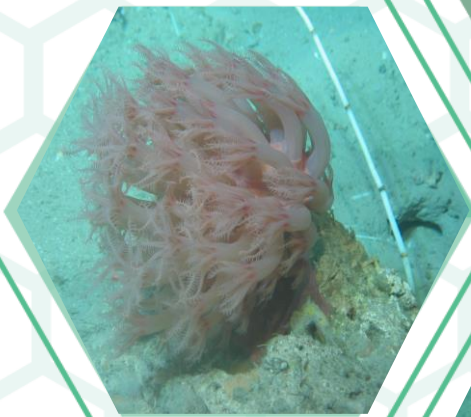
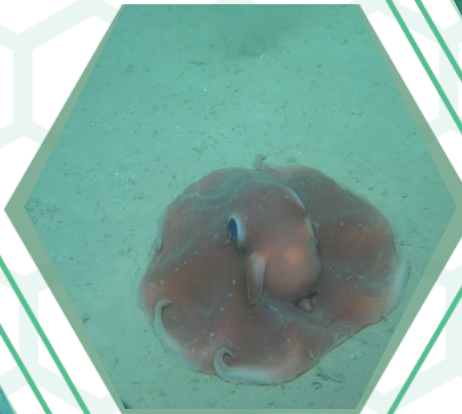


Assessment of Fisheries / Habitat interaction on offshore reefs

EMFF Off-shore Reef Survey

SEAROVER Cruise Report

2019



Authors: O'Sullivan D., Leahy Y., Healy L. & the Shipboard Scientific Party



Marine Biodiversity Scheme

Sustainable Development of Fisheries Fostering the Implementation of the Integrated Marine Policy

EMFF Offshore Reef Survey

Sensitive Ecosystem Assessment and ROV Exploration of Reef

SEAROVER 2019 Cruise Report

RV Celtic Explorer

Aug 1st – 21st 2019



An Roinn Talmhaíochta,
Bia agus Mara
Department of Agriculture,
Food and the Marine



EUROPEAN UNION
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Integrated Mapping for the
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of Ireland's Marine Resource



Geological Survey
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Document Summary

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EXECUTIVE SUMMARY

This report presents preliminary findings of the 2019 offshore reef survey over the Porcupine Seabight and adjacent areas. The survey is the final leg of an extensive three year project, beginning in 2017, that was coordinated and led by Ireland's Marine Institute and INFOMAR (Integrated Mapping for the Sustainable Development of Ireland's Marine Resource) and funded by the European Maritime and Fisheries Fund (EMFF) Marine Biodiversity Scheme and the National Parks and Wildlife Service (NPWS).

Project objectives are to implement the EMFF's Marine Biodiversity Scheme - Natura Fisheries by mapping offshore reef habitats with a view to protecting them from deterioration due to fishing pressures. The reef project aligns with sub-article 6.2 of the Habitats Directive (EC 92/43/EEC) which mandates member states to take measures to avoid deterioration of protected habitats. The project will also generate baseline data from which appropriate monitoring of Reef habitat within Special Areas of Conservation (SAC) can be established. The initial survey in July 2017 primarily focussed on the Continental margin west and northwest of Ireland. In 2018 the survey team extended coverage along the Irish Continental margin and the eastern flank of the Rockall Bank.

The third survey leg took place in August 2019 aboard the RV *Celtic Explorer*. The survey vessel was equipped with the Marine Institute's Remotely Operated Vehicle (ROV) *Holland 1* to observe seabed features and biological associations. The *Holland 1* employs high-definition (HD) camera, various composite video feeds and a robotic arm to facilitate sample collection. The scientific objective was to map the distribution and abundance of geogenic and biogenic reef habitat at spatially discreet locations along the southern Porcupine Bank, Porcupine Seabight, Goban Spur, Southwest Approaches and other areas of interest. The scope of work also included collection of biological samples for genetic and population analysis and the collection of sediment cores for ground-truthing acoustic seabed mapping data and analysis of micro-plastics within deep-water sediment.

Individual survey transects were pre-selected in consultation with National Parks and Wildlife Service. Selection criteria included depth range, areas of highly sloping terrain, geographical spatial discreteness, historical fishing activity, historical scientific studies and

the presence or absence of certain target geomorphological features which include canyons and canyon walls, escarpments and carbonate mounds.

Fifty two transects were surveyed with a combined 87 hours sampling and recording HD video on the seabed. The ROV surveyed 104 km of seafloor whilst also collecting 27 biological specimens and 48 sediment samples.

In addition, the survey:

- Identified biologically sensitive Annex 1 reef-forming, cold-water coral species (*Desmophyllum pertusum* - previously *Lophelia pertusa*, and *Madrepora oculata*).
- Explored previously undocumented geomorphological features along the southern extent of Ireland's Economic Exclusion Zone including the Porcupine Seabight, Goban Spur and Southwest Approaches.
- Sampled a previously unknown aggregation of the birds nest sponge, *Pheronema carpenleri*. The finding helps ground-truth and refine predictive ecological models created by the Marine Biology and Ecology Research Centre, University of Plymouth.
- Provided biological samples to the Marine Biodiscovery programme at NUI Galway and the DeepLinks project at University of Plymouth and Oxford University to study the ecological diversity of the North Atlantic Ocean.
- Provided sediment cores to Galway / Mayo Institute of Technology for micro-plastics analysis and research.

The findings of the SeaRover survey will contribute to the provision of conservation objectives for the offshore Special Areas of Conservation (SAC) work carried out by NPWS and will partially fulfil the Department of Agriculture, Food and Marine (DAFM) obligations to map vulnerable fisheries resources. The survey data will improve our understanding of the extent of sensitive ecosystems in Irish waters and broadens our understanding of the ecological requirements for these environments in support of the sustainable management of Ireland's marine resources.

Keywords: Offshore reef habitat, Irish continental margin, cold-water coral, *Desmophyllum pertusum*, *Madrepora oculata*

1. Introduction

Offshore reef is an Annex I habitat (Habitat Code: 1170) under the European Union (EU) Directive on the conservation of Habitats, Flora and Fauna (92/43/EEC). Commonly known as the Habitats Directive, it requires that each EU member state introduce a range of measures for the protection and monitoring of the conservation status of habitats and species listed in Annex I, II & IV of the directive. In an assessment of Ireland's Annex I reef habitat, reef status in Irish waters was reported as Unfavorable/Bad with an ongoing decline (NPWS, 2013a). Significant data gaps were reported within the assessment relating to the area, range, structure and function of reef habitat, as well as potential associated pressure components.

In response an extensive offshore reef survey of Ireland's Economic Exclusion Zone was commissioned. The three year project, beginning in 2017, was coordinated and led by Ireland's Marine Institute and INFOMAR (Integrated Mapping for the Sustainable Development of Ireland's Marine Resource) and funded by the European Maritime and Fisheries Fund (EMFF) Marine Biodiversity Scheme and the National Parks and Wildlife Service (NPWS). Survey operations were led by the Marine Institute, INFOMAR and NPWS, accompanied by scientists from NUI Galway and Marine Biology and Ecology Research Centre, University of Plymouth, and supported by scientists in Geological Survey Ireland and the Norwegian Marine Institute.

The survey team employed the Marine Institute's ROV *Holland 1* to collect high definition video footage, biological and sediment samples. Areas of focus included seabed features comprising sea-mounds, canyons and escarpments as well as areas of low fishing effort to allow study on the health of these sensitive ecosystems. The survey area included the southern extent of the Porcupine Bank, the Porcupine Seabight, the Goban Spur, the Southwest Approaches, other areas of interest and the Belgica Mound Province Special Area of Conservation. These data will be used to set site specific conservation objectives for this SAC, for monitoring purposes and to evaluate change due to anthropogenic activities.

1.1 Objectives

The primary objective of SeaRover was to undertake a comprehensive assessment of Ireland's marine biodiversity by mapping the distribution of geogenic and biogenic reef habitat within Ireland's EEZ using a ROV. Secondary objectives included the collection of biological and sediment samples. These data, once analysed, will benefit national policy development and support future Irish marine research.

2. Methods

2.1 Survey Vessel

The RV *Celtic Explorer* was chartered for 21 days in August 2019. The multifunctional research vessel is 65.5 m in length and can accommodate 35 personnel including 22 scientists for up to 35 days at sea. For the duration of the survey the back deck housed the ROV control centre and workshop and bespoke launch and recovery platform including hydraulic A-frame & winch. In 2018 additional cable was added to extend the operational depth of the ROV to 3000 m.

2.2 Remotely Operated Vehicle

The Marine Institute's ROV *Holland 1*, is a SMD Quasar Hydraulic work-class 100 hp hydraulic vehicle. The vehicle is operated from a dedicated launch and recovery system consisting of a winch carrying 4000 m of main lift wire plus an A frame. An additional 1000 m of cable was fitted before the 2018 survey which increased maximum depth range to 3000 m. The ROV descends at ~ 30 m/min and is flown along a pre-determined transect line 1-2m above the seabed.

The ROV has two manipulator arms for sample collection and a retractable tool sled carries sample drawers for stowage and sampling tools (push-cores, scoops & slurp guns). The ROV

was fitted with water sampling apparatus to facilitate collection of water beside selected sponge specimens. The vehicle is fitted with a high-definition television camera (recording in 1080i resolution), up to 7 phase alternating line video cameras plus a 5 mega-pixel digital stills camera fitted with a flash. Illumination for the cameras is primarily provided by two 400 W hydrargyrum medium-arc iodide lights.

The ROV underwater positional information is recorded using an Ultra Short Baseline (USBL) system with a transponder/responder fitted onto the ROV frame. The USBL system calculates the position of the ROV by measuring the range and bearing from a vessel-mounted transceiver to an acoustic transponder. In addition to an acoustic transceiver and in-water transponders, the USBL system includes attitude sensors for the accurate determination of vessel pitch, roll and heading.

2.3 Site Selection

The 2019 survey area included the southern extent of the Porcupine Bank, the Porcupine Seabight, the Goban Spur and the Southwest Approaches including the Whittard Canyon system and other areas of interest specific to the survey objectives.

Bathymetric data suggest small canyon systems occur along the southern extent of the continental margin of the Porcupine Bank and around its southern tip. The investigation of this section completes the spatial coverage along Ireland's western continental margin acquired during previous SeaRover legs carried out in 2017 and 2018 (O'Sullivan et al. 2017 & 2018).

Water depths within the Porcupine Seabight range from 400 m in the north to 3000 m in the southwest. The most significant identified geomorphological feature within the Porcupine Seabight is the 300 km Gollum Channel system which stretches from the shelf break to the Porcupine Abyssal Plain. The gentle slope and less complex relief indicate increased sedimentary deposition which is generally sub-optimal for reef formation (Dorschel et al. 2010). As this area remains largely unexplored and little or no video footage exists, it was necessary to acquire baseline data and to establish presence / absence of biogenic reef. In contrast, the margins of the Seabight are well studied, in particular a series of carbonate mound provinces along the north-eastern flanks. One of these, the Belgica Mound Province,

is the last offshore SAC to be surveyed as part of this offshore reef project and is of particular interest to NPWS. The Hovland Mound Province SAC to the north was surveyed in 2018.

The Goban Spur is a triangular extension of continental crust between the Porcupine Seabight and the Southwest Approaches. Some southern areas contain steep slopes which were targeted as part of the current survey. The Southwest Approaches mark the southern extent of the Irish seabed and contain numerous submarine canyons, the largest of which is the Whittard Canyon stretching nearly 300 km (through both UK and Irish waters). While this morphologically complex terrain has been generally well-studied, the current study focussed on less well known canyon walls, branches and escarpments to ensure even spatial coverage over the entire area.

Search criteria, employed to identify smaller survey units or transects within the above areas, were originally determined in 2017, repeated during the 2018 survey and again here. These were to target areas of steeply sloping terrain, historically low fishing effort (which are more likely to be ecologically preserved) and historically low scientific studies/surveys.

Additionally, target areas would be spatially discrete along the shelf-edge allowing for a full geographic spread. They would contain the presence of one or more target morphological features identified with cold-water coral reef habitat including terraces, gullies, steep-sided canyon walls, escarpments, ridges, mounds and cobble fields.

2.4 Spatial Data

A Geographic Information System (GIS) spatial database was created in ArcMap 10.2 and populated with known records from a number of sources. These sources were:

- Irish National Seabed Survey (INSS) - provided the offshore bathymetry data to help target seabed features associated with cold-water coral reef and was made available through the national seabed mapping programme INFOMAR.
- NPWS - commissioned an extensive desktop report and supporting GIS which collated existing spatial data on offshore reef habitat (Forde et al. 2017).

- FEAS (Marine Institute) – provided historical fisheries data comprised of electronic Vessel Monitoring System (VMS) logbook data from all boats fishing in Irish waters from 2005 to 2018 which indicates where fishing effort is concentrated.
- Atlas of the deep-water seabed: Ireland (Dorschel et al. 2010).
- Marine Biology and Ecology Research Centre, University of Plymouth - predictive modelling of species distributions has indicated the possible presence of various Vulnerable Marine Ecosystems (VMEs) including *Desmophyllum pertussum* reefs and *Pheronema carpenteri* aggregations within the survey area. Some individual transects were chosen in order to validate the predictive models and assess their performance.

