Marine Biodiversity Hub

National Environmental Science Programme

# An eco-narrative of Gifford Marine Park – Temperate East marine region

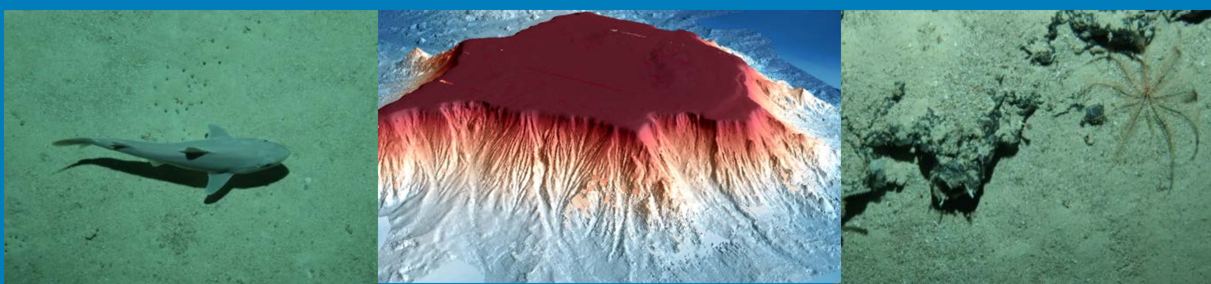
## Marine Park Eco-narrative Series

Rachel Nanson, Andrew Carroll, Zhi Huang, Scott Nichol, Karen Miller

*Project D1 – National data collation, synthesis and visualisation to support sustainable use, management and monitoring of marine assets*

2 August 2018

*Milestone 14 - Research Plan v4 (2018)*
*Final report on ecologically important features of selected Australian Marine Parks*



Australian Government

Australian Institute of Marine Science

Australian Government

Geoscience Australia

**Enquiries should be addressed to:**
Karen Miller
Australian Institute of Marine Science
Indian Ocean Marine Research Centre
Crawley WA 6009
k.miller@aims.gov.au

Scott Nichol
Geoscience Australia
PO Box 378
Symonston, ACT, 2601
scott.nichol@ga.gov.au

## Project Leader's Distribution List

| | |
|---|---|
| Amanda Richley | Parks Australia<br>Department of the Environment & Energy |
| Bianca Priest | |
| Jennifer Hoy | |
| John Lloyd | |
| Cath Samson | |
| Jason Mundy | |
| Amelia Tandy | Marine Policy<br>Department of the Environment & Energy |
| Jillian Grayson | |
| Christine Lamont | National Offshore Petroleum Safety and Environmental Management Authority |

## Preferred Citation

*Nanson, R. Carroll, A., Huang, Z., Nichol, S., Miller, K. (2018). An eco-narrative of Gifford Marine Park: Temperate East marine region.* Report to the National Environmental Science Programme, Marine Biodiversity Hub. *Geoscience Australia.*

## Copyright



## Acknowledgement

This work was undertaken for the Marine Biodiversity Hub, a collaborative partnership supported through funding from the Australian Government's National Environmental Science Programme (NESP). NESP Marine Biodiversity Hub partners include the University of Tasmania; CSIRO, Geoscience Australia, Australian Institute of Marine Science, Museum Victoria, Charles Darwin University, the University of Western Australia, Integrated Marine Observing System, NSW Office of Environment and Heritage, NSW Department of Primary Industries. Geoscience Australia acknowledges the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) for acquisition of bathymetry data used to produce the bathymetry collation presented in this report.

## Important Disclaimer

# Contents

# List of Figures



# List of Tables

# EXECUTIVE SUMMARY

This report is one in a series of eco-narrative documents that synthesise our existing knowledge of Australia's individual Marine Parks. This series is a product of the National Environmental Science Program Marine Biodiversity Hub Project D1, which seeks to collate, synthesise and visualise biophysical data within the parks. These documents are intended to enable managers and practitioners to rapidly ascertain the ecological characteristics of each park, and to highlight knowledge gaps for future research focus.

The Gifford Marine Park is dominated by two submerged flat-topped seamounts (guyots) that rise up to three kilometres above the surrounding abyssal plain and provide a diversity of benthic environments. These range from gently sloping plains atop the seamount plateaus to near-vertical towering cliffs of exposed bedrock that encircle both seamounts, and abyssal plains that characterise the northern third of the park. Depositional cones and mass movement scars alternate around the upper to mid slopes of the seamounts, and illustrate the processes by which these extant volcanic features are undergoing escarpment retreat.

The information in this eco-narrative forms an initial characterisation of Gifford Marine Park. The key gaps in our knowledge of the park are its specific oceanographic processes and its ecological significance; only limited ecological and oceanographic sampling has been undertaken within the park. Surveys have revealed lower than expected species richness and abundance, likely linked to the nutrient-poor waters over the Gifford guyot. Nevertheless, the extensive escarpment surfaces and the relatively shallow plateau surfaces do provide important habitat for sparse epibenthic communities. Sea surface temperatures within the park display only a slight warming trend since 2002, at an annual rate of 0.016$^{o}$C. Targeted oceanographic and more extensive biological surveys over both seamounts are needed to develop a more informed overall assessment of the biological significance of the park ecosystem and identify potential anthropogenic threats to park health.

# 1. INTRODUCTION

The Gifford Marine Park is located in the southern Coral Sea, approximately 700 km east of Brisbane and to the west of the Lord Howe Rise plateau. The Park covers an area of 5824 km$^2$ and incorporates two volcanic seamounts, Gifford Guyot and a smaller unnamed seamount in the southwest corner of the Park (Figure 1).

