Quantifying **I**rish **M**arine **P**lac**e**r **R**esources **(QuIMPeR)**

Survey CV17020

RV Celtic Voyager

Killybegs –Galway

24th July to 5th August 2017

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1 Executive Summary

A series of areas were surveyed to locate, delineate and sample heavy mineral sands near to beaches where heavy minerals had already been sampled. All areas surveyed were mapped with non-overlapping multibeam lines at 250m or 500m apart. The multibeam bathymetry and backscatter clearly identified areas of flat sandy (or gravelly) seabed between rock outcrops. Sparker and pinger lines run simultaneous with the multibeam provided sub-seabed information showing the depth to bedrock and/or and consequently the thickness of the surface layer or layers. Magnetometer data was also collected although it is not clear if this will be useful in quantifying the heavy mineral sand. It needs to be normalised water depth and depth to bedrock and tested with heavy mineral sand concentrations. The above mapping allowed for the targeting of physical samples the shipek and the vibrocorer for subsequent lab analysis.

Area A (outer Mullet Peninsula) was not studied as weather and time considerations prohibited entry to the West Connacht SAC here. Strict guidelines for the operation of seismics in this SAC (West Connacht SAC) are required to protect bottlenose dolphins.

138 km of sparker, pinger, multibeam and magnetometer data were collected in Area B (Blacksod Bay). This was groundtruthed by 27 shipek grab samples and two 3m vibrocores. The seabed in the area was relatively flat with minimal rock outcrops except at the edges of the area. The survey area delineated a large sand body that generally fines to the north and thickens into the middle of the basin. A simple “layer-cake” stratigraphy is revealed in the seismic data. Good vibrocore penetration was achieved collecting 2.7m average of sands. One vibrocore was taken off Blacksod Pier and one off of Doogort Beach on North Achill Island. Both beaches had been noted for heavy mineral sands. Two CTDs were taken to calibrate the sound velocity for the multibeam echosounder.

57 km of sparker, pinger, multibeam and magnetometer data were collected in Area C (offshore North Achill Island). This was groundtruthed by 9 shipek grab samples and four 3m vibrocores. The seabed in the area was relatively flat with obvious heavy mineral sands visible in the shipek samples.

19 km of sparker, pinger, multibeam and magnetometer data were collected in Area D (offshore SW Achill Island to Keem Bay). This was groundtruthed by 7 shipek grab samples and four 3m vibrocores. The seabed below the cliffs of SW Achill showed flat terraces of shell hash accumulating between rock ridges exposed on the seabed. This part of area D was deem unsuitable for further heavy mineral sand studies. In outer

Keem Bay, areas of sand exist between large rock outcrops, some of which form navigational hazards. A CTD was taken to calibrate the sound velocity on this side of the island for the multibeam echosounder.

26 km of sparker, pinger, multibeam and magnetometer data were collected in Area E (offshore Dooagh Beach). This was groundtruthed by 3 shipek grab samples. Dooagh Beach made the news this year as sand reappeared on the beach after an absence of 30 years. The multibeam and seismic data revealed areas of sediment accumulation between rocky seabed at the western and eastern limits of the survey. Samples were coarse and shelly and hard to sample suggesting that these may be a thin veneer over a hard substrate. Vibrocoring was not attempted here because of concern for the gear.

14 km of sparker, pinger, multibeam and magnetometer data were collected in Area F (offshore Keel Bay). This was groundtruthed by 5 shipek grab samples. This area revealed a significant area of sand bounded by rocky outcrops. Heavy minerals concentrations were not high on Keel Beach and this area was a lower priority area with no vibrocores taken. Opportunities to vibrocore were severely weather restrict.

26 km of sparker, pinger, multibeam and magnetometer data were collected in Area G (offshore Dooega Bay). This was groundtruthed by 11 shipek grab samples and three 3m vibrocores. Sandy areas with rock outcrop were present on the seabed. Heavy mineral sands were obvious in both the vibrocores and rock samples. Recent landslides on the cliffs surrounding this bay were visible for the vessel and may be contributing sediment to the survey area.

95 km of sparker, pinger, multibeam and magnetometer data were collected in Area H (offshore Old Head in SW Clew Bay). This was groundtruthed by 14 shipek grab samples and three 3m vibrocores. The seabed revealed extensive areas of flat sediment rich seabed and submerged drumlins. Shipeks revealed sand in the east of the area but pebbles in the west. Three vibrocores were taken off the mouth of Bunowen River and contained sands, gravel and muds. Heavy minerals were not obvious.

52 km of sparker, pinger, multibeam and magnetometer data were collected in Area I (offshore Emlagh Point). This was groundtruthed by 11 shipek grab samples and three 3m vibrocores. This area revealed an area of heavy mineral rich sands near shore with rock outcrop becoming more dominant further offshore. Patches of sand and gravel were found further offshore between rock outcrops. One of the vibrocore revealed a 30cm layer of sand over gravel.

One final shipek sample was taken off Achill Sound on north Clew Bay and revealed a coarse shelly sand.

Permission to work in the SACs was acquired prior to the survey. This survey contributed data to the iCRAG FLIPeR PhD project.

2 Background

Heavy mineral sands are common on the beaches of the Belmullet Peninsula and Achill Island as well as southern outer Clew Bay. The combination of metamorphic and igneous terrane adjacent to high energy coastlines offers a clear scenario for heavy mineral sand development in Ireland. In the 1980s, the Geological Survey of Ireland (Geoghegan *et al*., 1988; Sutton *et al*., 2001) revealed several offshore finds whilst heavy mineral sands on Irish beaches have been known since the last century. Geoghegan *et al*. (1988) noted finds offshore of Wicklow Head, Brittas Bay and Gorey in the southern Irish Sea, and offshore Falcarragh (Co. Donegal), Portacloy, Blacksod Bay and Achill Island (Co. Mayo) and Clogher Head (Co. Kerry) on the west coast.

Also in the 1980s, Burmin Exploration & Development Plc. took out a prospecting licence to assess heavy mineral sands in the Blacksod Bay area where 30 km^2 of seabed showing heavy mineral finds presumed to be eroding from the Annagh Gneiss Complex and Dalradian. Although economic grade deposits have not been established, ilmenite, magnetite, sphene and gold were present. Cassiterite and columbite-tantalite series mineral resources were also postulated.

Although of unlikely economic significance, the data set can be used to assess nearshore sand accumulation with the intent of understanding the sources of this sands and their connectivity to beaches in terms of sediment exchange. The Blacksod, Achill and Clew Bay beaches are subject to seasonal erosion and replenishment. The beaches also contain heavy minerals eroded from local lithologies that enables “fingerprinting” of sediment source areas. By studying sediment accumulation volumes and heavy mineral content we intend to determine onshore-offshore sediment exchange and accumulation budgets. An appraisal of potential offshore heavy mineral placer resources can also be developed from the same dataset.

Since the 1980’s, there have been major advances in the offshore exploration capabilities through technology developments. Systematic seabed mapping of Ireland offshore using groundtruthed multibeam echosounders and LIDAR has been undertaken through the Geological Survey of Ireland’s INFOMAR programme providing valuable baseline data to this project. TELLUS soil and stream geochemical data are also available showing on-land elemental anomalies enabling links between offshore resources and river fluvial pathways.

This survey provides data to the SFI-funded iCRAG (Irish Centre for Research in Applied Geosciences) project FLIPeR (Formation of Littoral and Offshore Irish Placer Resources).

References

Geoghegan, M., Gardiner, P.R.R., & Keary, R. (1989) Possibilities for commercial mineral deposits in the Irish Offshore Area. *Marine Mining*, 8, 267-282.

Sutton, G., Wheeler, AJ & O'Leary, E. (2001). *An assessment of the current status and RTDI requirements in respect of the development of Irish seabed resources*. Final Report to Marine Institute, Dublin. 242pp.

3 Survey Rationale and Objectives

The QuIMPeR survey focusses exclusively on studying offshore heavy mineral sand deposits in the Blacksod/Achill Island/SW Clew Bay area with the following .scientific objectives:

Objective 1: To map the spatial and volumetric extent offshore heavy mineral sand deposits

Objective 2: To retrieve samples to quantify the amount and type of heavy mineral sands and enable heavy mineral sand grain analysis for provenance studies and assays.

Objective 3: To retrieve cores through heavy mineral sand deposits to look a variation in heavy minerals sands through time and relate to temporal changes in environmental conditions and to allow better quantification.

To fullfil these objectives, the following operations were undertaken:

Collection of multibeam echounder data: multibeam backscatter is used to determine the extent and location of sand at the seabed as well as its water depth. Some of the areas (e.g. in Blacksod Bay) already have INFOMAR multibeam but repeat coverages can see if the sand has shifted. For most of the areas, complete mosaics are not possible (or needed) with the time constrains of the survey but c. c.80% coverage is possible.

Collection of magnetic data: some heavy minerals are magnetic giving the possibility that magnetic data may be able to identify heavy mineral sand concentrations. However, depth to bedrock also has an impact on the data so interpretation can be problematic. Processing and interpretation of the data on the fly may not be possible but this may prove a useful dataset when fully processes.

Collection of seismic and sub-bottom profiler data: this data will provide sub-seabed imaging enabling an interpretation of the depth of sand bodies and seabed stratigraphies.

Figure 1 shows the survey areas targeted based on the occurrence of heavy mineral sand on beaches historically known or sampled during the FLIPeR project (Formation of Littoral and Offshore Irish Placer Resources).

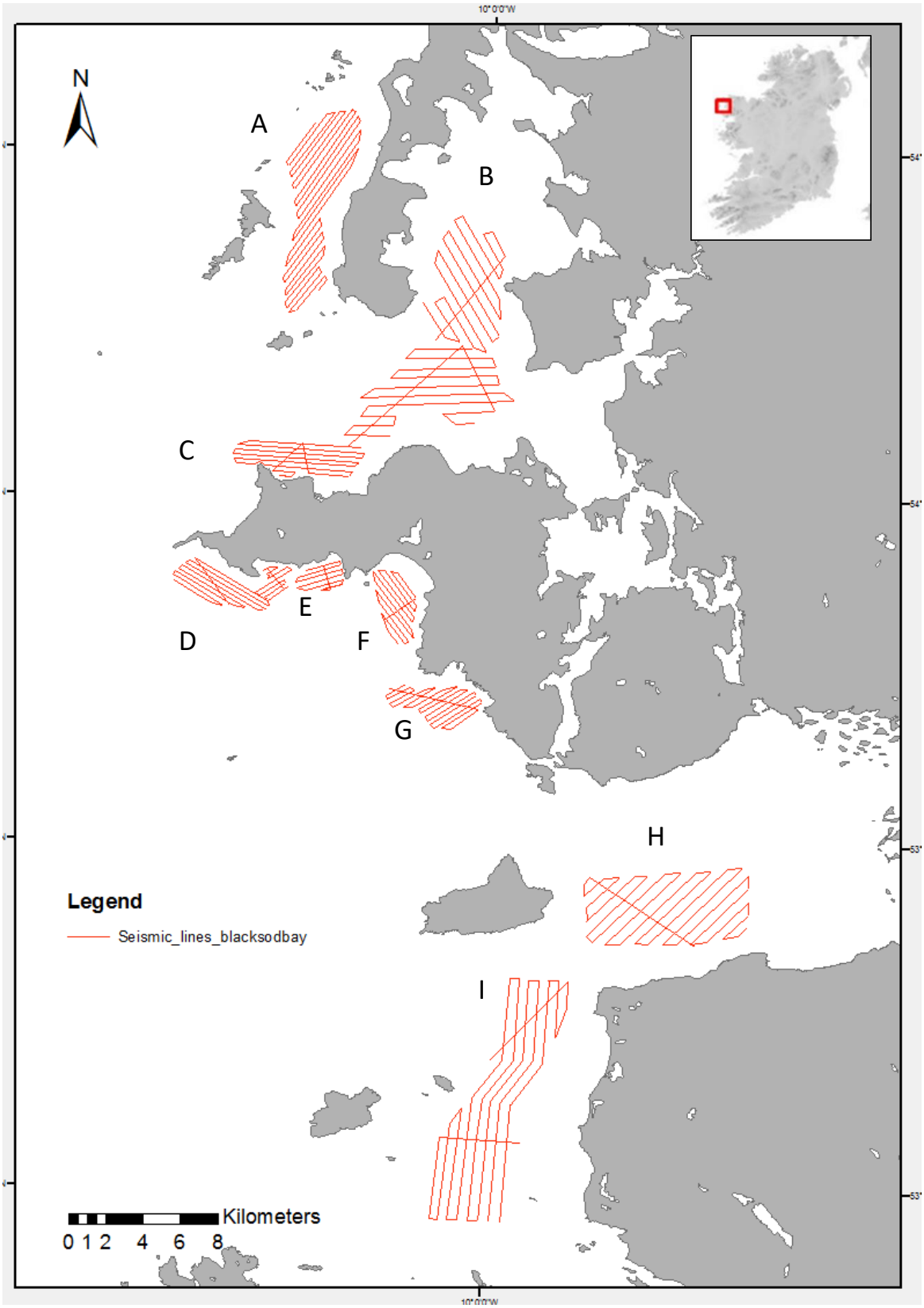


Figure 1. Planned survey areas (labelled A-I)

4 Equipment

RV Celtic Voyager

The RV Celtic Voyager is a fully equipped research vessel 31.4m in length and a 4m draught: the smaller of the two research vessels. The vessel has wet, dry and chemical laboratories, which are permanently fitted with standard scientific equipment. She can accommodate 6-8 scientists depending on the survey and can stay at sea for a maximum of 14 consecutive days. The vessel facilitates the collection of fisheries, geophysical, oceanographic and environmental data and is also used to provide practical training for the next generation of marine scientists. The RV Celtic Voyager is equipped with a hull mounted EM2040 Multi-beam echosounder.

Figure 2. RV Celtic Voyager

Simrad EM2040 Multibeam Echosounder

The Kongsberg Simrad EM2040 High Resolution Multi-beam Echosounder (MBES) is a type of sonar used to map the seabed. It emits sound waves in a fanshape beneath the hull of a vessel and the time it takes for the sound wave to return from the seabed to the receiver is used to calculate depth. The system has the ability to map large areas at high speed without compromising data quality and produce high-resolution, calibrated acoustic-backscatter imagery. It is designed to operate in a range of water depths from 50 to approximately 1500m, giving a greater range and flexibility in sea

bed mapping. The EM2040 has dual swath per ping that allows a doubling of survey speed and more efficient retrieval of data.

The EM2040 MBES holds four units, a transmit transducer, a receive transducer, a processing unit, and a workstation. The transducer has an angular coverage of 200º (±100º). This allows a coverage of 5.5 times water depth in comparison with a single receive transducer. Having a second receive transducer allows surveying to the water surface or up to 10 times water depth on flat bottoms. With this, The EM 2040 has a large operating bandwidth of 200 to 400 kHz which allows the system to have an output sample rate up to 58.8 kHz. 300 kHz is used for near bottom, 200 kHz for deeper waters, and 400 kHz for very high resolution inspection.