Survey methods were developed during the initial NPWS ROV survey in 2009 and refined during SeaRover 2017 & 2018 (further details in O’Sullivan et al. 2017). Fifty target transects were initially identified and prioritised; P1 (highest), P2 and P3, based on the above criteria. In addition, 4 transects were identified in situ in response to survey progress and dynamic environmental conditions (T51 – T54). The survey area, with the locations of individual target transects, is illustrated in Figure 1.

2.5 Real-time video data acquisition and processing

Ocean Floor Observation Protocol (OFOP) is a software package developed to facilitate real-time visual observations of video data acquired during the deployment of ROVs and TV-sled tows. OFOP reads a variety of position data including the Global Acoustic Positioning System (GAPS) underwater navigation system. Biological observations are logged to individual dive protocols during ROV operations.

Button files provide the user with a list of geomorphological, biological groupings and species which are used to characterise observable fauna and geomorphology from video footage. SeaRover specific ‘button files’ were created and refined in response to the most commonly observed species and habitats and drew on the experience acquired during previous benthic surveys (Guinan & Leahy 2009, O’Sullivan et al. 2018). Basic taxonomic groupings were provided to ensure a consistent level of accuracy (i.e. Ophiuroids, Sea Stars) amongst observers. Specific species lists were also provided (i.e. *Ophiothrix fragilis*, *Zoroaster fulgens*). A number of descriptors indicating anthropogenic disturbance were also employed.

2.6 Sediment Sampling

Sediment samples were gathered opportunistically by the ROV, generally at the beginning of each dive. A 30 cm long hollow tube with a diameter of 8 cm is used to extract a sediment core which can be recovered to the surface. Cores can only be extracted in areas of primarily muddy sediment. Coarse sand may not be retained in the core whilst areas of harder ground might prevent penetration of the core into the seafloor.

Duplicate samples were taken where possible. One sample is used to ground-truth acoustic backscatter data collected by INFOMAR. It is not necessary to retain any layers within the sediment core and instead the entire sample is analysed onboard (colour, sorting, clade, biogenic composition) and retained for Particle Size Analysis (PSA) at a later date.

A second duplicate core sample is taken with only the top 5 cm layer of sediment being retained. The samples are carefully recovered with a clean metal trowel and stored in a glass jar to avoid contamination. These samples will be analysed as part of a study to assess the proliferation of micro-plastics within benthic sediments by a scientific group based at Galway / Mayo Institute of Technology (GMIT).

2.7 CTD Sampling

Conductivity, temperature and depth (CTD) measurements were acquired directly from the ROV using SBE Data Processing software which consists of modular, menu-driven routines for converting, editing, processing, and plotting of oceanographic data acquired with Sea-Bird profiling CTDs and thermosalinographs.

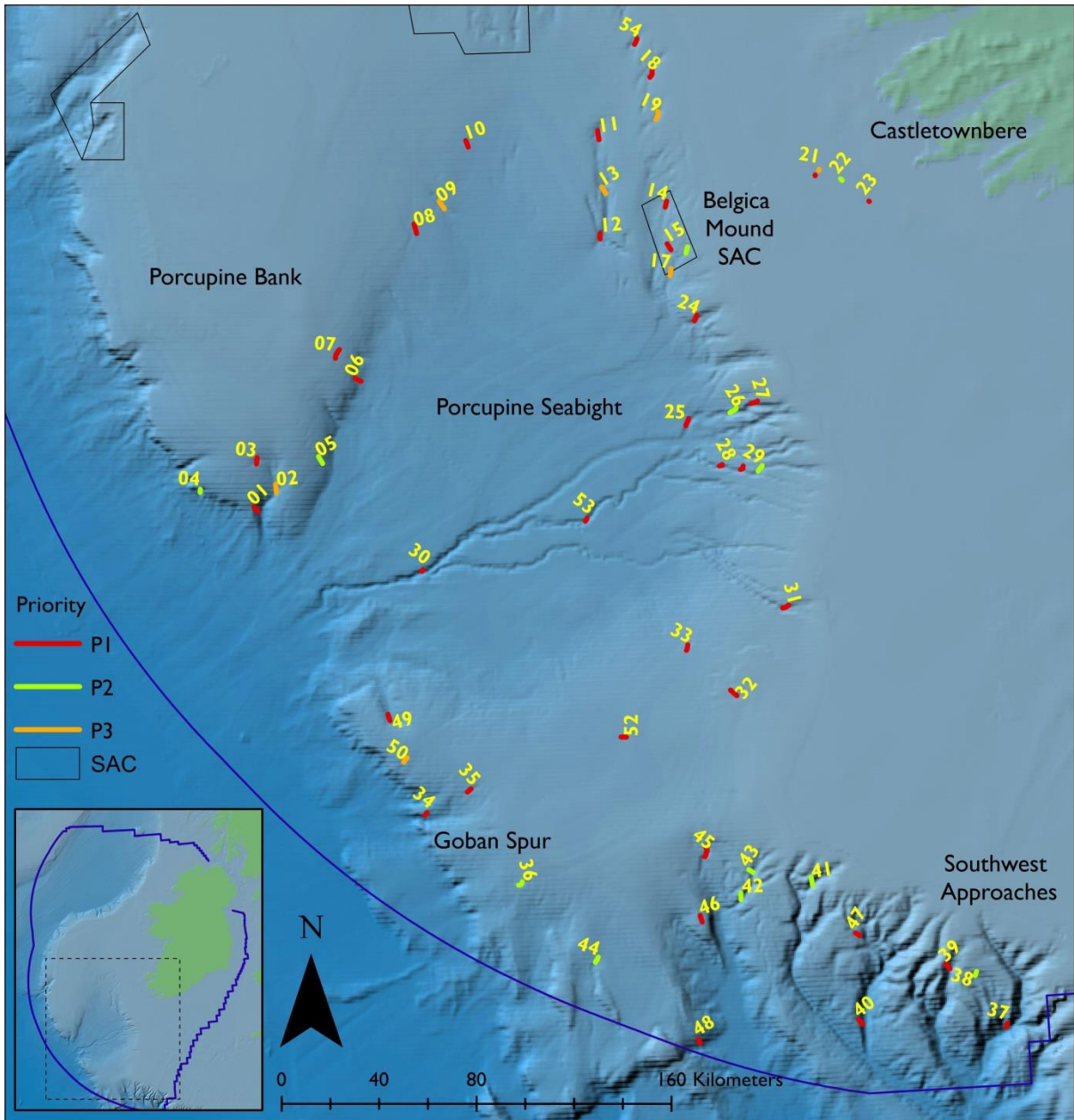


Figure 1. Numbered pre-survey target transects prioritised by colour with seafloor areas mentioned in text. Inset: Rep. of Ireland Economic Exclusion Zone (Blue) and enlarged area of interest (hatched).

3. Results

3.1 ROV Dive Summary

The RV *Celtic Explorer* was operational for 74.6% of the survey duration while the ROV *Holland 1* spent 87 hours sampling at depth (Table 1). The survey generated 5.5 TB of which 4.5 TB was HD video footage (Table 2).

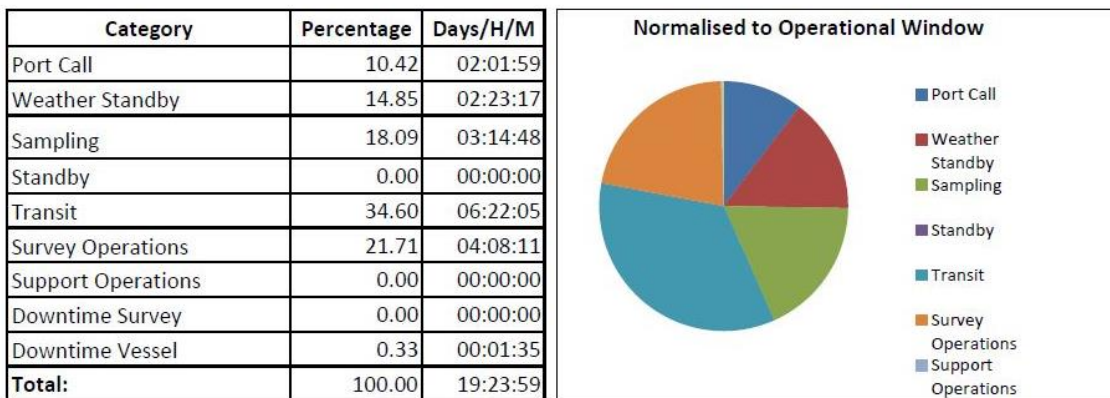


Table 1. Cumulative SeaRover survey statistics. ‘Survey Operations’ (deployment and recovery time), ‘Sampling’ refers to ROV time on the seafloor. Actual ROV time in water is the sum of both.

Camera	Recording format / view	Hours	File Size	No. of Images
HD Video	Forward facing	87	4.5 TB	-
Composite 1, 2, 3	Forward, Pilot. Downward	87	846 GB	-
Images	High definition Digi-stills	-	10.43 GB	~12 000

Table 2. Summary statistics for video footage and images captured during 52 individual ROV transects.

Of the 50 transects originally proposed, all but 2 (T02 & T50) were successfully surveyed. Four additional transects were added during the course of the survey as time allowed (T51 – T54). In total 52 dives were completed over the duration of the survey. The location, depth, duration and relevant samples taken during each dive are described in Table 3.

Dive *	Transect #	Date	Start Point (Bottom)	Depth (m) Start	End Point (Bottom)	Depth (m) End	ROV (mins)	Sampling (mins)	Total Dive (mins)	Samples Collected
648	T37	03/08/2019	50.0683; -10.8979	2884	48.0669; -09.9998	2657	386	149	397	No
649	T38	03/08/2019	48.0841; -09.9825	968	48.0842; -09.9813	911	232	69	243	Sediment
650	T39	03/08/2019	48.1187; -09.8481	1184	48.1178; -09.8496	1026	231	125	236	Sediment
651	T40	04/08/2019	48.1007; -09.8478	2999	48.1008; -10.0000	2832	352	109	364	Sediment, Cup Coral, Sea Pen
652	T47	04/08/2019	48.0857; -09.8644	1115	48.1000; -09.8497	1069	254	169	259	Sediment, Swiftia
653	T41	04/08/2019	48.1181; -10.9479	1074	48.1167; -10.9976	941	169	85	178	Sediment
654	T43	05/08/2019	48.0027; -10.9499	1328	49.0008; -10.9325	1003	236	132	244	Sediment
655	T42	05/08/2019	48.0834; -10.8659	1735	48.0850; -10.8663	1544	232	96	239	Sediment, Hyalonema, Zooanthids
656	T45	05/08/2019	49.0004; -10.8485	1393	49.0012; -10.8475	1244	228	127	236	Sediment, Anthomastus, Hyalonema
657	T46	05/08/2019	48.0025; -10.9827	1516	48.0011; -10.9826	1537	219	103	224	Sediment
658	T48	06/08/2019	48.0514; -10.9349	2983	48.0669; -10.9331	2900	334	104	341	Sediment, Radicipes, Anemone
659	T44	06/08/2019	48.0342; -11.8811	1967	48.0347; -11.8825	1928	215	71	221	Sediment
660	T36	06/08/2019	49.0002; -11.9656	1793	49.0013; -11.9662	1671	246	112	251	Sediment, Cup Coral
661	T35	07/08/2019	49.0168; -11.8500	1860	49.0189; -11.8647	1833	223	83	232	Sediment
662	T34	07/08/2019	49.1002; -12.9491	2990	49.1004; -12.9488	2868	372	151	378	Sediment, Coral
663	T49	07/08/2019	49.1350; -12.9161	2259	49.1347; -12.9143	2211	240	75	248	Sediment
664	T30	07/08/2019	50.0002; -12.9641	2892	50.0007; -12.9650	2771	328	99	336	No
665	T24	08/08/2019	51.0019; -10.9315	1139	51.0001; -10.9307	959	166	78	173	Sediment
666	T17	08/08/2019	51.0500; -10.9651	1138	51.0669; -10.9649	1091	195	102	202	Sediment, Candidella
667	T16	08/08/2019	51.1358; -10.8991	714	51.1356; -10.8994	621	144	81	151	Sediment
668	T15	09/08/2019	51.1509; -10.9665	901	51.1526; -10.9647	888	202	128	208	Sediment,
669	T14	09/08/2019	51.1336; -10.9482	855	51.1514; -10.9499	895	232	151	239	Sediment
670	T20	09/08/2019	51.0520; -09.8476	160	51.0668; -09.8485	159	88	57	94	Sediment
671	T21	09/08/2019	51.0835; -09.8655	157	51.0844; -09.8643	140	70	44	73	Sediment
672	T22	09/08/2019	51.0348; -09.9981	147	51.0356; -09.9992	145	116	91	122	Sediment, Coral
673	T23	09/08/2019	51.1187; -09.9831	143	51.1194; -09.9825	141	56	27	61	No

Table 3. Completed ROV *Holland 1* dives during Leg 1 (26), 1st - 10th August, 2019. * Sequential ROV dive number; ^ non-sequential transect number.

