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Summary of the 2015 snow crab trawl survey activities in the southern Gulf of St. Lawrence

M. Moriyasu, E. Wade, P. DeGrâce and M. Hébert

Fisheries and Oceans Canada
Science Branch
Gulf Region
P.O. Box 5030
Moncton, New Brunswick
E1C 9B6

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

The present document summarizes the details of the 2015 snow crab bottom trawl survey of the southern Gulf of St. Lawrence including the details of protocols used for the 2015 trawl survey, survey activities and characteristics of individual tows during the 2015 trawl survey as well as the basic information on the catch of snow crab and other species. The primary objective of the survey is to provide the data on abundance and distribution of snow crab and other by-catch species. The results of in-depth analysis of the survey data were presented in the assessment document. The survey was conducted from July 9 to October 15 using a chartered commercial fishing vessel, the "*Jean Mathieu*". A total of 355 grids were visited and 353 grids were successfully sampled. The total duration of the survey was 81 days with 50 days at sea. The total number of immature male crab captured increased from 9,736 individuals in 2014 to 11,498 in 2015, whereas mature male crab catches decreased from 4,129 to 3,755. For commercial-male crabs, the number captured decreased from 1,884 in 2014 to 1,741 in 2015. For females, the total number of immature female crabs captured increased from 3,939 in 2014 to 4,904 in 2015, and the number of mature female crabs increased from 6,700 in 2014 to 7,398 in 2015. By-catch (excluding snow crab) consisted of 82 species/groups comprised of 57 fish including skate egg capsules and 32 invertebrates including whelk capsules and two algae.

Résumé des détails sur le relevé de crabe des neiges dans le sud du golfe du Saint-Laurent en 2015

RÉSUMÉ

Ce document fournit un résumé des détails sur le relevé au chalut de fond du crabe des neiges entrepris dans le sud du golfe Saint-Laurent en 2015. Les détails sur le protocole, le déroulement du relevé, les caractéristiques de chaque trait ainsi que le sommaire des captures de crabe des neiges et des espèces accessoires sont présentés. L'objectif principal de ce relevé est de fournir les données de l'abondance et de la distribution du crabe des neiges et d'autres espèces de capture accessoires. Le relevé a été entrepris du 9 juillet au 15 octobre à bord d'un navire de pêche commerciale nolisé « Jean-Mathieu ». Au total, 355 quadrilatères ont été visités parmi lesquelles 353 quadrilatères ont été chalutés avec succès. Il n'y a eu aucun changement important du protocole utilisé pour le relevé en 2015 comparativement à celui de 2014. Les caractéristiques des traits étaient comparables à celles des années précédentes (2014 et 2013). La durée totale (en jours) du relevé a été de 81 jours avec 50 jours en mer. Le nombre total des males immatures capturés a augmenté de 9 736 individus en 2014 à 11 498 en 2015. La capture de males matures a diminué de 4 129 à 3 755 de 2014 à 2015. Pour les mâles de taille commerciale le nombre capturé a diminué de 1 884 en 2014 à 1 74 en 2015. Pour les femelles, le nombre total des immatures capturées a augmenté de 3 939 en 2014 à 4 904 en 2015, et le nombre de femelles matures capturées a également augmenté de 6 700 en 2014 à 7 398 en 2015. Les espèces (ou groupe d'espèces) accessoires (excluant le crabe des neiges) capturées comprenaient 82 espèces/groupes dont 57 poissons incluant les œufs des raies et 32 invertébrés incluant les capsules des buccins, et deux algues.

INTRODUCTION

The snow crab fishery in the southern Gulf of St. Lawrence (sGSL) began in the mid-1960s and entered into a development phase in the 1970s when initial landings by fishermen from the Maritime Provinces and Quebec were relatively low. Record landings were reached however during the early 1980s (Hébert et al. 2016b). Throughout this time, the status of snow crab population in the area was poorly understood and was based mostly on fishery statistics. In 1989, the Area 12 fishery was closed prematurely due to a rapid decline in catch rates associated with an increasing incidence of soft-shelled crabs being captured, consequently, new management measures were introduced in 1990.

One of the measures used was to determine the total allowable catch (TAC) based on the biomass index of adult male crab ≥ 95 mm (CW) as estimated from a bottom trawl survey. The annual snow crab survey is fishery independent and is the main assessment tool used by biologists for determining the status of the snow crab population as it provides indices of recruitment several years before crabs enter the fishery. Female snow crabs, inherently smaller than males, are also caught in the trawl net, therefore enabling the development of an index of the stock's reproductive potential. Other indices such as sex ratios, natural mortality, molting probabilities and relative exploitation rates can also be estimated through the trawl survey data analyses.

The snow crab trawl survey has been conducted since 1988 in Areas 12 and 25/26 (except for 1996), since 1990 in Area 19, since 1992 in Area 18 (except for 1997 and 1998) and since 1997 in Areas E and F. In Areas 12, 18, 25/26, E and F, the survey was conducted after the fishing season, which usually opened in late April and finishes by mid-July. The regular trawl survey normally started early to mid-July and ended in September. In Area 19, the fishing season was opened in two periods (spring and summer) between 1990 and 1992 and the survey was conducted between the two seasons. Since 1993, the survey in Area 19 has been conducted after the summer fishing season.

A systematic random sampling design was used to determine the location of trawl stations (Moriyasu et al. 2008). One or two locations were randomly chosen within each grid of 10 by 10 minutes latitude-longitude. The locations of trawl stations were remained fixed each year. In small areas such as Areas 18, 19, 25/26, 12E, 12F and in Chaleur Bay two stations within a 10 by 10 latitude-longitude grid were randomly chosen to increase the precision of the estimates in these small zones. In 1988, the survey area covered the expected boundaries of the commercial fishery in Area 12 only, and has since expanded to cover a much larger area.

There have been progressive changes in the sampling design and protocols of the sGSL trawl survey since its inception in 1988. Originally, the survey area was sub-divided using a lattice of 10 by 10 minute latitude-longitude grids. One or two sampling locations were then randomly selected and used as fixed stations in subsequent survey years. Initially, the survey area only covered Area 12 but was expanded to Area 19 in 1990. Area 12 was sampled before its fishery (July to October) for all years (except 1996 where there was no survey) and Area 19 was sampled before its fishery from 1990 to 1992 and then after its fishery from 1993 onward (Moriyasu et al. 2008).

In 1997, the survey area was again extended to include the new management Areas 12E and 12F. New stations were added randomly within grids as the survey expanded or if areas were targeted for more intensive sampling. Further details of these survey design changes are provided by Moriyasu et al. (2008).

The sampling design from 2006 to 2011 was modified in accordance with recommendations from the 2005 Assessment Framework Workshop on the sGSL snow crab (Moriyasu et al. 2008). The new design was introduced to achieve spatial sampling homogeneity. While this survey design was spatially unbiased in the sense that the expected number of stations per 10 by 10 minute grid was proportional to its surface area, in practice the realized number of stations per grid was either one or two stations, and grids along the survey area margins often had zero stations. Past survey stations were retained as much as possible, but others were removed or added to grids as prescribed by the sampling method (Moriyasu et al. 2008).

In 2012, the sampling design was again modified following recommendations from the 2011 Snow Crab Assessment Methods Framework Science Review (DFO 2012). The boundaries of the survey area were extended to the 20 and 200 fathom isobaths, encompassing the vast majority of favorable snow crab habitat (i.e. bottom temperatures less than 5°C) and thus the sGSL biological unit. To further improve spatial homogeneity, grids were set to be square rather than rectangular with dimensions defined as a function of the number of total samples, so that each grid included only a single sampling station (DFO 2012). This protocol resulted in an entirely new set of sampling stations. The revised survey sampling design in 2012 is presented in Wade et al. (2014).

For 2013, the number of stations increased from 325 to 355 following recommendations from the snow crab advisory committee to increase the precision of the biomass estimates in smaller fishing zones. The survey area was partitioned into square grids of 12.7 km x 12.7 km and a new set of sampling stations was generated. In 2014, the number of sampling stations remained at 355. However, the 352 successful sampling stations from the 2013 trawl survey were used as fixed stations in 2014 and a new set of 3 sampling stations (the 3 sampling stations that were abandoned in 2013) was generated randomly.

In the present document, the summary of the survey activities including detailed information on the protocol deployed and characteristics of each tow as well as the catches of snow crab and by-catch species are provided. As this is the last year of the current charter contract for the CFV Jean-Mathieu, the 2015 activities were also compared with the 2013 and 2014 activities conducted by the same vessel.

SURVEY DESIGN AND PROTOCOL FOR 2015

SURVEY PROTOCOL

The survey protocol (sampling grid setting, target number of stations, and their positions) modified/established was maintained for 2015 from previous years (2012 to 2014) (DFO 2015; Hébert et al. 2016b) except when the original position at a given grid was not amenable during the 2013 survey and an alternative position was successful, this alternative position was considered as the original position for the 2014 survey. The same protocol was applied to the 2015 survey.

The survey spatial sampling design for the 2015 season is based on a survey area partitioned into 355 square grids of 12.7 km x 12.7 km (Fig. 1) as in the 2013 and 2014 surveys. In each grid identified for sampling, a primary station and 3 (three) alternative stations (A1-3) in case that the primary station cannot be trawled were randomly chosen prior to the survey. If the trawl net was damaged while fishing at the primary station (P) and the station was considered untrawlable by the onboard biologist, a tow at the first alternate sampling station (A1) within the same grid was done. If the trawl net was considered as unsuccessful at the first alternative station (A1), a tow was conducted at the second alternate station (A2) up to the third alternative station (A3). If the primary (P) and the three alternative stations (A1 to A3) within a given grid were considered untrawlable, the grid was considered to be untrawlable and no further sampling was done.

Only good tows are considered in the analysis (see Hébert et al. 2016b). Bad tows are defined as torn or damaged nets resulting in loss of specimens and/or uncompleted tows due to the weather or sea conditions. In the case when the net has physically performed well but a malfunction of the electronic net sensors occurred (no real net behavior data available), the tow was considered good and the swept area for that tow was estimated as the mean swept area of the nearest 10 neighboring tows which were fully successful.

For the 2014 season, a new attempt for estimating swept area was introduced in order to compare with the traditional method (using mean swept surface of 10 neighboring successful stations) by using a known tow length at each station multiplied by the mean of the net spread in neighboring 10 stations. As no significant difference was observed between two results, we maintained the traditional method (i.e. using mean swept surface of 10 neighboring successful stations when a set of net spread measurements was not available at a given station) for the 2015 season.

Standard tows were made using a *Nephrops* trawl at a speed of 2 knots with a target duration of five minutes, based on the time the trawl touches the sea floor as determined by the analysis of the hydro acoustic system (Moriyasu et al. 2008). In 2015, Star Oddi® temperature/depth and temperature/depth/tilt sensors (Star Oddi®, Skeidaras 12210 Gardabaer, Iceland) introduced in the previous survey were deployed together with the traditionally used VEMCO® temperature / depth probes to try to improve the definition of net touch down. The VEMCO® temperature and depth probe is no longer available on the market and the information obtained by these new probes was used to determine the net touch-down by comparing with the VEMCO® probe. The 2015 survey is the last year for which the VEMCO® probes can be used. Information about the geometry of the trawl (horizontal spread of the doors and wings, vertical opening of the trawl and depth) was recorded for each tow using hydro acoustic sensors (eSonar®). Descriptions of the methodology for estimating the swept surface are provided by Moriyasu et al. (2008).

Trawling was always done during civil twilight time (civil twilight begins prior to sunrise when the geometric center of the sun reaches 6° below the horizon and ends when the geometric center of the sun reaches 6° below the horizon after the sunset). There is enough light from the sun during this period that artificial sources of light may not be needed to carry on outdoor activities; this usually occurs approximately 30 minutes earlier than sunrise and later than sunset.

The sampling protocol calls for the survey to be postponed in the event of adverse weather conditions; i.e., winds above 20 to 25 knot or sea conditions that may hinder the proper maneuverability of the boat.

At all visited sampling stations in 2015, a vertical profile of the water column was made using a newer model of CTD (SeaBird 19 plus®) as a replacement of older model (SeaBird 19 plus®) to obtain the information on the temperature, conductivity (salinity) and pressure (depth) information. The water temperatures are also measured with the Star Oddi® sensors placed on both head and foot rope of the trawl net and with the Vemco® minilog probe placed on the head rope. The information on the water temperatures (Appendix 1) are from the VEMCO® minilog probe attached to the head rope.

For each successful trawl tow, the catch was sorted by species, the number of individuals for fish and invertebrates was recorded, and each tow was photographed. Species identifications were made based on taxonomic information in Scott and Scott (1988), Pohle (1990), Squires (1990), and Brunel et al. (1998). Although species identification other than snow crab were recorded since the first year of the survey, the protocol and effort put on species other than snow crab have not been consistent over the years. It is only since 2006 that more complete collection of information on the count per species began and since 2010, size measurements of sub-sampled (maximum of 100 individuals per station) fish species from 100 pre-selected stations was conducted. All other catches were sorted by species or species group, counted, and returned to the sea.

For snow crab, detailed measurements included the carapace width (CW), chela height (for males larger than 40mm in CW only), shell hardness (for males larger than 60mm in CW only), carapace conditions (1-5: see Hébert et al. 2016a for details), gonad color (for all immature females), egg color, missing legs, and presence/absence of carapace disease and abnormalities such as malformation of carapace and appendices, and cigarette burn (chitinivorous bacteria) and BCD (Bitter Crab Disease).

NET SENSORS

Information about the geometry of the trawl (horizontal spread of the doors and wings, vertical opening of the trawl and depth) was recorded for each tow using hydro acoustic sensors (e-Sonar®). Descriptions of the methodology for estimating the swept surface are provided by Moriyasu et al. (2008). Trawling distances are derived from positions fixed between the start and end of each trawl using a DGPS on the vessel. Trawl widths are measured using trawl monitoring instrumentation which were manufactured by ScanMar®, Netmind®, and more recently eSonar®.

Locations of the e-Sonar sensor placement on the trawl are shown in Figure 2. A pair of distance (width) sensors (main and slave) are mounted slightly behind the wing to provide basic protection. The height sensor is mounted at the midpoint of the headline (Fig. 2). Floats are attached to counteract the negative buoyancy of the sensor and to avoid distortion of the headline. The sensors are deployed for all samples during the snow crab survey. They provide data on headline height, distance between the wings and distance from the bottom. A laptop PC on-board the vessel is used to log the data using a program provided by the suppliers.

The e-Sonar system, also used during the 2014 survey, records data at seven second intervals. The performance of the trawl is monitored during each tow. By evaluating information from these instruments during the trawling process, the on-board scientist is able to make decisions as to when the trawl reaches the bottom, and the overall quality of the trawl geometry. Because the trawl width sensor needs to be aligned correctly with the transponder on the opposite wing of the trawl, it often occurs that erroneous or very noisy trawl width information is transmitted to the laptop. The readings from the height sensor are generally more consistent than those from the wing spread sensors although they can be very noisy as well at times depending on factors such as bottom type, depth, and terrain profiles. The speed of the trawl through the water or the distance travelled by the trawl was not measured directly. Trawl speed during each sample was deduced from the distance travelled as measured from the ship's DGPS and the duration of the interval. This is assumed to provide the best approximation of the distance travelled by the trawl through the water.

The change in the pre-set maximum measurement range for the depth sensor from 2,000 m to 500 m and the height sensor from 2.1 to 1.5 m (minimum measured value) made in 2014 provided better and clearer determination of the net touch down duration (Table 1) (Moriyasu et al. 2015).

TEMPERATURE / DEPTH PROBE FOR SWEPT AREA ESTIMATION

The information on when the net touches the bottom and when the end of tow occurs is a prerequisite for accurate estimation of swept area. A calculation of the swept area by the net at each tow requires an estimate of the distance covered over the sea-floor. On the snow crab surveys, the on-board scientist estimates the time when the net arrives on the sea-floor based on information available from the hydro acoustic instruments. The end of the trawl, or when the trawl is deemed to stop fishing is taken as the time when the warps are hauled. In order to maintain continuity of the survey time series, the same protocol was used since the early years of the survey.

In addition to the hydro acoustic instruments attached to the trawl since the mid-1990s, an additional instrument called the ‘minilog’ sensor (VEMCO®) is attached to the headline of the trawl. It measures depth and temperature at one second intervals and provides much more reliable information on depth than the hydro acoustic data, and is very useful in establishing the touchdown time. However these data are analysed after the trawling operation is completed.

Once the survey is completed, a second estimate of the start time is calculated using information from the minilog sensor. Specifically, the data are analysed to estimate an inflection point in the minilog data depth profile using piecewise linear regression with assumption of having one inflection point. Data from the distance height sensors, depth sensors and the minilog sensors are plotted against time to provide profiles of the approach of the trawl on the bottom. Lines are drawn to indicate the start times and end times based on the scientist on board the vessel and the estimate from breakpoint analysis of the minilog data. The horizontal opening of the trawl provided by the width sensors is also charted. Graphical representation of the track of the boat and its speed over ground are provided.

Production of the traditionally used VEMCO® minilog sensor was discontinued in 2013 and the currently used probes will lose their battery power soon, therefore, new probes i.e. temperature/depth (TD) and temperature/depth/tilt (TDT), (Star Oddi®,Skeidaras 12210 Gardabaer, Iceland) were introduced for the 2014 survey as a replacement of the VEMCO® minilog. In 2014 and 2015, both VEMCO® minilog and Star Oddi® (TD and TDT) sensors were deployed. The VEMCO® minilog functioned throughout the 2015 survey.

One Star Oddi® TD was attached to head rope next to VEMCO® minilog and another TD and a TDT were placed into a separate plastic protective housing and placed into stainless steel carrier attached to the footrope of the trawl net (outside of the net) (Fig. 2). TD sensor attached to both head rope and foot rope measure the temperature and pressure (depth) at one second intervals. The TDT sensor attached to the foot rope measures in addition to the temperature and pressure (depth), the tilt angle of the x-axis, y-axis, and z-axis at every second (Moriyasu et al. 2015). All these information’s are compiled in a graphical report and then processed individually in order to make a proper selection of the start time based on all the information available. Ultimately these selected start times are used in the calculation of the swept area.

For the 2014 trawl survey, inflection-point models were applied to the data collected by e-Sonar net sensors, a VEMCO® minilog, two Star Oddi® TDs and a TDT to compare the net touch down and subsequent net swept surface. The preliminary analysis obtained (Moriyasu et al. 2015) suggested that the tilt sensor placed on the footrope clearer definition of the net touch down. In addition, the sensors located on the headline seem to have a more gradual interaction with the bottom, therefore more prone to giving a wider range of outcomes for start times, as opposed to a sensor located on the footrope. The estimates of start times based on protocols put in place in the late 1990’s concur with those estimates from the Star Oddi® probes. The preliminary results obtained during the 2014 trawl survey have shown that the performance of e-Sonar net sensors and Star Oddi® TDT facilitated the determination of net touch down and ensured the continuation of net swept surface estimation without VEMCO® minilog. However, the comparison of the results in net touch down determination between the minilog and the Star Oddi® TDT showed that minilog sensor enabled a relatively precise and unbiased determination of the start time. The replacement of the minlog sensor along with the more advanced post analysis method will ensure a continuation of proper determination of the start time. The swept area estimation for the 2015 survey was done by following traditional protocol using solely a VEMCO® probe as it has been done for the previous surveys.

SURVEY ACTIVITIES IN 2015

VESSEL, PERSONNEL AND ONBOARD TASKS

For the 2015 survey, we continued to use "Jean-Mathieu" (64' 11" in length, 99 t, with a 720 horse power engine and steel hull) introduced in the 2013 survey. The snow crab trawl survey has started in 1988 and four chartered vessels have been used until now:

- side trawler 'Emy-Serge' (64 ft in length with 375 hp engine and woden hull).from 1988 to 1998,
- stern trawler 'Den C Martin' (64 ft in length with a 402 hp diesel engine and steel hull) from 1999 to 2002,
- stern trawler 'Marco-Michel' (65 ft in length with a 660 hp engine and a fiberglass hull) from 2003 to 2012, and
- stern trawler Jean-Mathieu (64' 11" in length with a 720 hp engine and steel hull).

No catchability comparisons were made during the transitions.

Ghislain Bourgeois took command on "Jean-Mathieu" and there were always five crew members during the survey: O'Neil Poirier (winch operator, net repair master, engineer, left door setting), Tommy Turbide (net repairs, crab measurement data recording, helper in by-catch species measurements), Denis Poirier (CTD, net repairs, right door setting), Rémi Chevarie, a new member for the 2015 survey, (net repairs, helper in by-catch species measurements), and Denis Bénard (cook, net repairs).

Four employees (Pierre DeGrâce, Marc-André McCaie, Marcel Hébert, and Jean-François Landry) from DFO Science participated in the 2015 survey such that there were always at least two DFO Science employees on board at any given time throughout the survey period. After September 2, three employees (P. DeGrâce, M.A. McCaie and M. Hébert) were onboard until the end of the survey.

One DFO Science member was responsible for the operation of the e-Sonar®, CTD data recording, measurement of by-catch and determining the tow quality. CTD casting was ensured by Denis Poirier. The second DFO Science member was responsible for the measurement of crabs assisted by Tommy Turbide until September 1 (thereafter M.A. McCaie took over the measurement assistant task).

