

## Summary of the SponGES-Related Sampling Conducted on the Joint DFO-NEKTON XL Catlin Deep Ocean Survey (Hudson2016-019)

Beazley, L., Lirette, C., & Kenchington, E.

Fisheries and Oceans Canada (DFO) in collaboration with NEKTON (<https://nektionmission.org/>), SponGES (<http://www.deepseasponges.org/>), and ATLAS (<http://www.eu-atlas.org/>) led a multinational, multidisciplinary oceanographic research mission called the ‘Joint DFO-NEKTON XL Catlin Deep Ocean Survey’, from Halifax to Bermuda, July 19 – August 16<sup>th</sup>, 2016. The NEKTON Foundation is a non-profit organization based in the UK that strives to collect baseline data in unexplored or poorly known habitats in the deep ocean of the northwest Atlantic. The main goal of this mission was to collect baseline data for which to judge future climate change or other anthropogenic impacts. Dr. Ellen Kenchington, a research scientist with DFO based at the Bedford Institute of Oceanography (BIO), was chief scientist of the mission.

The mission was conducted onboard the Canadian Coast Guard vessel *Hudson*, and sailed from the Bedford Institute of Oceanography in Dartmouth, Nova Scotia to Bermuda and back. Figure 1 shows the track of the vessel and major locations where sampling was conducted. During the mission, benthic and pelagic sampling was conducted at several basins and deep-water canyons on the Scotian Shelf and Slope, on Kelvin Seamount of the New England Seamount Chain, and in the deep waters surrounding Bermuda (see Figure 1). Furthermore, targeted hydrographic and pelagic net sampling was conducted along the cold-water boundary of the Gulf Stream. Here, oceanographic data, water samples, and multinet and neuston net samples will be examined to determine whether these cold walls are major centres of ecological interaction.

Several pieces of gear and equipment were deployed during the mission, including a drop camera and ROV to collect *in situ* information and specimen samples from the seabed, a mega box-corer and van veen grab to collect biological specimens and sediment, a Moving Vessel Profiler (MVP), CTD and 24-bottle rosette, Expendable Bathythermographs (XBT) and Expendable Sound Velocimeters (XSV) to describe hydrography and ocean chemistry, and multinet and neuston nets to collect zooplankton and micronekton.

