Marine Biodiversity Hub

National Environmental Science Programme

South-west Corner Marine Park Post Survey Report

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Project D3 - Implementing monitoring of Australian Marine Parks and the status of marine biodiversity on the continental shelf

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Important Disclaimer

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Executive Summary

The South-west Corner Marine Park survey was undertaken as a collaboration between the University of Western Australia (UWA), Geoscience Australia (GA), the Institute for Marine and Antarctic Studies (University of Tasmania) and the IMOS AUV facility. The survey was a contribution to Marine Biodiversity Hub Project D3, 'Implementing monitoring of Australian Marine Parks and the status of marine biodiversity assets on the continental shelf'; that aims to build baseline knowledge for marine parks in priority areas of the national network.

South-west Corner Marine Park is one of 14 parks in the South-west Network of Australian Marine Parks. The park is the largest in the network, extending from offshore Cape Naturaliste around south-west Australia to offshore Esperance covering an area of 271,833 km^2. The NESP Marine Biodiversity Hub survey focused on continental shelf habitats within the National Park Zone and adjacent Special Purpose Zone (Mining Exclusion) offshore from the Cape Mentelle to Cape Freycinet coastline of southwest Western Australia.

The purpose of this survey was to apply standardised methods of data collection to build the baseline inventory of reef habitat at these locations that will be used to support ongoing monitoring of South-west Corner Marine Park. Due to the interruptions and delays caused by COVID not all data sets were able to be annotated and only exploratory analysis of the processed data was undertaken in the current report.

Despite these issues an initial picture of patterns in seabed habitats and demersal fish assemblages within National Park and adjacent Special Purpose Zones is starting to emerge. Several small isolated high-profile reefs exist in ~30-50m depth in the south-east of the National Park Zone, with the majority of mid-shelf habitat consisting of flat pavement reefs interspersed with sand sediments, with both reef types supporting diverse assemblages of macroalgae, seagrass, hard corals and sponges. Further offshore, deeper ledge features, orientated in a north-south direction at ~100m depth, support a diverse filter feeding assemblage dominated by hard bryozoans, hydroids, black and octocorals, and sponges. Between 120m – 180m substrates are dominated by silty mud sediment with very sparse epibiota. Exploratory drop cameras sampling was also conducted on the continental shelf break in 250m depth revealing deeper sponge gardens on the shelf break supporting large-bodied groper aggregations.

Total abundance and species richness in demersal fish assemblages showed no marked difference between Zones, but did show clear declines at depths >120m, which is likely reflective of a lack of reefal habitat. Some differences in individual species abundance and biomass may be evident between Marine National Park and Special Purpose (Mining exclusion) Zones. Although a more thorough analysis is required to explore these initial observations further.

We have found evidence of a potential aggregation site for grey nurse sharks (C*archarias taurus*) within the National Park Zone. To our knowledge this potentially represents the deepest known aggregation site for *C. taurus* and would represent the second aggregation site in WA. Repeat surveys are needed to confirm site temporal consistency of site use, and to determine whether this site is used seasonally, or year-round.

This survey provides an effective example of the multiple extensive data sets able to be collected by integration of nationally accepted Standard Operating Procedures appropriate for AMP surveys in shelf-habitats, and will provide an exemplar case study to explore how these data can further be used to identify key natural values and potential reporting indicators and metrics to inform Parks Australia's Monitoring Evaluation and Reporting (MERI) framework.

We recommend that follow up NESP projects should be undertaken to finish the annotation and processing of the data collected in this survey and that the data should then be interrogated and compared with other comparable national datasets, to identify key natural values and develop potential reporting indicators and metrics.

1. INTRODUCTION

1.1 Background and rationale for survey

The South-west Corner Marine Park survey was designed to establish a comprehensive baseline for benthic habitats and associated demersal fish assemblages on the continental shelf within the marine park (Figure 1). The survey focused on the region offshore from the Cape Naturaliste to Cape Leeuwin coast (hereafter "the Capes region") where, beyond a general and broad understanding of the biodiversity and environmental processes of the region, our knowledge base to inform the ongoing management of the marine park is limited. Key data gaps include bathymetry coverage at high resolution (and related understanding of the extent and spatial distribution of shelf habitats), observations of benthic reef and soft sediment biological assemblages, and data to describe spatial variations in those communities. By addressing these information gaps, the data collected during this survey will contribute to ongoing inventory and monitoring within the South-west Marine Park network as part of the current 10-year management plan (Director of National Parks, 2018).

Existing knowledge of the key natural values in the Southwest Corner Marine Park is limited, with only ~ 8% of the continental shelf area of the park now mapped, and only a very small amount of biological sampling. However, that sampling is sufficient to suggest rich seabed assemblages consisting of sponges, bryozoans and some octocorals may be present (Monk et al., 2017). The University of Western Australia had previously sampled the fish assemblages of the Southwest Corner Marine Park using baited remote underwater stereo-video systems (stereo-BRUVs) in 2010. While sampling was limited to 7 deployments in the northern-eastern end of the Special Purpose Zone (Mining exclusion), it indicated that swallowtail (*Centroberyx lineatus*) and trevally (*Pseudocaranx* spp) were abundant (Monk et al., 2017).

In contrast, the adjacent Ngari Capes Marine Park established in 2019 has extensive benchmark data on fish and benthic assemblages, including baseline surveys using stereo-BRUV, Diver Operated stereo-Video (stereo-DOV) and diver visual census of fish assemblages, diver based surveys of macroalga and surveys of mobile invertebrates dating back to 2006 and continuing to the present (Westera et al., 2008, B. French Pers. Com.). These data sets have contributed to publications highlighting the high species richness and endemism of both fish (Langlois et al., 2012) and benthic assemblages (Smale et al., 2011), and the impacts of recent marine heatwaves of fish and macroalgal assemblages (Wernberg et al., 2012).

The Ngari Capes Marine Park also extends into Geographe Bay, and is adjacent to the Geographe Marine Park in Commonwealth waters. The Geographe region is also relatively data rich, with extensive historical and modern marine biodiversity surveys within State waters (Westera et al., 2008, B. French Pers. Com.) and the Geographe Marine park being the subject of a 2014 NERP Benchmark Survey (Lawrence et al., 2016) and a recent synthesis report for Parks Australia to optimise the monitoring of fish and benthic assemblages (Giraldo Ospina et al., in prep).

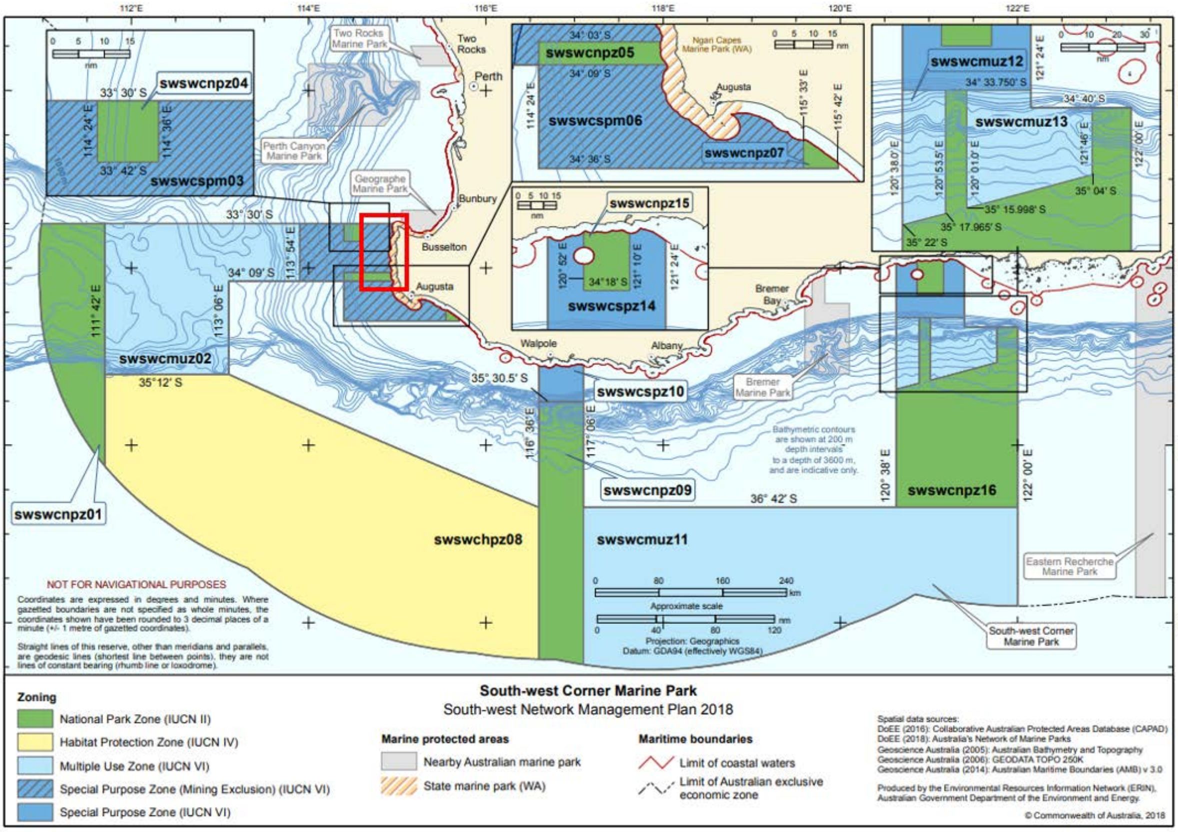

Figure 1. South-west Corner Marine Park.
Survey area indicated (red box).

1.2 Australian Marine Park Context

South-west Corner Marine Park is one of 14 parks in the South-west Network of Australian Marine Parks. The park is the largest in the network, extending from offshore Cape Naturaliste around south-west Australia to offshore Esperance covering an area of 271,833 km^2. The park extends across the continental shelf and upper continental slope to the limit of Australia's exclusive economic zone. Conservation values within the park include reefs and banks on the continental shelf, submarine canyons that locally connect the shelf to the deeper waters of the continental slope, the extensive Naturaliste Plateau located beyond the slope, and the Diamantina Fracture Zone that reaches to depths of 6,500m (Director of National Parks, 2018). Benthic biological communities within the marine park include sponges, hard and soft corals associated with reefs and hard substrates, but information on these communities is limited. Pelagic species observed within the region include a variety of whale species (Antarctic blue, humpback, sperm, southern right and pygmy blue), sharks and sea lions. The region is also valued as a key habitat for western rock lobsters (recognised as a Key Ecological Feature of the south-west marine region).

South-west Corner Marine Park comprises 16 management zones that include National Park Zones (seven areas), Habitat Protection Zone (one area), Multiple Use Zones (four areas), Special Purpose Zone (one area) and Special Purpose Zone (Mining Exclusion; two areas). This survey focused on data collection within the National Park Zone and adjacent Special

Purpose Zone (Mining Exclusion) offshore from the Cape Mentelle to Cape Freycinet coastline.

Two of the no-take Sanctuary Zones within the adjacent Ngari Capes Marine park adjoin no-take National Park Zones within the Geographe and South-west Corner Marine Parks. In particular, where the South-west Corner Marine Park and Ngari Capes Marine park adjoin off Contos Beach this creates on the most extensive no-take area that touches the shore within Australia's marine estate.

1.3 Traditional Knowledge informing marine park biodiversity surveys

Traditional Ecological and Scientific Knowledge was integrated into the current survey through a cultural mapping project documented in a separate Hub report “The Cultural Seascape of Wadandi Boodja: The Cultural Values of Australia’s South West Marine Parks” and via frequent communication via the project lead (Tim Langlois) with Traditional Owners in the region. Traditional Ecological and Scientific Knowledge informed the planning, activity and interpretation of marine biodiversity data revealed in the current survey.

1.4 Aims and objectives

The overall aim of the survey was to build baseline information for key benthic habitats and demersal fish assemblages on the continental shelf within South-west Corner Marine Park. Information from the survey will support ongoing monitoring of the park and inform future assessments of the effectiveness of the management plan for the South-west Network.

2. SURVEY AREA

2.1 Mapping Area

The zoning of the South-west Corner Marine Park guided the prioritisation of areas to acquire high-resolution bathymetry data and observations of benthic biological communities. Mapping and sampling focused on characterising the shelf environments within the National Park Zone (NPZ) offshore from Cape Freycinet and the Special Purpose Zone (Mining Exclusion) that adjoins the northern boundary to the NPZ (Figure 1). Water depths across these zones range from ~35 m on the inner shelf to 130 m beyond the shelf break, within bounding coordinates of 34.07º S, 114.71º E and 34.13º S, 114.94º E, representing an approximate area of 330 km^2.

3. SURVEY DESIGN

Due to interruptions caused by COVID, the survey was undertaken over six stages of data acquisition and sampling between the period March 2020 and March 2021 as given in Table 1.

Stage 1: 9 –12 March 2020. Seabed mapping within the National Park Zone. Prioritisation of mapping areas was based on concurrent cultural mapping work with Traditional Owners in the region (Figure 2). This initial map of the seabed revealed high relief reefs in the south-east corner of the National Park Zone but was terminated early due to COVID-19 travel restrictions.

Stage 2: 2 – 3 June 2020. Stereo-BRUV sampling of shallow reefs and adjacent areas up to 60 m of depth in the south-east of the National Park Zone (Figure 3). The survey design was based on clustered deployments of four stereo-BRUVS and was stratified by depth around the reefs, and to the west of the reefs to a maximum depth of 60 m.

Stage 3: 12 October – 23 November 2020. Stereo-BRUV and drop camera and sampling (Figure 4, Figure 5). The survey design was based on clustered deployments of four stereo-BRUVS. To benchmark the fish assemblages in the region, the sampling design was divided into two areas: 1) National Park Zone, and 2) high use area, which included the marine park areas down to ~60 m of depth.

Stage 4: 27 January – 17 February 2021. Continuation of seabed mapping within the National Park Zone and Special Purpose Zone (Figure 2).

Stage 5: 1 – 7 March 2021. AUV sampling within the National Park Zone and Special Purpose Zone (Figure 6). The AUV grids were based on seafloor features obtained from the multibeam survey (Stages 1 and 4), and field of view information obtained from stereo-BRUV and drop-camera surveys (Stages 2 and 3).

Stage 6: 8 – 11 March 2021. Drop camera sampling within the National Park Zone and Special Purpose Zone (Figure 7). The survey design was based on rugosity of the seafloor derived from multibeam bathymetry data (Stages 1 and 4).

Sampling stations for stereo-BRUV and drop camera deployments were determined using the 'MBHdesign' package in R software to distribute sites across each survey grid in a spatially balanced pattern following NESP Marine Biodiversity Hub Field Manuals and following methods given in (Foster et al., 2017).

Table 1. Summary of survey stages
NPZ =National Park Zone and SPZ = Special Purpose Zone (Mining Exclusion)

Stage	Dates	Methods	Objective	Area / No. samples	Sampling design
1	9 –12 March 2020	Seabed mapping	Seabed mapping within the NPZ - stopped due to COVID travel ban.	NPZ	Preferential
2	2 – 3 June 2020	Stereo-BRUV	Sampling shallow reefs up to 60 m in the NPZ	NPZ shallow reefs/ n = 31 deployments	Spatially balanced
3	12 October – 23 November 2020	Stereo-BRUV and drop camera	Stereo-BRUV and drop camera sampling in the NPZ and high use area	NPZ and high use area / n = 244 and 264 deployments	Spatially balanced
4	27 January – 17 February 2021	Seabed mapping	Continuation of seabed mapping in the NPZ and SPZ	NPZ and SPZ	Preferential
5	1 – 7 March 2021	AUV	AUV transects at key sites in the NPZ and SPZ	NPZ and SPZ / n = 15 transects	Preferential
6	8 – 11 March 2021	Drop camera	Drop camera sampling within the NPZ and SPZ	NPZ / n = 154 deployments	Spatially balanced

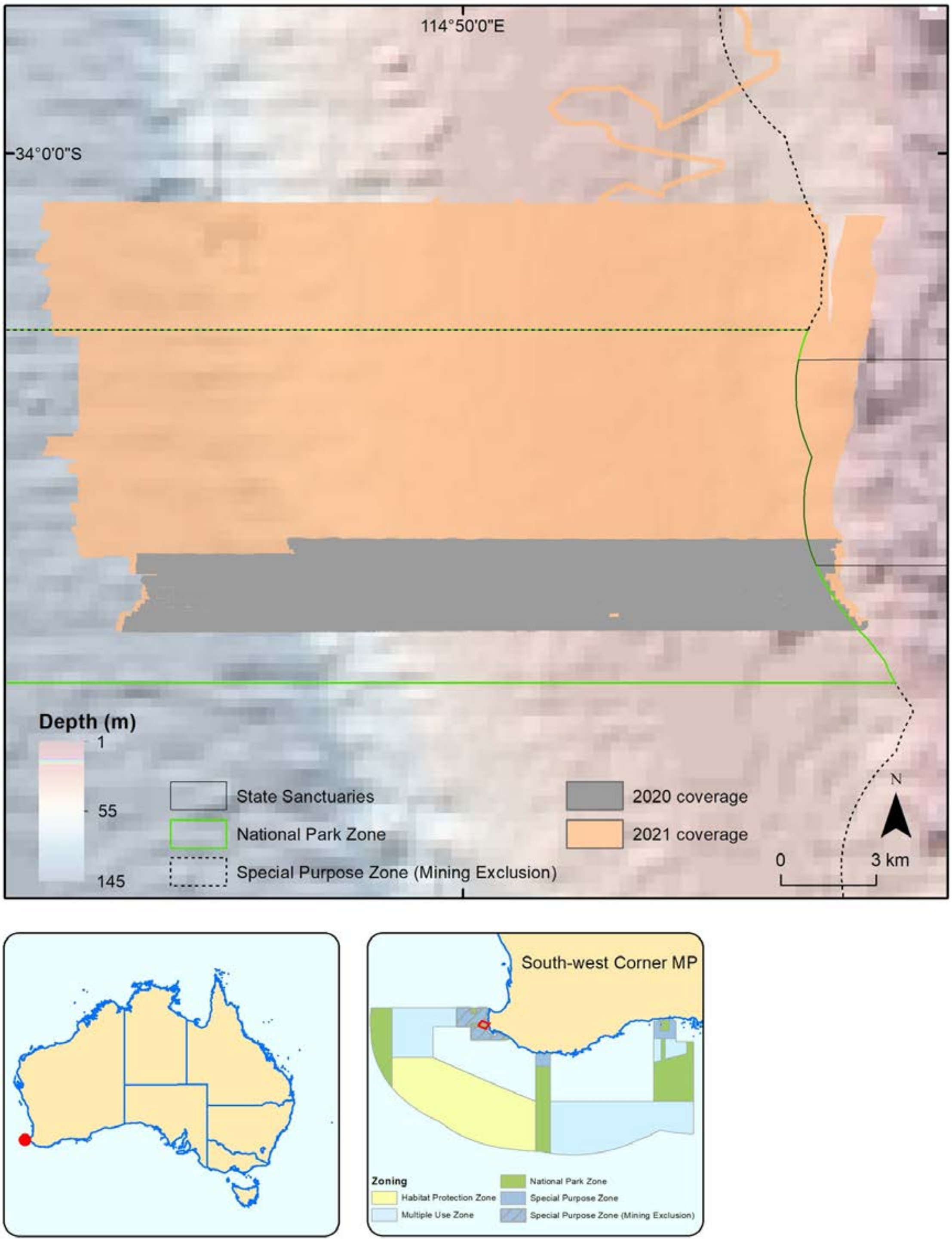

Figure 2. Multibeam extents from Stage 1 and Stage 4.
Data collected during 2020 for Stage 1 (grey) and 2021 for Stage 4 (orange).