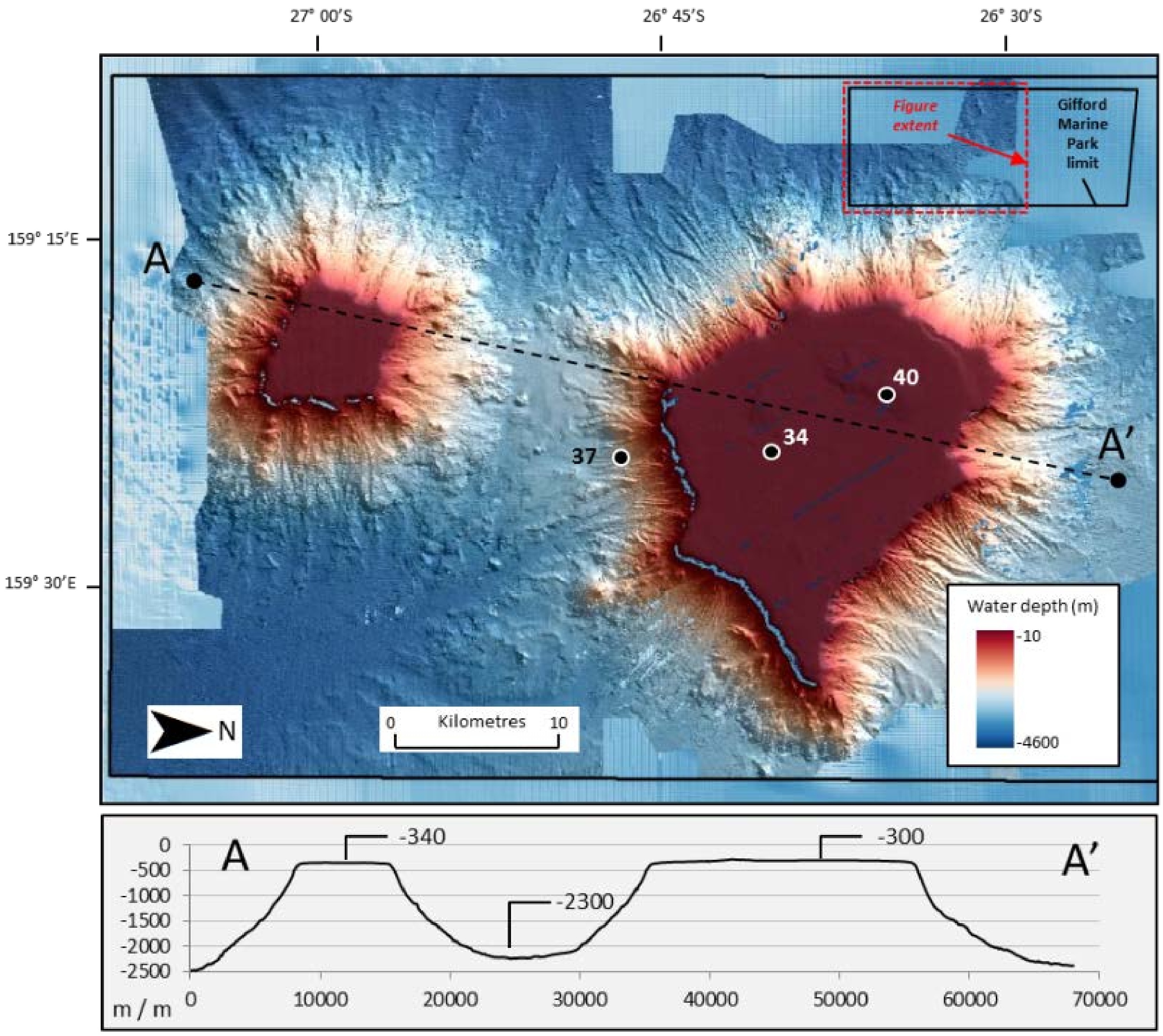



Figure 1: Seabed within Gifford Canyon Marine Park, showing hill-shaded 30 m resolution multibeam bathymetry data, which covers 52% of the Marine Park. The black outline indicates the Gifford Marine Park boundary, which extends further north of the figure extent; the full extent of the Gifford Marine Park is indicated by the inset figure. The background imagery is a 250 m bathymetry grid (Whiteway, 2009). Bathymetry transect A-A' illustrates the plateaued surfaces of both seamounts.

Water depths across the Gifford Marine Park range from 250 to 3400 m. The key known conservation values of Gifford Marine Park include the seamounts and surrounding plateau areas that are representative seafloor features providing habitat for protected migratory species, principally humpback whales and beaked whales. Information on the biodiversity of Gifford Marine Park is limited. However, seabed mapping of Gifford seamount in 2007 (Heap et al., 2009), and of the smaller seamount in 2017, has provided insights into the geomorphology and benthic communities of these features. This eco-narrative focuses on the two seamounts, providing an overview of the current knowledge of these major seabed features, including their oceanographic, geomorphic and biological values.

## 2. PHYSICAL SETTING

The Gifford guyots are two flat-topped seamounts, situated about halfway along the Lord Howe Seamount Chain on the western flank of the Lord Howe Rise. Seamounts in this chain formed during the Miocene epoch (23 – 5 Ma) from submarine volcanism as the Indo-Australian plate migrated north across a stationary magma source ("hotspot"). The Gifford Guyot is dated to the Middle Miocene (Heap et al, 2009) and the smaller seamount is likely a similar age. The seamounts in Gifford Marine Park have a depth range of approximately 3 km, rising from -3400 m on the abyssal plain to -250 to -350 m across their summits. Their generally flat (<2°) summits extend across 55 $km^2$ (unnamed guyot), and 350 $km^2$ (Gifford Guyot). The summit of the Gifford Guyot has semi-lithified bedform fields and two broad carbonate ridges. Their steeper flanks (10 – 40°) are dominated by debris cones and mass movement scars, the latter of which provide potential hard ground habitat for sessile organisms. Together, the two guyots cover 29% (1670 $km^2$) of the Marine Park.

# 3. OCEANOGRAPHY

Gifford Marine Park is situated within an open ocean environment that is beyond the influence of major regional oceanographic currents, including the East Australian Current and the Tasman Front. Little is known about the hydrodynamic and oceanographic conditions in the park, with regional scale models and satellite data providing the only insights. Satellite derived measures of chlorophyll-a indicate that the surface waters are oligotrophic (nutrient poor) (Figure 2).

Modelled values for bottom water nutrients (nitrate, phosphate and silicate) over the Gifford guyot summits are also low (CARS, http://www.marine.csiro.au/~dunn/cars2009/) (Figure 3). The predicted low nutrient levels of these ocean waters is supported by data from the only water column measurement over Gifford Guyot, which recorded barely detectable levels of suspended sediments (< 0.003 g / L) (Heap et al., 2009). The oligotrophic nature of the surface and bottom waters in the Marine Park, especially over the Gifford Guyot, may explain the relatively depauperate biota and the lower than expected species richness and abundance that is described later in this document.

Since 2002, satellite remote sensing data show that sea surface temperatures within Gifford Marine Park have warmed at a modest annual rate of 0.016 $^{o}$C (Figure 4). This rate is the lowest in the region and also much lower than the overall average across all Australian marine parks (0.046 ± 0.02 $^{o}$C) (Figure 4). Based on data from the coarse-resolution BlueLink ocean model, which combines observations of ocean temperature, salinity and currents in three dimensions (Oke et al., 2012), the overall bottom current velocity in the park appears to be quite low (<5 cm/s). The steep seamounts seem to be able to elevate the bottom current velocity to some degree (up to 7 cm/s), but this is still less than the threshold velocity for transporting sand.

