Thermograph network in the Gulf of St. Lawrence

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ABSTRACT

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The thermograph network program of the Maurice Lamontagne Institute started in 1993 with six monitoring stations. The main aim was to measure seawater surface temperature in the Estuary and Gulf of St. Lawrence and to maintain a database of those data. Today's measurements are no longer limited to surface water temperature: some stations are now equipped with multi-devices platforms allowing the measurement of oceanographic, optical and meteorological parameters. However, we focus our attention in this report exclusively on the seawater temperature records with the goal of facilitating their use by identifying available data as well as missing data records. We have tabulated relevant record numbers that characterize the completeness of the raw data files recorded during the period from 1993 to 2014. To complement these tables we plotted figures for every year that show the time intervals with valid data records for each station. We also present some examples of physical oceanographic phenomena in the coastal waters of the program area.

RÉSUMÉ

Pettigrew, B., Gilbert, D. and Desmarais R. 2016. Thermograph network in the Gulf of St. Lawrence. Can. Tech. Rep. Hydrogr. Ocean Sci. 311: vi + 77 p.

Le programme du réseau de thermographes de l'Institut Maurice-Lamontagne a débuté en 1993 avec six stations de monitorage. Le principal objectif consistait à mesurer les températures de surface de la mer dans l'estuaire et le golfe du Saint-Laurent tout en maintenant une base de données. Aujourd'hui les mesures ne sont plus limitées aux températures de surface de l'eau; certaines stations sont munies de plates-formes multi-instruments permettant la mesure de paramètres océanographiques, optiques et météorologiques. Cependant dans ce rapport nous mettons l'emphase exclusivement sur la disponibilité des enregistrements de température de l'eau dans le but d'en faciliter leur utilisation en identifiant les données disponibles de même que les données manquantes. Nous avons écrit dans des tableaux certains des nombres pertinents d'enregistrements qui caractérisent le degré d'intégralité des fichiers bruts enregistrés durant la période de 1993 à 2014. Pour compléter ces tableaux nous avons tracé pour chaque année une figure montrant les enregistrements valides pour chaque station. Nous présentons aussi quelques exemples de processus d'océanographie physique dans les eaux côtières du programme.

1.0 INTRODUCTION

The Global Climate Observing System (GCOS-164, 2012) describes sea surface temperature (SST) as an essential climate variable because of the key role that SST plays in air-sea interactions. Long-term SST time series require time (typically, more than 30 years) to attain a certain level of maturity but such time series are still relatively rare. Meanwhile, computer advancements have greatly facilitated the management and use of large amounts of data. However, there is no guarantee that any time series that started twenty years ago or so will survive the numerous obstacles that it will face, such as costs related to mooring installation and recovery, instrument purchase, instrument calibration and maintenance, data processing, and changes in corporate priorities.

In 1978, the Bedford Institute of Oceanography (Fisheries and Oceans Canada [DFO], Dartmouth NS) started measuring water temperature in some Gulf of St. Lawrence locations. At that time, they were using electro-mechanical thermographs (Ryan model; see Figure A1.1) capable of recording temperature for a period of a few months with an accuracy of 0.5°C. Ten years later, the Maurice Lamontagne Institute (MLI), a new DFO oceanographic research centre, took charge of monitoring surface water temperature in the Estuary and Gulf of St. Lawrence (hereafter EGSL). From 1988 to 1992, thermographs were installed by fishermen close to their fishing gear. This way of measuring water temperature cannot be considered a systematic monitoring program because fishermen did not necessarily place their fishing gear at the same location every year. Furthermore, fishing gears were sometimes moved even during the same year to increase catches. Coastal areas surrounding the EGSL have high SST variability caused by tides, winds, freshwater runoff, bathymetry, and shallow water. Such high SST variability over relatively short horizontal distances emphasizes the importance of fixed stations. The data recorded from 1988–1992 should be used carefully because of large uncertainties for depth and position. We do not report on those data here.

For all the above reasons, it was decided in 1993 to set up fixed-sites monitoring program resulting in what is known as the MLI thermograph network (MTN). The initial goal of this program was to create a database of coastal SST in the EGSL. We started the program with six sampling stations and gradually increased the number of stations to obtain a better spatial coverage of the study area (Figure 1).

This monitoring program is greatly indebted to the Canadian Coast Guard (CCG). Indeed, over the years we have used maritime traffic buoys as platforms for installing most of our thermographs. Because of mooring costs it would have been impossible to proceed without this partnership with the CCG. Since 1996, we have used robust steel supports for our thermographs that were especially built to be installed close to the CCG buoy anchor. All CCG buoy stations currently measure SST and sea bottom temperature (SBT) along with temperature at intermediate depths at some stations. To fulfill some specific scientific needs including the validation of satellite-derived SST and ocean color, MLI technicians have built oceanographic buoys (MOB: MLI Oceanographic Buoy) to be moored at locations that are further offshore than the usual CCG maritime traffic buoys. These MOBs are equipped with oceanographic, meteorological and optical sensors. Here again, we benefited from our partnership with the CCG, who installed and recovered these buoys during their normal operations in the spring and fall. We also maintain a year-round mooring in the Strait of Belle Isle that measures ocean currents with an Acoustic Doppler Current Profiler (ADCP) installed on the seafloor; bottom temperature, salinity and pressure are also recorded.

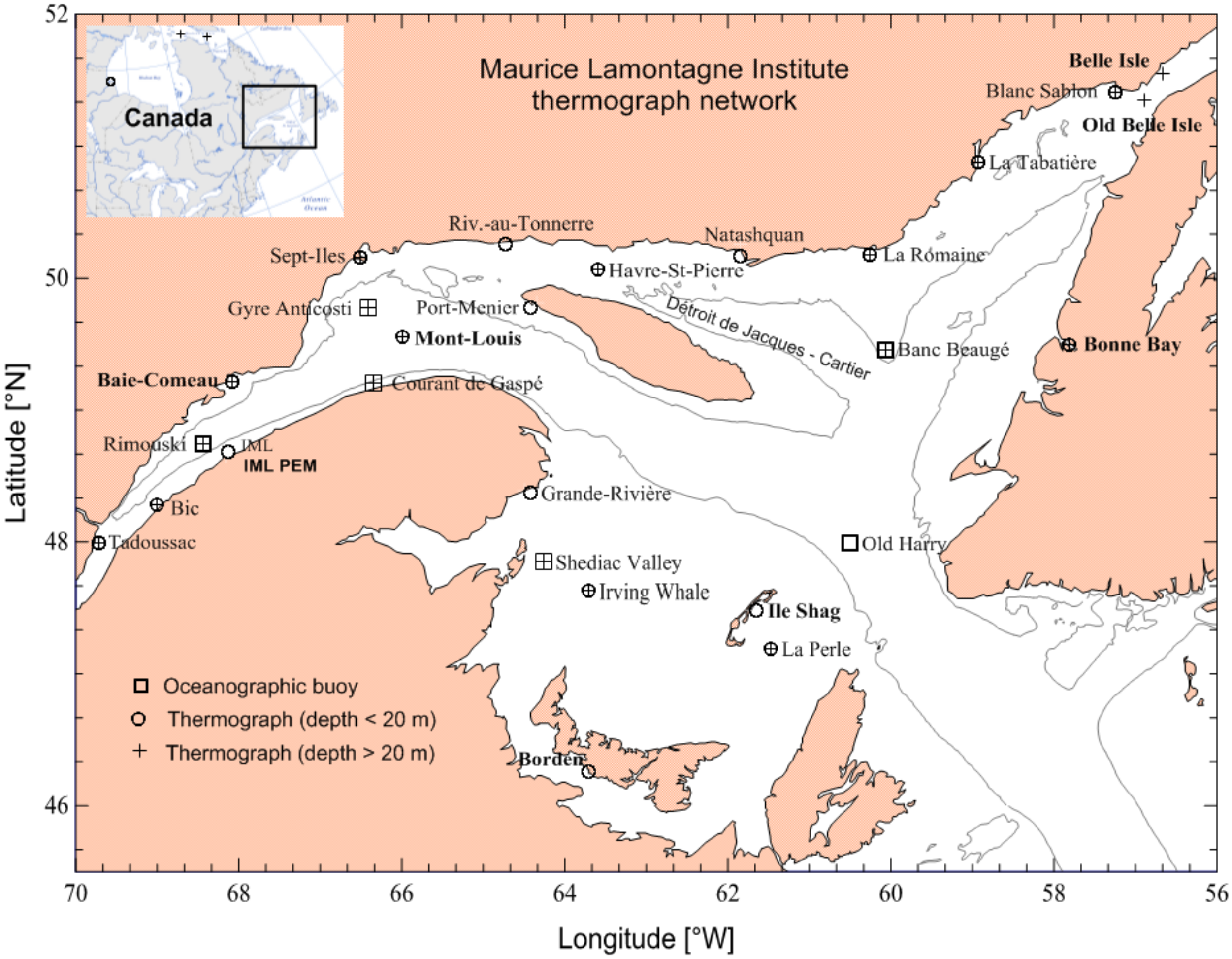

Figure 1. Thermograph network station positions during the 1993–2014 period. The inset map shows the northernmost year-round stations, Hudson-1 and Hudson-3, as well as the seasonal Churchill station on the west coast of Hudson Bay. Year-round station names are in bold type. The 200 m isobath is plotted.

An increasing need for SST time series of at least 30 years in duration mainly comes from the numerous research projects on climate. None of our time series has that minimum age yet, but a few are getting close. Nevertheless some SST time series, like the ones recorded by the oceanographic buoys, are very useful for validating the Advanced Very High Resolution Radiometer (AVHRR) SST products processed at MLI (Pettigrew et al., 2011). Water temperature can also be very useful for biologists in their studies on commercial species (e.g. lobster, crab, scallop). In situ SST data can also contribute to the validation of hydrodynamic models (Saucier et al., 2003). It is worth mentioning that a MOB has real-time transmitting capability, so it is possible for these data to be used in environmental emergencies or during a CCG Search and Rescue event.

Statistics from MTN seawater temperature time series, e.g., monthly means were described for the first time in Gilbert et al. (1997). They are also regularly included in research documents on oceanographic conditions in the EGSL (e.g., Galbraith et al., 2015).

The main goal of this report is to help MTN data users by documenting the presence of gaps. The visualization of gaps will rapidly inform the reader about time-series completeness, the number of gaps and their maximum length. Finally some oceanographic processes present in the EGSL will be showcased using seawater temperature time series from the network.

2.0 METHODS

2.1 THE LOGISTICS

In this section, we explain the various logistical steps that take place between programming an instrument, its installation on a CCG buoy, and the publication of the resulting seawater temperature time series. The field logistics of the thermograph network (Figure 1, Table 1) is an important component of this program, and it involves a close collaboration between MLI employees and staff of the CCG Aids to Navigation Program of the Québec and Maritimes regions, as well as CCG ship crew members. Aids to Navigation provide visual aids such as lights, beacons, and surface buoys.

We have equipped 11 maritime traffic buoys with our water temperature recorders. A robust steel thermograph support is welded onto the buoy, allowing water temperature to be measured between 0.5 and 2.0 m of depth depending on the shape or type of the CCG buoy. To measure bottom temperature, we use a shackle to attach a double thermograph support (Figure A1.2) directly on the sinker. We initially thought that the use of a support for two instruments was justified because recovering a bottom instrument is likely more risky and damage is sometimes inevitable, so the double support would maximize our chances of getting data. But, in fact, the thermographs attached to the surface buoy are equally at risk: the thermograph support welded onto the buoy side can be damaged when the buoy is stowed in the ship's hold before installation or after recovery. Although initially we thought that using CCG buoys was risky for both surface and bottom instruments, we found after more than 20 years that the risk turned out to be minor. We will see later that the dual bottom instruments can be used to check instruments accuracy. Thermographs are installed on buoys by MLI staff before the buoys are taken on board whereas the thermographs close to the anchor are installed by CCG ship crew just before buoy deployment. The instruments supplied to CCG by MLI staff are clearly identified to ensure that each instrument will be installed on the right buoy.

We targeted five sites (Banc Beaugé, Courant de Gaspé, Gyre Anticosti, Rimouski and Shediac Valley) to be equipped with a MOB. These five sites constitute a separate network within the thermograph network. A MOB has meteorological, oceanographic and optical sensors; they can transmit and receive data using a cellular link that has a working range estimated at 15 km from a cell antenna, a UHF modem if the buoy is less than 30 km from a terrestrial reception antenna, or a satellite link that has no distance limitation. Shediac Valley is a high frequency Atlantic Zone

Table 1. Thermograph network stations. In the “Ending year” column, ---- means still in operation. H is the water depth, and the nominal instrument depth is given by Z. The last column indicates the platform instrument owner (PIO) where CCG, EC, MLI, and PB identify respectively maritime traffic CCG buoy, meteorological buoy of Environment Canada, MLI buoy or mooring, and private buoy. The Belle Isle station has an ADCP close to the sea bottom that measures currents throughout the water column; bottom water temperature as well as salinity and pressure are measured year-round. The three stations with an * are opportunistic and may be removed at any time. The buoy at Natashquan was moved during the first year of operation. Stations equipped with a MOB are in bold type.

Station	Starting year	Ending year	Latitude N	Longitude W	H m	Z m	PIO
Baie-Comeau	1999	----	49° 12.07′	68° 03.35′	82.3	1, 82.3	CCG
Banc Beaugé	1998	----	49° 30.73′	60° 04.32′	97	0.5, 1, 97	MLI
Belle Isle	2007	----	51° 34.80′	56° 37.20′	75	71	MLI
Bic	1994	----	48° 19.95′	69° 09.92′	30.5	1, 2, 30.5	CCG
Blanc-Sablon	1999	----	51° 23.97′	57° 11.65′	22.0	1, 22	CCG
Bonne Bay	1993	2004	49° 32.30′	57° 56.00′	25.0	0.5, 25	MLI
Borden	1993	----	46° 14.96′	63° 42.06′	1.5	1.25	MLI
Churchill	2006	2007	58° 49.67′	94° 06.27′	30	0.5	PB
Courant de Gaspé	2005	----	49° 14.50′	66° 12.00′	165	0.5, 165	MLI
Grande-Rivière	1994	----	48° 23.33′	64° 29.53′	10	0.5, 2, 10	MLI
Gyre Anticosti	2005	2011	49° 43.00′	66° 15.00′	337	0.5, 337	MLI
Havre-St-Pierre	1996	----	50° 06.50′	63° 38.50′	120	1, 2, 120	MLI
Hudson-1*	2013	----	60° 38.53′	65° 52.08′	270.7	268.4	MLI
Hudson-3*	2012	----	62° 57.18′	74° 41.13′	161.7	159.4	MLI
IML	1994	----	48° 39.60′	68° 09.39′	14	0.5, 14	MLI
IML PEM	1994	----	48° 39.52′	68° 09.39′	13	12.4	MLI
Ile Shag	1993	----	47° 28.51′	61° 41.30′	10	1, 10	MLI
Irving Whale	1998	----	47° 24.20′	63° 23.53′	67	1, 67	MLI
La Perle	1996	----	47° 19.45′	61° 34.30′	26	1, 26	CCG
La Romaine	1994	----	50° 07.31′	60° 18.58′	21.9	1, 2, 21.9	CCG
La Tabatière	2002	----	50° 51.20′	58° 57.01′	39	1, 39	CCG
Mont-Louis	1994	----	49° 32.35′	65° 42.64′	325	0.35, 0.5, 1.1 2.1, 30, 200	EC
Natashquan	1994	----	50° 11.20′	61° 50.67′	5.4	1, 5.4	CCG
Natashquan	1993	1994	50° 11.00′	61° 50.95′	12	12	CCG
Old Belle Isle	2004	2006	51° 21.10′	56° 52.50′	111	105	MLI
Old Harry*	2014	----	48° 00.00′	60° 30.00′	450	0.5	MLI
Port-Menier	1994	----	49° 46.23′	64° 20.62′	12.8	2, 12.8	CCG
Rimouski	2002	----	48° 40.00′	68° 35.00′	330	0.5, 330	MLI
Riv.-au-Tonnerre	1998	----	50° 15.83′	64° 46.79′	16	1, 16	CCG
Sept-Iles	1993	----	50° 10.29′	66° 25.76′	21.9	1, 2, 21.9	CCG
Shediac Valley	2004	----	47° 47.00′	64° 02.00′	85.8	0.5, 85.8	MLI
Tadoussac	1993	----	48° 07.19′	69° 40.50′	36.6	1, 36.6	CCG

Monitoring Program (AZMP; see Therriault et al., 1998) station since 1998 and so is Rimouski station, but since 2014 only. It is worth mentioning that Courant de Gaspé and Gyre Anticosti used to be AZMP stations until 2013, after which they were replaced by the Rimouski station.

There is enough flash memory in the MOB controller to save all data recorded during a sampling season. These buoys are the result of a partnership between MLI and a private company (Multi-Électronique [MTE] Inc., Rimouski, QC, Canada); they were especially built to validate satellite data like remote SST from AVHRR sensors and satellite water colour data from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS). The first generation MOB was installed at Rimouski station in 2002. In spring 2013, the first new-generation "Viking" MOB was deployed at Rimouski station; other stations should be similarly equipped in the years to come. In 2014, a second Viking MOB was installed at Old Harry station. However, this is an opportunistic station, meaning that the buoy can be retired at any time. We also installed instruments on the two other opportunistic mooring stations, Hudson-1 and Hudson-3. In 2015, a third Viking buoy was installed at Shédiac station to replace the first generation buoy. This Viking MOB has a bigger hull than the first generation MOB, making the Viking a much more stable buoy that facilitates secure at-sea maintenance. The MOB controller has been updated with more digital ports and fewer analog ports**.** MLI staff deploy the MOBs from a buoy tender in spring and recover them in late fall.

Additional sites were chosen to measure SST and bottom temperature to get better offshore coverage. This explains the existence of the Havre Saint-Pierre and Irving Whale stations. CCG decided in 2012 to eliminate their maritime traffic buoy at Grande-Rivière, which had been a monitoring station since 1994. This site is now equipped with our own buoy to continue the monitoring of seawater temperature at the same location. The station IML (measuring SST at 0.5 m depth and SBT at 13.7 m depth) is located 190 m north of the IML PEM station. The instrument on the IML PEM station is installed by divers during the yearly fall maintenance of the MLI seawater intake. Finally, we also have year-round sites at Shag Island and Borden, where instruments are installed and recovered by local personnel. At the Shag Island station, an instrument measuring SST during ice-free months is installed on a small buoy while SBT is measured year-round. We measured SST (at 0.5 m) at Borden station from 1993 to 1995, then from 1995 we started to measure SBT (at 1.5 m); however, monitoring was interrupted in 2003 and began again in spring 2008 to measure SBT (at 1.25 m). To confirm instrument depth at Borden we used a Sea-Bird-37SM, which has a pressure sensor, in 2010. The lowest water column height is about 1.2, whereas the highest water column height is around 3.9 m. We also used to measure SST and SBT at a site in Bonne Bay (Newfoundland and Labrador). Unfortunately the loss of our local field logistics person stopped that time series in 2004.

2.2 INSTRUMENTS AND CALIBRATION

The basis of data quality assurance is the careful monitoring of instrument calibration. For every thermograph, a calibration file is produced that contains all calibrations done at various times, allowing us to estimate sensor drift. Because instruments do not reproduce the same count reading at different times of measurement for the same input signal, a calibration is done before deployment and right after instrument recovery. These calibrations are very helpful when one desires to determine the sensor drift that any device will experience over a period of time. A common practice is to use the average of pre- and post-calibration to compute seawater temperature. The comparison of temperatures obtained using both calibrations allows the calculation of sensor drift.

Because sensor drift depends on temperature, we strive to choose two raw values: one at the beginning of the time series and one that is 2–3 months later and for which seawater temperature is often warmer than at the beginning of time series. Most of the time, instruments are very stable and the drift is smaller than 0.001°C/month. Temperature sensor data that exhibit uncommon drift (say > 0.05°C/month) are not included in our database. When this happens, we ask for a calibration check; if the drift remains unchanged, the instrument is eliminated from the pool of instruments and its data are not considered reliable.

The MLI calibration laboratory produced the coefficients used to transform raw values into engineering values for all instruments deployed in this program except for instruments from Sea-Bird Electronics. Because of the high accuracy (0.002°C) of these instruments, we can only verify that the sensor has not drifted too much since the last verification. To do this, we compare our temperature reference instrument (Rosemount manufacturer, Model 162 CE, serial number 3825) with the Sea-Bird sensor's temperature value; the difference should be smaller than 0.01°C. If not, the instrument is sent back to the manufacturer for calibration. Sea-Bird instruments are usually calibrated every 5 years.

Over the last 20 years, instrument resolution and accuracy have improved and memory has increased, allowing us to store more and more data. Table 2 lists instruments (seen in Figure A1.1) used in the MTN program, which has recorded 964 time series from 1993 to 2014. Certain model resolutions are somewhat different from the specification published by the manufacturer; this is the case when the temperature range for calibration is too wide for our purposes. If a temperature sensor is calibrated over the range [-30°C, 40°C] by the manufacturer, then we will reduce the range during calibration at MLI so that it will be more representative of water temperatures found in our study area. A calibration temperature range like [-2.0°C, 22°C] instead of [-30°C, 40°C] will have the effect of improving the original resolution and accuracy of the instrument.

2.3 DATA PROCESSING AND VALIDATION

Some station metadata like location (latitude and longitude), instrument depth, date and time of instrument installation and recovery, instrument type, and instrument serial number are written in a logbook. This logbook is intensively used during data processing and any useful information will be written down on the station log sheet.

To transform raw temperature retrieved from different instrument models into engineering units, we used a homemade Graphical User Interface (GUI). This program writes the result in a uniform file format called TS9, which has a 59-line header of metadata followed by data columns of record time, water temperature, water temperature quality control (qc) flag, pressure, pressure qc flag, conductivity, conductivity qc flag, depth, depth qc flag, salinity, salinity qc flag, density anomaly (σ_t), and density anomaly (σ_t) qc flag. The GUI can help us to evaluate instrument drift, verify the integrity of the calibration file, and compute the mean calibration coefficients and it also offers time-series visualization capability. Visualization is very important in data quality control: it helps in identifying invalid or doubtful data. Indeed when SST is plotted, we expect to see of lot of small peaks due to semi-diurnal tidal cycles. We should also see the typical "bell shape," indicating the seasonal cycle for an instrument deployed near the surface (depth < 20 m or so). The visualization step also permits the detection of uncommon problems like abnormal sensor resolution that cannot be recognized by only computing sensor drift.

Table 2. Details of temperature sensor models used in the MTN. The column labelled "Period of Use" gives the range of years over which each model was used. N is the number of times series recorded with the specified instrument during the 1993–2014 period. There is a grand total of 964 seawater temperature time series recorded during that period. Resolution and accuracy were provided by the manufacturers in their instrument specifications except for the Vemco Minilog12 whose resolution and accuracy were determined at MLI.

Manufacturer	Instrument Model	Period of Use	Resolution °C	Accuracy °C	N
Hugrun	Seamon	1993–1999	0.10	0.10	19
Onset	Hobo	1994–2002	0.15	0.20	2
RBR	TR-1060	2009–2012	0.0005	0.005	6
Sea-Bird	SBE-37SI	2002–2014	0.0001	0.002	46
Sea-Bird	SBE-37SM	1999–2014	0.0001	0.002	49
Sea-Bird	SBE-37SM (+ pressure)	2007–2014	0.0001	0.002	40
Sea-Bird	SBE-37SM (+ pump)	2004–2006	0.0001	0.002	5
Sea-Bird	SBE-56	2014–2014	0.0001	0.002	9
Stowaway	Stowaway	1994–1999	0.13	0.23	4
Vemco	Minilog-TR (8 bits)	1995–2007	0.10	0.20	125
Vemco	Minilog-TDR (8 bits)	1995–1998	0.10	0.20	5
Vemco	Minilog12 (12 bits)	1998–2013	0.01	0.05	461
Vemco	Minilog16 (16 bits)	2011–2014	0.01	0.10	84
Vemco	Sealog-T	1993–2007	0.12	0.30	109

At the beginning of this program in 1993, we used two types of instruments: Seamon and Sealog-T. Therefore these instruments are principally associated with the oldest time series of this program (see Table 2). The Sealog-T had enough space for us to include a very small Hobo or Stowaway within it as a backup temperature recorder to minimize potential gaps in the time-series.

The Sealog-T failed six times to record temperature in situations where we were able to use the backup instrument (two Hobo and four Stowaway; Table 2). Technology evolved, and new Minilog-TDR and Minilog-TR 8-bit instruments first appeared in 1995, followed by the Minilog12 in 1998 and the Minilog16 in 2011. Sea-Bird instruments are mainly used on MLI buoys because of their greater size. A new thermograph support for SBT measurements has recently been built to hold one Sea-Bird SBE-56 instrument. As stated earlier, the support close to the buoy anchor can receive two side-by-side instruments. Let us now see how this duplication can be used to verify instrument accuracy. We usually process data from the first instrument. If this time series shows an acceptable drift then the second time series is just checked and not processed if the drift is the same or not better than the first one. After this step one instrument is designated as the main instrument and the second instrument as the backup.

Because of their size and cost, it would have been difficult to install two Sea-Bird SBE-37SM instruments near the anchor to measure SBT. However, the Minilog12 and Minilog16 instruments are small and cheap, and thus became good candidates to perform duplicate measurements. Before 2004, the backup file was used only when we had a problem with the instrument itself or with the raw data. Starting in 2004, instrument drift of the original and backup instruments were computed and the better of the two instruments (smallest drift) was kept. The two time series were fully processed by creating raw files allowing us to visualize them.

We have 76 SBT time-series pairs from 2005 to 2013 that come from 12 stations spread around the EGSL area. Two of these time-series pairs were eliminated: (1) one time series at Shediac Valley station in 2009 was withdrawn because the backup instrument showed a resolution problem, probably due to a weak battery problem, and (2) the time series of the backup instrument at Sept-Iles in 2006 had a large instrument drift and was discarded. Finally, because we only wish to compare time series recorded with the same instrument model, we were left with 63 time series pairs of which 51 came from Minilog12 models and 12 from Minilog16 models. We only focus here on results from the Minilog12. While some may say that using a main and a backup instrument is doubling the chance of problems, it can also be a very interesting way to validate data and instrument specifications from the manufacturers.

The distribution of the 417 564 temperature differences (Figure 2) that we have obtained from the 51 Minilog12 pairs is not Gaussian according to a Kolmogorov-Smirnov test. We found that different intervals ±0.025°C, ±0.05°C, ±0.10°C, ±0.20°C, and ±0.25°C, represent respectively 83.3%, 93%, 97.4%, 99.1%, and 99.4% of the total 417 564 temperature differences. To complement this information we checked the interval ±0.5°C which comprises 99.9% of differences or 417 115 values; thus we still have 449 values outside this interval. The accuracy of ±0.05°C for the Minilog12 was estimated at MLI by Robert Bélanger.

We still have 0.6% of the differences that lie outside the range ±0.25°C with values as large as -5.4°C (see Figure 3). To gain more confidence in the data recorded by these instruments we need to take a closer look at these difference values. Minilog instruments are subject to an important clock drift. This drift is ±2 min/month for the Minilog12 and ±1min/month for the Minilog16, both of which are very large when compared with a Sea-Bird SBE-56 instrument, which has a clock drift of merely ±5 s/month. Clock drift may be responsible for some of the measured temperature differences.

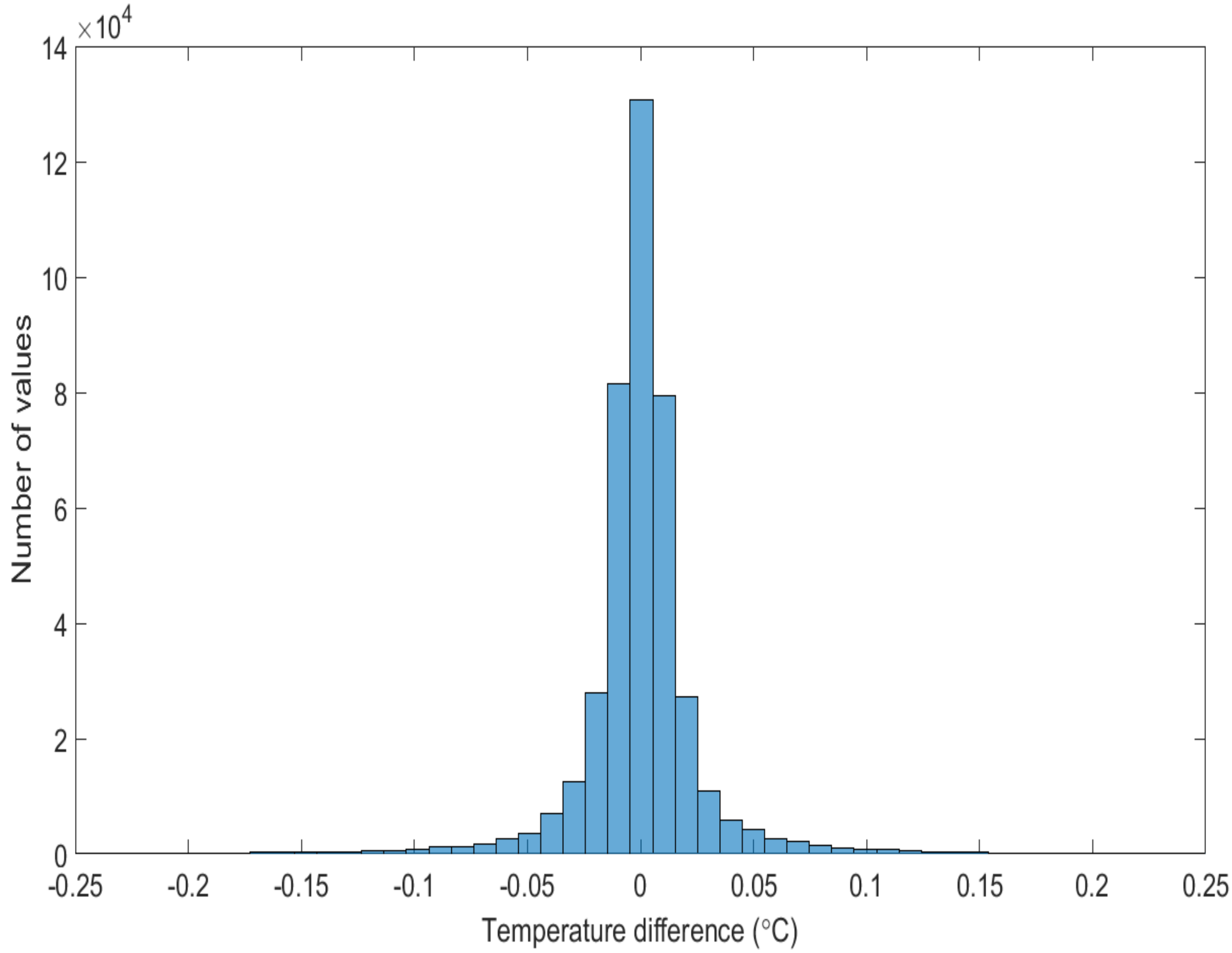

Figure 2. Distribution of seawater temperature differences for the Minilog12 for pairs of instruments deployed at the same depth, location and time period. Only the values in the interval ±0.25°C are shown. There are 415 080 values with a mean difference of 0.00074°C, a standard deviation of 0.03°C, and a median of 0.001°C.