### SponGES – Related Sampling on the Joint DFO-NEKTON XL Catlin Deep Ocean Survey

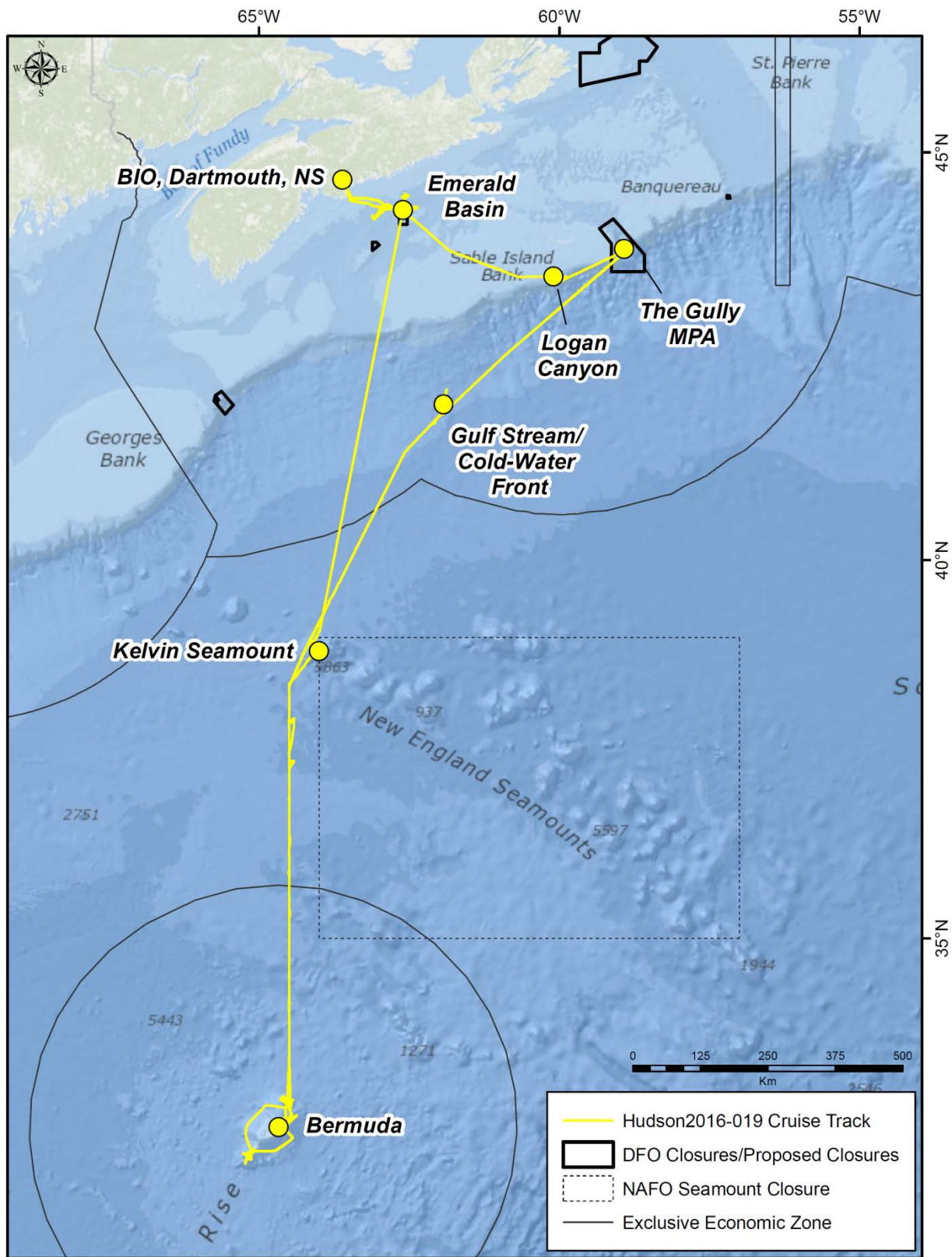
During the mission, all sampling related to the EU Horizon2020-funded project SponGES was focused in Emerald Basin off Nova Scotia, where a monospecific sponge ground formed by the Russian Hat sponge *Vazella pourtalesi* occurs. Stations here were planned within DFO’s Emerald Bank *Vazella* Closure where dense concentrations of *V. pourtalesi* have been previously reported from *in situ* camera surveys conducted in 2011 by DFO. Sampling in Emerald Basin

was conducted to satisfy multiple SponGES Work Packages, and was conducted in two phases: one at the beginning of the mission between July 20 and 21, and one at the end of the mission between August 13 and 15 before returning to BIO. The second phase of sampling at this location was necessary for the collection of live *V. pourtalesi* specimens which were brought back in an aquarium to BIO. Figure 2 shows an overview map of the sampling conducted in both phases.

