



Understanding the marine ecosystems surrounding Heard Island and McDonald Islands (HIMI) and their conservation status

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Summary Report



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Foreword



King Penguins on Ice at Heard Island. Photo: Kirk Zufelt.

Australia's External Territory of Heard Island and McDonald Islands is truly a remarkable place. Situated in the subantarctic waters of the Indian Ocean about halfway between mainland Australia and Africa, and 1,700 km north of Antarctica, Heard Island is one of the remotest places on earth.

Its surrounding seas are wild and its weather furious. Heard's mountain, Big Ben, is an active volcano, and the nearby McDonald Islands are being shaped by ongoing volcanic activity. The islands are rarely visited, most often seen by Australian fishing vessels, and sometimes glimpsed from passenger aircraft, almost always covered in cloud, on route from Australia to Africa. The nearest neighbour is France's Iles Kerguelen to the north, with which Australia shares a maritime territorial border. Heard Island and McDonald Islands is listed on the World Heritage List for its outstanding geological features, and its wildlife and ecological values.

The waters of the Territory sit atop the vast Kerguelen Plateau which stretches south to Antarctica, and much of which is part of Australia's extended continental shelf. The marine ecosystems of the Territory are unique on a global scale and represent a valuable natural asset. The Territory hosts a significant domestic fishery that was plundered by illegal, unreported and unregulated pirate fishing around the turn of this century. The maintenance of the fishery, and its long-term commercial viability, relies on both Australian domestic regulation, and international management through the Commission for the Conservation of Antarctic Marine Living Resources.

The declaration of the Heard Island and McDonald Islands Marine Reserve (hereafter referred to as The Reserve) represented a significant contribution to global marine protection. This current review of the Reserve, and the values and natural assets it protects, provides a unique opportunity to contribute further to the protection of Earth's oceans, especially now that the region is facing the immediate consequences of climate change. Protection of marine ecosystems from climate change and other human pressures is a valuable investment in Australia's economic future, and in global food security.

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Executive Summary

Heard Island and McDonald Islands (HIMI) are a remote subantarctic island group located about 4,000 km south-west of Western Australia and approximately 1,700 km from the Antarctic continent. The HIMI exclusive economic zone (EEZ) abuts the French EEZ around the Kerguelen Islands. The HIMI complex is part of the Kerguelen Plateau, which is a large submerged continental plateau that extends more than 2,000 km, with only a few emergent volcanic islands. Heard Island and McDonald Island are the two largest islands with the only two active volcanoes in Australia.

Both the marine and terrestrial environments of HIMI are globally recognized for their ecological significance, and include species not found elsewhere in Australia. Indeed, the entire region is subject to international agreements and regulations aimed at conserving its unique ecosystem.

Australia took possession of HIMI in 1947. The islands and territorial seas became a World Heritage Site in 1997, and a 65,000 km² Commonwealth Marine Reserve was declared in 2002. A conservation zone was declared at the same time for further consideration of areas to be added to the reserve following research on the interaction between fisheries and biodiversity in the region. Some parts of the conservation zone were added to the marine reserve in 2014 (an additional 6,200 km²), following a comprehensive scientific assessment of the region's conservation values and stakeholder engagement. The Reserve now covers 71,200 km² of the Australian EEZ. A management plan for the existing marine reserve came into effect in 2014 and is currently due for its ten-year statutory review.

Given the changes in our understanding over the past decade it is timely to assess how well the HIMI EEZ is represented in Australia's National Representative System of Marine Protected Areas and to make improvements to the levels of protection.