Most instruments are installed in May and recovered in October, which gives about a 6-month mooring period. So by September, we could have one Minilog12 with a time lag of 10 minutes behind while the other Minilog12 could be as much as 10 minutes fast. This means that what we think are simultaneous measurements for these two instruments could in fact be as much as 20 minutes apart. This large difference in sampling time could be responsible for some of the huge temperature differences we observed between the main and backup thermographs. Unfortunately, we do not generally know the true clock drift for these instruments. However, we performed a test during the download of data in fall 2013: we wrote down the thermograph time and the computer time to get quantitative estimates of the clock drift of those thermographs. All 17 Minilog12 instruments showed clock advances ranging from 2 to 10 minutes over a period of 5–6 months. If we accept this instrument behaviour as typical, we can say that the maximum time difference between two Minilog12 would be 8 minutes after 5–6 months.

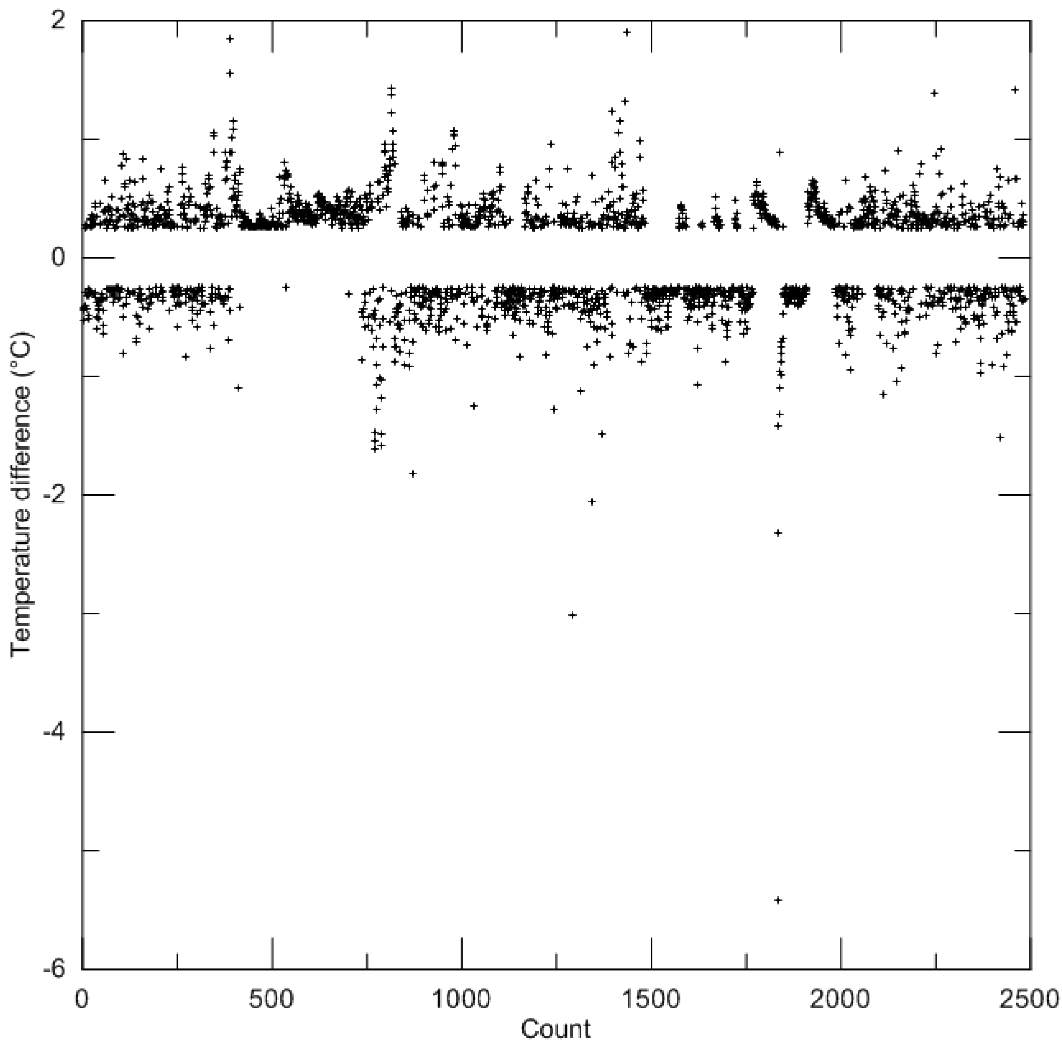

Figure 3. Seawater temperature differences for the Minilog12 outside the ±0.25°C, interval. There are 2484 values in this interval, with a minimum of -5.417°C and a maximum of 1.907°C. The mean difference value is 0.034°C, the standard deviation is 0.463°C, and the median is -0.264°C.

In an effort to better understand what can cause these differences between the two thermographs, we will look at the most extreme temperature difference data recorded at station La Perle in September 2007. We have reported in Table 3a some data from both the main and the backup thermograph; we can see that at 19:30 UTC we observed a difference of -5.4°C. This is the largest difference measured in this thermograph comparison among the 417 564 values. It is worth mentioning that during the previous 24 h the water temperature slowly rose from 4.7°C to 5.6°C, meaning that both instruments were likely in thermal equilibrium with sea bottom temperature at 18:00 UTC. What is also clear is that both thermographs "saw" the seawater warming afterwards, but not with the same magnitude. We believe that the main thermograph measured the water temperature first, just before the warming, and the backup measured the warming sometime after due to a clock drift. However, if this were the case, the main instrument should have measured a water temperature close to 12.4°C at 20:00 UTC but instead we have 10.7°C. Moreover, we see a similar temperature difference at the next sampling time. To explain this, we think that the main instrument was probably buried in the mud (one of us [R.D.] occasionally saw instruments in the support bracket coming back from the field with one instrument having a mud cap) while the backup had better contact with seawater. Perhaps the presence of mud increased the response time constant of the main thermograph, and so it took longer for it to measure the water warming or cooling compared with the backup instrument. Regarding the temperature sensor time response constant, we can add that a sensor does not immediately react to a sudden temperature change. It must first adjust to this temperature change before measuring correctly. For a Minilog12, the manufacturer specifies a time response constant of 30 seconds in stirred water.

Table 3a. Some instantaneous seawater temperatures recorded by the main and backup instruments at La Perle station on 5 September 2007 at 26 m.

Time (UTC)	Main (°C)	Backup (°C)	Difference (°C)
2007-09-05 18:00	5.586	5.554	0.032
2007-09-05 18:30	5.630	5.610	0.020
2007-09-05 19:00	5.652	5.643	0.009
2007-09-05 19:30	6.954	12.371	-5.417
2007-09-05 20:00	10.724	13.038	-2.314
2007-09-05 20:30	11.590	13.007	-1.417
2007-09-05 21:00	11.423	12.517	-1.094
2007-09-05 21:30	10.807	9.914	0.893
2007-09-05 22:00	10.031	11.347	-1.316
2007-09-05 22:30	10.776	11.734	-0.958
2007-09-05 23:00	11.340	12.215	-0.875

Table 3b. Some instantaneous seawater temperatures recorded by the main and backup instruments at La Perle station on 9 August 2007 at 26 m.

Time (UTC)	Main (°C)	Backup (°C)	Difference (°C)
2007-08-09 16:30	8.962	9.031	-0.069
2007-08-09 17:00	8.962	9.031	-0.069
2007-08-09 17:30	8.973	9.042	-0.069
2007-08-09 18:00	9.397	10.157	-0.760
2007-08-09 18:30	14.720	15.784	-1.064
2007-08-09 19:00	14.853	15.390	-0.537
2007-08-09 19:30	14.658	15.080	-0.422
2007-08-09 20:00	14.412	14.666	-0.254
2007-08-09 20:30	13.980	14.179	-0.199
2007-08-09 21:00	13.784	13.951	-0.167

We have reported in Table 3b a similar behaviour that occurred a month earlier and probably confirms that the instruments were not malfunctioning. Of course we cannot cover in detail here our investigation of the 2484 values found outside the ±0.25°C interval. Issues that we considered included trying to identify if there was an electronic problem (like battery failure), or rather a rapid change in SBT that is not seen at the same time by the two instruments because of instrument clock drift or a time response constant that was modified by the presence of mud or other obstructing material, resulting in seawater temperature differences between the two thermographs records. The Minilog12 is a good and inexpensive instrument. However we must take into account possible instrument clock drift when comparing time series.

Taking into consideration the 417 564 temperature differences that we obtained from the 51 pairs of Minilog12 instruments, we obtained a mean temperature difference of -0.000381°C, a standard deviation of 0.0469°C, and a median value of 0.001°C.

In Figure 4 we plotted the 111 072 temperature differences obtained from the 12 pairs of Minilog16; the values range roughly within the [-1.1°C, 1.2°C] interval. The temperature differences from counts between about 76 250 and 103 000 come from thermographs that were measuring SBT at 330 m depth at Rimouski station during field seasons 2011, 2012, and 2013. Because temporal seawater temperature variations are very weak at this depth, thermograph clock drift cannot induce large temperature differences.

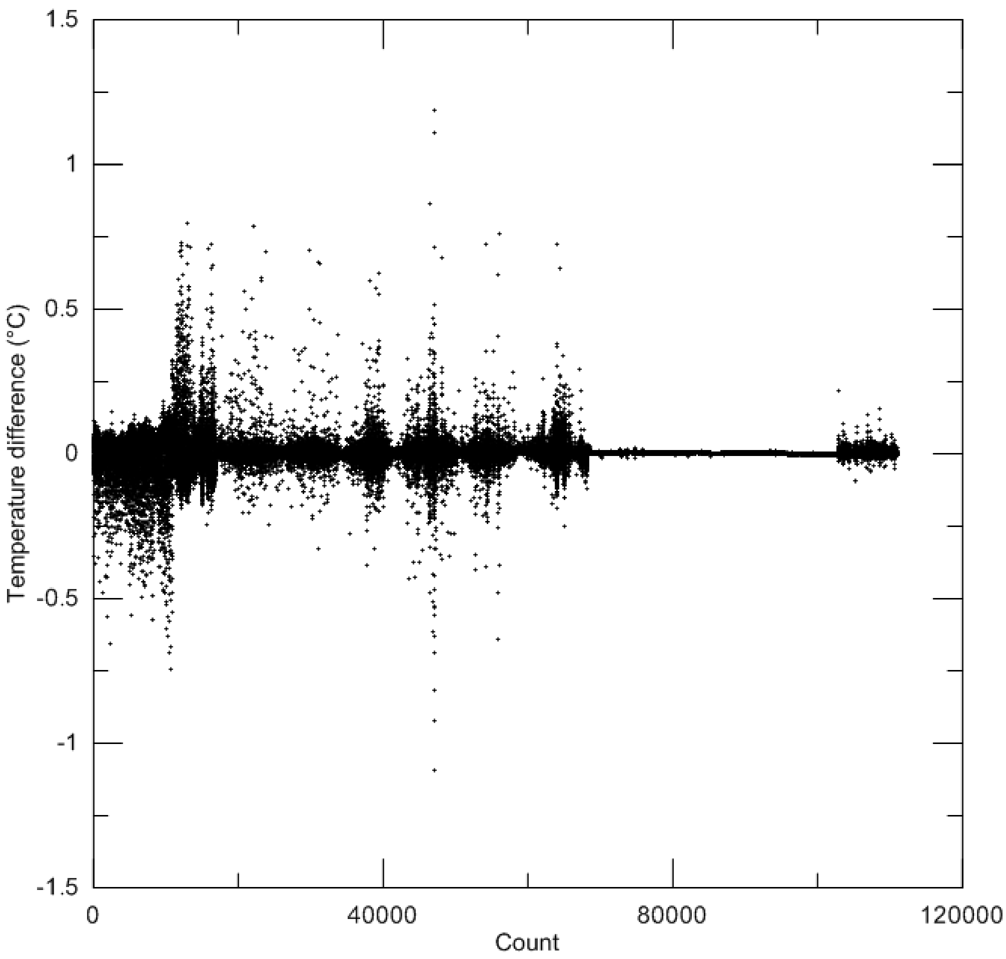

Figure 4. Seawater temperature differences for the Minilog16. There are 111 072 values, that come from 7 stations and 12 pairs of instrument, recorded from 2011 to 2013. The mean value difference is 0.002°C, the standard deviation is 0.043°C, and the median is 0.001°C.

2.4 INSTRUMENT DEPTH ADJUSTMENT AND OTHER RELEVANT DETAILS

The nominal instrument depth for SST (Figure A1.3) is probably more reliable than the nominal instrument depth used for SBT. The actual instrument depth for SST is the distance between the thermograph support on the buoy and the (mean) waterline, which remains constant. The actual instrument depth for SBT should be about equal to the water depth, with some uncertainty that is worth mentioning; indeed, only the instrument depth for IML, IML PEM, and Borden stations are already adjusted in Table 1. Once the buoy tender is on station for a CCG buoy deployment, the instruments are put inside the support and attached with a shackle directly to the ring on top of the buoy anchor (Figure A1.4). However, due to buoy movement, the anchor will eventually tip over and lay down on its side so that finally the instrument depth corresponds to water depth. We suppose that most of the time the anchor is not upright. But in circumstances where the anchor is upright, instrument depth would be about L metres less than the local water depth, where L is the CCG buoy anchor height.

A CCG buoy anchor is specially made to minimize buoy displacement, with spikes on its side to hinder movement. However, if the anchor is forced to move, it will plough the seafloor, building up a pile of mud (or sand) and probably bury the instruments support. Since 2014, in order to minimize the possibility of buried instruments, which can increase the thermograph time response constant as discussed above, we have installed the shackle on the chain at 1 m from the anchor, hoping that the instrument will stay in the water even when the anchor lays down on the seafloor. In this case, if we consider the anchor to be upright, then the instrument depth would be about L + 1 m less than the water depth. Because the CCG buoy anchor height and weight depend on the size of the CCG buoy, Table 4 reports the anchor height and weight for the CCG buoys used in the thermograph network.

Table 4. Height (L) and weight of CCG buoy anchors used at thermograph network stations. Station name is followed by sea bottom type in parenthesis, where MB, RB, and SB mean respectively muddy bottom, rocky bottom and sandy bottom. The Grande-Rivière station was equipped with a CCG buoy until 2011.

Station	L (m)	weight (kg)	Station	L (m)	weight (kg)
Baie-Comeau (MB)	1.5	3636	La Tabatière	0.75	1818
Bic (RB)	1.1	2955	Natashquan (SB)	0.5	682
Blanc-Sablon (RB)	1.1	2727	Port-Menier (RB)	1.1	2727
Grande-Rivière	1.5	3636	Riv.-au-Tonnerre (MB)	1.1	2727
La Perle (SB)	1.1	2727	Sept-Iles (SB)	1.1	2727
La Romaine (RB)	0.9	2273	Tadoussac (RB)	1.1	2727

In 2009, we learned that most CCG buoys are not installed right on the shoal but are instead put a short distance away from it. This caused a difference in the water depth instrument that we had initially inferred and the real one. We used to deduce the water depth directly from chart datum. We made changes in the raw file header on 8 an 9 July 2009, using information available through the CCG's SIPA database (this is a French acronym that is also used in English and means "*Système d'Information sur le Programme des Aides*"). We also changed the water depth metadata at Shediac Valley station on 7 January 2016. The water depth at IML station was first changed from 13.5 m to 15.0 m in July 2009, then on 8 January 2016 from 15.0 m to 14.0 m. All the changes are noted in Table 5.

Table 5. Water depth corrections. The station name is followed by the former depth and the corrected depth values. Corrections in the raw file database were carried out on 8–9 July 2009 and 7–8 January 2016.

Station	Former Depth (m)	Corrected Depth (m)	Station	Former Depth (m)	Corrected Depth (m)
Baie-Comeau	80.0	82.3	La Tabatière	36.0	39.0
Banc Beaugé	100.0	97.0	La Romaine	14.0	21.9
Bic	5.8	30.5	Natashquan	7.5	5.4
Grande-Rivière	7.0	10.0	Sept-Iles	25.0	21.9
Havre-St-Pierre	100.0	120.0	Shediac Valley	82.0	85.8
IML	15.0	14.0	Tadoussac	30.0	36.6
La Perle	8.5	26			

When available, a direct measure of instrument depth can be derived from thermograph pressure sensor data. Otherwise, it must be deduced from water depth (H) and instrument height (h) from the seafloor as

$$Z = H - h \tag{1}$$

The best available estimate of water depth comes from the SIPA database, followed by estimates from chart datum. The bottom instrument depths, Z, in Table 1 are the nominal values that are often set to water depth as a first approximation. Instrument depth for a thermograph installed close to a CCG buoy anchor is obtained using equation 1, with h set to the CCG buoy anchor height, L, before 2014 and L + 1 since 2014. Next instrument heights (h) are described for various stations:

- **Banc Beaugé**. From 1998 to 2011, the Banc Beaugé station was equipped with a first generation MOB (Figure A1.6) called IML-2. Starting in 2012, an MLI buoy smaller than a first generation MOB was used. The anchor consists of two train wheels, so the thermograph is about 0.45 m above the seafloor. The bottom material is not known.
- **Belle Isle**. The mooring at the Belle Isle station replaced the one at the Old Belle Isle station in November 2007. The water depth was deduced from chart datum. Estimated water depth can vary from 70.2 to 77.0 m while distances from the bottom to the instrument vary from 4.5 m to 6.8 m. However, the SBT is measured with a SBE37-SM equipped with a pressure sensor, meaning that instrument depth is accurately known for every SBT value.
- **Bonne Bay**. The Bonne Bay station mooring was installed and recovered by a person under contract with MLI. In 1995 we used a Minilog-TDR to record SBT and pressure; the 1995 depth time series is shown in Figure 5. The accuracy of the depth value is about ±2 m. It seems that the mooring drifted into shallow water until the field worker repositioned the mooring to the correct location. Because the thermograph was very close

to the seafloor, the instrument depth was likely within the [18.0 m, 22.0 m] interval while in the correct position.

- **Borden**. The Borden station is the shallowest station of the network measuring SBT. During the period from 19 July 2010 to 27 November 2010, an SBE-37SM with a pressure sensor was used. We measured a minimum depth of 1.6 m and a maximum depth of 4.2 m. Just before instrument mooring in July 2010, the pressure sensor showed a pressure offset of 0.35 m, giving a minimum depth of 1.25 m. Because instrument height is about 0.25 m above the seafloor we estimate that the water depth (H) is about 1.5 m.
  Note: Instrument depth from 1995 to 2002 was 1.5 m.
- **Courant de Gaspé**. The Courant de Gaspé station is equipped with a first generation MOB called IML-7. The buoy is exposed to strong currents that forced MLI staff to adjust the weight and shape of the buoy anchor to minimize displacement. Since the beginning in 2005 until 2014, we used two train wheels as a buoy anchor. We thought that a first buoy drift event in 2007 was exceptional and so we did not change the buoy anchor design (more precisely we had a first drift during 30 June–1 July, about 0.5 km to the North and 1.8 km to the East then we had a more important drift on 28–29 October where the buoy drifted about 3.2 km to the North and 16.7 km to the East). We had another buoy drift event in 2013 (the buoy drifted about 0.4 km to the North and 1.4 km to the East on 11 August), so we modified the buoy anchor in 2014 to three train wheels sitting on a metal plate (Figure A1.5). When large tensions are applied on the anchor cable the anchor will tilt and the metal plate will dig into the mud. In cases where the anchor was two train wheels, the instrument is 0.45 m above the seafloor, whereas the set-up of three train wheels on a metal plate leaves the instrument 0.75 m above the seafloor. Because mud is present, it seems reasonable to subtract 0.3 m; thus the instrument was likely about 0.15 m off-bottom with the two-train-wheel anchor and about 0.45 m above seafloor for the three-train-wheel anchor.
- **Grande-Rivière**. The Grande-Rivière station was equipped with a CCG buoy from 1994 to 2011. Since 2012, the station has been equipped with a smaller buoy called IML-9. The anchor consists of one train wheel, so the instrument is about 0.30 m above seafloor. The seafloor material is not known.
- **Gyre Anticosti**. The Gyre Anticosti station was equipped with a first generation MOB called IML-8. The anchor was two train wheels, meaning that the thermograph was about 0.45 m above seafloor. The bottom material is not known.
- **Havre-St-Pierre**. The Havre-St-Pierre station is equipped with an MLI buoy called IML-1. The anchor is one train wheel, so the thermograph is about 0.30 m above seafloor. The bottom material is not known.
- **Hudson-1**. The Hudson-1 station is a mooring. We started to measure SBT in fall 2013. The thermograph is about 2.3 m above seafloor including the one-train-wheel anchor. The bottom material is not known.
- **Hudson-3**. The Hudson-3 station is a mooring. During the mooring in September 2012, a depth sounding gave a water column depth of 161.7 m while during the mooring in October 2013 a depth sounding measured a water depth of 162.0 m, which is nearly identical. The thermograph is about 2.3 m above seafloor including the one-train-wheel anchor. The bottom material is not known.

- **IML**. The IML station is equipped with a small MLI buoy called IML-3. The anchor is one train wheel, so the thermograph is about 0.3 m above seafloor and instrument depth is about 13.7 m. The bottom material is not known.
- **IML PEM**. The IML PEM (PEM is a French acronym meaning: *Prise d'Eau de Mer*) station has its thermograph attached to the water intake of MLI's seawater pumping system. For the last three years, the SBE-37SM that is equipped with a pressure sensor has allowed us to measure the instrument's depth at about 12.4 m. We have estimated that H is about 13 m.
- **Ile Shag**. The Ile Shag station is equipped with a very small surface buoy for SST measurements. SBT is measured with a thermograph on a mooring line lying on the seafloor. From 21 September 2007 to 23 May 2008, we used an SBE-37SM that was equipped with a pressure sensor. We measured a minimum depth of 9.44 m and a maximum depth of 11.48 m. Just before instrument mooring, the pressure sensor showed a pressure offset of -0.11 m. We should thus adjust the minimum depth to 9.55 m; however, the thermograph is about 0.2 m above seafloor, giving an instrument depth of about 9.75 m.
- **Irving Whale**. The Irving Whale station is equipped with an MLI buoy called IML-5. The anchor is one train wheel, meaning that the thermograph is about 0.30 m above seafloor. The bottom material is not known.
- **Mont-Louis**. The Mont-Louis station is equipped with an EC meteorological buoy (Figure A1.6). During the 1994–1995 field season, a mooring was installed about 660 m from the EC buoy at a water depth of about 334 m. The thermograph was inside the acoustic release gear that is about 1 m above the seafloor. The thermograph at the intermediate (200 m) depth is installed in late fall and recovered the next spring. According to pressure data recorded in 2010, the instrument depths varied from 192.7 m to 197.4 m, with a mean of 194.5 m. It is worth mentioning that the EC buoy position has changed a little over the years. This is mainly due to fishing gears that get entangled with the EC buoy anchor line. The buoy positions through the years are presented in Table 6.
- **Old Belle Isle**. At the Old Belle Isle station, a mooring recorded year-round from January 2004 to November 2007. The water depth was deduced from chart datum since the thermograph had no pressure sensor. The instrument was about 7.3 m above seafloor, which gave 103.7 m for the instrument depth. The anchor was not recovered and the bottom material is not known.
- **Rimouski**. The Rimouski station was equipped with a first generation MOB from 2002 to 2012 called IML-4. During that period the buoy anchor was two train wheels, so the thermograph was 0.45 m above the seafloor. Because the sea bottom was known to be mud, it seems reasonable to subtract 0.20 m, so that the instrument is likely 0.25 m above the seafloor. Since 2013, the station has been equipped with a Viking MOB with three-train-wheel anchor (Figure A1.5), meaning that the thermograph is about 0.75 m above the seafloor. Because of the mud, in this case we subtract 0.3 m, so the instrument is likely 0.45 m above the seafloor. The IML-4 buoy once drifted about 350 m to the East on 22 September 2002.
- **Shediac Valley**. The Shediac Valley station was equipped with a first generation MOB from 2004 to 2010 called IML-6. During that period, the buoy anchor was two train wheels, meaning that the thermograph is about 0.45 m above the seafloor. Because the sea bottom was known to consist of mud, it seems reasonable to subtract 0.2 m. This will

give a thermograph that is about 0.25 m above the seafloor. In 2011, the recovery buoy's handle broke during loading onto the ship, so we cancelled the 2011 monitoring season. During the field seasons 2012 and 2013, the station was equipped with an MLI buoy with a one-train- wheel buoy anchor, meaning that instrument depth is very close to water depth. In 2014 we re-equipped the station with a first generation MOB.

- **Tadoussac**. A mooring was deployed from November 2002 to June 2003 at 48° 7.3′ N, 69° 40.3′ W. The water depth is about 45 m according to the chart datum and the instrument depth is about 43 m. This station was named Tadoussac-exp (43) and was about 340 m north-east of the Tadoussac station listed in Table 1.

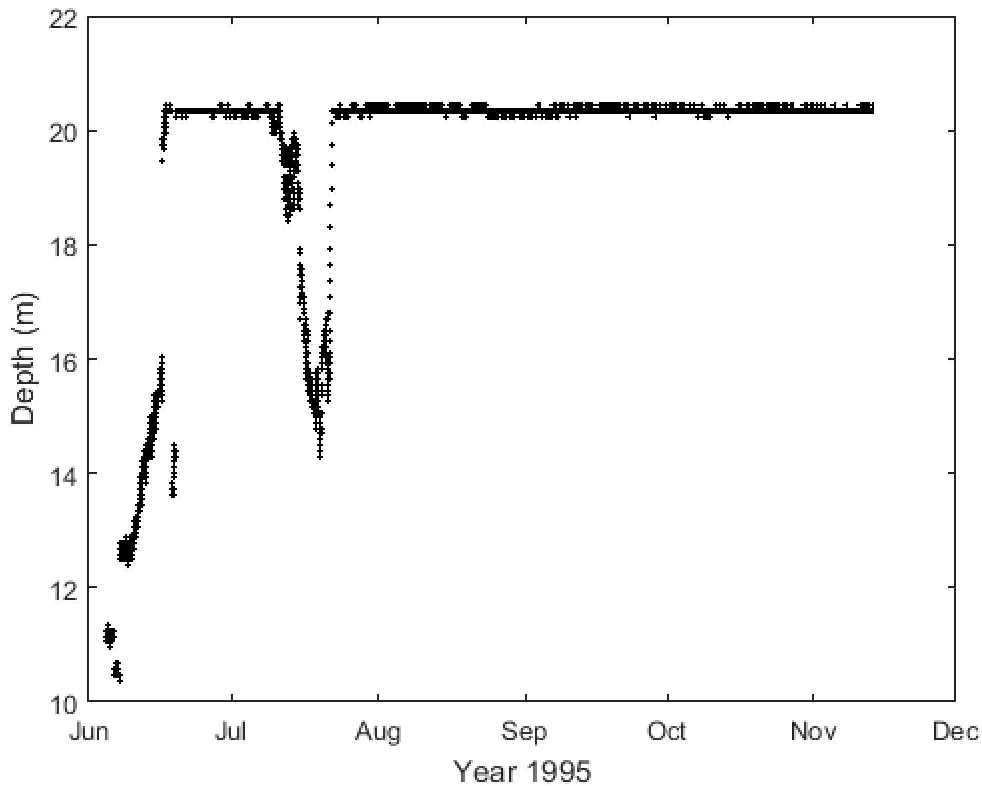

Figure 5. Instrument depth at Bonne Bay station.

Table 6. Positions of the EC meteorological buoy at Mont-Louis station from 1994 to 2014.

Starting year	Ending year	Latitude N	Longitude W
1994	1994	49° 33.618′	65° 45.552′
1995	1995	49° 31.998′	65° 43.698′
1996	1997	49° 32.808′	65° 44.508′
1998	2003	49° 32.592′	65° 46.320′
2004	2004	49° 33.210′	65° 45.798′
2005	2005	49° 33.270′	65° 45.528′
2006	2013	49° 32.598′	65° 45.582′
2014	ongoing	49° 32.346′	65° 42.642′

2.5 CHANGE IN STATION POSITION

We wish to emphasize the importance of keeping stations at fixed positions if at all possible. Suppose someone would like to use SST time series from the MTN for a study on climate change in the EGSL. Before proceeding, this person would need to make sure that the station has never been relocated.

Indeed, the time-series statistics can be affected if a station is moved, so observed changes cannot be ascribed only to climate variability but also to some effect related to relocation of station (Vincent, 1998).

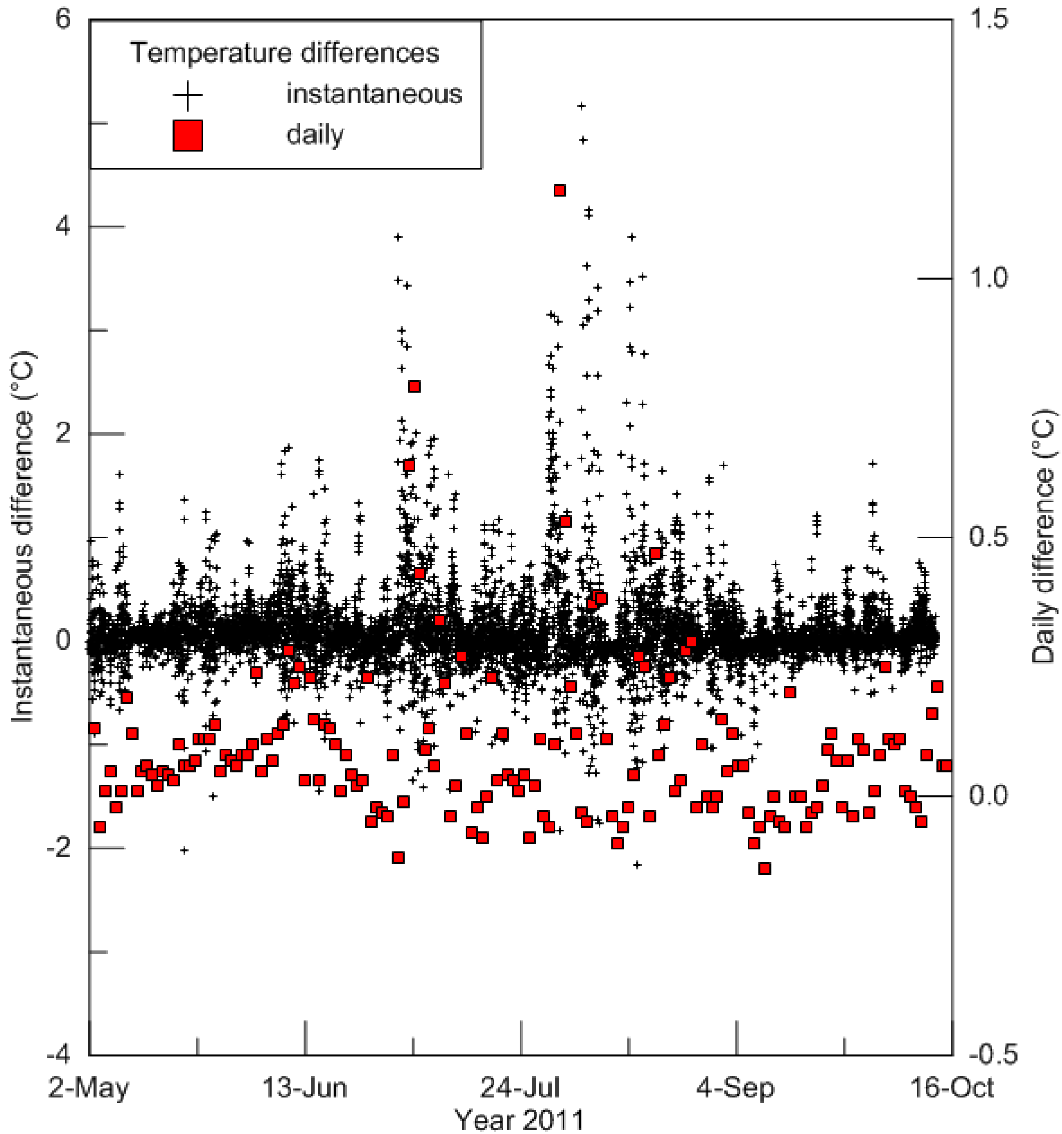

Figure 6. Seawater temperature differences between the original Grande-Rivière site and the proposed Grande-Rivière site at 2 m depth.