DURATION AND TIMING OF THE SURVEY

The 2015 survey started on July 9 and ended on the October 15 (99 days) (Fig. 3). The starting dates were the same as the last two years, and ending date was two days earlier than the 2013 survey and three days later than the 2014 survey. It took eight trips (10 in 2014 and 8 in 2013) to complete the survey with each total trip duration varying from 6 to 13 days (3 to 9 sea days) and the number of stations visited varied from 17 (trip I) to 70 (trip VIII) (Table 2). Approximately fifty percent (50 days) of the total duration of the survey (99 days) were spent at sea with at least one successful tow, comparable to the previous two years (47/97 days in 2014 and 49/98 days in 2013). Serious net damage (the crew cannot repair onboard and need to be done at wharf) occurred 30 times (20 and 28 times in 2014 and 2013, respectively) in 2015 and 3 out of 7 nets were deemed to be unrepairable during the season (1 in 2014 and 2 in 2013). Historical information of the survey timing and duration are summarized in Figure 3. All trawl activity took place during civil twilight time without exception (Table 3).

SURVEY ITINERARY

There were eight (8) trips for the 2015 survey, departing from different locations (Table 2; Figs. 4a to 4h and 5).

- The first trip departed from the port of Cheticamp on July 9 and trawled in the Area 12/12E and 12F. The trip was shortened due to mechanical problems (variable pitch) of the vessel. The vessel docked in Gaspe (QC) after three days of work at sea until the following departure on July 17 (Fig. 4a).
- The second trip departed from Gaspe on July 17 and conducted sampling off Gaspe and north of the Magdalen Islands including Area 12E and back to Magdalen Islands (Fig. 4b).
- The third trip departed from Magdalen Islands on August 1, sampled off Prince Edward Island and Shediac Valley, and returned to Gaspe on August 7 due to a mechanical problem (hydraulic system) until the following departure on August 16 (Fig. 4c).
- The fourth trip started from Gaspe and sampled mainly in Chaleur Bay, but was interrupted due to hydraulic system problem again and returned to Gaspe. After three days of inactivity, the survey resumed sampling off Gaspe then returned to Magdalen Islands on August 24 (Fig. 4d).
- The fifth trip departed from Cap-aux-Meules (Magdalen Islands) and trawled in Area 18 towards St. George's Bay and off the southern tip of the Magdalen Islands. The trip was shortened due to a boat mechanical problem and returned to Magdalen Islands on September 4 (Fig. 4e).
- The sixth trip departed from Cap-aux-Meules (Magdalen Islands) on September 8 and trawled in the northern Bradelle Bank, the southern part of the Magdalen Islands, and returned to Caraquet (NB) on September 14 (Fig. 4f).
- The seventh trip departed from Caraquet (NB) on September 17 and trawled in Bradelle Bank, and returned to Cap-aux-Meules (Magdalene Islands) on September 24 (Fig. 4g).
- The eighth and last trip departed Cap-aux-Meules (Magdalen Islands) on October 4 and trawled the remaining stations in the southern part of Bradelle Bank, Area 12F, and Area 19, and returned to Cheticamp on October 15 to unload equipment (Fig. 4h).

The monthly pattern of the trawl survey was comparable among the three years (2013 to 2015) by starting stations along the Laurentian Channel and in the Shediac valley area in July, in the area of Chaleur Bay, Gaspe, Bradelle Bank and Magdalen trough in August, and the southeastern corner of Area 12F, and stations in Magdalen Trough towards western Cape Breton Island and finishing in Area 19 in September and October (Fig. 6).

CHARACTERISTICS OF TOWS

A total of 355 grids were visited with 353 grids successfully sampled and two grids which were deemed to be untrawlable. A total of 423 tows were attempted in 2015 compared to 409 tows in

2014 and 447 tows in 2013. The 355 grids in the sampling design covered all crab fishing areas (CFA) and the number of grids in each CFA was similar among years. The majority of grids are found in CFA 12 (Fig. 7).

Originally CFA 12, 12E, 12F and 19 should contain 293, 13, 18 and 25 stations (for the period of 2013 to 2015). However, in 2015 two stations originally intended to be in CFA 12 fell in the neighboring CFAs (one in CFA 12E and other in CFA 12F) (Fig. 8).

Direction of a given trawl depends on the current and/or wind direction and in some cases the starting point falls in the neighboring grid. Based solely on the departure positions (not end position), there were three vacant grids AK20, AM13 and AU14 as the trawling was started in the neighboring grids (AK21, AN13 and AT14), which resulted also in three grids containing double trawled stations (AK21, AN13 and AT14). In 2014, there were five tows that ended in a neighboring grid (AR25 (AS25), AT9 (AT10), AS3 (AR3), AO16 (AO15) and AO28 (AO29), (original intended grid and (ended grid)), which resulted in five vacant grids and five grids with double stations. In 2013, this occurred in eight grids: AB22 (AB23), AT07 (AU07), AT14 (AT13), AU17 (AV17), AV15 (AU15), AW14 (AW15), AY14 (AY13), and AZ13 (BA13) (Fig. 8).

Among the 353 completed grids, trawling in 303 grids (312 and 282 in 2014 and 2013, respectively) were completed at the primary stations, whereas trawling in 39 grids (36 and 58 in 2014 and 2013, respectively) was completed at the first alternate station (A1), for 10 grids (3 and 11 in 2014 and 2013, respectively) at the second alternate station (A2) and for one grid (2 and 1 in 2014 and 2013, respectively) at the third alternate station (A3). Two grids were abandoned after four tow attemps (2 and 3 in 2014 and 2013, respectively). There were a total of 70 failed tows in 2015, representing 17% of the total number of tows tried (423). The failed tows were mostly located around Magdalen Islands, off the Gaspe Peninsula, and off Prince Edward Island towards Miscou Island (Fig. 8). In 2014, there were 56 failed tows out of 409 attempts (14%) and in 2013 there were 95 failed tows out of 447 attempts (21%).

Two survey grids (AT9, AZ10) were deemed to be untrawlable after four attempts, once at the primary station and at each of the three alternate stations. These grids were located off Cap-des-Rosiers (Gaspe Peninsula; AZ10) and northeast of Miscou Island (AT9) (Fig. 12). The untrawlable grids have differed among years; AZ10 and AT9 in 2015, AO10 and AS23 in 2014, and AI14, AR26 and AU18 in 2013.

The details of each tow (date, tow number, position, swept area estimation, depth, temperature (measured with a VEMCO® minilog attached to the head rope of the net), catch in number and estimated weight per tow of commercial crabs with carapace conditions 1 to 5 (total commercial crabs) and carapace conditions 3 to 5, quality indicator of each tow, type of successful tow, annual sequence of tow, as well as grid number completed are summarized in Appendix 1. The depth of the trawl station (measured with the vessel's depth sounder) varied from 33 m to 382 m which was quasi-constant over three years of the survey (33 to 384 m in 2014 and 33 to 366 m in 2013). The bottom temperature at each station varied from -1 to 12.9ºC with an average of 1.3ºC (-1.3 to 6.2ºC with an average of 0.9ºC in 2014, -0.3 to 7.6ºC with an average of 1.5ºC in 2013).

ONBOARD MEASUREMENT OF SNOW CRAB AND OTHER SPECIES (CHANGES IN MEASUREMENTS IN 2015)

Among the traditionally conducted measurements of previous years, the 5th abdominal width for females was not collected during the 2015 survey, as this morphometric information provides no meaningful information and has never been used so far.

Another measurement ceased this year is onboard weight measurement of hard-shelled, terminally molted commercial sized male crabs (with a Marel (Austurhraun 9, IS-210 Gardabaer Iceland) M1100 PL2260 marine scale maximum 3kg). This measurement was introduced in 2013, however the balance was not appropriate for a smaller vessel like ours and reliable weight measurements of individual snow crab could not be obtained. However, the weight measurement of by-catch species which began in 2013 was continued using a Marel M1100 PL4600 marine scale (max. weight of 60kg).

CATCH OF SNOW CRAB AND OTHER SPECIES

Snow crab

Snow crab were captured at 323 of 353 grids sampled in 2015 and the total catch was 27,734 individuals, sexes and sizes combined. The total number of snow crab caught has increased gradually since 2013 (24,504 in 2014, 21,621 in 2013). Only 30 grids in 2015 had no snow crab catch compared with 33 of 353 grids in 2014, and 32 of 352 grids in 2013. The geographic distributions of grids with no snow crab were the same in 2013 to 2015, occurring mainly along the Laurentian Channel, south of the Magdalen Islands, northeast of Prince Edward Island and between Miscou Island and western PEI (Fig. 9). The number of grids with no commercial-sized male snow crab was 98 in 2015, compared to 99 in 2014 and 112 in 2013.

The historical trends in the mean number per tow of all male snow crab caught (sizes and maturities combined) and sampled during the surveys are shown in Table 5 and Figure 10. The mean number per tow of male snow crab has fluctuated throughout the time series with notable peak values in 1999 of 70.2 male snow crab per tow, and in 2011 with 46.5 male snow crab per tow. The lowest value was recorded in 2009 at 33.7 male snow crab per tow. Of all the male snow crab caught in 2015, 75.4% were immature or adolescent, compared with 70.2% in 2014 and 67.6% in 2013 (Fig. 10).

The total number of commercial-sized male snow crab captured was highest in 2004 at 3,321 individuals and was at its lowest level of 900 individuals in 2009. Since the recent peak of 2,093 individuals in 2012, the number of individuals has been slowly decreasing and was 1,784 in 2015 (Table 6). Since 1997, the peak catch of commercial-sized adult male snow crab per tow was in 2004, at approximately 10 crabs per tow (Table 6). In 2015, the number of adult male crab per tow was 4.9 and below the historic average of 6 crabs per tow. The mean individual weight of commercial-sized adult male in 2015 was 585 grams, equal to the historic average value of 585 g (Table 6). The estimated density (number per km^2) of 1,784 crabs per km^2 in 2015 is lower than the historic average of 2,202 crabs per km^2.

The mean number of females per tow has also fluctuated throughout the time series (Table 7; Fig. 11) with peaks in 1999 of 62.4 females per tow, and in 2012 of 39.7 females per tow. The lowest value for females was in 2006 at 25.5 females per tow. In 2015, the mean number of females per tow was 34.9 which is below the historic average of 47.2 females per tow. In 2015, the percentage of mature female was 60% of total females caught compared to 63% in 2014 and 67% in 2013 (Table 7; Fig. 11).

By-catch species (all species)

The information on by-catch species during the 2015 survey and for 2013 and 2014 are summarized in Table 8. Species identifications (Landry et al. 2014; Moriyasu et al. 2015) were established for the snow crab survey in the southern Gulf of St. Lawrence based on Scott and Scott (1988), Pohl (1990), Squires (1990), Brunel et al. (1998), Nozères et al. (2010) and using an unpublished species identification guide developed for the Scotian Shelf snow crab survey.

The list contains a total of 91 species/groups comprised of 57 fish including skate egg capsules, 32 invertebrates including whelk capsules, and two algae. The majority of the invertebrates were not identified to the species level and were gathered into common name groups. From the species list, eel, pollock and gelatinous snail fish, barnacle, Jonah crab, gastropod, seaweed and kelp were either not caught during the surveys or not counted. A total of 28 species/groups of invertebrates (including egg capsules of whelk) and 54 species of fish (including egg capsules of skate) were collected during the survey in the last three years (Table 8).

The most common invertebrate species captured (and counted), by number, were snow crab (35,915 in 2015, 32,095 in 2014, and 21,621 in 2013) followed by sea urchin (14,997 in 2015, 15,672 in 2014, and 16,669 in 2013), and sand dollar (12,220 in 2015, 11,000 in 2014, and 9,010 in 2013). There was a notable change in the catch of large crustaceans, i.e., lobster, rock crab, and toad crabs. The total count for these species was 2 to 23 times higher in 2015 compared to 2013 and 2014.

For fish species, American plaice had the highest count (35,915) (32,095 in 2014, and 28,209 in 2013) followed by cod (4,002), (5,175 in 2014 and 3,179 in 2013) and redfish (1,690), (2,279 in 2014 and 1,166 in 2013). The highest total count species for both invertebrates and fish have not changed in the past three years of surveys (Table 8).

In terms of frequency of observation (presence within 353 or 352 grids sampled) for invertebrates, snow crab was most frequently observed (323, 320 and 320 grids in 2015, 2014 and 2013, respectively) followed by the starfish group (292, 282 and 281 grids in 2015, 2014 and 2013, respectively) (Table 8). For fish species, American plaice (331, 323 and 325 grids in 2015, 2014 and 2013, respectively) followed by cod (239, 252 and 243 grids in 2015, 2014 and 2013, respectively) were the most frequently observed. The highest catch species for both invertebrates and fish groups has not changed in the past three years of the survey.

By-catch of sedentary invertebrate species

With changes in sampling coverage and survey vessel as well as the length of the survey (longer than three months), it is very difficult to interpret the historical catch data of by-catch species especially for fish species and other migratory species. However, the catches of sedentary benthic invertebrate species should be efficiently caught by a Nephrops trawl net that digs into the sediment and these catch trends may be used as an indication of the relative performance of the gear, assuming equal relative abundance over time of these species.

By-catch of sedentary/benthic invertebrate species or groups of species which are always present in the catch since the early 1990’s include a number of crustaceans (hermit crab, northern stone crab, lobster, rock crab, toad crab), echinoderms (basket star, sand dollar, sea cucumber, sea potato, starfish, sea urchin), molluscs (clams, mussels, octopus/squid, scallop, whelk), annelids (sea mouse, sea worms), and cnidarians (sea anemone). In the present document, jellyfish and shrimp are excluded as they are not considered to be benthic/sedentary species.

The majority of these 19 sedentary/benthic invertebrate species or groups showed a recent decline in the catch except for basket star, sea potato, clam, rock crab, northern stone crab and lobster (Fig. 12). Further in-depth analysis is necessary to elucidate the fluctuation pattern of these species/groups of species.

The increase of lobster catch in 2015 was due to high catches in three coastal stations where the bottom water temperature was above 10˚C. These occurred in grid AE23 in CFA 12 on October 12 (13 lobsters were captured at a depth at 40 m and a bottom water temperature of 11.9˚C), in grid AD25 in CFA 12 on October 13 (170 lobsters at a depth of 38 m and a bottom water temperature of 12.9˚C), and at grid AH27 in CFA 19 on October 14 (1,090 lobsters at a depth of 40 m and a bottom water temperature at 11.7˚C) (Fig. 13). In grid AE23, four snow crabs (one male and three females) were captured but at the other two stations, no snow crab were caught.

In 2015, there were four stations where the bottom temperature was above 10˚C and at only one of these stations (grid AF23 at a depth of 40m and a bottom water temperature of 12.5˚C), no lobster was caught. Since 2003, the bottom temperature at trawled stations has infrequently been above 10˚C (10.4 ˚C at grid HA34, 11.3˚C at grid HB33, 12.0˚C at grid GU35 and 12.4˚C at grid GV35 in 2003; 12.6˚C at grid HH49 in 2006; 12.0˚C at grid GY35 and 12.1˚C at grid HB37 in 2008; 10.3˚C at gird GT35 and 15.5˚C at gird HH49 in 2009; 15˚C at grid HH49 in 2011). The high temperature of 15ºC recorded in 2011 was the highest recorded temperature in the survey history.

In 2015, high bottom temperatures were situated in the southeastern portion of the southern Gulf of St. Lawrence between Cape Breton Island and Prince Edward Island at depths of around 40 m. These unusually warm temperatures may occur due to seasonally recurring strong winds that cause a sudden exchange of the surface water and bottom water (J. Chassé, DFO Gulf Region, pers. comm.).

Collecting data on by-catch species is important to monitor and understand the ecosystem and habitat of snow crab. These oceanographic and biological data are essential sources of information to monitor and understand changes in the ecosystem that will certainly be issues with climate change. In coming years, DFO intends to add the collection of surface and bottom water at selected stations to measure ocean acidity that could have an impact on organisms, including snow crab.

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TABLES

Table 1. Information on the total number of data set used, mean door spread with standard deviation of door spread, sonar type and survey vessel from 2010 to 2014.

Survey year	Count[1]	Mean Door Spread (m)[1]	Standard Deviation of Door Spread (m)	Mean swept surface (m^2)	Sonar Type	Trawl Vessel
2010	331	8.40	1.78	2,734	NetMind	Marco-Michel
2011	302	8.45	2.44	2,708	NetMind	Marco-Michel
2012	281	8.71	1.61	2,677	NetMind	Marco-Michel
2013	281	8.19	1.48	2,600	e-Sonar	Jean-Mathieu
2014	338	7.89	1.54	2,600	e-Sonar[2]	Jean-Mathieu
2015	321	7.93	1.64	2,707	e-Sonar[2]	Jean-Mathieu

[1] Estimation was made using only good tows with usable door spread and tow distance information.

[2] Using decreased maximum door spread setting from 150 m to 30 m.

Table 2. Survey performance statistics (duration of each trip, number of days at sea, number of grids sampled, number of successful tows at primary station, number of tows succeeded at alternative station(s), number of abandoned grids and frequency of serious net damage) for the 2015 trawl survey in comparison with previous surveys in 2014 and 2013.

	Trip Number										
Statistics	I	II	III	IV	V	VI	VII	VIII	IX	X	Total
2015											
Duration (day) of each trip	6	14	12	10	8	8	10	13	na	na	81
Number of days at sea (day)	3	8	7	6	5	6	6	9	na	na	50
Number of grids sampled	17	51	69	40	24	34	50	70	na	na	355
Tows completed at primary station	13	43	56	32	18	27	46	68	na	na	303
Tows completed at 1st alternate station	4	5	8	5	4	7	3	2	na	na	38
Tows completed at 2nd alternate station	0	2	4	3	1	0	1	0	na	na	11
Tows completed at 3rd alternate station	0	0	0	0	1	0	0	0	na	na	1
Number of untrawlable grids	0	1	1	0	0	0	0	0	na	na	2
Number of tows with serious net damage	1	3	3	4	11	3	3	2	na	na	30
2014											
Duration (day) of each trip	7	8	8	9	6	7	5	5	11	4	70
Number of days at sea (day)	6	5	6	6	5	3	4	3	7	2	47
Number of grids sampled	39	45	40	42	50	24	24	19	54	18	355
Tows completed at primary station	28	40	35	40	46	23	21	14	47	18	312
Tows completed at 1st alternate station	10	4	5	2	2	1	3	2	7	0	36
Tows completed at 2nd alternate station	0	0	0	0	0	0	0	3	0	0	3
Tows completed at 3rd alternate station	0	1	0	0	1	0	0	0	0	0	2
Number of untrawlable grids	1	0	0	0	1	0	0	0	0	0	2
Number of tows with serious net damage	3	3	3	1	3	0	0	1	6	0	20
2013											
Duration (day) of each trip	10	5	8	7	11	8	9	7	na	na	65
Number of days at sea (day)	7	5	7	5	7	6	6	6	na	na	49
Number of grids sampled	50	34	53	35	51	45	53	34	na	na	355
Tows completed at primary station	38	20	48	27	38	37	49	25	na	na	282
Tows completed at 1st alternate station	9	12	3	7	10	6	3	8	na	na	58
Tows completed at 2nd alternate station	1	2	2	1	2	1	1	1	na	na	11
Tows completed at 3rd alternate station	0	0	0	0	0	1	0	0	na	na	1
Number of untrawlable grids	2	0	0	0	1	0	0	0	na	na	3
Number of tows with serious net damage	3	3	2	5	5	4	2	4	na	na	28

*Table 3. Start and end time of daily fishing operations and corresponding morning (mCtwt) (sunrise) and evening (eCtwt; sunset) civil twilight times during the 2015 trawl survey. Civil twilight times were for Charlottetown, PE (46º 39' N, 63º 13' W) based on [Sunrise/sunset calculator - National Research Council Canada](). *

Trip number	Date	First tow	mCtwt	Last tow	eCtwt
1	July 9, 2015	13:18:46	4:52	20:35:24	21:43
1	July10, 2015	05:02:43	4:53	19:45:58	21:42
1	July11, 2015	06:16:04	4:54	06:21:04	21:42
2	July17, 2015	05:08:37	5:01	20:24:33	21:37
2	July 18, 2015	05:09:48	5:02	12:28:38	21:36
2	July19, 2015	20:19:33	5:03	20:24:33	21:35
2	July22, 2015	12:16:52	5:07	12:21:52	21:31
2	July 23, 2015	09:50:11	5:08	17:25:02	21:30
2	July 25, 2015	05:21:03	5:10	20:32:46	21:28
2	July 26, 2015	05:22:29	5:12	20:16:29	21:26
2	July 27, 2015	05:39:02	5:13	20:25:28	21:25
3	August 1, 2015	05:32:09	5:20	19:12:27	21:18
3	August 2, 2015	05:44:38	5:21	20:30:44	21:17
3	August 3, 2015	08:20:46	5:22	19:33:41	21:15
3	August 4, 2015	05:42:15	5:24	18:44:38	21:14
3	August 5, 2015	06:39:56	5:25	20:40:10	21:12
3	August 6, 2015	05:52:43	5:26	14:17:57	21:10
3	August 7, 2015	07:24:24	5:28	15:08:02	21:09
4	August 16, 2015	06:09:26	5:40	19:57:46	20:53
4	August 17, 2015	06:03:16	5:41	20:27:00	20:52
4	August 18, 2015	06:09:43	5:43	12:20:05	20:50
4	August 22, 2015	07:42:35	5:48	18:49:28	20:42
4	August 23, 2015	06:38:39	5:50	20:20:54	20:41
4	August 24, 2015	06:27:42	5:51	17:56:49	21:39
5	August 30, 2015	07:15:25	5:59	20:24:21	20:27
5	August 31, 2015	06:23:25	6:01	08:43:23	20:25
5	September 2, 2015	13:38:02	6:03	20:13:38	20:21
5	September 3,2015	06:21:41	6:05	17:20:59	20:19
5	September 4, 2015	06:22:43	6:06	07:30:06	20:17
6	September 8, 2015	10:24:30	6:11	19:40:55	20:09
6	September 9, 2015	07:53:07	6:13	15:54:12	20:07
6	September 10, 2015	06:34:31	6:14	19;34:05	20:05
6	September 11, 2015	08:48:06	6:15	12:25:23	20:03
6	September 13, 2015	11:46:19	6:18	19:23:07	19:59
6	September 14, 2015	06:45:50	6:19	10:14:16	19:57
7	September 17, 2015	06:37:37	06:23	18:05:50	19:51
7	September 18, 2015	06:34:24	06:24	19:40:30	19:49
7	September 19, 2015	06:38:39	06:26	13:40:12	19:47
7	September 22,2015	06:40:51	6:29	19:12:56	19:41
7	September 23,2015	07:35:58	6:31	19:22:31	19:39
7	September 24,2015	08:03:33	6:32	10:26:59	19:37
8	October 4, 2015	07:59:32	6:45	15:17:57	19:17
8	October 5, 2015	07:00:18	6:46	19:05:58	19:16
8	October 6, 2015	06:57:26	6:48	18:07:01	19:14
8	October 7, 2015	07:50:09	6:49	18:21:34	19:12
8	October 9, 2015	07:04:52	6:52	18:05:09	19:08
8	October 12, 2015	07:09:24	6:55	18:04:30	19:02
8	October 13, 2015	07:03:58	6:57	17:27:57	19:01
8	October 14, 2015	13:07:18	6:58	18:12:32	18:59
8	October 15, 2015	07:10:41	6:59	12:15:30	18:57

Table 4. Number of grids sampled in total and by quality of tow (QT) for surveys in 1997 to 2015.Quality of tow labels are as follows: QT1 = successful trawl catch with acceptable area swept data at primary station; QT2 = successful trawl catch with unusable area swept data; QT3 = successful tow at the first alternative station (A1) with acceptable area swept data; QT4 = successful tow at the first alternative station (A1) with unusable area swept data, QT5 = successful tow at the second alternative station (A2) with acceptable area swept data, QT6 = successful tow at the second alternative station (A2) with unusable area swept data, QT7 = successful tow at the third alternative station (A3) with acceptable area swept data, QT8 = successful tow at the third alternative station (A3) with unusable area swept data, QT9 (Abd) = unsuccessful tows and grid deemed to be untrawlable (Abd).

