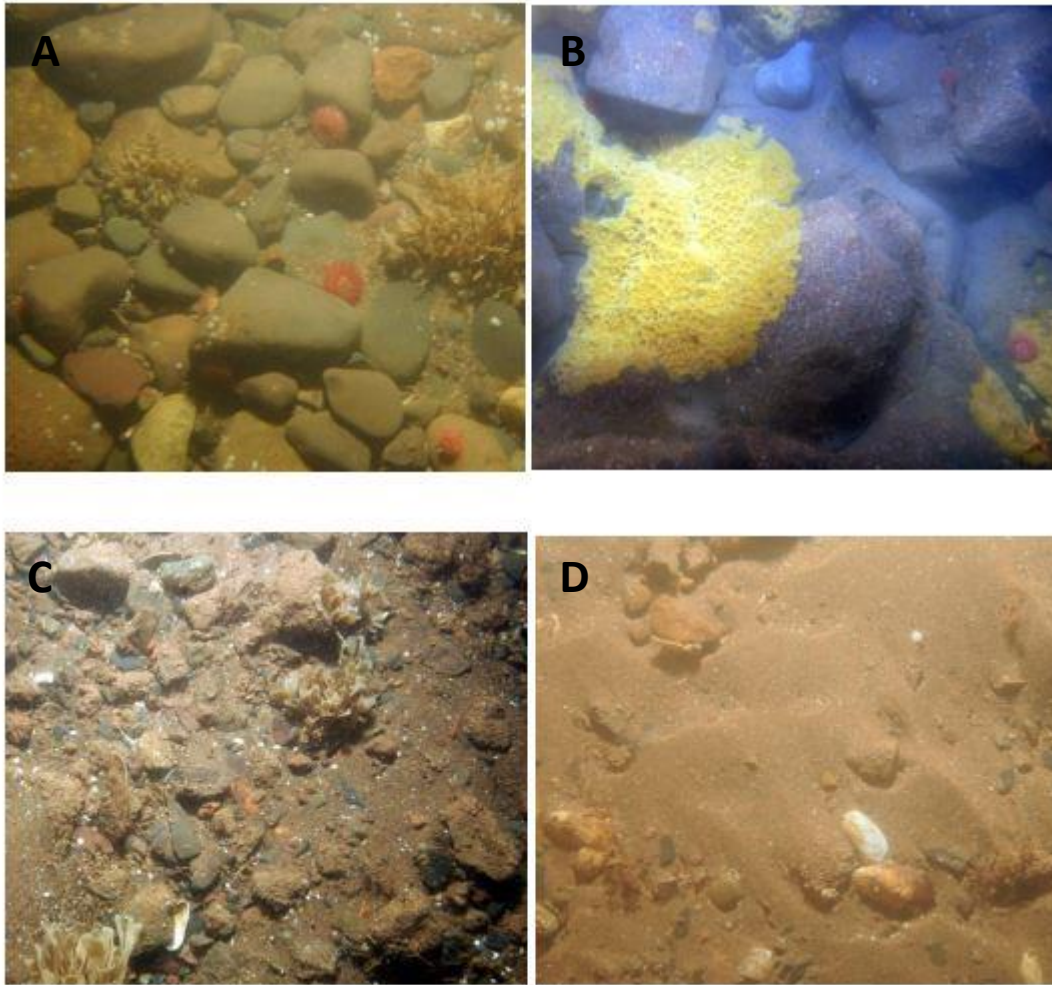


Figure 50. Representative seafloor substrate from zones 1-4 in still photos taken from video grab footage collected aboard the CCGS Hudson (2013-13) from June 6-14, 2013. A: Station G-359 (zone 1), B: FORCE test site (zone 2) C : Station G-056 (zone 3), D: Station G-100 (zone 4).

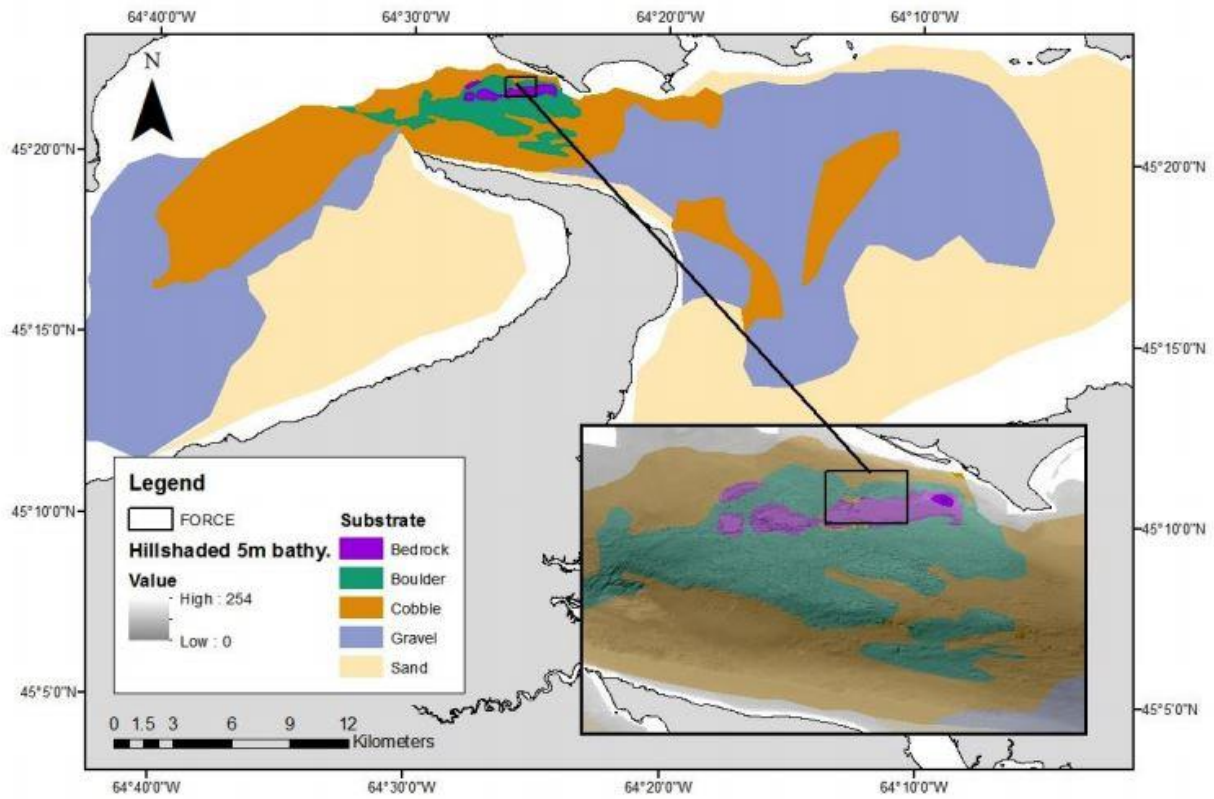


Figure 51. Upper Bay of Fundy general substrate distribution map (bedrock, boulder, cobble, gravel, sand) created using data from seafloor videos, photos, grab samples, and bathymetry.

Table 1. Station location data for anchor stations occupied during cruise Hudson 2013-013.

Station	Latitude	Longitude
ANC1	45.3276	-64.2107
ANC2	45.3188	-64.0096
ANC3	45.2400	-64.2583
ANC4	45.3422	-63.7830
ANC5	45.1884	-65.0772
SC4	45.3597	-64.1128

Table 2. Station location data for slow-cores collected during Hudson 2013-013 cruise.

Station	Core	Date	Time (GMT)	Latitude	Longitude	Depth (m)
G100	394577	12-Jun-13	13:08:22	45.2596	-64.1951	13.2
G49	394583	12-Jun-13	19:43:08	45.2556	-64.2998	25.3
G49	394584	12-Jun-13	20:00:50	45.2553	-64.2992	24.5

Table 3. Modified version of the Wentworth Classification Scheme for clastic sediments based on grain diameter in millimetres (adapted from Wentworth, 1922).

mm	Size Class
256-----	Boulder
64-----	Cobble
4-----	Pebble
2-----	Granule
1-----	Very Coarse Sand
0.25-----	Medium Sand
0.125-----	Fine Sand
0.0625-----	Very Fine Sand
0.002-----	Silt
	Clay

Table 4. Nutrient data collected during Hudson 2013-013 scientific cruise from 5-14 June 2013. Nitrate, nitrite, phosphate, silicate and ammonia are reported in micromolar (μM) units.

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC1	394157	2013-06-07	22:47:03	45.3286	-64.2130	30.88	1.58	0.13	0.45	0.65	0.71
ANC1	394159	2013-06-07	22:49:11	45.3286	-64.2130	15.42	1.62	0.14	0.48	0.74	0.78
ANC1	394161	2013-06-07	22:50:51	45.3286	-64.2130	5.75	1.16	0.12	0.45	0.71	0.80
ANC1	394163	2013-06-07	22:52:10	45.3286	-64.2130	2.02	1.74	0.14	0.46	0.77	0.72
ANC1	394168	2013-06-08	00:10:27	45.3275	-64.2102	31.31	1.34	0.11	0.41	0.67	0.73
ANC1	394170	2013-06-08	00:11:47	45.3275	-64.2102	15.38	0.94	0.07	0.37	0.45	0.73
ANC1	394172	2013-06-08	00:14:18	45.3275	-64.2102	5.17	1.58	0.11	0.42	0.58	0.96
ANC1	394174	2013-06-08	00:16:04	45.3275	-64.2102	2.37	1.74	0.11	0.43	0.70	0.80
ANC1	394178	2013-06-08	01:31:40	45.3282	-64.2085	35.82	1.60	0.11	0.44	0.77	1.24
ANC1	394180	2013-06-08	01:33:30	45.3282	-64.2085	15.98	1.25	0.11	0.48	0.74	1.08
ANC1	394182	2013-06-08	01:34:38	45.3282	-64.2085	5.60	1.76	0.10	0.45	0.87	0.82
ANC1	394184	2013-06-08	01:35:30	45.3282	-64.2085	2.28	1.10	0.12	0.47	0.83	1.07
ANC1	394190	2013-06-08	03:34:53	45.3282	-64.2086	15.45	1.47	0.12	0.52	0.90	1.15
ANC1	394192	2013-06-08	03:36:23	45.3282	-64.2086	5.47	1.81	0.13	0.48	0.98	1.17
ANC1	394194	2013-06-08	03:37:06	45.3282	-64.2086	2.49	1.59	0.13	0.55	0.98	1.56
ANC1	394198	2013-06-08	05:00:24	45.3282	-64.2108	40.79	1.41	0.10	0.45	0.80	1.02
ANC1	394200	2013-06-08	05:02:16	45.3282	-64.2108	15.71	1.31	0.09	0.47	0.80	1.09
ANC1	394202	2013-06-08	05:03:46	45.3282	-64.2108	5.78	1.54	0.12	0.51	0.99	1.55
ANC1	394204	2013-06-08	05:04:51	45.3282	-64.2108	2.54	1.62	0.12	0.47	0.98	1.12
ANC1	394209	2013-06-08	06:14:22	45.3282	-64.2130	39.97	1.42	0.10	0.49	0.79	1.24
ANC1	394211	2013-06-08	06:15:57	45.3282	-64.2130	15.46	1.56	0.13	0.56	1.09	1.28
ANC1	394213	2013-06-08	06:17:09	45.3282	-64.2130	5.37	1.05	0.12	0.41	0.56	1.49
ANC1	394215	2013-06-08	06:17:59	45.3282	-64.2130	2.12	0.97	0.10	0.43	0.56	1.40
ANC1	394219	2013-06-08	07:05:07	45.3280	-64.2135	35.95	1.19	0.10	0.44	0.95	1.21
ANC1	394221	2013-06-08	07:06:45	45.3280	-64.2135	15.56	1.22	0.10	0.38	1.14	1.19