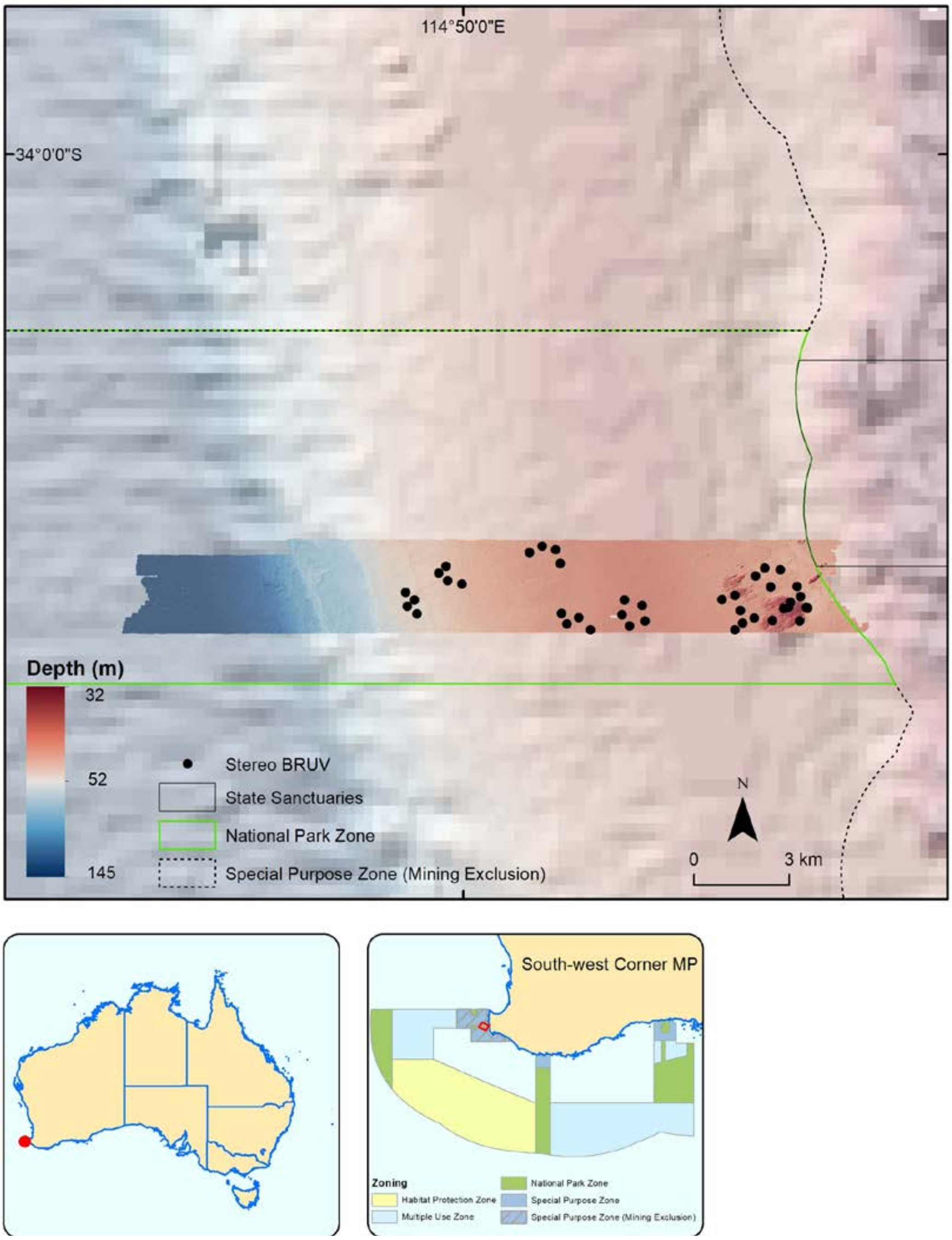

Figure 3. Location of stereo-BRUV samples in the South-west Corner Marine Park sampled during Stage 2.

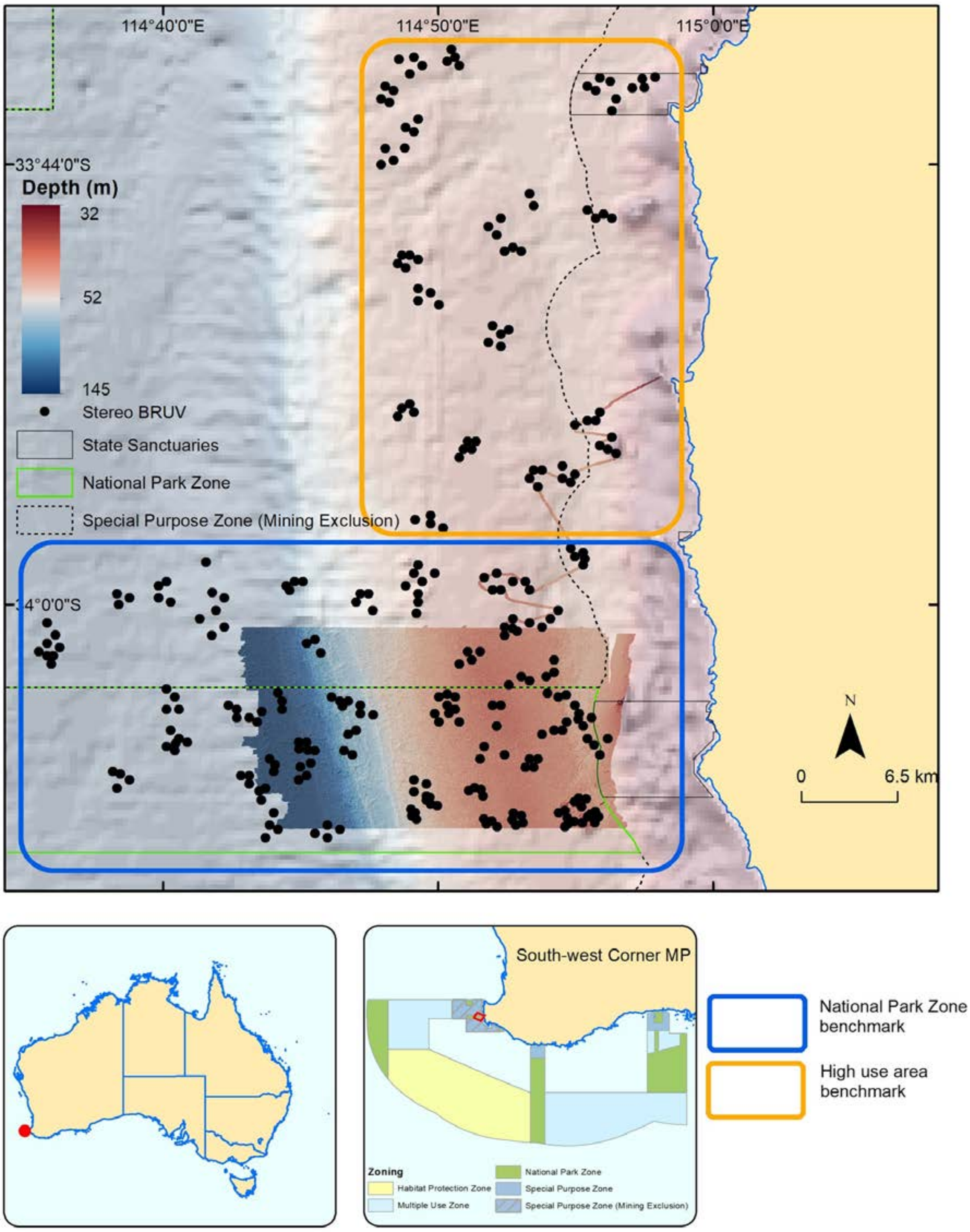

Figure 4. Location of stereo-BRUV samples in the South-west Corner Marine Park sampled during Stage 3.

Shows the two main survey designs for benchmarking the National Park Zone and the High use area. Sites outside of the South-west Corner Marine Park in the adjacent Ngari Capes Marine Park were sampled as they provided a comparison with the National Park Zone.

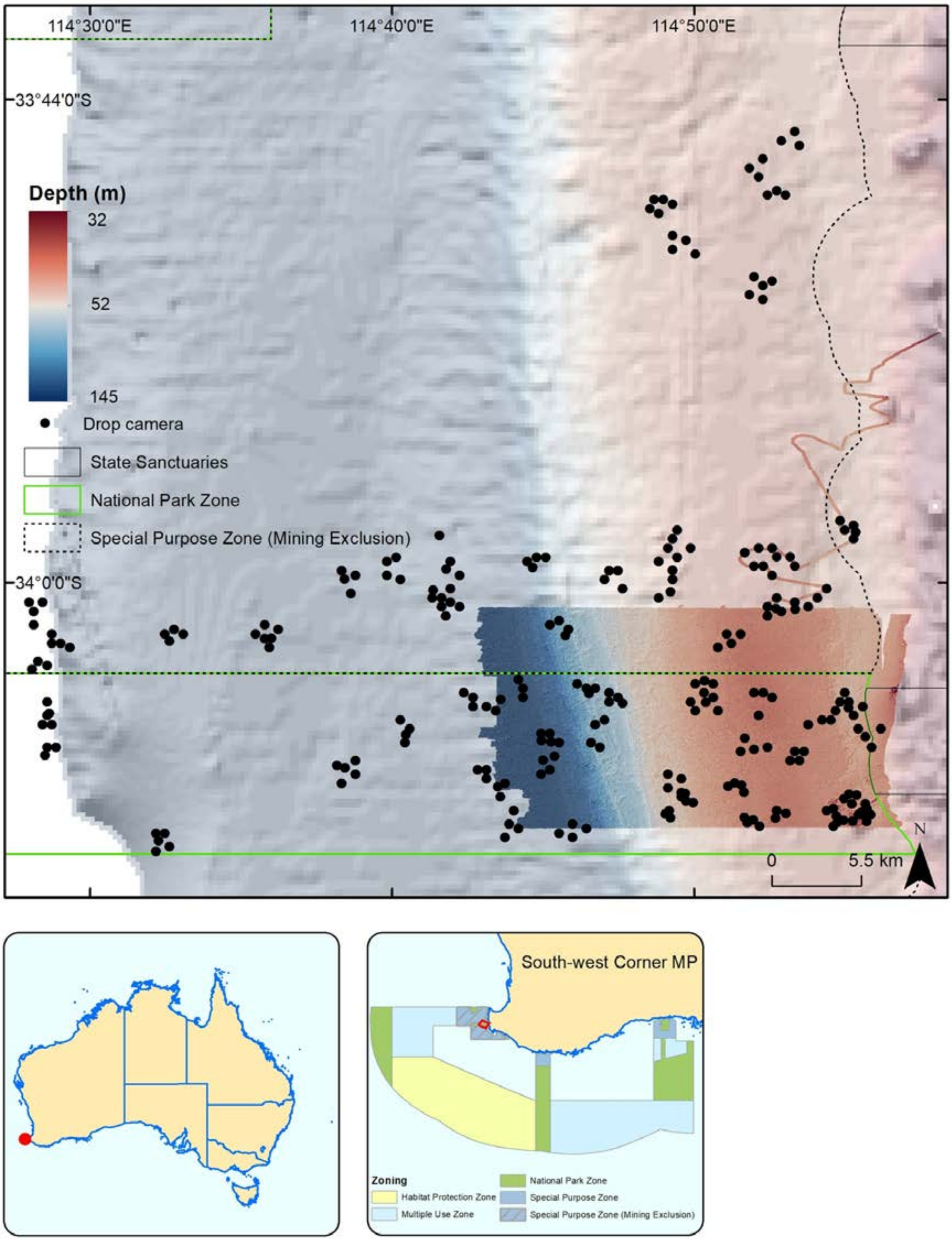

Figure 5. Location of drop camera samples in the South-west Corner Marine Park sampled during Stage 3.

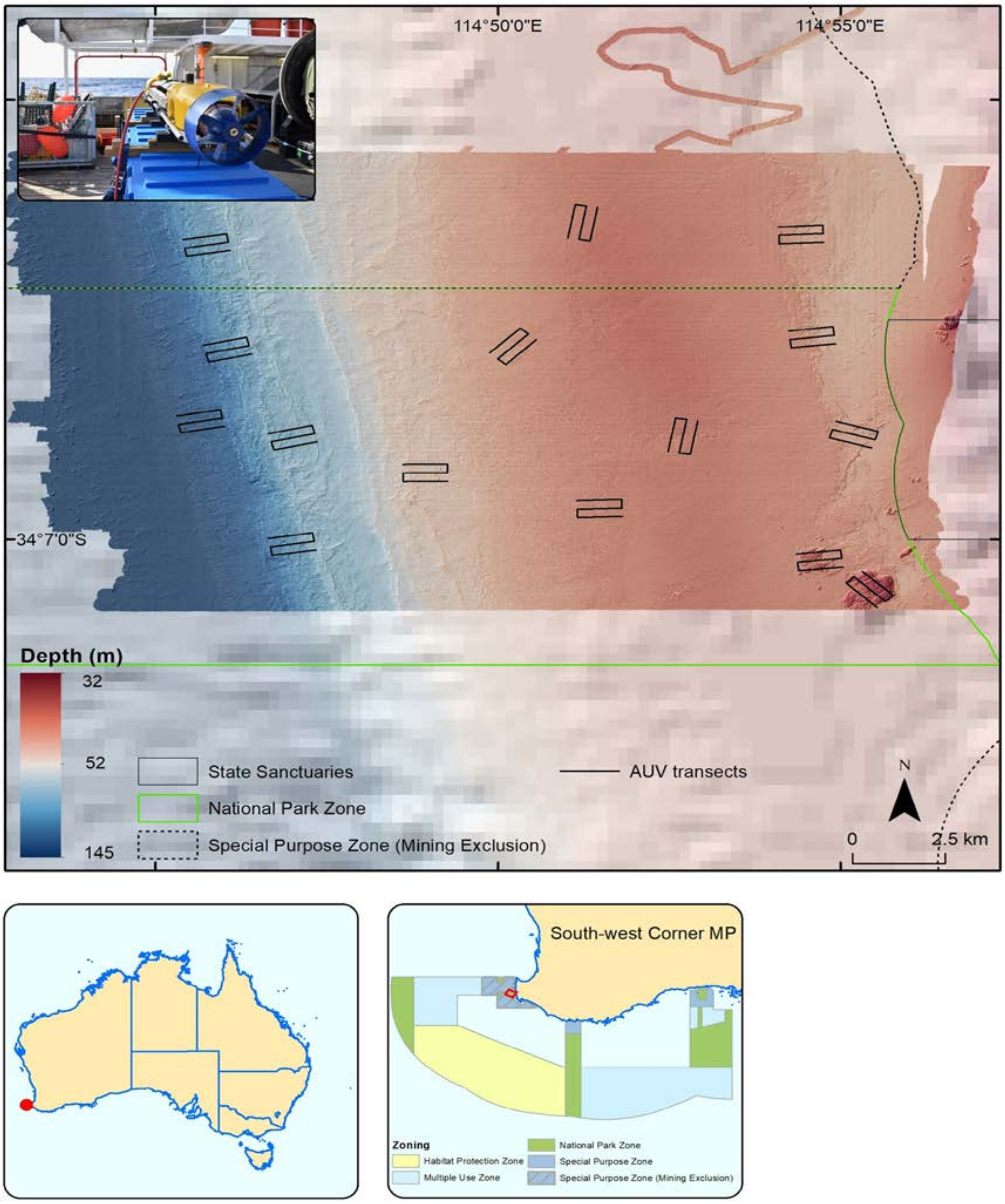

Figure 6. Location of the 15 Autonomous Underwater Vehicle (AUV) transects during Stage 5.
Sites were chosen to represent features identified by stereo-BRUV and drop camera samples during Stage 2 and 3.

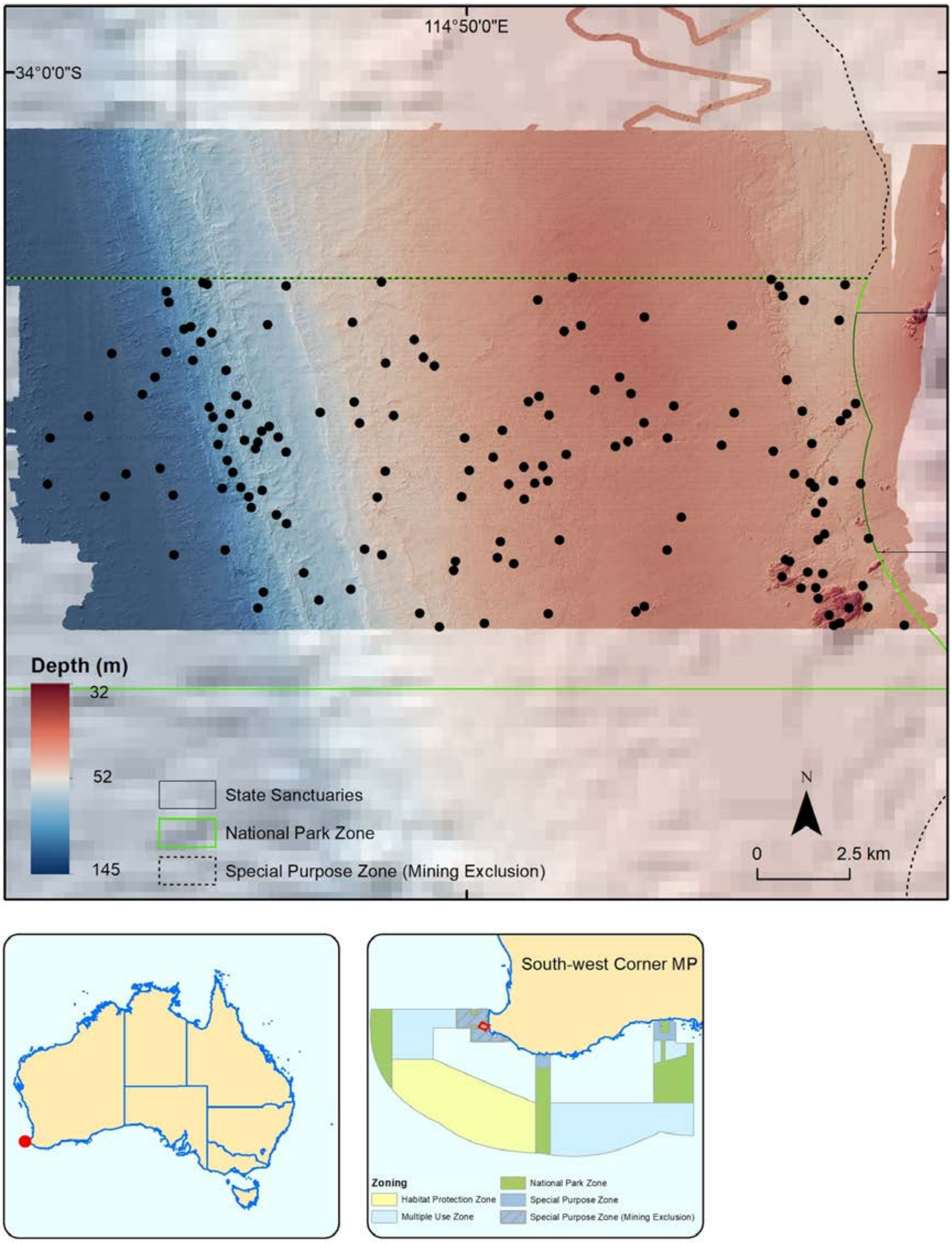

Figure 7. Location of the drop camera samples surveyed during Stage 6.
Samples with the National Park Zone designed to complement AUV survey.

4. METHODS AND DATA COLLECTED

4.1 Seabed mapping

Bathymetry and acoustic backscatter data were acquired using a Kongsberg EM2040C multibeam echo-sounder (MBES). The system was configured to operate using a single sonar transducer mounted in the moon-pool of FV Santosha and operating in dual-ping mode at vessel speeds of 7-9 knots. Vessel navigation and data acquisition used the Kongsberg Seabed Information System (SIS) software, with vessel motion data collected using an Applanix POS MV motion referencing system (Figure 8). Survey lines for seabed mapping were run in an east-west direction and were designed to provide 100 percent bathymetry and backscatter coverage of the survey area, with a minimum of 10 percent overlap between survey lines. Thus, a line spacing of approximately 250 m was used to provide swath coverage of up to 4x water depth for shallowest areas (~35 - 60 m), increasing to greater overlap in deeper areas (~80 - 120 m). To improve survey efficiency in deeper water and on days of high winds and seas, some survey lines were oriented north-south. The total area mapped for the study area covered approximately 330 km^2 in water depths ranging between 34 m and 130 m.