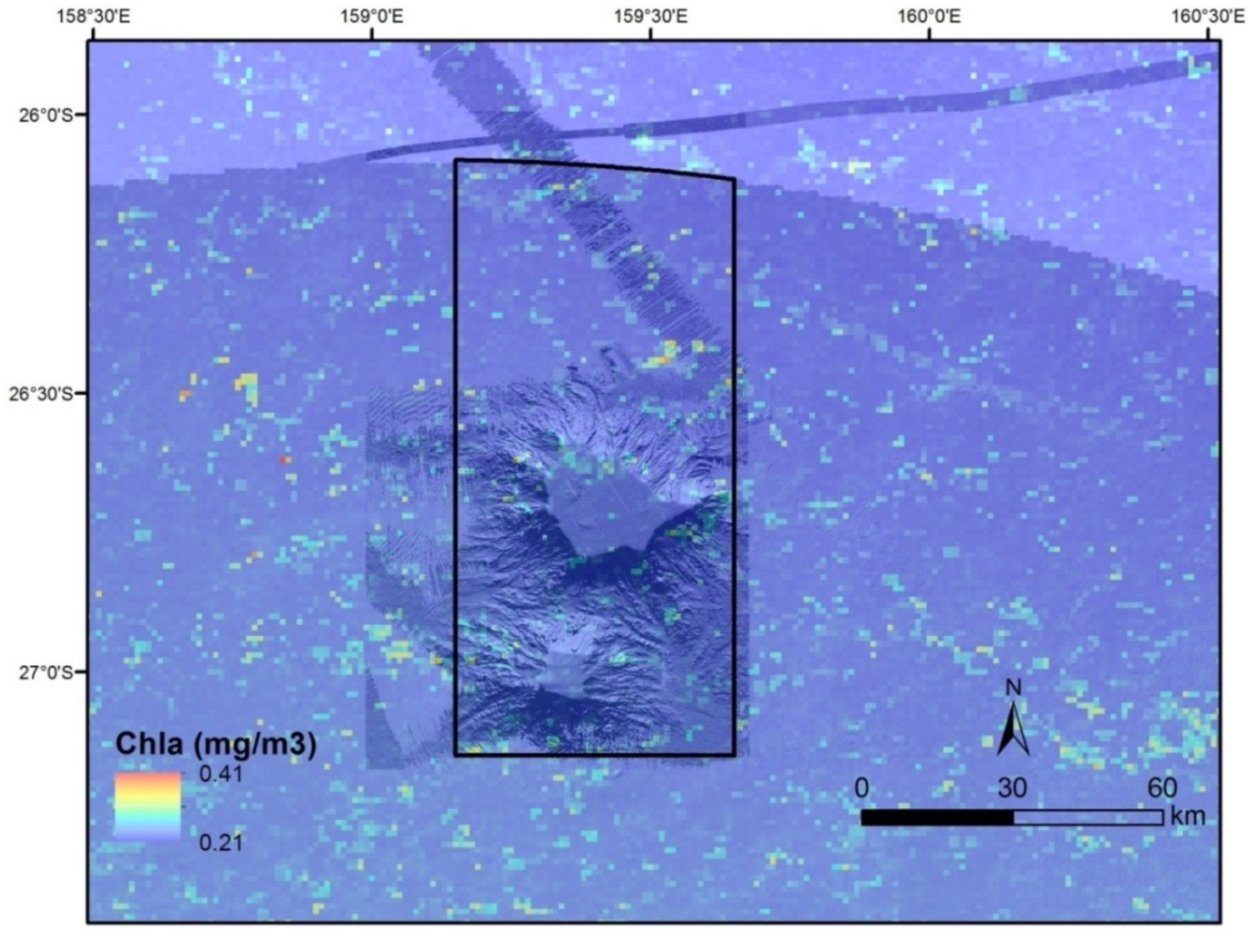



Figure 2: Mean annual chlorophyll-a concentrations over the Gifford Marine Park, derived from MODIS satellite imagery for the period 2002 to 2016. The long-term annual mean is 0.24±0.01mg/m3 , ranging from 0.2 – 0.4 mg/m3; winter levels are typically twice those in other seasons. This overall mean is the lowest among the marine parks in the temperate-east region and at the lower end nationally (peak values approach 15 mg/m.)

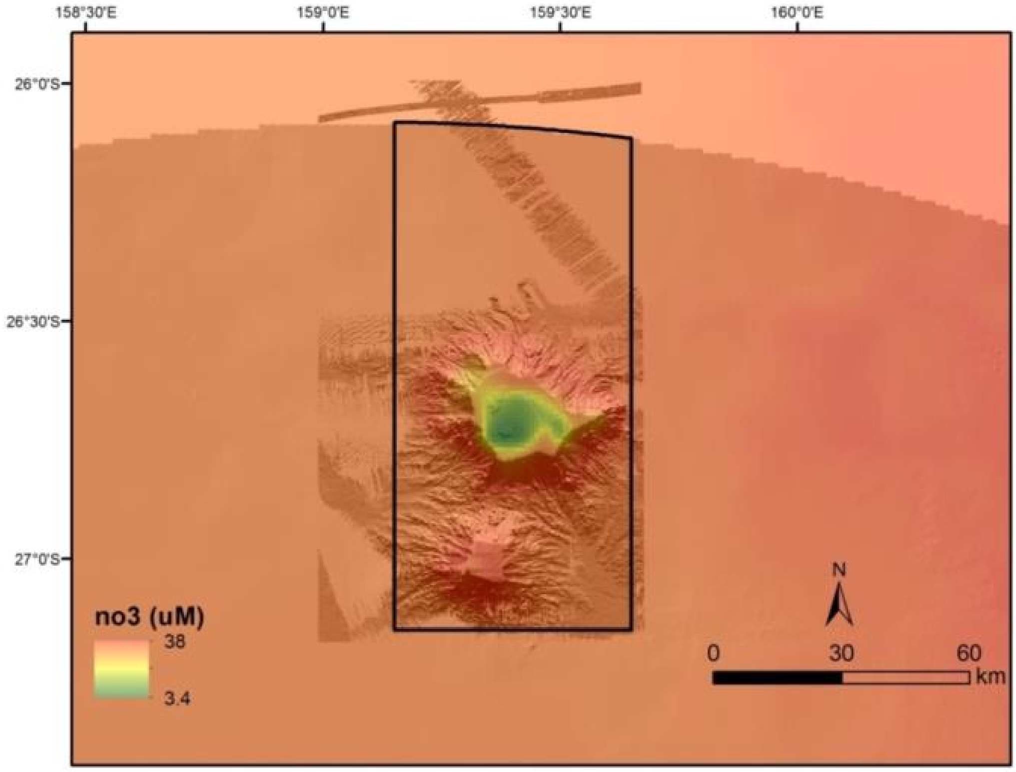



Figure 3: Mean bottom water nitrate concentrations over the Gifford Marine Park, derived from CSIRO Atlas of Regional Seas (CARS 2006) database.

