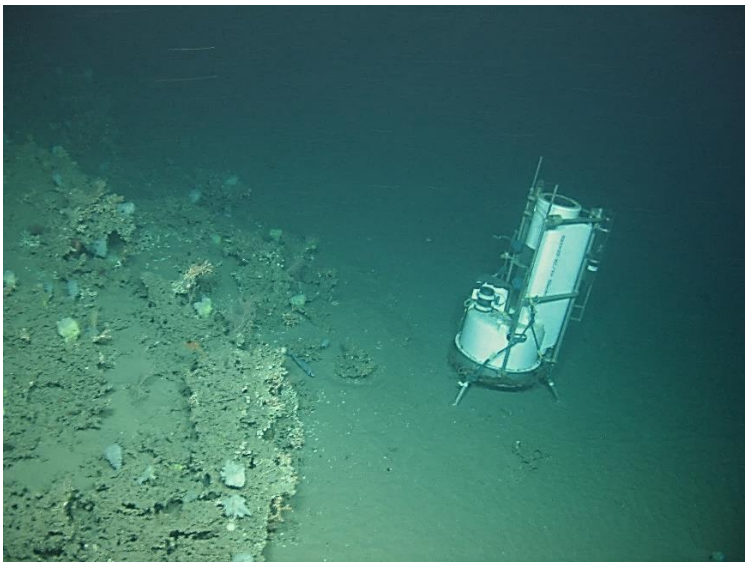
# CE22013 – Sediment Plume Sampling, Bedrock Drilling & Coral Surveying (SPeeD)



## RV Celtic Explorer & Holland 1 ROV

## Survey Number CE22013

## Galway – Porcupine Seabight – Galway

## 27th July – 13th August 2022

**Andrew J. Wheeler[1]*, Audrey Recouvreur[1], Felix Butschek[1], Florian Le Pape[2], Alicia Mateos Cárdenas[1], Clara Gomez Garcia[2], Laetitia Guibourdenche[3], Jessica Harty[1], Gerard Summers[1], ROV Technical Team[4], Officers & Crew of the RV Celtic Explorer[4]**

[1]School of Biological, Earth & Environmental Science, University College Cork, Ireland
[2]Dublin Institute of Advanced Science, Dublin, Ireland
[3]Institut de Physique di Globe de Paris, Paris, France
[4]P&O Maritime and Marine Institute, Galway, Ireland

Corresponding author*: a.wheeler@ucc.ie

# Table of Contents

# Executive Summary

This survey was severely impacted by COVID which infected several crew members resulting a loss of 10 days at sea, an unscheduled port call where crew and scientists were isolated for 9 days, a reduction to 12 hours deck operations, an early depart from the survey area and new demobilisation port call for scientists and the final patient. As a result, most of the original objectives for this survey were not possible to complete with survey work cancelled in the Whittard Canyon, Goban Spur and Porcupine Bank which where the main focus of the survey. However, we were successful in completing our objectives for the Porcupine Seabight.

In the Belgica Mounds SAC we retrieved two Little MonSta landers that collected ADCP data for 3 months and 12 months next to a Moira Mound. Two additional landers were deployed in the "coral ridge" area northeast of Galway Mound for 6 months (ADCP, sediment traps, CTD, pH, DO, turbidity) on a ridge crest and adjacent trough. CTD water samples to calibrate the turbidity and ADCP data were taken over the retrieved and deployed Little MonStas. We also collected tightly beam-spaced ship's multibeam echosounder coverage over the "coral ridge" area, as well as normally beam spaced multibeam echosounders data in the Moira Mound area where previously collected ROV multibeam coverage exists. The latter was to rectify offsets in the ROV MBES data.

In addition, we collected a number of coral samples to assess microplastic ingestion by the corals at five sites on Little Therese and Therese Mounds. Water samples for microplastic analysis were also collected from CTDs (basal, mid and upper waters) as well as plankton net tows offshore Cork, Belgica SAC and Galway Bay.

# Background

This survey was designed to address data requirements pertinent to a number of key research questions of significance to the international research community, however, due to COVID the obtained objectives have been limited to;

- Understanding seabed environmental parameters, variability and baselines for cold-water coral reefs;
- reappraising cold-water coral reef development models;
- appraising pollutant and microplastic impacts on cold-water coral habitat, the impact of benthic trawling on carbon budgets and the quality food supply to sessile organisms;

This survey collected data in in the Belgica Mound Province SAC and brings together an international (Irish-French), multidisciplinary team of marine geologists, geophysicists, and environmental scientists.

***Environmental controls of CWC reefs and reappraising reef development models***

Monitoring environmental controls on cold-water coral reefs in a dynamic changing ocean is critical to understanding the fate and management priorities for these important habitats as cold-water corals are considered ecosystem engineers that form the base for biodiversity hotspots (Roberts et al., 2006). The Moira Mounds are a assemblage of small (50m diameter) reefs in the Belgica Mound Province (Wheeler et al., 2011) and, along with associated giant carbonate mounds (Wheeler et al., 2007) have been designated as a Special Area of Conservation. A recent study from the area shows a decline in coral cover in the Moira Mounds across a 4 year span (Boolukos et al., 2019) although the environmental drivers for this are unclear. Investigations of temperature, current speeds and direction and supply of suspended particulate matter can provide crucial insights of why these organisms may be in a state of change. On this survey we recover two Little MonSta landers that will complete a 2 year lander time-series (O'Reilly et al, 2021) will help understand forcing factors.

Multibeam mapping of an area of ridge-reefs will allow a morphometric evaluation of this reef type to be integrated with quantified existing video data (O'Reilly et al, 2021). We anticipate this data will provide evidence to challenge existing reef development models (Squires, 1964; Roberts et al., 2006) as coral ridge types reefs are not well documented, especially in the Porcupine Seabight were there has been a focus on mounds

***Pollutants in Corals***

The study of microplastics in the deep sea is still in its infancy, with the majority of studies focussing on presence/absence and missing geological and biological processes that may have a key impact on deep sea biodiversity (Kane and Clare, 2019). CWC reefs offer a speciose habitat identified for monitored under the EU Habitats Directive. The results from the CWC sample collected will inform national and international policy on ocean pollution.

## Survey Objectives (and cruise track)

Several objectives were planned for this survey and are listed below in the order they were to be addressed. Task to fulfil the objectives are also listed:

*Objective 1*: to **recover long-term deployments of Little MonSta lander platforms from the Moira Mounds (Porcupine Seabight)** characterising environmental controls on cold-water coral reefs,

Task 1 – *Lander retrieval*: Two Little MonSta landers are to be retrieved from in the Moira Mounds (Belgica Mound SAC) following the year-long deployment (O'Reilly et al., 2021). These landers will extend the oceanographic and sedimentological dataset of the area to two years.

*Objective 2:* to map in high resolution an area of cold-water coral (CWC) ridge-reefs **to better understand CWC reef development models and biogeoenvironmental interactions,**

Task 2 – *ROV MBES survey of Moira Mounds ridge-reefs*: following the successful collection of benthic video footage from this area (O'Reilly et al., 2021), high resolution multibeam echosounder data will be collected by ROV at 150m above seabed with 330m swathe providing morphometric data relatable to video-based coral distribution and inferred sedimentology. Please note, however, that due to technical issues, ROV MBES was substituted for tight beam shipbased MBES.

Task 3 – *Lander deployment*: Two Little MonSta landers are to be deployed in the "coral ridge" area (Belgica Mound SAC) on top of a coral ridge and in a trough between ridges These landers will help us understand environmental drivers in this reef-type.

*Objective 3*: to collect cold-water coral samples for the study **of coral pollutant absorption and microplastic accumulation,**

Task 4 – *ROV sampling of live CWCs for pollutant and microplastic studies*: live coral samples are to be collected. These samples will be key to analyse the accumulation of microplastics in corals as well as the absorption of associated chemicals. These data directly feeds the MI funded Postdoctoral Fellowship "MopUp/Plast_Chem_Dora" Ref No: PDOC/19/03/01. In addition, water and plankton net samples will be collected to determine the levels of microplastics in the environment.

Dead coral frameworks are also to be collected for Martina O'Brien as part of an art-science outreach project with iCRAG