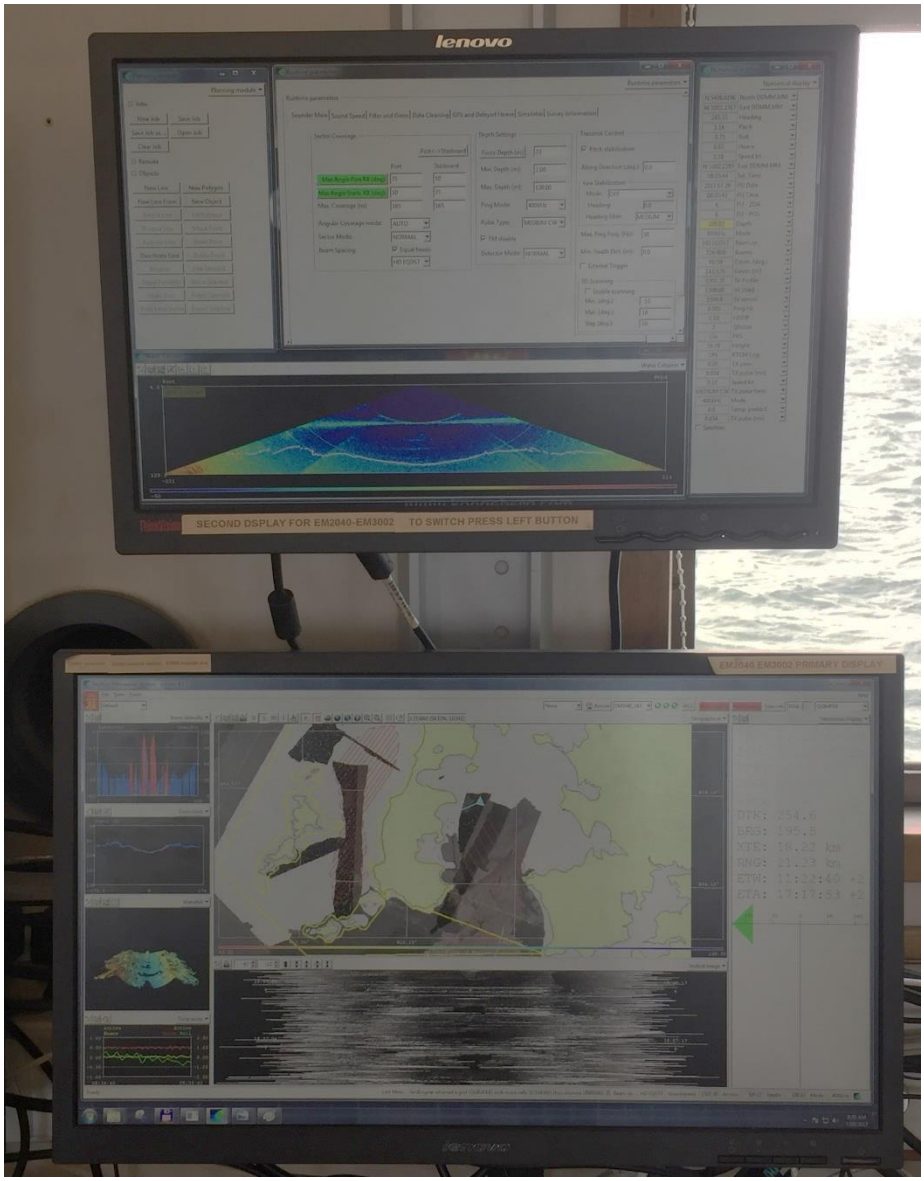


Figure 3: Multibeam echosounder supported by Kongsberg SIS software

Geo-Source GeoSpark 200 sub-bottom profiler

The Geo-Source GeoSparker200 sparker seismic system of the Marine Institute was used during the survey. This sparker seismic system consists of the Geo-Spark 6 kJ pulsed power supply which emits a pulse to the sparker source which is towed behind the vessel. The source comprises four electrode modules that are evenly spaced in a planar array. The return signal is picked up in Geo-Sense single channel hydrophone array. The system provides high resolution (<30cm) seismic profiles of the Shallow sub-bottom strata. The device achieves this level of accuracy due to its multi-tip array of sparker nodes, which are evenly spaced and set in-phase producing a very strong downward projection of acoustic energy. The system is designed to be towed on or just below the water-surface. High resolution seismic profiles of up to 300m depth can be imaged using the Geo-Spark 200 depending on the composition of the water column, sea conditions and the nature of the underlying geology.

The system is triggered from a CODA DA2000.

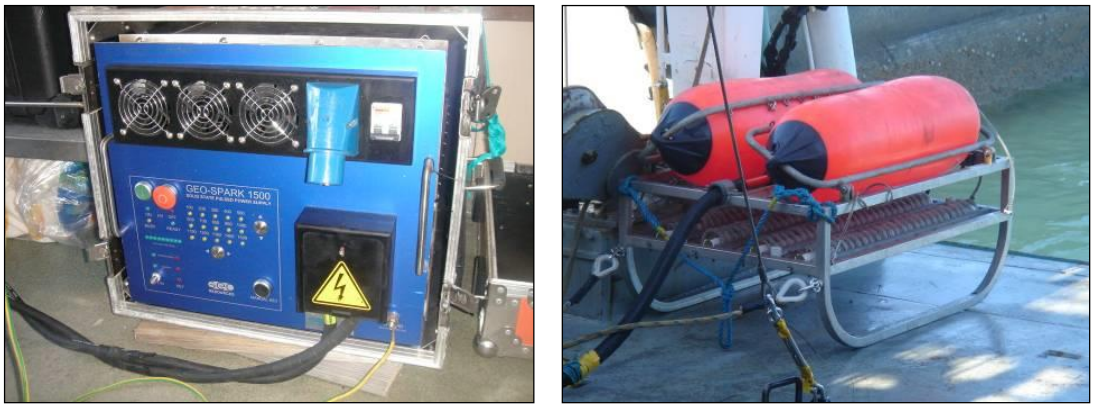


Figure 4: The Sparker "box" and catamaran

Hull mounted ESE 5001S 3.5 kHz pinger system

The Sonar Equipment Services Ltd Probe 5001S 3.5 kHz sub-bottom profiler comprises of a surface processor and a sub-surface transceiver. The processor is set up for 16 transducers (4 X 4 array). The transducers are located in starboard mid sea water ballast tank. Output Power is up to 10KW at an operating frequency of 3.5 to 9.0 kHz. Maximum repetition rate is 10Hz.

The system is triggered from a CODA DA2000.

SeaSPY/Explorer Magnetometer

The SeaSPY/Explorer is a highly sensitive total field magnetometer that detects magnetic variation in the marine substrate by detecting ferrous (Fe-rich) elements. Total field magnetometers measure the magnitude of the vector magnetic field i.e. vector components of the field in terms of declination (the angle between the horizontal component of the field vector and magnetic north) and the inclination (the angle between the field vector and the horizontal surface).

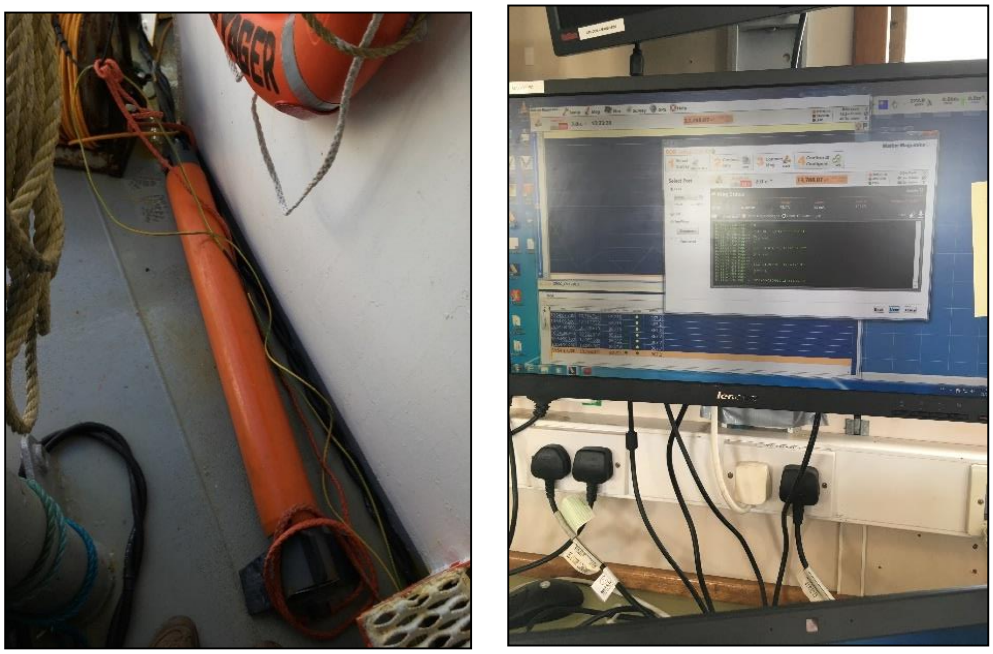


Figure 5: Total field magnetometer above deck (left) The SeaSpy/Explorer can be towed up to 25m behind the vessel. BOB software used for data acquisition and visualisation.

The SeaSPY/Explorer magnetometer overhauser sensor has the highest absolute accuracy of any magnetometer sensor available. It operates at an absolute accuracy of 0.1nT with a sensor sensitivity of 0.01nT and a counter sensitivity and resolution of 0.001nT. Its broad range makes it ideal for variation in sampling ranging from 18,000nT to 120,000nT. It has a sampling range of 4Hz — 0.1Hz and has a depth range of 1000m (1500psi), 3000m (5000psi), 6000m (9000psi) as standard. The housing comprises of 1⁄4" super strong fibreglass coated with a 'bumper' layer of polyurethane for extra shock absorption. A sensor located within the housing provides a visual queue and alarm sound if water penetrates the device if penetrated or damaged. The SeaSPY/Explorer is designed to be towed behind a vessel as the streamline design allows it to navigate through the water column seamlessly. The polyurethane coated tail with moulded fins acts as a bumber, while creating a stable towing platform.

BOB software is used on board to acquire and visualise data. Its geographical interface enables communication with the magnetometer with the ability to log and plot data in real time.

Geo-Resources 6000 vibrocorer

A 3m vibrocore was used and deployed using the A-frame. The Geo Resources 6000 vibrocorer recovers cores of 3 metres depending on the sediment type, with best penetration in fine grained sediments. The vibrocorer consists of a three meter metal tube approximately 20cm in diameter, which contains an interior plastic pipe, or liner used to gather a core of sediment from the upper few metres of the sea bottom. The tube is set within a large support frame in order to keep it upright on the seabed. Once securely on the seafloor, the vibrocorer is driven down into the substrate by a pneumatic vibro-head. This heavy vibro-head uses a combination of gravity and low amplitude, high frequency pneumatic vibrations in order to penetrate the seafloor and gather undisturbed cores of marine sediment. The low amplitudes (a few millimetres) combined with the high frequencies (3,000 – 11,000 vibrations per minute) serve to mobilise a thin layer of material on either side of the plastic core liner, which causes the sediment to behave in an almost fluid manner and allows easy penetration of the seafloor by the vibrocorer.

Figure 6. The Geo Resources 6000 vibrocorer

Shipek Grab

The Shipek Grab sampler has a capacity of 3000ml and acquires samples using a single rotating jaw scoop. The grab covers an area of approximately 0.04 m2 on the seafloor and to a depth of approximately 10cm. The grab is deployed by a winch into the water column. When it reaches the seafloor an automatic trigger system is activated and the grab sampling compartment encloses a sample from the seafloor. The recovered sediment is trapped within the rotating drum in an undisturbed and unwashed state. The Shipek Grab can be used on slope of 20° or more.

Figure 7. Shipek sediment sampler

5 Technical Difficulties

All times are recorded as local time (GMT=UTC+1hr)

24th July 2017: Killybegs Dock

Several problems occurred with the GeoSpark 200 during mobilisation making it inoperable.

Firstly, it was found that a high voltage copper pin in the junction box on the winch connecting the high voltage cable to the umbilical was corroded through and snapped off. This was temporarily bridged by a wire that was fabricated onshore but then 2 hours before sailing it was confirmed by GeoAcoustics that the fabricated wire was not thick enough and therefore a safety hazard.

Secondly, two of the GeoSpark 1500 power supply (100 to 500J & 600 to 1000J) were not powering up and therefore not usable. We needed to start the Sparker on 100J due to the JNCC regulations for Marine Mammals and only the high power settings were available.

Thirdly, the GeoSpark would not accept the trigger from the CODA. The trigger was coming out of the CODA as it was operating the pinger and the coaxial cable was testing OK. This appears to be a separate (or maybe related) fault in the boom box.

It was decided to try and replace the GeoSpark winch and power supply with a different system.

25th July 2017: Blacksod Bay (Area C) and South Achill Island (Areas D, E & G)

EA400 scientific echosounder is not working and giving spurious depth of over 100m in 30m of water. The technical team are remotely fixing. This was fixed by 10.30.

It was decided to break the survey and transit to an anchorage in Blacksod Bay at 20.15 as the wind and swell was rising and we needed to get around Achill Head before the gale came in.

26th July 2017: Blacksod Bay (Area B and at anchor)

Excessive swell outside of the bay, at anchor winds are at 28kts. It is not possible to survey outside of the bay, there is swell and heavy chop in large areas of the bay. Shipek samples were collected in sheltered areas in the bay. This was all that was possible.

Took charge of replacement Sparker but the high voltage power lead and connection box to the high voltage umbilical was missing. Sparker still not operational.

27th July 2017: Blacksod Bay (at anchor)

Still too rough to operate outside of the Bay. Winds at 21-30 kts at anchor.

Maggy BOB software will not export data. Download of new software not possible due to poor internet connection at anchor.

Navigation was not found in the header of the pinger data but can be added later. It is not clear why this occurred.

28th July 2017: Blacksod Bay (Area B and at anchor)

Still too rough to operate outside of the Bay. Winds at 22-28 kts at anchor. Picked up Xavier Monteys (GSI) and Jessica Ridge (Technician) as well as the GeoSpark 200 high voltage power lead from Blacksod Pier at 15.00. Sparker operational by 16.00. Technician investigated navigation input into the CODA and fixed it, there was a wrong navigation setting set up. BOB software export function worked on BOB installed on laptop. Still restricted in upper bay due to bad weather.

29th – 30th July 2017: Blacksod Bay (Area B & C)

Too rough to leave Blacksod Bay and be able to spark. We have used the time to collect a good coverage of Blacksod Bay.

31st July 2017: Blacksod Bay (Area B & C)

Too rough to leave Blacksod Bay and be able to spark. We have used time to continue to collect a good coverage of Blacksod Bay but ran out of meaningful data to collect in the bay by 14.32. Went to anchor.

1st August 2017: Blacksod Bay and South Achill Island (Area B, C, D, E & G)

It was too rough to operate in Area A which is in the West Connacht SAC. We therefore had to abandon this area to move the survey south.

6 Survey Narrative

All times are recorded as local time (GMT=UTC+1hr)

24th July 2017: Killybegs Dock

Commenced mobilisation in Killybegs Dock at 10.00 and proceeded all day. Sailed at 22.00.

25th July 2017: Blacksod Bay (Area C) and South Achill Island (Areas D, E & G)

Sunny and calm

Commenced vibrocoring operations at 08.00 in Area C on slack water. Collected **RV17020_V1** at 08.44 with full penetration, **RV17020_V2** at 09.19, **RV17020_V3** at 09.42 and **RV17020_V4** at 10.32. Operations run smoothly, vibrocoring stopped when the tide rose too much. **RV17020_CTD1** taken at 10.56 for an SVP and pinger, multibeam and maggy lines (**RV17020_St7 & 8**) were started at 11.34 finishing at 12.06 in Area C after an MMO watch and soft-start operations as per the NPWS regulations. Transit was made around Achill Island to the west to pick up stations on the south of the island. A SVP (**RV17020_CTD2**) was taken at 12.56 and a pinger, multibeam and maggy line (**RV17020_St9)** was run at 13.09 (Area D) (compliant with NPWS guidelines). At slack water, 4 vibrocores were taken in Area D (**RV17020_V5 to 8)** at 13.33, 14.11, 14.33 and 15.08 respectively. Vibrocores **RV17020_V6** and **RV17020_V7** were shell hash suggesting that most of area D was not of interest to us. However **RV17020_V5** and **RV17020_V8** in outer Keem Bay were sandy. Pinger, multibeam and maggy lines (**RV17020_St14 to 19)** were run mapping in outer Keem Bay (Area D) at 15.35 to 16.33 (compliant with NPWS guidelines). An addition block of pinger, multibeam and maggy lines (**RV17020_St20 to 25)** were run mapping Area E between 16.50 and 18.14. Multibeam lines were close enough to enable a full mosaic to be completed for Area E. At slack water, three vibrocores were taken in Area F (**RV17020_V9 to 11)** at 19.11, 19.34 and 19.53 respectively in Area G.

Transit to Blacksod Bay at 20.15 to take shelter from incoming gale. In anchor in Blacksod by 22.55.

26th July 2017: Blacksod Bay (Area B)

Gale with heavy chap and swell in sheltered bay

Remain in anchor in Blacksod Bay due to strong winds and heavy seas outside the bay prohibiting surveying. A shipek grab (**RV17020_S1**) was taken at the anchor site at 12.42. Anchor raised at 12.50 and shipek grabs **RV17020_S2** to **RV17020_S11** collected between 13.02 and 14.50 respectively. Arrived at Blacksod Pier to take the new sparker boom box and cable on at 15.07. Continued shipek sampling at 15.18 until 15.28 (**RV17020_S12** to **RV17020_S13**). Returned to anchorage at 15.40.

27th July 2017: Blacksod Bay (at anchor)

Gales

Remain at anchor in the bay due to adverse weather. New umbilical to sparker catamaran connected.

28th July 2017: Blacksod Bay (Area B)

Gales

Remain at anchor in the bay due to adverse weather in the morning. Picked up additional personnel (Xavier Monteys (GSI) and Technician) and the sparker high voltage cable at 15.00 from Blacksod Pier. Sparker was set up and tested following MMO and soft-start operations. Proceeded to run sparker, pinger, maggy and multibeam at 18.38 to 22.47 (**RV17020_St43** to **St51**) as a series if east-west lines in the sheltered northerly Blacksod Bay. Returned to anchor for the night.

29th July 2017: Blacksod Bay (Area B)

Gales

Started MMO operations at 07.30. Raised anchor at 08.15 and proceeded with soft-start finishing at 09.20. Start sparker, pinger, maggy and multibeam cross line at 09.24 to 10.04 (**RV17020_St52)**. Shipek samples were then taken covering the remainder of Area B and all of Area C except the western extremity where the operations was called off due to heavy swell (**RV17020_S14** to **S34**). The area was then left and MMO surveying commences at 17.25 with a soft-start commencing at 18.15. Sparker, pinger, maggy and multibeam lines in the southern part of Area B started at 19.04 and finished at 21.07 (**RV17020_St74** to **St75**).