Dive *	Transect #	Date	Start Point (Bottom)	Depth (m) Start	End Point (Bottom)	Depth (m) End	ROV (mins)	Sampling (mins)	Total Dive (mins)	Samples Collected
674	T27	11/08/2019	50.0683; -10.8979	1097	50.0687; -10.8993	806	232	68	239	Sediment
675	T26	11/08/2019	50.0334; -10.9311	1587	50.0524; -10.9481	1177	268	147	275	Sediment, Isididae
676	T25	11/08/2019	50.0008; -10.8484	1940	50.0015; -10.8484	1916	242	95	248	Sediment
677	T28	11/08/2019	50.0027; -10.8645	1729	50.0169; -10.8806	1435	270	147	277	No
678	T51	12/08/2019	50.0003; -10.9823	1421	50.0016; -10.9989	1226	254	156	261	Sediment.
679	T29	12/08/2019	50.1518; -10.9164	1212	50.0001; -10.9314	1034	241	141	251	Sediment, Gorgonian
680	T31	12/08/2019	49.1351; -10.9981	763	49.1527; -10.9976	673	157	94	161	Sediment
681	T32	12/08/2019	49.0182; -10.8652	604	49.0013; -10.8815	570	170	105	175	Sediment
682	T33	13/08/2019	49.0022; -10.9664	1170	49.0171; -10.9650	1166	200	111	208	Sediment, Xenophyophore
683	T52	13/08/2019	49.0335; -11.9992	1207	49.0335; -11.9973	1205	227	132	235	Sediment, Pheronema, Pheliactis, Hyalonema
684	T53	13/08/2019	50.0002; -11.9167	2511	50.0013; -11.9163	2487	229	53	239	Sediment
685	T05	14/08/2019	50.0669; -12.8996	2084	50.0690; -12.8982	2051	172	68	179	Sediment
686	T04	14/08/2019	50.1348; -13.8498	2970	50.1359; -13.8498	2650	343	100	350	Sediment, Sponge, Tunicate
687	T01	14/08/2019	50.0512; -13.9987	2948	50.0678; -13.9999	2832	292	80	296	Sediment
688	T03	15/08/2019	50.0688; -13.9993	1492	50.0846; -13.9984	1552	234	116	239	Sediment
689	T06	15/08/2019	50.0339; -12.9647	2118	50.0342; -12.9500	2020	237	93	243	Sediment
690	T07	15/08/2019	50.1178; -12.9820	1104	50.1194; -12.9822	1097	182	97	188	Sediment, Pheronema, Tunicate, Pheliactis, Hyalonema
691	T08	16/08/2019	51.0690; -12.9820	1292	51.0686; -12.9645	1280	190	66	197	Sediment
692	T09	16/08/2019	51.0001; -12.9993	1535	51.0015; -12.9979	1526	184	63	191	Sediment
693	T10	16/08/2019	51.0519; -11.9666	1239	51.0674; -11.9646	1215	210	126	234	Sediment, Sea Pen
695	T12	19/08/2019	51.0353; -11.9985	1617	51.0346; -11.9995	1484	200	81	209	Sediment
696	T13	19/08/2019	51.0352; -11.9976	1333	51.0336; -11.999	1228	223	120	230	Sediment
697	T11	19/08/2019	51.0677; -11.9987	1228	51.0690; -12.0000	1206	163	66	169	Sediment
698	T19	19/08/2019	51.1335; -10.9143	602	51.1355; -10.9167	584	99	45	107	Sediment
699	T18	19/08/2019	51.1178; -10.8984	620	51.1193; -10.8998	601	123	62	128	Sediment
700	T54	20/08/2019	52.0024; -10.9823	660	52.0022; -10.9816	643	148	83	153	Sediment

Table 3 contd. Completed ROV *Holland 1* dives during Leg 2 (26) 10th – 21st August, 2019. * Sequential ROV dive number; ^ non-sequential transect number.

The ROV can travel 30 m /min vertically taking approximately 32 minutes to descend/ascend 1000 m. The deepest dive recorded seabed at 2998 m (T34), the operational limit of the ROV with the available umbilical cable aboard for this survey is 3000 m. The number of dives in each depth range are described in Table 4.

Depth Range (m)	2017	2018	2019
0 - 500	0	2	4
500 - 1000	14	16	9
1000 - 1500	9	6	17
1500 - 2000	15	10	11
2000 - 2500	11	10	4
2500 - 3000	1	8	7

Table 4. Depth ranges of transects surveyed by SeaRover per year.

Four very shallow dives (T20-23), including the shallowest of the survey at 126m, were completed southwest of Castletownbere, Co. Cork to investigate areas of interest highlighted by VMS data and named locally as ‘Coral’ fishing grounds. No significant coral reef was observed, however two shipwrecks were encountered on consecutive dives (T20, T21). A small clump of *Lophelia* was evident within one wreck on T20. The wrecks are unnamed but have been previously recorded within the INFOMAR database.

An extensive aggregation of birds nest sponges, *Pheronema carpenleri*, was observed on T52 within the Porcupine Seabight, the first recorded in this area. Multiple specimens were sampled at the site. A benthic water sample was taken adjacent to each specimen for bacteriological tests.

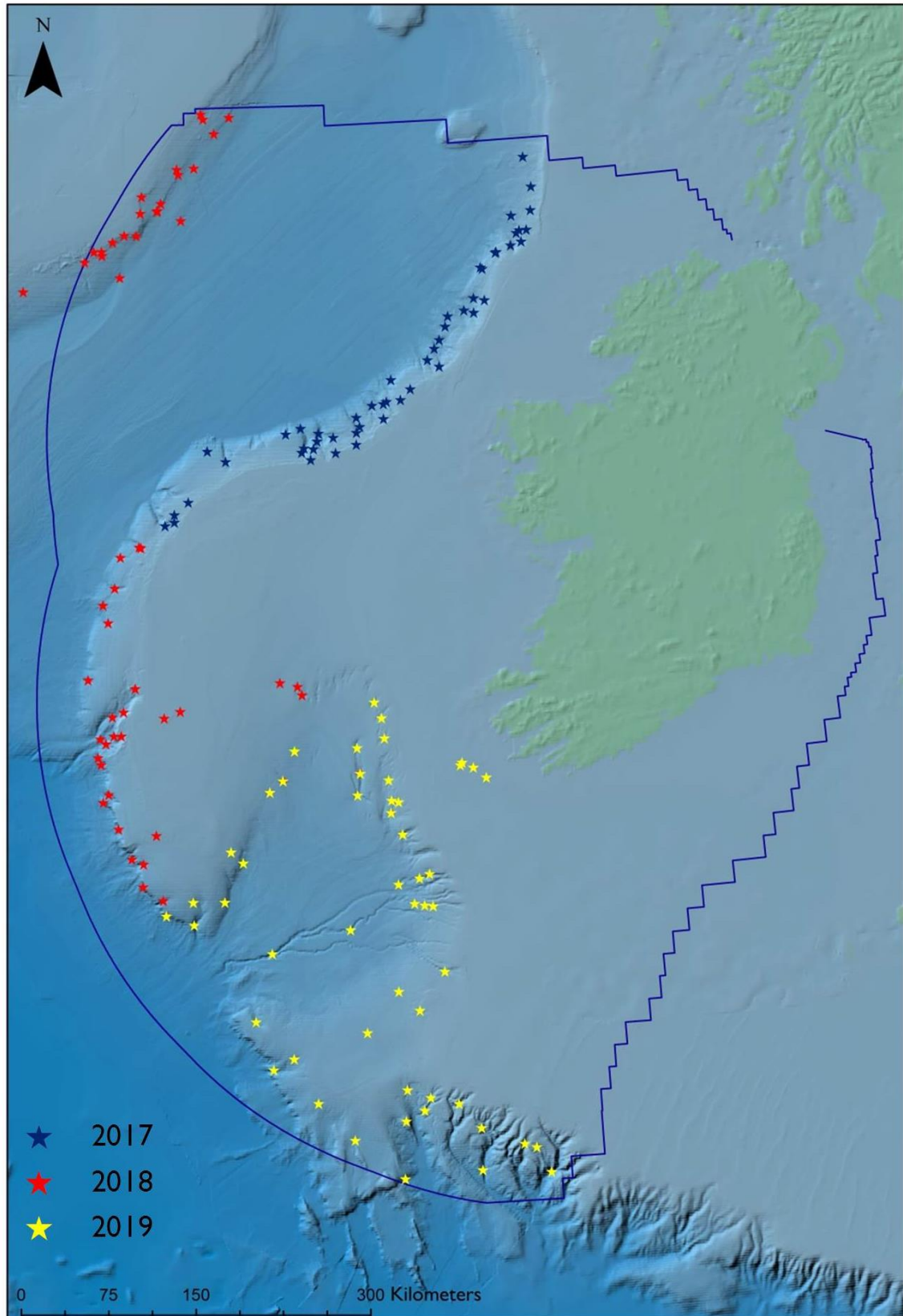


Figure 2 . Locations of surveyed transects from three offshore reef surveys in 2017, 2018 & 2019.

3.2 Sample Images

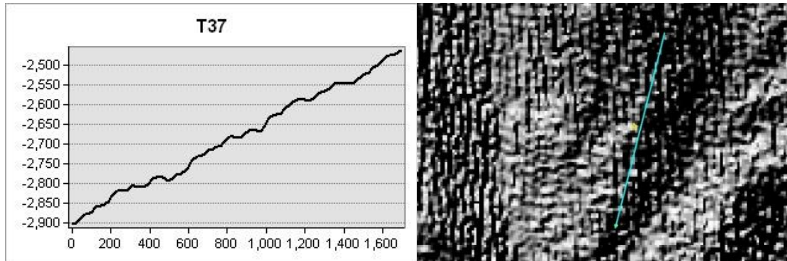


Figure 3. Top (L-R): Coral Garden, Anemones, Marine Litter. Second Row: Oil drum, Octopus, A Swiftia Octocoral. Third Row: Anthomastus, Jasonia, Stony Coral, Crinoids and Anemones on a vertical ledge. Bottom: Chimaera and a Seapen field, Barnacle covered rock, Pilot Whales.

3.3 Site Summaries

Leg 1

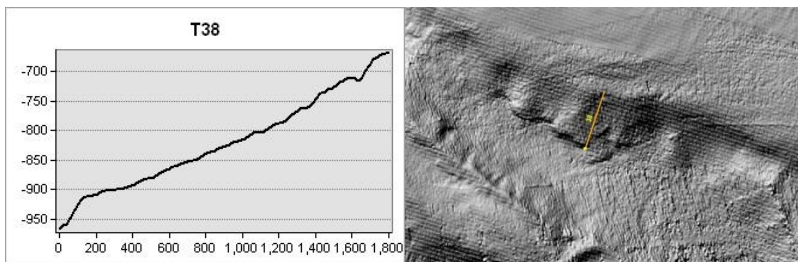
Transect 37 Dive 648



P1. Water Depth: 2924m. Feature: Slope with occasional terraces and cliffs

Seafloor is of soft sediment on a steep slope with occasional terraces and cliffs. Conspicuous fauna is sparse and includes small tubes, foraminiferans, occasional ophiuroids and echinoids. Burrows are also noted. Further upslope the sea pen *Distichoptilum* is common along with the soft coral *Anthomastus*. Burrows are present, with some containing galatheid crabs.

Transect 38 Dive 649

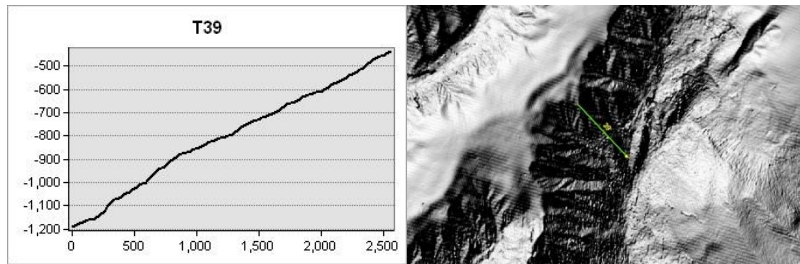


P2. Water Depth: 950m. Feature: Slope

Of note: Corals *Desmophyllum*, occasionally *Madrepora* and monofilament fishing line.

The bottom current is very strong and the seafloor is subject to scour, with development of wave forms throughout. Initially the substrate is pebbly, moving into ground dominated by coral rubble. Towards the top of the slope the substrate is sand. Fauna consists of clumps of live *Desmophyllum* and occasionally *Madrepora*. There are a lot of Clavulariidae octocorals and a single *Acanthogorgia*. The echinoid *Cidaris* is abundant, some anemones and hermit crabs also observed. The crinoid *Koehlermetra porrecta* is dense in places. Monofilament fishing line was observed towards the end of the dive.

