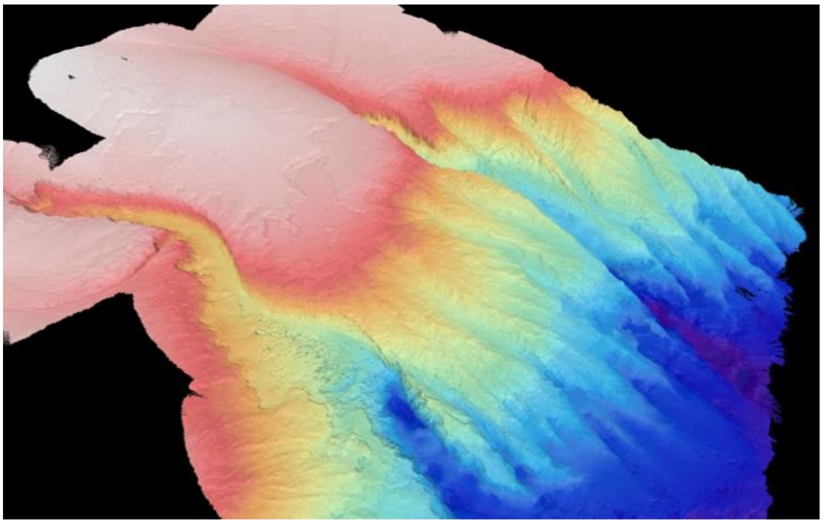
Australian Government
Geoscience Australia

Australian Government
Parks Australia

Australian Marine Parks

Marine Biodiversity Hub
National Environmental Science Programme



Gascoyne Marine Park

Post-survey report, RV *Falkor*, FK200308 (GA4859)

GEOSCIENCE AUSTRALIA
RECORD 2020/30

Alix Post[1], Rachel Przeslawski[1], Zhi Huang[1], Deb Smith[2], Lisa Kirkendale[3], Nerida Wilson[3]

1. Geoscience Australia
2. Schmidt Ocean Institute
3. Western Australian Museum

Department of Industry, Science, Energy and Resources
Minister for Resources, Water and Northern Australia: The Hon Keith Pitt MP
Secretary: Mr David Fredericks PSM

Geoscience Australia
Chief Executive Officer: Dr James Johnson
This paper is published with the permission of the CEO, Geoscience Australia

Geoscience Australia acknowledges the traditional custodians of the country where this work was undertaken. We also acknowledge the support provided by individuals and communities to access the country, especially in remote and rural Australia.

ISSN 2201-702X (PDF)
ISBN 978-1-925848-99-1 (PDF)
eCat 144204

Bibliographic reference: Post, A.L., Przeslawski, R., Huang, Z., Smith, D., Kirkendale, L., Wilson, N. 2020. *Gascoyne Marine Park post-survey report, RV Falkor, FK200308 (GA4859)*. Record 2020/30. Geoscience Australia, Canberra. http://dx.doi.org/10.11636/Record.2020.030

Version: 2002

Contents

Executive summary 1
1 Introduction 3
1.1 Background and Rationale for Survey 3
1.2 Australian Marine Park Context 5
1.3 Aims and Objectives 6
1.4 Survey Area 7
1.4.1 Geological history and setting 7
1.4.2 Oceanographic setting 7
1.4.3 Geomorphology and sedimentology 9
1.4.4 Benthic habitats and ecology 9
2 METHODS AND DATA COLLECTED 11
2.1 Survey Design 11
2.2 Multibeam sonar mapping 11
2.3 Sub-Bottom Profiles 14
2.4 Seabed sampling 14
2.5 ROV Deployments 15
3 Results and Preliminary Interpretations 17
3.1 Seabed features 17
3.1.1 Canyon morphology 17
3.1.2 Changes in canyon morphology over time 21
3.1.3 Sub-seabed structure 23
3.2 Biological communities 23
3.3 New Discoveries 27
4 CONCLUSIONS AND FUTURE WORK 29
5 REFERENCES 30
6 Acknowledgements 33
Appendix A - Survey participants 34
Appendix B – Permits 34
Appendix C – Summaries of ROV Image Transects 43
Transect S0332 43
Transect S0333 43
Transect S0335 44
Transect S0336 45
Transect S0337 46
Transect S0338 47
Transect S0339 47
Transect S0340 48
Transect S0342 48
Transect S0343 49
Transect S0346 49
Transect S0347 50

Appendix D – List of biological specimens collected ... 51
Crustacea ... 51
Fish ... 60
Marine Invertebrates ... 62
Molluscs ... 71
Worms ... 77

Executive summary

The deep waters within the Gascoyne Marine Park have been largely unexplored for their seafloor biodiversity. Survey FK200308 on the RV *Falkor* targeted two canyons within the Gascoyne Marine Park to understand and map the distribution and diversity of marine habitats and biota within the Cape Range and Cloates Canyons. These canyons were targeted to better understand their ecological significance as a conduit between shelf environments adjacent to the Ningaloo Reef and the abyssal plain. They occur within the habitat protection and multiple use zones of the Gascoyne Marine Park off north-western Australia.

Survey FK200308 was led by researchers at the Western Australian Museum, and included scientists from Geoscience Australia, Curtin University, Macquarie University and Scripps Institute of Oceanography. Multibeam sonar was used to map parts of the marine park, while a Remotely Operated Vehicle (ROV) SuBastian was deployed to undertake a comprehensive taxon inventory of the North-west canyon fauna based on underwater imagery and sampling. Additional biological samples were collected via plankton sampling, as well as fish and crustacean traps on a lander, and stand-alone fish trap deployments. Autonomous Reef Monitoring Structures (ARMS) were deployed at select sites to capture cryptic benthic organisms over several years. DNA samples from the water column (eDNA) were collected to enable a broader understanding of the biodiversity of the region, and to provide a methodological comparison to the organisms present at the time of sampling.

The key drivers for this survey were to collect information to enhance our understanding of Gascoyne Marine Park and deep-sea environments throughout Western Australia, and to facilitate comparisons between the north-west and eastern and southern Australian deep-sea waters. This information can be applied to inform marine park management, scientific research and industry activities for the North-west. Specifically, this survey provided:

- A faunal inventory as baseline information for monitoring deep water WA environments. A total of 2570 seafloor images were annotated from 12 quantitative transects in Cape Range Canyon, more than 1000 samples were curated and up to 30 new species discovered across both Cape Range and Cloates Canyons.
- High-resolution mapping of the seafloor across an area of 11,250 km^2.This detailed information on seabed habitats and environments in Gascoyne Marine Park provides a regional context in which to interpret the faunal inventory.
- Repeat multibeam mapping of the Cape Range and Cloates Canyons informed our understanding of seabed stability in the canyons of Gascoyne Marine Park, illustrating an application of seabed mapping to support monitoring in Australian waters.
- 20 deployments of a state-of-the-art ROV helped inform a new ROV field manual (Monk et al., 2020), which has been added to the existing suite of standard operating procedures used to guide marine sampling in Australian Marine Parks (https://marine-sampling-field-manual.github.io/).

This survey confirmed that canyons within Gascoyne Marine Park are ecologically important systems, supporting numerous deep-sea species, many of which were discovered to be new to science. The advanced capabilities of the ROV SuBastian to navigate and image complex (near vertical) walls and overhangs within the canyons revealed patterns in the distribution of the seafloor taxa consistent with small-scale environmental variability. Repeat multibeam mapping revealed a dynamic canyon system that continues to be shaped by turbidity currents. The occurrence of reworked seagrass blades within the canyons provided a new understanding of these canyon systems as an active conduit between shallow shelf and abyssal environments. The distribution of the seabed biota revealed through quantitative ROV transects emphasised the importance of disturbance patterns in shaping the canyon ecosystems.

1 Introduction

1.1 Background and Rationale for Survey

Very little is known about the deep waters of Australia's marine parks, particularly off the West Australian margin. The North-west Marine Park Network was established in 2012 to protect examples of the region's marine ecosystems and biodiversity within 13 marine parks, based largely on ten Key Ecological Features (KEFs), including the canyons extending from Cape Range to Cuvier Abyssal Plain (Falkner et al., 2009). Effective management of the marine parks requires baseline datasets to monitor and assess the effectiveness of management actions, and this can be particularly challenging in environments with high slope or rugosity as traditional imagery systems may not be suitable for deployment or acquisition of quality data. Prior to survey FK200308 on the RV *Falkor* there had been no comprehensive taxonomic survey to characterise the marine biodiversity of the Cape Range and Cloates Canyons within Gascoyne Marine Park, or to understand the distribution of canyon habitats in relation to the seabed morphology.

This survey targeted two significant and biologically unexplored submarine canyons (Cape Range and Cloates Canyon) within the habitat protection and multiple use zones of Gascoyne Marine Park (Figure 1). Falvey & Veevers (1974) described these canyons as low-relief and broad with smooth floors, suggesting that they are inactive. Existing bathymetry data collect in 2008 and a few previous seafloor images and dredges from the region provided a regional context for understanding the habitats in these canyons (Daniell et al., 2009). High-resolution bathymetry mapping was undertaken during the current survey to extend the baseline dataset of environments and seabed habitats, and to provide further context for undertaking a comprehensive taxonomic survey of the region. Repeat multibeam surveys over the canyons provided information on seabed stability in the canyon over a 12 year period, a rare opportunity to apply multibeam mapping as a tool for monitoring change (e.g. Normandeau et al., 2019).

A comprehensive taxon inventory was established through use of a state-of-the-art Remotely Operated Vehicle (ROV). Imagery and samples collected with the ROV SuBastian provided the high spatial accuracy required for a baseline characterisation of the biodiversity of the North-west canyon fauna.

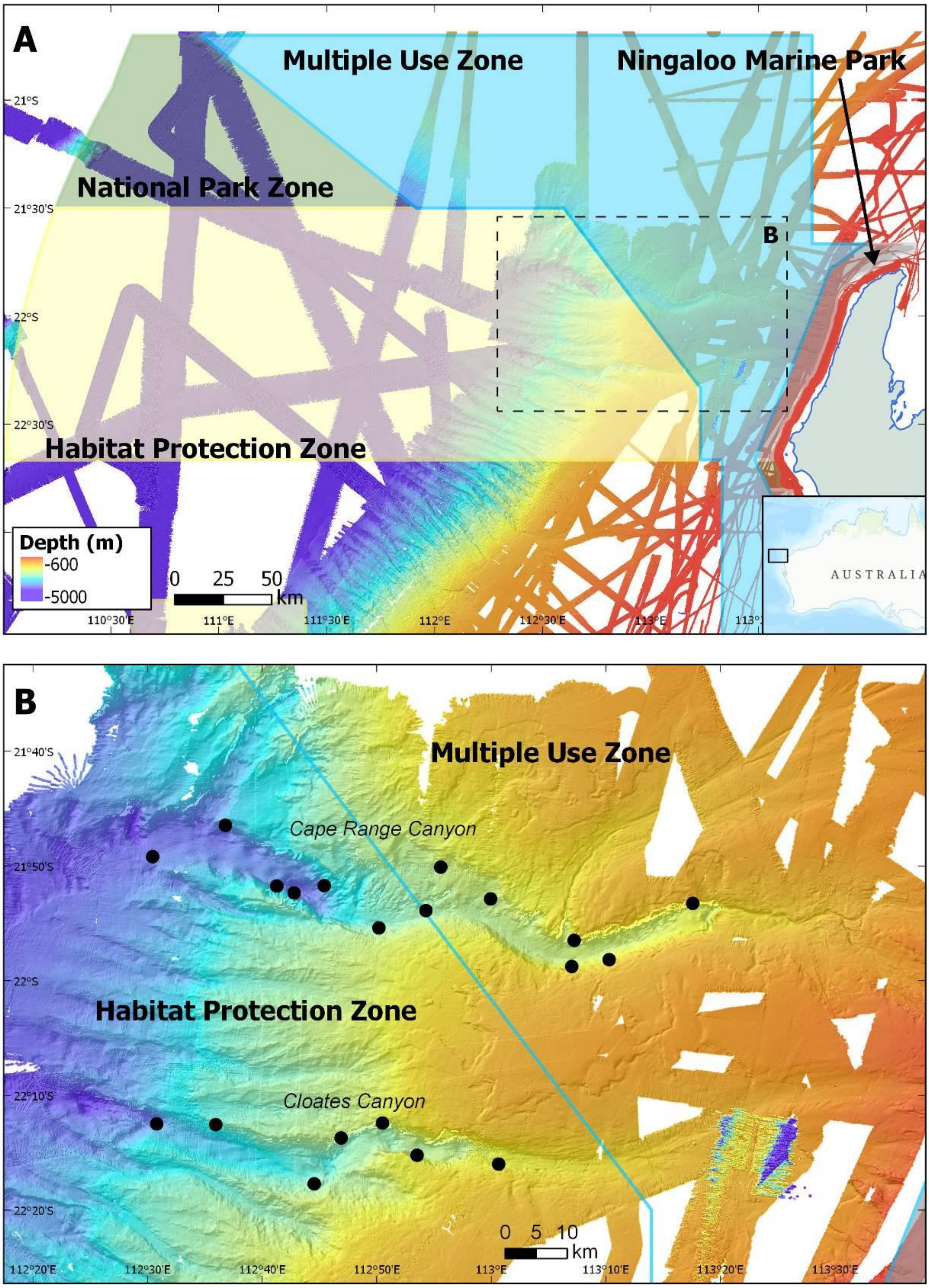


Figure 1. A) Gascoyne Marine Park zones of the NW margin of Western Australia showing existing multibeam mapping prior to the survey. The survey area is outlined (dotted line) and shown in B. B) Planned ROV transects (black dots) within Cape Range Canyon and Cloates Canyon. Blue line indicates boundary between zones within Gascoyne Marine Park.

1.2 Australian Marine Park Context

Gascoyne Marine Park covers 81,766 km^2, with a depth range of 15 to 6000 m. The marine park encompasses several Key Ecological Features (KEFs): 1) Exmouth Plateau, a tropical deep-sea plateau; 2) Cape Range and Cloates submarine canyons; and 3) Continental Slope demersal fish communities (Figure 2) (Falkner et al., 2009). The upper slope of Gascoyne Marine Park is also an important foraging area for the pygmy blue whale (Double et al., 2014).

Gascoyne Marine Park lies adjacent to the Ningaloo Coast World Heritage Area which comprises: Ningaloo Marine Park (Commonwealth waters), a KEF identified as “Commonwealth waters adjacent to the Ningaloo Reef”; Ningaloo Marine Park (State waters) including Ningaloo Reef, the largest fringing reef in the world; and terrestrial areas that include Cape Range National Park.

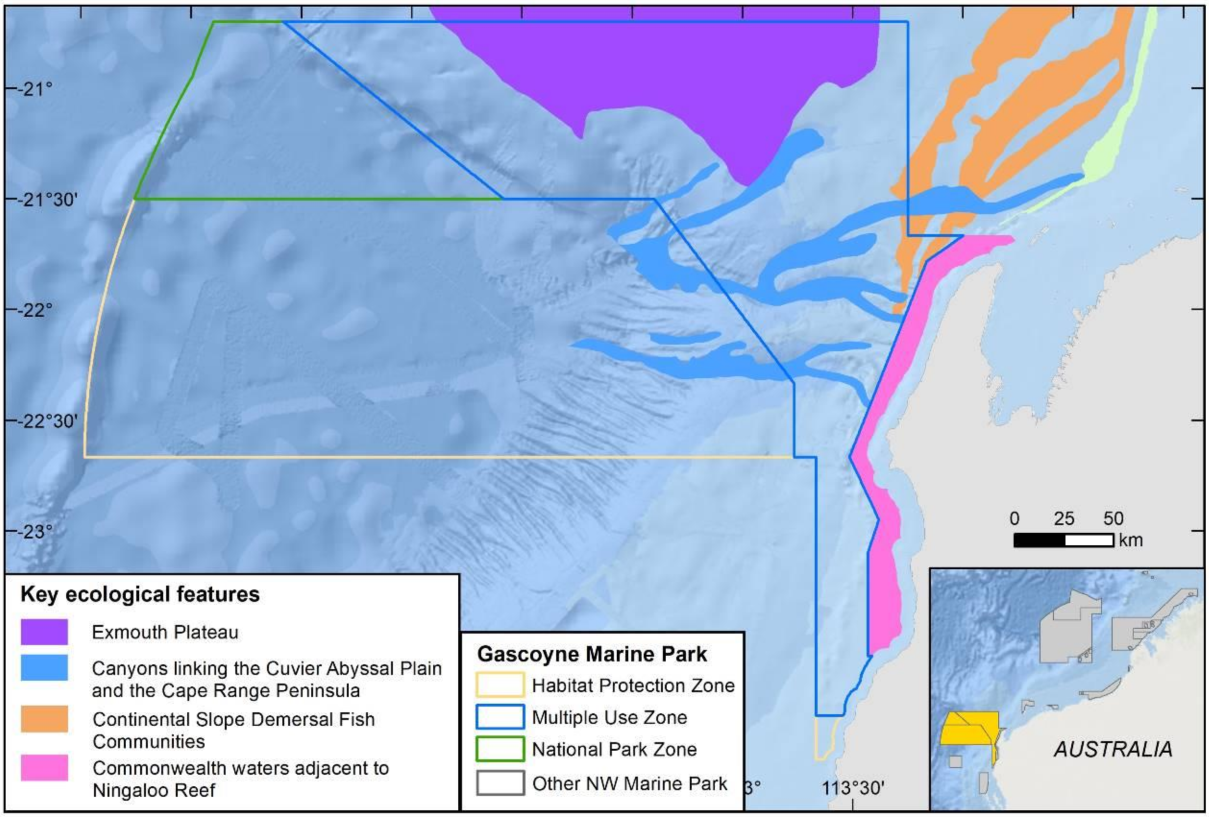


Figure 2. Key Ecological Features within the Gascoyne Marine Park, North-West Australia. The inset shows the location of the Gascoyne Marine Park (yellow) within the Northwest Marine Park network (dark grey).

Canyons in this area provide an important connection between the abyssal plain environments and the Commonwealth waters adjacent to Ningaloo Reef on the continental shelf. The canyons also connect to the Exmouth Plateau on their northern side. A combination of internal tides and eddies at the heads of the Cape Range and Cloates Canyons are thought to aid upwelling of nutrient-rich Antarctic intermediate water onto the continental shelf, where it interacts with the Leeuwin Current to produce localised patches of high productivity (Brewer et al., 2007). This high productivity has been related to aggregations of whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish and seabirds in the area (Sleeman et al., 2007). The hard canyon walls have been shown to provide habitat for deepwater snapper (Brewer et al., 2007), as well as a range of sessile invertebrates, while soft sediments on the canyon floor support a range of mobile invertebrates (Daniell et al., 2009). However, prior to this survey there had been no comprehensive taxonomic survey to characterise the marine biodiversity of the canyons or to understand the distribution of canyon habitats in relation to the seabed morphology.

1.3 Aims and Objectives

The survey within Gascoyne Marine Park aimed to understand and map the distribution and diversity of marine habitats and biota in the Cape Range and Cloates Canyons. The survey, led by the Western Australian Museum (WAM; Chief Scientist, Nerida Wilson), included other experts from WAM, Curtin University, Macquarie University, Geoscience Australia and Scripps Institute of Oceanography (see full list in Appendix A). Multibeam sonar was used to map parts of the marine park, while a Remotely Operated Vehicle (ROV) was deployed to undertake a comprehensive taxon inventory of the North-west canyon fauna based on underwater imagery and sampling. Additional biological samples were collected via plankton sampling, as well as fish and crustacean traps on a lander, and stand-alone fish trap deployments. Autonomous Reef Monitoring Structures (ARMS) were deployed at select sites to capture cryptic benthic organisms over several years. DNA samples from the water column (eDNA) were undertaken to enable a broader understanding of the biodiversity of the region, and to provide a methodological comparison to the organisms present at the time of sampling.

Information from this survey will greatly enhance our understanding of Gascoyne Marine Park and deep-sea environments throughout Western Australia, as well as facilitating comparisons between recent deep-sea information from eastern and southern Australia. This information will be applied to inform marine park management, scientific research and industry activities for the North-west. Specifically:

- The faunal inventory provides baseline environmental information for monitoring deep water WA environments. This may be used to assess impacts of natural and anthropogenic activities that occur in the region e.g. heat waves (Caputi et al., 2019); offshore industry (Spies et al., 2017), as well as contributing to our knowledge of the biogeography of deep-sea and canyon-associated fauna.
- The seafloor mapping extends and provides a more detailed understanding of seabed habitats and environments in Gascoyne Marine Park, providing the regional context of canyon habitats in which to interpret the faunal inventory.
- Repeat mapping provides information on seabed stability in the canyons of Gascoyne Marine Park, illustrating an application of seabed mapping to support monitoring in Australian waters.
- The e-DNA component, to be presented in future scientific papers, will serve as a comparison to more traditional techniques to inform future baseline and monitoring approaches that may be suitable (or unsuitable) for marine park management, thereby informing future SOPs that may be developed.
- Deployment of a state-of-the-art ROV helped inform a new ROV field manual (Monk et al., 2020), which has been added to the existing suite of standard operating procedures used to guide marine sampling in Australian Marine Parks (https://marine-sampling-field-manual.github.io/).

1.4 Survey Area

1.4.1 Geological history and setting

Cape Range Canyon lies directly to the south of Exmouth Plateau, lying offshore from the Cuvier margin. The bulk of the sedimentary succession on the NW Australian margin accumulated during Early Jurassic to Early Cretaceous rifting from Greater India (Ali & Aitchison, 2005). The Exmouth Plateau has been a carbonate-dominated deep-marine basin since the Late Cretaceous (Exon et al., 1992). The Exmouth Sub-basin, to the south east, contains up to 15 km of Triassic to Recent marine and non-marine siliciclastics and supports prospective Mesozoic petroleum systems (Daniell et al., 2009). A regional seal is formed by Lower to Upper Cretaceous marine shales and siltstones, while Upper Jurassic marine shales form the principal hydrocarbon source.

Depositional processes over the Exmouth Plateau can be divided into two periods. During the Late Cretaceous to late Miocene, depositional and erosional features were dominated by slope-parallel bottom currents, whereas from the late Miocene to present, deposition was dominated by down-slope, gravity-driven processes (Nugraha et al., 2019). These regimes were associated with changes in the global and regional oceanography caused by the opening of the southern margin between Australia and Antarctica, and the closing of the Indonesian Seaway to the north.

The lack of seismic coverage over the Cape Range and Cloates canyons makes it difficult to predict whether these canyons are underpinned by sedimentary rocks or basement. Dredges and grabs collected in the more deeply incised sections of the Cape Range Canyon during a 2008 survey on the RV *Sonne* yielded a variety of rock types including sandstone, siltstone, claystone, limestone and some volcanics (Daniell et al., 2009). Extensive thick volcanic deposits formed along the western margin during continental breakup at ~135 Ma (Symonds et al., 1998). Dredges and grabs collected from Cloates Canyon recovered siltstones and stratified sandstone-siltstone (Daniell et al., 2009).

1.4.2 Oceanographic setting

Waters offshore of north-western Australia are dominated by the northward flowing Western Australian Current (WAC) and the southward flowing Leeuwin Current (Wells and Wells, 1994). The Western Australian Current occurs at depths of 300 – 2000 m (Tchernia, 1980) and is a cold, high salinity and nutrient-rich current (Spooner et al., 2011) formed from Antarctic Intermediate waters. The Leeuwin Current is a warm, nutrient-poor surface current, which in this region influences the nearshore area, forming a narrow strip (~50 km wide) centred over the shelf break (at ~200 m depth) (Brewer et al., 2007). Localised upwelling of nutrient-rich waters at the heads of large canyons and at the shelf break produces patches of high productivity within the euphotic zone. Offshore winds associated with the south-west monsoon can also create localised upwelling of nutrient-rich waters in the region (Lyne et al., 2005).

MODIS Sea Surface Temperature (SST) and Chlorophyll-a data were obtained from the Integrated Marine Observing System (IMOS; http://imos.org.au/) to analyse the SST and Chlorophyll-a characteristics of Gascoyne Marine Park. Analysis of MODIS SST from Gascoyne Marine Park shows a clear seasonal pattern (Figure 3a). The highest SST occurs in March and April with a monthly mean of ~28°C; while the lowest SST occurs in September with a monthly mean of ~23°C. The pattern of inter-annual variation is also clear (Figure 3b). Over the last 16 years (2003 to 2018 inclusive), the marine park has exhibited a warming trend at a rate of 0.036°C / year (statistically significant at a 90% confidence level). The long-term average SST varies spatially by over 2°C within the marine park, reducing gradually from 26.3°C in the north-eastern corner to 24.1°C in the south-western and southern corners of the marine park (Figure 4a).

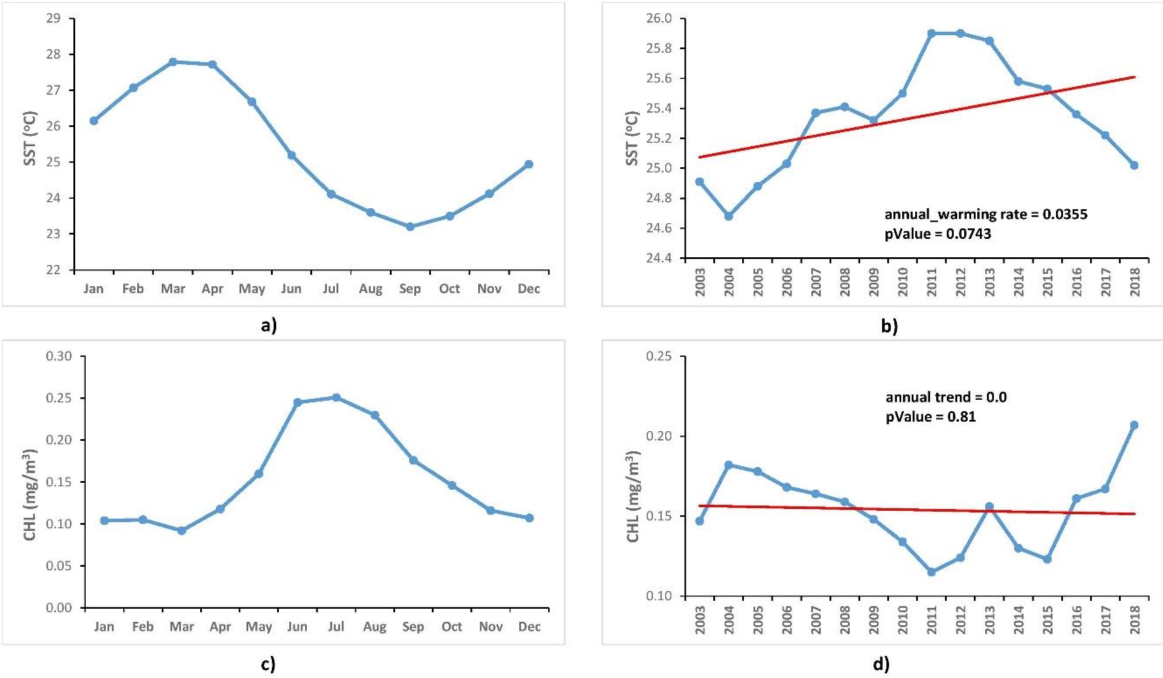


Figure 3. Sea Surface Temperature and Chlorophyll-a properties of Gascoyne Marine Park analysed from daily MODIS satellite imagery (July 2002- July 2019); a) SST seasonal variation; b) SST inter-annual trend; c) Chlorophyll-a seasonal variation; d) Chlorophyll-a inter-annual trend.