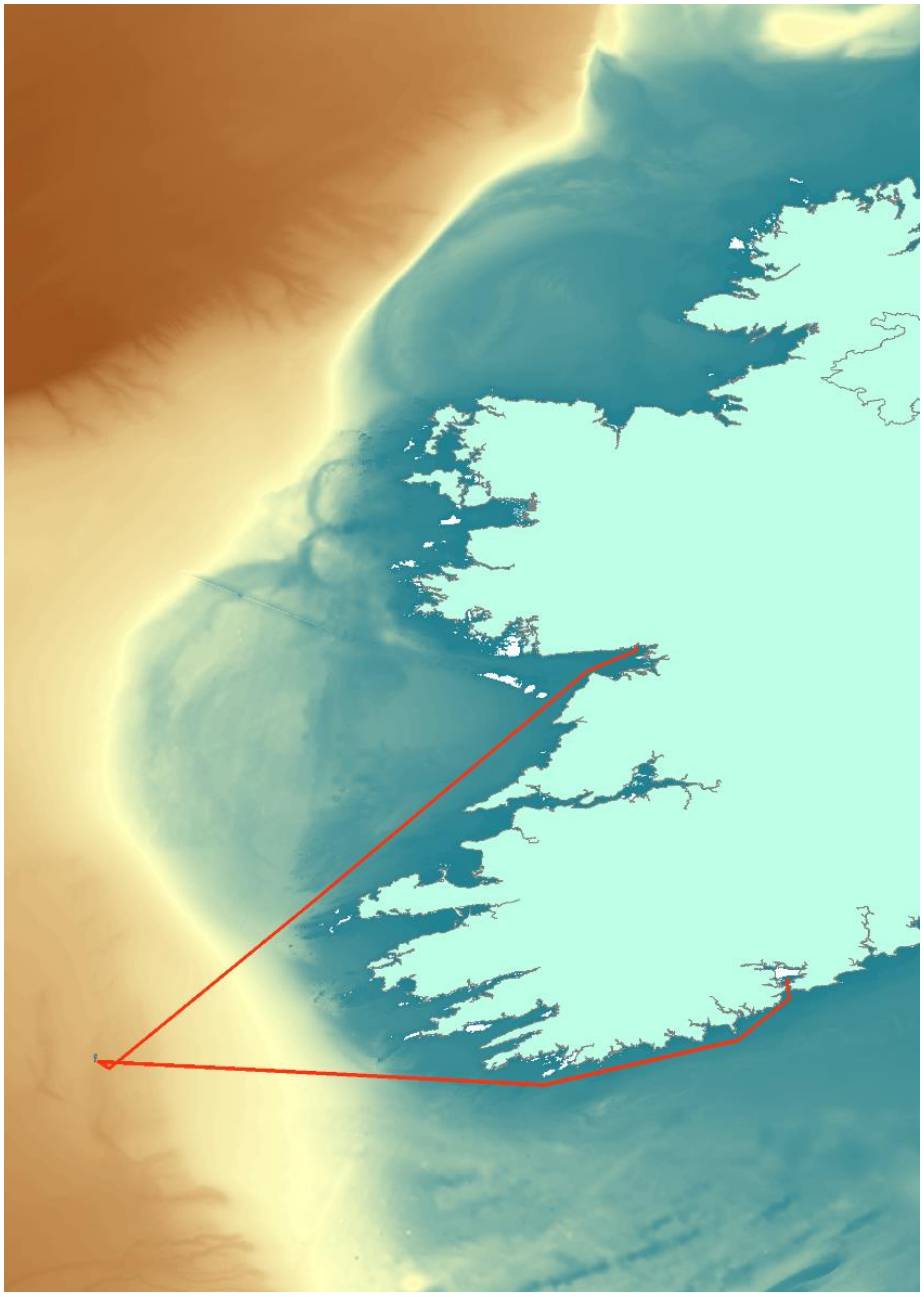


*Figure 1. CE22013 SPeeD survey shiptrack: Galway to Porcupine Seabight to Cork to Porcupine Seabight to Galway*

## Equipment

***RV Celtic Explorer***

The RV Celtic Explorer is a 65.5 m multi-purpose research vessel. The vessel has wet, dry and chemical laboratories, which are permanently fitted with standard scientific equipment, a fume hood and can accommodate 20-22 scientists along with 13-15 crew who are highly-skilled with the handling and deployment of scientific equipment. It has a maximum endurance of 35 days. The RV Celtic Explorer is equipped with two Trimble 300-D GPS' and has Dynamic Positioning. The aft deck has a 25 tonne "A-frame" with a 4 m outward and inward reach in addition to a 3 m, 10 tonne starboard T-frame. The ship also comprises of a

midship, forward and aft crane as well as a 6 tonne CTD winch. The CTD and plankton net are part of the vessel equipment pool.


*Figure 2. RV Celtic Explorer*

***Holland 1 ROV***

The Holland 1 3000m depth ROV (remote operated vehicle) is a platform for capturing underwater footage of the seabed, and transmitting the video as a live-feed to the scientists aboard the vessel, and for remote sampling. It has 100 hp engine with a maximum speed of 3 knots. The Holland 1 has a HDTV camera, low resolution cameras and a HD digital stills with laser rangers which are well illuminated providing pan-and-tilt forward views, below and aft. It is also fitted with a CTD and 2 robotic arms for sampling (1X7F and 1X5F) as well as an aspirator. Collected samples are stored in bio-boxes (divided into 8 compartments) and the aspirator tank. An EM2040 multi-beam echo sounder (not equipped on this survey) can be mounted on the vehicle for high resolution bathymetry imagery & precision mapping of the seabed. The EM2040 operates at 200 - 400 kHz and is effective to 600m. Underwater navigation is done via USBL position unless greater precision is required for MBES mapping where an integrated inertial navigation and Doppler system can be used.


*Figure 3. Holland 1 Remotely Operated Vehicle*

***Little Monsta benthic lander monitoring platforms***

Six "Little MonSta" benthic lander monitoring platforms, referred to as "Landers", were mobilised for this survey with two additional Little MonStas recovered from the seabed and one redeployed. Each Little MonSta is equipped with an Acoustic Doppler Current Profiler (ADCP), Sediment Trap and Multi-sensor CTD package.

- The **ADCP** is a 1 Hz ***Nortek Aquadopp***, depth-rated to 3000 m water depth and powered by a battery pack that can continually measure data from 0-25 m from the transducer for up to six months. The ADCP is mounted vertically, pointed upwards, near the top of the Little MonSta.
- The sediment trap is a ***Technicap* sediment trap**, depth-rated to 6000 m water depth. It is made up of a streamline (teardrop-shaped) carbon fibre housing for minimal disturbance to the local hydrodynamic regime. The housing has a funnel which allows particles (e.g. sediment, POM, and microplastics) to settle into the trap. The sediment is stored within 24 x 500 ml bottles, which open at defined intervals to trap particulates during each period. The titanium motor is battery operated and can continuously record for up to 3 months. The motor controls the rotation of the bottle carousel.
- The **IDRONAUT *CTD multi-sensor*** consists of conductivity, temperature, pressure, pH, dissolved oxygen, turbidity and reference sensors.
  - The ***pressure sensor*** is an annually calibrated strain gauge with an accuracy of 0.05%FS and response time of 50ms.
  - The ***temperature sensor*** has a platinum resistance thermometer fitted to a stainless steel/titanium housing. This sensor can withstand 700bar and has a response time of 50ms.

- A thermic insulated cylindrical plastic body houses the ***conductivity sensor cell*** used as a proxy for salinity. The sensor is a flow-through self-flushed cell consisting of seven platinum ring electrodes. Two adjacent pairs of rings sense the relative drop in voltage due to electrical conductivity of the measured water. Electrical interference from outside the measuring cell is shielded from the outermost pair of rings. Response time is 50ms per 1m/s waterflow.

*Figure 4 Little MonSta lander "Charlotte" ready for deployment on the front of the Holland 1 ROV*

- The ***dissolved oxygen sensor*** contains a fluorescent dye that is excited by a certain wavelength. Luminescence response depends on amount of oxygen molecules present. This excitation of light is transmitted by a polymer fibre, simultaneously transmitting the fluorescence response of the sensor to the measurement device. The oxygen sensitive dye is immobilized in a polymer matrix. The sensor if stable over long deployment period. REDFLASH technology is excitable by red light and show oxygen-dependent luminescence in the NIR. Luminescence decreases with increasing of oxygen in the NIR. Excellent luminescence brightness of REFLASH indicator allows sensor matrix to be thin, leading to fast response times for oxygen sensors. A blue measuring membrane cap is fitted inside the titanium support to prevent unwanted removal or

accidental loss. It is made of blue plastic to shield external light. A black sensor spot on the bottom of the cap allows for oxygen measurement.

- The ***IDRONAUT reference sensor*** is in contact with the unknown sample by means of a small hole in the glass tip. The reference sensor is a silver/silver chloride cell in a saturated potassium chloride solid gel and the sensor head is made of titanium. It is developed for long-term monitoring where the internal cell is 0.7 mol NaCl. The glass body of the sensor is fitted with a plastic hydrating cap filled with the IDRONAUT reference sensor storage solution based on 3-mol KCl (or NaCl). This cap is to be removed before measurements.
- The ***pH sensor*** has a titanium head, a glass body, and a pH sensitive glass tip, which can withstand max pressures of 700 bar. When inactive, the glass tip must be fitted with a white plastic hydrating cap filled with the pH 7 Buffer Solution, or clean water. This cap is to be removed before measurements. The pH sensor measurement range is 1-13pH, with an accuracy of 0.01pH, a response time of 3s, and resolution of 0.001pH.
- A **turbidity meter** is fitted externally for the main IDRONAUT pressure vessel and is place at the top of the Little MonSta next to the opening of the sediment trap. It measures water turbidity with a range of 15cm from the sensor head.

***Kongsberg EM 302 multibeam echosounder***

The EM 302 multibeam echo sounder is designed to perform seabed mapping at 30 kHz frequency with high resolution and accuracy to a maximum depth of more than 7000 m. The system has up to 432 soundings per swath with pointing angles automatically adjusted according to achievable coverage or operator defined limits. It is integrated with a sound velocity probe, C-Nav navigation, a motion reference unit, and a dedicated processing unit. All planning and data acquisition is carried out in SIS.

***CTD with water bottle rosette***

A Sea Bird Electronics SBE 911 plus CTD was used to calibrate ADCP backscatter and to sample water for microplastics in the water column. The CTD is equipped with the following: SBE 35 Digital Thermometer, a SBE44plus conductivity sensor, a Digiquartz pressure sensor, a SBE 43 dissolved oxygen sensor, altimeter, fluorometer and a nitrogen saturation sensor. A series of 12 water bottle are attached to a rosette and can be fired by live feed in realtime from the deck unit.