30th July 2017: Blacksod Bay (Area B & C)

Sunny with low swell the sheltered bay

MMO survey started at 06.00 and anchor raised at 06.30. Following a soft-start, a sparker, pinger, maggy and multibeam line was run from at 07.30 to 08.29 (**RV17020_St76)** and an SVP was taken at the end of the line (**RV17020_CTD4)** at 08.37. Sparker, pinger, maggy and multibeam lines resumed at 08.56 (**RV17020_St78)** all in Area B. MMO started continuous observations at 10.50 as we entered the buffer zone of the West Connacht SAC as per the NPWS guidelines. Sparker, pinger, maggy and multibeam lines in Area B completed at 17.03 (**RV17020_St89**) and proceeded to collect lines in Area C (**RV17020_St91** to **St95**) preceded by a cross line (**RV17020_St90**). It was not possible to survey beyond Saddle Head due to large swell affecting the sparker data. Surveying stopped at 21.33 (**RV17020_St95**). Proceed to anchor.

31st July 2017: Blacksod Bay (Area B & C)

Sheltered in the bay

MMO watch started at 08.17. Anchor lifted at 08.25. Started sparker, pinger, maggy and multibeam line (**RV17020_St96**) at 09.38 following a soft-start followed by the

cross-line (**RV17020_St97**) at 10.25 finishing Area B. Started sparker, pinger, maggy and multibeam lines (**RV17020_St98** to **St106**) at 10.50 in Area C (compliant with NPWS guidelines) finishing at 14.32. No more surveying possible so transited to the head of Blacksod Bay and went to anchor at 17.00.

1st August 2017: Blacksod Bay (Area B & C) to South of Achill Island (Area D, E & G)

Sunny with low swell

Anchor raised at 07.30 and a vibrocore (**RV17020_VC12**) was taken at 08.12 in Area B near Blacksod Pier. Xavier Monteys (Scientist) taken off vessel by boat transfer at 08.30. Final vibrocore in Area B near Achill Island taken at 09.12 (**RV17020_VC13**). Took two shipek grabs at the western end of Area C (**RV17020_S35 & S36**) at 10.09 and 10.22 respectively. Started sparker, pinger, maggy and multibeam lines (**RV17020_St110** to **St115**) in Area D after MMO and soft-start at 12.15 finishing at 14.12. All lines were run out of the bay. Continued with sparker, pinger, maggy and multibeam lines (**RV17020_St116** to **St121**) in Area E running out of the bay from 14.14 to 16.30. Continued to run sparker, pinger, maggy and multibeam lines (**RV17020_St122** to **St124**) in Area G running out of the bay from 17.30 to 21.26 with all lines running out of the bay. Went to anchor on the south shore of Clew Bay (Old Head) ay at 22.50.

2nd August 2017: South of Achill Island (Area D, E, F & G)

Windy with moderate swell

Raised anchor at 08.05 and head to Area D. Started shipek grabs in Area D from 10.18 to 11.07 (**RV17020_S37 to S43**), followed by Area E from 11.35 to 13.05 (**RV17020_S44 to S46**), and followed by Area G, from 14.05 to 16.35 (**RV17020_S47 to S57**). Following an MMO survey and soft-start, sparker, pinger, maggy and multibeam lines (**RV17020_St151** to **St158**) were run in Area F from 17.45 to 20.49 followed by shipek grabs (Area F) (**RV17020_S58 to S62**), from 20.59 to 21.45. Returned to anchor off the south side of Clew Bay (Old Head) at 23.30.

3rd August 2017: South of Achill Island (Area H)

Fine and calm

MMO watch started at 06.00 followed by soft start. Sparker, pinger, maggy and multibeam lines (**RV17020_St164** to **St172**) were run in Area H from 08.13 to 18.16. Continuous MMO ops were undertaken in the SAC and SAC 1.5km buffer zone. Shipek grabs (**RV17020_S63 to S70**) were taken in Area H from 18.41 to 19.55 followed by three vibrocores (**RV17020_VC14 to VC15)** at 20.08 and 20.23. Two shipeks (**RV17020_S71 and S72)** was taken at 20.38 and 20.49 respectively. Followed by a final vibrocore (**RV17020_VC16**) and final shipek (**RV17020_S73**) at 21.02 and 21.13 respectively. Went to anchor on the north side of Clew Bay at 22.05 off Mulranny.

4th August 2017: South of Achill Island (Area H)

Fine and calm

Following and MMO watch and soft start, sparker, pinger, maggy and multibeam lines (**RV17020_St187** to **St188**) were run in Area H from 07.31 to 09.24 and continued into Area I (**RV17020_St189** to **St202**) from 09.25 to 16.47. A series of shipek grabs (**RV17020_S74** to **S83**) were then taken in Area I with vibrocores I (**RV17020_VC17** to **VC19**) between 17.11 and 19.34. The vessel returned to Area H and collected the final sparker, pinger, maggy and multibeam lines (**RV17020_St217** to **St219**) in this area from 21.55 to 23.32 following an MMO watch and soft start. Three shipek grabs (**RV17020_S84** to **Sx86**) were then taken in Area H at 23.48.

5th August 2017: South of Achill Island (Area H)

Fine and calm

A shipek grab (**RV17020_S86**) was taken at 00.36 on the north side of Clew Bay near Achill Sound. Following and MMO watch and soft start, a sparker, pinger, maggy and multibeam line (**RV17020_St223**) was run in Area H from 07.18 to 07.56. The course was then set for Galway arriving in Galway at 16.40. Vessel tied up. Survey complete.

7 Weather Report

All times are recorded as local time (GMT=UTC+1hr)

25th July 2017 – Blacksod Bay (Area C) and South Achill Island (Areas D, E & G)

00.00 Wind N, Force 1-2, rippled sea, slight swell, cloudy and fine
04.00 Wind E, Force 3, 7 kts, slight swell, cloudy
08.40 Wind light, rains, calm sea
12.00 Wind SW, Force 2-3, variable 2-3.
16.00 Wind slight, light airs, cloudy

26th July 2017 – Blacksod Bay (Area B)

00.00 Wind S, Force 5, choppy sea, overcast with rain (in anchor)
08.00 Wind WSW, Force 6, 24 kts, overcast, showers, moderate sea, calm swell, moderate visibility (in anchor)
12.00 Wind W, Force 7, choppy, moderate sea in sheltered water. Overcast with rain showers
15.45 Wind SW, Force 6, 23 kts, overcast, rain, moderate sea, moderate visibility
18.00 Wind WSW, Force 6, 25 kts gusting 30 kts, cloudy, good visibility, moderate sea, bright, swell, good visibility
24.00 Wind WSW, Force 6, sheltered waters, cloudy with showers

27th July 2017 – Blacksod Bay (at anchor)

02.00 Wind SW, Force 6, moderate sea, cloudy, moderate visibility
04.00 Wind SW , Force 6, moderate sea, cloudy, moderate visibility
06.00 Wind SW, Force 5, 21 kts, moderate sea with slight swell, overcast, showers, good visibility, good visibility
08.00 Wind SW, Force 6, 23 kts, moderate sea and slight swell, cloudy, showers, good visibility, good visibility
12.00 Wind SW, Force 6, sheltered waters, cloudy with rain showers
16.00 Wind SW, Force 6, 27 kts, Cloudy, moderate sea, moderate visibility
18.00 Wind SW, Force 6, 27 kts, overcast and rain, good visibility
20.00 Wind SW, Force 6, 25 kts, overcast and rain, moderate sea and slight swell, moderate visibility
24.00 Wind SW, Force 7-8, sheltered waters, overcast with passing rain showers

28th July 2017 – Blacksod Bay (Area B)

04.00 Wind WSW, Force 6, 25 kts, moderate seas, cloudy, moderate visibility
06.00 Wind SW, Force 6, 22 kts, overcast, showers, slight sea and swell
08.00 Wind SW, Force 5, 21 kts, slight sea and swell, showers
12.00 Wind SW, Force 6, sheltered waters, cloudy
16.10 Wind SW, Force 5, 20 kts, cloudy, rain
20.00 Wind SW, 2 Force 6, 24 kts, cloudy with heavy showers, good visibility
24.00 Wind SW, Force 6, sheltered waters, cloudy occasional showers

29th July 2017 – Blacksod Bay (Area B)

04.00 Wind SW, Force 5, 21 kts, moderate sea, cloudy, good visibility
06.00 Wind SW, Force 6, 25 kts, moderate sea and slight sea, heavy showers, moderate visibility.
08.00 Wind SW, Force 6, 24 kts, moderate sea and slight swell, moderate visibility
12.00 Wind SW, Force 5-6, Moderate sea and swell
16.00 Wind SW, Force 5, 19 kts, moderate sea, good visibility
18.10 Wind SW, Force 4, 16 kts, moderate sea and swell, overcast with showers, moderate visibility
20.00 Wind SW, Force 4, 16 kts, moderate sea and swell, showers, good visibility
24.00 Wind SW, Force 5, overcast with showers

30th July 2017 – Blacksod Bay (Area B & C)

04.00 Wind SW, Force 4, 14 kts, calm seas, good visibility
06.00 Wind SW, Force 4, 12 kts, calm sea and slight swell, cloudy, good visibility
08.00 Wind WSW, Force 4, 15 kts, moderate sea and swell, overcast, heavy showers, moderate visibility, moderate visibility
12.00 Wind W, Force 4, slight sea and swell, overcast with rain
14.00 Wind SW, Force 4, 15 kts, slight sea, swell, good visibility, good visibility
16.00 Wind W, Force 4, 15 kts, slight sea/swell, good visibility, good visibility
18.00 Wind SW, Force 5, 17 kts, moderate sea and swell, showers, good visibility
20.00 Wind SW, Force 5, 18 kts, moderate sea and swell, overcast and showers, good visibility
24.00 Overcast heavy rain showers

31st July 2017 – Blacksod Bay (Area B & C)

04.00 Wind SW, Force 4, 13 kts, calm sea, good visibility
06.00 Wind SW, Force 4, 15 kts, overcast, showers, calm sea and swell, good visibility
08.00 Wind SW, Force 4, 17 kts, calm sea and slight swell, showers, good visibility
12.00 Wind SW, Force 5, moderate sea and swell, light cloud, fine
14.00 Wind SW, Force 5, 20 kts, moderate sea / swell, cloudy, good visibility
16.00 Wind SW, Force 4, 16 kts, moderate sea/swell, cloudy, good visibility
18.00 Wind SW, Force 5, 18 kts, Calm sea and swell, cloudy and showers, good visibility

1st August 2017 – Blacksod Bay (Area B & C) and South Achill Island (Area D, E & G)

04.00 Wind SW, Force 4, 15 kts, calm sea, cloudy, rain, good visibility
06.00 Wind W, Force 3, 12 kts, calm sea and swell, cloudy, showers, good visibility
12.00 Wind SW, Force 3, slight sea and swell, light cloud, fine and clear
14.00 Wind SW, Force 5, 17 kts, slight sea and swell, light cloud, good visibility
16.00 Wind SW, Force 4, 14 kts, slight sea and swell, light cloud, good visibility

18.00 Wind SW, Force 4, 13 kts, moderate sea and swell, cloudy and bright, good visibility
20.00 Wind SW, Force 4, 13 kts, slight sea and moderate swell, cloudy, dry, good visibility
24.00 Wind SE, Force 2-3, slight sea, overcast

2nd August 2017 –South Achill Island (Area D, E, F & G)

04.00 Wind E, Force 3, 8 kts, calm sea, rain, good visibility
06.00 Wind E, Force 5, 21 kts, slight sea and calm swell, overcast and rain, good visibility
08.00 Wind ENE, Force 6, 22 kts, calm sea and swell, rain, moderate visibility
12.00 Wind S, Force 4-5, moderate sea, overcast with rain showers
16.00 Wind SW, Force 5, 20 kts, moderate sea with swell, overcast with rain showers
20.00 Wind S, Force 4,15 kts, moderate sea and swell, overcast with rain showers, moderate visibility
24.00 Wind light and variable, calm sea, overcast with rain

3rd August 2017 –South Achill Island (Area H)

04.00 Wind variable, calm sea, good visibility
06.00 Wind light and variable, calm sea and swell, overcast and dry, good visibility
08.00 Wind W, Force 3, 12 kts, calm sea and swell
12.00 Wind WNW, Force 4, slight sea and swell, light cloud, fine and clear
14.00 Wind WNW, Force 3, 12 kts, slight sea and swell, cloud, good visibility
16.00 Wind WNW, Force 4, 15 kts, slight sea and swell, cloudy, good visibility
18.00 Wind NW, Force 4, slight sea and swell, light cloud, fine and clear
20.00 Wind NW, Force 3, 12 kts, calm sea and slight swell, cloudy, bright, good visibility
24.00 Cloudy, fine and clear

4th August 2017 –South Achill Island (Area H & I)

04.00 Wind NW, Force 3, 12 kts, calm sea, good visibility
06.00 Wind NW, Force 3, 10 kts, calm sea and swell, cloudy, dry, good visibility
08.00 Wind NW, Force 3, 10 kts, calm sea and slight swell, overcast, dry, good visibility
12.00 Wind NW, Force 2-3, slight sea and swell, light cloud, fine weather
14.00 Wind NW, Force 4, 12 kts, slight sea and swell, light cloud, good visibility
16.00 Wind NW, Force 4, 16 kts, slight sea and swell, good visibility
18.09 Wind NW, Force 3, 9 kts, slight sea and swell, light cloud, good visibility
24.00 Wind W, Force 2, slight sea, cloudy, fine and clear

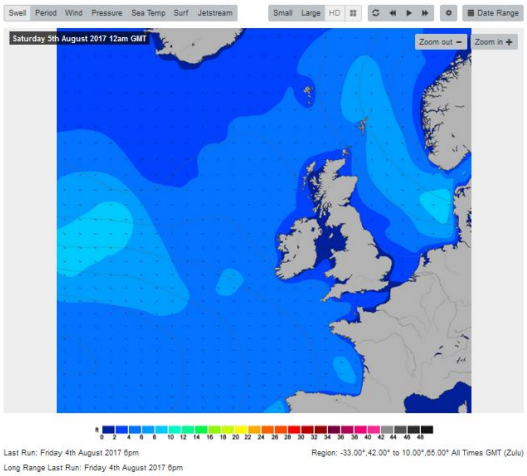
5th August 2017 –South Achill Island (Area H)

04.00 Wind N, Force 3, 10 kts, moderate sea and swell, cloudy, good visibility

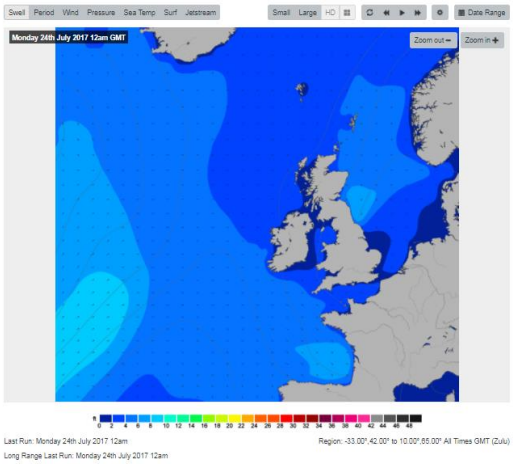
06.00 Wind N, Force 2, 6 kts, calm sea and slight swell, overcast and showers, good visibility
08.03 Wind light and variable, slight sea and swell, cloudy, good visibility.
12.00 Wind WNW, Force 3-4, slight sea with moderate swell. Light cloud, fine, clear
16.00 Wind SW, Force 5, 18 kts, Slight sea and swell, good visibility