Survey year	Total successful tows	Primary		A1		A2		A3		Qt9 (Abd)	Total tows attempted
		QT1	QT2	QT3	QT4	QT5	QT6	QT7	QT8		
1997	259	190	51	15	3	0	0	0	0	0	277
1998	261	152	95	9	3	1	1	0	0	0	277
1999	277	127	127	14	6	1	2	0	0	0	303
2000	280	232	30	10	1	6	0	0	0	0	302
2001	292	253	15	13	7	1	2	1	0	0	321
2002	319	285	13	15	4	1	1	0	0	0	342
2003	317	283	10	13	1	6	1	3	0	0	354
2004	333	271	46	4	5	6	0	1	0	0	357
2005	344	290	11	32	3	8	0	0	0	0	395
2006	354	294	34	17	1	8	0	0	0	1	395
2007	355	294	31	13	3	12	1	1	0	0	400
2008	355	284	37	23	0	8	1	2	0	0	402
2009	355	293	39	10	0	11	1	0	0	0	388
2010	354	285	32	23	7	7	0	0	0	1	401
2011	353	274	46	24	3	3	2	1	0	2	401
2012	321	220	50	36	5	7	1	2	0	4	400
2013	352	230	52	45	13	10	1	1	0	3	447
2014	353	295	17	36	0	2	1	2	0	2	409
2015	353	275	28	36	3	9	1	1	0	2	423

Table 5. Number of mature and immature males captured during the survey, mean number of immature, mature, and total male crabs per tow (unadjusted for swept area), and estimated mean density (number per km²) of total (mature and immature) male crabs during 1997 to 2015.

	Total counts		Crabs/tow			Mean density
Year	Immature	Mature	Immature	Mature	Total	(number per km²)
1997	10,996	3,134	42.5	12.1	54.6	24,322
1998	12,300	3,848	47.1	14.7	61.8	26,563
1999	13,948	5,489	50.4	19.8	70.2	28,035
2000	13029	5,249	46.5	18.8	65.3	23,779
2001	12,962	5,405	44.4	18.5	62.9	23,208
2002	10,574	5,500	33.1	17.2	50.3	20,417
2003	11,468	6,301	36.2	19.9	56.1	19,613
2004	10,424	6,655	30.0	19.2	49.2	15,424
2005	8,590	4,910	24.2	13.8	38.0	13,863
2006	7,923	4,364	22.4	12.3	34.7	12,252
2007	8,279	3,964	23.3	11.2	34.5	12,602
2008	8,705	3,502	24.5	9.9	34.4	13,007
2009	9,030	2,954	25.4	8.3	33.7	11,954
2010	12,514	3,800	35.4	10.7	46.1	16,818
2011	11,316	5,073	32.1	14.4	46.5	16,959
2012	10,019	4,778	31.2	14.9	46.1	17,036
2013	8281	3,961	23.5	11.3	34.8	13,383
2014	9736	4,129	27.6	11.7	39.3	15,228
2015	11,498	3,755	32.6	10.6	43.2	16,317

Table 6. Number of commercial-sized (>= 95 mm carapace width) adult male crabs captured during the survey, mean number of crabs per tow (unadjusted for swept area), estimated mean weight of commercial-sized adult crab, and estimated mean density (number per km²) of commercial crab, 1997 to 2015.

Year	Number of crabs sampled	Crabs per tow	Mean weight (g)	Mean density (number per km^2)
1997	1,335	5.2	600	2,383
1998	1,419	5.4	596	2,258
1999	1,472	5.3	563	2,166
2000	1,346	4.8	587	1,798
2001	1,724	5.9	540	2,168
2002	1,913	6.0	546	2,530
2003	2,682	8.5	560	3,150
2004	3,321	9.6	577	3,221
2005	2,327	6.8	585	2,656
2006	2,302	6.5	616	2,558
2007	1,911	5.4	610	2,252
2008	1,431	4.0	611	1,787
2009	900	2.5	610	1,029
2010	1,057	3.0	607	1,280
2011	1,970	5.6	584	2,036
2012	2,093	6.5	566	2,359
2013	1,886	5.4	596	1,994
2014	1,884	5.3	581	2,011
2015	1,741	4.9	584	1,784

Table 7. Number of mature and immature females captured during the survey, mean catch number of immature, mature and total female crabs per tow (unadjusted for swept area), and estimated mean density (number per km²) of female crab (mature and immature combined) during 1997 to 2015.

	Total counts		Mean catch per tow			Density
Year	Immature	Mature	Immature	Mature	Total	(number per km²)
1997	7,577	6,663	29.3	25.7	55.0	23,975
1998	7,176	7,753	27.5	29.7	57.2	24,486
1999	6,168	11,109	22.3	40.1	62.4	24,792
2000	3,966	11,168	14.2	39.9	54.1	19,931
2001	1,746	12,128	6.0	41.5	47.5	17,696
2002	1,610	10,775	5.0	33.8	38.8	15,246
2003	2,655	10,677	8.4	33.7	42.1	14,534
2004	3,366	9,578	9.7	27.6	37.3	12,129
2005	3,718	6,633	10.5	18.7	29.2	10,611
2006	4,527	4,490	12.8	12.7	25.5	9,062
2007	5,489	5,069	15.5	14.3	29.8	10,716
2008	5,063	4,969	14.3	14.0	28.3	10,649
2009	4,590	5,118	12.9	14.4	27.3	9,680
2010	5,983	7,841	16.9	22.2	39.1	14,079
2011	5,467	7,866	15.5	22.28	37.7	13,796
2012	5,271	7,470	16.4	23.3	39.7	14,690
2013	3,055	6,231	8.7	17.7	26.4	10,062
2014	3,939	6,700	11.2	19.0	30.2	11,404
2015	4,904	7,398	13.9	21.0	34.9	12,822

Table 8. Summary of total catches (by number and total weight in kg) by species of invertebrates and fish, and number of grids sampled where the species were present in the catches of the survey in 2013 to 2015. [1] Identified only to group, not to genus or species. A dash indicates no catch or for snow crab total weights are not recorded.

		2015			2014			2013		
Species common name	Latin name	Count	Grids	Weight (kg)	Count	Grids	Weight(kg)	Count	Grid	Weight (kg)
Invertebrates										
Anemone	[1] Actiniaria	1,984	74	154	990	65	187	11,161	66	195
Basket star	*Gorgonocephalus sp*	3,326	137	690	2,525	132	522	2,658	142	567
Brittle star*	Ophiuroidea	445	15	251		14	389		13	453
Hermit crab*	*Pagurus sp.*	469	115	17	509	111	17	693	126	22
Toad Crab (Hyas araneus)	*Hyas araneus*	597	82	70	352	81	42	397	82	60
Toad Crab (H. coarctatus)	*Hyas coarctatus*	1,610	168	111	1,326	154	93	794	140	70
Iceland clam	*Clinocardium islandicum*	1,121	19	49	45	11	3	498	22	20
Jellyfish*	*Atolla sp.*	-	-	-	7	1	< 1	126	71	51
Lobster	*Homarus americanus*	1,283	11	342	59	5	20	55	3	18
Mussel*	*Mytilidae*	10	5	687	-	-	-	2	2	< 1
Northern stone crab	*Lithodes maja*	71	30	30	113	28	37	133	27	43
Octopus/Bobtail squid*	*Rossia spp, Bathypolypus bairdii*	19	11	1	5	5	< 1	9	6	< 1
Quahog	*Arctica islandica*	192	17	10	277	10	14	34	11	2
Rock crab	*Cancer irroratus*	209	8	19	38	7	4	30	8	4
Sand dollar	*Echinarachnius parma*	12,220	74	247	11,000	87	315	9,010	86	159
Scallop	*Placopecten magellanicus*	77	19	6	33	16	3	72	23	9
Sea cucumber*	[1] Holothuroidea	461	66	172	711	82	334	730	73	305
Sea mouse	*Aphrodita hastate*	15	6	2	10	3	< 1	170	17	6
Sea potato	*Boltenia ovifera*	1,831	101	190	1,619	72	170	1,932	83	204
Sea urchin*	*Strongylocentrotus sp.*	14,997	202	582	15,672	214	748	16,669	213	63
Sea worm*	*Polychaeta sp.*	1	1	< 1	1	1	< 1	1	1	< 1
Shrimp*	[1] *Decapoda*	8,828	95	46	3,947	75	44	18,436	120	74
Snow crab	*Chionoecetes opilio*	27,734	323	na	24,504	320	-	21,621	320	-
Soft shelled clam	*Mya arenaria*	-	-	-	-	-	-	-	-	-
Sponge*	[1] *Porifera*	20	41	80	85	30	47	195	38	71
Squid	*Illex illecebrosus*	-	-	-	2	2	< 1	2	2	< 1
Starfish*	[1] Asteroidea	8,076	291	533	3,976	282	548	16,447	281	515
Whelk*	[1] Buccinidae	710	154	30	858	148	31	879	156	30
Whelk eggs*	[1] Buccinidae	106	38	6	97	35	4	118	36	7
Fish										
Alewife	*Alosa pseudoharengus*	1	1	< 1	-	-	-	2	1	< 1
American plaice	*Hippoglossoides platessoides*	35,915	331	3,012	32,095	323	2,734	28,209	325	2,135
Arctic hookear sculpin	*Artediellus uncinatus*	-	-	-	8	2	1	8	3	1
Arctic stughorn sculpin	*Gymnocanthus tricuspis*	834	137	59	772	126	58	1,026	114	72
Atlantic alligatorfish	*Aspidophoroides monopterygius*	151	52	2	53	28	1	130	45	2
Atlantic cod	*Gadus morhua*	4,002	239	1,502	5,175	252	2,207	3,179	243	855

		2015			2014			2013		
Species common name	Latin name	Count	Grids	Weight (kg)	Count	Grids	Weight(kg)	Count	Grid	Weight (kg)
Atlantic eelpout	*Lycodes terraenovae*	5	3	1	10	9	3	12	7	1
Atlantic hookear sculpin	*Artediellus atlanticus*	1	1	< 1	12	3	1	4	3	< 1
Atlantic poacher	*Leptagonus decagonus*	211	60	7	230	75	6	203	82	6
Atlantic wolf fish	*Anarhichas lupus*	12	6	6	77	32	3	9	5	2
Capelin	*Mallotus villosus*	184	10	2	684	32	10	913	39	10
Common wolf eel	*Lycenchelys paxillus*	5	5	2	9	7	3	1	1	< 1
Dogfish	*Centroscyllium fabricii*	3	2	1	8	3	4	3	2	2
Doubed shanny	*Leptoclinus maculatus*	1	1	< 1	1	1	< 1	8	7	< 1
Four-beareded rockling	*Enchelyopus cimbrius*	52	23	3	44	20	2	33	18	2
Fourline skate blenny	*Eumesogrammus praecisus*	59	31	3	77	32	3	45	27	2
Greenland halibut	*Reinhardtius hippoglossoides*	68	25	34	62	20	29	51	22	33
Grubby sculpin	*Myoxocephalus aenaeus*	8	6	6	47	15	5	13	5	1
Haddock	*Melanogrammus aeglefinus*	10	3	8	6	3	4	12	3	4
White Hake	*Urophycis tenuis*	361	38	136	289	26	89	289	26	89
Halibut	*Hippoglossus hippoglossus*	9	9	67	11	10	30	10	8	55
Herring	*Clupea harengus*	241	23	30	104	8	17	368	7	49
Laval's eelpout	*Lycodes lavalaei*	171	94	70	112	73	41	126	71	51
Longfin hake	*Phycis chesteri*	73	9	9	78	8	8	78	5	6
Longhorn Sculpin	*Myoxocephalus octodecemspinosus*	210	36	26	165	32	22	224	36	27
Lumpfish	*Cyclopterus lumpus*	4	4	1	3	3	2	9	9	1
Mackerel	*Scomber scombrus*	2	2	< 1	-	-	-	-	-	-
Monkfish	*Lophius americanus*	3	3	17	2	2	4	5	5	11
Moustache sculpin	*Triglops murrayi*	281	73	5	31	16	1	95	46	2
Redfish	*Sebastes sp.*	1,690	75	209	2,279	77	291	1,166	64	181
Rock cod	*Gadus ogac*	49	10	20	51	17	18	12	9	4
Roundnose grenadier	*Nezumia bairdii*	409	24	13	388	22	14	427	20	17
Sea raven	*Hemitripterus americanus*	30	9	15	14	8	6	31	18	7
Sea tadpole	*Careproctus reinhardti*	2	2	< 1	3	3	< 1	1	1	< 1
Shorthorn Sculpin	*Myoxocephalus scorpius*	119	41	23	146	46	19	144	62	32
Silver hake	*Merluccius bilinearis*	16	8	5	18	11	4	49	17	10
Skate eggs*	[1] *Rajidae egg case*	23	3	< 1	7	3	< 1	512	13	4
Smelt	*Osmerus mordax*	218	27	3	1	1	< 1	-	-	-
Smooth skate	*Malacoraja senta*	117	34	59	99	26	52	141	32	60
Snake blenny	*Lumpenus lampretaeformis*	124	27	3	165	23	3	119	30	2
Spatulate sculpin	*Icelus spatula*	19	3	1	74	33	2	64	31	2
Spiny lump sucker	*Eumicrotremus spinosus*	58	42	3	29	25	1	16	15	1
Spotted wolf fish	*Anarhichas minor*	2	1	< 1	-	-	-	1	1	< 1
Stout eel blenny	*Anisarchus medius*	3	1	< 1	-	-	-	-	-	-
Thorny skate	*Amblyraja radiata*	520	68	188	359	76	180	394	72	120
Two horn sculpin	*Icelus bicornis*	167	41	4	134	34	3	105	32	3
Variegated snailfish	*Liparis gibbus*	723	59	40	283	40	17	224	41	18
Winter flounder	*Pseudopleuronectes*	542	11	52	118	9	18	223	13	27

		2015			2014			2013		
Species common name	Latin name	Count	Grids	Weight (kg)	Count	Grids	Weight(kg)	Count	Grid	Weight (kg)
Winter skate	*Leucoraja ocellata*	2	1	< 1	11	10	14	28	15	20
Witch flounder	*Glyptocephalus cynoglossus*	724	75	199	859	85	230	765	72	202
Wolf eelpout	*Lycenchelys verrillii*	1	1	2	-	-	-	3	2	< 1
Wrymouth	*Cryptacanthodes maculatus*	1	1	< 1	-	-	-	2	1	< 1
Yellowtail flounder	*Limanda ferruginea*	2,236	74	133	1,314	77	84	2,165	100	132

FIGURES

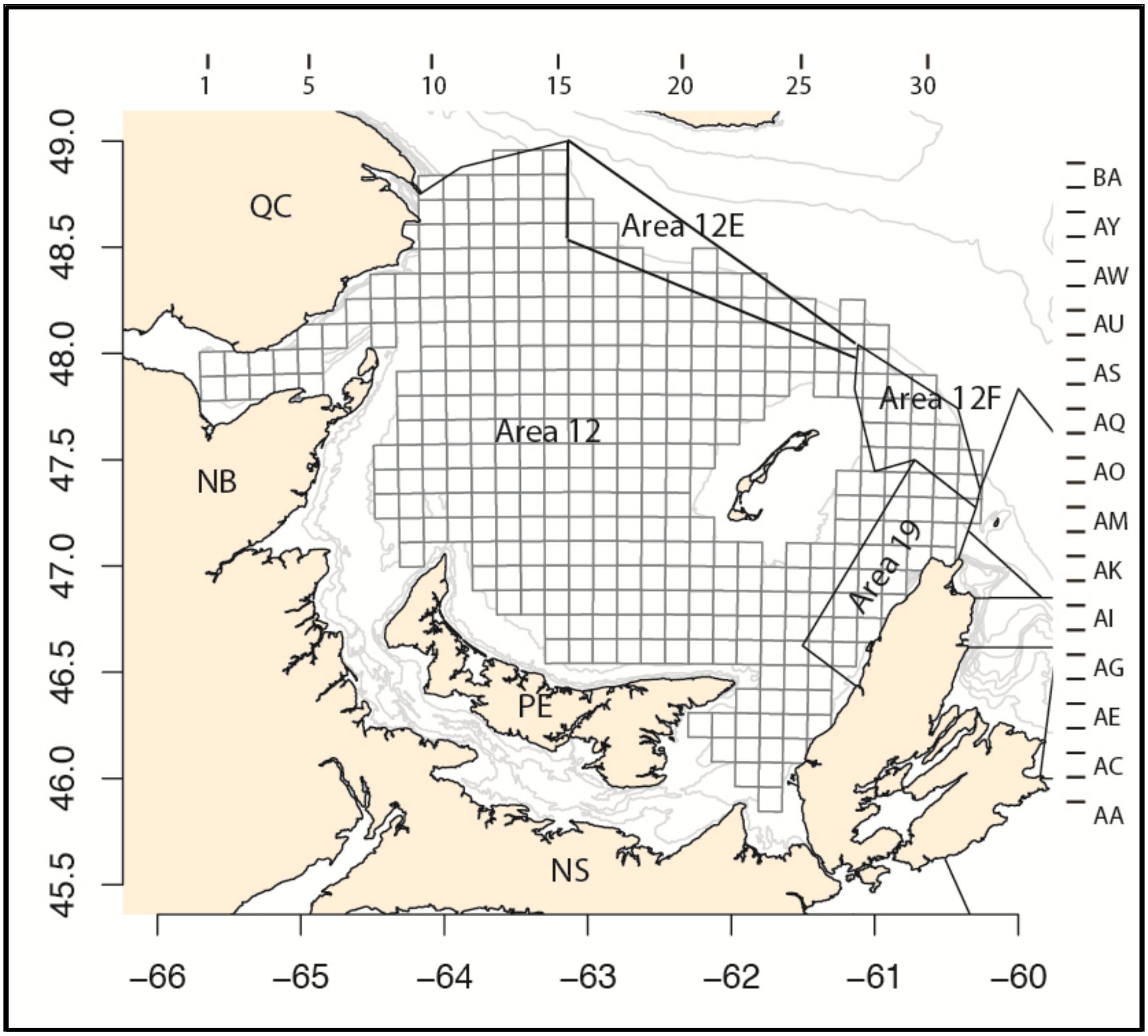

Figure 1. Snow crab trawl survey grid sampling design for the southern Gulf of St. Lawrence deployed since 2013. There are a total of 355 sampling grids defined by squares measuring 12.7 by 12.7 kilometres.