Analysis of Chlorophyll-a concentrations in Gascoyne Marine Park shows a clear seasonal pattern (Figure 3c). The highest Chlorophyll-a concentrations occur in the austral winter, with a monthly mean of ~0.25 mg/m^3, while summer concentration are ~0.1 mg/m^3. The inter-annual variation of the Chlorophyll-a concentrations over the period 2003 to 2018 are relatively small, without any clear trend (Figure 3d). However, there is a clear spatial pattern in the long-term mean Chlorophyll-a concentrations (Figure 4b). The highest Chlorophyll-a concentrations occur in the shallow waters of the marine park, adjacent to Ningaloo Marine Park, with concentrations up to 0.7 mg/m^3. This reduces to ~0.1 mg/m^3 further offshore.

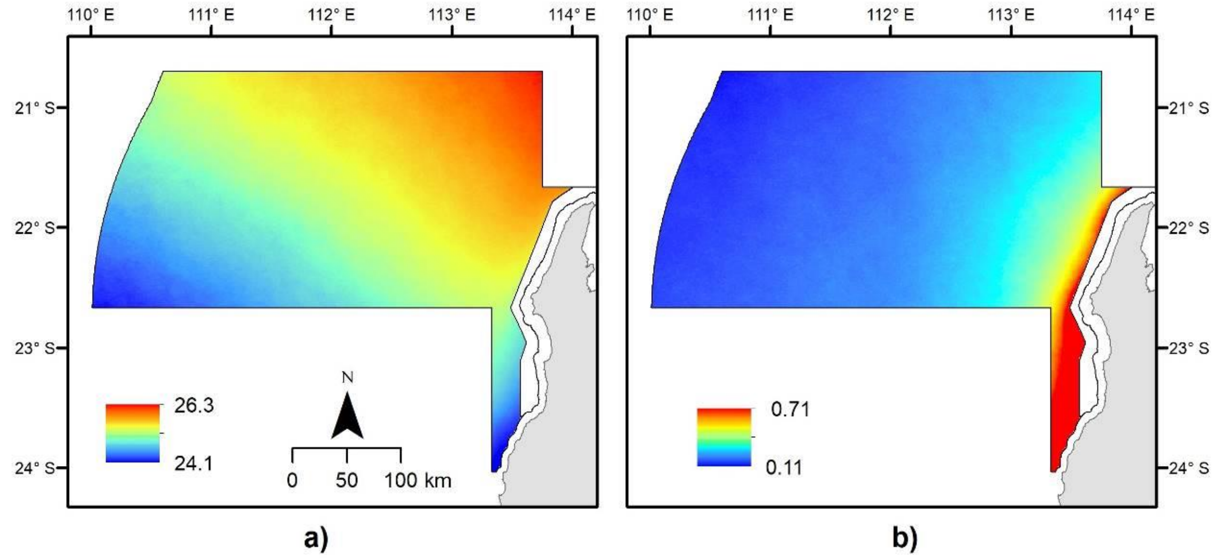


Figure 4. Long-term mean a) sea surface temperature (°C) and b) Chlorophyll-a (mg/m^3) analysed for Gascoyne Marine Park, derived from daily MODIS satellite imagery for the period 2003 to 2018 inclusive.

1.4.3 Geomorphology and sedimentology

Previous multibeam mapping of the Cape Range and Cloates Canyons indicated that these are blind canyons, meaning that they are confined to the continental slope, and do not incise the continental shelf (Huang et al., 2014). However, multibeam data upslope and on the northern wall of the Cape Range Canyon reveals limited connection to the shelf via small channels and gullies. Both canyons have a simple form, with a single valley incised straight down the continental slope. This is typical of canyons that form via headwall retreat into relatively uniform and soft sediments (Hill et al., 2005). The primary mechanisms for canyon formation on the Australian margin are mass wasting (via slumping and landslide events) and erosion by turbidity flows (Farre et al., 1983).

1.4.4 Benthic habitats and ecology

Most of the ecological knowledge of this region has so far been limited to the continental shelf. Patches of coral reefs and rhodolith beds can occur in shallow water on the inner shelf (Brooke et al., 2009), while deeper shelf waters (>40 m) are dominated by sponges and soft corals, which provide habitat to other organisms (Schoenberg & Fromont, 2011). These environments also support diverse assemblages of small macrofauna and infauna dominated by crustaceans (Przeslawski et al., 2013). Unlike other regions in Australia, the clear waters of Western Australia support seagrasses to depths of >40 m, and meadows of *Posidonia coriacea* seagrass have been found in the coastal waters adjacent to the canyons and southwards to Point Cloates (van Keulen & Langdon, 2011).

The benthic invertebrate megafauna of the upper continental slope, off the Cape Range Peninsula, may be distinct from those along the rest of the slope in the North-West bioregion, showing more similarity to those in the South-West bioregion (Williams et al., 2010). Video transects from the lower continental slope along the Cuvier margin (2123–4660 m) reveal scattered benthic invertebrates and demersal fish, with the mouth of the Cloates Canyon home to comparatively higher abundances of suspension feeders, particularly gorgonians (Daniell et al., 2009).

There have been no targeted surveys over the vast abyssal plains of this region, so our understanding of this environment is limited to the knowledge base of other regions, notably, the assumption that the abyssal plain supports cosmopolitan deep-water communities with patches of highly diverse and specialised communities supported by rocky outcrops, hydrothermal vents and whale falls (Levin et al., 2001). Cape Range and Cloates Canyons are notable in the NW region for providing a continuous connectivity corridor between the Cape Range Peninsula (<100 m) and the Cuvier Abyssal Plain (>4500 m), which may regulate the nutrient conditions that support the high biodiversity of Ningaloo Reef.

2 METHODS AND DATA COLLECTED

2.1 Survey Design

Sampling and mapping focussed on areas within and adjacent to the Cape Range and Cloates Canyons (Figure 5). Mapping was designed to provide repeat coverage over the Cape Range and Cloates Canyons, enabling assessment of change and sediment mobility within the canyons compared to data collected by GA on the RV *Sonne* in 2008 (Daniell et al., 2009). Additional gaps in multibeam coverage were also highlighted for mapping, as time permitted.

Twenty ROV transects were planned to characterise fauna across a variety of habitat types within the canyons, including canyon floors, walls and adjacent flanks. Thirteen transects were planned within Cape Range Canyon, and seven within Cloates Canyon. Planned depths for transects ranged from ~1900 m to 4400 m. ROV deployments were designed to include sediment sampling (with a push core) and quantitative video transects (led by GA), in addition to biological sampling and exploratory ROV dives (led by WAM). Other work led by the WAM, but not reported further here included deployment of fish traps, CTD casts, plankton tows and ARMS to be retrieved in the future.

Initial plans were to apply a spatially balanced design for transect-based surveys (Foster et al., 2019), but the low number of sites in each canyon meant random points were sufficient to meet national standards (Foster et al., 2020). Survey locations were chosen using random points along a depth gradient, with the mandatory inclusion of transect S0342 to attempt the collection of Monoplacophora, a very rare and enigmatic class of mollusc previously collected (Daniell et al., 2009). Those points not already close to the canyon wall were moved to the nearest such location so that the unique capability of the ROV to traverse challenging canyon terrain was appropriately used (Monk et al., 2020). Each point denoted the start of an image transect near the canyon floor, and continued upslope for 500 m.

2.2 Multibeam sonar mapping

Bathymetry and acoustic reflectance (backscatter) data were acquired using a Kongsberg 30 kHz EM 302 deep water multi-beam echo sounder with a 1° array. An area of 11,250 km^2 was surveyed along 4100 line kilometres within Gascoyne Marine Park (Figure 5). In addition, 2495 line kilometres was surveyed along transits between Fremantle, Exmouth and Broome. A Kongsberg EM 710 multibeam echo sounder was used in addition to the EM 302 system along shallower parts of the transits. Depths across the survey region ranged from 1110 – 4900 m. Backscatter values ranged from -10 – -40 dB. Navigation and motion were recorded with an Applanix POSMV V5, while sound speed profiles were processed with the software Sound Speed Manager to correct acoustic data.

Raw files were imported onboard into Quimera 2.0 software for processing. A 30 m resolution CUBE surface was generated in Quimera to edit large artefacts and noise from the data. Onboard processing did not include delayed heave correction or application of tide data. Final grids were exported in UTM49S and WGS84 coordinate systems. Backscatter data were imported as GSF files into the Fledermaus Geocoder Toolbox (FMGT) for processing. During processing turn segments were removed where possible, and the data mosaicked to a 30 m resolution grid using the auto processing mode.

Morphology was mapped from the gridded bathymetry data according to the MIM-GA Two-part geomorphological classification scheme. All features were hand digitised at a scale of 1:50,000. Slope values were used to separate the region into areas of Planes (0 – 2°), Slopes (2 – 10°) and Escarpments (>10°).

Sediment stability (erosion vs deposition) was assessed by calculating the difference in depth between multibeam data collected in 2008 by the RV *Sonne* and in 2020 by the RV *Falkor*. The RV *Sonne* data was collected with a SIMRAD EM120 12 kHz system, also with a 1° beam width. The F200308 data was resampled to a 100 m grid, consistent with the RV *Sonne* data, and both grids were projected to UTM49S. The Raster calculator in ArcGIS was then used to subtract the 2008 *Sonne* grid from the 2020 *Falkor* grid. Negative values in the resulting raster reflect erosion since 2008, while positive values reflect sediment deposition.

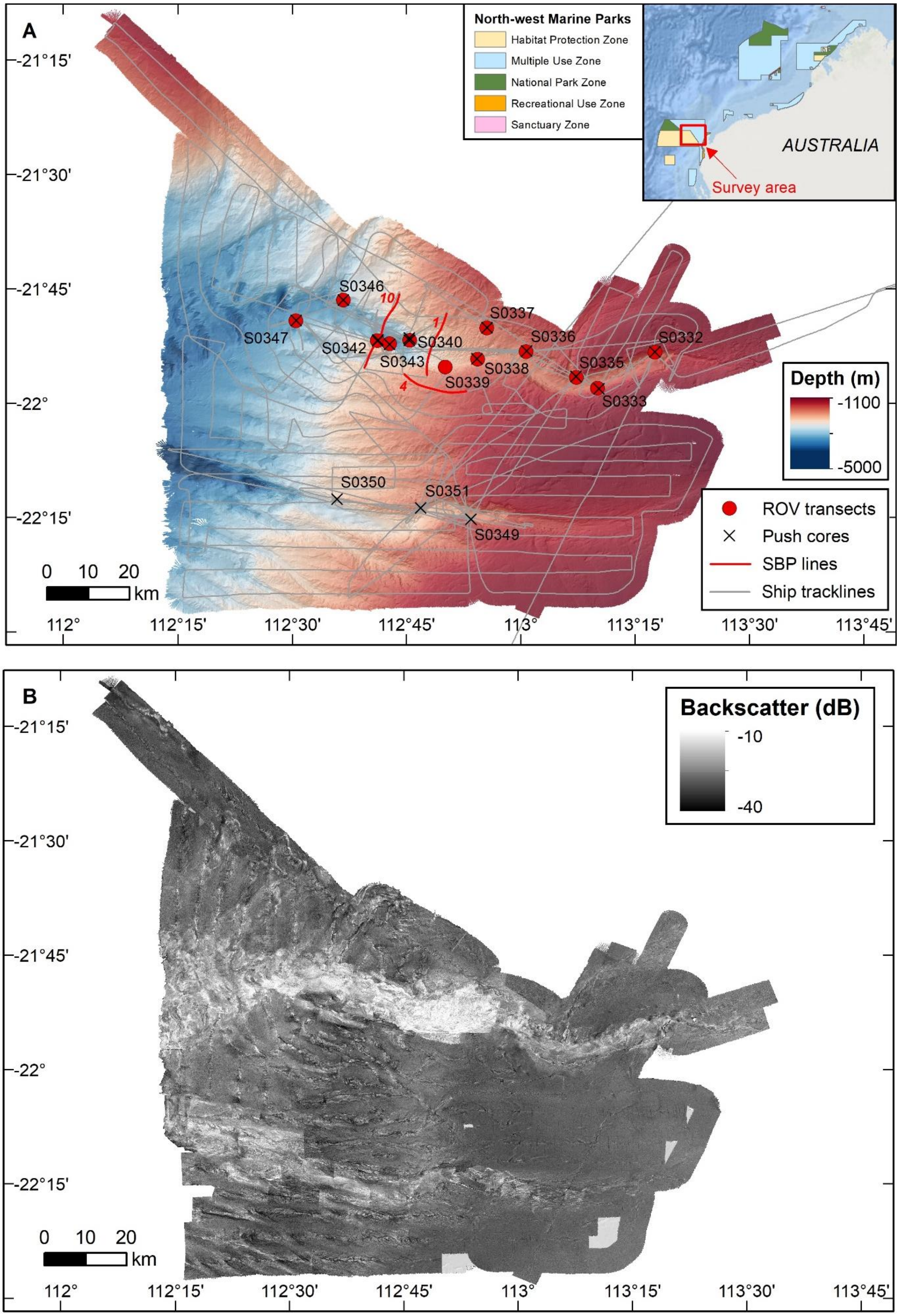


Figure 5. A) Map showing multibeam data, push cores, ROV transects, shiptracks and sub-bottom profile lines completed during survey FK200308. B) Map of backscatter revealing high backscatter within the Cape Range Canyon, and slightly higher values than the surrounding slope within Cloates Canyon.

2.3 Sub-Bottom Profiles

Due to interference with the multibeam system, sub-bottom profiles were only acquired along three lines (Figure 5) with a 12 kHz Knudsen CHIRP 3260 system. Deep water depths meant that there was very little sub-surface penetration along these lines. Due to these limitations of the data they do not provide further context for understanding the processes and evolution of the canyons and are not considered further here.

2.4 Seabed sampling

Sediment samples were collected as push cores by the ROV SuBastian. Push cores were a maximum of 254 mm long and 69.85 mm in diameter and were collected at the start of each ROV transect. A total of 18 cores were collected across 14 sites within Cape Range and Cloates Canyons over a depth range of 2050 – 4500 m (Table 1; Figure 5). The surface of each core was sub-sampled at 0 to 2 cm and will be analysed for sediment texture and composition. Sub-samples for sediment grainsize analysis are lodged at GA.

Elutriation was attempted for two pushcores based on national protocols (Przeslawski et al., 2020), but no animals were found and it was deemed an unsuitable sampling method for deep-sea infauna.

Table 1. Push cores collected during voyage FK200308.

Sample ID	ROV transect	ROV container	Date collected (UTC)	Time collected (UTC)	Latitude	Longitude	Depth (m)
FK200308/01MC08	S0332	MC08	3/11/2020	1:24:29	-21.8882	113.2934	2046
FK200308/02MC02	S0333	MC02	3/12/2020	2:41:41	-21.9687	113.1710	2081
FK200308/04MC02	S0335	MC02	14/03/2020	1:37:36	-21.9421	113.1208	2183
FK200308/05MC01	S0336	MC01	15/03/2020	1:51:59	-21.8861	113.0131	2524
FK200308/06MC01	S0337	MC01	16/03/2020	2:17:14	-21.8352	112.9264	2537
FK200308/06MC02	S0337	MC02	16/03/2020	2:26:33	-21.8352	112.9264	2537
FK200308/07MC02	S0338	MC02	17/03/2020	1:55:48	-21.9035	112.9045	2906
FK200308/09MC02	S0340	MC02	19/03/2020	2:38:26	-21.8627	112.7568	3887
FK200308/09MC01	S0340	MC01	19/03/2020	5:10:15	-21.8579	112.7569	3726
FK200308/09MC01_foram	S0340	MC01	19/03/2020	5:10:15	-21.8579	112.7569	3726
FK200308/11MC01a	S0342	MC01	21/03/2020	0:53:27	-21.8640	112.6874	4169
FK200308/10MC01	S0343	MC01	22/03/2020	3:23:56	-21.8714	112.7132	4473
FK200308/11MC01b	S0344	MC01	24/03/2020	2:30:59	-21.8619	112.6877	4374
FK200308/11MC01c	S0345	MC01	25/03/2020	2:08:24	-21.8620	112.6877	4376
FK200308/12MC01	S0346	MC01	26/03/2020	1:50:55	-21.7745	112.6126	4222
FK200308/13MC02	S0347	MC02	27/03/2020	3:25:40	-21.8197	112.5092	4493

Sample ID	ROV transect	ROV container	Date collected (UTC)	Time collected (UTC)	Latitude	Longitude	Depth (m)
FK200308/15MC01	S0349	MC01	2/04/2020	7:58:07	-22.2537	112.8918	2644
FK200308/19MC01	S0350	MC01	4/04/2020	1:09:22	-22.2098	112.5984	3420
FK200308/17MC01	S0351	MC01	5/04/2020	1:19:03	-22.2291	112.7816	2717

2.5 ROV Deployments

The ROV SuBastian was used to conduct imagery transects and undertake sample and specimen collection. SuBastian is a custom-built work class ROV that conducts scientific work down to 4500 m. It is equipped with a Sulis Subsea Z70 deep sea science camera, with 4K UHD 2160p optics and sensors for temperature, depth, conductivity and oxygen. A robotic arm was used to collect biological specimens, water samples and push cores as described above.

Twenty ROV dives were completed across 16 stations, and these included 12 quantitative transects within the Cape Range Canyon (**Error! Reference source not found.**; Figure 5). No quantitative transects were conducted in the Cloates Canyon due to delays caused by poor weather. The quantitative transects were run for 500 m upslope, ideally at a speed of 0.3 knots and an altitude of 2 m above the seafloor or rock walls. Use of zoom functions were limited during quantitative transects to ensure a consistent field of view. Lighting was calibrated at the beginning of each dive. Still images were acquired every 5 seconds, with additional frames added manually as required. If the ROV slowed or paused to zoom into or collect a specimen, the automated acquisition was paused until the ROV was back on transect position with designated speed, altitude and camera settings. There was some variation in speed and altitude due to safety concerns and challenges maintaining consistency when operating over rugged terrain. As per national protocols for work class ROVs, for all other deployment requirements, we relied on the expertise of trained ROV pilots and technicians to follow the SuBastian's operating procedures (Monk et al., 2020).

Still images from most transects were primarily annotated onboard using the RV *Falkor's* private instance of SQUIDLE+, but three transects (S0343, S0346, S0347) were annotated post-survey using the public instance of Squidle+ (http://squidle.org/). Annotations were made from images acquired every 10-20 seconds to ensure continuous imagery with minimal spatial overlap (Appendix C). Biota and substrates were characterised according to the CATAMI image classification scheme (Collaborative and Automated Tools for Analysis of Marine Imagery, Althaus et al., 2015), consistent with the national standard operating procedures established for marine imagery analysis (Carroll et al., 2018). Manual points were added to annotate all occurrences of biota in each image, and a whole image annotation was applied for relief (e.g. high and wall), substrate (e.g. mud, sand, gravel, rock), ripples (e.g. 2-D, 3-D), and presence of bioturbation. The same researcher annotated all transects, thus limiting observer bias.

Table 2. Location and depth of ROV quantitative transects within Cape Range Canyon on voyage FK200308.

ROV transect	Start/End	Latitude	Longitude	Depth (m)	Date collected (UTC)	Time collected (UTC)	Distance (m)
S0332	Start	-21.8876	113.2935	2009	11/3/2020	1:38:49	
	End	-21.8831	113.2936	1762	11/3/2020	4:41:35	492
S0333	Start	-21.9695	113.1718	2047	12/3/2020	2:57:33	
	End	-21.9732	113.1733	1915	12/3/2020	5:14:16	443
S0335	Start	-21.9415	113.1206	2165	14/3/2020	3:11:23	
	End	-21.9379	113.1200	1928	14/3/2020	7:34:52	402
S0336	Start	-21.8854	113.0135	2513	15/3/2020	2:59:18	
	End	-21.8816	113.0154	2471	15/3/2020	5:30:48	464
S0337	Start	-21.8346	112.9264	2525	16/3/2020	4:01:42	
	End	-21.8301	112.9263	2450	16/3/2020	6:05:47	497
S0338	Start	-21.9026	112.9045	2915	17/3/2020	2:38:51	
	End	-21.8980	112.9046	2917	17/3/2020	3:48:29	506
S0339	Start	-21.9229	112.8366	3028	18/3/2020	7:58:17	
	End	-21.9274	112.8366	2920	18/3/2020	8:32:52	500
S0340	Start	-21.8610	112.7568	3857	19/3/2020	3:32:48	
	End	-21.8575	112.7568	3734	19/3/2020	5:31:50	385
S0342	Start	-21.8641	112.6874	4167	21/3/2020	0:57:53	
	End	-21.8672	112.6873	3759	21/3/2020	3:36:19	347
S0343	Start	-21.8720	112.7128	4433	22/3/2020	06:58:25	
	End	-21.8734	112.7123	4292	22/3/2020	08:19:11	165
S0346	Start	-21.774	112.6126	4187	26/3/2020	04:06:24	
	End	-21.7694	112.6127	3944	26/3/2020	06:42:32	505
S0347	Start	-21.8199	112.5094	4490	27/3/2020	03:55:39	
	End	-21.8159	112.5114	4510	27/3/2020	05:59:13	489

3 Results and Preliminary Interpretations

3.1 Seabed features

3.1.1 Canyon morphology

New mapping of the Cape Range and Cloates Canyons enables an improved understanding of the morphology and evolution of these canyons. Both canyons initiate well below the shelf break, at depths of 1800 m and 2100 m, respectively, on the continental slope, and they extend to depths of at least 4400 and 4900 m, respectively (Table 3, Figure 6). Both canyons have limited connection to the shelf via small channels and gullies. The morphology of the canyons suggests that they have formed primarily via headwall retreat into relatively uniform and soft sediments (Hill et al., 2005). The primary mechanisms for canyon formation on the Australian margin are mass wasting (via slumping and landslide events) and erosion by turbidity flows (Farre et al., 1983). Evidence of both of these processes are revealed by the morphology of the Cape Range Canyon, while the morphology of Cloates Canyon is more consistent with formation by turbidity flows.

Table 3. Geometry within upper to lower reaches of Cape Range and Cloates Canyons. Representative profiles for each section of the canyons are also shown in Figure 6.

Canyon	Distance from canyon head (km)	Depth range (m)	Width (km)	Height (m)	Slope of floor (°)	Slope of northern wall (°)	Slope of southern wall (°)	Cross-section shape
Cape Range	0 – 25	1800 – 2500	4 – 8	500 – 900	0.5 – 45	15 – 65	3 – 45	U-shaped, symmetrical
Cape Range	25 – 65	2500 – 3500	8 – 12	550 – 850	1 – 5	1.5 – 5	10 – 25	U-shaped, asymmetrical
Cape Range	65 – 90	3500 – 4400	8 – 10	750 – 1350	0.5 - 10	15 – 35	15 – 35	U-shaped, symmetrical
Cape Range	90 – 130	4400 – 4750	10 – 14	200 – 600	0.5 – 16	0.5 – 5	0.5 – 5	U-shaped, symmetrical
Cloates	0 – 25	2100 – 3200	4 – 6.5	500 - 800	1 - 40	3 – 50	3 – 65	U-shaped, symmetrical
Cloates	25 – 55	3200 – 3900	6 – 9	350 - 900	2 – 15	2 – 34	3 – 40	U-shaped, symmetrical
Cloates	55 – 90	3900 – 4900	3 – 7	250 – 600	0.5 – 6	1 – 50	4 – 45	U-shaped, symmetrical

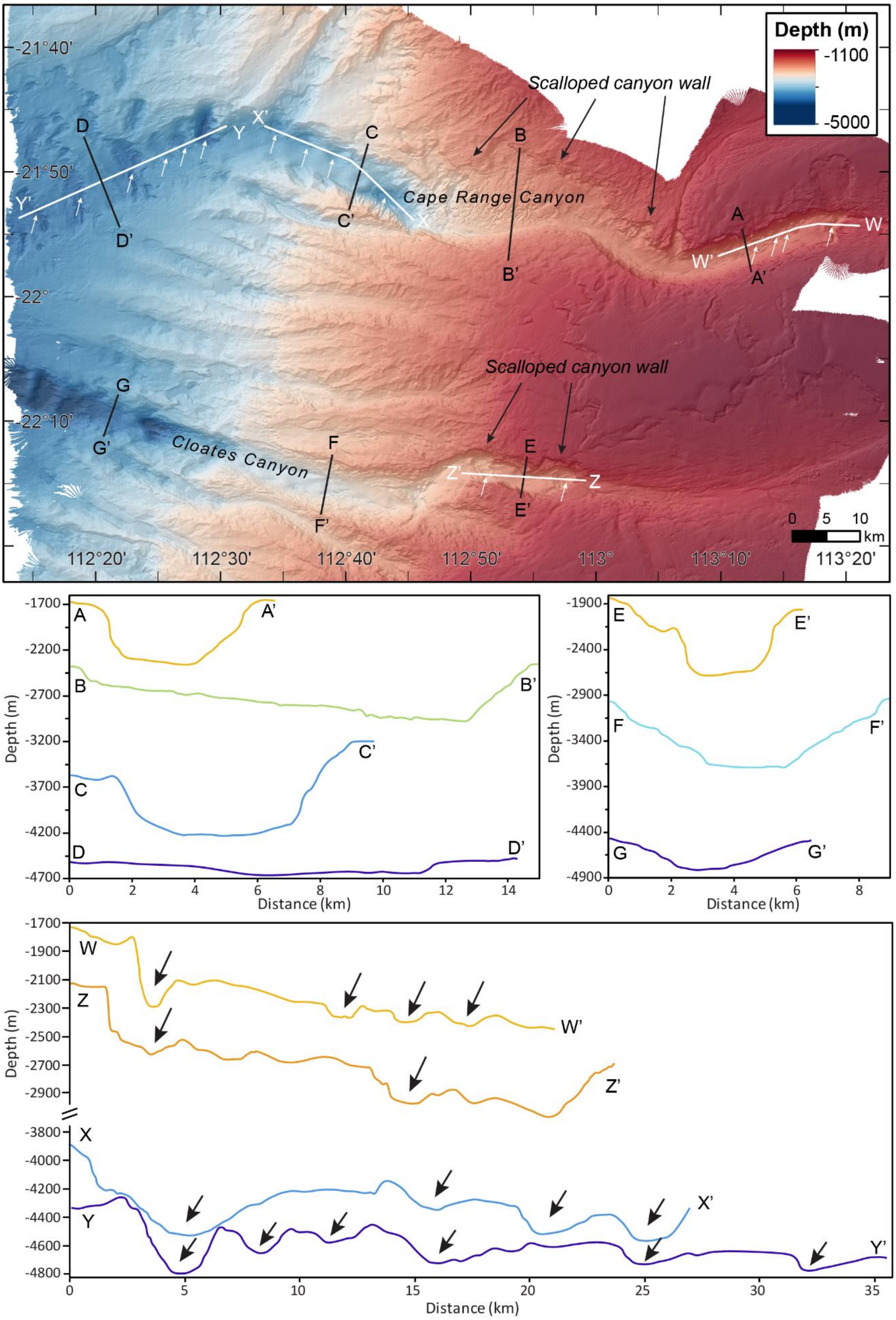


Figure 6. Cross and down canyon profiles within the Cape Range and Cloates Canyons. Cross profiles within Cape Range Canyon (A to D) reveal variable width, incision depth and symmetry within the canyon. Cross profiles within Cloates Canyon (E to G) indicate greater consistency in width, depth of incision and symmetry, though with decreasing incision depth towards the base of the canyon. Downslope profiles in Cape Range Canyon (W to Y) and Cloates Canyon (Z) reveal a number of depressions, highlighted with arrows on the map and profile graphs.