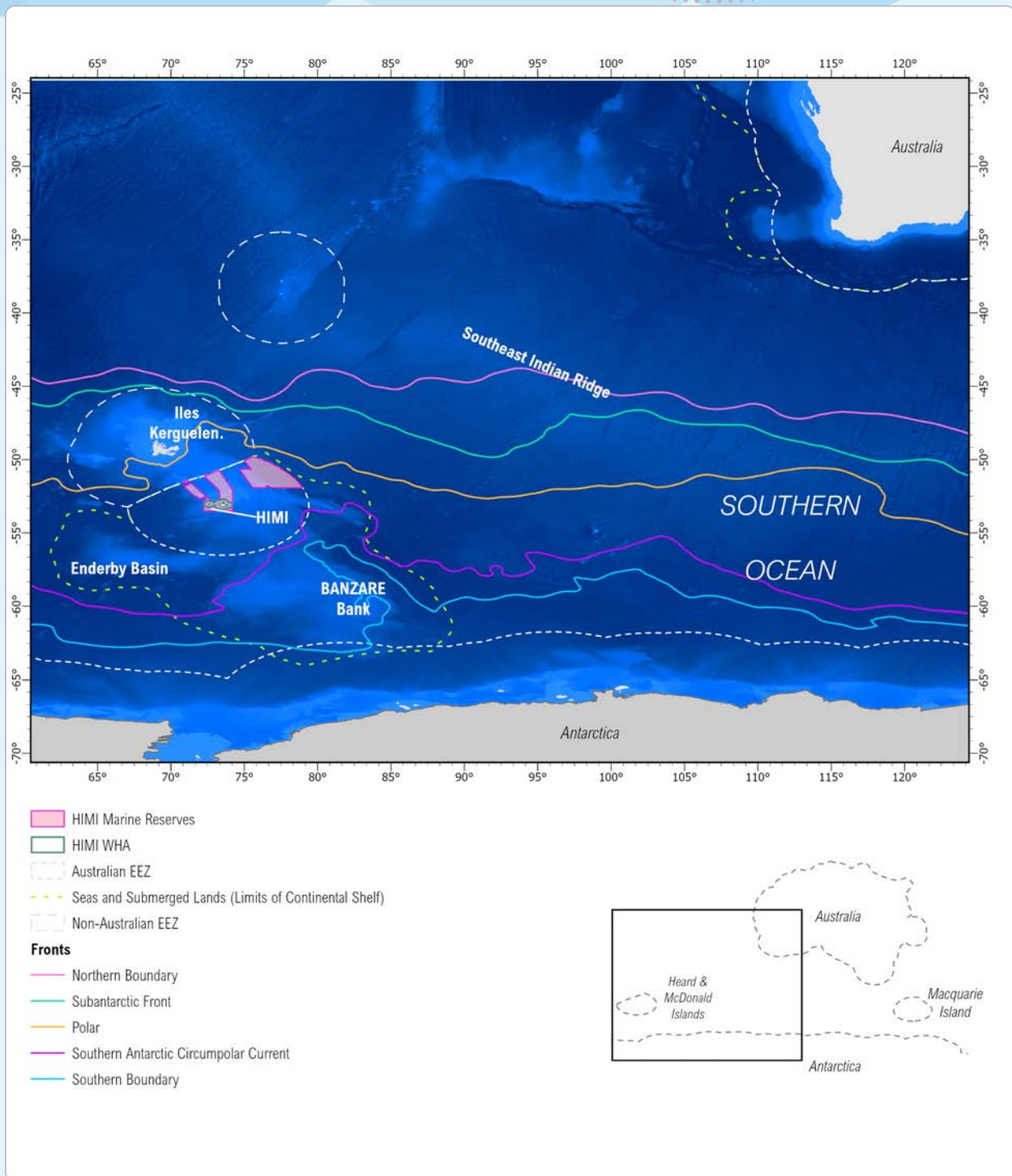
The Australian EEZ surrounding the islands was declared in 1978 and covers 410,722 km². Only 17% of the EEZ is protected in the The Reserve.

The remote location and strong ocean currents can limit the dispersal of organisms to and from the islands. While this isolation leads to higher rates of endemism and can protect native species from certain invasive organisms, it also limits genetic diversity and can make the ecosystem more vulnerable to disturbances. HIMI is difficult to access, which combined with Australia's strict management of the islands means they are unique globally and one of the world's rare near-pristine island ecosystems being largely devoid of non-native species.

HIMI is part of the Kerguelen Plateau which is considered a significant site for scientific understanding of our planet due to its role in oceanic and atmospheric processes. It is one of the world's largest oceanic ridges and one of only three significant ridges in the Southern Ocean that impede the eastward flow of the Antarctic Circumpolar Current. The plateau, impacts oceanic currents and circulation patterns, influencing the movement of water masses and providing a source of nutrients from which stems an abundance of marine life.

The Kerguelen Plateau ecosystem serves as an important natural laboratory for understanding complex interactions in the Southern Ocean and the broader global climate system. The deep-sea ecosystems surrounding the Kerguelen Plateau are also of great interest, including unique and often poorly known species which have adapted to extreme conditions in the deep, cold ocean.