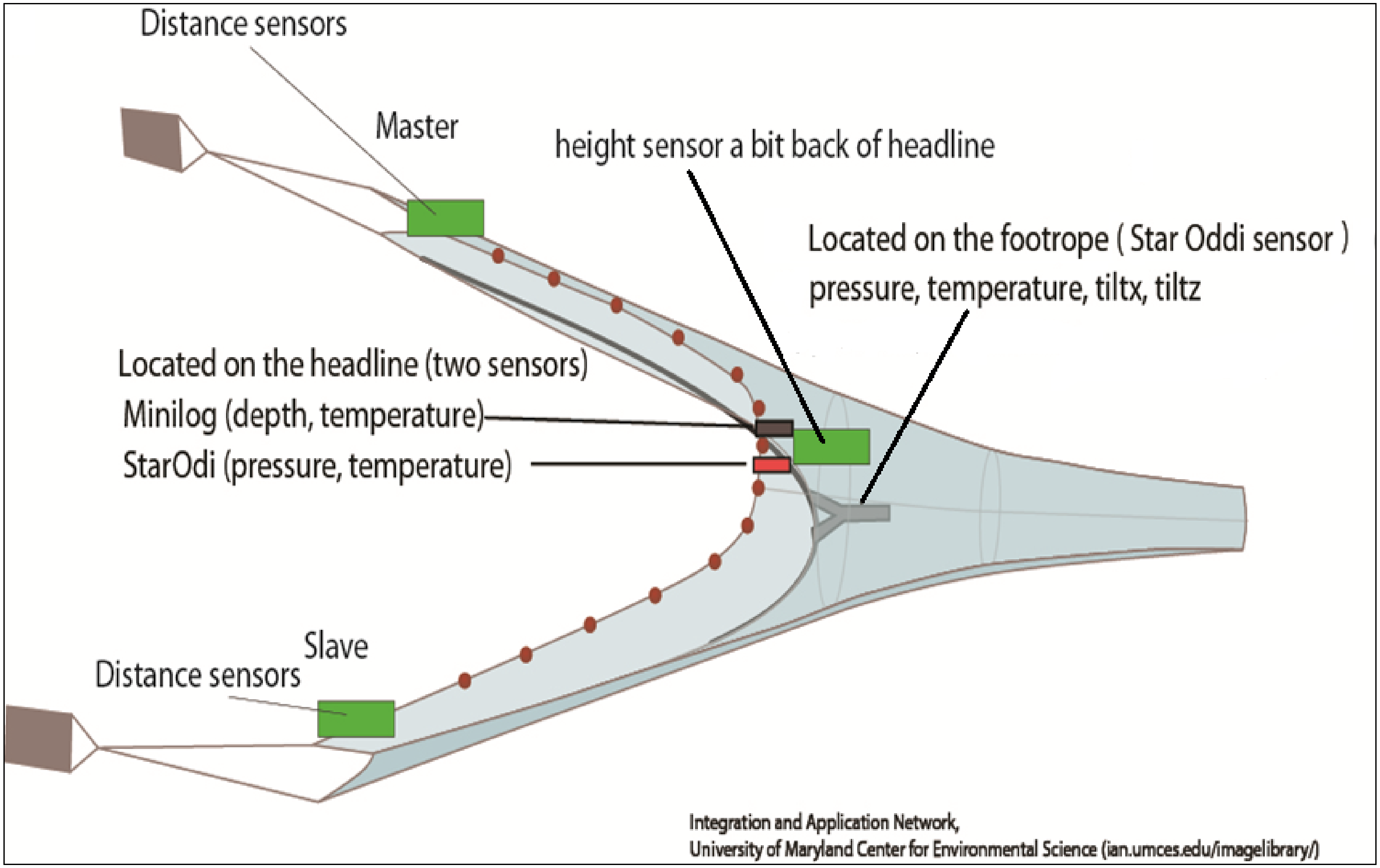

Figure 2. Schematic view of the various sensors deployed for the 2015 snow crab bottom trawl survey. e-Sonar net sensors (a pair of distance sensors and height sensor), Star Oddi temperature/depth sensors, and temperature/depth/tilt sensor together with a Vemco mini-log temperature/depth sensor.

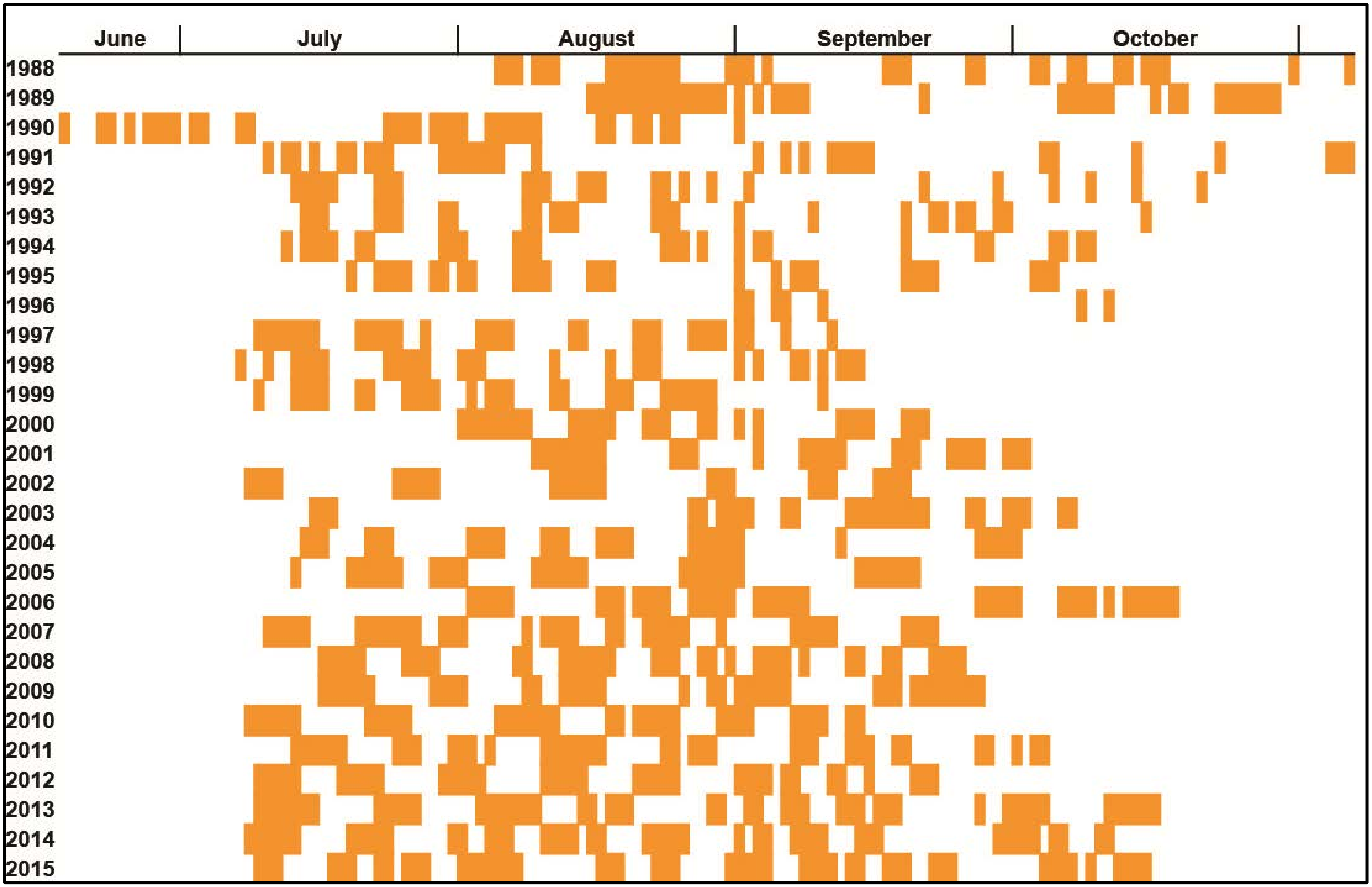

Figure 3. Timing and duration of the snow crab bottom trawl surveys, 1988 to 2015.

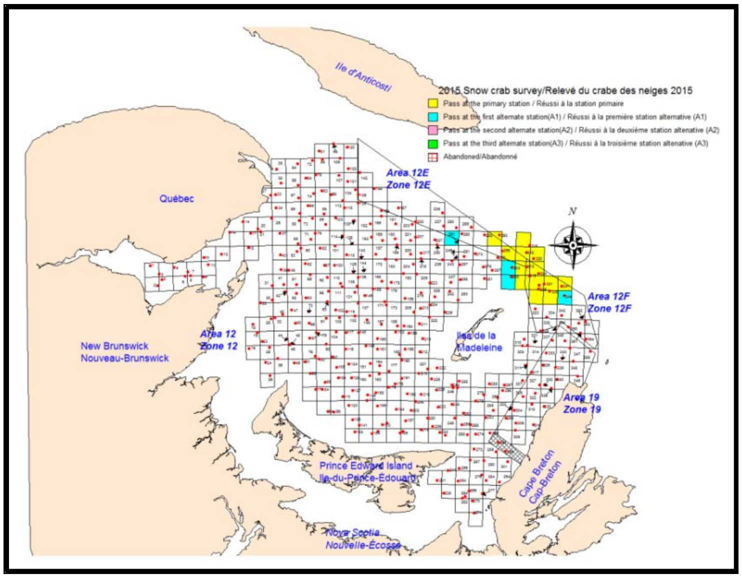

Figure 4a. The first trip departed from the port of Cheticamp on July 9 and trawled in the Area 12/12E and 12F. The trip was shortened due to mechanical problems (variable pitch) of the vessel. The vessel docked in Gaspe (QC) after 3 days of work at sea until the following departure on July 17. One net was damaged.

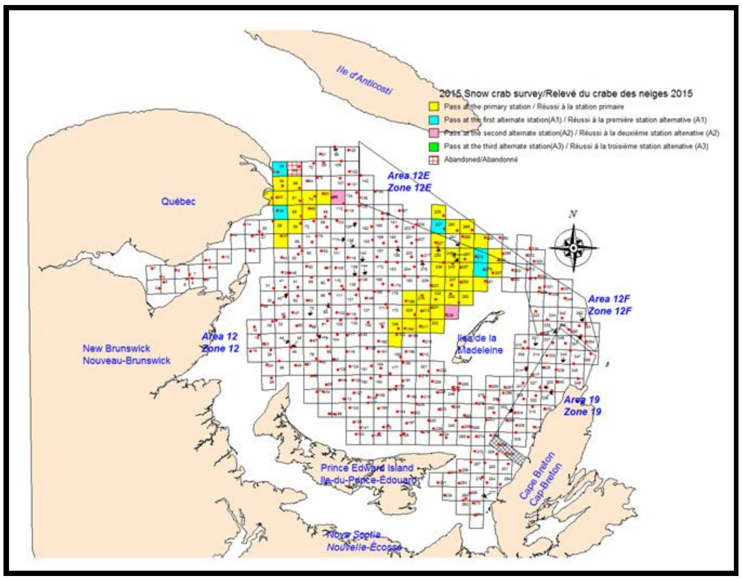

Figure 4b. The second trip departed from Gaspe on July 17 and conducted sampling off Gaspesie and in the north of Magdalen Islands including Area 12E and back to Magdalen Islands. One station off Cape-Rosier was abandoned. Three nets were damaged among which one net was completely damaged and not reparable during the 2015 survey period.

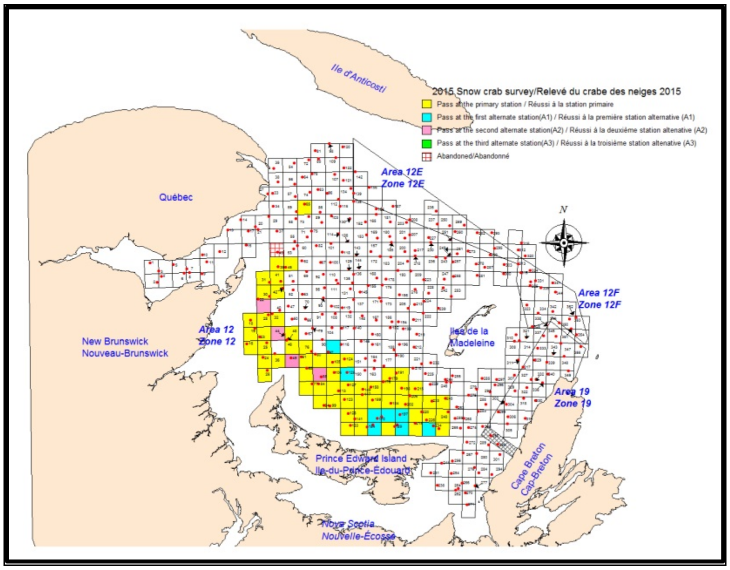

Figure 4c. The third trip departed from Magdalen Islands on August 1, sampled off Prince Edward Island and the Shediac Valley and returned to Gaspe on August 7 due to mechanical problem (hydraulic system) until the following departure on August 16. Total of 68 were successfully trawled. However, one station off Miscou Island was abandoned after 4 trials. Three nets were damaged.

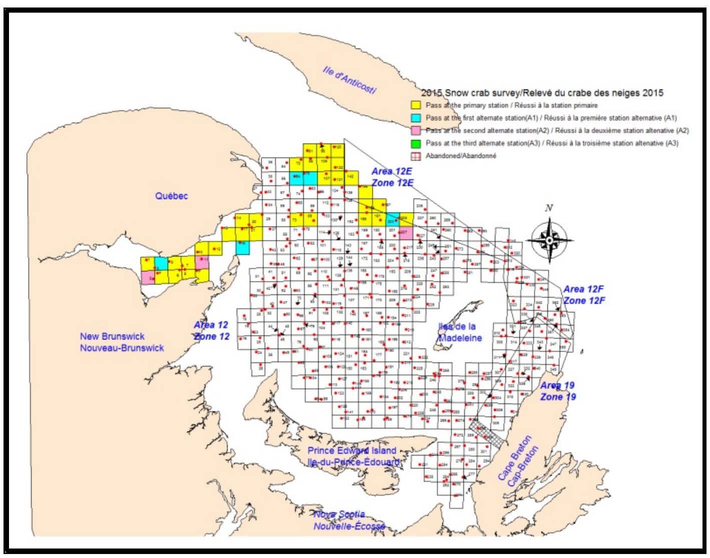

Figure 4d. The fourth trip started from Gaspe and sampled mainly in Chaleur Bay, but it was interrupted due to hydraulic system problem again and returned to Gaspe. After 3 days of inactivity, the survey resumed sampling off Gaspe then returned to Magdalen Islands on August 24. Four nets were damaged but were repaired before the next departure. No serious net damage occurred.

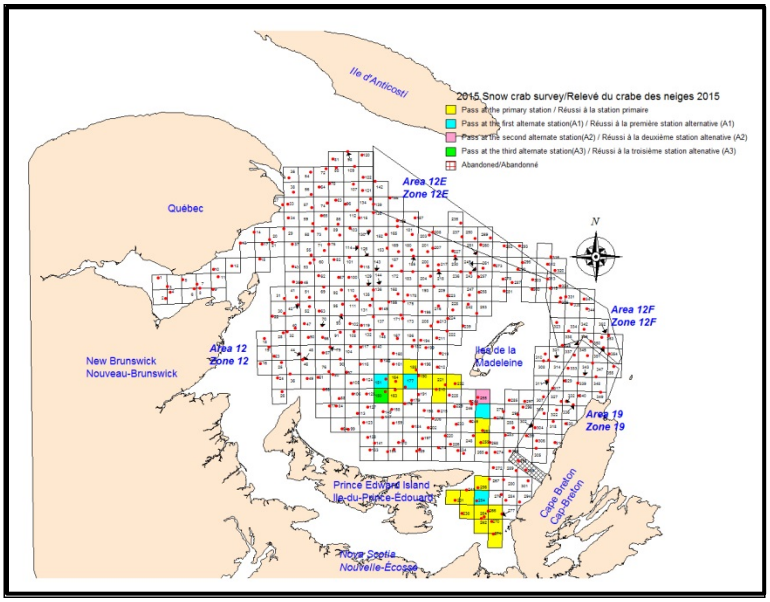

Figure 4e. The fifth trip departed from Cap-aux-Meules and trawled in Area 18 towards St. George's Bay and off the southern tip of Magdalen Islands. The trip was shortened due to high wind and boat's mechanical problem and returned to the Magdalen Islands on September 4. Only twenty four (24) stations were trawled with success without any abandoned stations. The number of damaged nets (14) was the highest since the beginning of the survey in 2015.

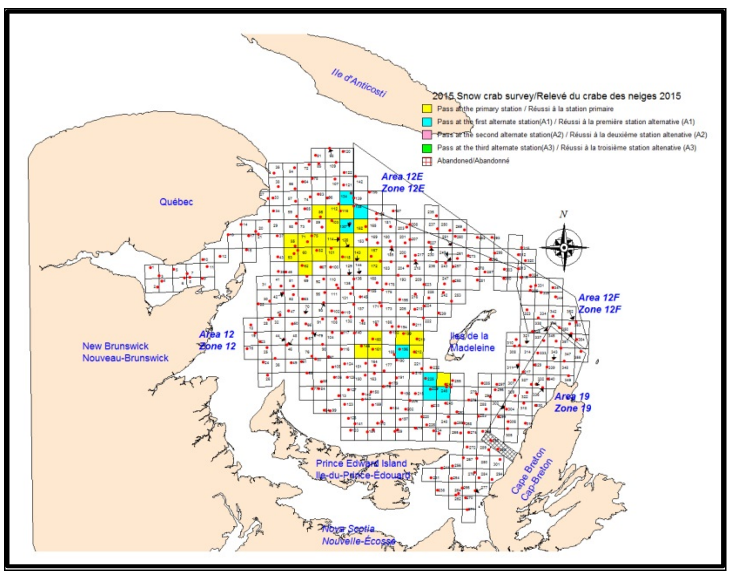

Figure 4f. The sixth trip departed from Cap-aux-Meules on September 8 and trawled in the northern Bradelle Bank and southern part of Magdalen Islands, and returned to Caraquet (NB) on September 14 with almost two full days of waiting period at wharf due to strong winds. In total, thirty-four (34) stations were trawled with success without any abandoned station. The number of damaged net was low (3) compared to the previous trip.

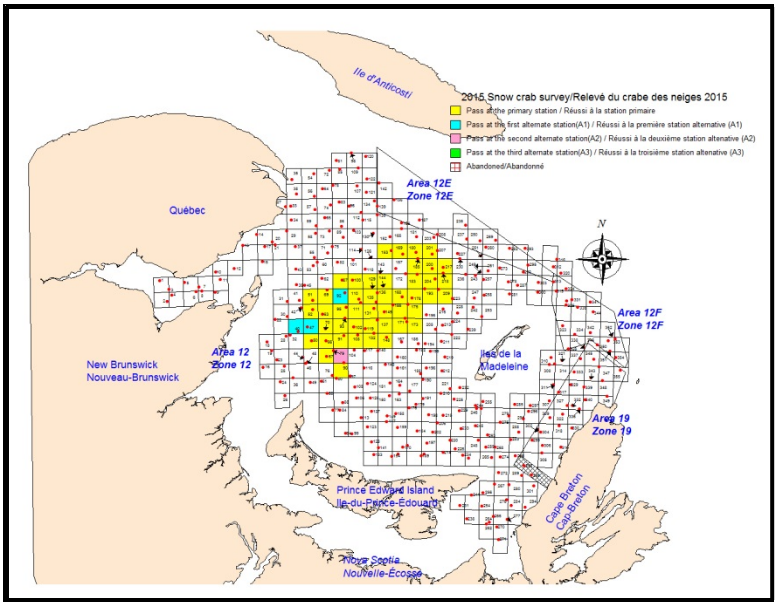

Figure 4g. The seventh trip departed from Caraquet on September 17 and trawled in Bradelle Bank and returned to Cap-aux-Meules on September 24. The length of this trip was shortened due to strong winds (September 20 and 21). Fifty (50) stations were trawled with success without any abandoned station. The number of damaged net was low (3).

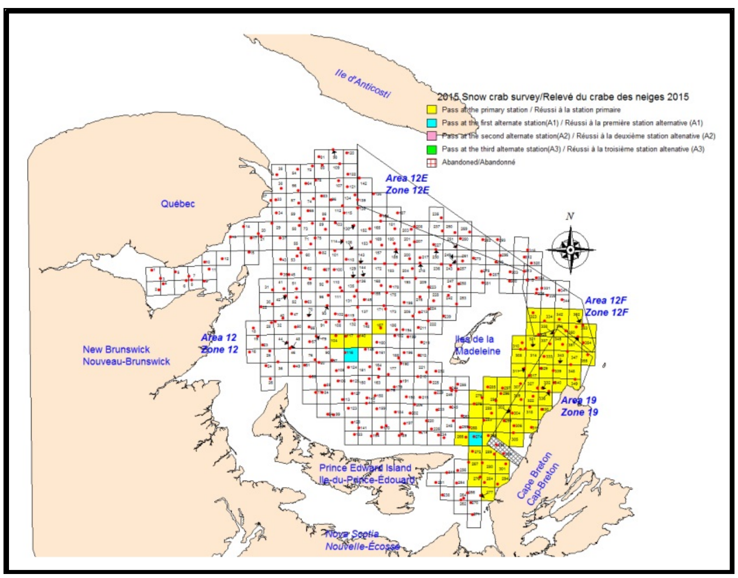

Figure 4h. After a long waiting period (9 days since September 25th) due to high winds, the eighth and last trip started on October 4. The trip departed Cap-aux-Meules on October 4 and trawled the remaining stations in the southern part of Bradelle Bank and Area 12F and 19. The length of this trip was extended due to strong winds (October 8, 10 and 11). Seventy (70) stations distributed namely in Area 19 were trawled with success without any abandoned station. On October 15 last 2 stations were trawled and the vessel sailed to Cheticamp to unload equipment. There were two damaged nets.