The Cape Range Canyon is relatively narrow with a symmetric cross-sectional profile in the upper 25 km, but broadens through its middle reaches (Table 3, Figure 6). This middle section (25-65 km from the canyon head) has a much more asymmetric cross-profile, characterised by a gradually sloping northern wall and a steeper southern wall (profile B-B' on Figure 6). The northern wall is comprised of small steps or terraces forming a scalloped pattern. The section from 65 to 95 km is more confined, with a return to a symmetrical cross-profile with steeper walls (profile C-C' on Figure 6). The lower part of the canyon (>95 km) is much less distinct, with lower incision (mostly 200 – 300 m depth) and low slope angles along the walls (profile D-D' on Figure 6).

The scalloped morphology along the northern walls in the mid-section of the Cape Range Canyon indicates a gradual broadening over time caused by sediment wasting, or slumping, along the edges (Figure 6). Slumping would release sand and gravel, contributing to the flow of turbidity currents, which can actively cut the canyon walls. The steepness of the southern wall and throughout much of the rest of the canyon, indicates erosion by these strong, sediment-laden currents. Turbidity currents were likely active during early formation of the canyon during past geological intervals when the sea level was much lower than today, exposing large parts of the continental shelf as dry land (Exon et al., 2005). Rivers or migrating dunes along this expanded coastal zone could have fed sand and gravel into the canyons. Today, sediment at depths above the canyon, on the continental shelf, can be mobilised by large storms or perhaps earthquakes, in addition to slumping at the head and sides of the canyon, generating turbidity currents within the canyon (Exon et al., 2005; Hill et al., 2005).

Backscatter is higher within the canyons than on the adjacent ridges and platforms, particularly within the mid part of the Cape Range Canyon (Figure 5). Push cores collected within the canyons (Figure 5) consisted of fine-grained material, and many of the side walls imaged were bare rock, or had minimal sediment drape. The high acoustic reflectance within the canyons suggests that the seabed comprises at most only a thin layer of fine sediment overlying bedrock, while areas around the canyons are blanketed in thick deposits of fine grained soft sediment, and hence have a low acoustic return. High-energy turbidity currents generated at the shelf edge likely flush sediment from the canyon walls and floors, maintaining only a thin sediment drape in places. The observation of displaced intact blades of seagrass in multiple ROV transects within Cape Range Canyon, including the deepest record at 4515 m, confirms transport from the shelf through this canyon.

Cloates Canyon has a fairly uniform morphology along its length. This canyon is symmetrical in cross-section, is generally narrower than Cape Range Canyon, and initiates further downslope (Table 3, Figure 6). It is connected upslope by a shallow channel (200 – 300 m deep), which continues upslope to gullies initiated at the continental shelf break. The canyon walls are generally steep along the whole canyon length, reflecting canyon cutting by turbidity current flow, although there is some evidence of slumping along the northern wall within the upper reaches of the canyon (e.g. profile E-E' on Figure 6). The canyon head forms a very steep wall (>70°; profile Z-Z' on Figure 6), and possibly an overhang that was not able to be imaged by the multibeam sonar path. The steepness of this wall may reflect the presence of erosion resistant strata on the surface above the canyon.

Downslope profiles within both canyons indicate the occurrence of several depressions. Some of these occur at breaks in slope, including at the head of both canyons. Downslope profiles from the head of Cape Range Canyon indicate the occurrence of four successive depressions (profile X-X' on Figure 6). The depression directly below the canyon head is 200 m deep, while the others are ~100 m deep. The mid- to lower slope also features large depressions (profiles Y to Y' and Z to Z' on Figure 6). The largest depression occurs just below a break in slope on the mid-slope. This feature is 300 m deep, 8 km long and almost 3 km wide. A series of depressions occur below this in a chain spanning the mid- to lower slope. Similar development of depressions is observed below breaks in slope on the mid- and lower slope within Cloates Canyon.

Depressions that form at major breaks in slope are termed plunge pools. These are associated with an abrupt decrease in slope by at least 4°, though more commonly a decrease of ~10° (Lee et al., 2002). As dense turbidity currents cascade down slope, they excavate the seabed through the force of hydraulic jumps at breaks in slope (Gardner et al., 2020). Hydraulic jumps are a short zone within which the flow rapidly changes from shallow, swift supercritical flow to deep, slow sub-critical flow (Fidani et al., 2006). In the slower sub-critical zone there is enhanced deposition, while the faster supercritical zones result in net sediment erosion. Sediment banks are often found immediately downstream of plunge pools. Mounds observed directly downslope from plunge pools (e.g. profiles X to X' and Z to Z' on Figure 6) may represent sediment banks deposited from some of the material excavated from the plunge pools. A train of sediment waves or erosional scours can develop, termed cyclic steps, which migrate upstream. Sub-bottom profiles are required to confirm the depositional control of the mounds, their relationship to the plunge pools, and possible upslope migration in the form of cyclic steps. The occurrence of plunge pools related to breaks in slope and erosion by down slope turbidity flows has been observed on other parts of the Australian margin, including the Murray Canyons, off southern Australia (Hill et al., 2005), and the SE Australian margin (Boyd et al., 2010).

The morphology of the canyons and surrounding continental slope can be summarised into three classes based on the seafloor slope (Figure 7). These are relatively flat areas (0 - 2°) classed as Planes, steeper areas of Slope (2 - 10°) and very steep Escarpments (>10°). Areas of escarpment are clearly visible along the canyon walls, as well as around smaller gullies and steps within the canyons. Planes form platforms on adjacent plateaus and towards the distal ends of the canyons and gullies. These three classes illustrate, in broad terms, areas of distinct seafloor habitat.

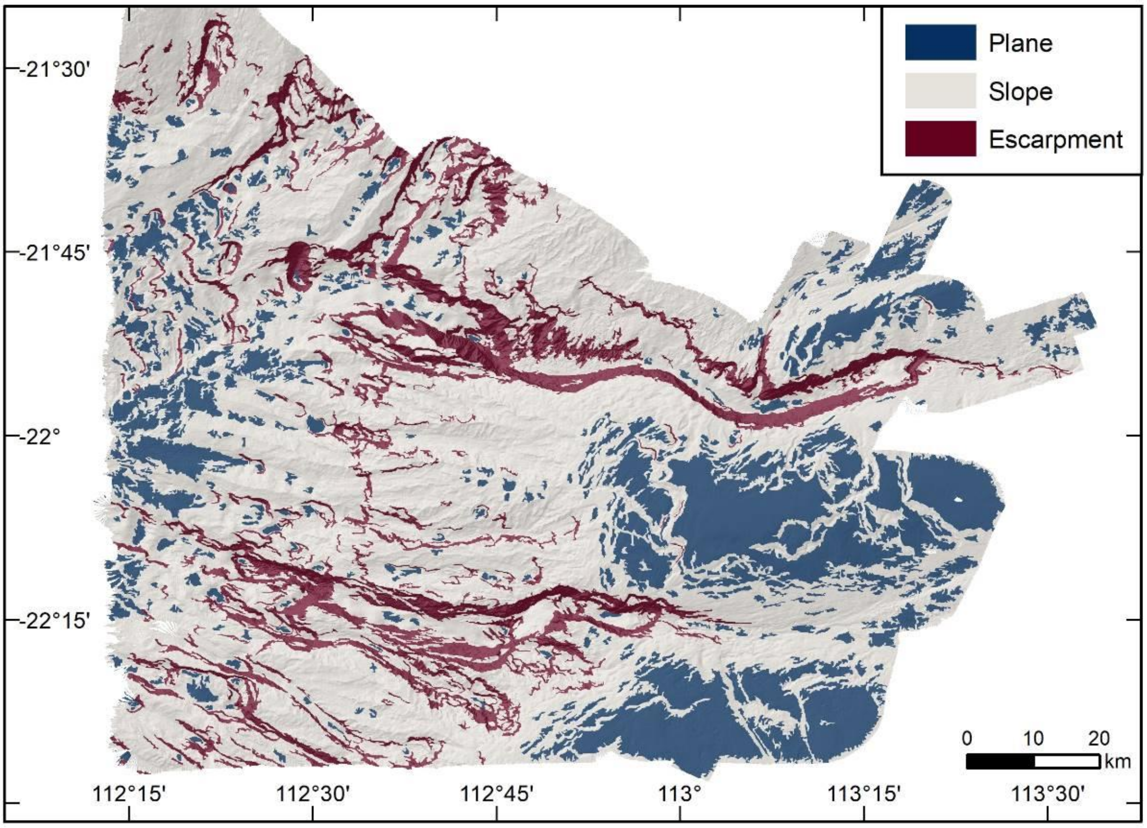


Figure 7. Three distinct surfaces illustrate the different environments within the Cape Range region. These are areas of Plane (slope 0 - 2°), Slope (slope 2 - 10°) and Escarpment (slope >10°).

3.1.2 Changes in canyon morphology over time

Seabed stability is assessed for the two canyons based on comparison to previous multibeam mapping in the area by the RV *Sonne* in 2008. While further work is required to fully quantify changes in depth between the two surveys, our initial assessment indicates active sediment processes within both canyons (Figure 8). The heads and southern walls of both canyons are actively eroding, showing extensive areas of depth increases of 10 – 50 m and locally up to 200 m since 2008 (Figure 8a and d). The northern walls, by contrast, have largely decreased in depth by up to 150 m since 2008, indicating active sedimentation. This pattern is consistent with the observed morphology of the canyons, revealing that slumping along the northern side is still active, while turbidity currents are continuing to erode the southern walls. Holes and gullies are becoming more deeply eroded within parts of the canyon walls (Figure 8b) and the floor of the canyons (Figure 8c).

Parts of the canyon floors have minor infill (~2 – 5 m), while the adjacent areas of Slope and Plane have received sediment input of a few metres. Backscatter data indicates that sediments within the canyon are relatively coarse grained, while that over the Slopes and Planes is finer grained (Figure 5). In addition, intact seagrass blades are present throughout the Cape Range Canyon (observed on 6 ROV transects) and Cloates Canyons (observed on 1 ROV transect). These observations indicate active sediment processes within both canyons, with evidence for the delivery of sediments from the shelf, and likely from slumping on the northern canyon walls. These sediments are then flushed through the canyons via turbidity currents. The finer grained material deposited over the surrounding areas of Slope and Plane likely reflects background pelagic sedimentation. Overall, there is more deposition than erosion in both the Cape Range and Cloates Canyons (Figure 8; Figure 9). Understanding patterns of sedimentation and erosion is significant for understanding the distribution of the seabed biota, and the stability of these canyon habitats.

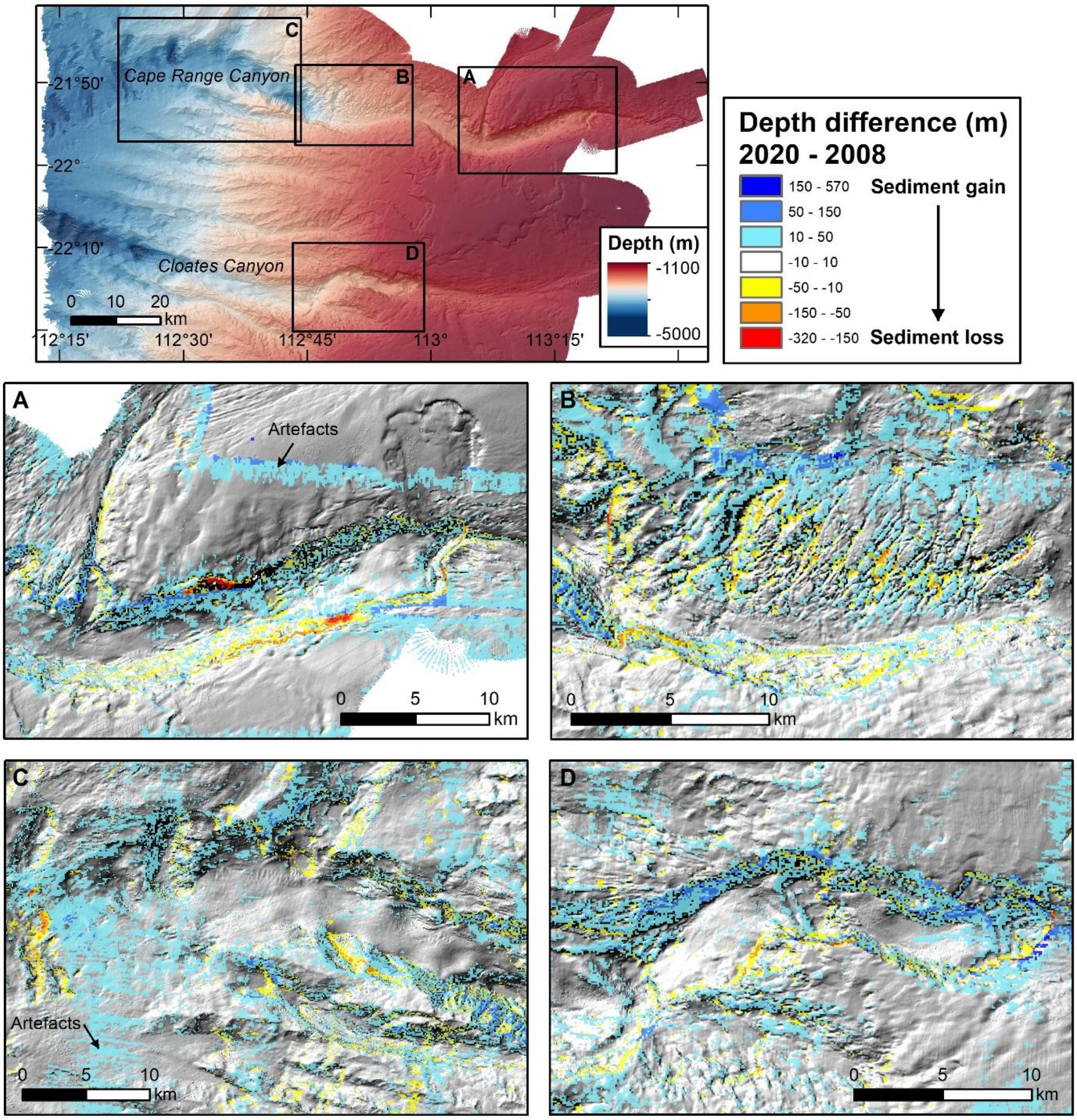


Figure 8. The difference in depth between multibeam data collected during 2008 and 2020 within the Cape Range and Cloates Canyons. Negative values reflect a loss of sediment since 2008, while positive values indicate sediment deposition since 2008. Striping in the data is caused by artefacts in the multibeam grid.

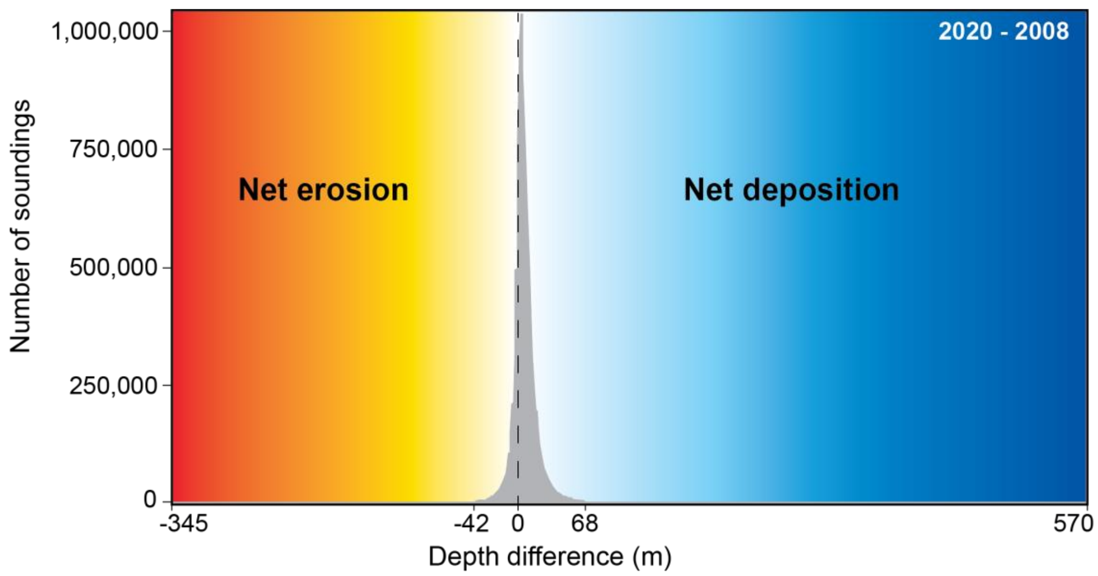


Figure 9. Histogram showing the distribution of depth differences between 2020 and 2008 multibeam data. The histogram indicates overall net deposition between these two periods.

3.1.3 Sub-seabed structure

The location and lack of penetration of sub-bottom profile lines does not provide any further context for understanding processes and evolution of the canyons.

3.2 Biological communities

The Cape Range and Cloates Canyons are characterised by a generally sparse occurrence of epibenthos, with large areas of exposed rock on the canyon walls and extensively bioturbated fine sediment on the canyon floors. The biological communities of the Cape Range and Cloates Canyons are likely regulated by disturbance associated with sedimentation in the canyons. Much of the rock was overlain with a layer of fine sediment, but even exposed rock supported very few sessile invertebrates. The exception to this were overhangs which often supported glass sponges, octocorals, and ascidians (Figure 10) and a spectacular cliff edge which supported high densities of suspension feeders (crinoids, brisingid seastars, brittlestars), likely due to low sedimentation rates and high nutrient levels delivered by stronger currents (Figure 10).

Figure 10. High densities of sessile invertebrates were only rarely observed in the canyons and included [top] glass sponge gardens on rocky overhangs (4026 m from ROV S0342) and [bottom] echinoderm fields on rocky cliff crest (1930 m from ROV S0335).

Quantitative transect annotations from 2570 images confirmed that the canyons support low abundances of epifauna, with most transects supporting less than an average of 0.7 epifaunal organisms per image (Figure 11). The only two transects that supported higher abundances were on ROV dives S0335 and S0342 due to the localised high-density communities shown in Figure 10; interestingly these were transects with high slopes (Figure 11). There was little relationship between slope and the dominant taxonomic group at each transect, although echinoderms seemed to be more prevalent at low slopes than other taxa (Figure 11).

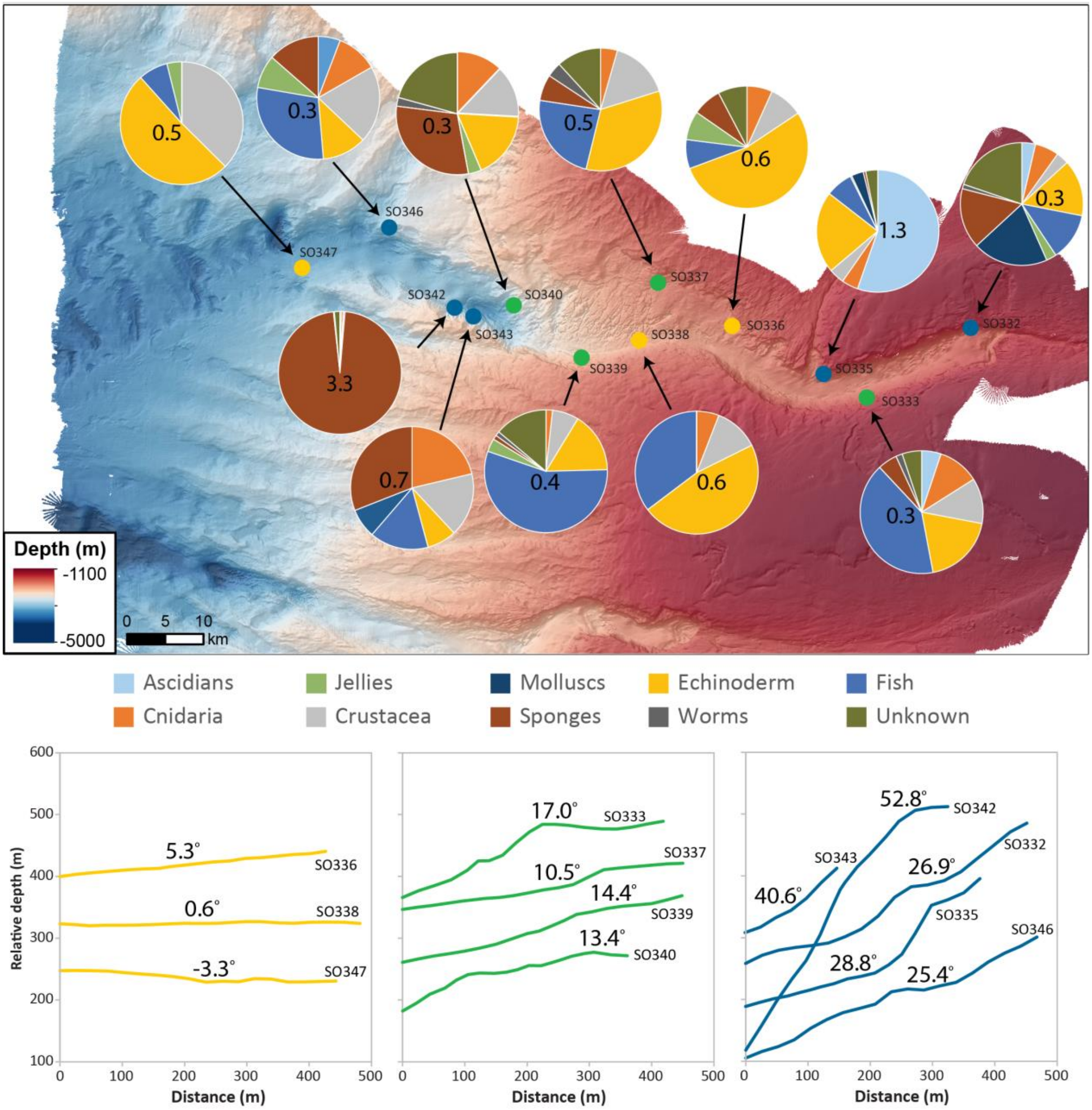


Figure 11. Relative abundances of taxonomic groups within Cape Range Canyon, showing average abundance of organisms per image for the transect (number on pie graphs) and topographic profiles (lower panels). Sites on the map are coloured according to topographic profiles as low slope (yellow), medium slope (green) and steep (blue). Average slope values (degrees) for each transect are shown on the profile plots.

Seagrass fragments were observed and collected at seven sites deeper than approximately 3000 m (Figure 12). A total of 23 blades of *Posidonia* were recorded from the quantitative transects in the Cape Range Canyon, as confirmed by magnified imagery and collection of some specimens (Figure 13). ROV S0342 returned the most observations of seagrass fragments, with 11 observations from a 500 m transect. The deepest fragment was observed at 4515 m. A total of five blades of *Posidonia* were collected from both the Cape Range and Cloates Canyons (Figure 12); these blades were observed to provide an attachment for small gastropods and bivalves (Figure 13).

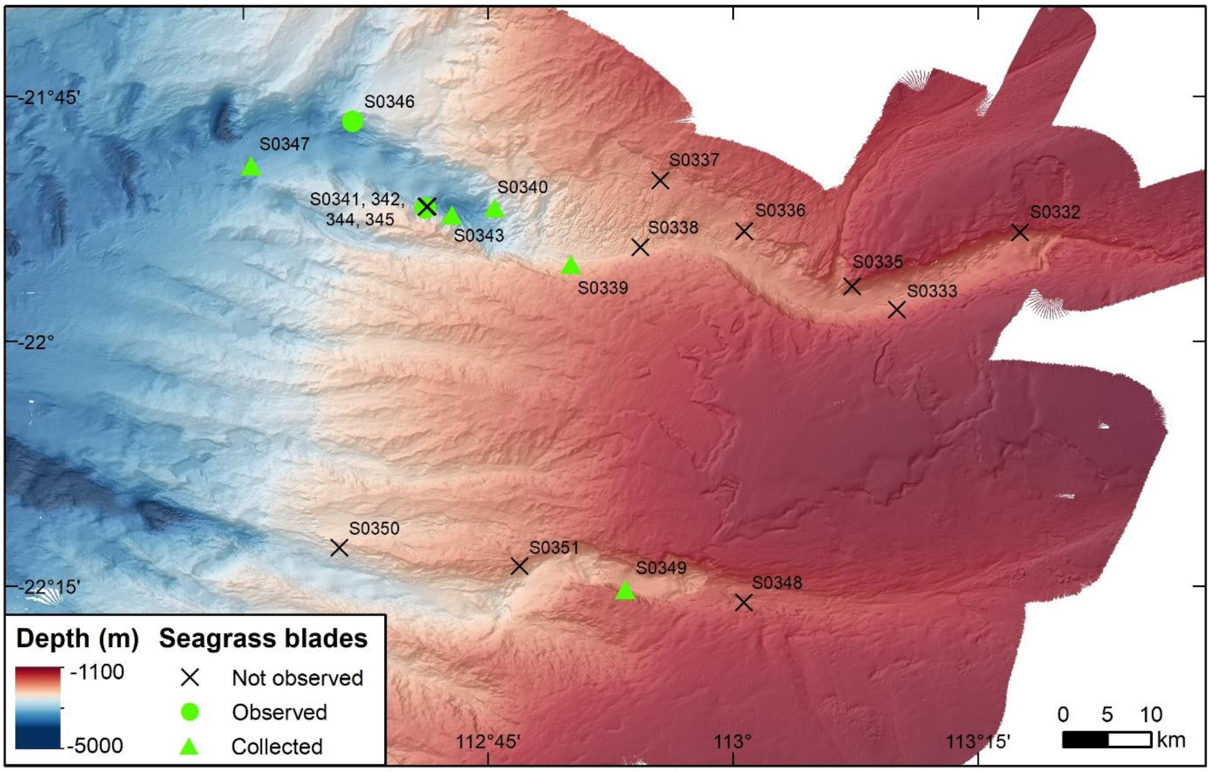


Figure 12. Locations of seagrass observed and collected with the ROV SuBastian. Pelagic dive S0334 is not included here. All dives had quantitative image transects (Table 2) except for S0344, S0345 and dives in the Cloates Canyon. Note some sites appear to overlap at the scale of this figure due to their close spacing.