Figure 8. Multibeam sonar acquisition workstation on board FV Santosha

Data processing of bathymetry data was completed using the Caris HIPS & SIPS suite v.11.3.8. Raw sounding data was corrected for ship motion (pitch, roll and heave), navigation and sound velocity. The data was reduced to the ellipsoid using realtime ellipsoid heights. True heave and realtime RMS (root mean square error) values were imported from Applanix 000 files and used in the final computed solution and to calculate Total Propagated Uncertainty for each individual sounding. Bathymetry surfaces were gridded using the CUBE algorithm at a spatial (horizontal) resolution of 4 m. Outliers were removed using a combination and surface filters and visual outlier removal. Shifting the ellipsoid referenced soundings to MSL was done by subtracting within the earth gravitational model (EGM2008).

Along with bathymetric data, the MBES generated co-registered seabed backscatter data. Backscatter data provides a measure of the intensity of the sound (measured in decibels, dB) reflected by the seabed, with higher intensity indicating harder seabed (e.g. rock, gravel). These data were processed using the CMST-GA MB Process v15.04.04.0 (.64) toolbox software co-developed by the Centre for Marine Science and Technology (CMST) at Curtin University and GA, described in Parnum & Gavrilov (2011). The process involved: removal of the system transmission loss; removal of the system model; calculation of the incidence angle; correction of the beam pattern; calculation of the angular backscatter response within a sliding window of 100 pings with a 50 % overlap in a 1° bin; removal of the angular dependence, and; restoration to the backscatter intensity at an incidence angle of 40°. The final processed data were gridded to 4 m horizontal resolution, then exported as a gridded surface for further analysis.

4.2 Benthic community observations

4.2.1 Stereo-BRUVs

Observations of demersal fish communities within the survey area were undertaken using stereo-BRUV units (Figure 9). Each stereo-BRUVS comprises a pair of either Canon Legria HF G25 video cameras, set to a focus point of three meters (to prevent them from focusing on individual fish) and set to record at 1080p resolution at a rate of 25 frames per second, GoPro Hero 7 Black cameras, set at 1080p resolution and a wide field of view, at a rate of 30 frames per second, or Sony FDR-X3000 cameras, set at resolution of 1080p and a medium field of view, at a rate of 60 frames per second. The cameras are separated by 650 mm and each inwardly converged at 7º to provide an overlapping field of view and allows for the accurate identification and stereo-photogrammetric measurement of individual fish from 0.5 to 8 m in front of the stereo-BRUVs. To maximise calibration stability, the cameras and housings were mounted on a base bar to eliminate camera movement within the housing and between the cameras. The stereo-video systems were calibrated in a pool to synchronise the cameras prior to and post deployment in the field. Further information on the design and calibration of these systems can be found in (Harvey & Shortis, 1995).

In addition to the stereo camera setup a single rearward facing GoPro Hero 3+ Silver or Sony FDR-X3000 in a waterproof housing was positioned facing backwards in the centre of the base bar to record additional habitat information. The camera was set to take an image every minute in medium field of view. Forward and rearward white LED lights were also attached to the base bar to illuminate the field of view in front of the forward-facing stereo cameras and rearward facing habitat camera.

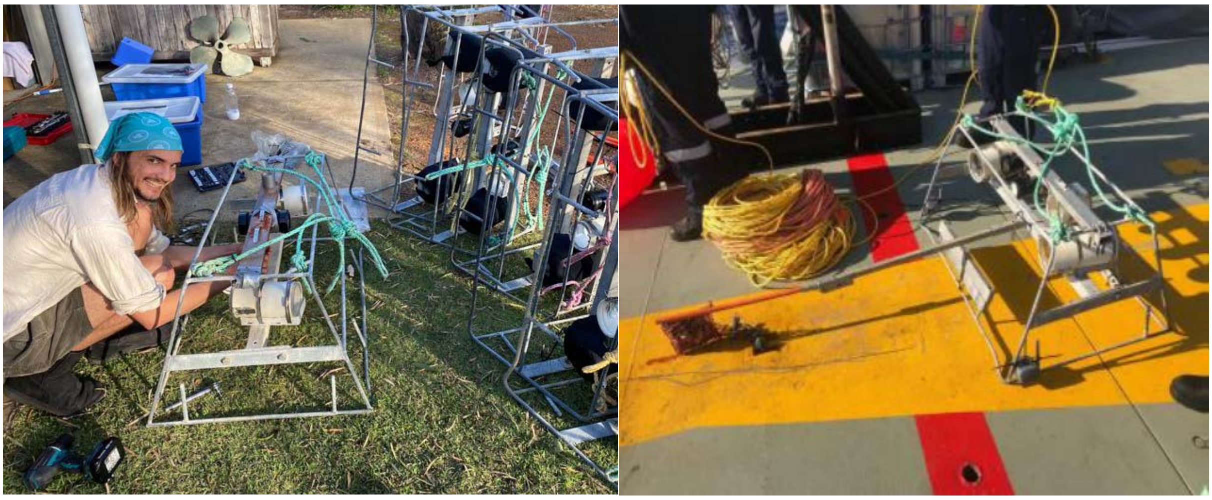

Figure 9. stereo-BRUV sampling equipment.
Being assembled prior to sampling (above) and on deck prior to deployment (below).

Each stereo-BRUV was baited with approximately ~1 kg of crushed pilchards (*Sardinops spp.)* held within a plastic-coated wire mesh basket, attached to a stainless steel bait arm and positioned 1.2 m in front of the cameras. Each system was deployed for 60 minutes on the seafloor. Neighbouring deployments were separated by at least 400 m to reduce the likelihood of fish swimming between neighbouring stereo-BRUV deployments. Stereo-BRUV units were deployed at 315 sites in water depths that ranged from 35 to 142 m (Figure 3, Figure 4).

The left camera of each video was analysed using EventMeasure™ software ((SeaGIS, 2011)). During analysis, all fish were identified to their lowest possible taxonomic level. The maximum number of individuals of a single species in one frame (MaxN) was recorded. Habitat composition was obtained from video footage from both the forwards and backwards cameras at the time the stereo-BRUVs landed on the seabed using TransectMeasure™. The percentage composition of habitat, was recorded from a 5 x 4 grid overlay following methods developed in (McLean et al., 2016) and (Collins et al., 2017) and applying a modified version of the CATAMI habitat classification scheme (Althaus et al., 2015) with the addition of a visual estimate of relief complexity (0-5) (Wilson et al., 2007).

4.2.2 Drop Camera

More detailed observations of benthic habitat within the survey area were undertaken using a drop camera system (Figure 10). This drop camera consisted of synchronised GoPro Hero 3+ camera units facing in four directions to give a more complete picture of habitat at a given point. Habitat images were taken at the same timecode for each camera to ensure no overlap of images. The system also had a downwards facing camera to collect detailed downwards facing imagery.

Due to its low profile form-factor and different method and timeframe of deployment, this drop camera was able to be deployed deeper than the stereo-BRUV units during Stage 3 sampling. It proved particularly useful in areas such as at the edge of the continental shelf, where steep drop-offs are common and currents are strong.

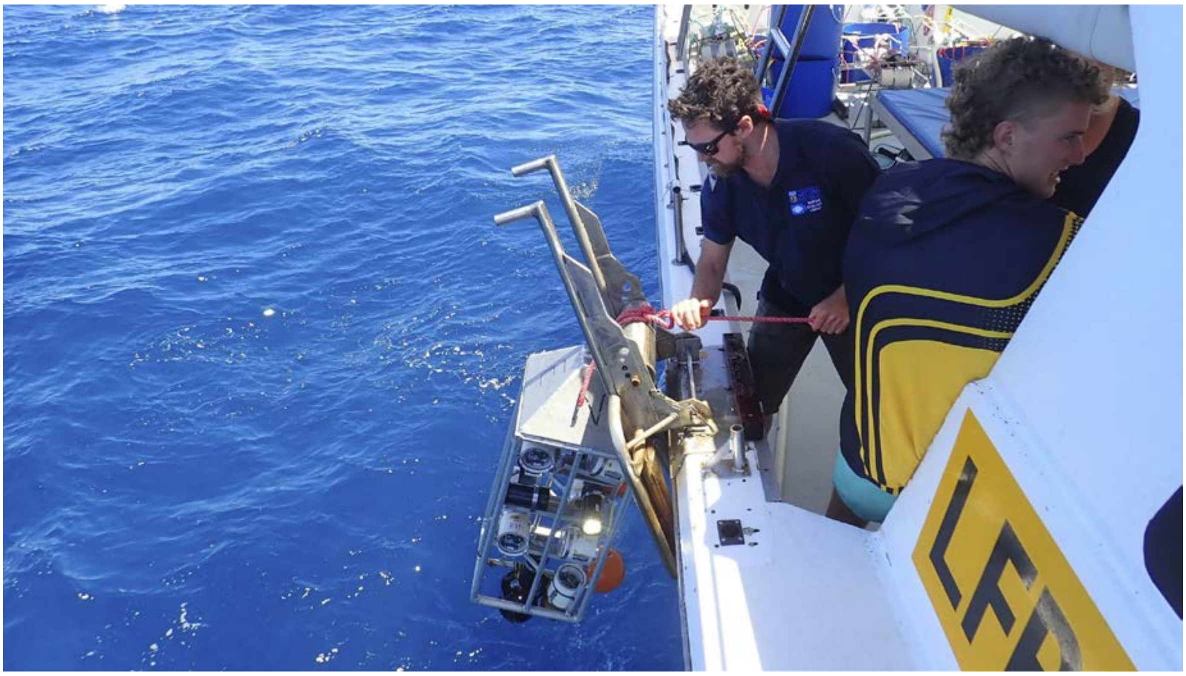

Figure 10. Drop camera system.
Deploying a drop camera system from FV Santosha.

For each deployment, the four horizontally facing camera images will be analysed for the percentage composition of habitat. Annotation of each will consist of 20 randomly positioned points per image, using the same CATAMI habitat classification scheme (Althaus et al., 2015). Given the propensity for the top half of images to contain open water or contain biota too far away to confidently classify, points will be positioned in the lower 50% of each image (Figure 11). Annotation will be done using Transect Measure™ software (SeaGIS, 2011).

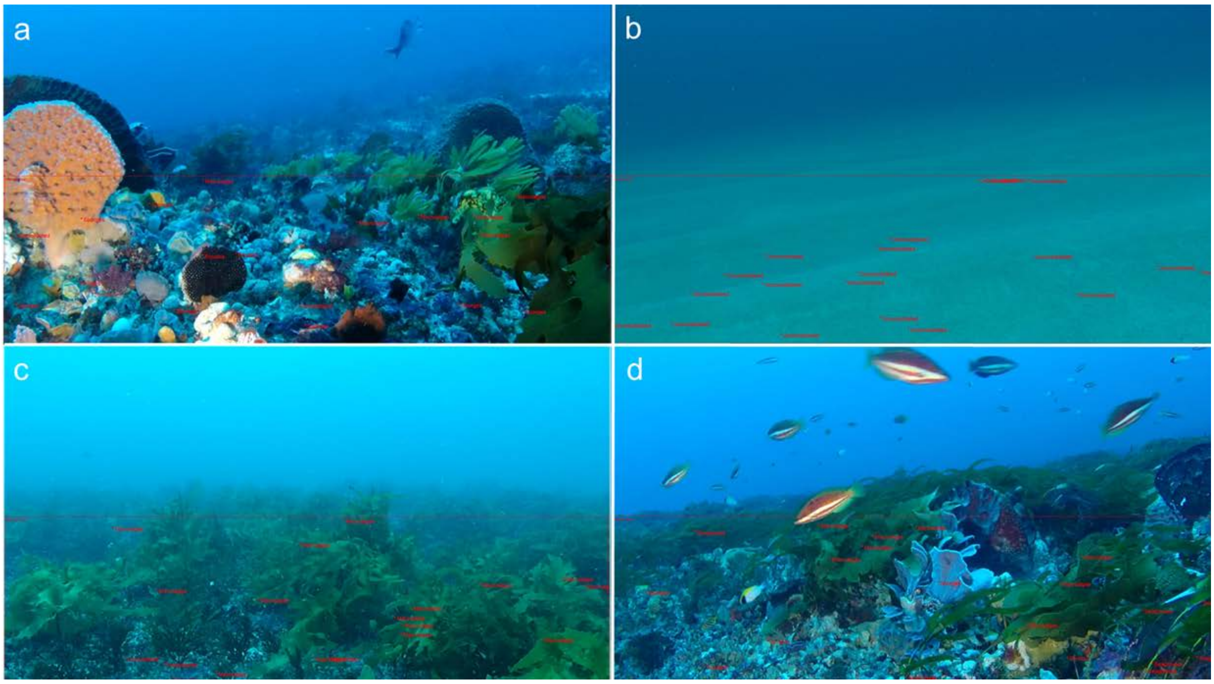

Figure 11. example habitat images with annotation points assigned.
(a) Sponges, macroalgae and bryozoans (b) unconsolidated (c) macroalgae and (d) macroalgae, sponges and seagrasses.

4.2.3 AUV

A benthic survey of the National Park Zone and Special Purpose zone was conducted using the IMOS autonomous underwater vehicle (AUV) 'Nimbus' (Figure 12). The AUV is equipped with a calibrated pair of downward looking 9 MP machine cameras illuminated with synchronised strobes. The transect path and associated imagery is precisely georeferenced using a Ultra Short Baseline Acoustic positioning system (USBL) and post-processed detailed in the NESP AUV field manual (Monk et al., 2020).

Each AUV deployment consisted of a broad grid of three 1 km parallel transects separated by 250 m (Figure 6). The location of the grids was selected to survey geomorphological features identified from the multibeam bathymetry data, and areas with mixed benthic communities of macroalgae, seagrass and sponges that were identified through previous drop-camera surveys (Stage 3). A total of 12 grids in the NPZ and three in the SPZ were surveyed. No detailed annotations of AUV imagery has been completed due to delays in fieldwork due to COVID.

Figure 12. IMOS Autonomous Underwater Vehicle 'Nimbus'.
AUV mounted on the launch and recovery system on the vessel.

5. RESULT AND PRELIMINARY OBSERVATIONS

5.1 Seabed features

Seabed mapping of the continental shelf within the National Park Zone and adjacent Special Purpose Zone of the Capes region of South-west Corner Marine Park covered an area of 330 km^2 between the eastern boundary of the park and the shelf break (Figure 13). Mapping has revealed a largely uniform, planar seabed with small, isolated reefs on the inner shelf and low-profile stepped reefs (ledges) on the outer shelf. The most extensive area of inner shelf reef is located within the southeast of the National Park Zone (Figure 14). Here, a flat-topped mound rises about 13 m from a basal depth of 48 m and covers an area of approximately 2 km^2. Smaller isolated reefs are located within similar water depths nearby, and all are characterised by a generally smooth surface but with linear grooves that incise up to 4 m into the reef surface. This morphology is consistent with weathered and fractured rock, and is interpreted as outcrop of granitic gneiss from the Leeuwin Complex that forms the headlands onshore along the Capes region coast (Wilde & Nelson, 2001). This is the only example of this type of reef outcrop within the mapped area of the marine park.

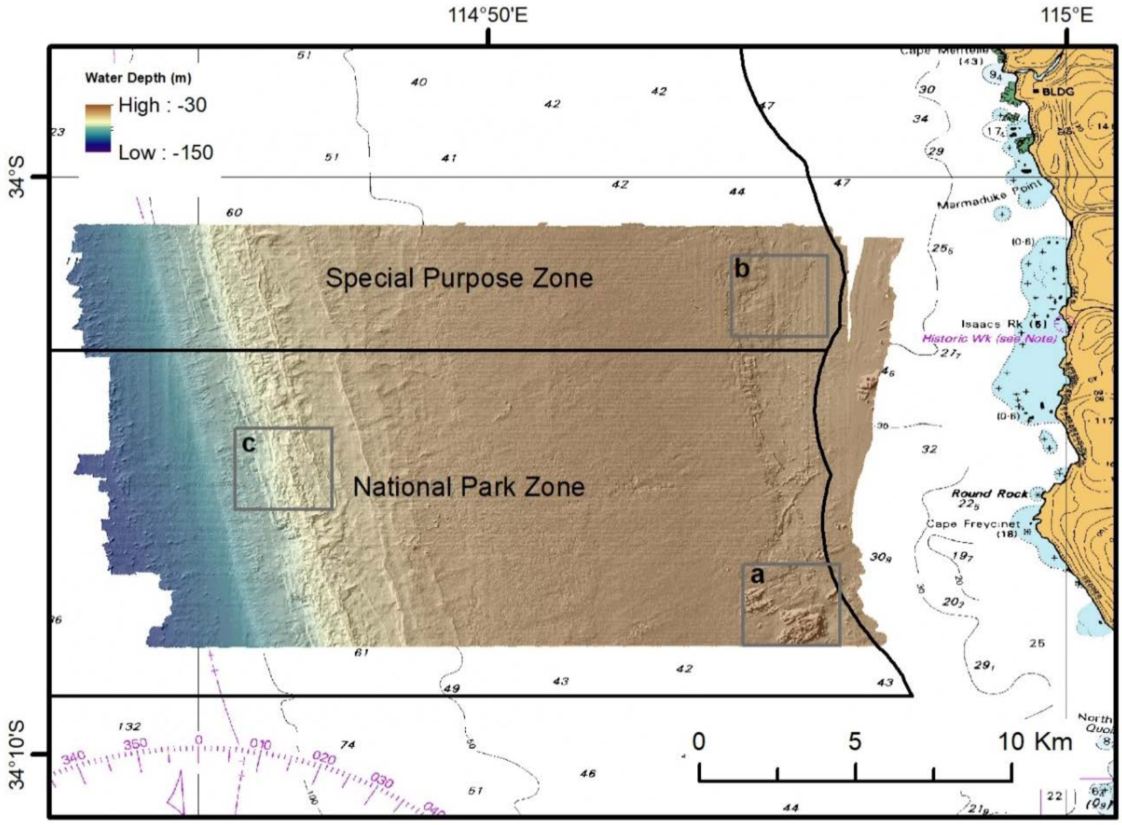

Figure 13. Bathymetry coverage within the National Park Zone and Special Purpose Zone (Mining Exclusion), Southwest Corner Marine Park.
Inset boxes indicate locations of Figures 14 (inset a), 15 (inset b) and 16 (inset c).