HIMI contains globally significant benthic (sea floor) and pelagic (shelf and open ocean) ecosystems, with 56 species of seabirds recorded, of which 19 breed on Heard Island including four species of penguin, three species of albatross, and seven species of petrel. The Heard Island imperial shag and the Heard Island subspecies of black-faced sheathbill are endemic to Heard Island. Four species of seabird are listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act): the northern royal albatross, Amsterdam albatross, Tristan albatross and grey-headed albatross. There are also eight seabird species that are listed as vulnerable under the EPBC Act: the southern royal albatross, sooty albatross, Indian yellow-nosed albatross, Campbell albatross, white-capped albatross, northern giant-petrel, blue petrel and soft-plumaged petrel. 26 species of marine mammals have been observed in the HIMI EEZ, including the subantarctic fur-seal, the southern right whale and pygmy blue whale which are listed as endangered under the EPBC Act. All of these animals rely on the productive waters surrounding HIMI as a food source.



Overview map of Heard Island and McDonald Islands (HIMI) in the Southern Ocean



King penguins. Photo: Scott Portelli.

Knowledge of benthic habitats and fauna in the HIMI EEZ is limited by sampling effort in this remote area. Despite recently improved benthic mapping of the HIMI EEZ, it is likely that many deeper seafloor features will not be identified without targeted swath mapping. Additionally, the lack of formal identification and naming of the samples that have been collected restricts interpretation. Despite this, nineteen species were identified as likely endemics from samples sorted to only operational taxonomic unit level as part of a study to guide earlier conservation planning. Additional likely endemics would almost certainly be present in several diverse taxonomic groups (e.g. amphipods, bryozoans, molluscs, pycnogonids) which remain largely unsorted. The lack of knowledge of benthic fauna in deeper areas, including the string of seamounts on Williams Ridge that rise from deeper water to peak in waters less than 1,000 m, is a limitation in understanding the impacts of the fishery in recent years since an expansion in fishing footprint. There is an urgent need for updated publicly available information on the impacts of demersal gear on benthic habitats, particularly in previously unfished areas.

Heard Island and McDonald Islands and the surrounding ocean ecosystem are subject to various pressures due to their isolation, unique geography, and vulnerability.

This report describes these pressures including from climate change, pollution, tourism, scientific research, and fisheries. The fisheries primarily target Patagonian toothfish, but with a smaller variable catch of mackerel icefish. Both of these species are important components of the HIMI ecosystem as top predators and as part of the food web connecting pelagic and benthic ecosystems.

The fishery for mackerel icefish uses both bottom trawl and midwater trawl gear and the Patagonian toothfish is mostly harvested with demersal longlines.

These fisheries have direct impacts on biodiversity during the capture process, many of which have been intensively mitigated. Management is provided by the Australian Fisheries Management Authority (AFMA) and both fisheries operate in accordance with Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) Conservation Measures. These fisheries are the only fisheries in the CCAMLR area that use bottom trawling methods.

A major impact of the Australian Patagonian toothfish and mackerel icefish fisheries is a large bycatch of numerous protected species, as well as skates, sharks, and rays. Skates are the most frequent bycatch. The lack of a fishery independent assessment for deepwater skates is of concern and there is a need for improved understanding of bycatch from the fishery. A more detailed spatial analysis of deepwater skate bycatch in the fishery is needed to identify further management requirements.

Our scientific understanding of the area has improved greatly since the establishment of the marine reserve with two significant changes since that time, namely (i) climate change is having a demonstrable effect, and (ii) fisheries for Patagonian toothfish and mackerel icefish have expanded over that time, including to depths unsurveyed for their benthic biodiversity.

Climate changes to the biophysical environment may be significantly affecting the ecology of the system, including cold-adapted subantarctic species and the recruitment of young Patagonian toothfish to the population. The Patagonian toothfish is an apex predator of this marine ecosystem and changes in its status will have a cascading impact on many other species. As a result, there is a need for a review of the suitability of current fishery management models and whether the method for setting catch limits is sufficient for achieving objectives based on an assumption of stable recruitment of target species. Also, further protections within the marine reserve will be needed to maximise resilience of cold-adapted species, such as mackerel icefish, to climate change.

While fisheries vessels regularly visit the area no data are publicly available on the fisheries activities in space or time across the EEZ. There is only annual reporting of total catches with no defined footprint for the fisheries available publicly except that the fisheries operate throughout the Australian Fishing Zone around HIMI. Annual Trawl Surveys are conducted by the Australian Antarctic Division (AAD) in partnership with Australian Fisheries Management Authority (AFMA) and the fishing industry, however these data are not publicly available. Fisheries data are confidential. Given the high conservation value of this area and the collaborative arrangement of the fishers it would be useful to review the purpose of current data confidentiality arrangements and whether data could be made freely available.