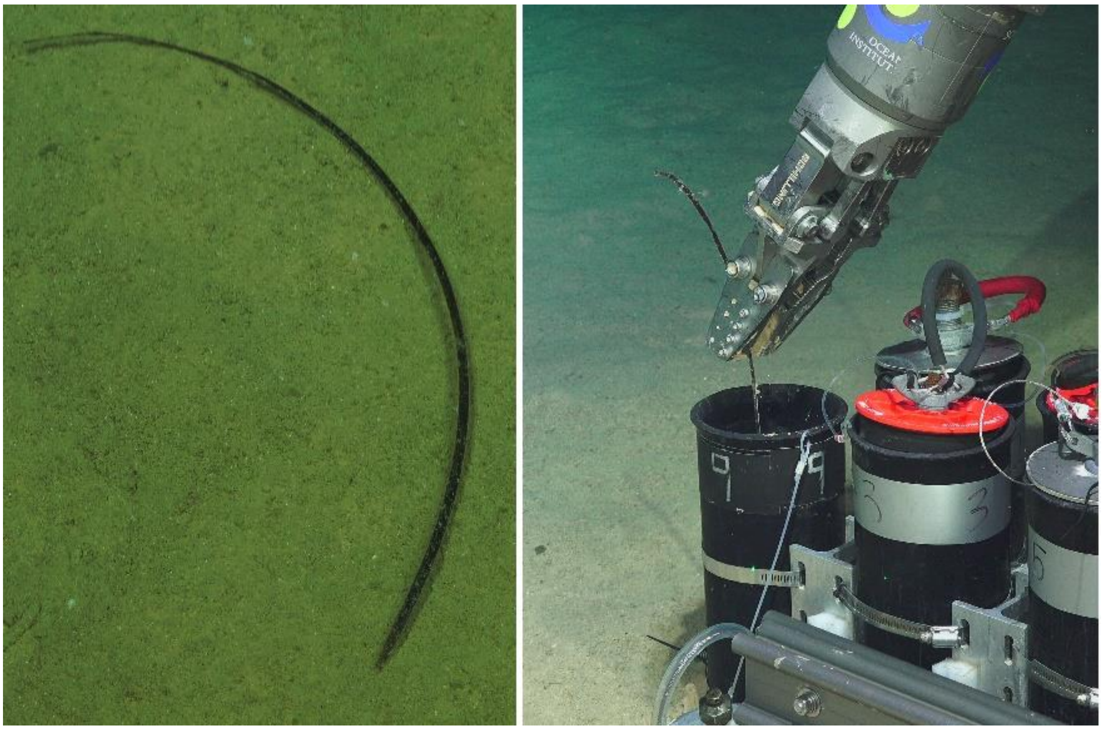


Figure 13. Posidonia seagrass [left] collected in situ by the ROV SuBastian (S0347, ~4500 m) [right].

A descriptive summary of each imagery transect is included in Appendix C. A biological specimen list is included in Appendix D.

3.3 New Discoveries

Over 1000 biological specimens were collected and curated during this expedition, including:

- The deepest fish records for Western Australia (4470 m),
- Collection of the first giant hydroids in Australian waters (> 1 m tall),
- Collection of the first intact acorn worm from the Australian deep-sea,
- Significant communities of glass sponges in the Cape Range Canyon, and
- What may be the longest animal (a siphonophore) to have been observed in the world (~46 metres) (Figure 14).

Up to 30 new species of marine animals across numerous phyla were also discovered. All faunal specimens have been registered into databases at the WA Museum where they will undergo additional taxonomic and genetic analysis. In addition, seagrass fragments were found throughout both canyon systems up to 4515 m depth, as evidence for active transport of sediment from the continental shelf into these canyons.

This survey demonstrates the utility of repeat multibeam surveys for assessing sediment dynamics and seabed mobility in deep seabed habitats. Multibeam surveys undertaken 12 years apart reveal that large volumes of sediment are being eroded and deposited within these canyon systems, providing a new understanding of the dynamics of this environment and the ongoing influence of turbidity events in shaping these canyons. Repeat surveys of the Australian margin should be considered as a tool for monitoring, particularly in marine parks, and for adding to our understanding of physical processes that occur across our marine estate. Recommendations for how this work should be undertaken are provided in Picard et al. (2018).

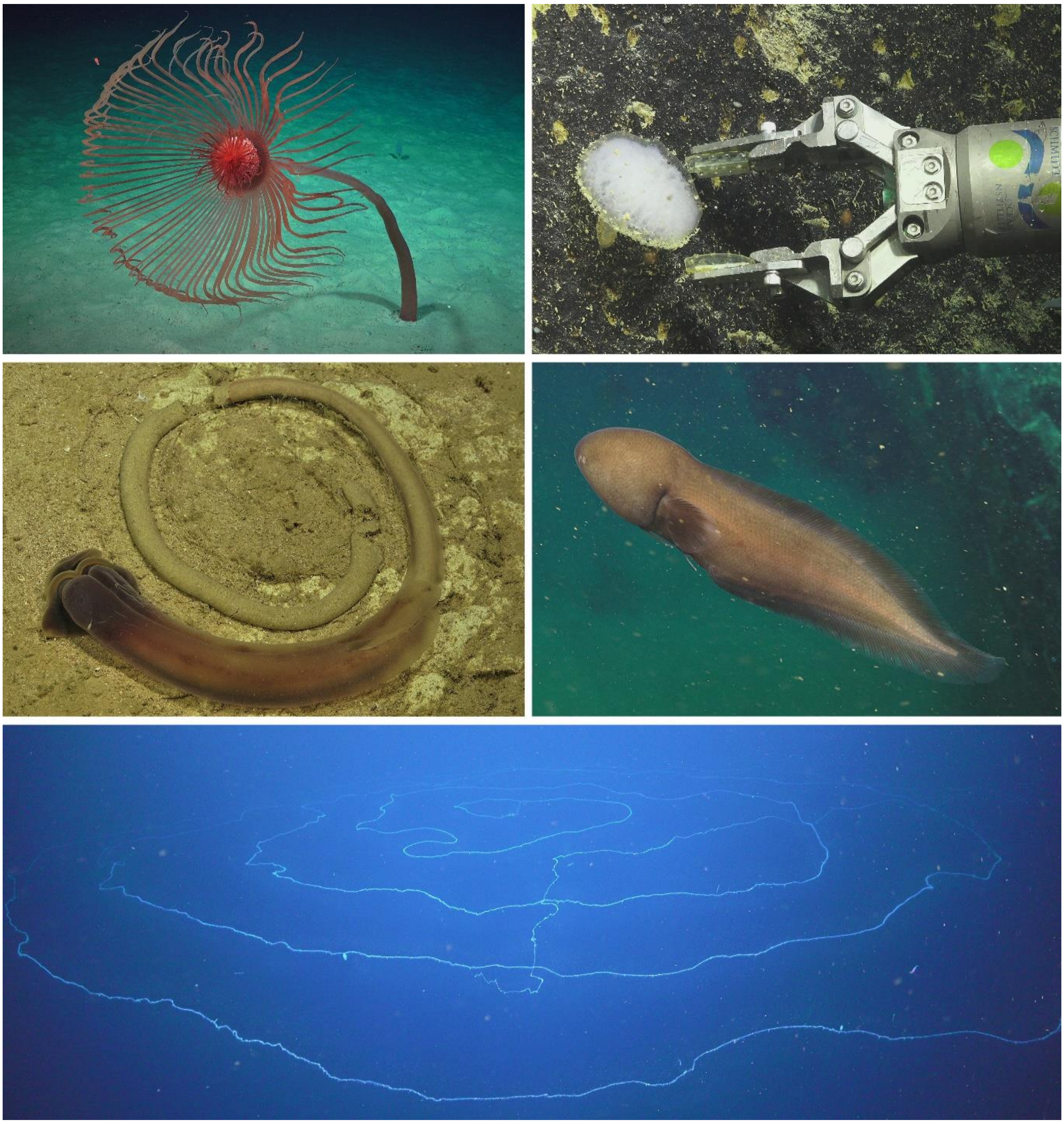


Figure 14. Representative images of the key biological discoveries on this survey (clockwise from top left): A giant hydroid *Branchiocerianthus sp*. (S0336, ~1 m tall), hexactinellid glass sponge (S0342, ~15 cm diameter), faceless cusk eel *Typhlonus nasus* (S0341, ~35 cm long), giant siphonophore (S0337, ~46 m long), and an acorn worm *Tergivelum sp*. (S0335, ~20 cm long).

4 CONCLUSIONS AND FUTURE WORK

Samples and data collected during survey FK200308 provide a baseline for ongoing monitoring of canyon habitats and ecosystems within Gascoyne Marine Park. The localised patches of glass sponges and other invertebrates are likely unique and important. Monitoring could focus on measuring changes in environmental parameters (e.g. Chambers and Dick, 2007) and using the global body of deep-sea research to extrapolate findings to the communities of interest in the Gascoyne canyons. EMeta-genomic techniques (i.e. e-DNA) may also provide promising cost-effective monitoring options in these environments (Guardiola et al., 2016). Ongoing work by the WA Museum will continue to reveal the taxonomic and genetic diversity of the two canyons, including eDNA analyses from water column samples to understand the distribution of mobile organisms not imaged or sampled.

The use of a world class ROV with state-of-the-art cameras confirmed the value of such equipment in monitoring Australian Marine Parks, allowing us to characterise in detail canyon slopes, walls, and overhangs. The 4K image resolution allowed clear observation of small organisms (< 1 cm) or organism parts (e.g. polyps, mouthparts) to assist with identification; this level of accuracy from imagery in such challenging habitats is not usually possible with other imagery systems. Clearly, ROV transects provide records of the occurrence and abundance of benthic taxa with sufficient positional accuracy to allow future repeat surveys to monitor these ecosystems.

Future work will be undertaken to understand the distribution and composition of benthic biota in relation to sediment dynamics and mobility revealed by repeat multibeam mapping. This will provide an understanding of the importance of sedimentary processes in shaping ecosystems within these canyon systems. The analysis of sediment samples will provide further understanding of canyon processes and depositional environments that affect the nature of seafloor habitats. Once taxonomic identifications are completed, we will be able to compare biological communities in this area to those in other deep-water environments that have recently been sampled (e.g. Tasmanian seamounts, eastern Australian abyss, Queensland Plateau). Preliminary comparisons indicate that biological communities in the Cape Range Canyon show similar broad patterns to other Australian canyons, with biological communities generally dominated by suspension-feeding organisms (Currie and Sorokin 2013). Observations of localised densities of glass sponges and other sessile invertebrates in the Cape Range Canyon are consistent with those from southeastern Australian canyons that show ‘site-to-site variation in diversity and species composition [of sponges] within individual canyons suggests that biological patterns may be finer-grained than the spatial scale of conventional geomorphic units’ (Schlacher et al., 2007).

5 REFERENCES

Ali, J.R., Aitchison, J.C., 2005. Greater India. *Earth-Science Reviews*, 72, 169-188.

Althaus, F., Hill, N., Ferrari, R., Edwards, L., Przeslawski, R., Schönberg, C.H.L., Stuart-Smith, R., Barrett, N., Edgar, G., Colquhoun, J., Tran, M., Jordan, A., Rees, T., Gowlett-Holmes, K., 2015. A Standardised Vocabulary for Identifying Benthic Biota and Substrata from Underwater Imagery: The CATAMI Classification Scheme. *PLoS ONE*, 10, e0141039.

Boyd, R., Keene, J., Hubble, T., Gardner, J., Glenn, K., Ruming, K., Exon, N., 2010. Southeast Australia: a Cenozoic continental margin dominated by mass transport. *In*: Mosher, D.C. et al. (eds.), *Submarine mass movements and their consequences*. Springer, Dordrecht, 491-502.

Brewer, D.T., Lyne, V., Skewes, T., Rothlisberg, P., Last, P., Ward, B., Meekan, M., Smith, L. and Steinberg, C., 2007. *Trophic systems of the North-west Marine Region*. Department of the Environment, Water Heritage and the Arts, CSIRO Marine and Atmospheric Research, Cleveland.

Brooke, B., Nichol, S., Hughes, M., McArthur, M., Anderson, T.J., Przeslawski, R., Siwabessy, J., Heyward, A.J., Battershill, C.N., Colquhoun, J., Doherty, P.J., 2009. Carnarvon Shelf Post-Survey Report. Record 2009/02. Geoscience Australia, Canberra.

Carroll, A., Althaus, F., Beaman, R., Friedman, A., Ierodiaconou, D., Ingleton, T., Jordan, A., Linklater, M., Monk, J., Post, A., Przeslawski, R., Smith, J., Stowar, M., Tran, M., Tyndall, A., 2018. Marine sampling field manual for towed underwater camera systems. *In:* Przeslawski, R., Foster, S. (eds.), *Field Manuals for Marine Sampling to Monitor Australian Waters*. National Environmental Science Programme (NESP), pp. 131–152.

Caputi, N., Kangas, M., Chandrapavan, A., Hart, A., Feng, M., Marin, M., de Lestang, S., 2019. Factors affecting the recovery of invertebrate stocks from the 2011 Western Australian extreme heat wave. *Frontiers in Marine Science.* doi.org/10.3389/fmars.2019.00484.

Chambers, C.A, Dick, T.A., 2018. Using environmental variables to predict the structure of deep-sea Arctic fish communities: Implications for food web construction. *Arctic, Antarctic and Alpine Research.* 39, 2-8.

Daniell, J., Jorgensen, D.C., Anderson, T., Borissova, I., Burq, S., Heap, A.D., Hughes, M., Mantle, D., Nelson, G., Nichol, S., Nicholson, C., Payne, D., Przeslawski, R., Radke, L., Siwabessy, J., Smith, C., and Shipboard Party, 2010. *Frontier Basins of the West Australian Continental Margin: Post-survey Report of Marine Reconnaissance and Geological Sampling Survey GA2476*. Record 2009/38. Geoscience Australia, Canberra.

Double, M.C., Andrews-Goff, V., Jenner, K.C.S., Jenner, M-N., Laverick, S.M., Branch, T.A., Gales, N.J., 2014. Migratory movements of Pygmy Blue Whales (Balaenoptera musculus brevicauda) between Australian and Indonesia as revealed by satellite telemetry. PLoS One, 9, e93578.

Exon, N., Haq, B., & Von Rad, U., 1992. Exmouth plateau revisited: Scientific drilling and geological framework. *In*: U. VonRad, B. U. Haq, R. B. Kidd, & S. B. O'Connell (eds.), *Proceedings of the Ocean Drilling Program, Scientific Results*, 122, 3–20. College Station, TX.

Exon, N.F., Hill, P.J., Mitchell, C., Post, A., 2005. Nature and origin of the submarine Albany canyons off southwest Australia. *Australian Journal of Earth Sciences*, 52, 101-115.

Falkner, I., Whiteway, T., Przeslawski, R., Heap, A.D., 2009. Review of Ten Key Ecological Features (KEFs) in the Northwest Marine Region. Record 2009/13. Geoscience Australia, Canberra.

Falvey D.A., Veevers J.J., 1974. Physiography of the Exmouth and Scott Plateaus, Western Australia, and adjacent Northeast Wharton Basin. Marine Geology 17, 21-59.

Farre, J.A., McGregor, B.A., Ryan, W.B., Robb, J.M., 1983. Breaching the shelfbreak: passage from youthful to mature phase in submarine canyon evolution. *SEPM Special Publication,* 33, 25-39.

Fildani, A., Normark, W.R., Kostic, S., Parker, G., 2006. Channel formation by flow stripping: large-scale scour features along the Monterey East Channel and their relation to sediment waves. *Sedimentology,* 53, 1265-1287.

Foster, S.D., Hosack, G.R., Monk, J., Lawrence, E., Barrett, N.S., Williams, A., Przeslawski, R., 2019. Spatially balanced designs for transect-based surveys. Methods in Ecology and Evolution, 11, 95-105.

Foster, S.D., Monk, J., Lawrence, E., Hayes, K.R., Hosack, G.R., Langlois, T., Hooper, G., Przeslawski, R., 2020. Statistical considerations for monitoring and sampling. In Field Manuals for Marine Sampling to Monitor Australian Waters,Version 2. Przeslawski R, Foster S (Eds). National Environmental Science Program (NESP).

Gardner, J.V., Peakall, J., Armstrong, A.A., Calder, B.R., 2020. The Geomorphology of Submarine Channel Systems of the Northern Line Islands Ridge, Central Equatorial Pacific Ocean. *Frontiers in Earth Science,* 8.

Guardiola, M., Wangensteen, O.S., Taberlet, P., Coissac, E., Uriz, M.J., Turon, X., 2016. Spatio-temporal monitoring of deep-sea communities using metabarcoding of sediment DNA and RNA. *PeerJ.* 4, e2807.

Hill, P.J., De Deckker, P., Exon, N., Exon, N.F., 2005. Geomorphology and evolution of the gigantic Murray canyons on the Australia southern margin. *Australian Journal of Earth sciences,* 52, 117-136.

Huang, Z., Nichol, S.L., Harris, P.T., Caley, M.J., 2014. Classification of submarine canyons of the Australian continental margin. *Marine Geology,* 357, 362-383.

Lee, S.E., Talling, P.J., Ernst, G.G., Hogg, A.J.J.M.G., 2002. Occurrence and origin of submarine plunge pools at the base of the US continental slope. *Marine Geology,* 185, 363-377.

Levin, L.A., Etter, R.J., REx, M.A., Gooday, A.J., Smith, C.R., Pineda, J., Stuart, C.T., Hessler, R.R., Pawson, D., 2001. Environmental influences on regional deep-sea species diversity. Annual Review of Ecology and Systematics, 32, 51-93.

Lyne, V. and Hayes, D. (2005) Pelagic Regionalisation: National Marine Bioregionalisation Integration Project Report. Department of the Environment and Heritage and CSIRO.

Monk, J., Barrett, N., Bond, T., Fowler, A., McLean, D., Partridge, J., Perkins, N., Przeslawski, R., Thomson, P.G, Williams, J., 2020. Field manual for imagery based surveys using remotely operated vehicles (ROVs). In Field Manuals for Marine Sampling to Monitor Australian Waters, Version 2. Przeslawski R, Foster S (Eds). National Environmental Science Programme (NESP).

Normandeau, A., Bourgault, D., Neumeier, U., Lajeunesse, P., St-Onge, G., Gostiaux, L., Chavanne, C., 2019. Storm-induced turbidity currents on a sediment-starved shelf: insight from direct monitoring and repeat seabed mapping of upslope migrating bedforms. Sedimentology, 67, 1045-1068.

Nugraha, H.D., Jackson, C.A.L., Johnson, H.D., Hodgson, D.M., Reeve, M.T.J.B.R., 2019. Tectonic and oceanographic process interactions archived in Late Cretaceous to Present deep-marine stratigraphy on the Exmouth Plateau, offshore NW Australia. *Basin Research,* 31, 405-430.

Picard, K., Austine, K., Bergersen, N., Cullen, R., Dando, N., Donohue, D., Edwards, S., Ingleton, T., Jordan, A., Lucieer, V., Parnum, I., Siwabessy, J., Spinoccia, M., Talbot-Smith, R., Waterson, C., Barrett, N., Beaman, R., Bergersen, D., Boyd, M., Brace, B., Brooke, B., Cantrill, O., Case, M., Daniell, J., Dunne, S., Fellows, M., Harris, U., Ierodiaconou, D., Johnstone, E., Kennedy, P., Leplastrier, A., Lewis, A., Lytton, S., Mackay, K., McLennan, S., Mitchell, C., Monk, J., Nichol, S., Post, A., Price, A., Przeslawski, R., Pugsley, L., Quadros, N., Smith, J., Stewart, W., J., S., Tran, M., Whiteway, T., 2018. *Australian Multibeam Guidelines*. Record 2018/19. Geoscience Australia, Canberra. http://dx.doi.org/10.11636/Record.2018.019.

Przeslawski, R., Berents, P., Clark, M., Dittmann, S., Edgar, G., Frid, C., Hooper, G., Hughes, L., Ingleton, T., Kennedy, D., Nichol, S., Smith, J., 2020. Marine sampling field manual for grabs and box corers. In: Przeslawski, R., Foster, S. (eds.), Field Manuals for Marine Sampling to Monitor Australian Waters, Version 2. National Environmental Science Programme (NESP). https://grabs-and-boxcorers-field-manual.github.io/

Przeslawski, R., McArthur, M.A., Anderson, T.J., 2013. Infaunal biodiveristy patterns from Carnarvon Shelf (Ningaloo Reef), Western Australia. Marine and Freshwater Research,64, 573-583.

Schlacher, T.A., Schalcher-Hoenlinger, M.A., Williams, A., Althaus, F., Hooper, J.N.A., Kloser, R., 2007. Richness and distribution of sponge megabenthos in continental margin canyons off southeastern Australia. *Marine Ecology Progress Series.* 340, 73-88.

Schönberg, C.H.L., Fromont, J., 2012. Sponge gardents of Ningaloo Reef (Carnarvon Shelf, Western Australia) are biodiversity hotspots. Hydrobiologica, 687, 143-161.

Sleeman, J.C., Meekan, M.G., Wilson, S.G., Jenner, C.K., Jenner, M.N., Boggs, G.S., Steinberg, C.C. and Bradshaw, C.J., 2007. Biophysical correlates of relative abundances of marine megafauna at Ningaloo Reef, Western Australia. Marine and Freshwater Research, 58(7), 608-623.

Spies, R.B., Mukhtasor, M., Burns, K.A., 2017. The Montara oil spill: a 2009 blowout in the Timor Sea. *Ocean Spills and Accidents.* 73, 55-62.

Spooner, M. I., De Deckker, P., Barrows, T. T., & Fifield, L. K. (2011). The behaviour of the Leeuwin Current offshore NW Australia during the last five glacial-interglacial cycles. *Global and Planetary Change*, 75, 119–132.

Symonds, P.A., Planke, S., Frey, O. and Skogseid, J., 1998. Volcanic evolution of the Western Australian continental margin and its implications for basin development. *In*: Purcell, P.G. and Purcell, R.R. (eds.), *The Sedimentary Basins of Western Australia*, Volume 2, p.33-54. Petroleum Exploration Society of Australia, Perth, Western Australia.

Tchernia, P. (1980). *Descriptive regional oceanography*. New York, Pergamon Press.

Wells, P. E., & Wells, G. M. (1994). Large-scale reorganization of ocean currents offshore Western Australia during the late quaternary. *Marine Micropaleontology*, 24, 157–186.

van Keulen, M. and Langdon, M.W. (2011). *Biodiversity and Ecology of the Ningaloo Reef Lagoon.* Ningaloo Collaboration Cluster / CSIRO.

Williams, A, Althaus, F., Dunstan, P.K., Poore, G.C.B., Bax, N.J., Kloser, R.J., McEnnulty, F.R., 2010. Scales of habitat heterogeneity and megabenthos biodiversity on an extensive Australian continental margin (100-1100 m depths). *Marine Ecology,* 31, 222-236.

6 Acknowledgements

We are extremely grateful to the Schmidt Ocean Institute and all the staff who made this survey possible, both onboard and onshore. The Ningaloo Canyons Expedition (FK200308) in 2020 was the result of a partnership between Schmidt Ocean Institute and the WA Museum, with collaborators from Curtin University, Scripps Institution of Oceanography and Geoscience Australia, and the assistance of Kaycee Handley from Macquarie University. We would particularly like to thank the skilful ROV pilots: Jason, Russel, Kris, Ben and Cody for their prowess piloting and controlling the ROV. Andrew Carroll (GA), Scott Nichol (GA) and several Parks Australia staff provided helpful comments on the draft report. We also thank Gary Kendrick (UWA) who provided advice on seagrass distribution in Western Australia.

This work was partly funded by the Australian Government's National Environmental Science Program (NESP) Marine Biodiversity Hub, the Director of National Parks, and the Foundation for the WA Museum who contributed funds through a Woodside Marine Biodiversity Grant to assist with supporting logistics. This research was conducted in the Gascoyne Marine Park under permit number PA2019-00114-1 and AU-COM2020-476 issued by the Director of National Parks, Australia. The views in this publication do not necessarily represent the views of the Director of National Parks. AP and RP publish with the permission of the Chief Executive Officer, Geoscience Australia.

Appendix A - Survey participants

Scientific Personnel

Nerida Wilson (WA Museum, Chief Scientist)
Liam Cook, High school student
Kaycee Handley, Macquarie University
Andrew Hosie, WA Museum
David Juszkiewicz, Curtin University
Lisa Kirkendale, WA Museum
Glenn Moore, WA Museum
Georgia Nester, Curtin University
Rachel Przeslawski, Geoscience Australia
Jenelle Ritchie, WA Museum
Greg Rouse, Scripps Institution of Oceanography

Non-survey participants (due to Covid-19 constraints)

Mark Allen, WA Museum
Michelle Childs, Teacher/Mentor
Ana Hara, WA Museum
Peter Kohnert, Bavarian State Collection of Zoology
Alix Post, Geoscience Australia
Mandy Reid, Australian Museum
Shanae Tesling, High school student
Corey Whisson, WA Museum

Ship Crew

Peter Reynolds (Captain)
Bert Bakering (Head Chef)
Albert Barcelo (Fitter)
Archel Benitez (Deckhand)
Russell Coffield (ROV Team)
Elizabeth Corkerton (Deckhand)
Lady Rose Cudal (Stewardess)
Allan Doyle (Chief Officer)
Paul Duncan (Lead Technician)
Peter Goeppel (Chef)
Douglas Hay (2nd Engineer)
Kris Ingram (ROV Team)
Alex Ingle (Multimedia Correspondent)
Leena Inkinen (Purser)
Januarie Jangcan (Stewardess)
Kolos Kovacs (Systems Engineer)
Taigh MacManus (2nd Officer)
Tony McCan (2nd Officer
Neil McNaught (3rd Engineer)
Markus Ninemets (Deckhand)
Andreas Ott (3rd Engineer)
Cody Peyres (ROV Team)
Kaarel Kaspar Rais (Marine Technician)
Jason Rodriguez (ROV Team)
Dante Sarzuelo (Fitter)
Deborah Smith (Multibeam technician)
Michael Utley (Bosun)
Allan Watt (Chief Engineer)

Appendix B – Permits

Australian Government
Director of National Parks

Australian Marine Park Activity Permit

Issued under r.12.06(2), 12.09(1) and Division 17 of the
Environment Protection and Biodiversity Conservation Regulations 2000.

