# NATIONAL COASTAL & MARINE SPATIAL BIODIVERSITY PLAN

## VERSION 1.2

TECHNICAL REPORT

*Securing South Africa's coastal and marine biodiversity to support economic development and sustainable resource use*

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## (RELEASED 12-04-2022)

## TECHNICAL REPORT

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# Executive Summary

Maps of Critical Biodiversity Areas (CBA Maps) have been used successfully to inform land-use planning and land-based protected area expansion in South Africa for many years. They are one of the key tools for protecting terrestrial and inland water biodiversity, and for supporting sustainable development on land. This technical report describes South Africa's National Coastal and Marine Spatial Biodiversity Plan Version 1.2, comprising the National Coastal and Marine CBA Map and accompanying sea-use guidelines. The intent of this plan is to consolidate the biodiversity sector's spatial prioritisation of the South African coast and ocean to provide inputs into national Marine Spatial Planning (MSP) as well as other planning and decision-making processes. This is to ensure that marine biodiversity assets and ecological infrastructure are secured, and that development of the ocean economy is sustainable. The plan builds on progress achieved through the National Biodiversity Assessment 2018, Benguela Current Marine Spatial Management and Governance (MARISMA) Project on Ecologically or Biologically Significant Marine Areas (EBSAs), and work that supported the declaration of 20 new marine protected areas (MPAs) in 2019.

The overall goal of the National Coastal and Marine Spatial Biodiversity Plan is to safeguard a sufficient, representative sample of coastal and marine biodiversity that can persist into the future, in support of sustainable economic development. The key objectives are to:

- Provide a robust, systematic spatial biodiversity prioritisation that follows international best practice in systematic conservation planning
- Adequately represent biodiversity patterns and ecological processes in a design that is spatially efficient and well connected
- Avoid spatial overlap (conflict) with other sectors where possible, but still meet targets for all biodiversity features
- Provide the basis for the biodiversity sector's input to the emerging MSP process
- Provide a robust starting point to support other area-based processes, such as MPA expansion

A CBA Map presents a spatial plan for the natural environment, designed to inform planning and decision-making in support of sustainable development. In terms of the Technical Guidelines for CBA Maps developed by the South African National Biodiversity Institute (SANBI 2017), CBA Maps must be developed using the principles of systematic biodiversity planning. These maps comprise three categories of biodiversity priority areas: Protected Areas, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs), which are jointly important for the persistence of a viable representative sample of all ecosystem types and species, as well as the long-term ecological functioning and connectivity of the landscape or seascape as a whole.

Protected Areas, CBAs and ESAs are discrete map categories that do not overlap, and have their own specific management objectives. For Protected Areas, these objectives are as per their gazetted management plans. For CBAs, the objective is to maintain these areas in or restore them to a natural or near-natural state, and for ESAs, the objective is to avoid further deterioration in ecological condition. Management recommendations for activities within CBAs and ESAs are then determined according to the compatibility of each activity with the respective management objectives. The assessment of activity compatibility and associated management recommendations form the sea-use guidelines that accompany the CBA Map.

The planning domain comprises the South African mainland marine territory, extending from the dune base to the outer edge of the exclusive economic zone, with provision made for aligning the new marine biodiversity priorities with those on land and with adjacent countries. This planning domain was split into planning units comprising a 1′ grid, with the shore delineation built in. All the input data were coded to these planning units, which in turn formed the basis of the spatial prioritisation analysis.

Version 1.2 of the National Coastal and Marine CBA Map includes 976 biodiversity features and design elements. The biodiversity features (n=437) include ecosystem types (n=190 features); distributions and areas of importance for species such as turtles, seabirds, dolphins, whales, seals, sharks and rays (n=188 features); unique or special habitats or features (n=15); ecological processes (n=18); ecological infrastructure (n=2); and existing priority areas (n=24). The design elements (n=539) are grouped into the following categories: edge-matching and aligning priority areas across land and sea, across shared international boundaries, and with existing initiatives (n=52); culturally important areas (n=6); ecological condition (n=332); and climate-change adaptation (n=149). Targets were set for each of these features using heuristics principles. The difference between biodiversity features and design elements is that the targets for the former are required to be met, whereas design elements serve rather to guide selection where there is choice and therefore the targets are not required to be met.

The cost layer is a spatial representation of areas to be avoided in spatial prioritisation. It comprises four components, two of which specifically aim to reduce conflict with 19 different sectors: petroleum, mining, a variety of fisheries, aquaculture, and transport. The other two components relate to the cumulative impact of past and current activities, and the area (in $km^2$) of the planning units. Areas with higher values (i.e., that carry more conflict, and are more impacted) are avoided more strongly in the analysis, but can still be selected if these are the only options for meeting biodiversity feature targets.

All spatial prioritisation was conducted using the decision-support software, Marxan, with parameter calibrations following the guidelines for good practice. Two scenarios of Marxan were run, each time with 100 runs of 1 billion iterations. After the first scenario, planning units selected ≥90% of the time were locked into the solution of the second scenario, and Marxan was rerun. From these outputs, CBAs were identified. CBA 1s (irreplaceable to near-irreplaceable sites) were those selected 100% of the time in the first scenario, and CBA 2s (best-design sites) were those selected ≥28% of the time in the second scenario, which is the selection-frequency threshold at which all biodiversity feature targets were met at a 95% level.

Given that some CBAs were not in natural or near-natural ecological condition but still have very high biodiversity importance and are needed to meet biodiversity feature targets, CBA 1 and 2 were split into two types based on their ecological condition. CBA Natural sites have natural/near-natural ecological condition, with the management objective of maintaining the sites in that natural/near-natural state; and CBA Restore sites have moderately modified or poorer ecological condition, with the management objective to improve ecological condition and, in the long term, restore these sites to a natural/near-natural state, or as close to that state as possible. As a minimum in CBA Restore sites, further deterioration in ecological condition must be avoided, and options for future restoration must be maintained. The ESAs include all portions of EBSAs that are not already within MPAs or CBAs, and a 5-km buffer area around all MPAs (where these areas are not already CBAs or ESAs), with the exception of the eastern edge of Robben Island MPA in Table Bay where a 1.5-km buffer area was applied. The National Coastal and Marine CBA Map thus comprises: 5.4% MPAs, 18% CBA Natural

(12.3% CBA 1, 5.7% CBA 2), 3.6% CBA Restore (2.2% CBA 1, 1.4% CBA 2), and 6.6% ESAs. Therefore, in total, biodiversity priority areas make up 33.6% of South Africa's mainland marine extent.

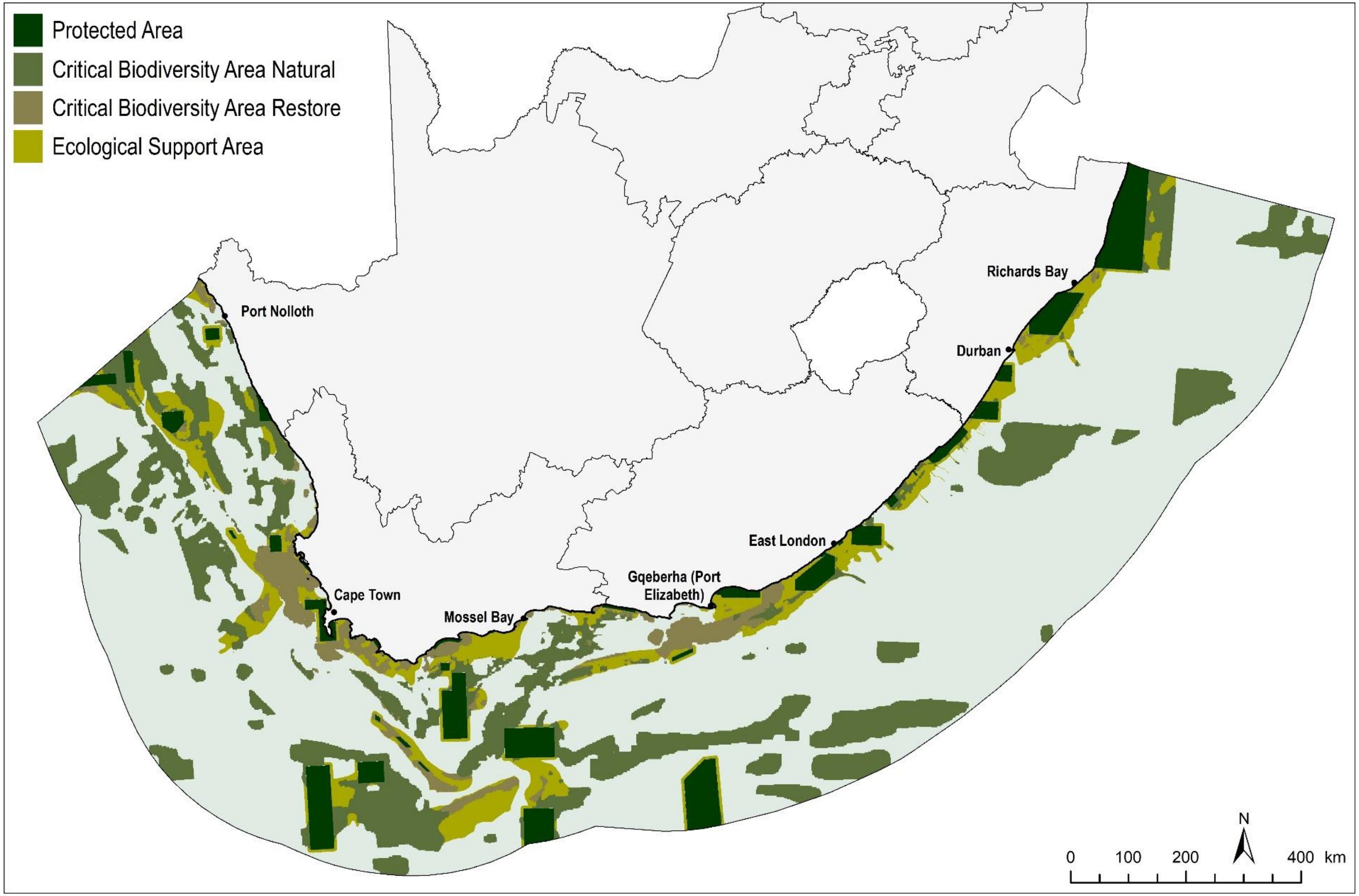
The sea-use guidelines table comprises a list of all sea-use activities grouped into broad sea uses and related MSP zones, and indicates which activities are compatible, not compatible or have restricted compatibility with the management objectives of CBAs (Natural, Restore) and ESAs; and noting that activities in MPAs are managed according to their gazetted regulations. The compatibility assessment between activities and the management objectives builds on the principles of the IUCN Red List of Ecosystems criterion C3, which considers the extent and severity of degradation relative to a reference condition of natural. It thus also draws from the analysis of ecological condition of marine ecosystem types in the National Biodiversity Assessment 2018, especially the ecosystem-pressure matrix, which in turn was used in the ecosystem threat status assessment in NBA 2018 (which also included an assessment of criterion C3).

Activities that were assessed as being compatible with the management objectives of CBAs and ESAs are recommended to be permitted in those areas according to the existing rules and regulations for that activity (general); activities that are not compatible are recommended to be prohibited. Activities with restricted compatibility require a detailed assessment to determine whether the recommendation is that they should be permitted (general), permitted subject to additional regulations (consent), or prohibited, depending on a variety of factors. Examples of these factors include: the ecosystem type in which the activity occurs; the intensity of the activity; gear types, etc. Management recommendations and regulations for these activities need to take into account the context in which the activities take place or are proposed to take place. It is also critical to take cumulative impacts into account, which may have implications for the intensity, extent or even the presence of activities, especially new or expanding activities in a biodiversity priority area. Given that there is a deliberate effort to align biodiversity priority areas across the land-sea interface in the coastal zone, there is brief reference to the land-use guidelines in the four coastal provinces in Appendix 3.

The development of the National Coastal and Marine CBA Map and sea-use guidelines is an iterative process, and therefore, attention is paid to data gaps and limitations that need to be addressed in the next versions. The intention is to: continue to enhance conflict avoidance with other sectors in the spatial prioritisation, especially addressing unmapped areas of high cost; keep expanding the suite of input datasets, especially for species; strengthen inclusion of ecological corridors, connectivity, ecological infrastructure, ecological processes, and traditional, scientific, technical, and technological knowledge of indigenous and local communities. Further work is underway to refine coastal priorities by improved land-sea integration, including estuaries. It is also anticipated that the sea-use guidelines will continue to be refined, and finally, revisions to the Technical Guidelines are recommended following the advances made through this process. Work will continue to iteratively update and improve the National Coastal and Marine Spatial Biodiversity Plan over time.

This technical report comprises eight chapters, and five appendices. The first three chapters give background information and context, before the analyses and results are presented. The background information starts with an introduction (Chapter 1), followed by definitions and a description of the coastal and marine environment in South Africa (Chapter 2). Background to systematic biodiversity planning is then presented, including how it is applied in South Africa, especially in developing CBA Maps (Chapter 3). The methodology for developing the National Coastal and Marine CBA Map is described (Chapter 4), including descriptions of the planning domain, input layers, biodiversity targets, cost layer, and analysis methods. The National Coastal and Marine CBA Map is presented (Chapter 5), together with the sea-use guidelines and links to MSP (Chapter 6). Finally, gaps, limitations, and plans for future work are outlined (Chapter 7), and the references used the report are listed (Chapter 8). The five appendices provide supplementary information, including verification of target achievement (Appendix 1), an inventory of datasets used and proposed to be used in the analyses (Appendix 2), details on the CBA Map sub-categories, alignment with land-based protected areas, CBAs and ESAs, with reference to the coastal land-use guidelines (Appendix 3), details on the stakeholder engagements for the National Coastal and Marine Spatial Biodiversity Plan that have been held to date (Appendix 4) and the progress made through the iterative improvements is documented in the version history (Appendix 5). A list of figures, tables and acronyms are given at the end of the report, as well as a glossary of key terms.

12 April 2022




*National Coastal and Marine CBA Map Version 1.2 (Released: 12-04-2022)*

*Sea-use guidelines Version 1.2 (Released 12-04-2022). List of all sea-use activities, grouped by their broad sea use and Marine Spatial Planning (MSP) Zones, and assessed according to their compatibility with the management objective of Critical Biodiversity Areas (CBA-N = CBA Natural; CBA-R = CBA Restore) and Ecological Support Areas (ESA). Activity compatibility is given as Y = yes, compatible, R = restricted compatibility, or N = not compatible. Marine Protected Areas (MPAs) are managed according to their gazetted regulations.*

| Broad sea use | Associated MSP Zones | Associated sea-use activities | MPA | CBA-N | CBA-R | ESA |
|---|---|---|---|---|---|---|
| Conservation | Biodiversity Zones | Expansion of place-based conservation measures (e.g., MPA expansion) | Sea-use activities as per gazetted MPA regulations | Y | Y | Y |
| Recreation and tourism | Marine Tourism Zone | Beach recreation, non-motorised water sports | | Y | Y | Y |
| | | Ecotourism (e.g., shark cage diving, whale watching) | | Y | Y | Y |
| | | SCUBA diving | | Y | Y | Y |
| | | Motorised water sports (e.g., jet skis) | | R | R | Y |
| | | Recreational fishing (e.g., shore-based, boat-based and spearfishing) | | N | R | Y |
| | | Shark control: exclusion nets | | Y | Y | Y |
| | | Shark control: drumlines and gillnets | | N | R | Y |
| Heritage | Heritage Conservation Zone | Protection of sites of heritage importance, including historical shipwrecks | | Y | Y | Y |
| | | Protection of sites of seascape value | | Y | Y | Y |
| Fisheries | Commercial and Small-Scale Fishing Zones | Abalone harvesting | | R | R | Y |
| | | Linefishing | | N | R | R |
| | | Demersal shark longlining | | N | R | Y |
| | | Demersal hake longlining | | N | R | R |
| | | Midwater trawling | | N | R | Y |
| | | Pelagic longlining | | R | R | Y |
| | | Small pelagics fishing | | N | R | Y |
| | | South coast rock lobster harvesting | | R | R | Y |
| | | Squid harvesting | | R | R | Y |
| | | Tuna pole fishing | | R | R | Y |
| | | West coast rock lobster harvesting | | R | R | Y |
| | | Crustacean trawling | | N | N | R |
| | | Demersal hake trawling (inshore and offshore) | | N | R | R |
| | | Hake handlining | | R | R | Y |
| | | Seaweed harvesting | | R | R | Y |
| | | Commercial white mussel harvesting | | R | R | Y |
| | | Beach seining | | R | R | Y |
| | | Gillnetting | | R | R | Y |
| | | Kelp harvesting | | R | R | Y |
| | | Oyster harvesting | | R | R | Y |
| | | Small-scale fishing | | R | R | Y |
| | Fisheries Resource Protection Zone | Resource protection | | Y | Y | Y |
| Aquaculture | Aquaculture Zone | Sea-based aquaculture | | N | R | R |
| Mining | Mining Zone | Mining: prospecting (non-destructive) | | R | R | R |
| | | Mining: prospecting (destructive, e.g., bulk sampling) | | N | N | R |
| | | Mining: mining construction and operations[1] | | N | N | R |
| Petroleum | Petroleum Zone | Petroleum: exploration (non-invasive) | | R | R | R |
| | | Petroleum: exploration (invasive, e.g., exploration wells) | | R | R | R |
| | | Petroleum: production[1,2] | | N | N | R |
| | | Petroleum: oil and gas pipelines | | N | N | R |
| Renewable Energy | Renewable Energy Zone | Renewable energy installations | | N | R | R |
| Defence | Military Zone | Military training and practice areas | | R | R | Y |
| | | Missile testing grounds | | R | R | Y |
| Transport | Maritime Transport Zone | Designated shipping lanes (including port approach zones) | | R | R | Y |
| | | Anchorage areas | | R | R | Y |
| | | Bunkering | | N | N | R |
| | | Ports and harbours (new) | | N | N | R |
| | | Dumping of dredged material | | N | N | R |

| Broad sea use | Associated MSP Zones | Associated sea-use activities | MPA | CBA-N | CBA-R | ESA |
|---|---|---|---|---|---|---|
| Infrastructure | Underwater Infrastructure Zone | Pipelines (excluding oil and gas) | | N | R | Y |
| | | Undersea cables (new installations) | | N | R | Y |
| | Land-based Infrastructure Zone | Coastal development (new installations, including piers, breakwaters, and seawalls)[3] | | N | N | R |
| Abstraction and Disposal | Disposal Zone | Waste-water (new installations) | | N | R | Y |
| | Sea-water abstraction and disposal | Sea-water abstraction and disposal (e.g., desalination) | | R | R | Y |
| | | Sea-water abstraction and disposal (e.g., aquaculture disposal) | | N | R | Y |

[1] The activity should not be permitted to occur in CBAs because it is not compatible with the respective management objective. However, if significant mineral or petroleum resources are identified during prospecting/exploration, then the selection of the site as a CBA could be re-evaluated as part of compromises negotiations in current or future MSP processes. This would require alternative CBAs and/or biodiversity offsets to be identified. However, if it is not possible to identify alternative CBAs to meet targets for the same biodiversity features that are found at the site, it is recommended that the activity remains prohibited.

[2] The recommended prohibition of the activity in CBAs (because it is not compatible with the management objective) refers to the location of the biodiversity disturbance rather than the location of the petroleum resource. If petroleum production is possible using lateral drilling or other techniques that do not result in any impacts on biodiversity within the CBAs, then production may be treated as an activity with restricted compatibility (i.e., recommended to be a consent activity).

[3] New coastal development should not be permitted in CBA Restore sites unless it is part of rehabilitation and restoration activities to improve ecological condition.

# Contents

## Acknowledgements

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In particular, we thank the biodiversity planners of South Africa who have developed a strong community of practice over the last two decades, and the scientists who contribute the foundational research to inform spatial assessments and plans. We are grateful to DFFE's National Marine Biodiversity Scientific Working Group, the National Ecologically or Biologically Significant Marine Areas (EBSA) Task Team, the Biodiversity Planning Technical Working Group convened by SANBI, and the participants of the annual Biodiversity Planning Forum convened by SANBI who helped shape and review this work. We also thank the estuarine and inland water scientists for initial discussions around advancing and integrating spatial biodiversity priorities across realms. The various industries and sectors were supportive in providing data and helping us to best represent their priority areas for consideration in the biodiversity planning, and we are very grateful for their engagement, participation and inputs. We thank everyone who attended the launch of the first beta version of the National Coastal and Marine Spatial Biodiversity Plan, and appreciate the comments, suggestions, and feedback we received. Altogether, representatives from nearly 100 organisations have attended various presentations and discussions relating to this work.

Our sincerest thanks to those who have contributed spatial data to inform the National Coastal and Marine CBA Map. The sources of data are indicated in the main text, and summarised in Appendix 2. We also thank those who have been actively engaging with us over datasets that are lacking or need to be strengthened, and for undertaking research that will help to fill those data gaps for future iterations.

We thank Dr Hedley Grantham (Wildlife Conservation Society) and Dr Kira Gee (Helmholtz-Zentrum Geesthacht) for serving as international reviewers of the National Coastal and Marine Spatial Biodiversity Plan Version 1.0 (Beta 1); we sincerely appreciate their careful consideration of the technical report and their insightful comments.

We welcome further engagement and additional data. Please visit the EBSA Portal for options to provide feedback and to submit data.

## Supporting information and recommended resources

| | |
|---|---|
| **Acronyms** | List of acronyms used in this report (at the end of the report on pg. 274) |
| **Glossary** | Definitions of key words used in this report (at the end of the report on pg. 275). Also see the Lexicon of Biodiversity Planning in South Africa. |
| **Annexure 1** | Review to support the inclusion of climate change resilience and genetic connectivity in coastal and marine biodiversity plans for South Africa. This document, compiled by Tatjana Baleta, may be available on request to Prof. Kerry Sink (k.sink@sanbi.org.za). |
| **Annexure 2** | Responses to comments from the Information Sharing Session held on 22 October 2020. Available on the EBSA Portal. |
| **Additional resources** | Links to various related resources available on the EBSA Portal. Includes links to the National Biodiversity Assessment 2018 Marine and Coast reports; information on Ecologically or Biologically Significant Marine Areas; Technical Guidelines for developing CBA Maps; videos of presentations from the Information Sharing Session held on 22 October 2020; a short video explaining Marine Spatial Planning (available in four official languages); and more. |

# 1. Introduction

## 1.1. What is the National Coastal and Marine Spatial Biodiversity Plan?

This technical report presents Version 1.2 of the National Map of Critical Biodiversity Areas and Ecological Support Areas (CBA Map) and associated sea-use guidelines for South Africa's coastal and marine environment. A CBA Map is a spatial plan for the natural environment, intended to inform planning and decision-making in support of sustainable development. It comprises a portfolio of biodiversity priority areas that are identified using principles of systematic biodiversity planning[1]. These priority areas are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes and ecological infrastructure, and for providing ecosystem services (SANBI 2016). The sea-use guidelines enhance the use of the CBA Map in a range of planning and decision-making processes by indicating the compatibility of various sea-use activities with the different biodiversity priority areas so that the broad management objective for each priority area can be maintained. Together, the CBA Map and sea-use guidelines form a Spatial Biodiversity Plan, with the overall goal of safeguarding a sufficient, representative sample of coastal and marine biodiversity that can persist into the future, in support of sustainable economic development (see Section 4.1 for the planning objectives that support this goal).

## 1.2. Why was the National Coastal and Marine Spatial Biodiversity Plan developed, and how is it envisaged to be used?

Operation Phakisa is a presidential ocean economy initiative that was launched in 2014 to help fast-track implementation of the National Development Plan (Republic of South Africa 2014). Operation Phakisa Oceans Economy aims to unlock the economic potential of South Africa's oceans (Department of Planning Monitoring and Evaluation 2015), with a view to accelerating diversification and intensification of activities in the country's coastal zone and oceans to grow the blue economy. Recognising the need to plan for these activities, South Africa is developing a national, multi-sector Marine Spatial Plan (MSP).

On land, the biodiversity sector's spatial input into multi-sectoral planning processes (equivalent to MSP) takes the form of a CBA Map (Botts et al. 2019). To date, CBA Maps have been compiled for the whole land-based portion of the country (terrestrial and inland aquatic realms), as well as for the marine area adjacent to KwaZulu-Natal (Harris et al. 2012). The National Biodiversity Assessment 2018 (Skowno et al. 2019a), with its updated ecosystem maps and assessments, provided an opportunity for a preliminary National Coastal and Marine CBA Map (Version 0) to be developed (Harris and Sink 2019). This was substantially expanded through four subsequent iterations prior to the current version (Version 1.2). In developing the National Coastal and Marine CBA Map, we consolidate several past and present spatial assessment and planning initiatives to provide a coherent map of the coastal and marine biodiversity priority areas in South Africa that require focused management measures to support sustainable development of the blue economy. These initiatives include: the most recent classification, mapping and assessment of coastal and marine biodiversity in South Africa (Harris et al. 2019a; Harris et al. 2019f; Sink et al. 2019f); identification, revised delineation and proposed

[1] In the academic literature, this is referred to as Systematic Conservation Planning (SCP). However, SCP is often interpreted as being about spatial prioritisation for protected area expansion only. Given the broader application of SCP in South Africa, where it is used to identify spatial priorities to inform land- or sea-use planning and decision-making, it is more appropriately referred to as systematic biodiversity planning.

management of Ecologically or Biologically Significant Marine Areas (EBSAs; MARISMA 2020b); and other spatial prioritisations done at national, provincial, local or other sub-national scales, e.g., the Offshore Marine Protected Areas (OMPA) project (Sink et al. 2011), and the Algoa Bay Systematic Conservation Plan (Algoa Bay Project 2019).

There are several ways in which the National Coastal and Marine Spatial Biodiversity Plan can be used. First, it is a consolidation of the biodiversity sector's spatial priorities; therefore, it can inform the multi-sectoral MSP process (Figure 1), as per the MSP Act: No. 16 of 2018 (Republic of South Africa 2018), in the same way that CBA Maps with accompanying land-use guidelines inform Spatial Development Frameworks on land in terms of the Spatial Planning and Land Use Management Act (SPLUMA; Act 16 of 2013). Accordingly, the National Coastal and Marine CBA Map and accompanying sea-use guidelines have provided the basis for the draft Marine Biodiversity Sector Plan (DFFE 2022) that will inform the three Marine Area Plans around the South African mainland in the emerging MSP process. Second, Spatial Biodiversity Plans can inform and streamline environmental decision-making, including Environmental Impact Assessments, in the landscape and seascape. Third, the priority areas identified in the CBA Map can guide restoration activities. And finally, the priority areas identified in the CBA Map can potentially inform focus areas for protected area expansion.

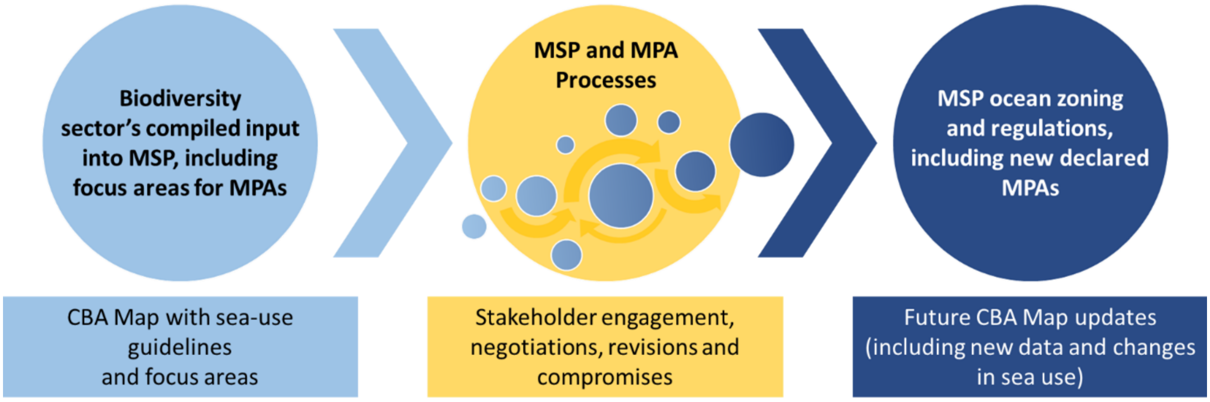


**Figure 1.** *Conceptual illustration showing how the biodiversity sector's input to the MSP process are incorporated into the MSP and MPA processes. The biodiversity sector's input includes the CBA Map and associated sea-use guidelines, and proposed focus areas for marine protected area (MPA) expansion based on the CBA Map. Through substantial stakeholder engagement and negotiations, the proposed biodiversity priority areas are expected to go through several iterations that aim to accommodate other sector's requirements as far as possible, recognising that it is likely that all sectors will need to make adjustments and compromises to their initial priority areas during MSP negotiations. Future updates of the National Coastal and Marine Spatial Biodiversity Plan will incorporate outcomes of the Marine Area Plans and MPA expansion, along with new data, to ensure targets are still met for all biodiversity features.*

A related application of the National Coastal and Marine CBA Map is to inform the recommended management of South Africa's Ecologically or Biologically Significant Marine Areas (EBSAs; see Box 3 in Section 4.4.6.5), which are part of the biodiversity sector's integrated input into the MSP process. EBSAs were conceptualised by the Convention on Biological Diversity (CBD), initially as part of the work on approaches to promote international cooperation and coordination for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction. However, the value of identifying EBSAs in areas under national jurisdiction was recognised, and States were urged to do so at the 9th Convention of Parties (COP) in 2009 (decision IX/20). It was also noted that EBSAs may require enhanced conservation management measures (decision X/29) to secure their constituent marine biodiversity, and that this was a matter for States.

South Africa's EBSAs were adopted by the CBD at COP 12 in 2014. Under the current regional Marine Spatial Management and Governance (MARISMA) Programme (see Box 3 in Section 4.4.6.5), South Africa has revised its EBSAs and is preparing management recommendations for each one. EBSA management will take the form of a proposed zoning with accompanying sea-use guidelines per zone. Delineation of the zones is based on the National Coastal and Marine CBA Map, and the recommendations for management per zone are from the sea-use guidelines. This careful and deliberate alignment of the National Coastal and Marine CBA Map and the EBSA zones is important for identifying a single, coherent portfolio of coastal and marine biodiversity priorities to inform multi-sectoral processes, such as MSP (see Box 3 in Section 4.4.6.5).

### 1.3. How does the National Coastal and Marine Spatial Biodiversity Plan fit into biodiversity assessment, planning and prioritisation in South Africa?

The National Biodiversity Assessment (NBA) is a primary tool for reporting on the state of biodiversity in South Africa. In this assessment, the threat status and protection level of all ecosystem types is determined across the entire national territory in four realms: terrestrial, inland aquatic, estuarine and marine, with a cross-realm coastal integration (see Section 2.1). Species assessments and the state of genetic biodiversity are also reported in the NBA, along with chapters on the benefits of biodiversity, pressures and threats to biodiversity, and priority actions for managing and conserving biodiversity. The foundational data (e.g., maps of ecosystem types) and headline indicators (e.g., Ecosystem Threat Status, and Ecosystem Protection Level) that are assessed for the NBA are key inputs into spatial biodiversity planning (Figure 2). Ecosystem Threat Status gives an indication of the risk of ecosystem collapse, and Ecosystem Protection Level gives an indication of how well represented an ecosystem type is in the protected area network relative to its biodiversity target.

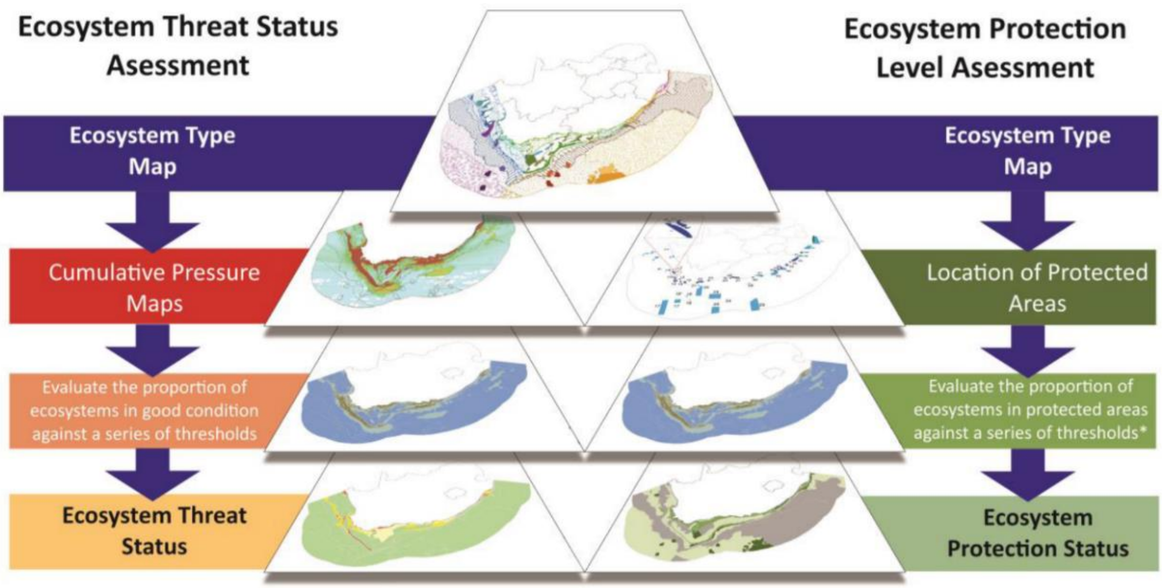


**Figure 2.** *Steps in assessing Ecosystem Threat Status and Ecosystem Protection Level. *Note: there is a link between protection level and ecological condition, where only natural/near-natural areas contribute to protection level targets. Figure from: Sink et al. (2019e).*

Spatial biodiversity planning uses a systematic approach to identify a portfolio of priority areas within which biodiversity needs to be secured, and also makes recommendations for conserving and managing those areas. In South Africa, CBA Maps and associated land- or sea-use guidelines are the typical spatial biodiversity planning products (Figure 3). In the marine realm, EBSAs (see Box 3 in Section 4.4.6.5) are also a form of spatial biodiversity planning, with associated management recommendations. The National Coastal and Marine CBA Map has incorporated the EBSAs so that, as discussed above, there is a single consolidated input from the biodiversity sector into MSP and other multi-sector processes.

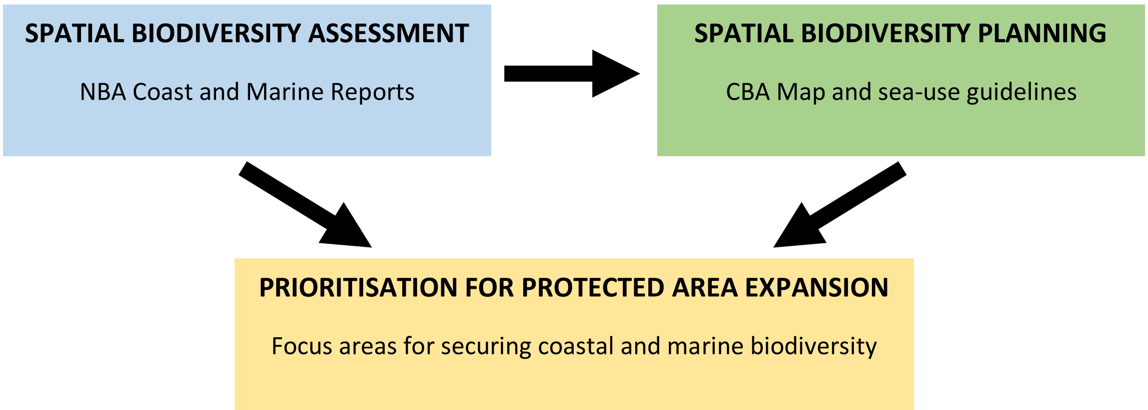


**Figure 3.** *Conceptual relationships among spatial biodiversity assessment, spatial biodiversity planning and prioritisation for protected area expansion in South Africa.*

Outputs from both spatial biodiversity assessment and spatial biodiversity planning inform spatial prioritisation for protected area expansion (Figure 3). In terms of spatial biodiversity assessment, the NBA identifies ecosystem types that are under-protected, and the headline indicators of Ecosystem Threat Status and Ecosystem Protection Level (Figure 2) guide which ecosystem types are highest priority for protection. For example, a Critically Endangered ecosystem type that is Not Protected (i.e., <5% of the biodiversity target is met) is at high risk of its constituent biodiversity being lost. Spatial biodiversity planning gives the most efficient spatial configuration within which to meet targets for biodiversity features. For example, it will give the best spatial configuration in which to meet targets for the Critically Endangered, Poorly Protected ecosystem type such that the protection level is improved to Well Protected. These outputs facilitate identification of focus areas for formal protection in MPAs (that also take other factors into account), which can be explored further in multi-sector negotiations.

The value of taking this systematic, spatially explicit approach to biodiversity assessment, planning and prioritisation (Figure 3) is exemplified by the recently declared MPAs in the Phakisa network. These MPAs were underpinned by the spatial biodiversity assessments undertaken in 2004 (Lombard et al. 2004) and 2011 (Sink et al. 2012), and a spatial biodiversity plan that led to the identification and prioritisation of focus areas for MPA expansion (Sink et al. 2011). The MPA network that was declared in 2019, after stakeholder consultation and negotiation, is highly efficient in spatial terms. It represents 87% of the 150 marine ecosystem types in just 5.4% of South Africa's mainland marine territory (Sink et al. 2019d).

### 1.4. Intended users of the National Coastal and Marine Spatial Biodiversity Plan

The National Coastal and Marine Spatial Biodiversity Plan is intended to be used by managers and decision-makers in those national government departments whose activities occur in the coastal and marine space, e.g., environment, fishing, transport (shipping), petroleum, mining, and others. It is relevant for the Marine Spatial Planning National Working Group where many of these departments are participating in developing South Africa's emerging marine spatial plans, and it provides the basis for the Marine Biodiversity Sector Plan (DFFE 2022) as an input into the MSP process. It is also intended for use by relevant managers and decision-makers in the coastal provinces and coastal municipalities, EIA practitioners, organisations working in the coast and ocean, civil society, and the private sector.

### 1.5. How this document is structured

Following this Introduction, the coastal and marine environment in South Africa is defined and described (Section 2). Background is provided on the development and application of systematic biodiversity planning, including its application in developing CBA Maps (Section 3). The methodology for developing the National Coastal and Marine CBA Map is provided, including descriptions of the planning domain, input layers, biodiversity targets, and analysis methods (Section 4). The spatial outputs (Section 5, see also Appendix 1 for a summary of target achievement) and accompanying sea-use guidelines are presented and discussed (Section 6). Given that developing and updating the National Coastal and Marine CBA Map and sea-use guidelines is an iterative process, attention is paid to data gaps and limitations that need to be addressed in the next iterations and future updates of this Spatial Biodiversity Plan (Section 7, Appendix 2). Details of the CBA Map sub-categories are presented alongside the coastal land-based protected areas, CBAs and ESAs, with reference to the coastal land-use guidelines and links to integrated coastal zone management (Appendix 3). A summary of stakeholder engagements is provided (Appendix 4), as well as a version history (Appendix 5). A list of figures, tables and acronyms are given at the end of the report, as well as a glossary of key terms.

# 2. Coastal and marine biodiversity in South Africa

## 2.1. Boundaries and definitions of the planning domain

### 2.1.1. The coastal zone

The land-sea interface is a complex space in which to work, partly because of the myriad of definitions and delineations of “the coast” and “the coastline”. A particular challenge has been the spatial misalignment of terrestrial, estuarine and marine maps along their seams within this coastal interface. Importantly, this precluded cross-realm analyses and accurate assessment of coastal biodiversity, and made it difficult to include biodiversity pattern and ecological processes meaningfully in spatial biodiversity plans. This was addressed in the NBA 2018 by integrating the national maps of ecosystem types in the terrestrial, estuarine and marine realms to form a single seamless map of ecosystem types for the first time (Harris et al. 2019a; Skowno et al. 2019a).

The first step toward achieving this seamless integration was to construct a conceptual framework (see Figure 5 below) for dividing the land-sea interface using boundaries that marked an appropriate divide between the terrestrial and marine realms, and that best represented ecosystem types that occur across the ecotone (transitional zone) between land and sea. The seashore zone, comprising the backshore (foredunes) and shore (from the dune base to the back of the surf zone), was defined, with the backshore marking the seaward edge of the terrestrial National Vegetation Map (Dayaram et al. 2019) and the shore marking the landward edge of the map of marine ecosystem types (Sink et al. 2019a). Delineating the seashore required high-resolution mapping at a fine scale (<1:3000) (Harris et al. 2019a). Estuaries intersect the seashore zone all along the South African coastline, and these too needed to be seamlessly integrated as well (Harris et al. 2019a). In the map of estuarine ecosystem types, estuaries are delineated as the Estuarine Functional Zone (EFZ; Van Niekerk et al. 2019a). Where these intersect the seashore, the EFZ and backshore boundaries were aligned as necessary, and the seaward edge of the EFZ was extended to include the full extent of the shore zone (i.e., to the back of the surf zone). The result of digitizing the seashore (including estuarine shores) at such a high resolution was achieving accurate representation of these very narrow ecosystem types for the first time (Harris et al. 2019a), and facilitating the compilation of the seamless, integrated map of ecosystem types for the entire area under South Africa’s national jurisdiction (Skowno et al. 2019a).

Once the maps of ecosystem types were seamlessly aligned, an ecologically determined coastal zone was identified (Harris et al. 2019a), comprising coastal ecosystem types from the terrestrial, estuarine and marine realms (Figure 4). Inland aquatic features are not included in the ecologically determined coast at this time (Van Deventer 2019). The fundamental principle by which the ecologically determined coastal zone was identified was to select ecosystem types that had an influence from both land and sea (see Harris et al. 2019a for details). Therefore, vegetation types were considered coastal if they had >70% of their extent within 10 km of the dune base and/or the description of the vegetation type in the National Vegetation Map (Dayaram et al. 2019) mentioned a coastal affinity. The vegetation types that matched these criteria were included (full extent per vegetation type) to comprise the coastal terrestrial portion of the map. All estuaries were considered coastal, and were mapped and included as the estuarine functional zone (EFZ). And finally, all marine ecosystem types in the shore and inner shelf zones, and those further offshore that are influenced by outflow from rivers are included in the ecologically determined coastal zone: this is the coastal marine portion of the map (see Figure 5 for a schematic representation).

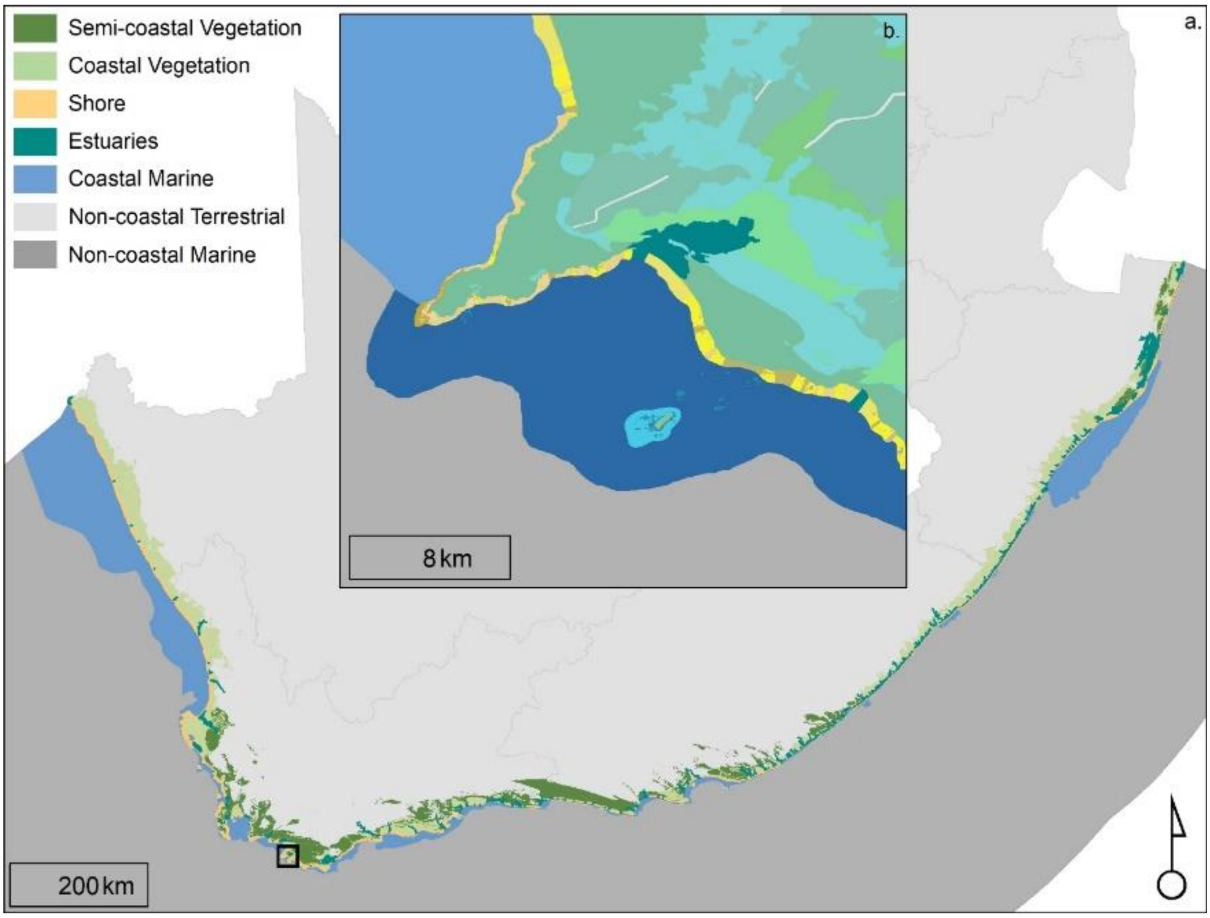


**Figure 4.** *(a) South Africa's ecologically determined coastal zone given in colour, with the adjacent land and sea shown in grey, showing the portions of the land (terrestrial vegetation types and estuaries) and sea (coastal marine ecosystem types) that comprise the coast. (b) Representing ecosystem types accurately in the coast, especially in the seashore zone, required high-resolution mapping (see Harris et al., 2019a). Note that the legend is applicable only to panel a, with ecosystem types in panel b shown in shades of the same zone colours as in panel a.*

#### 2.1.2. South Africa's marine territory

South Africa's marine territory comprises the territorial seas (extends to 12 NM offshore), and the Exclusive Economic Zone (EEZ; extending from 12 NM to 200 NM offshore) around the country's mainland and the Sub-Antarctic Prince Edward Islands (PEI). Note that in this report, reference to the country's marine territory refers only to that around the mainland. This is the same extent as the Marine Realm in the NBA 2018 (Sink et al. 2019f).

#### 2.1.3. What areas are included in the National Coastal and Marine Spatial Biodiversity Plan?

The planning domain for the National Coastal and Marine Spatial Biodiversity Plan is the marine territory (Figure 5). It is explicitly for South Africa's mainland and excludes PEI. (See Lombard et al. (2007b) for a systematic biodiversity plan for PEI that underpinned the declaration of the PEI MPA). It is also noted that this planning domain covers the entire mainland area under the jurisdiction of the MSP Act. However, given that the coast is a cross-realm zone, deliberate alignment of land-based and coastal marine biodiversity priority areas is needed. To highlight this, the National Coastal and Marine CBA Map is presented with the biodiversity priority areas for all coastal municipalities that are within 10 km of the shore (see Appendix 3). This inland area covers the full extent of the ecologically determined coastal zone, and is a preferable inland extent because it is an administrative boundary (Botts et al. 2019), even though it unavoidably includes some areas that are not coastal, especially in the Northern Cape. Some alignment of biodiversity priorities was included in the current version of the National Coastal and Marine CBA Map, and will be advanced through cross-realm planning in future versions (see Section 7.2 for details).

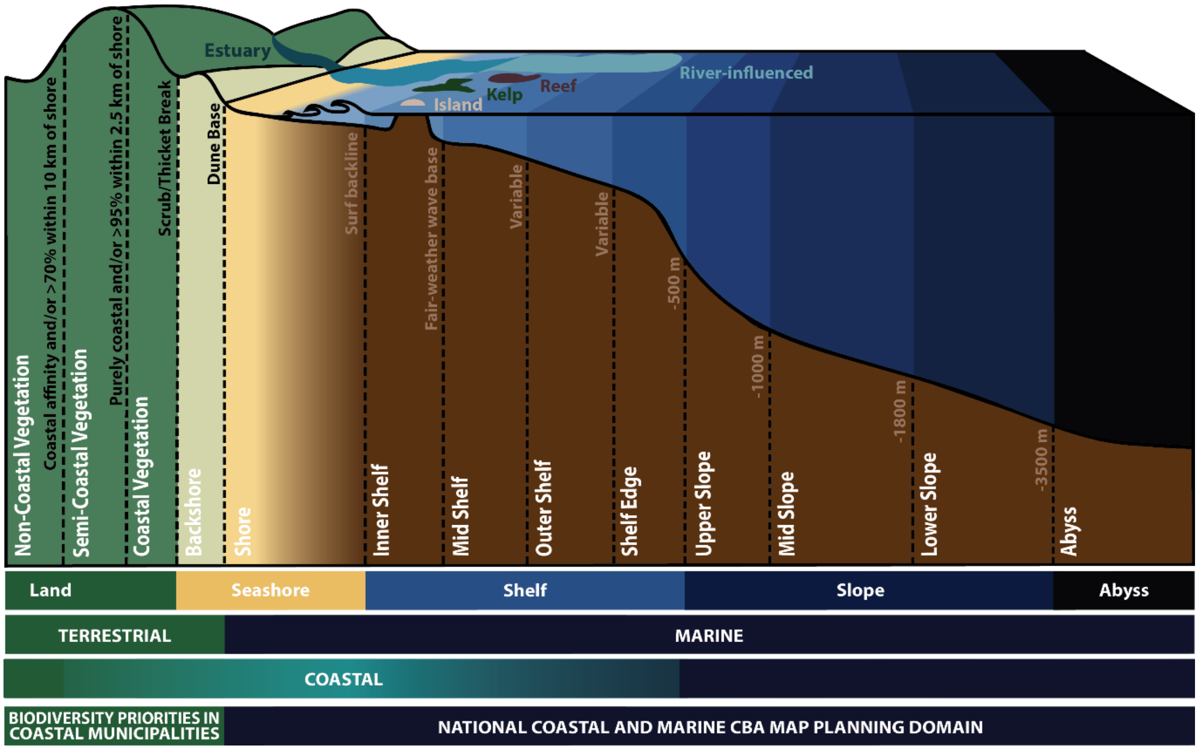


**Figure 5.** *The planning domain (extent of the National Coastal and Marine CBA Map) includes the full extent of the marine realm (marine territory), with the existing biodiversity priorities from the Provincial and Metro CBA Maps shown for the coastal municipalities that span the ecologically determined coastal zone and a bit beyond. The coast is a cross-realm zone comprising: terrestrial coastal and semi-coastal vegetation types, including those in the backshore; all estuaries; and all marine ecosystem types from the shore and inner shelf, and those ecosystem types that are river-influenced. Cross-realm alignment of biodiversity priorities is needed in the coastal zone.*

No new planning was done for the land-based portion of the planning domain; only for the area that is seaward of the dune base (Figure 5; see also Figure 9 in Section 4.1). The biodiversity priority areas (protected areas, CBAs and ESAs) for the coastal municipalities were taken directly from the existing provincial biodiversity plans for the four coastal provinces (Northern, Western and Eastern Cape, and KwaZulu-Natal), which have been developed by (or for) their respective provincial conservation authorities (see Section 4: Methods for details, and Appendix 3).

## 2.2. Biodiversity Profile of South Africa's coast and oceans

Coastal and marine biodiversity in South Africa is exceptional. As the southern tip of Africa, the country is influenced by three ocean basins, each with contrasting oceanographic conditions. The west coast is influenced by the Benguela Current that brings cold water from the western and southern portion of the South Atlantic Gyre, with characteristic upwelling in the region resulting in some of the highest marine primary productivity in the world. The east coast is bounded by the warm, fast-flowing Agulhas Current that sweeps warm tropical waters southward along the eastern seaboard. These two currents meet each other and brush past the northern extent of the Southern Ocean along the southern margin of the country.

These three ocean systems give rise to stark contrasts among ecosystems, communities and species on the cool temperate west coast, warm temperate south coast, and subtropical east coast, such that 150 marine ecosystem types in 15 broad ecosystem groups have been identified for South Africa. These groups are: Sandy Shores; Rocky and Mixed Shores; Islands; Bays; Kelp Forests; Shallow Reef; Shallow Soft Shelf; Shallow Rocky Shelf; Deep Soft Shelf; Deep Rocky Shelf; Slope; Plateau; Seamount; Canyon; and Abyss (Sink et al. 2019a). These are nested into five ecoregions (Figure 6), some of which are split further into sub-regions. The ecoregions are: cool temperate Southern Benguela (Namaqua and Cape sub-regions); warm temperate Agulhas; subtropical Natal-Delagoa (Delagoa, KwaZulu-Natal Bight and KZN-Pondoland sub-regions); Southeast Atlantic; and Southwest Indian (Sink et al. 2019a). Although the South African territory includes the sub-Antarctic Prince Edward Islands (PEI) in the Southern Ocean (Whitehead et al. 2019), this report focuses on only the mainland coastal and marine environment and excludes PEI (see also Lombard et al. 2007b).

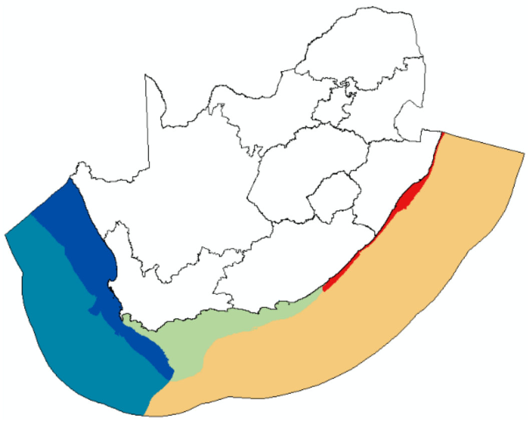

**Figure 6.** *Five marine ecoregions of South Africa (Sink et al., 2019a): Southern Benguela Shelf (dark blue), South East Atlantic (turquoise blue), Agulhas Shelf (green), Natal-Delagoa Shelf (red), and Southwest Indian (yellow).*

The contrasting ocean currents and differences in topography between the eastern and western portions of the country results in the bulk of South Africa's rain falling on the eastern half of the country. In turn, the vast majority of our 290 estuaries and 42 micro- estuaries are located on the east coast (Van Niekerk et al. 2019a). There are nine types of estuaries, ranging from fluvially dominated to small temporarily closed systems, and four bioregions (Cool Temperate, Warm Temperate, Subtropical, Tropical), giving a total of 22 estuarine ecosystem types, and a further nine micro-system (micro-estuary, micro-outlet, coastal waterfall) ecosystem types (van Niekerk et al. 2020).

South Africa is recognised as a megadiverse country (Mittermeier et al. 1997) because of its particularly high species richness. Because of the contrasts in productivity and temperature between the west and east coasts, community biomass is generally higher on the west coast, and diversity is higher on the east coast (Bustamante and Branch 1996). Endemism, however, is often highest along the south coast. This is true of beach species and foredune plants (Harris et al. 2014b), coastal fish (Turpie et al. 2000), and marine invertebrates (Awad et al. 2002; Griffiths and Robinson 2016), including decapods (Kensley 1981). Moreover, new species are continually being discovered the more we explore our oceans (e.g., Samaai et al. 2017). To date, it is estimated that South Africa's marine ecosystems support more than 13 000 species (Sink et al. 2019e), with estimates of marine endemism for different groups of taxa ranging between 26 and 33% (Awad et al. 2002; Costello et al. 2010; Gibbons 1999; Griffiths and Robinson 2016; Griffiths et al. 2010). Globally, South Africa is reported as having the third highest marine endemism (28%) after New Zealand (51%) and Antarctica (45%), as well as the third highest number of species per unit area after South Korea and China (Costello et al. 2010). The richness and uniqueness of South Africa's biodiversity is also illustrated in the biodiversity data that are included in National Coastal and Marine Spatial Biodiversity Plan (see Section 4.4). In short, South Africa has a lot to celebrate in terms of its abundant biodiversity, and it is imperative to safeguard this national asset for the myriad of benefits it delivers to people, and as a legacy for future generations.

# 3. Systematic biodiversity planning: background and application in South Africa

## 3.1. What is a CBA Map?

A Map of Critical Biodiversity Areas and Ecological Support Areas (CBA Map) presents a spatial plan for the natural environment, designed to inform planning and decision-making in support of sustainable development. The map comprises three main sets of biodiversity priority areas: protected areas, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) that are jointly "important for the persistence of a viable representative sample of all ecosystem types and species as well as the long-term ecological functioning of the landscape [and seascape] as a whole" (SANBI 2017). Areas not selected as biodiversity priorities are categorised as Other Natural Areas (ONA) or No Natural Remaining (NNR). SANBI has developed Technical Guidelines for CBA Maps (SANBI 2017, hereafter called the Technical Guidelines), which include a requirement for CBA Maps to be based on systematic biodiversity planning principles (see Section 3.3).