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC1	394223	2013-06-08	07:08:13	45.3280	-64.2135	5.80	1.11	0.10	0.31	1.22	0.98
ANC1	394225	2013-06-08	07:09:21	45.3280	-64.2135	1.80	1.28	0.11	0.35	1.04	0.87
ANC1	394585	2013-06-12	21:33:21	45.3284	-64.2153	40.57	2.18	0.14	0.52	1.32	1.45
ANC1	394587	2013-06-12	21:34:54	45.3284	-64.2153	15.29	2.03	0.14	0.49	1.50	1.19
ANC1	394589	2013-06-12	21:36:03	45.3284	-64.2153	5.36	1.65	0.13	0.45	1.21	0.87
ANC1	394591	2013-06-12	21:36:54	45.3284	-64.2153	1.79	1.50	0.11	0.42	1.05	0.98
ANC1	394593	2013-06-12	22:53:02	45.3283	-64.2154	37.05	1.65	0.13	0.45	1.13	1.03
ANC1	394595	2013-06-12	22:54:11	45.3283	-64.2154	15.27	1.58	0.13	0.45	1.12	0.86
ANC1	394597	2013-06-12	22:55:17	45.3283	-64.2154	5.38	1.58	0.13	0.44	1.06	0.93
ANC1	394599	2013-06-12	22:56:01	45.3283	-64.2154	2.20	1.67	0.13	0.42	0.94	1.32
ANC1	394601	2013-06-12	23:57:32	45.3284	-64.2153	34.75	1.80	0.13	0.42	0.90	0.90
ANC1	394603	2013-06-12	23:58:53	45.3284	-64.2153	15.35	1.68	0.14	0.45	1.27	1.03
ANC1	394605	2013-06-12	23:59:53	45.3284	-64.2153	5.64	1.58	0.15	0.45	1.15	0.98
ANC1	394607	2013-06-13	00:00:37	45.3284	-64.2153	1.95	1.51	0.16	0.44	1.17	0.91
ANC1	394609	2013-06-13	01:25:29	45.3281	-64.2152	32.88	1.59	0.14	0.42	1.02	0.91
ANC1	394611	2013-06-13	01:26:44	45.3281	-64.2152	15.28	1.64	0.17	0.47	1.17	0.92
ANC1	394613	2013-06-13	01:27:35	45.3281	-64.2152	5.37	2.13	0.19	0.46	1.02	0.96
ANC1	394615	2013-06-13	01:28:13	45.3281	-64.2152	2.48	1.80	0.17	0.46	1.08	1.01
ANC1	394619	2013-06-13	02:50:00	45.3280	-64.2133	33.99	1.80	0.14	0.45	1.09	0.95
ANC1	394621	2013-06-13	02:51:22	45.3280	-64.2133	15.56	2.00	0.14	0.48	1.29	0.84
ANC1	394623	2013-06-13	02:52:37	45.3280	-64.2133	5.41	1.86	0.13	0.46	1.08	1.06
ANC1	394625	2013-06-13	02:53:17	45.3280	-64.2133	2.72	2.16	0.13	0.41	0.98	0.86
ANC1	394630	2013-06-13	04:15:19	45.3284	-64.2110	39.66	1.73	0.12	0.42	0.99	0.93
ANC1	394632	2013-06-13	04:16:46	45.3284	-64.2110	16.41	1.88	0.14	0.46	1.23	0.91
ANC1	394634	2013-06-13	04:17:37	45.3284	-64.2110	5.56	1.85	0.14	0.46	1.11	1.00
ANC1	394636	2013-06-13	04:18:15	45.3284	-64.2110	1.72	1.64	0.12	0.41	0.83	0.92
ANC1	394638	2013-06-13	05:23:13	45.3285	-64.2110	42.90	1.96	0.12	0.45	1.05	1.09
ANC1	394640	2013-06-13	05:24:40	45.3285	-64.2110	16.13	2.51	0.15	0.51	1.49	1.24

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC1	394642	2013-06-13	05:25:46	45.3285	-64.2110	5.49	2.31	0.15	0.50	1.38	1.32
ANC1	394644	2013-06-13	05:26:31	45.3285	-64.2110	2.47	1.78	0.15	0.47	1.27	1.49
ANC1	394646	2013-06-13	06:28:02	45.3284	-64.2111	44.75	1.91	0.17	0.51	1.46	1.36
ANC1	394648	2013-06-13	06:29:35	45.3284	-64.2111	15.56	2.05	0.14	0.49	1.36	1.33
ANC1	394650	2013-06-13	06:30:29	45.3284	-64.2111	5.39	1.82	0.15	0.50	1.37	1.55
ANC1	394652	2013-06-13	06:31:12	45.3284	-64.2111	2.50	2.26	0.14	0.49	1.34	1.33
ANC1	394654	2013-06-13	08:01:53	45.3277	-64.2124	41.08	2.27	0.13	0.49	1.32	1.40
ANC1	394656	2013-06-13	08:03:13	45.3277	-64.2124	15.36	1.89	0.14	0.51	1.38	1.36
ANC1	394658	2013-06-13	08:04:09	45.3277	-64.2124	5.64	2.13	0.13	0.48	1.37	1.39
ANC1	394660	2013-06-13	08:04:53	45.3277	-64.2124	2.52	2.36	0.12	0.48	1.22	1.35
ANC2	394393	2013-06-10	21:20:34	45.3179	-64.0130	26.18	1.79	0.24	0.56	1.18	0.90
ANC2	394395	2013-06-10	21:21:55	45.3179	-64.0130	15.73	1.97	0.28	0.59	1.34	0.94
ANC2	394397	2013-06-10	21:23:14	45.3179	-64.0130	5.96	2.11	0.26	0.58	1.33	0.92
ANC2	394399	2013-06-10	21:24:10	45.3179	-64.0130	1.82	2.16	0.28	0.59	1.30	1.13
ANC2	394403	2013-06-10	22:25:40	45.3180	-64.0130	23.07	2.77	0.29	0.62	1.94	1.03
ANC2	394405	2013-06-10	22:26:52	45.3180	-64.0130	15.76	2.82	0.32	0.69	2.02	1.08
ANC2	394407	2013-06-10	22:27:49	45.3180	-64.0130	5.79	2.71	0.29	0.64	1.99	1.01
ANC2	394409	2013-06-10	22:28:34	45.3180	-64.0130	2.39	2.55	0.29	0.59	1.86	1.10
ANC2	394427	2013-06-10	23:42:59	45.3179	-64.0130	21.60	2.72	0.46	0.77	2.43	1.47
ANC2	394429	2013-06-10	23:44:01	45.3179	-64.0130	15.29	2.96	0.45	0.80	2.65	1.22
ANC2	394431	2013-06-10	23:44:55	45.3179	-64.0130	5.39	3.37	0.46	0.85	3.05	1.10
ANC2	394433	2013-06-10	23:45:34	45.3179	-64.0130	2.09	3.44	0.50	0.90	3.17	1.21
ANC2	394437	2013-06-11	01:32:17	45.3179	-64.0110	22.67	2.20	0.33	0.64	1.90	1.06
ANC2	394441	2013-06-11		45.3179	-64.0110		3.44	0.35	0.76	2.99	1.17
ANC2	394443	2013-06-11		45.3179	-64.0110		3.51	0.31	0.62	2.79	1.06
ANC2	394448	2013-06-11	02:59:41	45.3179	-64.0992	26.90	2.13	0.23	no data	1.29	0.96
ANC2	394450	2013-06-11	03:00:54	45.3179	-64.0992	15.43	2.54	0.30	no data	1.62	1.18
ANC2	394452	2013-06-11	03:01:54	45.3179	-64.0992	5.79	2.46	0.27	no data	1.50	1.10

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC2	394454	2013-06-11	03:02:35	45.3179	-64.0992	2.22	2.06	0.28	no data	1.36	1.15
ANC2	394458	2013-06-11	04:41:43	45.3177	-64.0100	30.59	1.69	0.14	no data	0.97	0.82
ANC2	394460	2013-06-11	04:43:04	45.3177	-64.0100	15.72	1.54	0.15	no data	0.90	0.79
ANC2	394462	2013-06-11	04:44:16	45.3177	-64.0100	5.37	1.58	0.16	0.43	1.10	1.10
ANC2	394464	2013-06-11	04:45:02	45.3177	-64.0100	2.25	1.68	0.17	0.47	1.06	1.07
ANC2	394468	2013-06-11	06:25:57	45.3175	-64.0108	33.70	1.09	0.14	0.43	1.02	0.88
ANC2	394470	2013-06-11	06:27:27	45.3175	-64.0108	15.30	1.91	0.14	0.43	1.01	0.81
ANC2	394472	2013-06-11	06:28:35	45.3175	-64.0108	5.72	1.65	0.15	0.44	0.96	0.90
ANC2	394474	2013-06-11	06:29:26	45.3175	-64.0108	2.62	1.42	0.14	0.41	0.98	0.89
ANC2	394477	2013-06-11	07:38:55	45.3177	-64.0122	31.60	1.31	0.13	0.38	0.81	0.95
ANC2	394479	2013-06-11	07:40:08	45.3177	-64.0122	15.56	1.50	0.15	0.44	0.97	0.81
ANC2	394481	2013-06-11	07:41:35	45.3177	-64.0122	5.76	1.38	0.13	0.40	0.96	1.09
ANC2	394483	2013-06-11	07:42:33	45.3177	-64.0122	2.16	1.33	0.15	0.44	1.03	1.11
ANC3	394063	2013-06-06	23:09:51	45.2553	-64.2653	20.97	1.14	0.11	0.49	0.85	0.82
ANC3	394065	2013-06-06	23:12:56	45.2553	-64.2653	15.30	1.37	0.11	0.47	0.77	0.84
ANC3	394067	2013-06-06	23:15:03	45.2553	-64.2653	5.08	1.26	0.13	0.48	0.78	1.08
ANC3	394083	2013-06-07	00:28:54	45.2551	-64.2658	15.39	1.14	0.13	0.49	0.92	1.12
ANC3	394085	2013-06-07	00:32:38	45.2551	-64.2658	5.36	1.70	0.12	0.47	0.84	1.08
ANC3	394087	2013-06-07	00:35:39	45.2551	-64.2658	2.68	1.13	0.10	0.45	0.77	1.05
ANC3	394091	2013-06-07	01:41:04	45.2551	-64.2665	28.62	1.73	0.11	0.46	0.90	1.29
ANC3	394093	2013-06-07	01:43:09	45.2551	-64.2665	15.84	1.23	0.13	0.48	0.93	1.49
ANC3	394095	2013-06-07	01:45:07	45.2551	-64.2665	5.63	1.09	0.12	0.45	0.84	1.66
ANC3	394097	2013-06-07	01:47:37	45.2551	-64.2665	2.47	1.05	0.13	0.45	0.76	1.75
ANC3	394101	2013-06-07	03:09:02	45.2554	-64.2664	32.41	1.39	0.12	0.47	0.92	1.26
ANC3	394103	2013-06-07	03:11:43	45.2554	-64.2664	15.12	1.35	0.12	0.49	0.98	1.26
ANC3	394105	2013-06-07	03:13:58	45.2554	-64.2664	5.07	1.40	0.11	0.49	0.98	1.24
ANC3	394107	2013-06-07	03:15:21	45.2554	-64.2664	2.04	1.58	0.11	0.56	1.08	1.32
ANC3	394113	2013-06-07	04:34:48	45.2560	-64.2673	31.39	1.84	0.13	0.50	1.04	1.16