Swell charts for the duration of the survey

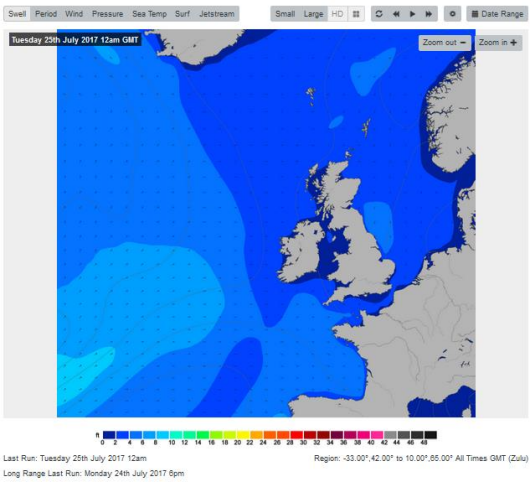
24th July 2017



25th July 2017



26th July 2017



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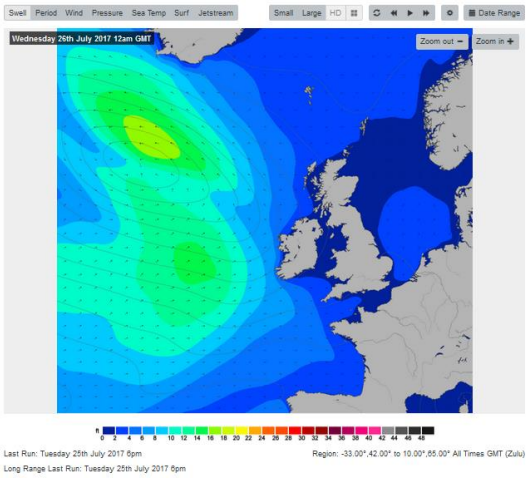
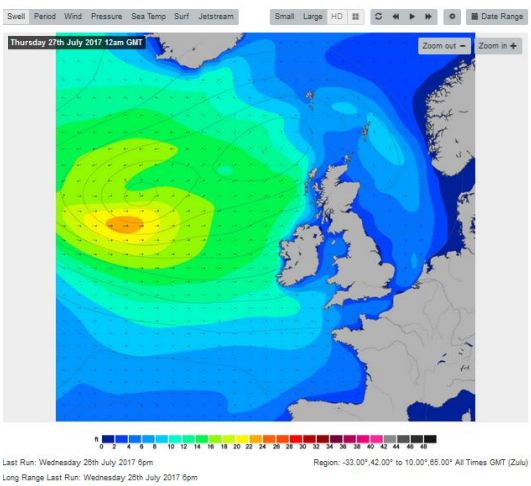
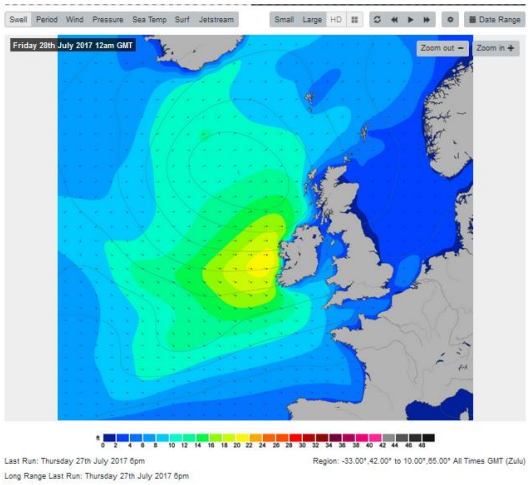


28th July 2017

29th July 2017





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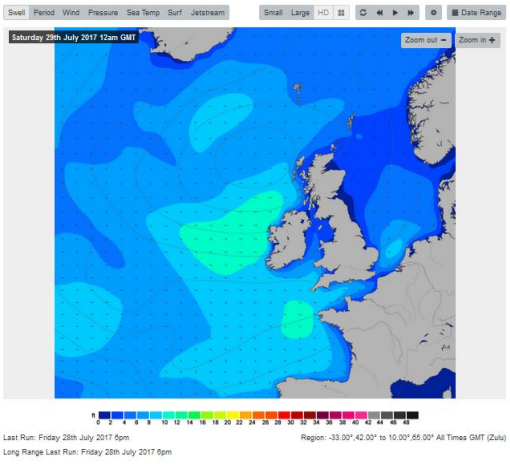
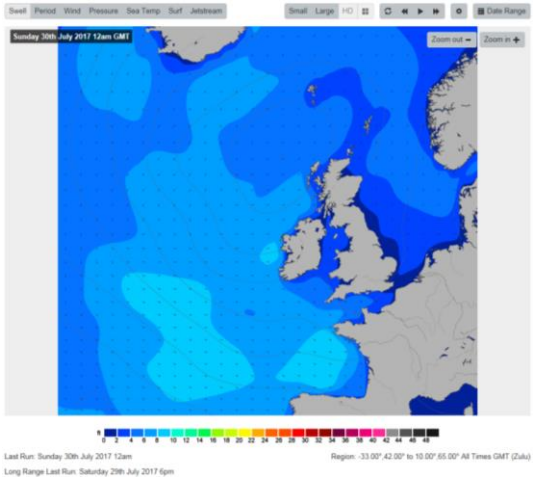
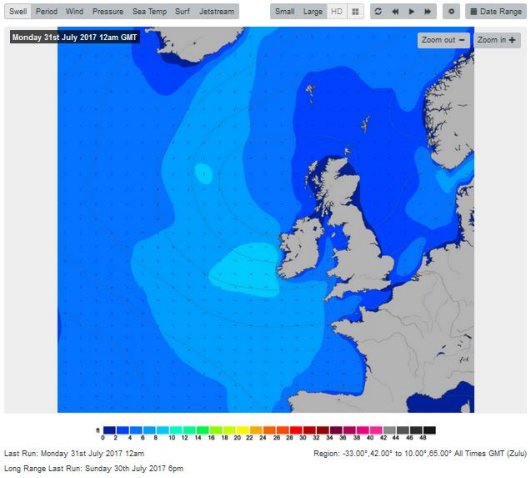