On land, CBA Maps in South Africa are compiled at a sub-national level, usually provincial, and in some cases for individual metropolitan areas. These CBA Maps and accompanying land-use guidelines provide the biodiversity sector's input into a range of multi-sectoral planning and assessment processes that relate to land-use planning and decision making, including municipal Integrated Development Plans and Spatial Development Frameworks. CBAs are also among the features that trigger environmental authorisation processes through the Environmental Impact Assessment Regulations, published under the National Environmental Management Act (No. 107 of 1998). Protected areas and CBAs also feature as part of the Natural Resource and Ecological Infrastructure subframe in the draft National Spatial Development Framework, which was published for public comment in early 2020. In short, CBA Maps are a powerful tool to bring the biodiversity sector's spatial priorities into a range of planning, assessment and decision-making processes from the national to local level, with the ultimate intent of securing biodiversity assets and ecological infrastructure in support of long-term sustainable development (SANBI 2017). The effectiveness of CBAs in avoiding biodiversity loss has also been clearly demonstrated (von Staden et al. 2022).

To ensure consistency among CBA Maps produced by different planners for different areas and realms (terrestrial, inland aquatic, estuarine and marine), a set of Technical Guidelines was compiled to give clear instructions regarding the technical aspects of the process (SANBI 2017). For example, the Technical Guidelines state that CBA Maps must be designed from a minimum of four input layers: existing protected areas; ecosystem types; areas of importance for ecological processes; and a spatial assessment of ecological condition. Additional inputs, such as species of special concern, unique or special habitats or features, ecological infrastructure, and socio-economic constraints can add substantial value where such data are available. These input layers and data are used to prioritise portions of the landscape or seascape in a spatially efficient and connected network of sites that are representative of the biodiversity in the planning domain. This prioritisation is based on a systematic biodiversity plan, which in South Africa is most commonly undertaken using the decision-support tool, Marxan (Ball et al. 2009; Botts et al. 2019; see Box 1). The Technical Guidelines provide guidance on target setting for the biodiversity features that are fed into the systematic biodiversity plan (see also Section 4.6). There are also clear instructions on how to translate the input layers and the outputs from the systematic biodiversity plan into the various types of biodiversity priority areas that comprise a CBA Map (Figure 7).

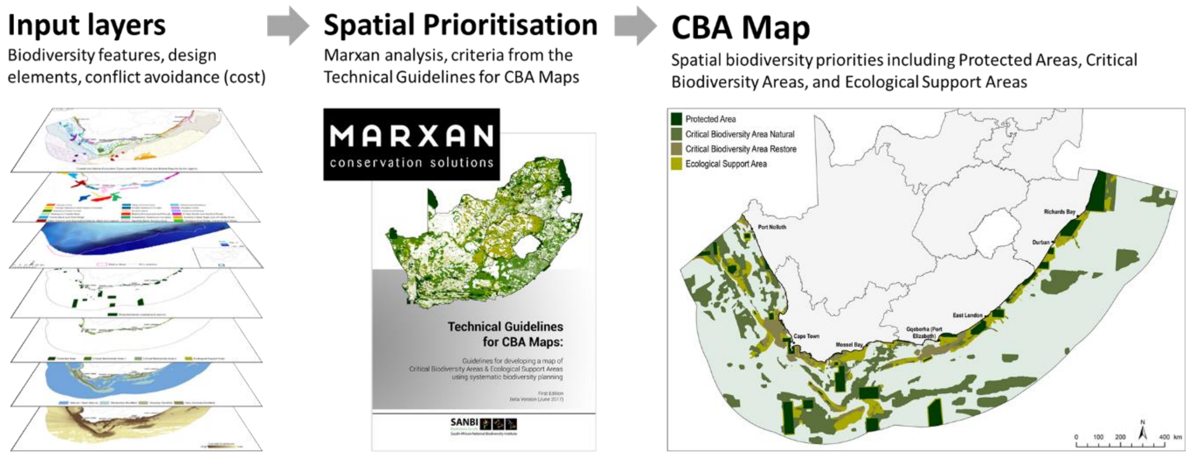


***Figure 7.*** *Schematic diagram showing an overview of the technical process of developing a CBA Map.*

The identified biodiversity priority areas are divided among three main CBA Map categories: protected areas, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) (Table 1), with CBAs and ESAs each generally divided further into two sub-categories: CBA 1 and CBA 2; ESA 1 and ESA 2. The split between CBA classes is based on how irreplaceable the features are in the landscape or seascape, and the split between ESA classes is based on the ecological condition of the sites. It is emphasised that protected areas are a separate map category and are not a subset of CBAs or ESAs. Further, none of the map categories overlap: a site is allocated to only one map category.

***Table 1.*** *Conceptual framework of biodiversity priority areas in CBA Maps (adapted from SANBI 2017).*

| Category | Definition and purpose | Broad management objective |
|---|---|---|
| **Protected Areas** | These are protected areas declared or recognised in the National Environmental Management: Protected Areas Act (No. 57 of 2003). They provide formal long-term protection for important biodiversity and landscape/seascape features; and together with CBAs, they ensure that a viable, representative sample of biodiversity can persist. | As per each Protected Area Management Plan. |
| **Critical Biodiversity Areas (CBAs)** | CBAs are sites that, together with Protected Areas, are required to meet targets for biodiversity features. Ideally these sites are natural or near-natural. Together with Protected Areas, they ensure that a viable, representative sample of biodiversity can persist. | Must be kept in or restored to a natural or near-natural ecological condition. |
| **Ecological Support Areas (ESAs)** | ESAs are sites that are not CBAs but are still important for meeting targets for biodiversity and ecological processes. They ensure the long-term ecological functioning of the landscape/seascape as a whole. | Further deterioration in ecological condition must be avoided. |

Areas that are not classified as biodiversity priority areas are represented on a CBA Map as Other Natural Areas (ONA) or as No Natural Remaining (NNR), depending on the ecological condition of the area. However, these two map categories are not included in the National Coastal and Marine Spatial Biodiversity Plan; the focus is rather on the biodiversity priority areas. Further, ONA and NNR are not covered by any use guidelines (for either land-based planning or marine planning). However, environmental management measures must still be applied in these zones as well. These measures are the set of general principles and rules that are applied throughout South Africa's marine territory. These principles and rules represent key aspects of marine management and include all relevant non-spatial management processes and requirements for the sustainable use of marine resources, such as: ecosystem-based management of fisheries; seasonal fisheries regulations, quotas and size limits; required regulatory processes and associated impact assessments; and measures required to manage climate change impacts, introduction of alien invasive species, under-water noise, and disaster-risk management.

## 3.2. Origins of systematic biodiversity planning

Historically, nature conservation reflected the thinking of the time: that humans were separate from the environment and so biodiversity was protected by fencing off areas of wilderness (Mace 2014). However, design and placement of land-based protected areas was often ad hoc, poorly accounted for biodiversity representation, largely comprised areas that were unsuitable for urban development or agriculture, and in hindsight, were often very inefficient solutions (Pressey 1994). As the understanding of people's relationship with nature grew through time (Mace 2014), so too did methods for designing appropriate protected areas until, at the turn of the century, systematic conservation planning was formally defined (Margules and Pressey 2000). In their seminal paper, Margules and Pressey (2000) define systematic conservation planning as a six-stage process that aims to achieve representation and persistence of biodiversity in an efficient portfolio of priority areas that is in least conflict with competing uses and users, often with limited resources (Margules and Pressey 2000). These six steps are:

1. Compile data on the biodiversity of the planning region
2. Identify conservation goals for the planning region
3. Review existing conservation areas
4. Select additional conservation areas
5. Implement conservation actions
6. Maintain the required values of conservation areas

Although systematic conservation planning was initially used to design protected area networks, this has been extended to broader land-use planning (Botts et al. 2019). Given this broader application of systematic conservation planning in South Africa, it is more appropriately referred to as systematic biodiversity planning. By having tools such as systematic biodiversity planning available for marine planning from the outset, it is possible to avoid designs for protected area networks that are biased and often inefficient, as are frequently found in terrestrial areas (Pressey 1994). This has already been demonstrated in South Africa, where the new MPA network was designed using systematic biodiversity planning, and includes at least some representation for 87% of the 150 marine ecosystem types in just 5.4% of the mainland marine territory (Sink et al. 2019d).

Initially, practitioners in South Africa (and globally) used custom algorithms to undertake systematic biodiversity planning until specialised software became available (Botts et al. 2019), with the most commonly used programmes including Marxan (Ball et al. 2009; see Box 1 below), C-Plan (Pressey et al. 2009) and Zonation (Moilanen et al. 2009a). In South Africa, Marxan is most commonly used (Botts et al. 2019), and is the algorithm used for this National Coastal and Marine Spatial Biodiversity Plan. Marxan is the abbreviation for *"marine reserve design using spatially explicit annealing"*, although it is commonly used beyond the marine realm. Using an algorithm to search the decision space is substantially more accurate and efficient compared to doing it by hand. Because a site can either be selected or not selected as a biodiversity priority area, a planning domain divided into 100 000 planning units can have 100 000[2] (10 billion) possible solutions. The National Coastal and Marine CBA Map has nearly four times as many planning units, therefore, there are nearly 160 billion possible solutions. The algorithm searches the decision space far quicker than is humanly possible to find the most efficient solution to meet the targets for all the biodiversity features in a configuration that is in least conflict with other activities.

## Box 1. Technical explanation of Marxan

The minimum set problem formulation, in its simplest form, is defined in the equations below (Moilanen et al. 2009b):

$$\min \quad \sum_{i=1}^{N_s} c_i x_i$$

given the constraints that

$$\sum_{i=1}^{N_s} x_i r_{ij} \geq T_j \quad \text{for all features } j$$

$$\text{and} \quad x_i \in \{0,1\} \quad \text{for all sites } i$$

where $N_s$ is the number of sites, $c_i$ is the cost of site $i$, $r_{ij}$ is the occurrence level of feature $j$ in site $i$, and $T_j$ is the target level for each feature $j$. The Boolean control variable $x_i$ has value 1 for selected sites, and value 0 for sites not selected.

Marxan uses simulated annealing to solve this algorithm. It seeks to meet feature targets across the decision space with the least conflict to other sectors or activities (cost) by evaluating different combinations of selected planning units. With each iteration in the routine, Marxan either selects or unselects a planning unit and evaluates if this improved (lowered) or worsened (increased) the overall score, initially allowing increases in score to avoid falling in local minima such that the global minimum score can be found (or at least, closely approximated; Figure 8). By including a penalty term for boundary length (the boundary length modifier), Marxan also has to trade off higher penalties for having fragmented solutions of very low cost and selecting planning units of higher cost but that comprise neat, compact selections.

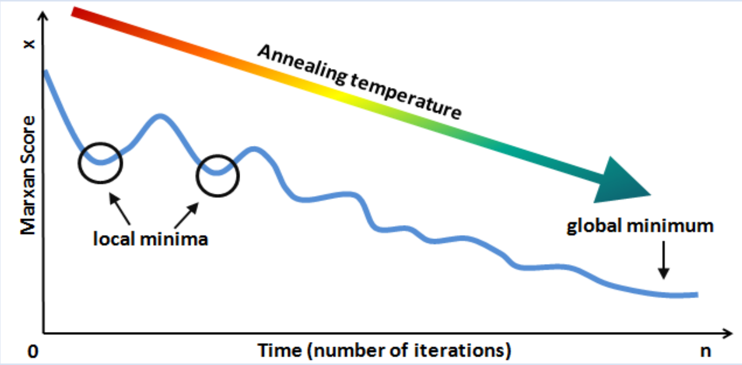


**Figure 8.** *Illustration of how the Marxan score (0 - x; blue line) could change over time (where time is measured as the number of iterations in the routine; 0 - n). The Marxan score decreases with every "good move", and increases with every "bad move". Early in the routine (when the annealing temperature is high), bad moves are accepted to prevent the algorithm from slipping into a local minimum, but fewer of these are allowed as the annealing temperature cools (coloured arrow). If the routine duration is long enough (user-defined number of iterations), then the solution should come close to achieving the global minimum. (Figure from Harris 2012).*

Given that Marxan is a minimum set algorithm, complementarity and efficiency are at its core. By the end of the routine, it selects a portfolio of sites such that user-defined biodiversity targets are met for all features at the lowest cost to competing activities and in the most efficient configuration. Calibrating parameters (see Section 4.7.1) allows for optimal clustering of selected sites without large increases in cost for minimal improvements in clustering.

### 3.3. Principles and essential characteristics of systematic biodiversity planning

The Technical Guidelines highlight three principles of systematic biodiversity planning that need to be reflected in a CBA Map: representation, persistence and target setting (SANBI 2017). The principle of representation is that a sufficient sample of all biodiversity is selected for inclusion in the priority areas; and the principle of persistence requires maintaining ecological processes so that biodiversity will persist over time, particularly in the face of rapid global change. Fundamental to realising both principles is setting and achieving quantitative biodiversity targets for mapped (surrogates of) biodiversity pattern and ecological processes.

For the National Coastal and Marine CBA Map Version 1.2, representation was achieved by using the National Map of Marine Ecosystem Types (Sink et al. 2019a) and a map of pelagic ecosystem types (Roberson et al. 2017; Sink et al. 2012) as the main surrogate for marine biodiversity, and setting quantitative biodiversity targets for all ecosystem types. This was supplemented by as many additional biodiversity datasets as were available at the time of analysis, with particular focus on species that are not well represented by ecosystem types (e.g., seabirds, turtles, seals, cetaceans, sharks and rays), and setting targets for these features as well. Achievement of the biodiversity targets was assessed as part of the methodology (see Section 4 below for more details, and Appendix 1). Further effort is needed to increase and consolidate species atlas data for inclusion in future versions of the National Coastal and Marine CBA Map to support and strengthen species representation, e.g., fish and invertebrates, especially for those species that are not well represented by ecosystem types. (See also Section 7.1.2).

Fully addressing the principle of persistence is a current limitation of the CBA Map, and is an area requiring more research and engagement with the scientific community. For coastal and marine biodiversity to persist into the future and for the long term, it is imperative to maintain pathways of dispersal, replenishment of local populations, and gene flow, and protect of the full spectrum of genetic diversity, all in the face of global change and increasing ocean-based economic activity. The systematic biodiversity plan thus needs to include biodiversity features and/or design criteria that can:

- accommodate species shifts in response to climate change through inclusion of ecological corridors, or a series of refugia (or 'stepping stones') that are appropriately sized and spaced;
- support persistence of metapopulations through larval dispersal and/or immigration and emigration between areas that are appropriately sized and spaced;
- secure critical portions of animal migration routes and/or home ranges, particularly those required for animals to complete their life-history stages (e.g., breeding or nesting grounds);
- provide resilience to the pressures on genetic diversity and continuity (e.g., overfishing);
- adequately represent ecological processes that support persistence of species (e.g., productivity).

For the most part, these elements can be addressed by having appropriate biodiversity targets for species (ideally based on population viability analyses, although these tend to be rarely available) and the areas critical for them to complete their lifecycles, including appropriate ecological corridors and processes that support species persistence.

Persistence is currently accounted for by including data on ecological processes and some biodiversity features that are important for species to complete their lifecycles. This includes having higher biodiversity targets for special ecosystem types (i.e., types that are more diverse, more sensitive and have a disproportionately high contribution to ecological processes compared to other ecosystem types), such as canyons, seamounts and reefs (see Section 4.6). Ecological processes were also accounted for by including the full extent of Ecologically or Biologically Significant Marine Areas (EBSAs), many of which were delineated to include sites of key ecological processes (e.g., sites of importance for key life-history stages and areas of high productivity; Box 3 in Section 4.4.6.5). Additionally, there are datasets representing productivity and importance for life-history stages, including spawning and nursery areas, migration routes, breeding and foraging areas. There is also a design element for climate velocity, the inclusion of which facilitates preferential selection of those portions of ecosystem types that are most stable to sea-surface temperature change.

The biggest gap (in both available data and our understanding) in including persistence in the CBA Map is in terms of seascape connectivity (see characteristic 3 below). Seascape connectivity is fundamentally different to landscape connectivity, and the approaches to defining and mapping ecological corridors on land are not necessarily applicable in the sea. In the ocean, it is more important to have a network of refugia that are appropriately sized and spaced than having contiguous corridors as is required on land. This aspect needs to be iteratively improved in future iterations of the CBA Map (see Section 7.1.3).

In implementing the three principles above, there are five essential characteristics of systematic biodiversity planning (listed below) that are required in a CBA Map (SANBI 2017).

1. **Complementarity and spatial efficiency** relate to selecting sites with complementary assemblages of biodiversity to represent all species in the most spatially efficient configuration. This was addressed by using Marxan to select the priority sites. As described above, Marxan accounts for these attributes by being a minimum-set algorithm and selecting the most efficient portfolio of planning units that meet targets for biodiversity features. It achieves this by selecting complementary sites rather than all sites of highest diversity (i.e., 'hotspots' that, collectively, may not be representative of all biodiversity in the planning domain).
2. **Conflict avoidance** relates to meeting biodiversity targets in areas that avoid as much competing use for those same areas as possible. This was addressed by including a 'cost layer' in the Marxan analysis, with two of the four components comprising the cost metric explicitly aimed at reducing conflict with other sectors. Marxan seeks to meet targets for the lowest cost, i.e., with the least conflict to other uses and users of the marine environment, as far as possible. In some cases, avoiding conflict may not be possible, e.g., for rare or Critically Endangered features that are in an area of high importance for another sector. To further minimize cost, we selected input parameters that result in slightly less spatial efficiency in favour of stronger conflict avoidance (see Section 4.7.1, Figure 178).
3. **Connectivity** relates to the connectedness of the selected sites in a way that makes provision for species to move along geographic, climatic, productivity and oceanographic gradients, for metapopulations to be maintained, and migratory (and wide-ranging) species to complete their lifecycles. It is addressed by focussing on including networks of sites that can serve as refugia for species. As a first step, the existing MPA and EBSA networks were included as connected networks of priority areas. It is recognised that the connectivity among these areas will need further testing, for example, in terms of species' dispersal distances (see Box 2 below). For the coast, however, landscape-scale ecological corridors are appropriate and essential. Therefore, connectivity is also addressed by including the existing land-based biodiversity priority areas (see Section 4.4.7.1), and edge-matching the coastal marine priority areas to ensure contiguous, land-

sea, catchment-to-coast connectivity.[2] This also has scope to be improved through cross-realm planning (see Section 7.2).

4. A spatial biodiversity plan is required to be **data driven**. The biodiversity input layers are all based on the best-available data and have quantitative biodiversity targets, both of which follow the requirements and recommendations in the Technical Guidelines. The cost layer (see Section 4.5) was compiled using data largely provided by the respective government departments and industries, to best represent the interests of other sectors. It also included data from the NBA 2018. The input parameter calibrations and spatial prioritisation methods all follow the Marxan good practice guidelines (Ardron et al. 2010; Game and Grantham 2008), and the biodiversity priority areas were selected by the Marxan algorithm. Therefore, the selection of priority areas is considered to be objective, and data driven.
5. The prioritisation is made **explicit and repeatable** by detailing all steps taken during the planning process in this technical report. There is also deliberate minimization of manual design steps, using the outputs from the spatial prioritisation analysis almost exclusively, with manual design only for the final alignment in the transboundary EBSAs.

[2] There are intended updates of the national map of Freshwater Ecosystem Priority Areas (FEPAs) and a planned project to compile a national Estuary CBA Map. Together with this Coastal and Marine CBA Map, the intention is to deliberately and explicitly edge-match priorities from freshwater catchments, through estuaries to offshore river-influenced marine ecosystem types, both up- and downstream, to enhance land-sea connectivity in the respective plans.

## Box 2: Including connectivity in systematic biodiversity planning: brief overview of the literature

Connectivity is highlighted here because it underpins one of the requirements of a CBA Map: to include ecological corridors that facilitate metapopulation connectivity and species' range shifts as part of achieving persistence of biodiversity. However, connectivity in marine planning is different to that in terrestrial planning because the oceans are fundamentally more connected than the land because of the water medium. This has key implications for designing the required large-scale ecological corridors, as per the Technical Guidelines (SANBI 2017). After reviewing the scientific literature and discussing this issue with the broader biodiversity planning community in South Africa, it was decided that having a well-designed network of sites in the marine realm that supports metapopulation connectivity and could facilitate species' range shifts (e.g., be suitably sized and spaced) is more appropriate than including ecological corridors in the same way that they are delineated and included in terrestrial plans. As a first step, in addition to the existing MPA network, connectivity is addressed in this plan by including the entire EBSA network, recognising that this is an aspect of the CBA Map that needs testing and refinement (see also Annexure 1).

Including connectivity in biodiversity plans for the marine environment is an area of active research, globally. As noted above, the oceans are fundamentally more connected than is the terrestrial environment. Furthermore, the concept of designing corridors for maintaining ecological processes (e.g., animal migration routes, climate-change-adaptation corridors, connections between sites of importance for life-history stages) is also different because there are many activities that can block species movement on land, whereas in the sea, numerous activities may occur at the same place (e.g., shipping, longline fishing), and still be permeable enough to allow connectivity through the rest of the water column. It has thus been argued that accounting for connectivity in marine planning relates more to the sizing and spacing of protected areas in connected networks than including corridors *per se.*

Notwithstanding, there are several tools by which connectivity can be included in systematic biodiversity plans. Examples include sampling by electronic tracking (telemetry), capture-mark-recapture, *in situ* observations (e.g., visual surveys), stable isotope ratios, population genetics and passive acoustic monitoring (Dunn et al. 2019). However, these methods tend to be very data-intensive, and consequently are generally applied in marine plans covering a small planning domain or for specific taxa, e.g., for migratory or nomadic birds. For example, (1) to include dynamic distributions of species requires sampling over the animals' full home range over multiple seasons and years (Runge et al. 2015). By modelling the distribution at multiple timesteps, critical areas in the home range can be identified and prioritized (Runge et al. 2015; Runge et al. 2016). (2) From tracking data of migratory species, connectivity matrices can be compiled and summed to get a surface of relative importance for connectivity across the seascape for the migration (Beger et al. 2015). Currently, there are global efforts to synthesize information on animal movement to inform international marine policy that guides conservation, e.g., the MiCO system (Dunn et al. 2019; https://mico.eco). Another option (3) is to include spawning areas as biodiversity features, with a buffer representing "fish spawning area catchments" and setting an appropriate biodiversity target for those buffers (Beger et al. 2015). This can be supplemented with larval dispersal models that account for pelagic larval duration, survival rates and behaviour (Beger et al. 2015) to determine how near to each other sites need to be for connectivity to be maintained.

Most recent is the development of a new application called Marxan Connect (Daigle et al. 2020). It allows inclusion of different types of connectivity calculated from demographic data (e.g., dispersal models, tracking data) and/or landscape data (e.g., isolation by resistance). Options like this and other tools, such as using circuit theory to incorporate connectivity in spatial planning (Dickson et al. 2019), provide opportunities to strengthen inclusion of ecological connectivity in the National Coastal and Marine CBA Map, depending on data availability as required by the different tools. These options will be explored in future versions of the CBA Map.

# 4. Methods

This section explains the methods used to develop the National Coastal and Marine CBA Map Version 1.2, including descriptions of the planning goal and objectives, delineation of the planning domain and planning units; input layers and biodiversity targets; and technical methods and parameter calibrations.

## 4.1. Goal and objectives

As specified in Section 1.1, the overall goal is to safeguard a sufficient, representative sample of coastal and marine biodiversity that can persist into the future, in support of sustainable economic development. The key objectives are to:

- Provide a robust, systematic spatial biodiversity prioritisation that follows international best practice in systematic conservation planning
- Adequately represent biodiversity patterns and ecological processes in a design that is spatially efficient and well connected
- Avoid spatial overlap (conflict) with other sectors where possible, but still meet targets for all biodiversity features
- Provide the basis for the biodiversity sector's input to the emerging MSP process
- Provide a robust starting point to support other area-based processes, such as MPA expansion

## 4.2. Planning domain

The planning domain for the National Coastal and Marine CBA Map is the mainland marine territory (i.e., excluding PEI; Figure 9; see also Section 2.1 and Figure 5). In addition, municipalities that are within 10 km of the shore were selected to represent an administrative inland coastal extent. Existing biodiversity priority areas within these municipalities were extracted from the provincial biodiversity plans for the four coastal provinces (Figure 5). Protected areas and CBAs adjacent to the shore were included in the systematic biodiversity plan to ensure proper edge-matching across the land-sea interface as a design element (see Section 4.4.7.1), although this needs to be refined (see Section 7.2).

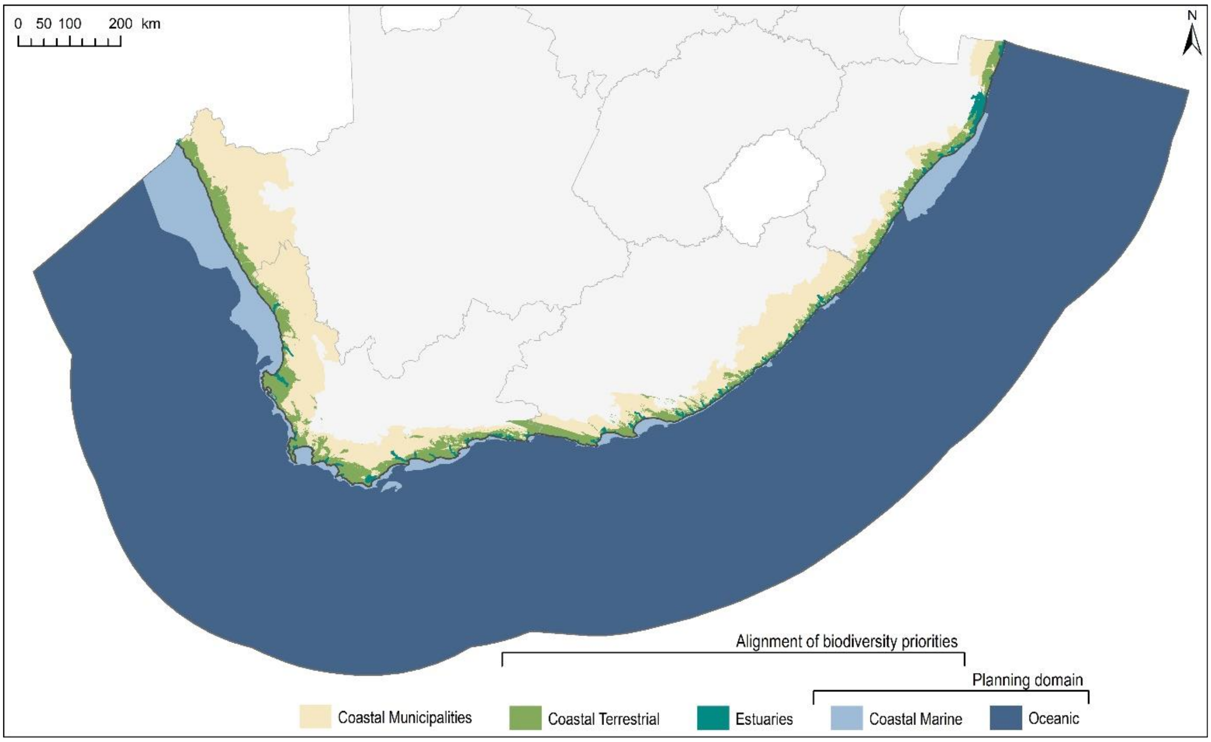


**Figure 9.** *The planning domain is the marine territory, including the coastal marine and oceanic components (blue). New spatial priorities were identified in the marine territory only, but were aligned with existing land-based biodiversity priority areas in the coastal zone. (Data source: Harris et al. 2019a; Sink et al. 2019a; STATS-SA).*

## 4.3. Planning units

Previous spatial prioritisations for the marine realm used a 5' grid (e.g., Majiedt et al. 2013; Sink et al. 2011). Given improvements in the input data, especially fine-scale coastal ecosystem types, a 1' grid (approximately 1.5 km x 1.8 km blocks) was used that extended 5 km inland (for aligning with terrestrial biodiversity priorities) and 5 km into Namibian waters (to align with their marine biodiversity spatial priorities). There is already transboundary protection between South Africa and Mozambique, including the iSimangaliso MPA on the South African side, and so further alignment there was not considered necessary. Note that planning units outside of South Africa's marine territory (i.e., on land and in Namibia) were not included in the map of marine biodiversity priorities; they were used only as a design element to align priorities. The marine priorities were confined to the marine territory (i.e., slivers of MPAs that are declared to the high-water mark but extend onto land because of an inaccurate coastline delineation at the time of proclamation, were removed), and the land-based priorities were trimmed to the dune base to create a seamless CBA Map (see Appendix 3). This coastal integration will be improved in future iterations (see Section 7.2). As a step towards refining the land-sea integration of priority areas, the 1' grid was intersected with the shore zone from the 2018 Coast Ecosystem Map (Harris et al. 2019a) to create finer scale planning units for the shore. This also allowed more accurate attribution of data to the shore, and to the areas either side of it (see also Section 7.2). Altogether, there are 387 843 planning units in the National Coastal and Marine CBA Map Version 1.2.

## 4.4. Biodiversity input layers

The National Coastal and Marine CBA Map is built using a series of input layers in two classes: biodiversity features and design elements. The difference between these two data classes is that the biodiversity feature targets are required to be met in MPAs and CBAs, whereas the targets for design elements do not need to be met in these areas. The purpose of the design elements is rather to preferentially select sites in particular places where there is otherwise equal choice, e.g., prefer selection in areas of good ecological condition and/or that have the most stable velocity of climate change. Version 1.2 of the National Coastal and Marine CBA Map includes 976 biodiversity features and design elements. The biodiversity features (n=437) include: ecosystem types (n=190 features); species such as turtles, seabirds, dolphins, whales, seals, sharks and rays (n=188 features); unique or special habitats or features (n = 15); ecological processes (n=18); ecological infrastructure (n=2); and existing priority areas (n=24). The design elements (n=539) include: edge-matching and aligning priority areas across land and sea, shared international boundaries and with existing initiatives (n=52); culturally important areas (n=6); ecological condition (n=332); and climate-change adaptation (n=149). The list of features included in the spatial biodiversity plan has been growing rapidly (Beta 1=541; Beta 2=615; Version 1=886; Version 1.1=911, Version 1.2=976; Appendix 5), and the number of datasets in each of these categories that are used in the spatial biodiversity plan is expected to increase in future versions. Appendix 2 contains lists of all the features that are intended to be included in future iterations of the National Coastal and Marine CBA Map. The biodiversity input layers are each presented and described below, with bullets at the end of each subsection summarising how the data were coded to the planning units and used in the analysis.

### 4.4.1. Ecosystem types

#### 4.4.1.1. Coastal and marine ecosystem types

Ecosystem types (Figure 10) are one of the primary surrogates of biodiversity in systematic biodiversity plans (Botts et al. 2019). Updated maps of ecosystem types were created for all realms during the NBA 2018, allowing seamless integration of the maps across the land-sea interface for the first time (see also Section 2.1). This map thus represents the latest information in ecosystem classification for the entire country. All ecosystem types that are within the planning domain are included in the systematic biodiversity plan. This includes 150 marine ecosystem types and the shores of 24 estuarine ecosystem types[3] (including three micro-estuary types). Full details on coastal and marine ecosystem classification are available in Harris et al. (2019a) and Sink et al. (2019a); and for estuarine classification, in van Niekerk et al. (2020). See also the South African National Ecosystem Classification System (Dayaram et al. 2021).

- Ecosystem types were coded to the planning units on the basis of area of each ecosystem type in each planning unit.

[3] There are 25 estuarine ecosystem types; however, Langebaan is an Estuarine Lagoon (Van Niekerk et al. 2020) and does not have an estuarine shore component to the estuarine functional zone, and therefore, this ecosystem type does not fall within the planning domain. This is why there are 24 (of 25) estuarine ecosystem types represented in the systematic conservation plan.

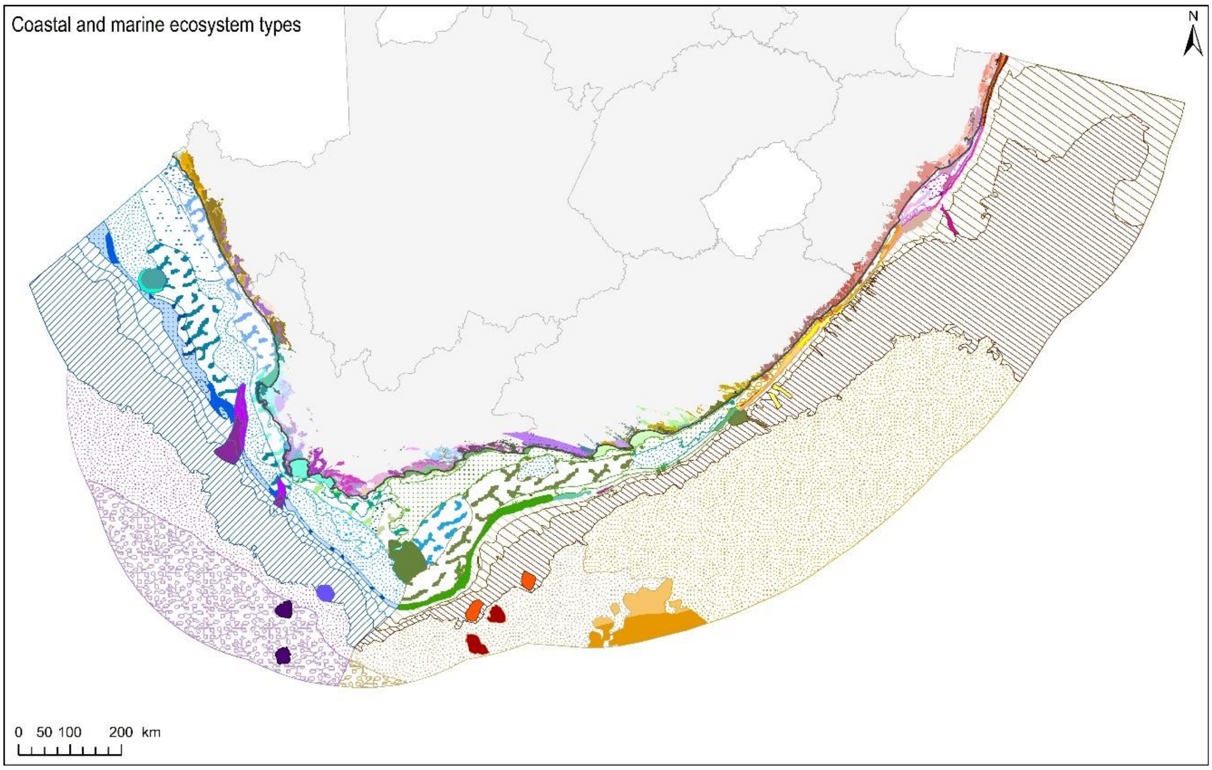


**Figure 10.** *National map of coastal and marine ecosystem types. (Data source: Harris et al. 2019a; Harris et al. 2019b; Sink et al. 2019a). Note that only the marine ecosystem types and shores of estuaries were included in the current analysis (see also Sections 7.2 and 7.3 for plans to integrate estuaries in the cross-realm coastal integration). See the NBA 2018 Coast and Marine reports for the legend.*

#### 4.4.1.2. Pelagic ecosystem types

There is debate in marine ecosystem classification whether to have separate maps for benthic and pelagic systems or to have a single integrated map. In the NBA 2011, separate maps were produced (Sink et al. 2012), but in 2018, a single map was produced in response to feedback from scientists and managers (Sink et al. 2019a), noting that this is still a point of discussion within the Marine Ecosystem Committee and with the IUCN in terms of the Global Ecosystem Typology (Keith et al. 2020). In order to deliberately represent pelagic ecosystem types in the National Coastal and Marine CBA Map, the pelagic bioregionalisation by Roberson et al. (2017) was also incorporated. The bioregionalisation identified 16 different pelagic ecosystem types in South Africa based on sea-surface temperature, chlorophyll-*a*, net primary productivity, mean sea-level anomalies, seabed slope and depth (Figure 11).

- Ecosystem types were coded to the planning units on the basis of area of each ecosystem type in each planning unit.

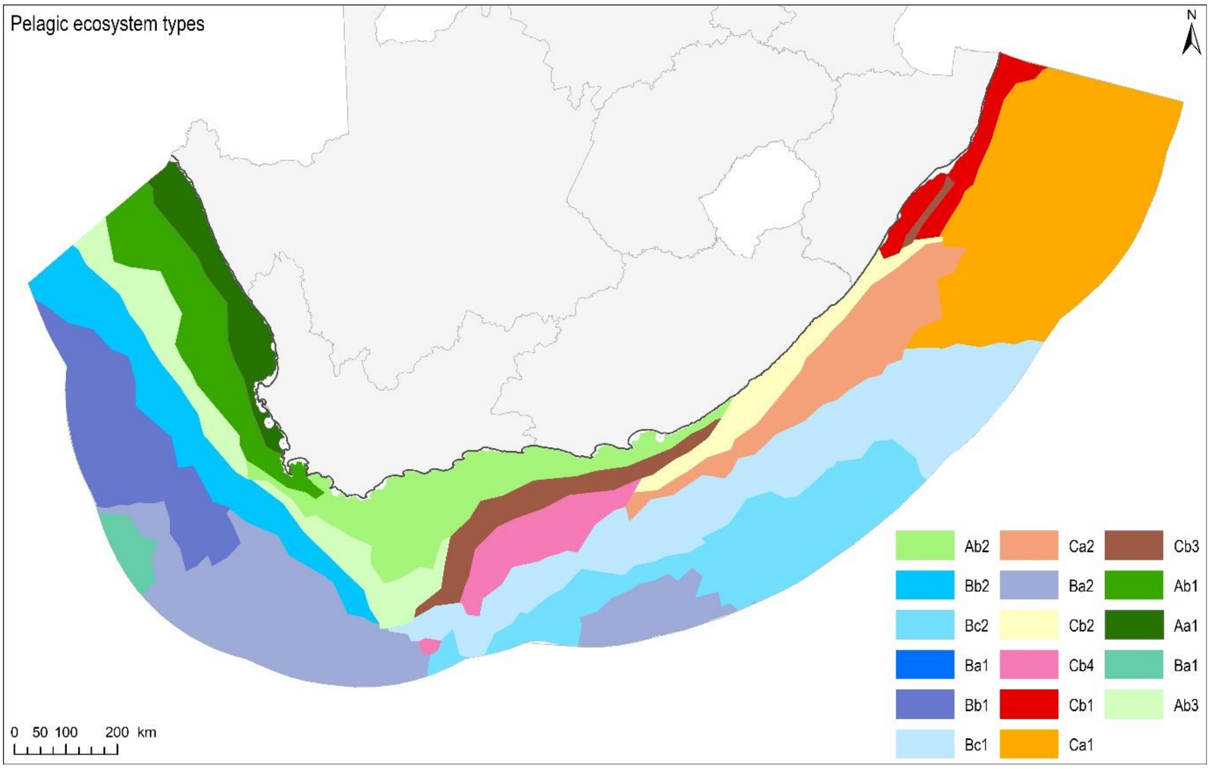


**Figure 11.** *National map of 16 pelagic ecosystem types. (Data source: Roberson et al. 2017; Sink et al. 2012).*

### 4.4.2. Species

#### 4.4.2.1. Turtles

Sea turtles are conservation-dependent reptiles that have a complex life history. Adult male and female turtles migrate from their foraging grounds to their natal beaches (from which they hatched), where they mate offshore. Females haul out onto the nesting beaches after sunset, dig a nest above the high-water mark, deposit a clutch of eggs, cover up the nest, and return to the sea. Females deposit several of these clutches within a nesting season at regular intervals of about two weeks, depending on the species (Nel et al. 2013). During the internesting periods (time between successive nests), females remain close to the nesting beaches (Harris et al. 2015). After breeding, adult turtles leave the rookery, migrating back to their foraging grounds, which can be several thousand kilometres away (Harris et al. 2018; Luschi et al. 2006; Luschi et al. 2003). Approximately two months later, the eggs hatch and the hatchlings crawl to the sea and disperse in the ocean currents (Le Gouvello et al. 2020). Very little is known about the oceanic juvenile life-history stages, called the "lost years", because they are so difficult to study (Mansfield et al. 2021) and turtles at this life-history stage have a high mortality rate. Young turtles then return to neritic habitats, where they live and forage on reefs and seagrass beds. Leatherback turtles are the exception: they remain as pelagic drifters throughout their lives. Once sexually mature, the turtles will undergo the migration back to their natal nesting beaches to breed. Although turtle nesting is an annual phenomenon, individual turtles do not breed every year, but rather every two to three years (Nel et al. 2013). Although most turtles have a global distribution, each population is effectively separate from the others (known as regional management units) because of the clear link to their natal beaches (Wallace et al. 2010).

Two turtle species nest in South Africa, in iSimangaliso Wetland Park: Loggerheads (regionally Near Threatened), and Leatherbacks (regionally Critically Endangered). Reefs and seagrass beds in South

Africa also serve as developmental grounds for Green Turtles (Endangered) and Hawksbills (Critically Endangered). Olive Ridleys (Vulnerable) are also sometimes present, but these are considered to be vagrants. South Africa has a long history of turtle conservation, with the annual monitoring programme first starting in 1963 (McAllister et al. 1965). The programme employs members of the local community to participate in data collection and turtle tagging. Turtles also underpin several ecotourism ventures, including some that employ local community members as turtle guides, as well as other turtle tours that are offered by some of the lodges in iSimangaliso.

Turtle information was included in three different categories: nesting grounds (Figure 12) (digitized from information drawing from Harris et al. 2015; King 2019; Nel et al. 2013); internesting areas (Figure 13, Figure 14) (Harris et al. 2015); and migration routes for Loggerheads (Figure 15) and Leatherbacks (Figure 16) (Harris et al. 2018). Planned updates for turtle data include adding in the latest tracking information to include data on Green Turtles, Hawksbills, key turtle foraging areas, and the juvenile life-history stages. There have also been several additional Leatherbacks tracked since the migration routes were first compiled by Harris et al. (2018), thus an update of the Leatherback migration routes from this new information is required for inclusion in future updates of the National Coastal and Marine CBA Map.

- Nesting grounds were coded to the planning units based on area (i.e., the 'amount' value for this feature is the area within each planning unit that comprises turtle nesting grounds).
- Internesting and migration routes were coded to the planning units based on a zonal statistic of utilization distribution (intensity of use) per planning unit.

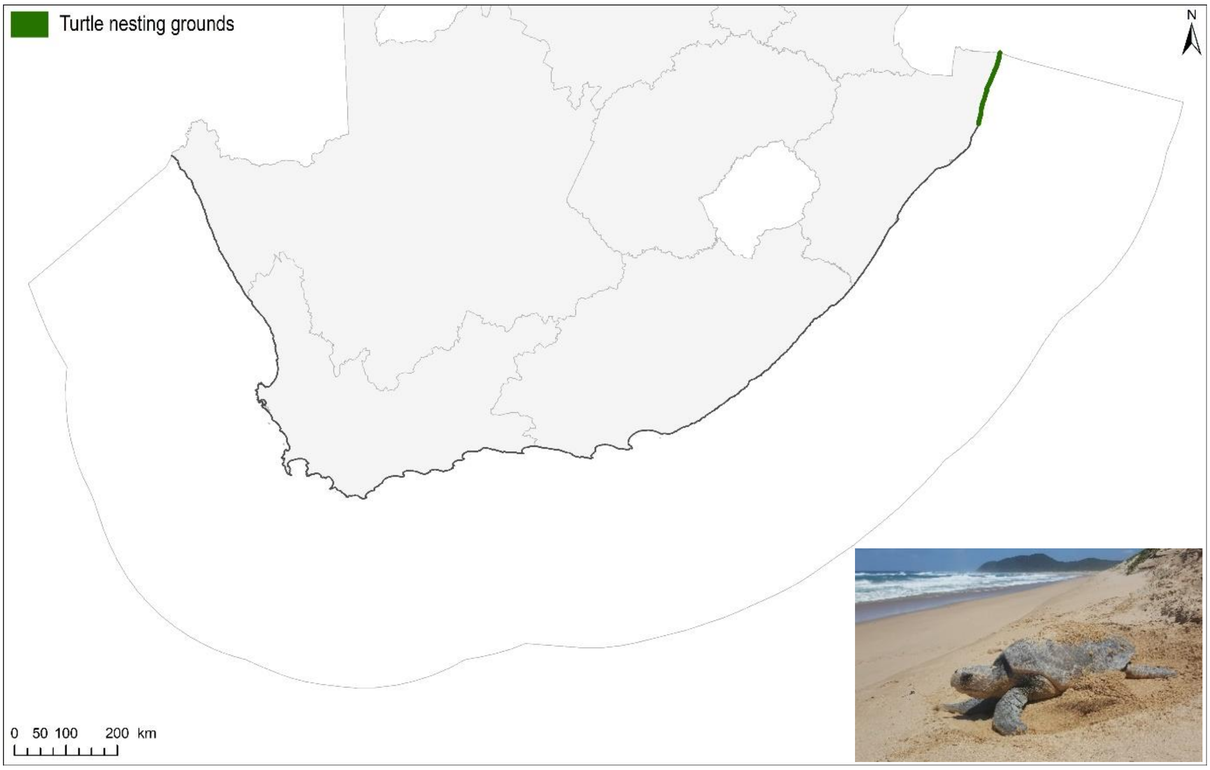


**Figure 12.** *Nesting grounds for Loggerhead and Leatherback turtles. Note that the symbology has been enhanced so that the data are visible in the map. Insert image credit: © Linda Harris. (Data source: Harris et al. 2019a; Harris et al. 2015; King 2019; Nel et al. 2013).*

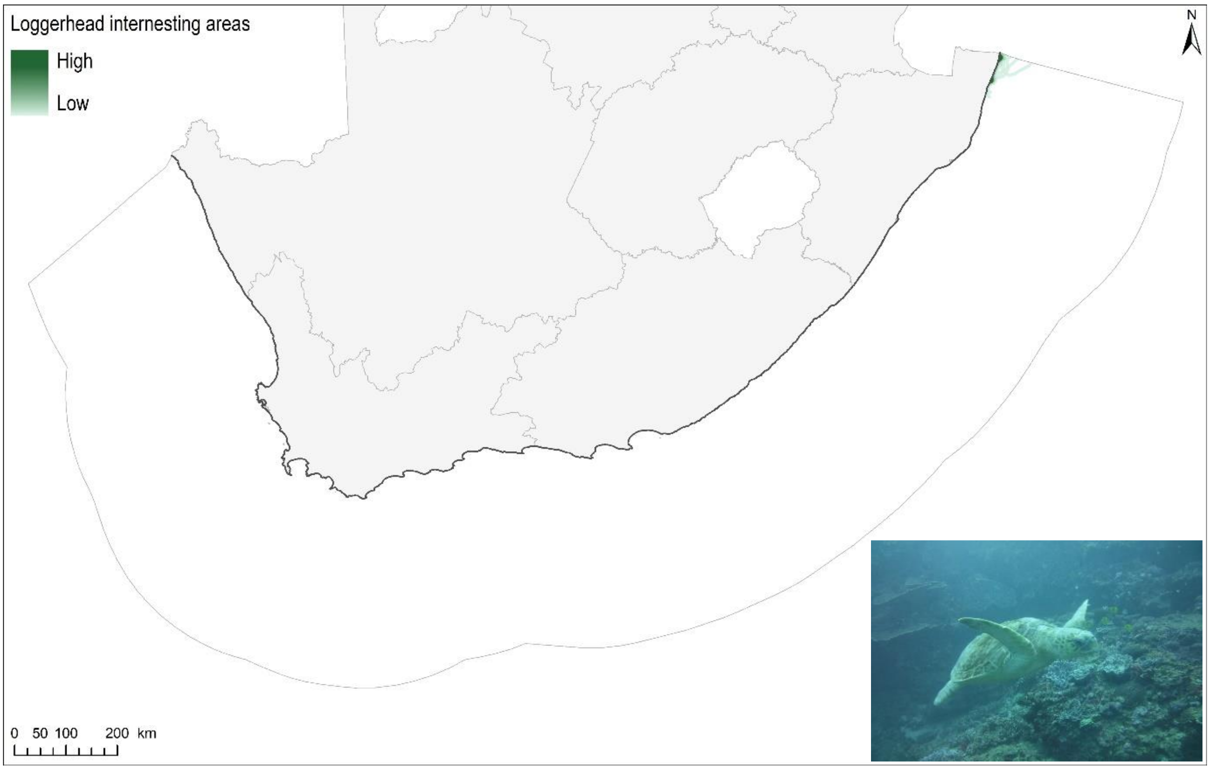


**Figure 13.** *Internesting areas (areas frequented between successive nesting events within a season) for Loggerhead turtles. Higher intensity of use is indicated by darker green shades. Insert image credit: © Wildlife and Ecological Investments. (Data source: Harris et al. 2015).*

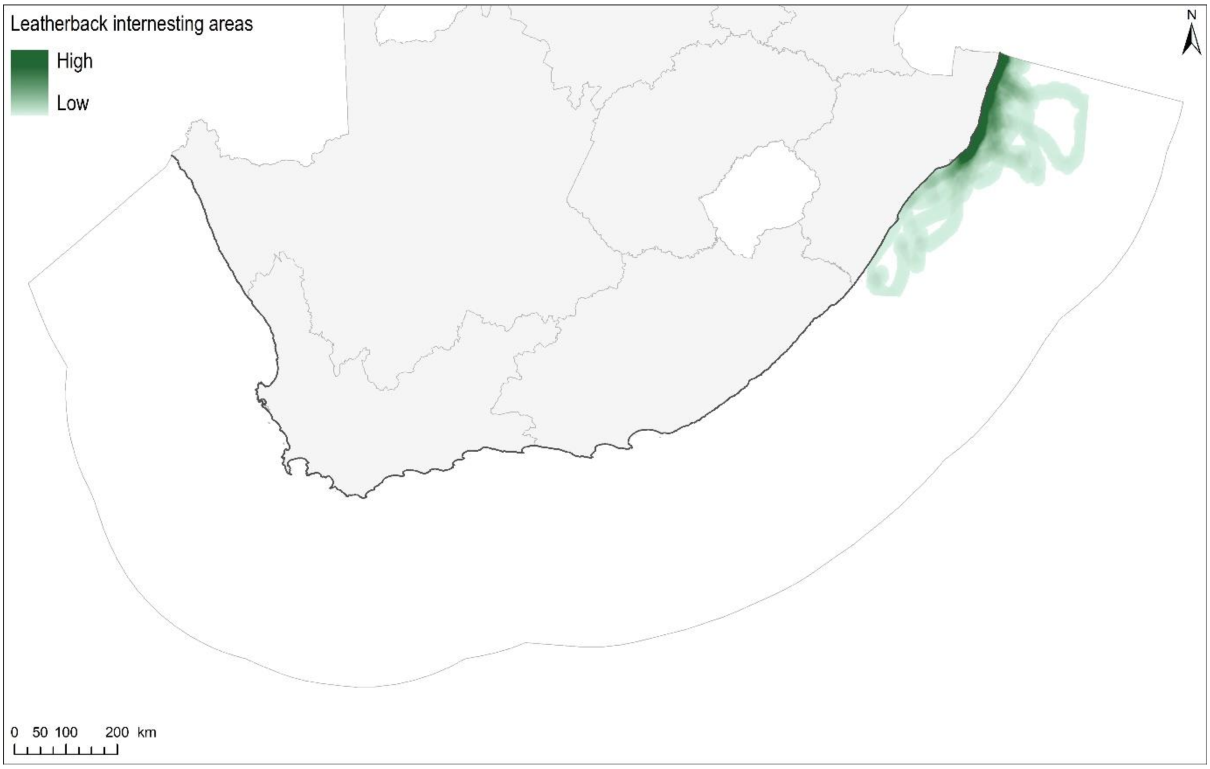


**Figure 14.** *Internesting areas (areas frequented between successive nesting events within a season) for Leatherback turtles. Higher intensity of use is indicated by darker green shades. (Data source: Harris et al. 2015).*

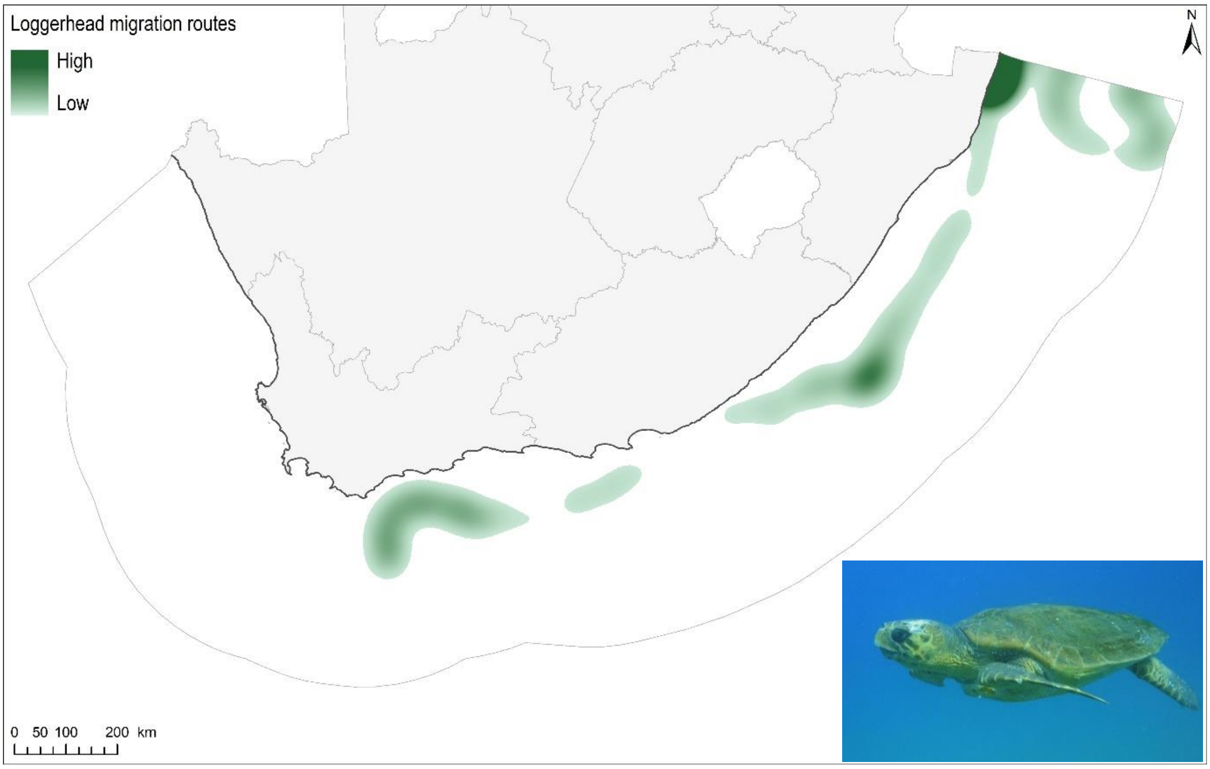


**Figure 15.** *Post-nesting migration routes by Loggerhead turtles to their foraging grounds. Higher intensity of use is indicated by darker green shades. Insert image credit: © Rowan Watt-Pringle. (Data source: Harris et al. 2018).*

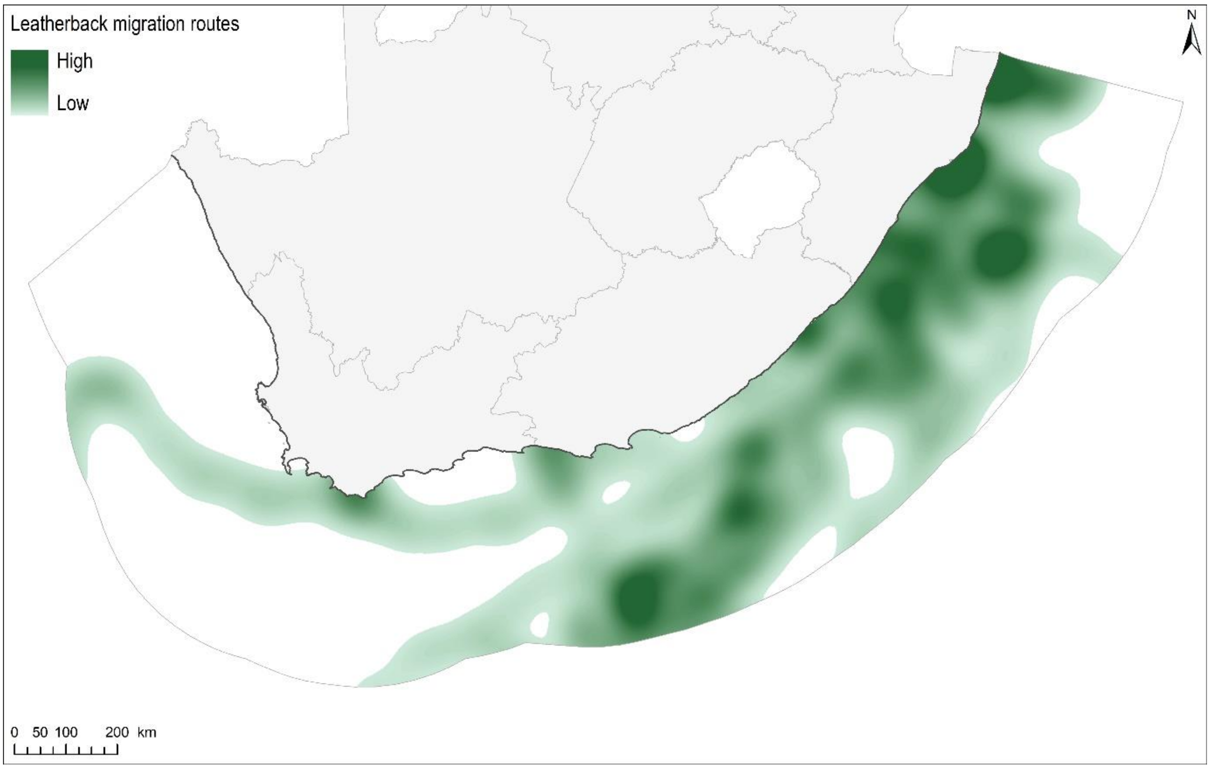


**Figure 16.** *Post-nesting migration routes by Leatherback turtles to their foraging grounds. Higher intensity of use is indicated by darker green shades. (Data source: Harris et al. 2018).*

#### 4.4.2.2. Seabirds

Seabirds are the most threatened group of birds, and their conservation status is declining more rapidly than that of the other bird groups (Croxall et al. 2012; Skowno et al. 2019a). Globally, 28% of the 364 seabirds species are threatened and a further 10% are Near Threatened, with key pressures at sea including fisheries and pollution, and land-based pressures including habitat destruction, human disturbance and alien invasive species (Croxall et al. 2012). The South African mainland and Prince Edward Island (PEI) marine territories provide breeding and foraging grounds to many species of seabirds. The global trends are reflected here too: many seabird species are facing declines in abundance and conservation status.