Permit Number	PA2019-00114-1
Permitted Activity	Scientific Research – ROV sampling to characterise deep sea benthos, seabed mapping and environmental DNA collection for sections 354354A of the *Environment Protection and Biodiversity Conservation Act 1999* and regulation/s 12.10 of the *Environment Protection and Biodiversity Conservation Regulations 2000*.
Marine Park/s	Gascoyne Marine Park
Permit Area	Gascoyne Marine Park: • National Park Zone 1 • Habitat Protection Zone 2 • Multiple Use Zone 3 as specified in the North-west Marine Parks Network Management Plan 2018 for the Gascoyne Marine Park available at the Federal Register of Legislation.
Commencement Date	8 March 2020
Expiry Date	8 April 2020
Permittee	Name: Diana Jones Position: Executive Director, Collections and Research Organisation: Western Australian Museum Address: Locked Bag 49, Welshpool DC, WA, 6986 Phone: 0892123899 Email: diana.jones@museum.wa.gov.au

Permittee Representative	Name: Glenn Moore Position: Curator of Fishes Organisation: Western Australian Museum Address: Locked Bag 49, Welshpool DC, WA, 6986 Phone: [redacted] Email: glenn.moore@museum.wa.gov.au

Nominated Vessel/s	Name: RV Falkor / Registration number: 7928677 Type: Research Vessel / Capacity: 42 Length: 82.9 m / Tonnage: 2,024

Activity Conditions This permit is subject to the following activity specific conditions to reduce impacts on marine park values.	1. The Permitted Activity must be undertaken in accordance with Schedule 1 (PA2019-00114 submitted application), except where inconsistent with this permit. 2. At least two weeks before entering a Park, the Permittee must notify the Director of the dates of the proposed visit, the Nominated Vessel and whether there is a berth availability for a Parks Australia officer. 3. The Permittee must ensure only the following equipment is used: a) Multibeam echosounder b) Sub-bottom profiler c) Conductivity, Temperature, Depth Rosette (CTD) and niskin bottles d) Autonomous Reef Monitoring Structures (ARMS) e) Sediment corer, suction sampler and robotic arm f) Remotely Operated Vehicle (ROV) g) Biopsy equipment h) Baited traps i) Plankton nets and tows j) Meteorological sensors k) Surface seawater sensors 4. All Nominated Vessels must display, at all times within the Marine Park, signage with the words 'Research' of a size similar to the vessel registration number. 5. The Permittee must provide bathymetry data to Geoscience Australia obtained within the marine park compatible with Geoscience Australia database requirements within three months of completion of all surveys in the Marine Park. 6. The Permittee must notify the Director within 10 days of the submission of the bathymetry data to Geoscience Australia. 7. The Permittee must ensure that all equipment placed in the Park and left unattended is clearly marked with the name of the Permittee and Permit number.

General Conditions The following conditions apply to all permits.	*General conditions* 8. The Permittee must not conduct the Permitted Activity before the commencement date or after the expiry date shown on the permit. 9. An electronic or hard copy of this permit and attached application (Schedule 1) must be kept on board each Nominated Vessel and must be produced for inspection on request by a Warden. 10. The Permittee must inform the Director of proposed changes to the Nominated Vessels at least 14 days before the proposed trip. 11. If a Permittee is a company or other incorporated body the Permittee must not, without the approval of the Director, have as a director or officer holder a person who has been convicted of an offence against the EPBC Act or the EPBC Regulations within the previous 10 years. 12. The Permittee must not, without the approval of the Director, use directly in the conduct of the Permitted Activity the services of any person who has been convicted of an offence against the EPBC Act or the EPBC Regulations within the previous 10 years. *Compliance and auditing* 13. The Permittee must comply with the EPBC Act, the EPBC Regulations, the Management Plan, all permit conditions and any other notices or directions issued by the Director relating to the Permitted Activity or Marine Parks specified on this permit. 14. Unless specifically authorised by this or another permit, the Permittee must comply with all prohibitions and determinations made by the Director under the EPBC Regulations. 15. The Permittee must comply with all Commonwealth and State or Territory law relating to the Permitted Activity and hold all permits, licences and other relevant authorisations required by law for the conduct of the Permitted Activity. 16. The Permittee must ensure that all Participants are fully informed of and understand these permit conditions before they take part in the Permitted Activity. 17. The Permittee must take all reasonable steps to ensure all Participants comply with all permit conditions. 18. The Permittee must allow a Warden access to Nominated Vessels at any time for the purpose of performing the functions and powers of Wardens under the EPBC Act. 19. The Permittee must, and must take reasonable steps to ensure all Participants in the Permitted Activity, comply with all lawful directions issued by a Warden. 20. The Permittee must, at no cost to the Director but subject to availability and the provision of reasonable notice, allow a member of the Director's staff to accompany a trip conducting the Permitted Activity for the purpose of evaluating compliance with these Permit conditions. *Training and qualifications* 21. The Permittee must maintain relevant training, qualifications and experience to competently conduct the Permitted Activity. 22. The Permittee must ensure that all Participants are appropriately trained and/or accredited to competently conduct the Permitted Activity.

	Safety 23. The Permittee must ensure that appropriate risk management systems, strategies and procedures are in place to minimise foreseeable risks to the Participants in the Permitted Activity and members of the public and must produce evidence of such systems, strategies and procedures on request of the Director. 24. The Permittee must ensure that they fully inform themselves of, and equip themselves for, all potential hazards and conditions they may encounter while conducting the Permitted Activity. 25. The Permittee acknowledges that the Director has no ability to monitor or warn the Permittee of changing environmental hazards or developing hazards within a Marine Park. 26. The Permittee must inform the Director of any potential safety hazard or risk encountered or discovered while in a Marine Park as soon as practicable. 27. If anyone taking part in the Permitted Activity is seriously injured, becomes seriously ill or goes missing while in a Marine Park, the Permittee must ensure: (a) notification to the relevant emergency response authority as soon as possible; (b) compliance with any requests or directions from those authorities in relation to the safety of that person or any other person; and (c) notification to the Director's Marine Compliance Duty Officer as soon as practicable. ***Note:*** The Director is not an emergency response agency and all relevant emergency response agencies should be contacted prior to informing the Director of any incident or safety hazard/risk. *Vessel operations* 28. The Permittee must ensure, or satisfy themselves, that all Nominated Vessels are registered, are suitable for the conduct of the Permitted Activity, have appropriate safety equipment on board at all times, and are operated and maintained in accordance with all relevant and applicable Commonwealth, State and Territory laws. The Permittee must, if requested by the Director, provide copies of all relevant certificates and other documents demonstrating compliance with this condition. 29. The Permittee must ensure that a person qualified to operate each Nominated Vessel remains on board at all times to monitor and assure secure anchorage. 30. The Permittee must: (a) Use appropriate moorings if available; or (b) (if moorings are not available) ensure that minimal damage is caused to the marine environment as a result of anchoring. Anchoring cannot occur on coral. 31. When using an existing Parks Australia mooring, the Permittee must: (a) not exceed the weight capacity of the mooring. (b) not tie to a vessel already using a mooring. 32. The Permittee must ensure that Nominated Vessels do not discharge any fuels or chemical wastes into a Marine Park.

	33. The Permittee must not, and must take reasonable steps to ensure all Participants in the Permitted Activity do not, litter in a Marine Park. All refuse must be placed in containers on board Nominated Vessels which are designed to fully contain refuse material. 34. The Permittee must ensure that Nominated Vessels have been antifouled within the last two years and are generally free from fouling. Vessels cannot be cleaned of fouling inside a Marine Park. *Environment and heritage protection* 35. Unless specifically authorised by this permit, the Permittee must not, and must take reasonable steps to ensure that all Participants in the Permitted Activity do not: (a) behave contrary to any warning or regulatory signs displayed at boat ramps used by the Permittee to access a Marine Park or displayed on marker buoys within a Marine Park; (b) collect, pick, interfere with, feed, handle or disturb any native flora or fauna, or handle or disturb the dwelling place of any native fauna; (c) remove shells, coral, plants or animals from a Marine Park. (d) touch, interfere with, or capture images or sound of, Indigenous Cultural and Intellectual Property without the consent of the owner; or (e) impede public access to any part of a Marine Park. 36. The Permittee must take all reasonable steps to prevent the introduction of pests into a Marine Park or the transfer of pests between locations within a Marine Park. Reasonable steps can include, but are not limited to, scheduled inspection and cleaning of the vessel and any in-water equipment, and/or passenger briefings. 37. The Permittee must ensure that all gear, equipment, and other articles lost in a Marine Park that are likely to cause environmental harm, are reported to the Director's Marine Compliance Duty Officer as soon as practicable, and within 10 days in any event, after the loss occurs. The report must include a description of what was lost, the location of loss/suspected loss and the date and time of loss.

Failure to adhere to this permit and the conditions above may result in a variation to or cancellation of this permit or the imposition of criminal penalties under the EPBC Regulations. A person convicted under the EPBC Regulations may be ineligible for future permits in Australian Marine Parks.

Reporting of potential noncompliance and notifications in accordance with General Conditions 26, 27 and 37 should be made to the **24-hour Marine Compliance Duty Officer on 0419 293 465**. For all other enquiries relating to this permit, please contact: marineparks@environment.gov.au.

Stephen Weber

Director

Authorisations and Compliance

Marine Parks Branch

Delegate of the Director of National Parks

29 January 2020

Interpretation

In the permit and permit conditions:

Agreement means the agreement executed by the Permittee when applying for this permit.

Director means the Director of National Parks and the Director's delegates, and includes any statutory successor to the Director.

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

EPBC Regulations means the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth).

Indigenous Cultural and Intellectual Property means all aspects of Aboriginal or Torres Strait Islander people's cultural products, expressions knowledge and heritage, whether (a) intangible, such as songs, dances, stories, and ecological and cultural knowledge; or (b) tangible, such as human remains, artworks and artefacts.

Marine Park means the Australian Marine Parks under the EPBC Act for which this permit is issued.

Management Plan means the management plan or management plans made under the EPBC Act in operation from time to time for the Marine Parks specified by this permit.

Participants means the Permittee's employees, contractors, other agents and other individuals who take part in the Permitted Activity.

Permittee means each person (individual, company or other legal entity) to whom this permit is issued.

Permitted Activity means the specified activity or activities for which this permit is issued.

Warden means a person appointed as a warden under s.392 of the EPBC Act.

Australian Government

Environment Protection and Biodiversity Conservation Regulations 2000

Access to Biological Resources in a Commonwealth Area for Non-Commercial Purposes

Permit number	AU-COM2020-476
Date of issue	08 March 2020
Date of expiry	08 April 2020

Name and organisation of person to whom the permit is issued:	Diana Jones Glenn Moore Western Australian Museum 49 Kew Street, Welshpool Western Australia, 6106

Provision of Regulations for which permit issued	8A.06

Collection of biological material from Gascoyne Marine Park- Western Australia Museum

Access is permitted 08 March 2020 to the following location:

- Gascoyne Marine Park

to collect the following biological resources for non-commercial purposes:

Common name	Taxon (to the most specific taxonomic level known)	Amount/number/volume
Marine Invertebrates	*Acanthocephala* *Annelida* *Arthropoda* *Brachiopoda* *Bryozoa* *Chaetognatha* *Cnidaria* *Ctenophora* *Echinodermata* *Entoprocta* *Gastrotricha* *Gnathostomulida* *Hemichordata* *Kinorhyncha* *Loricifera* *Mollusca* *Nematoda* *Nemertea* *Onychophora* *Orthonectida* *Phoronida* *Platyhelminthes* *Porifera* *Priapulida* *Rhombozoa* *Sipunculida* *Tardigrada* *Xenocoelomorpha*	Up to 6 specimens per morphospecies, per collection site (**≤8** per dive), by ROV from the National Marine Park. **Note:** number of samples collected will be based on relative abundance, with only 1 or 2 specimens taken where abundance is low. Number of collection depth sites will vary depending on ROV dive depth, conditions, and faunal abundance.
Fishes	*Cyclostomata* *Elasmobranchii* *Holocephali* *Actinopterygii* *Sarcopterygii*	1-5 Individuals per species per site **Note:** By catch may be retained if return of samples is not possible, or if they have already perished. Number of samples collected will be based on relative abundance, with less than 5 specimens taken where abundance is low
Deep sea benthos	Various as above	Up to 3 sediment (push) core samples collected by ROV from 20 sites within each of the proposed locations within the National Marine Park
eDNA from filtered sea water samples	Various as above	eDNA will be filtered from a maximum of 3600 L of sea water from the National Marine Park. Water will not be retained.

Australian Government

Environment Protection and Biodiversity Conservation Regulations 2000

Conditions:

1. The permit holder may authorise in writing another person to perform actions specified in this permit.
2. The permit holder must obtain all other required permit(s) to conduct the specified project.
3. Collection methods shall not attract undue attention or cause unapproved damage, depletion, or disturbance to the environment and other resources such as historic sites.
4. The permit holder will maintain records for each biological sample taken in accordance with subregulation 8A.19 of the *Environment Protection and Biodiversity Conservation Regulations 2000* and provide a copy of these records to the Commonwealth within a reasonable period after the sample is taken.
5. No specimens (including materials) may be collected unless authorised by this permit.
6. The permit holder who undertakes an activity that results in the unintentional death, injury, trading, taking, keeping or moving of a member of a listed threatened species (except a conservation dependent species), a member of a listed threatened ecological community, a member of a listed migratory species, or a member of a listed marine species in or on a Commonwealth area that was not authorised by the permit must notify the Department of the Agriculture, Water and Environment (The Secretary, Department of the Agriculture, Water and the Environment, GPO Box 787, Canberra ACT 2601; email: EPBC.Permits@environment.gov.au) within 7 days of becoming aware of the results of the activity.
7. The permit holder shall not use the biological resources to which this permit relates for commercial purposes and will provide a written report on the results of any research on the biological resources to the Commonwealth of Australia.
8. The permit holder will not give the sample to any person without permission of the Commonwealth of Australia.
9. The permit holder will not carry out, or allow others to carry out, research or development for commercial purposes on any genetic resources, or biochemical compounds, comprising or contained in the biological resources unless a benefit sharing agreement has been entered into with the access provider.
10. Access is permitted for Non-Commercial purposes. Failure to adhere to these conditions is an offence and may also result in suspension or cancellation of this permit.

Kynan Gowland, Director, Parks Science and Strategy Section, Parks Australia

Permit issued by Delegate of the Minister for the Environment

18/02/2020

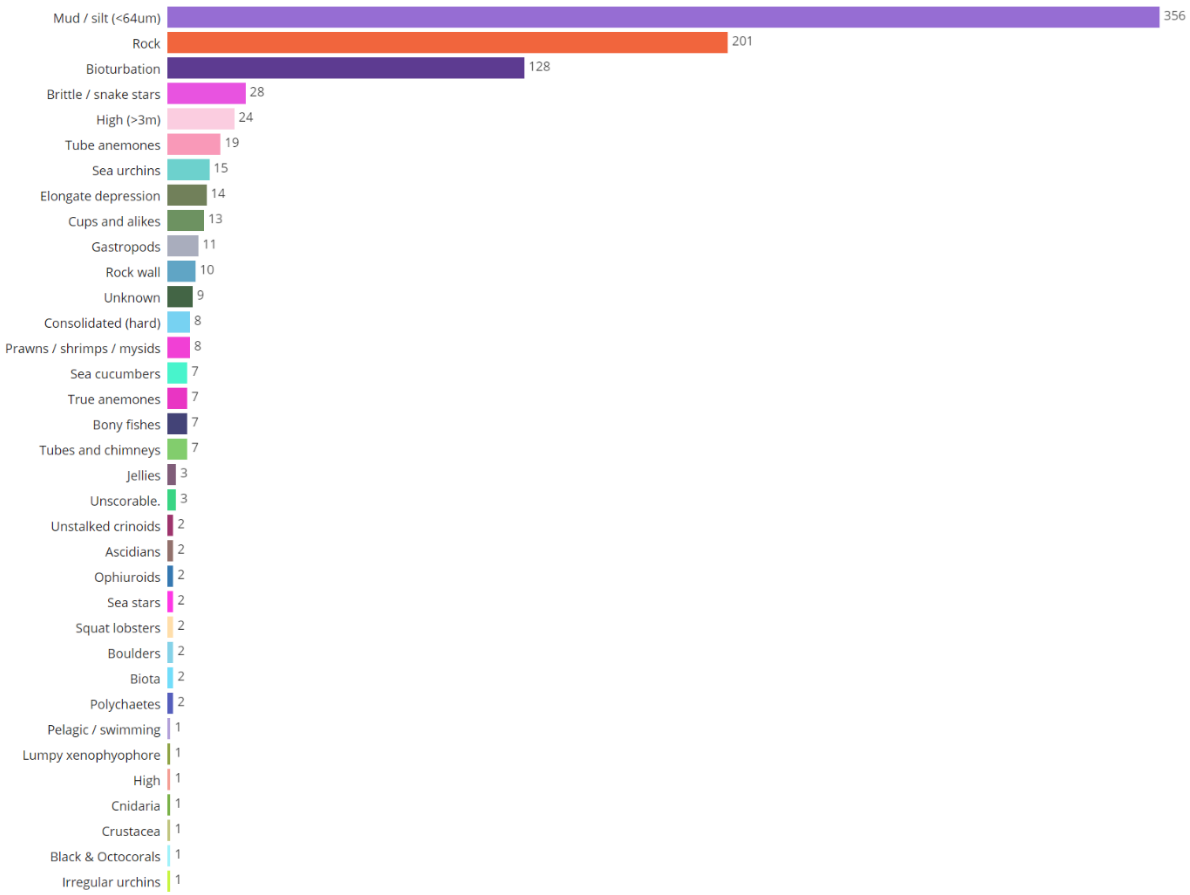
Permit Number: AU-COM2020-476

Appendix C – Summaries of ROV Image Transects

Transect S0332

This transect was annotated onboard using a still image acquired every 10 seconds of video.

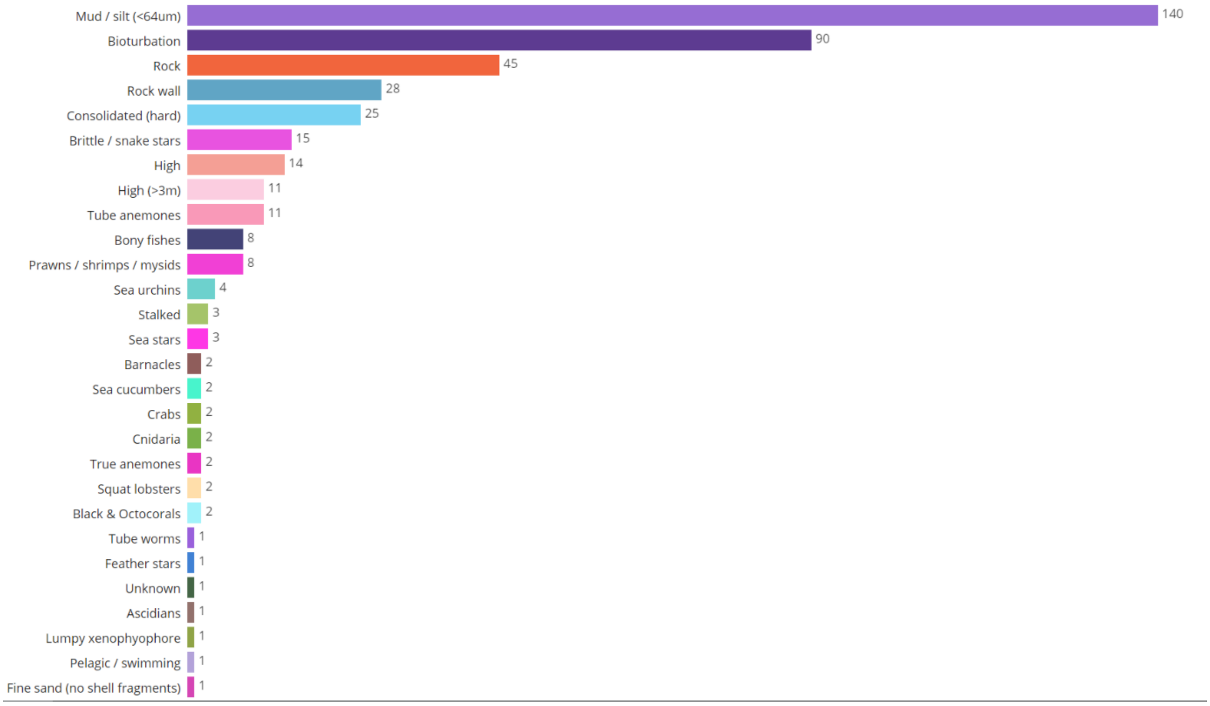
The transect was dominated by bioturbated muddy flat expanses with bioturbation and no ripples. **Distinctive features** on this transect were crevice *Lebensppuren* (traces on the sediment made by organisms) which were not observed on all other transects. The rest of the transect was typical of other observed images at this depth in the Cape Range canyons regarding features and fauna.



Transect S0333

This transect was annotated onboard using a still image acquired every 20 seconds of video.

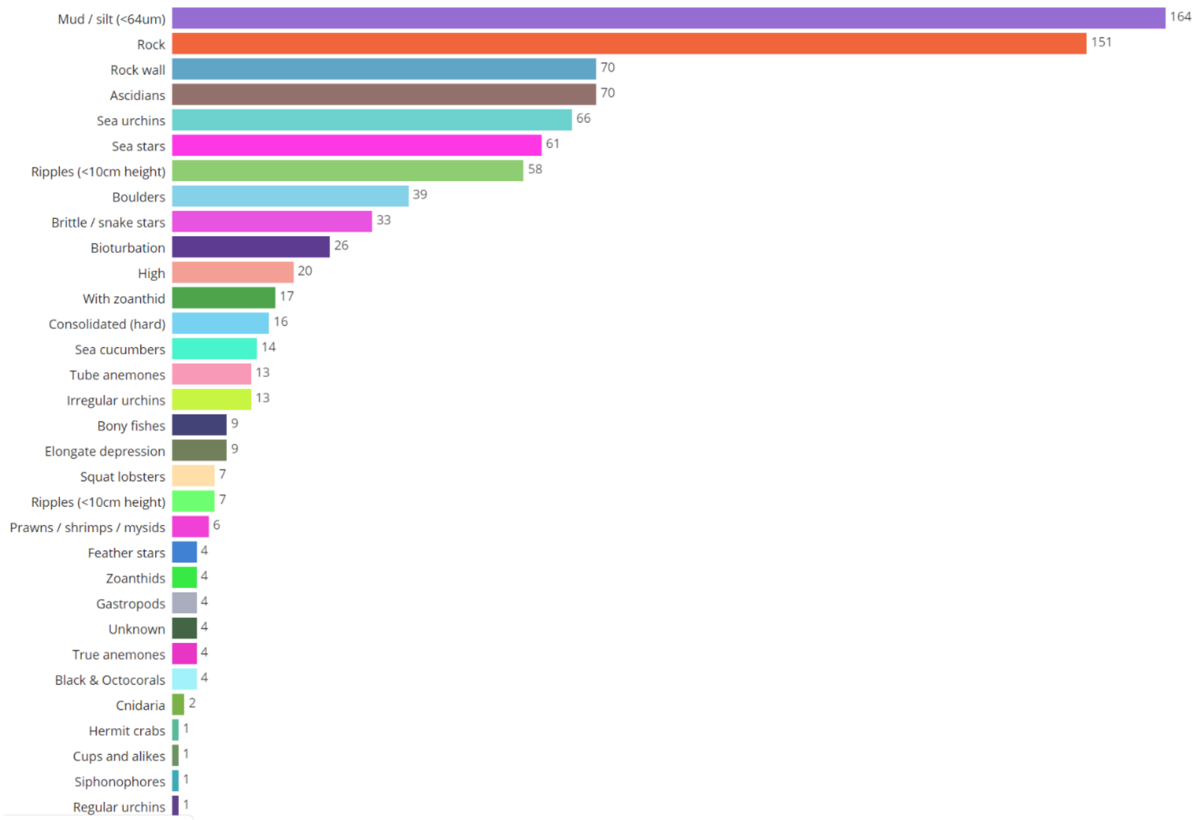
It was dominated by muddy flat expanses, with no ripples. **Distinctive features** were large smooth outcrops of siltstone or silt-crusted rock towards the middle of the transect. There were localised areas of moderate-density brittlestars on the muddy expanses and evidence of bioturbation throughout most of the transect. The rest of the transect was typical of other observed images at this depth in the Cape Range canyons regarding features and fauna.



Transect S0335

This transect was annotated onboard using a still image acquired every 20 seconds of video.

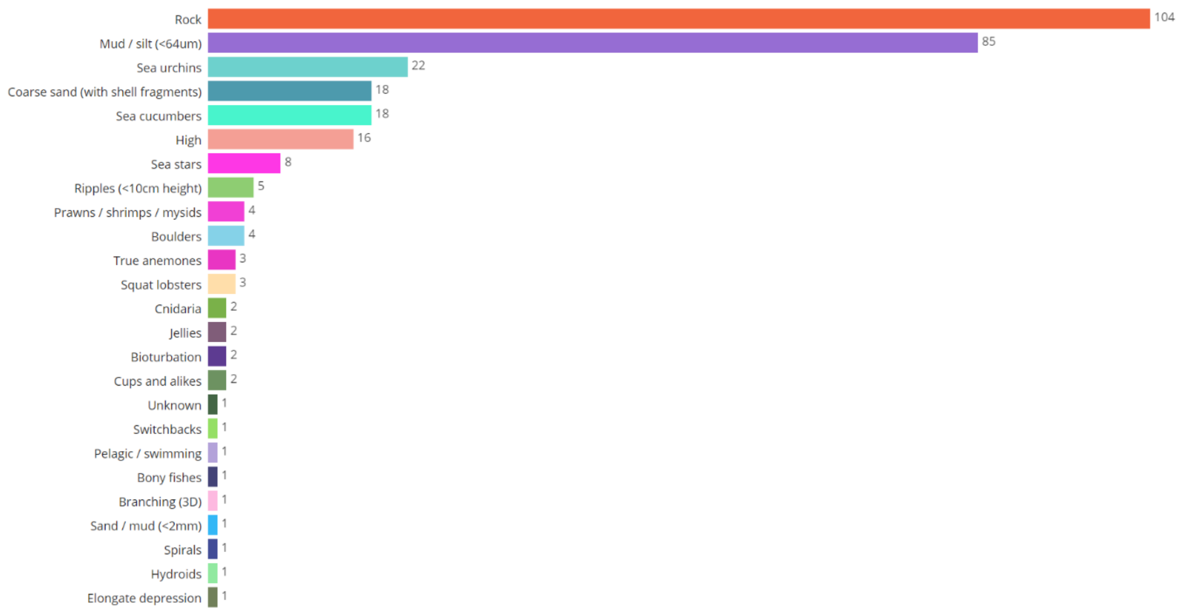
Distinctive features on this transect were 3-dimensional ripples in the muddy flat expanses. Partway through, there was an area of large, pock-marked rounded ledges and attached boulders interspersed with muddy flat corridors on the slope. At the end of the transect, there was a high barren vertical rock face at the top of which was a flat mud expanse. **Distinctive fauna** common on this transect were hermit crabs with red anemones, heart urchins within the first half of the transect, regular urchins, and clear carnivorous ascidians that clung to hard rock faces towards the latter half of the transect. As we neared the top of the wall, brisingid seastars and ophiuroids dominated, with very high densities at the crest.



Transect S0336

This transect began with a muddy expanse with minimal bioturbation and no ripples. It rapidly transitioned into rocky outcrops with small patches of low-relief mud or sandier shell hash. **Distinctive features** on this transect with rocky outcrops and boulders with sheer faces and patches of shell hash distinctive from surrounding rock and mud. **Distinctive fauna** on this transect were shaggy-dog sea cucumbers (covered in hydroids) that were specific to rocky outcrops, long-spiked sea urchins in higher abundance than previous transects, and very low abundance of fish.