If the station displacement is permanent, it should be well documented, and we should (at least ideally) have one season of overlapping data to compare time series and adjust the new one. In

2011, we were forewarned by CCG that a buoy at Grande-Rivière station was going to be relocated by an alignment on the Grande-Rivière pier for season 2012.

To prepare ourselves for this change, during season 2011, in addition to the buoy installed at the original Grande-Rivière station, another buoy was moored on the proposed new site of Grande-Rivière station that is located on the same isobath as the original station, but about 250 m to the north. In Figure 6, we show the large SST instantaneous differences that vary from -2.2°C to 5.2°C and the mean SST daily differences varying from -0.14°C to 1.2°C between the two sites at 2 m depth. We also found monthly mean differences of 0.09°C, 0.17°C, 0.12°C, and 0.02°C for the months of June to September 2011 respectively. Monthly mean differences about equal to or greater than 0.1°C are important, and adjustment on SST time series from the old site to the new site must be done when one attempts to use it in climatological studies. These statistics clearly show that even a small displacement of a station can have important effects on time-series statistics that are not totally related to climate variability and change. In the end, the CCG agreed to keep the Grande-Rivière station at the original location that we had been using since 1994.

3.0 RESULTS

Statistical results from the thermograph network such as monthly means of water temperature and salinity and plots of daily water temperature and salinity are routinely published in annual DFO research documents on the physical oceanographic conditions of the Gulf of St. Lawrence (e.g. Galbraith et al., 2015). As a complement to the results already available, missing records will be documented here, and examples of oceanographic processes present in the EGSL will be shown.

3.1 MISSING DATA ESTIMATION

As of the end of 2014, there were 964 time series and this number is expected to exceed 1000 in 2016. When one wants to use these data, it can be very helpful to know if data from a specific station for a specific period of time have been recorded or not or partially recorded. Thermographs are electronic devices that can fail to measure water temperature, creating gaps that can be short or long. In some other cases, instead of missing records, we will have unscheduled supplementary records that only occur due to the MOB controller and are likely caused by interference between the buoy data acquisition system and online communication done by MLI staff for operational purposes. During the visualization step of time series, doubtful or erroneous data are sometimes detected and flagged, increasing the number of missing data.

As a last effort to qualify time series we have computed some record numbers, described below, that summarize the extent to which a temperature series is complete. For this purpose, we used information contained in the header of TS9 files, such as the times of first and last valid record and the sampling interval, to compute the expected number of records, Ne. This is the number of samples that we should normally get, and it serves as a reference to evaluate the number of missing records.

A computer program reads valid data from the time of the first valid sample to the time of last valid sample; this gives Nv(t), which is the date and hour of every valid record. The number of valid records Nv is the size of Nv(t). It is worth mentioning that the word "valid" includes all records, even those with a quality control flag (Table 7) greater than 1. Let Nf(t) be the time series of the date and hour of flagged records having values of 2, 3, 4, or 9, with a length of Nf.

Table 7. Quality control flag meanings.

Flag	Meaning
0	No quality control was done
1	Datum seems correct
2	Datum seems inconsistent with other data
3	Datum seems doubtful
4	Datum seems incorrect
5	Datum has been modified
6 to 8	Undefined
9	Datum is missing

To obtain the number of missing records, Nm, normally we just have to subtract Nv from Ne. However, Nv is sometimes greater than Ne, leading to a negative value for Nm. This implies that we have read more values than expected. To take this oversampling issue into account, we can write down the following relation:

$$\mathrm{Ne} - \mathrm{Nv} = \mathrm{Nm} - \mathrm{No} \qquad (2)$$

where No in the number of oversampled records.

In equation 2, even if Ne – Nv is zero, Nm and No may still be non–zero. To determine Nm and No, the number of good records is introduced. A good record is a single record taken within ± 3 minutes of the estimated time. Any record outside this time interval is considered to be oversampling. We will also consider as an oversampling record the case of successive records that are separated by less than 3 minutes. The number of valid records can then be defined as:

$$\mathrm{Nv} = \mathrm{Nf} + \mathrm{No} + \mathrm{Ng} \qquad (3)$$

We can combine equations 2 and 3 to get an equation for Nm that is independent of No:

$$\mathrm{Nm} = \mathrm{Ne} - \mathrm{Nf} - \mathrm{Ng} \qquad (4)$$

We will define a final number that is the total number of missing records:

$$\mathrm{Ntm} = \mathrm{Nm} + \mathrm{Nf} \qquad (5)$$

Even if the proposed missing data estimation model defined by equations 2–5 is general, the way we compute the various record numbers is not foolproof, meaning that an oversampling record would sometimes be better described as a delayed record; an example of this issue is shown in the last paragraph of section 4.1. The number of missing records does not tell the full story, and the localization of data gaps can be very important. For example, large gaps can render time series unsuitable for harmonic analysis. For every temperature time series from 1993 to 2014, we have computed Ne, Ng(t), No(t), and Nm(t), and the resulting numbers, including Nf and Nv, are presented in tables in Appendix 2. We have also included two other numbers derived from Ng(t) in these tables: the number of gaps, NOG, and the maximum gap, MG. In these tables the suffix "exp" which stands for experimental, has been added to some station names. Experimental measurements can occur for various reasons (e.g., specific demands from researchers, depth validation, diurnal warming study, moving a station) and are situations where an instrument is added to an existing station for a restricted period of time that can last some years; this instrument will eventually be removed once the experiment ends. Table 8 contains definitions of various record numbers.

Table 8. Record number definitions.

Number	Definition
Ne	Expected record number
Nv	Valid record number
Nf	Flagged record number
Nm	Missing record number
No	Oversampling record number
Ng	Good record number
Ntm	Total number of missing record
NOG	Number of gaps
MG	Maximum gap

Here is an example to show how the Appendix 2 tables are constructed. If we look at Table A2.22 at Old Harry station, which is equipped with a Viking MOB called IML-10, we should have had 13 481 records according to the Ne value. On the other hand according to the Nv value, we have read only 10 194 records, 10 191 of which are good data (Ng) and 3 of which are flagged data (Nf). So all the 10 191 good data have been recorded at the right time. In accordance to relations (4) and (5), the total number of missing records Ntm = Nm + Nf = Ne – Ng = 13 481 – 10 191 = 3290. Because we have three flagged data with Nf = 3, we get Nm = 3287. We also see that we have 82 gaps and the maximum gap has a size of 3208 records. Apart from the MG value, that still leaves 82 missing records distributed among the other 81 gaps. This huge gap of 3208 records was caused by a battery failure that required MLI staff to visit IML-10 to fix the problem.

In the Appendix 2 tables, we can observe irregularities if one attempts to compute the number of missing records using relation (2). To better understand this issue, we will proceed with an example by choosing the Bic (1) station from Table A2.3. We should have Ntm = 1 instead of Ntm = 0, because Ne – Nv = 7658 – 7657 = 1. By looking over the raw file associated with these data, we realized that approximately once every 24 hours the sampling time interval between two consecutives records is 8 seconds longer. Because this 8 seconds delay is much shorter than our ±3 minutes criterion for sampling time, we could not detect any missing records. Globally, this is equivalent to having a longer sampling interval, resulting in fewer records than expected.

According to the manufacturer, this problem is likely due to a weak battery problem. We observed this same technical issue at several other stations; these are listed in the following tables: Table A2.3: Bonne Bay(25), La Romaine (1), and Mont-Louis(30); Table A2.4: Mont-Louis (30); Table A2.6: Irving Whale(67), La Perle (26), and Tadoussac(36.6); Table A2.7: Bonne Bay (0.5); Table A2.9: IML PEM(12.4); Table A2.10: Borden(1); Table A2.15: IML PEM (12.4). These entries were written in bold type to facilitate their detection.

3.2 YEARLY DATA AVAILABILITY CHART

Though the data metrics presented in the previous section provide a good overview of the water temperature records as a function of time, we also present a more visual way of showing all the data recorded during a specific year from 1 January to 31 December for all stations. We used the preceding results that served to compute the record numbers described in tables A2.1–A2.22 to build a yearly data chart for every thermograph network station. Because some stations record year-round, we have to merge data from different instrument deployments to display all available data from a specific year. This can cause some apparent discrepancies for year-round stations between the results presented in Appendix 2 tables and the numbers that have been written for some stations in Appendix 3 figures.

In these figures, the station name is followed by the record numbers No, Ntm, Nf, and MG. Because these four numbers are generally equal to zero, they are not indicated except when Ntm or No is non-zero. This facilitates the identification of time series having issues in terms of record numbers. For each station, we plotted a continuous horizontal line showing the range of valid data records for that year, then we drew the locations of oversampling records, the total missing records, the flagged data with quality control flag greater than 1, except the qc flag equal to 5, and the maximum gap. In cases when we have more than two equal MG values, only the first one is plotted.

3.3 SPRING–NEAP TIDAL CYCLE AT BIC STATION

Among the seawater temperature time series recorded by the MTN since 1993, it seems those measured at Bic station are the most sensitive to the spring and neap tidal cycle. The 2007 Bic station water temperature time series is perhaps the best candidate to illustrate how seawater temperature variability can be largely modulated by the astronomic events of full moon and new moon (see red curve in Figure 7, where semi-diurnal and diurnal tides are filtered out to enhance the spring and neap tidal signal).

Two interesting delays are readily apparent in Figure 7. The first delay, referred to as "age of the tide" in oceanography, is the delay of about 1 to 2 days between the astronomical full moon and maximum daily tidal range. The second delay is that between maximum tidal range and minimum sea surface temperature. Tidal currents are at their maximum speed when tidal height range is maximum. Those maximum tidal currents favor various phenomena (internal tides, solitary waves, mixing through shear instabilities) that can entrain cold intermediate layer (CIL) waters into the surface layer. The spring-neap SST minima generally occur 2.5 to 8 days after the full moon or the new moon.

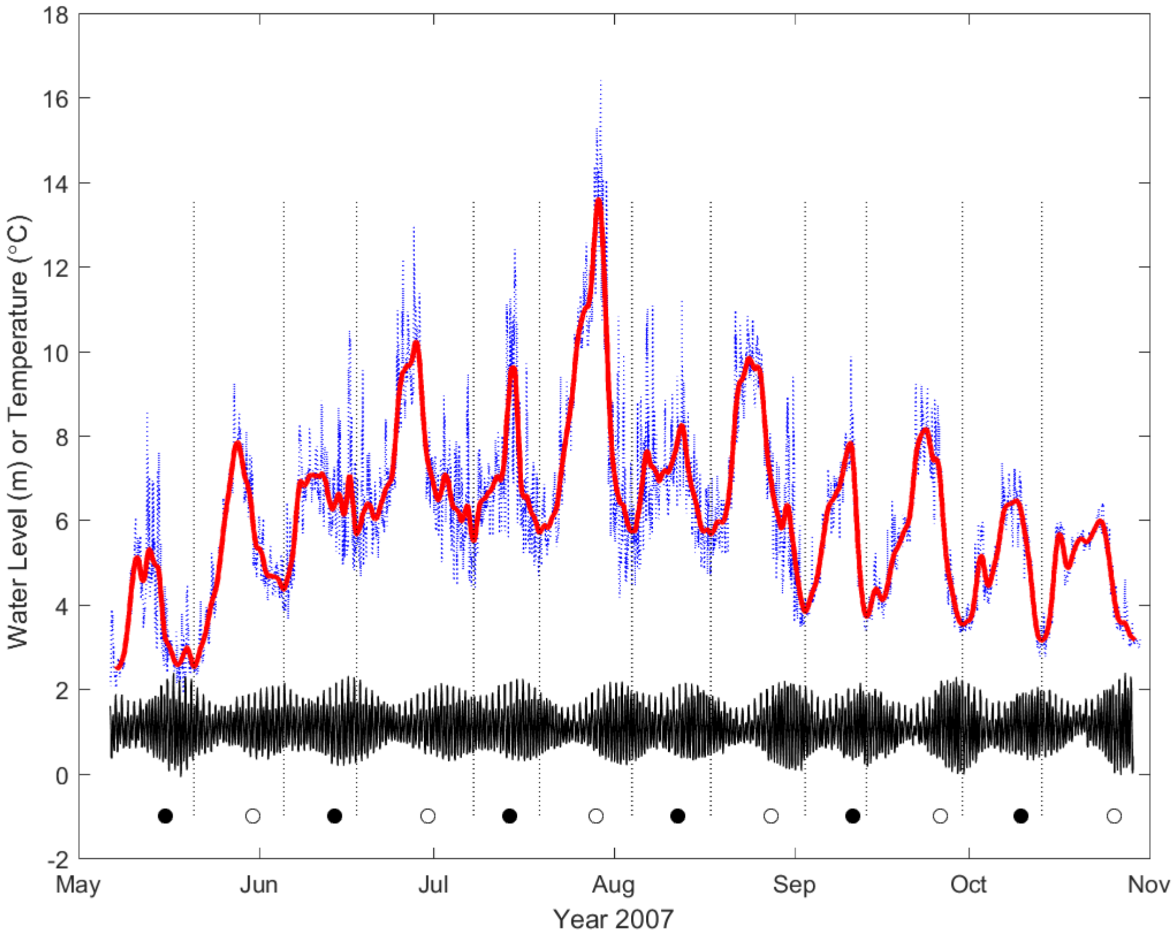

Figure 7. Temperature at Bic station at 1 m depth in 2007. The blue curve shows all data while the red curve is using a 48-hours triangular filter. The black full circles indicate the new moon while the empty circles indicate the full moon. The vertical dotted lines pinpoint the local non-filtered SST minimum for each spring-neap tidal cycle. The lower black curve is the hourly water level (divided by 2 to improve graphic visualization) measured at Rimouski by a Canadian Hydrographic Service tide gauge (station no. 2985).

3.4 WIND EFFECT AT LA TABATIERE STATION

It is well known that coastal waters of the Québec Lower North Shore are subject to episodic upwelling (Bourque and Kelley, 1995) and downwelling events induced by wind. The La Tabatière station data show two major downwelling events in 2014 (Figure 8, [top]) that coincide with northeast wind events measured at Blanc-Sablon (Figure 8, [bottom]), 100 km away, by the Atmospheric Environment Service (AES, Environment Canada).

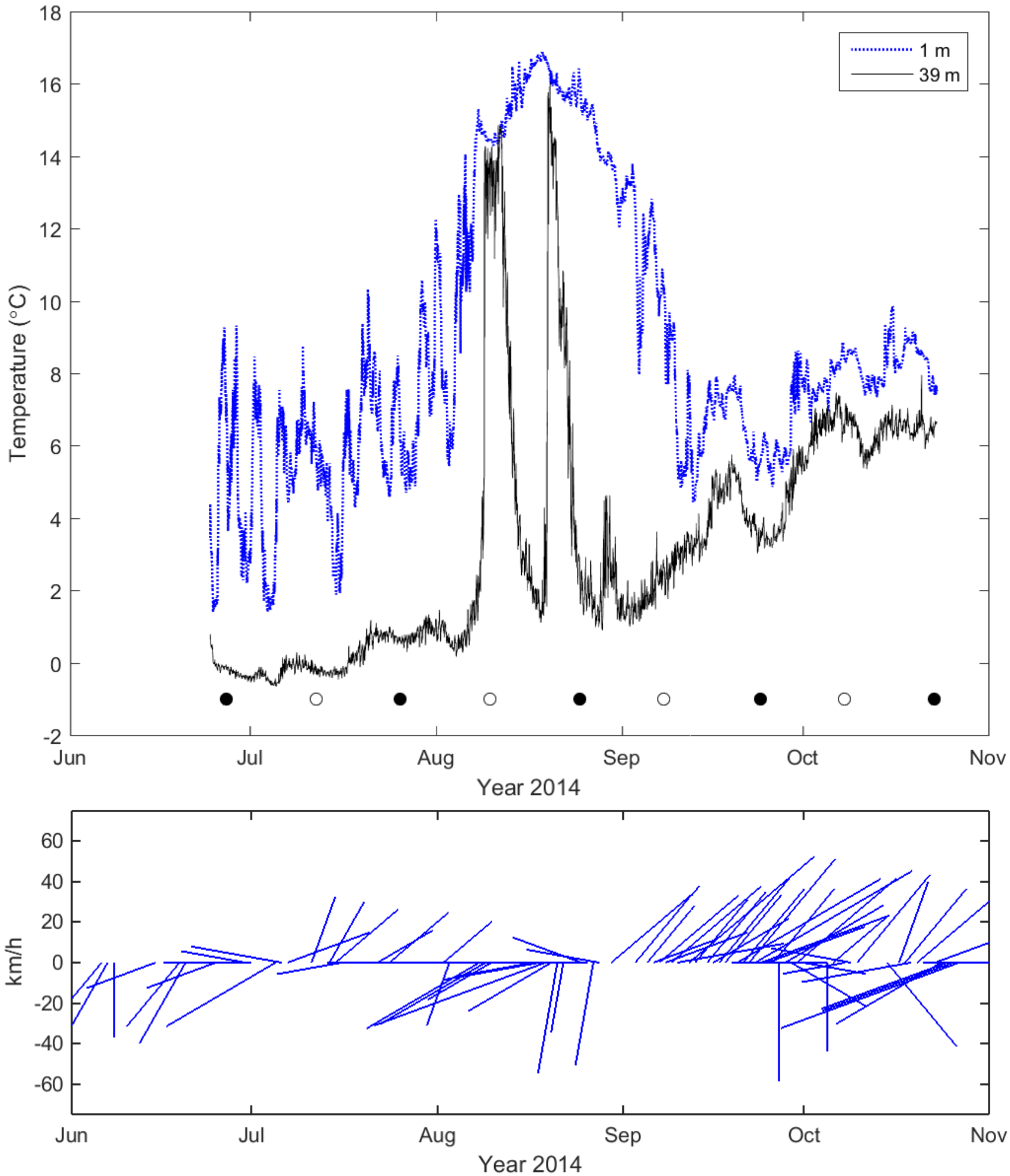

Figure 8. Seawater temperature at La Tabatière station in 2014 at 1 m (blue dotted line) and 39 m (black line). The black full circles indicate the new moon while the empty circles indicate the full moon (top). Daily wind measured at Blanc-Sablon in 2014 by AES. The wind direction is defined here as the direction toward which the wind blows. Only winds higher than 32 km/h are shown (bottom).

There are gaps in the time series of daily winds caused by winds lower than 31 km/h. In Figure 8, a downwelling event was observed to begin around 8 August and ended on 17 August. It appears likely that northeast wind at the beginning of August could explain this first downwelling event. The comparison between the wind and the second downwelling event, which started on 20 August to end on 25 August, is less conclusive.

4.0 DISCUSSION

4.1 THE OVERSAMPLING ISSUE

The oversampling issue discussed in section 3.1 was discovered with the deployment of MOB in the EGSL, and is exclusively found in those buoys. Every 15 minutes the MOB controller issues about forty commands that last less than 3.75 minutes. The pump is started to clean the tubing, then optical measurements are made for one minute followed by some statistics computing, then meteorological sensors and oceanographic sensors measure also for one minute. Finally the controller sends data according to its configuration. Roughly speaking, optical data streams end at minutes 0, 15, 30 and 45 while seawater temperature and conductivity data streams end at minutes 3, 18, 33, 48; this is what we usually get but not exclusively.

Only one MOB (Rimouski station) transmits every 15 minutes using a UHF link while other MOBs transmit a chosen group of parameters every 4 hours using a satellite link, although that used to be every 8 hours, with only a subset of data recorded at minute 3 transmitted to save on telecom costs. We do not think that the problem of oversampling is linked to instrument measurements themselves as it is actually the MOB controller that sends commands to the thermograph (Sea-Bird-37SI) to take measurements at every sampling interval (usually 15 minutes). This problem does not appear to be directly related to satellite telecom either. It might be interference between the data acquisition system and online communication with the buoy by MLI staff. It seems that the controller waits for a signal before proceeding with data acquisition and consequently misinterprets the MLI staff communication as a signal to start data acquisition.

In 2014, Courant de Gaspé (0.5) and Rimouski (0.5) stations both had one record from oversampling (No=1). At Courant de Gaspé station on 28 July, data were recorded at 00:03:22, 00:18:22, 00:33:22, 00:48:22 and 00:51:44 indicating the presence of oversampling at 00:51:44. At Rimouski station on 15 May data were recorded at 22:03:24, 22:18:24, 22:33:23, 22:42:25 and the next record is at 2014/05/18 18:03:27. The oversampling record at 22:42:25 is just preceding the max gap (MG = 269 records). The oversampled water temperature value appears to be correct when compared with surrounding values. The detection of oversampling records is not irrefutable, but indicates possible problems with the recording.

We provide a last example about oversampling records by looking at results from Shediac Valley (0.5) station in 2008 (Table A2.16). The usual way to determine the number of missing records in a time series is to subtract Nv from Ne; in this example Ne – Nv = 16 693 – 16 693 = 0, implying that no record is missing. According to equation (2) even if Ne – Nv is zero, it does not necessarily follow that Nm (or No) is zero. Here we have Ne – Nv = 0 because the number of missing records is exactly compensated by the number of oversampling records.

We mentioned earlier that the oversampling issue is only related to MOB. However, we have found one exception to this rule at station IML (0.5) in 1999 (Table A2.7). The SBE-37SM was programmed to take a sample every 5 minutes, but recorded on 26 November 1999 16:27:30 instead of 26 November 1999 16:25:00. Technically speaking we have here a real oversampling record, however we can also say that it was not an extraneous oversampling record, but simply recorded 2.5 minutes later than expected. This has raised the number of missing record by 1 but the other 6 missing records are real.

4.2 THE MISSING RECORD MODEL

To characterise the missing records in water temperature time series we have presented some record numbers that are linked together by four mathematical relations (section 3.1). We have gathered in Tables of Appendix 2 all the computed numbers for every raw file in our database. Some stations maintained year-round can have more than one table entry. Recall that record numbers Nv, No, Ng, Nm and Nf are the size of time series Nv(t), No(t), Ng(t), Nm(t) and Nf(t) respectively. The time series Nv(t) and Nf(t) are readily obtained during the file reading step whereas the other three time series need specialized algorithms and computer programs to be estimated. Using these record number time series, yearly data charts were produced for every year, resulting in 22 plots in Appendix 3. Together these figures form a kind of yearly catalog of available water temperature time series.

5.0 CONCLUSIONS

Since 1993 we have strived to build a thermograph network in the Gulf of St. Lawrence dedicated to collect sea surface temperature (SST) records. As this program evolved sea bottom temperature (SBT) also began to be recorded, instruments with conductivity cells were used and oceanographic buoys with real-time data transmission capability were developed in order to improve our knowledge of the oceanography of the EGSL.

In section 2 we described the nuts and bolts of our data quality control. Our results suggest that we should privilege the use of low clock drift instruments, such as the Sea-Bird SBE-56 that has a ±5 s/month clock drift, because problems associated with clock drift are difficult to detect. We have also shown that moving a “fixed” station must be done with great care if it cannot be avoided. At least one entire field season of overlapping data is necessary to describe the transition from the old site to the new site.

The relatively large annual volume of data can justify creating software tools that enable a rapid look at the data to detect issues about seawater temperature time-series record numbers. We presented a homemade record number model to estimate and locate missing records and other pertinent record numbers. We produced tables containing record numbers for every raw file, and then using time series record numbers we plotted yearly data charts. These plots provide a quick and convenient way of identifying available data for all stations, which together with the record number tables constitute the main results of this report.

We have always considered that the MOBs form a separate network within the MTN. This is due to the two-way, real-time data transfer and the multi-device and multi-sensor platform capability that make them unique. Real-time *in situ* SST data are extremely useful: they can be used to validate satellite infrared sensor data from the well-known AVHRR or data from the more recent satellite microwave sensors. Similarly, real-time sea surface salinity (SSS) data can help calibrate satellite SSS measurements, such as those from the Soil Moisture and Ocean Salinity (SMOS) mission of the European Space Agency (ESA, ongoing) and the Aquarius/SAC-D (mission starts 10 June 2011, ends 17 June 2015) of the National Aeronautics and Space Administration (NASA) in collaboration with Argentina.

Finally, we hope this report will be useful for the future of the Maurice Lamontagne Institute's thermograph network.

6.0 ACKNOWLEDGEMENTS

During the 22 years on which we are reporting here, many people have contributed to maintaining the thermograph network, especially those who have taken care of instrument calibrations; these include Robert Bélanger (now working for Defense Research and Development Canada, Valcartier, QC), Daniel Thibeault (now working at the CCG College, Sydney, NS) and Michel Rousseau of Science Advice, Information and Support Branch (SAISB). We acknowledge the great contribution of Roger Pigeon (SAISB) to the conception and the building of the MLI oceanographic buoys (MOB). We are grateful to Daniel Beaulieu (now retired) for building diverse robust thermograph supports and to CCG staff for their contribution to the MTN. The authors thank Laure Devine (technical report editor, SAISB) and the reviewers Peter Galbraith of Pelagic and Ecosystem Science Branch (PESB) and Diane Lavoie (PESB) for their constructive comments. We also thank people under MLI contract for their past and present contribution to this program: Raymond Arsenault, Roy Bannister, Jean-Yves Couture, Félix Saint-Pierre, and Martin Turbide.

7.0 REFERENCES

Bourque, M.-C., and Kelley, D.E. 1995. Evidence of wind-driven upwelling in Jacques-Cartier Strait. Atmosphere-Ocean 33 (4): 621–637.

Galbraith, P.S., Chassé, J., Nicot, P., Caverhill, C., Gilbert, D., Pettigrew, B., Lefaivre, D., Brickman, D., Devine, L., and Lafleur, C. 2015. Physical oceanographic conditions in the Gulf of St. Lawrence in 2014. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/032. v + 82 p.

GCOS-164. 2012. *Report of the Twentieth Session of the WMO-IOC-UNEP-ICSU Steering Committee for GCOS, Geneva, Switzerland, September 2012*, Doc. 16.2, GCOS 20th Anniversary 'Think Tank' Session.

Gilbert, D., Vézina, A.F., Pettigrew, B., Swain, D.P., Galbraith, P.S., Devine, L., and Roy, N. 1997. État du golfe du Saint-Laurent : conditions océanographiques en 1995. Rapp. tech. can. hydrogr. sci. océan. 191: xii + 113 p.

Pettigrew, B., Larouche, P., and Gilbert D. 2011. Validation des images composites des températures de surface produites au laboratoire de télédétection de l'Institut Maurice-Lamontagne. Rapp. tech. can. hydrogr. sci. océan. 270: viii + 31 p.

Saucier, F. J, Roy, F., Gilbert, D., Pellerin, P., and Ritchie, H. 2003. Modeling the formation and circulation processes of water masses and sea ice in the Gulf of St. Lawrence, Canada. J. Geophys. Res., 108, 3269, doi: 10.1029/2000JC000686, C8.

Therriault, J.-C., Petrie, B., Pépin, P., Gagnon, J., Gregory, D., Helbig, J., Herman, A., Lefaivre, D., Mitchell, M., Pelchat, B., Runge, J., and Sameoto, D. 1998. Proposal for a Northwest Atlantic zonal monitoring program. Can. Tech. Rep. Hydrogr. Ocean Sci., 194: vii + 57 pp.

Vincent, L. A. 1998. A technique for the identification of inhomogeneities in Canadian temperature series. J. Climate 11**:** 1094–1104.

APPENDIX 1. THERMOGRAPH NETWORK PHOTO LIBRARY

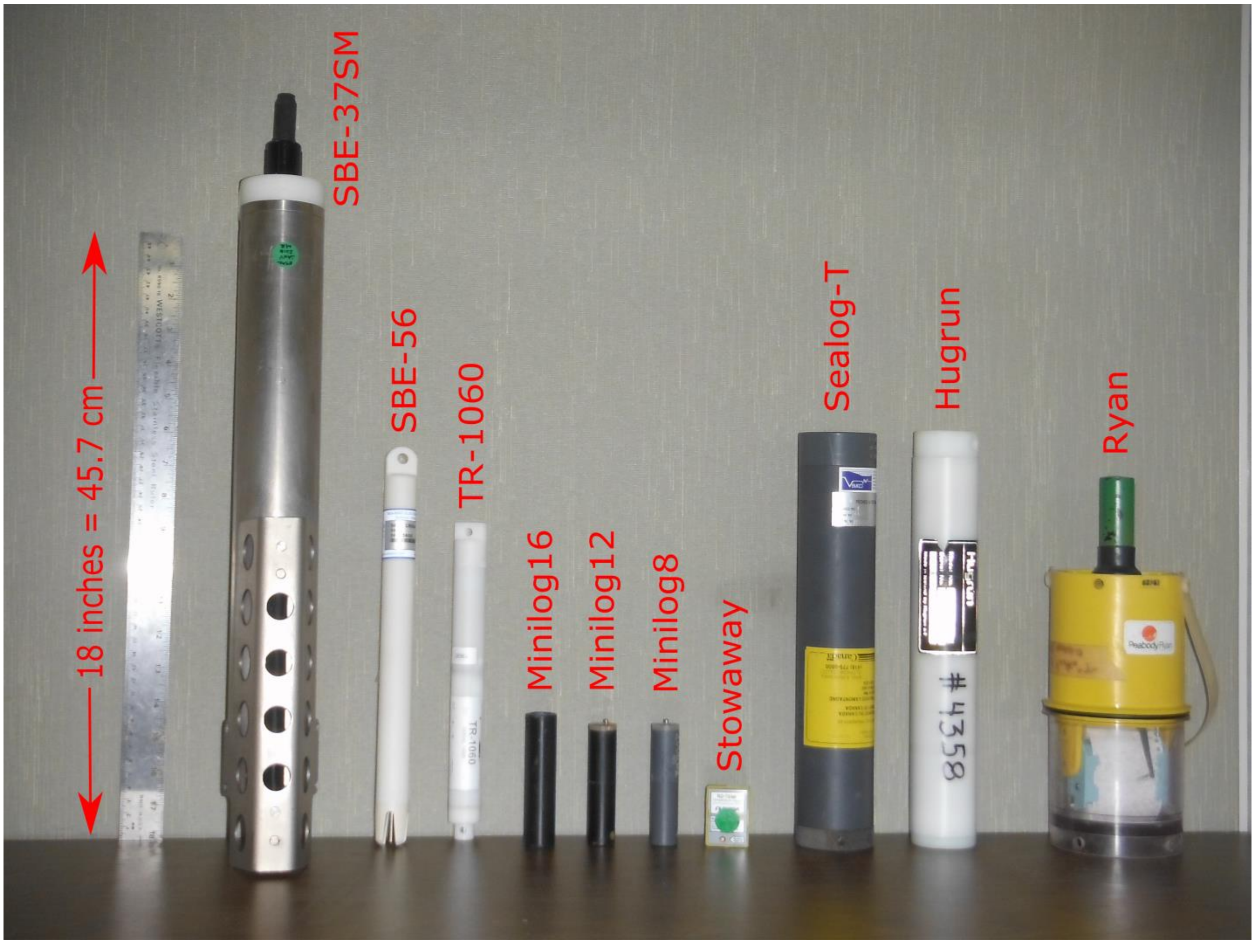

Figure A1.1 Instruments used in the thermograph network. From left to right: 45.7 cm long ruler for scale, SBE-37SM, SBE-56, TR-1060, Minilog16, Minilog12, Minilog8, Stowaway, Sealog-T, and Hugrun. At the extreme right is an electro-mechanical Ryan thermograph model that was used before the first digital thermographs such as the Hugrun and Sealog-T.