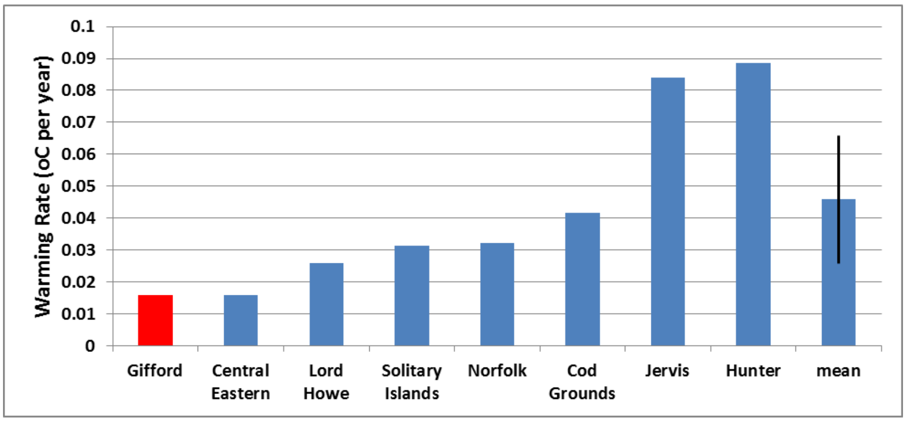



Figure 4: Sea Surface Temperature (SST) trends within the Marine Parks of Temperate-East region and against the national mean for all marine parks, derived from the MODIS SST data between 2002 and 2016; standard deviation indicated by a vertical line.

# 4. GEOMORPHOLOGY AND POTENTIAL HABITATS

Two volcanic seamounts, Gifford Guyot and a smaller unnamed seamount to the southwest, rise from low gradient abyssal plains to dominate the seascape of the Gifford Marine Park. Both seamounts have relatively shallow flat tops and have maximum diameters of 26 km (Gifford Guyot) and 9 km (unnamed guyot). Seamounts with flat tops are classified as guyots, which are seamounts that have undergone erosion of their summits by wave action. A low gradient saddle links the two seamounts, and small conical volcanic peaks (<250 m high) protrude through the saddle floor (cf. Heap et al., 2009). The guyot flanks are dominated by mass wasting scars and depositional cones, which coalesce distally to form lower gradient debris aprons and fans (Figure 5). The largest mass movement (slump) scar is situated on the northern side of the Gifford Guyot (Figure 5). This scar measures 6.3 km along the headwall at -350 m, and extends to at least 14 km downslope where a single runout scar dissipates at -2500 m on the border of the 30 m bathymetric grid.

Seabed sediments on the Gifford Guyot sampled in 2007 reveal that its surface is covered by a veneer of poorly sorted muddy to gravelly sands (Heap et al., 2009). Several fields of semi-lithified dunes and two broad carbonate ridges have also been identified on the platform summit, and these contrast with poorly sorted muddy sand to sandy mud that have accumulated on the seamount flanks. In all samples from the Gifford guyot, bulk carbonate content is high (89 to 96%) - accordingly, sand fractions of all samples include evidence of life: forams, bryozoans, shell fragments and sponge spicules, and fragments of limestone.

A new seafloor mapping scheme (detailed in Appendix A), designed to harness the predictive potential of detailed seafloor data, was applied to the 30 m bathymetric grid to characterise the likely diversity of potential habitats within the park based on seafloor features. By linking the seafloor morphology to geomorphic process and substrate, we assessed the stability of the potential habitats within the park. Three slope categories represent broad habitat settings found across the park: 1) low gradient Planes of <2° (11%); 2) Slopes of 2-10° (43%); and 3) Escarpments steeper than 10° (45% - Figure 6). Slope surfaces rim the upper margin of the guyot platforms, and also dominate the seafloor towards the toe of the flanking aprons. Between these, steep Escarpments ring both guyots. These are characterised by exposed rock faces that provide ideal substrate for sessile biological communities. Within the mapped region of the Gifford Marine Park, the nearly half of the seafloor (45%) that is comprised of Escarpment may provide habitat for sessile communities, though water depth may limit this toward the lower apron.

Three discrete ridges were mapped on the Gifford Guyot summit in water depths of 250–300 m (Heap et al., 2009). These ridges vary in size (2–8 km long and 1–3 km wide) and height (10–30 m). Sonar backscatter data from the ridges suggest the presence of scattered patches of hard substrate in shallow-water depths (Anderson et al. 2010). These could provide habitat for sessile organisms like sponge and soft coral communities. The small peaks and steeper ridges of the guyot are generally characterised by discontinuous sediment, punctuated by low lying rocky outcrops. Anderson et al (2010) noted that the instability and movement of coarse sediments over these low-lying rocky outcrops could impact the settlement, growth, and subsequent survival of sessile suspension-feeding invertebrates and may explain the low density of suspension-feeding assemblages on this seamount.

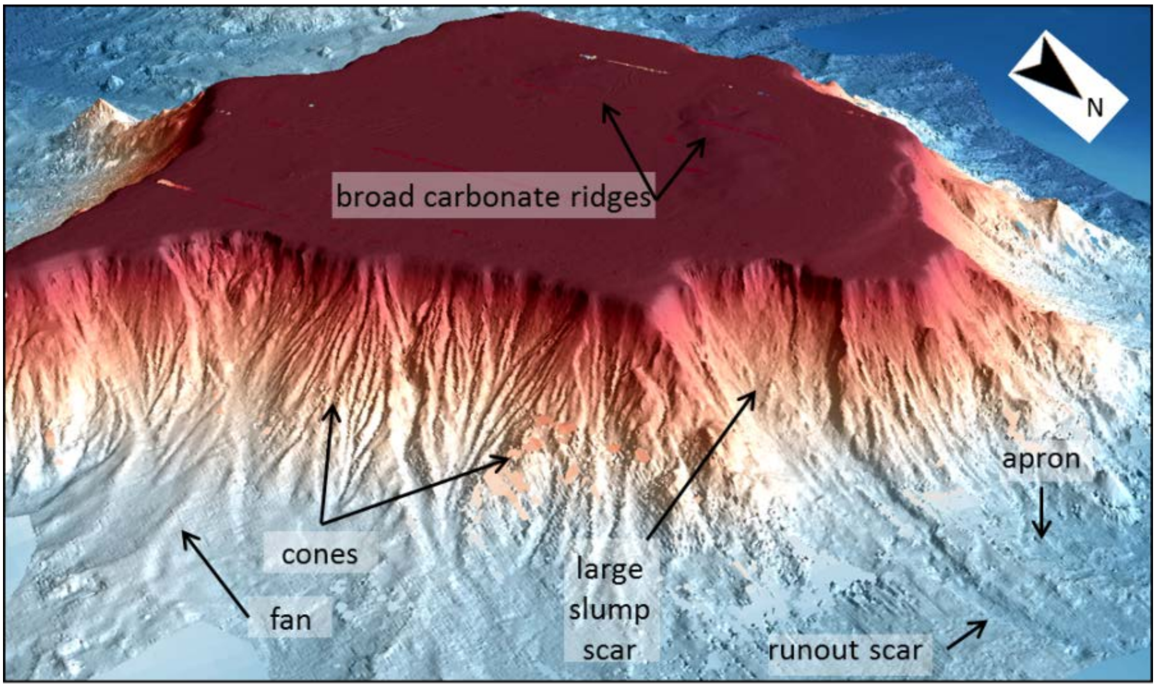



Figure 5 An oblique view of the northern Gifford Guyot, illustrating the major features described in text, including the largest recorded slump in the Park.