Transect 39 Dive 650

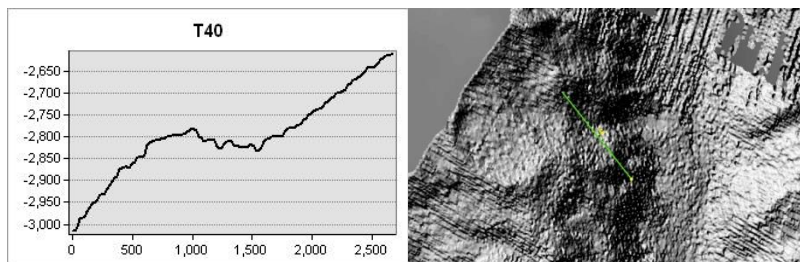


P1. Water Depth: 1184m. **Feature:** Slope with escarpment

Of note: Escarpments with coral (*Lepidisis* and *Madrepora*)

Unusual geology here in the form of large rounded pillars. The substrate is largely an overlay of fine sediment on carbonate rock. Larger outcrops, both carbonate and igneous, are also present. About midway through the dive a series of escarpments occur, first as small ridges then as very large vertical escarpments. Along the escarpments the biodiversity is rich and include the corals *Lepidisis* and *Madrepora*, crinoids and anemones. Orange roughy and octopuses are observed.

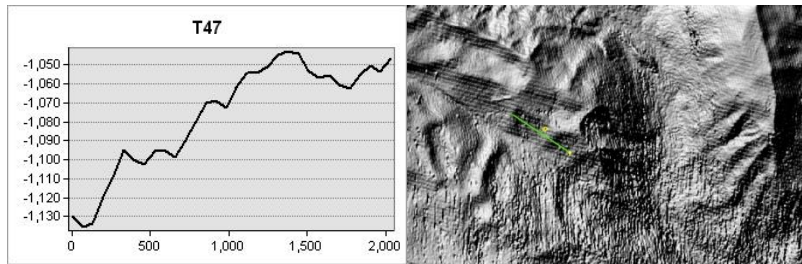
Transect 40 Dive 651



P1. Water Depth: 3000m. **Feature:** Slope, depth

Soft sediment throughout the dive. Numerous burrows and occasional pteropod shells are present. The main faunal components are worm tubes and holothurians. Occasional sea pens, echinothurioids and elpidiids occur. The soft coral *Anthomastus* is observed as are some decapods and fish including grenadiers and scabbards. One or two cup corals observed; attempts made to collect one failed. No cores taken for technical reasons.

Transect 47 Dive 652

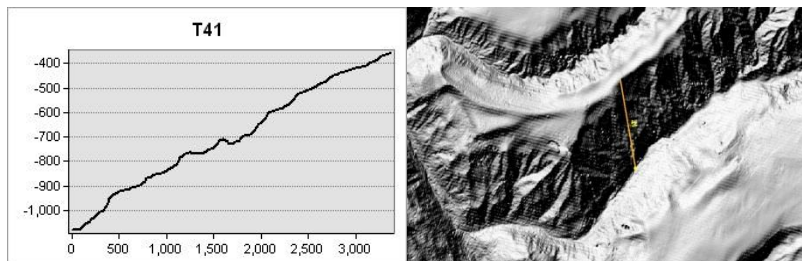


P1. Water Depth: 1115 m. **Feature:** Unknown area

Of note: Corals *Desmophyllum pertussum* and *Madrepora oculata*

The seafloor is mainly soft sediment with some boulders. An area of coral reef is present with intermittent coral rubble followed by more soft sediment. The main faunal components are anemones and foraminifera. Sea pens, eels and fish are observed on the soft sediment. Glass sponges, the corals *Desmophyllum pertussum* and *Madrepora oculata* and crinoids are observed on boulders. An unknown anthozoan was collected. On the biogenic reef some gorgonian corals are observed which could not be identified.

Transect 41 Dive 653

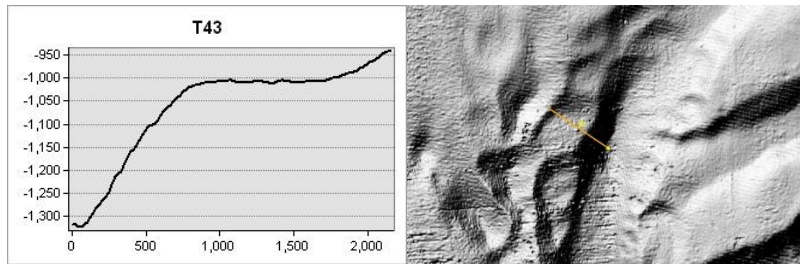


P2. Water Depth: 1074m. **Feature:** Unknown area

Of note: Fishing nets, rubbish

The seafloor consists of ridges covered in coarse sand and sediment waves with occasional rocks. Towards the end of the dive, the topology becomes quite mountainous with towering shoulders of sediment containing many burrows. The fauna includes large barnacles, *Swiftia*, *Desmophyllum*, a variety of sea pens including *Kophobelemnon* and *Pennatula* are noted as are some ophiuroids. Numerous fish include *Lepidion eques* and eels. Much fishing gear is observed, entangled on rocks and much rubbish is also observed. Visibility is very poor due to suspended sediment in the water, possibly as a result of nearby trawling activity which was apparent on the radar.

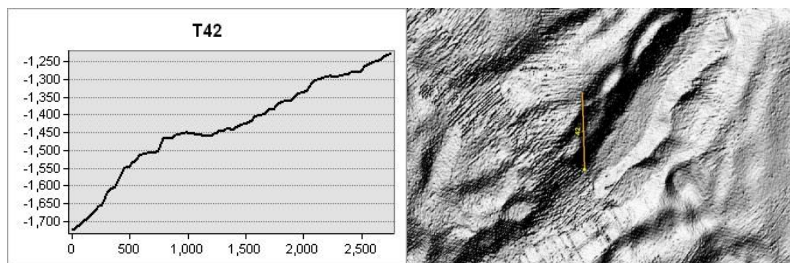
Transect 43 Dive 654



P2. Water Depth: 1328m. Feature: Slope
Of note: Sea pen field, fishing gear, plastic rubbish

An initial gentle incline with mixed sediment becomes more steep and meets vertical carbonate cliffs. The cliffs host only sparse epifauna. At the top of the cliffs there is a gentle to moderate slope with fine sediment containing some burrows. Occasional sparse cobbles and boulders are observed throughout the area. An extensive field of sea pens including *Pennatula* sp. and *Kophobelemnion* sp. occur, and the bamboo coral *Acanella* (both fir tree and bush-like forms) are recorded amongst the sea pens. Some fishing gear as well as plastic rubbish is observed on this dive. Dolphins (possibly common dolphins) were observed on the surface as the ROV was being deployed.

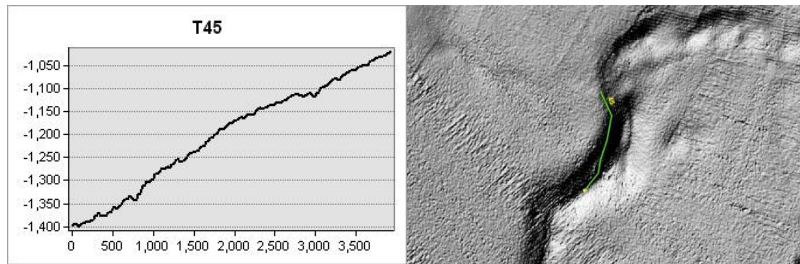
Transect 42 Dive 655



P2. Water depth: 1735m. Features: Slope

A lot of marine snow over a very muddy, steep slope. Two *Hyalonema* sponges are observed, and one was sampled for zooanthids. Fauna are generally scarce and include seapens, cerianthids and occasional small sea stars. Fish (also scarce) include eels, grenadiers, some orange roughly and a cartilaginous fish.

Transect 45 Dive 656

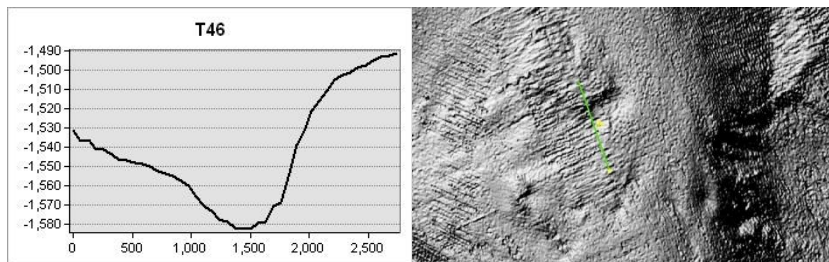


P1. Water depth: 1393m. **Features:** Ridge

Of note: Bamboo coral stalks, marine litter, fishing line and net

Seafloor is initially soft, sandy sediment. Boulders, large basalt rocks and carbonate terraces are present towards the end of the dive. Bare stalks of bamboo corals are present on these rocks. Sea pens and cerianthids are abundant with evidence of coral rubble. Occasional *Hyalonema* sponges, stalked crinoids and the octocoral *Umbellula* sp. are observed. A *Hyalonema* specimen (with zooanthids on its stalk) and a large *Anthomastus* sp. were sampled.

Transect 46 Dive 657

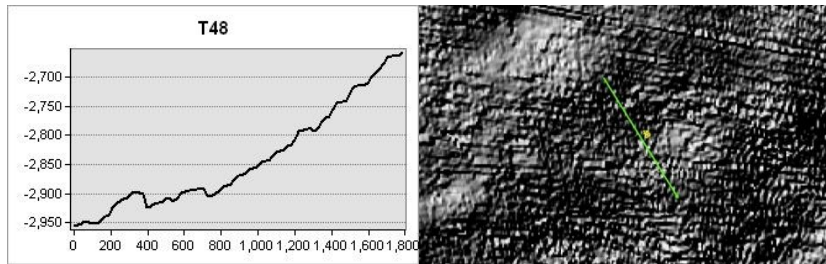


P1. Water depth: 1516m – 1537m. **Feature:** Downhill slope.

Of note: Abundant and diverse fish species

The seafloor consists of soft muddy bottom with many burrows and varying morphology, on a gentle slope. There is very little marine snow and limited current. Epifauna is scarce and consists mainly of cerianthids and very small sea pens (possibly *Anthoptilium*). Fish species included eels, grenadiers, a *Bathypterios* sp. and a chimerid. An enormous stalked hexactinellid (*Hyalonema* – like), the head of which was at least 30 cm across was observed.

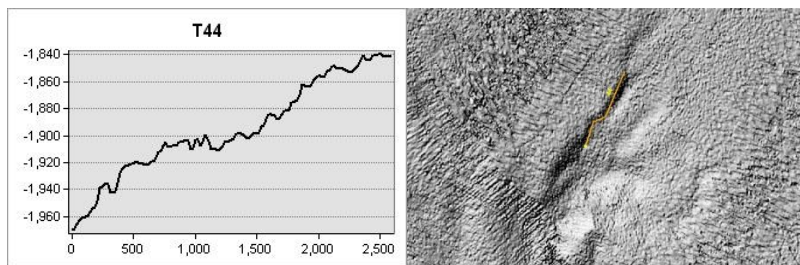
Transect 48 Dive 658



P1. Water depth: 2900m. **Feature:** Gentle, muddy slope

The seafloor is a soft muddy bottom on a gentle slope with frequent burrows. Epifauna is sparse and includes a variety of holothurians and the octocoral *Radicipes* sp.. Flocculent material, most likely marine snow is observed. Litter identified included plastic and metal.

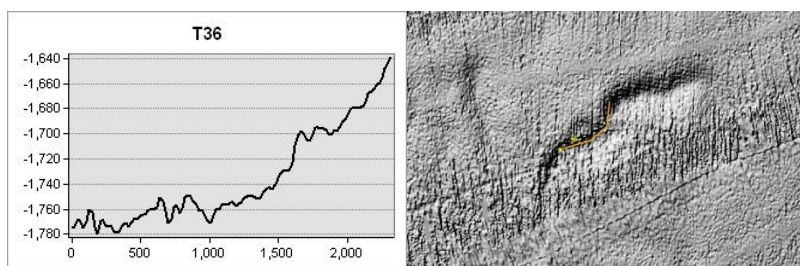
Transect 44 Dive 659



P2. Water depth: 1967m. **Feature:** Slope

The seafloor is soft muddy sediment with numerous burrows present, some are quite large. Crustaceans are noted at the entrances to some burrows. The holothurian *Benthogone* is present throughout. Some pycnogonids are present although generally very little conspicuous fauna. A single dropstone with six *Phelliactis* sp. is observed. Plastic rubbish is encountered.