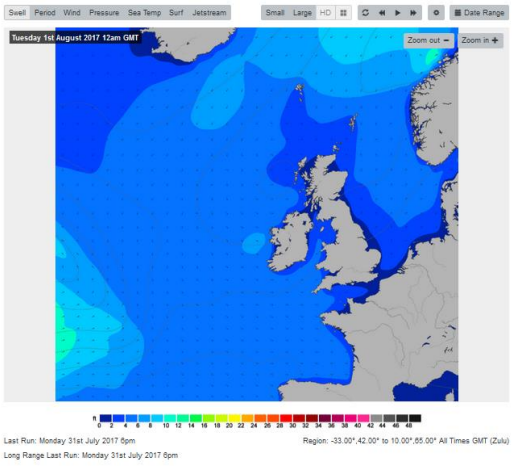
31st July 2017



1st August 2017

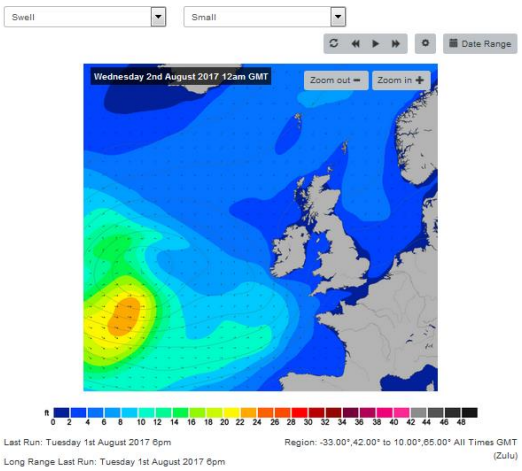


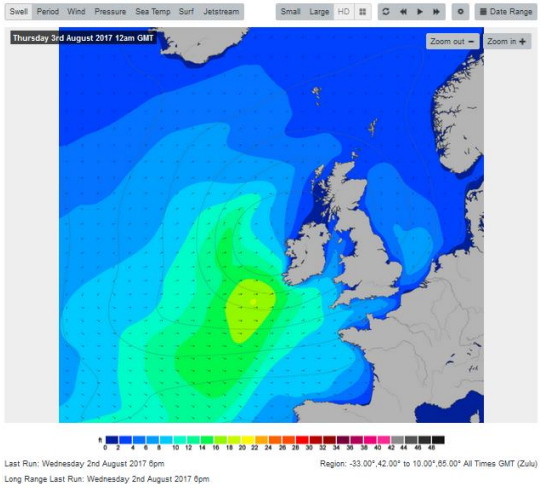
2nd August 2017



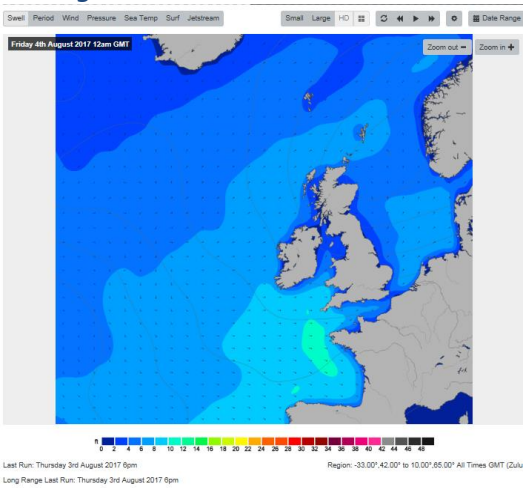
3rd August 2017

4th August 2017





5th August 2017



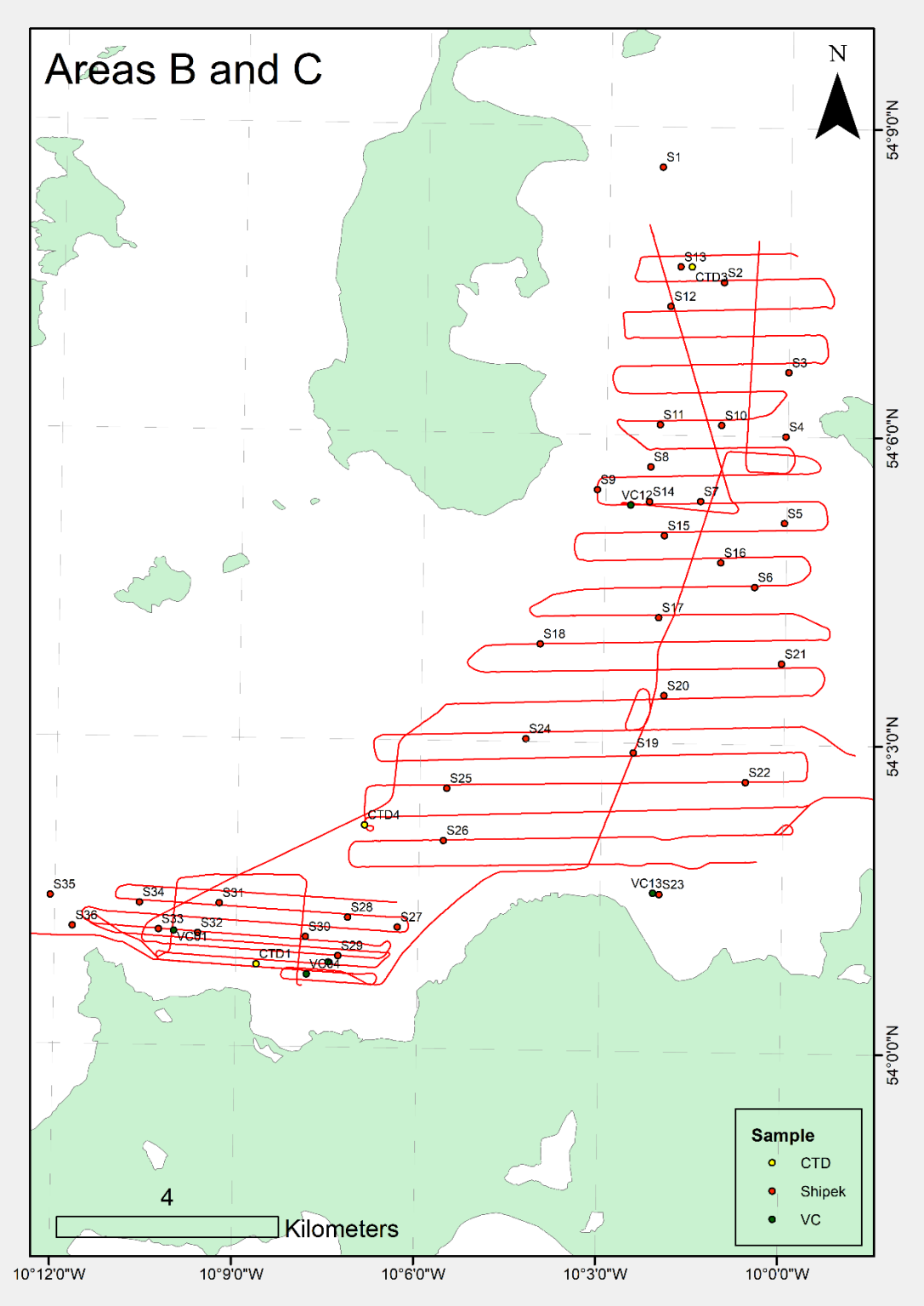
Appendices

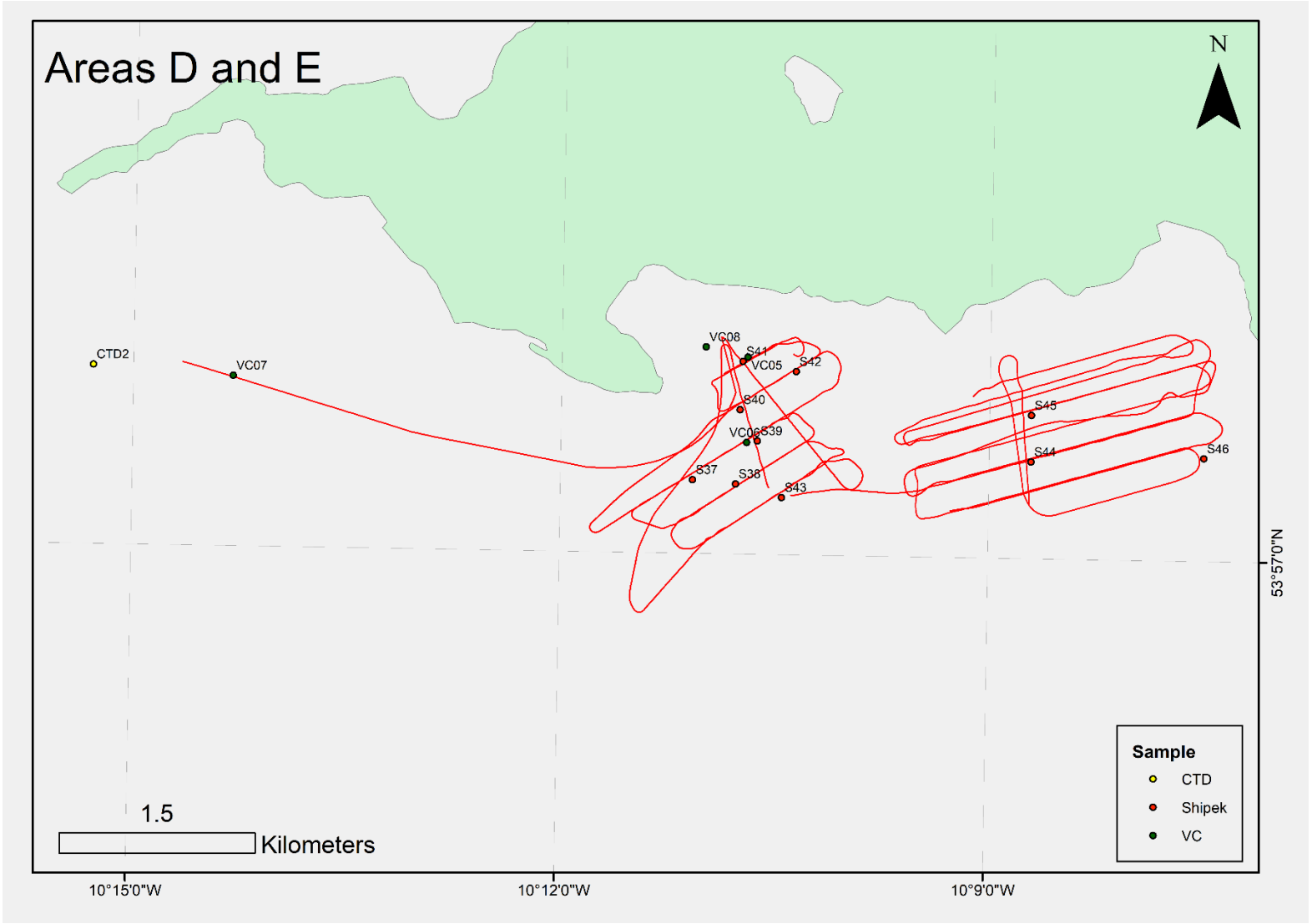
Appendix I

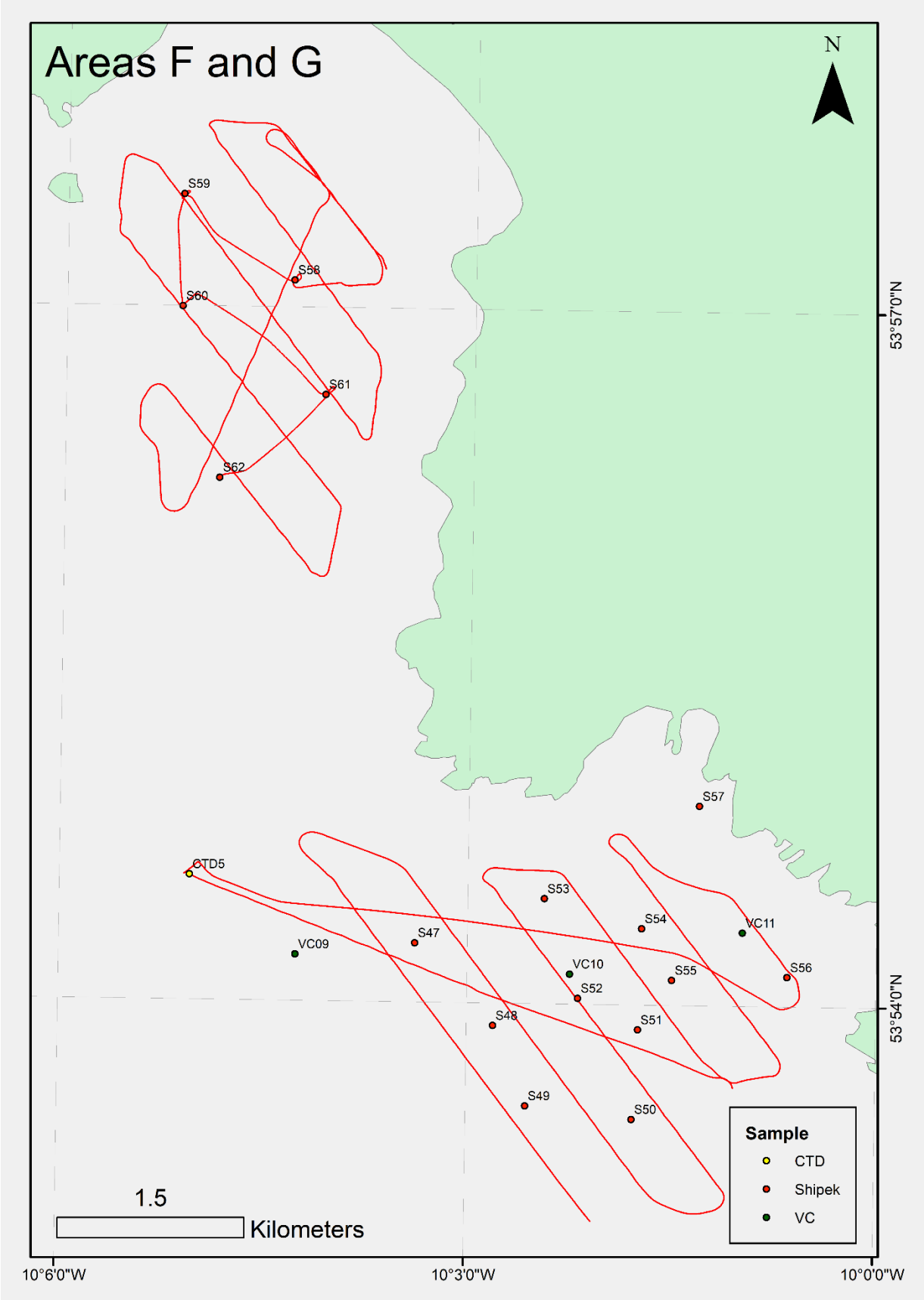
Personnel

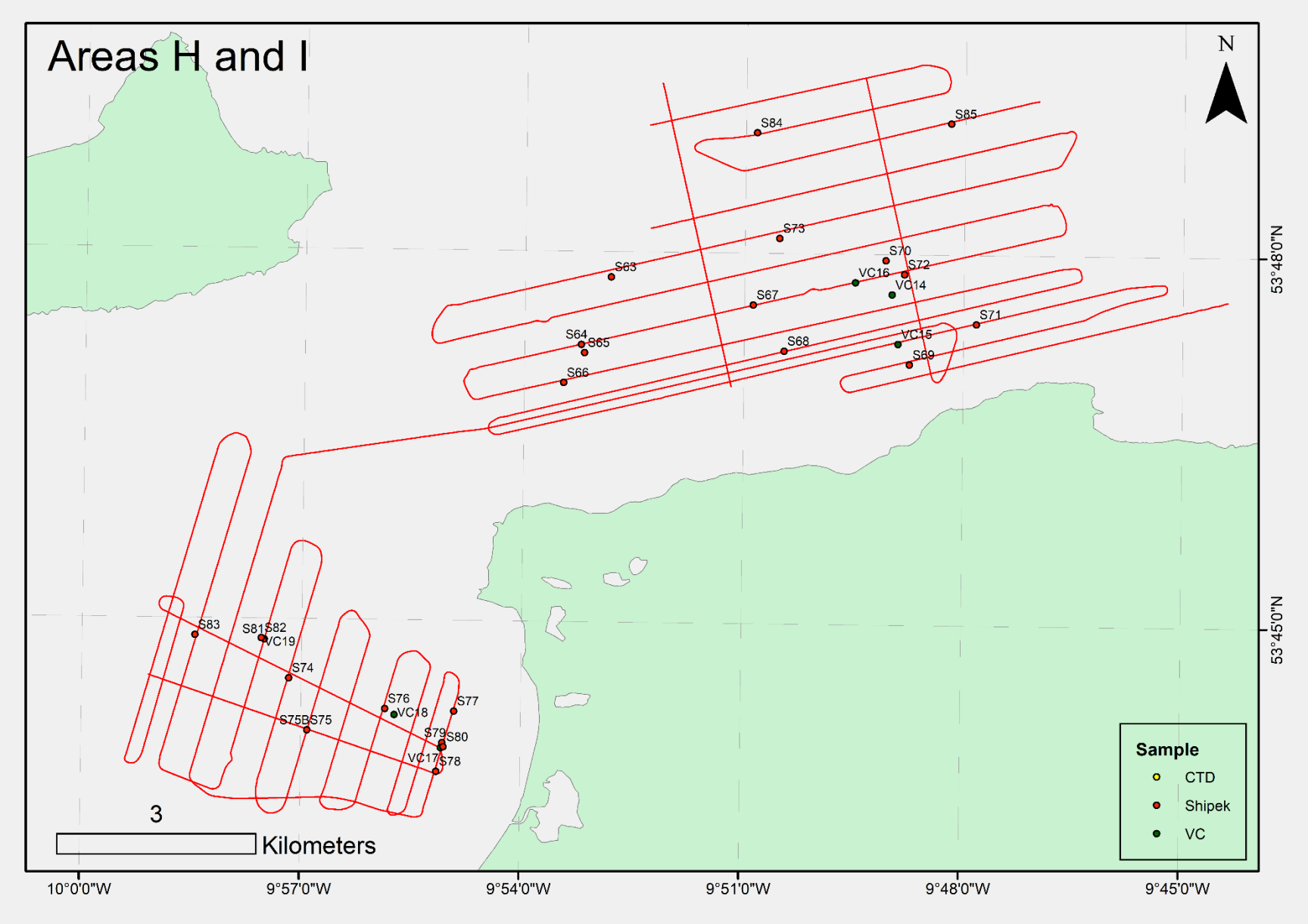
Ship's Officers & Crew	**Scientific Party**
Phillip Baugh *Master*	Prof. Andy Wheeler *Chief Scientist – Geologist (UCC)*
Dennis Burke *Mate*	Dr. Aaron Lim (UCC) *Geologist*
Connor Bishop *Chief Engineer*	Siobhan Burke (UCC) *Geologist*
Wojciech Paterek *2nd Officer*	Xavier Monteys (GSI) *Geologist*
Tommy Byrns Motorman	Luke O'Reilly (UCC) *Geologist*
Tommy Grealy *Boson*	Marian McGrath (Freelance) *Marine Mammal Observer*
Lar Moran *Deck hand*	
Jessica Ridge *Technician*	
Brian Robertson *Cook*	

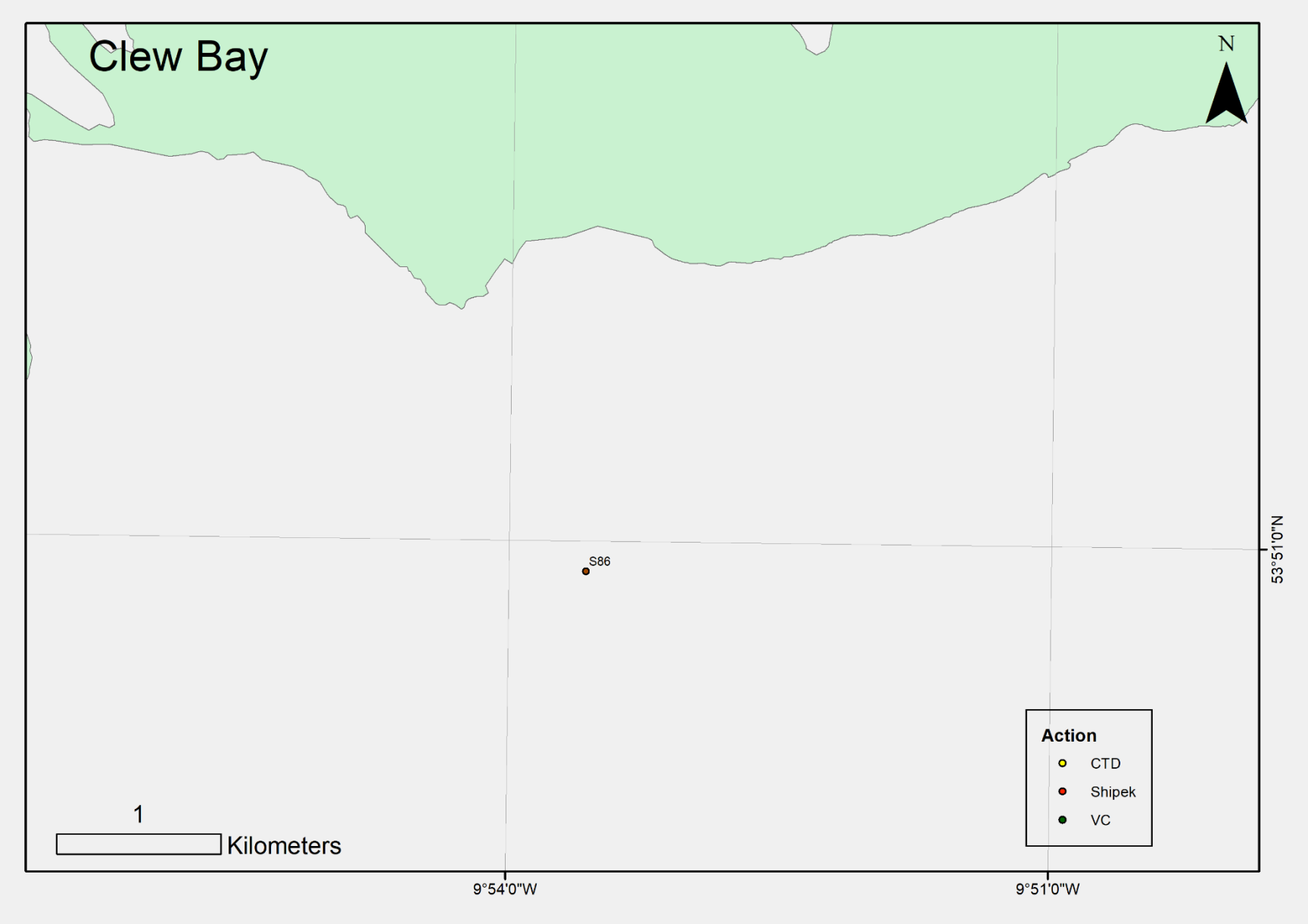
Appendix II
Area maps




Areas D and E
N
CTD2
VC07
VC08
S41
VC05
S42
S40
VC06
S39
S37
S38
S43
S45
S44
S46
1.5
Kilometers
Sample
CTD
Shipek
VC
10°15'0"W
10°12'0"W
10°9'0"W
53°57'0"N


Areas F and G
N
S59
S58
S60
S61
S62
S57
CTD5
S53
S54
VC11
S47
VC09
VC10
S55
S56
S52
S48
S51
S49
S50
Sample
CTD
Shipek
VC
1.5
Kilometers
53°57'0"N
53°54'0"N
10°6'0"W
10°3'0"W
10°0'0"W


Areas H and I
N
S84
S85
S73
S70
S72
S63
VC16
VC14
S67
S71
S64
S65
S68
VC15
S69
S66
S83
S81
S82
VC19
S74
S76
VC18
S77
S75B
S75
S79
S80
VC17
S78
3
Kilometers
Sample
CTD
Shipek
VC
53°48'0"N
53°45'0"N
10°0'0"W
9°57'0"W
9°54'0"W
9°51'0"W
9°48'0"W
9°45'0"W


Clew Bay
N
S86
53°51'0"N
Action
CTD
Shipek
VC
1
Kilometers
9°54'0"W
9°51'0"W

Appendix III
Station Lists

Master Log (showing all Multibeam, Sparker, Pinger and Maggy lines in grey)

All times are recorded as UTC (GMT-1hr)

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
1	25.07.2017	C	-	07:44	54°01.116	10°10.03	35.5				°		VC01		
2	25.07.2017	C	-	08:19	55°01.006	10°07.875	40						VC02		
3	25.07.2017	C	-	08:42	54°00.83	10°07.472	37						VC03		
4	25.07.2017	C	-	09:32	54°00.71	10°07.827	36						VC04		
5	25.07.2017	C	-	09:56	54°00.8	10°08.66	35.8					CTD1			
6	25.07.2017	C	SOL	10:34	54°00.716	10°07.036			10:33	0000	Area C				
	25.07.2017	C	EOL	10:53	54°00.856	10°10.450			10:33	0000	Area C				Cut: close to rock
7	25.07.2017	C	SOL	10:57	54°01.019	10°11.082	37.89		10:57	0001	Area C				
	25.07.2017	C	EOL	11:06	54°01.069	10°12.259			10:57	0001	Area C				
8	25.07.2017	D	-	11:56	53°57.74	10°15.28	58.9					CTD2			
9	25.07.2017	D	SOL	12:09	53°57.759	10°14.646	63.5		12:08	0003	Area D				
	25.07.2017	D	EOL	12:26	53°57.674	10°10.772	36		12:08	0003	Area D				
10	25.07.2017	D	-	12:33	53°57.815	10°10.697	29						VC05		
11	25.07.2017	D	-	13:11	53°57.462	10°10.697	51.5						VC06		
12	25.07.2017	D	-	13:38	53°57.704	10°14.300	62.6						VC07		
13	25.07.2017	D	-	14:08	53°57.854	10°10.991	23.1						VC08		
14	25.07.2017	D	SOL	14:35	53°57.857	10°10.816			14:34	0004	Area D				
	25.07.2017	D	EOL	14:42	53°57.279	10°09.921			14:34	0004	Area D				
15	25.07.2017	D	SOL	14:47	53°57.351	10°10.228			14:46	0005	Area D				
	25.07.2017	D	EOL	14:54	53°57.019	10°11.121			14:46	0005	Area D				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
16	25.07.2017	D	SOL	14:56	53°57.148	10°11.096			14.56	0006	Area D				
	25.07.2017	D	EOL	15:03	53°57.540	10°10.261			14.56	0006	Area D				
17	25.07.2017	D	SOL	15:05	53°57.565	10°10.438			15:05	0007	Area D				
	25.07.2017	D	EOL	15:15	53°57.081	10°11.757			15:05	0007	Area D				
18	25.07.2017	D	SOL	15:21	53°57.436	10°11.115			15:21	0008	Area D				
	25.07.2017	D	EOL	15:29	53°57.882	10°10.343			15:21	0008	Area D				
19	25.07.2017	D	SOL	15:30	53°57.846	10°10.591			15:30	0009	Area D				
	25.07.2017	D	EOL	15:33	53°57.880	10°10.143			15:30	0009	Area D				
20	25.07.2017	E	SOL	15:50	53°57.710	10°08.963			15:50	0010	Area E				
	25.07.2017	E	EOL	15:59	53°57.916	10°07.608			15:50	0010	Area E				
21	25.07.2017	E	SOL	16:01	53°57.873	10°07.789			16:01	0011	Area E				
	25.07.2017	E	EOL	16:14	53°57.472	10°09.570			16:01	0011	Area E				
22	25.07.2017	E	SOL	16:15	53°57.486	10°09.390			16:15	0012	Area E				
	25.07.2017	E	EOL	16:28	53°57.820	10°07.425			16:15	0012	Area E				
23	25.07.2017	E	SOL	16:31	53°57.682	10°07.693			16:31	0013	Area E				
	25.07.2017	E	EOL	16:46	53°57.253	10°09.485			16:31	0013	Area E				
24	25.07.2017	E	SOL	16:48	53°57.322	10°09.201			16:48	0014	Area E				
	25.07.2017	E	EOL	17:00	53°57.601	10°07.448			16:48	0014	Area E				
25	25.07.2017	E	SOL	17:02	53°57.485	10°07.509			17:02	0015	Area E				
	25.07.2017	E	EOL	17:14	53°57.204	10°09.188			17:02	0015	Area E				
26	25.07.2017	G	-	18:11	53°54.200	10°04.260	49.5						VC09		
27	25.07.2017	G	-	18:34	53 54.130	10 02.245	38.5						VC10		
28	25.07.2017	G	-	18:53	53°54.318	10°00.981	25.5						VC11		
29	26.07.2017	B	-	11:40	54°08.611	10°02.128	10.1							S1	
30	26.07.2017	B	-	12:02	54°07.494	10°01.088	12							S2	
31	26.07.2017	B	-	12:21	54°06.627	10°00.001	13.7							S3	
32	26.07.2017	B	-	12:35	54°06.002	10°00.036	12.7							S4	
33	26.07.2017	B	-	12:46	54°05.159	10°00.042	15.5							S5	