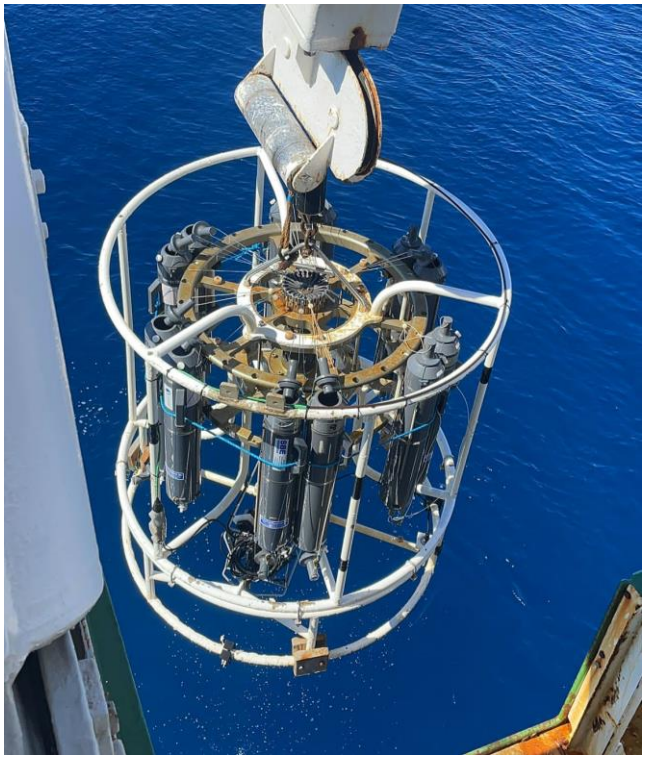


*Figure 5. Sea Bird Electronics SBE 911 plus CTD*

***Plankton net***

A conical Duncan & Associates plankton net of mesh size 200 µm and 40 cm in diameter equipped with a HYDRO BIOS flow meter with mechanical counter was used to sample surface waters horizontally for microplastics and plankton biomass.

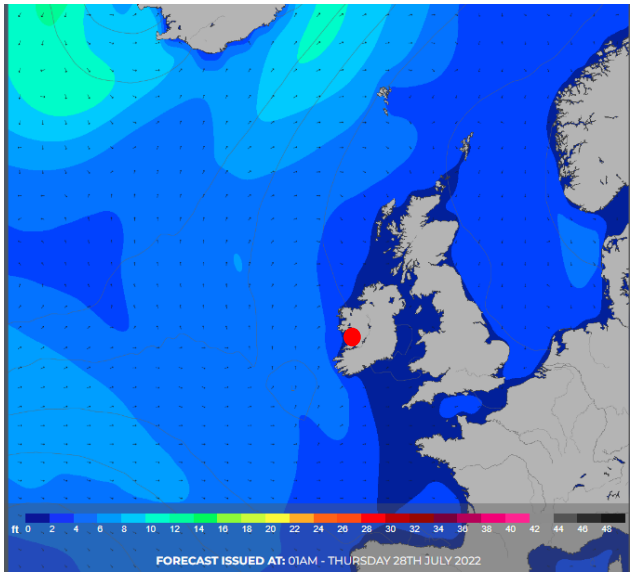
*Figure 6. Duncan Associates plankton net*

## Survey Log

**Note: all times are in UTC (-1hr Shiptime)**

*27th July 2022: Galway Harbour*
ROV mobilisation starts **08.00**. COVID discovered on-board, patient isolated and removed from vessel.

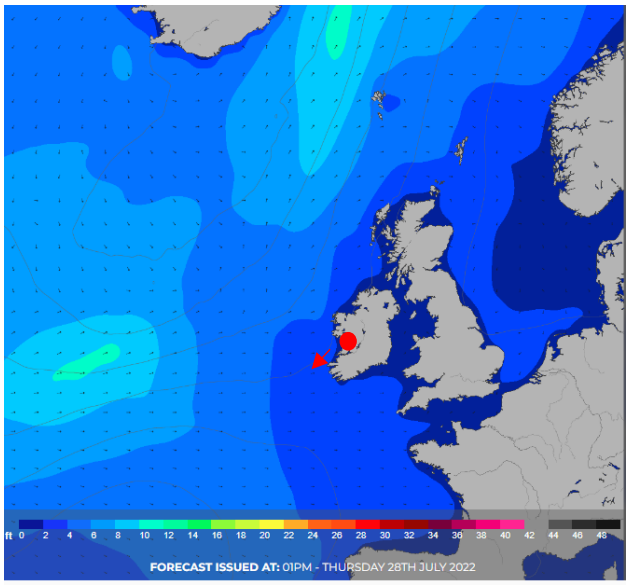
*28th July 2022: Galway Harbour*
*Blue skies with some cloud, light breeze*




*Swell height 9.00am 28th July 2022*

Scientific party arrive **11.15**. ROV mobilisation continues. Additional COVID cases are found and patients removed from vessel. Deck operations reduced to 12 hour (6am to 6pm) operations although non-deck vessel operations can continue on a 24hr basis.

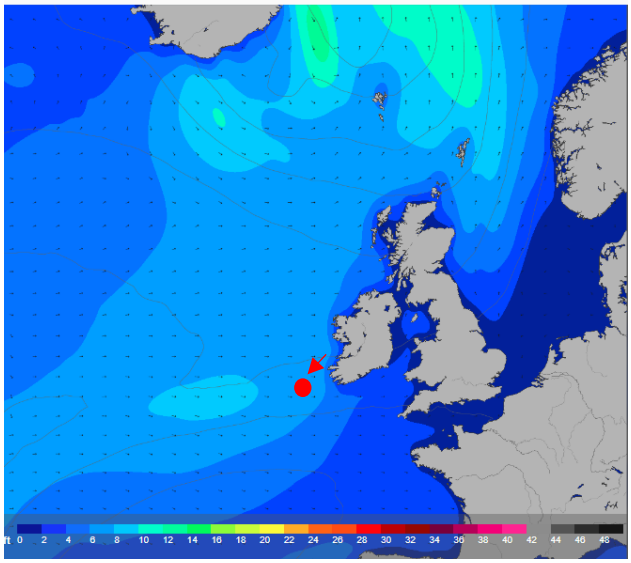
*29th July 2022: Galway Harbour – Galway Bay – Irish western shelf*
*Cloudy with visibility decreasing being soft drizzle. Light winds*




*Swell height 9.00am 29th July 2022*

**03.32** Vessel leaves Galway Dock and transits up Galway Bay. All remaining scientists, crew and officers have negative PCR tests, antigens and no symptoms. **06.20** on DP in the bay off Rossaveal. New ship's complement taken on board at **10.20** to replace a COVID patient, deck operations remain at 12 hrs. **11.30** ROV wet test starts and recovered **12.16**. **14.36** Plankton net configured off the starboard stern. **14.59** plankton net tow (**CE22013_1**) at 1.4 kts for 20 minutes with prop engaged in Galway Bay at 0-0.5m below the sea surface, good recovery. **15.30** Temporary black out on the vessel. **15.51** ROV wet test resumes to check USBL beacons. ROV recovered at **16.40** and all test satisfactory. **16.50** commence transit to Belgica Mounds area, Porcupine Seabight.

*30th July 2022: Irish Western Shelf – NE Porcupine Seabight- Irish Southern Shelf*
*Foggy, light breeze*

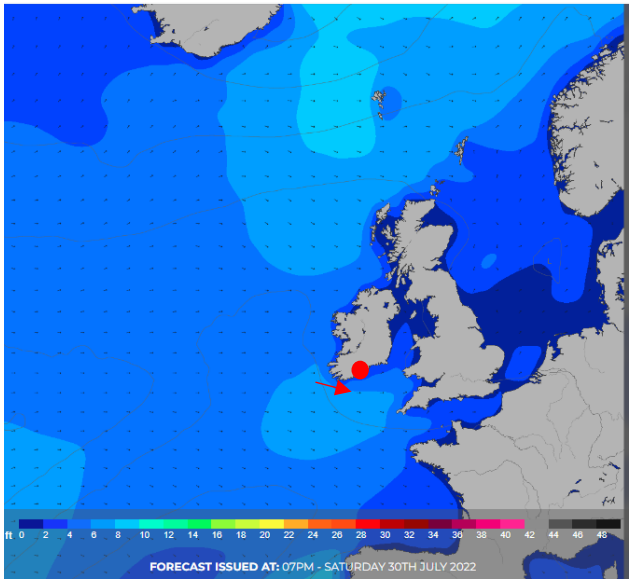



*Swell height at 9.00am 30th July 2022*

**08.20** Arrive on station and end transit. Additional COVID patient test positive overnight and is isolated despite negative PCR tests and antigen tests the day before. Swell height is at 0.5m. Wind speed 19kts, poor visibility. Ship on DP. **08.45** ROV in water. ROV on bottom at **09.42** (**CE22013_2**). Seabed is strongly current swept with little sand visible and comet marks behind dropstones. Lander Beyonce deployed the year before found on its side at **09.54**. It was 42m west from its known position due to USBL calibration issues. Beyonce was recovered by the ROV (frame bent and split by ROV). Recovered safely to deck at **11.27**. CTD with rosettes deployed at **11.47** (**CE22013_3**) recording salinity, temperature, turbidity, dissolved oxygen, fluorescence. CTD on deck at **12.37**. Bottles fired at 958m (for ADCP calibration), 953m (for ADCP calibration), 550m (bogus turbidity spike), 479m (for microplastics) and 4.5m (for microplastics). Wind speed 22kts SW. ROV in water to recover President Higgins deployed last year at **12.55**. ROV on seabed at **13.44**. Strong currents made finding the lander difficult but was located with the homer beacon 12 at **14.49**. Lander President Higgins picked up and hooked to the ROV, perched on the front of the ROV with its base (but not the feet) and held by the two ROV arms (**CE22013_4**). Hydraulic failure of the ROV at **15.26** with all power lost to ROV. Camera feeds restored after 1 minute but not thruster power. ROV dead sub recovery procedure immediately enacted. ROV pulled away from the coral reef and hazard on the umbilical immediately by the vessel and recovered to mid-water by the umbilical. **15.48** Lander observed on the front of the ROV wobbling in the current. **15.54** All power lost to the ROV and in the ROV shack. ROV dead sub recovery plan continues. **16.00** ROV recovering to surface and ROV hauled in with floats removed. **16.15** Lander spotted hanging off the lander just below the surface having broken free of the ROV arms presumably at the surface but at least after the video black out. **16.18** ROV lifted out of the water with the Lander hanging below it on the hook and swinging wildly. Weight of the Lander straightens the hook and he fell off ROV and sank to the seabed 970m below. Position marked (**CE22013_5**). Commence transit to Cork at **16.45** to take COVID patient ashore and find replacement ship's staff.