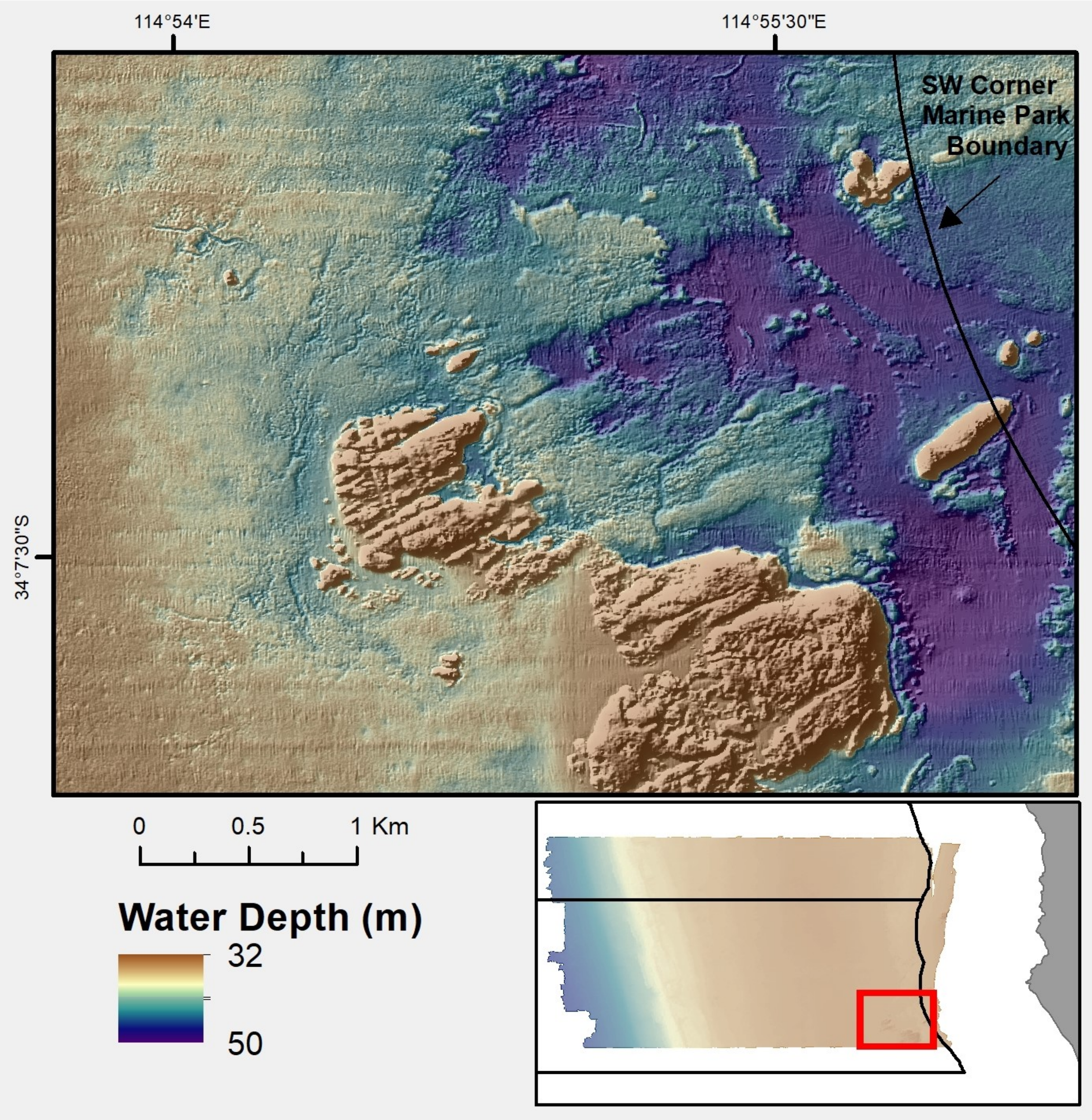

Figure 14. High resolution bathymetry for an area of granite (gneiss) reef
with surrounding irregular seabed within the National Park Zone of South-west Corner Marine Park. Inset map shows location.

Elsewhere on the inner and mid shelf, the seabed forms an extensive flat pavement with no evidence for active fields of sedimentary bedforms (e.g. sand waves). In places, small linear to curved ridges rise 2 - 3 m above the pavement surface (Figure 15). These ridges range from <100 m to 500 m in length and are approximately 20 m wide. The orientation and form of these ridges is consistent with terrestrial dunes. It is likely these features are relict sand dunes that are preserved as lithified aeolianite and are offshore outcrops of the Tamala Limestone that occurs along the Capes region coastline (Lipar & Webb, 2014).

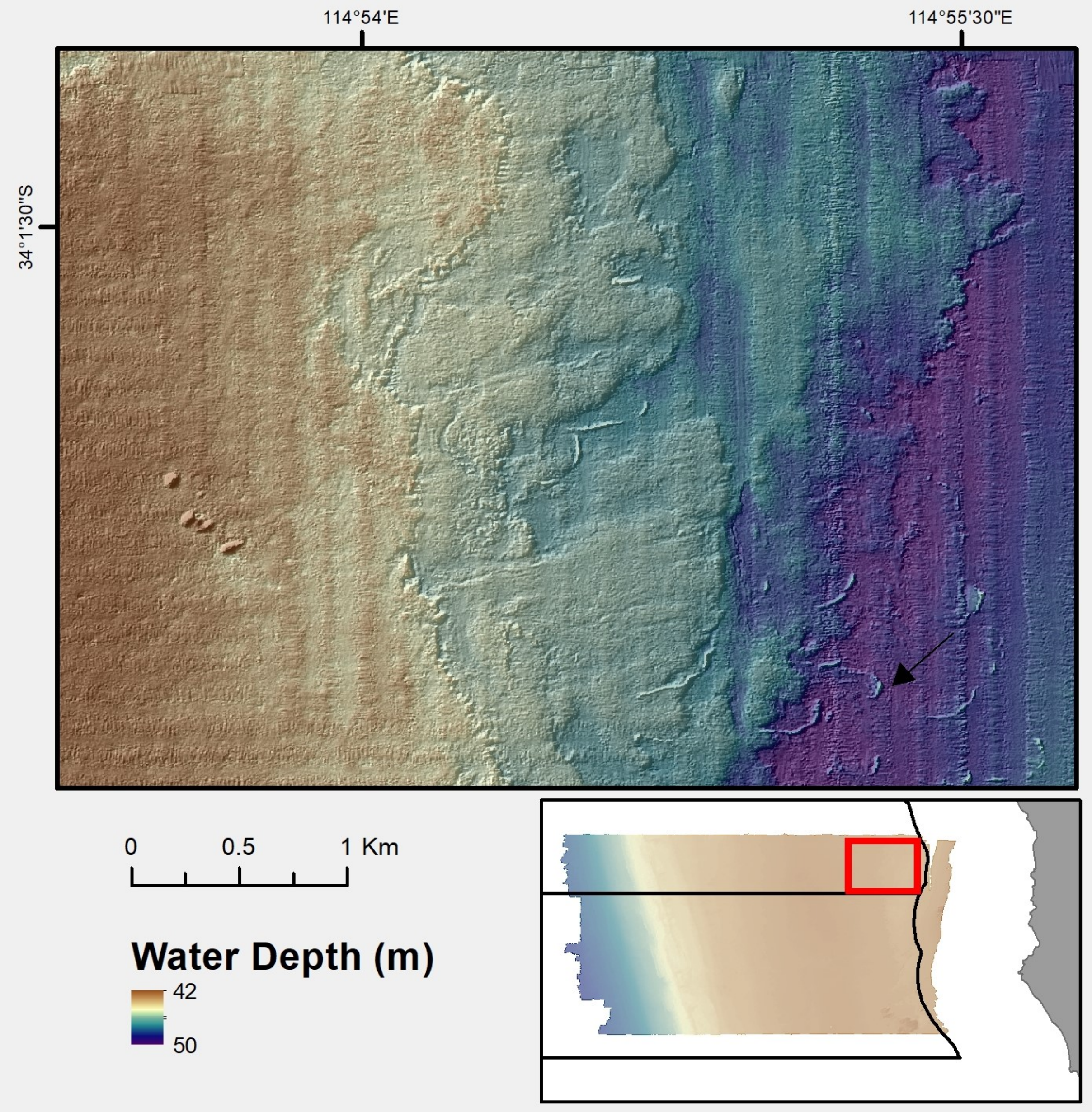

Figure 15. High resolution bathymetry for area of planar to irregular seabed with isolated linear reefs
Example features are indicated by the arrow within the Special Purpose Zone of South-west Corner Marine Park. Inset map shows location.

The outer shelf of the survey area is characterised by a series of low profile ridges and stepped ledges that extend north-south along the shelf as continuous features for the extent of the mapped area (~13 km) (Figure 16). In cross-section, these ridges and ledges are 150 - 400 m wide with steps that range in height between 5 and 8 m. Water depths range from 90 m to 60 m across the west-east extent of the ridges. The seabed is generally smooth and flat on the reef ledges, with the exception of discontinuous linear ridges that are ~2 m high, 10 - 20 m wide and extend up to 1 km along the shelf in water depths of ~60 m. These are likely additional examples of relict coastal dunes, preserved as aeolianite that define the position of an ancient coastline (likely age approximately 12,000 years; (Brooke et al., 2017)).

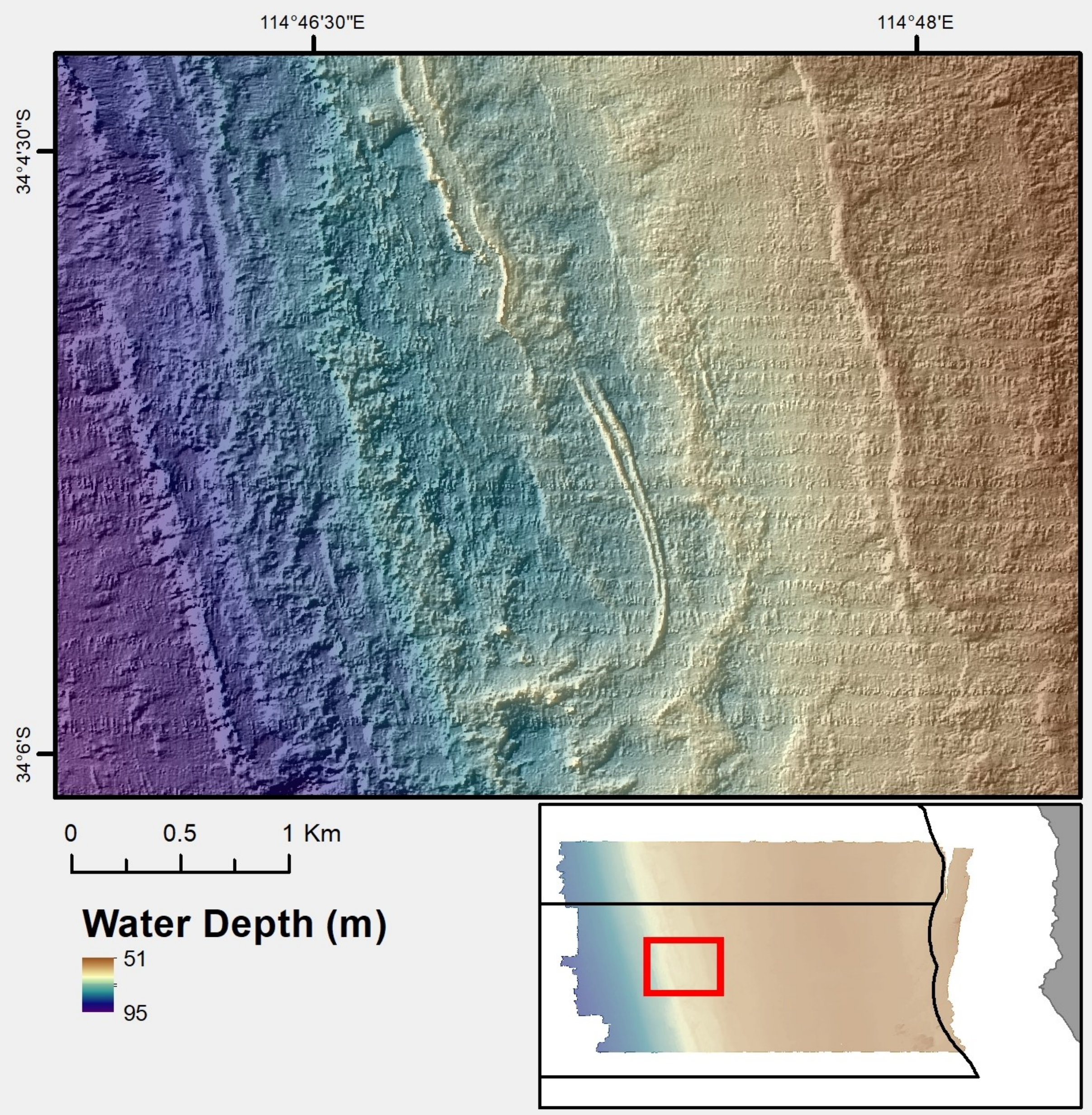

Figure 16. High resolution bathymetry for area of linear, low profile ridges (ledges)
Mapped area is located on the outer continental shelf within the National Park Zone of South-west Corner Marine Park. Inset map shows location.

Acoustic backscatter

As a proxy of the relative hardness of the seabed, acoustic backscatter data reveals a broadly uniform pattern across the mapped area (Figure 17). Backscatter values lie within a relatively narrow range of -20 dB (lower intensity; softer seabed) to -10 dB (higher intensity; harder seabed). Lower intensity backscatter was recorded on seabed where local patches of sand/gravel occur, such as around the base of the reef in the southeast corner of the survey area (Figure 18) and in shallow depressions between ledges on the outer shelf (Figure 19). Higher intensity backscatter was associated with the deeper water areas on the outer shelf and is likely an indicator of coarse sediment (gravel) and possibly areas of hard pavement (e.g. exposed limestone). Areas of reef were characterised by mid-range backscatter intensity (-15 dB to -18 dB), but were not the hardest substrate. This response is interpreted to be a function of the irregular surface of the gneiss reefs that would cause greater scattering of the acoustic signal (hence a weaker return), and to the dense benthic cover of sponges that would absorb some of the signal. For the area of flat pavement, which covers the greater proportion of the survey area across the mid shelf, the backscatter intensity displayed little spatial variation (in the range -17 to -13 dB). This is consistent with the observations from drop cameras and AUV of a relatively hard seabed with thin to negligible sediment cover.

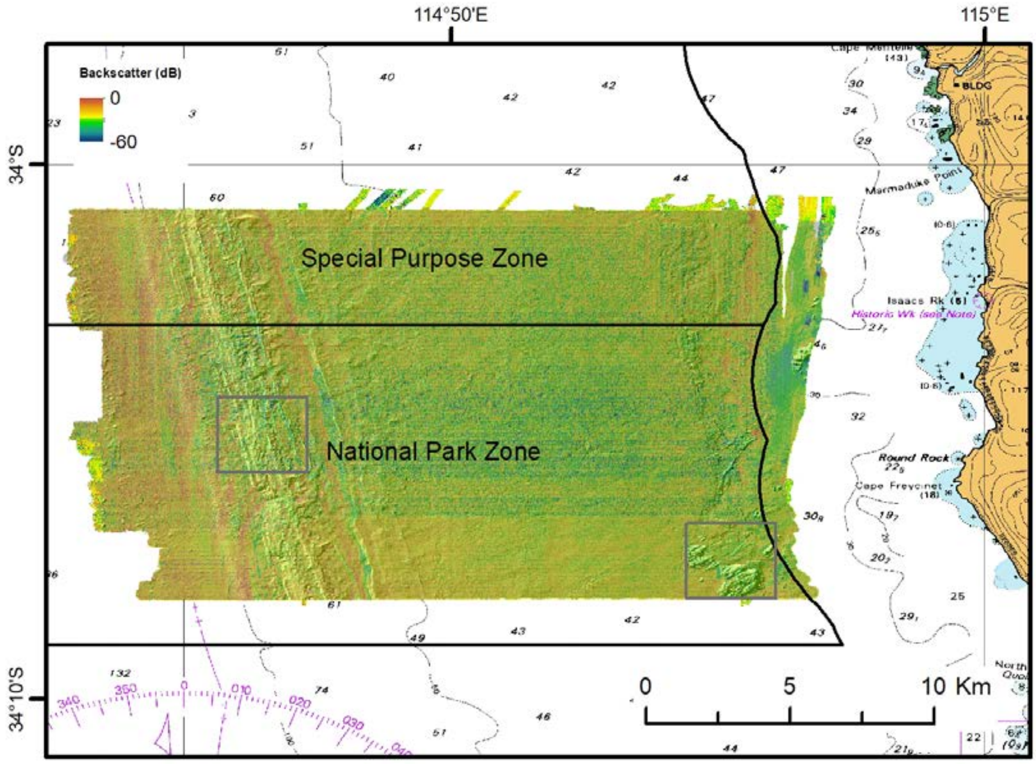

Figure 17. Acoustic backscatter map for the survey area.
Mapped areas are within the National Park Zone and Special Purpose Zone of South-west Corner Marine Park. Inset boxes show location of (*Figure 18*, *Figure 19*).

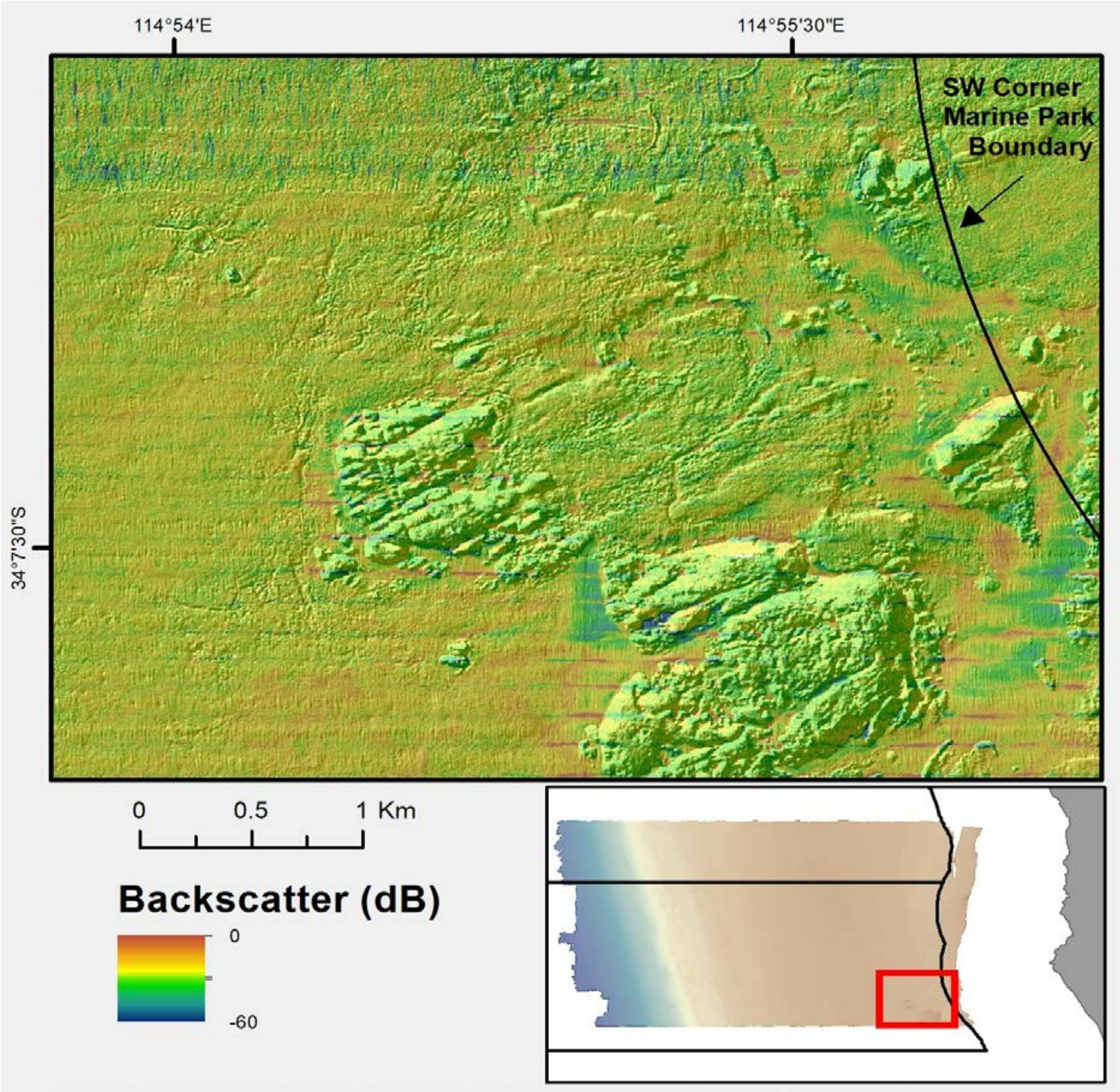

Figure 18. Acoustic backscatter map for the area of reef (gneiss) and surrounding hard pavement within the National Park Zone.

Lower backscatter intensity (-20 dB indicated by green to blue) was recorded around the base of the reef where sand/gravel patches occur. Inset map shows location.