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC3	394115	2013-06-07	04:37:11	45.2560	-64.2673	15.45	2.05	0.11	0.51	0.96	1.22
ANC3	394117	2013-06-07	04:39:12	45.2560	-64.2673	5.21	1.57	0.11	0.48	0.94	1.16
ANC3	394119	2013-06-07	04:40:37	45.2560	-64.2673	2.23	1.44	0.10	0.42	1.19	1.12
ANC3	394122	2013-06-07	05:52:31	45.2565	-64.2672	28.37	1.73	0.14	0.50	1.00	1.63
ANC3	394124	2013-06-07	05:55:35	45.2565	-64.2672	15.41	1.43	0.11	0.48	0.92	1.14
ANC3	394126	2013-06-07	05:57:18	45.2565	-64.2672	5.22	1.21	0.10	0.45	0.80	0.93
ANC3	394128	2013-06-07	05:59:08	45.2565	-64.2672	2.17	1.19	0.12	0.43	0.64	1.55
ANC3	394132	2013-06-07	06:56:45	45.2566	-64.2674	25.77	1.35	0.10	0.43	0.73	1.04
ANC3	394134	2013-06-07	06:59:32	45.2566	-64.2674	15.57	1.32	0.10	0.42	0.59	0.77
ANC3	394136	2013-06-07	07:01:41	45.2566	-64.2674	5.49	0.90	0.10	0.42	0.68	0.74
ANC3	394138	2013-06-07	07:03:38	45.2566	-64.2674	2.34	1.16	0.11	0.46	0.79	0.85
ANC3	394142	2013-06-07	08:19:51	45.2566	-64.2673	20.77	1.07	0.13	0.43	0.66	1.39
ANC3	394144	2013-06-07	08:21:03	45.2566	-64.2673	15.01	1.10	0.11	0.45	0.83	0.69
ANC3	394146	2013-06-07	08:22:34	45.2566	-64.2673	5.48	1.11	0.14	0.46	0.79	0.81
ANC3	394148	2013-06-07	08:23:55	45.2566	-64.2673	2.27	0.90	0.15	0.42	0.63	1.28
ANC3	394237	2013-06-08	21:47:36	45.2451	-64.2617	18.68	0.86	0.11	0.44	0.88	0.58
ANC3	394239	2013-06-08	21:49:05	45.2451	-64.2617	15.37	0.77	0.11	0.41	0.78	0.53
ANC3	394241	2013-06-08	21:50:12	45.2451	-64.2617	5.91	0.94	0.10	0.43	1.00	0.53
ANC3	394243	2013-06-08	21:51:06	45.2451	-64.2617	2.01	0.90	0.10	0.44	0.95	0.54
ANC3	394247	2013-06-08	23:28:28	45.2444	-64.2605	17.82	0.84	0.08	0.36	0.49	0.84
ANC3	394249	2013-06-08	23:29:24	45.2444	-64.2605	15.59	0.85	0.08	0.34	0.57	0.84
ANC3	394251	2013-06-08	23:30:39	45.2444	-64.2605	5.21	0.70	0.09	0.36	0.69	0.70
ANC3	394253	2013-06-08	23:31:39	45.2444	-64.2605	2.14	0.55	0.09	0.35	0.67	0.79
ANC3	394258	2013-06-09	00:49:37	45.2438	-64.2604	18.96	1.16	0.12	0.35	0.62	0.93
ANC3	394260	2013-06-09	00:50:51	45.2438	-64.2604	15.43	1.20	0.12	0.39	0.75	1.27
ANC3	394262	2013-06-09	00:51:54	45.2438	-64.2604	5.34	1.32	0.14	0.38	0.88	1.11
ANC3	394264	2013-06-09	00:52:46	45.2438	-64.2604	2.27	1.30	0.12	0.36	0.88	1.08
ANC3	394268	2013-06-09	02:09:24	45.2436	-64.2606	22.65	1.63	0.14	0.45	0.97	1.13

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC3	394270	2013-06-09	02:10:21	45.2436	-64.2606	15.70	1.67	0.13	0.44	0.99	1.04
ANC3	394272	2013-06-09	02:11:22	45.2436	-64.2606	5.65	1.80	0.12	0.50	1.01	1.03
ANC3	394274	2013-06-09	02:12:06	45.2436	-64.2606	2.28	1.69	0.12	0.44	0.94	1.20
ANC3	394278	2013-06-09	03:50:52	45.2438	-64.2612	26.75	1.80	0.11	0.45	1.03	1.49
ANC3	394280	2013-06-09	03:52:04	45.2438	-64.2612	15.13	1.75	0.12	0.44	0.99	1.51
ANC3	394282	2013-06-09	03:52:58	45.2438	-64.2612	5.75	1.94	0.13	0.48	1.20	1.27
ANC3	394284	2013-06-09	03:53:41	45.2438	-64.2612	2.20	1.57	0.10	0.43	0.81	1.28
ANC3	394288	2013-06-09	05:34:57	45.2445	-64.2618	28.65	1.65	0.12	0.43	0.87	1.15
ANC3	394290	2013-06-09	05:36:03	45.2445	-64.2618	15.26	1.55	0.09	0.41	0.78	1.20
ANC3	394292	2013-06-09	05:37:06	45.2445	-64.2618	5.54	1.84	0.13	0.46	1.11	1.27
ANC3	394294	2013-06-09	05:37:51	45.2445	-64.2618	2.38	1.67	0.13	0.43	0.95	1.54
ANC3	394299	2013-06-09	06:53:54	45.2449	-64.2620	25.90	1.77	0.12	0.43	1.55	1.21
ANC3	394301	2013-06-09	06:55:06	45.2449	-64.2620	15.46	1.83	0.12	0.46	1.04	1.17
ANC3	394303	2013-06-09	06:56:08	45.2449	-64.2620	5.48	1.83	0.13	0.46	1.04	1.09
ANC3	394305	2013-06-09	06:57:14	45.2449	-64.2620	1.73	1.64	0.12	0.42	0.85	1.06
ANC3	394309	2013-06-09	07:49:39	45.2450	-64.2619	22.87	1.46	0.14	0.31	2.09	1.21
ANC3	394311	2013-06-09	07:50:58	45.2450	-64.2619	15.75	1.53	0.14	0.30	2.35	1.18
ANC3	394313	2013-06-09	07:52:28	45.2450	-64.2619	5.52	1.52	0.15	0.42	0.90	0.91
ANC3	394315	2013-06-09	07:53:12	45.2450	-64.2619	1.96	1.46	0.13	0.40	0.85	0.83
ANC4	394326	2013-06-10	00:09:10	45.3400	-63.7936	17.66	7.09	1.16	1.77	9.38	1.22
ANC4	394328	2013-06-10	00:09:58	45.3400	-63.7936	15.26	6.29	1.20	1.76	8.51	1.19
ANC4	394330	2013-06-10	00:11:01	45.3400	-63.7936	5.52	7.61	1.74	2.28	10.60	1.21
ANC4	394332	2013-06-10	00:11:50	45.3400	-63.7936	2.16	5.81	1.13	1.67	8.62	1.11
ANC4	394336	2013-06-10	01:30:30	45.3409	-63.7920	17.54	5.20	0.94	1.44	6.26	1.05
ANC4	394338	2013-06-10	01:31:17	45.3409	-63.7920	15.14	5.92	0.98	1.54	6.97	1.30
ANC4	394340	2013-06-10	01:32:09	45.3409	-63.7920	6.07	5.17	0.88	1.38	6.19	1.06
ANC4	394342	2013-06-10	01:33:10	45.3409	-63.7920	1.84	6.66	0.79	1.30	8.44	1.10
ANC4	394346	2013-06-10	02:21:06	45.3412	-63.7917	19.16	4.94	1.56	2.30	6.39	1.14

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC4	394348	2013-06-10	02:22:23	45.3412	-63.7917	15.61	4.88	1.45	2.11	6.01	1.24
ANC4	394350	2013-06-10	02:23:52	45.3412	-63.7917	5.38	4.82	1.24	2.00	5.61	1.16
ANC4	394352	2013-06-10	02:24:51	45.3412	-63.7917	1.80	4.62	0.94	1.50	5.23	1.06
ANC4	394356	2013-06-10	03:18:51	45.3412	-63.7916	22.53	3.48	0.65	1.08	3.30	1.11
ANC4	394358	2013-06-10	03:19:45	45.3412	-63.7916	15.42	3.83	0.72	1.10	3.42	1.28
ANC4	394360	2013-06-10	03:21:11	45.3412	-63.7916	5.94	4.01	0.62	1.09	3.61	1.27
ANC4	394362	2013-06-10	03:22:05	45.3412	-63.7916	1.93	4.08	0.67	1.18	3.73	1.32
ANC4	394364	2013-06-10	04:40:50	45.3412	-63.7914	25.43	2.68	0.31	0.61	1.63	1.19
ANC4	394366	2013-06-10	04:41:57	45.3412	-63.7914	15.71	2.51	0.29	0.64	1.57	1.10
ANC4	394368	2013-06-10	04:42:59	45.3412	-63.7914	5.66	2.95	0.28	0.57	1.78	1.33
ANC4	394370	2013-06-10	04:43:53	45.3412	-63.7914	2.48	2.61	0.23	0.59	1.68	1.07
ANC4	394372	2013-06-10	06:15:19	45.3406	-63.7921	26.74	2.70	0.30	0.66	1.78	1.23
ANC4	394374	2013-06-10	06:16:30	45.3406	-63.7921	15.48	2.91	0.36	0.71	1.91	1.25
ANC4	394376	2013-06-10	06:17:35	45.3406	-63.7921	5.29	2.99	0.32	0.68	1.93	1.20
ANC4	394378	2013-06-10	06:18:30	45.3406	-63.7921	2.41	2.63	0.30	0.63	1.57	1.19
ANC4	394383	2013-06-10	07:23:20	45.3402	-63.7936	26.65	3.36	0.33	0.70	2.08	1.34
ANC4	394385	2013-06-10	07:24:35	45.3402	-63.7936	15.10	3.01	0.30	0.68	1.91	1.20
ANC4	394387	2013-06-10	07:25:37	45.3402	-63.7936	5.78	3.52	0.37	0.77	2.39	1.28
ANC4	394389	2013-06-10	07:26:28	45.3402	-63.7936	2.39	2.89	0.31	0.67	2.15	1.46
ANC4	394493	2013-06-11	21:43:23	45.3421	-63.7881	22.00	4.11	0.60	1.16	4.10	1.45
ANC4	394495	2013-06-11	21:44:23	45.3421	-63.7881	15.29	3.88	0.52	1.03	4.17	1.30
ANC4	394497	2013-06-11	21:45:21	45.3421	-63.7881	5.37	4.78	0.60	1.07	4.75	1.35
ANC4	394499	2013-06-11	21:46:35	45.3421	-63.7881	2.07	4.75	0.45	0.89	4.53	1.89
ANC4	394503	2013-06-11	22:48:20	45.3421	-63.7881	18.83	5.88	0.95	1.58	6.98	1.21
ANC4	394505	2013-06-11	22:49:23	45.3421	-63.7881	15.26	6.09	1.20	1.86	7.57	1.34
ANC4	394507	2013-06-11	22:50:32	45.3421	-63.7881	5.21	6.37	1.12	1.89	7.99	1.23
ANC4	394509	2013-06-11	22:51:24	45.3421	-63.7881	2.18	5.73	0.90	1.45	7.07	1.46
ANC4	394511	2013-06-11	23:46:41	45.3421	-63.7881	16.10	6.91	1.46	4.04	9.80	1.29