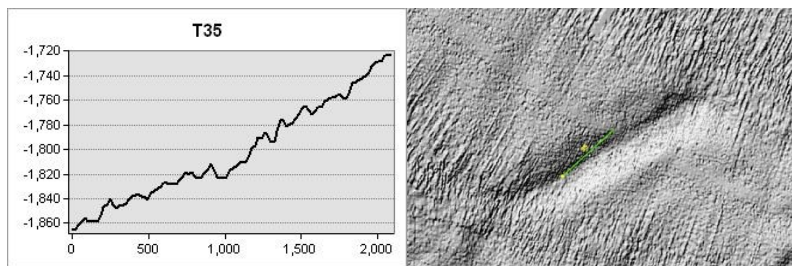
Transect 36 Dive 660



P2. Water depth: 1793m. **Feature:** Slope
Of note: Corals

The seafloor is initially fine sediment with little visible fauna. Upslope there are occasional drop stones and more prevalent rocky outcrops. At the top of the slope, the seafloor is again soft sediment. Initially the fauna consists of cup corals and a few cerianthids with a lot of medusae in the water column. Rocks are populated with starfish and the holothurian *Psolus* sp., sponges and the anemone *Actinerus michaelisarsis*. Occasional black corals are present including *Stauropathes*, *Bathypathes*, and *Stichopathes*. On the soft sediment there are several species of holothurians including *Benthogone* and *Mesothuria*, the crinoid *Pentametrocrinus* and ophiuroids. The stone coral *Solenosmilia variabilis* is present on a large rock. Towards the end of the dive, some pink corals are observed (probably *Chrysogorgia* sp.) and a single nephtheid coral (possibly *Gersemia* sp.).

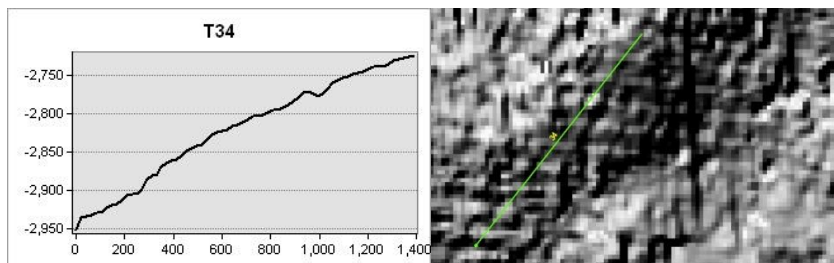
Transect 35 Dive 661



P1. Water depth: 1860m. **Feature:** Muddy slope
Of note: Paucity of epifauna

The seafloor here is primarily composed of soft sediment with bioturbation. Epifauna are rare but include the anemone *Phelliactis* sp. and the echinoid *Phormosoma*. Fish species encountered include eel-like fish, chimerids and a bent nose rabbitfish.

Transect 34 Dive 662

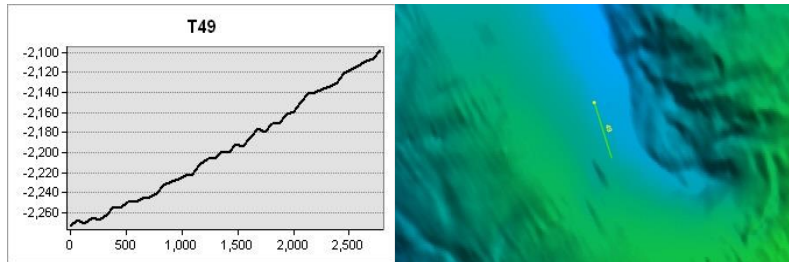


P1. Water depth: 2990m. **Feature:** Rocky ridge
Of note: Corals, sponges

The seafloor is primarily soft sediment either side of a rocky ridge. Fauna is initially sparse and includes the occasional holothurian *Mesothuria*, cerianthids and anemones, the chrysogorgiid

coral *Radicipes* and the sea pen *Pennatula*. Along the ridge, there are numerous large vase sponges and flabellate sponges with some stalked Hexactinellids. A variety of corals are observed including *Chrysogorgia*, *Anthomastus*, several species of black coral (including *Telopathes* and *Stauropathes*) and two octocorals, one of which is large and red (perhaps Plexauridae) and the other, a large Isididae.

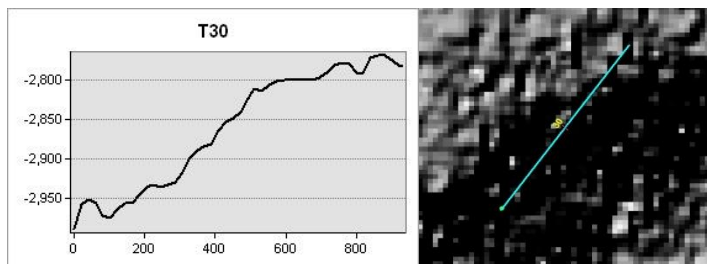
Transect 49 Dive 663



P1. Water depth: 2270m. **Feature:** Slope
Of note: Xenophyophores

The seafloor at the base of this gentle slope is mixed sediment with some pebbles and cobbles. Erosion marks on the seafloor indicate movement of cobbles. Very little conspicuous fauna, but some small crinoids and the occasional *Lepidion eques* are present. Numerous tetrapod shells observed over this area and Xenophyophores are abundant throughout.

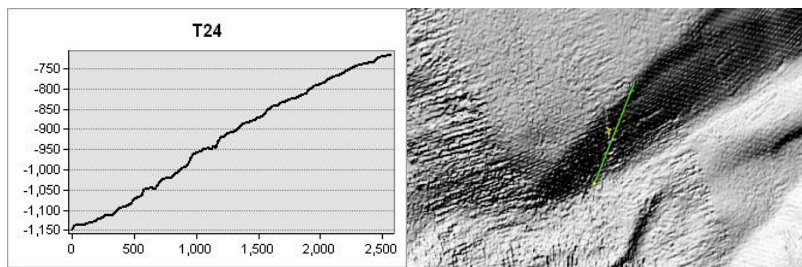
Transect 30 Dive 664



P1. Water depth: 2892m. **Feature:** Cliff areas

Initially there is a steep slope of exposed bedrock with some soft sediment and scattered rocks. Further upslope, cliffs are apparent. Corals and stalked crinoids are observed on the cliffs. Asteroids and elpidiid holothurians present in soft sediment after the cliffs. Numerous grenadiers are present throughout.

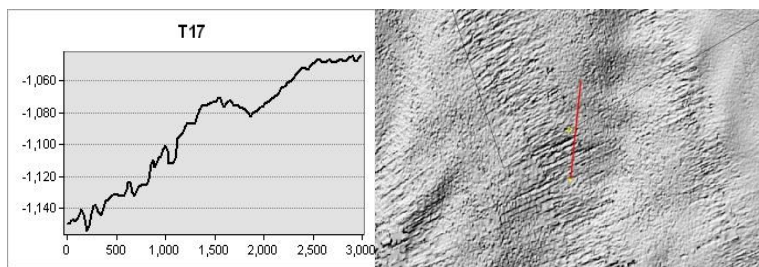
Transect 24 Dive 665



P1. Water depth: 1140m. **Feature:** Slope
Of note: Very little fauna present

The seafloor throughout is entirely flat sand with no features. The fauna predominately consists of mobile crinoids, anemones, hermit crabs and echinoids. The fish are *Lepidion eques*, eels, chimerids and grenadiers. One very large asteroid (cushion like) is observed.

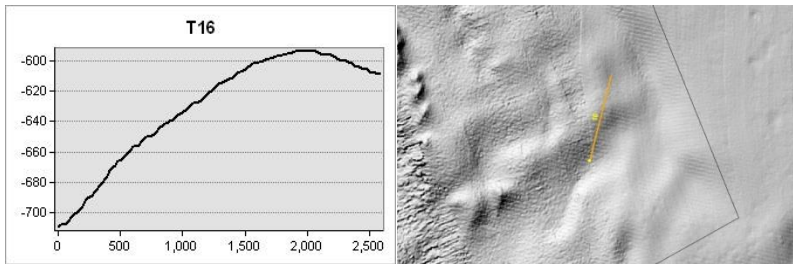
Transect 17 Dive 666



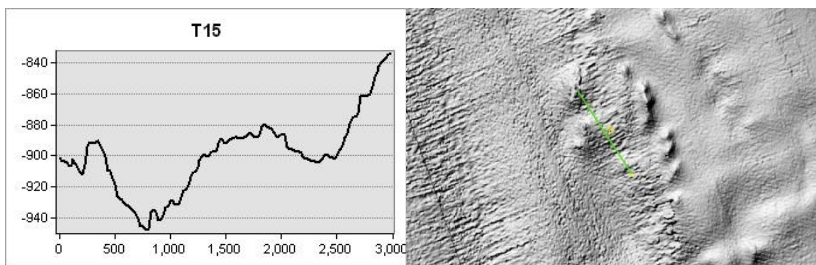
P3. Water depth: 1138m. **Feature:** Slope, SAC.
Of note: Corals

There is initially soft sediment with pebbles. Upslope the substrate becomes coarser with more cobbles and pebbles. This is followed by a steep slope of rippled sand and mud.

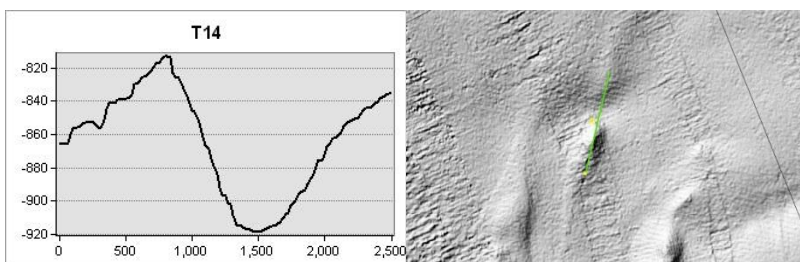
Fauna include glass sponges and demospongiae, some coral rubble is encountered. Clumps of the stone coral *Madrepora oculata* are encountered (< 1% living). On soft ground echinoids and eels are frequent. Octocorals are observed on hard ground and include frequent clumps of *Acanthogorgia*, less frequent *Candidella*, and some plexaurids including *Paramuricea*. Chimerid and some squid also observed.

Transect 16 Dive 667**P2. Water depth: 714m. Feature: SAC, Slope**

The seafloor consists of sand ripples, occasional depressions and some small boulders. The echinoid *Cidaris cidaris* is commonly seen along with gastropods and hermit crabs. Fish species include grenadiers, *Lepidion eques* and eels. A fishing net is observed.

Transect 15 Dive 668**P1. Water depth: 901m. Feature: Within SAC**

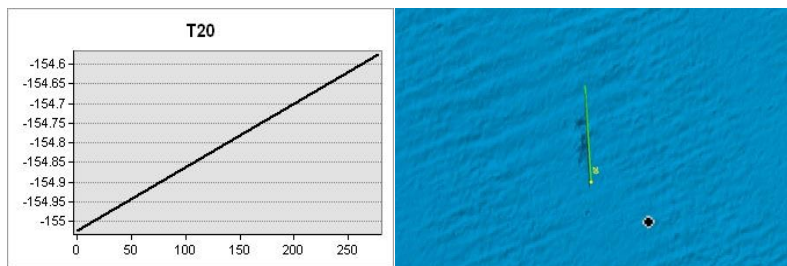
There is soft sediment interspersed with rocks and an area of coral rubble with large drop stones colonised by barnacles and cup corals. Numerous stylastrids hydroids and holothurians encountered as were encrusting sponges. The holothurian *Psolus* sp. noted on cobbles and boulders. On soft ground echinoids species including *Cidaris cidaris* are numerous. The decapod *Paramola cuvieri* and an octopus are also observed.

Transect 14 Dive 669**P1. Water depth: 855m. Feature: Within SAC**

Of note: *Desmophyllum* reef

Initially there is a gentle slope with some coral rubble. As the slope becomes steeper, reef cover (*Lophelia pertusa* and some *Madrepora oculata*) increases. Initially, occasional colonies of the stone coral *Madrepora oculata* are observed. The octocorals *Paramuricea*, *Muricea*, *Clavularia* and *Acanthogorgia* are abundant. Crabs include *Bathynectes*. There are many hexactinellid sponges and encrusting sponges including *Hymedesmia*. On the pebbly slope the holothurian *Psolus*, stylasterid hydroids and the soft coral *Anthomastus* are abundant. The echinoid *Cidaris cidaris* is common. Fish species include numerous *Lepidion eques*, the blackbelly rosefish, large monkfish and a large shark.

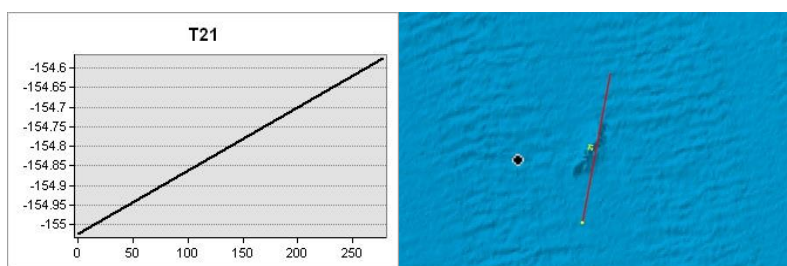
Transect 20 Dive 670



P1. Water depth: 161m. Feature: VMS data and local fisher knowledge

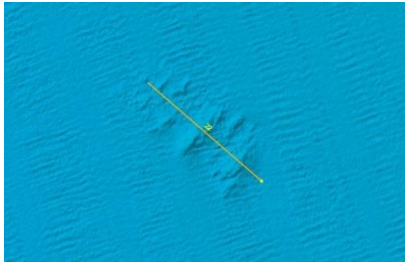
The sediment here is primarily soft sand with occasional areas of pebbles and small rocks. Conspicuous fauna consists largely of ophiuroids and anemones. A large uncharted steel hulled ship wreck is observed, with fishing gear snagged on it. Shoals of pollack are abundant here.