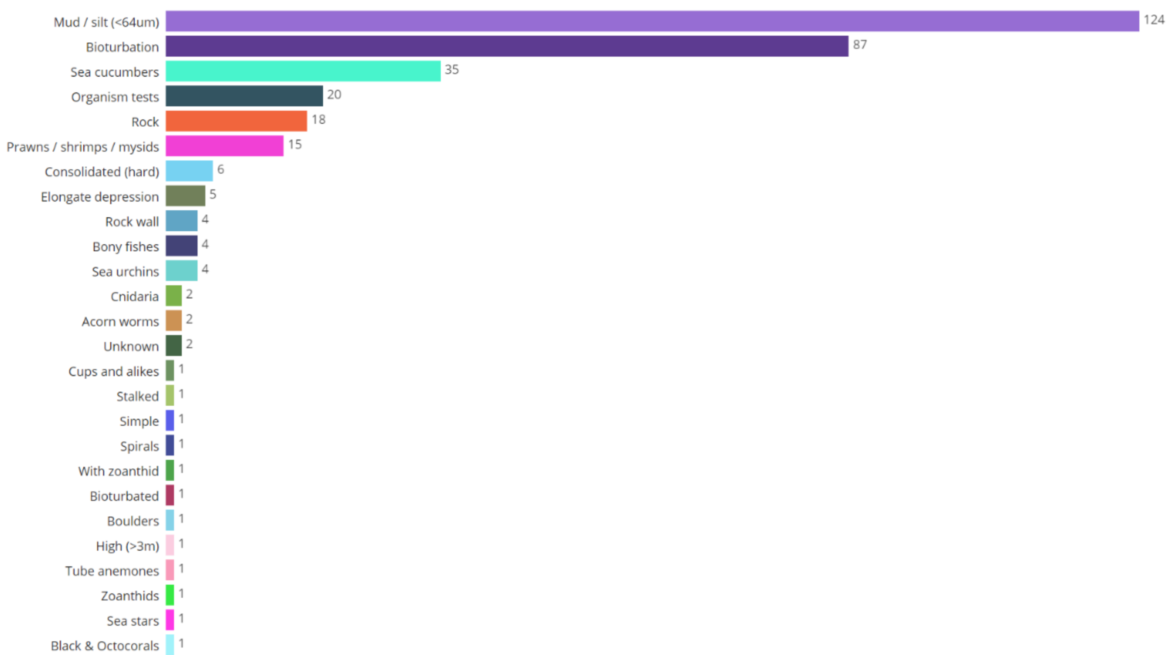
This transect was annotated onboard using a still image acquired every 20 seconds of video.



Transect S0337

This transect began with a muddy expanse with moderate to high levels of bioturbation and no ripples. There was a vertical rock wall midway through the transect followed by another muddy low-relief expanse which ended up on a steep but still low-relief slope. Unlike transect S0336, the crest of this rock wall did not have any obvious biota on it. After the transect finished, there were a few other vertical walls of a few metres, rather like the occasional step up the muddy expanses. There were no obvious distinctive features which matched those found in earlier sites. **Distinctive fauna** were a few tulip-shaped glass sponges anchored in the sediment, flat sponge-like flattened erect sediment tests (likely xenophyophore) which hadn't been seen in shallower sites, and multiple species of holothurian.

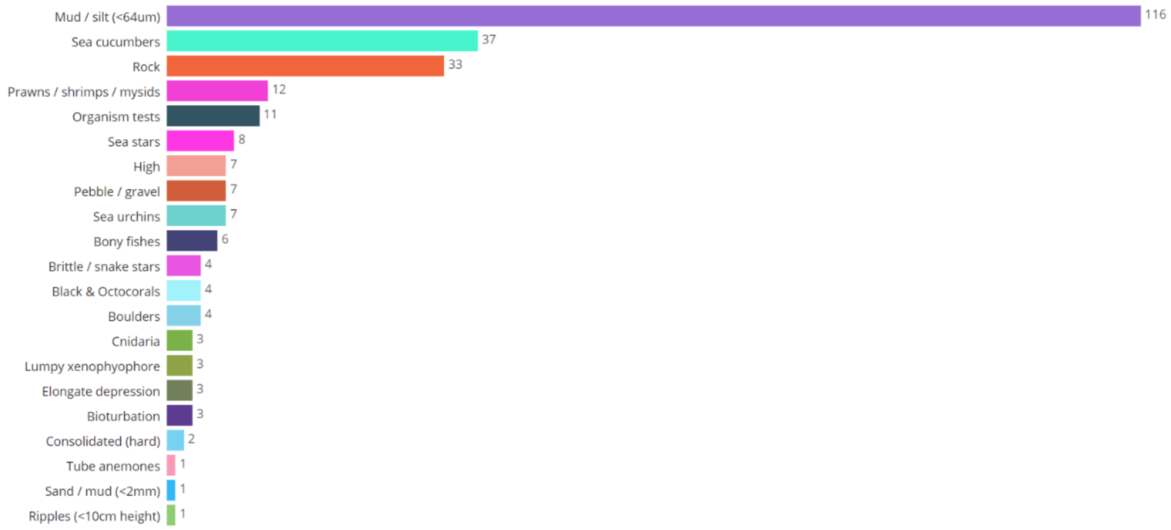
This transect was annotated onboard using a still image acquired every 20 seconds of video.



Transect S0338

The transect began with strips of exposed high-relief rock interspersed with large expanses of mud with minimal bioturbation. The muddy expanses were undulating, almost like dunes with rocky outcrops beneath. **Distinctive features** include patches of gravel and rubble between a high-relief rocky ridge seen towards the middle of the transect and minimal bioturbation compared to most other previous sites. **Distinctive fauna** included a wavy xenophyophore test composed of sediment and multiple species of holothurian.

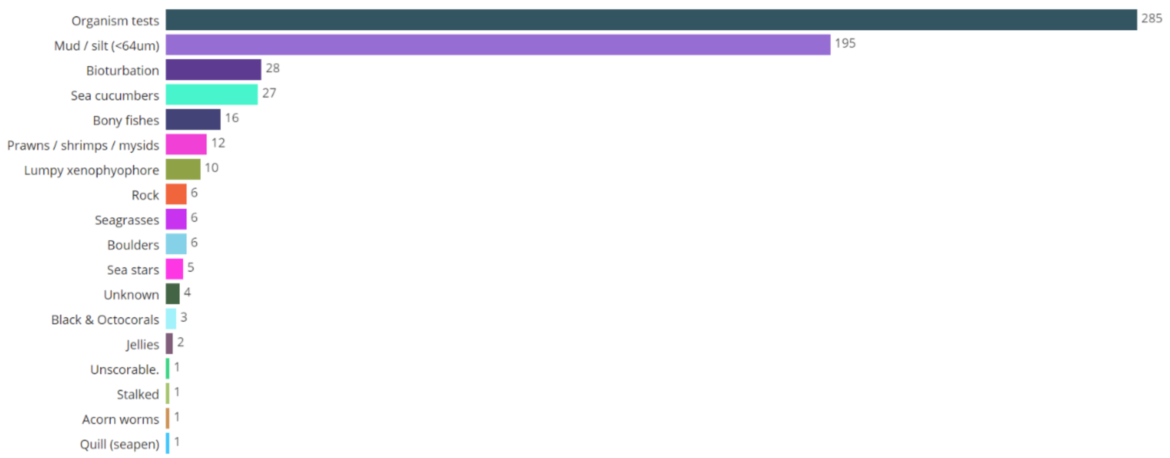
This transect was annotated onboard using a still image acquired every 20 seconds of video.



Transect S0339

Distinctive features included almost exclusively muddy substrate with only the occasional rock (including a boulder with odd gouging). **Distinctive organisms** included very high abundances of the wavy xenophyophore test previously only seen on Transect S0338 in low abundances, some lumpy xenophyophores, sporadic seagrass blades, and a conspicuous grideye fish (*Ipnops* sp.).

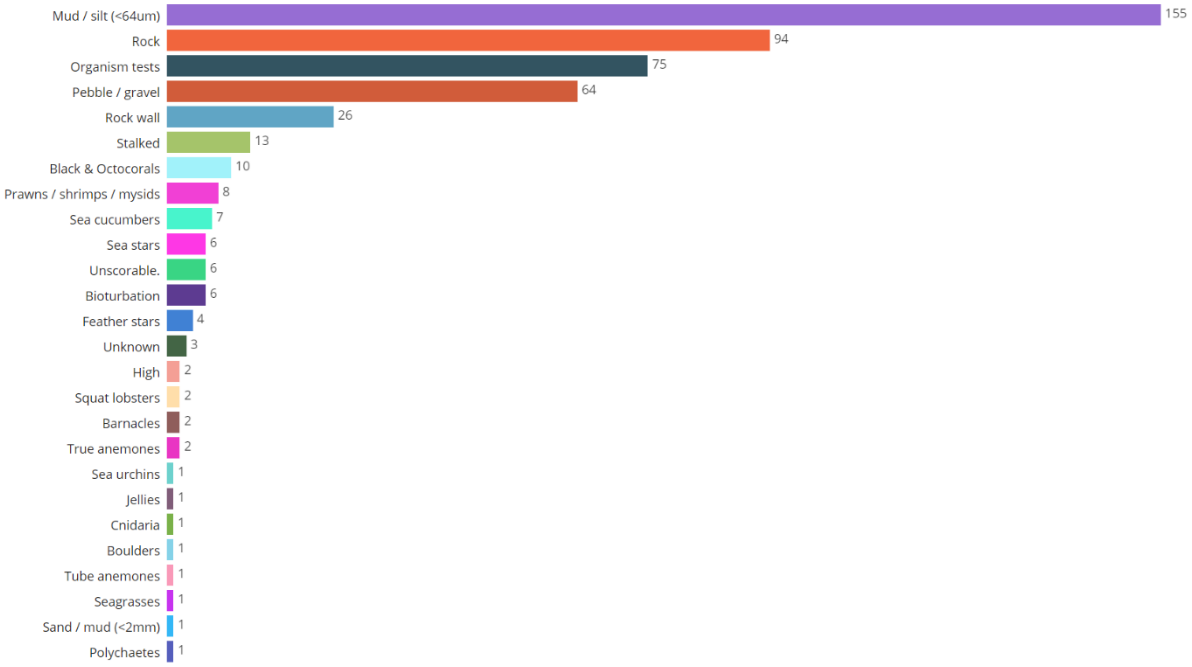
This transect was annotated onboard using a still image acquired every 10 seconds of video, as the ROV pilots travelled faster on this transect (~0.4 knots) due to reduced dive time.



Transect S0340

Distinctive features included muddy expanses with minimal bioturbation, and patches of large gravel and pebbles. **Distinctive fauna** include stalked glass sponges throughout the soft sediment (including dead but persisting stalks upon which other macrofauna lives) and moderate abundances of the wavy xenophyophore tests.

This transect was annotated onboard using a still image acquired every 20 seconds of video for the first part of the transect, and then every 10 seconds for some of the latter part in the low relief areas, as the ROV sped up to 0.4 knots in these habitats towards the end.

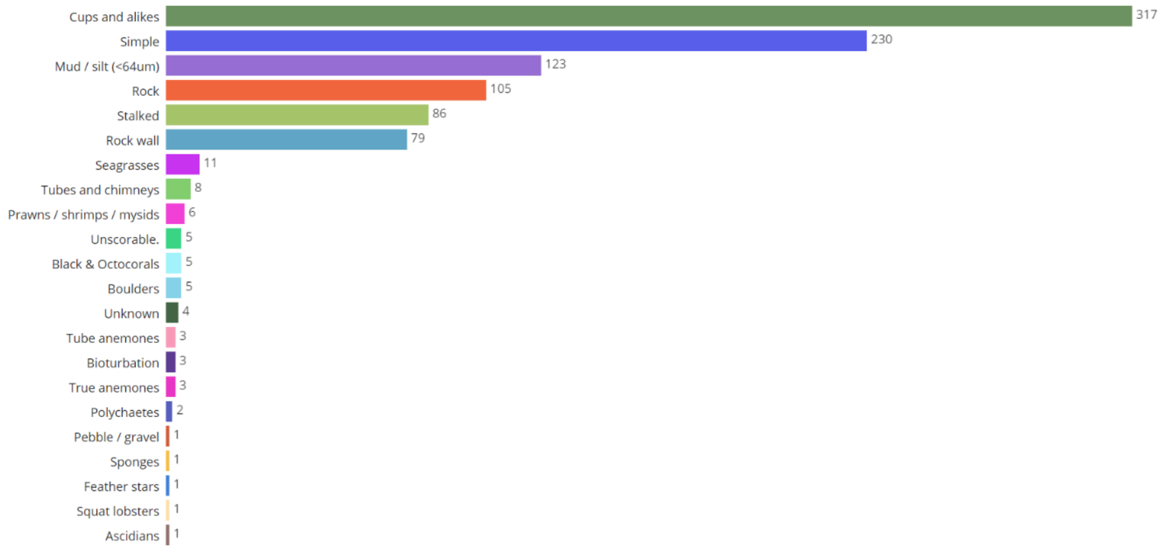


Transect S0342

Distinctive features include steps of muddy slopes with minimal bioturbation alternating with vertical or very steep rock walls as well as some overhang. **Distinctive fauna** include glass sponge gardens of multiple species on overhangs of vertical rock walls, the almost complete lack of biota and bioturbation on the steep muddy slopes, and prevalence of seagrass blades at the beginning of the transect.

There was a small break in the transect towards the latter half, as the ROV was having technical issues with the imagery feed and maintaining safe operations over the rock wall.

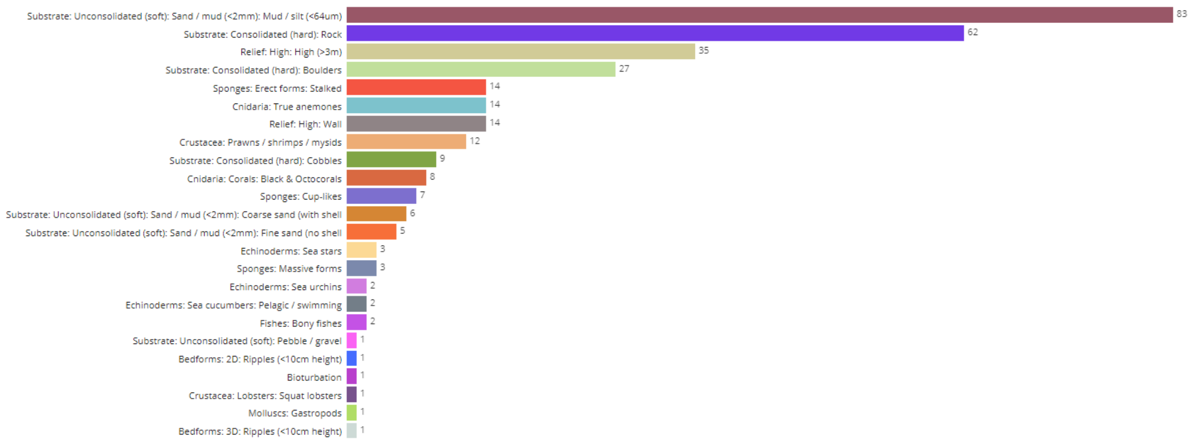
This transect was annotated onboard using a still image acquired every 20 seconds of video.



Transect S0343

Distinctive features included steep sediment-covered canyon walls interspersed with bare rocks (uncommon) or sediment-covered rocks (common). Towards the steeper part of the transect, conglomerated sediment protrusions jutted out from the canyon slope (scored as 'boulders). Some parts of the transect appeared to be vertical walls of consolidated sediment. These had odd vertical tube structures which may have been biogenic but were not annotated due to uncertainty. **Distinctive fauna** included highly localised abundances of carnivorous sponges and anemones, communities of which were found each on a single rock. There was very little evidence of bioturbation.

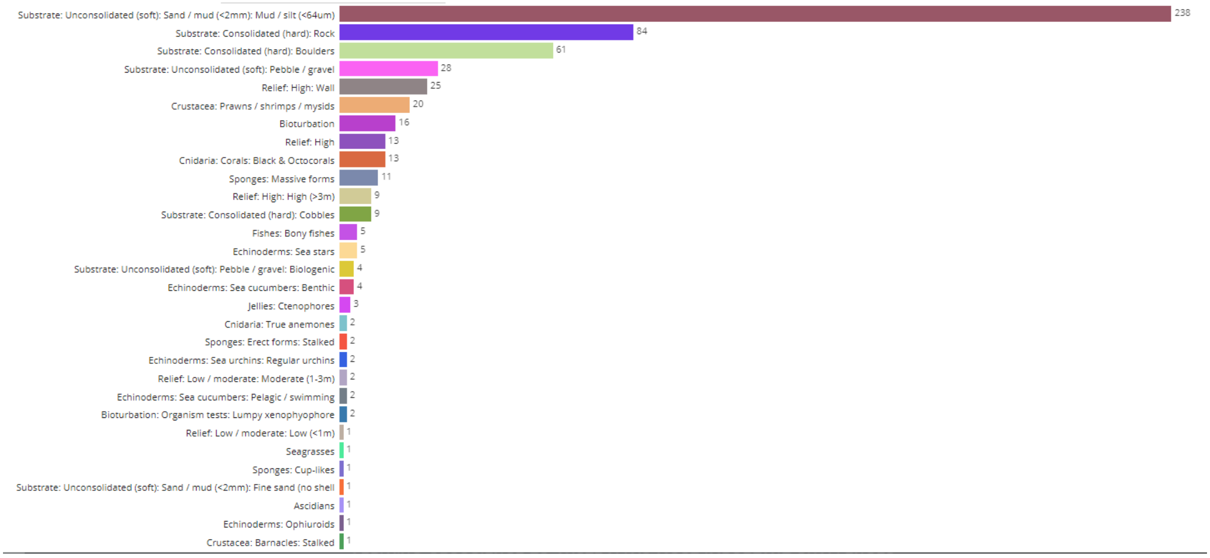
This transect was annotated post-survey (July 2020) using a still image acquired every 20 seconds of video.



Transect S0346

Distinctive features included a muddy slope at the start of the transect, followed by a steep rocky slope with patches of mud, gravel, and jagged boulders. **Distinctive fauna** include circles in the sediment with a gelatinous organism on the circumference seen at the beginning of the transect at the muddy crest of a rocky berm (currently unlabelled annotations). Translucent organisms were seen on the surface of the muddy sediment expanse after the first major rock wall; these were tentatively identified as benthic ctenophores. Scattered black corals which seemed to be the same species occurred in the muddy sediment plains.

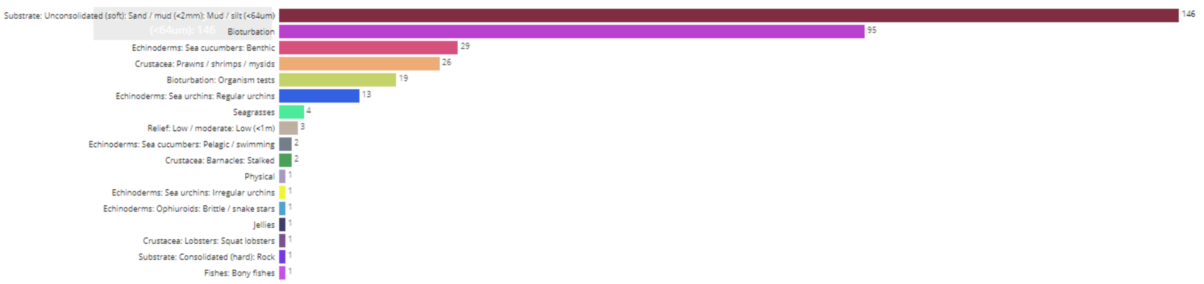
This transect was annotated post-survey (June 2020) using a still image acquired every 20 seconds of video most of the transect but every 10 seconds during and immediately after the rock walls to account for the increase in speed to ~0.4 knots.



Transect S0347

Distinctive features include an almost completely homogenous abyssal plain. There was sign of a sediment-veneer slope in the first half of the transect, but only a couple of images showed exposed rocks. **Distinctive fauna** included a common oddly-shaped sea cucumber with a large translucent tube parachuting off the top of the main body – most individuals were purple, but some were golden. Small round globules were seen towards the latter part of the transect; these were annotated as ‘organism tests’ because they had a similar shape to xenophyhore globules seen in previous video from GA2476, but these were not covered in sediment and may instead have been benthic ctenophores. There were some mounds of sediment observed throughout the transect that may have been buried heart urchins or sea cucumbers, but these were not annotated due to strong uncertainty. There was only a single fish observed.

This transect was annotated post-survey (June 2020) using a still image acquired every 20 seconds of video.