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC4	394513	2013-06-11	23:47:44	45.3421	-63.7881	10.40	7.21	1.46	3.97	10.26	1.51
ANC4	394515	2013-06-11	23:48:49	45.3421	-63.7881	5.21	7.11	1.52	3.32	10.46	1.25
ANC4	394517	2013-06-11	23:49:39	45.3421	-63.7881	1.98	7.53	1.16	2.77	10.07	1.75
ANC4	394519	2013-06-12	01:27:24	45.3421	-63.7879	15.42	7.96	1.91	4.70	12.27	1.26
ANC4	394521	2013-06-12	01:28:22	45.3421	-63.7879	10.31	7.58	1.92	3.98	11.70	1.22
ANC4	394523	2013-06-12	01:29:04	45.3421	-63.7879	5.30	8.00	1.43	2.20	11.46	1.26
ANC4	394525	2013-06-12	01:29:51	45.3421	-63.7879	2.56	8.52	1.18	1.91	11.86	1.34
ANC4	394530	2013-06-12	02:45:27	45.3429	-63.7855	16.55	5.11	0.80	1.52	6.14	2.07
ANC4	394532	2013-06-12	02:46:44	45.3429	-63.7855	14.99	6.44	1.09	1.85	7.97	1.19
ANC4	394534	2013-06-12	02:47:59	45.3429	-63.7855	5.77	6.71	0.97	1.69	8.29	1.31
ANC4	394536	2013-06-12	02:49:13	45.3429	-63.7855	3.52	6.55	0.83	1.47	8.30	1.34
ANC4	394538	2013-06-12	02:50:01	45.3429	-63.7855	1.74	6.82	0.77	1.39	8.31	1.24
ANC4	394540	2013-06-12	03:51:14	45.3428	-63.7844	19.89	5.47	1.47	2.33	7.47	1.34
ANC4	394542	2013-06-12	03:52:00	45.3428	-63.7844	15.84	5.08	1.44	2.72	6.75	1.34
ANC4	394544	2013-06-12	03:53:07	45.3428	-63.7844	5.77	4.99	1.00	1.69	6.22	1.43
ANC4	394546	2013-06-12	03:53:53	45.3428	-63.7844	1.96	5.29	1.05	1.86	6.57	1.44
ANC4	394548	2013-06-12	04:55:24	45.3429	-63.7845	22.77	4.04	0.54	1.00	3.48	1.21
ANC4	394550	2013-06-12	04:56:25	45.3429	-63.7845	15.51	3.85	0.55	0.96	3.45	1.28
ANC4	394552	2013-06-12	04:57:37	45.3429	-63.7845	5.23	3.73	0.45	0.92	3.19	1.41
ANC4	394554	2013-06-12	04:58:24	45.3429	-63.7845	1.86	3.45	0.41	0.80	2.90	1.44
ANC4	394556	2013-06-12	06:25:24	45.3421	-63.7844	26.90	2.91	0.34	0.72	2.21	1.15
ANC4	394558	2013-06-12	06:26:32	45.3421	-63.7844	15.16	2.90	0.32	0.69	2.38	1.20
ANC4	394560	2013-06-12	06:27:28	45.3421	-63.7844	5.47	3.21	0.32	0.69	2.42	1.17
ANC4	394562	2013-06-12	06:28:16	45.3421	-63.7844	2.67	2.58	0.28	0.63	2.07	1.20
ANC4	394566	2013-06-12	07:40:35	45.3421	-63.7879	26.42	3.06	0.30	0.67	2.01	1.21
ANC4	394568	2013-06-12	07:41:35	45.3421	-63.7879	15.43	3.33	0.32	0.68	2.20	1.30
ANC4	394570	2013-06-12	07:42:50	45.3421	-63.7879	5.47	3.00	0.27	0.66	2.13	1.31
ANC4	394572	2013-06-12	07:43:38	45.3421	-63.7879	2.32	3.21	0.25	0.64	2.23	1.34

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC5	394023	2013-06-06	01:42:52	45.1885	-65.0756	74.96	3.35	0.10	0.57	1.60	2.09
ANC5	394025	2013-06-06	01:47:09	45.1885	-65.0756	15.40	3.43	0.10	0.59	1.62	2.11
ANC5	394027	2013-06-06	01:49:13	45.1885	-65.0756	5.39	3.57	0.10	0.59	1.59	2.11
ANC5	394029	2013-06-06	01:51:39	45.1885	-65.0756	2.06	3.62	0.10	0.59	1.73	2.11
ANC5	394033	2013-06-06	03:46:04	45.1876	-65.0788	72.53	2.67	0.07	0.53	1.26	2.06
ANC5	394035	2013-06-06	03:49:45	45.1876	-65.0788	14.71	2.84	0.11	0.58	1.69	2.02
ANC5	394037	2013-06-06	03:51:57	45.1876	-65.0788	4.52	2.92	0.11	0.60	1.64	2.06
ANC5	394039	2013-06-06	03:55:59	45.1876	-65.0788	3.32	2.12	0.07	0.54	1.12	1.92
ANC5	394043	2013-06-06	05:22:46	45.1847	-65.0841	71.44	2.25	0.09	0.52	1.31	1.84
ANC5	394045	2013-06-06	05:26:19	45.1847	-65.0841	15.10	2.61	0.11	0.58	1.55	1.98
ANC5	394047	2013-06-06	05:29:10	45.1847	-65.0841	5.23	2.45	0.12	0.58	1.61	1.99
ANC5	394049	2013-06-06	05:31:00	45.1847	-65.0841	2.76	2.35	0.11	0.58	1.58	2.03
ANC5	394053	2013-06-06	06:39:08	45.1861	-65.0970	55.36	1.99	0.10	0.55	1.56	2.20
ANC5	394055	2013-06-06	06:42:26	45.1861	-65.0970	15.35	1.64	0.10	0.51	1.25	2.11
ANC5	394057	2013-06-06	06:44:50	45.1861	-65.0970	5.12	2.72	0.13	0.62	1.64	1.95
ANC5	394060	2013-06-06	06:46:42	45.1861	-65.0970	2.52	2.31	0.10	0.52	1.29	1.71
SC4	394668	2013-06-13	21:43:53	45.2443	-64.7993	51.81	3.58	0.15	0.59	1.86	1.66
SC4	394670	2013-06-13	21:45:32	45.2443	-64.7993	16.26	3.17	0.15	0.58	1.79	1.64
SC4	394672	2013-06-13	21:46:42	45.2443	-64.7993	5.93	2.57	0.14	0.56	1.64	1.57
SC4	394674	2013-06-13	21:47:48	45.2443	-64.7993	1.69	3.01	0.14	0.54	1.58	1.53
SC4	394676	2013-06-13	22:56:00	45.2445	-64.7994	50.28	2.79	0.15	0.56	1.76	1.55
SC4	394678	2013-06-13	22:58:15	45.2445	-64.7994	16.19	3.09	0.16	0.57	1.82	1.49
SC4	394680	2013-06-13	22:59:07	45.2445	-64.7994	5.67	2.58	0.15	0.56	1.76	1.45
SC4	394682	2013-06-13	22:59:52	45.2445	-64.7994	1.77	2.16	0.14	0.54	1.61	1.49
SC4	394684	2013-06-13	23:57:28	45.2445	-64.7994	48.56	2.37	0.14	0.51	1.52	1.39
SC4	394686	2013-06-13	23:59:12	45.2445	-64.7994	15.85	1.76	0.13	0.49	1.31	1.33
SC4	394688	2013-06-14	00:00:17	45.2445	-64.7994	5.64	2.49	0.14	0.50	1.36	1.33
SC4	394690	2013-06-14	00:01:11	45.2445	-64.7994	2.62	2.00	0.13	0.53	1.46	1.39

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
SC4	394692	2013-06-14	01:16:08	45.2444	-64.7992	47.56	2.30	0.14	0.53	1.49	1.40
SC4	394694	2013-06-14	01:17:35	45.2444	-64.7992	15.56	2.57	0.13	0.56	1.61	1.30
SC4	394696	2013-06-14	01:18:32	45.2444	-64.7992	5.52	2.27	0.14	0.55	1.64	1.29
SC4	394698	2013-06-14	01:19:22	45.2444	-64.7992	2.58	2.59	0.14	0.52	1.49	1.25
SC4	394703	2013-06-14	02:28:44	45.2447	-64.7978	48.96	2.28	0.16	0.55	1.66	1.40
SC4	394705	2013-06-14	02:30:30	45.2447	-64.7978	15.24	2.02	0.15	0.54	1.54	1.31
SC4	394707	2013-06-14	02:31:20	45.2447	-64.7978	5.24	1.96	0.14	0.53	1.43	1.44
SC4	394709	2013-06-14	02:31:59	45.2447	-64.7978	2.38	1.96	0.11	0.47	1.15	1.30
SC4	394713	2013-06-14	04:00:10	45.2447	-64.7978	53.20	2.12	0.15	0.55	1.44	1.48
SC4	394715	2013-06-14	04:01:46	45.2447	-64.7978	16.36	2.40	0.18	0.57	1.56	1.53
SC4	394717	2013-06-14	04:02:46	45.2447	-64.7978	5.31	2.96	0.17	0.55	1.53	1.46
SC4	394719	2013-06-14	04:03:31	45.2447	-64.7978	2.14	1.31	0.18	0.55	1.47	1.46
SC4	394721	2013-06-14	05:06:49	45.2453	-64.7948	54.99	1.00	0.17	0.59	1.91	1.41
SC4	394723	2013-06-14	05:08:36	45.2453	-64.7948	16.15	0.44	0.19	0.54	1.59	1.38
SC4	394725	2013-06-14	05:09:37	45.2453	-64.7948	5.67	0.32	0.15	0.52	1.20	1.47
SC4	394727	2013-06-14	05:10:20	45.2453	-64.7948	2.22	0.46	0.15	0.59	1.56	1.44
SC4	394729	2013-06-14	06:12:56	45.2452	-64.7948	56.46	1.23	0.18	0.59	1.83	1.58
SC4	394731	2013-06-14	06:14:45	45.2452	-64.7948	15.82	1.76	0.17	0.63	1.90	1.59
SC4	394733	2013-06-14	06:15:44	45.2452	-64.7948	5.49	0.89	0.15	0.60	1.80	1.50
SC4	394735	2013-06-14	06:16:29	45.2452	-64.7948	2.82	0.89	0.16	0.59	1.79	1.56
SC4	394737	2013-06-14	08:20:00	45.2447	-64.7962	55.55	0.89	0.15	0.60	1.75	1.60
SC4	394739	2013-06-14	08:21:40	45.2447	-64.7962	15.25	0.89	0.17	0.60	1.78	1.62
SC4	394741	2013-06-14	08:22:53	45.2447	-64.7962	5.42	0.89	0.15	0.59	1.74	1.64
SC4	394743	2013-06-14	08:23:29	45.2447	-64.7962	2.47	0.53	0.37	1.16	1.69	2.01

Table 5. Nutrient data collected during Dominion Victory 2014-901 scientific cruise from 19-22 March 2014. Nitrate, nitrite, phosphate, silicate and ammonia are reported in micromolar (μM) units.

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC1	393421	2014-03-21	20:33:51	45.1534	-64.0167	28.16	6.11	0.28	0.79	5.33	1.04
ANC1	393422	2014-03-21	20:34:32	45.1534	-64.0167	14.57	6.88	0.32	0.86	6.23	1.10
ANC1	393423	2014-03-21	20:34:59	45.1534	-64.0167	4.59	5.38	0.33	0.84	5.05	1.14
ANC1	393424	2014-03-21	20:35:10	45.1534	-64.0167	0.81	6.74	0.39	0.95	6.45	1.19
ANC1	393425	2014-03-21	22:44:11	45.1533	-64.0186	23.26	10.08	0.58	1.22	9.92	1.63
ANC1	393426	2014-03-21	22:45:24	45.1533	-64.0186	14.99	10.25	0.54	1.29	10.61	1.91
ANC1	393427	2014-03-21	22:46:00	45.1533	-64.0186	5.08	10.49	0.54	1.27	11.05	1.72
ANC1	393428	2014-03-21	22:46:16	45.1533	-64.0186	0.87	10.48	0.68	1.40	11.45	1.94
ANC1	393431	2014-03-22	0:41:25	45.1533	-64.0193	18.96	10.01	0.81	1.51	11.81	2.52
ANC1	393432	2014-03-22	0:41:55	45.1533	-64.0193	16.44	10.91	0.85	1.52	12.92	2.68
ANC1	393433	2014-03-22	0:42:26	45.1533	-64.0193	6.29	11.17	0.82	1.55	13.78	2.72
ANC1	393434	2014-03-22	0:42:46	45.1533	-64.0193	0.84	11.19	1.06	1.84	11.76	3.36
ANC1	393437	2014-03-22	2:40:03	45.1539	-64.0166	17.29	11.51	1.28	1.96	11.40	4.91
ANC1	393438	2014-03-22	2:40:23	45.1539	-64.0166	15.88	11.42	1.23	1.91	13.88	5.05
ANC1	393439	2014-03-22	2:40:49	45.1539	-64.0166	5.93	10.62	1.28	1.92	12.69	5.62
ANC1	393440	2014-03-22	2:41:02	45.1539	-64.0166	0.78	11.54	1.19	1.88	12.84	7.22
ANC1	393443	2014-03-22	4:38:50	45.1538	-64.0155	22.30	10.67	1.00	1.86	11.71	no data
ANC1	393444	2014-03-22	4:39:17	45.1538	-64.0155	14.97	10.59	1.01	1.71	11.99	no data
ANC1	393445	2014-03-22	4:39:31	45.1538	-64.0155	4.90	9.95	0.99	1.79	11.64	no data
ANC1	393446	2014-03-22	4:39:38	45.1538	-64.0155	0.32	8.75	0.80	1.46	9.88	6.52
ANC1	393449	2014-03-22	6:42:20	45.1538	-64.0155	28.07	7.65	0.56	1.15	7.40	3.77
ANC1	393450	2014-03-22	6:43:01	45.1538	-64.0155	15.96	9.83	0.52	1.18	9.99	3.15
ANC1	393451	2014-03-22	6:43:18	45.1538	-64.0155	5.84	9.79	0.55	1.20	9.91	2.81
ANC1	393452	2014-03-22	6:43:25	45.1538	-64.0155	0.66	9.71	0.54	1.12	9.68	2.65
ANC1	393455	2014-03-22	8:37:19	45.1530	-64.0159	23.38	8.71	0.38	0.97	8.06	1.62