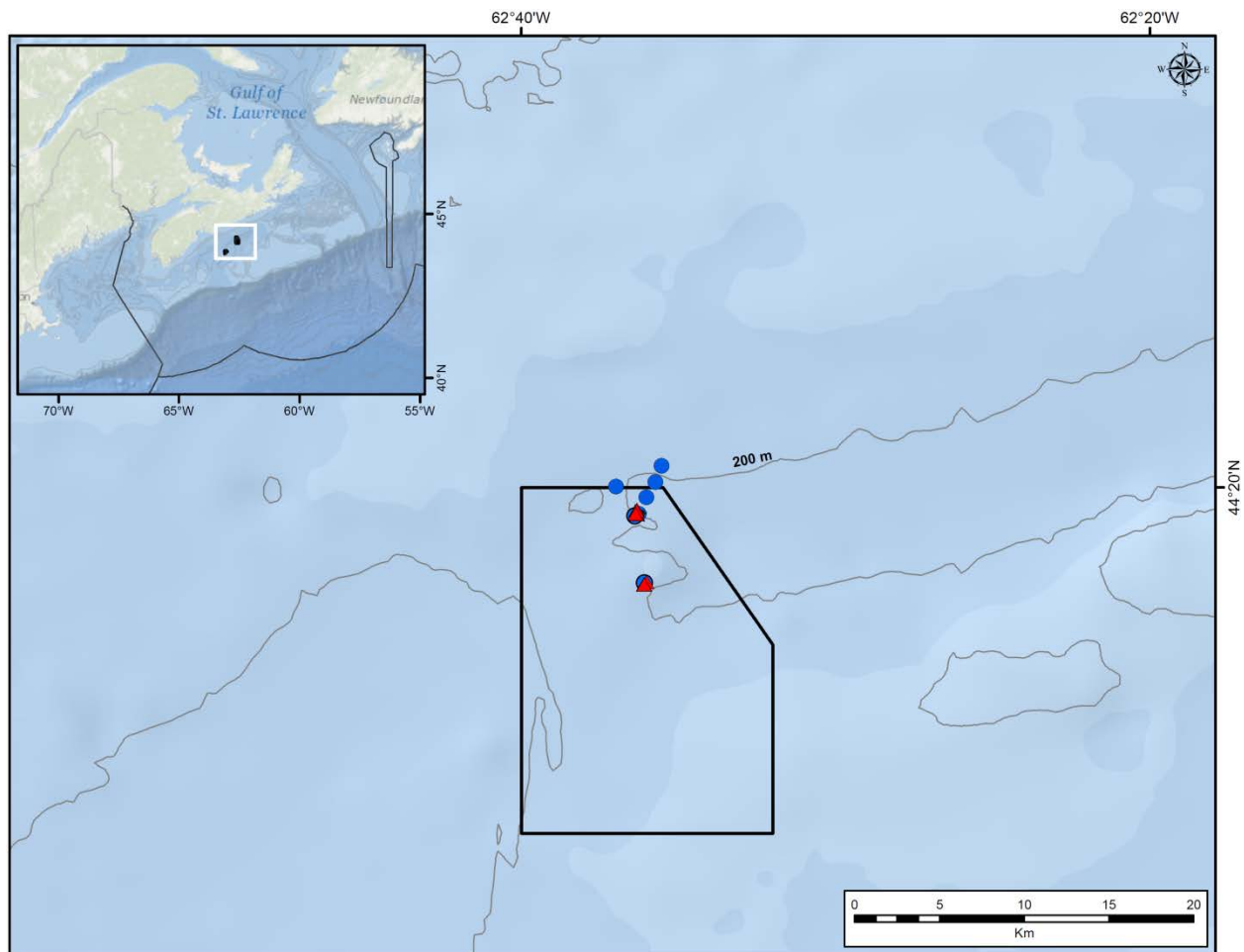
During Phase 1 in Emerald Basin, sampling was focused on collecting sponges to be preserved and used for several purposes, such as Genomics/Transcriptomics (WP3), Metagenomics/Metatranscriptomics (WP2), Phylogenetics/Barcoding (WP2), Metabolomics (WP5), Silicon Isotope Analysis (WP7), Reproduction (WP3), and associated biodiversity studies (WP2). Due to technical difficulties with the ROV, samples of *Vazella* were collected using a mega box-corer. Figure 3 shows the location of sampling conducted during Phase 1, and the associated metadata for each sampling event is shown in Table 2. A total of 4 *Vazella* sponges were collected with the box corer, as well as associated sediment and water samples for silicon isotope analysis and metagenomics. See Table 1 for a summary of the *Vazella* samples collected and preserved for the various SponGES tasks. CTD stations were conducted to measure the hydrographic conditions and nutrient concentrations within and outside the sponge grounds. Oceanographic data was collected over the CTD line using the Moving Vessel Profiler (MVP) (not shown in Figure 3).

The main purpose of sampling during Phase 2 was to collect live *Vazella* specimens for carbon and nitrogen cycling experiments conducted by Jasper de Goeij (University of Amsterdam), and silicate uptake experiments by Manuel Maldonado (Centre for Advanced Studies of Blanes (CSIC)). During this phase a total of 26 sponges were collected using the ROV and stored in a holding tank where they were brought back to BIO for experimentation. Figure 4 shows the location of sampling conducted during Phase 2, and the associated metadata for each sampling event is shown in Table 3. Some of these sponges were sampled for various tasks (e.g. reproductive studies) at the conclusion of experimentation. Several other *Vazella* sponges collected with ROV that were not suitable for live experiments were sampled for the various WP tasks (see Table 1), as well as associated water and sediment samples for silicon isotope analysis and metagenomics.