Figure A1.2 Instrument support brackets for buoy anchors. From left to right: 45.7 cm long ruler for scale, support that can hold two instruments, a variant of the first support model that can also hold two instruments, and the latest support specially made for the SBE-56.

Figure A1.3 Thermograph support bracket on CCG buoy. The support bracket at the left is welded under the hull behind the mooring chain buoy bracket, for measurements at 0.5 m depth. The other larger support shown at the right is welded on the buoy foot at 2 m depth.

Figure A1.4 CCG buoy anchor. A thermograph support that can hold two instruments is bolted to the top. Here the anchor height (L) is 0.9 m.

Figure A1.5 MLI buoy anchor. Three train wheels attached to a metal plate are used to anchor buoys like the Viking MOB. The thermograph support bracket is bolted to the ring on top of the anchor. The anchor height is 0.75 m. Anchors with only one or two train wheels are used for lighter buoys.

Figure A1.6 MLI and EC buoys. MOB of first generation (left), Viking MOB (4.5 m high and 2.1 m wide, center), EC meteorological buoy usually deployed at Mont-Louis station (right).

APPENDIX 2. TABLES OF RECORD NUMBERS

Table A2.1 Number of records and gaps in water temperature time series starting in 1993. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gaps, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Bonne Bay (25)	11247	11247	11247	0	0	0	0	0
Borden (0.5)	14838	14838	14701	0	137	137	31	9
Ile Shag (10)	16201	16201	16201	0	0	0	0	0
Natashquan (12)	17496	17496	17496	0	0	0	0	0
Sept-Iles (2)	4881	4881	4881	0	0	0	0	0
Tadoussac (0.5)	4643	4643	4643	0	0	0	0	0

Table A2.2 Number of records and gaps in water temperature time series starting in 1994. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Bic (1)	8333	8333	8332	0	1	1	1	1
Bic (2)	8334	8334	8330	0	4	4	3	2
Bonne Bay (0.5)	7489	6984	6984	0	505	0	1	505
Bonne Bay (25)	7572	7572	7572	0	0	0	0	0
Borden (0.5)	11798	11798	11779	0	19	19	3	14
Grande-Rivière (2)	8458	8458	8457	0	1	1	1	1
Ile Shag (10)	12568	12568	12568	0	0	0	0	0
IML (0.5)	6374	6374	6374	0	0	0	0	0
IML PEM (12.4)	4985	4985	4985	0	0	0	0	0
La Romaine (1)	1667	1667	1667	0	0	0	0	0
La Romaine (2)	7375	7375	7375	0	0	0	0	0
Mont-Louis (0.5)	7525	7525	7525	0	0	0	0	0
Mont-Louis-exp (325)	7137	7137	7137	0	0	0	0	0
Natashquan (1)	7593	7593	7593	0	0	0	0	0
Port-Menier (2)	1459	1459	1459	0	0	0	0	0
Sept-Iles (2)	8737	8737	8736	0	1	1	1	1

Table A2.3 Number of records and gaps in water temperature time series starting in 1995. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Bic (1)	7658	7657	7657	0	0	0	0	0
Bic (2)	9253	9253	9253	0	0	0	0	0
Bonne Bay (0.5)	7373	7373	7373	0	0	0	0	0
Bonne Bay (25)	**7792**	**7791**	**7791**	**0**	**0**	**0**	**0**	**0**
Bonne Bay (25)	2099	2099	2099	0	0	0	0	0
Bonne Bay (25)	10069	10069	10069	0	0	0	0	0
Borden (0.5)	6765	6765	6765	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Borden (1.5)	6678	6678	6678	0	0	0	0	0
Borden (1.5)	16742	16742	16742	0	0	0	0	0
Grande-Rivière (2)	9149	9149	9149	0	0	0	0	0
Ile Shag (1)	6058	6058	6058	0	0	0	0	0
Ile Shag (10)	6056	6056	6056	0	0	0	0	0
Ile Shag (10)	11812	11812	11812	0	0	0	0	0
IML (0.5)	5391	5391	5391	0	0	0	0	0
IML (0.5)	3025	3025	3025	0	0	0	0	0
IML PEM (12.4)	15807	15807	15807	0	0	0	0	0
La Romaine (1)	**6026**	**6025**	**6025**	**0**	**0**	**0**	**0**	**0**
La Romaine (2)	8615	8615	8615	0	0	0	0	0
Mont-Louis (0.5)	10073	10073	10073	0	0	0	0	0
Mont-Louis (30)	**7929**	**7928**	**7928**	**0**	**0**	**0**	**0**	**0**
Natashquan (1)	7430	7430	7430	0	0	0	0	0
Port-Menier (2)	9397	9397	9397	0	0	0	0	0
Sept-Iles (2)	9303	9303	9303	0	0	0	0	0
Tadoussac (0.5)	7298	7298	7298	0	0	0	0	0

Table A2.4 Number of records and gaps in water temperature time series starting in 1996. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Bic (1)	7828	7828	7828	0	0	0	0	0
Bic (2)	7828	7828	7828	0	0	0	0	0
Bic (30.5)	7829	7829	7829	0	0	0	0	0
Bonne Bay (25)	6912	6912	6911	0	1	1	1	1
Borden (1.5)	12340	12340	12340	0	0	0	0	0
Grande-Rivière (2)	8299	8299	8299	0	0	0	0	0
Grande-Rivière (10)	8299	8299	8299	0	0	0	0	0
Havre-St-Pierre (2)	7680	7680	7680	0	0	0	0	0
Havre-St-Pierre (120)	7707	7707	7707	0	0	0	0	0
Ile Shag (1)	5908	5908	5908	0	0	0	0	0
Ile Shag (10)	5908	5908	5908	0	0	0	0	0
Ile Shag (10)	11176	11176	11176	0	0	0	0	0
IML (0.5)	4044	4044	4044	0	0	0	0	0
IML (0.5)	2354	2354	2354	0	0	0	0	0
IML PEM (12.4)	16397	16397	16397	0	0	0	0	0
La Perle (1)	7741	7741	7741	0	0	0	0	0
La Romaine (1)	8106	8106	8106	0	0	0	0	0
La Romaine (2)	8106	8106	8106	0	0	0	0	0
La Romaine (21.9)	8106	8106	8106	0	0	0	0	0
Mont-Louis (0.5)	361	361	361	0	0	0	0	0
Mont-Louis (0.5)	9178	9178	9178	0	0	0	0	0
Mont-Louis (30)	362	362	362	0	0	0	0	0
Mont-Louis (30)	**7886**	**7885**	**7885**	**0**	**0**	**0**	**0**	**0**
Natashquan (1)	7774	7774	7774	0	0	0	0	0
Natashquan (5.4)	7774	7774	7774	0	0	0	0	0
Port-Menier (2)	8602	8602	8602	0	0	0	0	0
Port-Menier (12.8)	8577	8577	8577	0	0	0	0	0
Riv.-au-Tonnerre (16)	7058	7058	7058	0	0	0	0	0
Sept-Iles (2)	8883	8883	8883	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Sept-Iles (21.9)	8883	8883	8883	0	0	0	0	0
Tadoussac (36.6)	16227	16227	16227	0	0	0	0	0

Table A2.5 Number of records and gaps in water temperature time series starting in 1997. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Bic (2)	7908	7908	7908	0	0	0	0	0
Bic (30.5)	7908	7908	7908	0	0	0	0	0
Bonne Bay (0.5)	8380	8380	8380	0	0	0	0	0
Bonne Bay (25)	8762	8762	8531	0	231	231	1	231
Bonne Bay (25)	8164	8164	8164	0	0	0	0	0
Borden (1.5)	14536	14536	14536	0	0	0	0	0
Grande-Rivière (2)	8200	8200	8200	0	0	0	0	0
Grande-Rivière (10)	8200	8200	8200	0	0	0	0	0
Havre-St-Pierre (1)	7150	7150	7150	0	0	0	0	0
Havre-St-Pierre (2)	6813	6813	6813	0	0	0	0	0
Havre-St-Pierre (120)	7148	7148	7148	0	0	0	0	0
Ile Shag (10)	6140	6140	6140	0	0	0	0	0
Ile Shag (10)	10615	10615	10615	0	0	0	0	0
IML (0.5)	1009	1009	1009	0	0	0	0	0
IML (0.5)	8389	8389	8389	0	0	0	0	0
IML PEM (12.4)	18429	18429	18426	0	3	3	1	3
La Perle (1)	7669	7669	7669	0	0	0	0	0
La Perle (26)	9360	9360	9360	0	0	0	0	0
La Romaine (2)	7626	7626	7626	0	0	0	0	0
Mont-Louis (0.5)	9310	9310	9310	0	0	0	0	0
Natashquan (5.4)	7340	7340	7340	0	0	0	0	0
Port-Menier (2)	8354	8354	8354	0	0	0	0	0
Port-Menier (12.8)	8355	8355	8355	0	0	0	0	0
Riv.-au-Tonnerre (16)	8425	8425	8425	0	0	0	0	0
Sept-Iles (2)	9098	9098	9098	0	0	0	0	0
Sept-Iles (21.9)	9100	9100	9100	0	0	0	0	0

Table A2.6 Number of records and gaps in water temperature time series starting in 1998. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Banc Beaugé (1)	7870	7870	7870	0	0	0	0	0
Banc Beaugé (97)	7866	7866	7866	0	0	0	0	0
Bic (2)	7958	7958	7958	0	0	0	0	0
Bic (30.5)	7956	7956	7956	0	0	0	0	0
Bonne Bay (0.5)	6988	6988	6987	0	1	1	1	1
Bonne Bay (25)	6988	6988	6988	0	0	0	0	0
Bonne Bay (25)	15939	15939	15939	0	0	0	0	0
Borden (1.5)	17502	17502	17502	0	0	0	0	0
Grande-Rivière (2)	10407	10407	10407	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Grande-Rivière (10)	10407	10407	10407	0	0	0	0	0
Havre-St-Pierre (1)	8264	8264	8264	0	0	0	0	0
Havre-St-Pierre (120)	8261	8261	8261	0	0	0	0	0
IML (0.5)	6867	6867	6867	0	0	0	0	0
IML PEM (12.4)	16739	16739	16739	0	0	0	0	0
Ile Shag (10)	7386	7386	7386	0	0	0	0	0
Ile Shag (10)	10900	10900	10900	0	0	0	0	0
Irving Whale (0.5)	10836	10836	10836	0	0	0	0	0
Irving Whale (1)	10836	10836	10836	0	0	0	0	0
Irving Whale (67)	**7960**	**7959**	**7959**	**0**	**0**	**0**	**0**	**0**
La Perle (1)	7621	7621	7621	0	0	0	0	0
La Perle (26)	**7480**	**7479**	**7479**	**0**	**0**	**0**	**0**	**0**
La Romaine (2)	8053	8053	8053	0	0	0	0	0
La Romaine (21.9)	8054	8054	8054	0	0	0	0	0
Mont-Louis (0.35)	9562	9562	9562	0	0	0	0	0
Mont-Louis (0.5)	9562	9562	9562	0	0	0	0	0
Mont-Louis (0.65)	9562	9562	9562	0	0	0	0	0
Mont-Louis (0.90)	9562	9562	9562	0	0	0	0	0
Mont-Louis (1.1)	9562	9562	9562	0	0	0	0	0
Mont-Louis (2.1)	9562	9562	9562	0	0	0	0	0
Mont-Louis (30)	9562	9562	9562	0	0	0	0	0
Natashquan (1)	8153	8153	8153	0	0	0	0	0
Natashquan (5.4)	8154	8154	8154	0	0	0	0	0
Port-Menier (2)	6385	6385	6385	0	0	0	0	0
Riv.-au-Tonnerre (1)	8293	8293	8293	0	0	0	0	0
Riv.-au-Tonnerre (16)	1263	1263	1263	0	0	0	0	0
Riv.-au-Tonnerre (16)	1263	1263	1263	0	0	0	0	0
Sept-Iles (2)	8685	8685	8685	0	0	0	0	0
Tadoussac (0.5)	9592	9592	9592	0	0	0	0	0
Tadoussac (36.6)	**7898**	**7897**	**7897**	**0**	**0**	**0**	**0**	**0**
Tadoussac (36.6)	1550	1550	1550	0	0	0	0	0

Table A2.7 Number of records and gaps in water temperature time series starting in 1999. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	10610	10610	10610	0	0	0	0	0
Banc Beaugé (1)	8187	8187	8187	0	0	0	0	0
Banc Beaugé (97)	8187	8187	8187	0	0	0	0	0
Bic (1)	8695	8695	8695	0	0	0	0	0
Bic (2)	8695	8695	8695	0	0	0	0	0
Bic (30.5)	8695	8695	8695	0	0	0	0	0
Blanc-Sablon (1)	8386	8386	8386	0	0	0	0	0
Blanc-Sablon (22)	8386	8386	8386	0	0	0	0	0
Bonne Bay (0.5)	**6580**	**6579**	**6579**	**0**	**0**	**0**	**0**	**0**
Bonne Bay (25)	7154	7154	7154	0	0	0	0	0
Bonne Bay (25)	9893	9893	9889	0	4	4	2	2
Borden (1.5)	11720	11720	11720	0	0	0	0	0
Borden (1.5)	7097	7097	7097	0	0	0	0	0
Grande-Rivière (2)	10225	10225	10225	0	0	0	0	0
Grande-Rivière (10)	10225	10225	10225	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Havre-St-Pierre (1)	9048	9048	9048	0	0	0	0	0
Havre-St-Pierre (120)	9048	9048	9048	0	0	0	0	0
IML (0.5)	28317	28311	28310	1	7	0	2	6
IML (0.5)	28317	28311	28310	1	7	0	2	6
IML PEM (12.4)	9261	9261	9261	0	0	0	0	0
Ile Shag (1)	6466	6466	6466	0	0	0	0	0
Ile Shag (10)	5891	5891	5891	0	0	0	0	0
Ile Shag (10)	11048	11044	11044	0	4	0	2	2
Ile Shag-exp (0.2)	6466	6466	6466	0	0	0	0	0
Irving Whale (0.5)	9351	9351	9351	0	0	0	0	0
Irving Whale (1)	9351	9351	9351	0	0	0	0	0
La Perle (1)	7920	7920	7920	0	0	0	0	0
La Perle (26)	9835	9835	9835	0	0	0	0	0
La Romaine (2)	8846	8846	8846	0	0	0	0	0
La Romaine (21.9)	8846	8846	8846	0	0	0	0	0
Mont-Louis (0.35)	10125	10125	10074	0	51	51	1	51
Mont-Louis (0.5)	10125	10125	10074	0	51	51	1	51
Mont-Louis (1.1)	10125	10125	10074	0	51	51	1	51
Mont-Louis (2.1)	10125	10125	10074	0	51	51	1	51
Mont-Louis (30)	10125	10125	10024	0	101	101	7	86
Natashquan (1)	8973	8973	8973	0	0	0	0	0
Natashquan (5.4)	8973	8973	8973	0	0	0	0	0
Port-Menier (2)	10205	10205	10205	0	0	0	0	0
Port-Menier (12.8)	10205	10205	10205	0	0	0	0	0
Riv.-au-Tonnerre (16)	2144	2144	2144	0	0	0	0	0
Riv.-au-Tonnerre (16)	2144	2144	2144	0	0	0	0	0
Sept-Iles (2)	10686	10686	10686	0	0	0	0	0
Sept-Iles (21.9)	10686	10686	10686	0	0	0	0	0
Tadoussac (0.5)	9690	9690	9209	0	481	481	1	481

Table A2.8 Number of records and gaps in water temperature time series starting in 2000. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	9144	9144	9144	0	0	0	0	0
Baie-Comeau (82.3)	9144	9144	9126	0	18	18	1	18
Banc Beaugé (1)	7881	7881	7881	0	0	0	0	0
Bic (2)	8476	8476	8476	0	0	0	0	0
Bic (30.5)	8476	8476	8476	0	0	0	0	0
Blanc-Sablon (1)	7593	7593	7593	0	0	0	0	0
Blanc-Sablon (22)	7593	7593	7593	0	0	0	0	0
Bonne Bay (0.5)	7721	7721	7721	0	0	0	0	0
Bonne Bay (25)	7721	7721	7721	0	0	0	0	0
Bonne Bay (25)	9120	9120	9120	0	0	0	0	0
Borden (1.5)	28189	28189	28189	0	0	0	0	0
Grande-Rivière (2)	8944	8944	8944	0	0	0	0	0
Grande-Rivière (10)	8944	8944	8944	0	0	0	0	0
Havre-St-Pierre (1)	7814	7814	7814	0	0	0	0	0
Havre-St-Pierre (120)	7752	7752	7752	0	0	0	0	0
IML (0.5)	9066	9066	9066	0	0	0	0	0
IML PEM (12.4)	12188	12188	12188	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Ile Shag (1)	6384	6384	6068	0	316	316	1	316
Ile Shag (10)	6384	6384	6384	0	0	0	0	0
Ile Shag (10)	11467	11467	11467	0	0	0	0	0
Ile Shag-exp (0.2)	6384	6384	6068	0	316	316	1	316
Irving Whale (0.5)	7484	7484	7484	0	0	0	0	0
Irving Whale (1)	7460	7460	7460	0	0	0	0	0
La Perle (1)	9936	9936	9936	0	0	0	0	0
La Perle (26)	9936	9936	9936	0	0	0	0	0
La Romaine (1)	7782	7782	7782	0	0	0	0	0
La Romaine (2)	7782	7782	7782	0	0	0	0	0
La Romaine (21.9)	7781	7781	7781	0	0	0	0	0
Mont-Louis (0.35)	8978	8978	8978	0	0	0	0	0
Mont-Louis (0.5)	8979	8979	8979	0	0	0	0	0
Mont-Louis (1.1)	8978	8978	8978	0	0	0	0	0
Mont-Louis (2.1)	8978	8978	8978	0	0	0	0	0
Mont-Louis (30)	8978	8978	8978	0	0	0	0	0
Natashquan (1)	7808	7808	7808	0	0	0	0	0
Natashquan (5.4)	7808	7808	7808	0	0	0	0	0
Port-Menier (2)	8353	8353	8353	0	0	0	0	0
Port-Menier (12.8)	8354	8354	8354	0	0	0	0	0
Riv.-au-Tonnerre (1)	7788	7788	7788	0	0	0	0	0
Riv.-au-Tonnerre (16)	667	667	667	0	0	0	0	0
Riv.-au-Tonnerre (16)	667	667	667	0	0	0	0	0
Sept-Iles (2)	8730	8730	8730	0	0	0	0	0
Sept-Iles (21.9)	8730	8730	8730	0	0	0	0	0
Tadoussac (0.5)	9489	9489	9463	0	26	26	2	24
Tadoussac (36.6)	9489	9489	9465	0	24	24	2	22

Table A2.9 Number of records and gaps in water temperature time series starting in 2001. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	9062	9062	9062	0	0	0	0	0
Banc Beaugé (1)	8975	8975	8975	0	0	0	0	0
Banc Beaugé (97)	8975	8975	8975	0	0	0	0	0
Bic (1)	7724	7724	7724	0	0	0	0	0
Bic (2)	7723	7723	7723	0	0	0	0	0
Bic (30.5)	7724	7724	7724	0	0	0	0	0
Blanc-Sablon (1)	7388	7388	7388	0	0	0	0	0
Blanc-Sablon (22)	7388	7388	7388	0	0	0	0	0
Bonne Bay (0.5)	7823	7823	7823	0	0	0	0	0
Bonne Bay (25)	7849	7849	7849	0	0	0	0	0
Bonne Bay (25)	8838	8838	8838	0	0	0	0	0
Grande-Rivière (2)	8686	8686	8686	0	0	0	0	0
Grande-Rivière (10)	8686	8686	8686	0	0	0	0	0
Havre-St-Pierre (1)	9255	9255	9255	0	0	0	0	0
IML (0.5)	7789	7789	7789	0	0	0	0	0
IML PEM (12.4)	**22415**	**22414**	**22414**	**0**	**0**	**0**	**0**	**0**
Ile Shag (1)	6762	6762	6762	0	0	0	0	0
Ile Shag (10)	6761	6761	6761	0	0	0	0	0
Ile Shag (10)	9275	9275	9275	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Ile Shag-exp (0.2)	6762	6762	6762	0	0	0	0	0
Irving Whale (0.5)	9851	9851	9851	0	0	0	0	0
Irving Whale (1)	9851	9851	9851	0	0	0	0	0
Irving Whale (67)	9851	9851	9851	0	0	0	0	0
La Perle (1)	8154	8154	8154	0	0	0	0	0
La Perle (26)	8155	8155	8155	0	0	0	0	0
La Romaine (1)	8974	8974	8974	0	0	0	0	0
La Romaine (2)	8973	8973	8973	0	0	0	0	0
La Romaine (21.9)	8974	8974	8974	0	0	0	0	0
Mont-Louis (0.35)	9394	9394	9394	0	0	0	0	0
Mont-Louis (0.5)	9394	9394	9394	0	0	0	0	0
Mont-Louis (1.1)	9394	9394	9394	0	0	0	0	0
Mont-Louis (2)	9394	9392	9392	0	2	0	2	1
Mont-Louis (2.1)	9394	9394	9394	0	0	0	0	0
Mont-Louis (30)	9394	9394	9394	0	0	0	0	0
Natashquan (1)	9251	9251	9251	0	0	0	0	0
Natashquan (5.4)	9251	9251	9251	0	0	0	0	0
Port-Menier (2)	8839	8839	8839	0	0	0	0	0
Port-Menier (12.8)	8839	8839	8839	0	0	0	0	0
Riv.-au-Tonnerre (1)	9332	9332	9332	0	0	0	0	0
Riv.-au-Tonnerre (16)	8851	8851	8851	0	0	0	0	0
Sept-Iles (1)	8966	8966	8966	0	0	0	0	0
Sept-Iles (21.9)	8966	8966	8966	0	0	0	0	0
Tadoussac (0.5)	9404	9404	9394	0	10	10	1	10

Table A2.10 Number of records and gaps in water temperature time series starting in 2002. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	9560	9560	9560	0	0	0	0	0
Baie-Comeau (82.3)	1361	1361	1361	0	0	0	0	0
Baie-Comeau (82.3)	7222	7222	7222	0	0	0	0	0
Banc Beaugé (1)	7213	7213	7213	0	0	0	0	0
Banc Beaugé (97)	7213	7213	7213	0	0	0	0	0
Bic (1)	8437	8437	8437	0	0	0	0	0
Bic (2)	8437	8437	8437	0	0	0	0	0
Bic (30.5)	8437	8437	8437	0	0	0	0	0
Blanc-Sablon (1)	7017	7017	7017	0	0	0	0	0
Blanc-Sablon (22)	7016	7016	7016	0	0	0	0	0
Bonne Bay (0.5)	4444	4444	4444	0	0	0	0	0
Bonne Bay (25)	8142	8142	8119	0	23	23	1	23
Bonne Bay (25)	10620	10620	10620	0	0	0	0	0
Borden (1.5)	**26894**	**26893**	**26893**	**0**	**0**	**0**	**0**	**0**
Grande-Rivière (2)	8884	8884	8884	0	0	0	0	0
Grande-Rivière (10)	8884	8884	8884	0	0	0	0	0
Havre-St-Pierre (1)	7528	7528	7528	0	0	0	0	0
Havre-St-Pierre (120)	7528	7528	7528	0	0	0	0	0
IML (0.5)	8527	8527	8527	0	0	0	0	0
IML PEM (12.4)	26466	26466	26466	0	0	0	0	0
Ile Shag (1)	7095	7095	7095	0	0	0	0	0
Ile Shag (10)	7094	7094	7094	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Ile Shag (10)	10473	10473	10473	0	0	0	0	0
Ile Shag-exp (0.2)	7095	7095	7095	0	0	0	0	0
Irving Whale (0.5)	10114	10114	10114	0	0	0	0	0
Irving Whale (1)	10114	10114	10114	0	0	0	0	0
Irving Whale (67)	10114	10114	10114	0	0	0	0	0
La Perle (1)	10556	10556	10556	0	0	0	0	0
La Perle (26)	10556	10556	10556	0	0	0	0	0
La Romaine (1)	7291	7291	7291	0	0	0	0	0
La Romaine (2)	7291	7291	7291	0	0	0	0	0
La Romaine (21.9)	7291	7291	7291	0	0	0	0	0
La Tabatière (1)	6600	6600	6600	0	0	0	0	0
La Tabatière (39)	7170	7170	7170	0	0	0	0	0
Mont-Louis (0.35)	10601	10601	10601	0	0	0	0	0
Mont-Louis (0.5)	10601	10601	10601	0	0	0	0	0
Mont-Louis (1.1)	10601	10601	10601	0	0	0	0	0
Mont-Louis (2.1)	10601	10601	10601	0	0	0	0	0
Mont-Louis (30)	10600	10600	10600	0	0	0	0	0
Natashquan (1)	7552	7552	7552	0	0	0	0	0
Natashquan (5.4)	7553	7553	7553	0	0	0	0	0
Port-Menier (2)	9023	9023	9023	0	0	0	0	0
Port-Menier (12.8)	9023	9023	9023	0	0	0	0	0
Rimouski (0.5)	11521	11511	11510	0	11	1	6	3
Riv.-au-Tonnerre (1)	7639	7639	7639	0	0	0	0	0
Riv.-au-Tonnerre (16)	7639	7639	7639	0	0	0	0	0
Sept-Iles (1)	9460	9460	9460	0	0	0	0	0
Sept-Iles (21.9)	9460	9460	9460	0	0	0	0	0
Tadoussac (0.5)	10032	10032	10032	0	0	0	0	0
Tadoussac (36.6)	10032	10032	10032	0	0	0	0	0
Tadoussac-exp (43)	20333	20318	20318	0	15	0	15	1

Table A2.11 Number of records and gaps in water temperature time series starting in 2003. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8741	8741	8741	0	0	0	0	0
Baie-Comeau (82.3)	8738	8738	8738	0	0	0	0	0
Baie-Comeau (82.3)	8431	8431	8431	0	0	0	0	0
Banc Beaugé (1)	5938	5938	5938	0	0	0	0	0
Banc Beaugé (97)	5939	5939	5939	0	0	0	0	0
Bic (1)	7374	7374	7374	0	0	0	0	0
Bic (2)	7374	7374	7374	0	0	0	0	0
Bic (30.5)	7374	7374	7374	0	0	0	0	0
Blanc-Sablon (1)	5805	5805	5805	0	0	0	0	0
Blanc-Sablon (22)	16573	16573	16573	0	0	0	0	0
Bonne Bay (25)	8355	8355	8355	0	0	0	0	0
Grande-Rivière (2)	8554	8554	8554	0	0	0	0	0
Grande-Rivière (10)	8554	8554	8554	0	0	0	0	0
Havre-St-Pierre (1)	6275	6275	6275	0	0	0	0	0
Havre-St-Pierre (120)	6275	6275	6275	0	0	0	0	0
IML (0.5)	7428	7428	7428	0	0	0	0	0
Ile Shag (1)	6005	6005	6005	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Ile Shag (10)	5765	5765	5765	0	0	0	0	0
Ile Shag (10)	10417	10417	10417	0	0	0	0	0
Ile Shag-exp (0.2)	6005	6005	6005	0	0	0	0	0
Irving Whale (0.5)	9408	9404	9404	0	4	0	4	1
Irving Whale (1)	9408	9408	9408	0	0	0	0	0
Irving Whale (67)	9409	9409	9409	0	0	0	0	0
La Perle (1)	9416	9416	9416	0	0	0	0	0
La Perle (26)	9416	9416	9416	0	0	0	0	0
La Romaine (1)	5938	5938	5938	0	0	0	0	0
La Romaine (2)	5938	5938	5938	0	0	0	0	0
La Romaine (21.9)	5938	5938	5938	0	0	0	0	0
La Tabatière (1)	5800	5800	5800	0	0	0	0	0
La Tabatière (39)	5799	5799	5799	0	0	0	0	0
Mont-Louis (0.35)	9688	9688	9688	0	0	0	0	0
Mont-Louis (0.5)	9689	9689	9689	0	0	0	0	0
Mont-Louis (1.1)	9688	9688	9688	0	0	0	0	0
Mont-Louis (2.1)	9660	9660	9660	0	0	0	0	0
Mont-Louis (30)	9642	9642	9642	0	0	0	0	0
Natashquan (1)	6048	6048	6048	0	0	0	0	0
Natashquan (5.4)	6048	6048	6048	0	0	0	0	0
Rimouski (0.5)	14790	14790	14790	0	0	0	0	0
Riv.-au-Tonnerre (1)	6345	6345	6345	0	0	0	0	0
Riv.-au-Tonnerre (16)	6345	6345	6345	0	0	0	0	0
Sept-Iles (1)	8888	8888	8888	0	0	0	0	0
Sept-Iles (21.9)	8888	8888	8888	0	0	0	0	0
Tadoussac (0.5)	8749	8749	8749	0	0	0	0	0