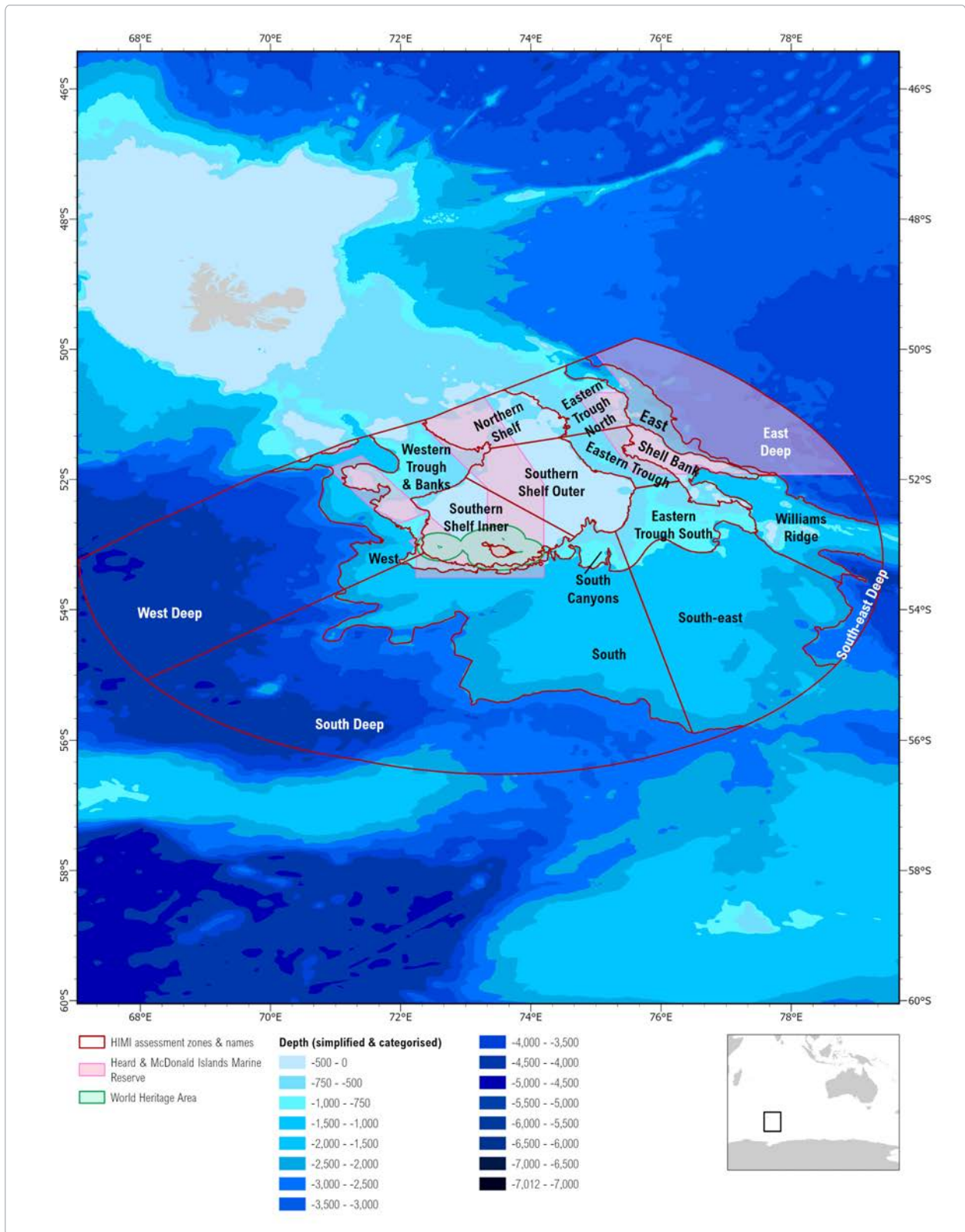
This report builds on the available scientific knowledge of the marine environment around HIMI examining its ecology in the context of the broader subantarctic, as well as further elaborating the differences between distinct marine biomes surrounding HIMI. It presents the spatial differences in the ecology of the region and the threats that climate change may have on these areas, thereby enabling us to consider requirements for conserving the unique marine biodiversity in the HIMI EEZ now and into the future.