Around the mainland, there are four Endangered locally breeding species: African Penguins, Bank Cormorants, Cape Cormorants, and Cape Gannets that breed almost exclusively on islands, and forage within the EEZ, mostly within close proximity to their colonies. Marked population declines have been recorded for these species, e.g., in the past 3 decades there has been a 65% decline in the population abundance of African Penguins (Sherley et al. 2020) and almost a 50% decline in the population abundance of Cape Cormorants (Crawford et al. 2016) with a key driver being attributed to reductions in prey availability (Crawford et al. 2016; Crawford et al. 2019; Grémillet et al. 2016). Several seabird species that breed in the Southern Ocean, including PEI, also forage within South Africa's mainland marine territory. Included among these species are Endangered Indian Yellow-nosed Albatrosses, Endangered Atlantic Yellow-nosed Albatrosses, Vulnerable Wandering Albatrosses, and Least Concern Northern Giant Petrels.

Data representing seabirds include locations of colonies of threatened seabirds (Figure 17) (Crawford et al. 2016; Kemper et al. 2007; Sherley et al. 2017; Sherley et al. 2020; Sherley et al. 2019), and generalised foraging areas of: African Penguins (Figure 18), Bank Cormorants (Figure 20), Cape Cormorants (Figure 21), and Cape Gannets (Figure 23). For these foraging areas, the same buffers around each species' colonies were used as in Majiedt et al. (2013), updated for the new maps of seabird colonies that include locations that were missing in Majiedt et al. (2013), except for Cape Gannets, for which the data did not change. These buffers are: 20 km for African Penguins; 10 km for Bank Cormorants; and 40 km for Cape Cormorants. In addition, maps of seabird distributions from tracking data were prepared by BirdLife South Africa for specific colonies and different life-history stages (e.g., breeding, incubation, pre-moult, etc). These distributions were for three of the four Endangered species listed above (Figure 18, Figure 21, Figure 23), as well as three albatross species (Figure 25, Figure 26, Figure 27) and one petrel species (Figure 28). Data were provided in two formats: aggregated core home ranges (based on the 50% utilization distribution of each individual); and core-use areas (draft Marine Important Bird Areas (MIBAs), derived from the aggregated core home ranges). For full details on preparation of these data layers, see BirdLife South Africa (2021); Handley et al. (2020). Note that the aggregated core home ranges were available only for African Penguins (Figure 19), Cape Cormorants (Figure 22) and Cape Gannets (Figure 24).

- Colonies were coded to the planning units based on area (i.e., the 'amount' value for this feature is the area within each planning unit that comprises seabird colonies).
- Generalised foraging areas were coded to the planning units based on area, with a separate feature for each colony or colony cluster where the shapes were contiguous. This was updated from Version 1.1, removing the foraging areas around Bird Island in Lambert's Bay for African Penguins and Bank Cormorants because these species no longer occur there (Stephen Kirkman and Bruce Dyer, pers. comm).

- Seabird core-use areas (draft MIBAs) from BirdLife South Africa were coded to the planning units based on area, with a separate feature for each core-use area, and one feature for all core-use areas per species. The data that were included in Version 1.1 were updated for Version 1.2.
- Aggregated core home ranges (50% UD) were reclassified into 25 quantiles (or the maximum number of quantiles allowed if less than 25) and coded to the planning units using an average zonal statistic value, where zones were planning units. The data that were included in Version 1.1 were updated for Version 1.2.

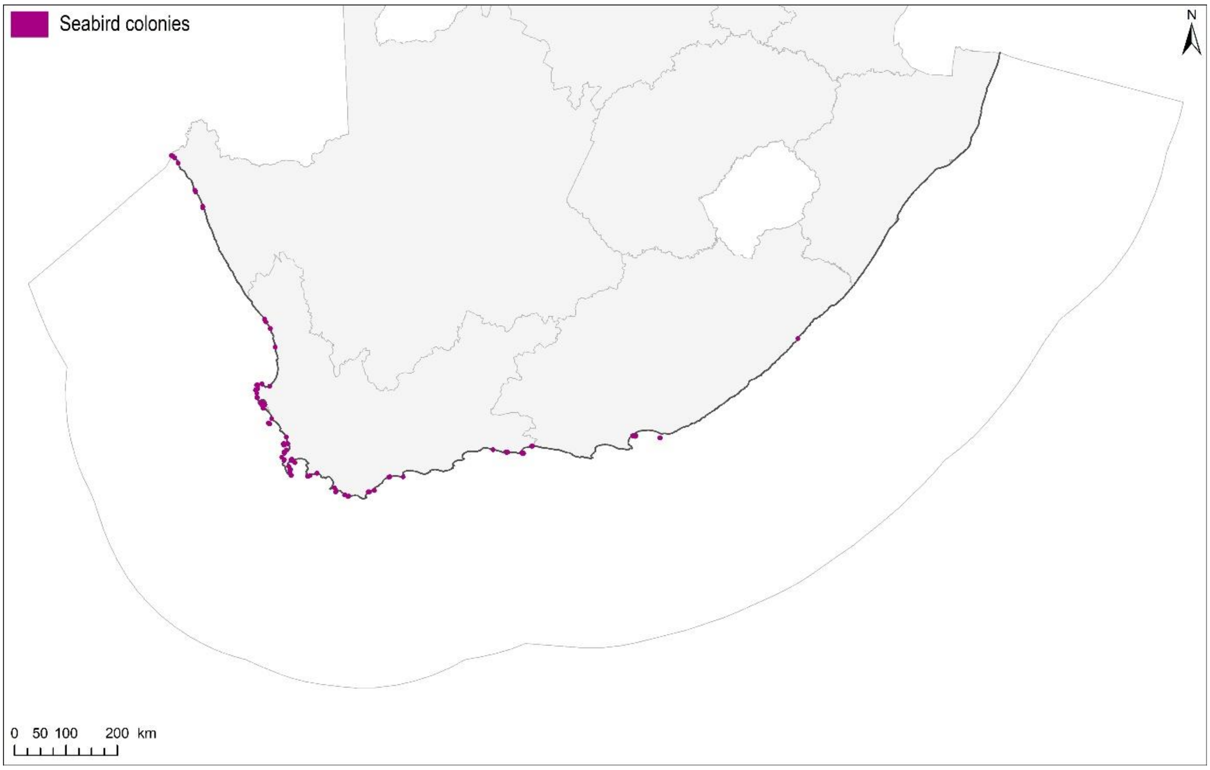


**Figure 17.** *Colonies of four species of Endangered seabirds in South Africa. Note that the symbology has been enhanced so that the features are visible at this scale. (Data source: DFFE Unpublished data; Crawford et al. 2016; Sherley et al. 2017; Sherley et al. 2020; Sherley et al. 2019; Cape Nature (Unpublished data)).*

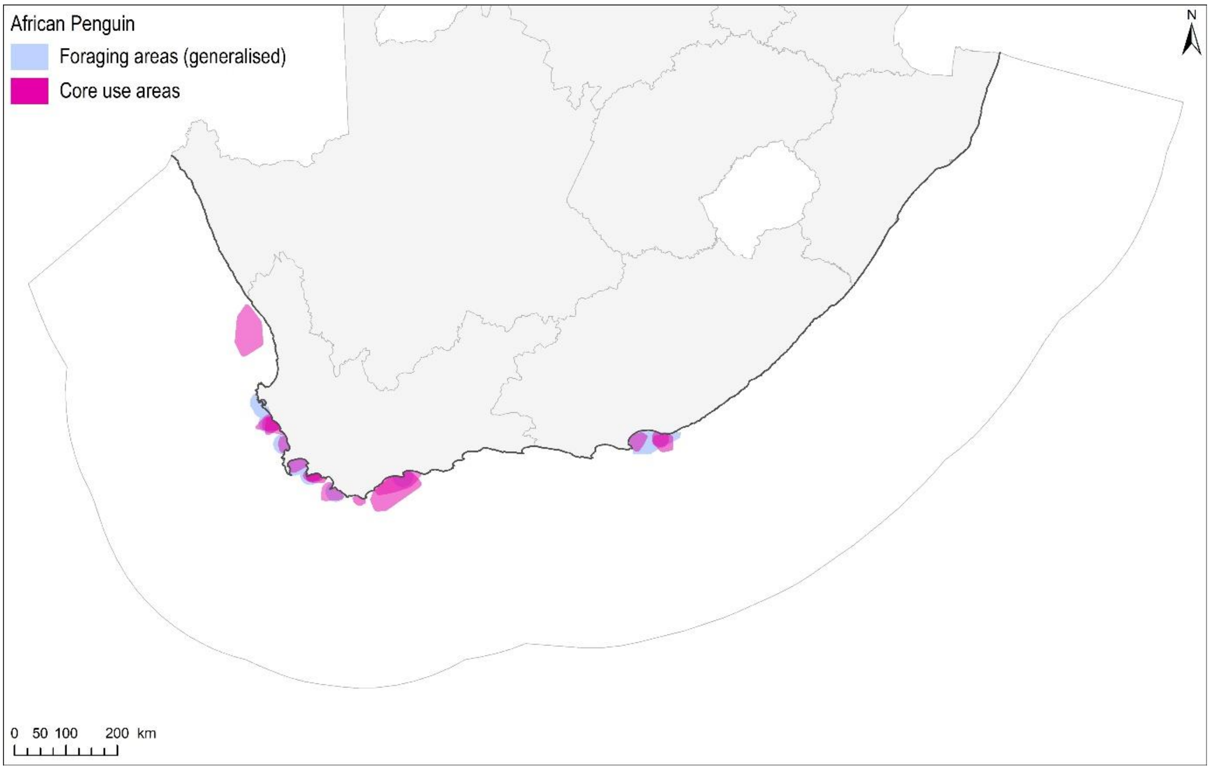


**Figure 18**. *Foraging areas of African Penguins. Light blue areas are the generalised foraging areas; pink shaded areas are the core-use areas (draft MIBAs) mapped by BirdLife South Africa. (Data source: BirdLife South Africa 2021; and data adapted from Majiedt et al. 2013)*.

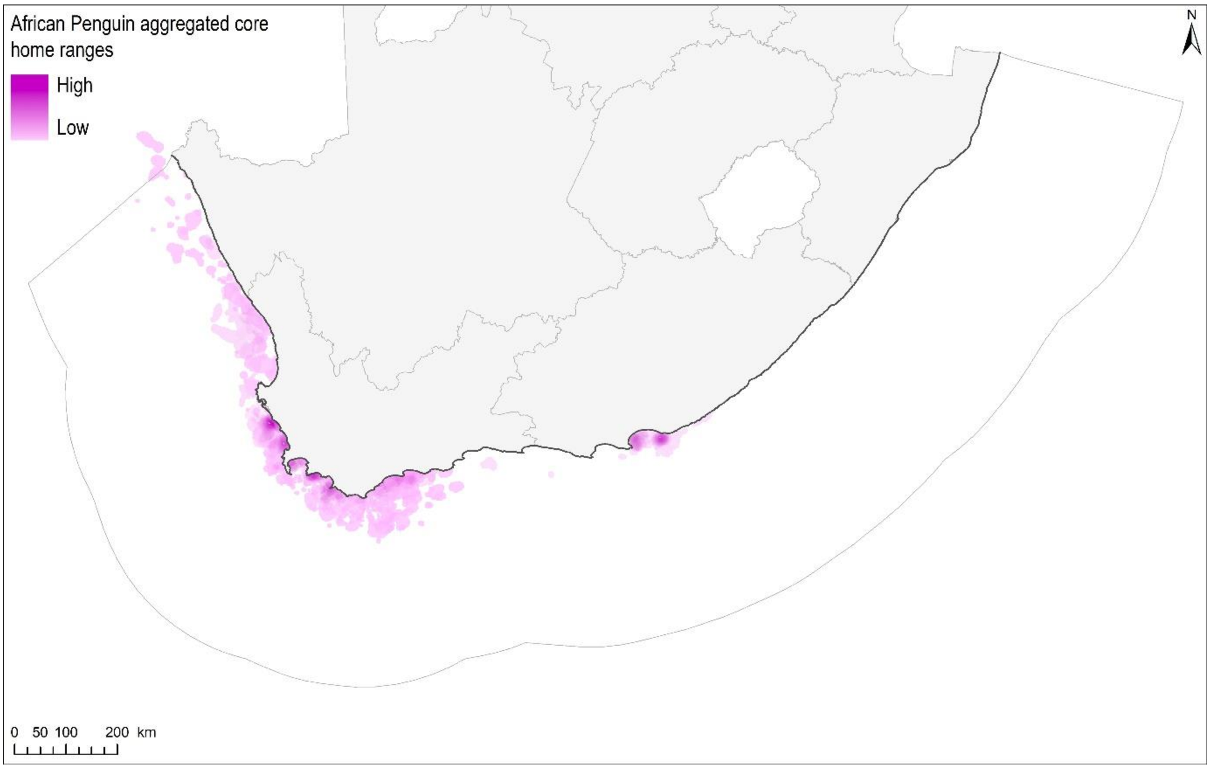


**Figure 19.** *Aggregated core home ranges of African Penguins for different colonies and life-history stages. (Data source: BirdLife South Africa 2021)*.

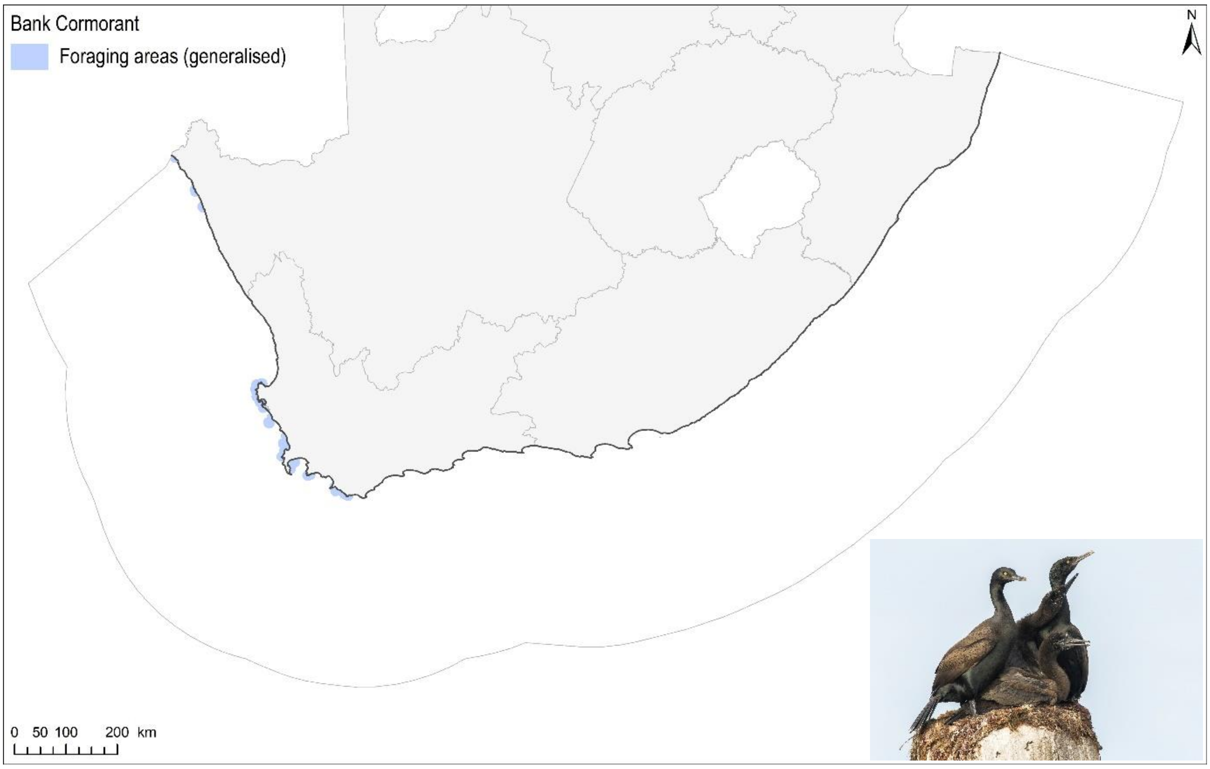


**Figure 20.** *Generalised foraging areas of Bank Cormorants. Insert image credit: © Peter Chadwick. (Data source: adapted from Majiedt et al. 2013).*

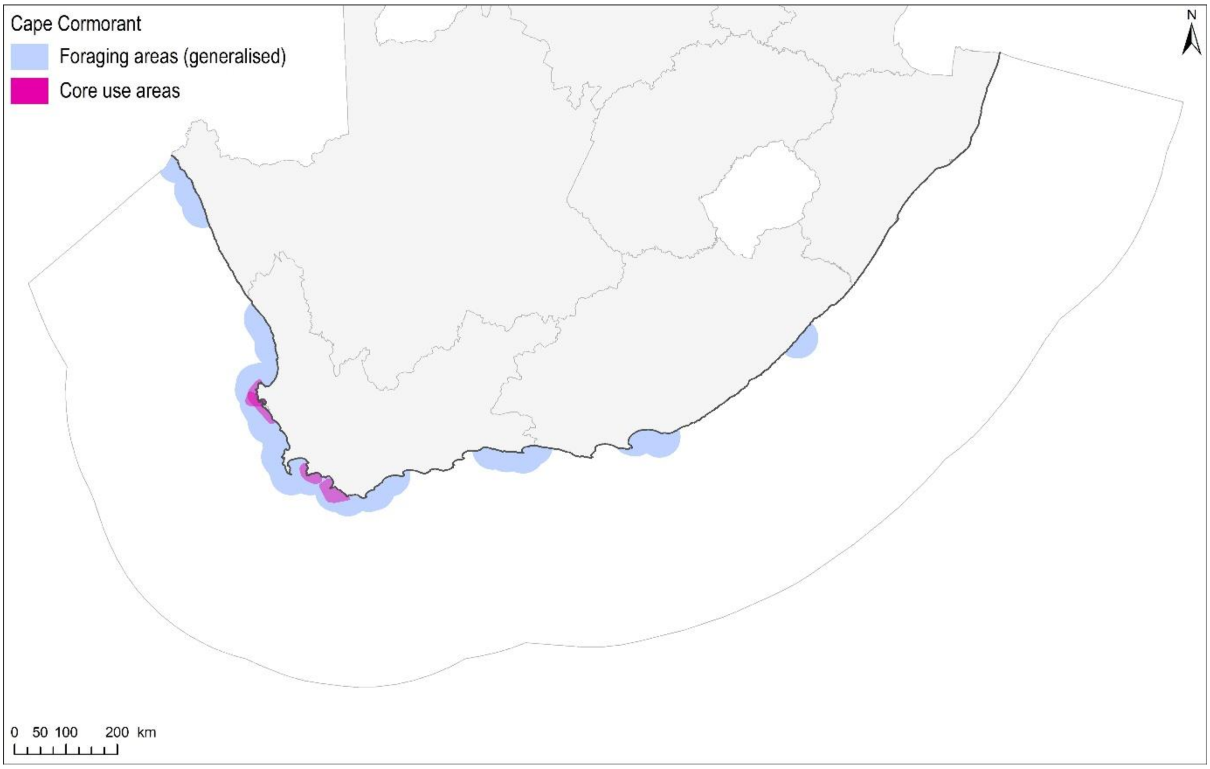


**Figure 21.** *Foraging areas of Cape Cormorants. Light blue areas are the generalised foraging areas; pink shaded areas are the core-use areas (draft MIBAs) mapped by BirdLife South Africa. (Data source: BirdLife South Africa 2021; and data adapted from Majiedt et al. 2013).*

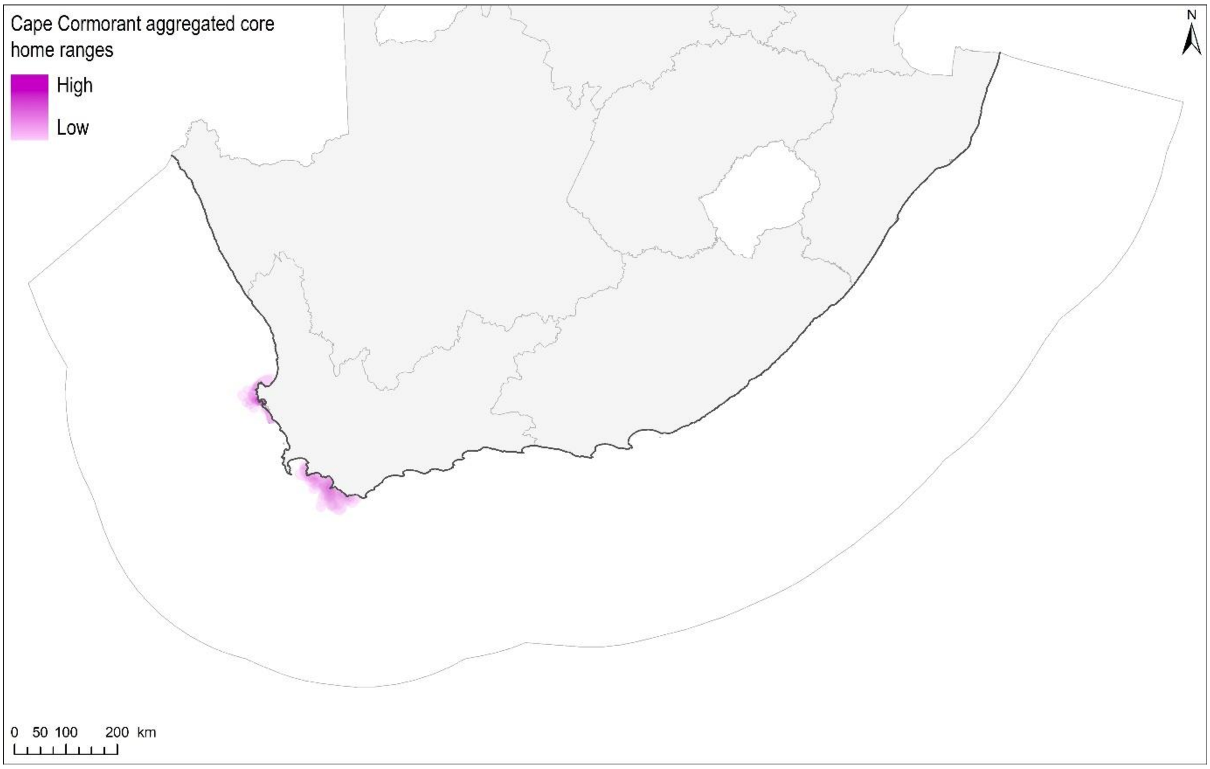


**Figure 22.** *Aggregated core home ranges of Cape Cormorants for different colonies and life-history stages. (Data source: BirdLife South Africa 2021).*

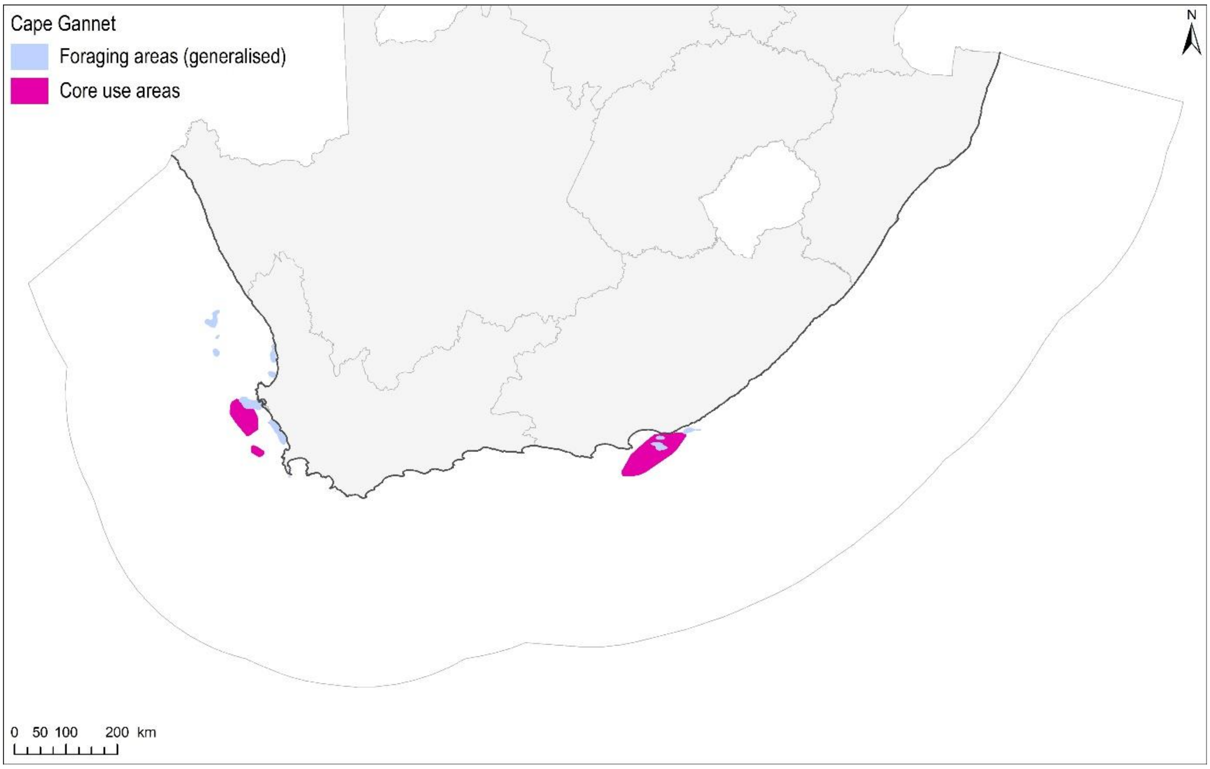


**Figure 23.** *Foraging areas of Cape Gannets. Light blue areas are the generalised foraging areas; pink shaded areas are the core-use areas (draft MIBAs) mapped by BirdLife South Africa. (Data source: BirdLife South Africa 2021; and Majiedt et al. 2013).*

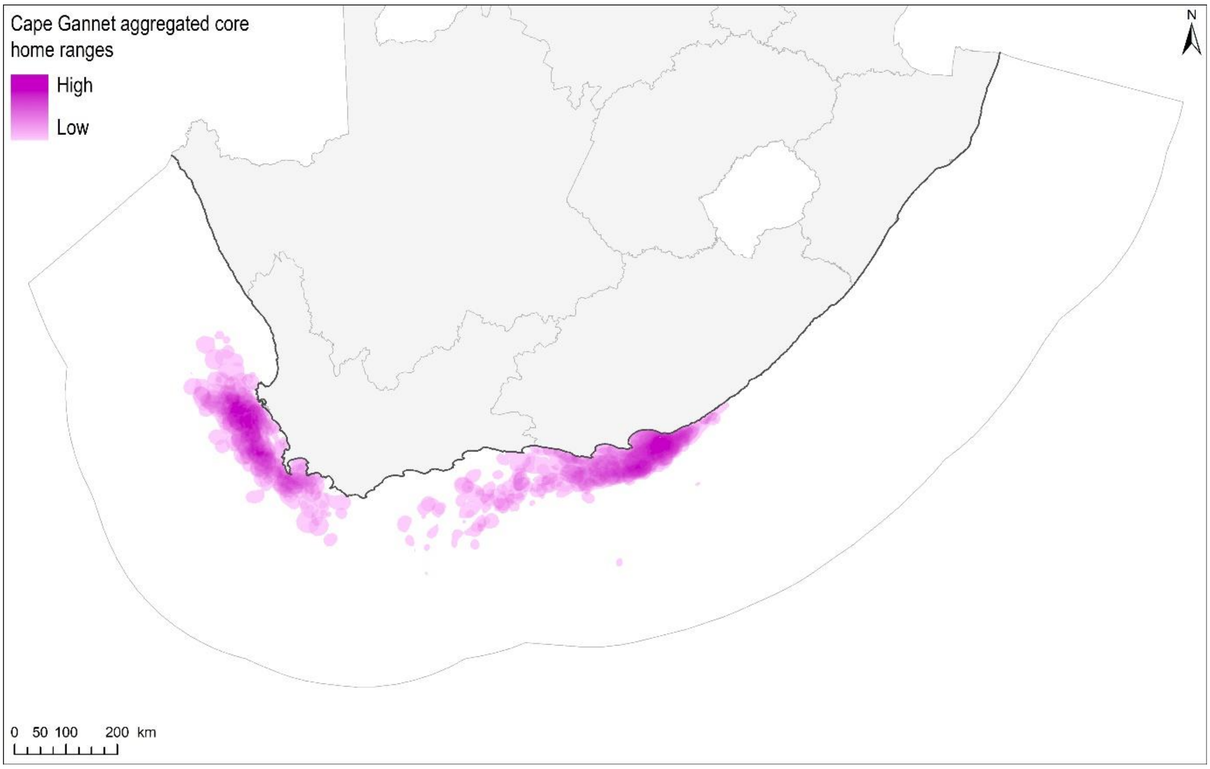


**Figure 24.** *Aggregated core home ranges of Cape Gannets for different colonies and life-history stages. (Data source: BirdLife South Africa 2021).*

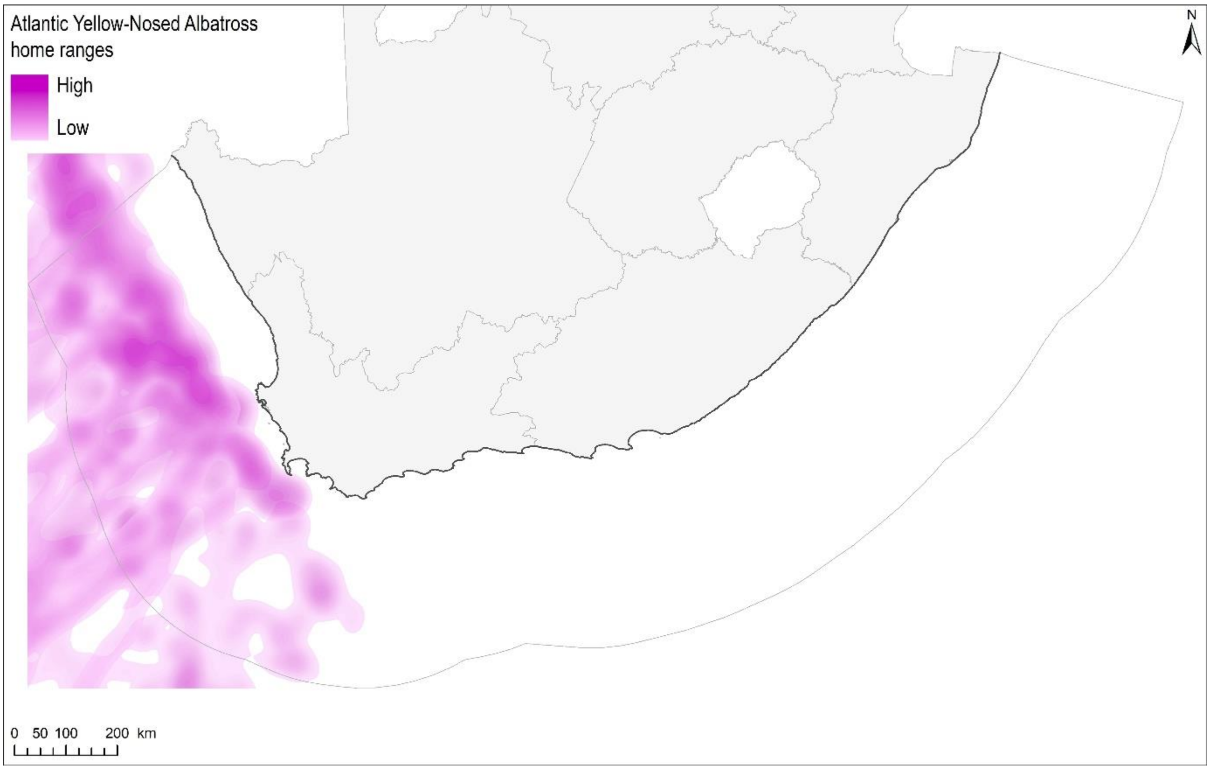


**Figure 25.** *Foraging areas of Atlantic Yellow-nosed Albatrosses. Darker shades are areas of higher use and where foraging areas from different colonies overlap. (Data source: BirdLife South Africa 2021).*

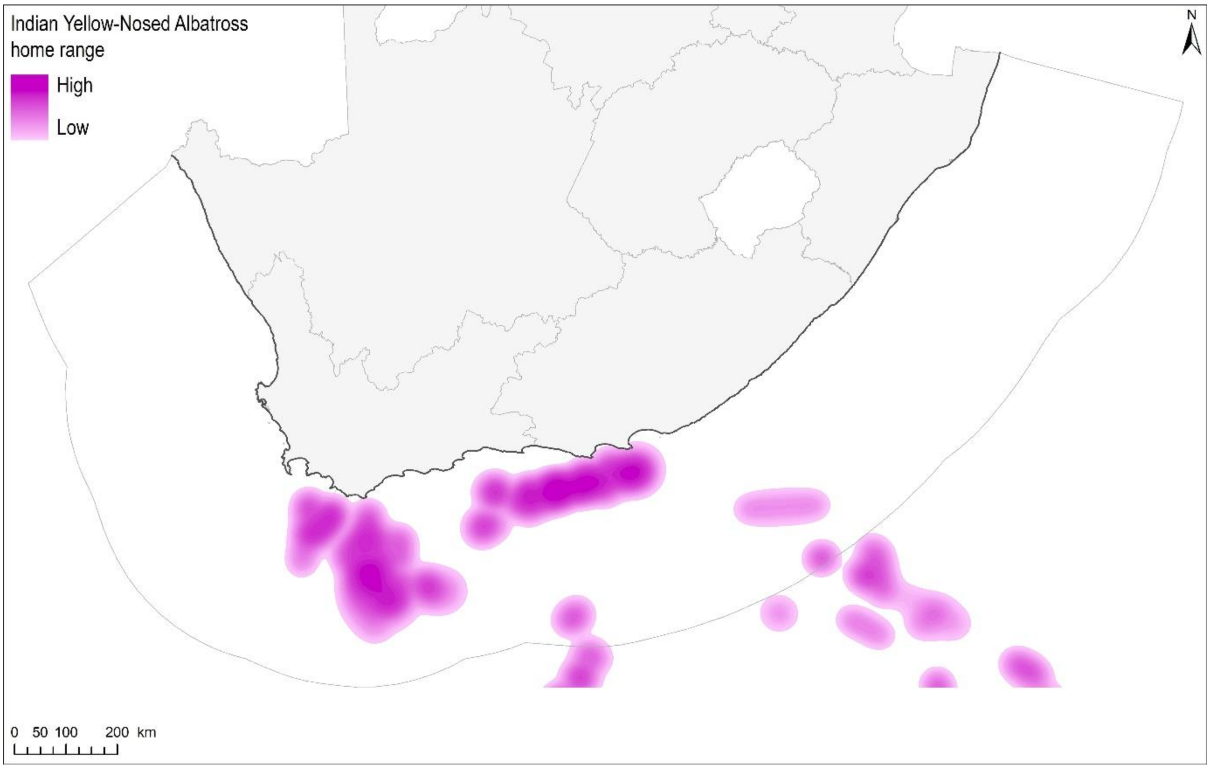


**Figure 26.** *Foraging areas of Indian Yellow-nosed Albatrosses. Darker shades are areas of higher use. (Data source: BirdLife South Africa 2021).*

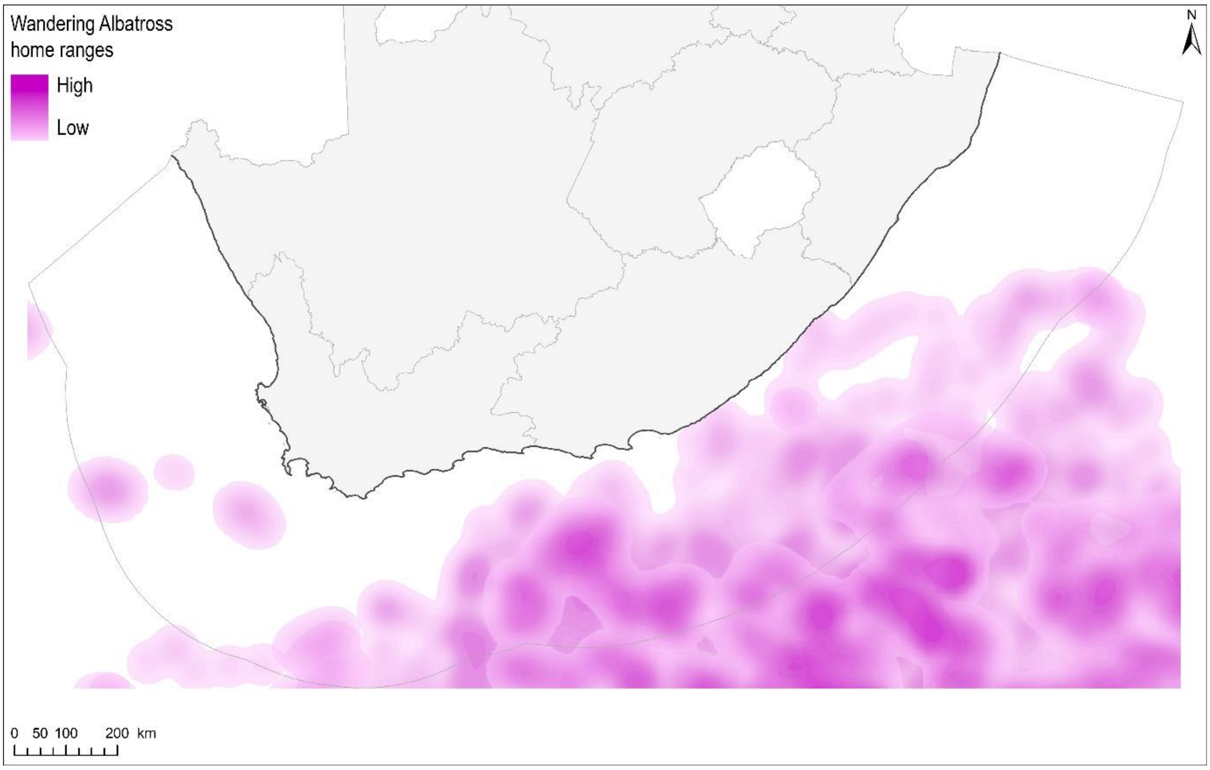


**Figure 27.** *Foraging areas of Wandering Albatross. Darker shades are areas of higher use and where foraging areas from different colonies overlap. (Data source: BirdLife South Africa 2021).*

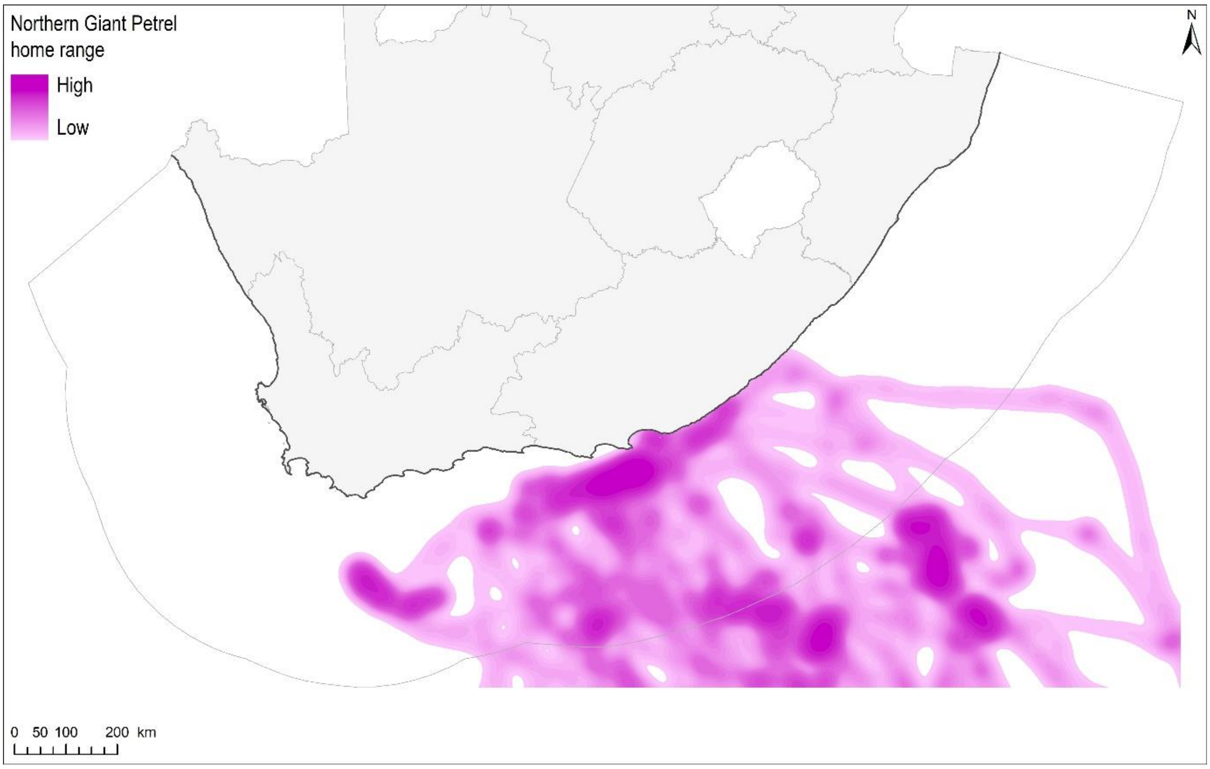


**Figure 28.** *Foraging areas of Northern Giant Petrel. Darker shades are areas of higher use. (Data source: BirdLife South Africa 2021).*

#### 4.4.2.3. Cetaceans

The southern African region is home to at least 51 species of whales and dolphins (and a single porpoise), which is about 63% of the world's cetacean species (Best 2007). Many of these species have high public appeal, and underpin numerous whale- and dolphin-viewing operations in South Africa that are popular with tourists. Observational data for some of the more conspicuous species have allowed for the production of predicted distribution maps modelled on the probability of occurrence (Purdon et al. 2020a; Purdon et al. 2020b). These species, all of which are Least Concern or Near Threatened, with the exception of the Endangered Indian Ocean Humpback Dolphin and Vulnerable Sperm Whale, are included in the National Coastal and Marine Spatial Biodiversity Plan. Although the southern African region is one of the key areas for beaked whale diversity in the world (Best 2007), at-sea observational data for these species are lacking and their distributions in South Africa's EEZ have not been modelled, with the exception of Southern Bottlenose Whales. Some other well-known species for which modelled distributions are not available include the Fin Whale and the iconic Blue Whale.

Predicted distributions of Indian Ocean Bottlenose Dolphins (Figure 29), Common Dolphins (Figure 30), Heaviside's Dolphins (Figure 31), Indian Ocean Humpback Dolphins (Figure 32), Risso's Dolphins (Figure 33), and Southern Bottlenose Whales (Figure 34) were included from Purdon et al. (2020a), and Bryde's Whales (Figure 35), Humpback Whales (Figure 36), Southern Right Whales (Figure 37) and Sperm Whales (Figure 38, Figure 39), were included from Purdon et al. (2020b). Killer Whales were excluded (on advice from Prof. Ken Findlay) because their distribution is ubiquitous and there's no information on finer scale habitat use. Given that the maps represent the probability of occurrence modelled from observational data and associated physical environmental variables, and generally spanned the entire EEZ, or at least a substantial portion of it, only the upper end of the probability distribution was included. These distributions were refined with input from Prof. Ken Findlay and Dr Stephen Kirkman, supported by maps in Best (2007). It is noted, though, that further refinement of the cetacean data is needed. See Appendix 2 for details.

- For species with predicted distributions that covered a smaller portion of the national EEZ, i.e., Indian Ocean Humpback Dolphins, Heaviside's Dolphins, Indo-Pacific Bottlenose Dolphins, Southern Bottlenose Whales, Common Dolphins, Killer Whales, and Risso's Dolphins, data that were >50% of the maximum value were selected and reclassified into ten quantiles, and assigned values 1-10 from lowest to highest probability of occurrence. In other words, only the upper 50% of the areas where these species are predicted to occur are included as biodiversity features.
- The much broader distributions of Sperm Whales, Bryde's Whales, Humpback Whales and Southern Right Whales necessitated a higher cut-off value to identify the areas of highest likelihood of occurrence (thereby avoiding having overly extensive features). For these species, data that were >75% of the maximum value were selected and reclassified into ten quantiles, and assigned values 1-10 from lowest to highest probability of occurrence. This means that only the upper 25% of areas where these species are predicted to occur are included as biodiversity features.
- Data were coded to the planning units based on a zonal statistic of the reclassified values per planning unit. In some cases, these distributions contained a few (≤6), very small (ca. 36 planning units) localities that were far (60-200 km) from the rest of the distribution, and had very low values for probability of occurrence. E.g., six locations of low probability for coastal humpback dolphins that were as far as 200 km offshore. These were removed given their low likelihood of containing the respective species.