Table A2.12 Number of records and gaps in water temperature time series starting in 2004. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8575	8575	8575	0	0	0	0	0
Baie-Comeau (82.3)	8575	8575	8575	0	0	0	0	0
Baie-Comeau (82.3)	8566	8566	8566	0	0	0	0	0
Banc Beaugé (1)	7001	7001	7001	0	0	0	0	0
Banc Beaugé (97)	7001	7001	7001	0	0	0	0	0
Bic (1)	8426	8426	8426	0	0	0	0	0
Bic (2)	8426	8426	8426	0	0	0	0	0
Bic (30.5)	8426	8426	8426	0	0	0	0	0
Blanc-Sablon (1)	6898	6898	6898	0	0	0	0	0
Blanc-Sablon (22)	6897	6897	6897	0	0	0	0	0
Bonne Bay (0.5)	7694	7694	7694	0	0	0	0	0
Bonne Bay (25)	7694	7694	7694	0	0	0	0	0
Grande-Rivière (2)	7546	7546	7546	0	0	0	0	0
Grande-Rivière (10)	7546	7546	7546	0	0	0	0	0
Havre-St-Pierre (0.5)	7191	7191	7191	0	0	0	0	0
Havre-St-Pierre (1)	7191	7191	7191	0	0	0	0	0
IML (0.5)	8444	8444	8444	0	0	0	0	0
IML PEM (12.4)	6823	6823	6823	0	0	0	0	0
IML PEM (12.4)	16227	16227	16227	0	0	0	0	0
Ile Shag (0.2)	7026	7026	7026	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Ile Shag (1)	7026	7026	7026	0	0	0	0	0
Ile Shag (10)	7026	7026	7026	0	0	0	0	0
Ile Shag (10)	10025	10025	10025	0	0	0	0	0
Irving Whale (0.5)	8988	8988	8988	0	0	0	0	0
Irving Whale (1)	8988	8988	8988	0	0	0	0	0
Irving Whale (67)	8987	8987	8987	0	0	0	0	0
La Perle (1)	9252	9252	8843	0	409	409	1	409
La Romaine (2)	6885	6885	6885	0	0	0	0	0
La Romaine (21.9)	6885	6885	6885	0	0	0	0	0
La Tabatière (1)	6891	6891	6891	0	0	0	0	0
La Tabatière (39)	6891	6891	6891	0	0	0	0	0
Mont-Louis (0.5)	7949	7949	7949	0	0	0	0	0
Mont-Louis (1.1)	7949	7949	7949	0	0	0	0	0
Mont-Louis (2.1)	7950	7950	7950	0	0	0	0	0
Mont-Louis (30)	7949	7949	7949	0	0	0	0	0
Natashquan (1)	6902	6902	6902	0	0	0	0	0
Natashquan (5.4)	6902	6902	6902	0	0	0	0	0
Old Belle Isle (105)	14444	14436	14436	0	8	0	8	1
Old Belle Isle (105)	18108	18108	18108	0	0	0	0	0
Port-Menier (2)	7848	7848	7848	0	0	0	0	0
Rimouski (0.5)	16890	15875	15875	0	1015	0	376	102
Riv.-au-Tonnerre (1)	7247	7247	7247	0	0	0	0	0
Riv.-au-Tonnerre (16)	7247	7247	7229	0	18	18	1	18
Sept-Iles (1)	8447	8447	8447	0	0	0	0	0
Sept-Iles (2)	8447	8447	8447	0	0	0	0	0
Sept-Iles (21.9)	8447	8447	8447	0	0	0	0	0
Shediac Valley (0.5)	15456	14561	14561	0	895	0	202	102
Tadoussac (0.5)	9405	9405	9405	0	0	0	0	0
Tadoussac (36.6)	9406	9406	9406	0	0	0	0	0

Table A2.13 Number of records and gaps in water temperature time series starting in 2005. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	9360	9360	9360	0	0	0	0	0
Baie-Comeau (82.3)	9674	9674	9674	0	0	0	0	0
Banc Beaugé (0.5)	16533	16504	16497	0	36	7	4	23
Banc Beaugé (1)	8266	8266	8266	0	0	0	0	0
Banc Beaugé (97)	8266	8266	8266	0	0	0	0	0
Bic (1)	8031	8031	8031	0	0	0	0	0
Bic (2)	8054	8054	8054	0	0	0	0	0
Bic (30.5)	8054	8054	8054	0	0	0	0	0
Blanc-Sablon (1)	8215	8215	8215	0	0	0	0	0
Blanc-Sablon (22)	8215	8215	8215	0	0	0	0	0
Courant de Gaspé (0.5)	1424	1424	1424	0	0	0	0	0
Courant de Gaspé (165)	711	711	711	0	0	0	0	0
Grande-Rivière (2)	9595	9595	9595	0	0	0	0	0
Grande-Rivière (10)	9594	9594	9594	0	0	0	0	0
Gyre Anticosti (0.5)	13564	13562	13562	0	2	0	2	1
Gyre Anticosti (337)	6781	6781	6781	0	0	0	0	0
Havre-St-Pierre (0.5)	8253	8253	8253	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Havre-St-Pierre (1)	8253	8253	8253	0	0	0	0	0
Havre-St-Pierre (120)	8252	8252	8252	0	0	0	0	0
IML (0.5)	8021	8021	8021	0	0	0	0	0
IML PEM (12.4)	2065	2065	2065	0	0	0	0	0
IML PEM (12.4)	19686	19686	19686	0	0	0	0	0
Ile Shag (10)	6984	6984	6984	0	0	0	0	0
Ile Shag (10)	10174	10174	10174	0	0	0	0	0
Irving Whale (0.5)	8247	8247	8247	0	0	0	0	0
Irving Whale (1)	8738	8738	8738	0	0	0	0	0
Irving Whale (67)	8738	8738	8738	0	0	0	0	0
La Perle (1)	8674	8674	8674	0	0	0	0	0
La Perle (26)	8674	8674	8674	0	0	0	0	0
La Romaine (1)	8551	8551	8551	0	0	0	0	0
La Romaine (2)	8551	8551	8551	0	0	0	0	0
La Romaine (21.9)	8551	8551	8551	0	0	0	0	0
La Tabatière (1)	8166	8166	8166	0	0	0	0	0
La Tabatière (39)	8166	8166	8166	0	0	0	0	0
Mont-Louis (0.35)	9814	9814	9814	0	0	0	0	0
Mont-Louis (0.5)	9814	9814	9814	0	0	0	0	0
Mont-Louis (1.1)	9814	9814	9814	0	0	0	0	0
Mont-Louis (2.1)	9814	9814	9814	0	0	0	0	0
Mont-Louis (30)	9814	9814	9814	0	0	0	0	0
Natashquan (1)	8265	8265	8265	0	0	0	0	0
Natashquan (5.4)	8265	8265	8265	0	0	0	0	0
Old Belle Isle (105)	10503	10503	10503	0	0	0	0	0
Port-Menier (2)	9276	9276	9276	0	0	0	0	0
Port-Menier (12.8)	9275	9275	9275	0	0	0	0	0
Rimouski (0.5)	16061	15678	15678	0	383	0	44	133
Rimouski (330)	8031	8031	8031	0	0	0	0	0
Riv.-au-Tonnerre (1)	8230	8230	8230	0	0	0	0	0
Riv.-au-Tonnerre (16)	8230	8230	8230	0	0	0	0	0
Sept-Iles (1)	9603	9603	9603	0	0	0	0	0
Sept-Iles (2)	9603	9603	9603	0	0	0	0	0
Sept-Iles (21.9)	9603	9603	9603	0	0	0	0	0
Shediac Valley (0.5)	19161	19160	19160	0	1	0	1	1
Shediac Valley (85.8)	9581	9581	9581	0	0	0	0	0
Tadoussac (0.5)	10598	10598	10598	0	0	0	0	0
Tadoussac (1)	10598	10598	10598	0	0	0	0	0

Table A2.14 Number of records and gaps in water temperature time series starting in 2006. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8543	8543	8543	0	0	0	0	0
Baie-Comeau (82.3)	8543	8543	8543	0	0	0	0	0
Baie-Comeau (82.3)	8145	8145	8145	0	0	0	0	0
Banc Beaugé (0.5)	16747	15299	15298	1	1449	0	1	1449
Banc Beaugé (1)	8373	8373	8373	0	0	0	0	0
Banc Beaugé (97)	8373	8373	8373	0	0	0	0	0
Bic (1)	8063	8063	8063	0	0	0	0	0
Bic (2)	8063	8063	8063	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Bic (30.5)	8063	8063	8063	0	0	0	0	0
Blanc-Sablon (1)	7537	7537	7537	0	0	0	0	0
Blanc-Sablon (22)	7536	7536	7536	0	0	0	0	0
Churchill (0.5)	3940	3940	3940	0	0	0	0	0
Courant de Gaspé (0.5)	16264	16201	16201	0	63	0	16	24
Grande-Rivière (2)	9136	9136	9136	0	0	0	0	0
Grande-Rivière (10)	9136	9136	9136	0	0	0	0	0
Gyre Anticosti (0.5)	16238	16238	16238	0	0	0	0	0
Gyre Anticosti (337)	8119	8119	8119	0	0	0	0	0
Havre-St-Pierre (0.5)	7494	7494	7494	0	0	0	0	0
Havre-St-Pierre (1)	7494	7494	7494	0	0	0	0	0
Havre-St-Pierre (120)	7493	7493	7493	0	0	0	0	0
IML PEM (12.4)	7870	7870	7870	0	0	0	0	0
Ile Shag (10)	7249	7249	7249	0	0	0	0	0
Ile Shag (10)	12196	12196	12196	0	0	0	0	0
Irving Whale (0.5)	9056	9056	9056	0	0	0	0	0
Irving Whale (1)	9056	9056	9056	0	0	0	0	0
Irving Whale (67)	9056	9056	9056	0	0	0	0	0
La Perle (1)	572	572	572	0	0	0	0	0
La Perle (26)	571	571	571	0	0	0	0	0
La Romaine (1)	7539	7539	7539	0	0	0	0	0
La Romaine (2)	7554	7554	7554	0	0	0	0	0
La Romaine (21.9)	7539	7539	7539	0	0	0	0	0
La Tabatière (1)	7669	7669	7669	0	0	0	0	0
La Tabatière (39)	7669	7669	7669	0	0	0	0	0
Mont-Louis (0.35)	8892	8892	8892	0	0	0	0	0
Mont-Louis (0.5)	8893	8893	8893	0	0	0	0	0
Mont-Louis (1.1)	8893	8893	8893	0	0	0	0	0
Mont-Louis (2.1)	8893	8893	8893	0	0	0	0	0
Mont-Louis (30)	8892	8892	8892	0	0	0	0	0
Natashquan (1)	7535	7535	7535	0	0	0	0	0
Natashquan (5.4)	7535	7535	7535	0	0	0	0	0
Old Belle Isle (105)	6613	6613	6613	0	0	0	0	0
Old Belle Isle (105)	17476	17476	17476	0	0	0	0	0
Port-Menier (2)	8641	8641	8641	0	0	0	0	0
Port-Menier (12.8)	8641	8641	8641	0	0	0	0	0
Rimouski (0.5)	15929	15927	15927	0	2	0	1	2
Riv.-au-Tonnerre (1)	7494	7494	7494	0	0	0	0	0
Riv.-au-Tonnerre (16)	7494	7494	7494	0	0	0	0	0
Sept-Iles (1)	8775	8775	8775	0	0	0	0	0
Sept-Iles (21.9)	8775	8775	8775	0	0	0	0	0
Shediac Valley (0.5)	16988	13675	13672	3	3316	0	95	381
Shediac Valley (85.8)	8552	8552	8552	0	0	0	0	0
Tadoussac (0.5)	10374	10374	10374	0	0	0	0	0
Tadoussac (1)	10374	10374	10374	0	0	0	0	0
Tadoussac (36.6)	10374	10374	10374	0	0	0	0	0

Table A2.15 Number of records and gaps in water temperature time series starting in 2007. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	9505	9505	9505	0	0	0	0	0
Baie-Comeau (82.3)	18209	18209	18209	0	0	0	0	0
Banc Beaugé (0.5)	15817	15684	15684	0	133	0	3	50
Banc Beaugé (1)	8197	8197	8197	0	0	0	0	0
Banc Beaugé (97)	8197	8197	8197	0	0	0	0	0
Belle Isle (71)	6944	6944	6944	0	0	0	0	0
Belle Isle (71)	17674	17674	17674	0	0	0	0	0
Bic (1)	8498	8498	8498	0	0	0	0	0
Bic (2)	8498	8498	8498	0	0	0	0	0
Bic (30.5)	7034	7034	7034	0	0	0	0	0
Blanc-Sablon (1)	7202	7202	7202	0	0	0	0	0
Churchill (0.5)	3583	3583	3583	0	0	0	0	0
Courant de Gaspé (0.5)	14041	14041	14041	0	0	0	0	0
Courant de Gaspé (165)	7021	7021	7021	0	0	0	0	0
Grande-Rivière (2)	9025	9025	9025	0	0	0	0	0
Grande-Rivière (10)	9025	9025	9025	0	0	0	0	0
Gyre Anticosti (0.5)	18753	18753	18753	0	0	0	0	0
Gyre Anticosti (337)	9376	9376	9376	0	0	0	0	0
Havre-St-Pierre (0.5)	8559	8559	8559	0	0	0	0	0
Havre-St-Pierre (1)	8560	8560	8560	0	0	0	0	0
Havre-St-Pierre (120)	8560	8560	8560	0	0	0	0	0
IML (0.5)	8502	8502	8502	0	0	0	0	0
IML PEM (12.4)	**8730**	**8729**	**8729**	**0**	**0**	**0**	**0**	**0**
IML PEM (12.4)	19282	19282	19282	0	0	0	0	0
Ile Shag (1)	4459	4459	4459	0	0	0	0	0
Ile Shag (1)	4459	4459	4459	0	0	0	0	0
Ile Shag (10)	5322	5322	5322	0	0	0	0	0
Ile Shag (10)	11765	11765	11765	0	0	0	0	0
Irving Whale (0.5)	11042	11042	11042	0	0	0	0	0
Irving Whale (1)	9634	9634	9634	0	0	0	0	0
Irving Whale (67)	9634	9634	9634	0	0	0	0	0
La Perle (1)	9225	9225	9225	0	0	0	0	0
La Perle (26)	10611	10611	10611	0	0	0	0	0
La Romaine (1)	8378	8378	8378	0	0	0	0	0
La Romaine (2)	8378	8378	8378	0	0	0	0	0
La Romaine (21.9)	8378	8378	8378	0	0	0	0	0
La Tabatière (1)	7941	7941	7941	0	0	0	0	0
La Tabatière (39)	7941	7941	7941	0	0	0	0	0
Mont-Louis (0.35)	9475	9475	9475	0	0	0	0	0
Mont-Louis (0.5)	9475	9475	9475	0	0	0	0	0
Mont-Louis (1.1)	9475	9475	9475	0	0	0	0	0
Mont-Louis (2.1)	9475	9475	9475	0	0	0	0	0
Mont-Louis (30)	5246	5246	5246	0	0	0	0	0
Natashquan (1)	8426	8426	8426	0	0	0	0	0
Natashquan (5.4)	8426	8426	8426	0	0	0	0	0
Port-Menier (2)	9133	9133	9133	0	0	0	0	0
Port-Menier (12.8)	9133	9133	9133	0	0	0	0	0
Rimouski (0.5)	20175	20173	20173	0	2	0	1	2
Rimouski (330)	10088	10088	10088	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Riv.-au-Tonnerre (1)	8562	8562	8562	0	0	0	0	0
Riv.-au-Tonnerre (16)	8561	8561	8561	0	0	0	0	0
Sept-Iles (1)	9505	9505	9505	0	0	0	0	0
Sept-Iles (2)	9505	9505	9505	0	0	0	0	0
Sept-Iles (21.9)	9505	9505	9505	0	0	0	0	0
Shediac Valley (0.5)	18228	15092	15092	0	3136	0	50	278
Shediac Valley (85.8)	9120	9120	9120	0	0	0	0	0
Tadoussac (1)	10307	10307	10305	0	2	2	1	2
Tadoussac (36.6)	10307	10307	10305	0	2	2	1	2

Table A2.16 Number of records and gaps in water temperature time series starting in 2008. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8689	8689	8689	0	0	0	0	0
Baie-Comeau (82.3)	17037	17037	17037	0	0	0	0	0
Banc Beaugé (0.5)	14962	14960	14955	5	7	0	7	1
Banc Beaugé (1)	7481	7481	7481	0	0	0	0	0
Banc Beaugé (97)	7481	7481	7481	0	0	0	0	0
Belle Isle (71)	10137	10137	10137	0	0	0	0	0
Bic (1)	8154	8154	8154	0	0	0	0	0
Bic (2)	8154	8154	8154	0	0	0	0	0
Bic (30.5)	8154	8154	8154	0	0	0	0	0
Blanc-Sablon (1)	6519	6519	6519	0	0	0	0	0
Blanc-Sablon (22)	6519	6519	6519	0	0	0	0	0
Borden (1.25)	20993	20993	20993	0	0	0	0	0
Borden (1.25)	60	60	60	0	0	0	0	0
Courant de Gaspé (0.5)	16654	16653	16653	0	1	0	1	1
Courant de Gaspé (165)	8328	8328	8328	0	0	0	0	0
Grande-Rivière (2)	8318	8318	8318	0	0	0	0	0
Grande-Rivière (10)	8318	8318	8318	0	0	0	0	0
Gyre Anticosti (0.5)	16630	14535	14534	1	2096	0	50	551
Gyre Anticosti (337)	8328	8328	8328	0	0	0	0	0
Havre-St-Pierre (0.5)	7865	7865	7865	0	0	0	0	0
Havre-St-Pierre (1)	7865	7865	7865	0	0	0	0	0
Havre-St-Pierre (120)	7865	7865	7865	0	0	0	0	0
IML (0.5)	8156	8156	8156	0	0	0	0	0
IML PEM (12.4)	15643	15643	15643	0	0	0	0	0
Ile Shag (1)	6238	6238	6238	0	0	0	0	0
Ile Shag (10)	5851	5851	5851	0	0	0	0	0
La Perle (1)	11111	11111	11111	0	0	0	0	0
La Romaine (1)	7920	7920	7920	0	0	0	0	0
La Romaine (2)	7920	7920	7920	0	0	0	0	0
La Romaine (21.9)	7920	7920	7920	0	0	0	0	0
La Tabatière (1)	6534	6534	6534	0	0	0	0	0
La Tabatière (39)	6534	6534	6534	0	0	0	0	0
Mont-Louis (0.5)	8404	8404	8404	0	0	0	0	0
Mont-Louis (30)	8404	8404	8404	0	0	0	0	0
Natashquan (1)	7921	7921	7921	0	0	0	0	0
Natashquan (5.4)	7057	7057	7057	0	0	0	0	0
Port-Menier (2)	8453	8453	8453	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Port-Menier (12.8)	8453	8453	8453	0	0	0	0	0
Rimouski (0.5)	18692	18690	18687	3	5	0	4	2
Rimouski (330)	9346	9346	9346	0	0	0	0	0
Riv.-au-Tonnerre (1)	7795	7795	7795	0	0	0	0	0
Riv.-au-Tonnerre (16)	7795	7795	7795	0	0	0	0	0
Sept-Iles (1)	8799	8799	8799	0	0	0	0	0
Sept-Iles (2)	8799	8799	8799	0	0	0	0	0
Sept-Iles (21.9)	8799	8799	8799	0	0	0	0	0
Shediac Valley (0.5)	16693	16693	16684	9	9	0	6	3
Shediac Valley (85.8)	8347	8347	8347	0	0	0	0	0
Tadoussac (1)	9407	9407	9407	0	0	0	0	0
Tadoussac (36.6)	9407	9407	9407	0	0	0	0	0

Table A2.17 Number of records and gaps in water temperature time series starting in 2009. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8286	8286	8286	0	0	0	0	0
Baie-Comeau (82.3)	17766	17766	17766	0	0	0	0	0
Banc Beaugé (0.5)	14053	14041	14041	0	12	0	12	1
Banc Beaugé (97)	7026	7026	7026	0	0	0	0	0
Belle Isle (71)	11339	11339	11339	0	0	0	0	0
Bic (1)	8168	8168	8168	0	0	0	0	0
Bic (2)	8168	8168	8168	0	0	0	0	0
Bic (30.5)	8168	8168	8168	0	0	0	0	0
Blanc-Sablon (1)	5574	5574	5574	0	0	0	0	0
Blanc-Sablon (22)	5574	5574	5574	0	0	0	0	0
Borden (1.25)	16863	16863	16863	0	0	0	0	0
Courant de Gaspé (0.5)	16415	16451	16414	37	1	0	1	1
Courant de Gaspé (165)	8208	8208	8208	0	0	0	0	0
Grande-Rivière (2)	7539	7539	7539	0	0	0	0	0
Grande-Rivière (10)	7539	7539	7539	0	0	0	0	0
Gyre Anticosti (0.5)	16263	8984	8982	2	7281	0	1	7281
Gyre Anticosti (337)	8132	8132	8132	0	0	0	0	0
Havre-St-Pierre (0.5)	7148	7148	7148	0	0	0	0	0
Havre-St-Pierre (1)	7148	7148	7148	0	0	0	0	0
Havre-St-Pierre (120)	7148	7148	7148	0	0	0	0	0
IML (0.5)	8161	8161	8161	0	0	0	0	0
IML PEM (12.4)	6797	6797	6797	0	0	0	0	0
IML PEM (12.4)	35694	35694	35694	0	0	0	0	0
Ile Shag (1)	6207	6207	6207	0	0	0	0	0
Ile Shag (10)	5855	5855	5855	0	0	0	0	0
Ile Shag (10)	7807	7807	7807	0	0	0	0	0
Irving Whale (67)	17737	17737	17737	0	0	0	0	0
La Perle (1)	9948	9948	9948	0	0	0	0	0
La Perle (26)	9305	9305	9305	0	0	0	0	0
La Romaine (1)	7026	7026	7026	0	0	0	0	0
La Romaine (2)	7026	7026	7026	0	0	0	0	0
La Romaine (21.9)	7026	7026	7026	0	0	0	0	0
La Tabatière (1)	6904	6904	6904	0	0	0	0	0
La Tabatière (39)	6904	6904	6904	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Mont-Louis (0.35)	8396	8396	8396	0	0	0	0	0
Mont-Louis (0.5)	8396	8396	8396	0	0	0	0	0
Mont-Louis (1.1)	8396	8396	8396	0	0	0	0	0
Mont-Louis (2.1)	8396	8396	8396	0	0	0	0	0
Mont-Louis (30)	8396	8396	8396	0	0	0	0	0
Natashquan (1)	7208	7208	7208	0	0	0	0	0
Natashquan (5.4)	7208	7208	7208	0	0	0	0	0
Port-Menier (2)	8063	8063	8063	0	0	0	0	0
Port-Menier (12.8)	8063	8063	8063	0	0	0	0	0
Rimouski (0.5)	18354	18044	18044	0	310	0	146	80
Rimouski (330)	9177	9177	9177	0	0	0	0	0
Riv.-au-Tonnerre (1)	7169	7169	7169	0	0	0	0	0
Riv.-au-Tonnerre (16)	7169	7169	7169	0	0	0	0	0
Sept-Iles (2)	8354	8354	8354	0	0	0	0	0
Sept-Iles (21.9)	8354	8354	8354	0	0	0	0	0
Shediac Valley (0.5)	8094	7416	7416	0	678	0	99	82
Shediac Valley (85.8)	7514	7514	7514	0	0	0	0	0
Tadoussac (0.5)	9592	9592	9592	0	0	0	0	0
Tadoussac (36.6)	9592	9592	9592	0	0	0	0	0

Table A2.18 Number of records and gaps in water temperature time series starting in 2010. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8974	8974	8974	0	0	0	0	0
Baie-Comeau (82.3)	17137	17137	17137	0	0	0	0	0
Banc Beaugé (0.5)	16539	16450	16450	0	89	0	89	1
Banc Beaugé (1)	8269	8269	8269	0	0	0	0	0
Banc Beaugé (97)	8269	8269	8269	0	0	0	0	0
Belle Isle (71)	17520	17520	17520	0	0	0	0	0
Bic (1)	8717	8717	8717	0	0	0	0	0
Bic (2)	8717	8717	8717	0	0	0	0	0
Bic (30.5)	8717	8717	8717	0	0	0	0	0
Blanc-Sablon (1)	8222	8222	8222	0	0	0	0	0
Blanc-Sablon (22)	8222	8222	8222	0	0	0	0	0
Borden (1.25)	6296	6296	6296	0	0	0	0	0
Borden (1)	32535	32535	32535	0	0	0	0	0
Courant de Gaspé (0.5)	14836	14819	14792	27	44	0	44	1
Courant de Gaspé (165)	9308	9308	9308	0	0	0	0	0
Grande-Rivière (2)	8964	8964	8964	0	0	0	0	0
Grande-Rivière (10)	8964	8964	8964	0	0	0	0	0
Gyre Anticosti (0.5)	18626	18713	18623	90	3	0	3	1
Gyre Anticosti (337)	9312	9312	9312	0	0	0	0	0
Havre-St-Pierre (0.5)	8461	8461	8461	0	0	0	0	0
Havre-St-Pierre (1)	8461	8461	8461	0	0	0	0	0
Havre-St-Pierre (120)	8461	8461	8461	0	0	0	0	0
IML (0.5)	8639	8639	8639	0	0	0	0	0
IML PEM (12.4)	15706	15706	15706	0	0	0	0	0
Ile Shag (1)	7345	7345	7345	0	0	0	0	0
Ile Shag (10)	7345	7345	7345	0	0	0	0	0
Ile Shag (10)	17758	17758	17758	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Irving Whale (0.5)	9886	9886	9886	0	0	0	0	0
Irving Whale (67)	9708	9708	9708	0	0	0	0	0
La Perle (1)	10393	10393	10393	0	0	0	0	0
La Perle (26)	10393	10393	10393	0	0	0	0	0
La Romaine (1)	8358	8358	8358	0	0	0	0	0
La Romaine (2)	8357	8357	8357	0	0	0	0	0
La Romaine (21.9)	8357	8357	8357	0	0	0	0	0
La Tabatière (1)	8253	8253	8253	0	0	0	0	0
La Tabatière (39)	8255	8255	8255	0	0	0	0	0
Mont-Louis (0.5)	9302	9302	9302	0	0	0	0	0
Mont-Louis (1.1)	9302	9302	9302	0	0	0	0	0
Mont-Louis (2.1)	9302	9302	9302	0	0	0	0	0
Mont-Louis (30)	9302	9302	9302	0	0	0	0	0
Mont-Louis (200)	50672	50672	50672	0	0	0	0	0
Natashquan (1)	8428	8428	8428	0	0	0	0	0
Natashquan (5.4)	8428	8428	8428	0	0	0	0	0
Port-Menier (2)	8783	8783	8783	0	0	0	0	0
Port-Menier (12.8)	8783	8783	8783	0	0	0	0	0
Rimouski (0.5)	18821	18748	18748	0	73	0	67	3
Rimouski (330)	9365	9365	9365	0	0	0	0	0
Riv.-au-Tonnerre (1)	8506	8506	8506	0	0	0	0	0
Riv.-au-Tonnerre (16)	8506	8506	8506	0	0	0	0	0
Sept-Iles (1)	8984	8984	8984	0	0	0	0	0
Sept-Iles (2)	8984	8984	8984	0	0	0	0	0
Sept-Iles (21.9)	8984	8984	8984	0	0	0	0	0
Shediac Valley (0.5)	17730	17734	17724	10	6	0	6	1
Shediac Valley (85.8)	8865	8865	8865	0	0	0	0	0
Tadoussac (0.5)	58211	58211	58211	0	0	0	0	0
Tadoussac (1)	9702	9702	9702	0	0	0	0	0
Tadoussac (36.6)	9702	9702	9702	0	0	0	0	0

Table A2.19 Number of records and gaps in water temperature time series starting in 2011. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8769	8769	8769	0	0	0	0	0
Baie-Comeau (82.3)	17168	17168	17168	0	0	0	0	0
Banc Beaugé (0.5)	14318	14318	14318	0	0	0	0	0
Banc Beaugé (1)	14318	14318	14318	0	0	0	0	0
Belle Isle (71)	35221	35221	35221	0	0	0	0	0
Bic (1)	8440	8440	8440	0	0	0	0	0
Bic (2)	8440	8440	8440	0	0	0	0	0
Bic (30.5)	16881	16881	16881	0	0	0	0	0
Blanc-Sablon (1)	8778	8778	8778	0	0	0	0	0
Blanc-Sablon (22)	8778	8778	8778	0	0	0	0	0
Borden (1.25)	32391	32391	32391	0	0	0	0	0
Courant de Gaspé (0.5)	16683	16643	16629	14	54	0	54	1
Courant de Gaspé (165)	8341	8341	8341	0	0	0	0	0
Grande-Rivière (2)	8403	8403	8403	0	0	0	0	0
Grande-Rivière (10)	8402	8402	8402	0	0	0	0	0
Grande-Rivière-exp (1)	15692	15692	15692	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Grande-Rivière-exp (1)	15692	15692	15692	0	0	0	0	0
Grande-Rivière-exp (10)	48754	48754	48754	0	0	0	0	0
Grande-Rivière-exp (2)	15692	15692	15692	0	0	0	0	0
Gyre Anticosti (0.5)	16395	16395	16395	0	0	0	0	0
Gyre Anticosti (337)	8197	8197	8197	0	0	0	0	0
Gyre Anticosti-exp (10)	16395	16395	16395	0	0	0	0	0
Havre-St-Pierre (0.5)	15927	15927	15927	0	0	0	0	0
Havre-St-Pierre (1)	7964	7964	7964	0	0	0	0	0
Havre-St-Pierre (120)	7964	7964	7964	0	0	0	0	0
Havre-St-Pierre-exp (10)	15928	15928	15928	0	0	0	0	0
IML (0.5)	8359	8359	8359	0	0	0	0	0
IML PEM (12.4)	14766	14766	14766	0	0	0	0	0
Ile Shag (1)	15249	15249	15249	0	0	0	0	0
Ile Shag (10)	7625	7625	7625	0	0	0	0	0
Ile Shag (10)	20639	20639	20639	0	0	0	0	0
Irving Whale (0.5)	12889	12889	12889	0	0	0	0	0
Irving Whale (67)	25778	25778	25778	0	0	0	0	0
La Perle (1)	10695	10695	10695	0	0	0	0	0
La Romaine (1)	9054	9054	9054	0	0	0	0	0
La Romaine (2)	9054	9054	9054	0	0	0	0	0
La Romaine (21.9)	9054	9054	9054	0	0	0	0	0
La Tabatière (1)	8978	8978	8978	0	0	0	0	0
La Tabatière (39)	8978	8978	8978	0	0	0	0	0
Mont-Louis (0.35)	8205	8205	8205	0	0	0	0	0
Mont-Louis (0.5)	16409	16409	16409	0	0	0	0	0
Mont-Louis (1.1)	8205	8205	8205	0	0	0	0	0
Mont-Louis (2.1)	8205	8205	8205	0	0	0	0	0
Mont-Louis (30)	8205	8205	8205	0	0	0	0	0
Natashquan (1)	7880	7880	7880	0	0	0	0	0
Natashquan (5.4)	7880	7880	7880	0	0	0	0	0
Port-Menier (2)	8327	8327	8327	0	0	0	0	0
Port-Menier (12.8)	8327	8327	8327	0	0	0	0	0
Rimouski (0.5)	17952	17929	17929	0	23	0	23	1
Rimouski (330)	8976	8976	8976	0	0	0	0	0
Rimouski-exp (10)	17951	17951	17951	0	0	0	0	0
Riv.-au-Tonnerre (1)	8007	8007	8007	0	0	0	0	0
Riv.-au-Tonnerre (16)	8008	8008	8008	0	0	0	0	0
Sept-Iles (1)	8754	8754	8754	0	0	0	0	0
Sept-Iles (2)	8754	8754	8754	0	0	0	0	0
Sept-Iles (21.9)	8754	8754	8754	0	0	0	0	0
Tadoussac (0.5)	9454	9454	9454	0	0	0	0	0
Tadoussac (1)	9454	9454	9454	0	0	0	0	0
Tadoussac (36.6)	9454	9454	9454	0	0	0	0	0