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC1	393456	2014-03-22	8:37:34	45.1530	-64.0159	17.12	9.35	0.39	0.99	8.90	1.95
ANC1	393457	2014-03-22	8:37:47	45.1530	-64.0159	7.41	9.77	0.46	1.03	9.60	1.68
ANC1	393458	2014-03-22	8:37:57	45.1530	-64.0159	0.58	5.12	0.69	1.00	5.58	1.52
ANC3	393251	2014-03-19	0:31:31	45.0884	-64.2635	22.04	9.69	0.42	1.12	8.99	1.31
ANC3	393252	2014-03-19	0:32:02	45.0884	-64.2635	14.71	10.18	0.47	1.15	9.46	2.30
ANC3	393253	2014-03-19	0:32:32	45.0884	-64.2635	4.76	10.11	0.52	1.21	9.63	1.63
ANC3	393254	2014-03-19	0:32:46	45.0884	-64.2635	0.87	10.08	0.47	1.19	9.49	1.43
ANC3	393257	2014-03-19	2:46:11	45.2550	-64.2637	25.77	9.24	0.28	0.91	7.78	1.21
ANC3	393258	2014-03-19	2:46:33	45.2550	-64.2637	14.65	8.33	0.28	0.90	6.96	0.87
ANC3	393259	2014-03-19	2:46:56	45.2550	-64.2637	6.27	9.22	0.32	0.96	7.75	1.08
ANC3	393260	2014-03-19	2:47:14	45.2550	-64.2637	0.75	8.39	0.31	0.89	6.87	1.45
ANC3	393263	2014-03-19	4:43:05	45.2548	-64.264	21.91	8.01	0.19	0.79	6.19	0.81
ANC3	393264	2014-03-19	4:43:19	45.2548	-64.264	14.66	8.95	0.22	0.84	6.96	0.80
ANC3	393265	2014-03-19	4:43:47	45.2548	-64.264	4.67	8.55	0.19	0.86	6.70	1.18
ANC3	393266	2014-03-19	4:43:58	45.2548	-64.264	0.81	8.93	0.22	0.85	7.05	0.92
ANC3	393269	2014-03-19	6:38:01	45.0891	-64.2651	32.27	7.88	0.20	0.82	6.20	0.82
ANC3	393270	2014-03-19	6:38:28	45.0891	-64.2651	16.53	8.71	0.26	0.87	7.11	0.77
ANC3	393271	2014-03-19	6:38:45	45.0891	-64.2651	6.52	8.49	0.21	0.90	6.65	0.86
ANC3	393272	2014-03-19	6:38:57	45.0891	-64.2651	0.49	8.69	0.24	0.92	6.87	0.81
ANC3	393275	2014-03-19	8:35:10	45.2559	-64.2651	28.98	8.91	0.21	0.89	7.02	0.73
ANC3	393276	2014-03-19	8:36:06	45.2559	-64.2651	15.38	7.66	0.25	0.86	6.21	0.74
ANC3	393277	2014-03-19	8:36:25	45.2559	-64.2651	5.16	8.96	0.26	0.86	7.27	0.80
ANC3	393278	2014-03-19	8:36:31	45.2559	-64.2651	0.46	8.67	0.24	0.87	7.21	0.80
ANC3	393285	2014-03-19	10:53:58	45.2565	-64.2649	22.11	4.97	0.46	0.95	4.85	1.28
ANC3	393286	2014-03-19	10:54:22	45.2565	-64.2649	14.57	8.45	0.42	1.02	7.97	1.45
ANC3	393287	2014-03-19	10:54:46	45.2565	-64.2649	4.56	5.98	0.45	0.90	5.83	1.05
ANC3	393288	2014-03-19	10:54:54	45.2565	-64.2649	0.65	7.20	0.38	0.92	6.95	1.25
ANC3	393291	2014-03-19	12:49:08	45.0922	-64.2640	21.83	6.51	0.54	1.03	6.25	1.45

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC3	393292	2014-03-19	12:50:08	45.0922	-64.2640	15.35	4.49	0.49	0.91	4.41	1.14
ANC3	393293	2014-03-19	12:50:49	45.0922	-64.2640	5.29	5.22	0.46	0.83	4.99	1.35
ANC3	393294	2014-03-19	12:51:09	45.0922	-64.2640	0.82	4.15	0.40	0.82	4.11	1.05
ANC3	393297	2014-03-19	14:55:32	45.0882	-64.2639	25.81	4.89	0.35	0.82	4.31	1.13
ANC3	393298	2014-03-19	14:56:32	45.0882	-64.2639	15.17	5.38	0.23	0.73	4.36	1.02
ANC3	393299	2014-03-19	14:57:06	45.0882	-64.2639	5.09	5.80	0.31	0.84	4.85	1.10
ANC3	393300	2014-03-19	14:57:21	45.0882	-64.2639	0.78	6.92	0.25	0.81	5.87	0.93
ANC3	393349	2014-03-20	13:03:09	45.0911	-64.2681	21.91	8.25	0.39	1.00	8.10	1.67
ANC3	393350	2014-03-20	13:03:32	45.0911	-64.2681	15.68	5.85	0.32	0.78	5.59	1.61
ANC3	393351	2014-03-20	13:04:11	45.0911	-64.2681	5.64	5.56	0.43	0.77	5.35	2.16
ANC3	393352	2014-03-20	13:04:30	45.0911	-64.2681	0.76	8.22	0.34	0.89	8.09	1.36
ANC3	393357	2014-03-20	15:16:53	45.0901	-64.2655	25.13	5.19	0.25	0.77	4.44	1.20
ANC3	393358	2014-03-20	15:17:16	45.0901	-64.2655	16.58	5.01	0.24	0.70	4.20	1.42
ANC3	393359	2014-03-20	15:17:45	45.0901	-64.2655	6.49	4.97	0.20	0.73	4.01	0.94
ANC3	393360	2014-03-20	15:17:59	45.0901	-64.2655	0.61	9.09	0.22	0.91	8.04	1.05
ANC3	393363	2014-03-20	17:16:35	45.0899	-64.2661	30.51	7.47	0.18	0.81	5.93	0.85
ANC3	393364	2014-03-20	17:17:16	45.0899	-64.2661	15.50	5.33	0.20	0.63	4.10	1.14
ANC3	393365	2014-03-20	17:17:43	45.0899	-64.2661	5.38	6.38	0.16	0.73	4.95	0.84
ANC3	393366	2014-03-20	17:17:55	45.0899	-64.2661	0.64	5.03	0.20	0.65	3.84	1.02
ANC3	393369	2014-03-20	19:17:00	45.0915	-64.2680	32.71	6.84	0.27	0.83	5.56	0.86
ANC3	393370	2014-03-20	19:17:58	45.0915	-64.2680	15.31	6.27	0.41	0.90	5.37	1.15
ANC3	393371	2014-03-20	19:18:34	45.0915	-64.2680	4.75	6.67	0.26	0.88	5.47	0.82
ANC3	393372	2014-03-20	19:18:45	45.0915	-64.2680	0.83	8.15	0.25	0.95	6.69	0.80
ANC3	393375	2014-03-20	23:53:40	45.0921	-64.2667	23.70	8.82	0.44	1.10	8.30	1.06
ANC3	393376	2014-03-20	23:54:10	45.0921	-64.2667	14.82	8.42	0.50	1.16	8.38	1.30
ANC3	393377	2014-03-20	23:54:42	45.0921	-64.2667	4.85	9.01	0.48	1.15	9.18	1.31
ANC3	393378	2014-03-20	23:54:55	45.0921	-64.2667	0.60	8.24	0.47	1.13	8.55	1.20
ANC3	393379	2014-03-21	1:46:05	45.0912	-64.2662	22.35	9.03	0.48	1.12	8.57	1.25

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC3	393380	2014-03-21	1:46:36	45.0912	-64.2662	14.88	9.21	0.45	1.07	8.98	1.11
ANC3	393381	2014-03-21	1:47:17	45.0912	-64.2662	4.74	9.27	0.45	1.12	9.13	1.40
ANC3	393382	2014-03-21	1:47:30	45.0912	-64.2662	0.78	9.28	0.42	1.11	8.98	1.21
ANC3	393385	2014-03-21	3:42:29	45.0901	-64.2657	26.01	8.90	0.37	0.98	7.73	1.06
ANC3	393386	2014-03-21	3:43:00	45.0901	-64.2657	13.81	8.82	0.33	0.98	7.75	1.02
ANC3	393387	2014-03-21	3:43:25	45.0901	-64.2657	3.73	8.91	0.32	0.97	7.73	1.08
ANC3	393388	2014-03-21	3:43:32	45.0901	-64.2657	0.56	8.53	0.29	0.92	7.31	1.04
ANC3	393391	2014-03-21	5:39:08	45.0900	-64.2662	31.53	8.13	0.27	0.91	6.46	1.05
ANC3	393392	2014-03-21	5:39:47	45.0900	-64.2662	15.16	8.80	0.23	0.93	7.01	0.88
ANC3	393393	2014-03-21	5:40:08	45.0900	-64.2662	4.80	8.72	0.23	0.89	6.92	0.79
ANC3	393394	2014-03-21	5:40:20	45.0900	-64.2662	0.74	8.75	0.24	0.91	6.96	0.83
ANC3	393397	2014-03-21	7:43:25	45.0906	-64.2669	32.61	8.21	0.21	0.84	6.48	0.78
ANC3	393398	2014-03-21	7:43:58	45.0906	-64.2669	14.96	8.83	0.22	0.84	6.92	1.12
ANC3	393399	2014-03-21	7:44:25	45.0906	-64.2669	5.13	8.77	0.21	0.86	6.98	0.79
ANC3	393400	2014-03-21	7:44:35	45.0906	-64.2669	0.65	8.81	0.24	0.89	7.04	0.74
ANC3	393403	2014-03-21	10:12:47	45.0920	-64.2673	28.73	5.74	0.21	0.76	3.59	0.76
ANC3	393404	2014-03-21	10:13:41	45.0920	-64.2673	15.22	7.16	0.20	0.79	5.06	0.90
ANC3	393405	2014-03-21	10:14:18	45.0920	-64.2673	5.25	6.72	0.23	0.80	4.96	1.22
ANC3	393406	2014-03-21	10:14:35	45.0920	-64.2673	0.83	7.49	0.24	0.84	6.03	0.95
ANC3	393411	2014-03-21	12:13:51	45.0921	-64.2668	23.61	7.31	0.30	0.86	5.71	0.96
ANC3	393412	2014-03-21	12:14:20	45.0921	-64.2668	14.60	5.69	0.28	0.82	4.61	0.88
ANC3	393413	2014-03-21	12:14:55	45.0921	-64.2668	4.63	5.30	0.28	0.77	4.48	0.96
ANC3	393414	2014-03-21	12:15:11	45.0921	-64.2668	0.77	6.26	0.30	0.82	5.73	1.03
ANC3	393415	2014-03-21	14:59:55	45.1617	-64.2086	32.76	6.56	0.49	1.09	6.21	1.32
ANC3	393416	2014-03-21	15:00:38	45.1617	-64.2086	14.40	7.01	0.45	1.07	7.11	1.27
ANC3	393417	2014-03-21	15:01:03	45.1617	-64.2086	4.57	4.90	0.44	0.92	4.78	1.15
ANC3	393418	2014-03-21	15:01:13	45.1617	-64.2086	0.56	8.09	0.41	1.02	8.11	1.44
ANC4	393301	2014-03-19	18:59:47	45.0072	-63.7925	25.68	5.79	0.98	1.42	6.71	1.99