\*Research conducted in Emerald Basin on *Vazella pourtalesi* was in support of the EU-funded SponGES project on "Deep-sea Sponge Grounds Ecosystems of the North Atlantic: an integrated approach towards their preservation and sustainable exploitation" - Grant Agreement no. 679849.



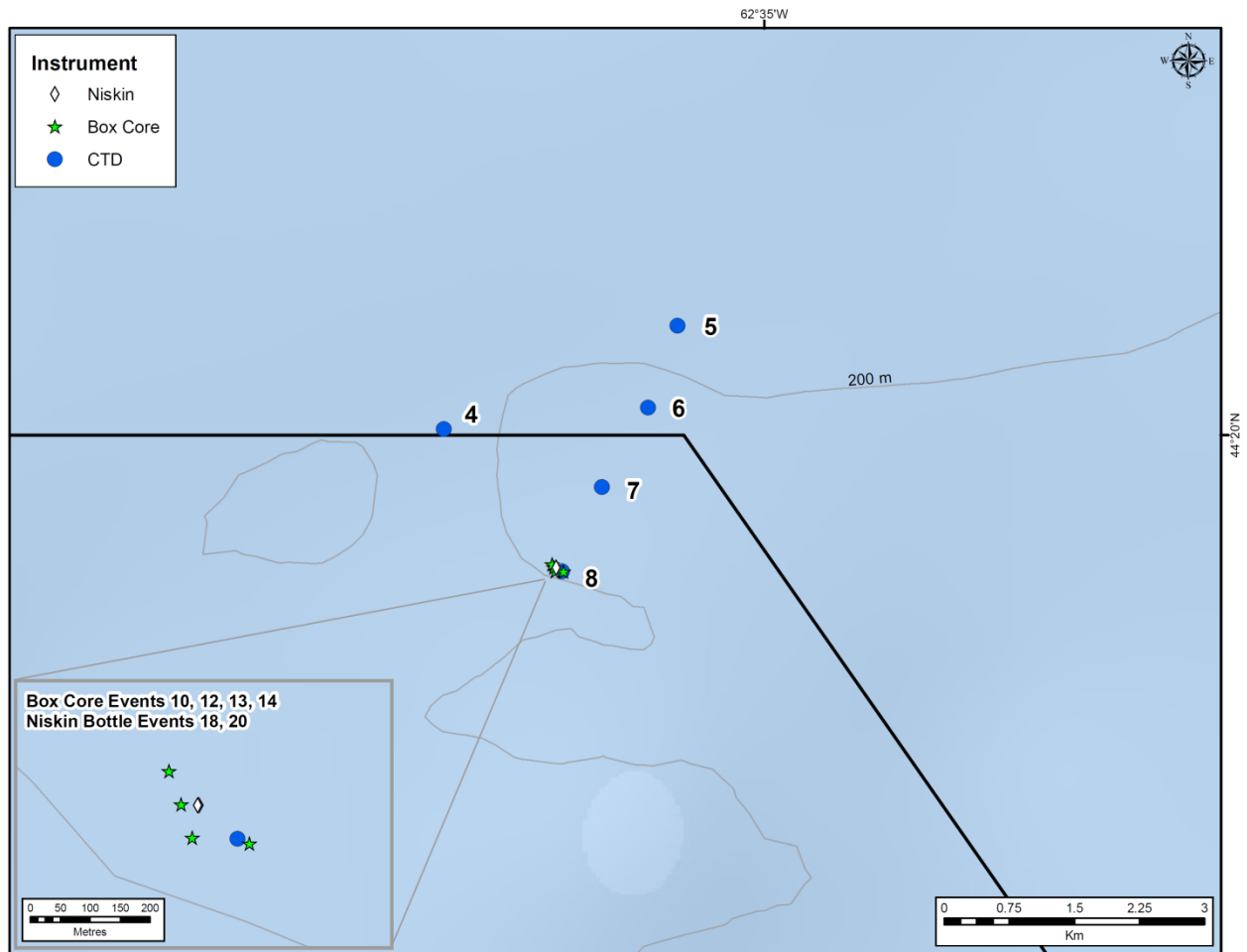
**Figure 1.** Overview map showing cruise track and major sampling locations for the Hudson2016-019 mission.