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
34	26.07.2017	B	-	12:55	54°04.534	10°00.519	18.8							S6	
35	26.07.2017	B	-	13:09	54°05.362	10°01.430	17.8							S7	
36	26.07.2017	B	-	13:21	54°05.693	10°02.265	17							S8	
37	26.07.2017	B	-	13:32	54°05.464	10°03.141	16.3							S9	
38	26.07.2017	B	-	13:46	54°06.104	10°01.100	15.1							S10	
39	26.07.2017	B	-	13:50	54°06.104	10°02.117	17.6							S11	
40	26.07.2017	B	-	14:18	54°07.257	10°01.968	13.8							S12	
41	26.07.2017	B	-	14:28	54°07.642	10°01.811	12.5							S13	
42	28.07.2017	B	-	15:18	54°07.642	10°01.626	12.25					CTD3			
43	28.07.2017	B	SOL	17:38	54°07.788	10°00.038	12.2	17:38	17:38	0016	Area B				
	28.07.2017	B	EOL	18:00	54°07.728	10°02.474	11.64	17:38	17:38	0016	Area B				
44	28.07.2017	B	SOL	18:05	54°07.493	10°02.444	13.3	18:05	19:05	0017	Area B				
	28.07.2017	B	EOL	18:28	54°07.543	09°59.456	12	18:05	19:05	0017	Area B				
45	28.07.2017	B	SOL	18:33	54°07.262	09°59.361	12.8	18:33	19:33	0018	Area B				
	28.07.2017	B	EOL	19:02	54°07.179	10°02.757	13.5	18:33	19:33	0018	Area B				
46	28.07.2017	B	SOL	19:07	54°06.938	10°02.622	15.9	19:07	20:07	0019	Area B				
	28.07.2017	B	EOL	19:30	54°06.997	09°59.494	13.8	19:07	20:07	0019	Area B				
47	28.07.2017	B	SOL	19:36	54°06.720	09°59.488	12.6	19:36	20:36	0020	Area B				
	28.07.2017	B	EOL	20:02	54°06.653	10°02.855	16.3	19:36	20:36	0020	Area B				
48	28.07.2017	B	SOL	20:07	54°06.406	10°02.586	19.6	20:07	21:07	0021	Area B				
	28.07.2017	B	EOL	20:25	54°06.424	10°00.040	16.1	20:07	21:07	0021	Area B				
49	28.07.2017	B	SOL	20:31	54°06.187	10°00.552	17.1	20:31	21:31	0022	Area B				
	28.07.2017	B	EOL	20:49	54°06.122	10°02.820	19.2	20:31	21:31	0022	Area B				
50	28.07.2017	B	SOL	20:53	54°05.861	10°02.272	20.6	20:53	21:53	0023	Area B				
	28.07.2017	B	EOL	21:10	54°05.850	09°59.895	15.8	20:53	21:53	0023	Area B				
51	28.07.2017	B	SOL	21:19	54°05.742	10°00.689	17.8	21:19	22:19	0024	Area B				
	28.07.2017	B	EOL	21:47	54°07.940	10°00.543	13.4	21:19	22:19	0024	Area B				
52	29.07.2017	B	SOL	05:45	54°05.474	10°00.982	18.8	8.24	05:45	0025	Area B				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
	29.07.2017	B	EOL	00:57	54°05.353	10°22.278	21.0	8.24	05:45	0025	Area B				
53	29.07.2017	B	-	09:29	54°05.353	10°02.278	21.0							S14	
54	29.07.2017	B	-	09:36	54°05.025	10°02.021	32.7							S15	
55	29.07.2017	B	-	09:43	54°04.768	10°01.084	22.7							S16	
56	29.07.2017	B	-	09:54	54°04.227	10°02.097	26.0							S17	
57	29.07.2017	B	-	10:17	54°03.956	10°04.048	31.0							S18	
58	29.07.2017	B	-	10:39	54°02.907	10°02.483	26.0							S19	
59	29.07.2017	B	-	10:43	54°03.468	10°01.992	24.5							S20	
60	29.07.2017	B	-	10:54	54°03.791	10°00.057	20.0							S21	
61	29.07.2017	B	-	11:11	54°02.634	10°00.627	20.2							S22	
62	29.07.2017	B	-	12:02	54°01.533	10°02.026	16.2							S23	
63	29.07.2017	B	-	12:37	54°03.030	10°04.261	34.3							S24	
64	29.07.2017	B	-	12:49	54°02.536	10°05.556	35.5							S25	
65	29.07.2017	B	-	13:02	54°02.028	10°05.599	34.7							S26	
66	29.07.2017	B	-	13:19	54°01.179	10°06.338	36.5							S27	
67	29.07.2017	C	-	13:26	54°01.268	10°07.160	37.0							S28	
68	29.07.2017	C	-	13:35	54°00.893	10°07.313	35.8							S29	
69	29.07.2017	C	-	13:44	54°01.074	10°07.853	37.0							S30	
70	29.07.2017	C	-	14:02	54°01.390	10°09.281	40.9							S31	
71	29.07.2017	C	-	14.17	54°01.095	10°09.632	37.8							S32	
72	29.07.2017	C	-	14.39	54°01.127	10°10.278	38							S33	
73	29.07.2017	C	-	15.23	54°01.384	10°10.599	44.5							S34	
74	29.07.2017	B	SOL	18:04	54°01.867	10°00.512	17.92	18:04	18:04	0026	Area B				
	29.07.2017	B	EOL	19:03	54°01.756	10°07.039	39.5	18:04	18:04	0026	Area B				
75	29.07.2017	B	SOL	19:07	54°02.009	10°06.942	40.2	19:07	19:07	0028	Area B				
	29.07.2017	B	EOL	20:07	54°02.140	09°59.845	16.9	19:07	19:07	0028	Area B				
76	30.07.2017	B	SOL	06:30	54°02.415	09°59.629	16.6	06:30	06:30	0029	Area B				
	30.07.2017	B	EOL	07:29	54°02.246	10°06.723	40.3	06:30	06:30	0029	Area B				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
77	30.07.2017	B	-	07:37	54°02.168	10°06.904	40.2					CTD4			
78	30.07.2017	B	SOL	07:56	54°02.556	10°06.530	40.1	07:56	07:56	0030	Area B				
	30.07.2017	B	EOL	08:43	54°02.655	09°59.668	20.1	07:56	07:56	0030	Area B				
79	30.07.2017	B	SOL	08:49	54°02.936	09°59.745	20.6	08:49	08:49	0031	Area B				
	30.07.2017	B	EOL	09:48	54°02.792	10°06.501	41.5	08:49	08:49	0031	Area B				
80	30.07.2017	B	SOL	09:54	54°03.048	10°06.490	42.1	09:54	09:54	0032	Area B				
	30.07.2017	B	EOL	10:21	54°03.138	10°02.390	24.3	09:54	09:54	0032	Area B				
81	30.07.2017	B	SOL	10:23	54°03.298	10°02.200	24.8	10:24	10:24	0033	Area B				
	30.07.2017	B	EOL	10:53	54°05.701	10°01.070	18.17	10:24	10:24	0033	Area B				
82	30.07.2017	B	SOL	11:07	54°05.657	09°59.559	14.83	11:07	11:07	0034	Area B				
	30.07.2017	B	EOL	11:59	54°05.370	09°59.456	16.1	11:07	11:07	0034	Area B				
83	30.07.2017	B	SOL	12:03	54°05.101	09°59.449	17.39	12:03	12:03	0035	Area B				
	30.07.2017	B	EOL	12:28	54°04.889	10°03.502	22.5	12:03	12:03	0035	Area B				
84	30.07.2017	B	SOL	12:31	54°04.772	10°03.305	22.2	12:30	12:30	0036	Area B				
	30.07.2017	B	EOL	12:52	54°04.782	09°52.622	17.5	12:30	12:30	0036	Area B				
85	30.07.2017	B	SOL	12:56	54°04.556	10°00.032	19.75	12:56	12:56	0037	Area B				
	30.07.2017	B	EOL	13:15	54°04.492	10°03.244	27.3	12:56	12:56	0037	Area B				
86	30.07.2017	B	SOL	13:24	54°04.239	10°04.182	28.6	13:24	13:24	0038	Area B				
	30.07.2017	B	EOL	13:50	54°04.217	09°59.566	17	13:24	13:24	0038	Area B				
87	30.07.2017	B	SOL	13:54	54°04.018	10°00.297	17.4	13:54	13:54	0039	Area B				
	30.07.2017	B	EOL	14:25	54°03.947	10°04.554	31.5	13:54	13:54	0039	Area B				
88	30.07.2017	B	SOL	14:33	54°03.671	10°04.938	32	14:40	14:40	0040	Area B				
	30.07.2017	B	EOL	15:09	54°03.749	09°59.410	17.5	14:40	14:40	0040	Area B				
89	30.07.2017	B	SOL	15:13	54°03.487	09°59.569	19.2	15:13	15:13	0041	Area B				
	30.07.2017	B	EOL	16:03	54°03.357	10°05.606	35.7	15:13	15:13	0041	Area B				
90	30.07.2017	B/C	SOL	16:06	54°03.272	10°05.736	37.3	16:06	16:06	0042	Area B/C				
	30.07.2017	C	EOL	16:48	54°01.001	10°10.484	37.5	16:06	16:06	0042	Area C				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
91	30.07.2017	C	SOL	16:49	54°00.999	10°10.384	37.45	16:49	16:49	0043	Area C				
	30.07.2017	C	EOL	17:16	54°00.873	10°06.261	43	16:49	16:49	0043	Area C				
92	30.07.2017	C	SOL	17:22	54°00.993	10°06.707	43	17:22	17:22	0044	Area C				
	30.07.2017	C	EOL	18:05	54°01.172	10°11.368	43	17:22	17:22	0044	Area C				
93	30.07.2017	C	SOL	18:09	54°01.298	10°11.169	43.5	18:09	18:09	0045	Area C				
	30.07.2017	C	EOL	18:56	54°01.133	10°06.214	34.7	18:09	18:09	0045	Area C				
94	30.07.2017	C	SOL	18:59	54°01.277	10°06.347	35	18:59	18:59	0046	Area C				
	30.07.2017	C	EOL	19:48	54°01.417	10°10.93	45.5	18:59	18:59	0046	Area C				
95	30.07.2017	C	SOL	19:55	54°01.533	10°10.265	44	19:55	19:55	0047	Area C				
	30.07.2017	C	EOL	20:33	54°01.421	10°06.294	35	19:55	19:55	0047	Area C				
96	31.07.2017	B	SOL	08:38	54°02.918	09°58.885	21.78	08:39	08:39	0048	Area B				
	31.07.2017	B	EOL	09:14	54°03.131	10°02.594	21.3	08:39	08:39	0048	Area B				
97	31.07.2017	B	SOL	09:25	54°03.267	10°02.250	24	09:25	09:25	0049	Area B				
	31.07.2017	B	EOL	09:46	54°01.829	10°03.191	25.5	09:25	09:25	0049	Area B				
98	31.07.2017	B	SOL	09:50	54°01.761	10°03.556	25.86	-	-	0050	Area B				Transit line. Seafloor assessed as rock - sparker/pinger disabled
	31.07.2017	B	-	10:07	54°01.496	10°05.265	33.22	10:07	10:07	0050	Area B				Seafloor reassessed as softer sediments - Sparker/pinger enabled
	31.07.2017	B	EOL	10:25	54°00.618	10°06.650	34	10:07	10:07	0050	Area B				
99	31.07.2017	C	SOL	10:25	54°00.610	10°06.689	32.55	10:25	10:25	0051	Area C				
	31.07.2017	C	EOL	10:25	54°00.764	10°08.150	37.5	10:25	10:25	0051	Area C				
100	31.07.2017	C	SOL	10:50	54°00.725	10°06.766	33	10:50	10:50	0052	Area C				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
	31.07.2017	C	-	11:10	54°00.788	10°09.150	37	10:50	10:50	0053	Area C				Line split
	31.07.2017	C	EOL	11:20	54°00.830	10°10.271	37.5	10:50	10:50	0053	Area C				
101	31.07.2017	C	SOL	11:22	54°00.910	10°10.230	38.1	11:22	11:22	0054	Area C				
	31.07.2017	C	EOL	11:51	54°00.785	10°06.719	34.5	11:22	11:22	0054	Area C				
102	31.07.2017	C	SOL	11:55	54°00.931	10°08.486	35.81	11:55	11:55	0055	Area C				
	31.07.2017	C	EOL	12:39	54°01.129	10°11.232	42.24	11:55	11:55	0055	Area C				
103	31.07.2017	C	SOL	12:54	54°00.958	10°10.078	38.22	12:55	12:55	0056	Area C				Transit line
	31.07.2017	C	EOL	13:03	54°01.626	10°09.884	43	12:55	12:55	0056	Area C				
104	31.07.2017	C	SOL	13:04	54°01.632	10°09.788	44.5	13:03	13:03	0058	Area C				
	31.07.2017	C	EOL	13:17	54°01.663	10°07.932	42.8	13:03	13:03	0058	Area C				
105	31.07.2017	C	SOL	13:18	54°01.600	10°07.847	41.7	13:18	13:18	0059	Area C				
	31.07.2017	C/B	EOL	13:32	54°00.644	10°07.776	35.7	13:18	13:18	0059	Area C/B				
106	01.08.2017	B	-	07:12	54°05.318	10°02.587	19.6						VC12		
107	01.08.2017	B	-	08:12	54°01.544	10°02.134	15						VC13		
108	01.08.2017	C	-	09:09	54°01.446	10°12.074	50.6							S35	
109	01.08.2017	C	-	09:22	54°01.149	10°11.701	43.23							S36	
110	01.08.2017	D	SOL	11:15	53°57.847	10°10.562	31	11:15	11:15	0061	Area D				Maggy start time: 11:12
	01.08.2017	D	EOL	11:22	53°57.716	10°10.938	34	11:15	11:15	0061	Area D				
111	01.08.2017	D	SOL	11:25	53°57.595	10°10.840	39.5	11:25	11:25	0062	Area D				
	01.08.2017	D	EOL	11:33	53°57.837	10°10.103	30	11:25	11:25	0062	Area D				
112	01.08.2017	D	SOL	11:36	53°57.697	10°10.101	31.5	11:36	11:36	0063	Area D				
	01.08.2017	D	EOL	11:55	53°57.172	10°11.487	49	11:36	11:36	0063	Area D				
113	01.08.2017	D	SOL	11:59	53°57.125	10°11.167	42	11:59	11:59	0064	Area D				
	01.08.2017	D	EOL	12:09	53°57.470	10°10.249	37.5	11:59	11:59	0064	Area D				
114	01.08.2017	D/E	SOL	12:13	53°57.416	10°10.052	28.5	12:13	12:13	0065	Area D/E				
	01.08.2017	E	EOL	12:27	53°57.069	10°10.938	32.9	12:13	12:13	0065	Area E				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
115	01.08.2017	E	SOL	12:58	53°57.835	10°10.818	26.9	12:58	12:58	0066	Area E				
	01.08.2017	E	EOL	13:12	53°57.278	10°10.535	44.2	12:58	12:58	0066	Area E				
116	01.08.2017	E	SOL	13:14	53°57.249	10°10.338	43	13:14	13:14	0067	Area E				
	01.08.2017	E	EOL	13;39	53°57.637	10°07.565	27.5	13:14	13:14	0067	Area E				
117	01.08.2017	E	SOL	13:44	53°57.917	10°07.593	18.5	13:44	13:44	0068	Area E				
	01.08.2017	E	EOL	14:04	53°57.550	10°09.529	29	13:44	13:44	0068	Area E				
118	01.08.2017	E	SOL	14:08	53°57.494	10°09.455	31.8	14:09	14:09	0069	Area E				
	01.08.2017	E	EOL	14:22	53°57.806	10°07.532	25.5	14:09	14:09	0069	Area E				
119	01.08.2017	E	SOL	14:25	53°57.707	10°07.577	25.2	14:25	14:25	0070	Area E				
	01.08.2017	E	EOL	14:44	53°57.371	10°09.508	40.1	14:25	14:25	0070	Area E				
120	01.08.2017	G	SOL	14:49	53°57.172	10°09.322	42.9	14:49	14:49	0071	Area G				
	01.08.2017	G	EOL	15:02	53°57.467	10°07.652	38.8	14:49	14:49	0071	Area G				
121	01.08.2017	G	SOL	15:20	53°57.752	10°08.762	59.6	15:20	15:20	0072	Area G				
	01.08.2017	G	EOL	15:30	53°57.177	10°08.700	473.2	15:20	15:20	0072	Area G				
122	01.08.2017	G	SOL	16:30	53°53.690	10°01.155	31.4	16:30	16:30	0073	Area G				
	01.08.2017	G	EOL	17:06	53°54.490	10°04.855	47.8	16:30	16:30	0073	Area G				
123	01.08.2017	G	-	17:10	53°54.540	10°05.043	19.7					CTD5			
124	01.08.2017	G	SOL	17:52	53°54.125	10°00.598	26.2	17:52	17:52	0074	Area G				
	01.08.2017	G	EOL	18:01	53°54.496	10°01.216	29.2	17:52	17:52	0074	Area G				
125	01.08.2017	G	SOL	18:11	53°54.634	10°01.841	27.7	18:10	18:10	0075	Area G				
	01.08.2017	G	EOL	18:27	53°53.747	10°00.692	30.9	18:10	18:10	0075	Area G				
126	01.08.2017	G	SOL	18:33	53°53.797	10°01.319	21.2	18:33	18:33	0076	Area G				
	01.08.2017	G	EOL	18:49	53°54.561	10°02.312	37.4	18:33	18:33	0076	Area G				
127	01.08.2017	G	SOL	18:54	53°54.518	10°02.840	37.4	18:54	18:54	0077	Area G				
	01.08.2017	G	EOL	19:21	53°54.187	10°01.090	32.2	18:54	18:54	0077	Area G				
128	01.08.2017	G	SOL	19:27	53°54.208	10°01.710	39.7	19:27	19:27	0078	Area G				
	01.08.2017	G	EOL	19:50	53°54.557	10°03.450	37.6	19:27	19:27	0078	Area G				
129	01.08.2017	G	SOL	19:57	53°54.650	10°04.214	44.5	19.57	19.57	0079	Area G				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
	01.08.2017	G	EOL	20:26	53°53.035	10°02.030	43.5	19.57	19.57	0079	Area G				
130	02.08.2017	D	-	09:18	53°57.305	10°11.072	46.13							S37	
131	02.08.2017	D	-	09:31	53°57.290	10°10.770	45							S38	
132	02.08.2017	D	-	09:36	53°57.469	10°10.623	40.2							S39	
133	02.08.2017	D	-	09:40	53°57.597	10°10.746	38.8							S40	
134	02.08.2017	D	-	09:48	53°57.797	10°10.731	31.9							S41	
135	02.08.2017	D	-	09:56	53°57.758	10°10.357	32.6							S42	
136	02.08.2017	D	-	10:07	53°57.237	10°10.447	42.9							S43	
137	02.08.2017	E	-	10:35	53°57.401	10°08.704	39							S44	
138	02.08.2017	E	-	10:39	53°57.593	10°08.705	36.2							S45	
139	02.08.2017	E	-	12:05	53°57.425	10°07.494	39.85							S46	
140	02.08.2017	G	-	13:08	53°54.256	10°03.383	42.25							S47	
141	02.08.2017	G	-	13:32	53°53.903	10°02.804	43							S48	
142	02.08.2017	G	-	13:38	53°53.557	10°02.560	45							S49	
143	02.08.2017	G	-	13:49	53°53.505	10°01.778	39.9							S50	
144	02.08.2017	G	-	14:06	53°53.893	10°01.741	35.3							S51	
145	02.08.2017	G	-	14:20	53°54.026	10°02.183	37.8							S52	
146	02.08.2017	G	-	14:37	53°54.455	10°02.437	37.2							S53	
147	02.08.2017	G	-	14:47	53°54.331	10°01.721	32.3							S54	
148	02.08.2017	G	-	15:02	53°54.109	10°01.496	31.5							S55	
149	02.08.2017	G	-	15:22	53°54.128	10°00.650	22.7							S56	
150	02.08.2017	G	-	15:35	53°54.864	10°01.309	31.5							S57	
151	02.08.2017	F	SOL	16:48	53°57.190	10°03.682	15.7	16:45	16:45	0080	Area F				
	02.08.2017	F	EOL	16:57	53°57.870	10°04.977	12.2	16:45	16:45	0080	Area F				
152	02.08.2017	F	SOL	19:12	53°57.471	10°05.194	15.8	17:02	17:02	0081	Area F				
	02.08.2017	F	EOL	16:48	53°56.774	10°03.701	23.7	17:02	17:02	0081	Area F				
153	02.08.2017	F	SOL	17:32	53°56.450	10°03.844	28.8	17:32	17:32	0082	Area F				
	02.08.2017	F	EOL	18:01	53°57.647	10°05.580	20.2	17:32	17:32	0082	Area F				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
154	02.08.2017	F	SOL	18:03	53°57.567	10°05.609	20.9	18:03	18:03	0083	Area F				
	02.08.2017	F	EOL	18:04	53°57.345	10°05.621	26.7	18:03	18:03	0083	Area F				
155	02.08.2017	F	SOL	18:07	53°56.288	10°05.556	31.5	18:07	18:07	0084	Area F				
	02.08.2017	F	EOL	18:33	53°56.116	10°03.977	32.2	18:07	18:07	0084	Area F				
156	02.08.2017	F	SOL	18:39	53°55.848	10°04.162	34.8	18:39	18:39	0085	Area F				
	02.08.2017	F	EOL	19:00	53°56.654	10°05.360	37.8	18:39	18:39	0085	Area F				
157	02.08.2017	F	SOL	19:11	53°56.177	10°05.070	39.6	19:11	19:11	0086	Area F				
	02.08.2017	F	EOL	19:31	53°57.491	10°04.093	16.5	19:11	19:11	0086	Area F				
158	02.08.2017	F	SOL	19:38	53°57.736	10°04.387	9.8	19:38	19:38	0088	Area F				
	02.08.2017	F	EOL	19:49	53°57.177	10°03.692	17.2	19:38	19:38	0088	Area F				
159	02.08.2017	F	-	19:59	53°57.116	10°04.334	25.5							S58	
160	02.08.2017	F	-	20:11	53°57.483	10°05.151	25							S59	
161	02.08.2017	F	-	20:21	53°56.998	10°05.153	34.7							S60	
162	02.08.2017	F	-	20:34	53°56.623	10°04.094	29.1							S61	
163	02.08.2017	F	-	20:45	53°56.258	10°04.864	37.5							S62	
164	03.08.2017	H	SOL	07:43	53°47.621	09°44.566	16	07:13	07:13	0089	Area H				
	03.08.2018	H	EOL	07:56	53°46.887	09°49.548	14.5	07:13	07:13	0089	Area H				
165	03.08.2018	H	SOL	07:59	53°47.017	09°49.573	15.3	07:59	07:59	0090	Area H				
	03.08.2018	H	EOL	08:37	53°47.413	09°45.221	25.6	07:59	07:59	0090	Area H				
166	03.08.2018	H	SOL	08:42	53°47.761	09°44.625	26.9	08:42	08:42	0091	Area H				
	03.08.2018	H	EOL	10:01	53°46.512	09°54.394	18.1	08:42	08:42	0091	Area H				
167	03.08.2018	H	SOL	10:05	53°46.658	09°54.234	12.5	10:05	10:05	0092	Area H				
	03.08.2018	H	EOL	11.12	53°46.658	09°46.506	27.3	10:05	10:05	0092	Area H				
168	03.08.2017	H	SOL	11:17	53°47.901	09°46.610	29	11:17	11:17	0093	Area H				
	03.08.2017	H	EOL	12:38	53°46.802	09°54.589	14.04	11:17	11:17	0093	Area H				
169	03.08.2017	H	SOL	12:43	53°47.041	09°54.603	13.96	12:43	12:43	0094	Area H				
	03.08.2017	H	EOL	13:44	53°48.183	09°46.030	32.59	12:43	12:43	0094	Area H				
170	03.08.2017	H	SOL	13:52	53°48.415	09°46.860	32.39	13:52	13:52	0095	Area H				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
	03.08.2017	H	EOL	15:00	53°47.268	09°55.008	16.03	13:52	13:52	OFF	Area H				
171	03.08.2017	H	SOL	15:07	53°47.563	09°54.861	19.51	15:07	15:07	0096	Area H				
	03.08.2017	H	EOL	16:17	53°48.697	09°46.869	32.5	15:07	15:07	OFF	Area H				
172	03.08.2017	H	SOL	16:25	53°49.003	09°46.661	26.6	16:25	16:25	0097	Area H				
	03.08.2017	H	EOL	17:16	53°48.191	09°52.337	29.4	16:25	16:25	OFF	Area H				
173	03.08.2017	H	-	17:41	53°47.799	09°52.826	29.3							S63	
174	03.08.2017	H	-	17:49	53°47.250	09°53.226	18.9							S64	
175	03.08.2017	H	-	17:57	53°47.184	09°53.180	19							S65	
176	03.08.2017	H	-	18:02	53°46.939	09°53.460	17.6							S66	
177	03.08.2017	H	-	18:23	53°47.585	09°50.879	23.5							S67	
178	03.08.2017	H	-	18:34	53°47.214	09°50.451	16.5							S68	
179	03.08.2017	H	-	18:49	53°47.114	09°48.737	21							S69	
180	03.08.2017	H	-	18:55	53°47.955	09°49.072	16.7							S70	
181	03.08.2017	H	-	19:08	53°47.679	09°48.982	18.46						VC14		
182	03.08.2017	H	-	19:23	53°47.279	09°48.895	20.5						VC15		
183	03.08.2017	H	-	19:38	53°47.444	09°47.824	25.5							S71	
184	03.08.2017	H	-	20:38	53°47.844	09°48.814	29.1							S72	
185	03.08.2017	H	-	21:38	53°47.774	09°49.486	27.55						VC16		
186	03.08.2017	H	-	22:38	53°48.126	09°50.528	29.41							S73	
187	04.08.2017	H	SOL	06:31	53°49.346	09°49.335	34.7	06:31	06:31	0098	Area H				
	04.08.2017	H	EOL	07:02	53°47.000	09°48.370	15.01	06:31	06:31	0098	Area H				
188	04.08.2017	H	SOL	17:12	53°47.433	09°48.424	21.1	07:12	07:12	0099	Area H				
	04.08.2017	H	EOL	08:24	53°46.390	09°57.240	21	07:12	07:12	0099	Area H				
189	04.08.2017	H	SOL	08:25	53°46.265	09°57.296	22.5	08:25	08:25	0100	Area I				
	04.08.2017	I	EOL	09:00	53°43.736	09°58.503	34.1	08:25	08:25	0100	Area I				
190	04.08.2017	I	SOL	09:25	53°43.439	09°55.320	14.5	09:25	09:25	0101	Area I				
	04.08.2017	I	EOL	09:43	53°44.441	09°54.843	15.2	09:25	09:25	0101	Area I				
191	04.08.2017	I	SOL	09:46	53°44.552	09°55.040	15.6	09:46	09:46	0102	Area I				