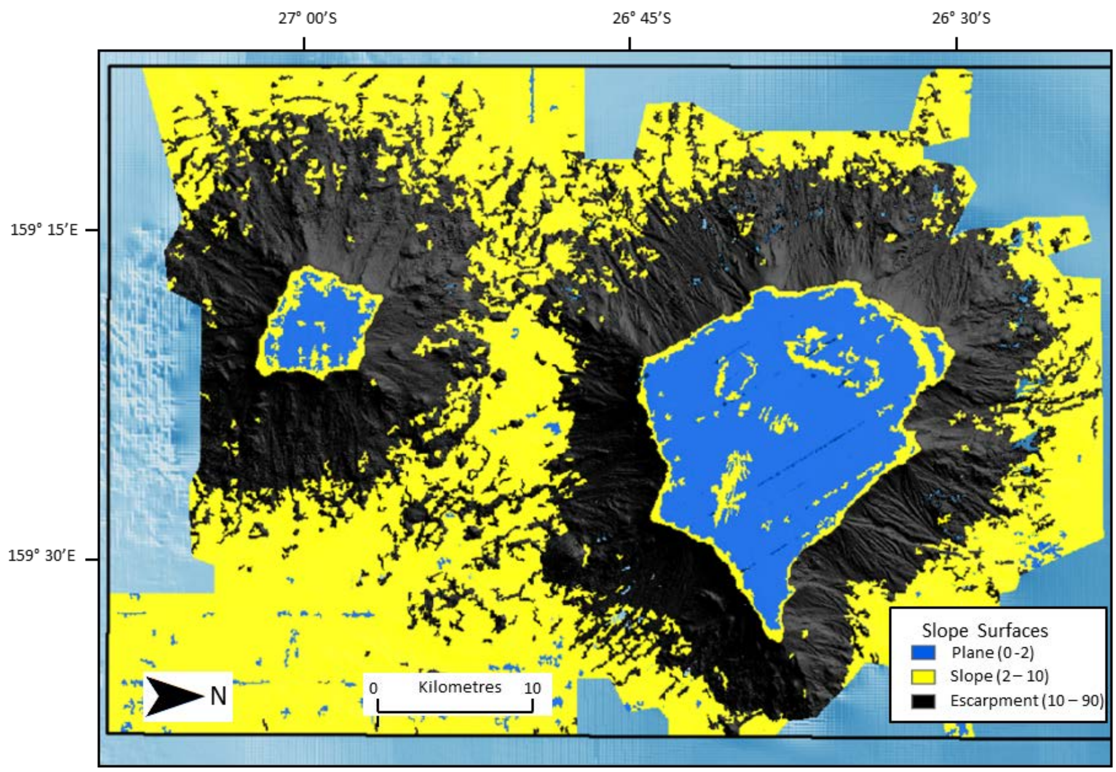



Figure 6 Seafloor Surfaces within Gifford Marine Park mapped from a 30 m bathymetry grid (Fig. 1), using a 9 second bathymetry grid as the background (Whiteway, 2009).

# 5. THE ECOLOGICAL SIGNIFICANCE OF GIFFORD GUYOT

## 5.1 Pelagic fauna and seabirds

The Gifford Marine Park is predicted to support a range of species listed as threatened, migratory, marine or cetacean under the EPBC Act. Biologically important areas within the park include foraging habitat for seabirds and a migratory pathway for humpback whales. Spanning over 3 km of ocean depths, these seabed features are likely to serve multiple and important roles as breeding locations, resting areas, navigational landmarks or supplementary feeding grounds for some cetaceans. In April – May 2016, Geoscience Australia, in collaboration with the Japan Agency for Marine-Earth Science and Technology, completed a marine survey of the Lord Howe Rise at sites ~120 km to the east of Gifford Marine Park (JAMSTEC-GA, 2016). A total of 29 marine fauna sightings and 50 marine fauna detections (via Passive Acoustic Monitoring) were recorded. Of these, sperm whales accounted for 70% of sightings and acoustic detections. These observations suggest that this remote region of the Coral Sea is an important habitat for sperm whales and may also act as important aggregation points for other highly migratory pelagic species also observed during the survey (e.g. blackfish, dolphins, whale sharks). Further research is needed however to determine the extent to which the Gifford Marine Park may act as biologically important habitat for these species.

## 5.2 Demersal fish

Ridges on the seamount summit support high occurrences of fishes (e.g. *Parapercis binivirgata*, *Parapercis* sp., *Hoplostethus intermedius*), rays, gurnard, small banded eel, *Neopriprion* sp., *Plectranthias* sp., *Eeyorius* sp., *Foetorepus* sp., Scorpaenidae, and the deep-water trumpet fish, *Fistularia commersoni*. In deeper waters of the seamount, fish species observed included numerous big-spined boarfish *Pentaceros decanthus*, associated with mixed rock and sand patches, the thorny tinselfish, *Grammicolepis brachiusculus*, Jellynose Fish, *Ateleopus* sp. (Figure 7f) and the tripodfish, *Bathypterois longifilis*. On the flanks of Gifford Guyot, deeper parts of the seamount apron (i.e. the lower apron >1500 m) supported habitats and assemblages indistinguishable from those of the plateau, with fish dominated by the family Macrouridae (grenadiers, rattails) (Anderson et al. 2010).

## 5.3 Benthic fauna

The rocky outcrops and sediment plains of the Gifford Guyot supported lower numbers and densities of benthic organisms than would typically be expected from seamounts, which are often associated with high species diversity and endemicity. Based on limited sampling, the exposed rocky habitats of the Gifford Guyot, support a relatively diverse, albeit sparse, epibenthic assemblage, including mixed cold-water coral and sponge assemblages (Anderson et al. 2010). Cold-water corals identified from underwater imagery collected in 2007 included *Plexipomisis* sp., *Villogorgia* sp., *Muriceides* sp., *Psuedothesea* sp., *Narella* sp., *Keroeides* sp. *Umbellulifera* and *Chrysogorgia*. Seamount ridges supported typical seamount fauna, including the seamount Xanthid crab, *Alainodaeus rimatara* and benthic ctenophores ('combjelly', order: Platyctenida). The seamount plateau also supported a variety of seamount-associated epifauna dominated by the sand dollar, *Peronella hinemoae* (Echinoidea), and species unique to the deeper seamount apron (e.g., the brittle stars, *Dictenophiura platyacantha*; the cushion seastar, *Pterasterobesus*; and the predatory gastropods: *Phos alabastrum* and Conus sp.), along with more generic fauna (e.g., the brittlestar, *Ophiomusium scalare*) (Anderson et al. 2010).

Soft sediment areas on Gifford Guyot are characterised by bioturbation with frequent trails, burrows, and mounds. However, evidence for bioturbation was significantly less on the upper sections of Gifford Guyot, with mostly trails on the more sediment starved environments (Heap et al. 2009). This pattern of higher bioturbation with depth may simply reflect greater sediment deposition with depth (Anderson et al. 2010).