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC4	393302	2014-03-19	18:59:47	45.0072	-63.7925	15.00	7.01	0.84	1.40	8.50	1.94
ANC4	393303	2014-03-19	18:59:47	45.0072	-63.7925	5.00	8.59	0.90	1.35	10.31	2.65
ANC4	393304	2014-03-19	18:59:47	45.0072	-63.7925	1.00	10.10	0.88	1.32	11.72	2.43
ANC4	393307	2014-03-19	20:14:43	45.0070	-63.7959	23.06	10.54	2.10	2.85	13.21	2.85
ANC4	393308	2014-03-19	21:15:08	45.0070	-63.7959	14.28	11.39	1.46	1.94	14.76	3.09
ANC4	393309	2014-03-19	21:15:39	45.0070	-63.7959	4.30	11.47	2.13	2.82	15.39	3.25
ANC4	393310	2014-03-19	21:15:50	45.0070	-63.7959	0.69	11.52	1.22	1.77	14.88	3.32
ANC4	393313	2014-03-19	23:07:52	45.0068	-63.7962	17.62	12.18	3.30	4.23	14.36	3.99
ANC4	393314	2014-03-19	23:08:04	45.0068	-63.7962	14.69	11.16	3.28	4.12	15.06	3.93
ANC4	393315	2014-03-19	23:08:48	45.0068	-63.7962	4.63	11.06	3.00	4.04	15.37	4.05
ANC4	393316	2014-03-19	23:09:05	45.0068	-63.7962	0.82	11.04	3.25	4.01	14.89	3.84
ANC4	393319	2014-03-20	1:44:52	45.0067	-63.7949	15.17	11.68	4.45	4.90	16.43	4.48
ANC4	393320	2014-03-20	1:44:53	45.0067	-63.7949	15.07	11.91	4.25	4.80	16.36	4.50
ANC4	393321	2014-03-20	1:45:34	45.0067	-63.7949	4.97	11.88	3.85	4.38	18.10	4.82
ANC4	393322	2014-03-20	1:45:48	45.0067	-63.7949	0.75	11.79	3.20	3.75	17.15	5.09
ANC4	393325	2014-03-20	3:28:32	45.0067	-63.7915	18.86	10.53	2.98	3.89	14.72	3.62
ANC4	393326	2014-03-20	3:28:52	45.0067	-63.7915	13.58	11.93	2.75	3.49	15.58	3.80
ANC4	393327	2014-03-20	3:29:17	45.0067	-63.7915	3.89	11.79	2.90	3.56	15.75	3.79
ANC4	393328	2014-03-20	3:29:28	45.0067	-63.7915	0.71	11.82	2.65	3.85	17.27	3.65
ANC4	393331	2014-03-20	5:40:22	45.0076	-63.7916	24.69	11.09	1.36	2.51	14.09	2.53
ANC4	393332	2014-03-20	5:41:20	45.0076	-63.7916	14.20	10.93	1.36	2.47	14.20	2.55
ANC4	393333	2014-03-20	5:41:47	45.0076	-63.7916	4.11	10.05	1.36	2.21	13.21	2.87
ANC4	393334	2014-03-20	5:41:57	45.0076	-63.7916	0.70	10.36	1.27	2.12	12.97	3.13
ANC4	393337	2014-03-20	7:19:31	45.0077	-63.7917	26.61	10.52	1.33	2.38	13.11	2.13
ANC4	393338	2014-03-20	7:19:59	45.0077	-63.7917	15.34	10.79	1.40	2.35	13.83	2.26
ANC4	393339	2014-03-20	7:20:26	45.0077	-63.7917	5.40	10.36	1.46	2.46	13.42	2.30
ANC4	393340	2014-03-20	7:20:37	45.0077	-63.7917	0.66	11.21	1.19	1.92	13.68	2.51
ANC4	393343	2014-03-20	9:13:26	45.0065	-63.7965	25.13	9.71	0.94	1.58	12.77	2.58

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	Nitrate (μM)	Nitrite (μM)	Phosphate (μM)	Silicate (μM)	Ammonia (μM)
ANC4	393344	2014-03-20	9:14:06	45.0065	-63.7965	14.74	6.87	0.89	1.42	9.20	2.27
ANC4	393345	2014-03-20	9:14:24	45.0065	-63.7965	4.30	6.05	0.76	1.20	8.02	2.55
ANC4	393346	2014-03-20	9:14:32	45.0065	-63.7965	0.51	9.26	0.89	1.45	12.83	2.67

Table 6. Sediment grain size data for grab samples collected during Hudson2013-013 cruise. Grain size is reported as percent weight for each sieve size.

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1 mm	2 mm	>4 mm
G-013	360967	2013-06-10	15:00	45.2012	-64.3740	3.8	5.06	12.72	51.87	25.20	4.11	0.48	0.25	0.32
G-017	369066	2013-06-10	15:04	45.2109	-64.3624	6.2	0.71	2.30	6.60	17.55	22.48	24.72	17.59	8.05
G-020	396093	2013-06-11	15:12	45.1653	-64.3483	4.6	0.65	1.25	13.46	28.54	24.44	16.94	9.77	4.94
G-022	352868	2013-06-10	15:19	45.2016	-64.3497	8.7	0.90	8.18	42.99	27.29	14.68	4.55	1.42	0.00
G-023	369065	2013-06-10	15:29	45.2194	-64.3501	11.3	0.55	3.88	37.37	41.22	15.11	1.33	0.55	0.00
G-030	344769	2013-06-10	15:33	45.2110	-64.3370	11.6	0.07	1.29	12.29	35.74	17.92	9.81	6.41	16.46
G-031	396064	2013-06-10	15:39	45.2304	-64.3396	15.5	1.26	3.27	15.09	17.42	8.49	11.53	17.61	25.33
G-034	396092	2013-06-11	15:48	45.1655	-64.3243	12.1	0.24	15.79	33.37	17.36	14.16	12.64	4.24	2.20
G-044	396091	2013-06-11	15:54	45.1659	-64.2984	8.9	5.96	21.50	48.12	12.73	5.65	2.56	2.01	1.46
G-046	328571	2013-06-10	16:29	45.2024	-64.2981	17.3	0.43	1.21	14.57	23.99	13.41	11.61	7.92	26.87
G-050	396090	2013-06-11	16:35	45.1660	-64.2853	6.6	1.00	8.74	34.41	10.92	7.16	2.32	2.70	32.74
G-052	320472	2013-06-10	16:40	45.2027	-64.2733	17.3	1.33	7.44	37.56	18.91	11.58	7.76	5.45	9.97
G-053	336670	2013-06-10	16:48	45.2016	-64.3246	15.2	5.13	17.36	30.48	25.09	13.55	5.41	2.02	0.96
G-060	396087	2013-06-11	16:54	45.1487	-64.2586	2.5	0.05	0.45	7.79	71.72	17.48	1.35	0.89	0.28
G-061	396088	2013-06-11	17:55	45.1574	-64.2592	5.4	0.14	2.64	19.65	31.16	5.05	11.99	22.33	7.04
G-066	396086	2013-06-11	18:01	45.1490	-64.2469	5.8	1.36	6.24	22.14	13.33	15.01	10.82	12.68	18.43
G-069	312373	2013-06-10	18:08	45.2025	-64.2483	15.3	0.03	0.18	6.32	55.26	26.72	9.36	1.63	0.51
G-073	396082	2013-06-11	18:16	45.1217	-64.2330	4.6	1.53	6.66	17.21	12.20	9.82	8.73	9.17	34.67
G-074	396083	2013-06-11	18:21	45.1299	-64.2345	10.4	0.03	0.06	0.37	68.05	26.30	2.32	1.75	1.11
G-075	396084	2013-06-11	18:30	45.1398	-64.2333	10.1	0.05	0.29	21.14	70.64	6.99	0.59	0.21	0.10
G-080	396081	2013-06-11	18:40	45.1223	-64.2201	9.9	0.21	6.43	8.21	67.63	12.63	3.22	1.36	0.31
G-081	396080	2013-06-11	18:54	45.1304	-64.2209	6	0.67	4.53	30.23	63.49	1.07	0.02	0.00	0.00
G-082	304274	2013-06-10	14:42	45.2027	-64.2227	16.6	0.73	2.01	8.26	38.07	7.24	2.60	3.25	37.83
G-095	396078	2013-06-11	14:55	45.1761	-64.2026	10.9	1.48	3.34	4.52	45.34	8.04	5.73	9.41	22.14
G-096	396077	2013-06-11	15:01	45.1938	-64.2091	6.8	0.04	0.09	2.78	84.78	9.77	1.41	0.80	0.33
G-111	396058	2013-06-09	15:22	45.3923	-64.1893	8.8	0.65	3.91	22.21	12.49	8.39	14.30	25.63	12.41