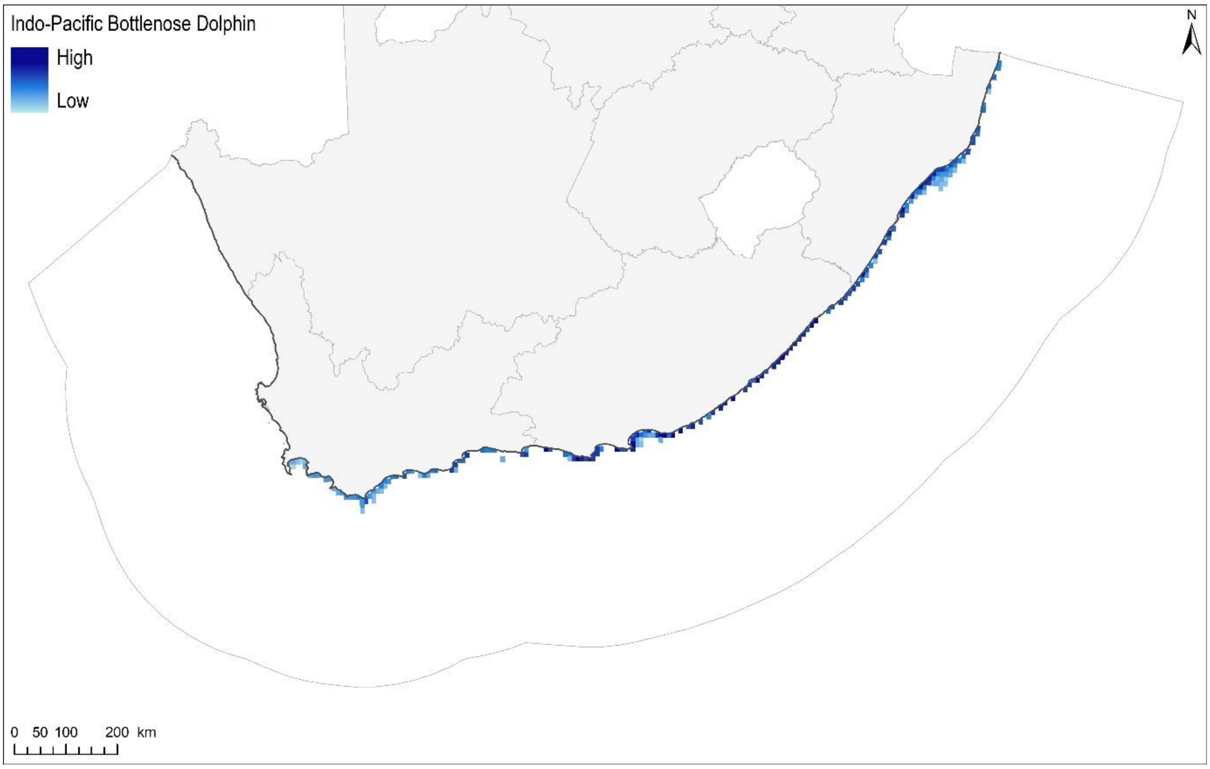


**Figure 29.** *Indo-Pacific Bottlenose Dolphin predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020a).*

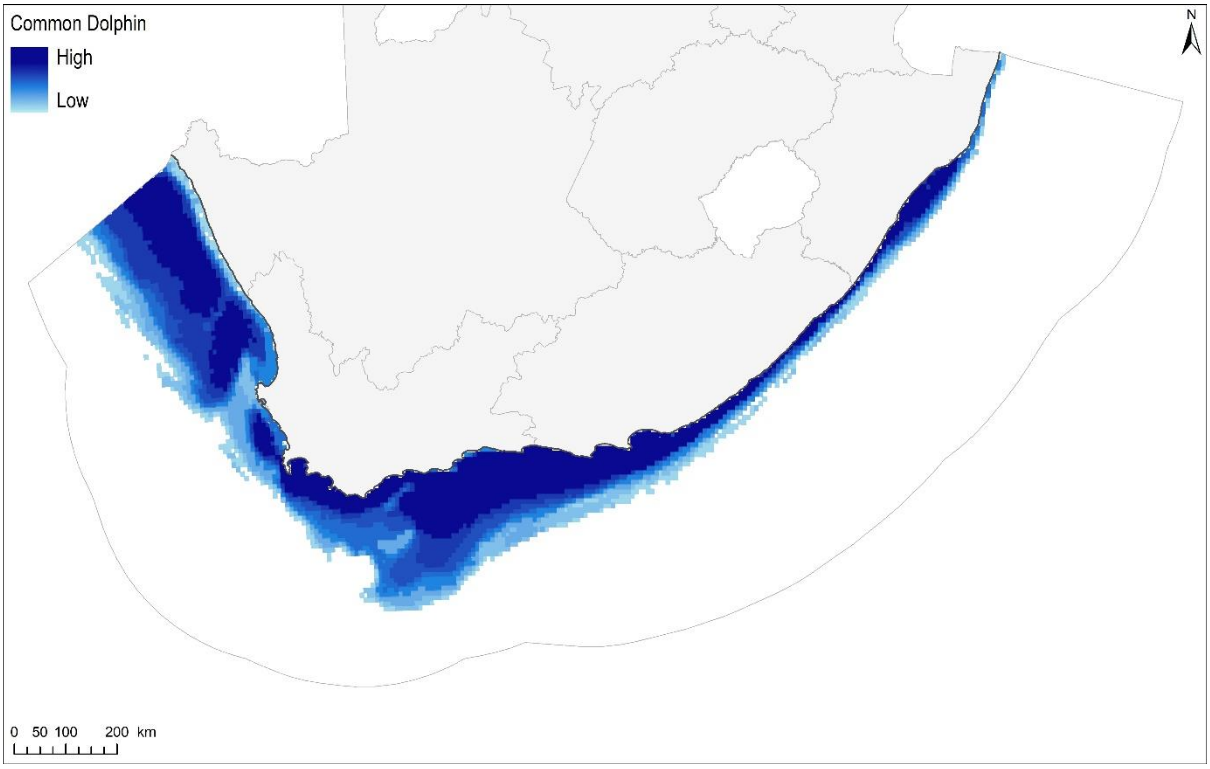


**Figure 30.** *Common Dolphin predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020a).*

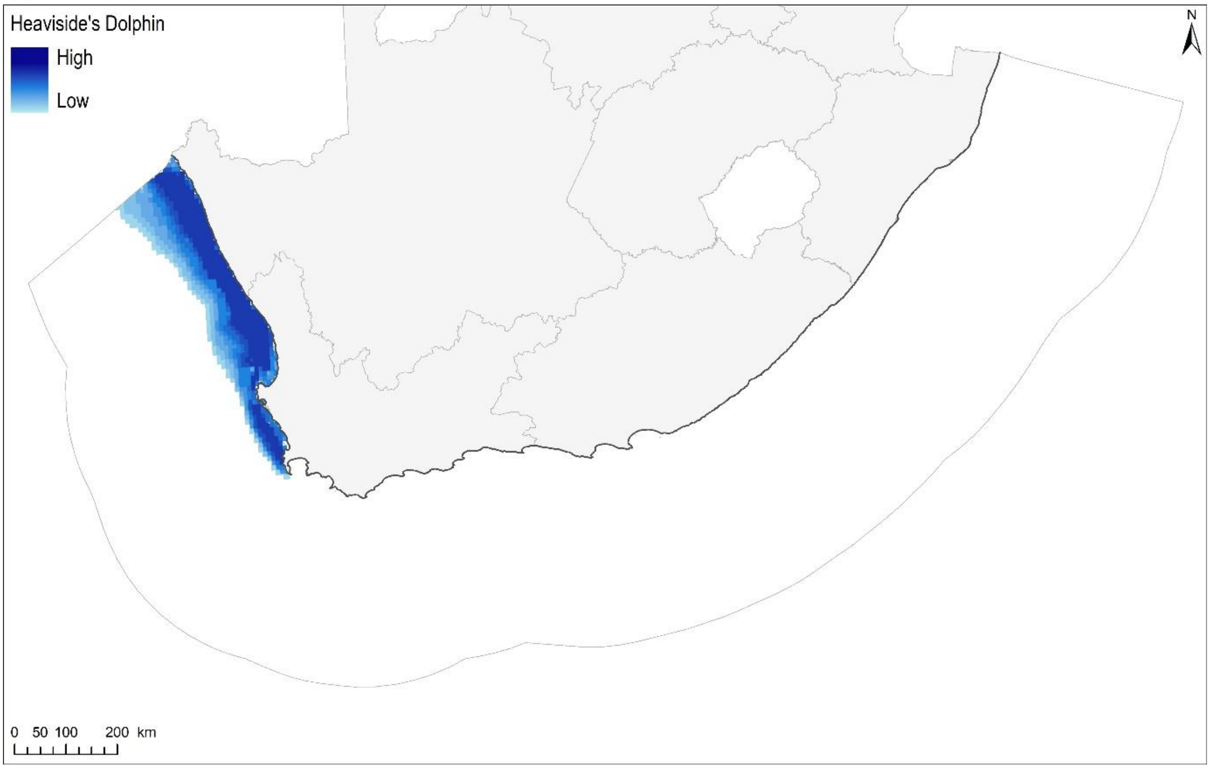


**Figure 31.** *Heaviside's Dolphin predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020a).*

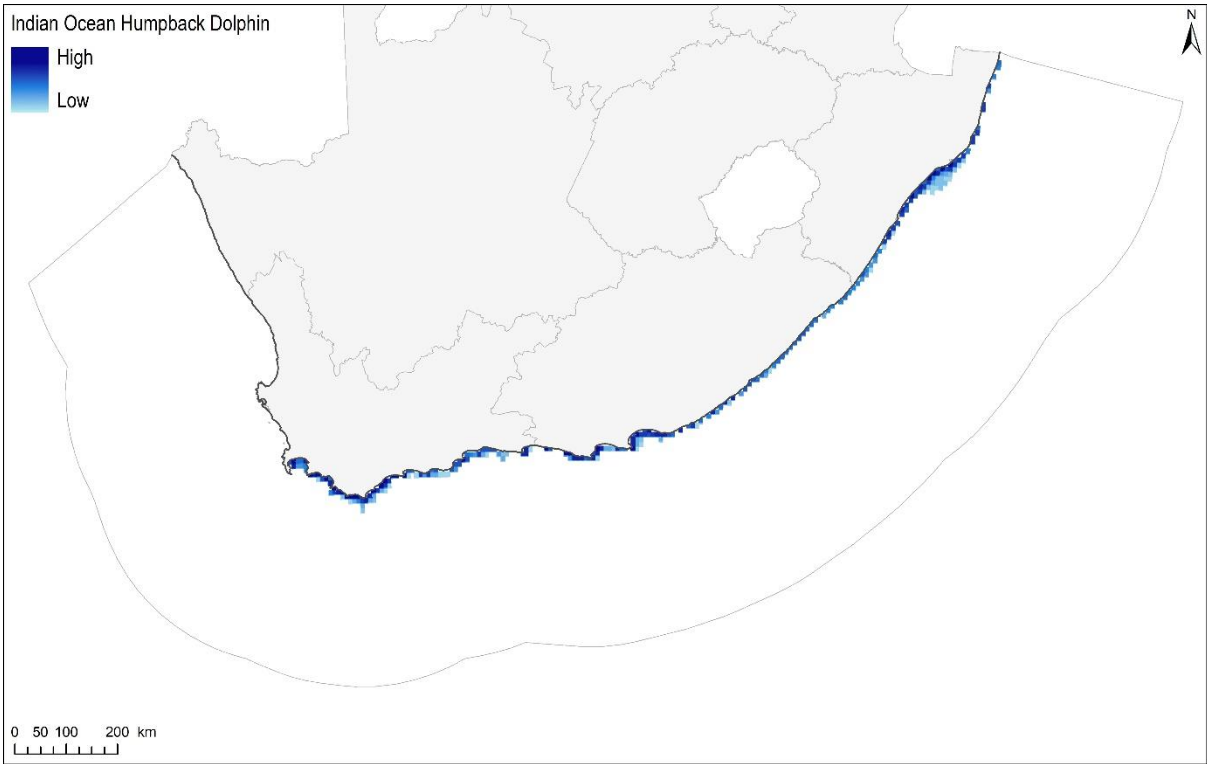


**Figure 32.** *Indian Ocean Humpback Dolphin predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020a).*

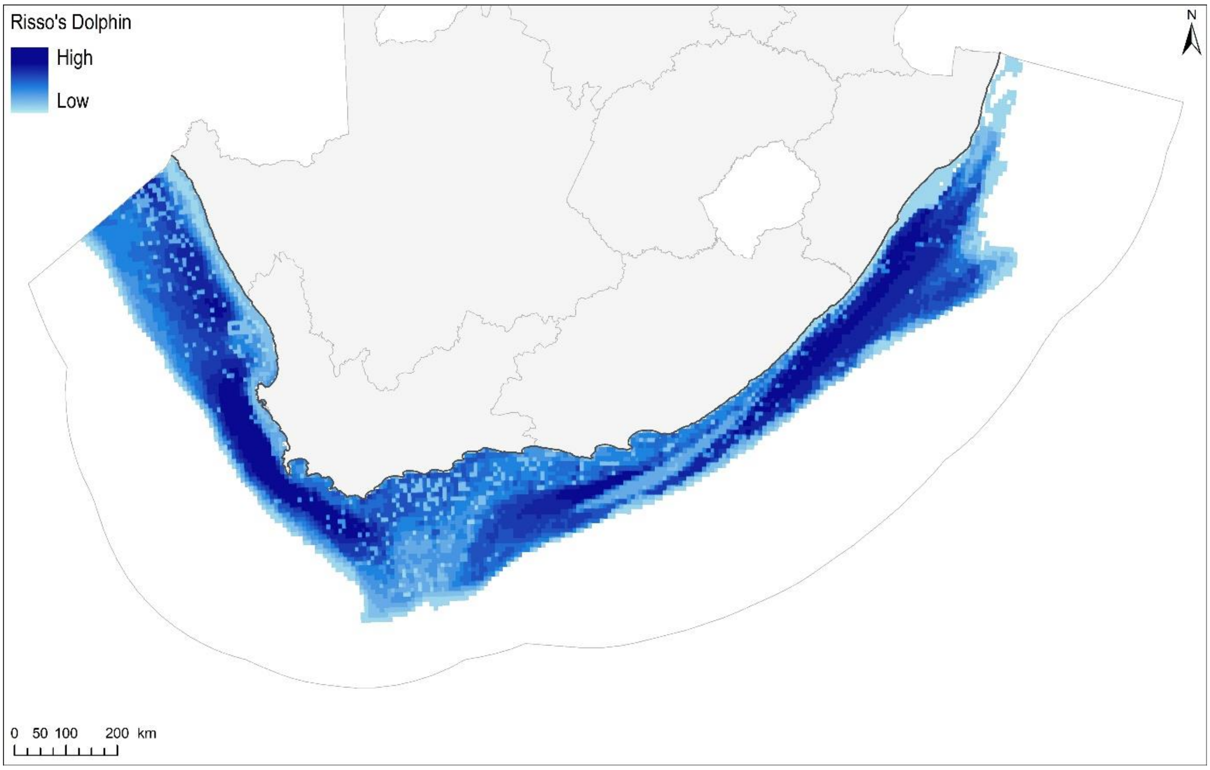


**Figure 33.** *Risso's Dolphin predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020a).*

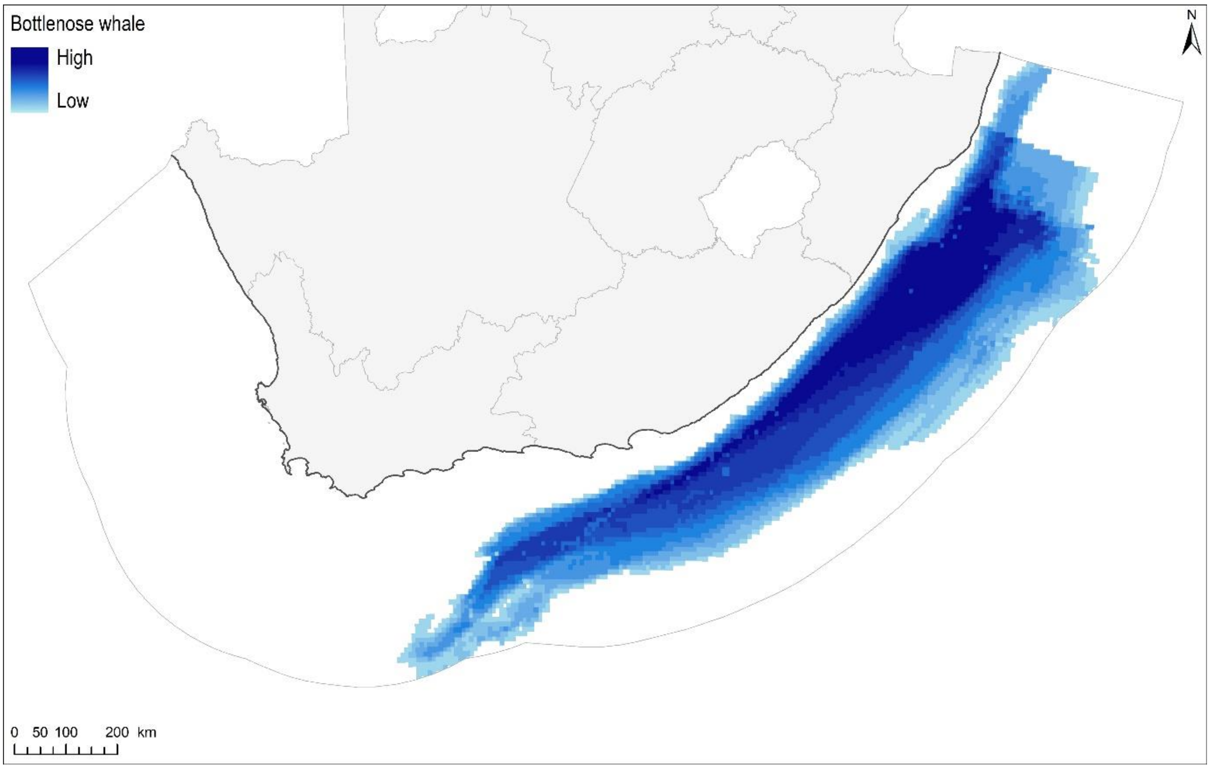


**Figure 34.** *Bottlenose Whale predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020a).*

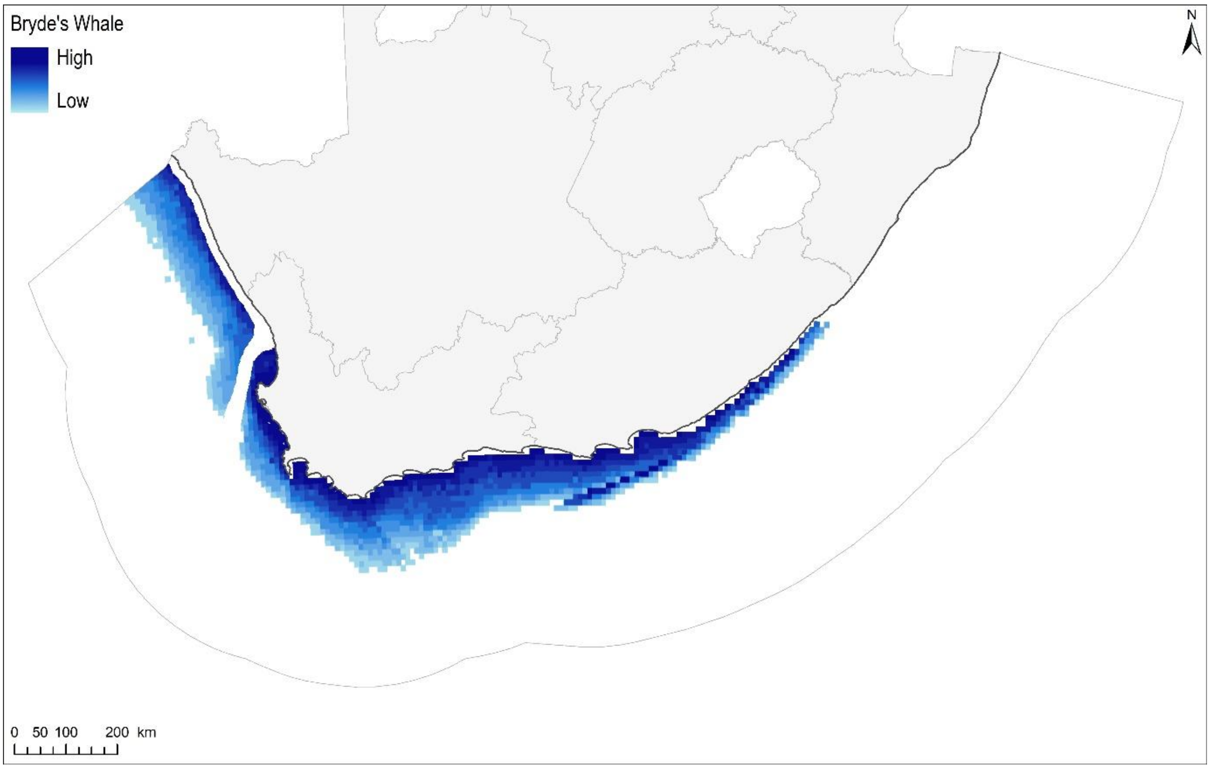


**Figure 35.** *Bryde's Whale predicted distribution for two forms – inshore form and the offshore migratory form, with darker shades of blue indicating highest likelihood of occurrence. (Data source: modified from Purdon et al. 2020b).*

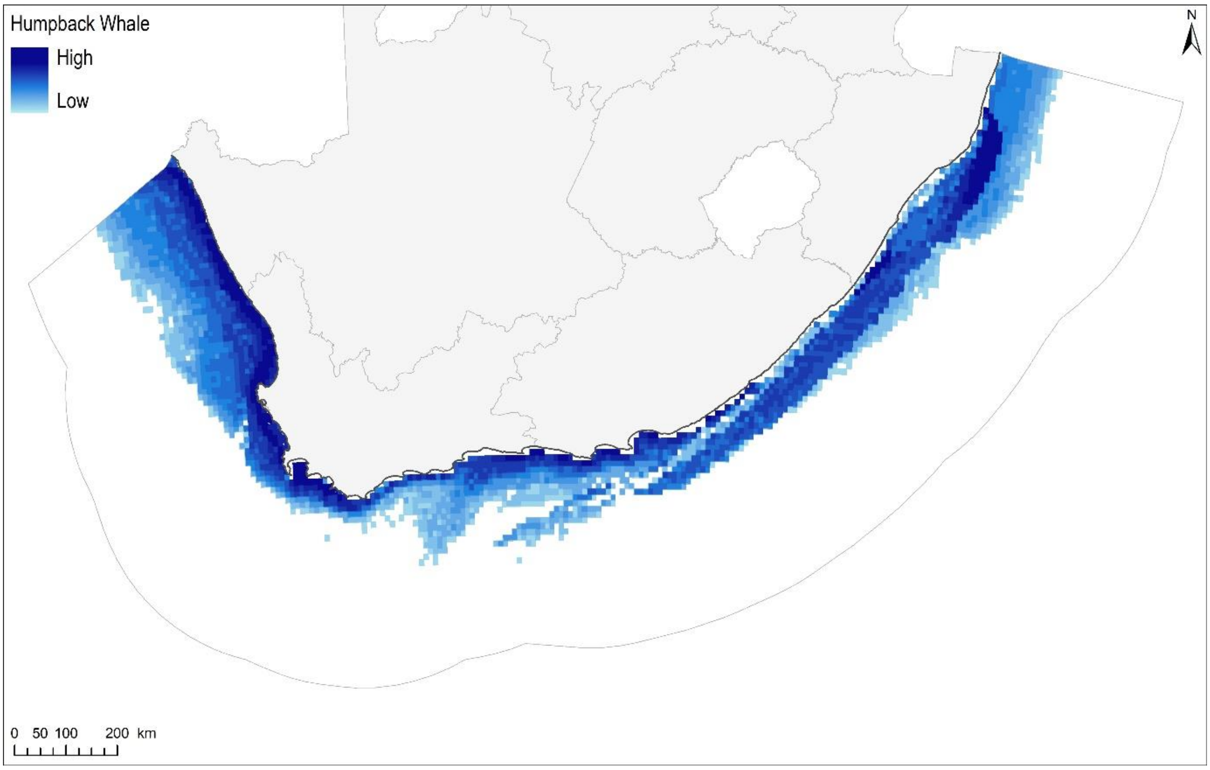


**Figure 36.** *Humpback Whale predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020b).*

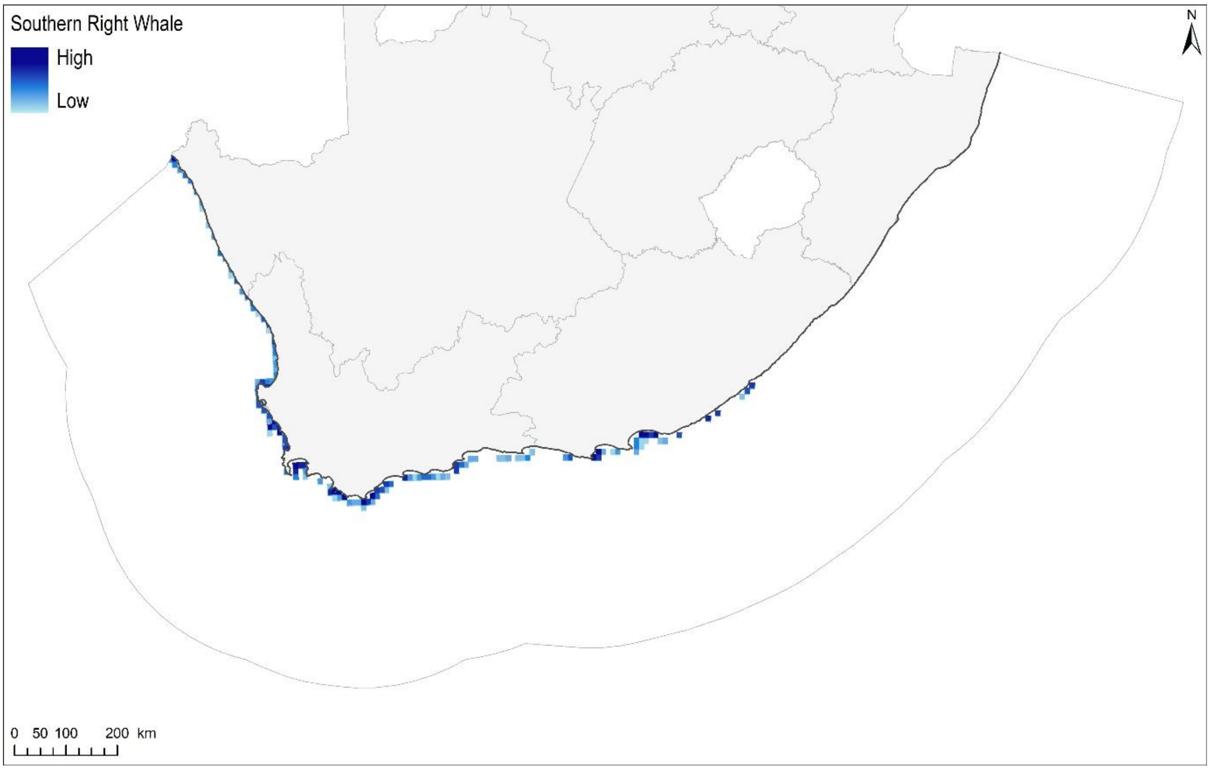


**Figure 37.** *Southern Right Whale predicted distribution, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020b).*

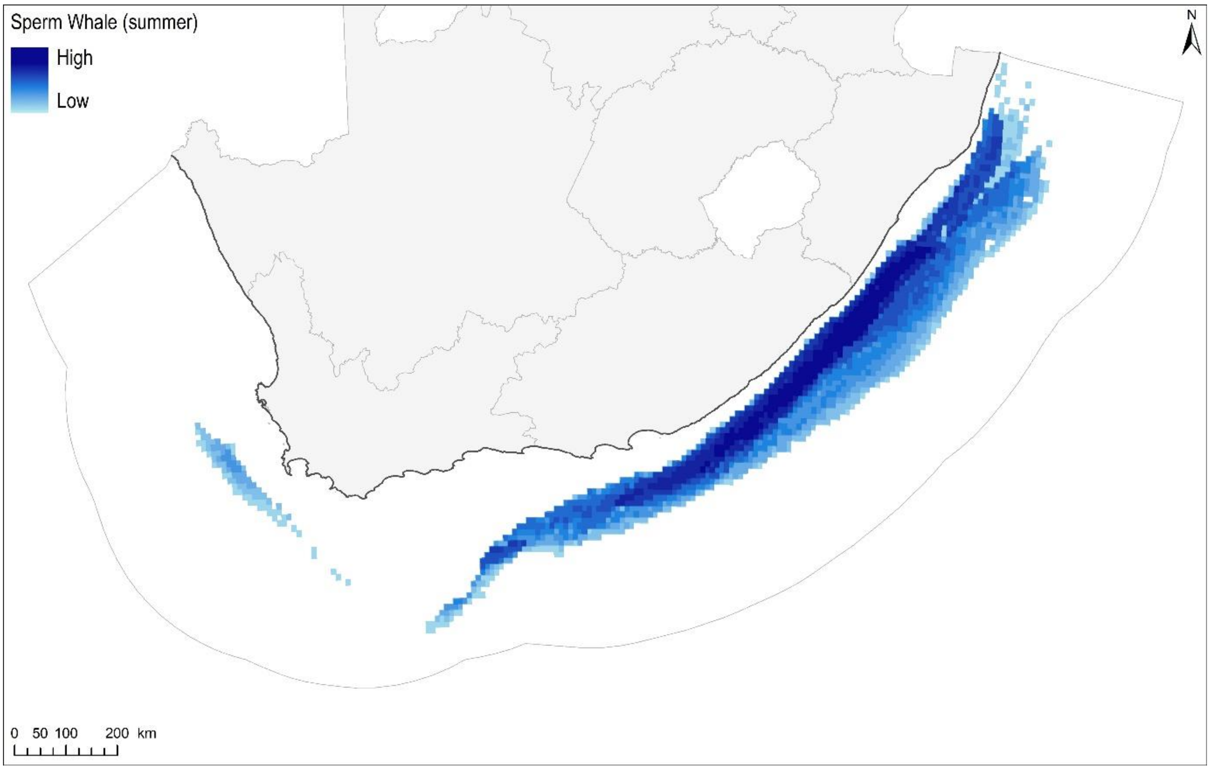


**Figure 38.** *Sperm Whale predicted distribution in summer, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020b).*

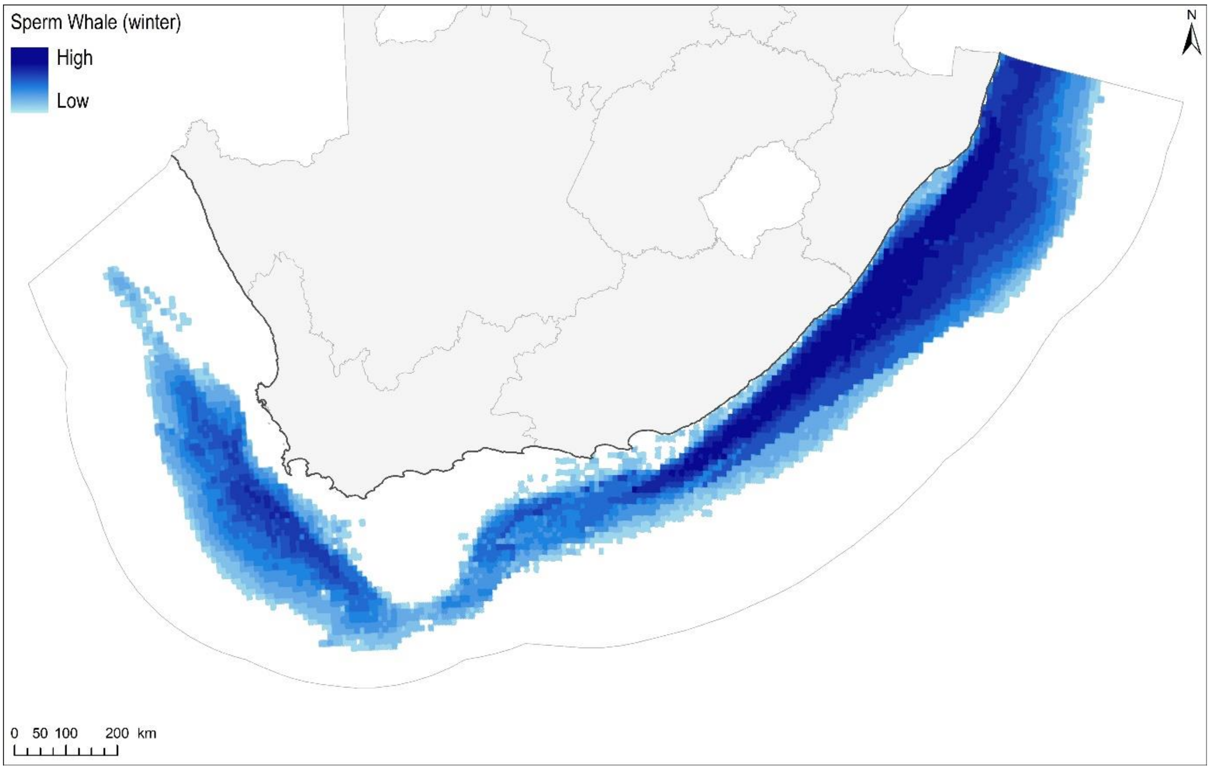


**Figure 39.** *Sperm Whale predicted distribution in winter, with darker shades of blue indicating highest likelihood of occurrence. (Data source: Purdon et al. 2020b).*

Some coastal areas, mostly bays (Figure 40), are associated with supporting key life-history stages of whales, including calving, nursery areas, and supergroup aggregations (see also Best 2000; Elwen and Best 2004a, b; Elwen and Best 2004c). These areas also contribute to societal benefits by underpinning some ecotourism ventures (i.e., whale-watching).

- An initial selection of whale-associated bays and other coastal areas were extracted from the marine map of ecosystem types (Sink et al. 2019a) and advice given by Prof. Ken Findlay. The data were coded to the planning units based on area.

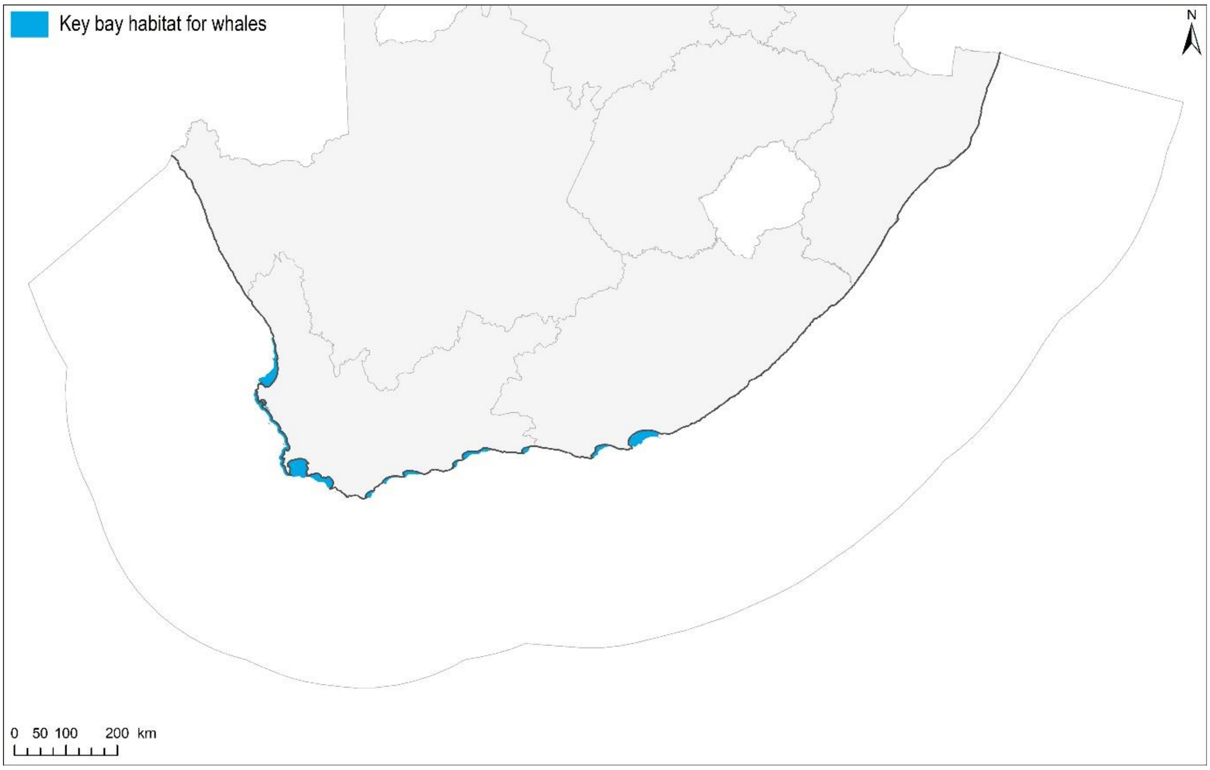


**Figure 40.** *Key bay habitat for whales. (Data source: data extracted from Sink et al. 2019a).*

#### 4.4.2.4. Seals

The Cape Fur Seal is the only pinniped that breeds in mainland South Africa (Kirkman and Arnould 2017). They breed in colonies along the west and south coasts of South Africa, on islands or on remote parts of the coast, with the eastern-most breeding colony found in Algoa Bay (Kirkman et al. 2007). Breeding occurs synchronously each year, between November and January. Between the time of pupping and the time of weaning, about ten months later, mothers alternate between foraging at sea and nourishing their pups at the colony. Cape Fur Seals are generalist foragers that eat a wide variety of pelagic, demersal and benthic prey, including commercially important species such as Cape Hakes, Horse Mackerel, Sardine, Anchovy, Chokka Squid and West Coast Rock Lobster. They feed largely over the continental shelf (Botha et al. 2020) and, as a top predator, they most likely have a critical role in prey regulation and the structure and functioning of the ecosystem. Cape Fur Seals have also been reported to predate on seabirds, including African Penguins and Cape Gannets, both of which are of conservation concern (see Section 4.4.2.2). On the other hand, Cape Fur Seals also serve as prey for other predators, including the iconic White Shark. The attractiveness of seal colonies on the south coast to White Sharks, and associated shark-seal predatory interactions, is critical for the commercial success of the White Shark viewing ecotourism industry. Cape Fur Seal colonies are also targeted for tourist viewing or in-the-water tourist experiences with seals.

Cape Fur Seals were formerly harvested commercially in South Africa until this was suspended in 1990. Regular aerial censuses are conducted on breeding colonies to determine population trends (Kirkman et al. 2013). Although the Cape Fur Seal has been assessed to be Least Concern in terms of IUCN Red List criteria (Kirkman et al. 2016), it is protected in South Africa in terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004). The same protection is also extended to other species of pinniped that can occur in South African waters, or haul out on its shores. Other pinniped species that have been recorded in mainland South Africa include the Sub-Antarctic Fur Seal (Shaughnessy and Ross 1980), Southern Elephant Seal (Penry et al. 2013), Leopard Seal (Vinding et al. 2013), and Crabeater Seal (Ross et al. 1978).

Data representing seals that were included in the CBA Map are of Cape Fur Seal colonies (Figure 41) (Kirkman et al. 2013) and foraging areas (Figure 42) based on tracking data around selected colonies (Benguela Environment Fisheries Training Interactions Programme (BENEFIT), Unpublished data; Botha et al. 2020) and generalised foraging areas around all colonies. The tracking data (n=201 tracks) were first cleaned by removing points on land (inland of the dune base), and removing all tracks from the dataset with fewer than 10 locations (n=24). Then, in R version 4.0.3 (R Core Team 2020), a speed filter was applied to remove all locations that were more than 3 $m.s^{-1}$ from the previous location (1.9% of the data), using the *vmask* function in the *argosfilter* package. Because the data from Botha et al. (2020) had already been cleaned using several speed filters (also using 3 $m.s^{-1}$ as a threshold), only inaccurate data from BENEFIT (Unpublished data) tracks were removed. Home ranges for the Kleinzee colony, south coast (False Bay, Geyser Rock; Mossel Bay) and Black Rocks colony were created using moment-based kernel density estimation from the *adehabitatHR* package (Calenge 2011), with a slightly smaller smoothing factor for the Black Rocks colony because of the finer-scale data. The rasters were resampled to a 50-m grid to ensure proper coding to the planning units, and the lowest UD values were removed using the Raster Calculator to remove areas of very infrequent use. Data were split into 20 quantiles to reduce the strong tail in the data distribution as a result of a land-based colony being the start and end point of each foraging trip. From these home ranges, the highest use areas around the colonies were approximately 20 km in diameter. Therefore, to account for foraging areas around colonies for which tracking data were not available, a 20-km buffer was applied to the colonies to give a generalised feeding area.

- Data on seal colonies were coded to the planning units on an area basis.
- Data were coded to the planning units based on a zonal statistic of the relative intensity of use per planning unit.
- It is recommended that the MBKDE analysis is recalculated based on all the raw tracks for a more accurate representation of seal foraging areas in the next iteration.

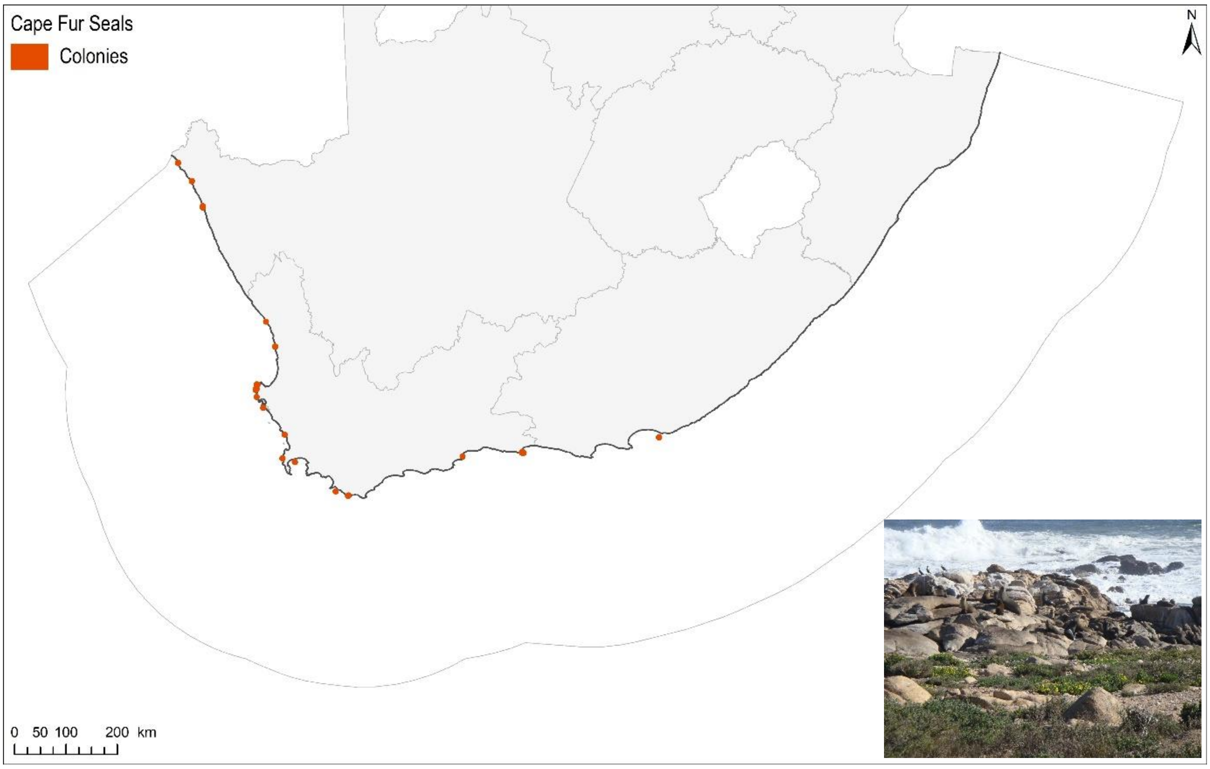


**Figure 41.** *Seal colonies around South Africa. Note that the symbology has been expanded so that the features are visible on the map. Insert image credit: ©Linda Harris. (Data source: Kirkman et al. 2013).*

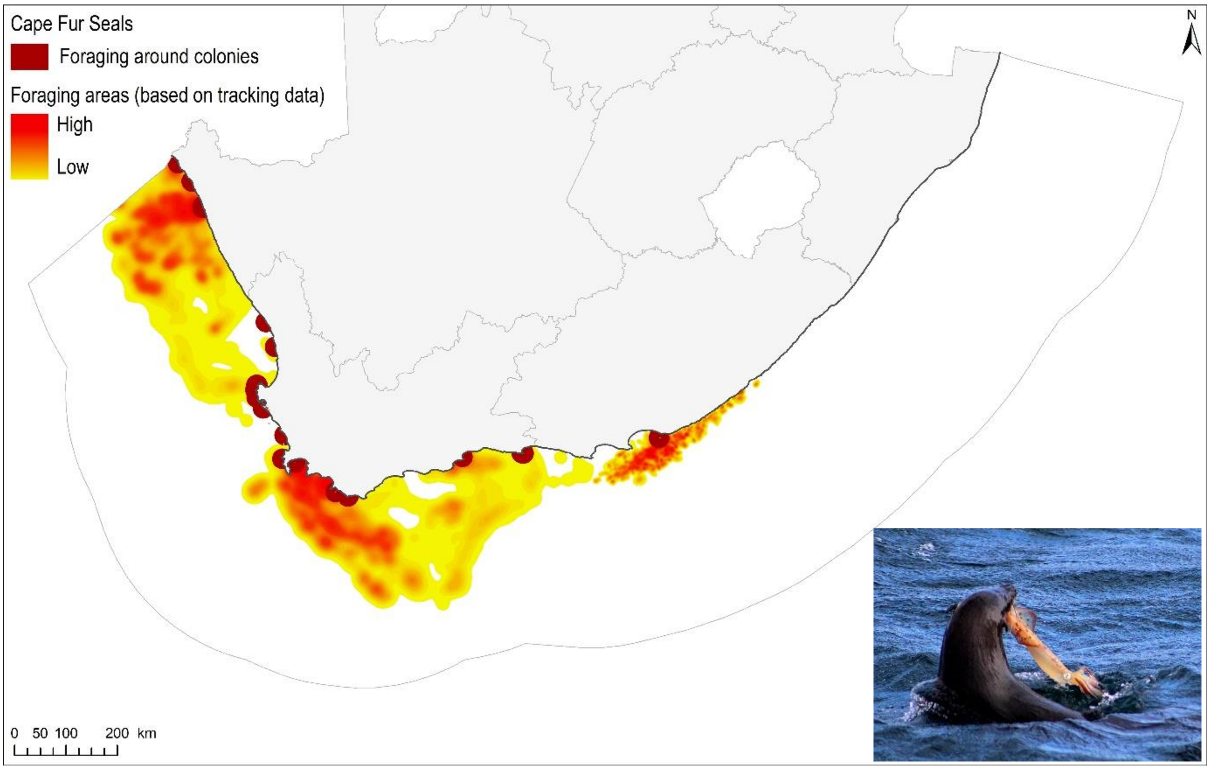


**Figure 42.** *Seal foraging areas, where brown areas are generalised foraging areas around colonies, and areas in shades of red are foraging areas based on tracking data. Darker shades of red indicate areas of higher use. Note that gaps in foraging areas, especially on the west coast, are more an artefact of incomplete coverage than areas of avoidance or absence. Insert image credit: © Frikkie van der Vyver. (Data source: BENEFIT, Unpublished data; Botha et al. 2020).*

#### 4.4.2.5. Sharks and rays

The status of sharks and rays globally is of particular concern. Since 1970, the abundance of these species in the world's oceans has declined by 71% as a result of an eighteen-fold increase in fishing (Pacoureau et al. 2021). In fact, more than a third of shark and ray species are threatened as a result of overfishing, and three species are listed as Critically Endangered (Possibly Extinct) because they have not been seen in more than 80 years (Dulvy et al. 2021). In short, chondrichthyans are in a state of crisis, requiring urgent conservation attention.

White Sharks are listed as Vulnerable by the IUCN, with a declining population trend, and have been protected in South Africa since 1991. Currently there is no consensus on the number of White Sharks in South Africa. Towner et al. (2013) estimated there to be about 900 White Sharks present in Gansbaai based on mark-recapture methods. This is similar to a past estimate for White Sharks captured in the shark nets in KZN (Cliff et al. 1996). Andreotti et al. (2016) provided an alternative estimate over a similar time period for the number of White Sharks nationally, based on mark-recapture and genetics, that was about half that estimated by Towner et al. (2013). However, the estimate by Andreotti et al. (2016) has been challenged (Irion et al. 2017). The precise population estimate notwithstanding, White Sharks are known to make transoceanic migrations (e.g., Bonfil et al. 2005) but also to aggregate in certain locations in South Africa during different parts of the year (Kock et al. 2013; Ryklief et al. 2014). These aggregations are also often associated with key life-history stages.

Two input features were included for White Sharks: core resident areas (Figure 43); and a distribution including both transiting and resident behaviours (Figure 44). These were based on data from Kock et al. (in review). To delineate the core resident areas, point locations associated with resident behaviour were filtered to remove points on land. A point-density analysis was run, with the output reclassified into 20 quantiles (excluding 0 values). Only the upper 10 quantiles were retained to represent the core-use areas. To plot the White Sharks' distribution, a second point density analysis was run on all of the data (both resident and transiting behaviours), and the data were reclassified as above. In this case, however, only the lowest two quantiles were excluded to represent the distribution of the sharks, whilst excluding areas that were generated on the basis of a single point locality.

- Data were coded to the planning units on the basis of an average zonal statistic, using the planning units as zones.
- Core resident areas: To remove very small regions as a result of excluding the lower 10 quantiles, only zonal static values >0.025 were included. Finally, single isolated planning units with values <1 were removed.
- Distribution areas: To remove very small regions as a result of excluding the lower two quantiles, only zonal static values >0.05 were included. Finally, isolated planning units in clusters of ≤5 with values <1 were removed.

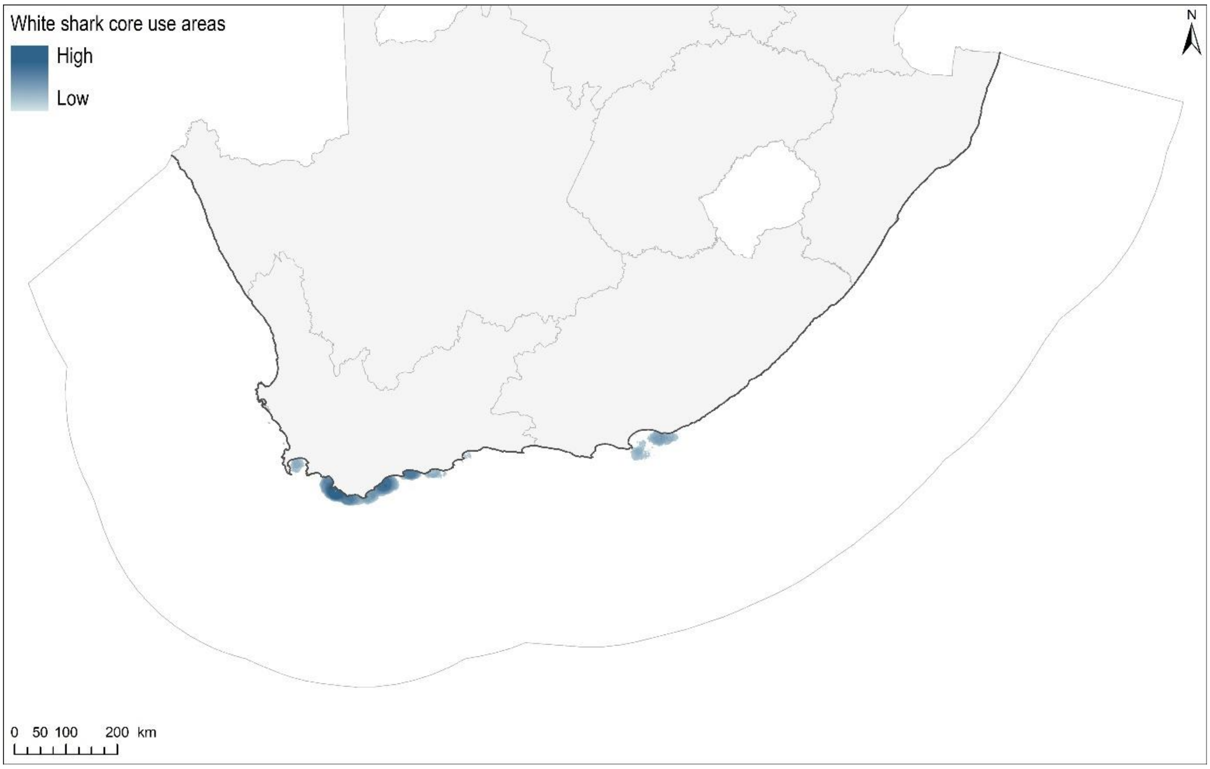


**Figure 43.** *White Shark core use areas. Darker blues indicate higher intensity of use. (Data source: Kock et al. in review)*

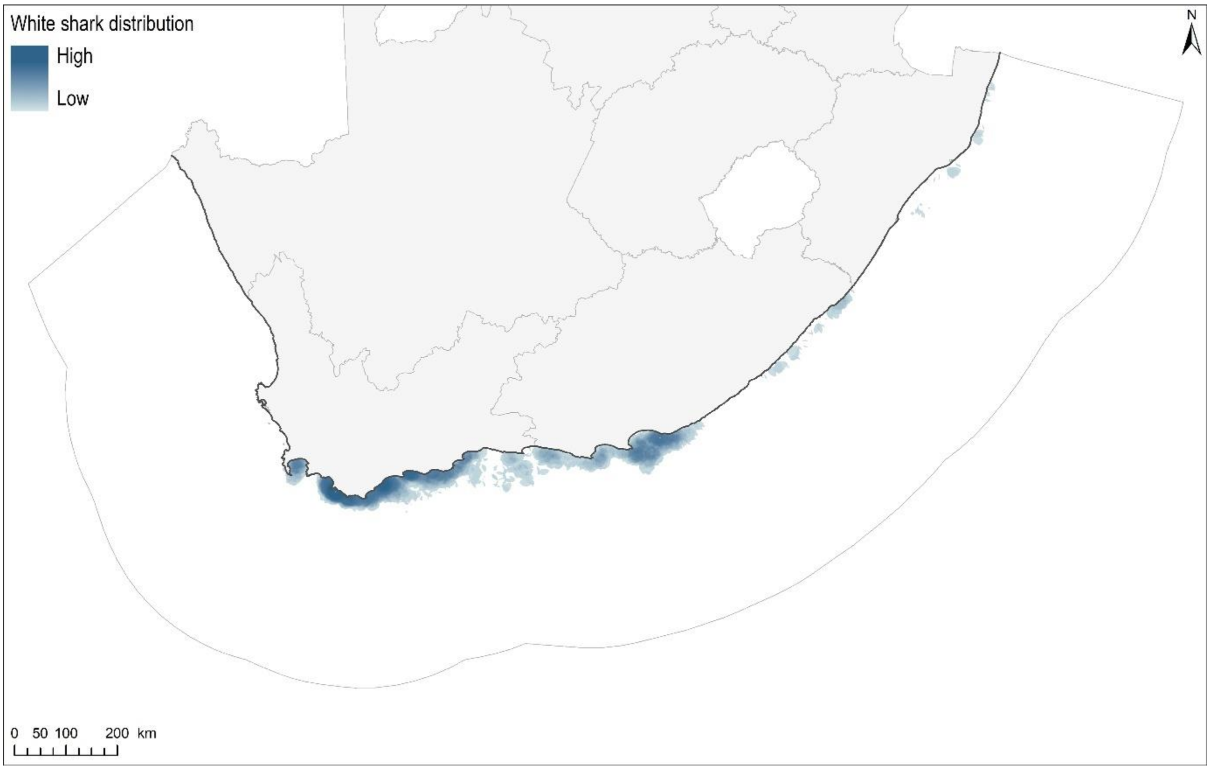


**Figure 44.** *White Shark distribution. Darker blues indicate higher intensity of use. (Data source: Kock et al. in review)*

For all other species of sharks and rays (Figure 45 - Figure 111), the distributions were modelled by Faure Beaulieu et al. (2021). Ensemble predictions were created from a General Linear Model (GLM) and Maximum Entropy (MaxEnt) model per species, split into a summer (September–February) and winter (March–August) distribution where possible, otherwise an aseasonal distribution was created.

- Rasters of the ensemble predictions were projected into Albers Equal Area projection customised for South Africa, snapped to a reference raster, and resampled to a smaller reference cell size (30 x 30 m).
- The projected rasters were reclassified into 20 quantiles, excluding values below the given threshold where the likelihood of occurrence the species is considered absent.
- Data were coded to the planning units on the basis of an average zonal statistic, using the planning units as zones.