This report assesses how well the existing marine reserve represents the diverse ecosystems found in the HIMI EEZ as part of Australia's National Representative System of Marine Protected Areas (NRSMPA). Our assessment builds on earlier conservation assessments and using the principles underpinning the NRSMPA makes recommendations on additions to the current marine reserve to achieve comprehensive, adequate, and representative (CAR) coverage for the biodiversity in the area.

The report provides new analyses of the origins and drivers of the distribution of biodiversity around HIMI and investigates the potential effects of climate change, comparing data between a baseline period (1993-2002) and the most recent decade (2013-2022). In recent years more robust spatial data have become available on the heterogeneous benthic habitats and the oceanographic conditions in the HIMI EEZ. We have used these to develop a more complete differentiation of biomes in the area drawing on improved knowledge of deep-sea fauna globally.

Evidence suggests that the existing marine reserve and fisheries conservation measures have provided effective protection for species and biodiversity in the shallower waters (less than 1,000 m deep). Options for similar levels of protection for all depths in the HIMI EEZ are recommended in order to ensure the marine reserve meets the conservation principles that form the basis of the NRSMPA goals and objectives.

Through an analysis of the key physical drivers that determine the distribution of biodiversity, combined with information on the distribution of the biodiversity, we classify the HIMI EEZ into 18 Assessment Zones that cover all depths and biophysical settings.



Assessment zones (red) on HIMI bathymetry

We provide an analysis of where the existing marine reserve requires expansion in order to protect all of the values of the region and provide scenarios for extending the marine reserve to adequately represent all areas important for biodiversity within the HIMI region. Extensions to the existing marine reserve are identified in six Key Conservation Areas:

- (1) HIMI Shelf shallower than 300 m - to maximise resilience of shelf biodiversity (particularly cold-adapted species) to climate change,
- (2) Shell Bank and Williams Ridge – to protect a currently unprotected unique feature of the marine environment in the HIMI EEZ, including unsurveyed seamounts, which also provides a significant contribution to pelagic food webs,
- (3) Elan Corridor - to provide a north-south linkage of different benthic habitats across the depth range of the HIMI EEZ which is currently only represented in the east of the EEZ. The Elan Corridor has different oceanographic conditions to that in the east and provides a link from the subantarctic to colder waters around Elan Bank,
- (4) Southern Canyons – to improve the representation of fish biodiversity in this depth range around the HIMI Shelf and provide suitable replication to Williams Ridge,
- (5) Western Plateau - to improve the representation of fish biodiversity in this area and account for the reported west-east divided in benthic biodiversity, along with protection of spawning grounds of Patagonian toothfish and areas of importance to pelagic food webs, and
- (6) South Pelagic - to provide areas of protection for pelagic food webs including important penguin feeding areas.

One to five above are proposed for the protection of both benthic and pelagic biodiversity, while the sixth area, the South Pelagic key conservation area, is proposed to protect pelagic biodiversity and the maintenance of pelagic food webs. The incorporation of the first five conservation areas in the existing marine reserve would increase the total protected area coverage in the EEZ from 17% to 38% for combined benthic and pelagic habitats. The incorporation of the sixth area for pelagic conservation only would provide protection for a further 43% of the EEZ.

While the Australian government has set an overall target of achieving '30% spatial coverage' of marine and terrestrial protected areas by 2030, given the complex marine ecosystem around HIMI and the current threats to this unique marine system it is appropriate to consider the 30% spatial coverage of the different assessment zones as a lower limit rather than a target.

It is 20 years since Australia's Cabinet agreed to pursue a claim for jurisdiction over its Extended Continental Shelf (ECS). This decision was based in part on the right to protect the marine environment of the extended continental shelf. Australia proclaimed 2,560,000 km² of the ECS in 2012, of which 1,130,000 km² was to the south of the HIMI EEZ on the Kerguelen Plateau. We explore mechanisms for developing protection of the ECS, including further topographic mapping, initiating benthic protection, and resubmitting the ECS claim for Williams Ridge to the Commission on the Limits of the Continental Shelf including reference to recent geological sampling on the Ridge designed for this purpose.