**Figure 2.** Overview of SponGES-related sampling in Emerald Basin. Sampling conducted in both Phase 1 and Phase 2 is shown.

**Table 1.** Summary of *Vazella pourtalesi* samples collected and preserved for the various SponGES tasks. Number in row indicates number of technical (tissue) replicates taken. \*Indicates sponge was used in silicate experiments in the lab prior to sampling. † Indicates sample was live-collected but not used in silicate experiments. ‘Range’ in the Event column indicates that these samples were collected over a range of ROV stations (events 380-395) and their exact location can not be determined.

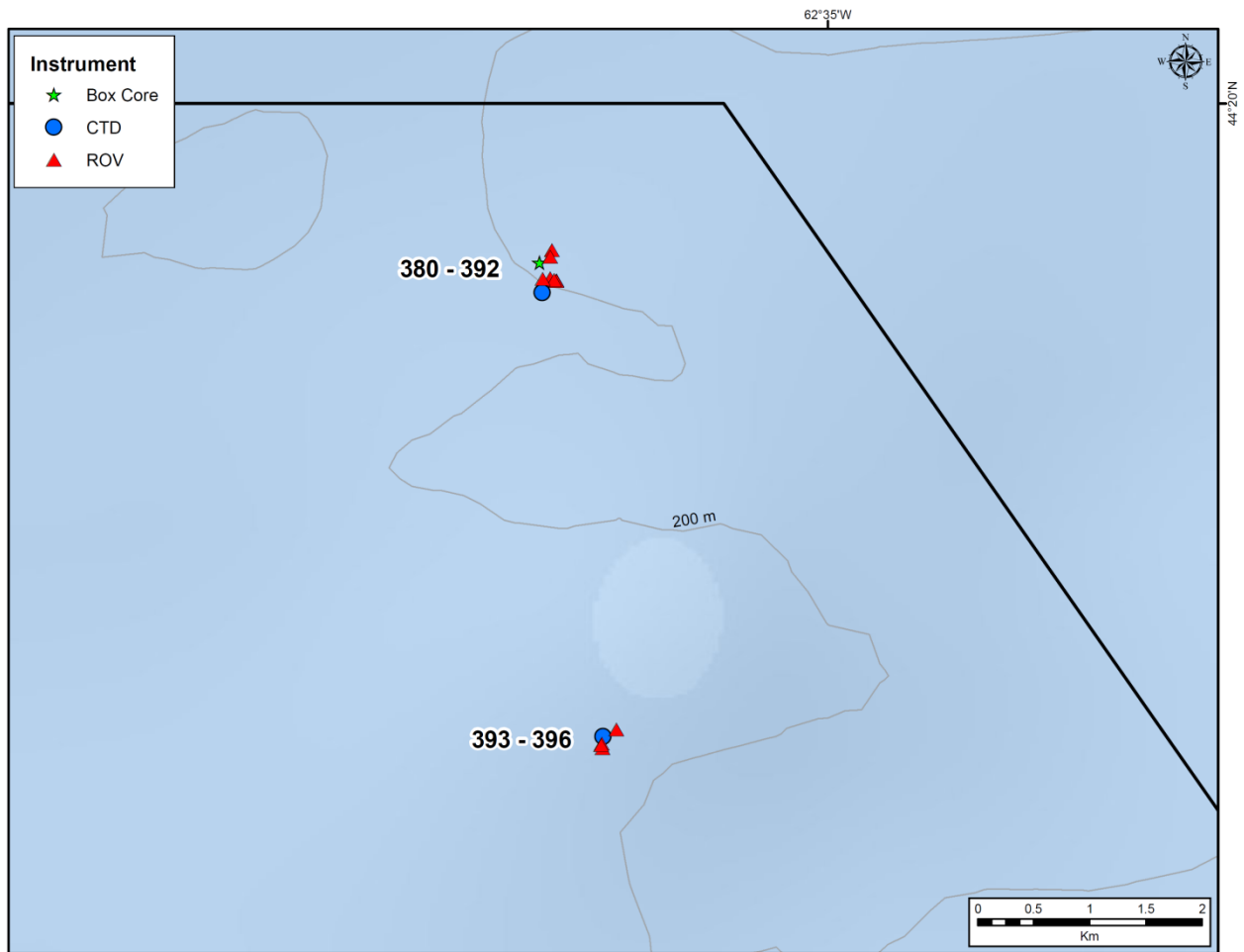
| Sponge ID    | Event | Gear      | Phylogen./<br>Barcoding | Genomics/<br>Transcript. | Metagenomics/<br>Metatranscript. | Metabolomics | Silicon<br>Isotopes | Morphol. | Reproduction<br>(Hist I, II, &<br>EM) |
|--------------|-------|-----------|-------------------------|--------------------------|----------------------------------|--------------|---------------------|----------|---------------------------------------|
| B0001        | 10    | Box corer | 1                       | 3                        | 3+ extra tissue                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0002        | 10    | Box corer | 1                       | 3                        | 3+ extra tissue                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0003        | 10    | Box corer | 1                       | 3                        | 3                                |              | 1                   | 1        | 1 rep. each                           |
| B0004        | 10    | Box corer | 1                       | 3                        | 3+ extra tissue                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0005 (dead) | 10    | Box corer |                         |                          |                                  |              |                     | 1        |                                       |
| B0132        | 383   | ROV       | 1                       | 3                        | 3+ extra tissue                  | 9            | 1                   | 1        | 3 reps. each                          |
| B0133        | 383   | ROV       | 1                       | 3                        | 3+ extra tissue                  | 9            | 1                   | 1        | 3 reps. each                          |
| B0197        | 391   | ROV       | 1                       | 3                        | 3                                |              | 1                   | 1        | 1 rep. each                           |
| B0216        | 395   | ROV       | 1                       | 3                        | 3+ extra tissue                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0230*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0241*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0252*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0263*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0274*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0285*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0296*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0307*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0318*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0329*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| B0340*       | Range | ROV       | 1                       | 3                        |                                  | 9            | 1                   | 1        | 1 rep. each                           |
| Vazella I†   | Range | ROV       | 1                       | 1                        |                                  | 1            |                     |          |                                       |
| Vazella II†  | Range | ROV       | 1                       | 1                        |                                  | 1            |                     |          |                                       |
| Vazella III† | Range | ROV       | 1                       | 1                        |                                  | 1            |                     |          |                                       |