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1 mm	2 mm	>4 mm
G-112	396036	2013-06-07	15:31	45.0599	-64.1661	9.8	26.79	46.70	14.76	8.00	3.54	0.21	0.00	0.00
G-113	396037	2013-06-07	15:40	45.0693	-64.1686	17.1	9.01	12.55	43.39	24.52	8.69	1.35	0.48	0.00
G-122	396032	2013-06-07	15:48	45.0523	-64.1514	13.1	2.08	16.31	67.59	13.62	0.40	0.00	0.00	0.00
G-123	396035	2013-06-07	16:00	45.0597	-64.1556	11.9	0.56	16.06	80.10	2.94	0.34	0.00	0.00	0.00
G-124	396038	2013-06-07	16:06	45.0688	-64.1561	8.9	0.69	21.14	73.38	4.37	0.41	0.00	0.00	0.00
G-129	396027	2013-06-07	16:18	45.0331	-64.1431	8.5	16.31	40.39	27.60	13.42	2.11	0.11	0.06	0.00
G-130	396031	2013-06-07	16:25	45.0425	-64.1427	7.8	18.95	47.21	19.40	4.92	2.01	0.28	0.13	7.10
G-131	396034	2013-06-07	16:50	45.0599	-64.1434	8.1	0.55	11.03	77.83	9.95	0.63	0.02	0.00	0.00
G-137	396028	2013-06-07	16:59	45.0326	-64.1309	8	21.86	41.80	27.61	7.35	1.32	0.07	0.00	0.00
G-138	396029	2013-06-07	17:12	45.0418	-64.1304	6.7	7.84	21.56	62.44	7.55	0.58	0.02	0.00	0.00
G-139	396030	2013-06-07	17:24	45.0508	-64.1304	8.1	10.02	35.33	49.88	4.00	0.60	0.09	0.02	0.07
G-160	396061	2013-06-09	17:30	45.3932	-64.0878	7.1	2.89	5.96	27.76	23.93	6.26	1.74	2.41	29.05
G-218	396110	2013-06-11	19:13	45.3773	-63.8569	8.4	2.38	4.65	12.75	18.28	19.13	17.38	12.96	12.46
G-240	396107	2013-06-11	19:31	45.3789	-63.7559	13.2	0.77	0.92	4.93	90.69	2.16	0.32	0.22	0.00
G-241	396103	2013-06-11	19:48	45.3149	-63.7050	7.2	15.26	27.44	24.67	18.81	10.94	1.60	0.67	0.61
G-242	396105	2013-06-11	13:53	45.3336	-63.7415	14.5	0.03	0.07	4.09	77.79	15.47	0.84	0.45	1.26
G-243	396106	2013-06-11	15:28	45.3517	-63.7439	26.3	0.14	0.25	0.87	10.57	42.64	21.89	18.33	5.32
G-249	396102	2013-06-11	18:35	45.3426	-63.7026	22.4	0.73	2.05	25.94	68.86	2.22	0.20	0.00	0.00
G-253	396101	2013-06-11	18:43	45.3431	-63.6760	13.1	0.05	0.78	19.53	78.46	1.17	0.00	0.00	0.00
G-260	396100	2013-06-11	18:50	45.3426	-63.6513	14.3	0.07	1.30	39.66	57.51	1.46	0.00	0.00	0.00
G-270	396099	2013-06-11	18:57	45.3427	-63.6261	13.2	0.45	7.83	80.38	11.33	0.01	0.00	0.00	0.00
G-281	396098	2013-06-11	19:03	45.3429	-63.5999	10.2	0.52	11.05	86.80	1.51	0.13	0.00	0.00	0.00
G-294	396097	2013-06-11	19:10	45.3433	-63.5741	9.6	1.30	8.41	28.27	59.82	2.13	0.05	0.01	0.00
G-304	396096	2013-06-11	19:18	45.3433	-63.5480	7.1	0.27	2.25	29.04	68.16	0.28	0.00	0.00	0.00
G-311	396095	2013-06-11	19:25	45.3433	-63.5064	7.4	2.59	17.53	71.58	8.19	0.12	0.00	0.00	0.00
G-313	396094	2013-06-11	19:33	45.3347	-63.5100	10.8	1.09	8.61	28.16	50.90	10.40	0.26	0.13	0.44
G-414	396108	2013-06-11	19:40	45.3960	-63.7552	7.6	0.24	1.55	10.49	67.27	16.15	2.78	1.03	0.51
G-432	396079	2013-06-11	12:59	45.1583	-64.2026	14.5	0.33	0.51	1.53	19.52	3.14	0.79	1.84	72.34

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1 mm	2 mm	>4 mm
G-433	396085	2013-06-11	13:08	45.1463	-64.2348	11	0.51	0.78	2.63	1.29	0.43	0.21	0.32	93.83
G-436	396089	2013-06-11	13:19	45.1662	-64.2718	6.7	0.25	7.67	81.22	6.45	3.20	1.08	0.13	0.00
G-440	396060	2013-06-09	13:27	45.4022	-64.1009	3.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.0
G-441	396059	2013-06-09	13:35	45.4020	-64.1242	3	5.45	7.49	25.25	27.19	20.75	9.08	4.26	0.53
G-839	396076	2013-06-11	13:47	45.2207	-64.2223	10.3	0.08	0.30	4.90	43.61	17.62	10.04	11.85	11.60
G-841	396075	2013-06-11	13:54	45.2393	-64.3058	14.2	1.01	2.43	16.77	47.45	3.21	3.32	9.37	16.44
G-999	396062	2013-06-10	14:01	45.3252	-64.6228	5.2	0.79	1.23	18.02	70.00	7.58	1.02	1.36	0.00
G-9999	396063	2013-06-10	14:15	45.3275	-64.4978	0.2	0.80	7.19	77.71	14.14	0.16	0.00	0.00	0.00
Kg-001	396006	2013-06-06	14:23	45.1518	-64.3739	4.2	9.58	10.29	28.68	28.07	15.15	5.45	1.64	1.14
Kg-002	396007	2013-06-06	14:36	45.1502	-64.3735	5.6	46.06	21.64	14.45	17.35	0.48	0.00	0.01	0.00
Kg-003	396019	2013-06-06	15:01	45.1484	-64.3724	2.7	20.08	34.49	27.94	10.87	5.63	0.61	0.23	0.16
Kg-004	396020	2013-06-06	15:08	45.1470	-64.3727	4.9	19.07	33.45	23.92	13.21	8.63	1.50	0.22	0.00
Kg-005	396021	2013-06-06	15:15	45.1457	-64.3719	1.9	7.68	37.51	36.07	11.49	6.11	0.65	0.10	0.38
Kg-006	396001	2013-06-06	15:22	45.1536	-64.3709	4.3	32.12	12.31	13.02	23.70	17.66	0.30	0.06	0.83
Kg-007	396005	2013-06-06	15:29	45.1519	-64.3707	5	14.43	11.65	21.94	22.40	17.42	5.76	1.12	5.28
Kg-008	396008	2013-06-06	15:35	45.1497	-64.3705	6.2	35.26	37.16	12.02	8.08	4.16	1.34	1.15	0.83
Kg-009	396057	2013-06-09	15:44	45.1479	-64.3701	7.7	20.82	40.88	15.16	12.92	7.52	1.60	0.46	0.65
Kg-010	396023	2013-06-06	15:52	45.1465	-64.3691	1.7	27.62	40.53	13.07	13.17	5.57	0.04	0.00	0.00
Kg-011	396022	2013-06-06	17:48	45.1450	-64.3693	5.3	28.42	17.61	10.76	17.07	18.16	3.62	0.83	3.51
Kg-012	396002	2013-06-06	17:55	45.1541	-64.3695	4.1	16.11	18.26	25.70	27.37	10.95	1.44	0.16	0.00
Kg-013	396004	2013-06-06	18:03	45.1528	-64.3658	5.4	19.80	28.49	36.60	7.81	4.33	1.98	0.76	0.23
Kg-014	396009	2013-06-06	18:11	45.1509	-64.3677	6.6	43.03	30.57	12.20	8.44	3.86	1.81	0.09	0.00
Kg-015	396056	2013-06-09	18:18	45.1487	-64.3663	7.8	19.14	44.59	24.49	9.87	1.80	0.12	0.00	0.00
Kg-019	396003	2013-06-06	18:41	45.1536	-64.3695	5.3	9.79	7.44	45.27	21.60	8.40	4.65	1.84	1.00
Kg-020	396010	2013-06-06	18:58	45.1518	-64.3648	5.8	22.48	22.89	29.55	19.32	5.09	0.57	0.09	0.00
Kg-021	396055	2013-06-09	19:09	45.1498	-64.3636	8.2	21.77	42.65	25.93	8.49	1.03	0.12	0.00	0.00
Kg-022	396054	2013-06-09	19:09	45.1478	-64.3617	9.1	22.63	47.97	22.84	5.87	0.61	0.06	0.02	0.00
Kg-023	396053	2013-06-09	19:22	45.1463	-64.3602	11.1	36.15	35.82	12.80	10.67	4.55	0.02	0.00	0.00

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1 mm	2 mm	>4 mm
Kg-024	396011	2013-06-06	19:36	45.1546	-64.3618	4.6	12.64	22.22	18.95	27.61	15.24	2.22	0.16	0.95
Kg-025	396014	2013-06-06	19:47	45.1524	-64.3610	6.2	18.65	30.54	47.92	2.16	0.55	0.09	0.07	0.02
Kg-027	396026	2013-06-06	19:56	45.1484	-64.3587	3.3	9.68	34.93	41.53	10.19	3.01	0.28	0.37	0.00
Kg-028	396012	2013-06-06	19:59	45.1553	-64.3597	5.3	5.49	5.08	50.10	34.39	4.08	0.38	0.30	0.19
Kg-029	396013	2013-06-06	20:13	45.1533	-64.3554	8.5	3.15	9.94	14.52	23.29	20.08	9.54	6.96	12.52

Table 7. Sediment grain size data for slow-core samples collected during Hudson2013-013 cruise. Grain size is reported as percent weight for each sieve size.

Core #	Depth (cm)	Sample #	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1mm	2mm	>4mm
394583	0-2	396251	0.54	1.09	3.31	28.77	13.66	10.60	12.37	29.65
	2-4	396252	0.97	2.08	4.84	25.42	8.97	5.72	7.98	44.01
	4-6	396253	2.25	5.83	11.71	33.22	9.83	5.10	6.49	25.56
	6-8	396254	1.58	6.20	10.97	28.61	11.45	6.76	9.08	25.35
	8-10	396255	3.97	7.63	14.93	32.49	10.31	5.82	8.61	16.24
	10-12	396256	2.20	11.82	16.98	39.40	10.99	5.15	5.16	8.29
	12-14	396257	7.53	18.54	21.93	35.77	7.60	2.90	2.91	2.82
	14-16	396258	8.43	16.40	22.31	31.54	7.63	2.66	3.61	7.41
	16-18	396259	5.53	15.79	21.78	32.53	9.10	3.68	3.67	7.92
	18-20	396260	6.31	13.52	16.74	28.92	10.09	5.30	5.88	13.25
	20-22	396261	3.82	13.89	13.41	33.73	10.00	5.03	5.80	14.31
	22-24	396262	8.53	12.57	14.77	32.09	8.78	3.67	3.58	16.02
	24-26	396263	8.07	13.90	19.46	37.29	9.58	3.67	3.58	4.46
	26-28	396264	8.07	9.42	13.43	31.71	9.21	3.63	4.02	20.50
	28-30	396265	7.80	9.91	15.57	35.23	11.23	3.52	3.14	13.61
	30-32	396266	10.65	14.97	14.34	33.66	10.61	3.18	3.73	8.85
	32-34	396267	9.82	13.03	14.77	35.37	10.76	3.66	4.33	8.26
	34-36	396268	12.83	14.80	16.88	30.91	9.80	3.17	2.73	8.89

Core #	Depth (cm)	Sample #	<63 µm	63 µm	125 µm	250 µm	500 µm	1mm	2mm	>4mm
394583	36-38	394269	10.08	15.98	18.72	30.13	12.19	3.67	2.90	6.32
394584	0-2	396270	0.43	0.84	2.35	21.68	7.83	4.48	7.66	54.74
	2-4	396271	0.70	1.25	3.19	21.39	7.25	4.37	7.66	54.21
	4-6	396272	0.69	1.29	3.26	26.20	11.35	7.87	10.49	38.86
	6-8	396273	0.53	1.59	4.04	28.45	14.13	10.70	11.77	28.79
	8-10	396274	0.92	2.09	5.16	30.13	11.81	8.55	10.26	31.08
	10-12	396275	1.49	3.82	8.64	37.16	12.50	6.30	7.78	22.30
	12-14	396276	2.75	6.83	14.62	37.16	11.84	5.70	6.39	14.71
	14-16	396277	2.94	6.69	12.23	37.10	13.98	6.89	8.69	11.47
	16-18	396278	1.40	8.31	13.21	35.86	19.60	7.52	7.48	6.62
	18-20	396279	3.11	8.67	11.69	33.20	13.96	5.87	5.20	18.30
	20-22	396280	4.20	12.12	15.86	34.26	12.97	4.11	4.20	12.28
	22-24	396281	5.72	9.34	19.23	34.51	16.92	7.06	4.04	3.17
	24-26	396282	6.64	15.39	16.68	27.47	12.77	5.50	3.97	11.58
	26-28	396283	8.91	18.02	18.79	28.69	9.33	3.83	3.76	8.66
	28-30	396284	10.05	15.69	19.21	34.53	9.89	3.90	3.62	3.11
	30-32	396285	10.76	14.99	17.70	33.27	8.68	3.28	4.19	7.14
	32-34	396286	11.16	15.30	16.76	33.57	10.48	3.65	3.92	5.17
	34-36	396287	12.30	16.05	17.52	34.14	9.10	2.89	2.34	5.67
	36-38	396288	10.79	17.08	17.79	32.30	9.77	3.01	3.45	5.82
	38-40	396289	9.64	13.27	14.56	31.24	9.50	3.12	2.68	15.98
	40-42	396290	7.82	16.45	15.78	30.71	10.99	4.15	4.49	9.61
394577	0-0.5	313223.1	0.70	1.73	3.03	18.01	5.73	3.75	7.31	59.75
	0.5-2	313223.2	0.44	1.31	3.26	29.50	14.12	7.36	14.59	29.43
	2-4	313223.3	0.73	2.18	5.12	37.89	11.48	6.73	11.92	23.96
	4-6	313223.4	1.24	2.60	6.91	42.09	11.76	5.85	10.23	19.31
	6-8	313223.5	2.35	4.49	10.34	45.38	12.31	4.92	8.32	11.89

Table 8. Sediment grain size data for video grab samples collected during Hudson2013-013 cruise. Grain size is reported as percent weight for each sieve size.