Finally, we propose that future work be done to ensure that:

- existing benthic samples collected in the HIMI EEZ be identified to the lowest possible taxonomic level in collaboration with French scientists to improve our understanding of the HIMI EEZ's place in the biogeography of Kerguelen Plateau and beyond;
- new tracking data for marine mammals and seabirds that breed on HIMI be obtained to better understand the use of the entire EEZ by different species;
- improved resolution bathymetry be extended to the southern HIMI EEZ and Australia's ECS, including identification of geomorphic units;
- benthic surveys be extended to deeper waters, especially significant geological features including the unsurveyed chain of seamounts on Williams Ridge as recommended by Hibberd et al. (2014), to improve knowledge of biodiversity and the robustness of existing predictions of benthic impact, and
- Australia's existing marine bioregional classification, Key Ecological Features and Biologically Important Areas be extended to include the HIMI EEZ.



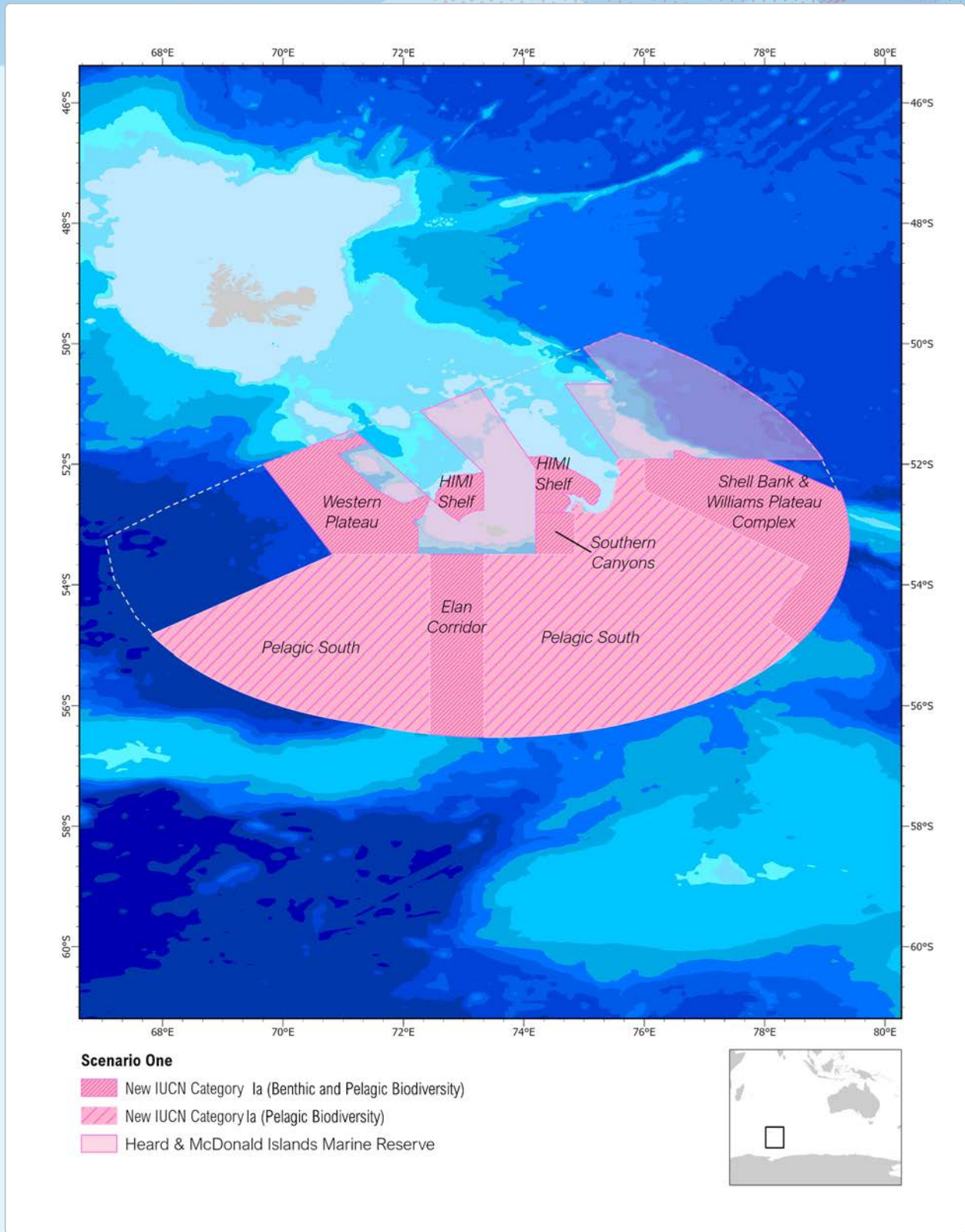
Southern Elephant Seal pup at the foot of the Baudissin Glacier, Heard Island. Photo: Inger Vandyke.