*31st July 2022: Irish Southern Shelf – Cork*

*Sunny, little wind, calm seas*




*Swell height at 9.00 am 30th July 2022*

09.05 Along side at Cork and waiting for replacement crew. A new patient test positive for COVID and is removed from vessel. 12.00 scientific party begin temporary disembarkation of the vessel due to COVID and isolates.

*1st August 2022: Cork*

Along side in Cork and waiting for replacement crew. Additional crew member gets COVID.

*2nd August 2022: Cork*

Along side in Cork, all personnel isolating. Scientists do PCR tests. Crew begin temporary disembarkation of the vessel due to COVID and isolates. All crew doing PCR tests.

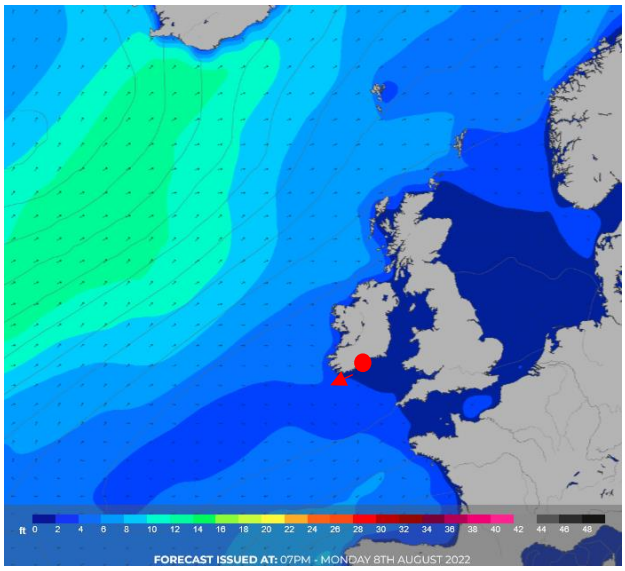
*3rd – 8th August 2022: Cork*

Along side in Cork, all personnel isolating.

*8th August 2022:*

Along side in Cork, and waiting for replacement crew. A new patient test positive for COVID.

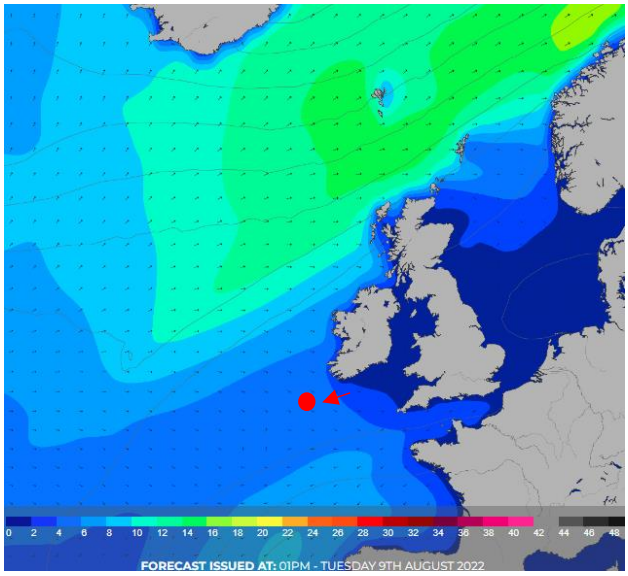
*9th August 2022: Cork to southern shelf*
*Very sunny with little wind*




*Swell height at 9.00 am 9th August 2022*

Scientific party join at **08.00** with negative tests. Depart Cork at **12.00** and head for the Porcupine Seabight transiting at 10 kts. **16.16** Plankton net tow (**CE22013_6**) at 1.8kts for 20 minutes with prop engaged offshore Oysterhaven Co. Cork at 0-0.5m below the sea surface, good recovery.

*10th August 2022: Southern shelf to Porcupine Seabight*
*Low old swell, little wind. A glorious day!*

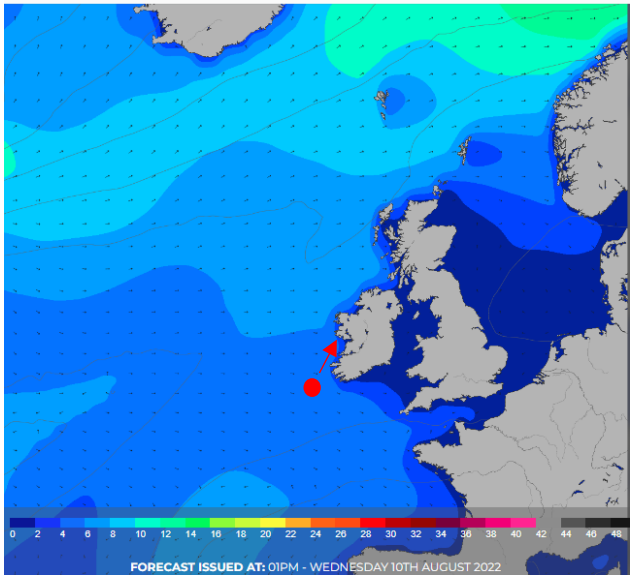



*Swell height at 9.00 am 10th August 2022*

Continue transit and arrive on station at **06.04** (**CE22013_7**) and commence ship MBES line across the Moira Mounds. This line will allow us to calibrate the ROV MBES USBL offset from the former ROV MBES coverage in this area. Note port mid-outer beam is working but

starboard beam is fine. Line finished at **06.46** and head to the lander recovery site. The ROV will dive 400m SE of the lander "drop" point to take account of potential current induced drift of the lander as it free-falled to the seabed. ROV in the water at **07.09** to attempt the recovery of President Higgins (**CE22013_8**). Search commenced at **07.50** but the wrong homer beacon was pinged. At **10.09** homer beacon 12 was pinged and the lander located 534m at 310$^{o}$ at **10.2**1. Lander President Higgins located on the seabed on its side but looking intact at **10.56**. Recovered to ROV at **11.34**. Another COVID patient tests positive for COVID at **12.15**. Recovered to deck at **12.27**. Start transit to Therese Mound. CTD taken at **13.42** on the edge of the Little Therese Mound firing bottles for microplastic and seawater calibration samples for IPGP (**CE22013_9**). Two bottles each were fired at 931m, 446m and 5 m at **14.05**, **14.16** and **14.25** respectively. ROV off deck at **14.50** and arrived at the seabed at **15.35** in 938 m water depth (**CE22013_10**). This dive was focussed on the Therese and Little Therese Mounds sampling a variety of coral for microplastic analysis. Dense biodiverse coral was found. Five stations were sampled and a Niskin fired at the seabed sampling by the ROV at **17.49** between the Little Therese Mound and Therese Mound (**CE22013_10**). Soft start of sub-bottom profiler started at **19.48** but technical issues found with the sub-bottom profiler and multibeam echosounder. Multibeam echosounder line started at **22.18** heading north over the "Coral Ridge" area (**CE22013_11**). Lander Apollo prepped for deployment in the Coral Ridge area for 6 month (for the ADCP and sediment trap) and 11 months for the IDRONAUT multi-sensor.

*11$^{th}$ August 2022: Porcupine Seabight to western shelf*
*Very sunny with little wind. A glorious day!*




*Swell height at 9.00 am 11$^{th}$ August 2022*

Multibeam line finished at **04.30** collection seabed coverage of the Coral Ridge area. Therese and Little Theresa Mounds and Moira Mounds. Vessel transits to the next ROV dive position. ROV off-deck at **08.24** with Lander Apollo on the ROV bumpers (**CE22013_12**). Homing beacon on Apollo is Beacon 12. ROV on bottom at **07.24** and Apollo lander deployed at **08.01** in the trough between two sediment ridges, seabed shows sand rather than gravels. ROV

off bottom at **08.52** after a short reconnaissance drive around the area. ROV on deck at **09.37**. Lander Charlotte prepped for a dive the same as Apollo. ROV off deck at **10.01** (**CE22013_13**). ROV on bottom at **10.57** and Lander Charlotte deployed on a top of the next coral ridge north of Apollo at **11.18** on a little flat area just below summit. ROV off bottom at **11.37** and recovered to deck at **12.18**. CTD taken at **12.40** at same location (**CE22013_14**) in 917m water depth. All bottle fired at 5m, 10m and 15m off the bottom and one at 5m from the surface to calibrate the ADCPs. Plankton net tow (**CE22013_15**) also here commenced at **13.37** to 20 minutes to assess microplastics. Survey complete. **14.02** begin transit to Galway.