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1mm	2mm	>4mm
G-003	394747	2013-06-14	11:51	45.2156	-64.6308	31.7	3.16	5.76	23.55	22.14	1.40	5.58	3.51	34.90
G-004	394758	2013-06-14	16:50	45.3244	-64.6327	55.0	0.00	0.01	0.02	0.05	0.07	0.08	0.10	99.66
G-005	394748	2013-06-14	12:12	45.2336	-64.6047	41.6	3.83	7.35	25.82	25.59	6.35	2.52	4.07	24.48
G-006	394749	2013-06-14	12:33	45.2520	-64.5797	36.0	0.53	1.10	7.63	33.42	3.79	2.21	7.15	44.16
G-007	394750	2013-06-14	12:54	45.2347	-64.5540	27.3	1.39	3.54	13.45	18.84	16.37	8.47	8.02	29.91
G-008	394751	2013-06-14	13:11	45.2537	-64.5291	28.0	1.55	3.97	12.36	30.64	33.83	7.27	2.70	7.69
G-009	394756	2013-06-14	15:20	45.2902	-64.5323	25.9	0.33	0.99	7.95	37.46	5.71	1.74	7.94	37.87
G-010	394753	2013-06-14	13:50	45.2714	-64.5061	26.1	0.77	1.81	7.02	21.38	12.42	9.35	13.41	33.85
G-011	394755	2013-06-14	14:36	45.3091	-64.5033	24.0	0.76	1.69	9.50	27.73	20.28	6.61	4.05	29.39
G-012	394754	2013-06-14	14:10	45.2902	-64.4822	23.5	1.66	3.86	22.21	36.35	8.21	5.51	6.71	15.48
G-048	394492	2013-06-11	18:43	45.2386	-64.3005	20.2	0.38	0.90	7.33	44.39	12.29	10.29	11.58	12.85
G-049	394156	2013-06-07	19:34	45.2560	-64.3000	18.1	1.42	2.79	6.80	29.79	11.80	8.17	10.44	28.79
G-055	394579	2013-06-12	15:52	45.2383	-64.2746	7.3	0.29	1.27	8.70	51.48	18.93	7.67	4.74	6.92
G-056	394155	2013-06-07	19:07	45.2586	-64.2777	22.1	0.18	0.47	2.27	38.10	17.20	9.27	9.15	23.36
G-071	394578	2013-06-12	15:34	45.2380	-64.2494	15.4	1.14	3.35	13.42	68.68	5.25	1.32	2.60	4.24
G-085	394490	2013-06-11	17:49	45.2561	-64.2252	37.0	0.47	1.12	4.88	35.91	9.10	6.05	13.52	28.93
G-086	394489	2013-06-11	17:22	45.2755	-64.2246	30.8	0.03	0.05	0.10	0.58	0.54	0.37	0.63	97.71
G-088	394488	2013-06-11	16:20	45.3109	-64.2253	25.6	0.04	0.14	0.53	19.02	8.77	4.06	9.30	58.14
G-089	394486	2013-06-11	15:27	45.3296	-64.2224	37.8	0.01	0.02	0.07	1.39	6.38	2.89	6.04	83.19
G-090	394325	2013-06-09	20:04	45.3466	-64.2270	39.1	0.03	0.06	0.17	4.12	4.04	1.99	5.30	84.28
G-100	394423	2013-06-10	17:27	45.2568	-64.1984	22.8	0.15	0.40	3.80	67.82	19.78	2.68	1.44	3.92
G-101	394422	2013-06-10	17:08	45.2749	-64.1985	27.8	0.77	1.48	3.83	29.05	12.00	3.82	8.63	40.41
G-102	394421	2013-06-10	16:48	45.2930	-64.1976	32.0	0.30	0.87	3.19	39.40	25.71	4.79	2.82	22.93
G-103	394420	2013-06-10	16:23	45.3119	-64.1966	36.0	0.05	0.10	0.80	82.75	7.73	2.12	1.59	4.86
G-105	394323	2013-06-09	18:26	45.3645	-64.2000	23.5	0.12	0.22	1.02	8.47	15.56	9.70	6.39	58.51
G-117	394416	2013-06-10	14:03	45.2753	-64.1726	16.9	0.21	0.55	5.84	62.36	9.96	3.31	5.04	12.72

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μ m	63 μ m	125 μ m	250 μ m	500 μ m	1mm	2mm	>4mm
G-118	394417	2013-06-10	14:27	45.2938	-64.1720	20.6	0.41	1.35	3.01	23.26	21.19	8.47	9.73	32.59
G-133	394232	2013-06-08	16:04	45.2938	-64.1472	24.4	0.67	1.72	3.32	17.16	16.76	9.31	8.68	42.38
G-134	394415	2013-06-10	13:25	45.3116	-64.1477	17.8	0.75	1.65	5.40	34.12	10.17	5.45	6.70	35.76
G-144	394233	2013-06-08	16:32	45.2939	-64.1219	23.8	0.33	1.04	3.58	22.78	16.82	5.62	10.97	38.85
G-153	394234	2013-06-08	17:08	45.2931	-64.0953	22.6	0.17	0.56	3.12	26.45	5.47	4.80	12.90	46.53
G-154	394080	2013-06-06	19:18	45.3113	-64.0978	20.5	0.23	0.55	4.68	36.94	7.21	6.03	7.77	36.59
G-352	394319	2013-06-09	16:44	45.3457	-64.3272	107.8	0.00	0.00	0.00	0.01	0.02	0.01	1.67	98.28
G-358	394666	2013-06-13	19:29	45.3425	-64.6073	48.6	5.37	4.27	5.41	8.54	8.49	5.37	7.77	54.78
G-360	394757	2013-06-14	15:43	45.3069	-64.5559	18.4	0.01	0.01	0.02	1.71	55.25	22.92	10.16	9.93
G-363	394229	2013-06-08	13:34	45.3319	-64.1257	18.6	0.21	0.53	1.92	10.05	8.01	4.81	8.40	66.08
G-364	394230	2013-06-08	14:03	45.3323	-64.0989	19.9	0.20	0.41	3.79	20.85	8.13	4.25	8.89	53.49
G-365	394419	2013-06-10	15:46	45.3296	-64.1725	29.4	0.78	1.92	6.55	61.31	16.89	3.25	1.92	7.39
G-366	394228	2013-06-08	12:42	45.3216	-64.1276	25.6	0.11	0.27	0.42	0.69	0.30	0.14	0.44	97.62
G-367	394079	2013-06-06	16:41	45.3117	-64.0475	28.4	0.02	0.05	0.52	13.38	1.84	3.20	11.40	69.60
G-375	394418	2013-06-10	15:17	45.3111	-64.1736	21.7	0.25	0.58	4.77	60.74	10.84	4.77	5.60	12.45
G-381	394322	2013-06-09	18:09	45.3652	-64.2254	24.8	0.48	0.91	2.98	15.64	13.97	8.82	6.70	50.50
G-382	394321	2013-06-09	17:52	45.3643	-64.2519	26.8	0.20	0.38	1.47	5.78	3.50	3.03	3.93	81.71
G-383	394320	2013-06-09	17:33	45.3641	-64.2776	25.3	1.54	6.15	9.24	19.98	17.66	9.86	10.98	24.58
G-391	394153	2013-06-07	16:03	45.3273	-64.3795	67.2	21.27	16.51	10.73	22.16	7.81	1.52	4.51	15.50
G-397	394236	2013-06-08	20:10	45.2930	-64.3014	36.2	0.07	0.14	0.30	0.70	0.35	0.18	0.08	98.18
G-410	394487	2013-06-11	15:54	45.3275	-64.2508	24.9	0.02	0.05	0.23	3.46	4.00	1.01	2.03	89.20
G-1002	394580	2013-06-12	16:22	45.2718	-64.2860	29.7	0.15	0.36	1.47	21.93	11.42	7.19	10.89	46.59
G-1003	394581	2013-06-12	16:58	45.2784	-64.2465	28.1	0.04	0.07	0.23	3.88	2.97	3.36	10.63	78.84
G-1005	394582	2013-06-12	17:28	45.2610	-64.2394	23.6	0.30	0.70	4.86	48.93	12.10	6.26	7.50	19.34
SC-002	394759	2013-06-14	19:05	45.2946	-64.9440	48.2	0.22	0.46	3.42	42.29	21.55	6.01	4.13	21.92
SC-005	394746	2013-06-14	11:22	45.2327	-64.6613	41.4	0.60	1.21	3.93	31.21	6.47	1.81	1.85	52.92
SC-007	394752	2013-06-14	13:29	45.2697	-64.5233	28.4	1.14	2.10	7.96	14.99	9.57	7.54	13.10	43.60
SC-009	394235	2013-06-08	18:00	45.3411	-64.2686	50.8	0.00	0.01	0.02	0.34	0.46	0.84	5.13	93.20

Station	Sample ID	Date	Time (GMT)	Latitude	Longitude	Depth (m)	<63 μm	63 μm	125 μm	250 μm	500 μm	1mm	2mm	>4mm
SC-011	394154	2013-06-07	18:29	45.2549	-64.2676	25.6	0.53	1.19	4.75	36.74	11.40	6.45	8.84	30.10
SC-012	394491	2013-06-11	18:22	45.2121	-64.2669	17.5	0.40	3.07	47.29	34.78	10.38	3.39	0.57	0.12
SC-013	394424	2013-06-10	17:51	45.2283	-64.1834	14.7	0.49	1.28	16.65	50.44	4.51	2.50	2.76	21.37
SC-014	394425	2013-06-10	18:26	45.2590	-64.1875	23.9	0.25	0.71	2.67	30.80	8.59	4.29	9.19	43.50
SC-015	394231	2013-06-08	15:22	45.3038	-64.1821	30.0	0.07	0.14	1.11	28.09	20.00	3.99	5.44	41.15
SC-016	394324	2013-06-09	19:09	45.3514	-64.1857	32.3	0.14	0.23	0.87	20.48	26.23	11.70	11.30	29.03
SC-017	394426	2013-06-10	19:25	45.3588	-64.1141	18.8	0.33	0.56	4.11	35.43	15.18	6.71	6.89	30.79
SC-018	394227	2013-06-08	11:40	45.3108	-64.1104	17.8	0.68	1.58	8.13	41.72	11.18	7.20	9.88	19.63
SC-019	394485	2013-06-11	11:32	45.2672	-64.1175	11.8	0.43	0.50	3.02	55.86	7.35	2.18	5.53	25.12
SC-020	394078	2013-06-06	16:03	45.2905	-64.0414	22.1	0.04	0.06	2.24	96.58	0.69	0.09	0.10	0.20
SC-022	394665	2013-06-13	16:52	45.3503	-64.0421	11.5	0.33	0.71	2.98	36.21	20.96	10.25	9.39	19.17
SC-023	394414	2013-06-10	12:00	45.3145	-63.9206	4.2	0.40	0.58	0.87	4.86	19.41	4.31	6.12	63.45
SC-024	394413	2013-06-10	11:30	45.3298	-63.8495	19.3	0.08	0.20	0.13	1.22	7.24	13.13	32.41	45.59
SC-025	394412	2013-06-10	9:23	45.3398	-63.7945	16.5	0.09	0.20	0.28	3.08	5.02	6.31	7.22	77.79