Recommendations

Scenario 1 - Ensure all six conservation areas are fully represented in The Reserve as IUCN Category 1a (strict nature reserve) under the EPBC Act.

This report demonstrates that all six Key Conservation Areas meet the criteria for inclusion in the NRSMPA and, as an integrated whole, they provide the most effective mechanism for the ongoing protection of the biodiversity in the region. Given the existing reserve is currently zoned IUCN Category 1a and the need to maintain the exceptional biodiversity values of the area, it is recommended to maintain the highest level of protection and assign IUCN Category 1a for reserve additions. Key Conservation Areas 1 to 5 are proposed for the protection of both benthic and pelagic biodiversity, while Key Conservation Area 6 is proposed to protect pelagic biodiversity and the maintenance of pelagic food webs (see page 9). The incorporation of the first five Key Conservation Areas in the existing marine reserve would increase the total protected area coverage in the EEZ from 17% to 38% for combined benthic and pelagic habitats. The incorporation of Key Conservation Area 6 as IUCN Category 1a (strict nature reserve) would provide protection for a further 43% of the EEZ.

These additions to The Reserve will provide important protections of different benthic habitats across the entire depth range of the HIMI EEZ, as well as protection of pelagic food webs and important pelagic foraging areas. The inclusion of the Elan Corridor Conservation Area provides representation of different oceanography to that in the east and provides links to the subantarctic with colder waters around Elan Bank. The protection of the Western Plateau Conservation Area increases the representation of fish biodiversity, provides protection for the spawning grounds of Patagonian toothfish, as well as other areas of importance to pelagic food webs, and accounts for differences in benthic species between the west and the east of the HIMI EEZ.



Scenario one - Proposed new IUCN 1a areas for addition to The Reserve

Recommendations

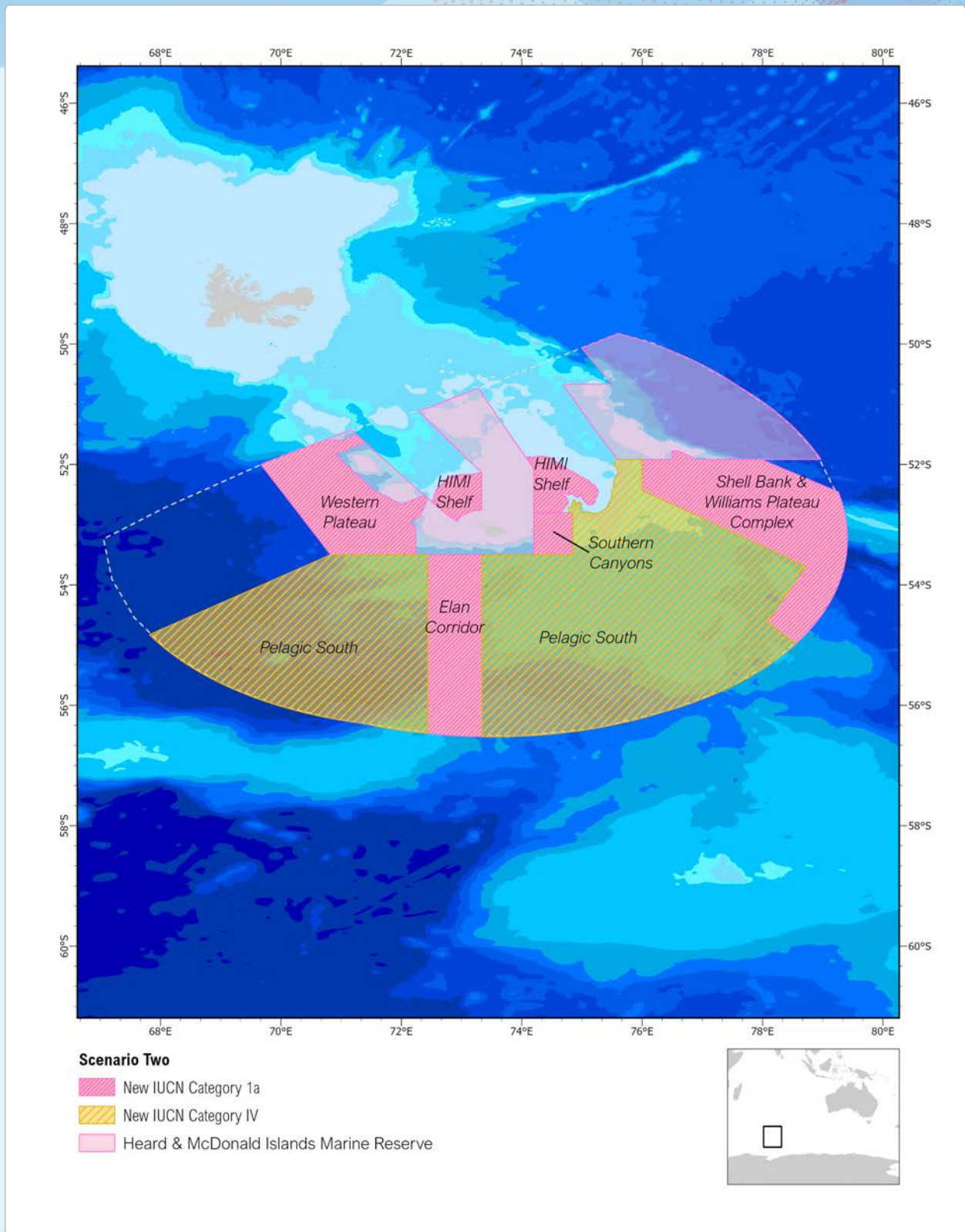
Scenario 2 - Ensure five Conservation Areas are fully represented in The Reserve as IUCN Category 1a (strict nature reserve) and protect the South Pelagic Conservation Area as IUCN Category IV (habitat or species management area).