Transect 21 Dive 671



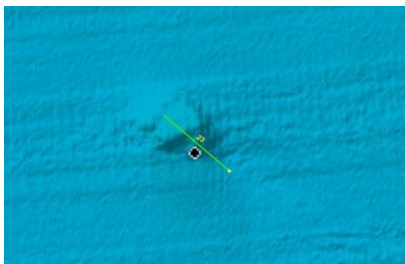
P3. Water depth: 157-140m. Feature: VMS data and local fisher knowledge Of note: *Desmophyllum* and large numbers of the blackbelly rosefish

A shipwreck is observed, with large numbers of pollack and blackbelly rosefish. Hydrozoans, soft corals, cup coral and the stone coral *Desmophyllum* are all observed on the super-structures. Crabs, lobster, galatheids and ophiuroids also present.

Transect 22 Dive 672

P2. Water depth: 147m **Feature:** VMS data and local fisher knowledge

Muddy seafloor on a moderate slope with sparse fauna including sponges and cephalopods. On rocky outcrops sponges, erect bryozoans and a variety of starfish including *Porania* are observed.

Transect 23 Dive 673

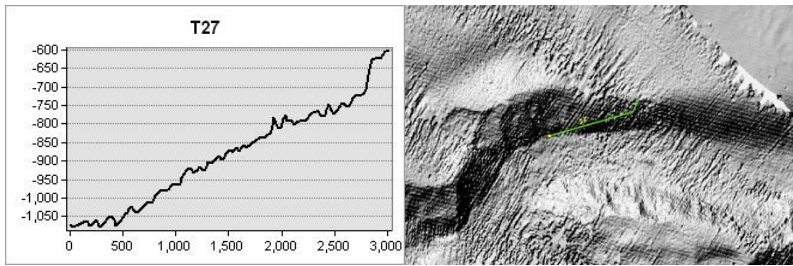
P1. Water depth: 143m **Feature:** VMS data and local fisher knowledge

Of note: A lot of octopuses

Initially soft sediment with very little visible fauna apart from some hermit crabs and a few anemones. Crabs, octopuses and ophiuroids occur on hard ground. Large numbers of fish, particularly pollack, are present.

Leg 2

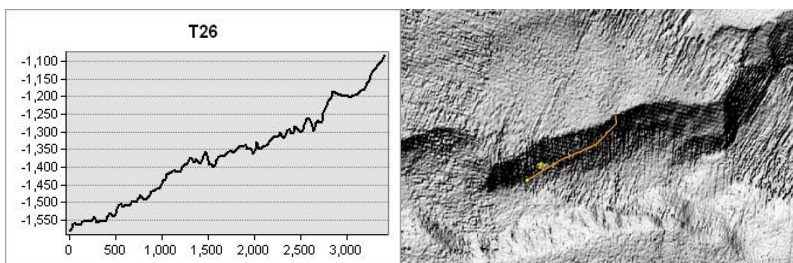
Transect 27 Dive 674



P1. Water depth: 1097 – 806m. **Feature:** Slope
Of note: Large bed of the sea pen *Kophobelemnon*

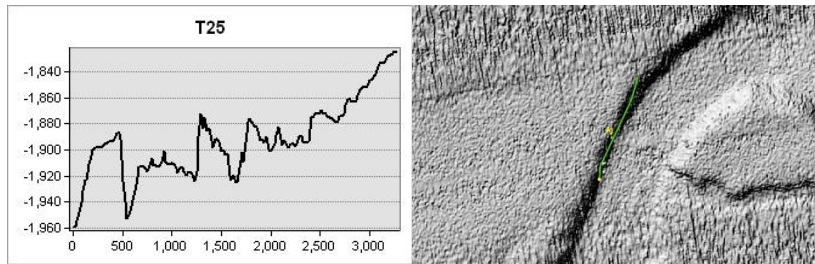
The sediment is soft and characterised by a large bed of the sea pen *Kophobelemnon* sp. with anemones and burrows. Up a steep slope the substrate is coarser and appears like relict coral overlain with sediment. Over the steep cliff the sediment is once again soft with a *Kophobelemnon* sp. field. Among these sea pens are anemones including cerianthids and burrows. Squid are common and fish species include eels, *Lepidion* and an occasional grenadier.

Transect 26 Dive 675



P2. Water depth: 1177m. **Feature:** Steep canyon wall
Of note: *Solenosmilia* reef, octocorals, numerous orange roughy.

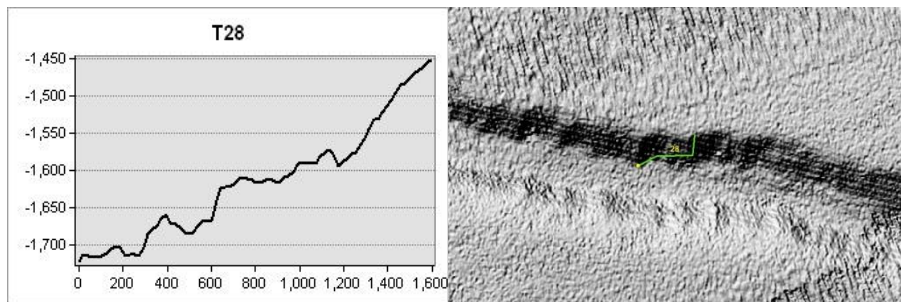
Initially there is soft sediment, transitioning to coral rubble and then *Solenosmilia* reef (50% living). Fish include grenadiers, eels, chimerids and numerous orange roughy. Sea-pens are noted amongst the coral rubble and a variety of soft corals are also present on the reef. A field of the bamboo coral *Acanella arbuscula* is observed towards the end of the dive which was sampled.

Transect 25 Dive 676

P1. Water depth: 1940–1916m. **Feature:** Canyon wall

Of note: A variety of sea pens including *Halapteris* and *Funiculina*

There is a soft sediment slope, steep in parts with multiple small tubes (possibly polychaetes). Occasional areas of numerous small white echinoids. Midway along the transect, large brown echinoids, including *Phormosoma* are present. Multiple large burrows, some with galatheids. Anemones include cerianthids, with the occasional *Phelliactis*. Sea-pens and cup corals, including *Flabellum* sp. are also observed. The large holothurian *Benthothuria* is frequently observed from midway through the dive. A variety of sea-pens including *Halapteris* and *Funiculina* also noted.

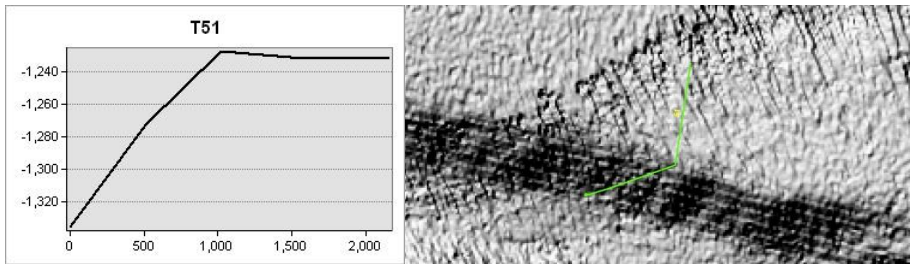
Transect 28 Dive 677

P1. Water depth: 1726-1425 m. **Feature:** Slope, Predicted *Pheronema* sponge

Of note: Aggregates of juvenile holothurians

Soft sediment, occasional fauna, include eels, grenadiers, holothurians (including *Benthogone rosea*), orange roughy and *Hyalonema* sponges. Aggregates of juvenile holothurians observed. Crabs, *Lithodes* are observed (one carrying another). No *Pheronema* observed.

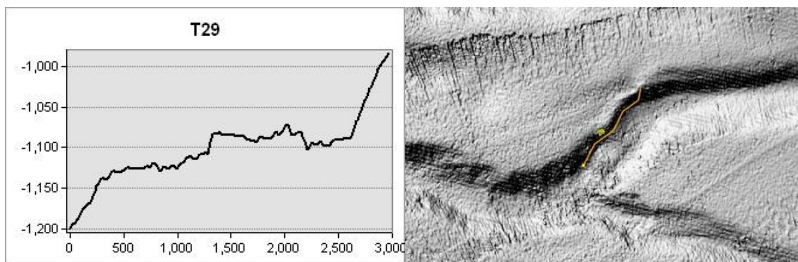
Transect 51 Dive 678



P1. Water depth: 1421 m. **Feature:** Muddy moderate to steep slope throughout.

Initially fauna is sparse, mainly grenadiers and eels. An extensive field of cup corals and later holothurians are abundant on the muddy slope. On soft sediment numerous burrows with a variety of holothurians species and the occasional *Mesothuria* sp. are noted. Various sea pens and a bamboo coral also evident on sediment. Anemones include cerianthids, cup corals, and the smooth variety of *Phelliactis* sp.

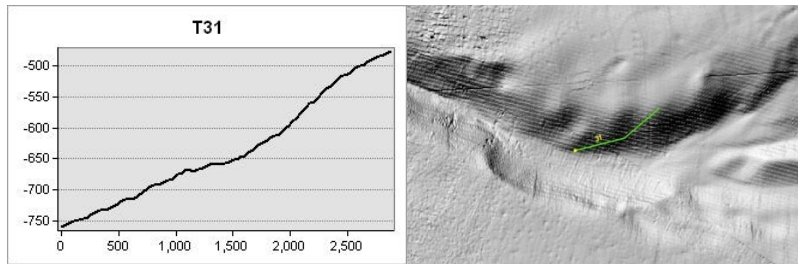
Transect 29 Dive 679



P2. Water depth: 1212m. **Feature:** Soft sediment slope
Of note: Clusters of brachiopods on soft sediment and a lot of plastic.

There is evidence of bioturbation and the occasional burrow in the soft sediment. Clusters of brachiopods and occasional xenophyophores occur. Numerous eels, starfish and some smooth *Phelliactis* anemones are also noted. The bamboo coral *Acanella* sp., anemones and asteroids are abundant on the lower slope. Sea-pens dominate at the upper end. Some *Desmophyllum* rubble is encountered. An interesting red octocoral was sampled. A lot of plastic is observed, scattered across the transect.

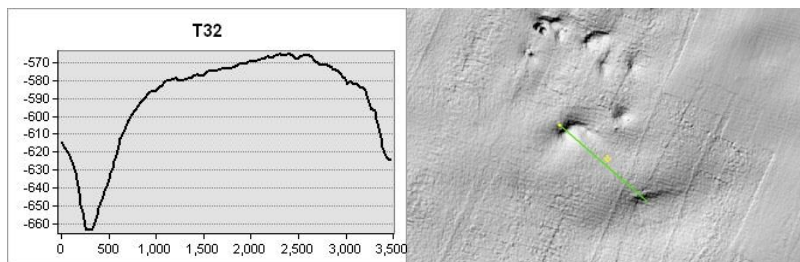
Transect 31 Dive 680



P1. Water depth: 763–673m. **Feature:** Gentle slope.
Of note: Fishing net

Cerianthids, the anemones *Bolocera* and the sea-pen *Kophobelemnon* sp. are commonly observed in the soft sediment. Burrows, some with crabs, are also common. An unknown white coral is observed as is a box crab, *Paramola cuvieri*, with a sponge hat. Fish species include grenadiers and greater forkbeard. A large fishing net was observed on the seabed.

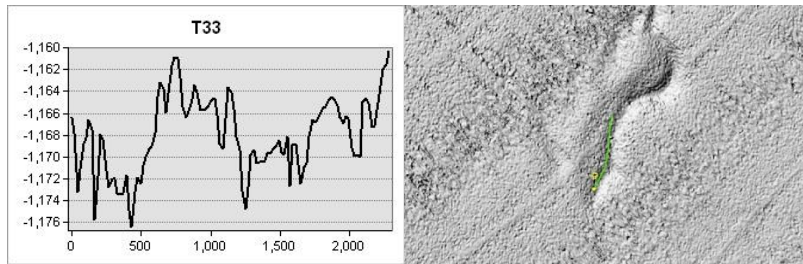
Transect 32 Dive 681



P1. Water depth: 604-570m. **Features:** Small mound

Initially the sediment is mixed sediment of rock and pebble. The dive progressed over the flank of a deep gorge with areas of rippled sediment present on the slope. Cup corals are abundant initially however conspicuous fauna (hermit crabs and cerianthid anemones) are occasional. Krill and fish including *Beryx decadactylus* and chimerids are common. Snagged fishing line and multiple fishing nets (10-15) are observed weighted down with concrete blocks.