Appendix D – List of biological specimens collected

Crustacea

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75559	Lepadiformes	Poecilasmatidae	Glyptelasma		S0332/021	1	3/11/2020	21°52`59"S	113°17`36"E
75560	Decapoda	Munididae	Munida		S0332/011	1	3/11/2020	21°53`0"S	113°17`37"E
75561	Decapoda	Munididae	Munida		S0332/018	1	3/11/2020	21°52`59"S	113°17`36"E
75562	Decapoda	Thoridae	Lebbeus		S0332/018	1	3/11/2020	21°52`59"S	113°17`36"E
75563	Decapoda	Pandalidae	Plesionika		S0332/018	1	3/11/2020	21°52`59"S	113°17`36"E
75564	Decapoda	Homolidae			S0332/026	1	3/11/2020	21°52`58"S	113°17`37"E
75565	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75566	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75567	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001	1	11/03/2020	21°58`3"S	113°10`19"E
75568	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001	1	11/03/2020	21°58`3"S	113°10`19"E
75569	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001	1	11/03/2020	21°58`3"S	113°10`19"E
75570	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001	1	11/03/2020	21°58`3"S	113°10`19"E
75571	Amphipoda				FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75572	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75573	Amphipoda				FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75574	Amphipoda	Tryphosidae	Cheirimedon?		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75575	Amphipoda		Amphipoda		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75576	Amphipoda	Tryphosidae	Orchomene?		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75577	Amphipoda	Tryphosidae?			FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75578	Amphipoda		Amphipoda		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75579	Amphipoda		Amphipoda		FK200308/LDR/001		11/03/2020	21°58`3"S	113°10`19"E
75580	Amphipoda		Amphipoda		S0333/003	4	3/12/2020	21°58`7"S	113°10`16"E
75581	Scalpelliformes	Scalpellidae	Verum		S0333/003	1	3/12/2020	21°58`7"S	113°10`16"E
75582	Decapoda	Munididae	Munida		S0333/009	1	3/12/2020	21°58`16"S	113°10`21"E
75583	Amphipoda	Hyperiidae			S0334/001	1	13/3/2020	21°33`17"S	112°27`27"E
75584	Amphipoda	Eurytheneidae	Eurythenes		FK200308/FTR/001	3	12/03/2020	21°58`5"S	113°10`4"E
75585	Amphipoda	Eurytheneidae	Eurythenes		FK200308/FTR/001	13	12/03/2020	21°58`5"S	113°10`4"E
75586	Amphipoda	Eurytheneidae	Eurythenes		FK200308/FTR/001	14	12/03/2020	21°58`5"S	113°10`4"E
75587	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/002	30	12/03/2020	21°58`14"S	113°10`10"E
75588	Isopoda	Sphaeromatidae	Sphaeromatidae		FK200308/LDR/002	1	12/03/2020	21°58`14"S	113°10`10"E
75589	Isopoda	Sphaeromatidae	Sphaeromatidae		FK200308/LDR/002	1	12/03/2020	21°58`14"S	113°10`10"E
75590	Amphipoda	Tryphosidae	Cheirimedon 1		FK200308/LDR/002	20	12/03/2020	21°58`14"S	113°10`10"E
75591	Amphipoda	Tryphosidae	Cheirimedon 2		FK200308/LDR/002	10	12/03/2020	21°58`14"S	113°10`10"E
75592	Cumacea		Cumacea		FK200308/LDR/002	1	12/03/2020	21°58`14"S	113°10`10"E
75593	Amphipoda		Amphipoda		FK200308/LDR/002	1	12/03/2020	21°58`14"S	113°10`10"E
75594	Amphipoda		Amphipoda		FK200308/LDR/002	2	12/03/2020	21°58`14"S	113°10`10"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75595	Amphipoda		Amphipoda		FK200308/LDR/002	4	12/03/2020	21°58`14"S	113°10`10"E
75596	Amphipoda		Amphipoda		FK200308/LDR/002	1	12/03/2020	21°58`14"S	113°10`10"E
75597	Amphipoda		Amphipoda		FK200308/LDR/002	10	12/03/2020	21°58`14"S	113°10`10"E
75598	Amphipoda		Amphipoda		FK200308/LDR/002		12/03/2020	21°58`14"S	113°10`10"E
75599	Amphipoda		Amphipoda		FK200308/LDR/002	3	12/03/2020	21°58`14"S	113°10`10"E
75600	Amphipoda	Tryphosidae	Cheirimedon 2		FK200308/LDR/002	3	12/03/2020	21°58`14"S	113°10`10"E
75601	Amphipoda		Amphipoda		FK200308/LDR/002	2	12/03/2020	21°58`14"S	113°10`10"E
75602	Amphipoda		Amphipoda		FK200308/LDR/002	1	12/03/2020	21°58`14"S	113°10`10"E
75603	Decapoda	Luciferidae	Lucifer		FK200308/PLK/001	10	13/03/2020	21°58`12"S	113°10`6"E
75604	Cyclopoida	Sapphirinidae	Sapphrina		FK200308/PLK/001	1	13/03/2020	21°58`12"S	113°10`6"E
75605	Sessilia	Verrucidae	Gibbosaverruca		S0335/018	1	14/3/2020	21°56`20"S	113°7`12"E
75606	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0335/022	1	14/3/2020	21°56`17"S	113°7`12"E
75607	Lepadiformes	Poecilasmatidae	Glyptelasma		S0335/022	5	14/3/2020	21°56`17"S	113°7`12"E
75608	Decapoda	Parapaguridae	Parapagurus		S0335/012	1	14/3/2020	21°56`27"S	113°7`14"E
75609	Decapoda	Munididae	Munidopsis		S0335/020	1	14/3/2020	21°56`17"S	113°7`12"E
75610	Scalpellifiormes	Scalpellidae	Catherinum		S0335/005	2	14/3/2020	21°56`32"S	113°7`15"E
75611	Amphipoda		Amphipoda		FK200308/LDR/003		14/03/2020	21°52`58"S	112°59`34"E
75612	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/003		14/03/2020	21°52`58"S	112°59`34"E
75613	Amphipoda	Tryphosidae?			FK200308/LDR/003		14/03/2020	21°52`58"S	112°59`34"E
75614	Decapoda	Munididae	Galacantha		S0336/025	1	15/03/2020	21°52`51"S	113°0`58"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75615			Copepoda		S0336/005	1	15/3/2020	21°53`9"S	113°0`48"E
75616	Scalpellifiormes	Scalpellidae	Neoscalpellum		S0336/006	1	15/3/2020	21°53`9"S	113°0`48"E
75617	Sessilia	Verrucidae	Altiverruca		S0336/016	2	15/3/2020	21°52`53"S	113°0`56"E
75618	Lepadiformes	Poecilasmatidae	Poecilasma		S0336/017	3	15/3/2020	21°52`53"S	113°0`56"E
75619	Decapoda	Pandalidae	Plesionika		S0336/023	1	15/3/2020	21°52`52"S	113°0`58"E
75620	Scalpellifiormes	Calanticidae	Scillaelepas		S0337/009	1	16/3/2020	21°50`5"S	112°55`35"E
75621	Scalpellifiormes	Calanticidae	Scillaelepas		S0337/009	1	16/3/2020	21°50`5"S	112°55`35"E
75622	Scalpellifiormes	Calanticidae	Scillaelepas		S0337/009	1	16/3/2020	21°50`5"S	112°55`35"E
75623	Scalpellifiormes	Calanticidae	Scillaelepas		S0337/009	1	16/3/2020	21°50`5"S	112°55`35"E
75624	Scalpellifiormes	Calanticidae	Scillaelepas		S0337/009	6	16/3/2020	21°50`5"S	112°55`35"E
75625	Decapoda	Parapaguridae	Parapagurus		S0337/023	1	16/3/2020	21°49`43"S	112°55`36"E
75626	Amphipoda		Amphipoda		S0337/016	1	16/3/2020	21°49`49"S	112°55`34"E
75627	Isopoda	Arcturidae			S0337/013	3	16/3/2020	21°49`52"S	112°55`35"E
75628	Lepadiformes	Poecilasmatidae	Poecilasma		S0337/013	7	16/3/2020	21°49`52"S	112°55`35"E
75629	Amphipoda	Eurytheneidae	Eurythenes		FK200308/FTR/002	3	17/03/2020	21°52`57"S	113°0`55"E
75630	Amphipoda	Tryphosidae	Cheirimedon 1		FK200308/FTR/002	10	17/03/2020	21°52`57"S	113°0`55"E
75631	Amphipoda	Tryphosidae?			FK200308/FTR/002	7	17/03/2020	21°52`57"S	113°0`55"E
75632	Decapoda	Munidopsidae	Munidopsis		S0338/022	1	17/3/2020	21°53`47"S	112°54`17"E
75633	Akentrogonida	Thompsoniidae	Polysaccus		S0338/022	1	17/3/2020	21°53`47"S	112°54`17"E
75634	Decapoda	Munidopsidae	Munidopsis		S0338/021	1	17/3/2020	21°53`48"S	112°54`17"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75635	Amphipoda	Epimeriidae	Epimeria		S0338/007	1	17/3/2020	21°54`6"S	112°54`16"E
75636	Decapoda	Benthesicymidae			S0339/008	1	18/3/2020	21°55`39"S	112°50`12"E
75637	Amphipoda		Amphipoda		S0338/007	1	17/3/2020	21°54`6"S	112°54`16"E
75638	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0340/033	3	19/3/2020	21°51`27"S	112°45`28"E
75639	Sessilia	Verrucidae	Gibbosaverruca		S0340/033	20	19/3/2020	21°51`27"S	112°45`28"E
75640	Lepadiformes	Poecilasmatidae	Glyptelasma		S0340/033	1	19/3/2020	21°51`27"S	112°45`28"E
75641	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0340/033	1	19/3/2020	21°51`27"S	112°45`28"E
75642	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0340/033	1	19/3/2020	21°51`27"S	112°45`28"E
75643	Lepadiformes	Poecilasmatidae	Glyptelasma		S0340/033	1	19/3/2020	21°51`27"S	112°45`28"E
75644	Amphipoda		Amphipoda		S0340/020	1	19/3/2020	21°51`27"S	112°45`25"E
75645	Isopoda	Cryptoniscidae	Cryptoniscus		S0340/033	2	19/3/2020	21°51`27"S	112°45`28"E
75646	Lepadiformes	Poecilasmatidae	Glyptelasma		S0340/007	12	19/3/2020	21°51`46"S	112°45`25"E
75647	Decapoda	Benthesicymidae			S0340/030	1	19/3/2020	21°51`27"S	112°45`28"E
75648	Decapoda	Solenoceridae			S0340/008	1	19/3/2020	21°51`45"S	112°45`24"E
75649	Amphipoda		Amphipoda		S0342/016	2	21/3/2020	21°51`59"S	112°41`14"E
75650	Sessilia	Verrucidae	Altiverruca		S0342/012	1	21/3/2020	21°51`59"S	112°41`14"E
75651	Decapoda	Munidopsidae	Munidopsis		S0342/014	1	21/3/2020	21°51`59"S	112°41`14"E
75652	Decapoda	Munidopsidae	Munidopsis		S0342/006	1	21/3/2020	21°51`57"S	112°41`15"E
75653	Decapoda	Munidopsidae	Munidopsis		S0342/018	1	21/3/2020	21°51`59"S	112°41`15"E
75654	Amphipoda	Tryphosidae	Cheirimdeon		FK200308/FTR/003	12	20/03/2020	21°51`52"S	112°41`29"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75655	Amphipoda	Eurytheneidae	Eurythenes		FK200308/FTR/003	3	20/03/2020	21°51`52"S	112°41`29"E
75656	Amphipoda		Amphipoda		FK200308/FTR/003	3	20/03/2020	21°51`52"S	112°41`29"E
75657	Amphipoda	Hyperiidae			FK200308/LDR/004	3	20/03/2020	21°51`44"S	112°41`23"E
75658	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/004	20	20/03/2020	21°51`44"S	112°41`23"E
75659	Amphipoda	Tryphosidae	Cheirimedon		FK200308/LDR/004	9	20/03/2020	21°51`44"S	112°41`23"E
75660	Amphipoda	Tryphosidae?			FK200308/LDR/004	3	20/03/2020	21°51`44"S	112°41`23"E
75661	Amphipoda		Amphipoda		FK200308/LDR/004	1	20/03/2020	21°51`44"S	112°41`23"E
75662	Amphipoda		Amphipoda		FK200308/LDR/004	8	20/03/2020	21°51`44"S	112°41`23"E
75663	Isopoda		Asellota		S0343/020	1	22/3/2020	21°52`22"S	112°42`45"E
75664	Amphipoda	Hyperiidae			FK200308/PLK/002		24/03/2020	21°46`54"S	112°39`36"E
75665	Decapoda	Luciferidae	Lucifer		FK200308/PLK/002		24/03/2020	21°46`54"S	112°39`36"E
75666	Cyclopoida	Sapphirinidae	Sapphrina		FK200308/PLK/002		24/03/2020	21°46`54"S	112°39`36"E
75667			Bulk Plankton		FK200308/PLK/002		24/03/2020	21°46`54"S	112°39`36"E
75668	Amphipoda	Hyperiidae			FK200308/PLK/002		24/03/2020	21°46`54"S	112°39`36"E
75669	Decapoda	Munidopsidae	Munidopsis		S0345/017	1	25/3/2020	21°51`53"S	112°41`15"E
75670	Amphipoda	Ischyroceridae	Siphonoecetes		S0345/018	1	25/03/2020	21°51`53"S	112°41`15"E
75671	Amphipoda	Ischyroceridae	Siphonoecetes		S0345/018	7	25/03/2020	21°51`53"S	112°41`15"E
75672	Amphipoda		Amphipoda		S0345/003	2	25/3/2020	21°51`44"S	112°41`16"E
75674	Isopoda		Asellota		S0345/020	2	25/03/2020	21°51`53"S	112°41`15"E
75675	Decapoda	Solenoceridae			S0346/010	1	26/3/2020	21°46`27"S	112°36`47"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75676	Tanaidacea		Tanaidacea		S0346/020	1	26/3/2020	21°46`9"S	112°36`46"E
75677	Scalpellifiormes	Scalpellidae	Amigdoscalpellum		S0346/014	1	26/3/2020	21°46`12"S	112°36`46"E
75678	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0347/012	1	27/3/2020	21°49`4"S	112°30`39"E
75679	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0347/012	1	27/3/2020	21°49`4"S	112°30`39"E
75680	Decapoda	Crangonidae			S0347/009	1	27/3/2020	21°49`12"S	112°30`34"E
75681	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/005	1	25/03/2020	21°48`60"S	112°30`41"E
75682	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/005	2	25/03/2020	21°48`60"S	112°30`41"E
75683	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/005	10	25/03/2020	21°48`60"S	112°30`41"E
75684	Amphipoda	Tryphosidae?			FK200308/LDR/005	10	25/03/2020	21°48`60"S	112°30`41"E
75685	Amphipoda	Eurytheneidae	Eurythenes		FK200308/FTR/004	1	25/03/2020	21°49`11"S	112°30`33"E
75686	Amphipoda		Amphipoda		FK200308/FTR/004	1	25/03/2020	21°49`11"S	112°30`33"E
75687	Decapoda	Parapaguridae	Parapagurus		S0348/001	1	28/3/2020	22°15`59"S	113°0`39"E
75688	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/006	10	28/03/2020	22°15`12"S	112°53`21"E
75689	Amphipoda	Tryphosidae?			FK200308/LDR/006	2	28/03/2020	22°15`12"S	112°53`21"E
75690	Amphipoda	Tryphosidae	Cheirimedon		FK200308/LDR/006	2	28/03/2020	22°15`12"S	112°53`21"E
75691	Amphipoda		Amphipoda		FK200308/LDR/006	8	28/03/2020	22°15`12"S	112°53`21"E
75692	Amphipoda		Amphipoda		S0349/007	1	2/04/2020	22°15`13"S	112°53`30"E
75693	Lepadiformes	Poecilasmatidae	Glyptelasma		S0349/015	5	2/04/2020	22°15`20"S	112°53`30"E
75694	Amphipoda		Amphipoda		S0349/015	1	2/04/2020	22°15`20"S	112°53`30"E
75695	Lepadiformes	Poecilasmatidae	Glyptelasma		S0349/015	1	2/04/2020	22°15`20"S	112°53`30"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75696	Amphipoda		Amphipoda		S0349/004	1	2/04/2020	22°15`12"S	112°53`30"E
75697	Lepadiformes	Poecilasmatidae	Glyptelasma		S0349/014	3	2/04/2020	22°15`19"S	112°53`30"E
75698	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0350/018	1	4/04/2020	22°12`26"S	112°35`56"E
75699	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0350/018	1	4/04/2020	22°12`26"S	112°35`56"E
75700	Scalpellifiormes	Scalpellidae	Trianguloscalpellum		S0350/018	1	4/04/2020	22°12`26"S	112°35`56"E
75701	Lepadiformes	Poecilasmatidae	Glyptelasma		S0350/018	1	4/04/2020	22°12`26"S	112°35`56"E
75702	Lepadiformes	Poecilasmatidae	Glyptelasma		S0350/018	2	4/04/2020	22°12`26"S	112°35`56"E
75703	Amphipoda		Amphipoda		S0350/018	1	4/04/2020	22°12`26"S	112°35`56"E
75704	Amphipoda	Eurytheneidae	Eurythenes		FK200308/LDR/007	4	1/04/2020	22°12`37"S	112°35`39"E
75705	Amphipoda	Tryphosidae	Cheirimedon		FK200308/LDR/007	3	1/04/2020	22°12`37"S	112°35`39"E
75706	Amphipoda	Tryphosidae?			FK200308/LDR/007	8	1/04/2020	22°12`37"S	112°35`39"E
75707	Decapoda	Munidopsidae	Munidopsis		FK200308/LDR/007	1	1/04/2020	22°12`37"S	112°35`39"E
75708	Decapoda	Munidopsidae	Munidopsis		FK200308/FTR/006	1	1/04/2020	22°12`40"S	112°35`39"E
75709	Decapoda	Munidopsidae	Munidopsis		FK200308/FTR/006	1	1/04/2020	22°12`40"S	112°35`39"E
75710	Decapoda	Munidopsidae	Munidopsis		FK200308/FTR/006	1	1/04/2020	22°12`40"S	112°35`39"E
75711	Decapoda	Munidopsidae	Munidopsis		FK200308/FTR/006	1	1/04/2020	22°12`40"S	112°35`39"E
75712	Decapoda	Solenoceridae			FK200308/FTR/006	1	1/04/2020	22°12`40"S	112°35`39"E
75713	Amphipoda		Amphipoda		S0350/005	1	4/04/2020	22°12`35"S	112°35`55"E
75714	Decapoda	Chirostylidae	Chirostylus		S0351/013	1	5/04/2020	22°13`41"S	112°46`52"E
75715	Decapoda	Chirostylidae	Chirostylus		S0351/006	1	5/04/2020	22°13`45"S	112°46`54"E

REGNO	ORDER	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
75716	Decapoda	Homolidae			S0351/012	1	5/04/2020	22°13`41"S	112°46`52"E

Fish

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
35075	*Osteichthyes*	Halosauridae	Aldrovandia		FK200308/S0332/030	1	11/03/2020	21.88260314°S	113.2935991°E
35076	*Osteichthyes*	Zoarcidae			FK200308/LDR/002	1	11/03/2020	21°58.22614`S	113°10.15965
35077	*Osteichthyes*	Larval	leptocephalus		FK200308/S0334/001	1	13/03/2020	21.5548°S	112.4576°E
35078	*Osteichthyes*	Larval			FK200308/PLK/001	3	13/03/2020	21°58.2`S	113°10.1`E
35079	*Osteichthyes*	Ophidiidae	Acanthonus	armatus	FK200308/S0335/009	1	14/03/2020	21.94157829°S	113.12070415°E
35080	*Osteichthyes*	Moridae	Antimora	rostrata	FK200308/S0336/022	1	15/03/2020	21.88140222°S	113.01586348°E
35080	*Osteichthyes*	Ophidiidae	Acanthonus	armatus	FK200308/S0336/022	1	15/03/2020	21.88140222°S	113.01586348°E
35081	*Osteichthyes*	Ophidiidae	Bassozetus		FK200308/S0336/024	1	15/03/2020	21.88103974°S	113.01616346°E
35082	*Osteichthyes*	Ipnopidae	Ipnops		FK200308/S0338/008	1	17/03/2020	21.9000455°S	112.9045575°E
35083	*Osteichthyes*	Ophidiidae	Bassozetus		FK200308/S0338/019	1	17/03/2020	21.896918°S	112.90491164°E
35084	*Osteichthyes*	Zoarcidae			FK200308/FTR/002	5	16/03/2020	21°52.94561`S	113°00.91735`E
35085	*Osteichthyes*	Exocoetidae	Exocoetus	volitans	FK200308/S0338/opp	1	17/03/2020	21.89°S	112.88°E
35086	*Osteichthyes*	Ophidiidae	Bassozetus		FK200308/S0339/010	1	18/03/2020	21.92755331°S	112.83621725°E
35087	*Osteichthyes*	Ipnopidae	Bathypterois		FK200308/S0339/012	1	18/03/2020	21.92757066°S	112.8358616°E
35088	*Osteichthyes*	Exocoetidae	Exocoetus	volitans	FK200308/S0340/opp	1	19/03/2020	21.89°S	112.75°E
35089	*Osteichthyes*	Ophidiidae	Typhlonus	nasus	FK200308/S0341/001	1	20/03/2020	21.86217661°S	112.6876227°E
35090	*Osteichthyes*	Exocoetidae	Exocoetus	volitans	FK200308/S0341/opp	2	20/03/2020	21.86°S	112.69°E
35091	*Osteichthyes*	Ophidiidae	Bassozetus		FK200308/S0343/023	1	22/03/2020	21.87370885°S	112.71205°E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
35092	*Osteichthyes*	Ophidiidae			FK200308/S0344/001	1	24/03/2020	21.86177926°S	112.68795529°E
35093	*Osteichthyes*	Larval			FK200308/PLK/002	10	24/03/2020	21°46.872`S	112°39.561`E
35093	*Osteichthyes*	Ophidiidae	larvae		FK200308/PLK/002	1	24/03/2020	21°46.872`S	112°39.561`E
35094	*Osteichthyes*	Ophidiidae	Porogadus		FK200308/S0346/004	1	26/03/2020	21.77435878°S	112.61259017°E
35095	*Osteichthyes*	Ophidiidae			FK200308/S0346/016	1	26/03/2020	21.76967367°S	112.6126946°E
35096	*Osteichthyes*	Zoarcidae			FK200308/S0347/001	1	27/03/2020	21.81971828°S	112.50932286°E
35097	*Osteichthyes*	Ophidiidae			FK200308/S0347/002	1	27/03/2020	21.81972926°S	112.50917676°E
35098	*Osteichthyes*	Ophidiidae			FK200308/LDR/005	3	25/03/2020	21°48.99989`S	112°30.67564`E
35099	*Osteichthyes*	Zoarcidae			FK200308/FTR/005	1	28/03/2020	22°15.21762`S	112°53.27893`E
35099	*Osteichthyes*	Zoarcidae			FK200308/FTR/005	1	28/03/2020	22°15.21762`S	112°53.27893`E
35100	*Osteichthyes*	Zoarcidae			FK200308/LDR/006	2	28/03/2020	22°15.19502`S	112°53.34870`E
35101	*Osteichthyes*	Zoarcidae			FK200308/FTR/006	1	1/04/2020	22°12.67176`S	112°53.64840`E
35101	*Osteichthyes*	Ophidiidae	Acanthonis	armatus	FK200308/FTR/006	1	1/04/2020	22°12.67176`S	112°53.64840`E
35102	*Osteichthyes*	Macrouridae			FK200308/S0351/001	1	1/04/2020	22.22905305°S	112.78158274°E

Marine Invertebrates

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100601	Crinoidea				S0332/021	1	11/03/2020	21°52`59"S	113°17`36"E
100602	Hexactinellida				S0332/021	1	11/03/2020	21°52`59"S	113°17`36"E
100603	Anthozoa				S0332/012	1	11/03/2020	21°53`0"S	113°17`37"E
100604	Hexactinellida				S0332/012	1	11/03/2020	21°53`0"S	113°17`37"E
100605	Holothuroidea				S0332/023	1	11/03/2020	21°52`58"S	113°17`37"E
100606	Anthozoa				S0332/026	1	11/03/2020	21°52`58"S	113°17`37"E
100607	Anthozoa	Caryophylliidae	Desmophyllum	sp.	S0332/027	1	11/03/2020	21°52`58"S	113°17`37"E
100608	Anthozoa	Cerianthidae	Cerianthus	sp.	S0332/008	1	11/03/2020	21°53`1"S	113°17`37"E
100609	Ophiuroidea				S0332/013	2	11/03/2020	21°52`60"S	113°17`37"E
100610	Asteroidea	Pterasteridae	Hymenaster	sp.	S0332/024	1	11/03/2020	21°52`58"S	113°17`37"E
100611	Hexactinellida				S0332/020	1	11/03/2020	21°52`59"S	113°17`36"E
100612	Anthozoa	Cerianthidae	Cerianthus		S0332/020	1	11/03/2020	21°52`59"S	113°17`36"E
100613	Asteroidea	Brisingidae			S0332/028	1	11/03/2020	21°52`58"S	113°17`37"E
100614	Hydrozoa	Rhodaliidae			S0333/005	1	12/03/2020	21°58`14"S	113°10`19"E
100615	Echinoidea	Cidaridae		sp.	S0333/003	1	12/03/2020	21°58`7"S	113°10`16"E
100616	Anthozoa	Chrysogorgiidae	Chrysogorgia	sp.	S0333/008	1	12/03/2020	21°58`16"S	113°10`21"E
100617	Ophiuroidea				S0333/008	1	12/03/2020	21°58`16"S	113°10`21"E
100618	Holothuroidea		Benthothuria		S0333/006	1	12/03/2020	21°58`14"S	113°10`19"E
100619	Hydrozoa				S0333/015	1	12/03/2020	21°58`27"S	113°10`26"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100620	Hydrozoa				S0333/013	1	12/03/2020	21°58`25"S	113°10`25"E
100621	Ascidiacea	Octacnemidae			S0333/006	1	12/03/2020	21°58`14"S	113°10`19"E
100622	Ascidiacea	Octacnemidae			S0333/006	1	12/03/2020	21°58`14"S	113°10`19"E
100623	Ascidiacea	Octacnemidae			S0333/006	1	12/03/2020	21°58`14"S	113°10`19"E
100624	Ascidiacea	Octacnemidae			S0333/007	1	12/03/2020	21°58`14"S	113°10`20"E
100626	Anthozoa				S0335/018	1	14/03/2020	21°56`20"S	113°7`12"E
100627	Enteropneusta	Torquaratoridae	Tergivelum	sp.	S0335/011	1	14/03/2020	21°56`28"S	113°7`14"E
100628	Ophiuroidea				S0335/022	1	14/03/2020	21°56`17"S	113°7`12"E
100629	Echinoidea				S0335/004	1	14/03/2020	21°56`32"S	113°7`15"E
100630	Echinoidea				S0335/006	1	14/03/2020	21°56`31"S	113°7`15"E
100631	Crinoidea		Pentametracrinus		S0335/020	1	14/03/2020	21°56`17"S	113°7`12"E
100632	Anthozoa				S0335/010	1	14/03/2020	21°56`29"S	113°7`14"E
100633	Echinoidea	Aspidodiadematidae	Aspidodiadema	sp.	S0335/013	1	14/03/2020	21°56`22"S	113°7`13"E
100634	Echinoidea	Echinothuriidae	Araeosoma	sp.	S0335/023	1	14/03/2020	21°56`17"S	113°7`11"E
100635	Crinoidea				S0335/019	1	14/03/2020	21°56`19"S	113°7`13"E
100636	Ascidiacea	Octacnemidae	Dicopia	sp.	S0335/008	1	14/03/2020	21°56`31"S	113°7`15"E
100637	Ascidiacea	Octacnemidae	Dicopia	sp.	S0335/008	1	14/03/2020	21°56`31"S	113°7`15"E
100638	Asteroidea	Pterasteridae	Hymenaster	sp.	S0336/019	1	15/03/2020	21°52`53"S	113°0`57"E
100639	Asteroidea	Pterasteridae	Hymenaster	sp.	S0336/020	1	15/03/2020	21°52`53"S	113°0`56"E
100640	Anthozoa	Schizopathidae	Alternatipathes	sp.	S0336/018	1	15/03/2020	21°52`53"S	113°0`56"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100641	Asteroidea				S0336/005	1	15/03/2020	21°53`9"S	113°0`48"E
100642	Holothuroidea	Synallactinidae			S0336/007	1	15/03/2020	21°53`7"S	113°0`49"E
100643	Ascidiacea	Octacnemidae	Megalodicopia	sp.	S0336/008	1	15/03/2020	21°53`3"S	113°0`51"E
100644	Anthozoa				S0336/008	1	15/03/2020	21°53`3"S	113°0`51"E
100645	Anthozoa	Isididae			S0336/016	1	15/03/2020	21°52`53"S	113°0`56"E
100646	Crinoidea				S0336/016	1	15/03/2020	21°52`53"S	113°0`56"E
100647	Anthozoa		Umbellula		S0336/004	1	15/03/2020	21°53`10"S	113°0`47"E
100648	Hydrozoa	Corymorphidae	Branchiocerianthus	sp.	S0336/009	1	15/03/2020	21°53`2"S	113°0`51"E
100649	Hydrozoa				S0336/007	2	15/03/2020	21°53`7"S	113°0`49"E
100650	Hexactinellida				S0337/013	1	16/03/2020	21°49`52"S	112°55`35"E
100651	Asteroidea				S0337/017	1	16/03/2020	21°49`49"S	112°55`33"E
100652	Hydrozoa	Corymorphidae	Branchiocerianthus	sp.	S0337/016	1	16/03/2020	21°49`49"S	112°55`34"E
100653	Holothuroidea	Synallactinidae			S0337/011	1	16/03/2020	21°49`57"S	112°55`35"E
100654	Hexactinellida				S0337/022	1	16/03/2020	21°49`46"S	112°55`36"E
100655	Asteroidea				S0337/007	1	16/03/2020	21°50`6"S	112°55`35"E
100656	Holothuroidea		Benthogone		S0337/007	1	16/03/2020	21°50`6"S	112°55`35"E
100657	Hydrozoa				S0337/024	1	16/03/2020	21°49`44"S	112°55`34"E
100658	Holothuroidea		Paleopadites		S0337/012	1	16/03/2020	21°49`56"S	112°55`35"E
100659	Enteropneusta	Torquaratoridae	Tergivelum	sp.	S0337/014	1	16/03/2020	21°49`49"S	112°55`35"E
100660	Anthozoa				S0337/023	1	16/03/2020	21°49`43"S	112°55`36"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100661	Hexactinellida				S0338/017	1	17/03/2020	21°53`51"S	112°54`19"E
100662	Holothuroidea				S0338/015	1	17/03/2020	21°53`52"S	112°54`19"E
100663	Holothuroidea				S0338/025	1	17/03/2020	21°53`46"S	112°54`18"E
100664	Demospongiae	Cladorhizidae?			S0338/015	1	17/03/2020	21°53`52"S	112°54`19"E
100665	Asteroidea				S0338/008	1	17/03/2020	21°54`6"S	112°54`16"E
100666	Hydrozoa				S0338/013	1	17/03/2020	21°53`52"S	112°54`19"E
100667	Anthozoa				S0338/007	1	17/03/2020	21°54`6"S	112°54`16"E
100668	Crinoidea				S0338/018	1	17/03/2020	21°53`49"S	112°54`18"E
100669	Hydrozoa				S0338/012	1	17/03/2020	21°53`52"S	112°54`19"E
100670	Demospongiae	Cladorhizidae			S0338/012	1	17/03/2020	21°53`52"S	112°54`19"E
100671	Demospongiae	Cladorhizidae			S0338/012	1	17/03/2020	21°53`52"S	112°54`19"E
100672	Anthozoa				S0338/006	1	17/03/2020	21°54`13"S	112°54`16"E
100673	Anthozoa				S0338/006	1	17/03/2020	21°54`13"S	112°54`16"E
100674	Holothuroidea				S0338/014	1	17/03/2020	21°53`52"S	112°54`19"E
100675	Hydrozoa				S0338/012	1	17/03/2020	21°53`52"S	112°54`19"E
100676	Hydrozoa				S0338/012	1	17/03/2020	21°53`52"S	112°54`19"E
100677	Holothuroidea		Peniagone		S0339/011	1	18/03/2020	21°55`40"S	112°50`10"E
100678	Hexactinellida				S0340/033	1	19/03/2020	21°51`27"S	112°45`28"E
100679	Anthozoa				S0340/033	1	19/03/2020	21°51`27"S	112°45`28"E
100680	Holothuroidea	Pelagothuriidae	Enypniastes	sp.	S0340/029	1	19/03/2020	21°51`27"S	112°45`27"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100681	Anthozoa				S0340/012	1	19/03/2020	21°51`28"S	112°45`25"E
100682	Crinoidea				S0340/010	1	19/03/2020	21°51`37"S	112°45`24"E
100683	Asteroidea	Brisingidae			S0340/018	1	19/03/2020	21°51`27"S	112°45`24"E
100684	Anthozoa	Schizopathidae	Alternatipathes	cf. alternata	S0340/005	1	19/03/2020	21°51`46"S	112°45`25"E
100685	Demospongiae	Cladorhizidae			S0340/022	1	19/03/2020	21°51`27"S	112°45`25"E
100686	Porifera				S0340/021	1	19/03/2020	21°51`27"S	112°45`25"E
100687	Porifera				S0341/020	1	20/03/2020	21°51`50"S	112°41`15"E
100688	Holothuroidea				S0340/027	1	19/03/2020	21°51`27"S	112°45`25"E
100689	Anthozoa		Umbellula		S0341/003	1	20/03/2020	21°51`44"S	112°41`16"E
100690	Demospongiae	Cladorhizidae			S0341/020	1	20/03/2020	21°51`50"S	112°41`15"E
100691	Demospongiae	Cladorhizidae			S0341/008	1	20/03/2020	21°51`45"S	112°41`16"E
100692	Bryozoa				S0341/010	1	20/03/2020	21°51`44"S	112°41`16"E
100693	Hexactinellida				S0342/015	1	21/03/2020	21°51`59"S	112°41`14"E
100694	Hexactinellida				S0342/017	1	21/03/2020	21°51`59"S	112°41`15"E
100695	Asteroidea				S0342/019	1	21/03/2020	21°51`59"S	112°41`14"E
100696	Ascidiacea		Megaladicopia		S0342/005	1	21/03/2020	21°51`56"S	112°41`15"E
100697	Crinoidea				S0342/008	1	21/03/2020	21°51`59"S	112°41`15"E
100698	Crinoidea				S0342/016	1	21/03/2020	21°51`59"S	112°41`14"E
100699					S0342/006	1	21/03/2020	21°51`57"S	112°41`15"E
100700	Anthozoa				S0343/006	1	22/03/2020	21°52`17"S	112°42`48"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100701	Anthozoa	Schizopathidae	Abyssopathes	cf. lyra	S0343/012	1	22/03/2020	21°52`18"S	112°42`47"E
100702	Holothuroidea				S0343/019	1	22/03/2020	21°52`22"S	112°42`45"E
100703	Bryozoa				S0343/018	1	22/03/2020	21°52`19"S	112°42`47"E
100704	Demospongiae				S0343/016	1	22/03/2020	21°52`19"S	112°42`46"E
100705	Anthozoa				S0343/017	1	22/03/2020	21°52`19"S	112°42`46"E
100706	Holothuroidea				S0344/002	1	24/03/2020	21°51`43"S	112°41`16"E
100707	Echinoidea				S0344/001	1	24/03/2020	21°51`43"S	112°41`16"E
100708	Holothuroidea	Psychropotidae	Psychropotes	longicauda	S0345/002	1	25/03/2020	21°51`43"S	112°41`16"E
100709	Anthozoa				S0345/004	1	25/03/2020	21°51`43"S	112°41`15"E
100710	Hexactinellida				S0345/015	1	25/03/2020	21°51`53"S	112°41`15"E
100711	Hexactinellida				S0345/015	1	25/03/2020	21°51`53"S	112°41`15"E
100712	Hexactinellida				S0345/019	1	25/03/2020	21°51`53"S	112°41`15"E
100713	Asteroidea				S0345/007	1	25/03/2020	21°51`46"S	112°41`16"E
100714	Hexactinellida				S0345/014	1	25/03/2020	21°51`53"S	112°41`15"E
100715	Holothuroidea				S0345/008	1	25/03/2020	21°51`53"S	112°41`15"E
100716	Crinoidea				S0345/018	1	25/03/2020	21°51`53"S	112°41`15"E
100717	Hexactinellida				S0345/021	1	25/03/2020	21°51`53"S	112°41`15"E
100718	Hexactinellida				S0345/013	1	25/03/2020	21°51`53"S	112°41`15"E
100719	Hexactinellida				S0345/012	1	25/03/2020	21°51`53"S	112°41`14"E
100720	Hexactinellida				S0345/020	1	25/03/2020	21°51`53"S	112°41`15"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100721	Anthozoa				S0345/003	1	25/03/2020	21°51`44"S	112°41`16"E
100723	Hydrozoa				S0346/005	1	26/03/2020	21°46`27"S	112°36`45"E
100724	Asteroidea	Brisingidae			S0346/011	1	26/03/2020	21°46`27"S	112°36`46"E
100725	Holothuroidea				S0346/012	1	26/03/2020	21°46`24"S	112°36`45"E
100726	Echinoidea				S0346/017	1	26/03/2020	21°46`10"S	112°36`46"E
100727	Enteropneusta	Torquaratoridae	Tergivelum		S0346/023	1	26/03/2020	21°46`8"S	112°36`46"E
100728	Scyphozoa				S0346/007	1	26/03/2020	21°46`28"S	112°36`45"E
100729	Hydrozoa	Corymorphidae	Branchiocerianthus	sp.	S0347/004	1	27/03/2020	21°49`11"S	112°30`33"E
100730	Anthozoa	Schizopathidae	Alternatipathes	cf. alternata	S0347/016	1	27/03/2020	21°48`59"S	112°30`41"E
100731	Holothuroidea	Psychropotidae	Psychropotes	longicauda	S0347/003	1	27/03/2020	21°49`11"S	112°30`33"E
100732	Holothuroidea				S0347/010	1	27/03/2020	21°49`9"S	112°30`35"E
100733	Holothuroidea	Psychropotidae	Psychropotes	longicauda	S0347/008	1	27/03/2020	21°49`12"S	112°30`34"E
100734	Demospongiae	Cladorhizidae			S0347/013	1	27/03/2020	21°49`4"S	112°30`39"E
100735	Hexactinellida				S0347/013	1	27/03/2020	21°49`4"S	112°30`39"E
100736	Demospongiae	Cladorhizidae			S0347/013	1	27/03/2020	21°49`4"S	112°30`39"E
100737	Brachiopoda				S0347/013	1	27/03/2020	21°49`4"S	112°30`39"E
100738	Asteroidea				S0348/002	1	28/03/2020	22°15`59"S	113°0`39"E
100739	Anthozoa				S0348/004	1	28/03/2020	22°15`59"S	113°0`39"E
100740	Holothuroidea	Pelagothuriidae	Enypniastes	sp.	S0348/003	1	28/03/2020	22°15`59"S	113°0`41"E
100741	Holothuroidea				S0348/009	1	28/03/2020	22°15`59"S	113°0`38"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100742	Brachiopoda				S0348/001	1	28/03/2020	22°15`59"S	113°0`39"E
100743	Anthozoa				S0348/004	1	28/03/2020	22°15`59"S	113°0`39"E
100744	Brachiopoda				S0348/001	1	28/03/2020	22°15`59"S	113°0`39"E
100745	Ascidiacea	Octacnemidae	Megalodicopia		S0348/005	1	28/03/2020	22°15`59"S	113°0`38"E
100746	Holothuroidea				S0349/010	1	2/04/2020	22°15`14"S	112°53`30"E
100747	Anthozoa	Chrysogorgiidae			S0349/011	1	2/04/2020	22°15`14"S	112°53`30"E
100748	Anthozoa	Isididae			S0349/014	1	2/04/2020	22°15`19"S	112°53`30"E
100749	Crinoidea				S0349/014	1	2/04/2020	22°15`19"S	112°53`30"E
100750	Anthozoa				S0349/015	1	2/04/2020	22°15`20"S	112°53`30"E
100751	Anthozoa				S0349/005	1	2/04/2020	22°15`12"S	112°53`30"E
100752	Anthozoa				S0349/004	1	2/04/2020	22°15`12"S	112°53`30"E
100753	Anthozoa				S0349/012	1	2/04/2020	22°15`14"S	112°53`30"E
100754	Ophiuroidea				S0349/012	1	2/04/2020	22°15`14"S	112°53`30"E
100755	Anthozoa				S0349/014	1	2/04/2020	22°15`19"S	112°53`30"E
100756	Ophiuroidea				S0349/014	1	2/04/2020	22°15`19"S	112°53`30"E
100757	Ophiuroidea				S0349/014	1	2/04/2020	22°15`19"S	112°53`30"E
100758	Hydrozoa				S0349/015	1	2/04/2020	22°15`20"S	112°53`30"E
100760	Sagittoidea				S0349/004	3	2/04/2020	22°15`12"S	112°53`30"E
100763	Anthozoa	Cladopathidae	Heteropathes	sp.	S0350/016	1	4/04/2020	22°12`27"S	112°35`55"E
100764	Anthozoa	Schizopathidae	Bathypathes	sp.	S0350/011	1	4/04/2020	22°12`30"S	112°35`55"E