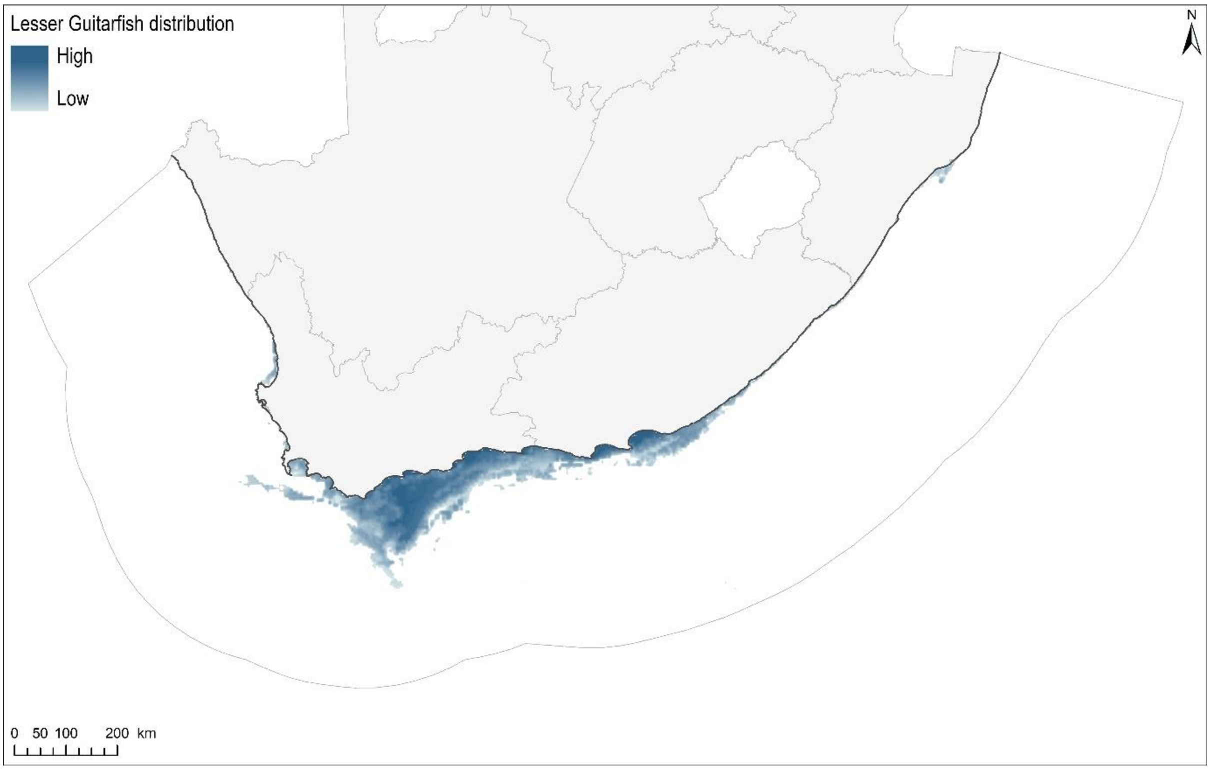


**Figure 45.** *Lesser Guitarfish distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

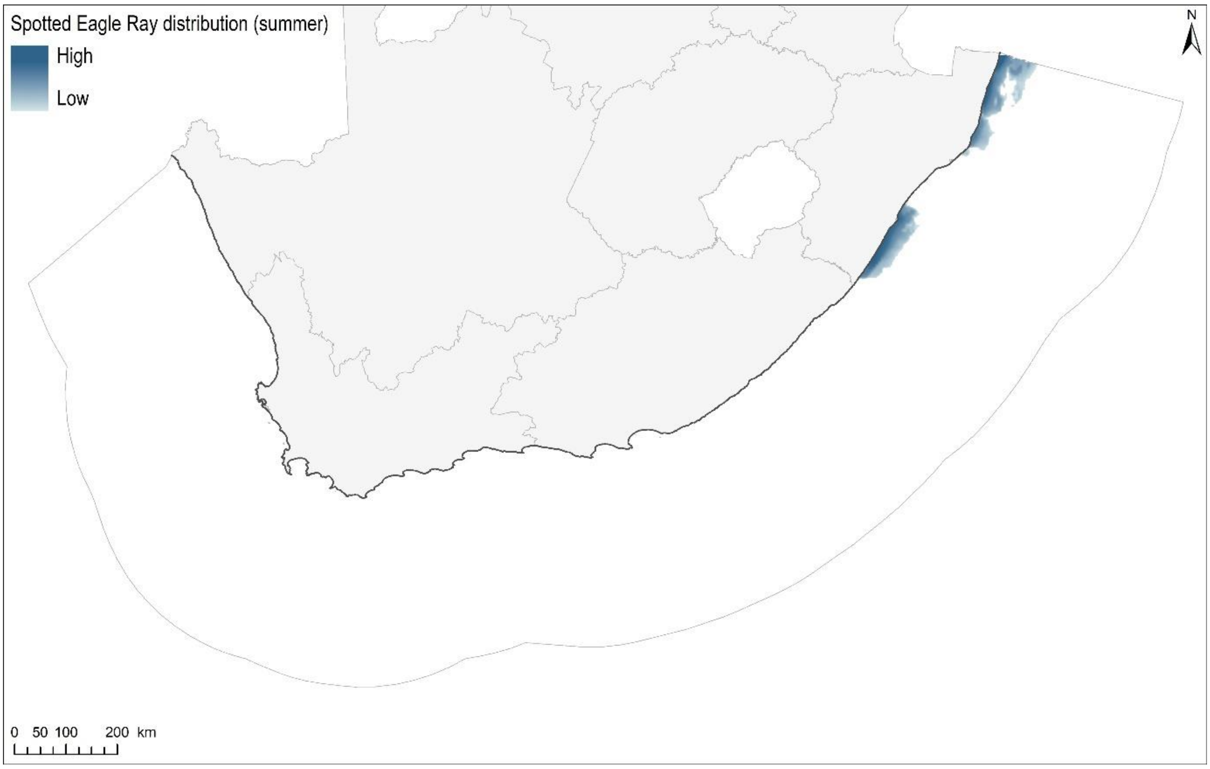


**Figure 46.** *Spotted Eagle Ray (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

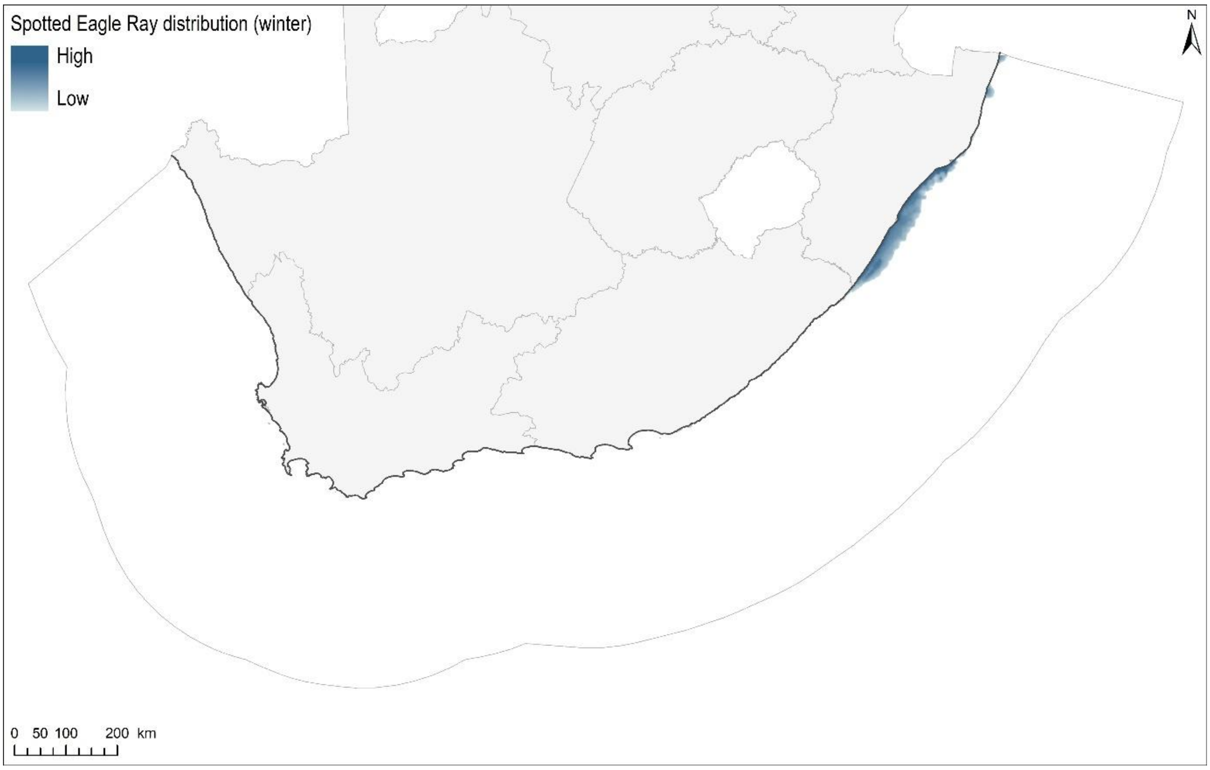


**Figure 47.** *Spotted Eagle Ray (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021)*

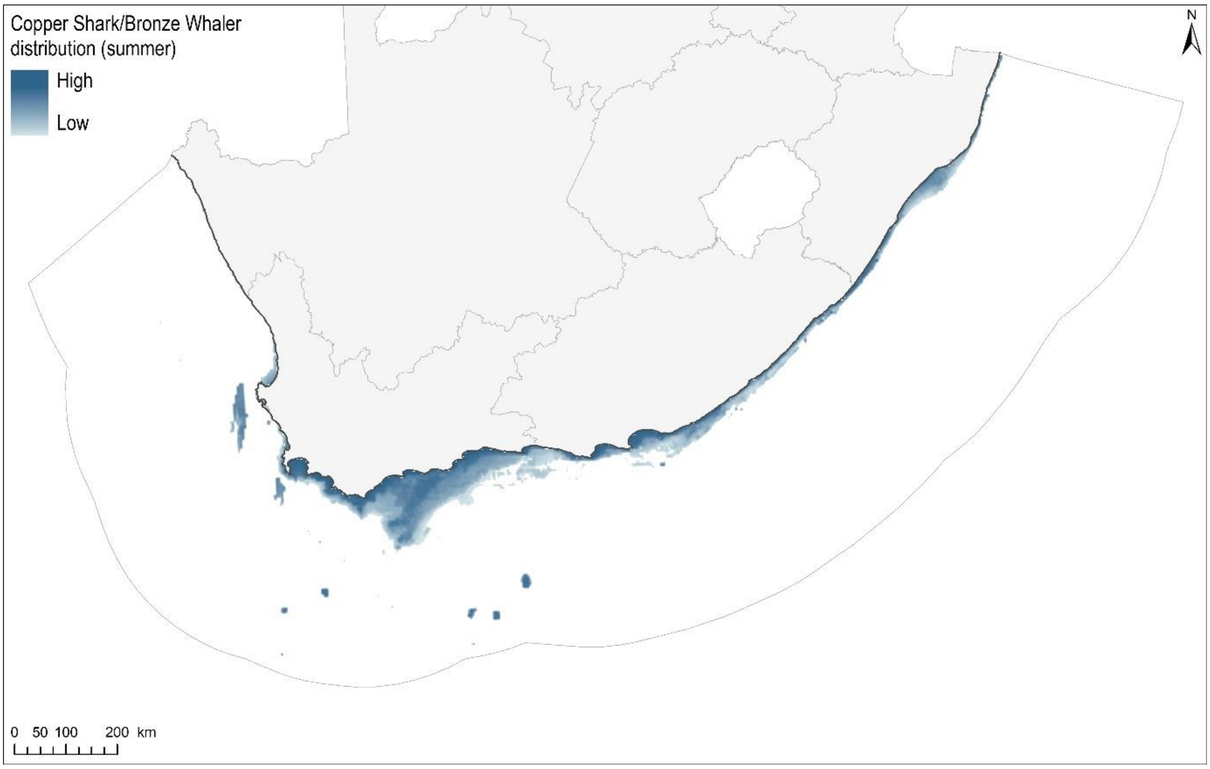


**Figure 48.** *Copper Shark/Bronze Whaler (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

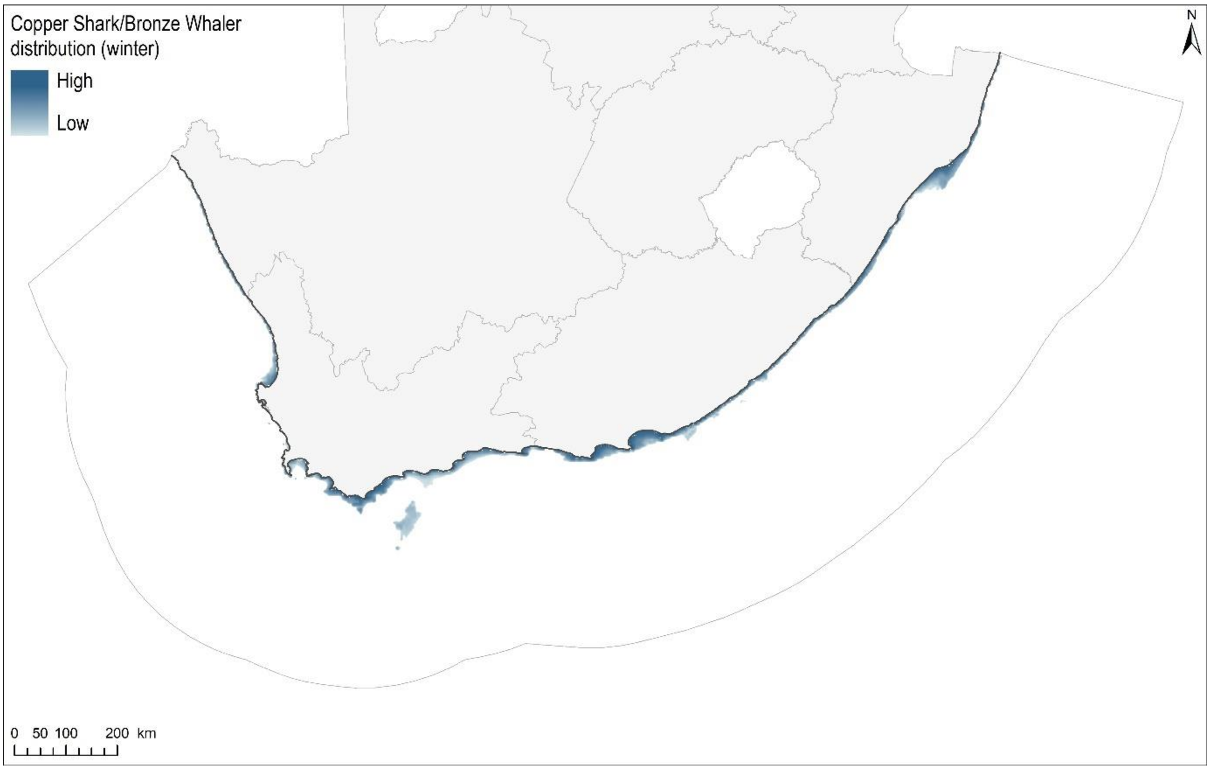


**Figure 49.** *Copper Shark/Bronze Whaler (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

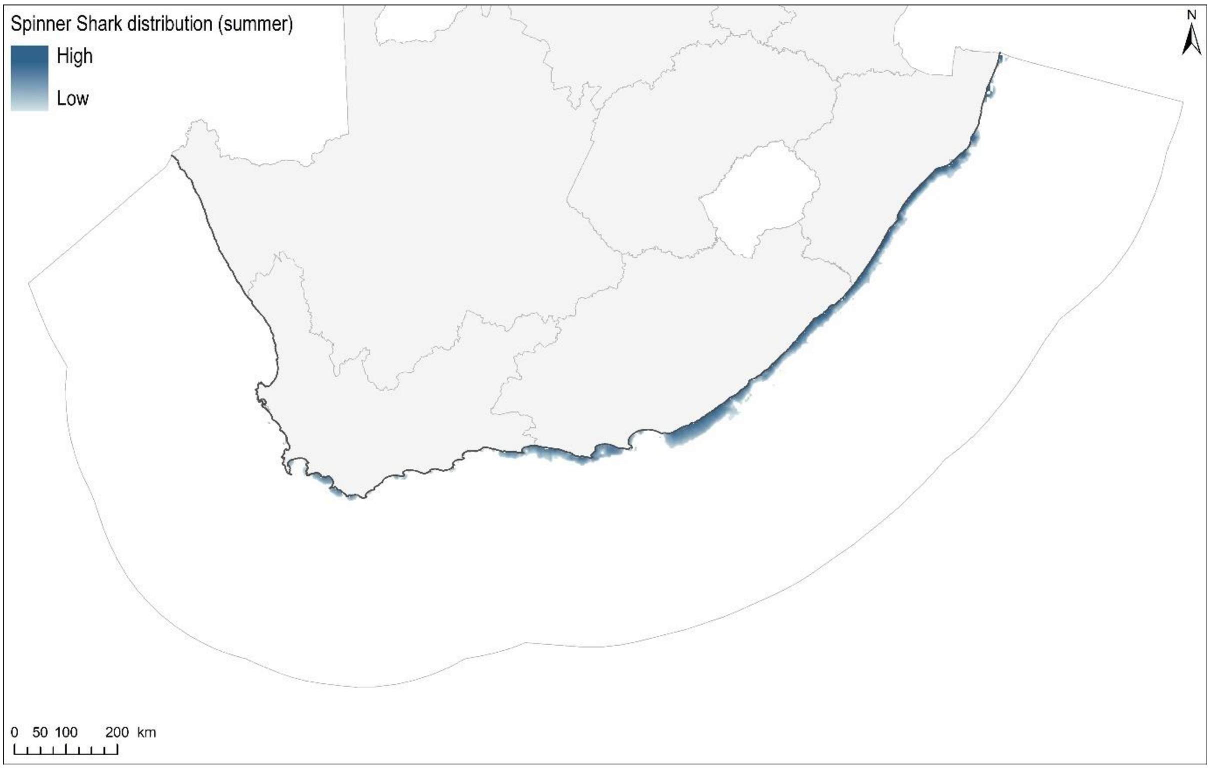


**Figure 50.** *Spinner Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021)*

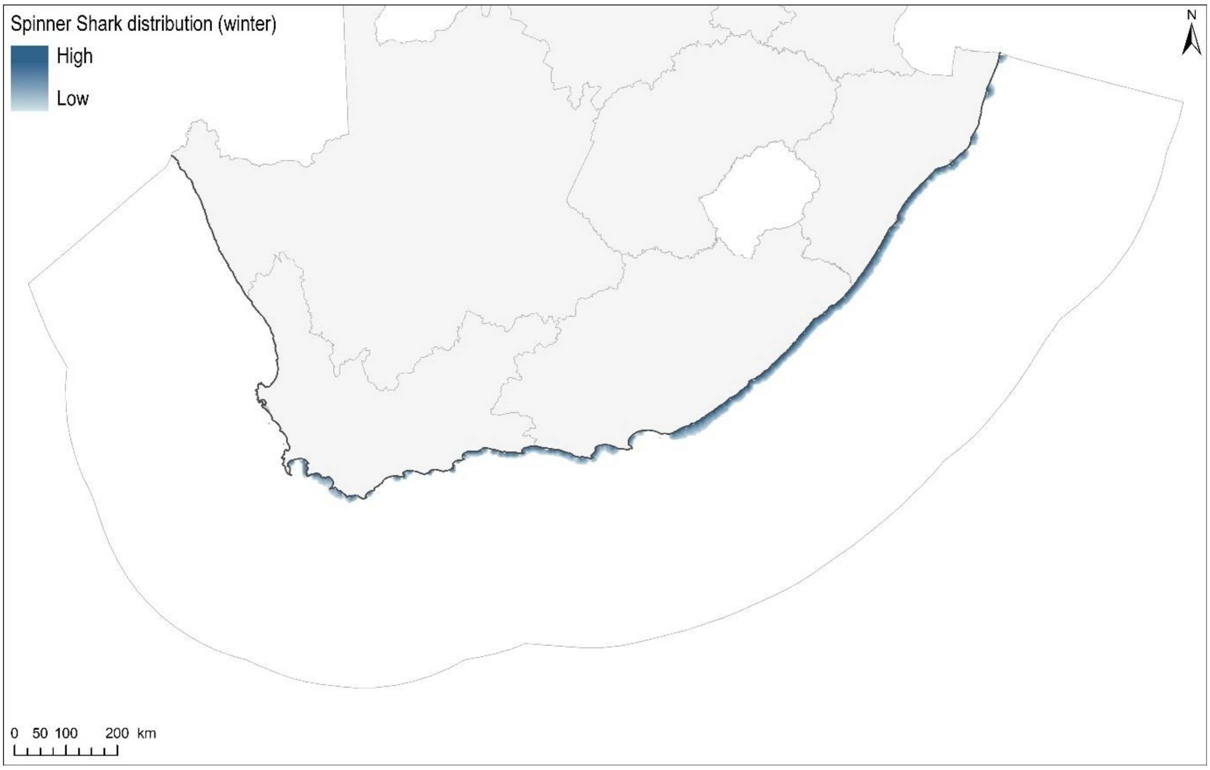


**Figure 51.** *Spinner Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

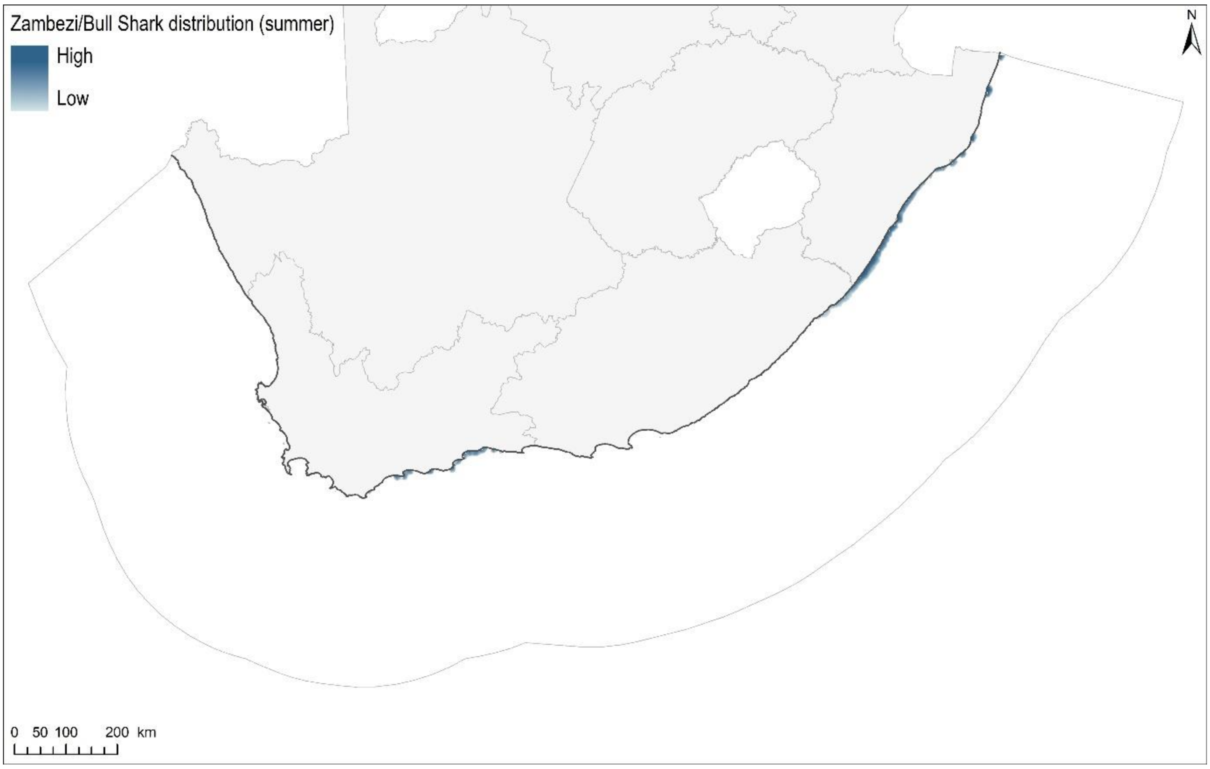


**Figure 52.** *Zambezi/Bull Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

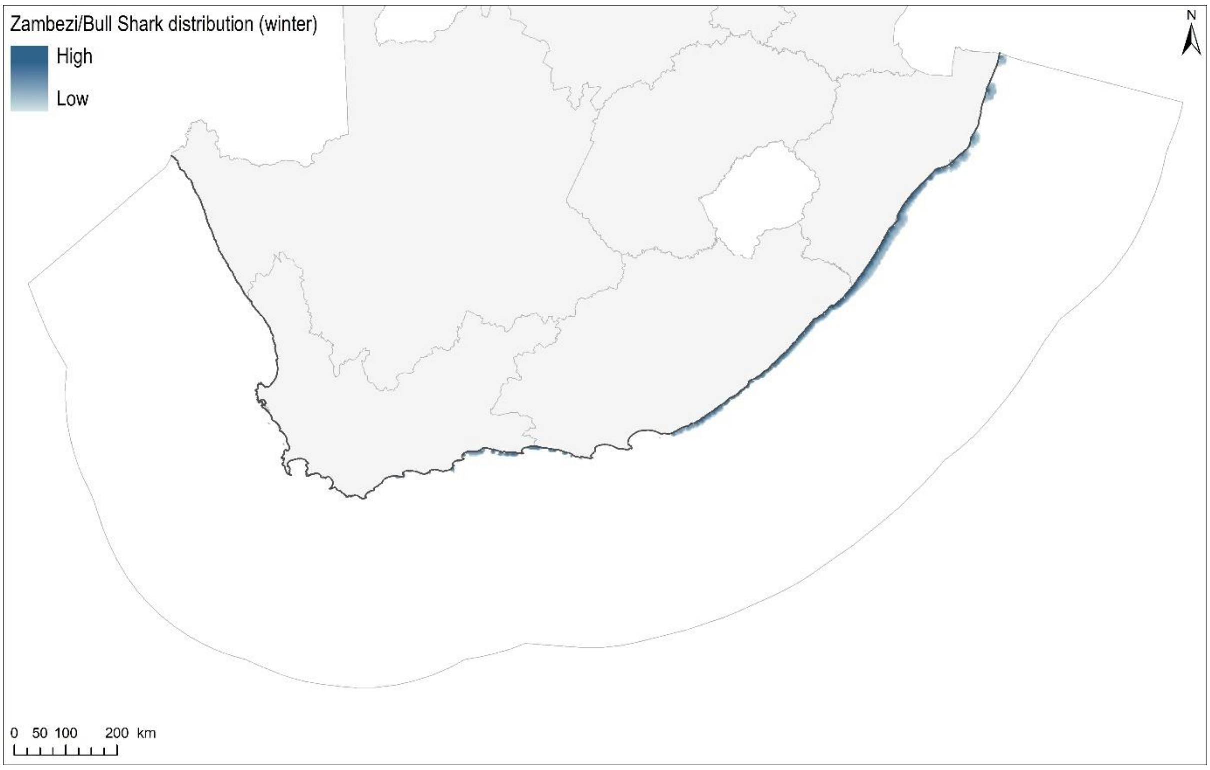


**Figure 53.** *Zambezi/Bull Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

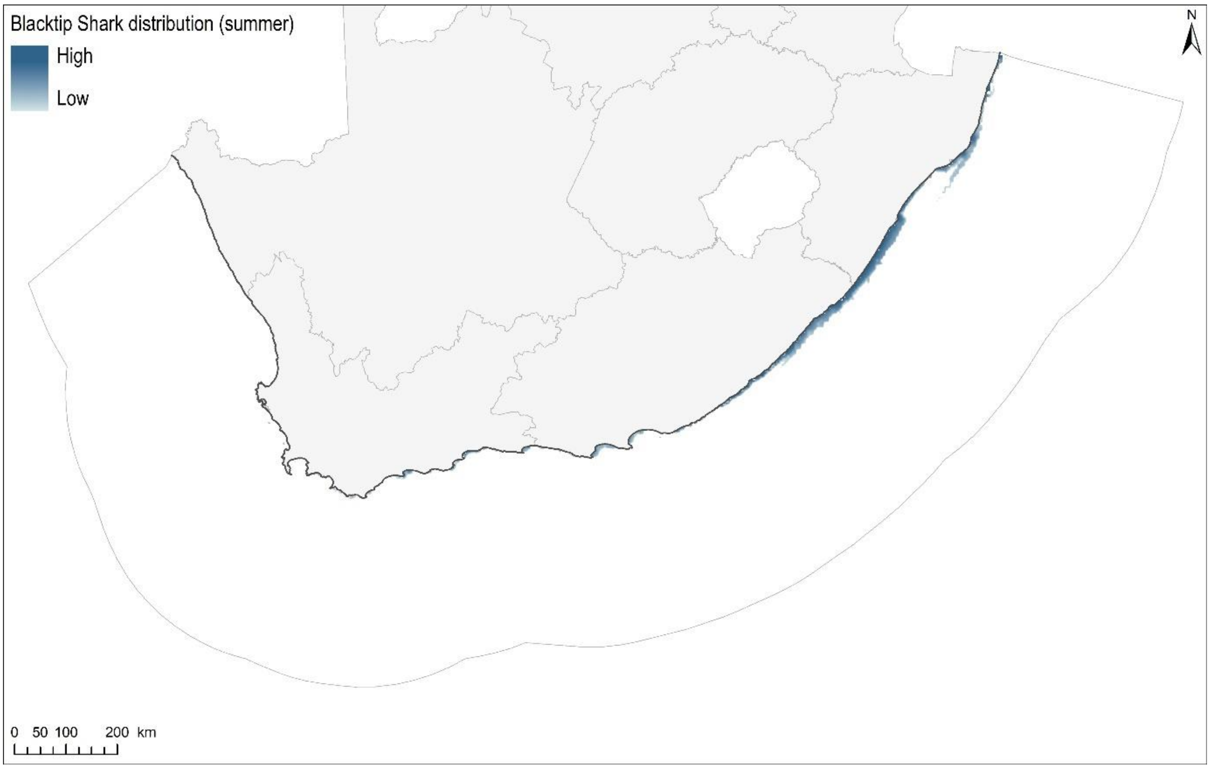


**Figure 54.** *Blacktip Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

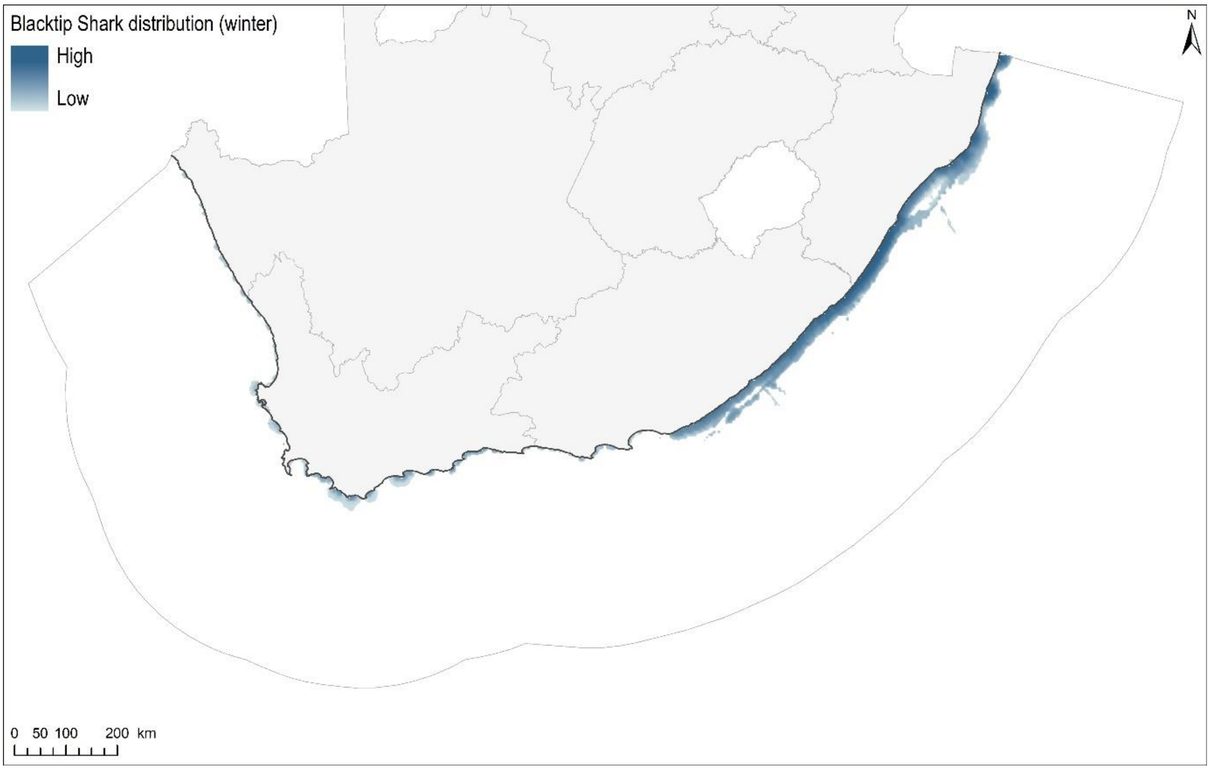


**Figure 55.** *Blacktip Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

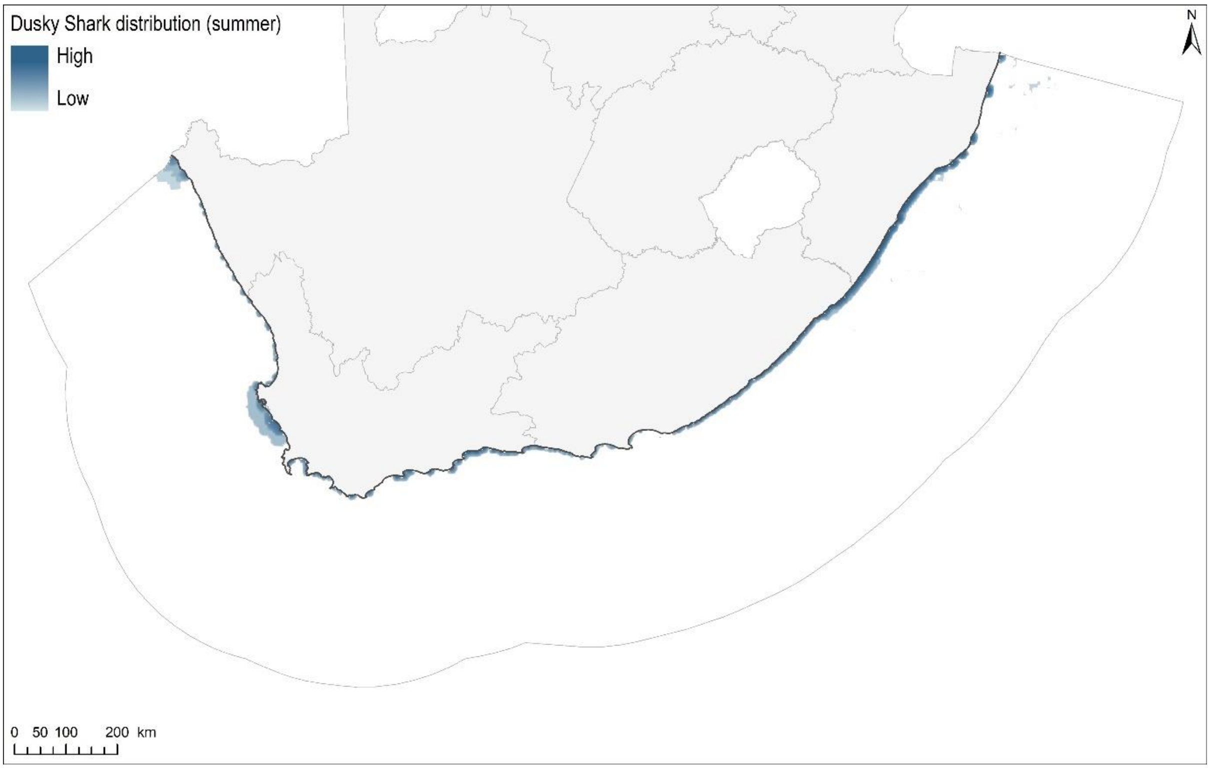


**Figure 56.** *Dusky Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

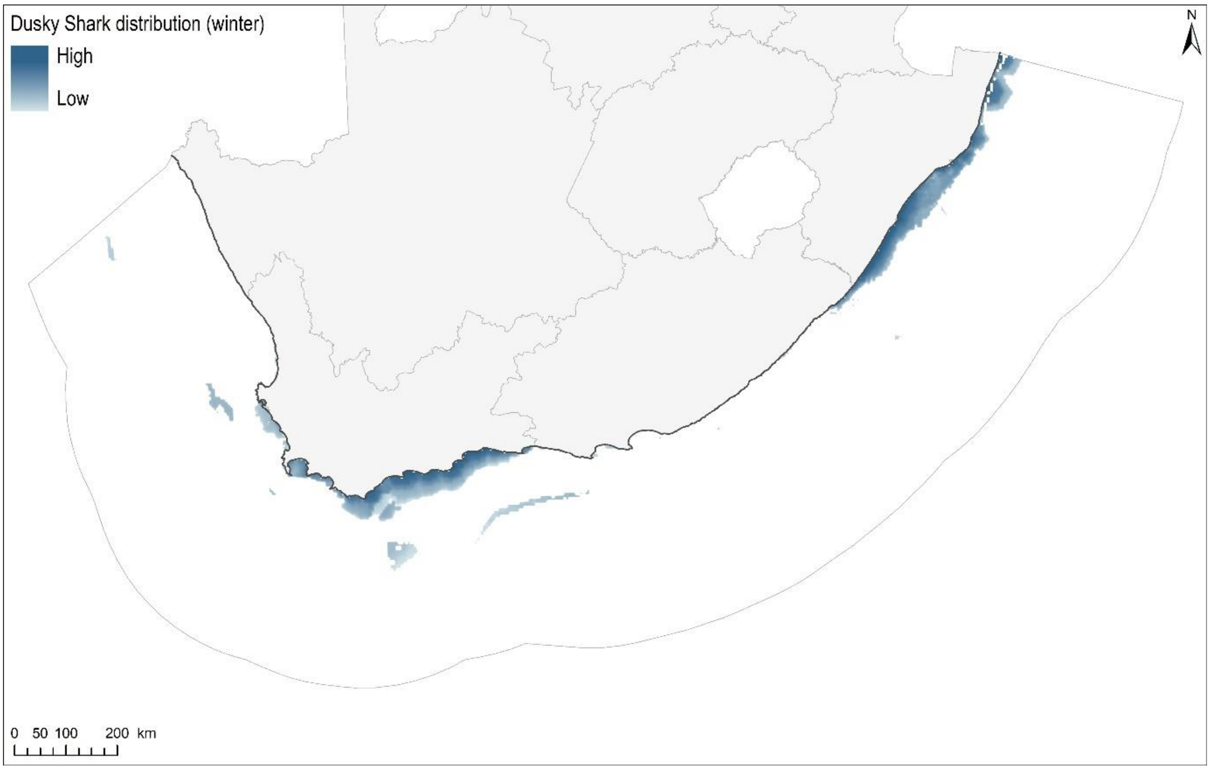


**Figure 57.** *Dusky Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

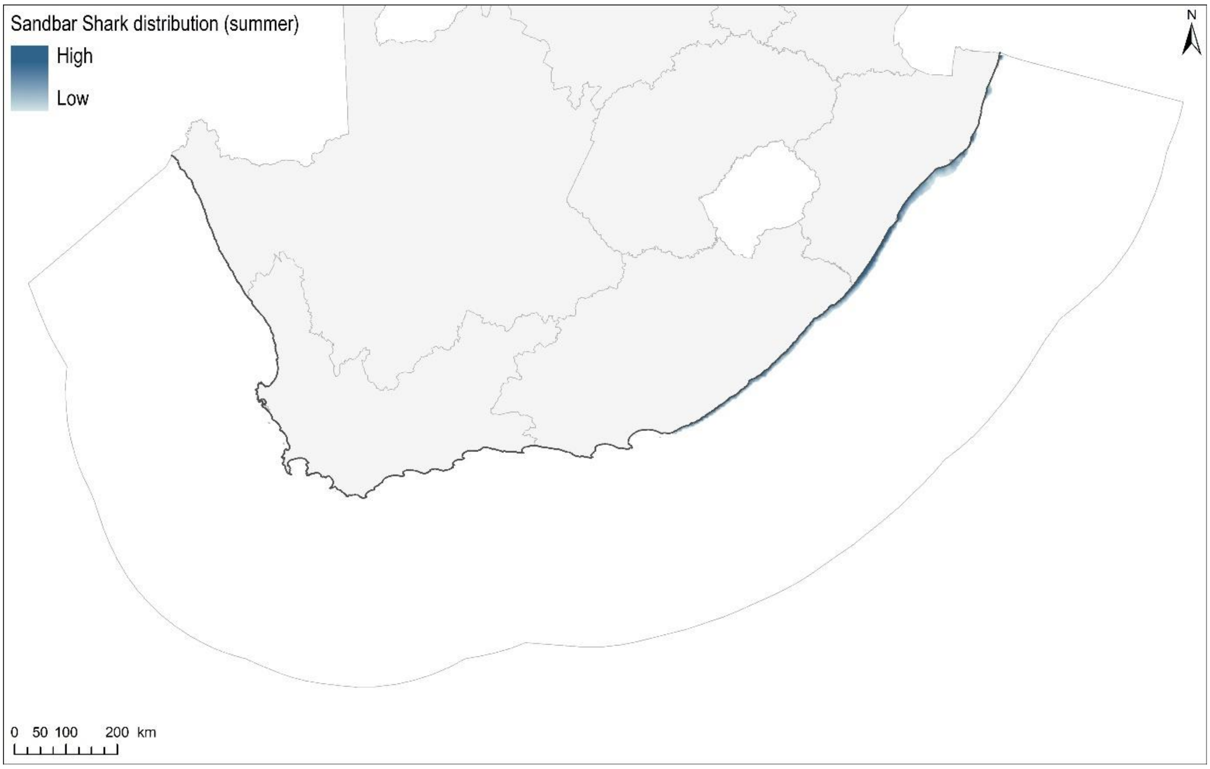


**Figure 58.** *Sandbar Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

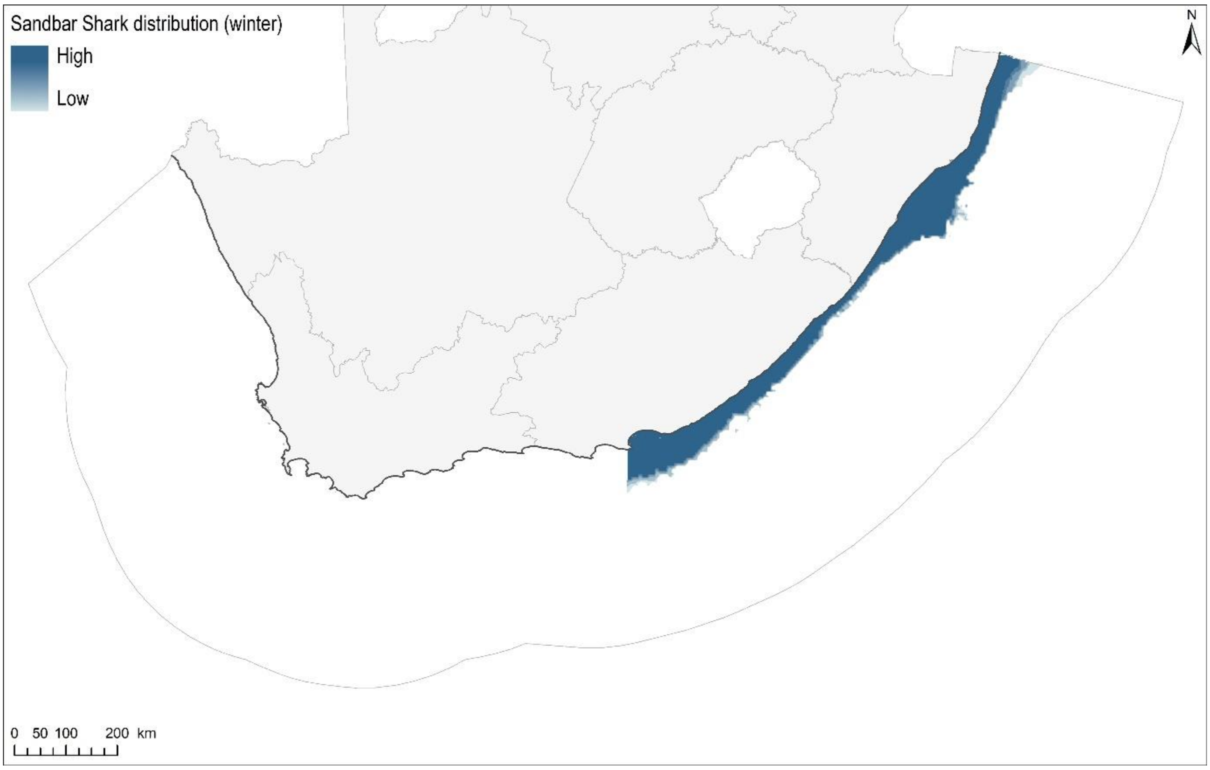


**Figure 59.** *Sandbar Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

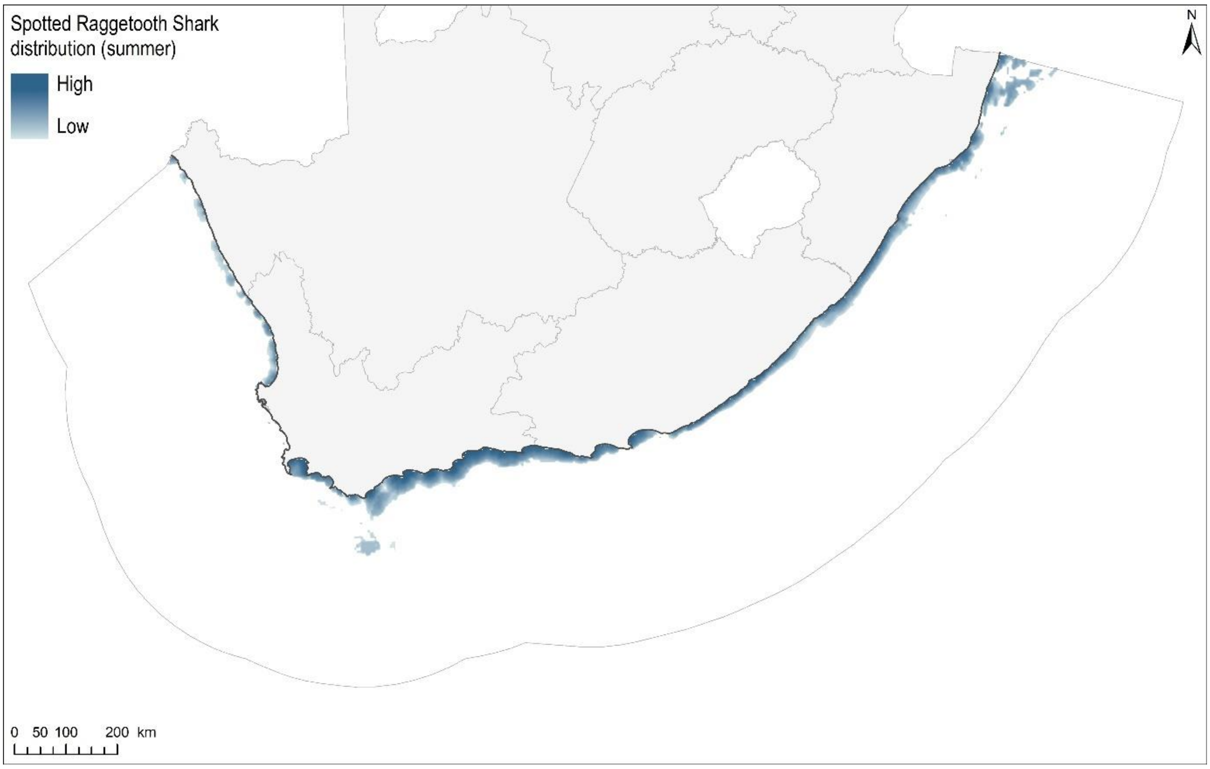


**Figure 60.** *Spotted Raggedtooth Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

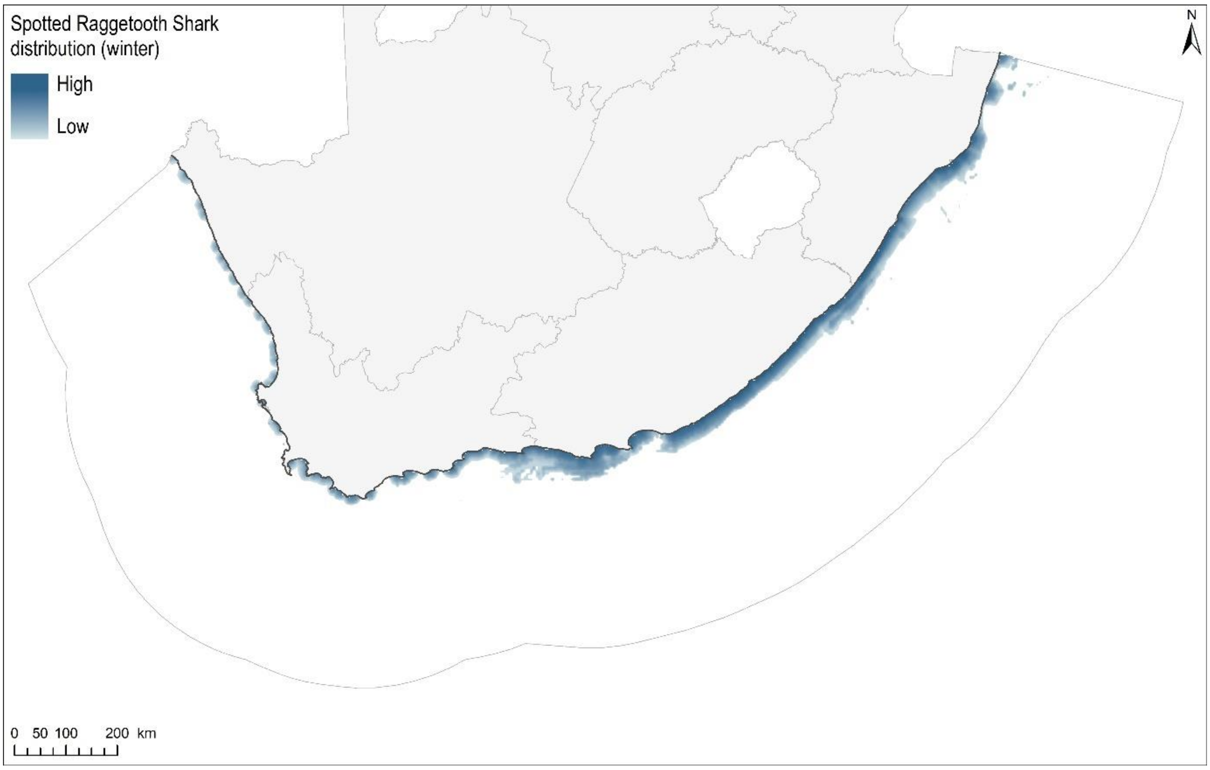


**Figure 61.** *Spotted Raggedtooth Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

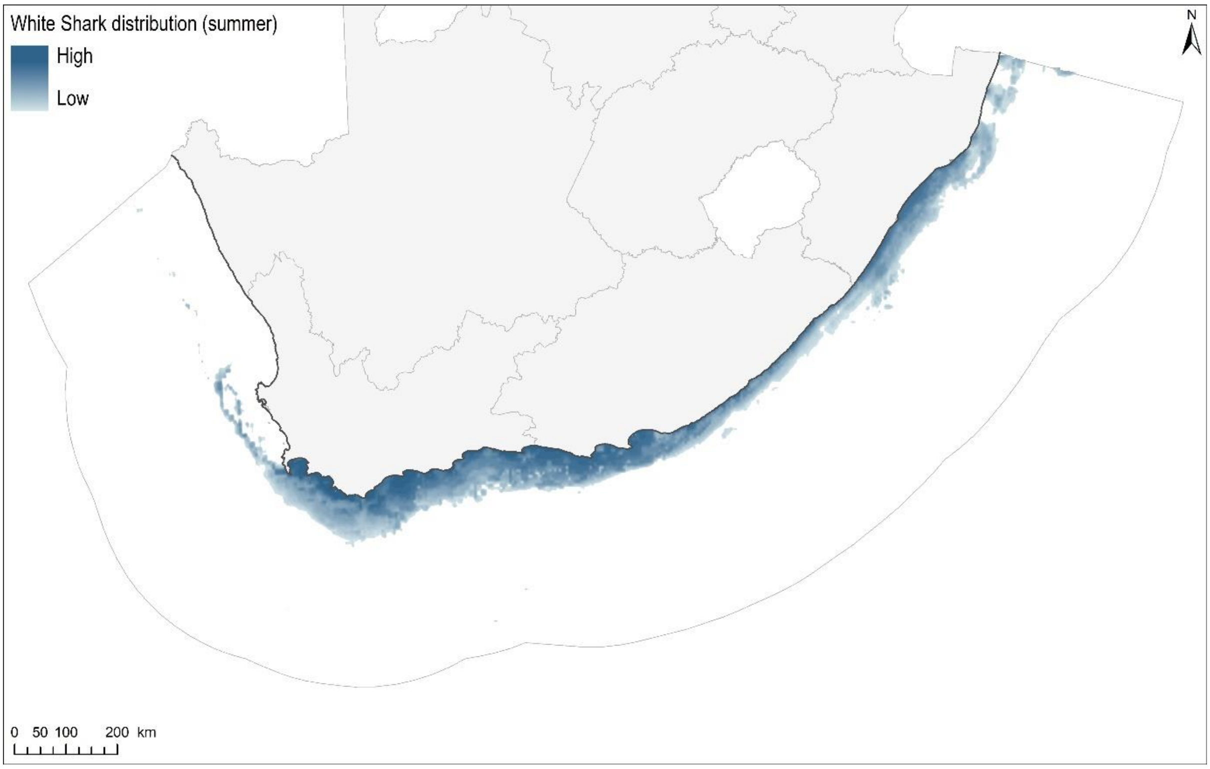


**Figure 62.** *White Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

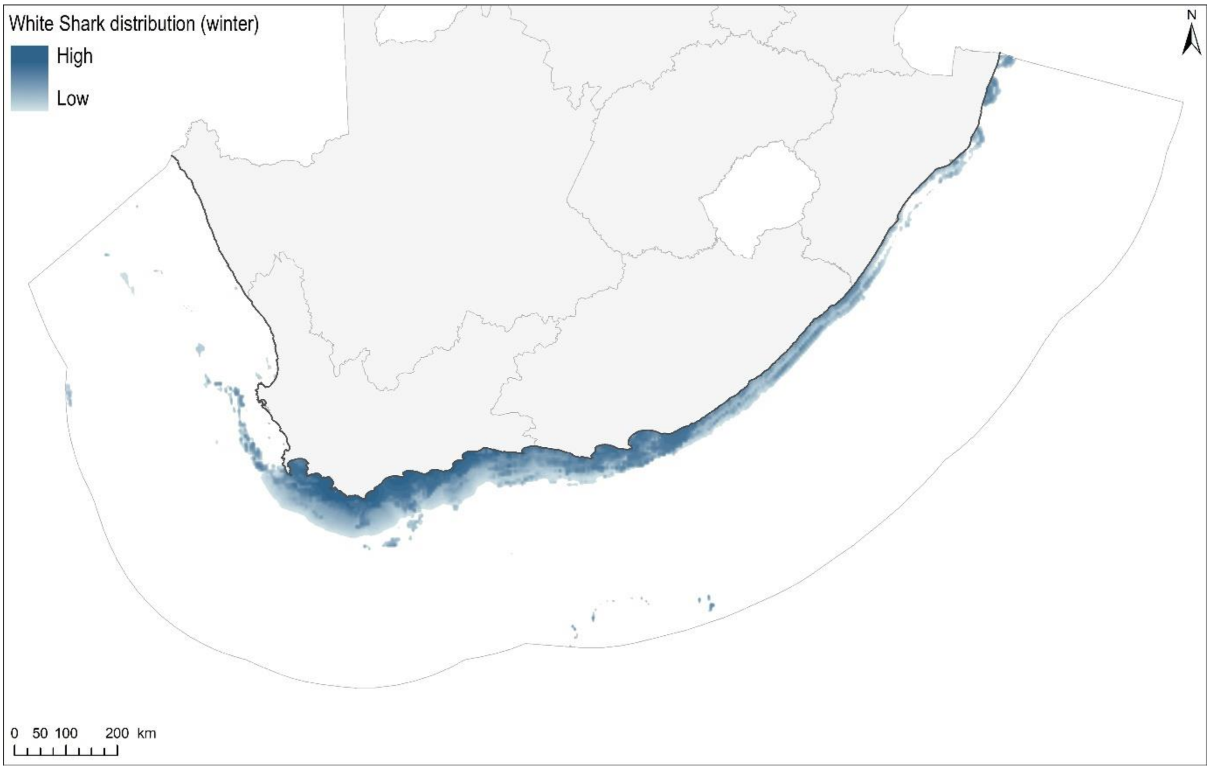


**Figure 63.** *White Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

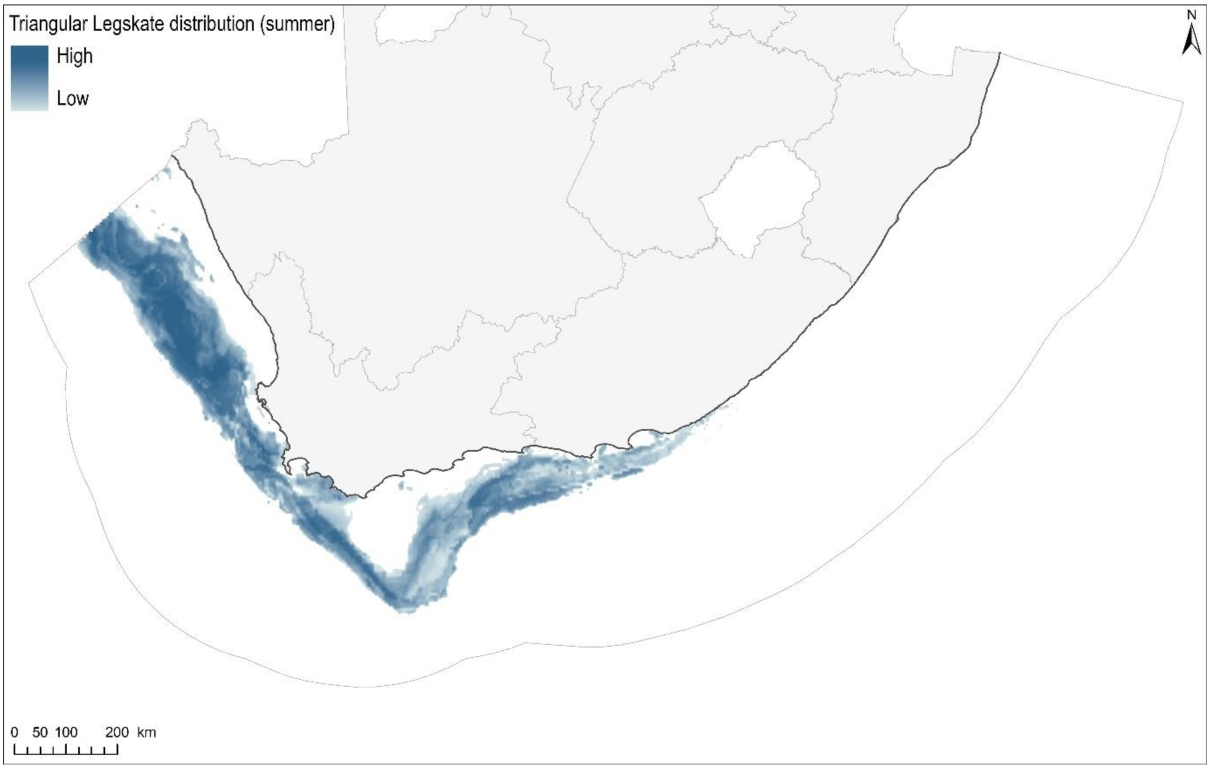


**Figure 64.** *Triangular Legskate (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

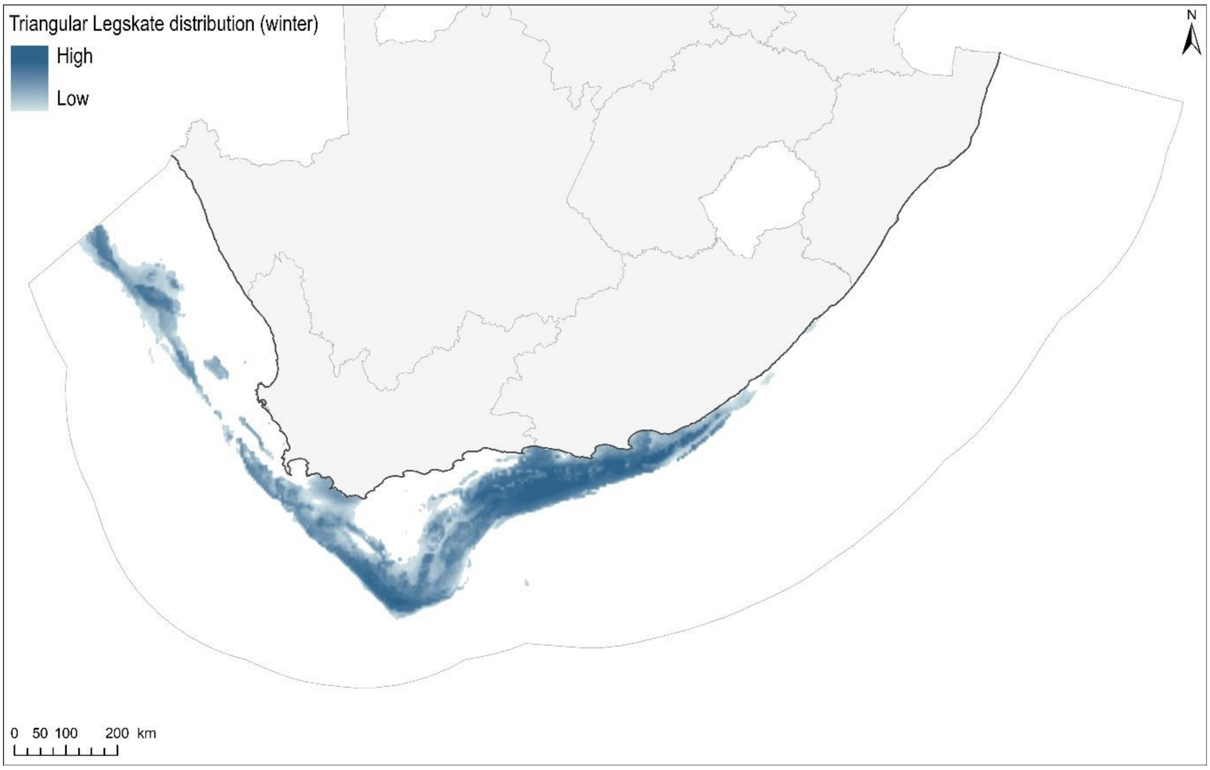


**Figure 65.** *Triangular Legskate (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

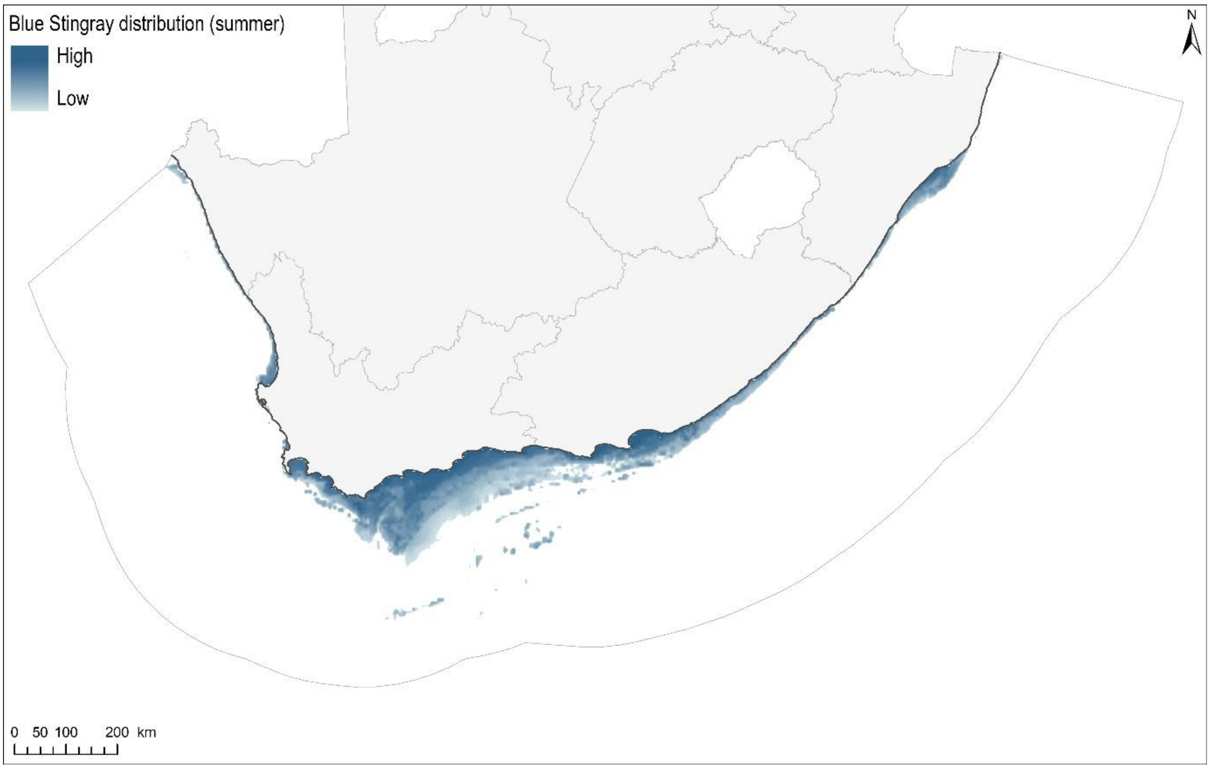


**Figure 66.** *Blue Stingray (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

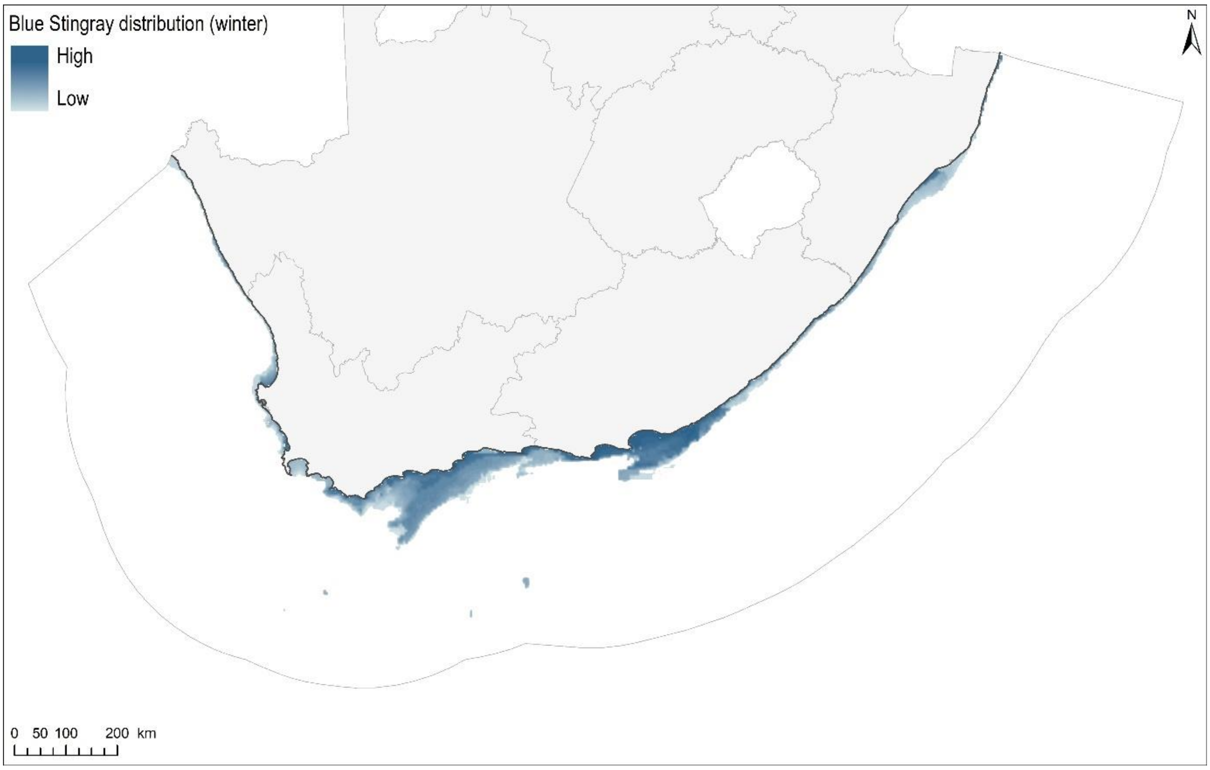


**Figure 67.** *Blue Stingray (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

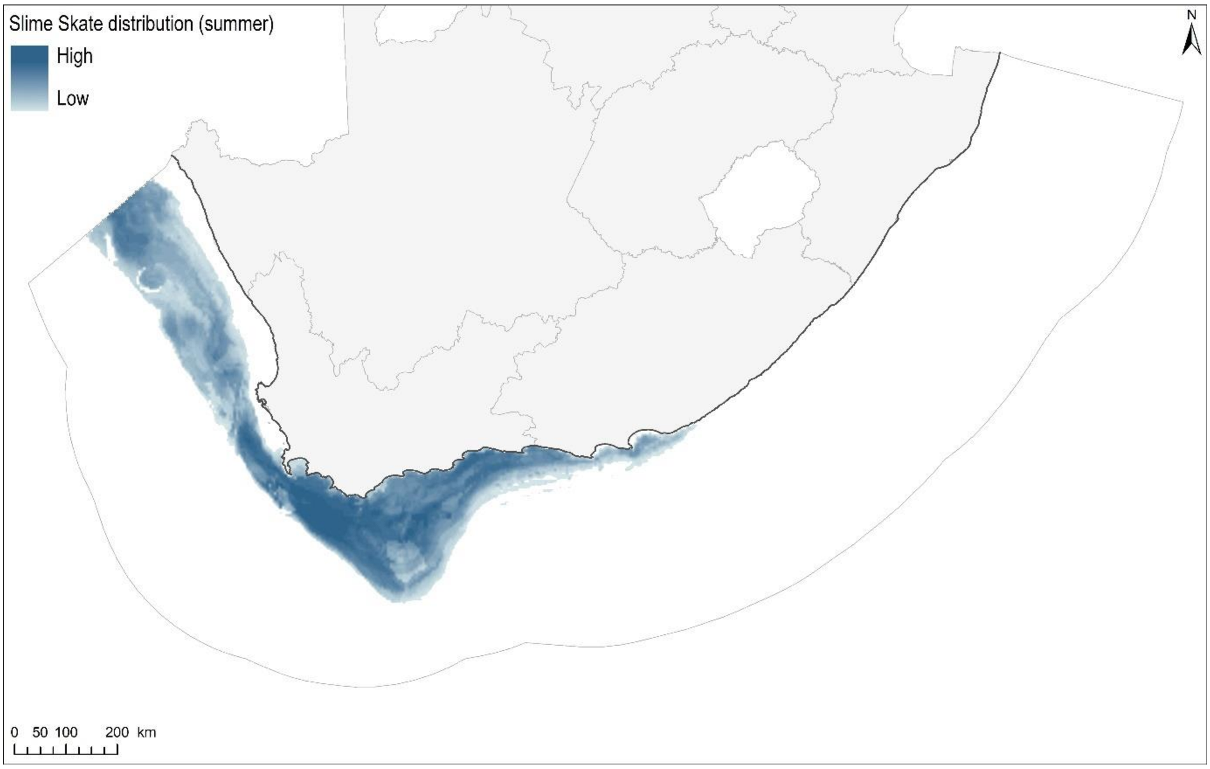


**Figure 68.** *Slime Skate (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

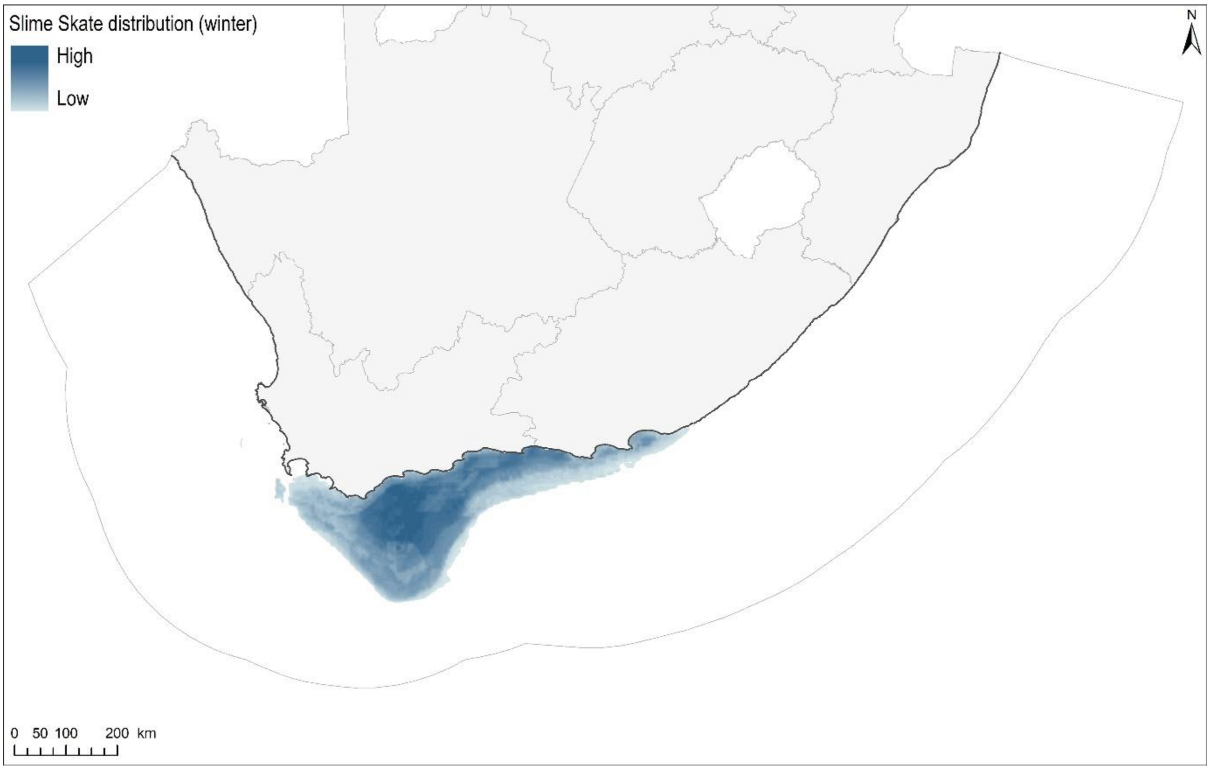


**Figure 69.** *Slime Skate (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

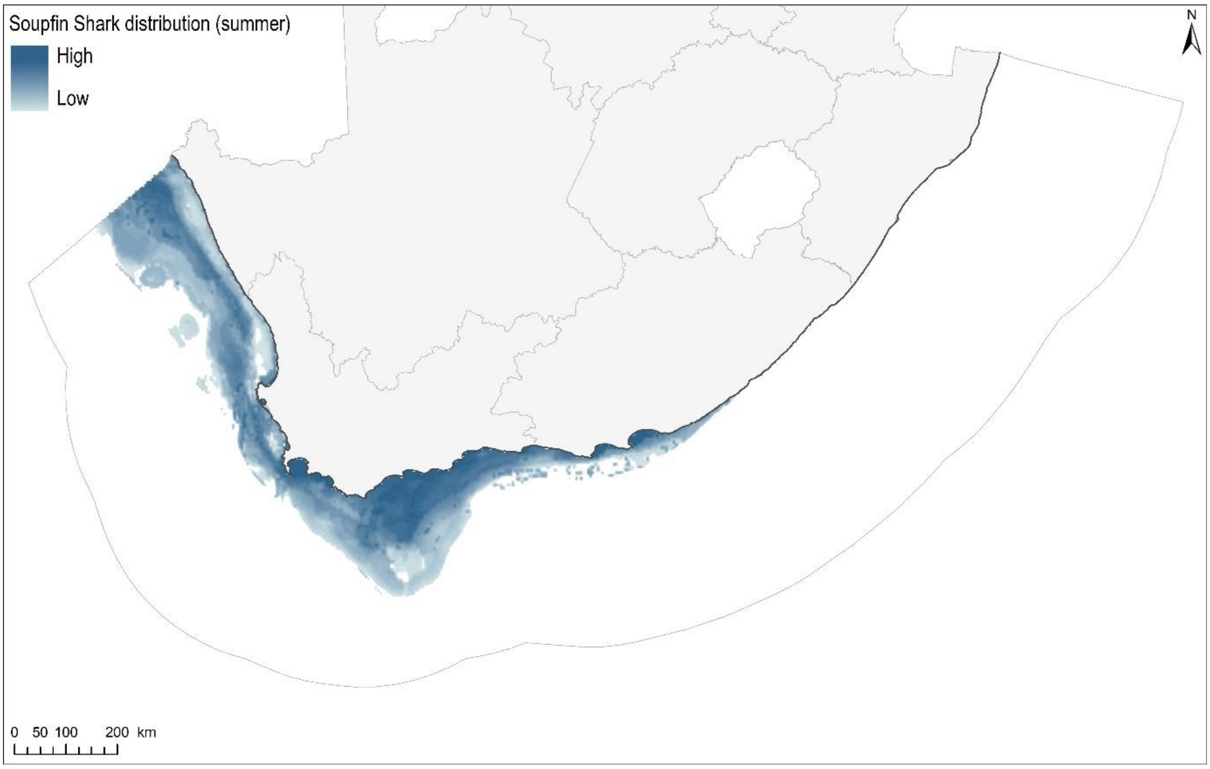


**Figure 70.** *Soupfin Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

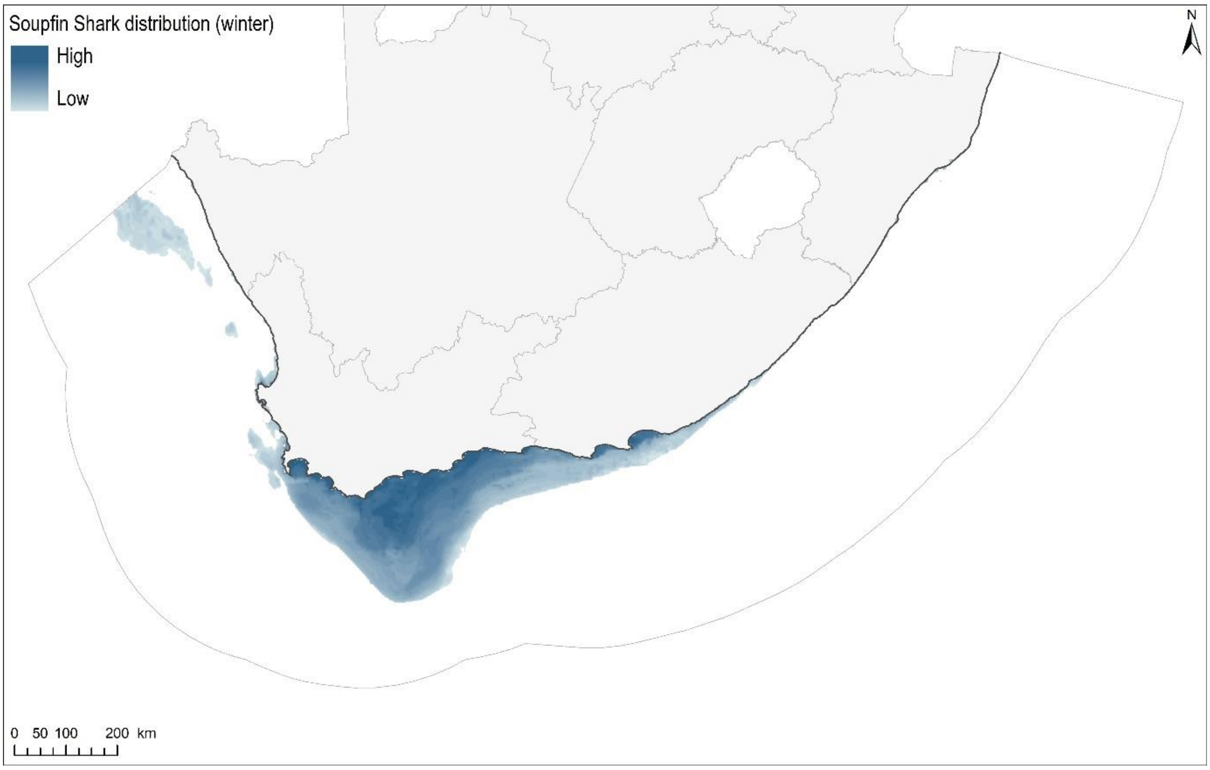


**Figure 71.** *Soupfin Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

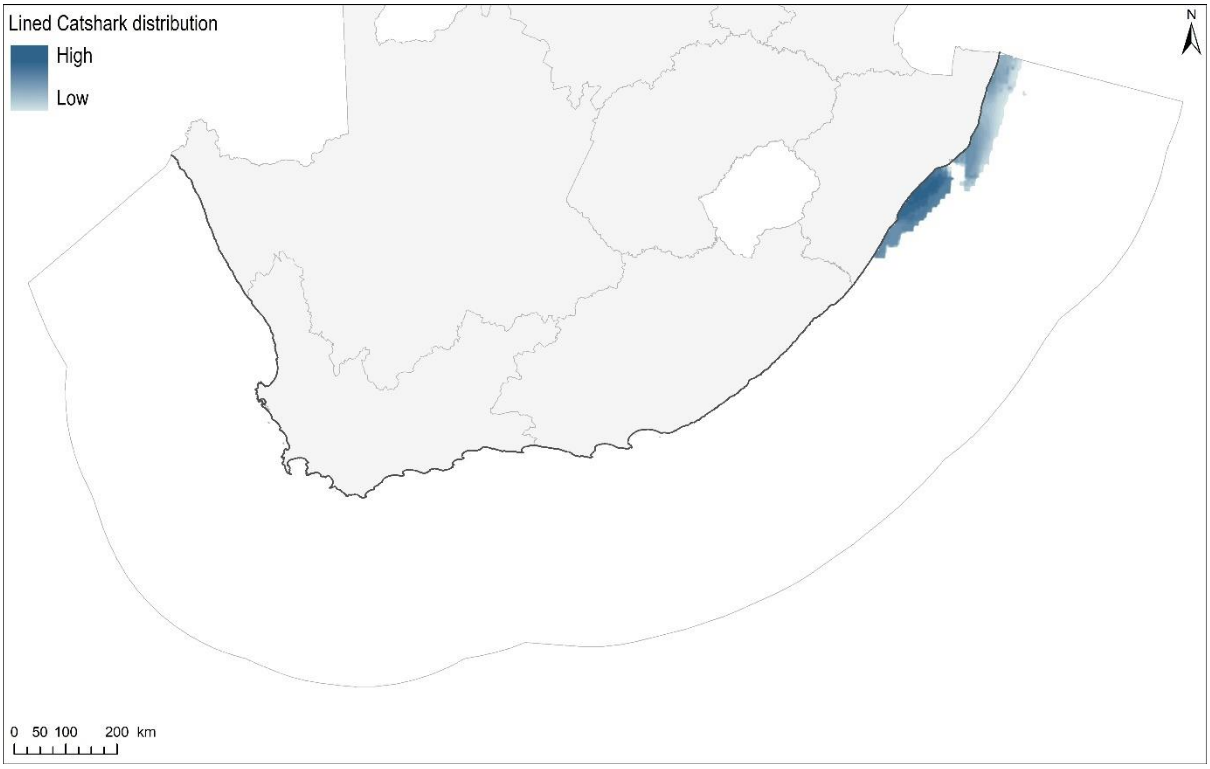


**Figure 72.** *Lined Catshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

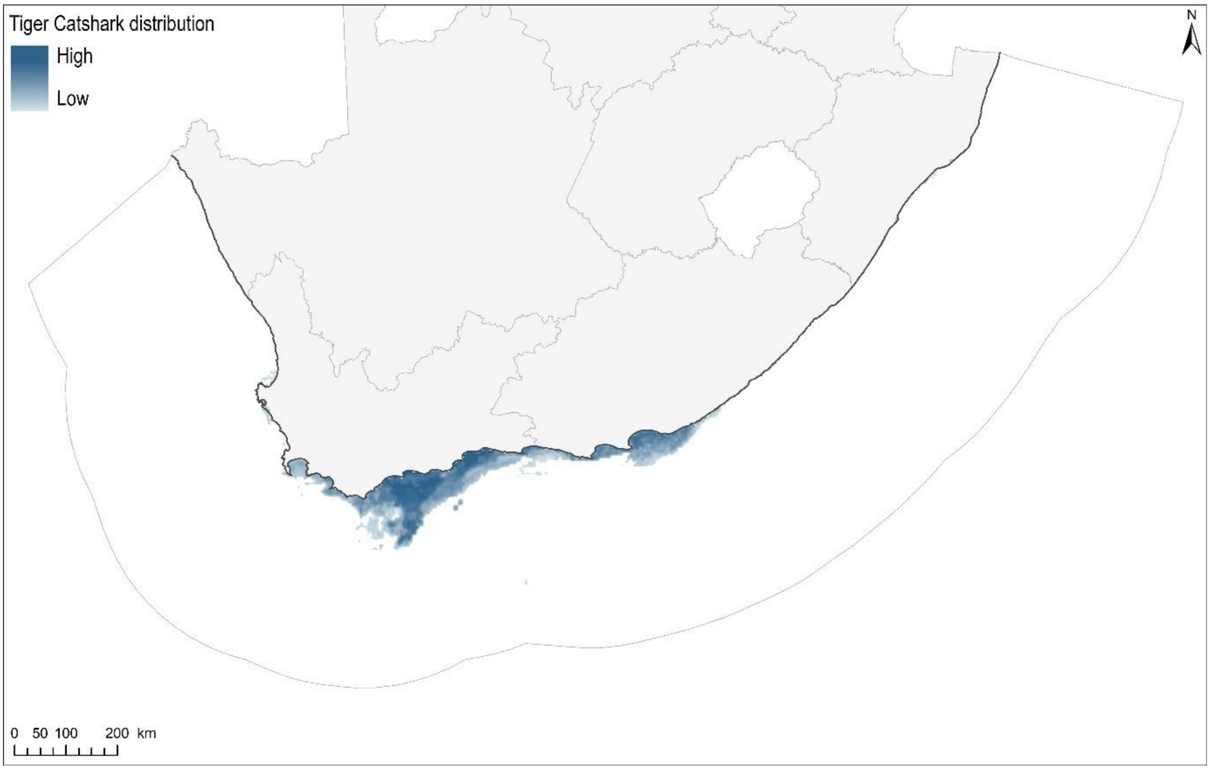


**Figure 73.** *Tiger Catshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

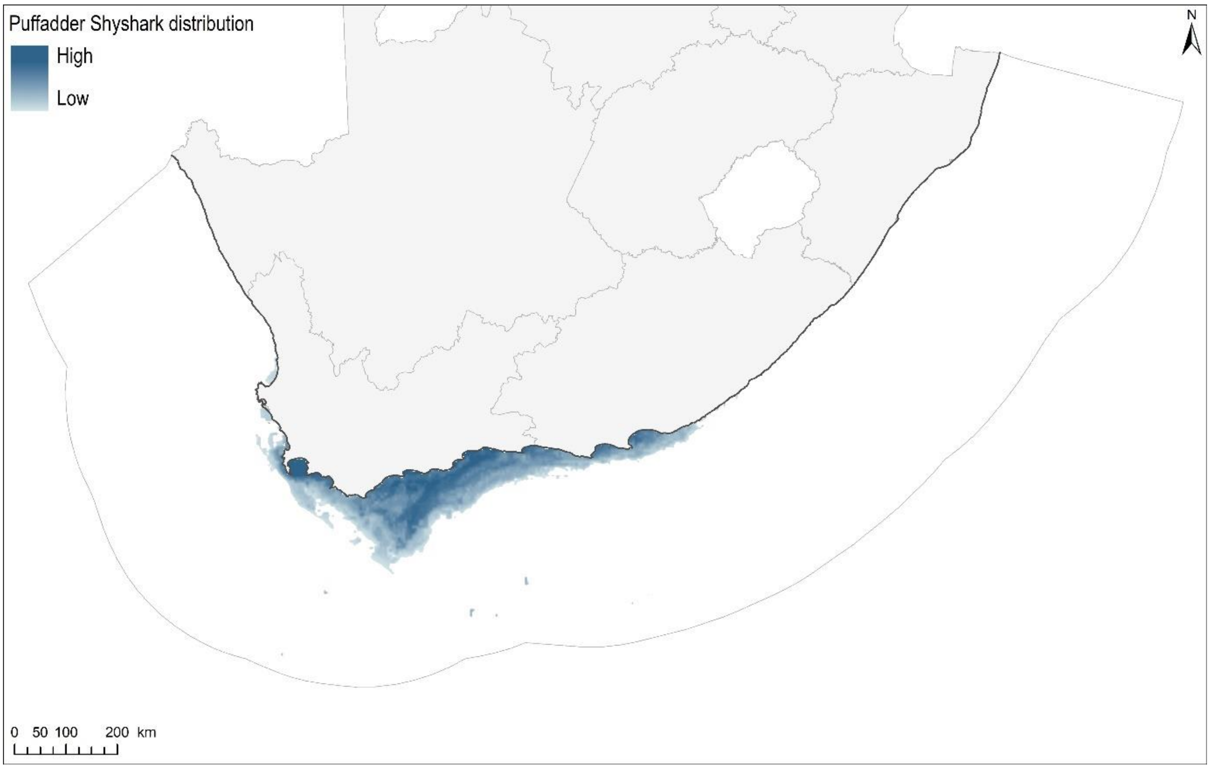


**Figure 74.** *Puffadder Shyshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

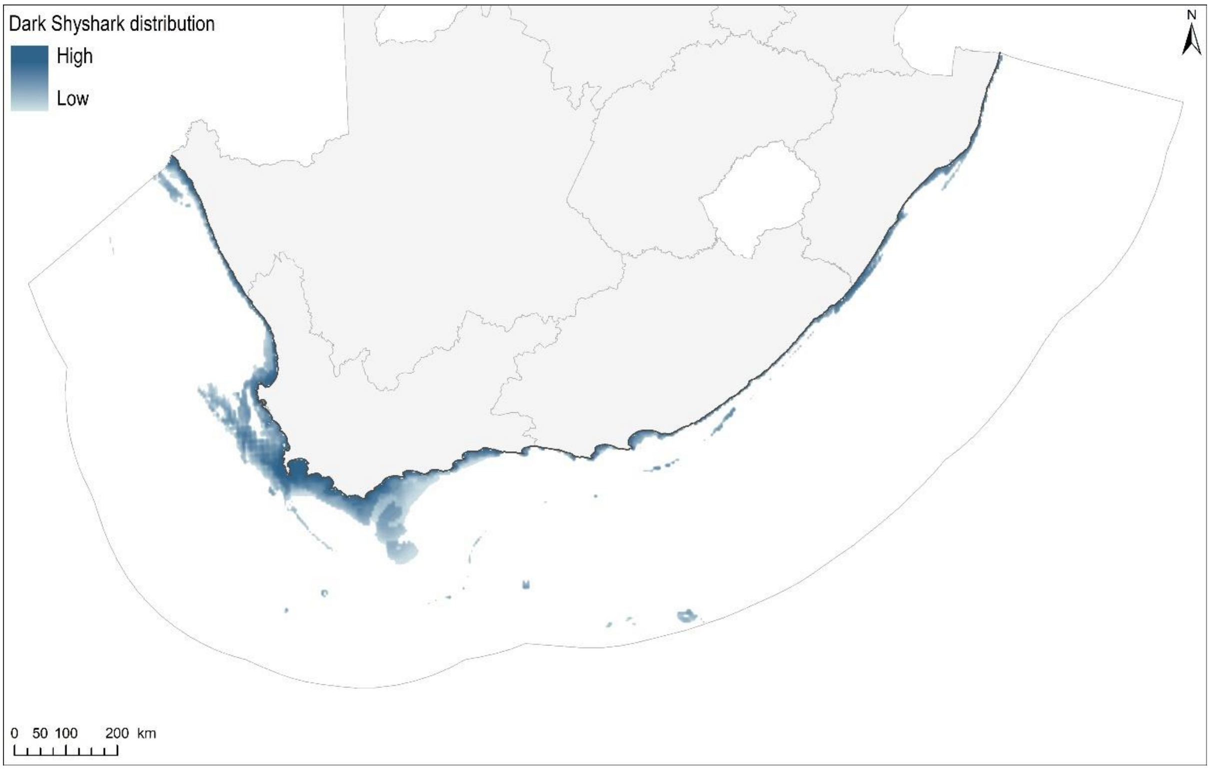


**Figure 75.** *Dark Shyshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

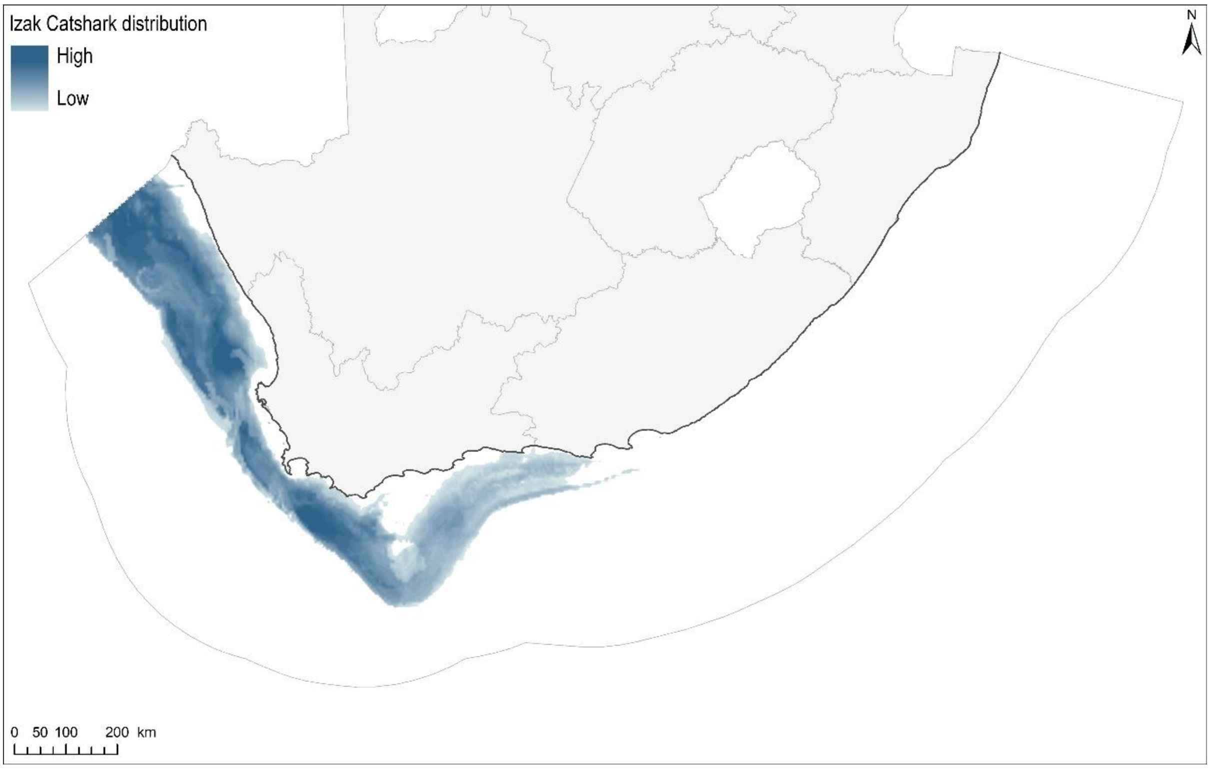


**Figure 76.** *Izak Catshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

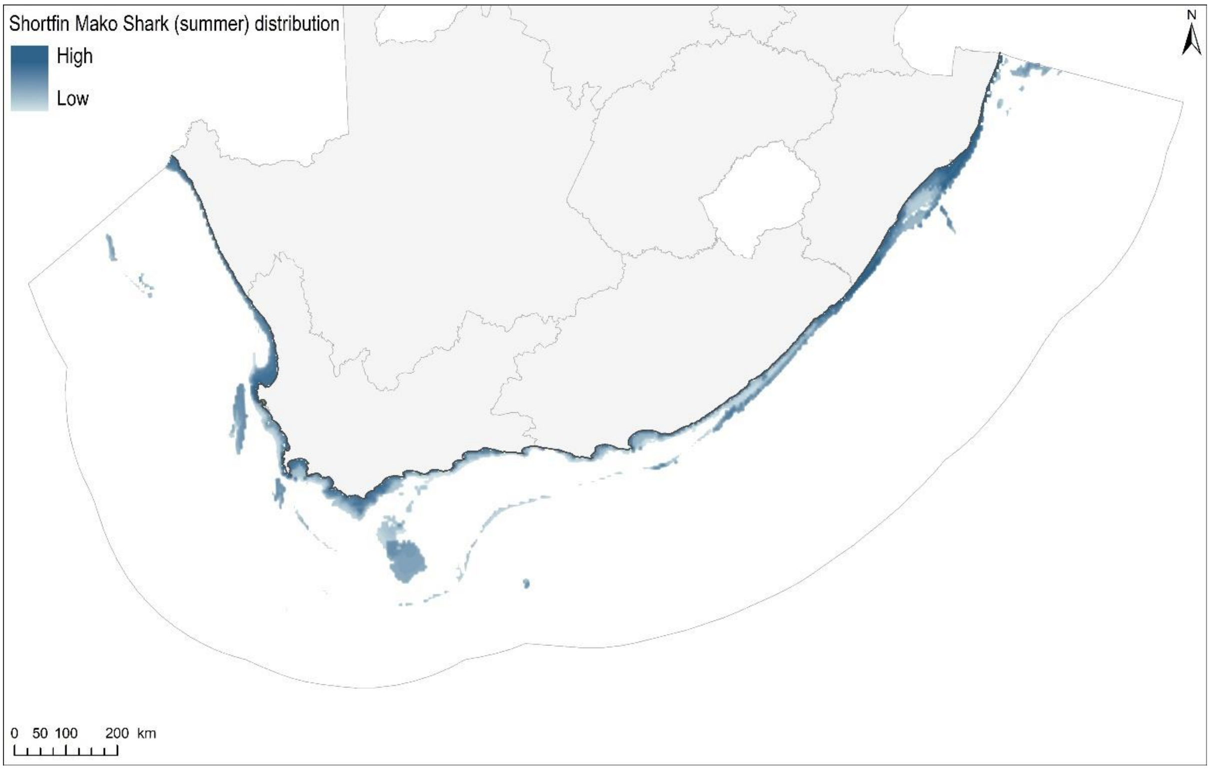


**Figure 77.** *Shortfin Mako Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

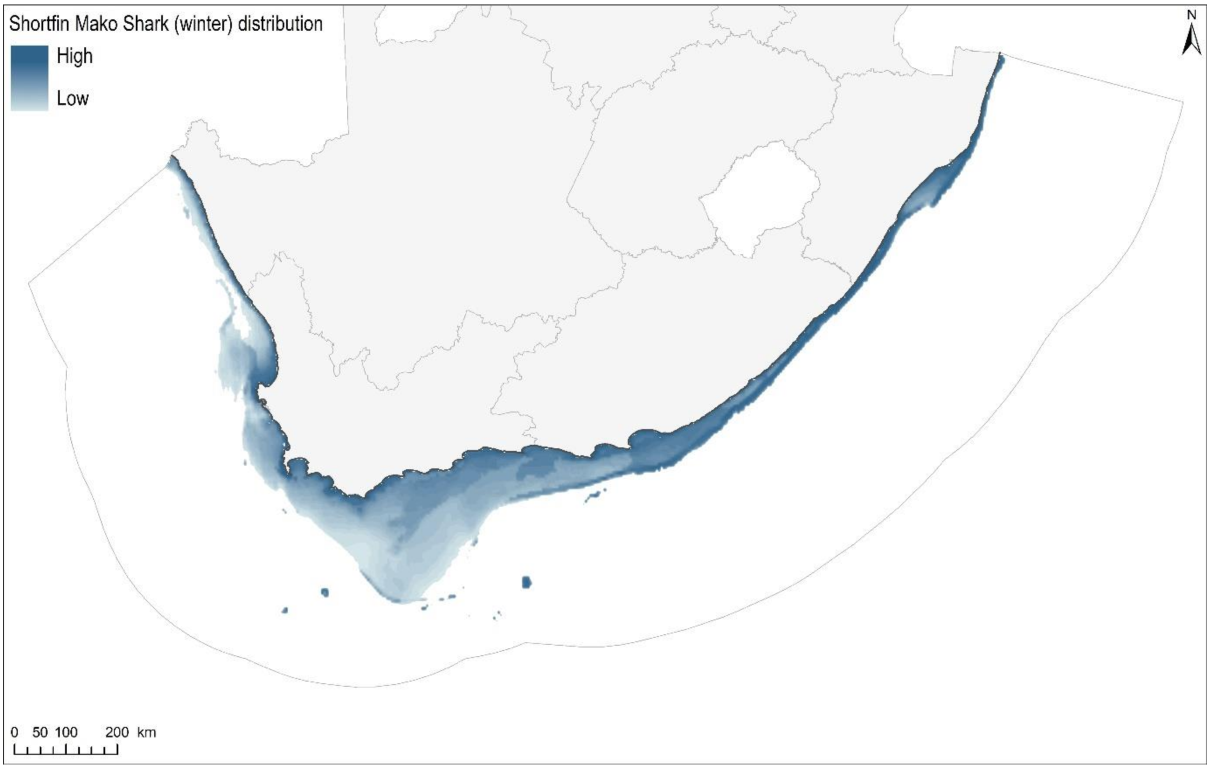


**Figure 78.** *Shortfin Mako Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

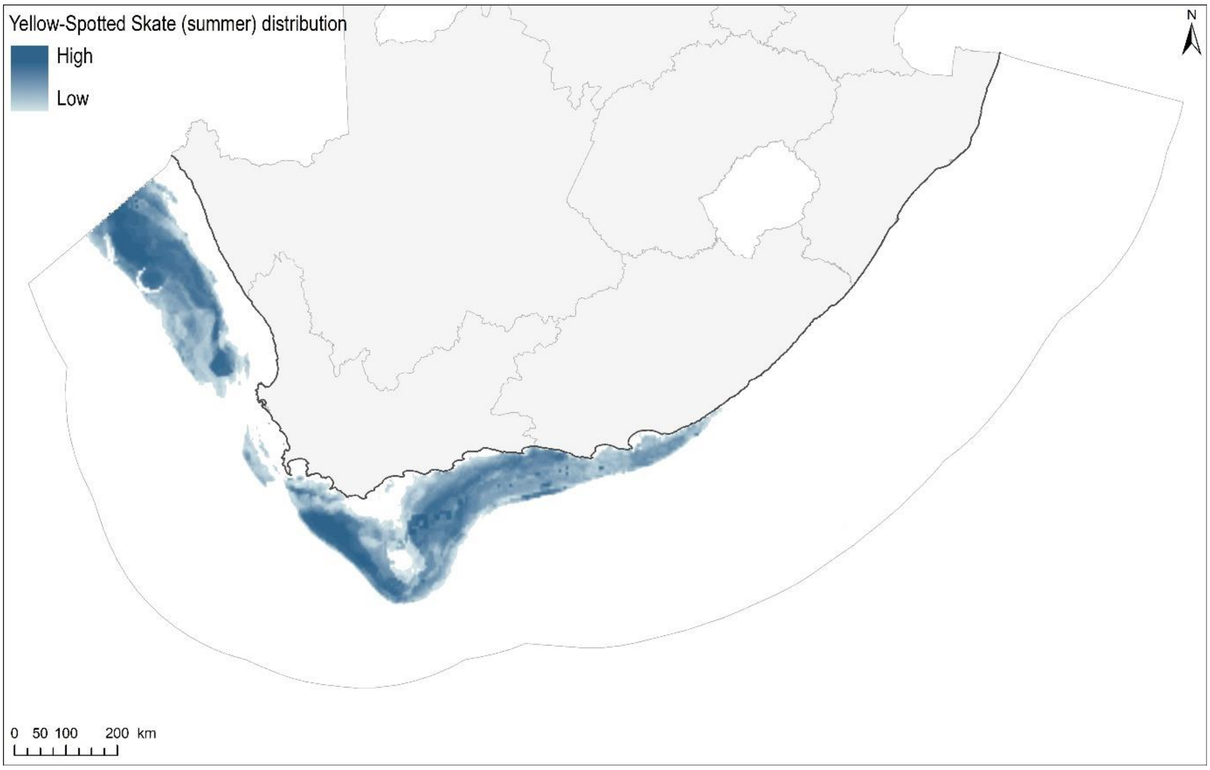


**Figure 79.** *Yellow-Spotted Skate (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

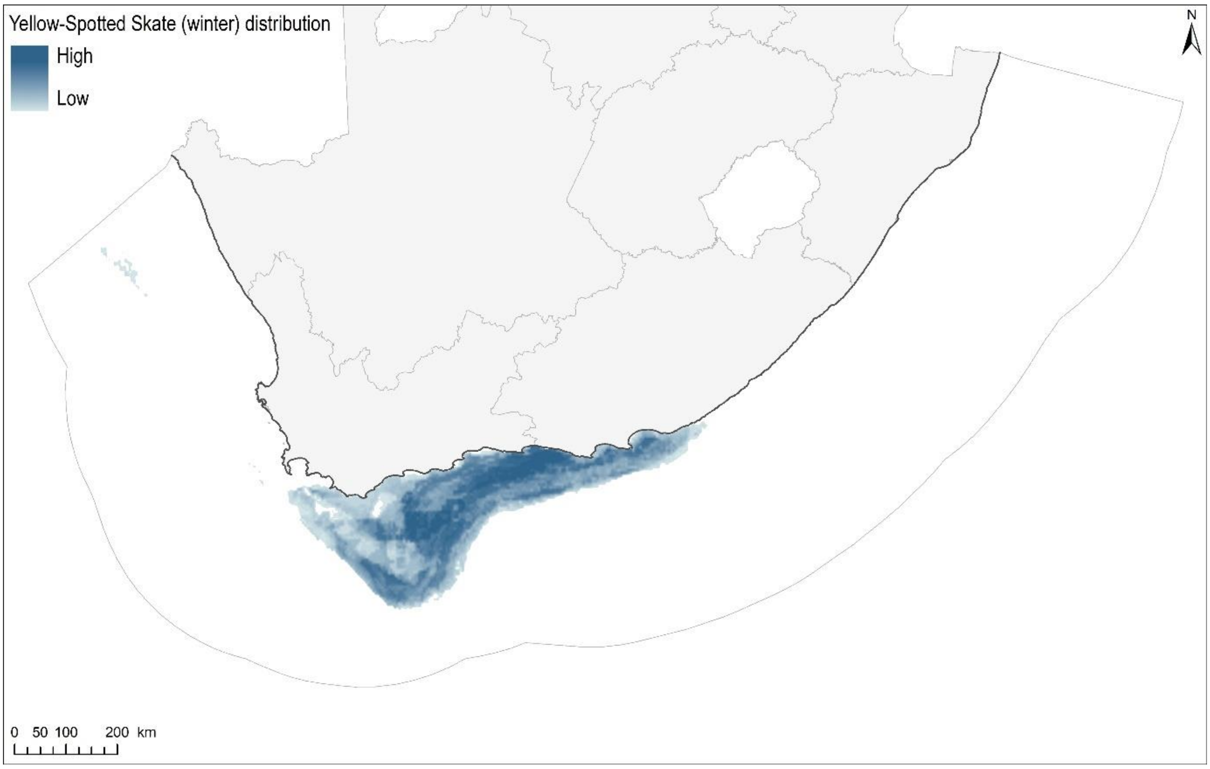


**Figure 80.** *Yellow-Spotted Skate (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

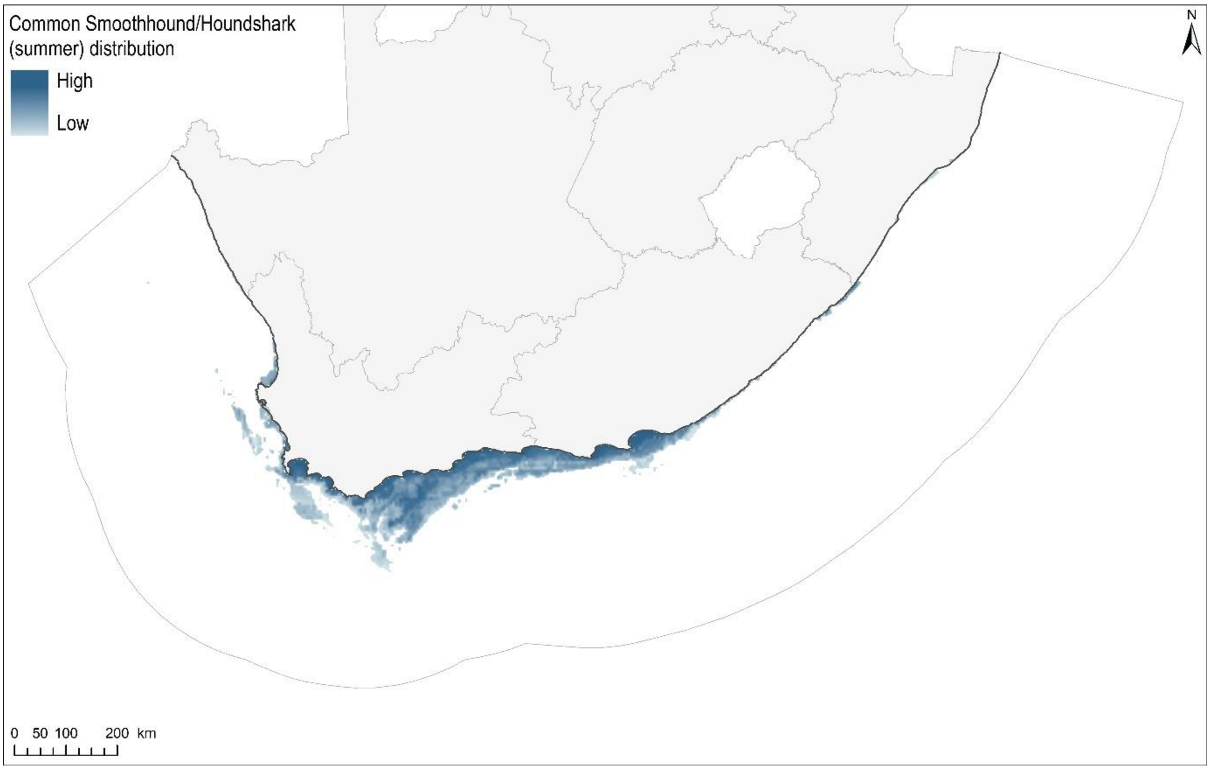


**Figure 81.** *Common Smoothhound/Houndshark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

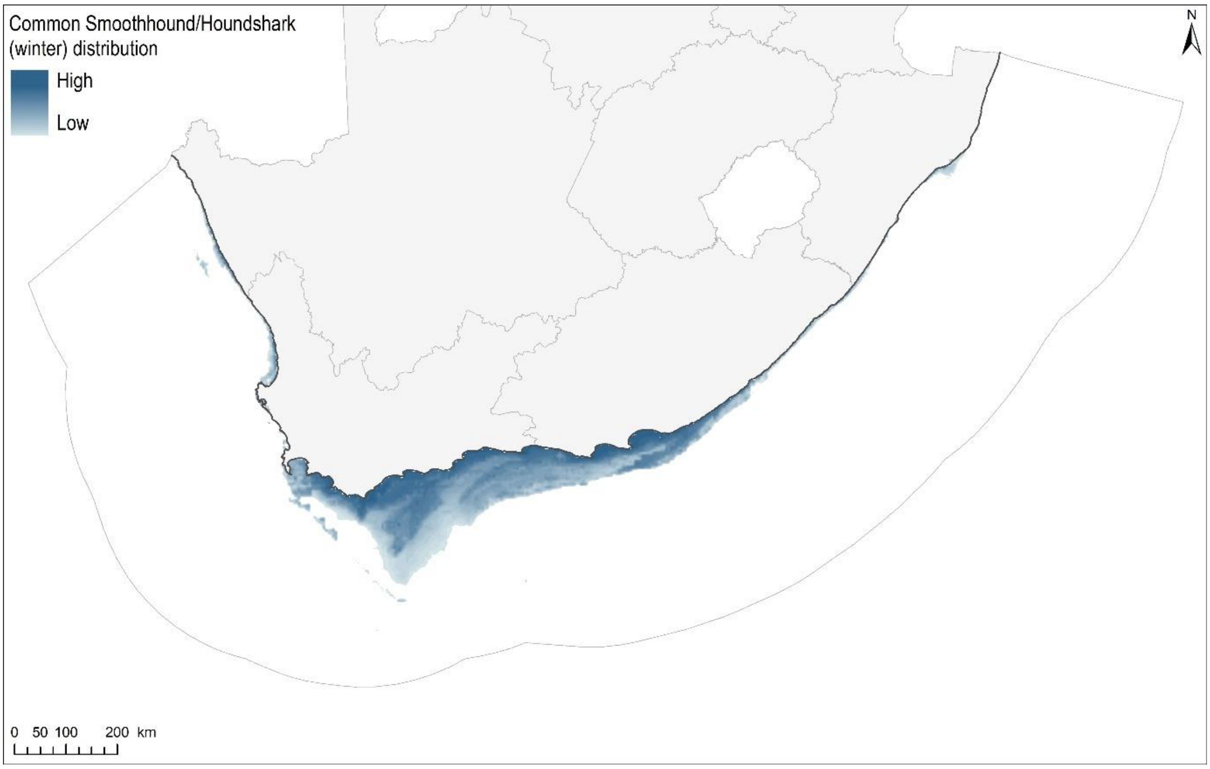


**Figure 82.** *Common Smoothhound/Houndshark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

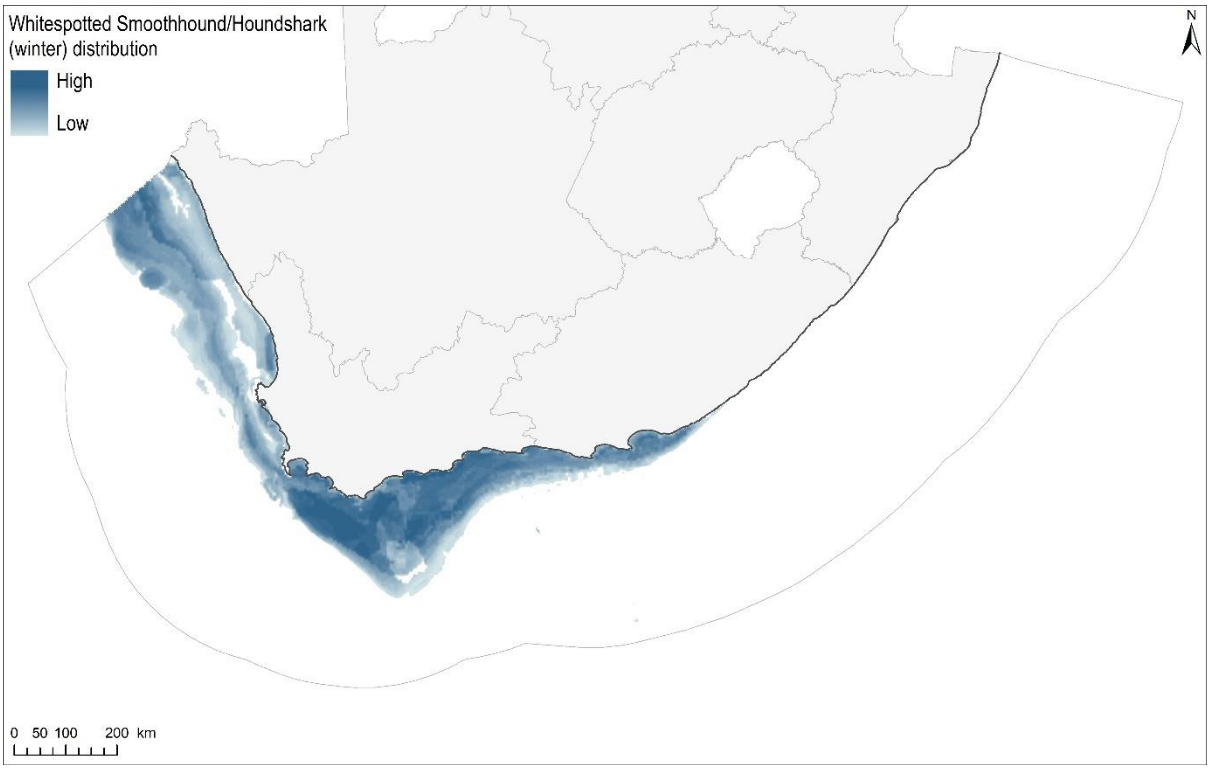


**Figure 83.** *White-Spotted Smoothhound/Houndshark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

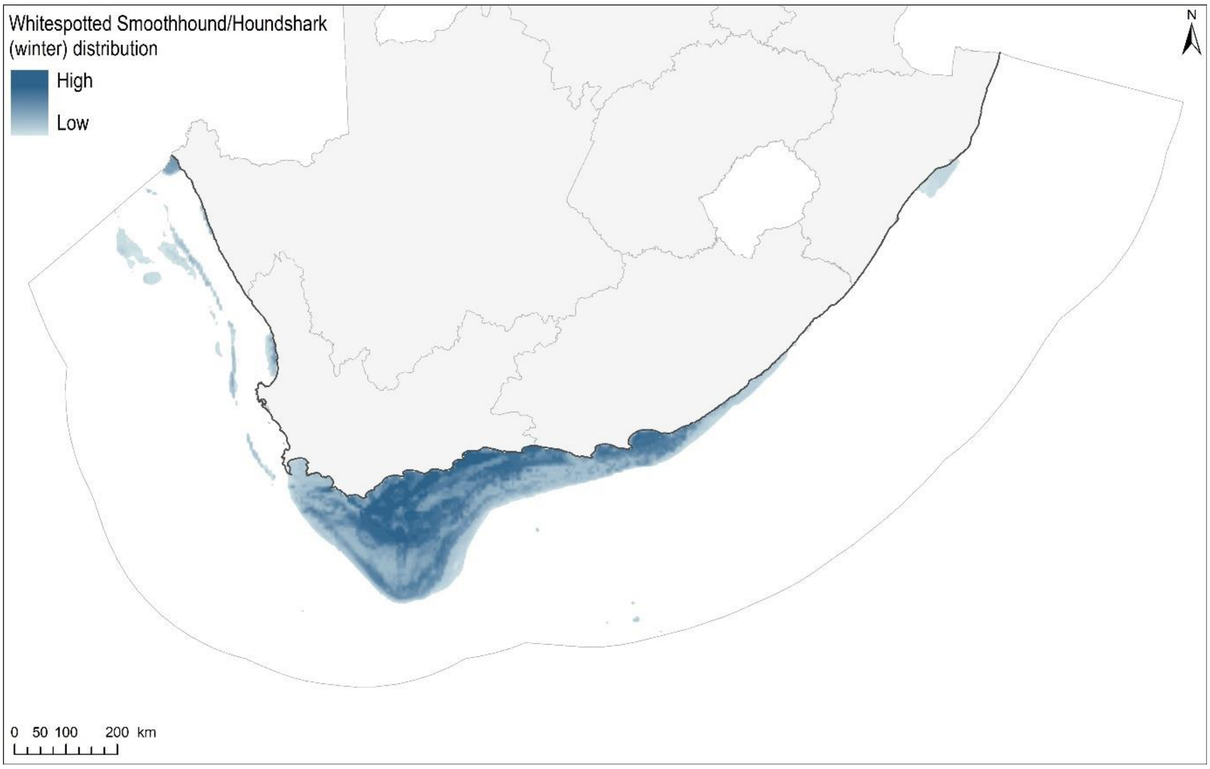


**Figure 84.** *White-Spotted Smoothhound/Houndshark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

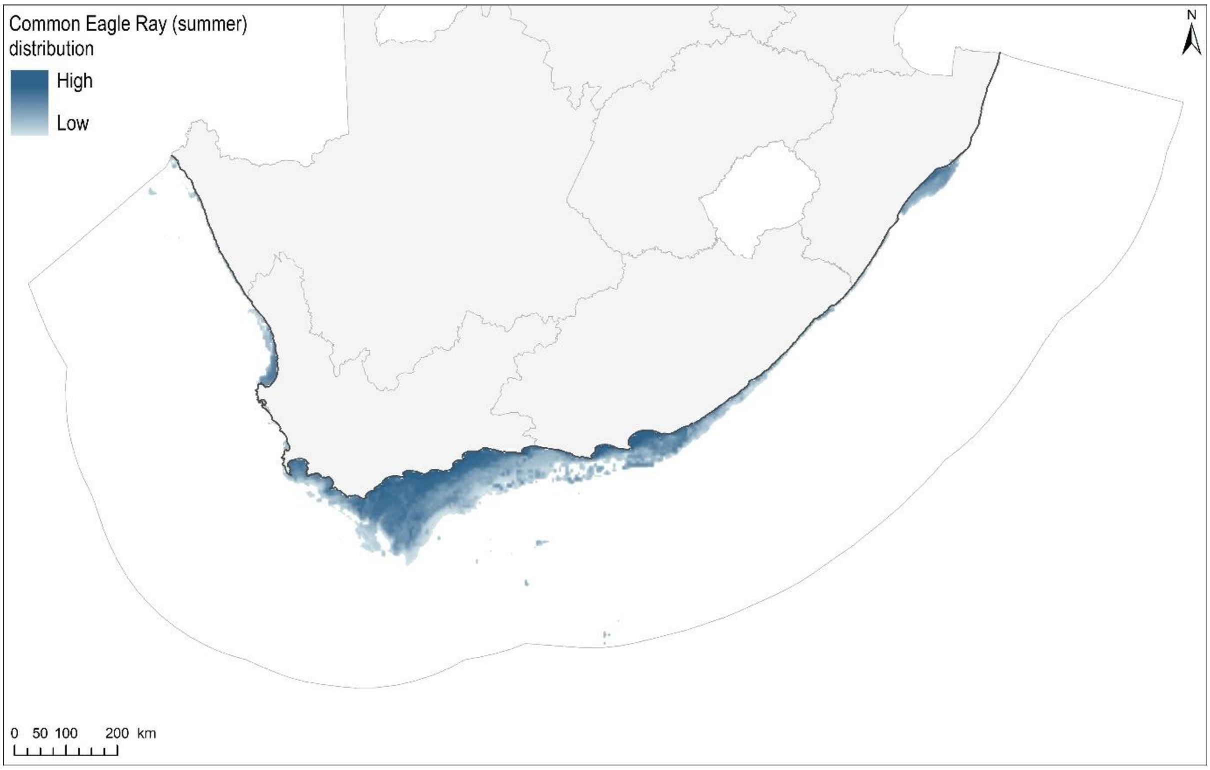


**Figure 85.** *Common Eagle Ray (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

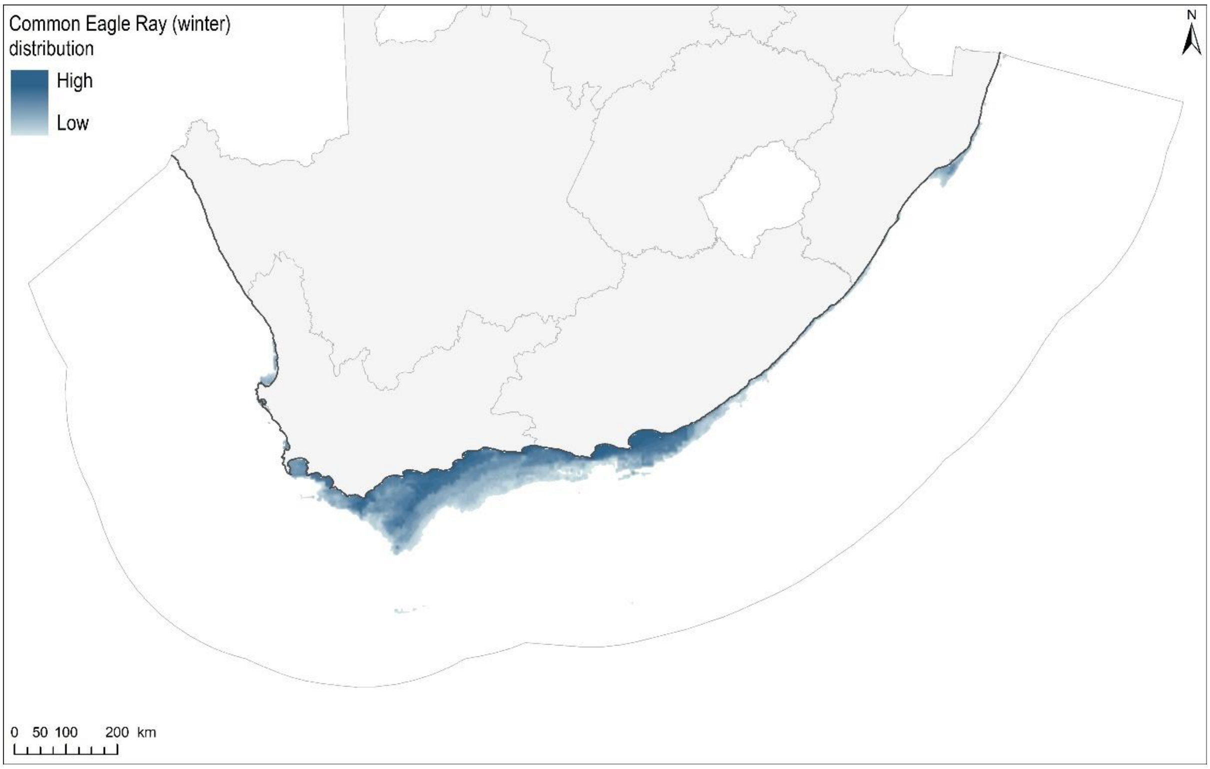


**Figure 86.** *Common Eagle Ray (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

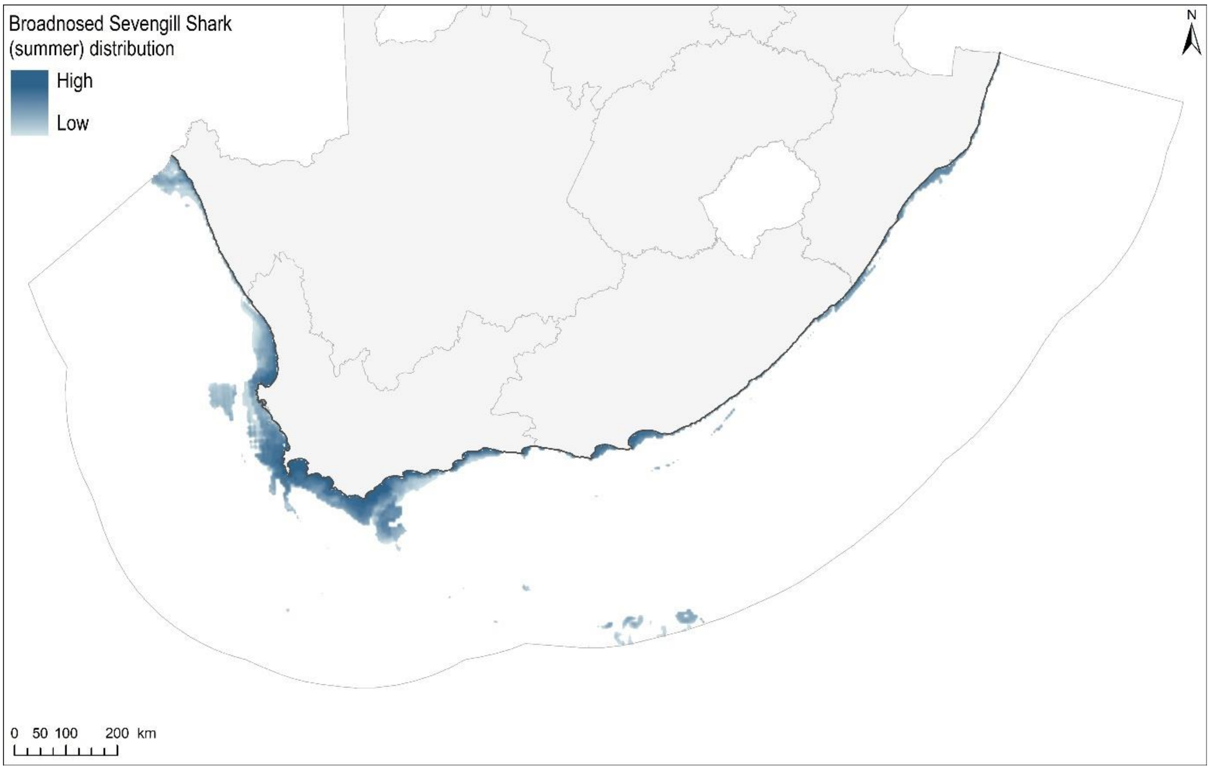


**Figure 87.** *Broadnose Sevengill Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

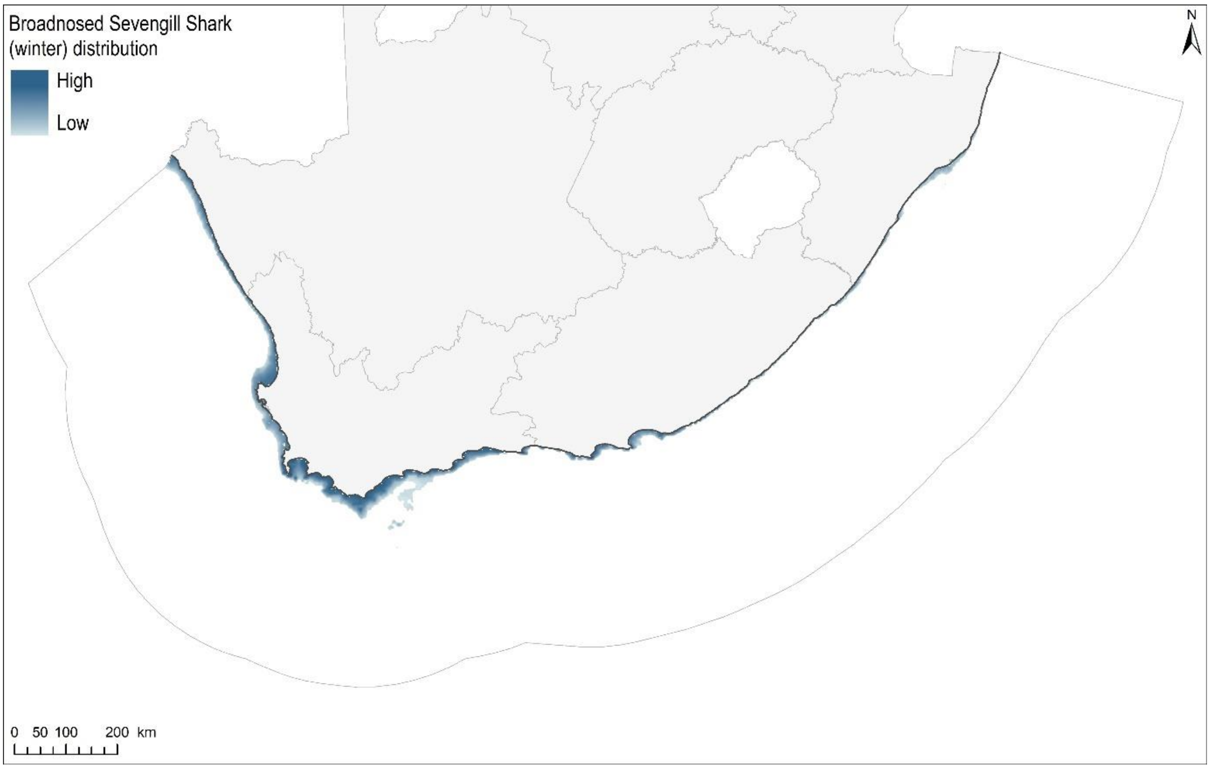