Table A2.20 Number of records and gaps in water temperature time series starting in 2012. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	9572	9572	9572	0	0	0	0	0
Baie-Comeau (82.3)	18637	18637	18637	0	0	0	0	0
Banc Beaugé (0.5)	7768	7766	7766	0	2	0	2	1

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Banc Beaugé (1)	7768	7768	7768	0	0	0	0	0
Banc Beaugé (97)	7768	7768	7768	0	0	0	0	0
Belle Isle (71)	31594	31594	31594	0	0	0	0	0
Bic (1)	8673	8673	8673	0	0	0	0	0
Bic (2)	8673	8673	8673	0	0	0	0	0
Bic (30.5)	8673	8673	8673	0	0	0	0	0
Blanc-Sablon (1)	7852	7852	7852	0	0	0	0	0
Blanc-Sablon (22)	7851	7851	7851	0	0	0	0	0
Borden (1.25)	13377	13377	13377	0	0	0	0	0
Courant de Gaspé (0.5)	18583	18583	18583	0	0	0	0	0
Courant de Gaspé (165)	9289	9289	9289	0	0	0	0	0
Grande-Rivière (0.5)	9116	9116	9116	0	0	0	0	0
Grande-Rivière (2)	9116	9116	9116	0	0	0	0	0
Grande-Rivière (10)	9116	9116	9116	0	0	0	0	0
Havre-St-Pierre (0.5)	8117	8117	8117	0	0	0	0	0
Havre-St-Pierre (1)	8117	8117	8117	0	0	0	0	0
Havre-St-Pierre (120)	8116	8116	8116	0	0	0	0	0
Havre-St-Pierre-exp (10)	8117	8117	8117	0	0	0	0	0
Hudson-3 (159.4)	17988	17988	17988	0	0	0	0	0
IML (0.5)	8669	8669	8669	0	0	0	0	0
IML PEM (12.4)	17520	17520	17520	0	0	0	0	0
Ile Shag (1)	6912	6912	6912	0	0	0	0	0
Ile Shag (10)	6911	6911	6911	0	0	0	0	0
Ile Shag (10)	10474	10474	10474	0	0	0	0	0
Irving Whale (0.5)	12036	12036	12036	0	0	0	0	0
Irving Whale (67)	12036	12036	12036	0	0	0	0	0
La Perle (1)	10949	10949	10949	0	0	0	0	0
La Perle (26)	10942	10942	10942	0	0	0	0	0
La Romaine (1)	7792	7792	7792	0	0	0	0	0
La Romaine (2)	7792	7792	7792	0	0	0	0	0
La Romaine (21.9)	7792	7792	7792	0	0	0	0	0
La Tabatière (1)	7629	7629	7629	0	0	0	0	0
La Tabatière (39)	7629	7629	7629	0	0	0	0	0
Mont-Louis (0.35)	9268	9268	9268	0	0	0	0	0
Mont-Louis (0.5)	9268	9268	9268	0	0	0	0	0
Mont-Louis (1.1)	9268	9268	9268	0	0	0	0	0
Mont-Louis (2.1)	9268	9268	9268	0	0	0	0	0
Mont-Louis (30)	9268	9268	9268	0	0	0	0	0
Natashquan (1)	8085	8085	8085	0	0	0	0	0
Natashquan (5.4)	8085	8085	8085	0	0	0	0	0
Port-Menier (2)	9363	9363	9363	0	0	0	0	0
Port-Menier (12.8)	9363	9363	9363	0	0	0	0	0
Rimouski (0.5)	18763	18730	18729	0	34	1	11	17
Rimouski (330)	9381	9381	9381	0	0	0	0	0
Rimouski-exp (10)	9381	9381	9381	0	0	0	0	0
Riv.-au-Tonnerre (1)	8975	8975	8975	0	0	0	0	0
Riv.-au-Tonnerre (16)	8975	8975	8975	0	0	0	0	0
Sept-Iles (1)	9504	9504	9504	0	0	0	0	0
Sept-Iles (2)	9504	9504	9504	0	0	0	0	0
Sept-Iles (21.9)	9504	9504	9504	0	0	0	0	0
Shediac Valley (0.5)	8255	8255	8255	0	0	0	0	0
Shediac Valley (85.8)	8255	8255	8255	0	0	0	0	0
Tadoussac (0.5)	9349	9349	9136	0	213	213	1	213
Tadoussac (1)	9349	9349	9136	0	213	213	1	213

Table A2.21 Number of records and gaps in water temperature time series starting in 2013. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	8049	8049	8049	0	0	0	0	0
Baie-Comeau (82.3)	19303	19303	19303	0	0	0	0	0
Banc Beaugé (0.5)	7297	7290	7290	0	7	0	7	1
Banc Beaugé (1)	7297	7297	7297	0	0	0	0	0
Banc Beaugé (97)	7297	7297	7297	0	0	0	0	0
Belle Isle (71)	40922	40922	40922	0	0	0	0	0
Bic (1)	8450	8450	8450	0	0	0	0	0
Bic (2)	8450	8450	8450	0	0	0	0	0
Bic (30.5)	8449	8449	8449	0	0	0	0	0
Blanc-Sablon (1)	7398	7398	7398	0	0	0	0	0
Blanc-Sablon (22)	7398	7398	7398	0	0	0	0	0
Borden (1.25)	15954	15954	15954	0	0	0	0	0
Courant de Gaspé (0.5)	15426	15426	15426	0	0	0	0	0
Grande-Rivière (0.5)	7785	7785	7785	0	0	0	0	0
Grande-Rivière (2)	7785	7785	7785	0	0	0	0	0
Grande-Rivière (10)	7785	7785	7785	0	0	0	0	0
Havre-St-Pierre (0.5)	7539	7539	7539	0	0	0	0	0
Havre-St-Pierre (1)	7539	7539	7539	0	0	0	0	0
Havre-St-Pierre (120)	7539	7539	7539	0	0	0	0	0
Havre-St-Pierre-exp (10)	7539	7539	7539	0	0	0	0	0
Hudson-1 (268.4)	17559	17559	17559	0	0	0	0	0
Hudson-3 (159.4)	17844	17844	17844	0	0	0	0	0
IML (0.5)	8450	8450	8450	0	0	0	0	0
IML (14)	8450	8450	8450	0	0	0	0	0
IML PEM (12.4)	21565	21565	21565	0	0	0	0	0
Ile Shag (1)	7238	7238	7238	0	0	0	0	0
Ile Shag (10)	7238	7238	7238	0	0	0	0	0
Ile Shag (10)	11524	11524	11524	0	0	0	0	0
Irving Whale (0.5)	9509	9509	9509	0	0	0	0	0
Irving Whale (67)	9509	9509	9509	0	0	0	0	0
La Perle (1)	10227	10227	10227	0	0	0	0	0
La Perle (26)	10227	10227	10227	0	0	0	0	0
La Romaine (1)	5194	5194	5194	0	0	0	0	0
La Romaine (2)	5194	5194	5194	0	0	0	0	0
La Tabatière (1)	7233	7233	7233	0	0	0	0	0
La Tabatière (39)	7233	7233	7233	0	0	0	0	0
Mont-Louis (0.35)	8124	8124	8124	0	0	0	0	0
Mont-Louis (0.5)	8123	8123	8123	0	0	0	0	0
Mont-Louis (1.1)	8128	8128	8128	0	0	0	0	0
Mont-Louis (2.1)	8124	8124	8124	0	0	0	0	0
Mont-Louis (30)	8124	8124	8124	0	0	0	0	0
Natashquan (1)	7477	7477	7477	0	0	0	0	0
Natashquan (5.4)	7476	7476	7476	0	0	0	0	0
Port-Menier (2)	8062	8062	8062	0	0	0	0	0
Port-Menier (12.8)	8062	8062	8062	0	0	0	0	0
Rimouski (0.5)	16787	15860	15860	0	927	0	119	509
Rimouski (330)	8393	8393	8393	0	0	0	0	0
Rimouski-exp (10)	8393	8393	8382	0	11	11	1	11
Riv.-au-Tonnerre (1)	6889	6889	6889	0	0	0	0	0

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Riv.-au-Tonnerre (16)	6889	6889	6889	0	0	0	0	0
Sept-Iles (1)	8072	8072	8072	0	0	0	0	0
Sept-Iles (2)	8072	8072	8072	0	0	0	0	0
Sept-Iles (21.9)	8071	8071	8071	0	0	0	0	0
Shediac Valley (0.5)	7722	7722	7722	0	0	0	0	0
Shediac Valley (85.8)	7722	7722	7722	0	0	0	0	0
Tadoussac (0.5)	8978	8978	8978	0	0	0	0	0
Tadoussac (1)	8978	8978	8978	0	0	0	0	0
Tadoussac (36.6)	8978	8978	8978	0	0	0	0	0

Table A2.22 Number of records and gaps in water temperature time series starting in 2014. Each line represents results from one raw file. Station name (depth, m) is followed by the expected number of records, Ne, the number of valid records, Nv, the number of good records, Ng, the number of oversampling records, No, the total number of missing records, Ntm, the number of flagged records, Nf, the number of gap, NOG, and the maximum gap, MG.

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Baie-Comeau (1)	6502	6502	6502	0	0	0	0	0
Banc Beaugé (0.5)	11441	11426	11426	0	15	0	15	1
Banc Beaugé (1)	11439	11439	11439	0	0	0	0	0
Banc Beaugé (97)	5720	5720	5720	0	0	0	0	0
Bic (1)	7186	7186	7186	0	0	0	0	0
Bic (2)	7186	7186	7186	0	0	0	0	0
Bic (30.5)	7186	7186	7186	0	0	0	0	0
Blanc-Sablon (1)	5675	5675	5675	0	0	0	0	0
Blanc-Sablon (22)	5675	5675	5675	0	0	0	0	0
Borden (1.25)	17461	17461	17461	0	0	0	0	0
Courant de Gaspé (0.5)	13152	13096	13095	1	57	0	1	57
Courant de Gaspé (165)	6576	6576	6576	0	0	0	0	0
Grande-Rivière (0.5)	6569	6569	6569	0	0	0	0	0
Grande-Rivière (2)	6569	6569	6569	0	0	0	0	0
Grande-Rivière (10)	6569	6569	6569	0	0	0	0	0
Havre-St-Pierre (0.5)	5660	5660	5660	0	0	0	0	0
Havre-St-Pierre (1)	5660	5660	5660	0	0	0	0	0
Havre-St-Pierre (120)	5659	5659	5659	0	0	0	0	0
IML (0.5)	7208	7208	7208	0	0	0	0	0
IML (14)	7208	7208	7208	0	0	0	0	0
Ile Shag (1)	5714	5714	5714	0	0	0	0	0
Ile Shag (10)	5713	5713	5713	0	0	0	0	0
Irving Whale (0.5)	11388	11388	11388	0	0	0	0	0
Irving Whale (67)	11419	11419	11419	0	0	0	0	0
La Perle (1)	11181	11181	11181	0	0	0	0	0
La Romaine (1)	5845	5845	5845	0	0	0	0	0
La Romaine (2)	5845	5845	5845	0	0	0	0	0
La Romaine (21.9)	5846	5846	5846	0	0	0	0	0
La Tabatière (1)	5812	5812	5812	0	0	0	0	0
La Tabatière (39)	5812	5812	5812	0	0	0	0	0
Mont-Louis (0.35)	6575	6575	6575	0	0	0	0	0
Mont-Louis (0.5)	6576	6576	6574	0	2	2	1	2
Mont-Louis (1.1)	6576	6576	6576	0	0	0	0	0
Mont-Louis (30)	6575	6575	6575	0	0	0	0	0
Natashquan (1)	5914	5914	5914	0	0	0	0	0
Natashquan (5.4)	5914	5914	5914	0	0	0	0	0
Old Harry (0.5)	13481	10194	10191	0	3290	3	82	3208

Station (depth, m)	Ne	Nv	Ng	No	Ntm	Nf	NOG	MG
Rimouski (0.5)	17381	16893	16875	1	506	17	35	269
Rimouski (330)	8788	8788	8788	0	0	0	0	0
Riv.-au-Tonnerre (1)	6042	6042	6042	0	0	0	0	0
Riv.-au-Tonnerre (16)	6042	6042	6042	0	0	0	0	0
Sept-Iles (1)	6479	6479	6479	0	0	0	0	0
Sept-Iles (2)	6479	6479	6479	0	0	0	0	0
Shediac Valley (0.5)	13142	13138	13138	0	4	0	1	4
Shediac Valley (85.8)	6571	6571	6571	0	0	0	0	0
Tadoussac (0.5)	45504	45504	45504	0	0	0	0	0
Tadoussac (1)	45506	45506	45506	0	0	0	0	0
Tadoussac (36.6)	7584	7584	7584	0	0	0	0	0

APPENDIX 3. CHARTS OF DATA AVAILABILITY

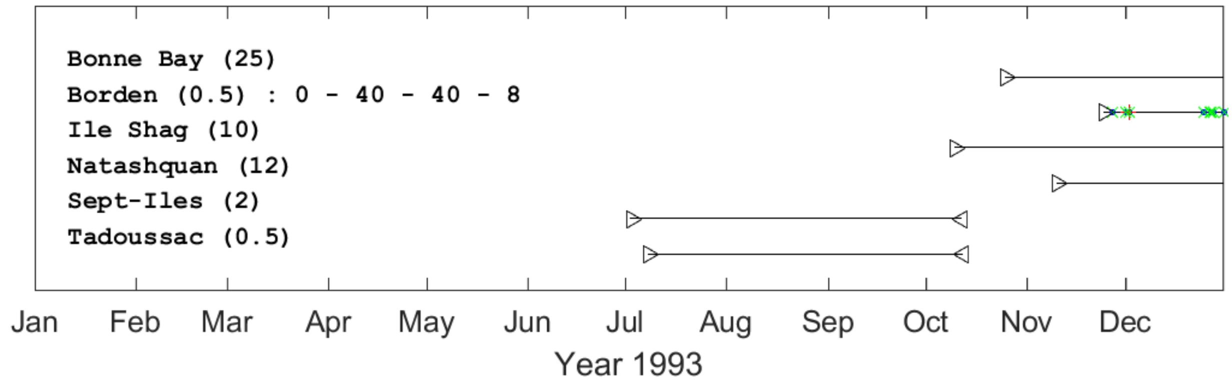

Figure A3.1 Data chart for 1993. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

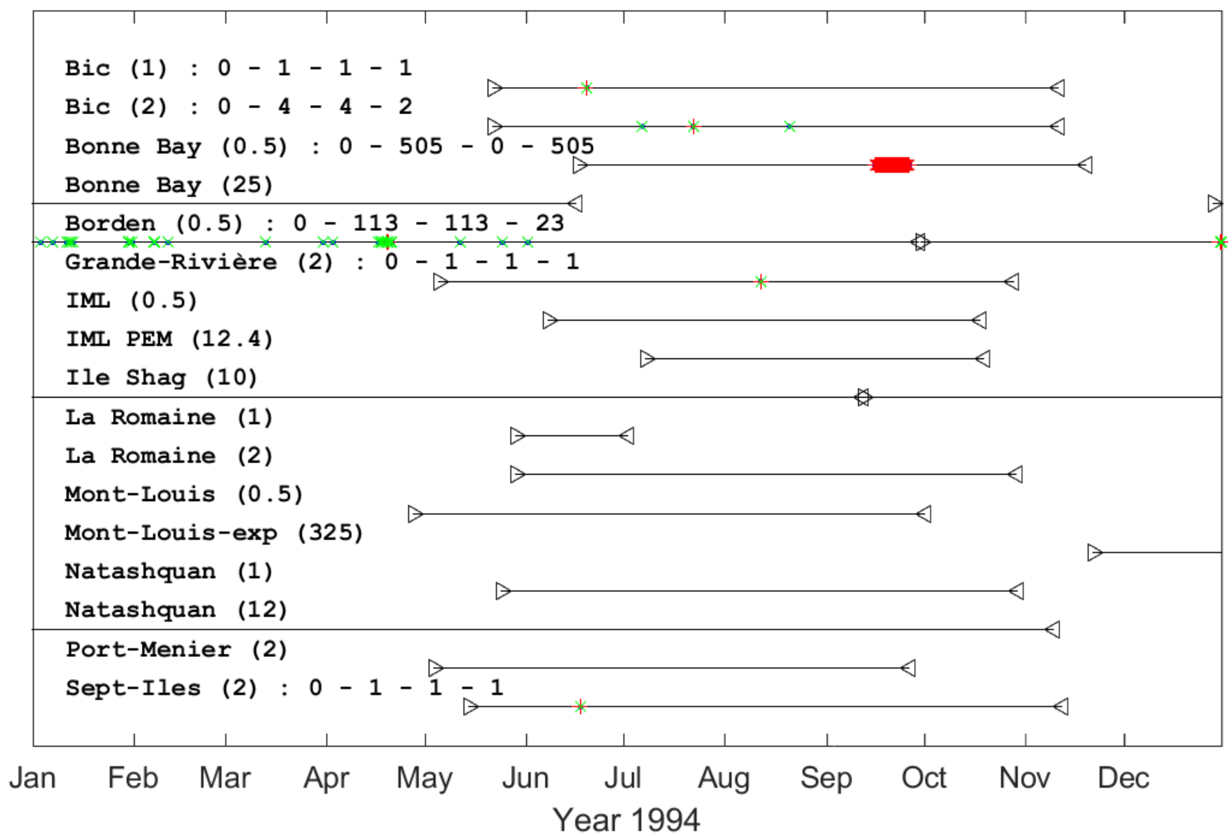

Figure A3.2 Data chart for 1994. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

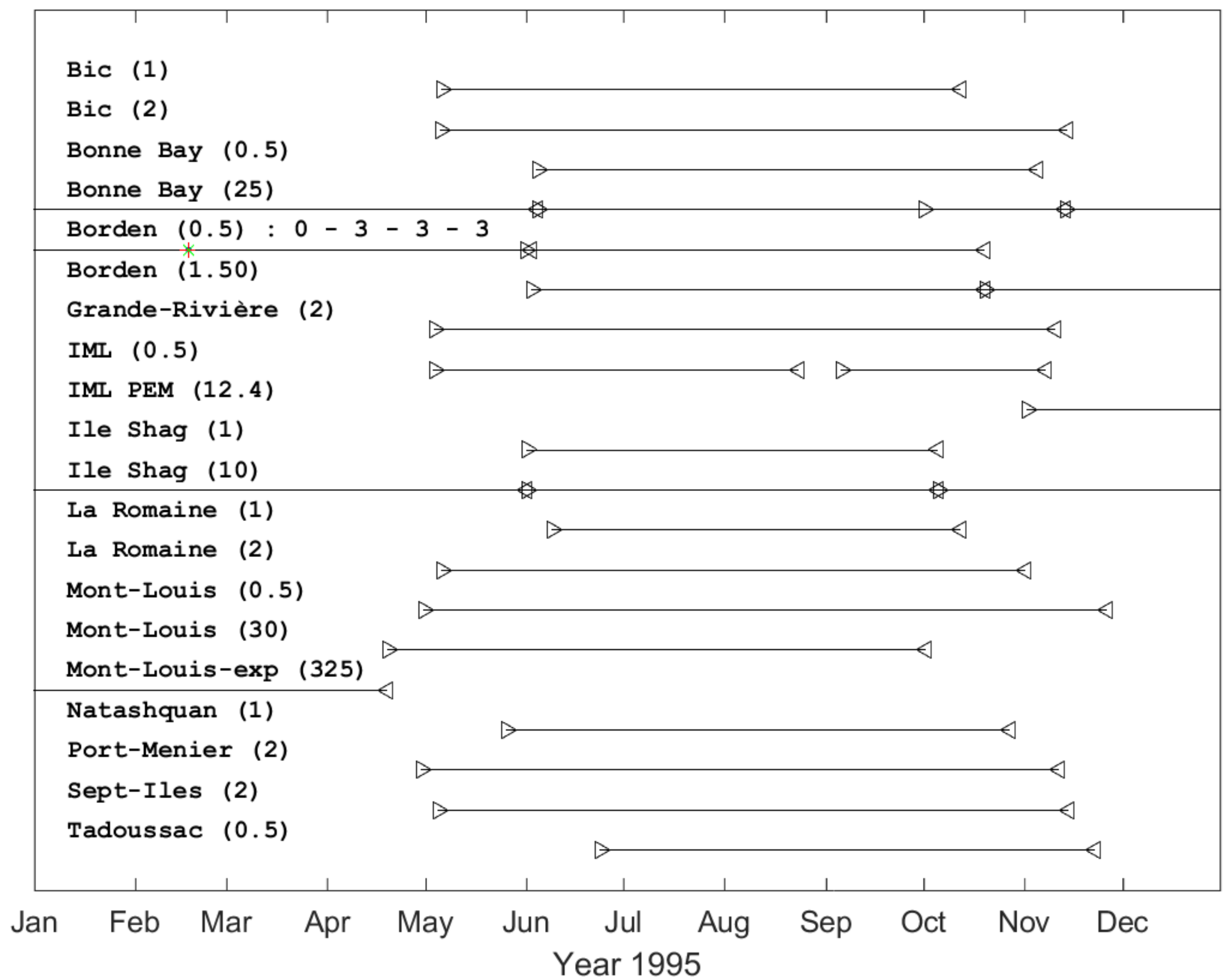

Figure A3.3 Data chart for 1995. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

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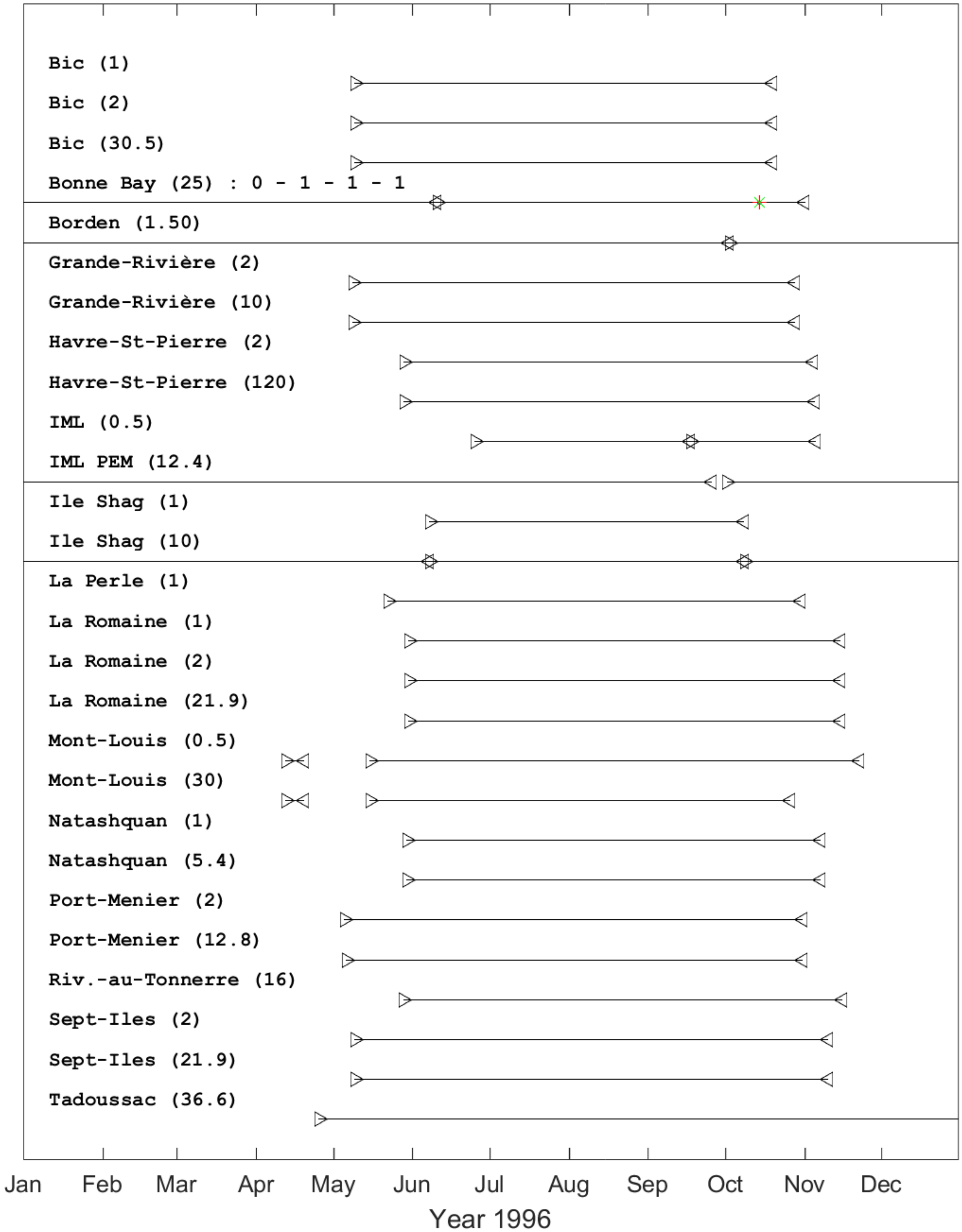

Figure A3.4 Data chart for 1996. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

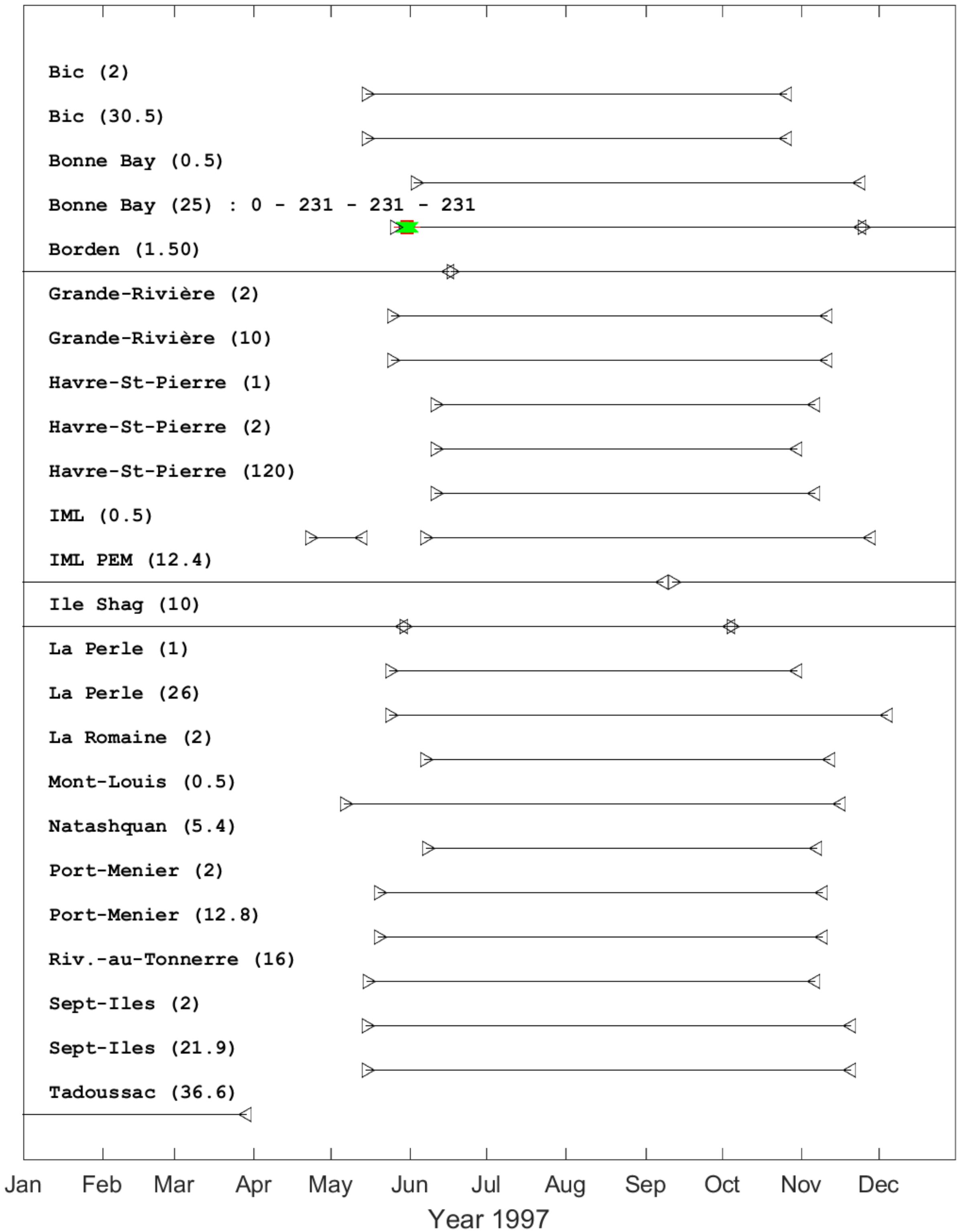

Figure A3.5 Data chart for 1997. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

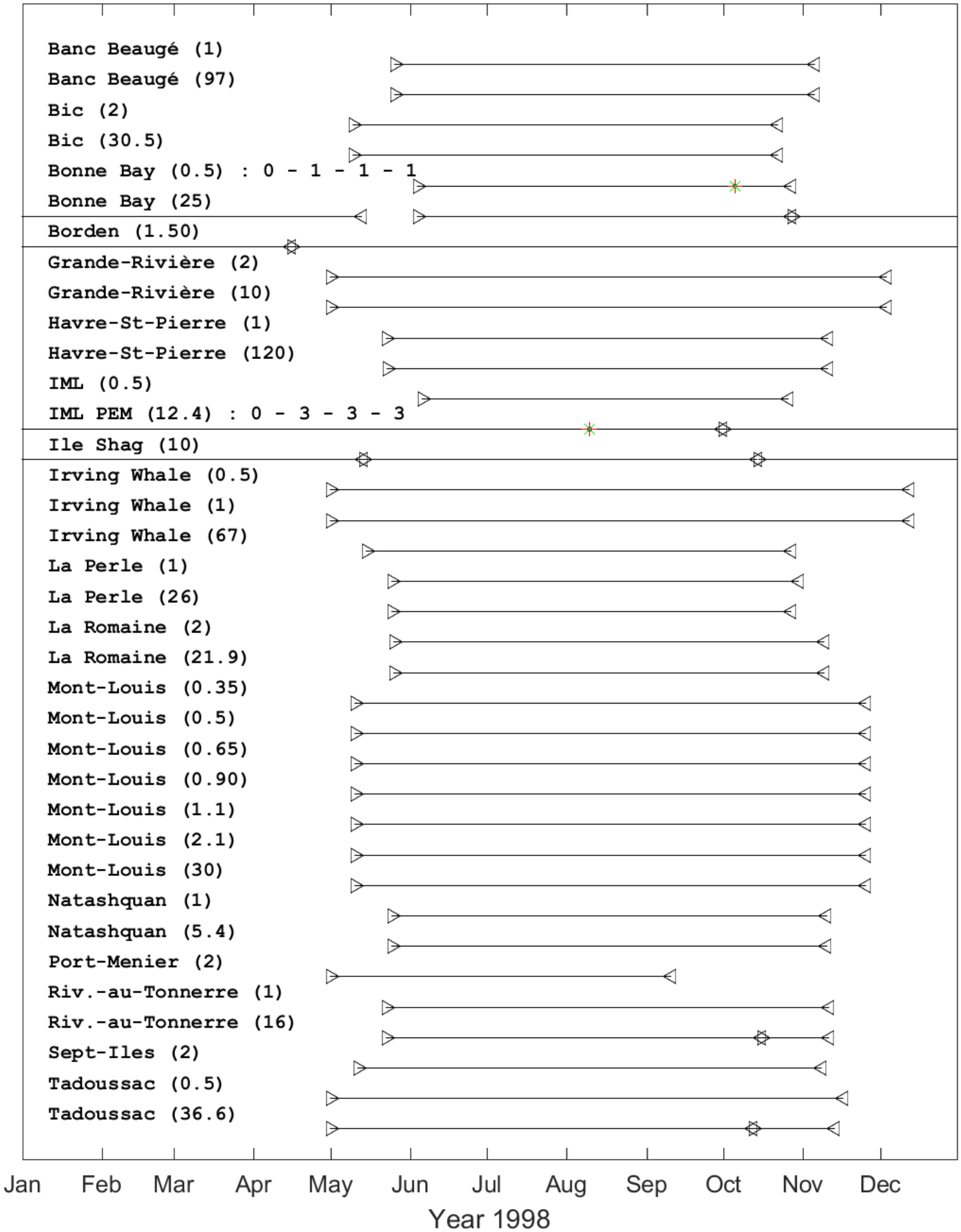

Figure A3.6 Data chart for 1998. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