*12th August 2022: western shelf and Galway Bay*
*Sunny*

Scientific party disembark in Galway at **08.00** with all samples, Equipment goes to Killybegs then back to Galway by truck for storage in warehouse.

## Downtime issues

***COVID***

This survey was severely impacted by COVID which infected several crew members resulting a loss of 10 survey days at sea. A reduction to 12 hours deck operations persisted thorough the survey when at sea. An unscheduled port call (with additional transit) was required to remove a patient and isolate the personel from the vessel. Scientists were isolated for 9 days, ships personel for less and some not at all. An early departure from the survey area to safe guard the scientists (the vessel decided to carry on operations with COVID on-board) with a new demobilisation port call for the scientists and the final patient.

As a result, most of the original objectives for this survey were not possible and cancelled with the ROV rockdrill and the DIAS scientists demobilised early in Cork. Survey work was cancelled in the Whittard Canyon, Goban Spur and Porcupine Bank which where the main focus of the science plan.

Despite efforts, COVID was not eradicated from the vessel and plagued the entire survey (which was much reduced) with ineffective COVID control measures enacted by the vessel operators as evidence by CXOVID cases emerging throughout the survey.

***Electric blackout of RV Celtic Explorer***

An electric blackout occurred on the vessel during mobilisation and in Galway Bay. Computer systems needed to be rebooted. No significant delay was caused or interference with operations. Problem fixed early in the survey and did not reoccur.

***ROV MBES***

Kongsberg failed to supply a multiplexor for the ROV MBES as promised meaning that this dataset could not be collected. This was required in the area that we managed to survey. Shipbased multibeam was done instead but was inadequate in resolution to enable morphometric analysis of the "Coral Ridge" area.

***Hydraulic failure on ROV***

Hydraulic leak on the Holland I ROV caused a power failure at the seabed during recovery of the President Higgins Little MonSta lander. This was unfortunate timing. A dead-sub recovery was undertaken hauling the ROV in by the umbilical with the unsecure on the front. The ROV was recovered with not additional damage. The Lander fell off the ROV and free-falled to the seabed from 970m. It survived the landing and was successfully recovered. No damage was done to the lander. All data was intact.

# Appendices

## Personnel

*Scientific Party*

| | | | |
|---|---|---|---|
| Prof Andy Wheeler | Chief Scientist | Cruise management, reporting | UCC |
| Dr Audrey Recouvreur | Scientist | Lead day – Rockdrill/Microplastics | UCC |
| Felix Butschek | Scientist | Lead night-Landers/Rockdrill/CTD | UCC |
| Dr Florian Le Pape | Scientist | OBS | DIAS |
| Ger Summers | Scientist | MBES/CTD/Landers | UCC |
| Dr Clara Gomez Garcia | Scientist | OBS | DIAS |
| Dr Alicia Mateos Cardenas | Scientist | Microplastics | UCC |
| Laetitia Guibourdenche | Scientist | General | IPGP |
| Jessica Harty | Scientist | General | UCC |

*Holland 1 ROV Technical crew*

| | |
|---|---|
| Paddy O'Driscoll | ROV superintendent |
| Karl Bredendieck | ROV pilot |
| Colin Ferguson | ROV pilot |
| Neil Morton | ROV pilot |
| Rob Carpenter | ROV pilot |
| George Findlay | ROV pilot |

*Officers and Crew of the RV Celtic Explorer*

| | |
|---|---|
| Antony Hobin | Master |
| Damien McCalling | Chief engineer |
| Ciaran Whelan/Basil Murphy | C/O & Security Officer |
| Paul Murphy | 2/O & Safety Officer |
| Michael Love | 2nd Engineer |
| Paul Stapleton | ETO |
| Ken O'Neill | Bosun |
| Michelin Faherty | Bosun's Mate |
| Philip Gunnip | AB Deckhand |
| Declan Horan | AB Deckhand |
| Jason Reynolds | AB Deckhand |
| Harry Nicholson | AB Deckhand |
| Gavin Cunningham/Philip Gunnip | Cook |
| Jacek Ronowicz/Declan Horan | Assistant cook |
| Ian Murphy | Technician |
| Joshua Abse | Technician |


*CE22013_SPeeD full scientific party*
*Left to Right: Clara Garcia Gomez, Felix Butschek, Gerard Summers, Andy Wheeler, Laetitia Guibourdenche, Alicia Mateos Cardenas, Audrey Recouvreur, Jessica Harty, Florian Le Pape*

# Captures of Lander configurations

***187 Charlotte configuration***

PwrExt [14.69]V Batt.[3.75]V
Pwr uPiT[14.0]C uPV[3.29]V uPVref[3.46]V
OCEAN SEVEN 310 - Id:0622187{USR}[sw](2.0_48 05/22)Aug 11 01:36:35.61 2022
Timed data acquisition configuration
Data acquisition step: 00:00:30.00
enter time [hh:mm:ss.hh]< 00:30:00
Number of acquisitions:0 enter new value< 16000
DataSet to be stored per each acquisition:60
Enter the starting acquisition time [HH:MM:SS]
Starting time: 00:00:00
enter time [hh:mm:ss] < 13:00:00
Do you confirm the above setup ?:No type [Y]es or [N]o < y
CAST temporary updating...done
Present time Aug 11 01:37:43.47 2022
Next timeout Aug 11 13:00:00.47 2022
Next acquisition on Aug 11 13:00:00.47 2022
Acquisitions left to do 16000
OCEAN SEVEN 310 - Id:0622187{USR}[sw](2.0_48 05/22)Aug 11 01:37:43.51 2022
SHUTDOWN..RTC alarm setup..Analog Pwr.Off..Done..Completed

***189 Apollo configuration***

OCEAN SEVEN 310 - startup ID:0622189 (2.0_47 04/22) Aug 11 01:27:20.38 2022
Data w[4.0]GByte!---..oK
Mem.Cnf[oK].Sta[Ok]Cal[:.....oK]
Port [Main,,Aux#3-]..oK
StartUp (TIMED),Verbose,WakeUp[USR-rs]
Analog .Pwr.Brd.Ok
WarmUp [2]s.
PwrExt [14.80]V Batt.[3.70]V
Pwr uPiT[16.0]C uPV[3.29]V uPVref[3.46]V
Timed Acquisition unforeseen wake up
Stop the timed acquisition ?:No
Timed acquisition power OFF
Present time Aug 11 01:27:28.87 2022
Next timeout Aug 11 13:00:00.87 2022
Next acquisition on Aug 11 13:00:00.87 2022
Acquisitions left to do 16000
CAST temporary updating...done
OCEAN SEVEN 310 - Id:0622189{USR}[sw](2.0_47 04/22)Aug 11 01:27:28.96 2022
SHUTDOWN..RTC alarm setup..Analog Pwr.Off..Done..Completed