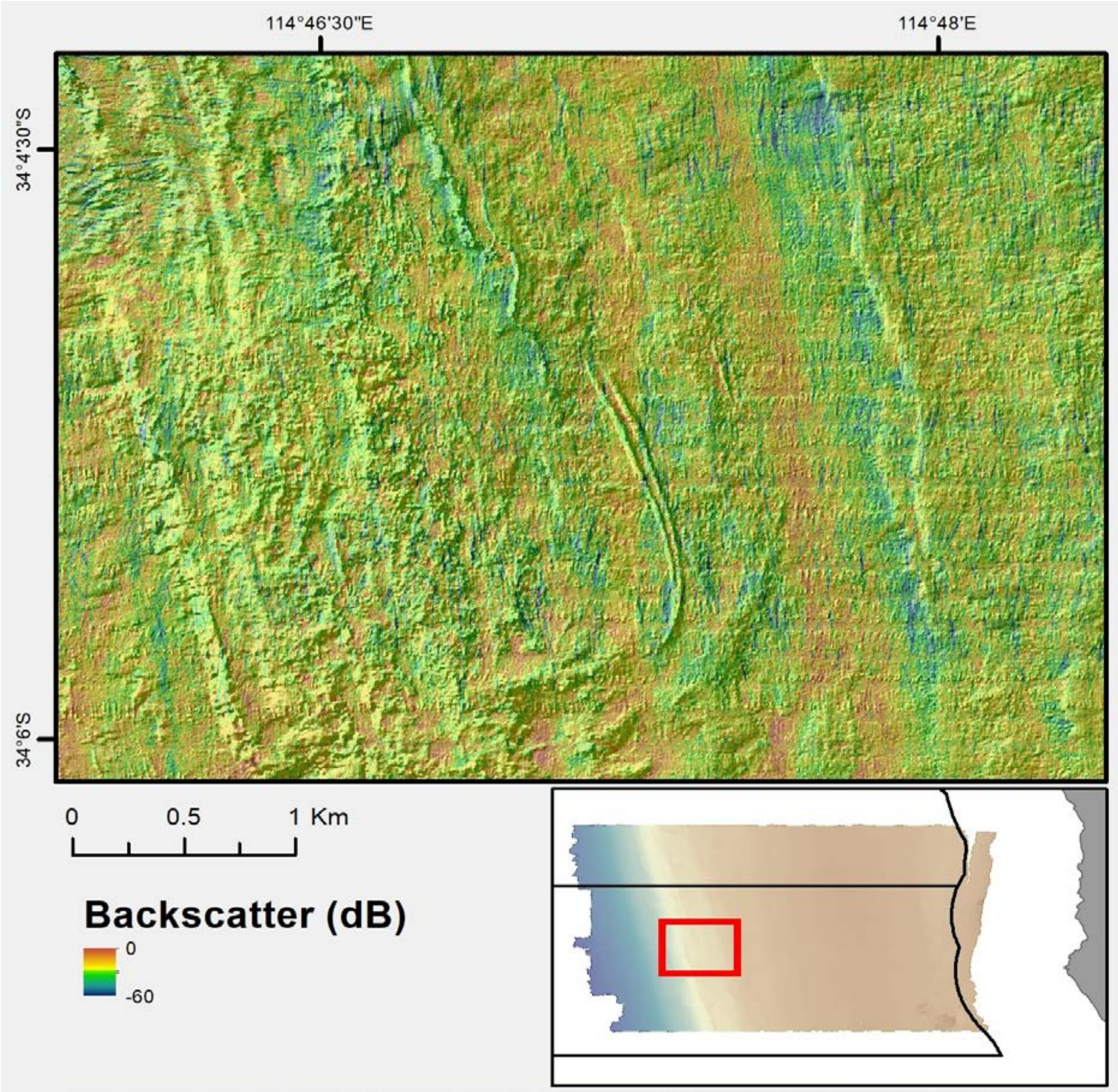

Figure 19. Acoustic backscatter map for the outer shelf area of low ridges and ledges within the National Park Zone.
Lower backscatter intensity (-20 dB indicated by green to blue) was recorded in shallow depressions between ridges where sediment deposits occur. Inset map shows location.

5.2 Seabed biological communities

5.2.1 Benthos

Initial observations of imagery from stereo-BRUV, drop camera and AUV suggests that the shallow regions (30-70m) of the park support a typical seagrass (dominated by seasonally variable, perennial *Thalassodendron pachyrhizum*) and macroalgae (dominated by *Ecklonia radiata* and fleshy reds) community with moderate cover (~20-50%; Figures 20-24). Importantly, there appears to be a difference in seagrass cover (mean ~10%) between the

National Park Zone and the Special Purpose Zone to the north (Figures 20-24). To a lesser extent, hard corals and massive sponges are also present around the mesophotic depths of the National Park and Special Purpose Zones of the South-west Corner Marine Park until the consolidated reefal pavement becomes more patchy in ~70-90m. Here the reef outcrops become interspersed with areas of coarse sandy sediment supporting a variety of communities dominated by a diverse assemblage of black and octocorals, hydroids and bryozoans, which peak in mean cover across depths of 70-120m (Figures 20-24). Some patches of Rhodoliths were also observed in the 40-100m depths although they appear to be not extensive. In the mesophotic depths 120-180m the substrate was almost exclusively soft sediments dominated by silty mud. The drop camera imagery of these areas indicate sessile benthic organisms are sparse (<0.1% cover) or entirely absent, although the prevalence of some bioturbation suggests the biota here is mainly infaunal. Exploratory drop cameras sampling was also conducted on the continental shelf break in 250m depth (Figure 5) revealing deeper sponge gardens on the shelf break with associated aggregations of Hapuka (*Polyprion oxygeneios)* (Figure 35).

Complete annotations of AUV and drop camera datasets are yet to be completed due to interruptions in the field work schedule associated with COVID.

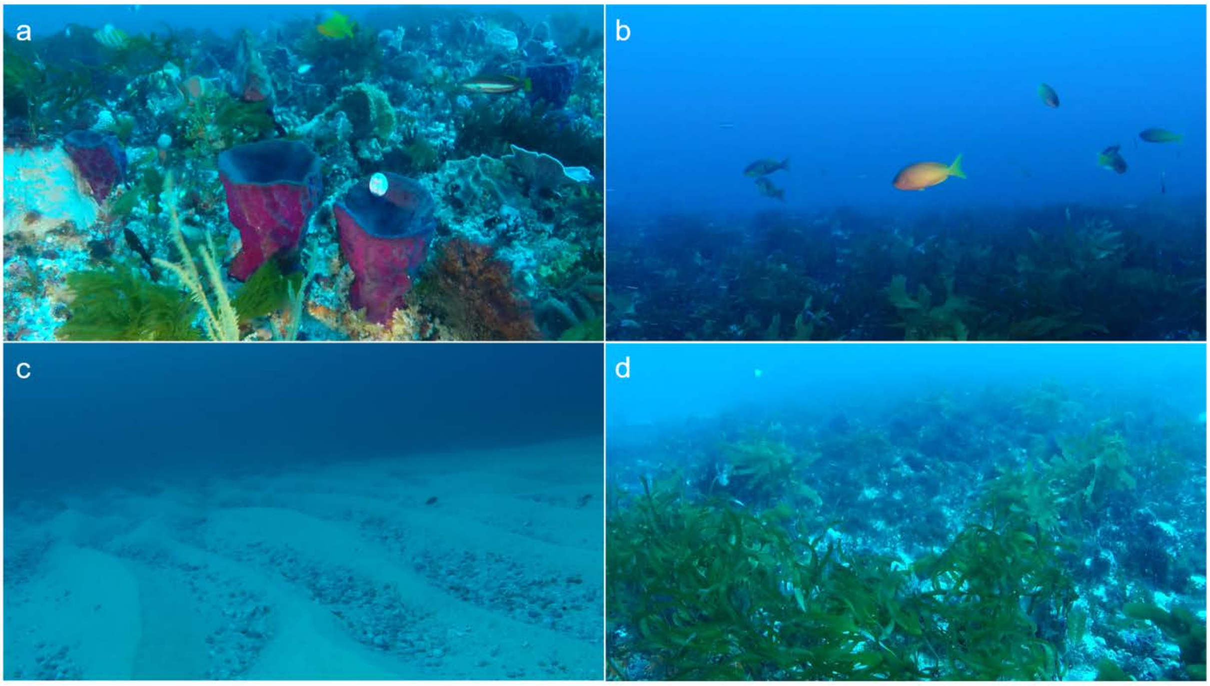

Figure 20. Examples of dominant habitat types observed on drop camera deployments as shown in Figure 23.

(a) Sponge garden interspersed with macroalgae and seagrass assemblages
(b) Macroalgae (*Ecklonia radiata*) dominated reef habitat
(c) Large sand ripples with what appears to be Rhodoliths in gutters
(d) Seagrass (*Thalassodendron pachyrhizum*) dominated low profile limestone reef

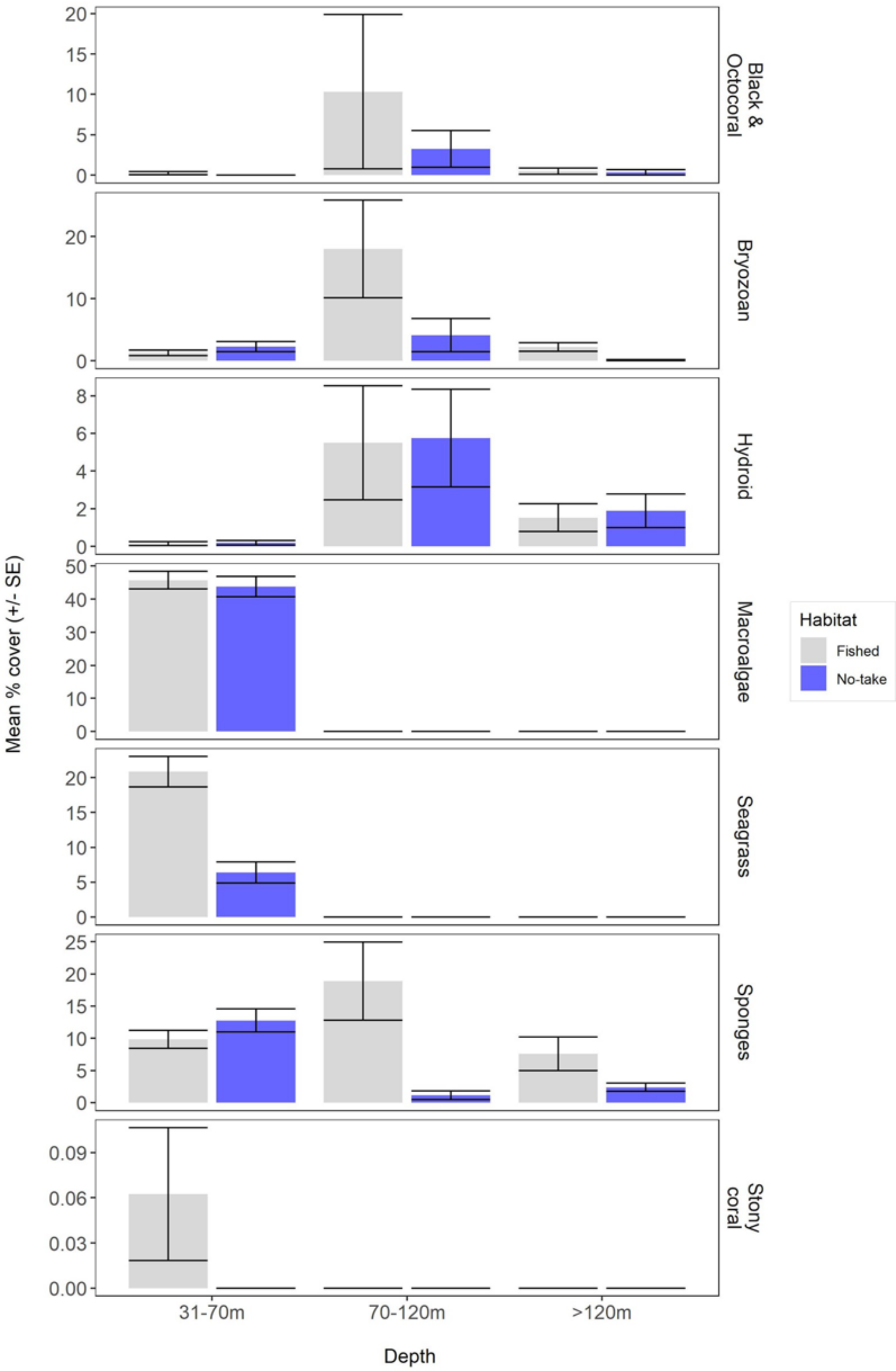

Figure 21. Mean cover of key epibiota groups recorded in stereo-BRUV dataset.
This highlights depth gradients and differences between Special Purpose (fished) and National Park (no-take) Zones.

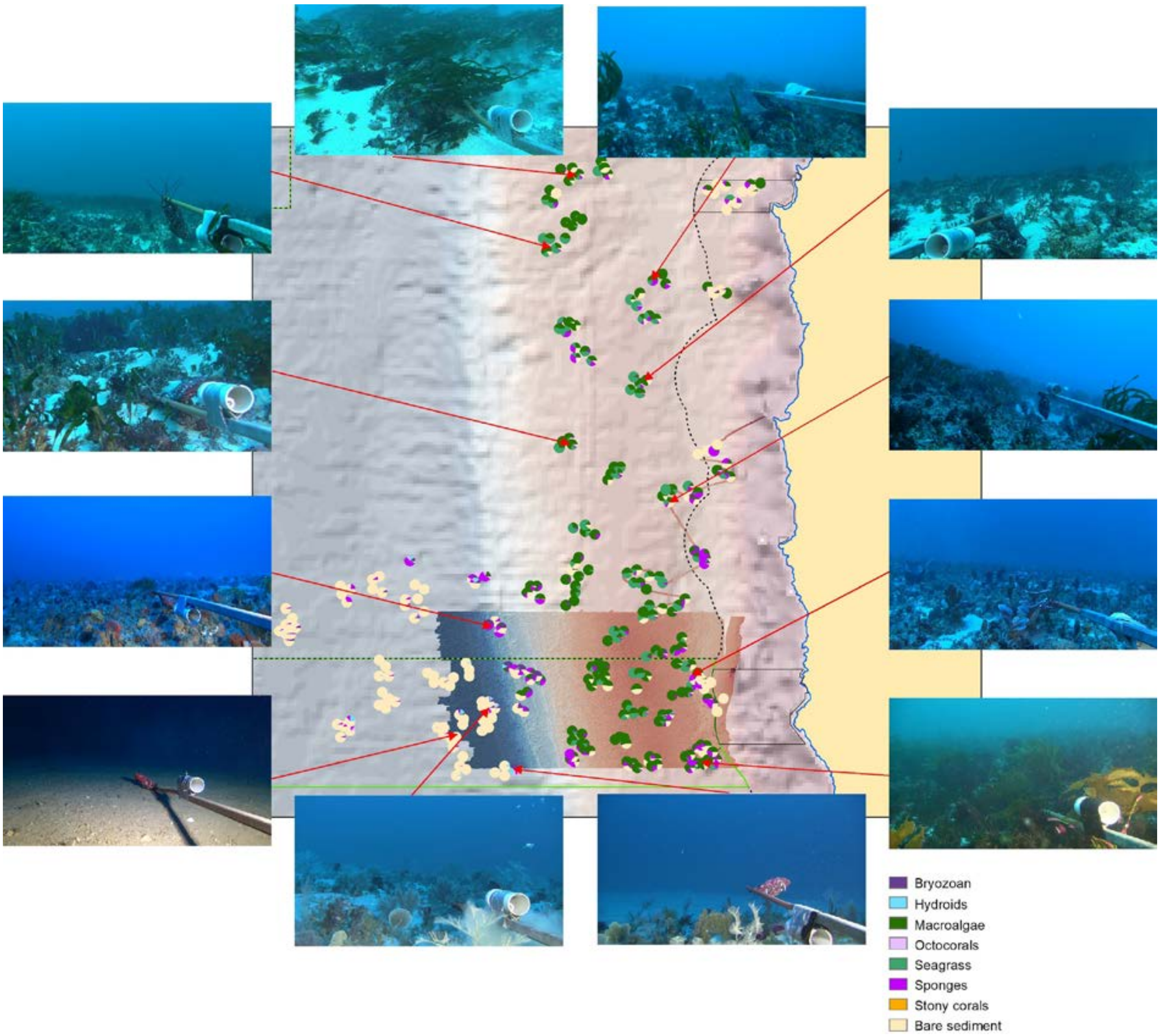

Figure 22. Habitat distribution from stereo-BRUV imagery.
Images highlight the extensive seagrass (*Thalassodendron pachyrizum)* on reefs in 30-70m and kelp *Ecklonia radiata* dominated isolated reef to the south-east and flat pavement reef interspersed with sand sediments in characteristic of the mid-shelf habitat. Deeper ledge habitat supports a diverse filter feeding assemblage dominated by hard bryozoans, hydroids and sponges. Beyond 120m substrates dominated by mud/silt sediment with very sparse epibiota.

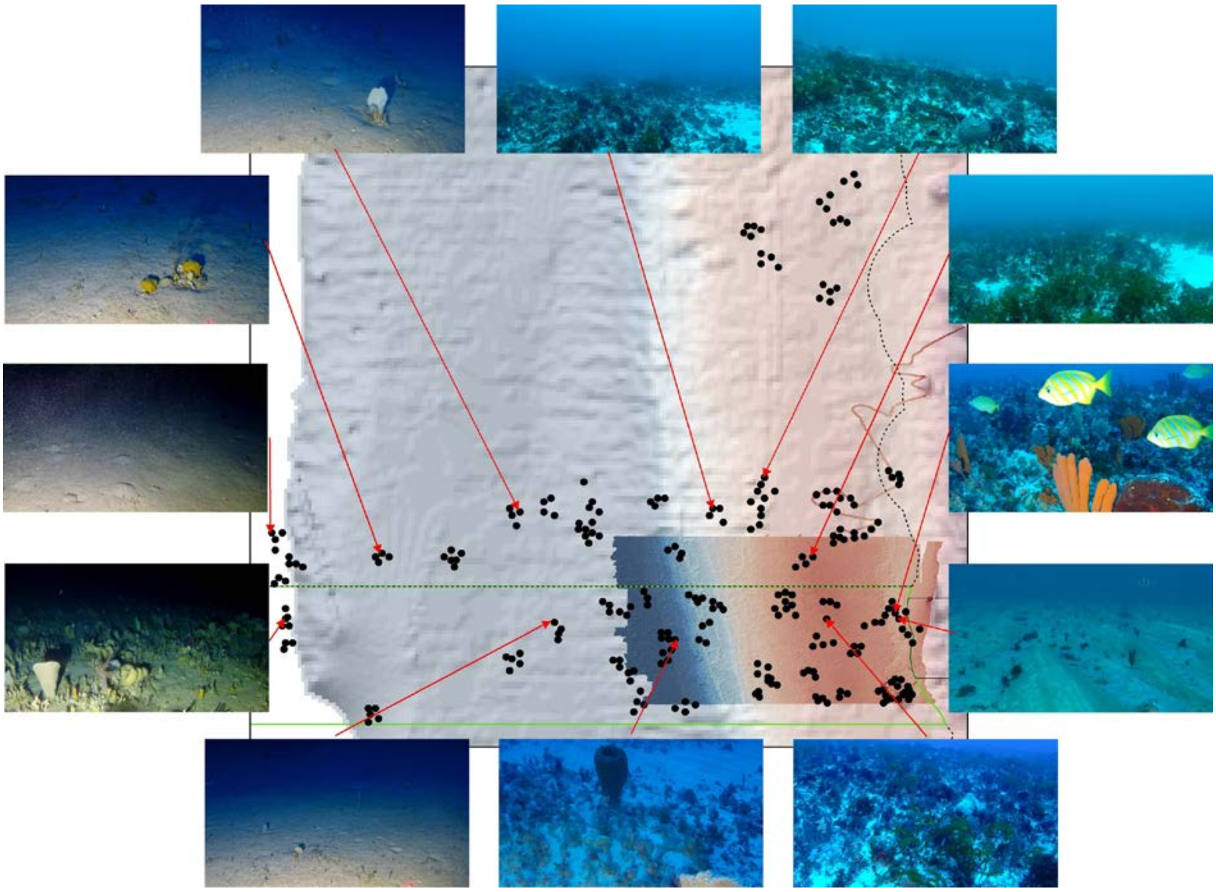

Figure 23. Habitat distribution from drop camera imagery.
Images collected during stage 2 again highlights the depth gradient from macroalgae, stony coral and seagrass dominated shallows to the sparse sessile invertebrate beds at depth.