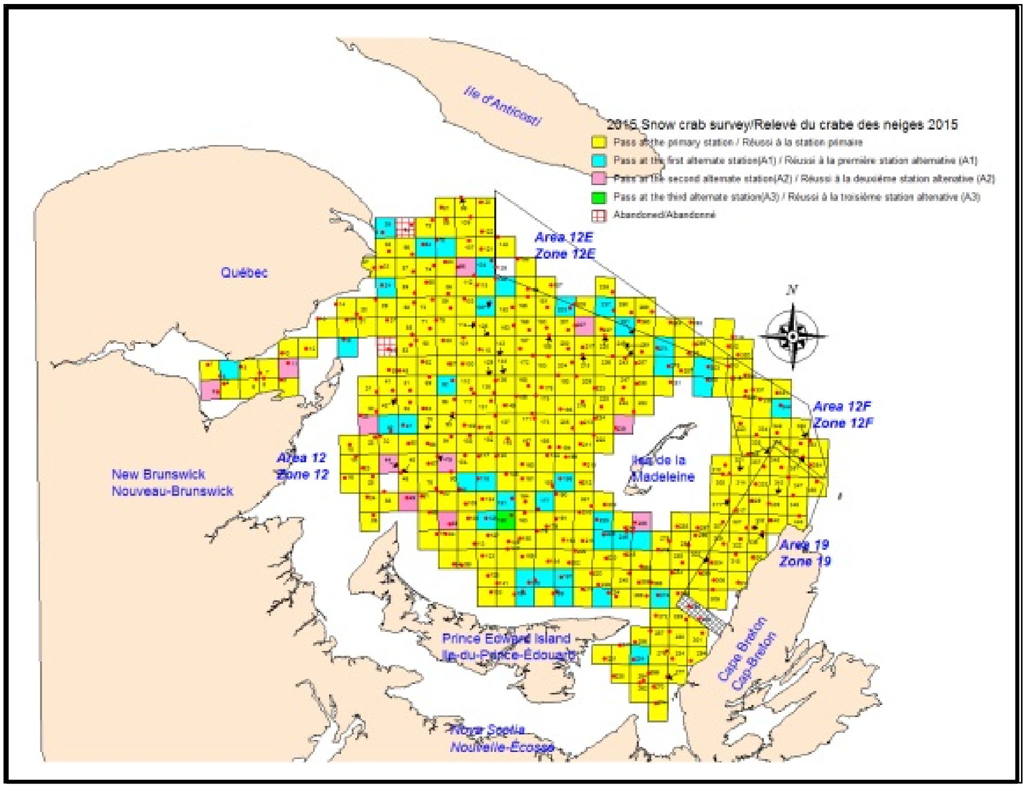

Figure 5. Summary of the 2015 trawl survey showing the geographic distribution of grids by tow quality.

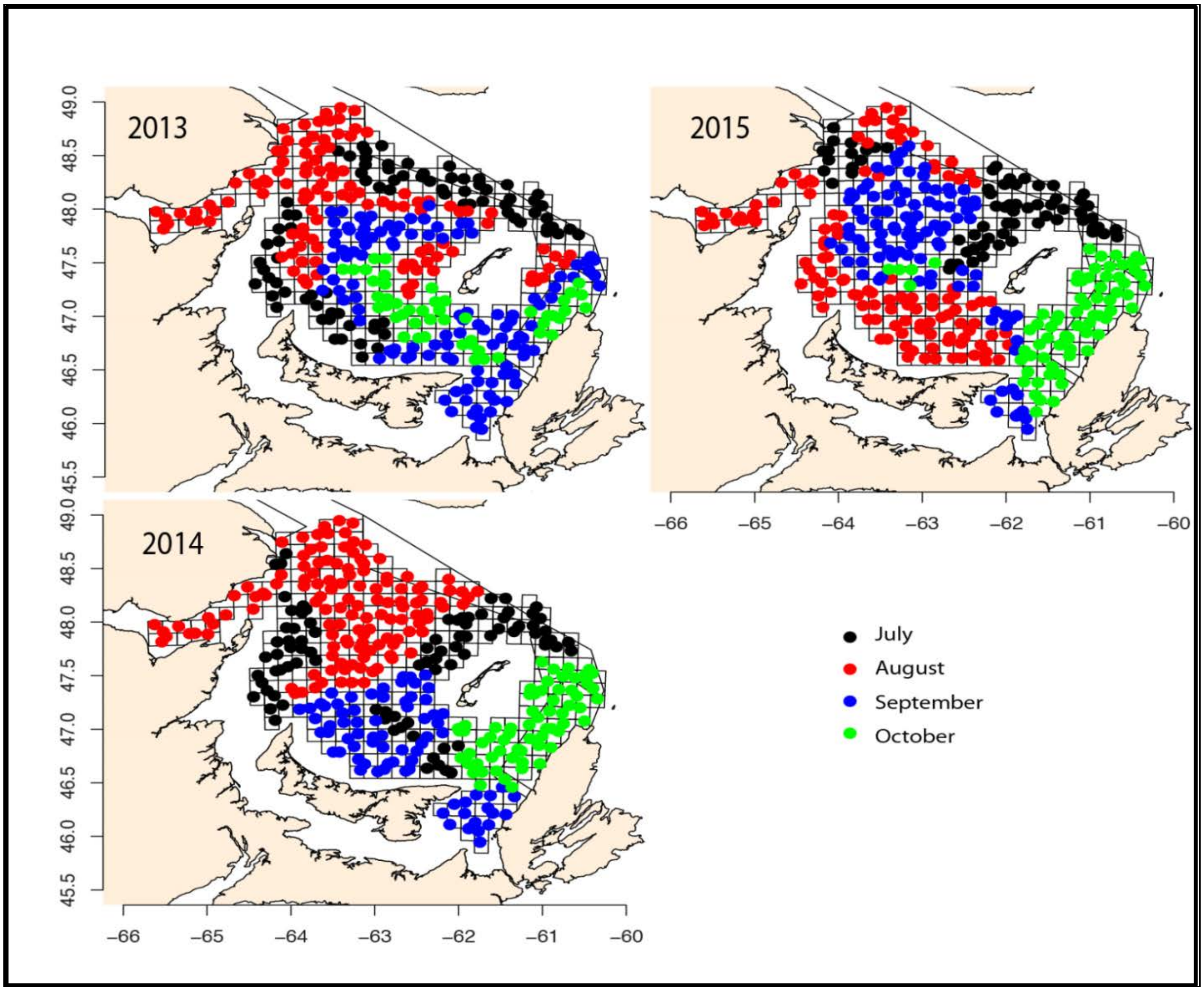

Figure 6. Monthly geographic distributions of visited stations during the snow crab survey between 2013 and 2015.

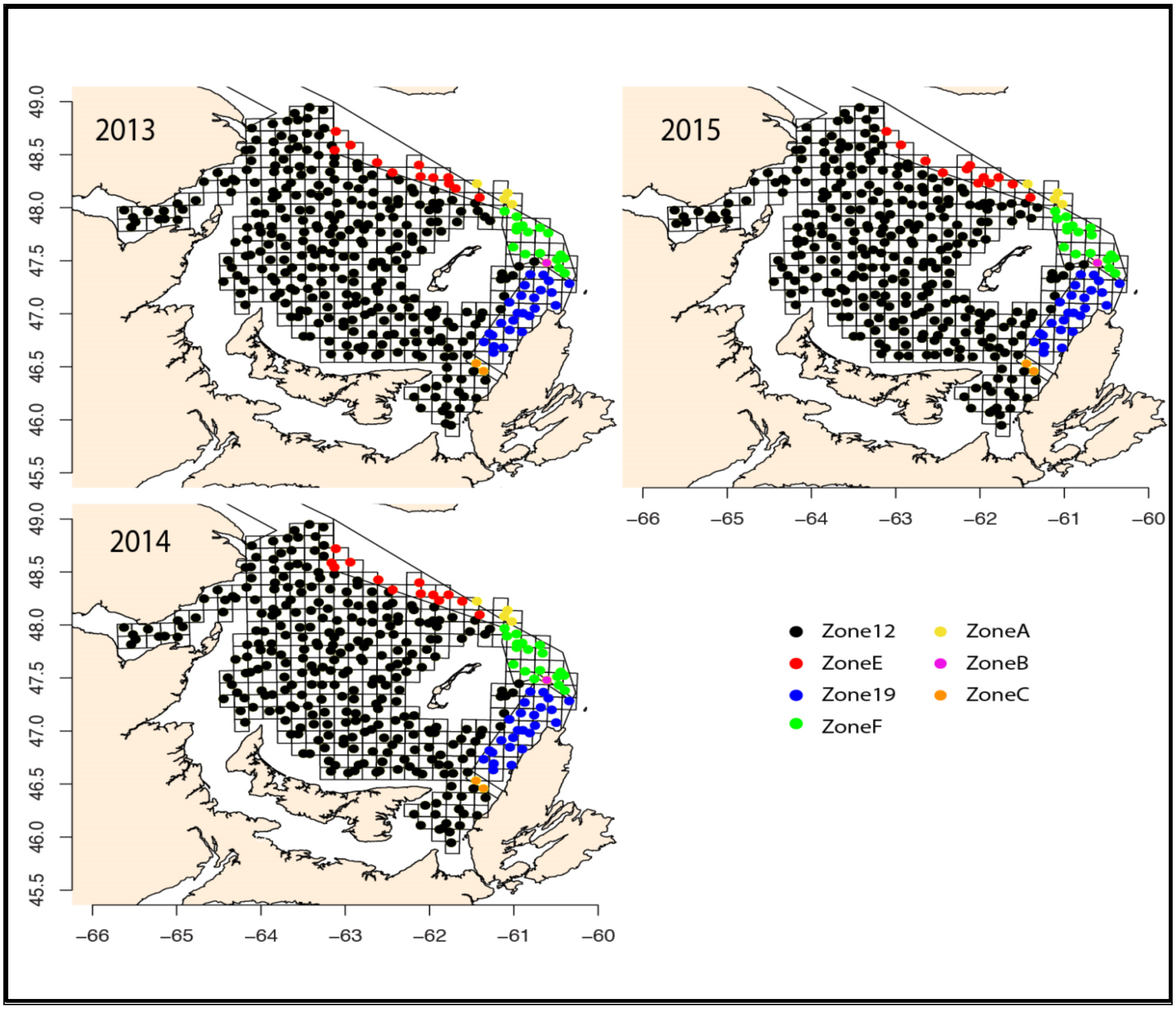

Figure 7. Geographic distribution of trawl stations by crab fishing zone (12, E, 19, F, Zone A, B and C).

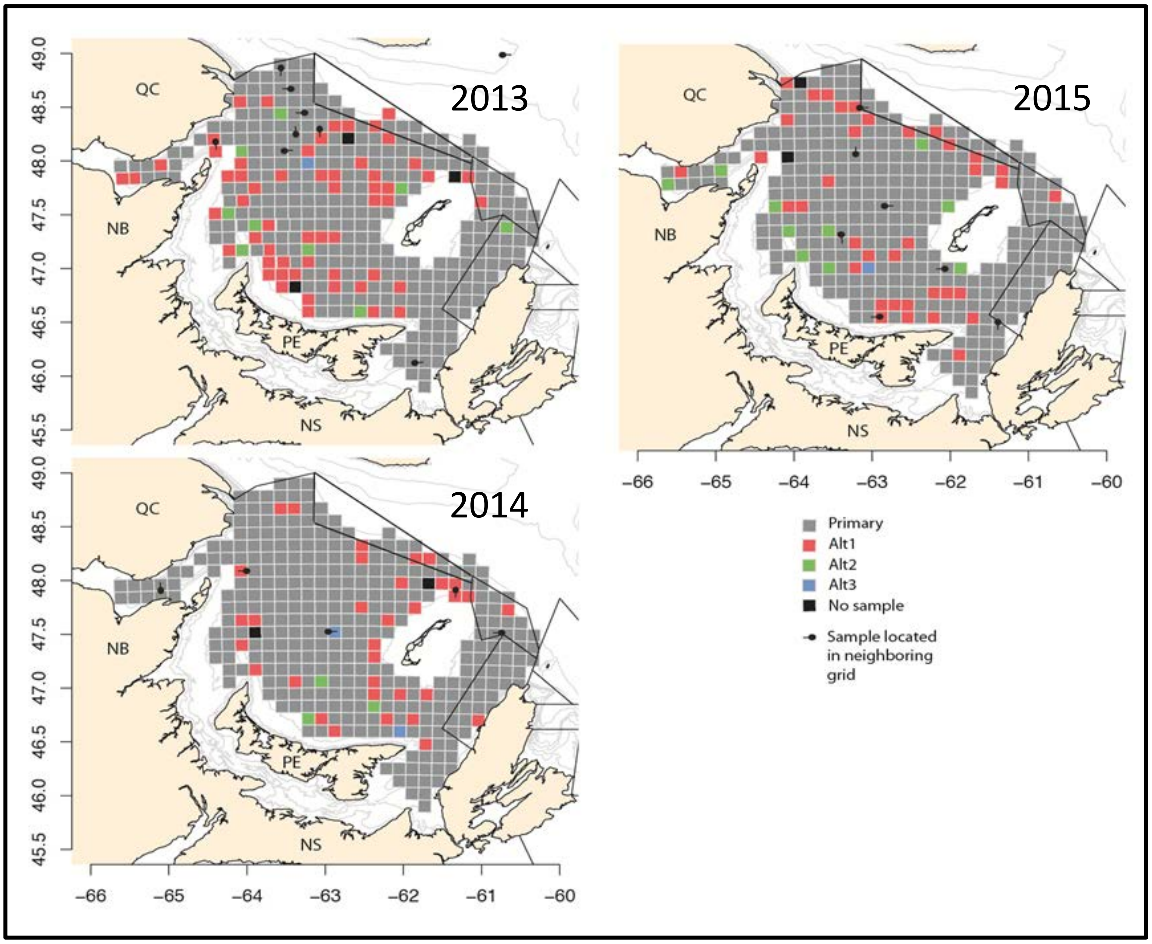

Figure 8. Geographic presentation of trawl tow quality and characteristics showing primary, alternative 1, alternative 2, alternative 3 and abandoned grids together with targeted grids not realized in annual trawl surveys of 2013 to 2015.

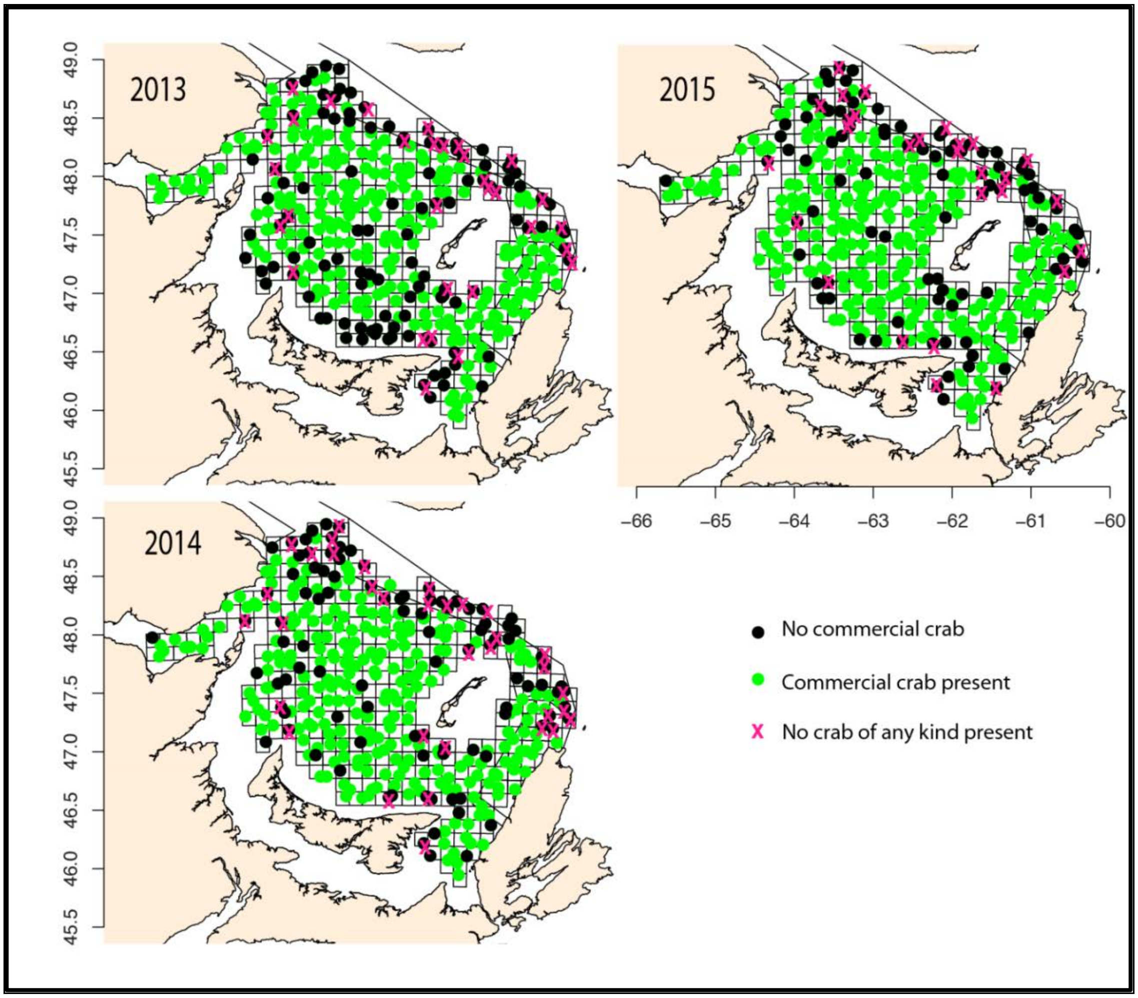

Figure 9. Geographic distribution of grids with no commercial sized snow crab captured, commercial sized snow crab captured, and no snow crab of any size captured during the trawl surveys of 2013 to 2015.

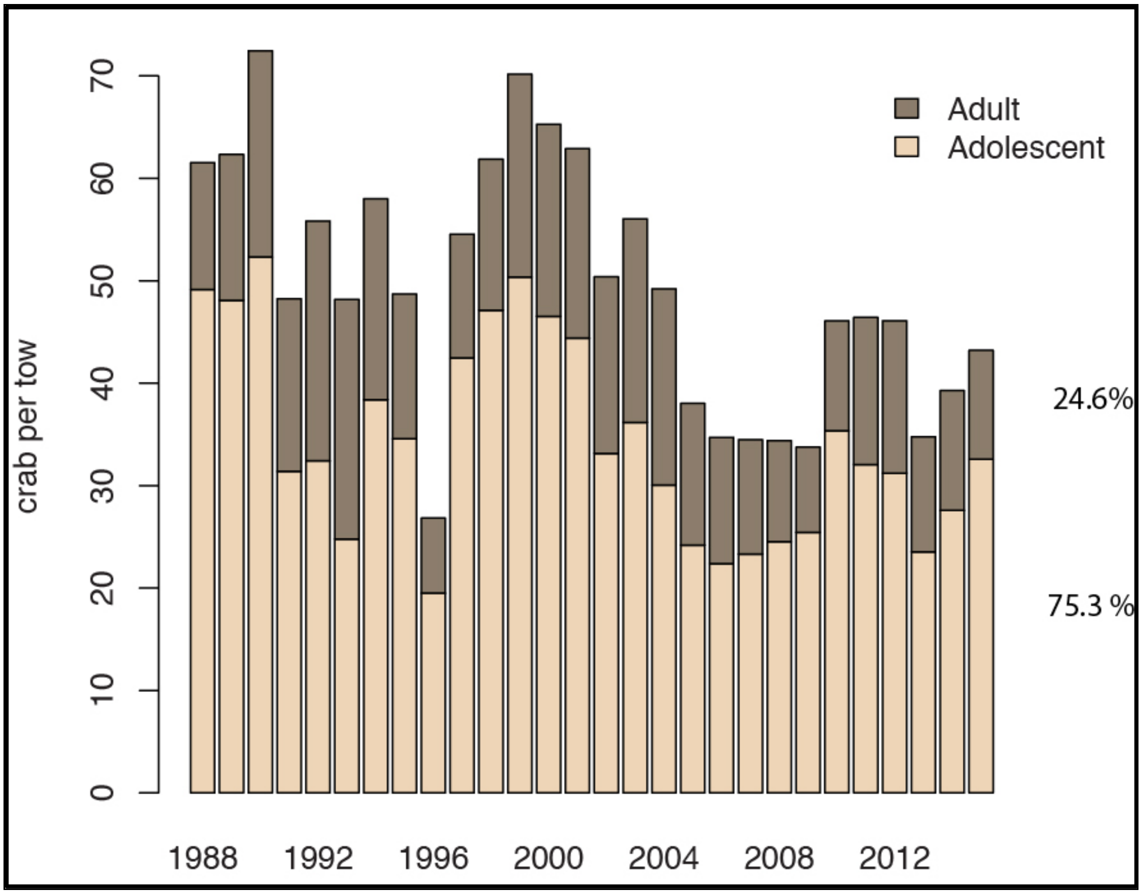

Figure 10. Mean number of male snow crab per tow, by maturity stage, sampled during the snow crab bottom trawl survey, 1988 to 2015. Percentage of the maturity stages in the catches for 2015 are shown in the panel (24.6% adult, 75.3% adolescent. Corresponding values for 2014 were 29.7% and 70.2%, respectively, and for 2013 were 32.5% and 67.5%, respectively.