**Figure 88.** *Broadnose Sevengill Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

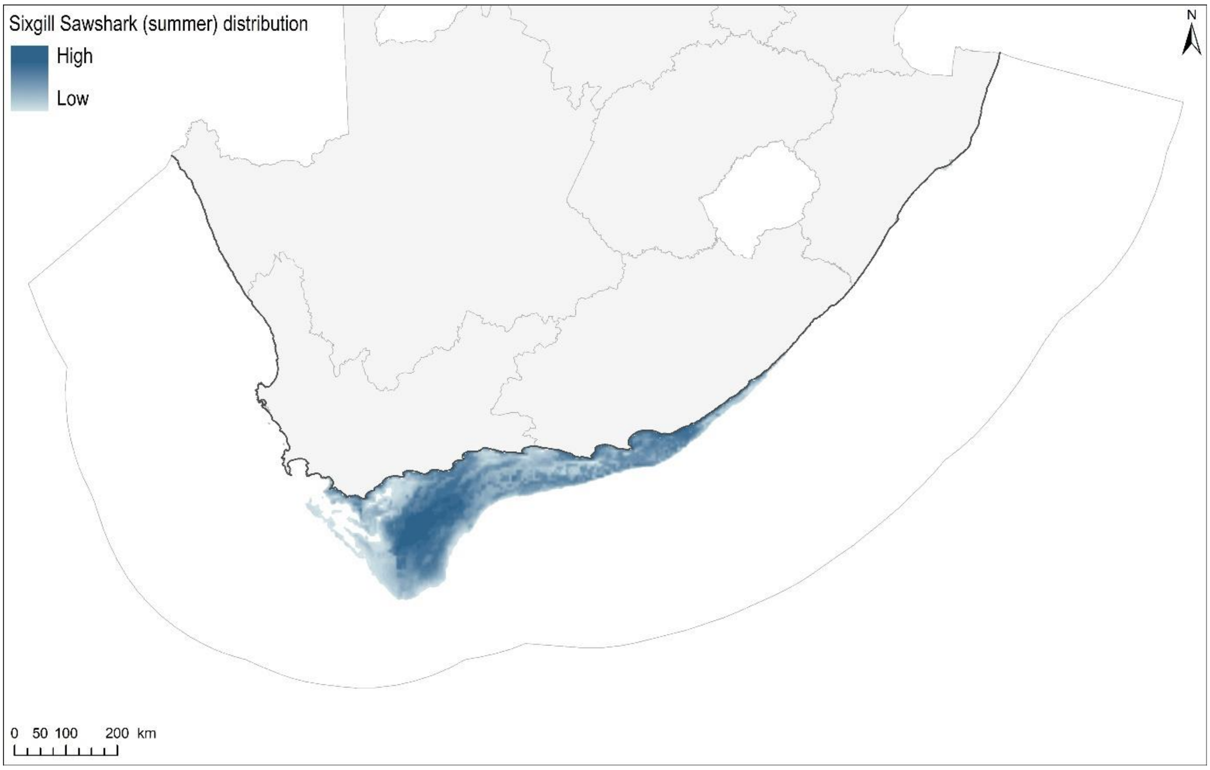


**Figure 89.** *Sixgill Sawshark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

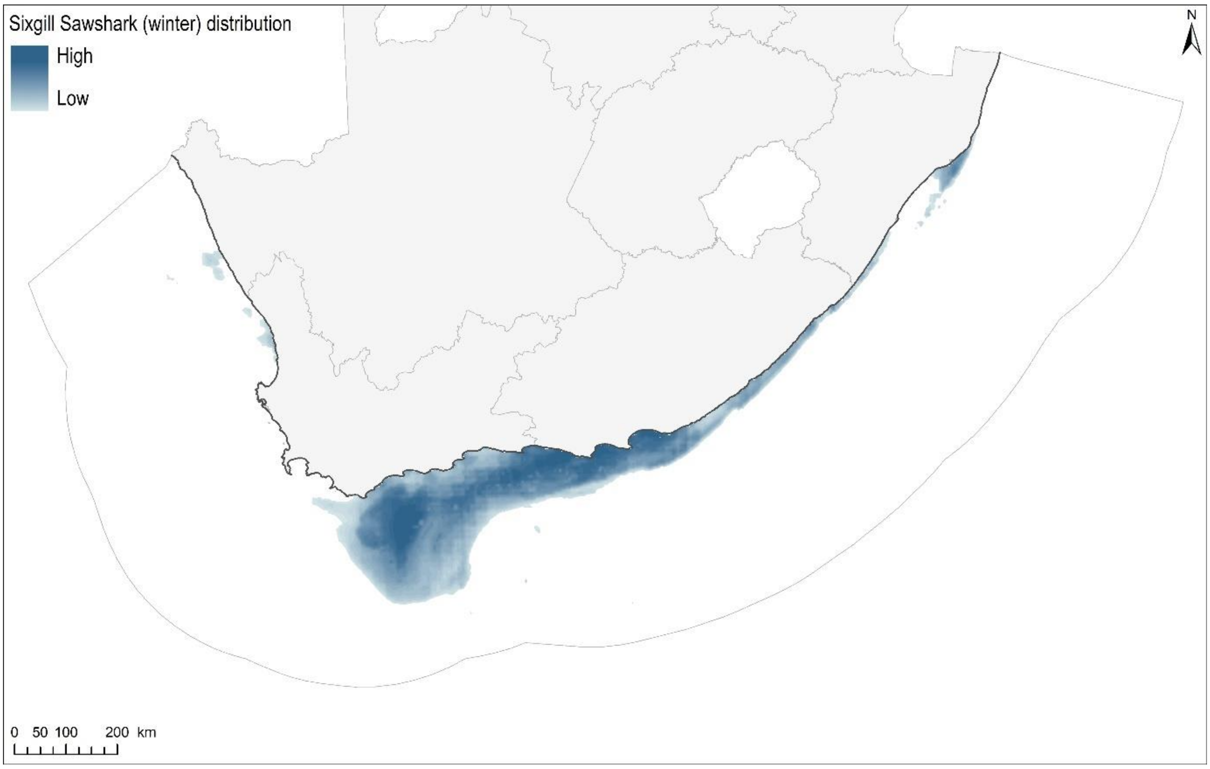


**Figure 90.** *Sixgill Sawshark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

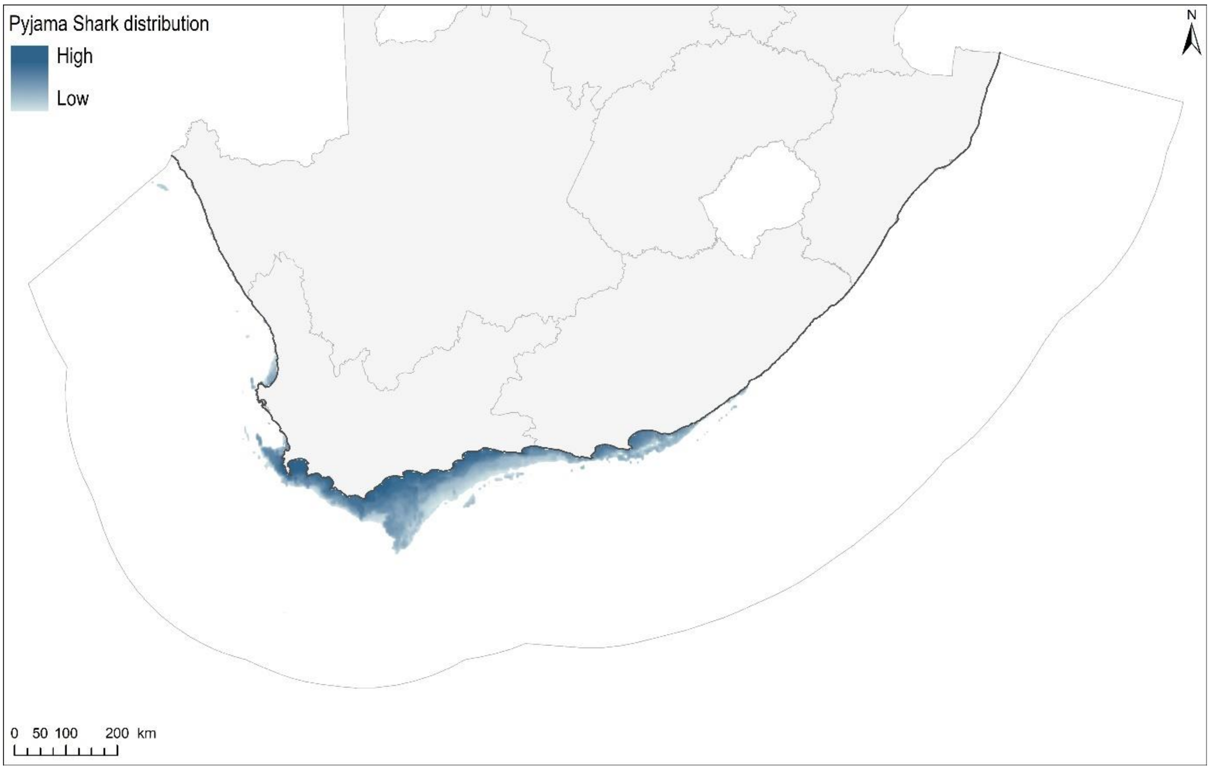


**Figure 91.** *Pyjama Shark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

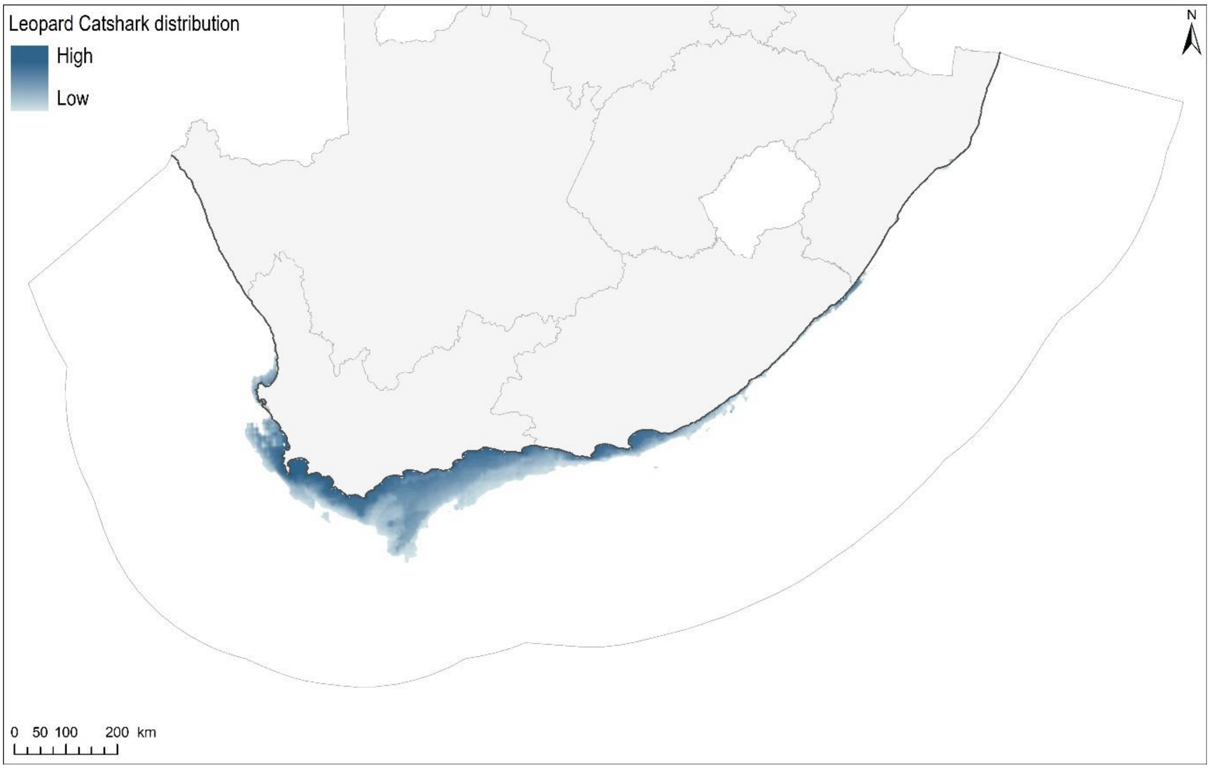


**Figure 92.** *Leopard Catshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

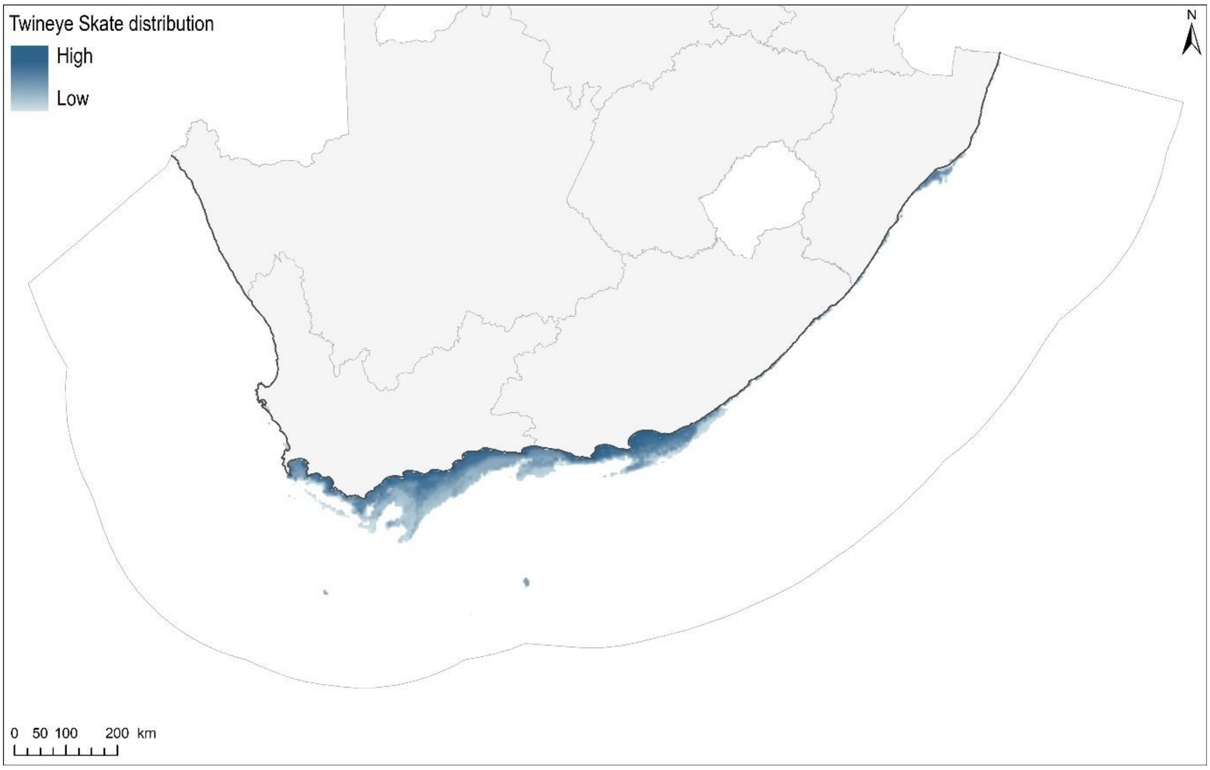


**Figure 93.** *Twineye Skate distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

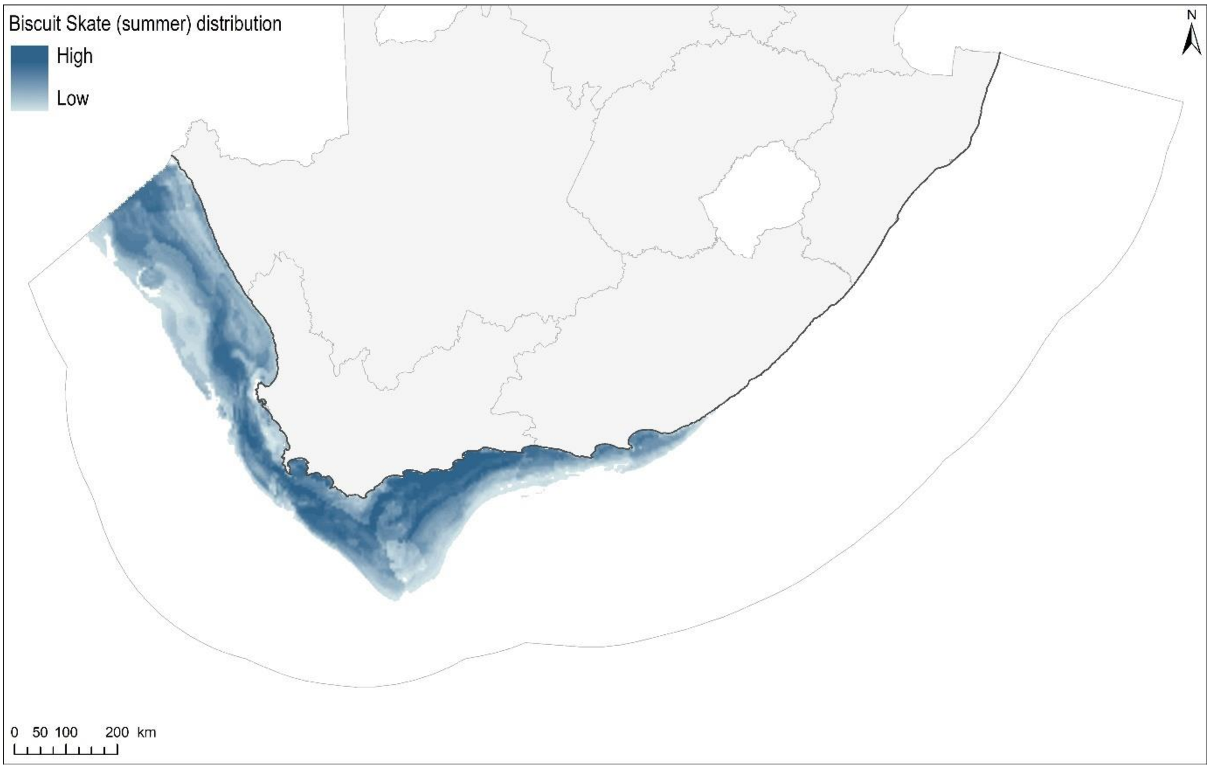


**Figure 94.** *Biscuit Skate (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

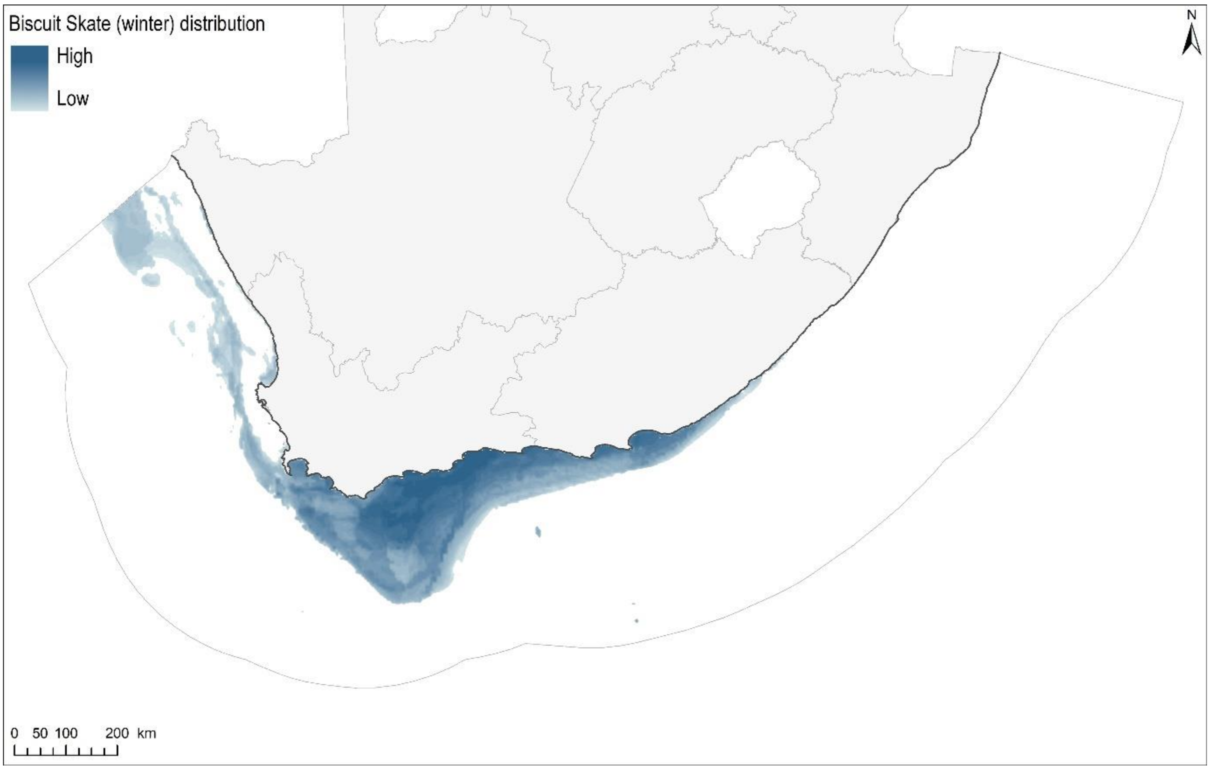


**Figure 95.** *Biscuit Skate (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

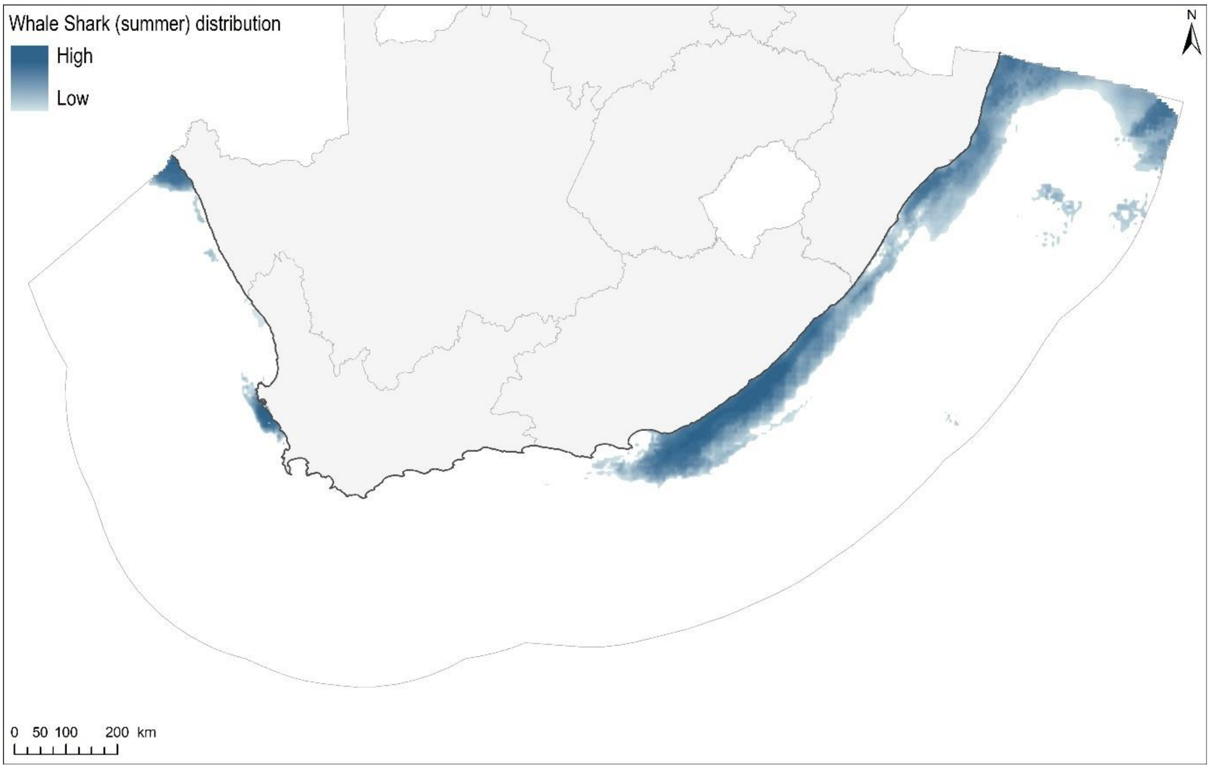


**Figure 96.** *Whale Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

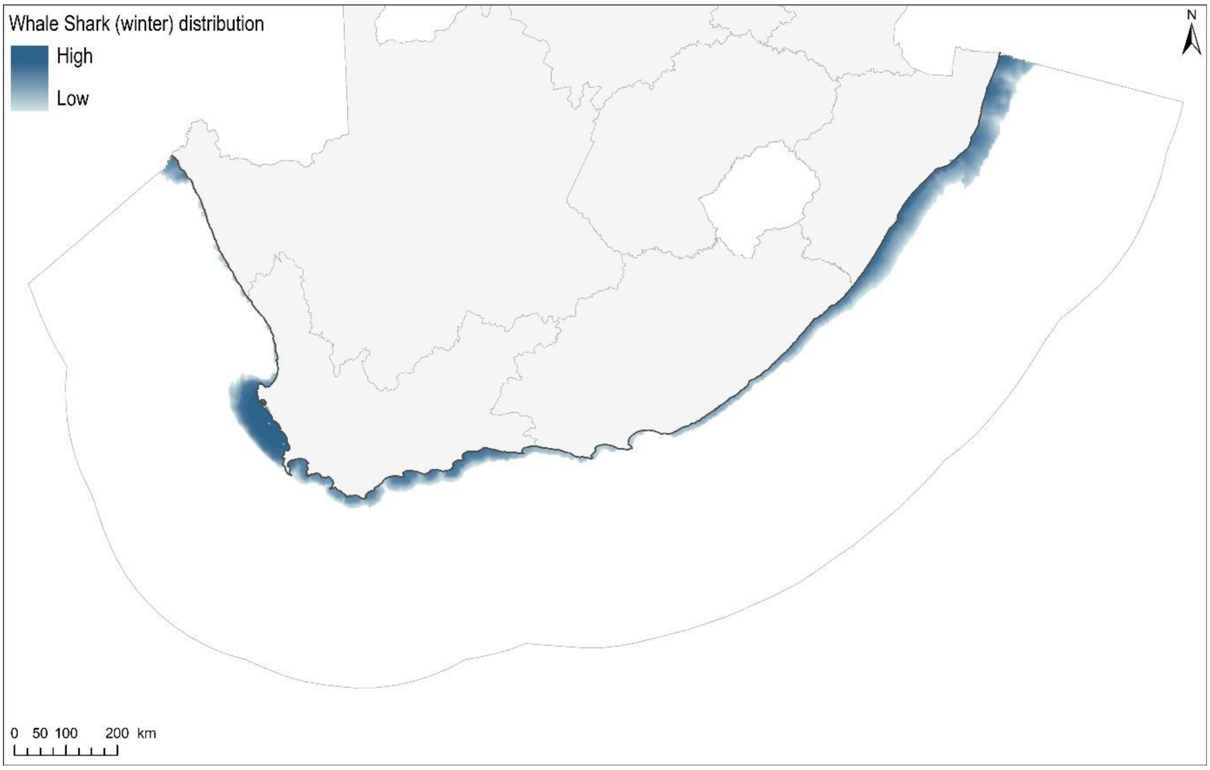


**Figure 97.** *Whale Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

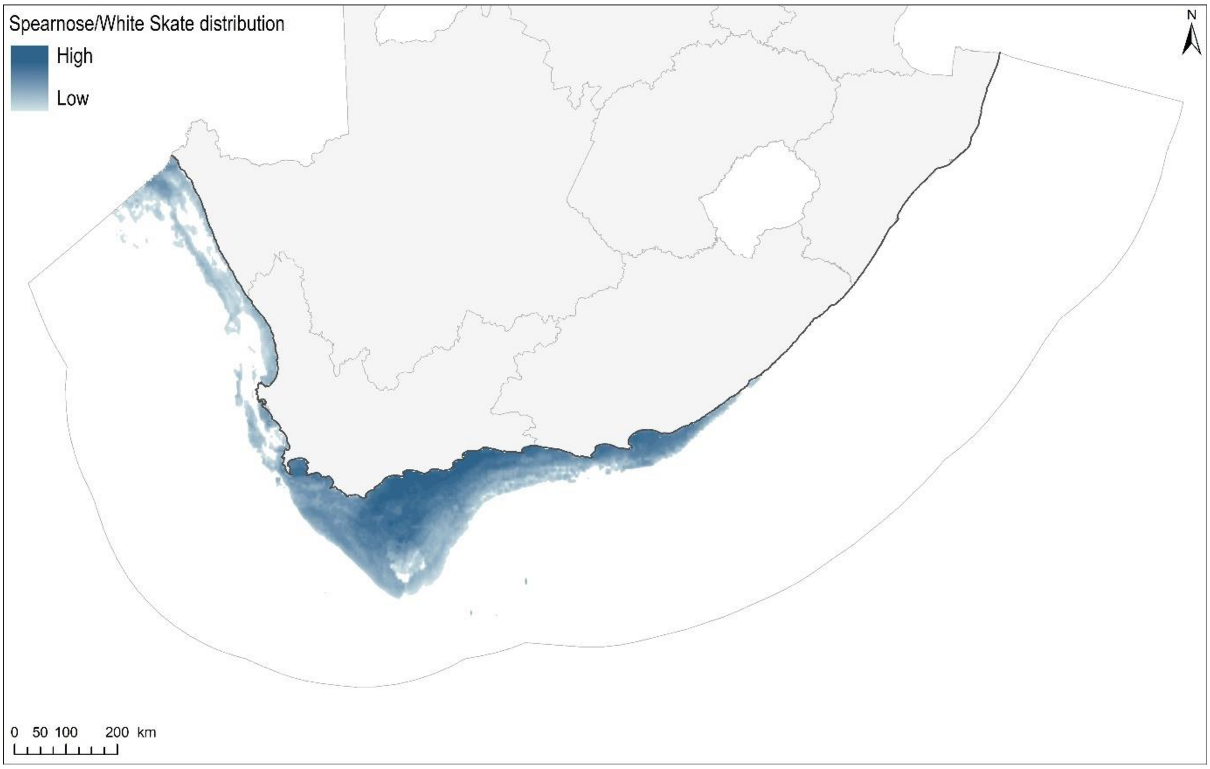


**Figure 98.** *Spearnose/White Skate distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

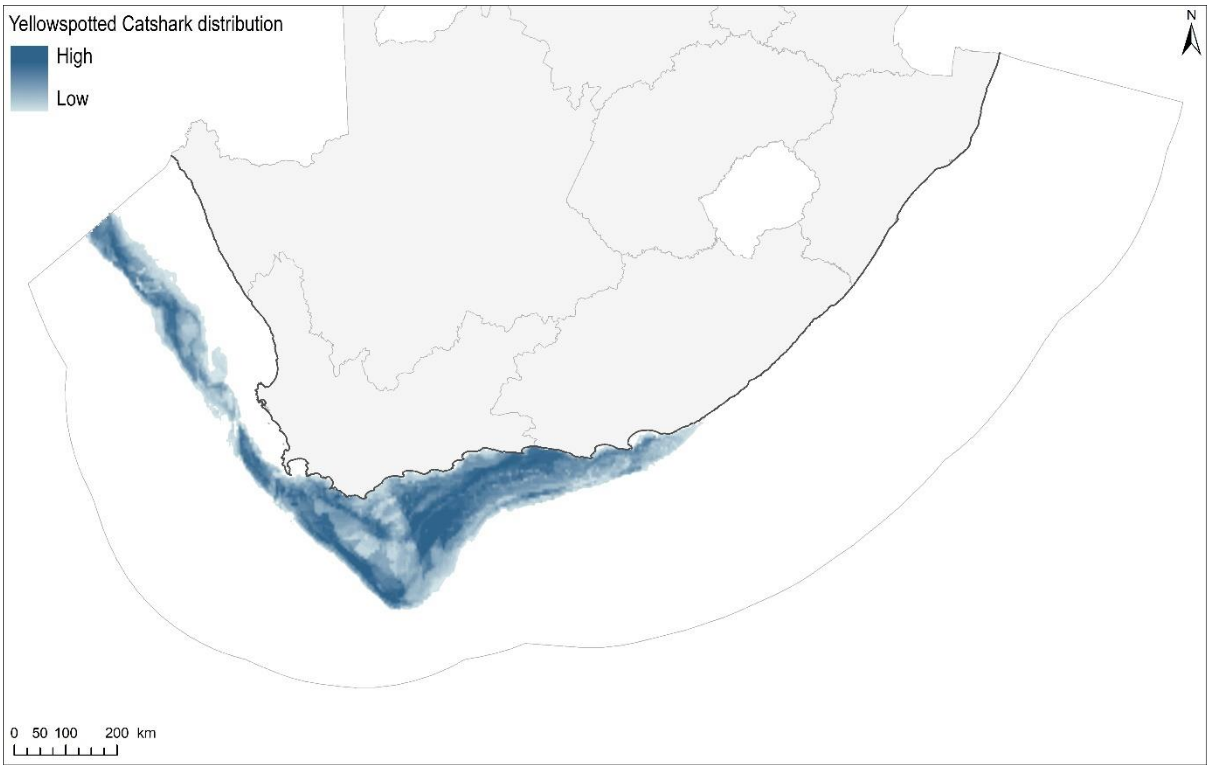


**Figure 99.** *Yellowspotted Catshark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

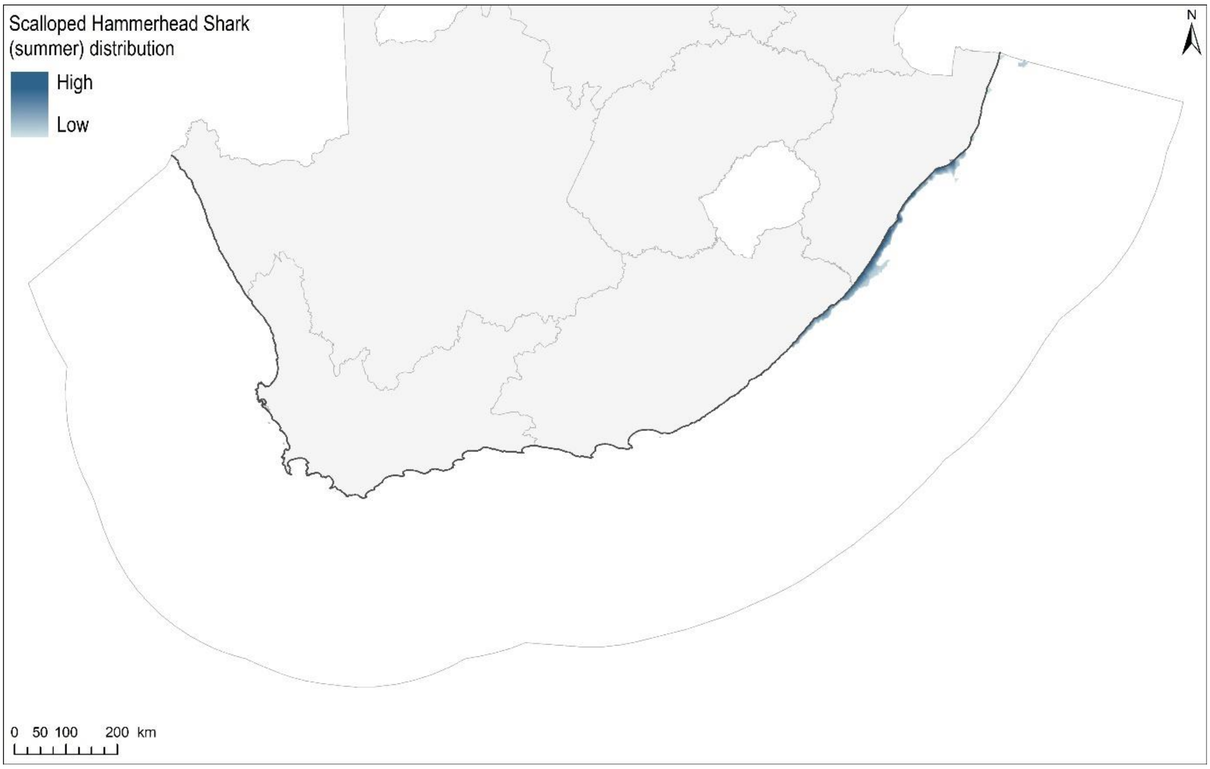


**Figure 100.** *Scalloped Hammerhead Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

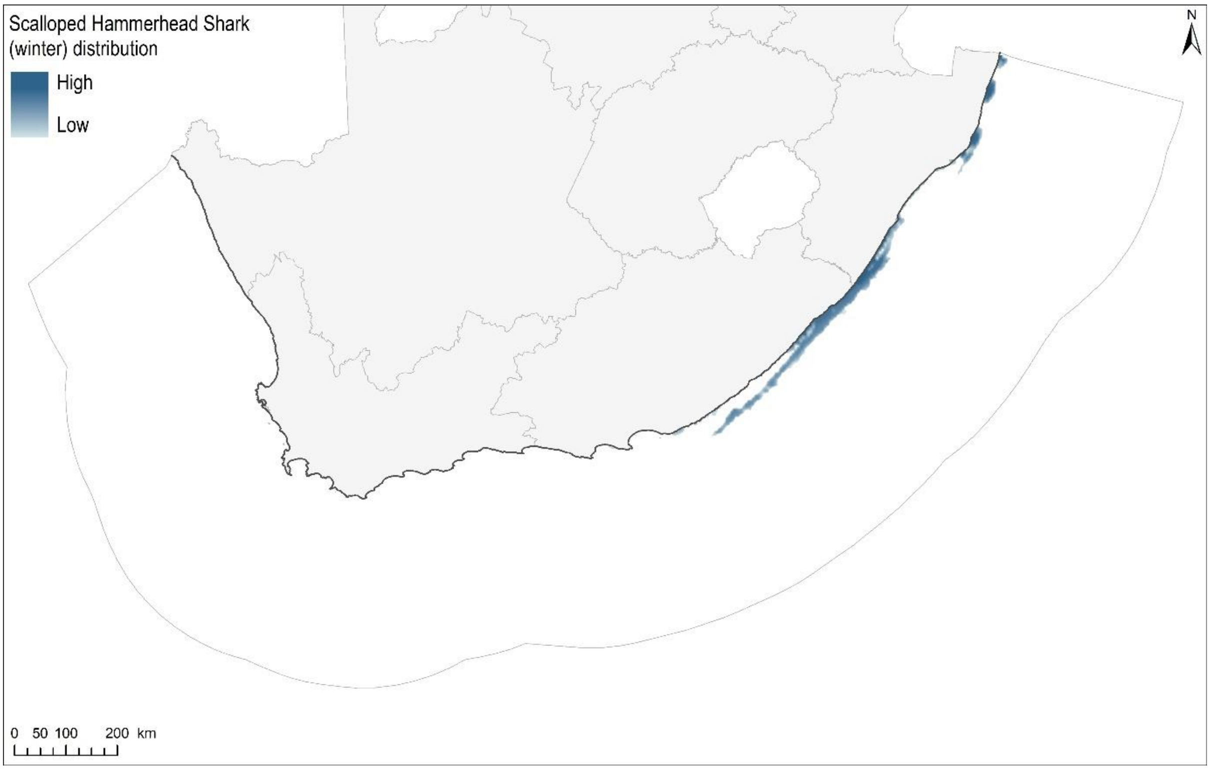


**Figure 101.** *Scalloped Hammerhead Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

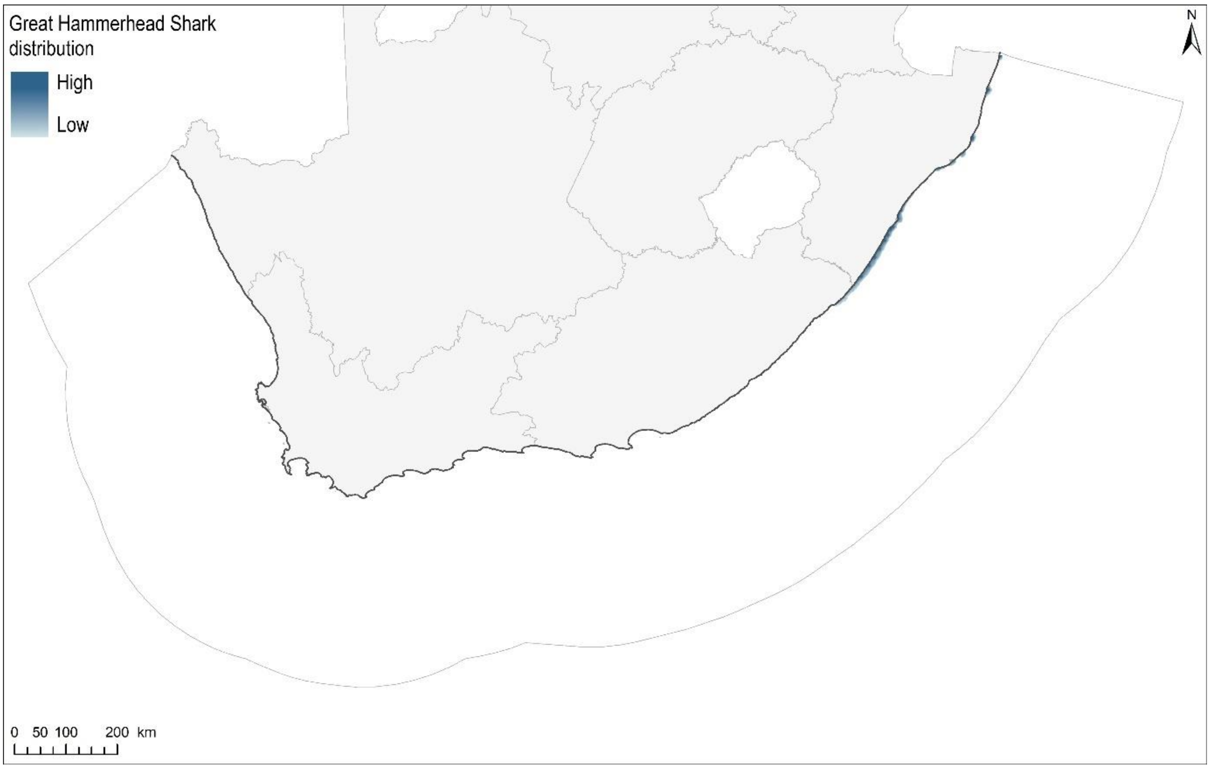


**Figure 102.** *Great Hammerhead Shark distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

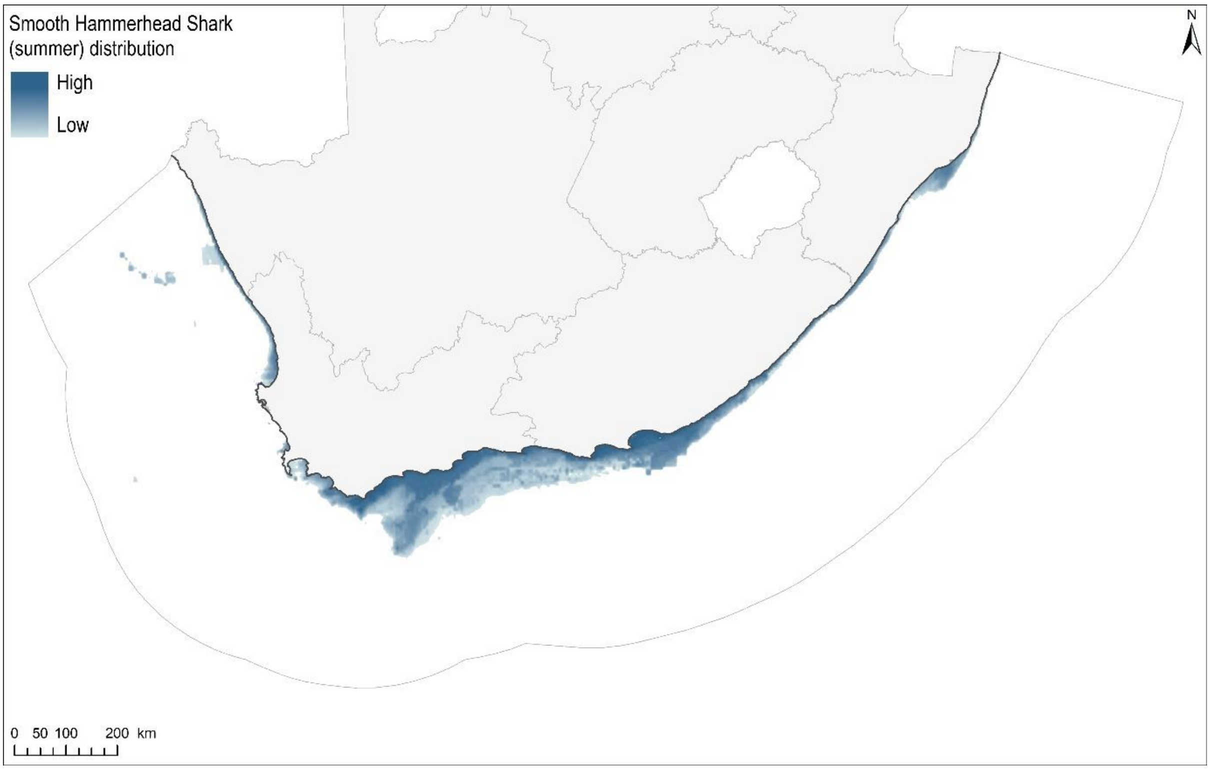


**Figure 103.** *Smooth Hammerhead Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

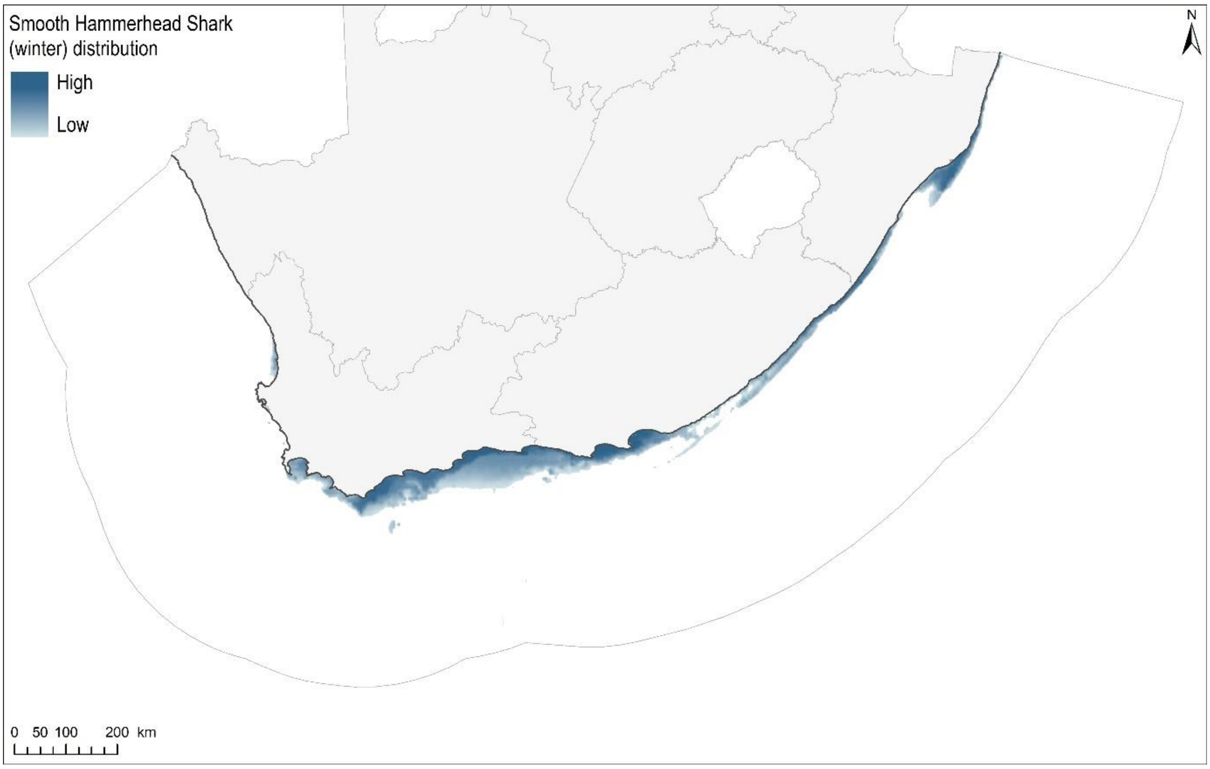


**Figure 104.** *Smooth Hammerhead Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

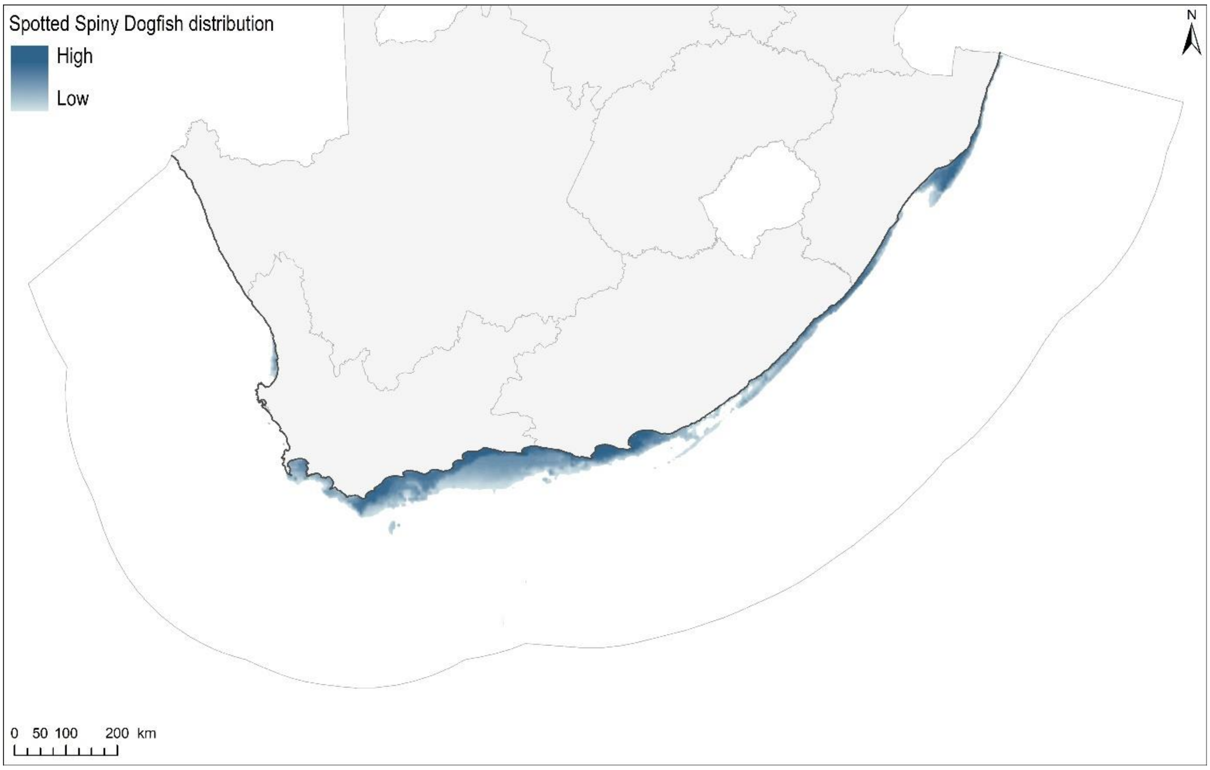


**Figure 105.** *Spotted Spiny Dogfish distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

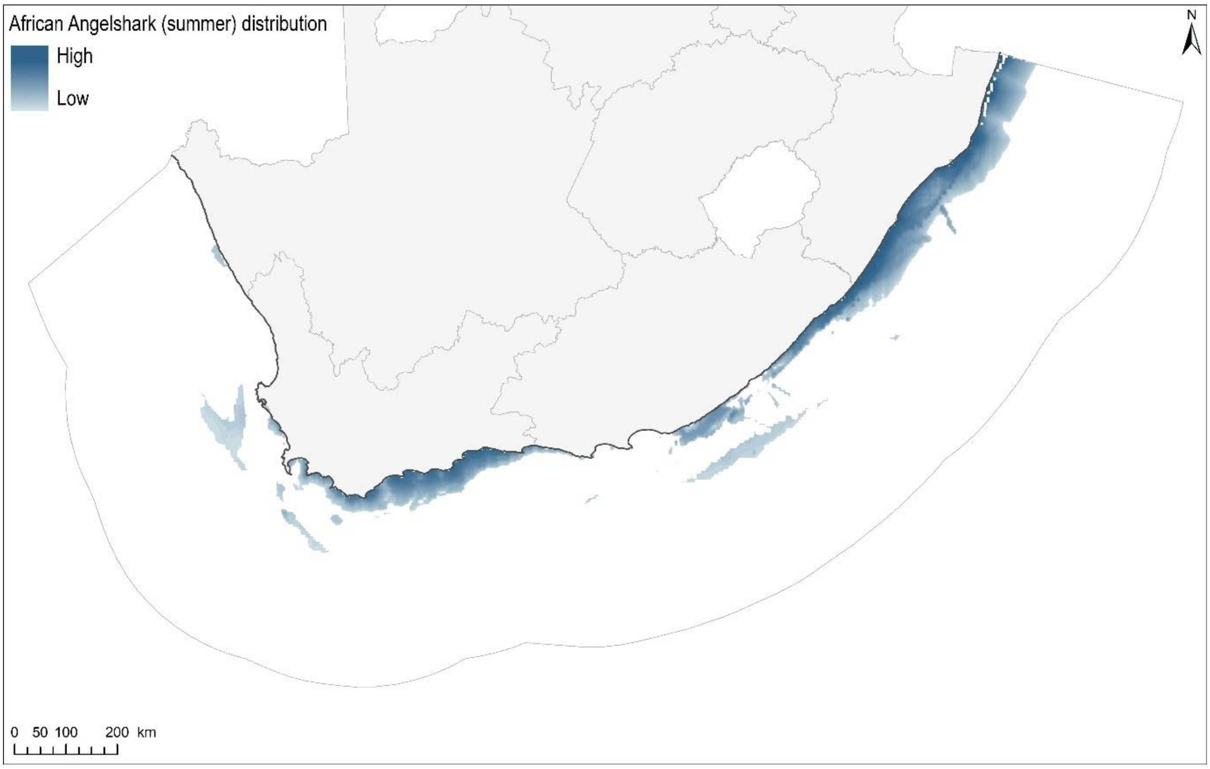


**Figure 106.** *African Angelshark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

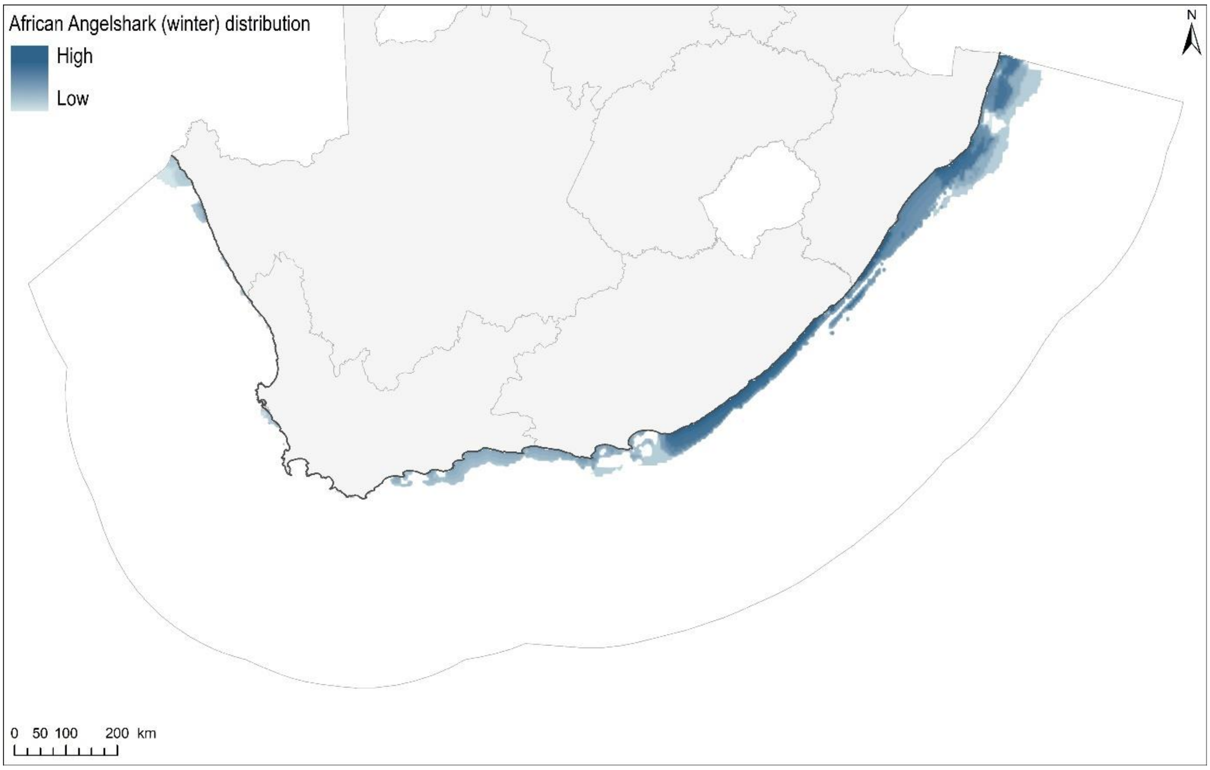


**Figure 107.** *African Angelshark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

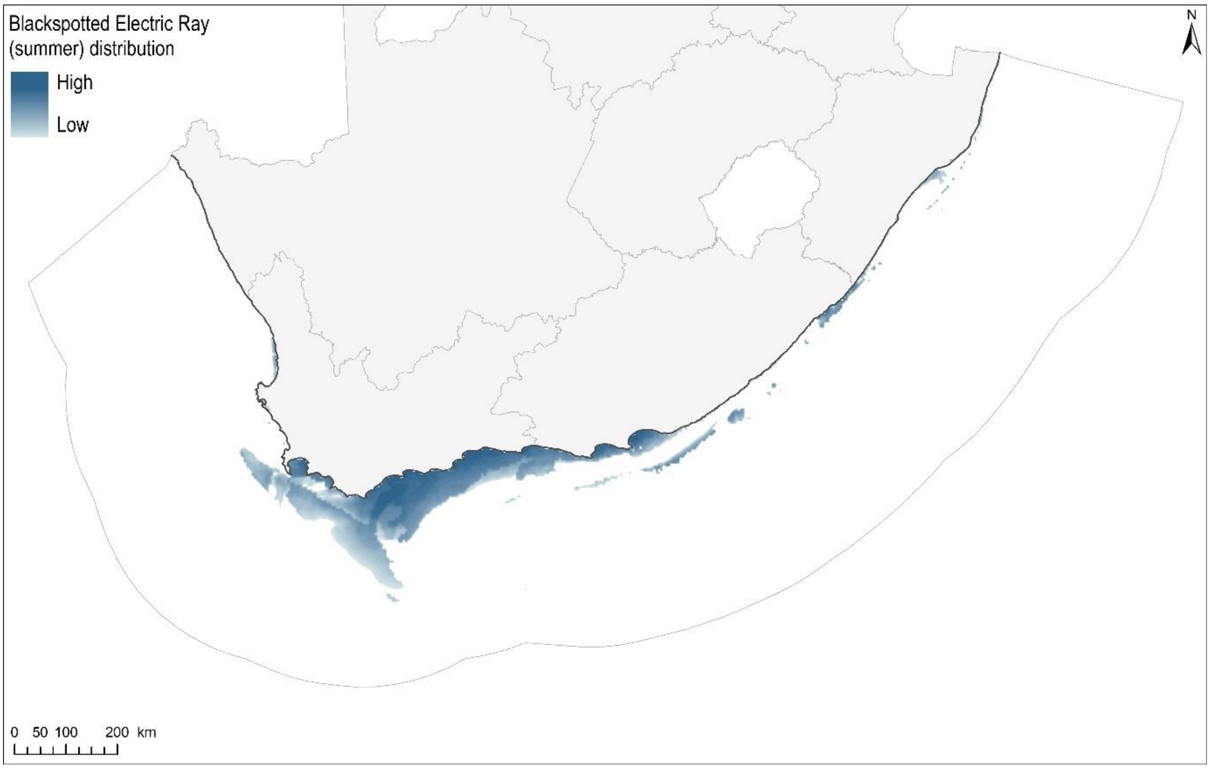


**Figure 108.** *Blackspotted Electric Ray (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

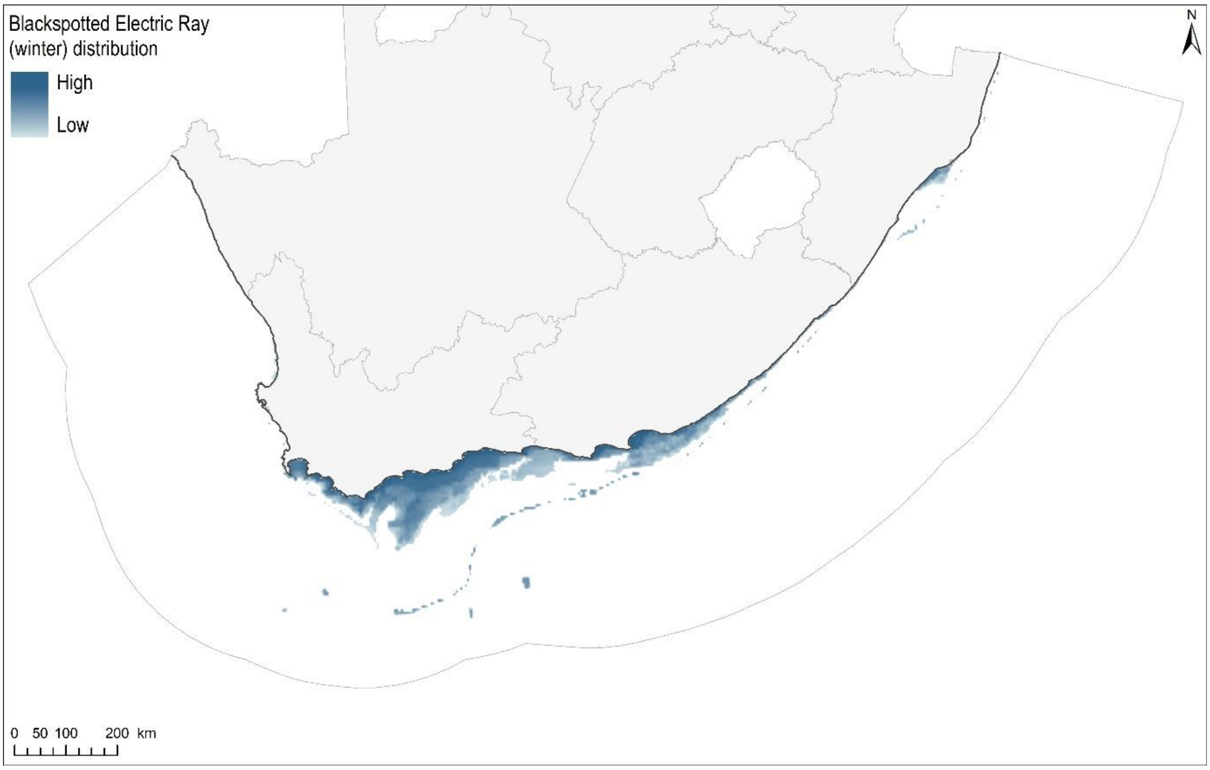


**Figure 109.** *Blackspotted Electric Ray (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

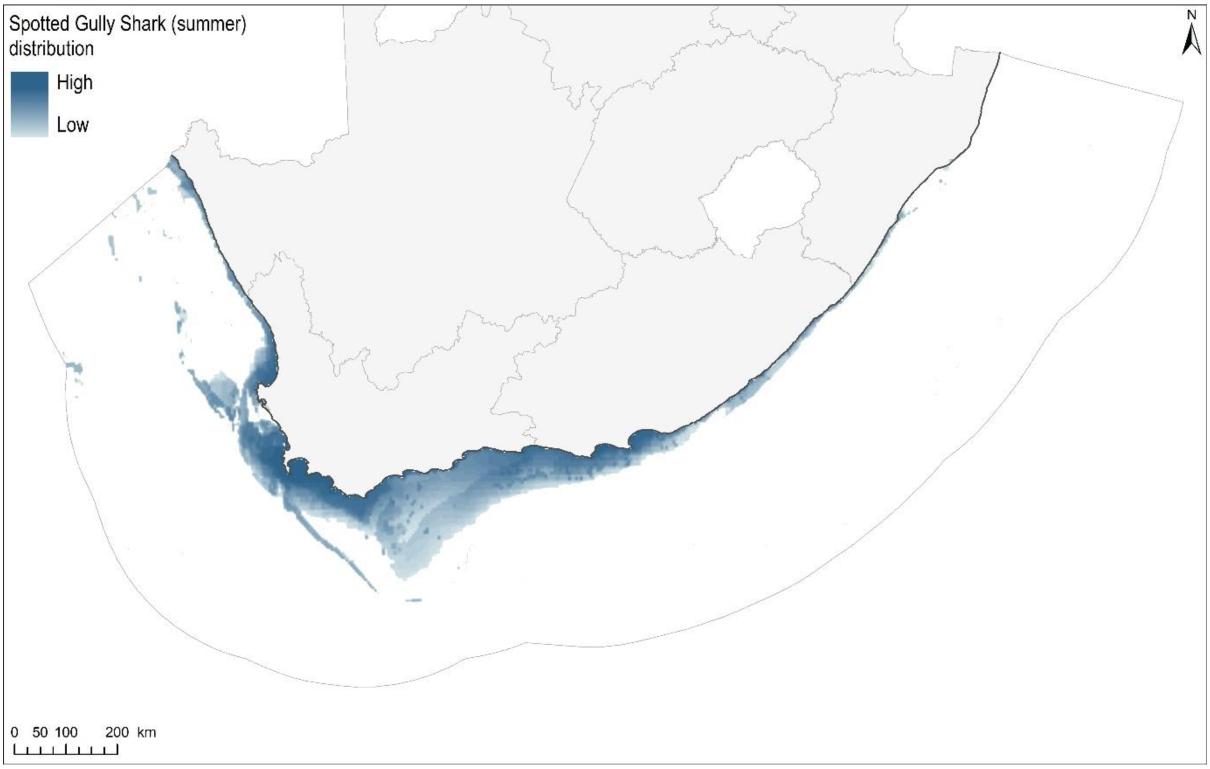


**Figure 110.** *Spotted Gully Shark (summer) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

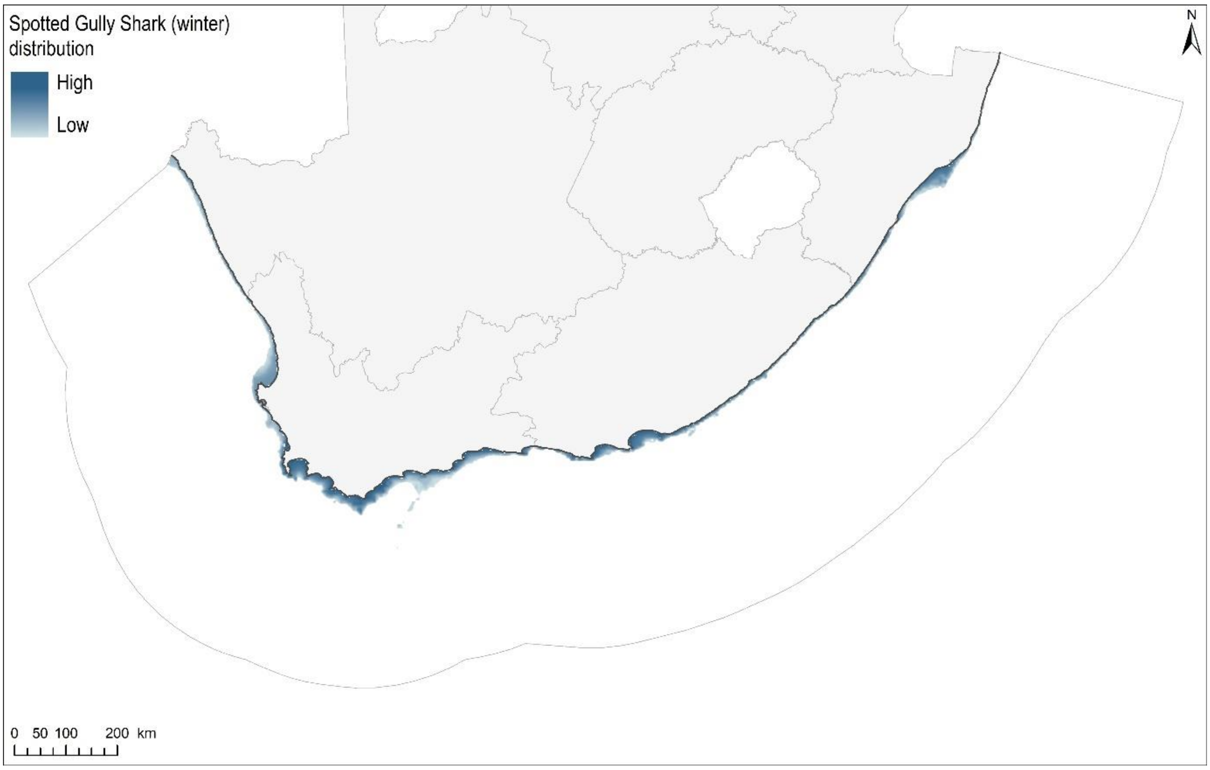


**Figure 111.** *Spotted Gully Shark (winter) distribution. Darker blues indicate higher probability of occurrence. (Data source: Faure Beaulieu et al. 2021).*

### 4.4.3. Unique, rare or special habitats or features

#### 4.4.3.1. Unique or rare habitats or features

The Alexandria Dunefield (Figure 112) is a unique coastal feature, located more on the land-based portion of the National Coastal and Marine CBA Map. It is the largest mobile active dunefield in the southern hemisphere, and a salient feature of South Africa's seashore that also contains dune slacks and bush pockets with high diversity (Gaylard et al. 1995; Kerley et al. 1996; McLachlan et al. 1996) and shell middens. It extends 50 km along the shore, and up to 2 km inland, and provides important breeding habitat for shorebirds such as African Black Oystercatchers, Whitefronted Plovers, and Damara Terns (Watson et al. 1997). It also provides important habitat for some supralittoral beach fauna, such as the Pill Bugs, *Tylos capensis*.

- Data were coded to the planning units based on area.

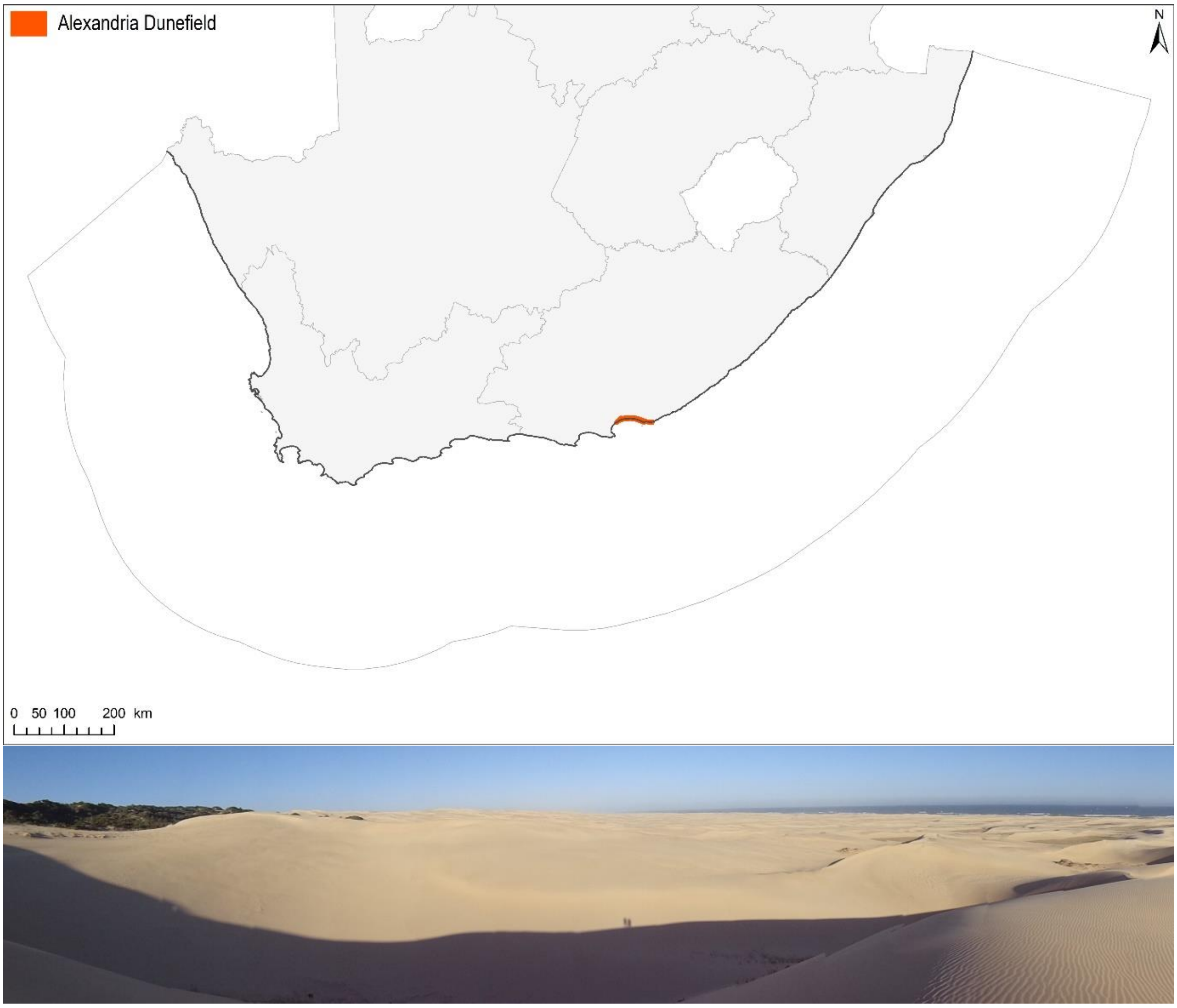


**Figure 112.** *The unique Alexandria Dunefield, wrapping along the shores of the eastern half of Algoa Bay. For scale, the two protrusions on the dune-ridge shadow in the image are from people. The symbology has been expanded so that the feature is visible at this scale. Image credit: © Linda Harris. (Data source: extracted from Harris et al. 2019a).*

Mallory Slope was identified as a unique geomorphic feature in South Africa's marine territory that is currently not represented in an MPA, but is a key feature for which the Mallory Escarpment and Trough EBSA is described. It lies in the Agulhas-Falkland Fracture Zone and the escarpment slopes steeply, with a 3-km drop over 14 NM (Figure 113). Slopes that are that steep are globally rare.

- Mallory Slope was digitised by tracing the bathymetric contours (De Wet 2012) at the top and bottom of the steep slope.
- Data were coded to the planning units based on area

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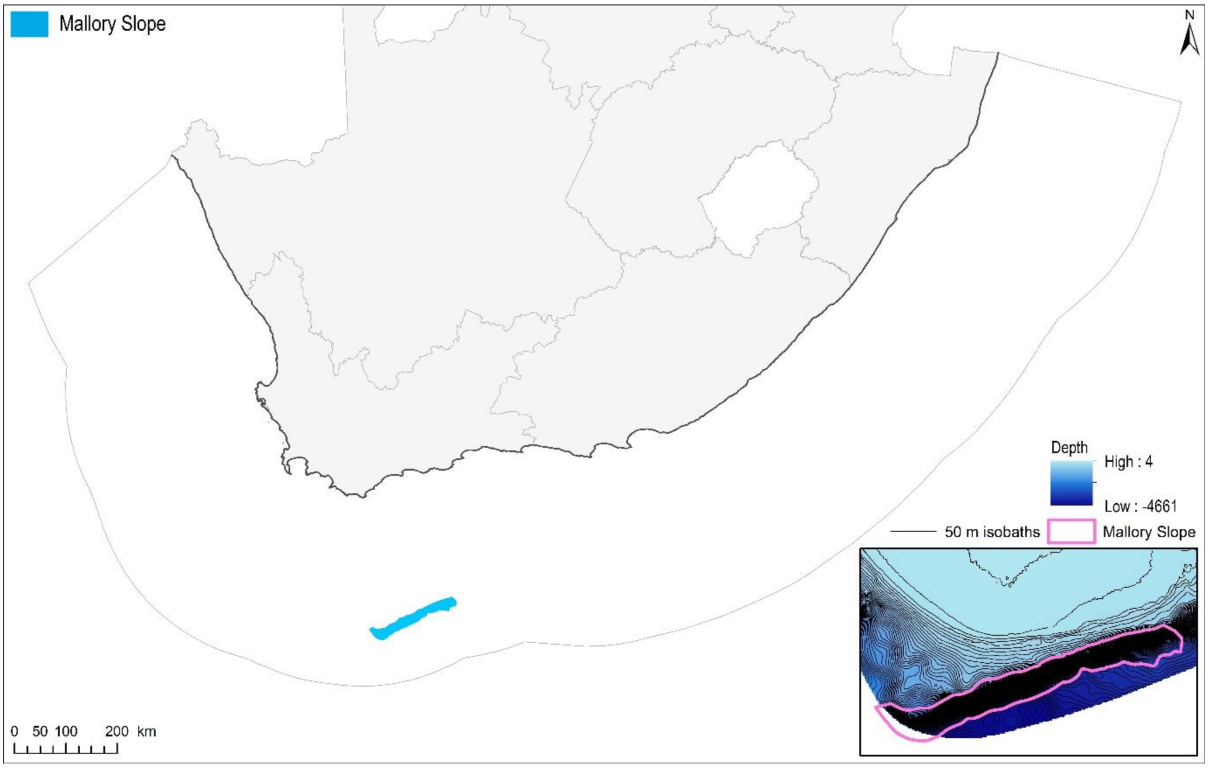



**Figure 113.** *Mallory Slope, with the substantial decrease in depth (m) across the slope visible in the bathymetry in the insert map. (Bathymetry data source: De Wet 2012).*

Childs Bank (Figure 114) is a unique geomorphic feature in South Africa's marine territory. It supports a rich diversity of benthic species, including fragile species such as cold-water corals and habitat-forming sponges, and provides nursery habitat for juvenile fish. It was recently afforded protection in the new Childs Bank Marine Protected Area, and is a key feature for which the Childs Bank and Shelf Edge EBSA is described.