The presence of numerous but mostly small sessile invertebrates on the upper-apron, where large suspension feeding invertebrates were either rare or absent, also suggests that these areas may be regularly disturbed. It is unclear, however, whether the constant raining of sediments down the slopes of the Gifford seamount inhibits the growth of species in this assemblage, or whether their small size reflects newly settled individuals re-colonising recently denuded surfaces following landslides or sediment burial (Anderson et al. 2010). Hence, while many seamounts may support dense coverage of cold water corals with high associated biodiversity (e.g. Koslow et al. 2001; Clark et al. 2006); others, like the Gifford Guyot, support only sparse assemblages. Consequently, it is clear that not all seamounts are the same (see Rowden et al. 2005, 2010; Clark et al. 2010) or equally capable of supporting high density assemblages, even when rocky substrata are present (Anderson et al. 2010). Anderson et al. (2010) concluded that variability in seamount species assortments and biodiversity are likely to reflect a breadth of environmental factors from broad- scale biogeographic, oceanographic, temperature and depth patterns, as well as finer-scale habitat structure and sediment dynamics, as well as anthropogenic impacts (Levin et al. 2001; Koslow et al. 2001; Stocks 2004; Pitcher et al. 2008; Clark et al. 2010; Williams et al. 2010).

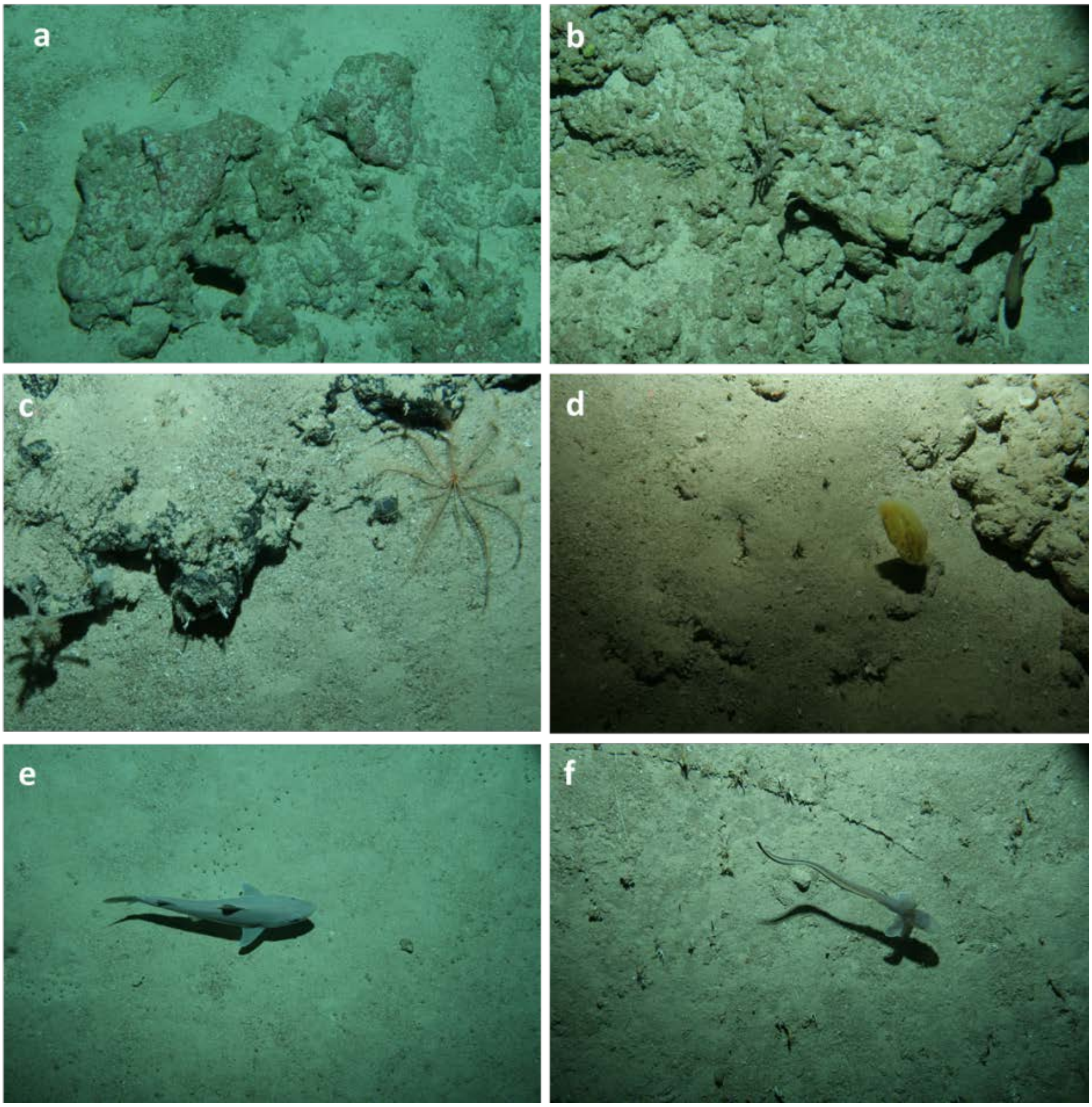



Figure 7: Still colour photographs of benthic habitats from Gifford Guyot collected during TAN0713 survey. a) Station 40 (248 m; summit): – low-relief limestone ridge with small gorgonians, sponges, and Parapercis fish, b) Station 40 (248 m; summit) – moderate-relief limestone ridge with sponges, gorgonian, and small fish, c) Station 37 (414 m; upper slope) – mixed sediment veneer and calcareous-conglomerate outcropping with crinoid, d) Station 34 (288 m; summit) – mixed sediment veneer and limestone outcropping with yellow ascidian (sea squirt), e) Station 34 (288 m; summit) – sediment veneer over consolidated bedform with shark (possibly Squalus griffini), f) Station 37 (414 m; upper slope) – sediment veneer over consolidated bedform with a Ateleopus sp.

# REFERENCES


Anderson TJ, Nichol SL, Syms C, Przeslawski R, Harris PT. (2010). Deep-sea bio-physical variables as surrogates for biological assemblages, an example from the Lord Howe Rise. Deep Sea Research Part II: Topical Studies in Oceanography. 2011 Apr 1;58 (7-8):979-91.

Clark, M.R., Rowden, A.A., Schlacher, T., Williams, A., Consalvey, M., Stocks, K.I., Rogers, A.D., O'Hara, T.D., White, M., Shank, T.M. and Hall-Spencer, J.M. (2010). The ecology of seamounts: structure, function, and human impacts. Annual Review of Marine Science, 2, pp.253-278.

Clark, M.R., Tittensor, D., Rogers, A.D., Brewin, P., Schlacher, T., Rowden, A., Stocks, K. and Consalvey, M. (2006). Seamounts, deep-sea corals and fisheries. UNEP-WCMC Biodiversity Series.

Dove, D., Bradwell, T., Carter, G., Cotterill, C., Gafeira, J., Green, S., Krabbendam, M., Mellet, C., Stevenson, A., Stewart, H., Westhead, K., Scott, G., Guinan, J., Judge, M. Monteys, X., Elvenes, S., Baeten, N., Dolan, M., Thorsnes, T., Bjarnadóttir, L., Ottesen, D. (2016). Seabed geomorphology: a twopart classification system. British Geological Survey, Open Report OR/16/001. 13 pages.