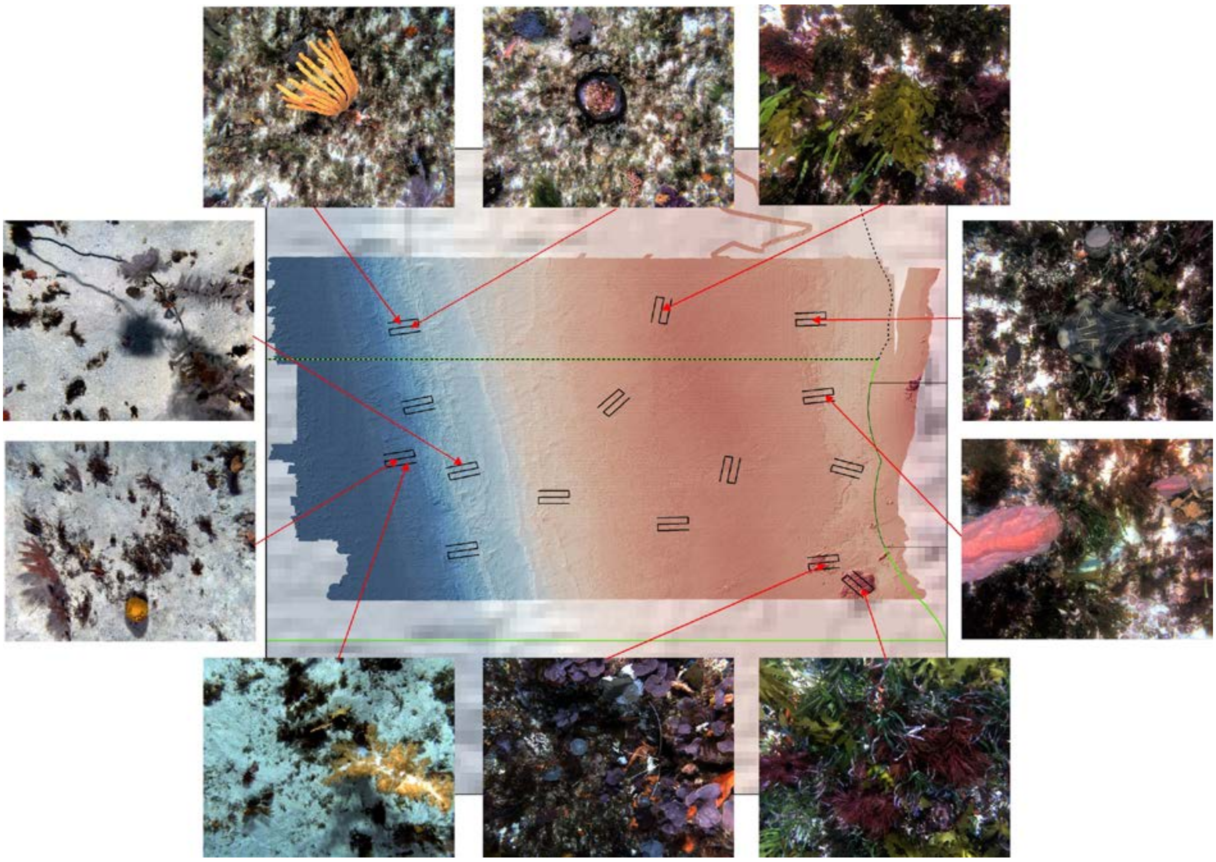

Figure 24. Habitat distribution from AUV imagery.
Images highlight similar patterns in epibiota as the drop and stereo-BRUV datasets with macroalgae, stony coral and seagrass dominating mesophotic depths to the sparse sessile filter feeding epibiota beds down to 120m.

5.3 Fishes

5.3.1 Description of fish assemblage

A total abundance of 13,901 fish were recorded across the 294 successful stereo-BRUV deployments from 140 species and 61 families (See Table 3; Figure 25). A total of 275 deployments were successful for length measurements. Both abundance and species richness showed no marked difference between Zones (Figures 26-28), but clear declines at depths >120 m (Figures 29,30) which is likely reflective of a lack of reefal habitat. The three most abundant species in the Marine National Park Zone differed slightly from the Special Purpose Zone (Mining exclusion) (Figure 26). In the Marine National Park Zone Western King wrasse (*Coris auricularis*, 1171 individuals), slender bullseye (*Parapriacanthus elongatus,* 748 individuals) and footballer sweep (*Neatypus obliquus*, 700 individuals) were most abundant (Figure 26). Whereas in the Special Purpose Zone (Mining exclusion) Western King wrasse (*Coris auricularis*, 1171 individuals), footballer sweep (*Neatypus obliquus*, 821 individuals) and the maori wrasse (*Ophthalmolepis lineolatus*, 620 individuals) were most abundant (Figure 26).

The three most ubiquitous species were the Western King wrasse (*C. auricularis* 73% of deployments;Figure 31), Southern Maori wrasse (*Ophthalmolepis lineolatus*, 61% of deployments) and the redband wrasse (*Pseudolabrus biserialis*, 54% of deployments). A number of recreationally targeted species were recorded, including Pink snapper (*Chrysophrys auratus*; Figure 32), West Australian dhufish *Glaucosoma hebraicum;* Figure 33), both Swallowtail (*Centroberyx lineatus*) and yelloweye redfish (*Centroberyx australis;* Figure 33*)* and Hapuka (Polyprion oxygeneios; Figure 35) (See Table 3 for full list, Figure 33) *(*Five species observed are ranked as vulnerable by the IUCN, the sandbar shark, *Carcharhinus plumbeus*, the Western blue groper, *Achoerodus gouldii*, the bigeye tuna, *Thunnus obesus*, the smooth hammerhead, *Sphyrna zygaena*, and the school shark, *Galeorhinus galeus* (See Table 3)*.*

The observed differences are not expected to be the result of zoning given that park management plans only came into effect 1 July 2018, but are instead suspected to be due to natural ecological variation. Further investigation of these patterns and analysis of the fish datasets are yet to be completed due to interruptions in the field work schedule associated with COVID, but are recommended to be done in follow up work.

Figure 25. Examples of fish, sharks, rays and other mobile fauna that were observed within the South-west Corner Marine Park.
(a) an endemic Horseshoe leatherjacket (*Meuschenia hippocrepis*, left) and bight redfish (*Centroberyx gerrardi*).
(b) Port Jackson shark (*Heterodontus portusjacksoni*, front) and pink snapper (*Chrysophrys auratus*, back).
(c) Smooth stingray (*Bathytoshia brevicaudata*).
(d) Curious cuttlefish (*Sepia* spp.).
(e) Harlequin fish (*Othos dentex*, front) and whiskery shark (*Furgaleus macki*, back).
(f) Smooth hammerhead (*Sphyrna zygaena*), listed as vulnerable by the IUCN.
(g) Woodward's Moray (*Gymnothorax woodwardi*) attacking the bait bag.
(h) a latchet (*Pterygotrigla polyommata*, right).
(i) an endemic common sawshark (*Pristiophorus cirratus*, right)

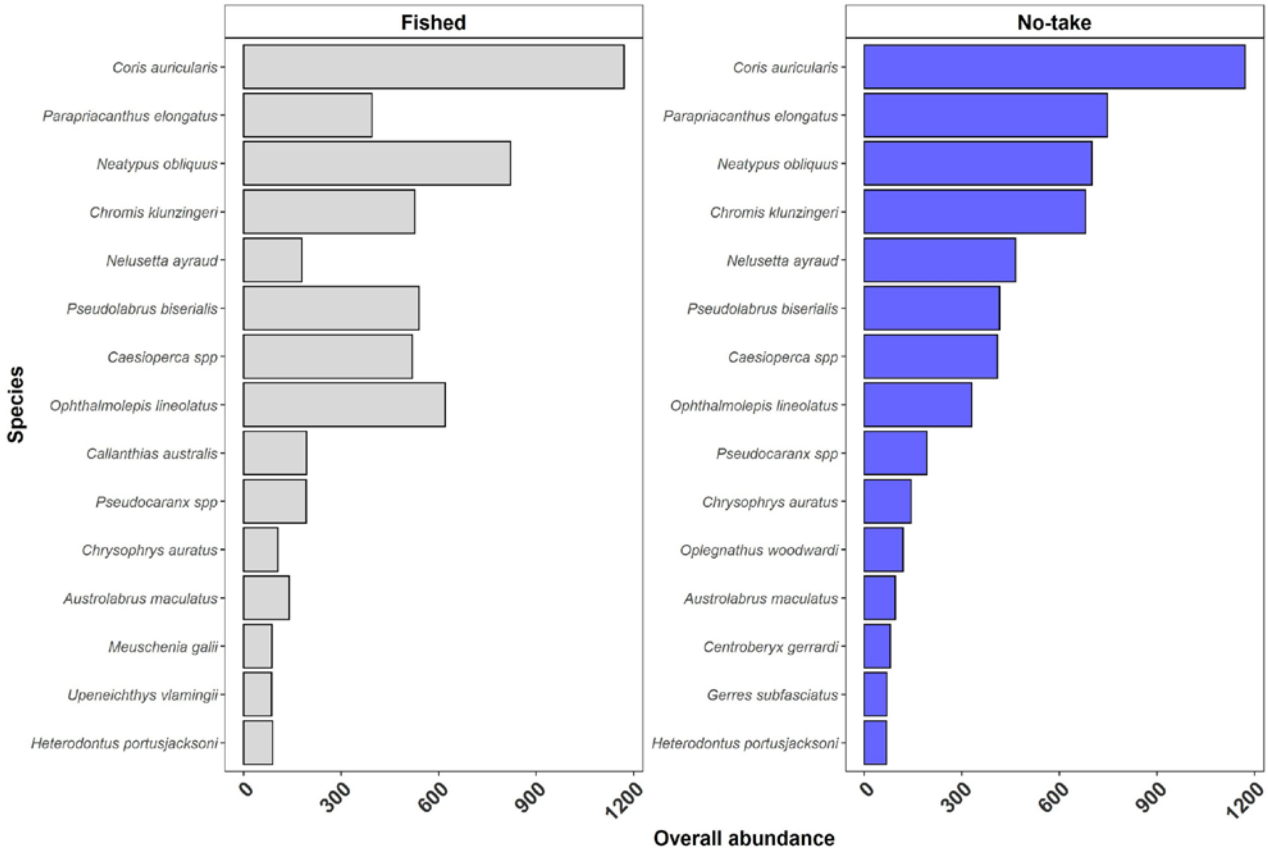

Figure 26. The 15 most abundant fish species observed on the stereo-BRUV deployments
Located in the Special Purpose (fished - grey) and Marine National Park Zones (no-take - blue).

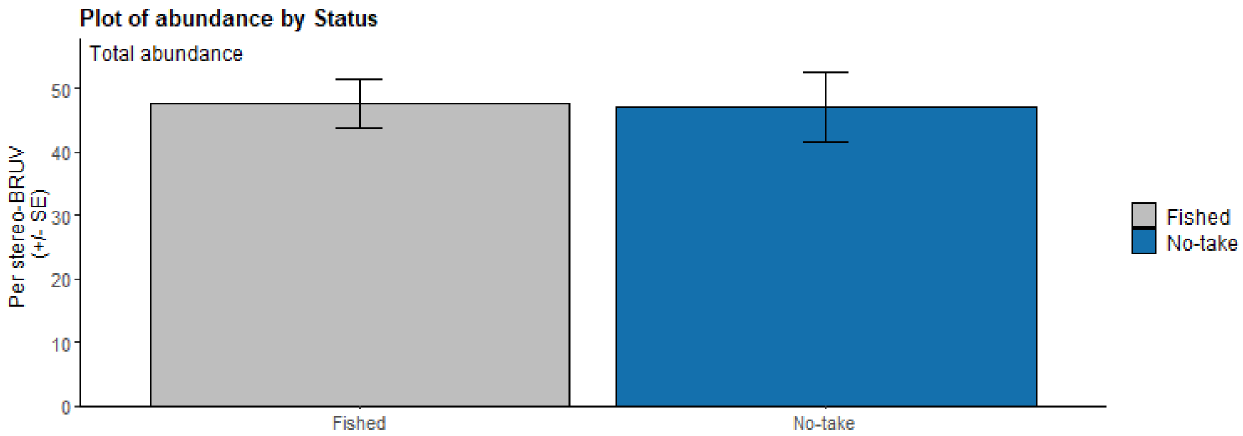

Figure 27. Average total abundance per stereo-BRUV deployment.
Plot made in the Visualiser app.

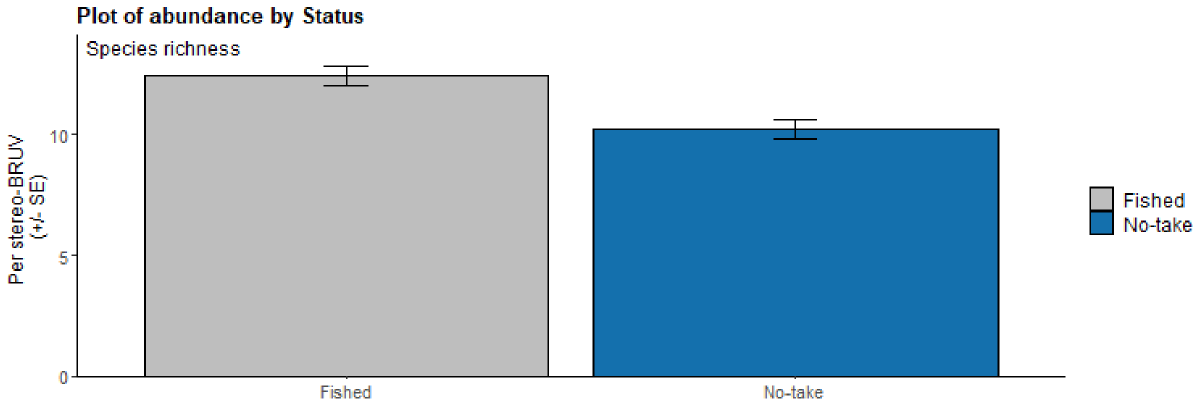

Figure 28. Average species richness per stereo-BRUV deployment.
Plot made in the Visualiser app.

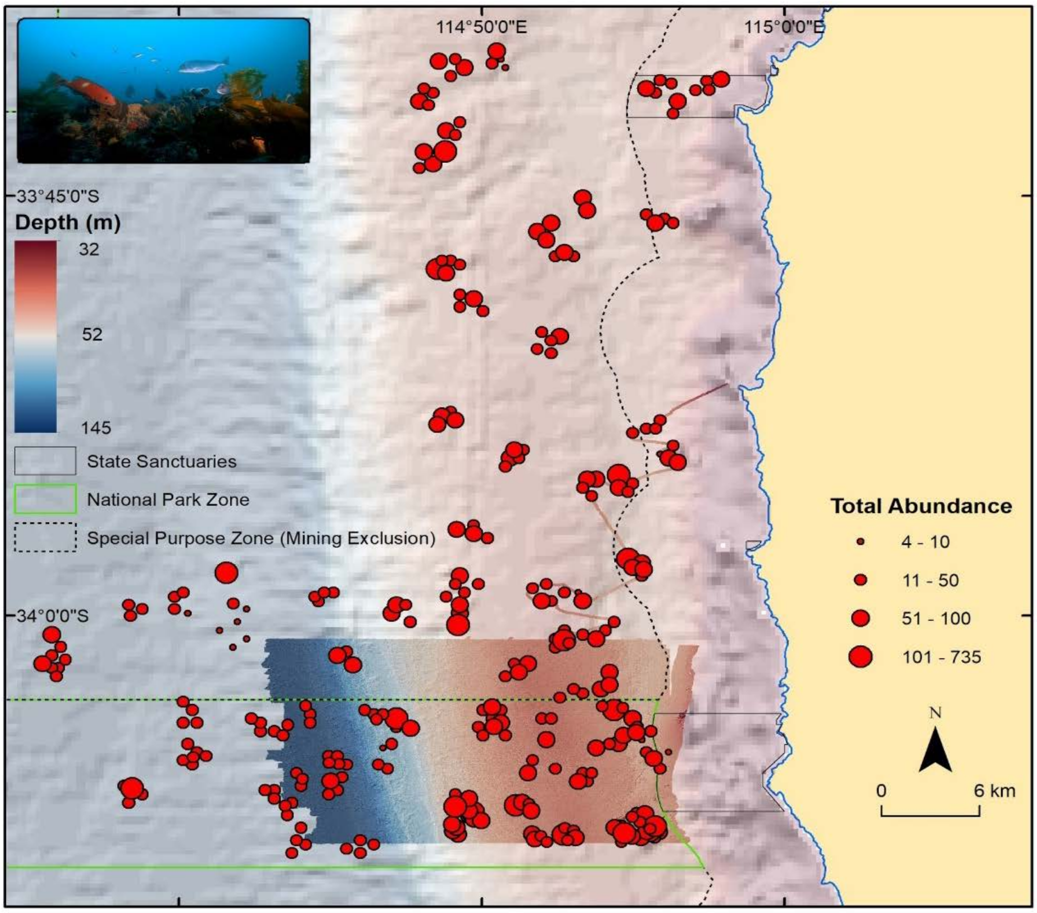

Figure 29 Spatial distribution of total abundance of all individual fish from stereo-BRUV samples.