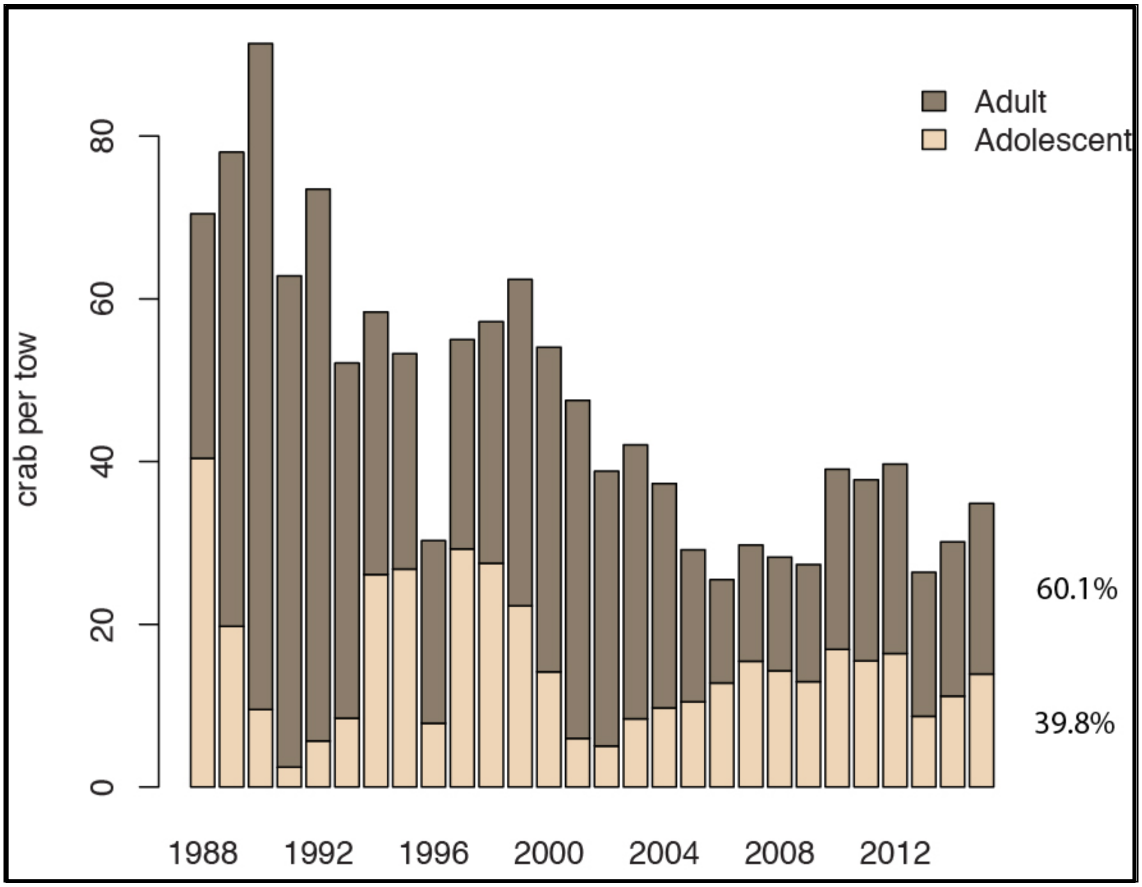

Figure 11. Mean number of female snow crab per tow, by maturity stage, sampled during the snow crab bottom trawl survey, 1988 to 2015. The percentages by the maturity stage in the catches for 2015 are shown in the panel (60.1% adult,39.8% adolescent). Corresponding values for 2014 were 62.8% and 37.1%, respectively, and for 2013 were 67.0% and 33.0%, respectively.

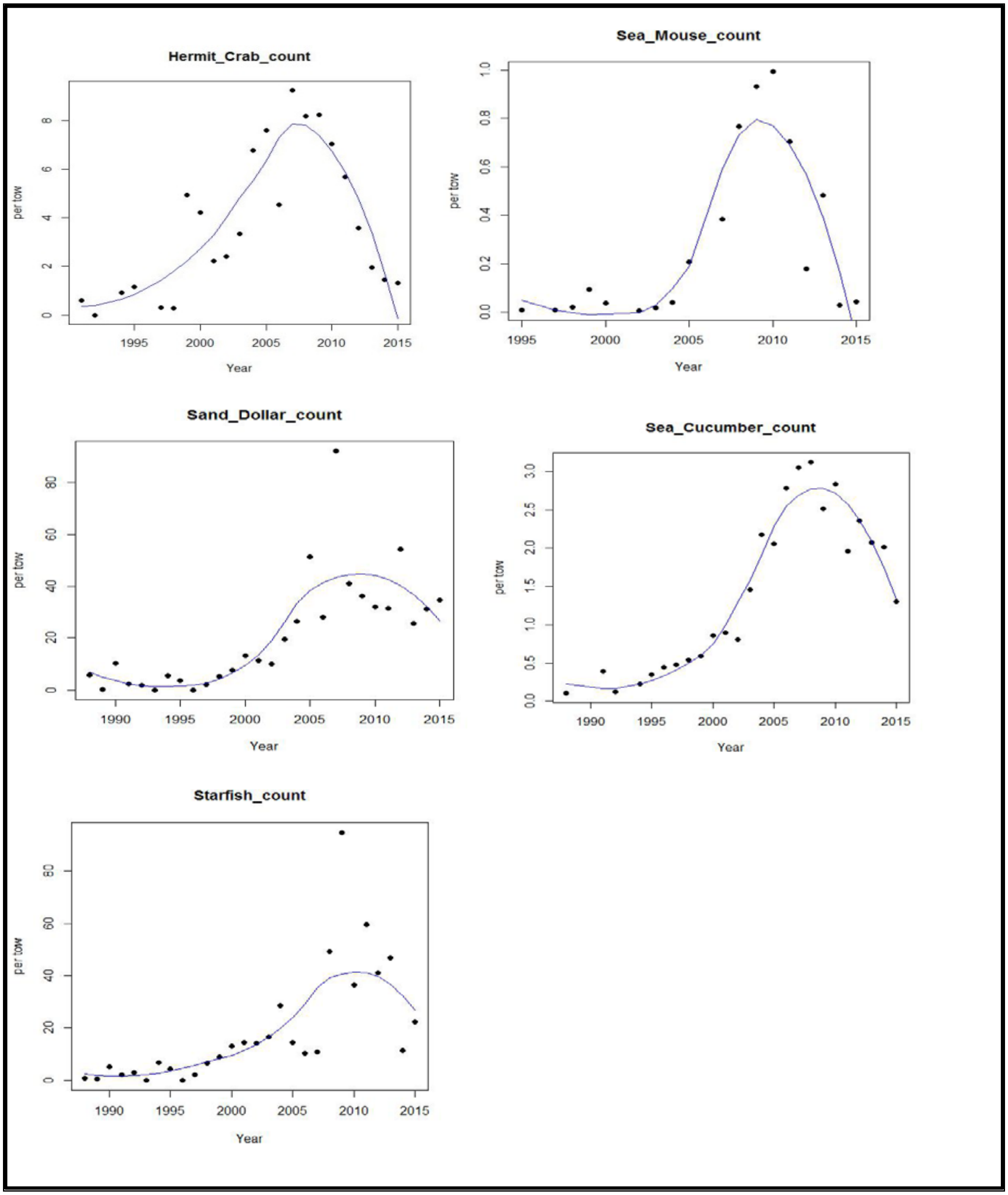

Figure 12a. Historic pattern in catch of sedentary invertebrate species during the annual snow crab trawl survey, 1988 to 2015.

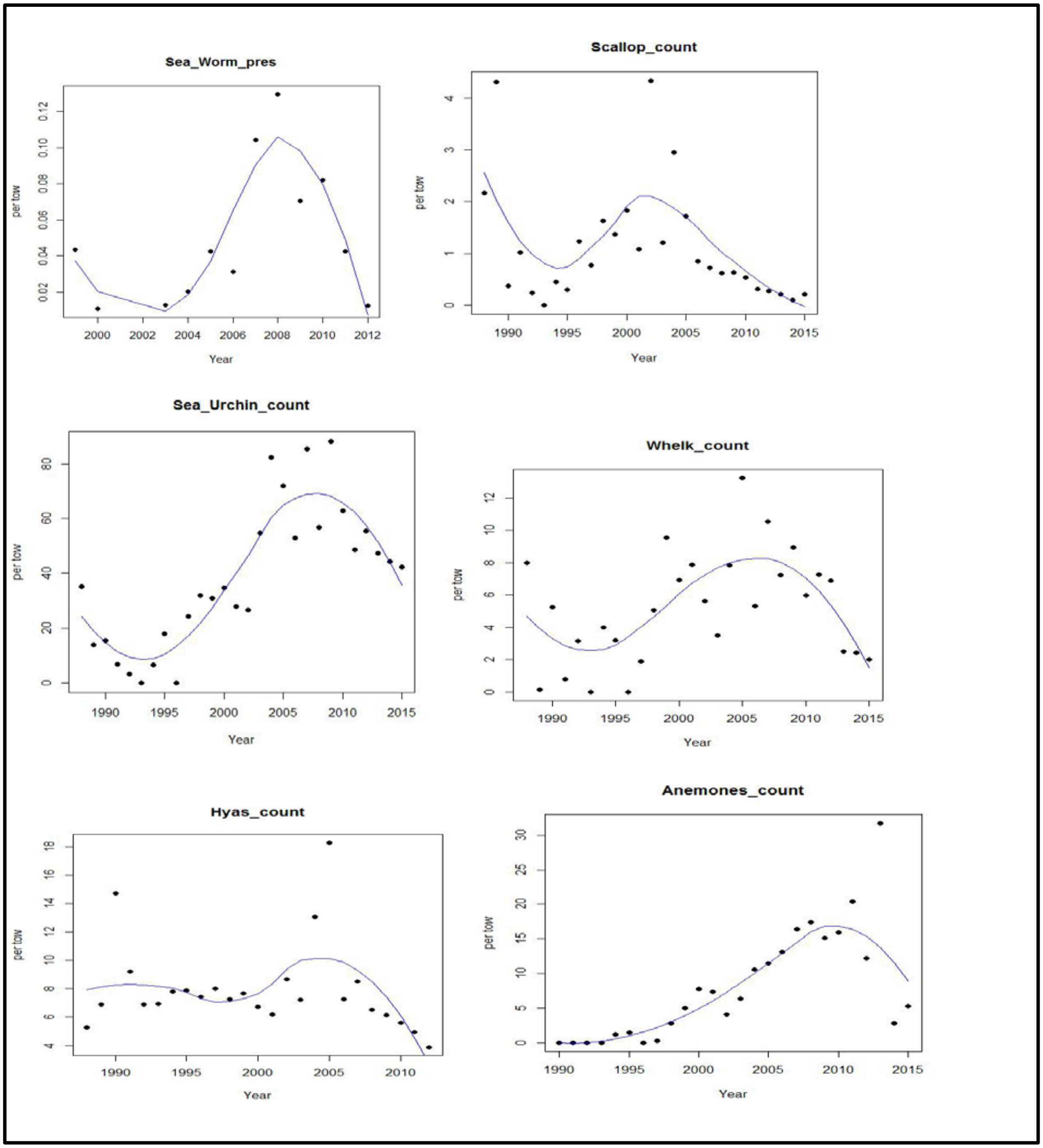

Figure 12b. Historical pattern in catch of sedentary invertebrate species during the annual snow crab trawl survey, 1988 to 2015.

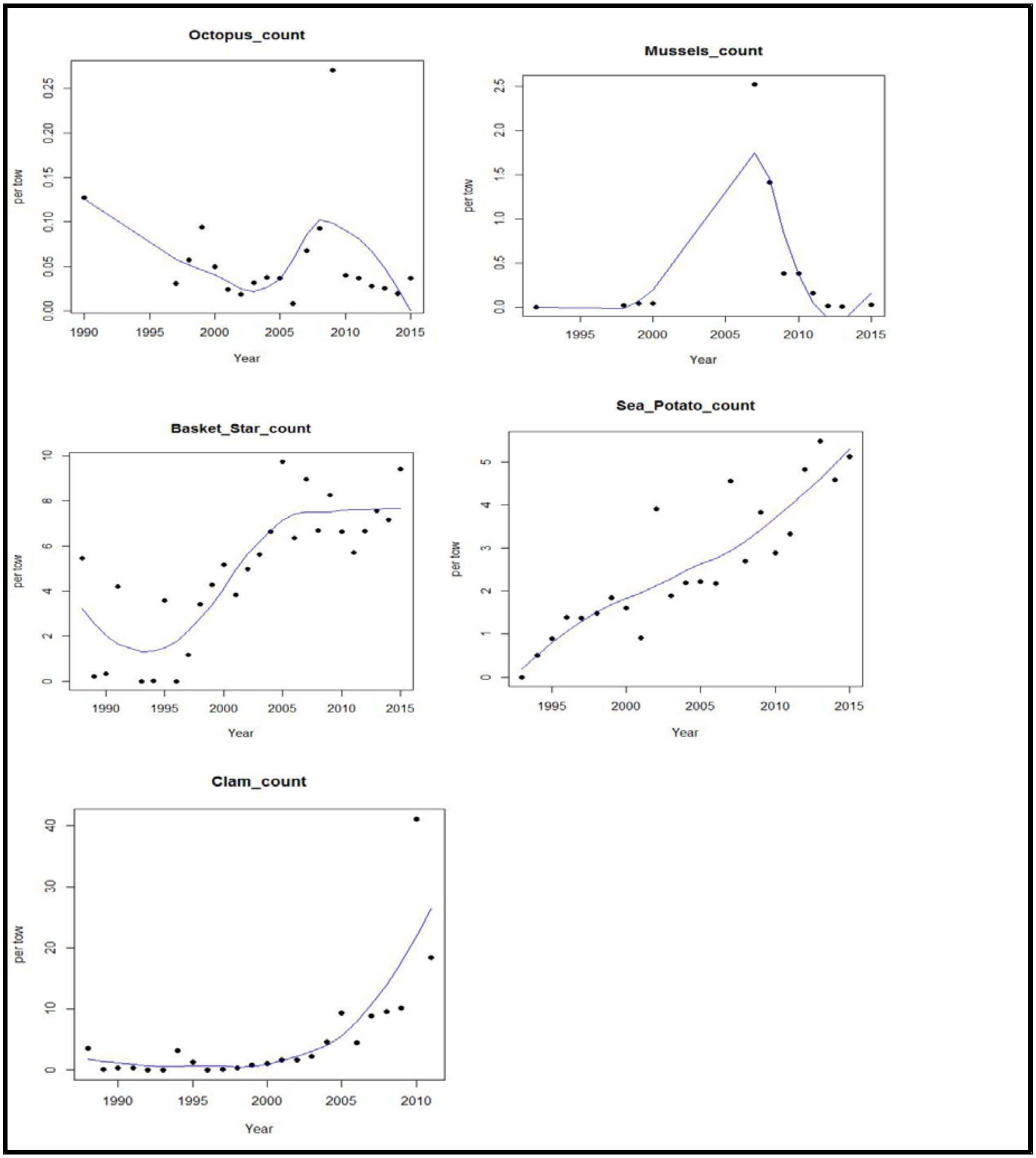

Figure 12c. Historic pattern in catch of sedentary invertebrate species during the annual snow crab survey, 1988 to 2015.

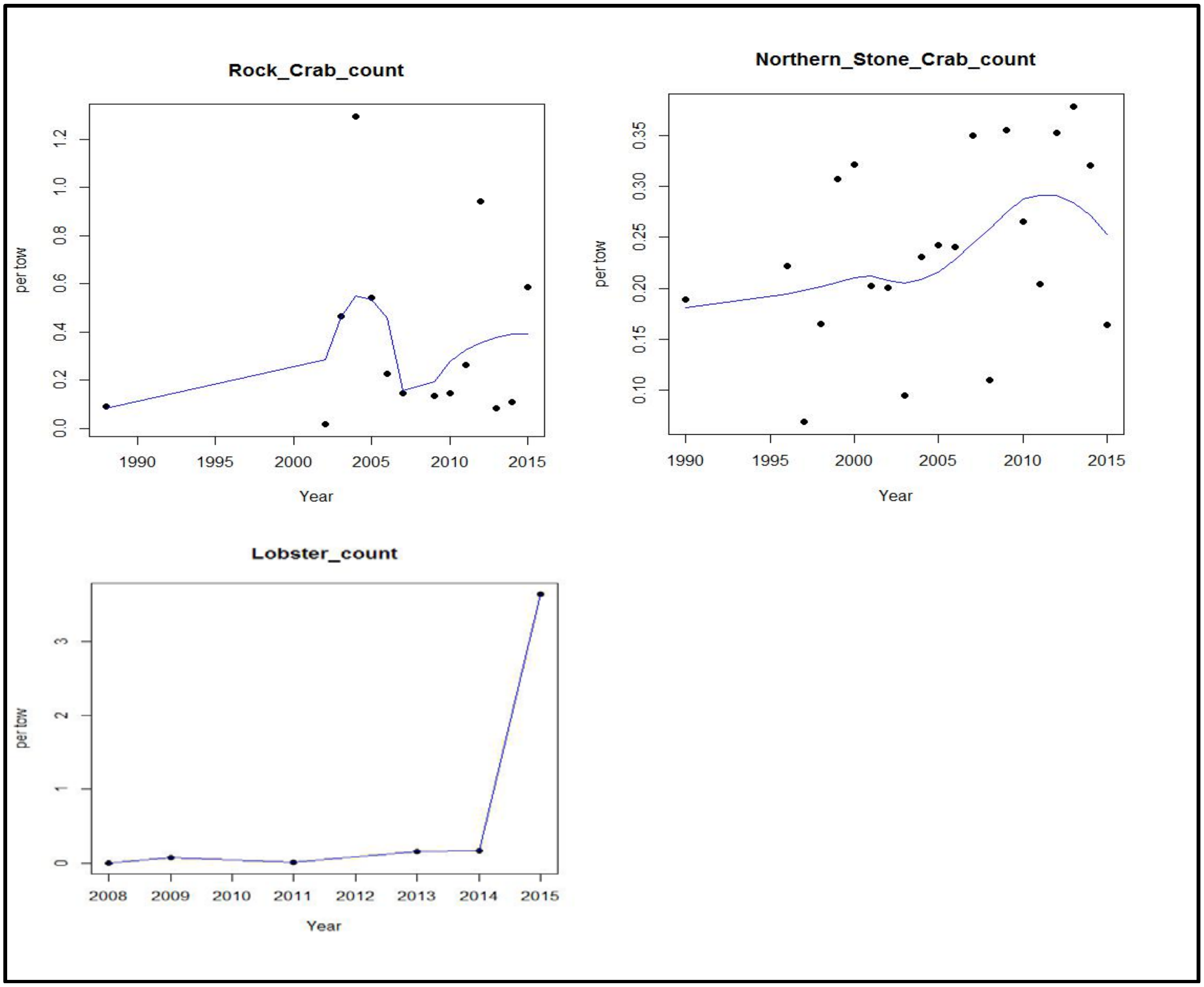

Figure 12d. Historical pattern in catch of sedentary invertebrate species during the annual snow crab trawl survey, 1988 to 2015.

Figure 13. Photographs of unusual catches of American lobster at grid AH25 (left) and AD25 (right).

APPENDIX

Appendix 1. Individual trawl sample details for 2015. Data by column are: Date (day, month in 2015), CFA (crab fishing area), T# (sequential daily tow number), Lat (latitude degree decimal), Lon (longitude degree decimal), TS (swept area estimate in m²), D (depth of the trawl station in m), Temp (bottom temperature at station in ºC), CC/t and CCW/t (catches in number and estimated weight in kg, respectively, of commercial-sized adult male snow crab of carapace conditions 1 to 5), RCC/t and RCW/t (catches in number and estimated weight in kg, respectively of commercial-sized adult male snow crab of carapace conditions 3 to 5), Tq (tow quality indicator), St(Successful station index as P = primary, A1 = alternative 1, A2 = alternative 2, and A3 = alternative 3), Se (trawl sequential number for the survey), Grid (grid id trawled). The tow quality indicator (Tq) values are coded as: 1 = successful trawl sample and acceptable area swept data; 2 = successful trawl sample and the area swept data was estimated by the average area swept of 10 neighboring stations; 3 = original trawl set unsuccessful, repeated successful tow at alternative station and acceptable area swept data; 4 = original trawl set unsuccessful, repeated successful tow at alternative station and the area swept data was estimated by the average area swept of 10 neighboring stations.