Harris, P.T., Macmillan-Lawler, M., Rupp, J., & Baker, E.K. (2014). Geomorphology of the oceans. Marine Geology, 352, 4-24.

Heap, A.D, Hughes, M., Anderson, T., Nichol, S., Hashimoto, T., Daniell, J., Przeslawski, R., Payne, D., Radke, L. (2009). Seabed environments and subsurface geology of the Capel and Faust basins and Gifford Guyot, Eastern Australia – post survey report. Geoscience Australia, Record 2009/22, 166 pp.

Heap, A.D., & Harris, P.T. (2008). Geomorphology of the Australian margin and adjacent seafloor. Australian Journal of Earth Sciences, 55, 555-585

JAMSTEC-GA (2016), Cruise Report R/V Kairei KR16-05 Acquisition of deep seismic, shallow sub-surface and seafloor bathymetry survey data for the Lord Howe Rise. http://www.godac.jamstec.go.jp/darwin/cruise/kairei/kr16-05_leg2/e

Koslow, J.A., Gowlett-Holmes, K., Lowry, J.K., O'Hara, T., Poore, G.C.B. and Williams, A., (2001). Seamount benthic macrofauna off southern Tasmania: community structure and impacts of trawling. Marine Ecology Progress Series, 213, pp.111-125.

Levin, L.A., Etter, R.J., Rex, M.A., Gooday, A.J., Smith, C.R., Pineda, J., Stuart, C.T., Hessler, R.R. and Pawson, D., (2001). Environmental influences on regional deep-sea species diversity. Annual Review of Ecology and Systematics 32(1), pp.51-93.

Oke, P. R., P. Sakov, M. L. Cahill, J. R. Dunn, R. Fiedler, D. A. Griffin, J. V. Mansbridge, K. R. Ridgway, A. Schiller, (2012). Towards a dynamically balanced eddy-resolving ocean reanalysis: BRAN3, Ocean Modelling, 67, 52-70.

Pitcher, T.J., Morato, T., Hart, P.J., Clark, M.R., Haggan, N. and Santos, R.S. eds., (2008). Seamounts: ecology, fisheries & conservation. John Wiley & Sons.

Rowden, A.A., Clark, M.R. and Wright, I.C., (2005). Physical characterisation and a biologically focused classification of "seamounts" in the New Zealand region. New Zealand Journal of Marine and Freshwater Research, 39(5), pp.1039-1059.

Rowden, A.A., Dower, J.F., Schlacher, T.A., Consalvey, M. and Clark, M.R., (2010). Paradigms in seamount ecology: fact, fiction and future. Marine Ecology, 31(s1), pp.226-241.

Stocks, K., (2004). Seamount invertebrates: composition and vulnerability to fishing. Fish. Cent. Res. Rep., 12(5), pp.17-24.

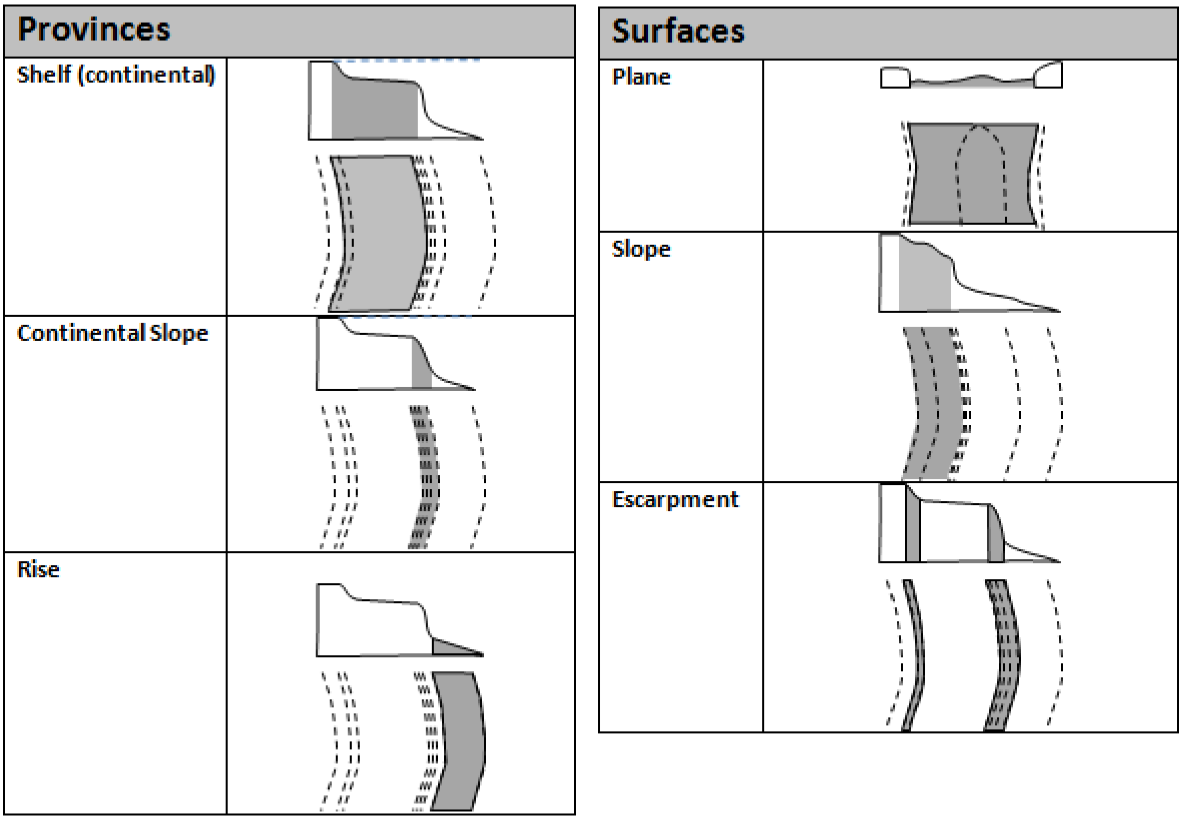
Whiteway, T.G., (2009). Australian bathymetry and topography grid. Geoscience Australia, Canberra.