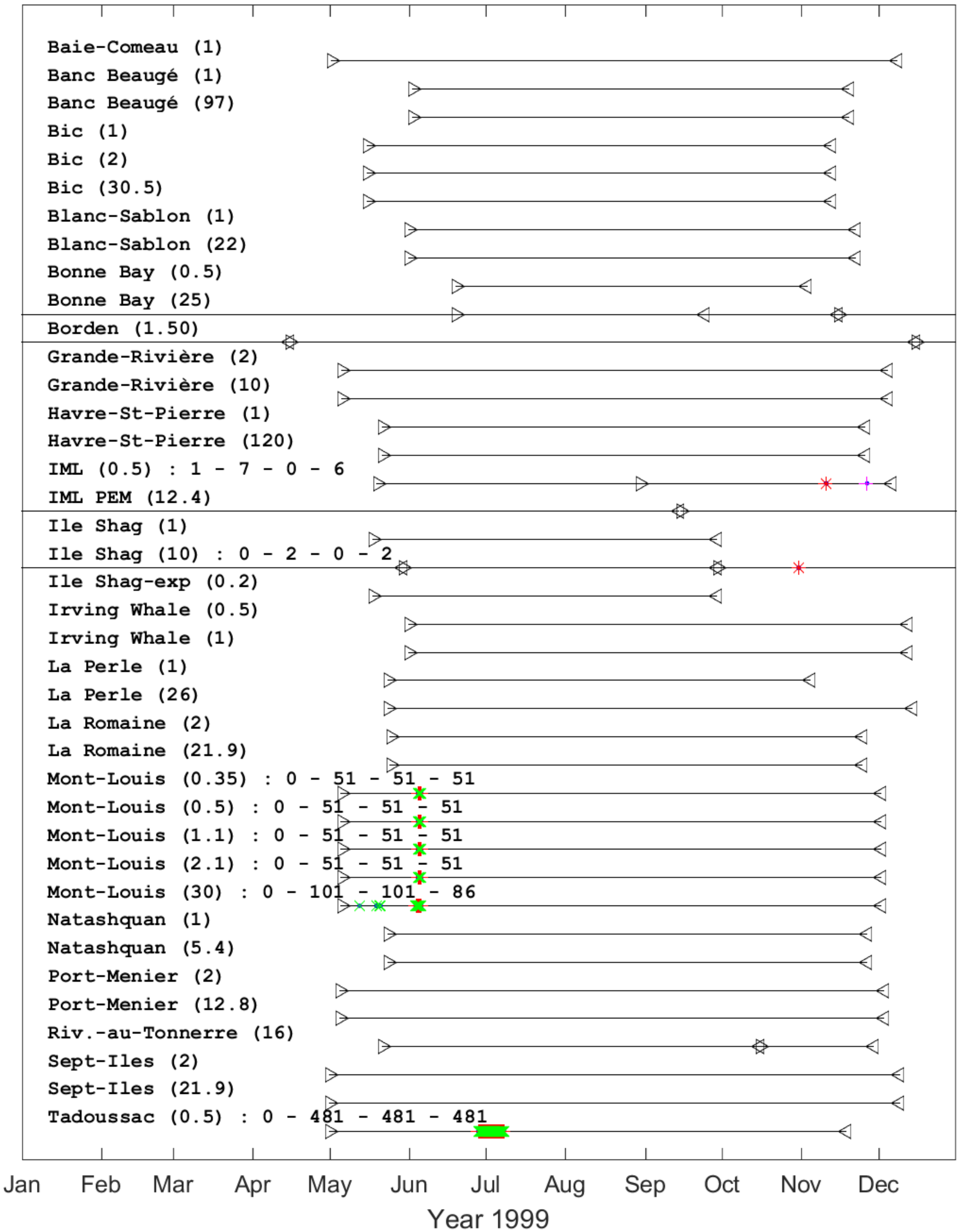

Figure A3.7 Data chart for 1999. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

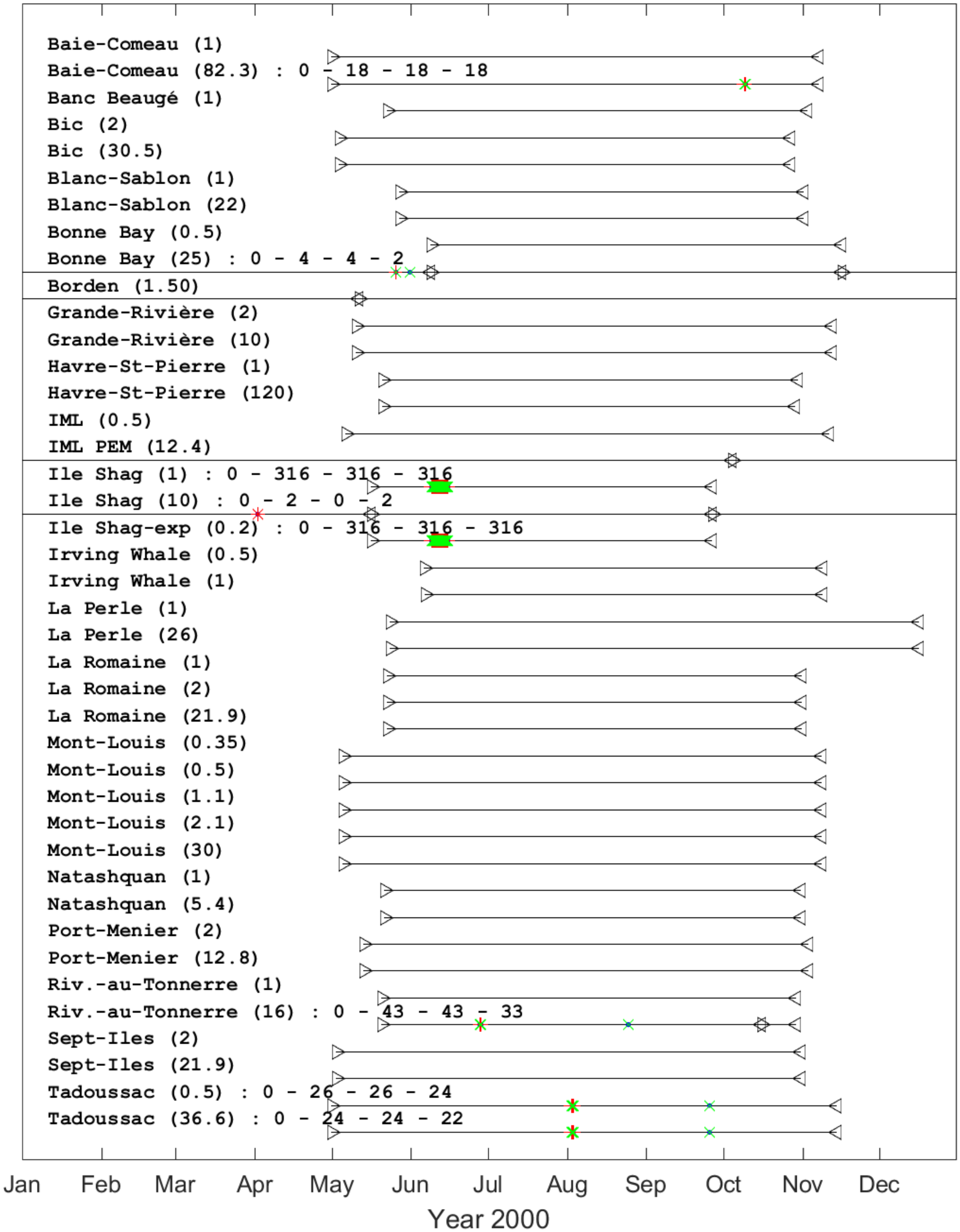

Figure A3.8 Data chart for 2000. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

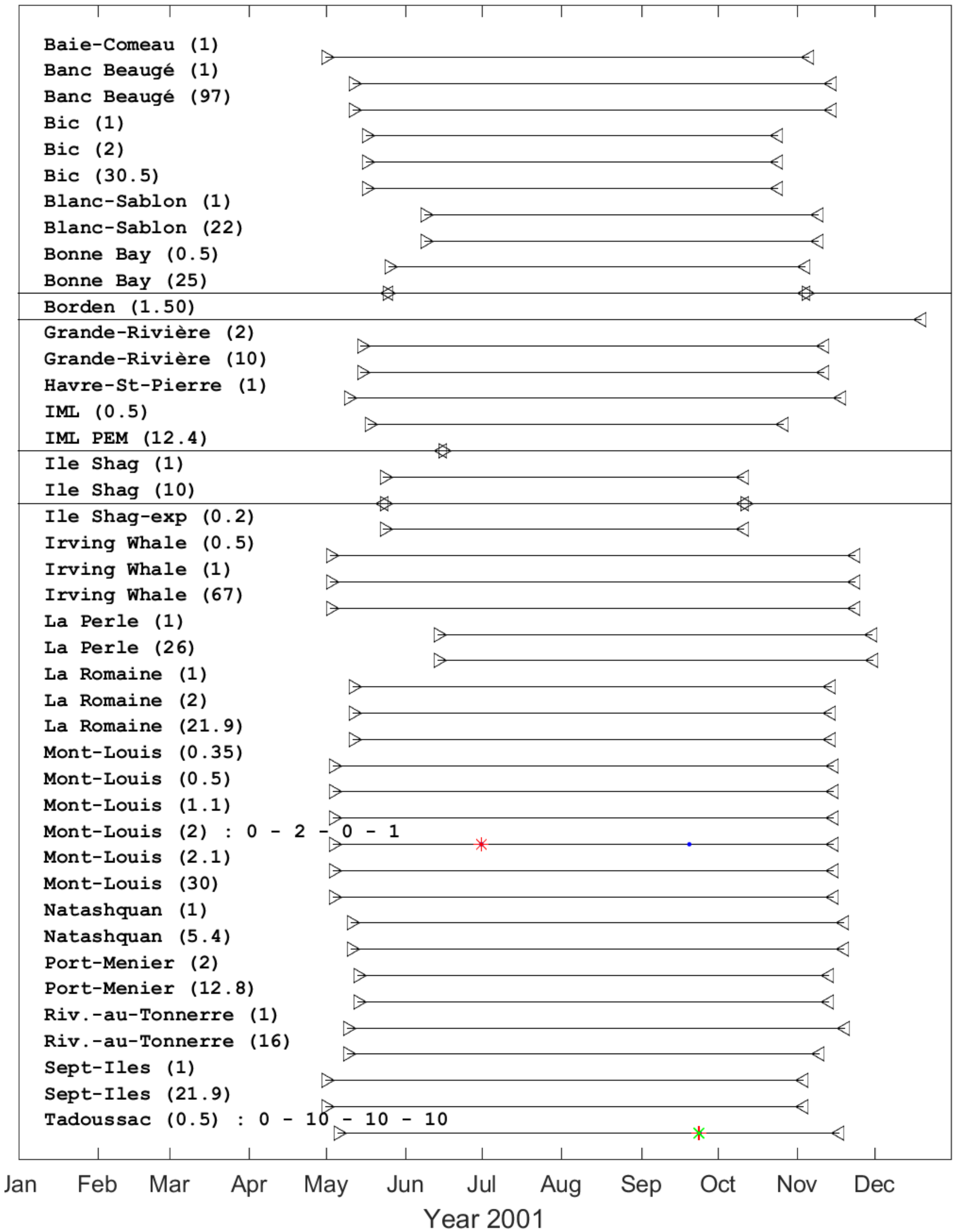

Figure A3.9 Data chart for 2001. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

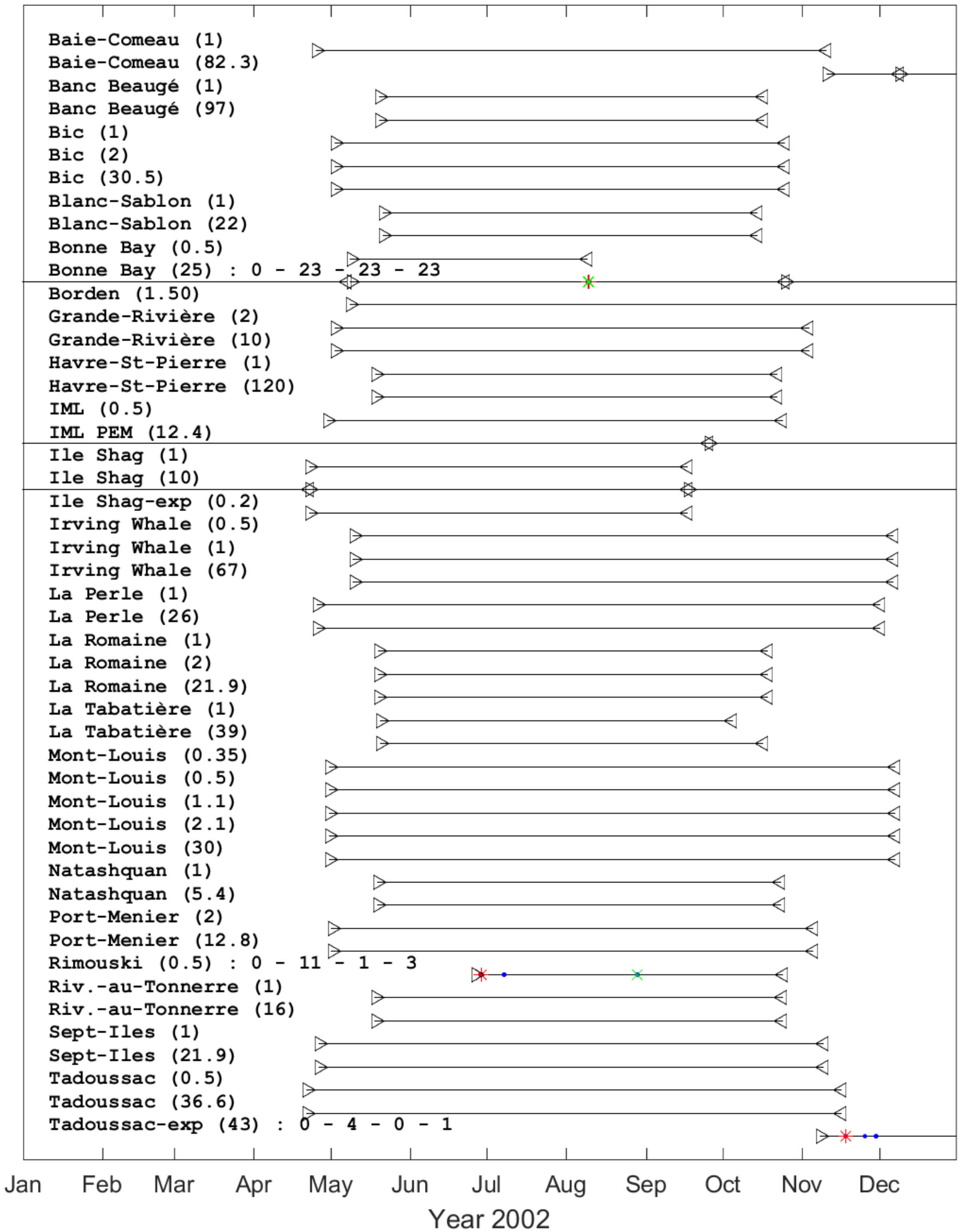

Figure A3.10 Data chart for 2002. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

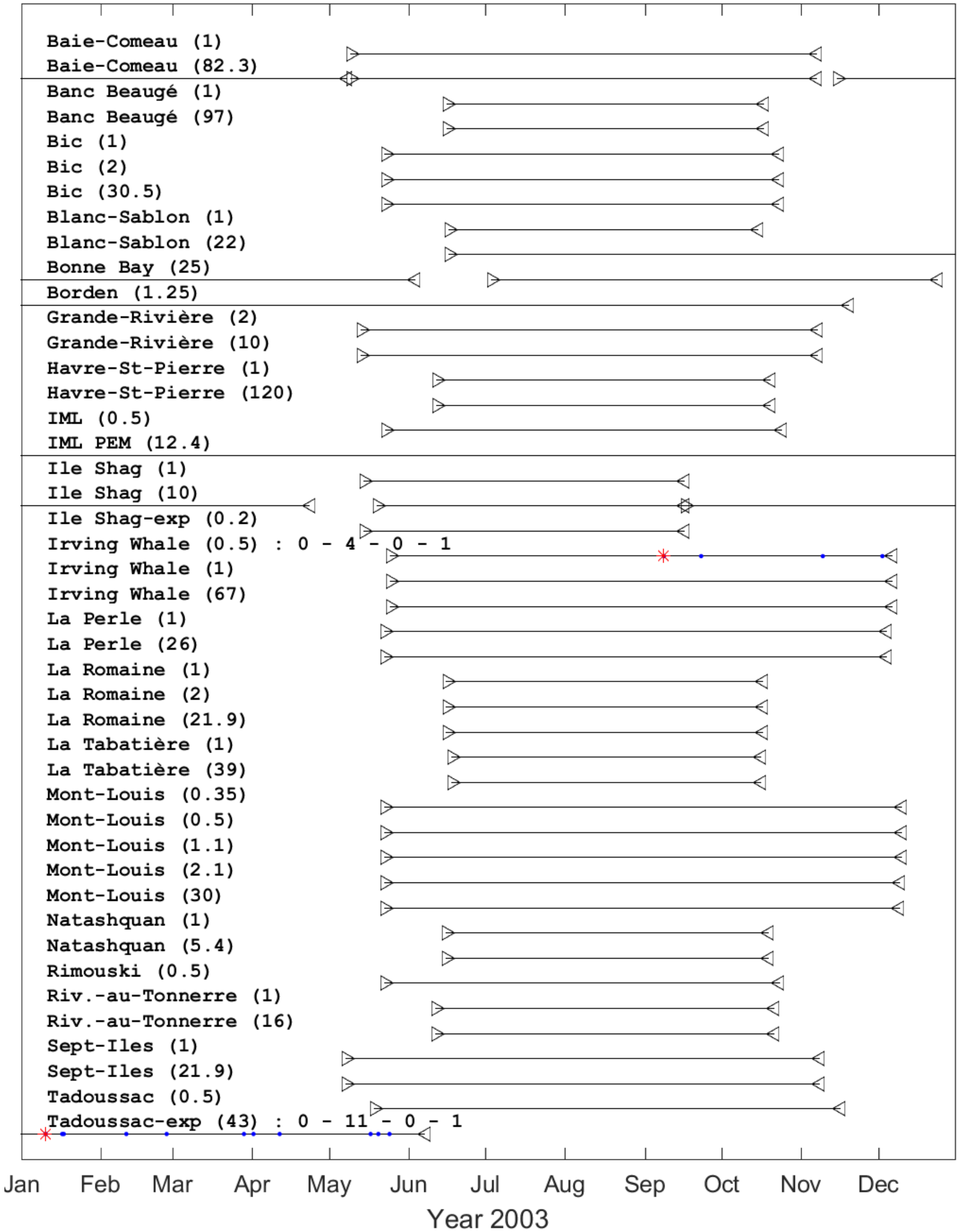

Figure A3.11 Data chart for 2003. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

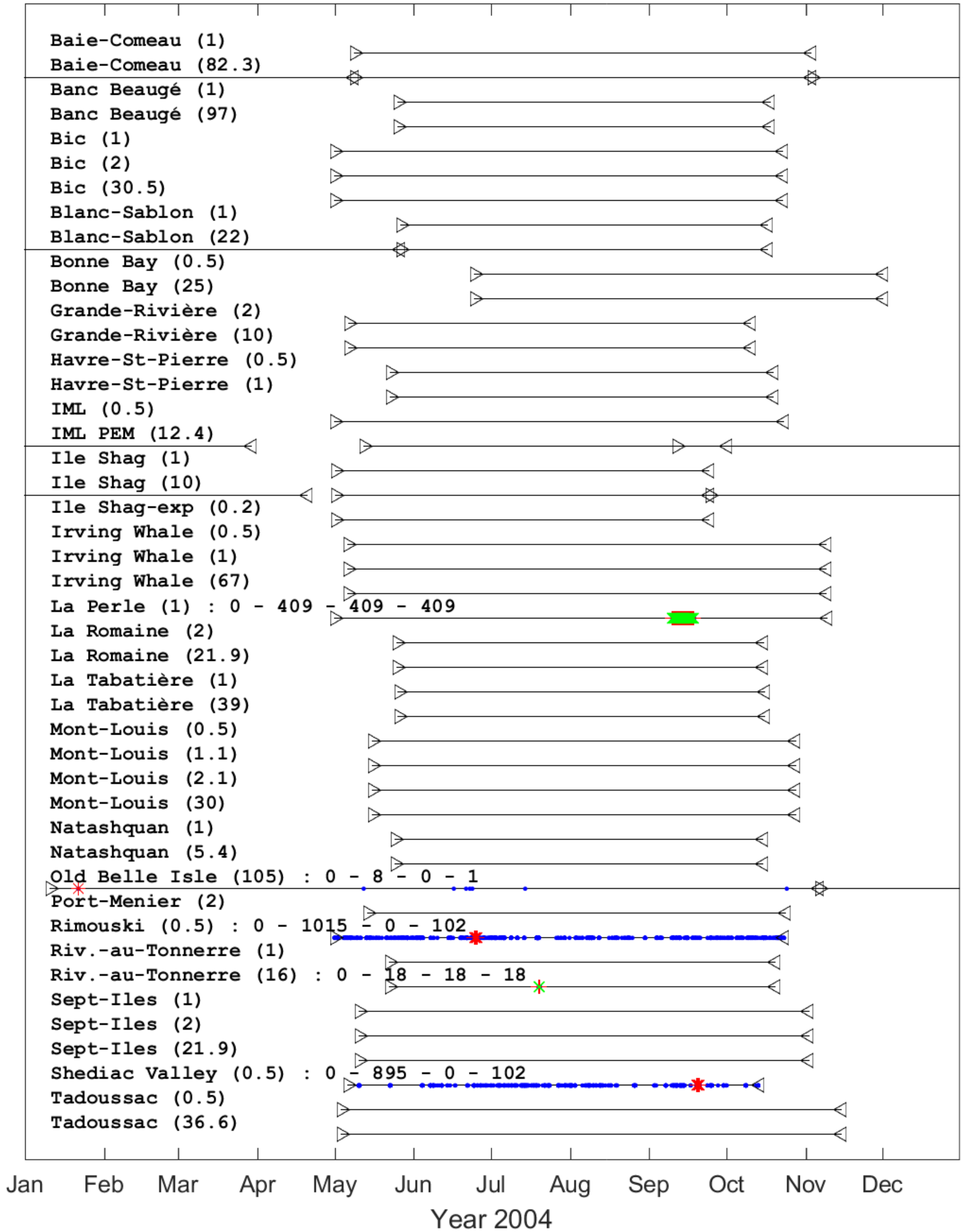

Figure A3.12 Data chart for 2004. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

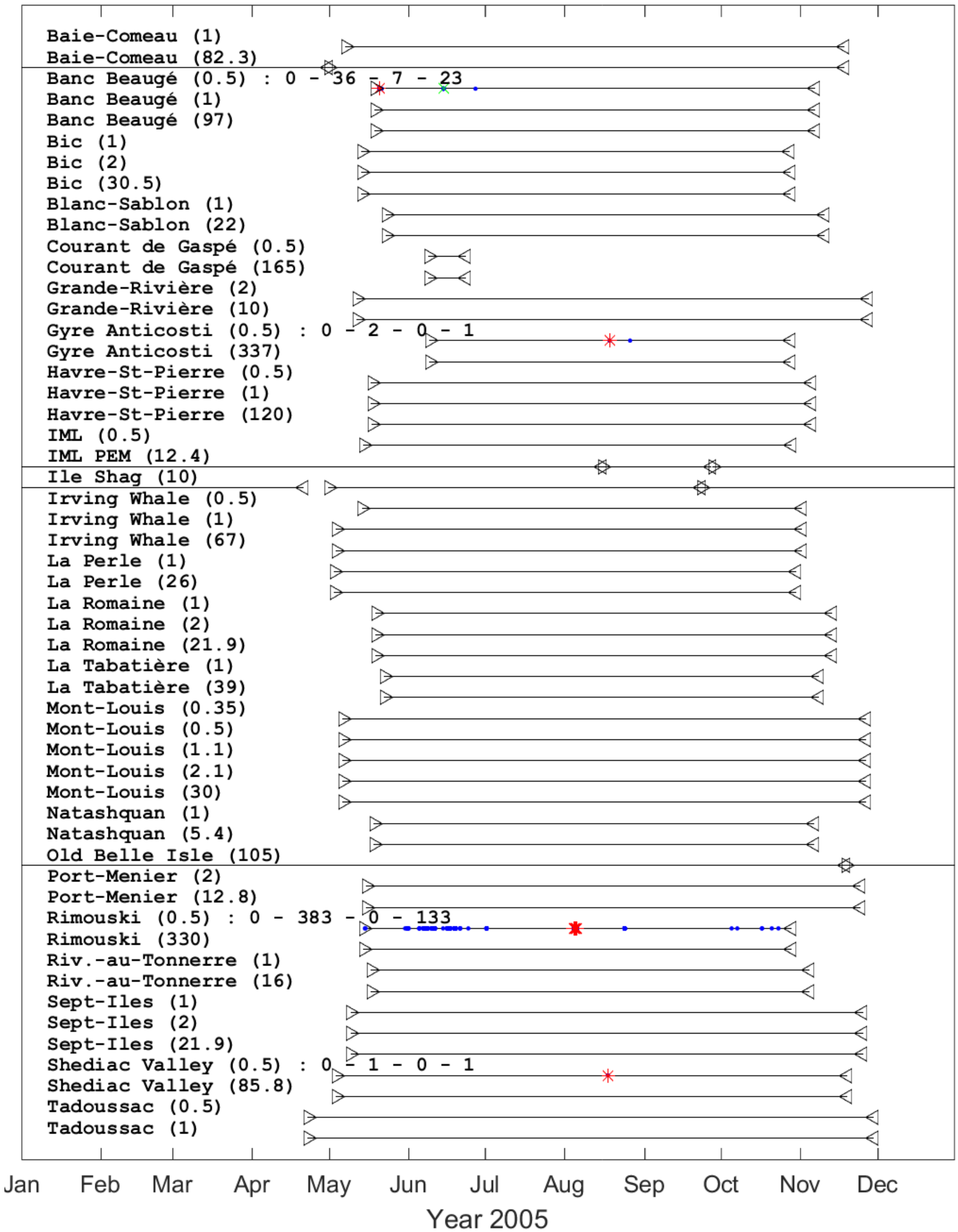

Figure A3.13 Data chart for 2005. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

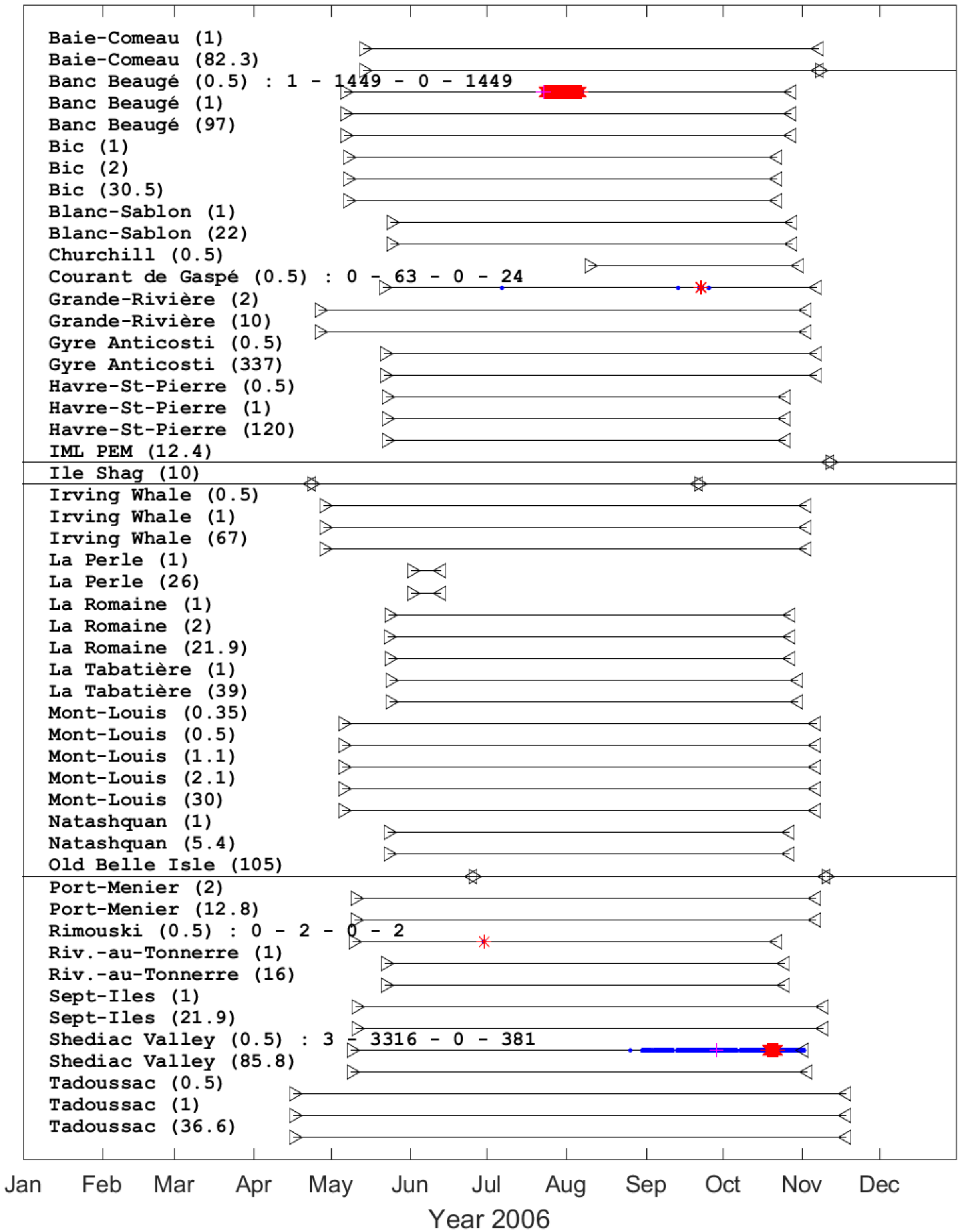

Figure A3.14 Data chart for 2006. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