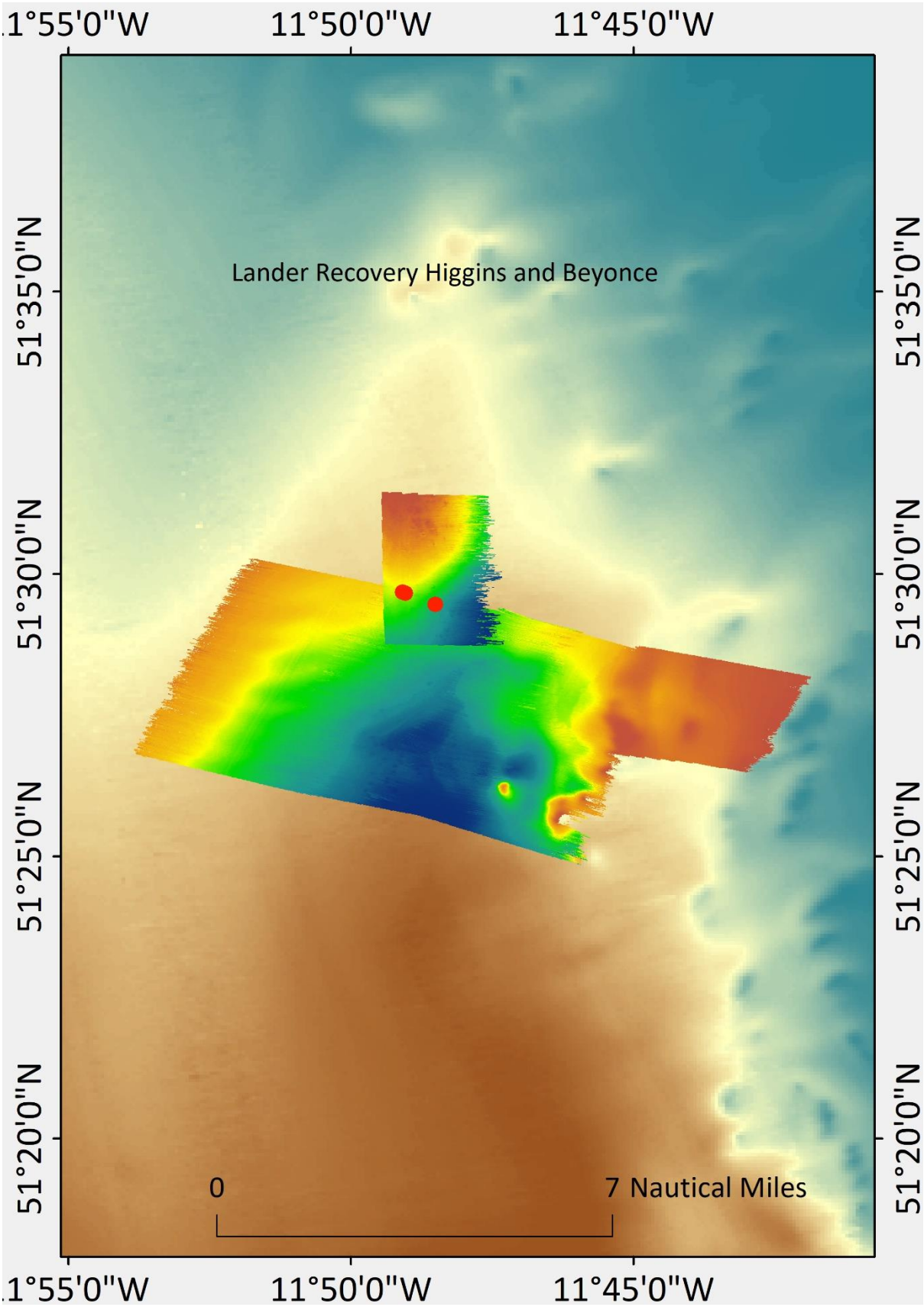
# Station Logs and Maps

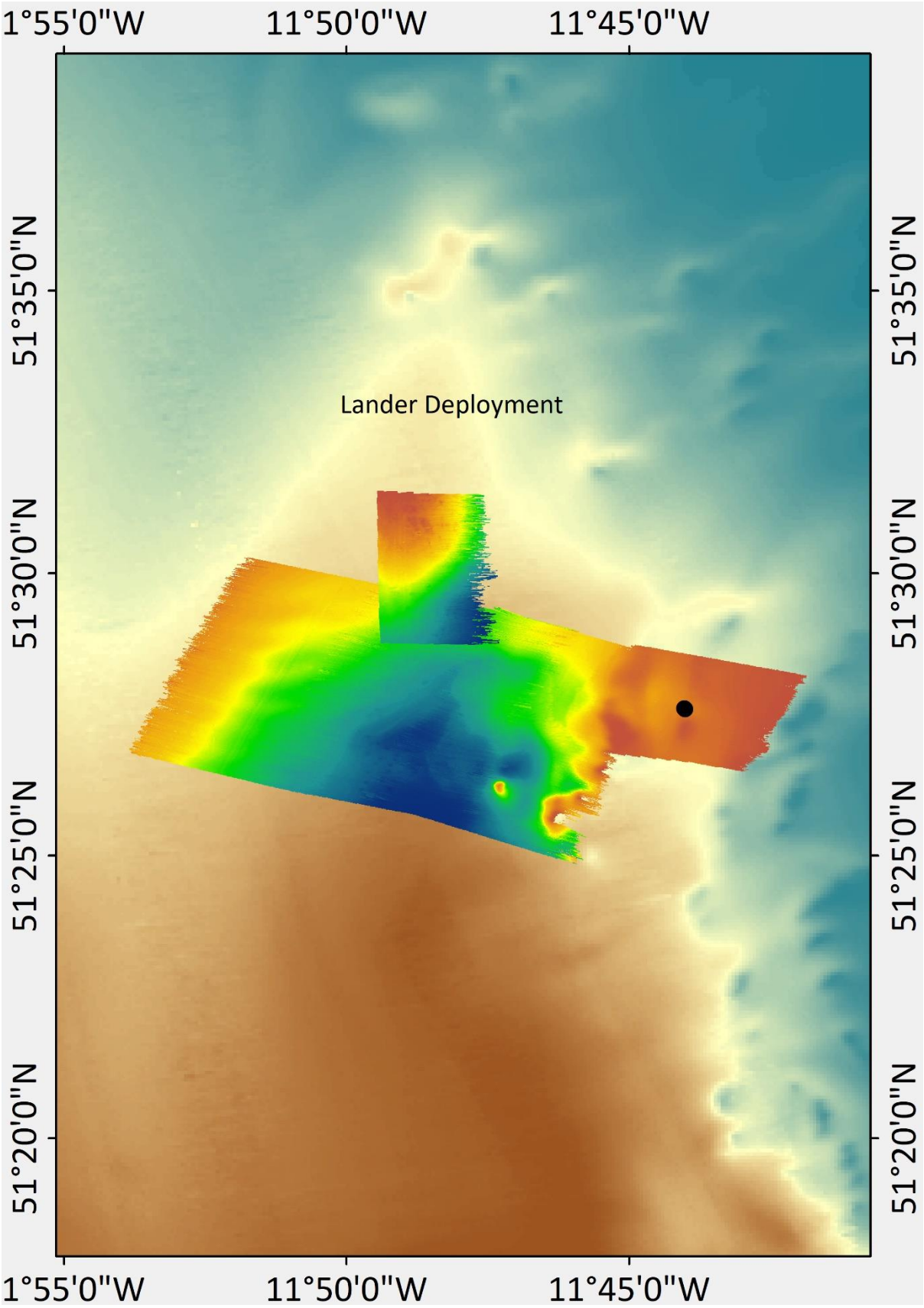
## *Master log*

| | | Time | | | | | ROV | | | | Tick appropriate | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Date | (UTC) | Lat | Long | Depth | Dive# | off deck | on seabed | off seabed | on deck | CTD | SVP | Lander | ROV video | ROV biobox | Hull MBES | Plankton | Note |
| 1 | 29/07/2022 | 14:59 | 53°10.77 | 09°37.12 | 0-0.5 | | | | | | | | | | | | x | Plankton net deployed in |
| 2 | 30/07/2022 | 08:45 | 51°29.66 | 11°49.036 | 970 | 1 | 08:45 | 09:41 | 10:34 | 11:27 | x | | x | x | | | | Beyonce recovery |
| 3 | 30/07/2022 | 11:47 | 51°29.68 | 11°49.08 | 962 | | | | | | x | | | | | | | CTD near Beyonce, bottle |
| 4 | 30/07/2022 | 12:52 | 51°29.68 | 11°49.09 | 964 | 2 | 12:52 | 13:14 | | | | | x | x | | | | President Higgins partial |
| 5 | | 16:22 | 51°29.59 | 11°48.78 | | 2 | | | | (16:22) | | | x | | | | | President Higgins lost and sank to seabed here |
| 6 | 09/08/2022 | 16:16 | 51°38.74 | 08°21.99 | 0-0.5 | | | | | | | | | | | | x | |
| 7 | 10/08/2022 | 06:04 | 51°31.42 | 11°49.10 | 936 | | | | | | | | | | | x | | |
| 8 | 10/08/2022 | 07:09 | 51°29.46 | 11°48.51 | 977 | 3 | 07:12 | 07:54 | 11:38 | 13:27 | | | x | x | | | | 10:54 Lander President |
| 9 | 10/08/2022 | 13:42 | 51°25.90 | 11°46.01 | 932 | | | | | | | x | | | | | | |
| 10 | 10/08/2022 | 14:50 | 51°25.91 | 11°46.02 | 938 | 4 | 14:50 | 15:35 | 18:09 | 18:49 | | water bottle | | x | x | | | |
| 11 | 10/08/2022 | 22:18 | 51°26.74 | 11°44.51 | | | | | | | | | | | | x | | |
| 12 | 11/08/2022 | 08:24 | 51°27.59 | 11°44.01 | 914 | 5 | 07:24 | 08:01 | 08:52 | 09:37 | | | x | x | | | | Apollo |
| 13 | 11/08/2022 | 11:18 | 51°27.60 | 11°44.02 | 912 | 6 | 10:01 | 10:57 | 11:37 | 12:18 | x | | | | | | x | Charlotte |
| 14 | 11/08/2022 | 12:40 | 51°27.60 | 11°43.98 | 917 | | | | | | | | | | | | | CTD with bottle |
| 15 | 11/08/2022 | 13:37 | 51°26.20 | 11.7350 | 0.5 | | | | | | | | | | | | | Plankton net |

## Lander log

| Station | Lander No | Date | Time UTC | ADCP | Motor | Beacon (y/n) | ROV Lat | ROV Long | Depth | Area | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Beyonce | 30/07/22 | 09:54:00 | | | 13 | 51o29.67 | -11o49.13 | 964 | Moira Mounds | Recovered, 5 months ADCP, Sed trap plugged |
| 4 | President Higgins | 30/07/22 | 14:49:00 | | | 12 | 51o29.69 | -11o49.11 | 966 | Moira Mounds | Lander upright on seabed and partial y recovered from this location |
| 5 | President Higgins | 30/07/22 | 16:18:00 | | | 12 | 51o29.59 | -11o48.78 | 970 | Moira Mounds | Lander dropped from lander at the surface and sank to the bottom at this location. |
| 8 | President Higgins | 10/08/22 | 10:55:00 | | | 12 | 51o29.59 | -11o48.62 | 971 | Moira Mounds | |
| 12 | Apollo | 11/08/22 | 08:24:00 | v | v | 12 | 51o27.05 | -11o43.98 | 914 | Coral ridges | |
| 13 | Charlotte | 11/08/22 | 11:18:00 | | | | 51o27.61 | -11o44.00 | 912 | Coral ridges | |


11°55'0"W
11°50'0"W
11°45'0"W
51°35'0"N
51°30'0"N
51°25'0"N
51°20'0"N
Lander Recovery Higgins and Beyonce
0
7 Nautical Miles