**Figure 3.** Sampling conducted during Phase 1 in Emerald Basin. Numbers next to the symbols indicate the event number. See Table 1 for associated metadata.

**Table 2.** Sampling conducted during Phase 1 in Emerald Basin. Coordinates are in decimal degrees. Note that coordinates for the CTD and Box Core are when the gear is either on bottom or closest to bottom. Coordinates for the Moving Vessel Profiler (MVP) are deployed and recovered coordinates.

| <b>Event</b> | <b>Instrument</b> | <b>Date</b> | <b>Action</b> | <b>Latitude</b> | <b>Longitude</b> | <b>Depth</b> |
|--------------|-------------------|-------------|---------------|-----------------|------------------|--------------|
| 4            | CTD               | 20/07/2016  | Bottom        | 44.3339         | -62.6165         | 382.19       |
| 5            | CTD               | 20/07/2016  | Bottom        | 44.3447         | -62.5923         | 183.62       |
| 6            | CTD               | 20/07/2016  | Bottom        | 44.3362         | -62.5954         | 204.01       |
| 7            | CTD               | 20/07/2016  | Bottom        | 44.3280         | -62.6002         | 211.48       |
| 8            | CTD               | 20/07/2016  | Bottom        | 44.3193         | -62.6043         | 204.47       |
| 10           | Box Core          | 20/07/2016  | Bottom        | 44.3193         | -62.6050         | 199.29       |
| 12           | Box Core          | 21/07/2016  | Bottom        | 44.3196         | -62.6051         | 197.52       |
| 13           | Box Core          | 21/07/2016  | Bottom        | 44.3200         | -62.6053         | 199.80       |
| 14           | Box Core          | 21/07/2016  | Bottom        | 44.3192         | -62.6041         | 200.23       |
| 15           | MVP               | 21/08/2016  | Deployed      | 44.2664         | -62.6473         | 181.93       |
|              |                   | 21/07/2016  | Recovered     | 44.2934         | -62.6229         | 169.21       |
| 16           | MVP               | 21/08/2016  | Deployed      | 44.3035         | -62.6130         | 169.13       |
|              |                   | 21/07/2016  | Recovered     | 44.3905         | -62.5656         | 168.89       |
| 18           | Niskin            | 21/07/2016  | Bottom        | 44.3196         | -62.6049         | 199.63       |
| 20           | Niskin            | 21/07/2016  | Bottom        | 44.3196         | -62.6049         | 198.71       |