- Data were coded to the planning units based on area.


**Figure 114.** *The unique Childs Bank feature off the South African west coast. Insert image credit: SAEON (Data source: Majiedt et al. 2013; Sink et al. 2012).*

Approximately 30 km off the South African west coast is a small rocky outcrop called the Namaqua Fossil Forest (Figure 115). This underwater forest comprises fossilised yellowwood trees, including a *Podocarpoxylon* species that was discovered as new to science (Bamford and Stevenson 2002; Stevenson and Bamford 2003). The outcrops comprise laterally extensive slabs of rock of dimensions >5 x <1 x <0.5 m (Bamford and Stevenson 2002). According to in-situ observations during submersible surveys, the fossilized wood has been colonized by scleractinian corals, and a habitat-forming sponge is also present in the area (Samaai et al. 2017). The fossils have been recently afforded protection in the Namaqua Fossil Forest MPA, and is the key feature underpinning the description of the Namaqua Fossil Forest EBSA.

- Data were coded to the planning units based on presence-absence.

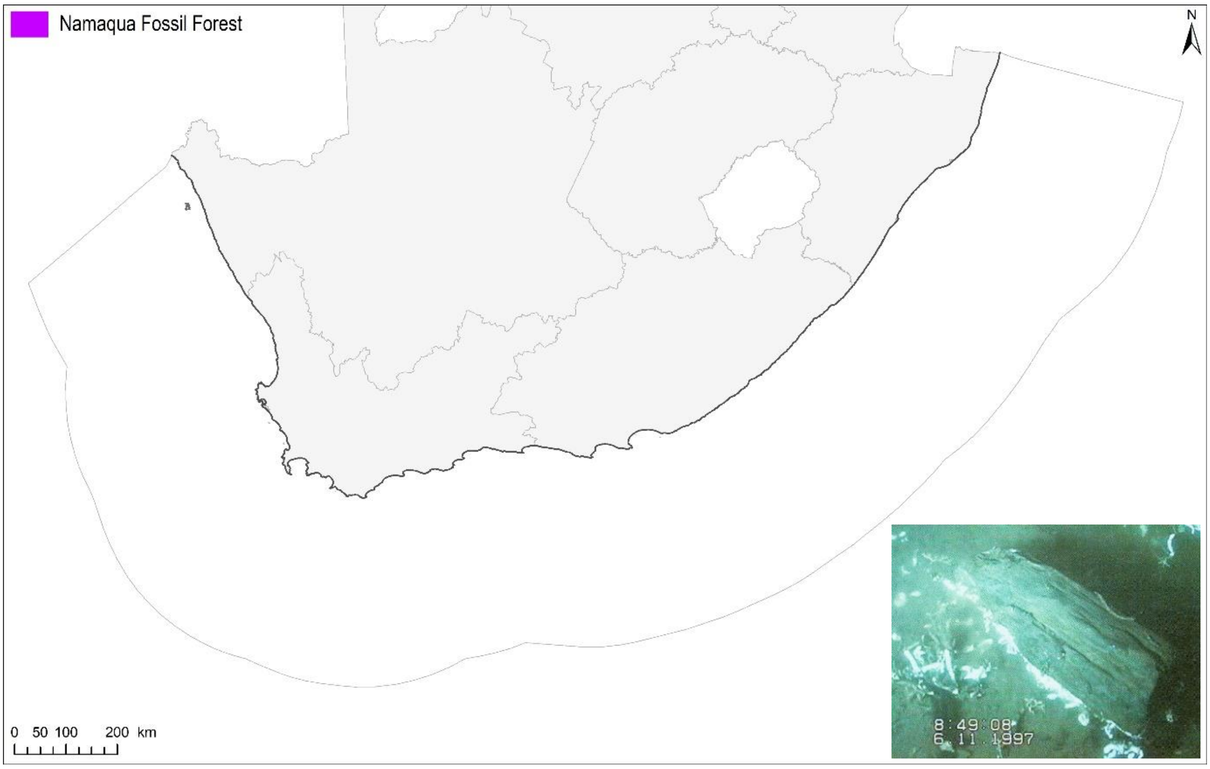



**Figure 115.** *The unique Namaqua Fossil Forest on South Africa's west coast, comprising fossilised yellowwood trees. Insert image credit: Stevenson and Bamford (2003). (Data source: extracted from Sink et al. 2019a).*

*In situ* underwater observations and surveys, particularly from the ACEP projects, have been invaluable in identifying key sites beneath the ocean surface that contain important biodiversity features. Recognising that there may be other places where the following features are located, the data points included are the only known sites where they occur.

The Port Elizabeth Ridge (Figure 116) is a unique rocky ridge that protrudes out of the upper slope, comprising the Endangered Kingklip Ridge ecosystem type. It supports corals and is covered by dense clouds of plankton and hake (Sink 2016). It has recently been afforded protection in the Port Elizabeth Corals MPA, and lies within the Kingklip Corals EBSA.

- Data representing the Port Elizabeth Ridge were coded to the planning units based on presence-absence.


**Figure 116.** *The unique Port Elizabeth Ridge south of Cape St Francis, shown in the insert as the vertical protrusion from the seabed (red), with a cloud of plankton and hake (blue) above the ridge. Insert image credit: © ACEP Deep Secrets Project, Sink (2016). (Data source: extracted from Sink et al. 2019a).*

Rhodoliths are free-living non-geniculate (non-articulated) coralline algae from the phylum Rhodophyta (red algae). They are habitat forming, and support a rich diversity. The only known rhodolith beds (Figure 117) were discovered offshore of the Kei River mouth at 30-65 m depth during the ACEP Imida cruise (Adams et al. 2020). They are protected in the newly proclaimed Amathole Offshore MPA.

- Data representing the rhodolith beds are points, and were coded to the planning units on the basis of presence-absence.


**Figure 117.** *The unique rhodolith beds near East London. The symbology has been expanded so that the features are visible at this scale. Insert image credit: © ACEP Imida. (Data source: ACEP Imida, Unpublished data; Adams et al. 2020).*

Algal dominated deep reefs (Figure 122) were also included as special features. These are poorly studied habitats, with species known from a limited number of sites (De Clerck et al. 2005). Only a few localities where such reefs occur are known for South Africa, based on visual surveys. Macroalgae are considered to have potentially significant contributions to carbon sequestration, largely as blue carbon donors (Hill et al. 2015; Trevathan-Tackett et al. 2015), and thus could also contribute to climate resilience.

- Data representing algal dominated deep reefs were points and were coded to the planning units on a presence-absence basis.

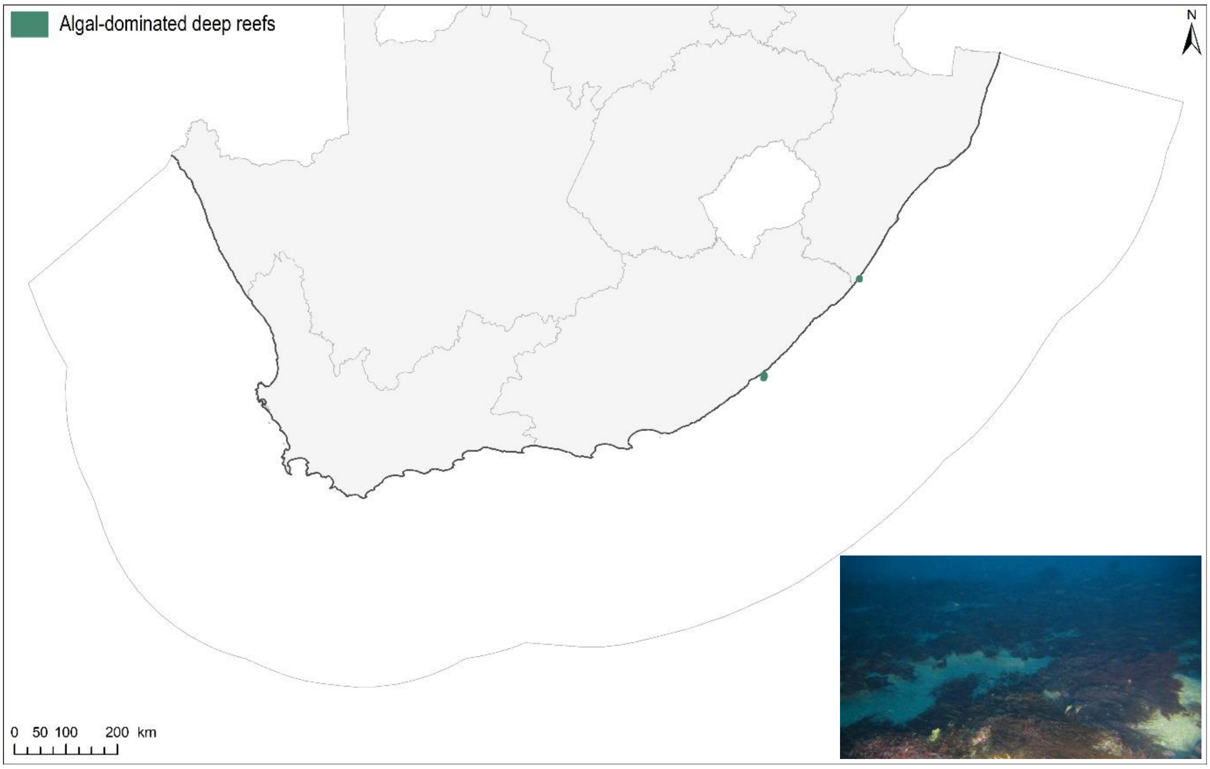



**Figure 118.** *Distribution of algal dominated deep reefs near East London and in southern KZN. The symbology has been expanded so that the feature is visible at this scale. Insert image credit: ACEP Imida. (Data source: ACEP Imida, Unpublished data).*

Only one locality is known where anemones form dense aggregations. This anemone garden was discovered during the ACEP Deep Secrets cruise, south of Cape St Francis (Figure 117). Similarly, only two locations are known where dense aggregations of Horse Mussels are found, discovered during the ACEP Deep Forests cruise outside St Francis Bay (Figure 120). Further, very few localities are known for Red Steenbras spawning areas; Wreck Fish aggregation sites; and Giant Guitarfish aggregation sites (Prof. Kerry Sink (SANBI), unpublished data; ACEP Imida, unpublished data). Although the Red Steenbras spawning site also sits under the Ecological processes: spawning and nursery areas classification (Section 4.4.4.2), it is included here because of the (known) rarity of the feature.

- Data representing the anemone garden, Horse Mussel aggregations, Red Steenbras spawning, Wreck Fish aggregation, and Giant Guitarfish aggregation sites are points, and were coded to the planning units on the basis of presence-absence.