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
	04.08.2017	I	EOL	10:00	53°43.441	09°55.615	16.8	09:46	09:46	0102	Area I				
192	04.08.2017	I	SOL	10:02	53°43.375	09°55.791	15.4	10:02	10:02	0103	Area I				
	04.08.2017	I	EOL	10:20	53°44.582	09°55.244	17.2	10:02	10:02	0103	Area I				
193	04.08.2017	I	SOL	10:28	53°46.515	09°55.762	22.9	10:27	10:27	0104	Area I				
	04.08.2017	I	EOL	10:44	53°43.465	09°56.384	17.2	10:27	10:27	0104	Area I				
194	04.08.2017	I	SOL	10:48	53°43.547	09°56.715	23	10:48	10:48	0105	Area I				
	04.08.2017	I	EOL	11:07	53°44.847	09°56.073	23.3	10:48	10:48	0105	Area I				
195	04.08.2017	I	SOL	11:12	53°45.010	09°56.472	24.8	11:12	11:12	0106	Area I				
	04.08.2017	I	EOL	11:31	53°43.591	09°57.159	28.3	11:12	11:12	0106	Area I				
196	04.08.2017	I	SOL	11:39	53°43.618	09°57.597	19.2	11:39	11:39	0107	Area I				
	04.08.2017	I	EOL	12:04	53°45.480	09°56.738	23.3	11:39	11:39	0107	Area I				
197	04.08.2017	I	SOL	12:10	53°45.578	09°57.155	27.4	12:10	12:10	0108	Area I				
	04.08.2017	I	EOL	12:37	53°43.724	09°58.054	33.9	12:10	12:10	0108	Area I				
198	04.08.2017	I	SOL	12:46	53°43.835	09°58.916	38.15	12:46	12:46	0109	Area I				
	04.08.2017	I	EOL	13:20	53°46.375	09°57.734	26.5	12:46	12:46	0109	Area I				
199	04.08.2017	I	SOL	13:26	53°46.378	09°58.177	28.9	13:26	13:26	0110	Area I				
	04.08.2017	I	EOL	14:03	53°43.833	09°59.370	38.9	13:26	13:26	0110	Area I				
200	04.08.2017	I	SOL	14:06	53°43.929	09°59.137	39365	14:06	14:06	0111	Area I				
	04.08.2017	I	EOL	14:23	53°45.113	09°58.624	35.23	14:06	14:06	0111	Area I				
201	04.08.2017	I	SOL	14:28	53°45.051	09°58.854	40.99	14:28	14:28	0112	Area I				Cross-line
	04.08.2017	I	EOL	15:00	53°43.956	09°55.077	17.1	14:28	14:28	0112	Area I				
202	04.08.2017	I	SOL	15:04	53°43.764	09°55.159	17.47	15:04	15:04	0113	Area I				Cross-line
	04.08.2017	I	EOL	15:47	53°44.553	09°59.189	46.48	15:04	15:04	0113	Area I				
203	04.08.2017	I	-	16:11	53°44.521	09°57.168	34.4							S74	
204	04.08.2017	I	-	16:19	53°44.101	09°56.911	37.12							S75	
205	04.08.2017	I	-	16:19	53°44.101	09°56.911	37.12							S75B	
206	04.08.2017	I	-	16:35	53°44.282	09°55.850	40.9							S76	
207	04.08.2017	I	-	16:51	53°44.268	09°54.907	16.9							S77	

Station No.	Date	Area	SOL/EOL	Time (UTC)	Lat DD	Long DD	Depth (m)	Sparker line	Pinger line	MBES line	Maggy area	SVP	Vibrocore	Shipek	Note
208	04.08.2017	I	-	16:58	53°43.779	09°55.142	17.24							S78	
209	04.08.2017	I	-	17:09	53°44.011	09°55.063	17.17							S79	
210	04.08.2017	I	-	17:28	53°43.970	09°55.083	17						VC17		
211	04.08.2017	I	-	17:42	53°43.978	09°55.048	16.62							S80	
212	04.08.2017	I	-	17:50	53°44.235	09°55.723	24.48						VC18		
213	04.08.2017	I	-	18:05	53°44.833	09°57.508	34.6							S81	
214	04.08.2017	I	-	18:21	53°44.843	09°57.549	35.08						VC19		
215	04.08.2017	I	-	18:21	53°44.843	09°57.549	35.08							S82	From VC19. Section C size underestimated
216	04.08.2017	I	-	18:34	53°44.861	09°58.455	39.75							S83	
217	04.08.2017	H	SOL	20:55	53°49.231	09°47.188	23.8	20:55	20:55	0115	Area H				
	04.08.2017	H	EOL	06:14	53°48.671	09°51.040	32	20:55	20:55	0115	Area H				
218	04.08.2017	H	SOL	21:33	53°44.912	09°51.581	32.3	21:33	21:33	0116	Area H				
	04.08.2017	H	EOL	21:58	53°49.352	09°48.221	29.2	21:33	21:33	0116	Area H				
219	04.08.2017	H	SOL	22:03	53°49.542	09°48.578	31.2	22:03	22:03	0117	Area H				
	04.08.2017	H	EOL	22:32	53°49.014	09°52.469	32.8	22:03	22:03	0117	Area H				
220	04.08.2017	H	-	22:48	53°48.979	09°50.849	33.6							S84	
221	04.08.2017	H	-	23:06	53°49.067	09°48.192	31.7							S85	
222	04.08.2017	H	-	23:36	53°30.901	09°53.573	27.88							S86	
223	05.08.2018	H	SOL	06:18	53°49.328	09°52.126	36.1	16.18	16.18	0118	Area H				
	05.08.2018	H	EOL	06:56	53°46.867	09°51.146	15.6	16.18	16.18	0118	Area H				

SVP Sample Stations *All times are recorded as UTC (GMT-1hr)*

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	SVP
5	25.07.2017	C	09:56	54°00.8	10°08.66	35.8	CTD1
8	25.07.2017	D	11:56	53°57.74	10°15.28	58.9	CTD2
42	28.07.2017	B	15.18	54°07.642	10°01.626	12.25	CTD3
77	30.07.2017	B	07:37	54°02.168	10°06.904	40.2	CTD4
123	01.08.2017	G	17:10	53°54.540	10°05.043	19.7	CTD5