**Figure 3.** Sampling conducted during Phase 2 in Emerald Basin. Numbers next to the symbols indicate the event number. Only start (on bottom) coordinates are shown for the ROV. See Table 2 for associated metadata.



**Table 3.** Sampling conducted during Phase 2 in Emerald Basin. Coordinates are in decimal degrees. For ROV dives the on bottom and off bottom coordinates are given, and deployed and recovered coordinates are given for the Moving Vessel Profiler (MVP).

| <b>Event</b> | <b>Instrument</b> | <b>Date</b> | <b>Action</b> | <b>Latitude</b> | <b>Longitude</b> | <b>Depth</b> |
|--------------|-------------------|-------------|---------------|-----------------|------------------|--------------|
| 380          | ROV               | 13/08/2016  | On Bottom     | 44.3194         | -62.6056         | 207.50       |
|              |                   | 13/08/2016  | Off Bottom    | 44.3191         | -62.6052         | 201.25       |
| 381          | ROV               | 13/08/2016  | On Bottom     | 44.3192         | -62.6051         | 202.92       |
|              |                   | 13/08/2016  | Off Bottom    | 44.3192         | -62.6059         | 202.65       |
| 382          | ROV               | 13/08/2016  | On Bottom     | 44.3191         | -62.6051         | 202.52       |
|              |                   | 13/08/2016  | Off Bottom    | 44.3192         | -62.6050         | 202.07       |
| 383          | ROV               | 13/08/2016  | On Bottom     | 44.3192         | -62.6052         | 202.75       |
|              |                   | 13/08/2016  | Off Bottom    | 44.3193         | -62.6051         | 202.70       |
| 385          | MVP               | 13/08/2016  | Deployed      | 44.3350         | -62.6752         | 154.38       |
|              |                   | 13/08/2016  | Recovered     | 44.3285         | -62.6405         | 204.77       |
| 386          | ROV               | 14/08/2016  | On Bottom     | 44.3216         | -62.6054         | 207.43       |
|              |                   | 14/08/2016  | Off Bottom    | 44.3219         | -62.6065         | 204.08       |
| 387          | Box Core          | 14/08/2016  | Bottom        | 44.3205         | -62.6064         | 202.83       |
| 388          | ROV               | 14/08/2016  | On Bottom     | 44.3211         | -62.6055         | 212.82       |
|              |                   | 14/08/2016  | Off Bottom    | 44.3216         | -62.6056         | 203.37       |
| 390          | MVP               | 14/08/2016  | Deployed      | 44.3189         | -62.5630         | 218.38       |
|              |                   | 14/08/2016  | Recovered     | 44.3208         | -62.5530         | 243.86       |
| 391          | ROV               | 15/08/2016  | On Bottom     | 44.3193         | -62.6062         | 206.40       |
|              |                   | 15/08/2016  | Off Bottom    | 44.3172         | -62.6076         | 193.32       |
| 392          | CTD               | 15/08/2016  | Bottom        | 44.3182         | -62.6062         | 204.82       |
| 393          | ROV               | 15/08/2016  | On Bottom     | 44.2832         | -62.6002         | 183.60       |
|              |                   | 15/08/2016  | Off Bottom    | 44.2831         | -62.6002         | 183.89       |
| 394          | ROV               | 15/08/2016  | On Bottom     | 44.2817         | -62.6013         | 190.56       |
|              |                   | 15/08/2016  | Off Bottom    | 44.2818         | -62.6015         | 190.30       |
| 395          | ROV               | 15/08/2016  | On Bottom     | 44.2819         | -62.6015         | 184.44       |
|              |                   | 15/08/2016  | Off Bottom    | 44.2820         | -62.6014         | 185.09       |
| 396          | CTD               | 15/08/2016  | Bottom        | 44.2825         | -62.6013         | 183.53       |