REGNO	PHYLA/CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
100765	Anthozoa	Corallimorphidae			S0350/008	1	4/04/2020	22°12`32"S	112°35`55"E
100766	Anthozoa	Schizopathidae	Bathypathes	cf. patula	S0350/019	1	4/04/2020	22°12`25"S	112°35`56"E
100767	Anthozoa				S0350/023	1	4/04/2020	22°12`24"S	112°35`56"E
100768	Anthozoa				S0350/023	1	4/04/2020	22°12`24"S	112°35`56"E
100769	Anthozoa				S0350/022	1	4/04/2020	22°12`24"S	112°35`56"E
100770	Anthozoa				S0350/025	1	4/04/2020	22°12`24"S	112°35`56"E
100771	Crinoidea				S0350/025	1	4/04/2020	22°12`24"S	112°35`56"E
100772	Ophiuroidea				S0350/018	1	4/04/2020	22°12`26"S	112°35`56"E
100773	Anthozoa				S0350/021	1	4/04/2020	22°12`24"S	112°35`56"E
100774	Anthozoa				S0350/021	1	4/04/2020	22°12`24"S	112°35`56"E
100775	Ophiuroidea				S0350/005	2	4/04/2020	22°12`35"S	112°35`55"E
100776	Anthozoa	Chrysogorgiidae	Chrysogorgia	sp.	S0351/006	1	5/04/2020	22°13`45"S	112°46`54"E
100777	Echinoidea				S0351/009	1	5/04/2020	22°13`44"S	112°46`54"E
100778	Asteroidea	Pterasteridae	Hymenaster	sp.	S0351/008	1	5/04/2020	22°13`45"S	112°46`54"E
100779	Crinoidea				S0351/011	1	5/04/2020	22°13`44"S	112°46`54"E
100780	Anthozoa				S0351/012	1	5/04/2020	22°13`41"S	112°46`52"E
100781	Anthozoa	Chrysogorgiidae	Chrysogorgia	sp.	S0351/013	1	5/04/2020	22°13`41"S	112°46`52"E
100782					S0335/008	1	14/03/2020	21°56`31"S	113°7`15"E

Molluscs

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
112000	Gastropoda	cf. Trochidae			332/CR1	2	11/03/2020	21.883149°S	133.293334°E
112011	Bivalvia	Pectinidae			332/CR1/025	1	11/03/2020	21.883201°S	113.293643°E
112013	Gastropoda				334/CR2a/002	1	13/03/2020	21.55467°S	112.457571°E
112014	Cephalopoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112015	Cephalopoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112016	Cephalopoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112017	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112018	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112019	Bivalvia				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112020	Gastropoda	Cavoliniidae			PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112021	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112022	Gastropoda	cf. Naticidae			PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112023	Gastropoda	Eulimidae			PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112024	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112025	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112026	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112027	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112028	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112029	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
112030	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112031	Gastropoda				PLK1	1	13/03/2020	21°58.2`S	113°10.1`E
112032	Gastropoda	Pleurobranchaeidae	Pleurobranchaea		335/CR4	1	14/03/2020	21.938126°S	113.120002°E
112033	Gastropoda	Velutinidae	cf. Marseniopsis		335/CR4	1	14/03/2020	21.939210°S	113.120223°E
112034	Gastropoda	Velutinidae	cf. Marseniopsis		335/CR4	1	14/03/2020	21.941860°S	113.120792°E
112035	Bivalvia	Arcidae	Bentharca	asperula	335/CR4	1	14/03/2020	21.941841°S	113.120796°E
112038	Gastropoda				335/CR4	1	14/03/2020	21.936155°S	113.120060°E
112039	Gastropoda	cf. Trochidae			335/CR4	1	14/03/2020	21.941841°S	113.120796°E
112040	Gastropoda	Raphitomidae			335/CR4	1	14/03/2020	21.939108°S	113.12016°E
112041	Cephalopoda					1	14/03/2020	21 53 421°S	112 59 346°E
112042	Gastropoda	Raphitomidae			336/CR5	1	15/03/2020	21.881366°S	113.015707°E
112043	Cephalopoda				337/CR6	1	16/03/2020	21.835248°S	112.926397°E
112044	Gastropoda				337/CR6	1	16/03/2020	21.834696°S	112.926370°E
112046	Aplacophora				338/CR7	1	17/03/2020	21.897685°S	112.905120°E
112048	Gastropoda	Skeneidae	Liotella	cf. endeavourensis	338/CR7	1	17/03/2020	21.897716°S	112.905207°E
112051	Gastropoda	cf. Pectinodontidae			338/CR7	11	17/03/2020	21.896469°S	112.904598°E
112052	Gastropoda	cf. Pectinodontidae			338/CR7	8	17/03/2020	21.896469°S	112.904598°E
112055	Cephalopoda		cf Stigmatoteuthis	hoylei	339/CR8	1	18/03/2020	21.921265°S	112.835667°E
112057	Bivalvia	Xylophagaidae			339/CR8	3	18/03/2020	21.927643°S	112.835967°E
112058	Bivalvia	Xylophagaidae			339/CR8	3	18/03/2020	21.927643°S	112.835967°E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
112059	Bivalvia	Xylophagaidae			339/CR8	2	18/03/2020	21.927643°S	112.835967°E
112060	Bivalvia	Xylophagaidae			339/CR8	3	18/03/2020	21.927643°S	112.835967°E
112063	Cephalopoda				340/CR9	1	19/03/2020	21.862685°S	112.756776°E
112065	Gastropoda				340/CR9	1	19/03/2020	21.857447°S	112.756809°E
112066	Bivalvia	Pectinidae			340/CR9	1	19/03/2020	21.857468°S	112.756847°E
112067	Gastropoda				340/CR9	1	19/03/2020	21.857468°S	112.756847°E
112069	Gastropoda				340/CR9	1	19/03/2020	21.857411°S	112.758134°E
112070	Gastropoda				340/CR9	3	19/03/2020	21.857411°S	112.758134°E
112071	Bivalvia	Xylophagaidae			340/CR9	few	19/03/2020	21.857411°S	112.758134°E
112073	Cephalopoda	Histioteuthidae	cf Stigmatoteuthis	hoylei	341/CR11	1	20/03/2020	21.864600°S	112.687837°E
112074	Polyplacophora				341/CR11	1	20/03/2020	21.863561°S	112.687447°E
112075	Gastropoda	Eulimidae			342/CR11	1	21/03/2020	21.866417°S	112.687171°E
112076	Gastropoda	Raphitomidae	Veprecula		341/CR11	1	20/03/2020	21.863662°S	112.687470°E
112077	Gastropoda				341/CR11	1	20/03/2020	21.862578°S	112.687521°E
112078	Gastropoda				341/CR11	1	20/03/2020	21.862557°S	112.687564°E
112079	Gastropoda	Fissurellidae	Fissurisepta		341/CR11	1	20/03/2020	21.862347°S	112.687828°E
112080	Polyplacophora				341/CR11	1	20/03/2020	21.862557°S	112.687565°E
112081	Gastropoda				341/CR11	1	20/03/2020	21.862340°S	112.687869°E
112082	Gastropoda				341/CR11	1	20/03/2020	21.863662°S	112.687470°E
112083	Gastropoda	Eulimidae egg masses			342/CR11	1	21/03/2020	21.866417°S	112.687171°E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
112084	Gastropoda	Eulimidae			342/CR11		21/03/2020	21.866417°S	112.687171°E
112085	Gastropoda				342/CR11		21/03/2020	21.866447°S	112.687374°E
112086	Polyplacophora				342/CR11		21/03/2020	21.866447°S	112.687374°E
112088	Bivalvia	Pectinidae			343/CR10	1	22/03/2020	21.871617°S	112.712997°E
112089	Gastropoda	Raphitomidae			343/CR10	1	22/03/2020	21.871535°S	112.713084°E
112090	Gastropoda	cf. Cancellaridae			343/CR10	1	22/03/2020	21.871535°S	112.713084°E
112091	Gastropoda	Epitoniidae			343/CR10	1	22/03/2020	21.872710°S	112.712451°E
112094	Bivalvia	Xylophagaidae			343/CR10	1	22/03/2020	21.871403°S	112.713226°E
112096	Cephalopoda	Octopoteuthidae	Taningia	danae	343/CR10	1	22/03/2020	21.870147°S	112.713259°E
112098	Gastropoda	Epitoniidae			343/CR10	4	22/03/2020	21.872710°S	112.712451°E
112099	Gastropoda				PLK2/	1	23/03/2020	21.7812°S	112.6594°E
112100	Cephalopoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112101	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112102	Heteropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112103	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112104	Cephalopoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112105	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112106	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112107	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112108	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
112109	Gastropoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112110	Cephalopoda				PLK2	1	23/03/2020	21.7812°S	112.6594°E
112111	Cephalopoda	Chiroteuthidae	cf. Chiroteuthis	sp.	345/CR11	1	25/03/2020	21.864350°S	112.687793°E
112112	Cephalopoda	Cranchiidae			345/CR11	1	25/03/2020	21.864611°S	112.687857°E
112113	Gastropoda	Eulimidae			345/CR11	1	25/03/2020	21.862781°S	112.687656°E
112114	Cephalopoda					1	25/03/2020	21°56.565\`S	112°25.317\`E
112115	Cephalopoda	Magnapinnidae	Magnapinna	sp.	346/CR12	1	26/03/2020	21.774628°S	112.612741°E
112116	Cephalopoda	Cranchiidae			346/CR12	1	26/03/2020	21.768776°S	112.613313°E
112117	Bivalvia	cf. Limopsidae			346/CR12	1	26/03/2020	21.774266°S	112.612861°E
112120	Gastropoda				347/CR13	1	27/03/2020	21.818002°S	112.510491°E
112122	Gastropoda				347/CR13	1	27/03/2020	21.818002°S	112.510491°E
112126	Gastropoda				350/C19	1	4/04/2020	22.207230°S	112.598789°E
112127	Bivalvia	Xylophagaidae			348/CL14	1	28/03/2020	22.266341°S	113.010835°E
112128	Bivalvia	Cuspidariidae			348/CL14	1	28/03/2020	22.266520°S	113.010660°E
112129	Bivalvia	Arcidae	Bentharca	asperula	348/CL14	1	28/03/2020	22.266520°S	113.010660°E
112130	Bivalvia	Limopsidae			348/CL14	1	28/03/2020	22.266520°S	113.010660°E
112131	Bivalvia	Mytilidae			348/CL14	1	28/03/2020	22.266520°S	113.010660°E
112133	Cephalopoda				349/CL15	1	2/04/2020	22.254357°S	112.892672°E
112134	Cephalopoda				349/CL15	1	2/04/2020	22.252817°S	112.890503°E
112135	Cephalopoda	Cranchiidae			349/CL15	1	2/04/2020	22.255736°S	112.892975°E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
112137	Bivalvia	Nuculanidae	Ledella	ultima	349/CL15	1	2/04/2020	22.253855°S	112.891764°E
112138	Gastropoda	Epitoniidae			349/CL15	1	2/04/2020	22.253377°S	112.891796°E
112139	Bivalvia	cf. Xylophagaidae			349/CL15	1	2/04/2020	22.253736°S	112.891755°E
112141	Gastropoda	Buccinidae			350/C19	1	4/04/2020	22.207264°S	112.598773°E
112144	Gastropoda				350/C19	1	4/04/2020	22.208379°S	112.598653°E
112145	Gastropoda				350/C19	1	4/04/2020	22.208379°S	112.598659°E
112146	Gastropoda				350/C19	1	4/04/2020	22.207995°S	112.598965°E
112147	Gastropoda				350/C19	1	4/04/2020	22.208818°S	112.598733°E
112148	Cephalopoda	Cranchiidae			351/CL17	1	5/04/2020	22.229045°S	112.781450°E

Worms

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
9804	Polychaeta	Acrocirridae	Teuthidodrilus	samae?	S0332/007	1	43904	21°56`31"S	113°7`15"E
9805	Polychaeta	Acrocirridae	Teuthidodrilus	samae?	S0332/007	1	43904	21°56`31"S	113°7`15"E
9806	Polychaeta	Polynoidae			S0332/026	1	44138	21°52`58"S	113°17`37"E
9809	Polychaeta	Oweniidae			S0332/019	1	43904	21°53`1"S	113°17`37"E
9810	Polychaeta	Polynoidae			S0333/014	1	43902	21°58`27"S	113°10`26"E
9811	Polychaeta	Tompteridae	Tomopteris		S0334/003	1	43903	21°33`18"S	112°27`31"E
9813	Polychaeta	Tompteridae	Tompteris		PLK/001	1	43903	21°58`12"S	113°10`6"E
9814	Polychaeta	Phyllodocidae	Alciopini		PLK/001	2	43903	21°58`12"S	113°10`6"E
9815	Polychaeta	Phyllodocidae	Alciopini		PLK/001	1	43903	21°58`12"S	113°10`6"E
9816	Polychaeta	Chrysopetalidae			PLK/001	1	43903	21°58`12"S	113°10`6"E
9817	Polychaeta	Goniadidae			S0336/012	1	43905	21°53`2"S	113°0`51"E
9818	Polychaeta	Dorvilleidae	Dorvillea		S0336/012	1	43905	21°53`2"S	113°0`51"E
9819	Polychaeta	Scalibregmatidae	Axiokebuita		S0336/012	1	43905	21°53`2"S	113°0`51"E
9820	Polychaeta	Travisiidae	Travisia		S0336/012	1	43905	21°53`2"S	113°0`51"E
9821	Polychaeta	Chaetopteridae			S0336/010	1	43905	21°53`2"S	113°0`51"E
9823	Polychaeta	Polynoidae			S0335/019	1	43904	21°56`19"S	113°7`13"E
9824	Polychaeta	Polynoidae			S0335/017	1	43904	21°56`20"S	113°7`12"E
9825	Polychaeta	Syllidae			S0336/012	1	43905	21°53`2"S	113°0`51"E
9826	Polychaeta	Goniadidae			S0336/012	1	43905	21°53`2"S	113°0`51"E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
9827	Polychaeta	Trichobranchidae			S0336/012	1	43905	21°53`2"S	113°0`51"E
9828	Polychaeta	Opheliidae			S0336/012	1	43905	21°53`2"S	113°0`51"E
9829	Polychaeta	Acrocirridae	Swima	tawitawiensis?	S0336/012	1	43905	21°53`2"S	113°0`51"E
9830	Polychaeta	Polynoidae	Macellicephala		S0337/021	1	43906	21°49`48"S	112°55`34"E
9831	Polychaeta	Acrocirridae	Teuthidodrilus	samae?	S0337/018	1	43906	21°49`49"S	112°55`33"E
9833	Polychaeta	Eunicidae			S0338/019	1	43907	21°53`49"S	112°54`18"E
9834	Polychaeta	Polynoidae			S0338/007	1	17/3/2020	21°54`6"S	112°54`16"E
9837	Polychaeta	Sabellidae			S0338/012	1	43907	21°53`52"S	112°54`19"E
9838	Polychaeta	Polynoidae			S0338/015	1	43907	21°53`52"S	112°54`19"E
9839	Polychaeta	Polynoidae			S0338/007	1	17/3/2020	21°54`6"S	112°54`16"E
9840	Polychaeta	Siboglinidae			S0338/023	1	43907	21°53`47"S	112°54`17"E
9841	Polychaeta	Serpulidae			S0338/016	1	43907	21°53`52"S	112°54`19"E
9842	Polychaeta	Polynoidae	Macellicepha		S0339/011	1	43908	21°55`40"S	112°50`10"E
9843	Polychaeta	Melinnidae	Melinniopsis?		S0340	1			
9844	Polychaeta	Polynoidae	Macellicepha		S0340/05	1	43909	21°51`46"S	112°45`25"E
9845	Polychaeta	Polynoidae	Macellicepha		S0340/22	1	43909	21°51`27"S	112°45`25"E
9846	Polychaeta	Sabellariidae	Lygdamis		S0343	1			
9847	Polychaeta	Sabellariidae	Lygdamis		S0343	1			
9848	Polychaeta	Serpulidae			S0343	1			
9854	Polychaeta	Maldanidae			S0340	1			

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
9855	Polychaeta	Polynoidae			S0341/015	1	43910	21°51`45"S	112°41`15"E
9856	Polychaeta	Acrocirridae	Flabelligena		S0341	1			
9857	Polychaeta	Polynoidae	Macellicepha		S0340	1			
9858	Polychaeta	Polynoidae			S0338/012	1	43907	21°53`52"S	112°54`19"E
9859	Polychaeta	Polynoidae			S0342/013	1	43911	21°51`59"S	112°41`14"E
9860	Polychaeta	Polynoidae			PLK/002	1	43914	21°46`54"S	112°39`36"E
9861	Polychaeta	Alciopidae			PLK/002	1	43914	21°46`54"S	112°39`36"E
9862	Polychaeta	Polynoidae			PLK/002	1	43914	21°46`54"S	112°39`36"E
9863	Polychaeta	Tomopteridae			PLK/002	1	43914	21°46`54"S	112°39`36"E
9864	Polychaeta		Polychaeta		PLK/002	1	43914	21°46`54"S	112°39`36"E
9865	Polychaeta	Syllidae			PLK/002	1	43914	21°46`54"S	112°39`36"E
9866	Polychaeta		Polychaeta		PLK/002	1	43914	21°46`54"S	112°39`36"E
9867	Polychaeta	Polynoidae			S0347/008	1	43917	21°49`12"S	112°30`34"E
9868	Polychaeta	Dorvilleidae			S0347/010	6	43917	21°49`9"S	112°30`35"E
9869	Polychaeta	Dorvilleidae			S0347/010	3	43917	21°49`9"S	112°30`35"E
9870	Polychaeta	Polynoidae			S0348/005	1	43918	22°15`59"S	113°0`38"E
9871	Polychaeta	Polynoidae			S0348/005	1	43918	22°15`59"S	113°0`38"E
9872	Polychaeta	Acrocirridae	Swima		S0349/003	1	43923	22°15`12"S	112°53`30"E
9873	Polychaeta	Acrocirridae	Swima		S0349/002	1	43923	22°15`12"S	112°53`30"E
9874	Polychaeta	Acrocirridae	Swima		S0349/002	1	43923	22°15`12"S	112°53`30"E

REGNO	CLASS	FAMILY	GENUS	SPECIES	STATION	SPECNUM	DTFR	LATITUDE	LONGITUDE
9875	Polychaeta	Sabellidae			S0349/007	1	43923	22°15`13"S	112°53`30"E
9876	Polychaeta	Acrocirridae	Swima		S0349/003	1	43923	22°15`12"S	112°53`30"E
9877	Polychaeta	Acrocirridae	Swima		S0350/015	1	43925	22°12`28"S	112°35`56"E
9878	Polychaeta	Acrocirridae	Swima		S0350/014	1	43925	22°12`29"S	112°35`56"E
9879	Polychaeta	Dorvilleidae			S0350/014	1	43925	22°12`29"S	112°35`56"E
9880	Polychaeta	Polynoidae			S0350/014	1	43925	22°12`29"S	112°35`56"E
9881	Polychaeta	Polynoidae			S0349/010	1	43923	22°15`14"S	112°53`30"E
9882	Polychaeta	Polynoidae			S0350/023	1	43925	22°12`24"S	112°35`56"E
9883	Polychaeta	Polynoidae			S0350/023	2	43925	22°12`24"S	112°35`56"E
9884	Polychaeta	Polynoidae			S0350/023	2	43925	22°12`24"S	112°35`56"E
9885	Polychaeta	Endomyoztomidae			S0351/011	1	43926	22°13`44"S	112°46`54"E
9886	Polychaeta	Endomyoztomidae			S0351/011	1	43926	22°13`44"S	112°46`54"E
9887	Polychaeta	Polynoidae			S0351/010	1	43926	22°13`44"S	112°46`54"E
9888	Polychaeta	Polynoidae			S0351/013	1	43926	22°13`41"S	112°46`52"E
9889	Polychaeta	Polynoidae			S0351/013	1	43926	22°13`41"S	112°46`52"E