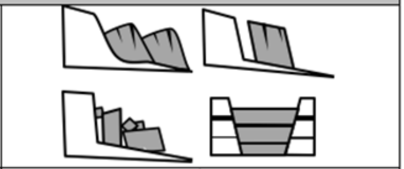
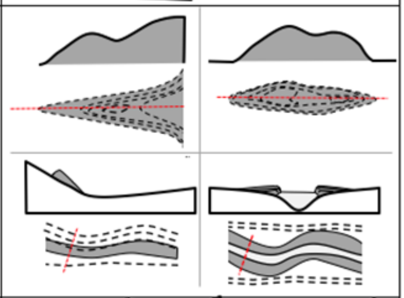
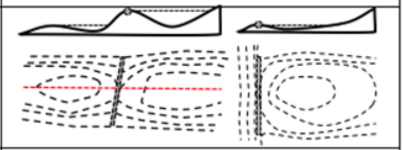
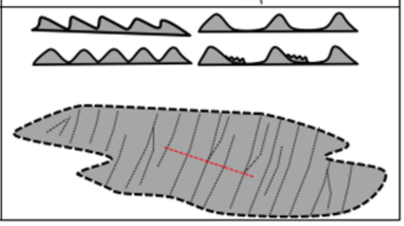
Williams, A., Althaus, F., Dunstan, P.K., Poore, G.C.B., Bax, N.J., Kloser, R., & McEnnulty, F.R. (2010). Scales of habitat heterogeneity and megabenthos biodiversity on an extensive Australian continental margin (100–1100 m depths). Marine Ecology, 31, 222-236

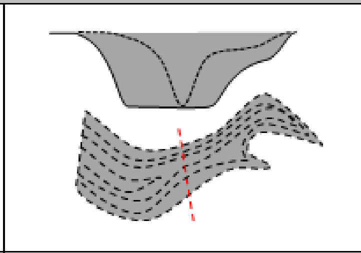
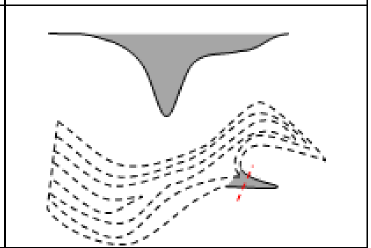
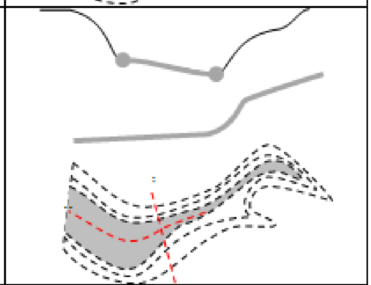
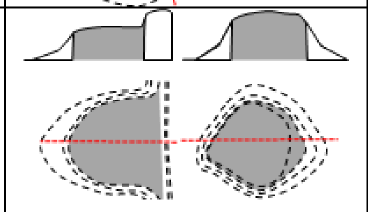
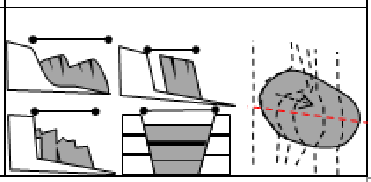
# APPENDIX A

Geoscience Australia is currently developing a new seabed geomorphology classification that draws on the Harris et al. (2014) geomorphic map of the world's oceans, and Dove et al. (2016) two-part system for classifying seafloor morphology. This system enables morphological mapping of the seafloor, with extension of the approach to interpretations of seafloor geomorphology where and when data is sufficient for detailed geomorphic interpretation. Table A.1 illustrates examples from the suite of Provinces, Surfaces and Features. Figure A.1 illustrates the semi-hierarchical structure of the scheme.

Table A.1: A sample of morphological units defined for the seabed mapping scheme (mapping units and their definitions are modified from: Heap & Harris 2008; Harris et al., 2014; Dove et al. 2016: http://nora.nerc.ac.uk/; https://www.iho.int; and https://www.cmecscatalog.org). Figure 6 illustrates the application of the "Surface" class to Gifford Marine Park.



| Features (highs) | |
|---|---|
| Block |  |
| Ridge |  |
| Sill (line) |  |
| Bedform (field) |  |

| Features (lows and other) | |
|---|---|
| Canyon |  |
| Tributary-canyon |  |
| Floor |  |
| Platform |  |
| Mass movement |  |

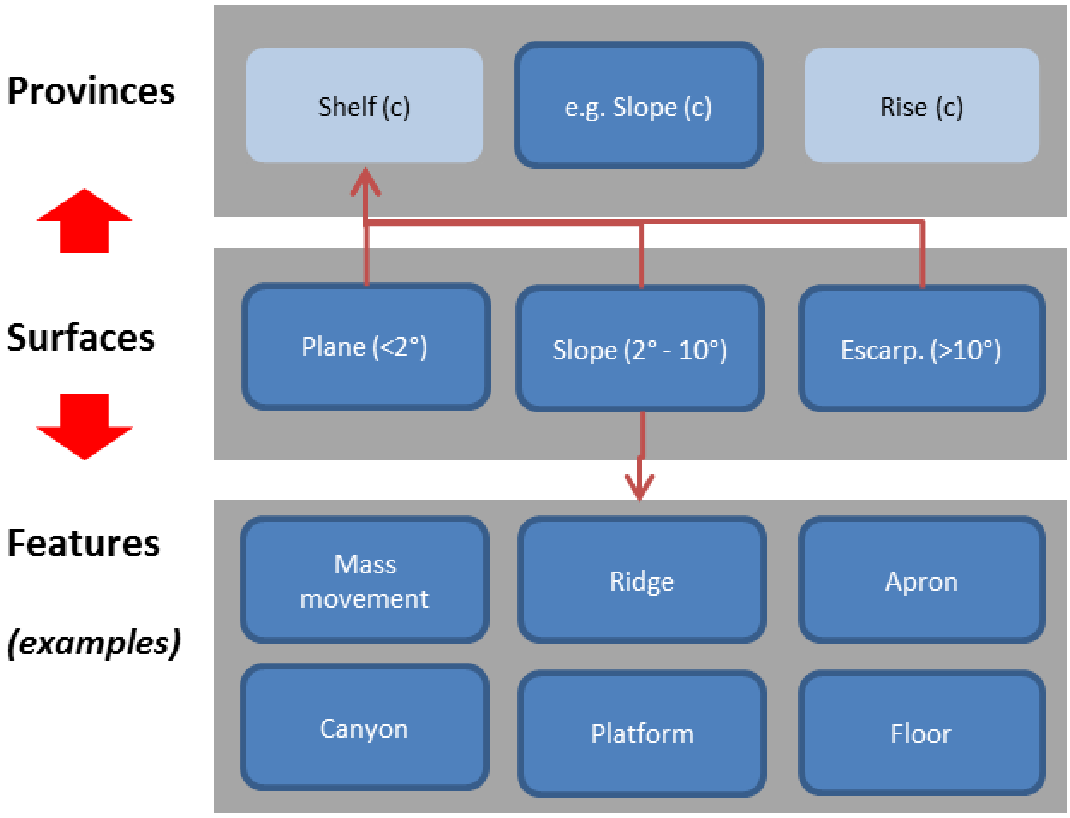



Figure A.1 *Surfaces* are the building blocks of higher level *Provinces* and are divided to define *Features*. For Gifford Marine Park, mass movements are key features of the guyots in terms of influencing habitat stability.

www.nespmarine.edu.au


Contact:

Scott Nichol
Geoscience Australia

Address | GPO Box 378|Symonston, ACT, 2601

email | scott.nichol@ga.gov.au

tel | +61 2 6249 9346