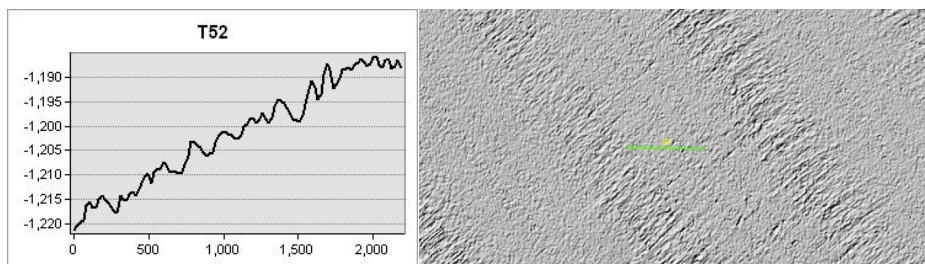
Transect 33 Dive 682



P1. Water depth: 1170 – 1166m. **Feature:** Shallow ridge.
Of note: Foraminifera field

Soft muddy substrate throughout. Fauna is sparse and primarily the anemones *Bolocera* sp. and cerianthids, and the echinoid *Hygrosoma*. Extensive field of foraminiferans (Xenophyphores) observed.

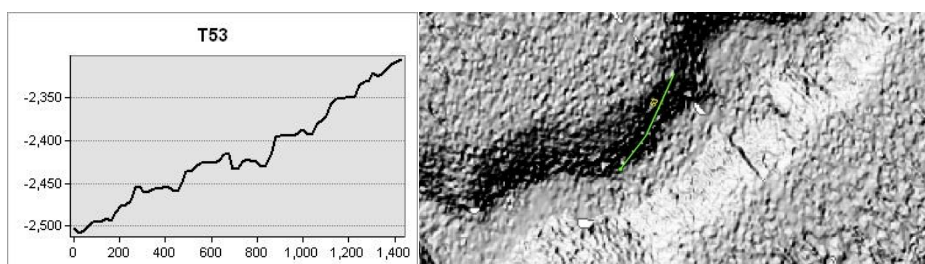
Transect 52 Dive 683



P1. Water depth: 1207 – 1205m. **Feature:** Pheronema prediction
Of Note: Field of *Pheronema* sponges

The *Pheronema* aggregation occurs on a soft silty bottom. Some tunicates, holothurians and crinoids observed among the sponges. The aggregation is very dense, with sponges varying both in shape and size. Extensive sampling of *Pheronema* specimens and its physical environment (benthic water samples) was undertaken. A single large *Hyalonema* sponge was also sampled.

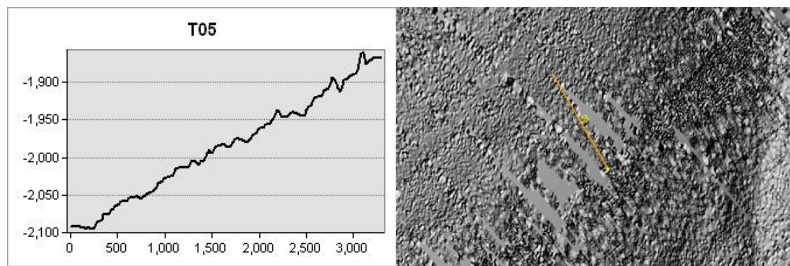
Transect 53 Dive 684



P1. Water depth: 2511-2487m. **Feature:** Canyon, escarpment
Of Note: Cup corals and soft coral *Anthomastus*, strong currents

Primarily soft sediment. Fauna includes the cup coral *Flabellum*, the soft coral *Anthomastus*, starfish, echinoids, ophiuroids and occasional burrows. A discarded, corroded oil drum is observed. Dive aborted after 50 minutes with a suspected umbilical problem.

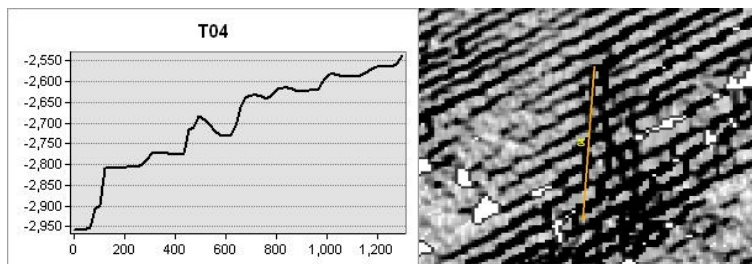
Transect 05 Dive 685



P2. Water depth: 2511-2487m. **Feature:** Canyon, escarpment
Of Note: Stalked crinoids and burrows

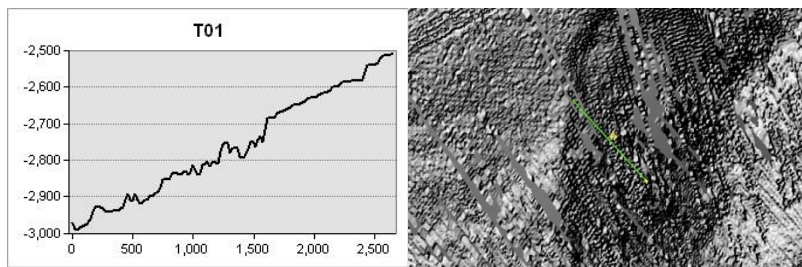
Soft sediment with stalked crinoids and burrows. Occasionally the crinoids have ophiuroids on them. A variety of sea pens including *Anthoptilium* are observed. Anemones are rare but include *Phelliactis* and cerianthids. Occasional echinoids are observed. Fish species include eels and grenadiers.

Transect 04 Dive 686



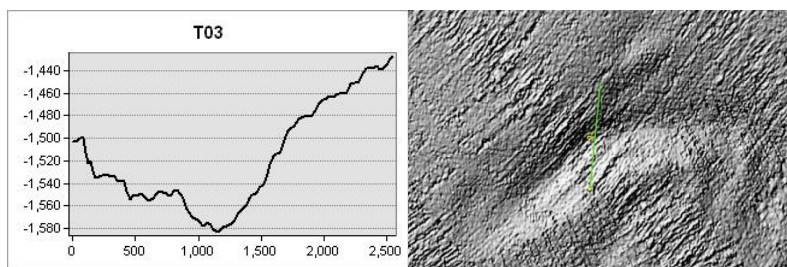
P2. Water depth: 2970-2650m. **Feature:** Slope
Of Note: Yellow Sponges/Tunicates

Predominantly vertical/steep walls, soft sediment and sparse epifauna. On an area of boulders and bedrock a distinct community of yellow sponges is observed and sampled.

Transect 01 Dive 687

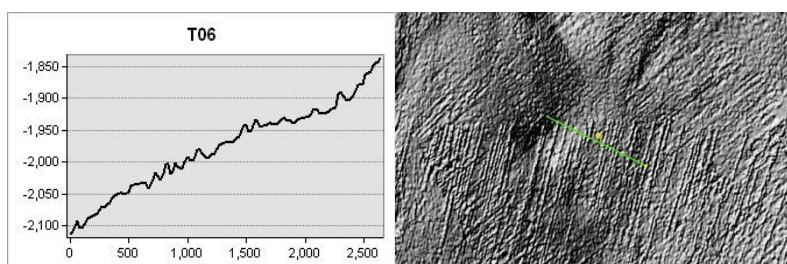
P1. Water depth: 2948–2832m. **Feature:** Steep slope

Soft sediment on a gentle slope. The fauna observed includes large purple holothurians and echinothurid urchins. Interestingly, many urchins have a small (probably juvenile) *Lithodes* crab beside them. Numerous unusual marks / tracks evident in the sediment, origin unknown.

Transect 03 Dive 688

P1. Water depth: 1492–1552m. **Feature:** Ledge
Of Note: Unusual areas of disturbed sediment

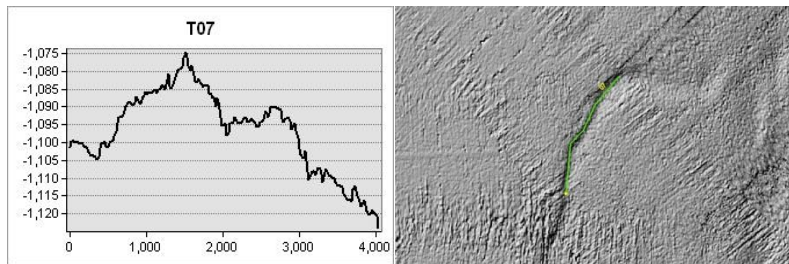
Seafloor is a gentle slope of soft sediment and burrows. Fauna include starfish, a variety of anemones (*Phelliactis* sp. & cerianthids) and holothurians, including *Mesothuria* sp. Dense aggregations of larvae / amphipods observed on occasion. Smooth furrows evident in sediment, origin unknown. Observed munitions shell casings.

Transect 06 Dive 689

P1. Water depth: 2118–2020m. **Feature:** Slope
Of Note: Occasional dense patches of small white echinoids

The seafloor was uniformly soft sediment with burrows. Fauna include ophiuroids, holothurians, stalked crinoids, and the occasional sea-pen. Anemones including cerianthids and *Phelliactis* are common, with cup corals occurring frequently. Fish are not common and include eels and grenadiers.

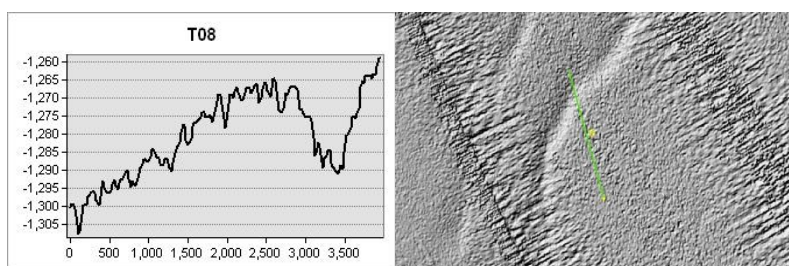
Transect 07 Dive 690



P1. Water depth: 1104m. **Feature:** Ridge
Of Note: *Pheronema* Aggregation

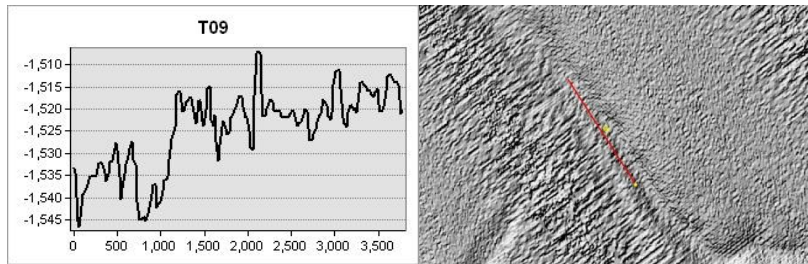
Primarily soft sediment with a strong bottom current throughout. Dense aggregation of *Pheronema* observed with diverse infauna including brisingids, anemones (including *Phelliactis* & cerianthids) and sea-pens (commonly *Kophobelemnon*). With the exception of *Lepidion* and the occasional eel, few fish species are present. Occasional bamboo coral *Acanella* and sponge *Hyalonema*. Where *Pheronema* was less dense holothurians, burrows and sea pens were common. Extensive sampling of *Pheronema* aggregation for University of Plymouth.

Transect 08 Dive 691

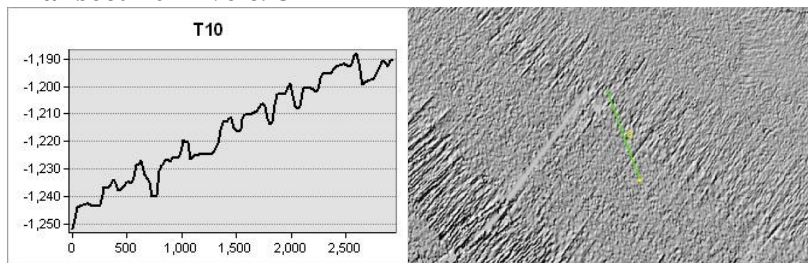


P1. Water depth: 1292m. **Feature:** Ridge
Of Note: Very small, possibly juvenile Chimerids.

The sediment is soft with burrows (some with galatheids). Fauna is sparse and includes cup corals, cerianthids, asteroids crinoids, sea pens and a variety of holothurian species. An expected *Pheronema* aggregation, nor any individual sponges are observed.

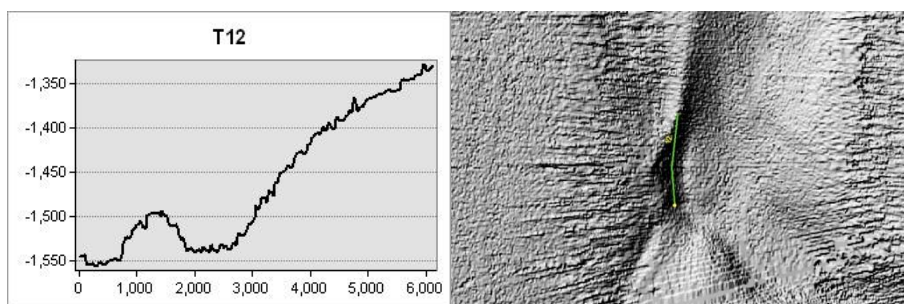
Transect 09 Dive 692**P3. Water depth: 1535m. Feature: Ridge**

Soft sediment with sparse fauna. Species include the asteroid *Zoroaster* sp. and cerianthid anemones. Fish species include grenadiers and cutthroat eels.