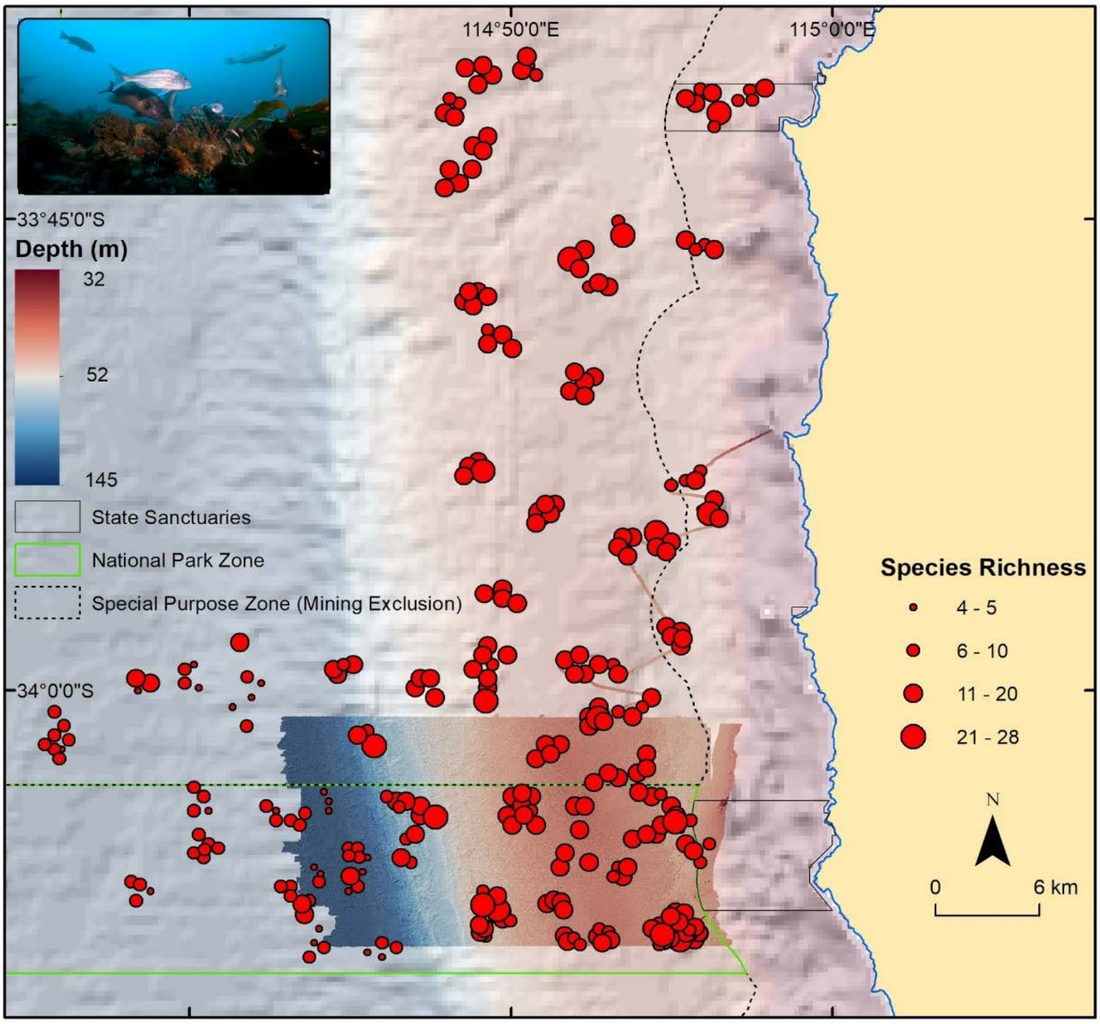

Figure 30. Species richness from stereo-BRUV samples

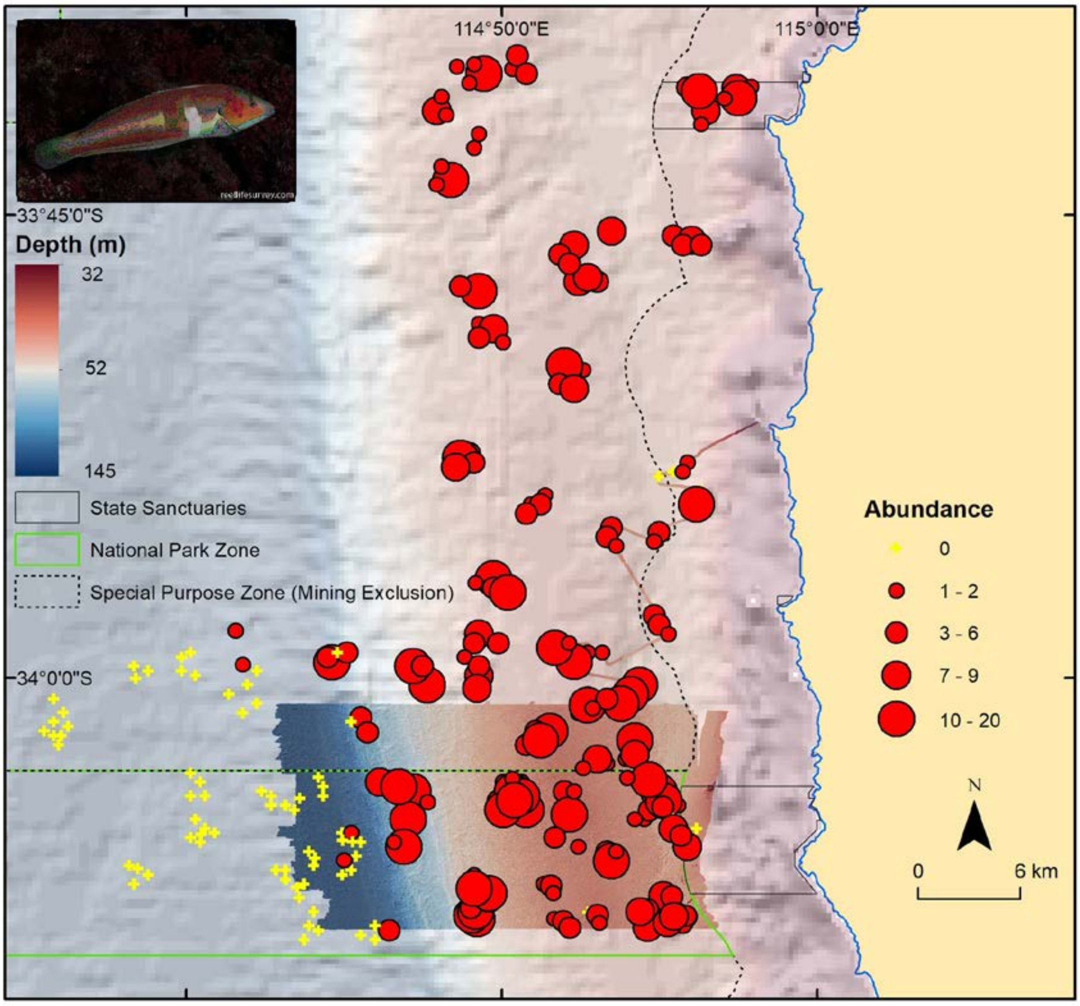

Figure 31. Spatial distribution of C. auricularis (Western King wrasse) from stereo-BRUV samples.

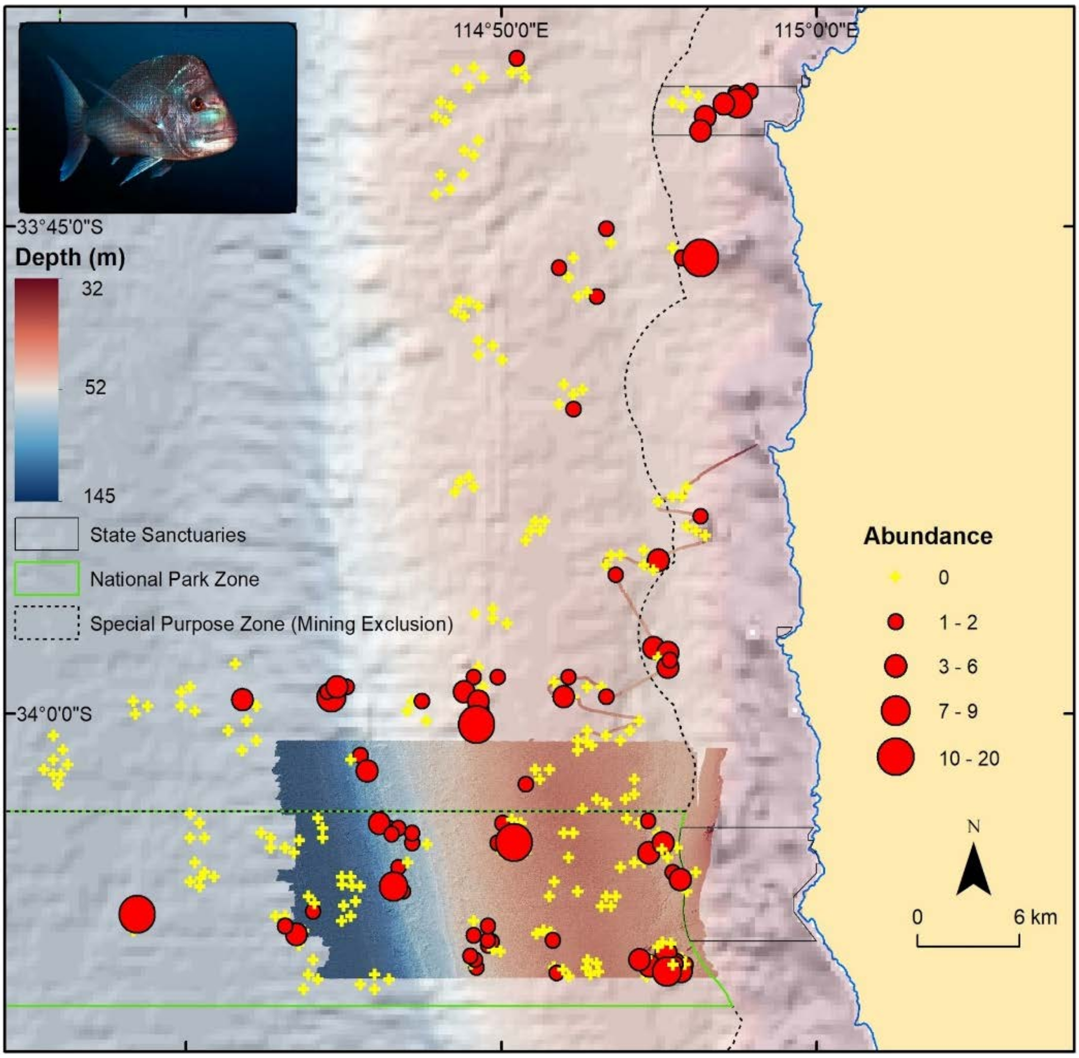

Figure 32. Spatial distribution of C. auratus from stereo-BRUV samples.

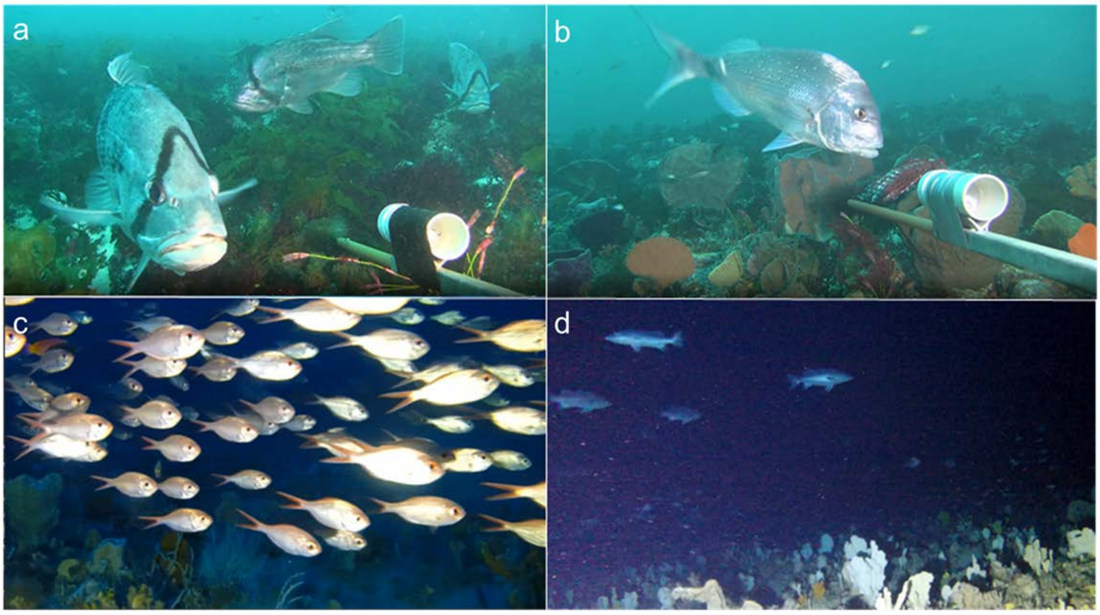

Figure 33. Examples of highly targeted species observed on stereo-BRUV (a-b) and drop camera (c-d) deployments.

a. West Australian dhufish, *Glaucosoma hebraicum* in 39 m
b. Pink snapper, *Chrysophrys auratus* in 46 m
c. Swallowtail, *Centroberyx lineatus* and yelloweye redfish, *Centroberyx australis* in 129 m
d. Hapuku, *Polyprion oxygeneios* in 201 m
e.

5.4 Threatened species

Within the National Park Zone we observed smooth hammerhead (Sphyrna zygaena: Figure 25 (f)), listed as vulnerable by the IUCN and currently under assessment through the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and found evidence of a potential aggregation site for grey nurse sharks (Carcharias taurus). Identification and protection of grey nurse shark aggregation sites is important for conserving this species (Lynch et al., 2013). Although the west coast population of C. taurus is listed as Vulnerable under the EPBC Act, the eastern Australian populations of this species are listed as Critically Endangered. Their biennial reproductive cycle and slow population growth make C. taurus populations vulnerable to decline (Hoschke & Whisson, 2016). We observed five individuals at one site at a depth of 137 m (Figure 34). To our knowledge this would represent the deepest aggregation site for C. taurus and would represent the second aggregation site identified in the west coast population, with the other site located at the Navy Pier in Exmouth (Hoschke & Whisson, 2016). Although population estimates have been made for the eastern Australian population, there is no such information for the western population reflecting the lack of knowledge and high degree of uncertainty on the status of this subpopulation (Bradford et al. 2018). Repeat surveys of this aggregation. Repeat surveys of this aggregation are needed to confirm site use on a recurrent basis, and to determine whether this site is used seasonally, or year-round.

Figure 34. A Grey nurse shark (Carcharias taurus) in the National Park Zone.
Imagery taken from a drop camera deployment in 141 m.

***Figure 35 Aggregation of Hapuka (Polyprion oxygeneios)* over sponge gardens on the continental shelf break in the National Park Zone.**
Imagery taken from a drop camera deployment in 250m.

6. Future work and Recommendations

Due to the interruptions and delays caused by COVID not all data sets were able to be annotated and only exploratory analysis of the processed data was undertaken in the current report (Table 2).

Despite these issues an initial picture of patterns in seabed habitats and demersal fish assemblages within National Park and adjacent Special Purpose Zones is possible. Several small isolated high-profile reefs exist in ~30-50 m depth in the south-east of the National Park Zone, with the majority of mid-shelf habitat consisting of flat pavement reefs interspersed with sand sediments, with both reef types supporting diverse assemblages of macroalgae, seagrass, hard corals and sponges. Further offshore, deeper ledge features, orientated in a north-south direction at ~100m depth, supports a diverse filter feeding assemblage dominated by hard bryozoans, hydroids, black and octocorals, and sponges. From 120-180m substrates are dominated by silty mud sediment with very sparse epibiota, whereas deep sponge gardens are again present on the high relief continental shelf break in 250m within the national Park Zone.

Total abundance and species richness in demersal fish assemblages showed no marked difference between Zones, but clear declines at depths >120m, which is likely reflective of a lack of reefal habitat. Some differences in individual species abundance and biomass may be evident between National Park and Special Purpose (Mining exclusion) Zones. Although a more thorough analysis is required to explore these initiation observations further.

This survey provides an excellent example of multiple extensive data sets collected by Standard Operating Procedures, and will provide an excellent case to explore how these data can be used to identify key natural values and potential reporting indicators and metrics to inform Parks Australia's Monitoring Evaluation and Reporting Framework.

We recommend that follow up NESP projects should be undertaken to finish the annotation and processing of the data collected in this survey and that the data should then be interrogated and compared with other comparable national datasets, to identify key natural values and develop potential reporting indicators and metrics.

Table 2. Summary of data collected and processed
NPZ =National Park Zone and SPZ = Special Purpose Zone (Mining Exclusion)

Methods	Area / No. samples	% of samples processed / annotated	Planned repository once complete
Seabed mapping	NPZ and SPZ	85	AusSeabed
stereo-BRUV	284	95	GlobalArchive
Drop camera	418	0	Squidle+ / UMI
AUV	15 transects	0	Squidle+ / UMI

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SUPPLEMENTARY MATERIAL

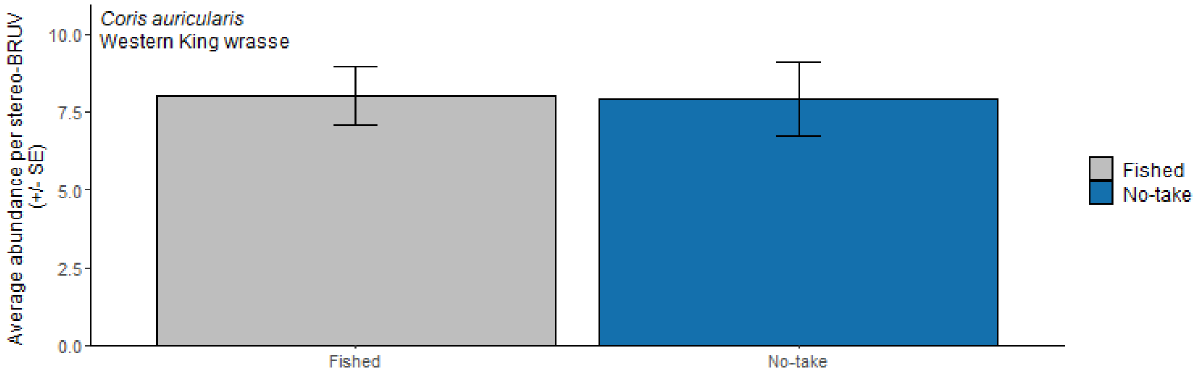

Figure 36. Average abundance of Western King wrasse.
Coris auricularis (Western King wrasse) per stereo-BRUV.
Plot made in the Visualiser app.

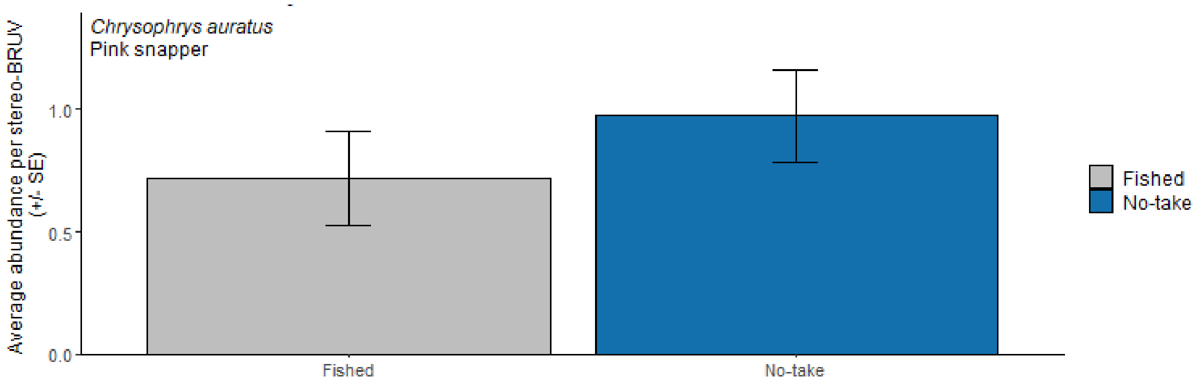

Figure 37. Average abundance of Pink snapper.
Chrysophrys auratus (Pink snapper) per stereo-BRUV.
Plot made in the Visualiser app.

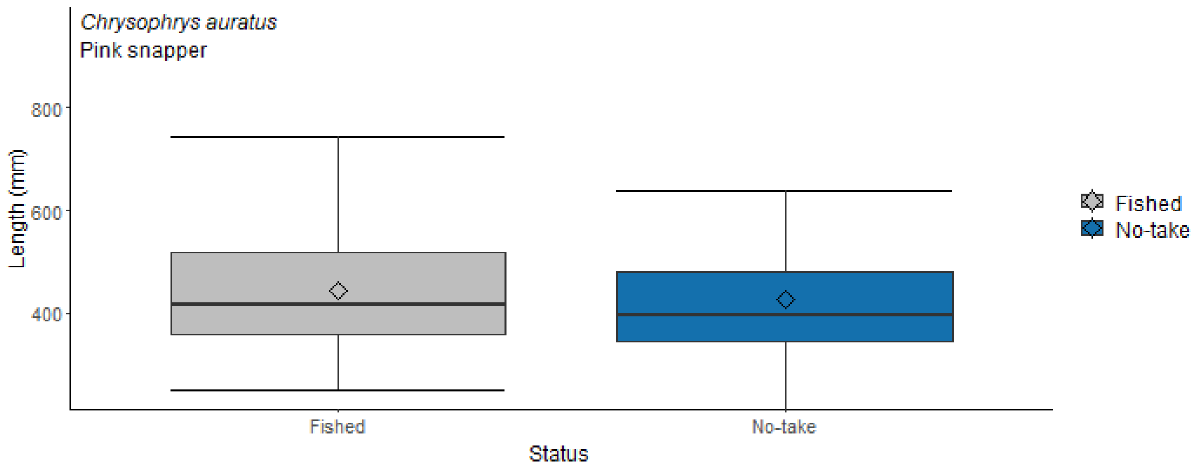

Figure 38. Length distribution for Pink snapper.
Chrysophrys auratus (Pink snapper) length distribution as a boxplot with mean length indicated by diamond.
Plot made in the Visualiser app.