Date	CFA	T#	Lat	Lon	AS	D(m)	T(C)	CC/t	CW/t	RC/t	RW/t	TQ	P/A	Se	Grid
09-Jul	F	2	47.74091	60.67642	3292	84	0.7	0	0	0	0	1	A1	1	AQ29
09-Jul	F	3	47.81038	60.68832	1306	192	5.3	0	0	0	0	1	P	2	AR29
09-Jul	F	4	47.77101	60.83263	2699	69	-0.2	4	1.964	3	1.595	1	P	3	AQ28
09-Jul	F	5	47.78766	60.96571	2393	55	-0.2	1	0.519	0	0	1	P	4	AQ27
09-Jul	F	6	47.82119	60.96367	2621	60	-0.4	1	0.459	0	0	1	P	5	AR27
09-Jul	F	7	47.83026	60.90235	2698	71	-0.4	0	0	0	0	1	P	6	AR28
09-Jul	F	8	47.91533	60.97536	2701	86	0.4	0	0	0	0	1	P	7	AS27
10-Jul	12	3	47.9016	61.39152	1785	53	0.1	0	0	0	0	3	A1	8	AR25
10-Jul	12	5	48.00019	61.31783	2974	64	-0.4	0	0	0	0	3	A1	9	AS25
10-Jul	12	7	48.033	61.02294	2151	285	5.9	0	0	0	0	1	P	10	AT27
10-Jul	12	8	48.14122	61.07627	2590	362	5.8	0	0	0	0	2	P	11	AU26
10-Jul	12	9	48.08148	61.11485	2590	298	5.9	0	0	0	0	2	P	12	AT26
10-Jul	12	11	48.22293	61.43476	2563	362	5.8	0	0	0	0	2	P	13	AU24
10-Jul	E	10	48.09521	61.40143	2641	97	1.3	0	0	0	0	1	P	14	AT25
10-Jul	F	1	47.89499	61.08215	2707	68	-0.1	0	0	0	0	1	P	15	AR26
10-Jul	F	6	47.96679	61.10837	2899	82	-0.1	1	0.414	1	0.414	1	P	16	AS26
11-Jul	E	2	48.23176	62.02013	2885	102	1.5	0	0	0	0	3	A1	17	AU21
17-Jul	12	1	48.63706	64.05652	3751	86	0.7	3	1.186	3	1.186	1	P	18	AY09
17-Jul	12	2	48.54711	64.12195	1985	101	1	7	4.522	2	0.881	1	P	19	AX09
17-Jul	12	3	48.54306	64.18184	1890	79	1	14	9.392	0	0	1	P	20	AX08
17-Jul	12	5	48.45969	64.11482	2719	66	1.2	0	0	0	0	3	A1	21	AW09
17-Jul	12	6	48.35578	64.17087	3060	80	1	0	0	0	0	1	P	22	AV09
17-Jul	12	7	48.24044	64.07105	3120	62	0.7	0	0	0	0	1	P	23	AU09
17-Jul	12	8	48.33901	63.83911	2106	108	1.2	4	2.458	2	1.21	1	P	24	AV10
17-Jul	12	9	48.38981	63.83428	2854	113	1.5	5	2.236	4	1.77	1	P	25	AW10
17-Jul	12	10	48.45595	63.73392	2629	152	2.6	3	1.706	3	1.706	2	P	26	AW11
17-Jul	12	13	48.57285	63.41869	2553	132	2.3	0	0	0	0	4	A1	27	AX13
18-Jul	12	1	48.57656	63.5663	2075	134	2.9	0	0	0	0	1	P	28	AX12
18-Jul	12	2	48.55239	63.6664	2364	141	2.4	3	1.862	3	1.862	1	P	29	AX11

Date	CFA	T#	Lat	Lon	AS	D(m)	T(C)	CC/t	CW/t	RC/t	RW/t	TQ	P/A	Se	Grid
18-Jul	12	3	48.52107	63.8456	2676	57	0.1	0	0	0	0	1	P	30	AX10
18-Jul	12	4	48.61784	63.84958	1733	168	3.3	2	1.1	1	0.612	1	P	31	AY10
18-Jul	12	6	48.75859	64.05851	3412	77	1.2	1	0.493	0	0	3	A1	32	AZ09
19-Jul	12	1	47.71347	-62.564	2937	82	-0.2	12	6.441	10	5.118	1	P	33	AQ18
22-Jul	12	1	47.55866	62.27547	1197	57	-0.6	6	2.968	6	2.968	1	P	34	AO20
23-Jul	12	3	47.66333	62.08549	2415	42	0.1	0	0	0	0	3	A2	35	AP21
23-Jul	12	4	47.70107	61.93257	2027	40	2	5	2.66	0	0	1	P	36	AQ22
23-Jul	12	5	47.86527	61.9094	2062	51	0.2	14	8.787	0	0	1	P	37	AR22
23-Jul	12	6	47.87192	61.61837	2324	51	-0.1	0	0	0	0	1	P	38	AR23
23-Jul	12	7	47.93764	61.52195	2816	57	0.2	0	0	0	0	1	P	39	AS24
23-Jul	12	9	48.01263	61.74067	2870	73	2.1	3	1.806	2	1.067	3	A1	40	AS23
23-Jul	12	10	48.0425	61.45965	2726	69	1	1	0.625	1	0.625	1	P	41	AT24
25-Jul	12	1	48.0399	61.62711	2906	64	1.6	0	0	0	0	3	A1	42	AT23
25-Jul	12	9	48.18479	62.21527	1406	86	0.6	0	0	0	0	1	P	43	AU20
25-Jul	12	10	48.1435	62.18617	2474	88	1.8	9	4.856	9	4.856	1	P	44	AT20
25-Jul	E	2	48.22204	61.61284	1886	315	5.8	0	0	0	0	1	P	45	AU23
25-Jul	E	3	48.28508	61.77843	2227	340	5.8	0	0	0	0	1	P	46	AV22
25-Jul	E	4	48.2318	61.88617	2800	210	5.8	0	0	0	0	1	P	47	AU22
25-Jul	E	5	48.28387	61.95624	2617	241	5.9	0	0	0	0	1	P	48	AV21
25-Jul	E	6	48.39964	62.11929	1904	362	5.8	0	0	0	0	1	P	49	AW20
25-Jul	E	8	48.36532	62.15565	2222	274	5.8	0	0	0	0	3	A1	50	AV20
26-Jul	12	1	48.02727	62.11873	3025	59	-0.2	0	0	0	0	1	P	51	AS20
26-Jul	12	2	48.01786	62.00804	3103	57	0.1	1	0.358	1	0.358	1	P	52	AS21
26-Jul	12	3	48.04189	61.95524	2970	60	0.2	4	2.242	3	1.729	1	P	53	AT21
26-Jul	12	4	48.04427	61.88549	2734	62	0.4	15	8.474	15	8.474	1	P	54	AT22
26-Jul	12	5	47.98383	61.91364	2829	59	0.4	16	9.845	14	8.768	1	P	55	AS22
26-Jul	12	6	47.86727	61.98266	2560	51	0.4	4	2.563	0	0	1	P	56	AR21
26-Jul	12	7	47.77109	62.03128	2610	49	-0.2	1	0.481	1	0.481	1	P	57	AQ21
26-Jul	12	8	47.83772	62.27196	2809	60	-0.1	3	1.5	3	1.5	1	P	58	AR20
26-Jul	12	9	47.76001	62.37507	2573	64	0.9	10	5.643	4	2.359	1	P	59	AQ19
26-Jul	12	10	47.72942	62.20754	2675	57	0.1	3	1.763	1	0.42	1	P	60	AQ20
26-Jul	12	11	47.66083	62.26938	2639	55	0.1	3	1.454	3	1.454	1	P	61	AP20
26-Jul	12	12	47.63301	62.38186	2657	55	-0.4	9	4.6	8	3.862	1	P	62	AP19
26-Jul	12	13	47.6013	62.46545	3419	75	0.4	10	5.536	3	1.694	1	P	63	AP18
26-Jul	12	14	47.5051	62.39454	2776	60	-0.2	3	1.385	3	1.385	1	P	64	AO19
27-Jul	12	1	47.48746	62.57873	2731	68	-0.1	3	1.571	0	0	1	P	65	AO18
27-Jul	12	2	47.48747	62.66019	2652	59	-0.4	2	1.219	2	1.219	1	P	66	AO17
27-Jul	12	3	47.4414	62.6784	2670	64	-0.6	5	2.698	2	0.919	1	P	67	AN17
01-Aug	12	1	46.84634	62.00247	3191	64	-0.7	6	2.883	2	1.024	1	P	68	AI21
01-Aug	12	2	46.82262	62.16961	2144	80	-0.7	1	0.614	1	0.614	1	P	69	AI20
01-Aug	12	3	46.7335	61.96786	3753	82	-0.4	3	1.42	2	0.811	1	P	70	AH21
01-Aug	12	4	46.59497	62.08703	2839	51	0.7	0	0	0	0	1	P	71	AG21
01-Aug	12	6	46.58557	62.24166	2242	49	0.4	0	0	0	0	3	A1	72	AG20
01-Aug	12	7	46.66565	62.23674	3124	59	-0.2	4	2.022	0	0	1	P	73	AH20

Date	CFA	T#	Lat	Lon	AS	D(m)	T(C)	CC/t	CW/t	RC/t	RW/t	TQ	P/A	Se	Grid
01-Aug	12	8	46.73383	62.29806	2316	64	-0.2	4	2.193	2	1.265	1	P	74	AH19
01-Aug	12	9	46.63719	62.37665	2668	59	-0.2	4	2.04	1	0.395	1	P	75	AG19
01-Aug	12	11	46.61149	62.53516	2375	49	-0.1	2	0.988	0	0	3	A1	76	AG18
01-Aug	12	12	46.6097	-62.6301	2182	48	0.6	0	0	0	0	1	P	77	AG17
02-Aug	12	1	46.74794	62.53872	2239	60	-0.4	3	2.069	0	0	3	A1	78	AH18
02-Aug	12	2	46.80671	62.67317	2877	60	-0.4	48	28.02	1	0.771	1	P	79	AI17
02-Aug	12	3	46.79798	62.49856	2478	62	-0.1	16	9.026	1	0.764	1	P	80	AI18
02-Aug	12	4	46.86826	62.44034	2582	66	-0.7	6	3.692	1	0.416	1	P	81	AI19
02-Aug	12	5	46.93118	62.37614	2685	62	-0.7	1	0.416	0	0	1	P	82	AJ19
02-Aug	12	6	46.93584	62.53916	2444	62	-0.6	2	0.819	2	0.819	1	P	83	AJ18
02-Aug	12	7	47.06	62.60557	2208	66	-0.7	1	0.392	1	0.392	1	P	84	AK18
02-Aug	12	8	47.01535	62.68895	3022	68	-0.6	13	6.221	13	6.221	1	P	85	AK17
02-Aug	12	9	46.98966	62.76661	2513	62	-0.9	14	7.126	14	7.126	1	P	86	AJ17
02-Aug	12	10	46.94243	62.91516	1631	60	-0.4	7	3.307	7	3.307	1	P	87	AJ16
02-Aug	12	11	46.92485	63.01896	2774	60	-0.6	5	2.789	3	1.312	1	P	88	AJ15
02-Aug	12	12	46.8799	63.0225	3090	62	-0.6	2	1.008	1	0.389	1	P	89	AI15
03-Aug	12	1	46.83236	62.89986	2939	60	-0.4	2	0.875	2	0.875	1	P	90	AI16
03-Aug	12	3	46.76692	62.6885	2812	55	-0.4	0	0	0	0	3	A1	91	AH17
03-Aug	12	5	46.705	62.87728	2689	55	-0.4	12	7.363	1	0.446	3	A1	92	AH16
03-Aug	12	7	46.60301	62.84609	2622	53	-0.2	3	1.907	0	0	3	A1	93	AG16
03-Aug	12	8	46.60557	62.96326	2068	46	0.2	0	0	0	0	1	P	94	AG16
03-Aug	12	9	46.62089	63.16993	1969	44	0.4	0	0	0	0	1	P	95	AG14
03-Aug	12	10	46.67695	63.11913	2219	46	0.2	9	4.953	1	0.371	1	P	96	AH15
03-Aug	12	11	46.71926	63.19308	2142	46	-0.2	9	5.324	0	0	1	P	97	AH14
03-08-	12	12	46.84089	63.24286	2604	55	-0.4	1	0.451	0	0	1	P	98	AI14
04-Aug	12	1	46.78673	63.41976	2010	44	-0.1	6	3.076	0	0	1	P	99	AI13
04-Aug	12	2	46.78699	63.49595	2025	42	0.4	3	1.697	0	0	1	P	100	AI12
04-Aug	12	3	46.91213	63.3174	2595	57	-0.6	5	2.778	0	0	1	P	101	AJ13
04-Aug	12	4	46.95977	63.19876	2467	59	-0.6	20	11.806	1	0.379	1	P	102	AJ14
04-Aug	12	6	47.10723	63.16887	3091	62	-0.7	7	3.634	2	0.871	3	A1	103	AK14
04-Aug	12	7	47.17854	63.24442	3556	66	-0.9	12	6.979	3	1.752	1	P	104	AL14
04-Aug	12	9	47.34725	63.38128	2481	73	-1	15	8.748	0	0	3	A1	105	AN13
04-Aug	12	10	47.15441	63.38698	2847	57	-0.6	10	6.431	0	0	1	P	106	AL13
04-Aug	12	11	47.06671	63.37188	2811	53	n/a	1	0.378	0	0	1	P	107	AK13
05-Aug	12	2	47.10644	63.57246	3222	55	-0.6	0	0	0	0	3	A2	108	AK12
05-Aug	12	3	46.97142	63.55879	1826	46	-0.1	0	0	0	0	1	P	109	AJ12
05-Aug	12	4	46.9705	63.64177	2477	46	0.2	0	0	0	0	1	P	110	AJ11
05-Aug	12	5	47.1	63.7092	3120	55	-1	0	0	0	0	1	P	111	AK11
05-Aug	12	6	47.21812	63.60221	3257	64	-0.9	5	2.634	2	1.084	1	P	112	AL12
05-Aug	12	7	47.24019	63.6435	3027	66	-1	5	2.664	1	0.463	1	P	113	AM11
05-Aug	12	8	47.19695	63.77355	2804	55	-0.9	14	7.747	0	0	1	P	114	AL11
05-Aug	12	11	47.20306	63.81405	2256	48	-0.6	5	2.95	0	0	3	A2	115	AL10
05-Aug	12	12	47.22432	64.09478	2295	38	0.8	2	1.224	1	0.648	1	P	116	AL09
05-Aug	12	13	47.08365	64.18552	2870	40	0.5	1	0.596	0	0	1	P	117	AK08

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06-Aug	12	1	47.19026	64.24219	2464	42	0.6	9	5.032	0	0	1	P	118	AL08
06-Aug	12	2	47.31151	64.19494	2824	46	0	4	2.397	1	0.682	1	P	119	AM08
06-Aug	12	3	47.33639	63.95007	2418	40	0	3	1.383	1	0.374	1	P	120	AM10
06-Aug	12	4	47.3462	63.93225	2766	48	-0.1	0	0	0	0	1	P	121	AN10
06-Aug	12	7	47.41641	64.08726	2073	37	1	3	1.906	1	0.516	3	A2	122	AN09
06-Aug	12	8	47.36046	64.28152	2917	55	-0.3	2	1.186	1	0.653	1	P	123	AN08
06-Aug	12	9	47.30348	64.44541	2985	42	0.6	4	1.94	0	0	1	P	124	AM07
06-Aug	12	10	47.43663	64.34569	2632	55	n/a	6	4.008	0	0	1	P	125	AN07
06-Aug	12	11	47.5036	64.39353	2288	46	0	9	5.343	0	0	1	P	126	AO07
06-Aug	12	12	47.54578	64.17954	2294	64	-0.3	5	3.407	2	1.239	1	P	127	AO08
06-Aug	12	13	47.555	64.12761	2539	68	-0.3	8	4.825	3	1.57	1	P	128	AO09
07-Aug	12	3	47.66091	64.16413	2457	69	0.1	9	5.527	5	3.116	3	A2	129	AP08
07-Aug	12	4	47.69905	64.16548	2376	71	0.6	15	8.256	12	5.977	1	P	130	AQ08
07-Aug	12	5	47.76328	64.00336	2662	82	0.6	4	2.058	1	0.418	1	P	131	AQ09
07-Aug	12	6	47.82418	64.0243	2482	88	0.6	3	1.854	2	1.016	1	P	132	AR09
07-Aug	12	7	47.81377	64.16558	2010	59	3.1	6	3.508	6	3.508	1	P	133	AR08
07-Aug	12	8	47.947	64.05408	3178	59	1.6	1	0.359	1	0.359	1	P	134	AS09
07-Aug	12	9	47.9386	63.96345	2513	91	0.8	3	1.252	2	0.732	1	P	135	AS10
16-Aug	12	1	47.92911	65.17227	2500	75	0.8	12	8.044	3	1.908	1	P	136	AS03
16-Aug	12	2	47.96182	65.33797	2567	46	1	6	5.601	0	0	1	P	137	AS02
16-Aug	12	3	47.97589	65.62416	2752	46	1.6	0	0	0	0	1	P	138	AS00
16-Aug	12	5	47.9179	65.51639	2426	48	1	2	1.17	0	0	3	A1	139	AS01
16-Aug	12	8	47.84929	65.60073	1805	38	1.1	1	1.02	0	0	3	A2	140	AR00
16-Aug	12	9	47.86424	65.48785	1911	60	0.6	5	3.194	1	0.46	1	P	141	AR01
16-Aug	12	10	47.8924	65.20941	2368	69	0.6	7	6.187	1	0.616	1	P	142	AR02
16-Aug	12	11	47.89497	65.13983	1908	77	0.6	6	5.062	0	0	1	P	143	AR03
17-Aug	12	1	47.88665	64.99064	2450	48	0.4	5	3.663	1	0.757	1	P	144	AR04
17-08-	12	4	47.95232	65.0152	2127	79	0.8	7	5.398	0	0	3	A2	145	AS04
17-Aug	12	5	48.04139	64.98431	2244	86	1	6	3.279	4	1.634	1	P	146	AT04
17-Aug	12	6	48.06777	64.77193	2191	84	0.9	1	0.874	0	0	2	P	147	AT05
17-Aug	12	8	48.14294	-64.3396	1827	35	8.2	0	0	0	0	3	A1	148	AT07
17-Aug	12	9	48.23788	64.42378	2253	102	1.2	4	2.924	0	0	1	P	149	AU07
17-Aug	12	10	48.24647	64.67634	1999	88	0.9	2	1.641	0	0	1	P	150	AU06
17-Aug	12	11	48.32832	64.51726	2336	77	0.9	1	0.634	1	0.634	2	P	151	AV07
18-Aug	12	1	48.27128	64.33393	2233	112	1	8	6.634	2	1.363	1	P	152	AV08
18-Aug	12	2	48.25407	64.30595	2272	104	1	11	8.712	2	0.985	1	P	153	AU08
18-Aug	12	3	48.35454	63.67942	3561	86	2	1	0.83	1	0.83	1	P	154	AV11
18-Aug	12	4	48.30899	63.52141	3650	97	1.8	0	0	0	0	1	P	155	AV12
22-Aug	12	2	48.67644	63.76055	1004	143	3.8	0	0	0	0	3	A1	156	AY11
22-Aug	12	4	48.61682	63.65297	1403	121	3.8	0	0	0	0	3	A1	157	AY12
22-08-	12	5	48.81837	63.68637	2165	216	5.2	5	2.382	5	2.382	1	P	158	AZ11
22-08-	12	6	48.8286	63.56135	1987	238	5.8	0	0	0	0	1	P	159	AZ12
22-Aug	12	7	48.89078	63.60516	2799	296	5.9	0	0	0	0	1	P	160	BA12
22-Aug	12	8	48.94575	63.42721	1822	351	5.9	0	0	0	0	1	P	161	BA13