Transect 10 Dive 693**P1. Water depth: 1239-1215m. Feature: Ridge**

Of Note: No *Pheronema*

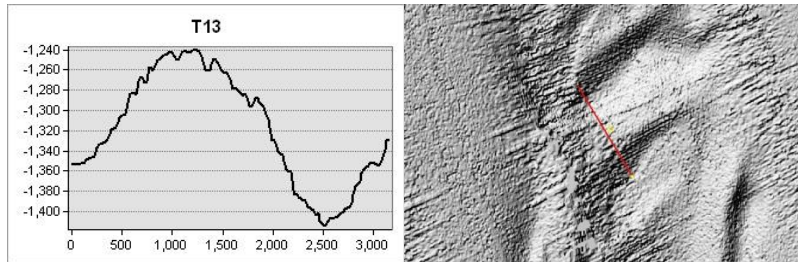
This site was selected as a potential location for *Pheronema* sponges as per the predictive ecological model, however none are observed. There is a gentle, muddy slope on which the holothurian *Laetmogone* sp. and cup corals are frequently observed. An unknown sea pen was sampled for identification.

Transect 12 Dive 695**P1. Water depth: 1646 -1500m. Feature: Interesting bathymetric data**

Of Note: *Solenosmilia* coral garden

Followed planned transect (~50 m) before turning west up-slope. A seafloor of pebble/cobble substrate and occasional rocks transitioning to fine sediment coral rubble upslope. A diverse coral garden is observed, with *Solenosmilia variabilis*, *Paramuricea* sp. and sponges (various morphotypes). Hermit crabs with zooanthids are common throughout the dive. Some litter encountered.

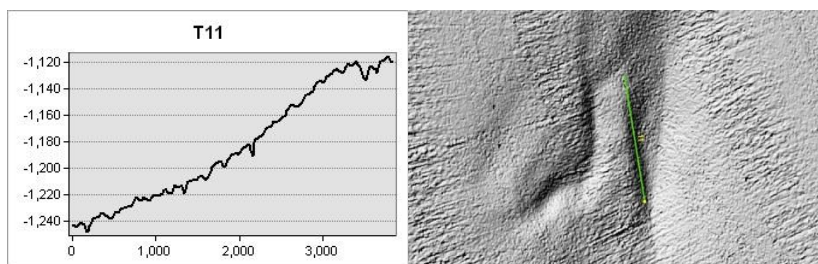
Transect 13 Dive 696



P3. Water depth: 1333–1228m. **Feature:** Interesting bathymetric feature
Of Note: *Solenosmilia*, diverse coral species, orange roughy.

Initially there is a dense bed of polychaete tubes *cf. Lanice* sp. *Solenosmilia* and a variety of corals species, including *Acanthogorgia* (a fine branching gorgonian) observed on boulders. Sponges, including *Aphrocallistes* also present on rocks. The ophiuroid *Gorgonocephalus* is observed. On soft ground, anemones including cerianthids, *Bolocera* and *Phelliactis* are present.

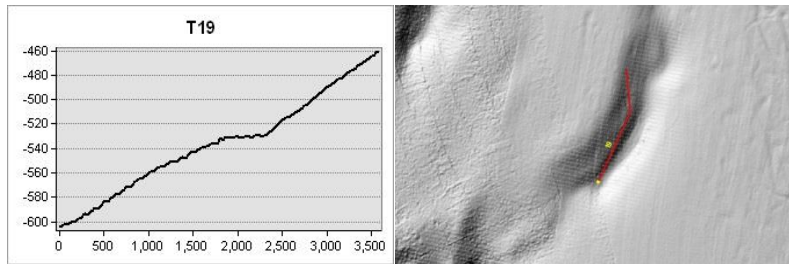
Transect 11 Dive 697



P1. Water depth: 1206–1228m. **Feature:** Slope

Soft sediment, muddy flat/gentle slope throughout the whole dive. Predominantly featureless with sparse fauna. Cutthroat eels are present from start to finish.

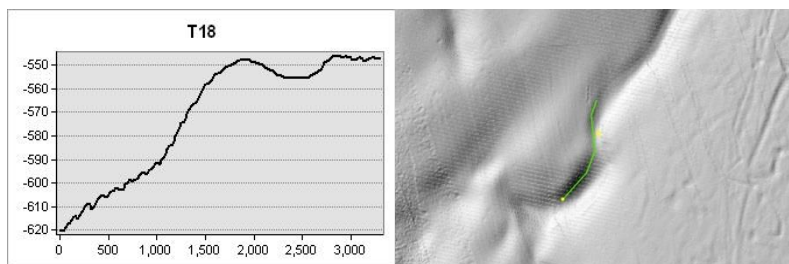
Transect 19 Dive 698



P3. Water depth: 602m. **Feature:** Slope
Of Note: Trawl marks.

Predominantly featureless soft sediment on flat/gentle slope throughout dive. Dense krill swarms initially with some scabbard fish. Occasional hermit crabs are the only observed fauna. Old trawl lines are visible on seafloor and on radar.

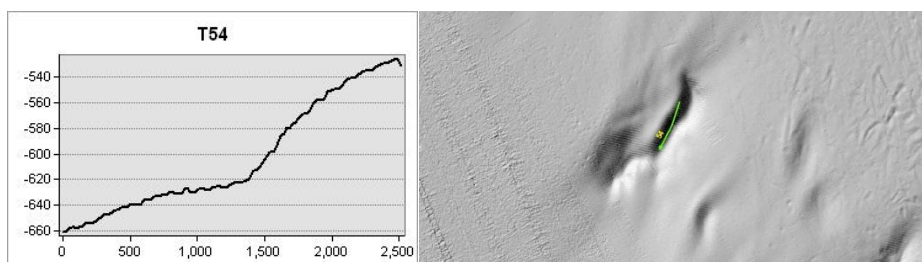
Transect 18 Dive 699



P1. Water depth: 620m. **Feature:** Track slope feature
Of Note: Strong down slope current, brisingids.

Soft sediment over a slope with a strong downslope current. Dense krill swarms initially. Frequent brisingids and a variety of anemones throughout the transect. Sea-pens are observed upslope. Fish include blackbellied rosefish (frequently), Chimerids and one large Angler fish (with crustaceans around it).

Transect 54 Dive 700



Water depth: 660m. **Feature:** Slope feature
Of Note: Abundant juvenile squat lobsters and dense krill

Soft sediment with numerous juvenile *Munida* sp. Juvenile squat lobsters also frequent. Cup corals, hermit crabs and the anemone *Actinauge* sp. are commonly observed. In one area a large number of hermit crabs were encountered. Periodically there were also dense patches of sponge. The second half of the dive was dominated by numerous *Bolocera* sp. anemones together and a variety of sea-pens, mainly *Kophobelemnion* sp. Some litter is present.

3.4 Survey Log

Thursday 01st August - Science team arrived and began mobilisation (YL, DOS, LH, FOT, GIB, PK, LA, HMC, LO). Artist (ANR) arrived. Safety tour and vessel orientation. Science team meeting to introduce survey objectives. Watch details agreed and duties assigned. Meeting with Captain and ROV team at to discuss survey plans. Prepped dry and wet lab for scientific operations. DOS disembarked.

Friday 02nd August - Departure delayed from 0600 to 1000 due to heavy fog. ROV wet test at 40m off Old Head (1245) and following successful completion began transit to T37. Conducted muster drill. Agreed short-term survey plan with captain.

Saturday 03rd August - 1130 Arrived at first site and deployed ROV with no issues. Trouble shooting with OFOP to fix calibration issue. Completed two stations, T37 & T38.

Sunday 04th August - Working to schedule with an eye on changeable weather conditions. Technical issue with ROV prevented sediment collection at T40. Completed T40, T47, T41.

Monday 05th August - Good progress as weather continues to hold. No issues reported. Completed T43, T42, T45 & T46.

Tuesday 06th August - Continued good progress. Routine collection of biological and sediment samples. Changeable weather and incoming storm front likely to impact on survey plan. Completed T48, T44, T36.

Wednesday 07th August - Very efficient progress through the survey area. Some minor OFOP technical issues resolved. Completed T35, T34, T49 & T30.

Thursday 08th August - Weather deteriorating all day, winds gusting at 21 knots at 1200 and increasing to 35knts at 1800. Progress continued by keeping ahead of weather.

Technical issue with ROV arm (right) and needs replacement part. Rearranged sampling tray and ROV configuration in the short-term. Completed T30, T24, T17 and T16 in SAC.

Friday 09th August - Weather continues to worsen but the vessel has avoided unworkable conditions by moving north and towards the Castletownbere port call. Completed T15 & T14. The remaining dives (T20, T21, T22 and T23) are in very shallow water (~140m) and were completed quickly before returning to CTB for Port Call.

Saturday 10th August - 1400 Port call in CTB harbour. Scientific personnel changeover with HMC, LA, PK & LO replaced by DOS, PC, RR & RS. Spare parts for ROV arm mobbed, fitted and tested successfully. Vessel orientation for new personnel. Data back-up from Leg 1 and prep for Leg 2. Very high swell / wind delayed departure. 2200 slow passage to new survey area.

Sunday 11th August - Leg 2 began in moderate conditions which improved all the time. Onboard training of survey procedures, report preparation and collation of outreach materials. Completed T27, T26 & T25.

Monday 12th August - Weather is stable. Onboard systems continue to work well, Completed T28, T51, T29, T31 & T32. T51 is an additional location along a prominent escarpment and based on predicted *Pheronema* model.

Tuesday 13th August - Discovered significant aggregation of *Pheronema* sponges and collected multiple samples. Encountered problem with ROV umbilical and ended dive (T53) early, inspection upon deck deemed ok to continue. No further issues, completed T32, T33, T52 & T53.

Wednesday 14th August - Slower progress due to longer transects, deeper dives and a building swell. Completed T05, T04 & T01.

Thursday 15th August - Continue to monitor the weather. No issues reported. Completed T03, T06 & T07.

Friday 16th August - Conditions unworkable for the ROV launch & recovery causing seven hour weather standby. Vessel moved east to avoid worsening conditions. Data back-ups complete. Completed T08, T09 & T10.

Saturday 17th August - On weather standby as conditions continue to worsen. Monitoring situation hourly.

Sunday 18th August - No significant improvement in weather. Moved west in anticipation of better conditions.

Monday 19th August - Resumed survey at 0400. Completed T12, T13, T11, T19 & T18.

Tuesday 20th August - Completed final dive of survey at 0400 and began transit to Galway.

Finalised data back-ups and cleaned down lab areas and work space. Met harbour pilot at 1900 and tied up in Galway docks at 2000.

Wednesday 21st August - Completed back-ups, demobbed survey gear and samples. ROV demobbed to P&O yard. 1300 Post-cruise meeting onboard CE. Scientific personnel signed off vessel by 1500.

4. Conclusions

These are preliminary findings of a collaborative survey undertaken at the Irish continental margin and Porcupine Seabight to document sensitive biological habitats in relation to geomorphic features. The survey areas encompass the slopes and canyon systems along the southern extent of Ireland's western shelf edge, including the Porcupine Bank, Porcupine Seabight, the Southwest Approaches and other areas of interest. In some cases the data are novel, being from previously undescribed areas, elsewhere the survey builds on existing knowledge. To better describe 'natural' habitats, areas with little historic anthropogenic interference were selected.

The characteristics of the seafloor delineate the structure and functioning of marine ecosystems, especially for species and communities living on the sea floor (benthic ecosystems). The combination of topography and water movement along the survey area can provide optimal conditions for filter-feeders such as cold-water coral. Biologically sensitive Annex 1 reef-forming, cold-water coral species *Desmophyllum pertusum* (previously *Lophelia pertusa*) and *Madrepora oculata* were identified in numerous locations. The stony coral, *Solenosmilia variabilis*, was also observed in individual clumps and forming reef at >1600m, which has previously only been reported in Irish waters by the 2017 EMFF off-shore reef survey (O'Sullivan et al. 2017).

Constant food supply and water movement can also promote wider marine biodiversity along the shelf edge. The survey also discovered a previously unknown aggregation of the birds nest sponge, *Pheronema carpenleri*. Multiple specimens and water samples were taken in the vicinity of the sponge field to help study the ecological diversity of the species within the wider North Atlantic. The finding also helps ground-truth niche ecological models developed to predict the presence or absence of biological communities at depth. Further biological sampling of various species will contribute towards ongoing population genetics studies while sediment samples will help study the proliferation of micro-plastics at depth.

The findings of the SeaRover survey will contribute to the setting of site specific conservation objectives by NPWS for the offshore Special Areas of Conservation (SAC) and will additionally contribute to fulfilling the Department of Agriculture, Food and Marine (DAFM) obligations to map vulnerable fisheries resources. The study will also be used within Descriptor

6 of the Marine Strategy Framework Directive (MSFD) which focusses on seafloor integrity. The data will help target future mapping of reef habitat and inform further study in other areas of Ireland's offshore territory. This will significantly strengthen the availability of comprehensive biological baseline datasets critical to the formulation of future policy on the management and conservation of Ireland's deep-water resource.

5. References

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Further details available on www.emff.marine.ie

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