This report demonstrates that all six Key Conservation Areas meet the criteria for inclusion in the NRSMPA. It is recommended Key Conservation Areas 1 to 5 be zoned IUCN Category 1a for the protection of the benthic and pelagic conservation values. The South Pelagic Conservation Area is recommended for the protection of pelagic food webs and the foraging grounds of resident marine mammals and birds, particularly during the summer breeding season and could be reserved specifically for species management and zoned as IUCN Category IV (see page 11). Currently The Reserve only protects 13%, 9% and 25% of the foraging areas of macaroni penguins, king penguins and fur seals, respectively. This would increase to 37%, 30% and 63% respectively with the addition of Key Conservation Areas 1 to 5. This protection is much less than the 75% target level for the escapement of prey to provide for predators in the CCAMLR area. The incorporation of Key Conservation Area 6 as IUCN Category IV (for habitat or species management area) is recommended for the protection of pelagic food webs and the foraging grounds of resident marine mammals and birds, and would raise protection a further 43% of the EEZ from any activities that are not compatible with the conservation values of the reserve.

Given the need to protect the on-going ecological, biological, and evolutionary processes of the area as a key component of the Outstanding Universal Value of the HIMI World Heritage Area, it is essential that the main foraging areas of apex predators that rely on the Southern Pelagic Conservation Area (seals, penguins and flying birds) are adequately protected and it is recommended to be included in The Reserve under some form of protection.



Black-browed Albatross in flight in the Southern Ocean. Photo: Inger Vandyke.



Scenario two - Proposed new IUCN 1a and IUCN IV areas for addition to The Reserve

Further, if the South Pelagic Conservation Area is not included in The Reserve as either IUCN 1a or IUCN IV it is recommended it be included in a 'Conservation Zone' under EPBC Part 15 Division 5 to protect the biodiversity in the area while it is being further assessed for inclusion in a Commonwealth reserve. If any new fishery were to be proposed in this area, it would need to be conducted in accordance with the CCAMLR requirements for exploratory fisheries including the setting of a precautionary catch limit at a level not substantially above that necessary to obtain the information required to evaluate the distribution, abundance and demography of the target species, and the fishery's potential impacts on dependent and related species (CCAMLR Conservation Measure 21-02 Exploratory Fisheries). A management strategy to protect these food webs would need to satisfy the CCAMLR requirement to maintain 75% escapement of fish from fisheries in order to sustain food webs.

Conclusions

This study is based on the information available in the public domain and synthesises a broad range of information including bathymetry, substratum, oceanography, and all readily accessible biological data. Further refinement of the findings may be possible with the use of detailed fisheries data and analyses, for which access was denied for this report. Nevertheless, much of the broader marine area is not well studied, particularly at depths greater than 1,000 m, with many areas having had no biological data collected. Therefore, it is necessary to rely on broader biogeographic patterns from similar systems and the abiotic drivers that define the habitats on which all life relies.

This study found the existing HIMI Marine Reserve to not adequately cover all of the natural values of the region and that an expansion of The Reserve would be necessary to meet Australia's CAR criteria for the NRSMPA.