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23-Aug	12	1	48.92227	63.26144	2108	382	5.8	0	0	0	0	1	P	162	BA14
23-Aug	12	2	48.83242	63.34681	2200	305	5.9	0	0	0	0	1	P	163	AZ13
23-Aug	12	3	48.70229	63.36095	998	188	5.1	0	0	0	0	1	P	164	AY13
23-Aug	12	4	48.75083	63.25337	2294	276	5.4	3	1.53	3	1.53	2	P	165	AZ14
23-Aug	12	6	48.64781	63.25499	2697	207	5.4	0	0	0	0	1	P	166	AY14
23-Aug	12	5	48.71961	63.11052	1567	340	5.9	0	0	0	0	1	P	167	AY15
23-Aug	12	8	48.59132	62.93889	2760	362	5.8	0	0	0	0	2	P	168	AX16
24-Aug	12	2	48.41578	62.85885	2462	166	5.7	0	0	0	0	1	P	169	AW16
24-Aug	12	3	48.37537	62.85459	3313	91	1.5	0	0	0	0	1	P	170	AV16
24-Aug	12	4	48.31294	62.68413	3354	93	1.5	3	1.796	2	0.979	1	P	171	AV17
24-Aug	12	7	48.27889	62.55991	3468	93	2.5	0	0	0	0	3	A1	172	AV18
24-Aug	12	10	48.24641	62.37384	2866	69	0.1	0	0	0	0	4	A2	173	AU19
24-Aug	E	1	48.44136	62.64658	2395	335	5.8	0	0	0	0	1	P	174	AW17
24-Aug	E	5	48.33035	62.44012	1983	146	4.9	0	0	0	0	1	P	175	AV19
30-Aug	12	2	47.16408	62.68607	3110	66	-0.2	13	6.06	11	5.137	3	A1	176	AL17
30-Aug	12	3	47.09742	62.87751	2759	60	-0.4	5	2.966	1	0.367	1	P	177	AK16
30-Aug	12	7	47.06831	63.0755	2847	57	n/a	2	1.296	1	0.529	3	A3	178	AK15
30-Aug	12	9	47.16961	63.1237	2851	60	-0.7	1	0.807	1	0.807	4	A1	179	AL15
30-Aug	12	10	47.16552	62.87775	2656	60	-0.6	1	0.482	0	0	2	P	180	AL16
30-Aug	12	11	47.25667	62.63192	2578	68	-0.2	6	3.038	5	2.319	2	P	181	AM17
30-Aug	12	12	47.2072	62.61343	2630	66	-0.2	11	5.399	11	5.399	2	P	182	AL18
31-Aug	12	1	47.09882	62.4058	2474	60	-0.4	3	1.375	3	1.375	1	P	183	AK19
31-Aug	12	2	47.13545	62.29848	2440	49	-0.1	0	0	0	0	2	P	184	AL19
31-Aug	12	3	47.1393	62.18724	2348	38	1.8	0	0	0	0	2	P	185	AL20
02-Sep	12	3	47.0063	61.87374	2009	42	5.5	0	0	0	0	3	A2	186	AK22
02-Sep	12	5	46.96989	61.94075	2596	46	0.7	1	0.581	0	0	3	A1	187	AJ22
02-Sep	12	7	46.77442	61.86815	3431	68	-0.4	6	3.296	5	2.709	1	P	188	AI22
02-Sep	12	8	46.68327	61.88708	2472	59	-0.2	2	1.663	0	0	1	P	189	AH22
03-Sep	12	1	45.94765	61.74598	2087	40	0.9	6	3.102	0	0	1	P	190	AA23
03-Sep	12	2	46.04677	61.76457	2086	49	0.4	1	0.467	0	0	1	P	191	AB23
03-Sep	12	3	46.0687	61.88083	2019	46	1.2	7	4.807	0	0	1	P	192	AB22
03-Sep	12	4	46.10862	62.10707	3156	38	3.5	0	0	0	0	1	P	193	AC21
03-Sep	12	5	46.2164	62.18561	2215	33	6.4	0	0	0	0	1	P	194	AD20
03-Sep	12	7	46.26482	61.86641	2743	49	1.3	14	9.125	3	1.71	3	A1	195	AD22
03-Sep	12	8	46.32083	61.92045	2233	40	3.5	1	0.884	0	0	1	P	196	AE22
03-Sep	12	9	46.30017	62.04677	1974	40	5.2	0	0	0	0	1	P	197	AD21
04-Sep	12	1	46.08817	61.84389	1997	48	1.3	2	0.929	1	0.478	1	P	198	AC22
04-Sep	12	2	46.11313	61.80144	1986	49	0.9	2	1.797	0	0	1	P	199	AC23
08-Sep	12	1	47.28018	62.39199	2516	53	-0.6	2	1.253	0	0	1	P	200	AM19
08-Sep	12	2	48.03056	62.809	3625	80	0.2	6	2.946	6	2.946	1	P	201	AS16
08-Sep	12	3	48.06956	62.91865	2808	66	0.1	8	4.012	6	2.908	1	P	202	AT16
08-Sep	12	4	48.04204	63.09431	3267	59	0.2	0	0	0	0	1	P	203	AT15
09-Sep	12	1	48.53163	63.2458	3512	126	4.3	0	0	0	0	3	A1	204	AX14
09-Sep	12	2	48.5889	63.16173	2735	221	5.3	1	0.436	1	0.436	1	P	205	AX14

Date	CFA	T#	Lat	Lon	AS	D(m)	T(C)	CC/t	CW/t	RC/t	RW/t	TQ	P/A	Se	Grid
09-Sep	12	4	48.3908	62.96664	2658	75	0.4	3	1.34	2	0.826	3	A1	206	AW15
09-Sep	12	5	48.31446	62.98273	2955	79	0.6	7	2.992	7	2.992	1	P	207	AV15
09-Sep	12	7	48.35188	63.15326	3086	57	0.4	1	0.384	1	0.384	3	A1	208	AV14
09-Sep	12	8	48.44348	63.29733	2566	99	2.7	0	0	0	0	1	P	209	AW14
10-Sep	12	1	48.49704	63.31786	3309	123	3.3	0	0	0	0	1	P	210	AW13
10-Sep	12	2	48.39009	-63.5359	3872	108	2.4	1	0.458	1	0.458	1	P	211	AW12
10-Sep	12	3	48.36069	63.39828	3476	86	1.2	0	0	0	0	1	P	212	AV13
10-Sep	12	4	48.21523	63.31366	4004	95	0.6	4	1.948	1	0.505	1	P	213	AU13
10-Sep	12	5	48.15251	63.2048	2972	73	0.2	4	2.432	2	1.032	1	P	214	AT14
10-Sep	12	6	48.06627	63.26995	4055	77	0.6	3	1.208	3	1.208	1	P	215	AT14
10-Sep	12	7	48.13485	63.40613	4044	110	0.9	10	6.093	3	1.713	1	P	216	AT13
10-Sep	12	8	48.11711	63.58196	3666	91	1.3	6	3.684	4	2.134	1	P	217	AT12
10-Sep	12	9	48.2383	63.64706	3877	99	1.5	2	1.182	1	0.492	1	P	218	AU12
10-Sep	12	10	48.18719	63.70351	3033	104	1.5	8	4.684	1	0.406	1	P	219	AU11
11-Sep	12	2	46.96642	62.17067	2165	53	-0.2	0	0	0	0	3	A1	220	AJ20
11-Sep	12	3	47.04276	62.11962	2285	49	0.1	0	0	0	0	3	A1	221	AK21
11-Sep	12	4	47.00924	62.00636	2001	49	0.4	1	1.051	0	0	1	P	222	AK21
11-Sep	12	5	46.90912	61.99991	2240	53	-0.1	0	0	0	0	3	A1	223	AJ21
13-Sep	12	2	47.28051	62.56935	2514	66	-0.4	12	6.256	10	5.151	3	A1	224	AM18
13-Sep	12	3	47.38615	62.35953	2621	55	-0.4	13	7.136	2	0.747	2	P	225	AN19
13-Sep	12	4	47.42901	62.51904	3078	75	-0.2	14	7.275	13	6.865	1	P	226	AN18
13-Sep	12	5	47.38399	62.89783	2495	51	0.4	2	1.076	0	0	1	P	227	AN16
13-Sep	12	6	47.30021	62.89996	1951	59	-0.4	1	0.362	1	0.362	1	P	228	AM16
13-Sep	12	7	47.32847	63.03558	2917	64	0.1	17	9.653	4	2.012	2	P	229	AM15
14-Sep	12	1	48.15049	63.85465	3446	71	0.9	0	0	0	0	1	P	230	AU10
14-Sep	12	2	48.11774	63.81975	3802	91	1.2	10	6.534	1	0.483	1	P	231	AT11
14-Sep	12	3	48.08769	63.86546	3112	95	1	6	3.807	0	0	1	P	232	AT10
14-Sep	12	4	47.99053	63.76894	3035	97	1.2	2	1.365	1	0.67	1	P	233	AS11
17-Sep	12	1	47.33904	63.51545	3698	69	0.2	18	10.696	3	1.481	1	P	234	AM12
17-Sep	12	2	47.38701	63.71028	3521	66	0.4	11	5.6	3	1.351	1	P	235	AN11
17-Sep	12	5	47.36758	63.48597	3845	73	0.2	19	11.337	2	0.995	3	A2	236	AN12
17-Sep	12	6	47.50909	63.72041	3865	69	0.7	9	4.795	3	1.546	1	P	237	AO11
17-Sep	12	7	47.50869	63.88691	3419	60	0.6	1	0.81	0	0	1	P	238	AO10
17-Sep	12	9	47.684	64.09151	2782	75	0.7	5	2.449	3	1.395	4	A1	239	AP09
18-Sep	12	1	47.62641	63.96343	2658	49	1.5	0	0	0	0	3	A1	240	AP10
18-Sep	12	2	47.64043	63.70234	4128	71	0.7	8	4.148	5	2.485	1	P	241	AP11
18-Sep	12	3	47.71639	63.76088	2385	64	0.9	0	0	0	0	1	P	242	AQ11
18-Sep	12	4	47.75336	63.87307	3878	75	1	11	6.595	4	2.281	1	P	243	AQ10
18-Sep	12	5	47.82436	63.873	3707	82	0.9	6	3.573	5	2.847	1	P	244	AR10
18-Sep	12	6	47.90726	63.7078	2890	68	0.7	1	0.407	1	0.407	1	P	245	AR11
18-Sep	12	7	47.9803	63.53742	4060	77	0.7	5	3.396	1	0.369	1	P	246	AS12
18-Sep	12	8	47.98141	63.41953	3946	77	0.7	0	0	0	0	1	P	247	AS13
18-Sep	12	10	47.86181	63.546	3593	64	0.6	1	1.005	0	0	3	A1	248	AR12
18-Sep	12	11	47.83256	63.33571	3700	77	0.2	10	4.843	3	1.581	1	P	249	AR13

Date	CFA	T#	Lat	Lon	AS	D(m)	T(C)	CC/t	CW/t	RC/t	RW/t	TQ	P/A	Se	Grid
19-Sep	12	1	47.65919	62.79407	2447	59	0.2	8	3.819	6	2.786	1	P	250	AP16
19-Sep	12	2	47.68816	62.81355	2627	57	-0.2	5	2.361	3	1.264	1	P	251	AP16
19-Sep	12	3	47.79471	62.77792	3002	64	0.4	3	1.65	0	0	1	P	252	AQ17
19-Sep	12	4	47.84011	62.7297	3248	69	0.7	10	5.904	8	4.26	1	P	253	AR17
19-Sep	12	5	47.85206	62.84752	3770	77	0.6	38	20.684	20	10.87	1	P	254	AR16
19-Sep	12	6	47.78932	62.94842	2240	71	0.6	2	0.908	2	0.908	1	P	255	AQ16
19-Sep	12	7	47.73458	63.05462	2712	71	0.2	20	10.371	12	6.239	2	P	256	AQ15
22-Sep	12	1	48.02278	62.67521	3346	86	0.7	14	7.688	8	4.064	1	P	257	AS17
22-Sep	12	2	47.91399	62.58771	2483	64	0.1	2	0.827	2	0.827	1	P	258	AR18
22-Sep	12	3	47.91069	62.42753	2951	73	0.4	15	7.792	10	5.124	1	P	259	AR19
22-Sep	12	4	47.98953	62.46678	2715	68	0.4	4	1.825	3	1.124	1	P	260	AS18
22-Sep	12	5	48.03536	62.3733	2710	80	0.7	7	3.582	5	2.399	2	P	261	AS19
22-Sep	12	6	48.0779	62.37455	3215	73	0.2	9	4.931	5	2.659	1	P	262	AT19
22-Sep	12	7	48.06827	62.49993	2680	60	0.2	7	3.519	4	1.775	1	P	263	AT18
22-Sep	12	8	48.18186	62.49977	3003	71	0.7	3	1.986	2	1.016	2	P	264	AU18
22-Sep	12	9	48.14622	62.6644	3977	99	1	10	5.339	8	4.163	1	P	265	AT17
22-Sep	12	10	48.19249	62.68568	3882	99	0.7	5	2.462	5	2.462	1	P	266	AU17
22-Sep	12	11	48.18055	62.84142	3290	75	0.2	7	4.129	6	3.667	1	P	267	AU16
22-Sep	12	12	48.20693	62.9677	3186	73	0.4	4	1.985	3	1.527	2	P	268	AU15
23-Sep	12	1	47.93668	63.06501	2572	62	0.2	5	3.06	1	0.581	1	P	269	AS15
23-Sep	12	2	47.92742	63.1898	2604	64	0.1	4	2.214	1	0.554	1	P	270	AS14
23-Sep	12	3	47.88344	63.13113	3101	69	0.2	4	2.181	1	0.431	1	P	271	AR15
23-Sep	12	4	47.80998	63.14765	3809	73	0.6	5	2.472	4	2.038	1	P	272	AR14
23-Sep	12	5	47.75827	63.17475	3627	71	0.2	2	1.084	1	0.688	1	P	273	AQ14
23-Sep	12	6	47.80406	63.3241	3843	80	0.4	6	3.01	2	1.2	1	P	274	AQ13
23-Sep	12	7	47.7709	63.48734	3822	77	0.4	1	0.503	0	0	1	P	275	AQ12
23-Sep	12	8	47.68647	63.50263	2950	71	0.4	5	2.697	2	0.849	1	P	276	AP12
23-Sep	12	9	47.61669	63.39987	3109	79	0.2	14	9.037	2	1.286	1	P	277	AP13
23-Sep	12	10	47.55066	63.51233	3581	71	0.2	34	20.713	9	4.545	1	P	278	AO12
23-Sep	12	11	47.55791	63.35615	3453	77	0.2	8	5.072	4	2.561	1	P	279	AO13
24-Sep	12	1	47.60305	63.26786	2290	86	0.2	12	7.388	8	4.311	1	P	280	AP14
24-Sep	12	2	47.67154	63.13039	2853	66	-0.2	15	9.548	2	0.808	1	P	281	AP15
24-Sep	12	3	47.57155	63.17233	2927	66	-0.2	14	7.365	9	4.559	1	P	282	AO14
24-Sep	12	4	47.53776	63.02184	2740	53	0.2	0	0	0	0	1	P	283	AO15
04-Oct	12	1	47.50015	62.85011	2435	51	-0.1	0	0	0	0	1	P	284	AO16
04-Oct	12	2	47.43669	63.12694	3204	69	0.2	29	15.994	20	10.65	1	P	285	AN15
04-Oct	12	3	47.43589	63.27594	3440	69	0.2	29	17.286	20	11.432	1	P	286	AN14
04-Oct	12	4	47.43893	63.39675	3511	80	0.4	17	10.576	6	3.413	1	P	287	AN13
04-Oct	12	6	47.28639	63.14451	3776	69	0.1	11	5.99	6	2.836	3	A1	288	AM14
05-Oct	F	1	47.28373	-60.3437	2292	183	5	0	0	0	0	1	P	289	AM31
05-Oct	F	2	47.38121	60.39664	2907	80	1.3	0	0	0	0	1	P	290	AN31
05-Oct	F	3	47.43143	60.46424	3122	95	2.1	1	0.701	1	0.701	1	P	291	AN30
05-Oct	F	4	47.5247	60.40468	1356	302	5.9	0	0	0	0	1	P	292	AO31
05-Oct	F	5	47.55639	60.44387	901	234	5.2	0	0	0	0	1	P	293	AP30

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05-Oct	F	6	47.51121	60.48531	2195	141	2.1	6	3.857	5	3.312	1	P	294	AO30
05-Oct	F	7	47.48115	-60.6074	2500	59	2	3	1.553	0	0	1	P	295	AO29
05-Oct	F	8	47.57136	60.69019	2940	57	0.2	6	3.048	1	0.405	1	P	296	AP29
05-Oct	F	9	47.56204	60.86431	2366	49	0.6	0	0	0	0	1	P	297	AP28
05-Oct	F	10	47.62833	61.00435	2664	38	2.6	0	0	0	0	1	P	298	AP27
06-Oct	19	1	47.44724	60.93707	2634	49	1	4	2.037	4	2.037	1	P	299	AO27
06-Oct	12	2	47.46378	60.76842	2589	57	1	3	1.451	0	0	1	P	300	AO28
06-Oct	19	3	47.36965	60.80363	2422	64	1.2	11	6.082	9	4.753	1	P	301	AN28
06-Oct	19	4	47.36598	60.64975	2502	64	1	1	0.611	0	0	1	P	302	AN29
06-Oct	19	5	47.30988	60.5882	4143	69	0.9	0	0	0	0	1	P	303	AM30
06-Oct	19	6	47.22158	60.68112	3111	95	1	0	0	0	0	1	P	304	AM29
06-Oct	19	7	47.19985	60.55166	1368	165	5.5	0	0	0	0	1	P	305	AL30
06-Oct	19	8	47.07872	60.49737	2321	146	5	1	0.649	0	0	1	P	307	AK29
06-Oct	19	10	47.15074	60.76028	2430	150	4.7	6	3.823	2	0.971	1	P	308	AL29
07-Oct	12	1	47.3804	61.14123	2650	44	n/a	1	0.592	1	0.592	2	P	309	AN26
07-Oct	12	2	47.32928	61.15498	2650	46	n/a	1	0.364	0	0	2	P	310	AM26
07-Oct	12	3	47.3307	61.09782	2650	51	n/a	3	1.996	2	1.326	2	P	311	AM27
07-Oct	12	4	47.36163	61.01283	2766	51	n/a	6	3.362	4	2.044	2	P	312	AN27
07-Oct	12	7	47.16762	61.11162	2688	59	n/a	8	4.79	8	4.79	2	P	313	AL26
07-Oct	19	5	47.26963	60.87202	2632	84	n/a	10	6.388	10	6.388	2	P	314	AM28
07-Oct	19	6	47.17193	60.91527	2712	82	n/a	1	0.63	1	0.63	2	P	315	AL28
07-Oct	19	8	47.10949	61.05231	2795	77	1.8	10	6.27	8	5.168	1	P	316	AL27
07-Oct	19	9	47.00856	60.95208	2434	102	2	4	2.381	1	0.686	1	P	317	AK27
07-Oct	19	10	47.00765	-60.8912	2761	113	2.4	3	2.161	0	0	1	P	318	AK28
07-Oct	19	11	46.98101	60.80928	2422	137	4.1	3	1.835	1	0.38	1	P	319	AJ28
09-Oct	12	1	47.04367	61.15755	2989	59	1.2	4	2.732	1	0.569	1	P	320	AK26
09-Oct	12	2	47.00802	61.37712	2211	46	0.6	3	1.588	2	0.901	1	P	321	AK25
09-Oct	12	3	46.9619	61.39941	2608	49	-0.1	1	0.384	1	0.384	1	P	322	AJ25
09-Oct	12	4	47.01806	61.55728	2706	33	4.7	0	0	0	0	2	P	323	AK24
09-Oct	12	5	46.92666	61.62397	2275	49	0.2	17	10.449	4	2.054	1	P	324	AJ23
09-Oct	12	6	46.87471	61.71765	2554	55	-0.2	7	4.438	4	2.631	1	P	325	AI23
09-Oct	12	7	46.90067	61.46269	3379	59	-0.1	3	1.745	1	0.534	1	P	326	AJ24
09-Oct	19	8	46.81534	61.2879	3270	62	0.6	8	5.804	5	4.029	1	P	327	AI25
09-Oct	19	9	46.79765	61.25609	3157	66	0.6	6	2.993	4	1.913	1	P	328	AI26
09-Oct	19	10	46.73406	61.35951	3183	68	0.7	9	6.313	8	5.619	1	P	329	AH25
12-Oct	12	1	46.79744	61.50606	3169	64	0.2	11	5.859	9	4.752	1	P	330	AI24
12-Oct	12	2	46.73765	61.60435	3910	73	0.1	4	1.994	4	1.994	1	P	331	AH24
12-Oct	12	3	46.67818	61.77733	2776	66	1.6	7	3.717	1	0.509	1	P	332	AH23
12-Oct	12	4	46.59529	61.82167	2321	55	4.1	0	0	0	0	1	P	333	AG22
12-Oct	12	6	46.63322	61.70617	2958	62	2.1	4	1.955	4	1.955	3	A1	334	AG23
12-Oct	12	7	46.47998	61.74194	2465	40	13	0	0	0	0	1	P	335	AF23
12-Oct	12	8	46.38964	61.78704	2602	40	12	0	0	0	0	1	P	336	AE23
12-Oct	12	9	46.38248	61.61952	2834	55	4.4	1	0.593	1	0.593	1	P	337	AE24
12-Oct	12	10	46.26439	61.65163	2258	57	4	37	23.414	7	4.42	1	P	338	AD23

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13-Oct	12	1	46.10733	61.63975	1833	49	3.8	2	0.864	0	0	1	P	339	AC24
13-Oct	12	2	46.21694	61.59171	2274	55	3.2	6	3.699	0	0	2	P	340	AD24
13-Oct	12	3	46.204	61.43655	2017	38	13	0	0	0	0	1	P	341	AD25
13-Oct	12	4	46.37012	61.33649	2388	51	5.5	0	0	0	0	1	P	342	AE25
13-Oct	12	5	46.45894	61.36229	2493	62	1.3	1	0.566	0	0	1	P	343	AF25
13-Oct	12	6	46.45655	61.47596	1938	64	0.7	20	12.799	10	5.939	1	P	344	AF24
13-Oct	12	7	46.53023	61.44891	3221	64	1.3	15	10.78	4	3.002	1	P	345	AF25
13-Oct	12	8	46.61236	61.54756	3258	60	0.4	13	9.107	5	3.847	1	P	346	AG24
13-Oct	19	9	46.63344	61.24469	3502	79	1.8	12	6.788	3	1.613	1	P	347	AG26
14-Oct	19	1	46.693	61.23646	3297	113	2.3	24	17.558	16	11.919	1	P	348	AH26
14-Oct	19	2	46.67775	61.02691	2879	40	12	0	0	0	0	1	P	349	AH27
14-Oct	19	3	46.83066	60.89969	3507	90	2.4	22	14.228	18	11.141	1	P	350	AI28
14-Oct	19	4	46.9386	61.00529	3438	99	2.6	2	1.283	0	0	1	P	351	AJ27
15-Oct	19	1	46.91199	61.14966	3077	62	0.6	2	1.468	2	1.468	1	P	352	AJ26
15-Oct	19	2	46.84751	61.0419	2516	102	2.4	10	6.688	5	3.625	1	P	353	AI27