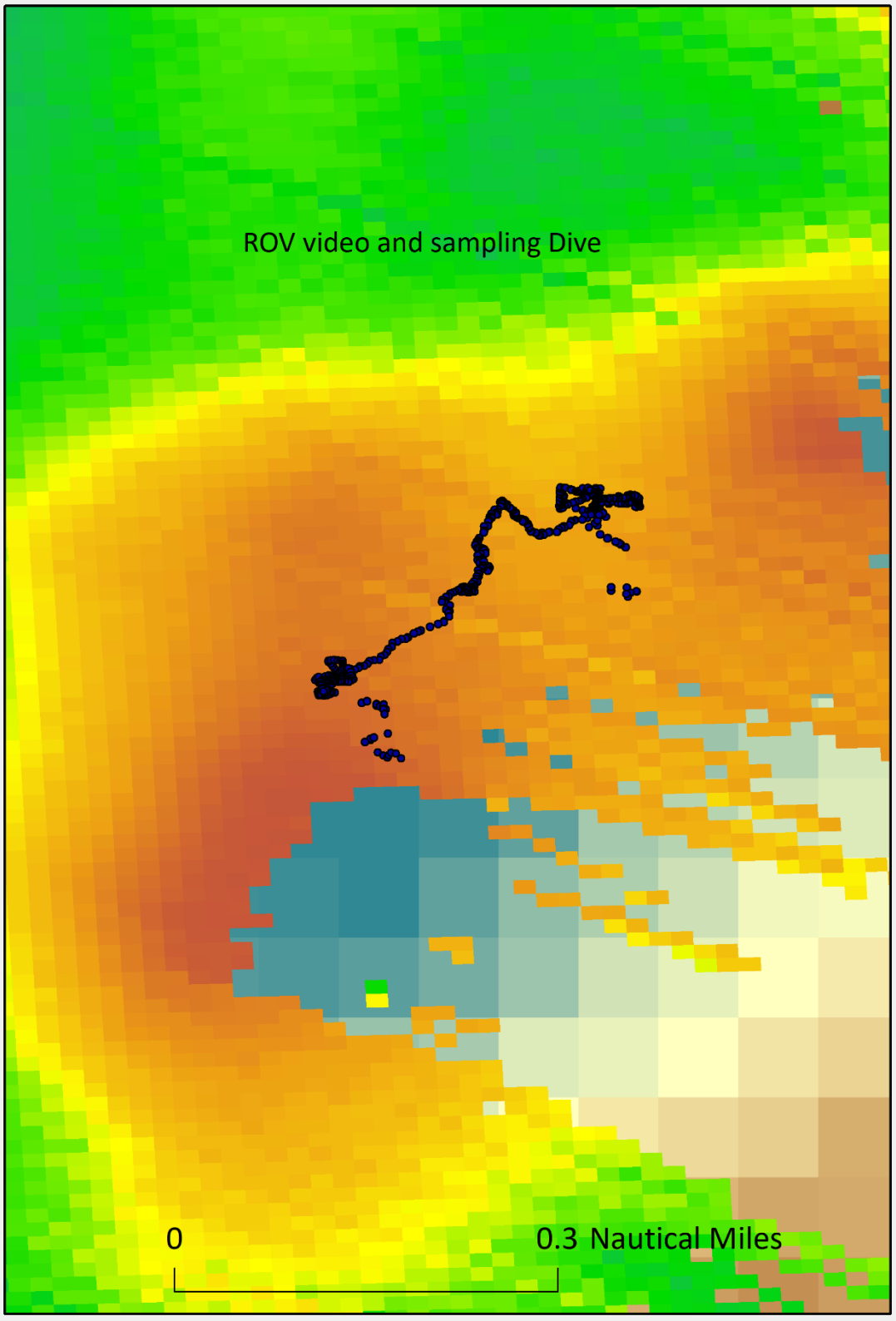

1°55'0"W
11°50'0"W
11°45'0"W
51°35'0"N
51°30'0"N
51°25'0"N
51°20'0"N
Lander Deployment

**ROV Dive log**

| | | | time | time | y/n | # + time | # + time | time | Who and which HD? | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lat | Long | Depth | ROV IN | ROV ON BOTTOM | Lasers on | Video Recording | Lander deployed | Video stopped | Data backed up? | Observation/note |
| 51o29.6 | -11.49 | 970 | 08:45 | 09:41 | yes | 09:42:00 | 10:32 | 10:30:00 | y | Beyonce recovered |
| 51o29.68 | -11o49.09 | 964 | 12:56 | 13:44 | no | 13:48:00 | 14:49 | | y | President Higgins not recovered?technical problems |
| 51 o29.45 | -11o48.51 | 977 | 07:12 | 07:54 | no | 07:55:00 | 10:54 | 11:41:00 | y | |
| 51o25.91 | -11o46.02 | 938 | 14:50 | 15:35 | yes | 15:35:00 | | 08:08:00 | y | |
| 51o27.59 | -11o44.01 | 914 | 07:24 | 08:01 | no | 08:05:00 | 08:22 | 08:54:00 | y | |
| 51o27.6 | -11o44.02 | 914 | 10:01 | 10:57 | no | 10:57 | 11:18:00 | 11:38 | y | |

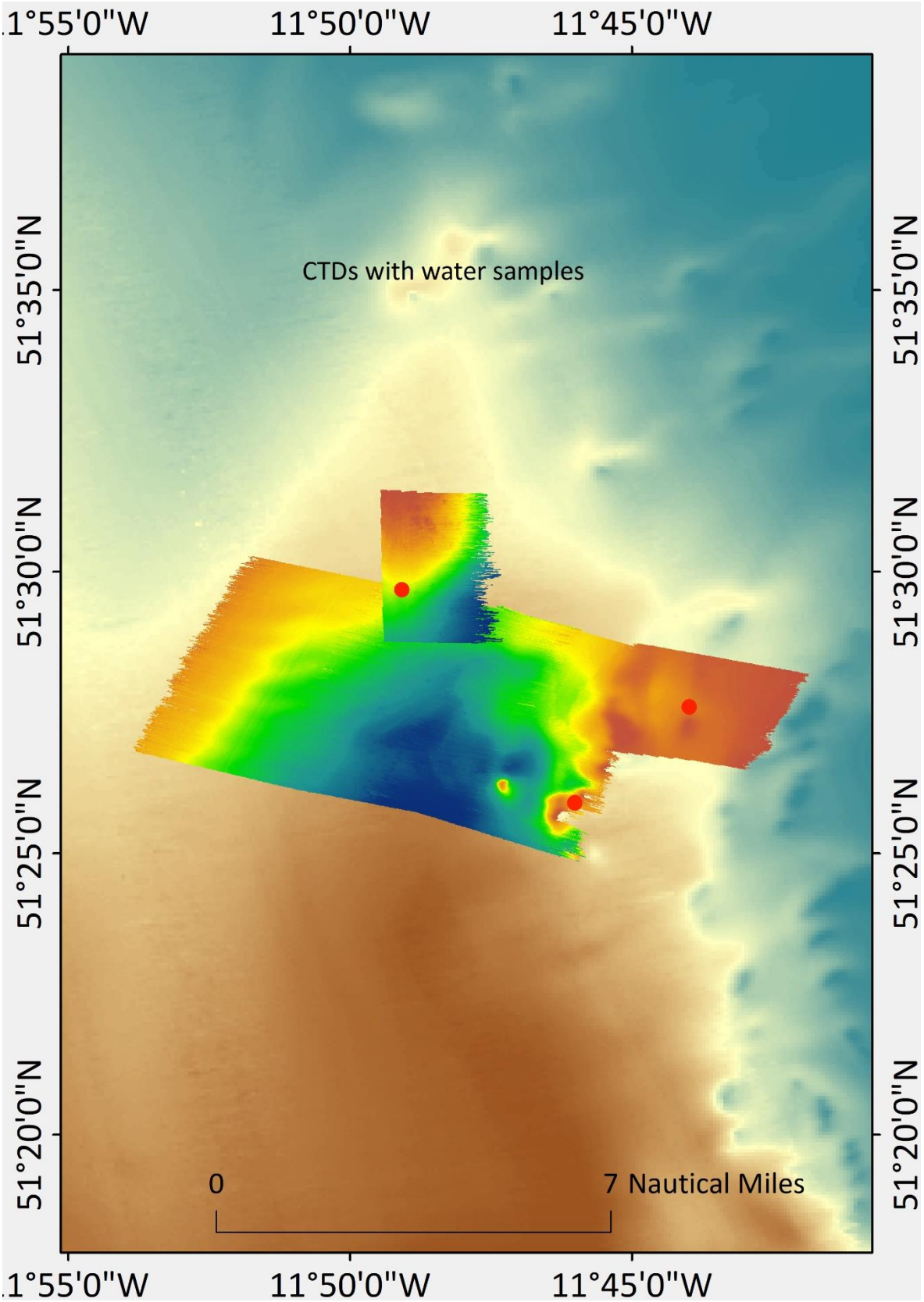
ROV Sample log

| | ROV core | | | ROV (Sampling) | | | | Comment |
|---|---|---|---|---|---|---|---|---|
| Date | Dive Number | Station | sample | Lat | Long | Depth | | T = 17.2°C; Sal. = 35.433 |
| 10/08/22 | 5 | 10 | Coral 1 | 51o25.967 | -11o46.04 | 937 | madrepora | |
| 10/08/22 | 5 | 10 | Coral 2 | 51o25.965 | -11o46.12 | 948 | Lophelia | |
| 10/08/22 | 5 | 10 | Coral 2 | 51o25.965 | -11o46.12 | 948 | black | |
| 10/08/22 | 5 | 10 | Coral 3 | 51o25.898 | -11o46.14 | 936 | 2 species | |
| 10/08/22 | 5 | 10 | Coral 4 | 51o25.897 | -11o46.15 | 930 | | |
| 10/08/22 | 5 | 10 | Coral 5 | 51o25.815 | -11o46.26 | 893 | | |
| 10/08/22 | 5 | 10 | water | 51o25.815 | -11o46.26 | 893 | 1L CTD 3 | |
| | | | Coral 5 | 51o25.815 | -11o46.26 | 893 | | |