Vibrocore Stations *All times are recorded as UTC (GMT-1hr)*

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	Vibrocore	Notes: Section A is base, B is middle and C is top section!
1	25.07.2017	C	07:44	54°01.116	10°10.03	35.5	VC01	Section A = 1m (OK), B = 1m (OK), C = 1m (top partly washed out). Heavy minerals Bagged samples: Core catcher
2	25.07.2017	C	08:19	55°01.006	10°07.875	40	VC02	Section A = 1m (OK), B = 1m (OK), C = 0.30m (bulk sample as sediment slide in core). Bagged samples: Core catcher
3	25.07.2017	C	08:42	54°00.83	10°07.472	37	VC03	Section A = 1m (OK), B = 1m (OK), C = 0.20m (bulk sample as sediment slide in core). Bagged samples: Core catcher, A/B, B/C, top of C
4	25.07.2017	C	09:32	54°00.71	10°07.827	36	VC04	Section A = 1m (OK), B = 1m (dropped on deck, some slight loss of sand from top), C = 0.25m (bulk sample as sediment slide in core). Bagged samples: Core catcher, A/B
10	25.07.2017	D	12:33	53°57.815	10°10.697	29	VC05	Section A = 1m (OK), B = 1m (OK), C = 0.89m (OK). Bagged samples: Core catcher
11	25.07.2017	D	13:11	53°57.462	10°10.697	51.5	VC06	Section A = 1m (OK), B = 1m (OK), C = 0.70m (OK). Bagged samples: Core catcher

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	Vibrocore	Notes: Section A is base, B is middle and C is top section!
12	25.07.2017	D	13:38	53°57.704	10°14.300	62.6	VC07	Section A = 1m (OK), B = 1m (OK), C = 0.64m (OK). Mostly shell hash Bagged samples: Core catcher
13	25.07.2017	D	14:08	53°57.854	10°10.991	23.1	VC08	Section A = 1m (OK), B = 1m (OK), C = 0.68m (OK). Mostly coarse sand Bagged samples: Core catcher
26	25.07.2017	G	18:11	53°54.200	10°04.260	49.5	VC09	Section A = 1m (OK), B = 1m (OK), C = 0.69m (OK). Bagged samples: Core catcher
27	25.07.2017	G	18:34	53 54.130	10 02.245	38.5	VC10	Section A = 1m (OK), B = 1m (OK), C = 0.66m (OK). Bagged samples: Core catcher
28	25.07.2017	G	18:53	53°54.318	10°00.981	25.5	VC11	Section A = 1m (OK), B = 1m (OK), C = 0.69m (Bulk sample as the core ran). Bagged samples: Core catcher
106	01.08.2017	B	07:12	54°05.318	10°02.587	19.6	VC12	Section A = 1m (OK), B = 1m (OK), C = 0.70m (Top 30cm = bulk sample as the core ran). Bagged samples: Core catcher
107	01.08.2017	B	08:12	54°01.544	10°02.134	15	VC13	Section A = 1m (OK), B = 1m (OK), C = 0.48m (Bulk sample as the core ran). Bagged samples: Core catcher
181	03.08.2017	H	19:08	53°47.679	09°48.982	18.46	VC14	Section A = 1m (OK), B = 1m (OK), C = 0.74m (Bulk sample as the core ran). Bagged samples: Core catcher, A/B, B/C
182	03.08.2017	H	19:23	53°47.279	09°48.895	20.5	VC15	Section A = 1m (OK), B = 0.70m (27cm of stratigraphy and top 43cm is a bulk sample as the core ran). Bagged samples: Core catcher, A/B, B/C
185	03.08.2017	H	21:38	53°47.774	09°49.486	27.55	VC16	Section A = 1m (OK), B = 1m (OK), C = 0.77m (26cm of stratigraphy and top 51cm is a bulk sample as the core ran). Bagged samples: Core catcher
210	04.08.2017	I	17:28	53°43.970	09°55.083	17	VC17	Section A = 1m (OK), B = 1m (OK), C = 0.73m (27cm of stratigraphy and top 46cm is a bulk sample as the core ran). Bagged samples: Core catcher
212	04.08.2017	I	17:50	53°44.235	09°55.723	24.48	VC18	Section A = 1m (OK), B = 1m (OK), C = 0.76m (11cm of stratigraphy and top 65 cm is a bulk sample as the core ran). Bagged samples: Core catcher
214	04.08.2017	I	18:21	53°44.843	09°57.549	35.08	VC19	Section A = 0.33cm (Bulk sample as the core ran). Bagged samples: Core catcher

Shipek Grab Stations *All times are recorded as UTC (GMT-1hr)*

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	Shipek	Note
29	26.07.2017	B	11:40	54°08.611	10°02.128	10.1	S1	Grey muddy sand with large shells and surpulid worm casts
30	26.07.2017	B	12:02	54°07.494	10°01.088	12	S2	Dark grey mud, appears to contain heavy minerals
31	26.07.2017	B	12:21	54°06.627	10°00.001	13.7	S3	Fine grained sand. Light orange with shell hash
32	26.07.2017	B	12:35	54°06.002	10°00.036	12.7	S4	Medium grained sand. No bioclasts
33	26.07.2017	B	12:46	54°05.159	10°00.042	15.5	S5	Medium grained sand. No bioclasts, dark
34	26.07.2017	B	12:55	54°04.534	10°00.519	18.8	S6	Very fine grained dark sand, small elongate shell, muddy
35	26.07.2017	B	13:09	54°05.362	10°01.430	17.8	S7	Medium to fine sand. Dark
36	26.07.2017	B	13:21	54°05.693	10°02.265	17	S8	Very sandy shell hash. No mud
37	26.07.2017	B	13:32	54°05.464	10°03.141	16.3	S9	Medium sand, light colour
38	26.07.2017	B	13:46	54°06.104	10°01.100	15.1	S10	Medium sand, light colour, some shell
39	26.07.2017	B	13:50	54°06.104	10°02.117	17.6	S11	Brown fine sand. Muddy with bioclasts
40	26.07.2017	B	14:18	54°07.257	10°01.968	13.8	S12	Dark black fine sand, Black particles floating
41	26.07.2017	B	14:28	54°07.642	10°01.811	12.5	S13	Dark muddy sand. Anoxic. Some bioclasts
53	29.07.2017	B	09:29	54°05.353	10°02.278	21	S14	Fine to medium grained sand. Shell hash. Moderately sorted. Angular
54	29.07.2017	B	09:36	54°05.025	10°02.021	32.7	S15	Fine grained, medium sorted, some shells, brown sand
55	29.07.2017	B	09:43	54°04.768	10°01.084	22.7	S16	Fine grained sand. Very little shell, HMS present. Rounded to subrounded. Anoxic sand present in layers
56	29.07.2017	B	09:54	54°04.227	10°02.097	26	S17	Fine to medium grained, poorly sorted. Anoxic grey sands. Some shell hash
57	29.07.2017	B	10:17	54°03.956	10°04.048	31	S18	Fine grained, well - mod sorting. Bio on top. Some bioclasts
58	29.07.2017	B	10:39	54°02.907	10°02.483	26	S19	Medium - well sorted, fine - medium grained sands, bioclasts/bivalves/echinoid fragments
59	29.07.2017	B	10:43	54°03.468	10°01.992	24.5	S20	Well sorted medium sand, distinct yellow/orange colour. Biogenic components
60	29.07.2017	B	10:54	54°03.791	10°00.057	20	S21	Well sorted silt. Mica rich. Very little biogenic material. Dark brown
61	29.07.2017	B	11:11	54°02.634	10°00.627	20.2	S22	Fine grained, well sorted, no biogenics. Dark, silt, anoxic (as determined from smell)
62	29.07.2017	B	12:02	54°01.533	10°02.026	16.2	S23	Well sorted medium grained sand. Lacks biogenic. Brown/orange
63	29.07.2017	B	12:37	54°03.030	10°04.261	34.25	S24	Well sorted fine sand, small amount of biogenic

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	Shipek	Note
64	29.07.2017	B	12:49	54°02.536	10°05.556	35.5	S25	Well sorted medium sand. Includes biogenic (shell) fragments
65	29.07.2017	B	13:02	54°02.028	10°05.599	34.7	S26	Well sorted fine - medium sands. Includes biogenic (shell) fragments
66	29.07.2017	B	13:19	54°01.179	10°06.338	36.5	S27	Well sorted silts. Includes biogenic material.
67	29.07.2017	C	13:26	54°01.268	10°07.160	37	S28	Well sorted fine sands. Includes biogenic material (shell fragments <1mm)
68	29.07.2017	C	13:35	54°00.893	10°07.313	35.75	S29	Well sorted medium sands. Includes biogenics (shell fragments etc.)
69	29.07.2017	C	13:44	54°01.074	10°07.853	37	S30	Well sorted medium sands. Includes biogenics (shell fragments etc.)
70	29.07.2017	C	14:02	54°01.390	10°09.281	40.9	S31	Well sorted medium sands. Includes biogenics (shells). Very small sample (3 shipek attempts)
71	29.07.2017	C	14:17	54°01.095	10°09.632	37.8	S32	Well sorted fine sands. Includes biogenic material (shell fragments) (3 shipek attempts)
72	29.07.2017	C	14.39	54°01.127	10°10.278	38	S33	Well sorted medium sand inc bioclasts (shell fragments)
73	29.07.2017	C	15.23	54°01.384	10°10.599	44.5	S34	Well sorted medium sand inc bioclasts
108	01.08.2017	C	09:09	54°01.446	10°12.074	50.6	S35	Medium grained, well sorted, some biogenics. Mostly white with some dark patches
109	01.08.2017	C	09:22	54°01.149	10°11.701	43.23	S36	Medium grained sand, coarse angular biogenics with no obvious heavy minerals
130	02.08.2017	D	09:18	53°57.305	10°11.072	46.13	S37	Coarse grained. Well sorted. Fine grained heavy minerals present. Some biogenics (≤1mm) (3 shipek attempts)
131	02.08.2017	D	09:31	53°57.290	10°10.770	45	S38	Very coarse grained. 3cm pebble. Poorly sorted. Mostly shell hash
132	02.08.2017	D	09:36	53°57.469	10°10.623	40.2	S39	Coarse grained. Moderately sorted. Very fine biogenics present. No heavy minerals
133	02.08.2017	D	09:40	53°57.597	10°10.746	38.8	S40	Coarse grained. Moderately sorted. Shell fragments (≤2mm). No obvious heavy minerals
134	02.08.2017	D	09:48	53°57.797	10°10.731	31.9	S41	Medium - coarse grained. Moderately sorted, Biogenics present (≤2mm)
135	02.08.2017	D	09:56	53°57.758	10°10.357	32.6	S42	Coarse grained. Moderately sorted
136	02.08.2017	D	10:07	53°57.237	10°10.447	42.9	S43	Very coarse grained. Poorly sorted. Shells present (≤3cm). Shell hash also present (≤2mm)
137	02.08.2017	E	10:35	53°57.401	10°08.704	39	S44	Coarse sample, shells, lithic fragments, poorly sorted
138	02.08.2017	E	10:39	53°57.593	10°08.705	36.2	S45	Very small sample, poorly sorted, shells, gravel.
139	02.08.2017	E	12:05	53°57.425	10°07.494	39.85	S46	Coarse - medium grained. Some biogenic material. Moderately sorted
140	02.08.2017	G	13:08	53°54.256	10°03.383	42.25	S47	Small sediment sample, fine grained. Some heavy minerals
141	02.08.2017	G	13:32	53°53.903	10°02.804	43	S48	Fine grained, well sorted, little biogenics

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	Shipek	Note
142	02.08.2017	G	13:38	53°53.557	10°02.560	45	S49	Small sample, fine grained, heavy minerals present, well sorted, no biogenics
143	02.08.2017	G	13:49	53°53.505	10°01.778	39.9	S50	Fine grained. Dark. Some bioclasts. Sample was smelly
144	02.08.2017	G	14:06	53°53.893	10°01.741	35.3	S51	Small sample, fine grained, heavy minerals present, well sorted, no biogenics
145	02.08.2017	G	14:20	53°54.026	10°02.183	37.8	S52	Very little sample, fine grained, heavy minerals present, no biogenics.
146	02.08.2017	G	14:37	53°54.455	10°02.437	37.2	S53	Small sample, fine grained, heavy minerals present, no biogenics
147	02.08.2017	G	14:47	53°54.331	10°01.721	32.3	S54	Small sample, fine grained, heavy minerals present, no biogenics
148	02.08.2017	G	15:02	53°54.109	10°01.496	31.5	S55	Fine grained, well sorted, heavy minerals present, little biogenics
149	02.08.2017	G	15:22	53°54.128	10°00.650	22.7	S56	Fine grained, well sorted
150	02.08.2017	G	15:35	53°54.864	10°01.309	31.5	S57	Heavy minerals present, fine grained, no biogenic material
159	02.08.2017	F	19:59	53°57.116	10°04.334	25.5	S58	Medium - fine grained. Well sorted. Some heavy minerals and bioclasts
160	02.08.2017	F	20:11	53°57.483	10°05.151	25	S59	Coarse grained sands. Shell hash prominent. Poorly sorted. Biogenics throughout
161	02.08.2017	F	20:21	53°56.998	10°05.153	34.7	S60	Fine grained sands/silts. Some dark content. Organics present on surface of sample during aquisition
162	02.08.2017	F	20:34	53°56.623	10°04.094	29.1	S61	Fine grained sand. No biogenics or evidence of heavy minerals. Well sorted
163	02.08.2017	F	20:45	53°56.258	10°04.864	37.5	S62	Fine grained sand. Biogenics on top. Moderately sorted. No obvious heavy minerals
173	03.08.2017	H	17:41	53°47.799	09°52.826	29.3	S63	Fine grained. Smell strong. Well sorted. Little biogenics
174	03.08.2017	H	17:49	53°47.250	09°53.226	18.9	S64	Large pebbles and surface biology. Poorly sorted sediments
175	03.08.2017	H	17:57	53°47.184	09°53.180	19	S65	Very poorly sorted sediments. Large pebbles present. Very coarse grained sand
176	03.08.2017	H	18:02	53°46.939	09°53.460	17.6	S66	Large pebbles. Surface biology prevalent. Coarse sands present
177	03.08.2017	H	18:23	53°47.585	09°50.879	23.5	S67	Coarse grained sand. Biogenics (Shells <2cm). Unsorted
178	03.08.2017	H	18:34	53°47.214	09°50.451	16.5	S68	Shelly material. Poorly sorted. Coarse grained
179	03.08.2017	H	18:49	53°47.114	09°48.737	21	S69	Medium - fine grained. Well sorted. Some heavy minerals. No bioclasts
180	03.08.2017	H	18:55	53°47.955	09°49.072	16.7	S70	Medium - coarse grained. Well sorted. No heavy minerals. No biogenics.
181	03.08.2017	H	19:38	53°47.444	09°47.824	25.5	S71	Medium - coarse grained. Moderately sorted. No heavy minerals or biogenics
182	03.08.2017	H	20:38	53°47.844	09°48.814	29.1	S72	Medium grained. Well sorted. Biogenics present (<1mm). No heavy minerals.
183	03.08.2017	H	22:38	53°48.126	09°50.528	29.41	S73	Fine - medium grained. Moderately sorted. Some biogenics. No heavy minerals.
203	04.08.2017	I	16:11	53°44.521	09°57.168	34.4	S74	Fine grained. Well sorted. Minor bioclasts (<1mm). Heavy minerals found in sample when unloading shipek into sample bag. Green colour

Station No.	Date	Area	Time (UTC)	Lat DD	Long DD	Depth (m)	Shipek	Note
204	04.08.2017	I	16:19	53°44.101	09°56.911	37.12	S75	Very poorly sorted. Large pebbles. Coarse sands. Benthic fauna on surface sediments
205	04.08.2017	I	16:19	53°44.101	09°56.911	37.12	S75B	Pebble rich retrieval
206	04.08.2017	I	16:35	53°44.282	09°55.850	40.9	S76	Fine - medium grained. Well sorted. No biogenics. Dark colour
207	04.08.2017	I	16:51	53°44.268	09°54.907	16.9	S77	Silt - fine grained. Well sorted. Some larger stones in sample
208	04.08.2017	I	16:58	53°43.779	09°55.142	17.24	S78	Fine grained. Moderately sorted. Dark colour (2 attempts)
209	04.08.2017	I	17:09	53°44.011	09°55.063	17.17	S79	Fine grained, moderately sorted, greeny colour sand
211	04.08.2017	I	17:42	53°43.978	09°55.048	16.62	S80	Fine - medium grained. Benthic fauna on surface. Well sorted
213	04.08.2017	I	18:05	53°44.833	09°57.508	34.6	S81	Medium grained. Well sorted. Orange colour. Still darks throughout
215	04.08.2017	I	18:21	53°44.843	09°57.549	35.08	S82	This sample was retrieved from VC19 (Section C underestimated during cutting). Medium grained. Orange colour. Well sorted
216	04.08.2017	I	18:34	53°44.861	09°58.455	39.75	S83	Very orange colour. Darks prominent. Medium grained. Biogenics within (<1mm). Well sorted.
220	04.08.2017	H	22:48	53°48.979	09°50.849	33.6	S84	Medium Grained. Moderately sorted. <1cm clasts. Biology present (shells). Anoxic sands
221	04.08.2017	H	23:06	53°49.067	09°48.192	31.7	S85	Medium grained. Biology on surface (starfish). Moderately sorted
222	04.08.2017	H	23:36	53°30.901	09°53.573	27.88	S86	Coarse grained. Sand eel in sample. Poorly sorted with angular debris

Appendix IV

Deck Plan