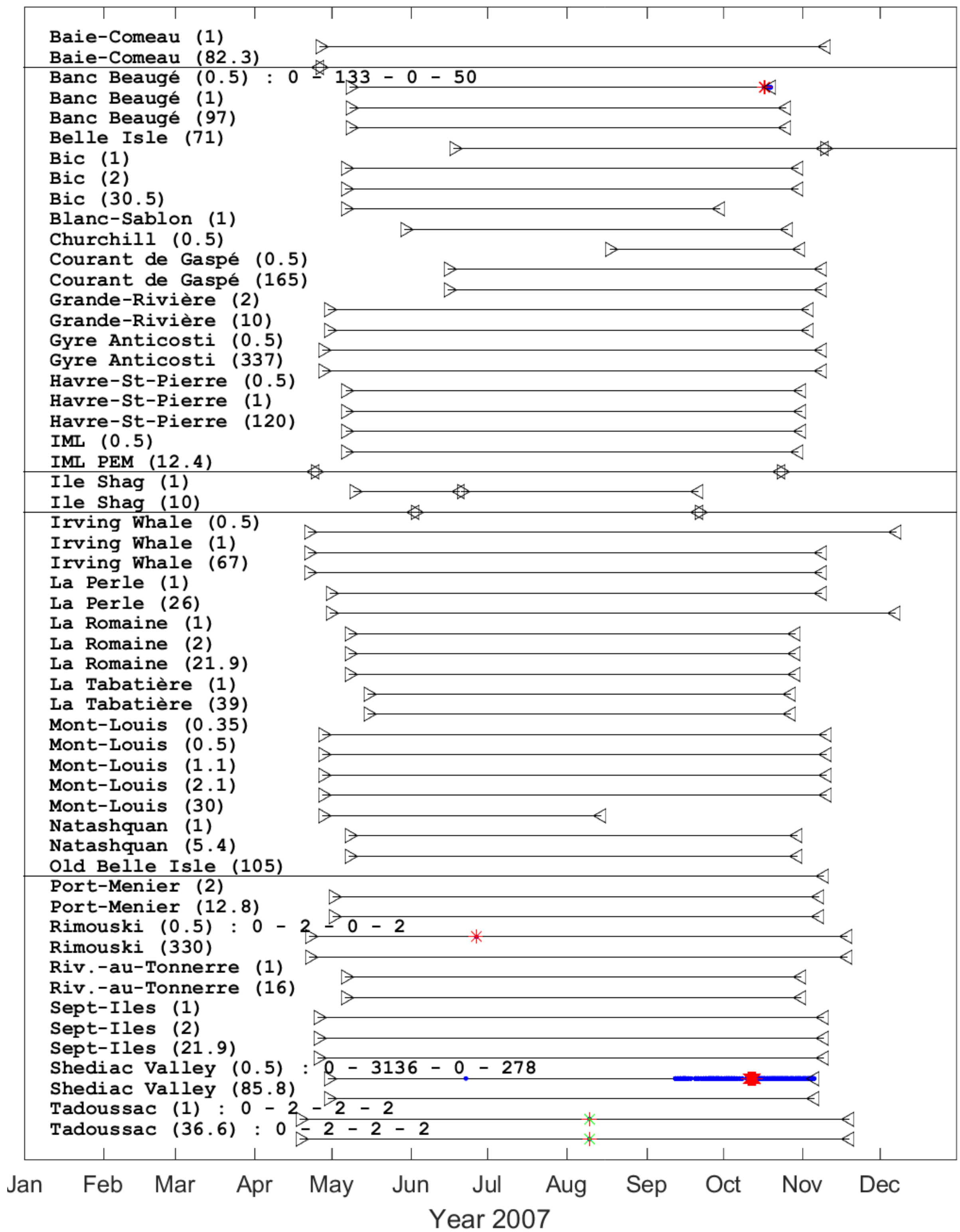

Figure A3.15 Data chart for 2007. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

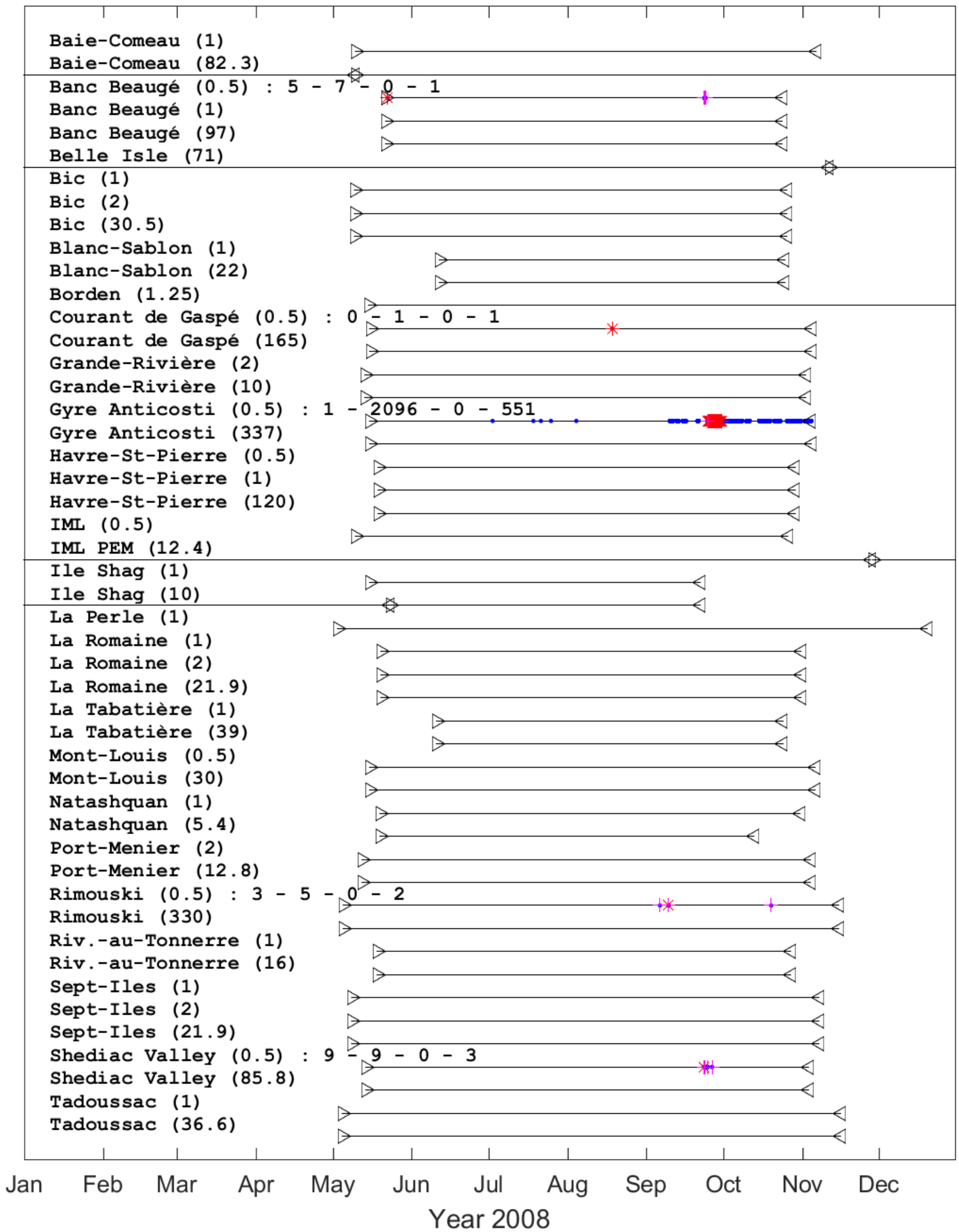

Figure A3.16 Data chart for 2008. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

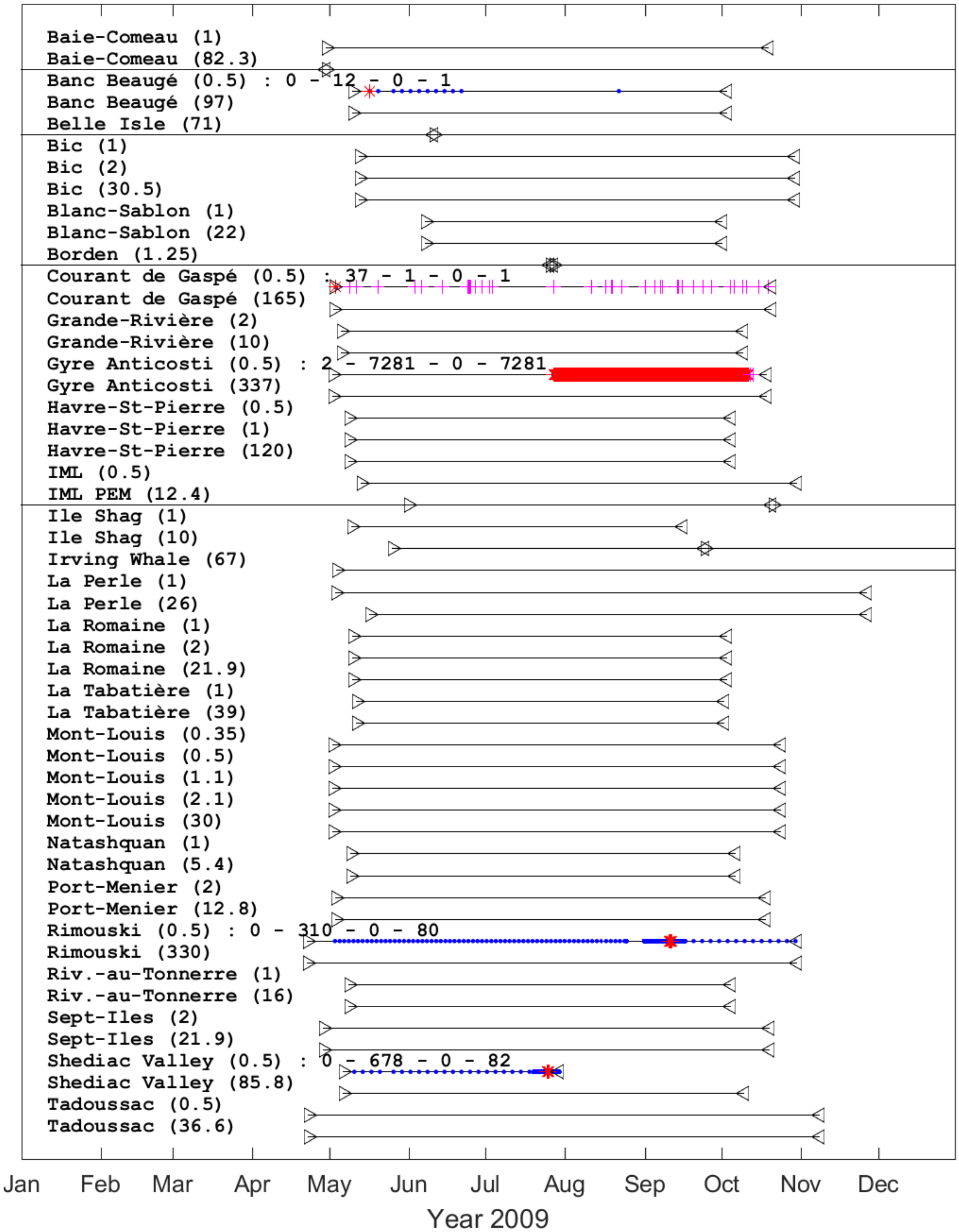

Figure A3.17 Data chart for 2009. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

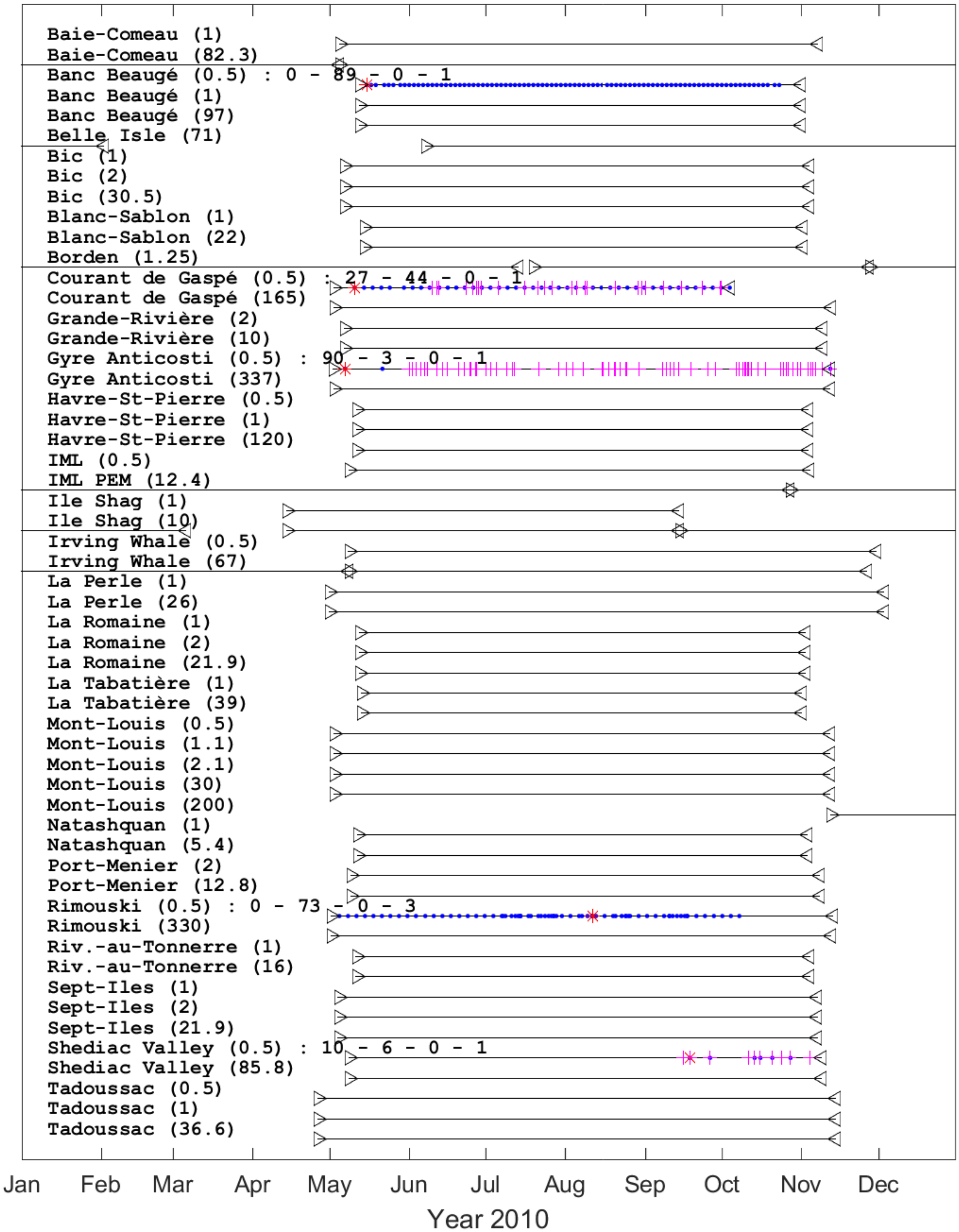

Figure A3.18 Data chart for 2010. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

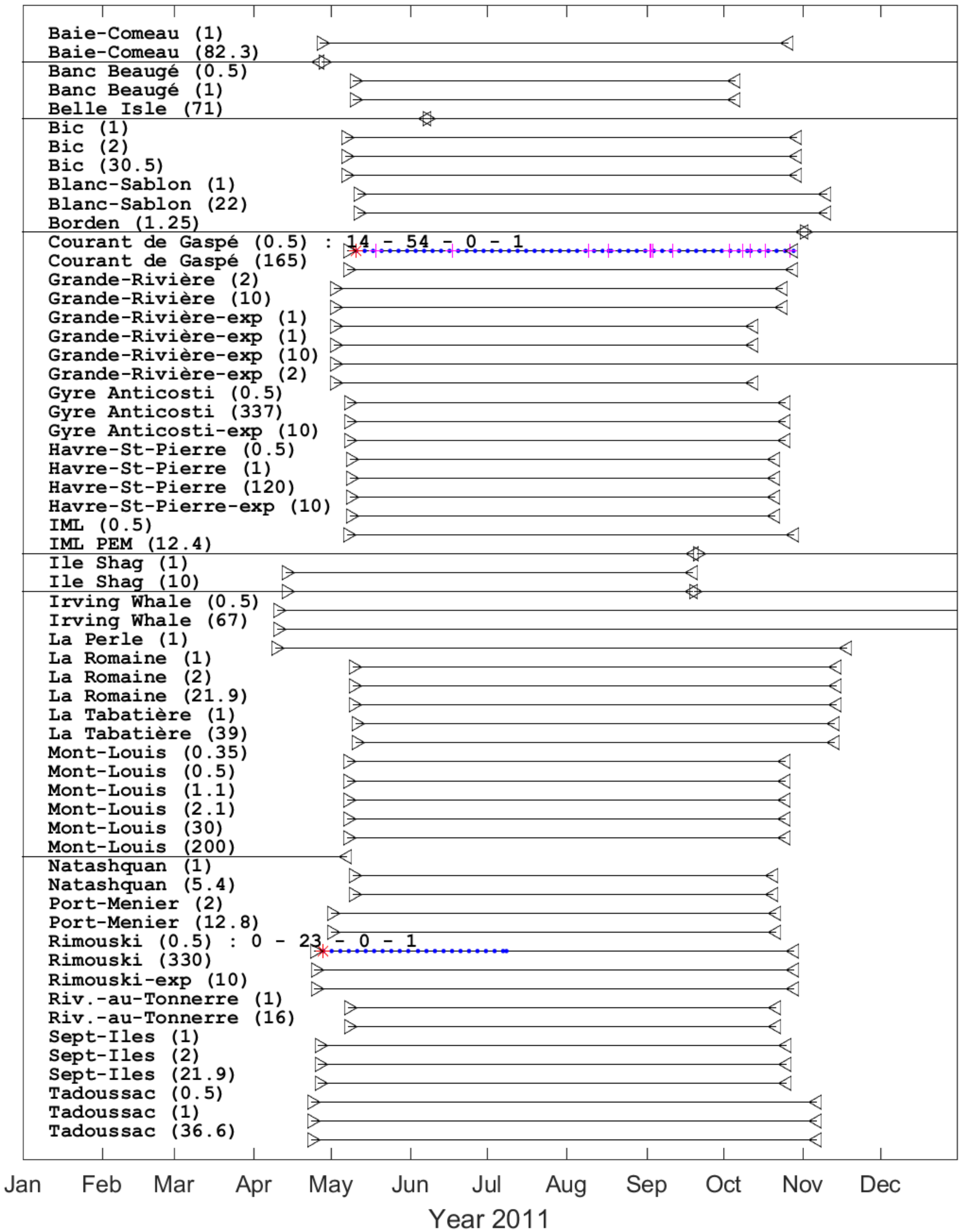

Figure A3.19 Data chart for 2011. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

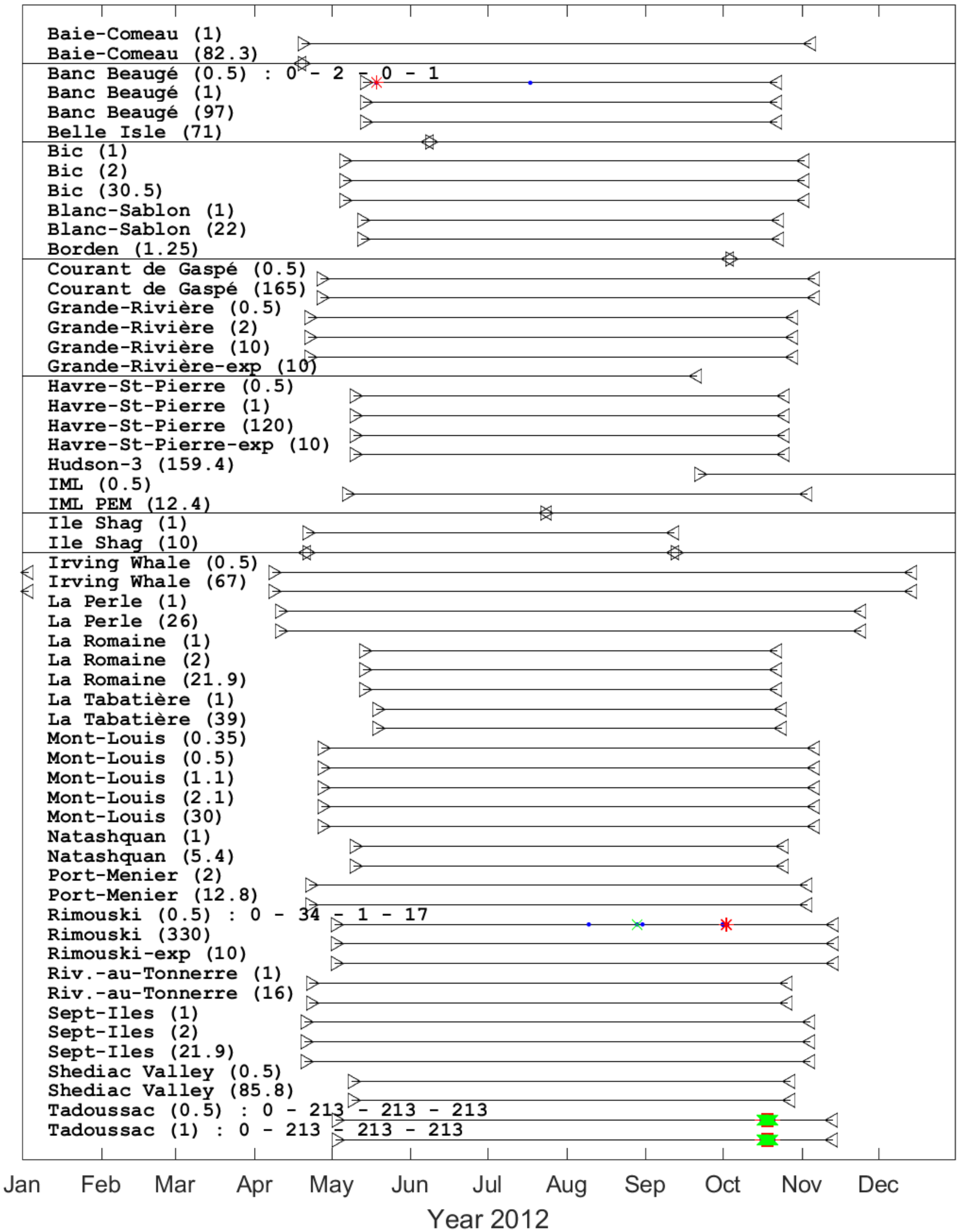

Figure A3.20 Data chart for 2012. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

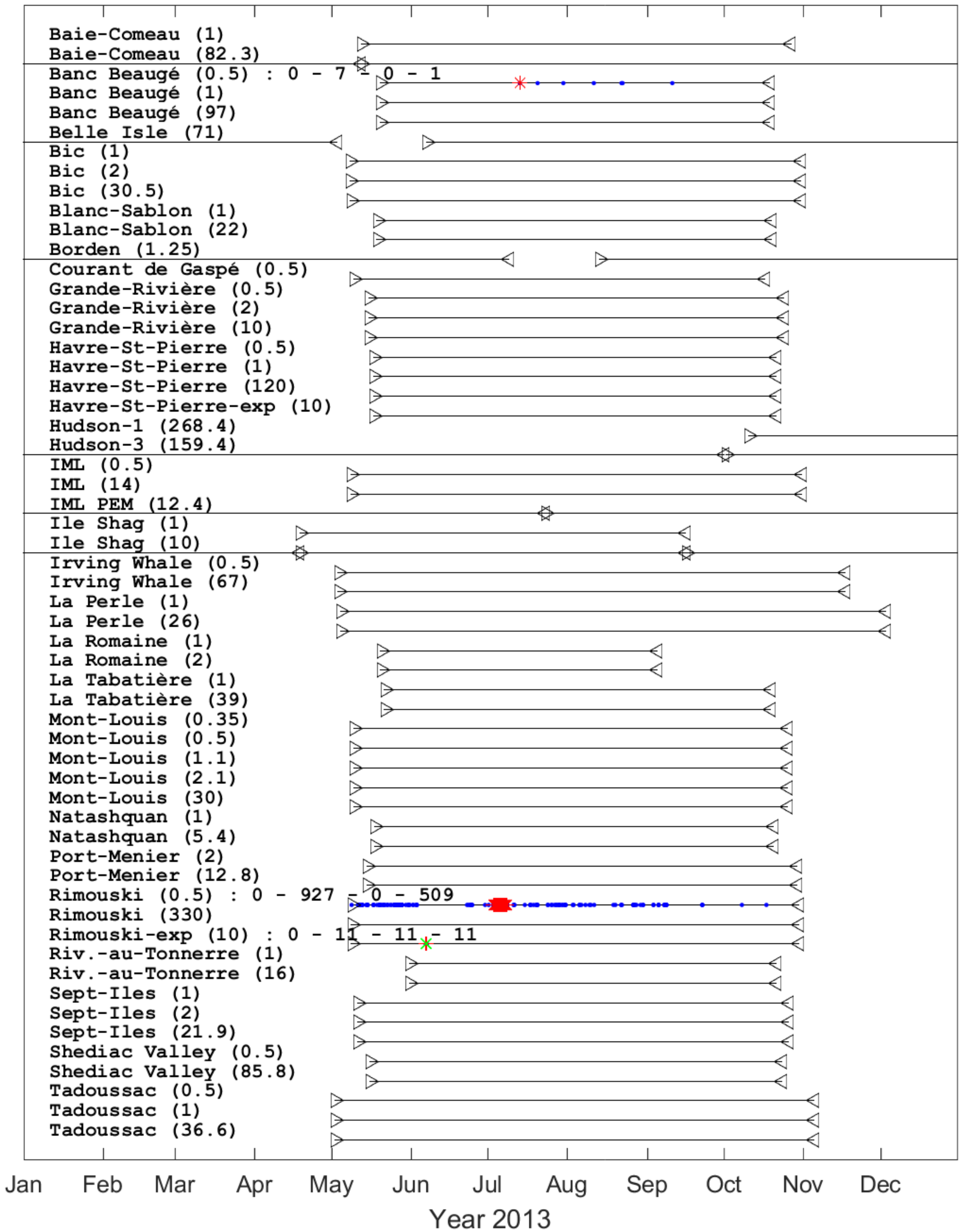

Figure A3.21 Data chart for 2013. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.

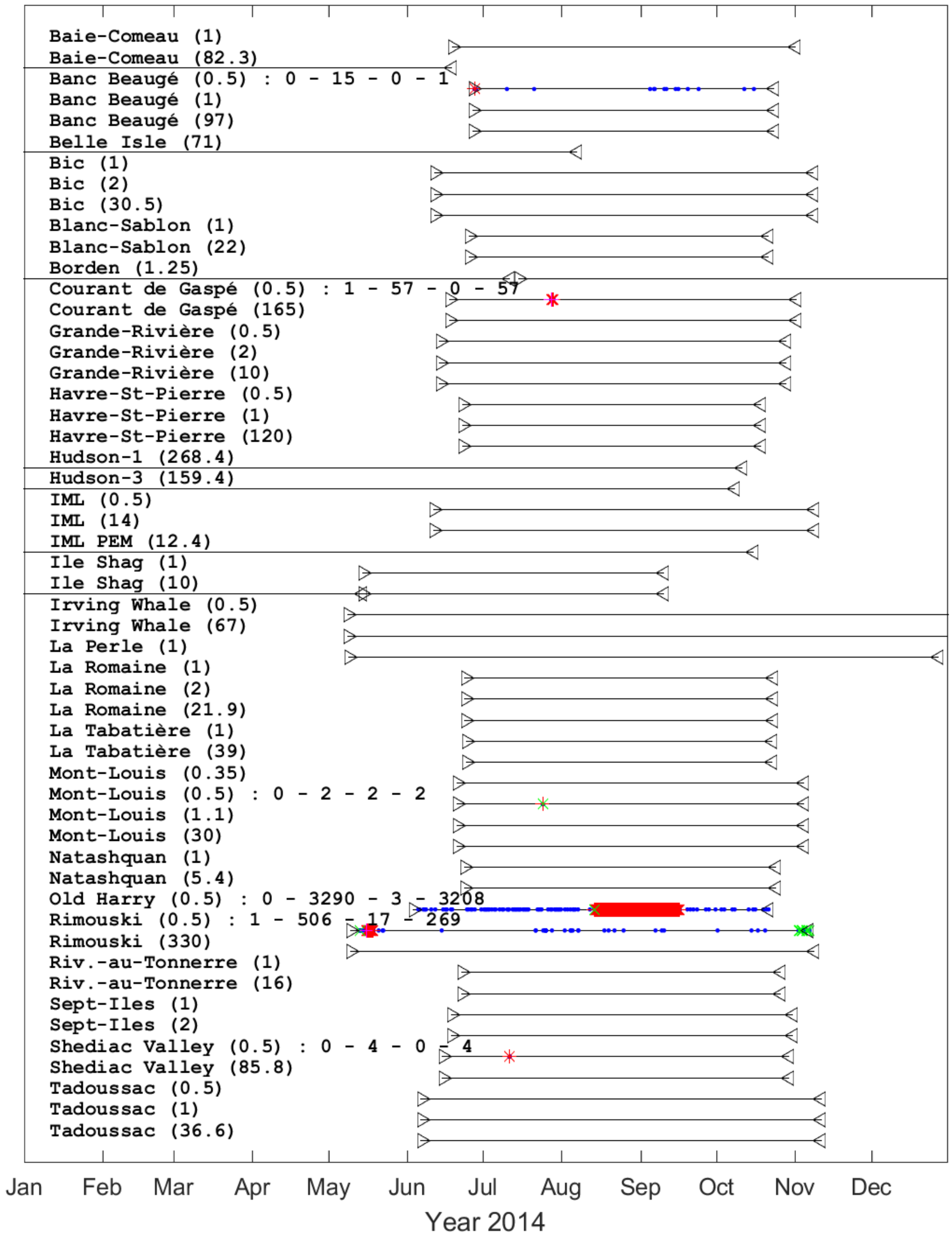

Figure A3.22 Data chart for 2014. The horizontal line below the station name (depth, m) shows the valid range of records. The yearly record number No (oversampled, magenta plus sign), Ntm (total missing, blue dot), Nf (flagged, green x) and MG (maximum gap, red asterisk) are respectively indicated only when No or Ntm is non-zero. The right and left pointing triangles respectively indicate the start and end of a time series.