ROV video and sampling Dive
0
0.3 Nautical Miles

## CTD log

| | CTD/SVP log | | | | | Time | DD | DD | | CTD bottles |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Station # | CTD # | ROV/ROSETTE | SVP FILE NAME | Bottle fired | (UST) | Lat | Long | Depth (m) | Notes |
| 30/07/22 | 2 | | ROV | Beyonce | | 08:45:00 | 51o29.66 | 11o 49.036 | 970 | Downcast |
| 30/07/22 | 3 | 1 | Rosette | Str_3.hex | | 11:47:00 | 51°29.68 | 11°49.09 | 958 | Felix |
| | | | | | 1 | 12:10:00 | | | 958 | Alicia |
| | | | | | 2 | 12:10:00 | | | 953 | Felix |
| | | | | | 5 | 12:11:00 | | | 550 | Felix |
| | | | | | 6 | 12:22:00 | | | 479 | Alicia |
| | | | | | 9 | 12:25:00 | | | 4.5 | Alicia |
| | | | | | 10 | 12:35:00 | | | | |
| 10/08/22 | 9 | 2 | Rosette | | | 13:42:00 | 51°25.91 | 11°46.01 | | |
| | | | | | 1 | 14:05:00 | | | 931 | |
| | | | | | 2 | 14:05:00 | | | 931 | didn't fire |
| | | | | | 5 | 14:16:00 | | | 446.4 | |
| | | | | | 6 | 14:16:00 | | | 446.6 | |
| | | | | | 9 | 14:25:00 | | | 4.5 | didn't fire |
| | | | | | 10 | 14:25:00 | | | 4.5 | didn't fire |
| 10/08/22 | 10 | 3 | rov | Dive 4 | 1 | 17:49:00 | 51°25.81570 | 11°46.26132 | 893 | |
| 11/08/22 | 14 | 4 | Rosette | | | 12:40:00 | 51°27.60 | 11°43.98 | | |
| | | | | | 1 | | | | 914 | /5m asf |
| | | | | | 5 | | | | 914 | /5m asf |
| | | | | | 6 | | | | 914 | /5m asf |
| | | | | | 9 | | | | 909 | /10m asf |
| | | | | | 10 | | | | 909 | /10m asf |
| | | | | | 13 | | | | 5 | |
| | | | | | 14 | | | | 5 | |


11°55'0"W
11°50'0"W
11°45'0"W
51°35'0"N
51°30'0"N
51°25'0"N
51°20'0"N
CTDs with water samples
0
7 Nautical Miles

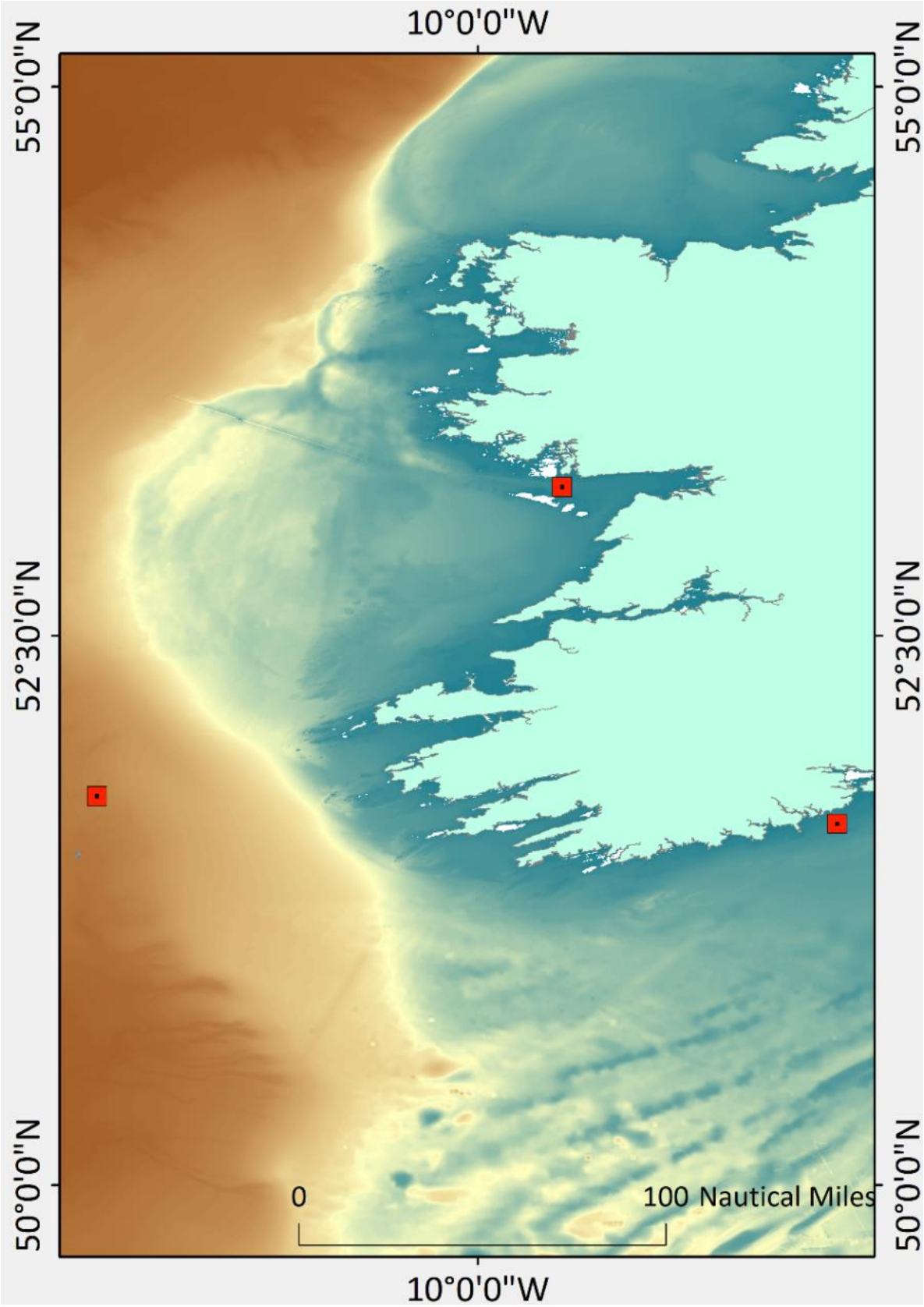
## Multibeam echosounder log

| Time (UTC) | Date | Lat SOL | Long SOL | Lat EOL | Long SOL | EoL time | WCD? Y/N | note (302/2040) |
|---|---|---|---|---|---|---|---|---|
| 06:04:00 | 10/08/2022 | 51° 31.42 | 11° 49.10 | 51° 28.74 | 11° 49.09 | 06:46:00 | n | Port multibeam not working |
| 22:18:00 | 10/08/2022 | 51° 26.74 | 11°44.51 | 51° 26.69 | 11° 42.10 | 04:30:00 | n | |

Multibeam echsounder coverage is shown on the above maps

## Plankton net log

| | UTC | | | | | | Deployment | tres (plankton ne | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Station | Time (SOL) | Time (EOL) | Lat | Long | Depth below surface | Location | duration | Before | After | Volume | Ship speed | Water T°C | Water Salinity | Sample label |
| 1 | 14:59:00 | 15:19:00 | 53°10.77 | 9°37.12 | 0-0.5 | Galway Bay | 00:20:00 | 25993 | 27283 | 1290 | 1.4 | 16.4 | 34.728 | SAMPLE_1 |
| 6 | 16:16:00 | 16:36:00 | 51°38.74 | 8°21.99 | 0-0.5 | Offshore Kinsale | 00:20:00 | 27288 | 27594 | 306 | 1.2 | 17.4 | 34.626 | SAMPLE_2 |
| 15 | 13:37:00 | 13:57:00 | 51°462.78 | 11°735042 | 0-0.5 | Porcupine | 00:20:00 | 27600 | 29571 | 1971 | 1.8 | 18.6 | 35.457 | SAMPLE_3 |




*Plankton net tow at 0 to 0.5m water depth for future microplastic analysis*

## Acknowledgements

This research survey is carried out with the support of the Marine Institute, funded under the Marine Research Programme 2014-2020 by the Irish Government to support and promote the Atlantic Ocean Research Alliance (2018-2021). Felix Butschek is funded by a Marine Institute Cullen Scholarship. Audrey Recouvreur is funded by a PIPCO grant, Alicia Mateos Cardenas is funded by Marine Institute, Gerard Summers is funded by the INTERREG 5 project 'Marine Protected Areas Monitoring and Mapping' (MarPaMM). Florian Le Pape and Clara Garcia Gomez are funded through DIA grants and Laetitia Guibourdenche through an IPGP grant.

We would like to thank Paddy O' Driscoll for his support in the year leading up to the survey in designing and implementing the fabrication of the Holland 1 ROV-adapted landers and ROV rockdrill as well as Dr. Aaron Lim for his guidance with the set up for the 3.5 kHz sub-bottom profiler. The authors would like to thank Anthony Hobin, the crew, officers and technical staff of the Holland 1 ROV and RV Celtic Explorer, P&O Maritime and Marine Institute shore-side support.

**The new Lander Charlotte depicted to Charlotte Appah, the mother of UCC Marine Geosciences PhD student John Appah, who sadly died due to COVID. Rest in Peace**