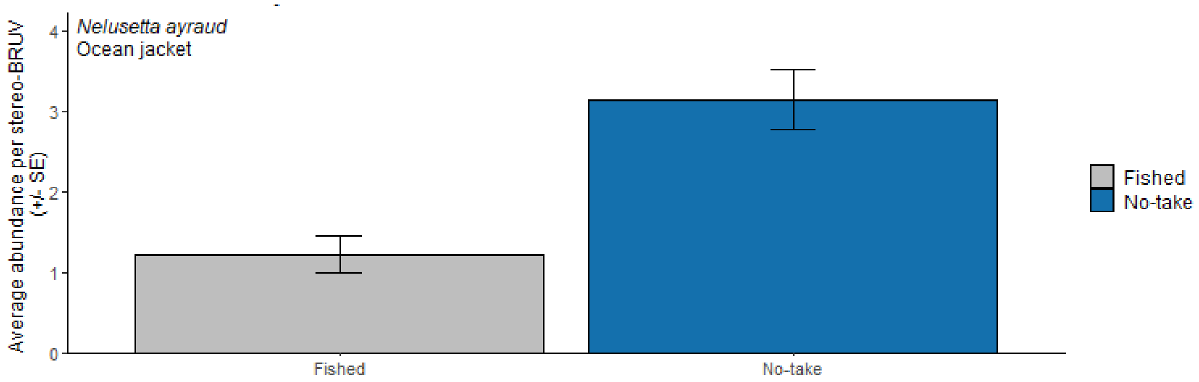

Figure 39. Average abundance of Ocean leatherjacket.
Nelusetta ayraud (Ocean leatherjacket) per stereo-BRUV.
Plot made in the Visualiser app.

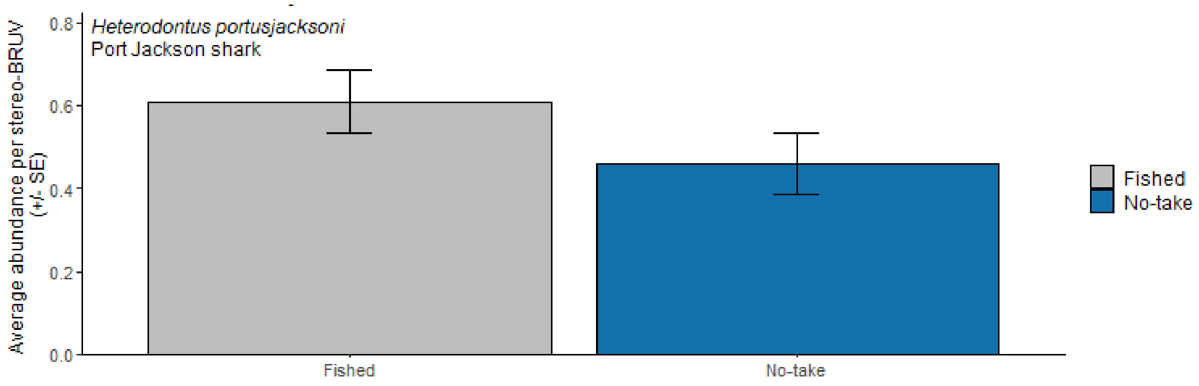

Figure 40. Average abundance of Port Jackson shark*.*
Heterodontus portusjacksoni (Port Jackson shark) per stereo-BRUV.
Plot made in the Visualiser app.

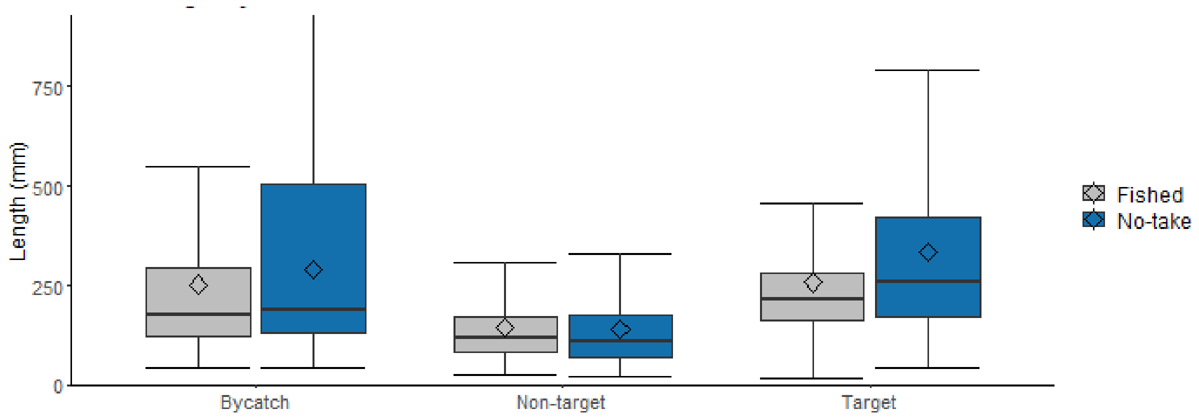

Figure 41. Length distribution for fish of different target levels.
Box-plots fish that are non-targeted but retained (Bycatch), non-target species and those that are targeted (both commercially and/or recreationally), .
Plot made in the Visualiser app.

Table 3. Mean relative abundance per stereo-BRUV deployment and total abundance for all fish species observed and their archetype.

Species listed as 'sp' could not be identified but comprised a single species whilst those listed as 'spp' could not be identified and may possess more than one species. IUCN status of each species is recorded where available. Hapuka (*Polyprion oxygeneios*) and Grey nurse shark (*Carcharias taurus*) are not listed here as they we observed on the drop camera imagery that has not yet been formally annotated.

Family	*Species*	Common name	Targeted	IUCN status	Mean relative abundance per deployment ± SE	Total relative abundance
Aplodactylidae	*Aplodactylus westralis*	Western seacarp			0.02 +/- 0.01	7
Aracanidae	*Anoplocapros amygdaloides*	Western smooth boxfish			0.02 +/- 0.01	5
	Anoplocapros lenticularis	Whitebarred boxfish			0.08 +/- 0.02	23
	Caprichthys gymnura	Rigid boxfish			0.02 +/- 0.01	5
Aulopidae	*Latropiscis purpurissatus*	Sergeant baker	Commercial		0.05 +/- 0.01	15
Batrachoididae	*Batrachomoeus rubricephalus*	Pinkhead frogfish			0 +/- 0	1
Berycidae	*Centroberyx australis*	Yelloweye redfish	Commercial		0.15 +/- 0.12	44
	Centroberyx gerrardi	Bight redfish	Commercial		0.3 +/- 0.23	87
	Centroberyx lineatus	Swallowtail	Commercial		0.39 +/- 0.24	115
	Unknown sp	An unknown redfish			0 +/- 0	1
Callanthiidae	*Callanthias allporti*	Rosy perch			0.01 +/- 0.01	3
Callanthiidae	*Callanthias australis*	Splendid perch			0.78 +/- 0.33	230
Carangidae	*Pseudocaranx spp*	Silver trevally			1.31 +/- 0.17	384
	Seriola hippos	Samsonfish	Commercial	Least Concern	0.12 +/- 0.06	36
	Seriola lalandi	Yellowtail kingfish	Commercial	Least Concern	0.02 +/- 0.01	6
	Trachurus novaezelandiae	Yellowtail scad			0.01 +/- 0.01	3
Carcharhinidae	*Carcharhinus brevipinna*	Spinner shark		Near Threatened	0.01 +/- 0.01	4
	Carcharhinus limbatus	Common blacktip shark	Commercial	Near Threatened	0.02 +/- 0.01	5
	Carcharhinus plumbeus	Sandbar shark	Commercial	Vulnerable	0.01 +/- 0.01	4
	Carcharhinus spp	An unknown shark			0.01 +/- 0.01	3
	Unknown spp	An unknown shark			0 +/- 0	1

Family	*Species*	Common name	Targeted	IUCN status	Mean relative abundance per deployment ± SE	Total relative abundance
Chaetodontidae	*Chelmonops curiosus*	Western talma		Least Concern	0.07 +/- 0.02	20
Cheilodactylidae	*Dactylophora nigricans*	Dusky morwong			0.02 +/- 0.01	6
	Nemadactylus valenciennesi	Blue morwong	Commercial		0.31 +/- 0.04	92
Clupeidae	*Hyperlophus vittatus*	Sandy sprat		Least Concern	0 +/- 0	1
Dasyatidae	*Bathytoshia brevicaudata*	Smooth stingray			0.14 +/- 0.02	42
Dinolestidae	*Dinolestes lewini*	Longfin Pike	Commercial		0.08 +/- 0.06	23
Diodontidae	*Diodon nicthemerus*	Globefish			0.02 +/- 0.01	6
Enoplosidae	*Enoplosus armatus*	Old wife			0.05 +/- 0.02	15
Gerreidae	*Gerres subfasciatus*	Common silverbiddy		Least Concern	0.31 +/- 0.09	92
	Parequula melbournensis	Silverbelly			0.42 +/- 0.08	124
Glaucosomatidae	*Glaucosoma hebraicum*	West Australian dhufish	Commercial		0.14 +/- 0.03	41
Gobiesocidae	*Aspasmogaster occidentalis*	Western clingfish			0 +/- 0	1
	Unknown spp	An unknown clingfish			0.01 +/- 0	2
Haemulidae	*Plectorhinchus flavomaculatus*	Goldspotted sweetlips			0 +/- 0	1
Heterodontidae	*Heterodontus portusjacksoni*	Port Jackson shark		Least Concern	0.53 +/- 0.05	157
Holocentridae	*Unknown spp*	Unknown			0.05 +/- 0.05	15
Kyphosidae	*Kyphosus sydneyanus*	Silver drummer			0.09 +/- 0.09	27
Labridae	*Achoerodus gouldii*	Western blue groper		Vulnerable	0.02 +/- 0.01	7
	Austrolabrus maculatus	Blackspotted wrasse		Least Concern	0.8 +/- 0.06	235
	Bodianus frenchii	Foxfish	Commercial	Near Threatened	0.12 +/- 0.02	35
	Bodianus vulpinus	Western pigfish		Least Concern	0.01 +/- 0.01	4
	Choerodon rubescens	Baldchin groper	Commercial	Least Concern	0.14 +/- 0.02	42
	Coris auricularis	Western King wrasse		Least Concern	7.97 +/- 0.75	2342
	Eupetrichthys angustipes	Snakeskin wrasse		Least Concern	0.36 +/- 0.03	106

Family	*Species*	Common name	Targeted	IUCN status	Mean relative abundance per deployment ± SE	Total relative abundance
	Halichoeres brownfieldi	Brownfield's wrasse		Least Concern	0 +/- 0	1
	Heteroscarus acroptilus	Rainbow cale		Least Concern	0 +/- 0	1
	Labroides dimidiatus	Common cleanerfish		Least Concern	0 +/- 0	1
	Notolabrus parilus	Brownspotted wrasse		Least Concern	0.11 +/- 0.02	32
	Ophthalmolepis lineolatus	Southern Maori wrasse		Least Concern	3.23 +/- 0.2	950
	Pictilabrus laticlavius	Senator wrasse		Least Concern	0 +/- 0	1
	Pseudolabrus biserialis	Redband wrasse		Least Concern	3.25 +/- 0.27	956
	Suezichthys bifurcatus	Striped Rainbow wrasse		Data Deficient	0.29 +/- 0.06	86
	Suezichthys cyanolaemus	Bluethroat rainbow wrasse		Least Concern	0 +/- 0	1
	Unknown spp	An unknown wrasse			0 +/- 0	1
Lethrinidae	*Gymnocranius spp*	An unknown seabream			0 +/- 0	1
Monacanthidae	*Acanthaluteres brownii*	Spinytail leatherjacket			0.04 +/- 0.01	11
	Acanthaluteres vittiger	Toothbrush leatherjacket			0.24 +/- 0.11	70
	Brachaluteres jacksonianus	Southern pygmy leatherjacket		Least Concern	0.01 +/- 0	2
	Eubalichthys bucephalus	Black Reef leatherjacket			0.01 +/- 0	2
	Eubalichthys mosaicus	Mosaic leatherjacket			0 +/- 0	1
	Meuschenia australis	Brownstriped leatherjacket			0.01 +/- 0	2
	Meuschenia flavolineata	Yellowstriped leatherjacket			0.12 +/- 0.03	34
	Meuschenia freycineti	Sixspine leatherjacket			0.06 +/- 0.01	19
	Meuschenia galii	Bluelined leatherjacket			0.4 +/- 0.04	119
	Meuschenia hippocrepis	Horseshoe leatherjacket		Least Concern	0.02 +/- 0.01	6
	Meuschenia scaber	Velvet leatherjacket			0.1 +/- 0.03	30

Family	*Species*	Common name	Targeted	IUCN status	Mean relative abundance per deployment ± SE	Total relative abundance
	Meuschenia venusta	Stars-and-stripes leatherjacket			0.04 +/- 0.01	11
	Nelusetta ayraud	Ocean jacket			2.19 +/- 0.23	644
	Scobinichthys granulatus	Rough leatherjacket			0.21 +/- 0.03	63
	Unknown spp	An unknown leatherjacket			0 +/- 0	1
Monocentridae	*Cleidopus gloriamaris*	Australian pineapplefish			0.01 +/- 0.01	3
Moridae	*Pseudophycis barbata*	Bearded rock cod	Commercial		0.02 +/- 0.02	5
Mullidae	*Parupeneus chrysopleuron*	Rosy goatfish			0.11 +/- 0.02	33
	Upeneichthys vlamingii	Bluespotted goatfish	Commercial		0.45 +/- 0.03	132
Muraenidae	*Gymnothorax prasinus*	Green moray			0.02 +/- 0.01	5
	Gymnothorax woodwardi	Woodward's moray			0.01 +/- 0.01	4
Myliobatidae	*Myliobatis tenuicaudatus*	Southern eagle ray		Least Concern	0.27 +/- 0.03	80
Nemipteridae	*Pentapodus vitta*	Western butterfish			0 +/- 0	1
Neosebastidae	*Neosebastes bougainvillii*	Gulf gurnard perch			0.05 +/- 0.01	16
	Neosebastes nigropunctatus	Blackspotted gurnard perch			0.05 +/- 0.02	16
	Neosebastes pandus	Bighead gurnard perch			0.08 +/- 0.02	23
Odacidae	*Olisthops cyanomelas*	Herring cale		Least Concern	0.01 +/- 0	2
	Siphonognathus caninis	Sharpnose weed whiting		Least Concern	0.12 +/- 0.02	36
	Siphonognathus sp	An unknown weed whiting			0.03 +/- 0.02	10
Oplegnathidae	*Oplegnathus woodwardi*	Knifejaw		Data Deficient	0.67 +/- 0.07	196
Orectolobidae	*Orectolobus spp*	Wobbegong			0.05 +/- 0.01	14
Ostraciidae	*Aracana aurita*	Shaw's cowfish			0.02 +/- 0.01	5
Paralichthyidae	*Pseudorhombus spp*	An unknown flounder			0 +/- 0	1
Parascylliidae	*Parascyllium ferrugineum*	Rusty carpetshark		Least Concern	0 +/- 0	1
	Parascyllium variolatum	Varied carpetshark		Least Concern	0.02 +/- 0.01	5

Family	*Species*	Common name	Targeted	IUCN status	Mean relative abundance per deployment ± SE	Total relative abundance
Pempheridae	*Parapriacanthus elongatus*	Elongate bullseye			3.89 +/- 2.49	1143
Pempherididae	*Pempheris klunzingeri*	Rough bullseye			0.26 +/- 0.14	77
Pentacerotidae	*Parazanclistius hutchinsi*	Short boarfish	Commercial		0 +/- 0	1
Pinguipedidae	*Parapercis haackei*	Wavy grubfish			0.03 +/- 0.01	10
	Parapercis ramsayi	Spotted grubfish			0.1 +/- 0.02	28
	Parapercis spp	An unknown grubfish			0.01 +/- 0	2
	Unknown spp	An unknown grubfish			0 +/- 0	1
Platycephalidae	*Leviprora spp*	An unknown flathead			0 +/- 0	1
	Platycephalus spp	Flathead			0.2 +/- 0.05	58
Plesiopidae	*Paraplesiops meleagris*	Southern blue devil			0.01 +/- 0	2
	Trachinops noarlungae	Yellowhead hulafish			0.1 +/- 0.05	30
Pomacentridae	*Chromis klunzingeri*	Blackhead puller			4.11 +/- 0.55	1207
	Chromis westaustralis	West Australian puller			0.08 +/- 0.02	23
	Parma bicolor	Bicolor scalyfin			0.03 +/- 0.01	10
	Parma occidentalis	Western scalyfin			0.02 +/- 0.01	5
Pristiophoridae	*Pristiophorus cirratus*	Common sawshark	Commercial	Least Concern	0.02 +/- 0.01	7
Rhinobatidae	*Aptychotrema vincentiana*	Western shovelnose ray		Least Concern	0.02 +/- 0.01	6
	Trygonorrhina dumerilii	Southern fiddler ray			0.32 +/- 0.03	95
Scombridae	*Sarda orientalis*	Oriental bonito		Least Concern	0.01 +/- 0.01	2
	Thunnus obesus	Bigeye tuna	Commercial	Vulnerable	0 +/- 0	1
	Unknown spp	An unknown tuna			0.07 +/- 0.02	20
Scorpaenidae	*Scorpaena sumptuosa*	Western red scorpionfish			0.02 +/- 0.01	7
Scorpididae	*Neatypus obliquus*	Footballer sweep			5.17 +/- 0.54	1521
	Scorpis aequipinnis	Sea sweep	Commercial		0.04 +/- 0.02	13
	Scorpis georgiana	Banded sweep	Commercial		0.04 +/- 0.01	12

Family	*Species*	Common name	Targeted	IUCN status	Mean relative abundance per deployment ± SE	Total relative abundance
Scorpididae	*Tilodon sexfasciatus*	Moonlighter			0.18 +/- 0.03	52
Scyliorhinidae	*Asymbolus occiduus*	Western spotted catshark		Least Concern	0.07 +/- 0.02	20
	Aulohalaelurus labiosus	Blackspotted catshark		Least Concern	0.03 +/- 0.01	9
Serranidae	*Caesioperca spp*	Seapearch			3.16 +/- 0.51	929
	Epinephelides armatus	Breaksea cod	Commercial	Near Threatened	0.19 +/- 0.03	56
	Hypoplectrodes nigroruber	Banded seaperch			0.06 +/- 0.01	17
	Hyporthodus octofasciatus	Eightbar grouper	Commercial	Data Deficient	0 +/- 0	1
	Othos dentex	Harlequin fish	Commercial		0.02 +/- 0.01	6
Sillaginidae	*Sillago spp*	Whiting			0.02 +/- 0.02	6
Sparidae	*Chrysophrys auratus*	Pink snapper	Commercial	Least Concern	0.85 +/- 0.13	249
Sphyraenidae	*Sphyraena novaehollandiae*	Snook			0.03 +/- 0.01	8
Sphyraenidae	*Sphyraena spp*				0 +/- 0	1
Sphyrnidae	*Sphyrna spp*	An unknown hammerhead			0 +/- 0	1
	Sphyrna zygaena	Smooth hammerhead	Commercial	Vulnerable	0.01 +/- 0	2
Squalidae	*Squalus spp*	An unknown dogfish			0.13 +/- 0.03	37
Tetraodontidae	*Omegophora armilla*	Ringed toadfish		Least Concern	0.02 +/- 0.01	6
Triakidae	*Furgaleus macki*	Whiskery shark	Commercial	Least Concern	0.11 +/- 0.02	33
	Galeorhinus galeus	School shark	Commercial	Vulnerable	0.01 +/- 0.01	3
	Mustelus antarcticus	Gummy shark	Commercial	Least Concern	0.04 +/- 0.01	12
Triglidae	*Chelidonichthys kumu*	Red gurnard	Commercial	Least Concern	0.02 +/- 0.01	7
	Pterygotrigla polyommata	Latchet	Commercial		0.03 +/- 0.01	10
Urolophidae	*Trygonoptera mucosa*	Western shovelnose stingaree		Least Concern	0.01 +/- 0.01	3
	Trygonoptera ovalis	Striped stingaree		Least Concern	0.32 +/- 0.03	93
	Urolophus circularis	Circular stingaree		Least Concern	0.02 +/- 0.01	6

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