- Note that the Red Steenbras spawning areas, Wreck Fish aggregation sites, and Giant Guitarfish aggregation site are sensitive data and are not shown here.

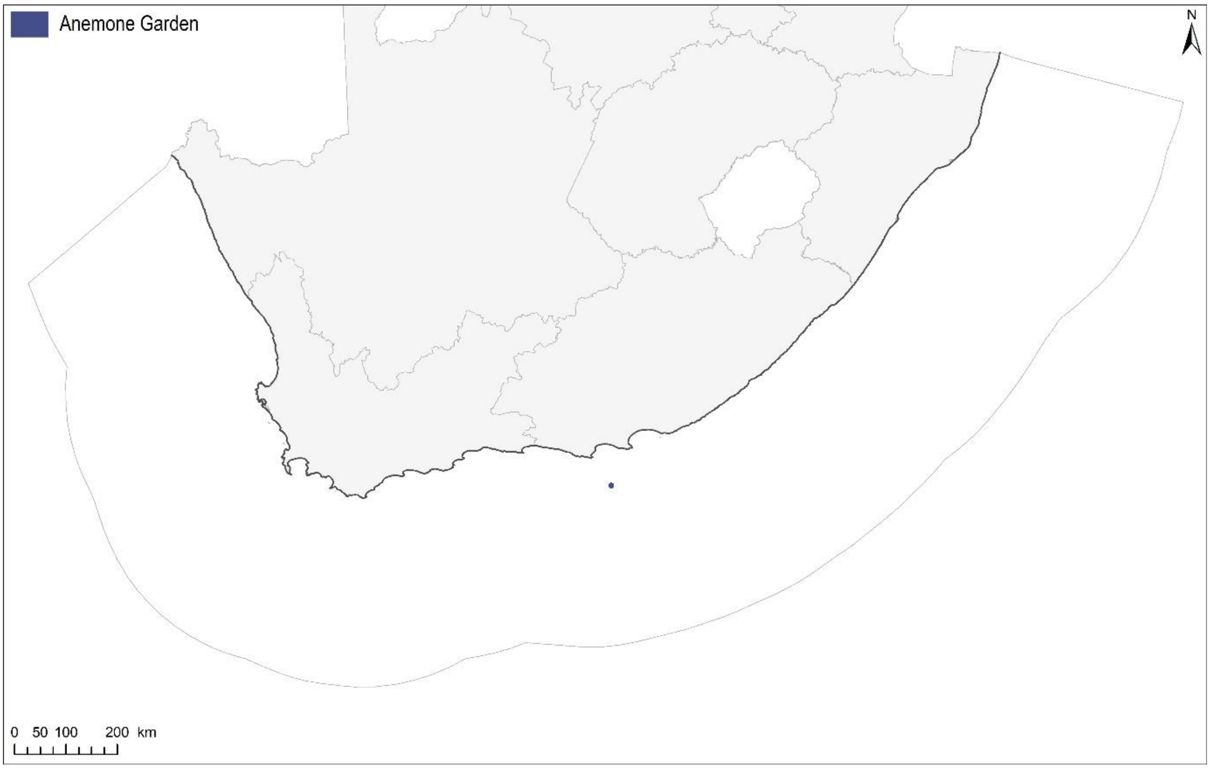



**Figure 119.** *The unique anemone garden south of St Francis Bay. The symbology has been expanded so that the feature is visible at this scale. (Data source: ACEP Deep Secrets, Unpublished data).*

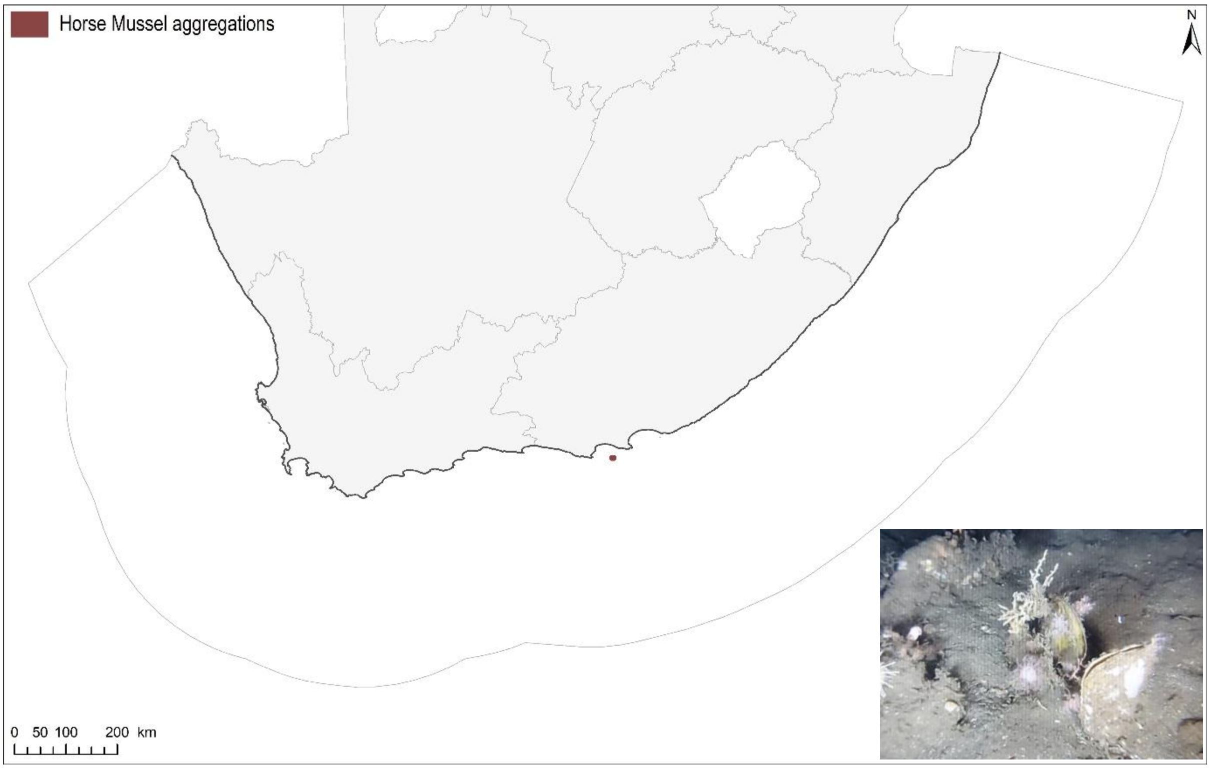



**Figure 120.** *Horse Mussel aggregations around St Francis Bay. The symbology has been expanded so that the feature is visible at this scale. Insert image credit: © ACEP Deep Forests. (Data source: ACEP Deep Forests, Unpublished data).*

#### 4.4.3.2. Special habitats or features

There are six different types of special habitats or features included in the analysis, some of which are also rare. Included among these are the estuary mouths and shores of flagship and non-flagship free-flowing rivers, where water flows unimpeded by dams, weirs or other structures from the catchment source to the sea. Consequently, there is a natural (not reduced) supply of freshwater and sediment through these catchments to the coast. Flagship free-flowing rivers were identified based on their national representativeness and importance for ecological processes and biodiversity (Nel et al. 2011b). The inclusion of free-flowing rivers (via the associated estuarine shores and mouths) also contributes to improving alignment of priorities from catchments through to the coast, and strengthening connectivity between land and sea by including these "pinch-points" of connection.

- The estuary mouths and shores (as part of the EFZ delineation) of flagship and non-flagship free-flowing rivers were buffered by 1 km, and cut to the planning domain.
- Data were coded to the planning units based on area.

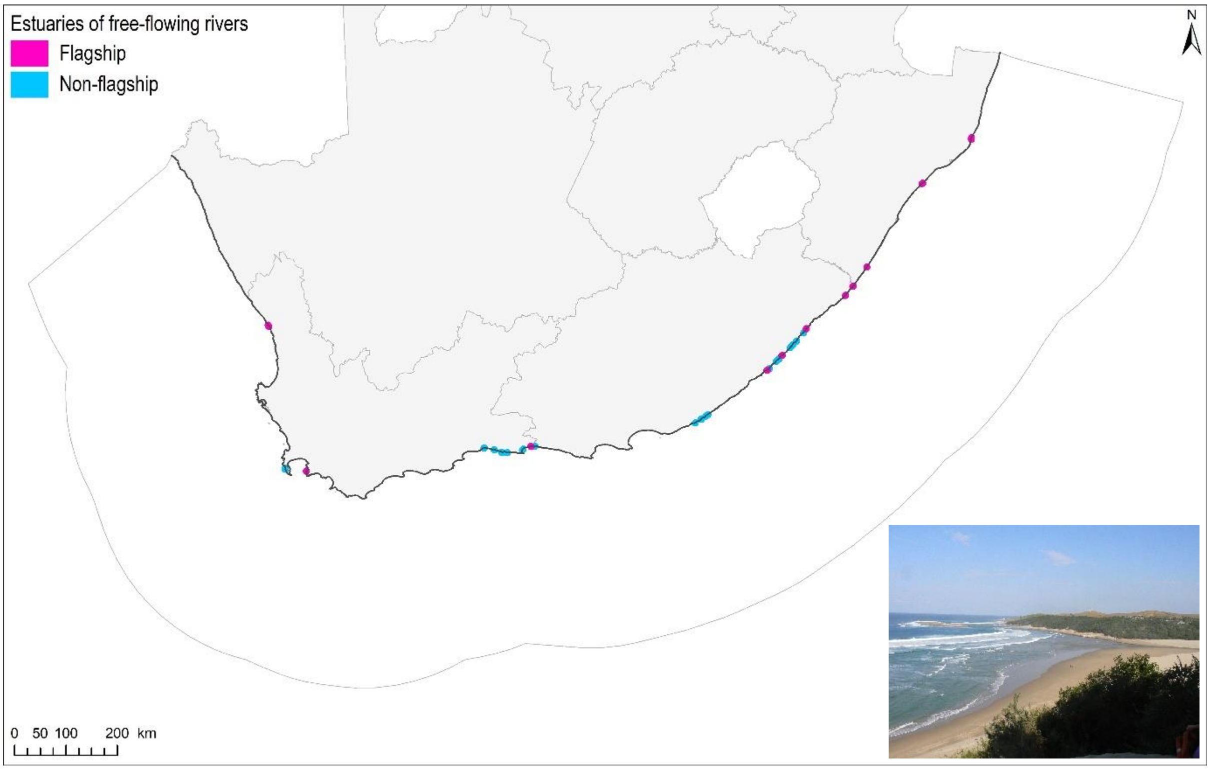



**Figure 121.** *Estuaries of the flagship and non-flagship free-flowing rivers in South Africa, where there is uninterrupted flow of water from the catchment source to the sea. The symbology has been expanded so that the feature is visible at this scale. Insert image is of Msikaba Estuary mouth, a free-flowing river over 100 km long. Insert image credit: © Linda Harris. (Data source: extracted from Harris et al. 2019a; Nel et al. 2011a; Nel et al. 2011b).*

Known and potential cold water coral reefs were included based on data provided by SANBI. This includes a polygon for Secret Reef, a feature discovered during the ACEP Deep Secrets cruise and verified by tow camera surveys. It also includes probable coral mounds based on echosounder imagery. Features between -5 m and -70 m on the seabed were mapped from imagery provided by Robin Leslie (DFFE) during research trawl surveys (Figure 122).

- Data representing cold-water corals comprised both points and polygons, and thus were coded to the planning units on a presence-absence basis.

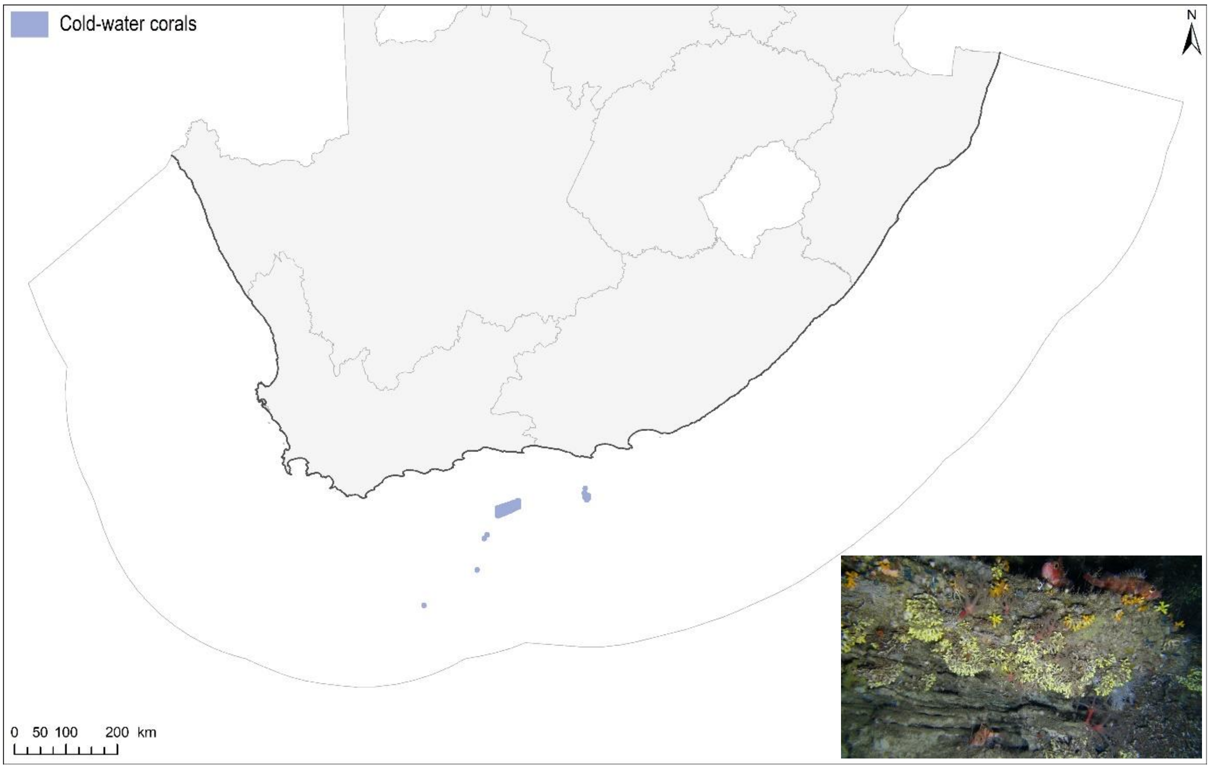



**Figure 122.** *Distribution of cold-water corals, including point localities and Secret Reef. Image credit: © ACEP Deep Forests. (Data source: ACEP Deep Secrets, Unpublished data).*

Vulnerable Marine Ecosystems (VMEs) are fragile habitats characterised by significant densities of slow-growing taxa that are sensitive to the impacts of demersal fisheries (FAO 2009). Potential VMEs include features likely to host VMEs, or areas identified by the presence of VME indicator taxa. In terms of the former, seamounts, submarine canyons and steep rocky areas are included as potential VME features in South Africa (Figure 123). In terms of the latter, these areas are usually identified by *in situ* surveys where indicator taxa are found. To facilitate this process in South Africa, potential local VME indicator taxa were identified in 2018 (Atkinson and Sink 2018) and were mapped using invertebrate catch data from demersal research trawl surveys (Sink et al. 2019a) based on 10 years of DFFE and SAEON demersal trawl surveys. Quantitative data have not yet been analysed to examine the abundance of indicator species, hence these sites (trawl start positions) are noted as Potential VME records (Figure 123). Ongoing visual survey work, largely from the ACEP cruises, is providing additional information, with sites surveyed by submersibles, Remotely Operated Vehicles, tow cameras and drop cameras. These data are providing the location of new VME records and are identifying further potential VME locations where additional footage analysis is required to confirm whether the site is a VME (Figure 123). For sites where visual surveys have been conducted, VMEs are recognised as those sites where more than 100 records of VME taxa were recorded in ten minutes or less (Sink et al. 2021). VME research is an active area of effort, particularly considering the new eco-certification conditions raised for habitat management by the Marine Stewardship Council for South Africa's hake trawl fishery.

- Data representing potential VME features (seamounts, canyons, etc) were coded on the basis of area.
- Data representing VMEs (from visual surveys) and potential VME records are point data and were coded to the planning units as follows; see Sink et al. (2021) for details.
    - VMEs got a value of 1 (highest confidence). These were determined by visual surveys, where more than 100 records of VME taxa were recorded in ten minutes of footage or less.
    - Potential VMEs requiring further analysis of visual survey data got a value of 0.5.
    - Potential VME records from the trawl data got a value of 0.3.

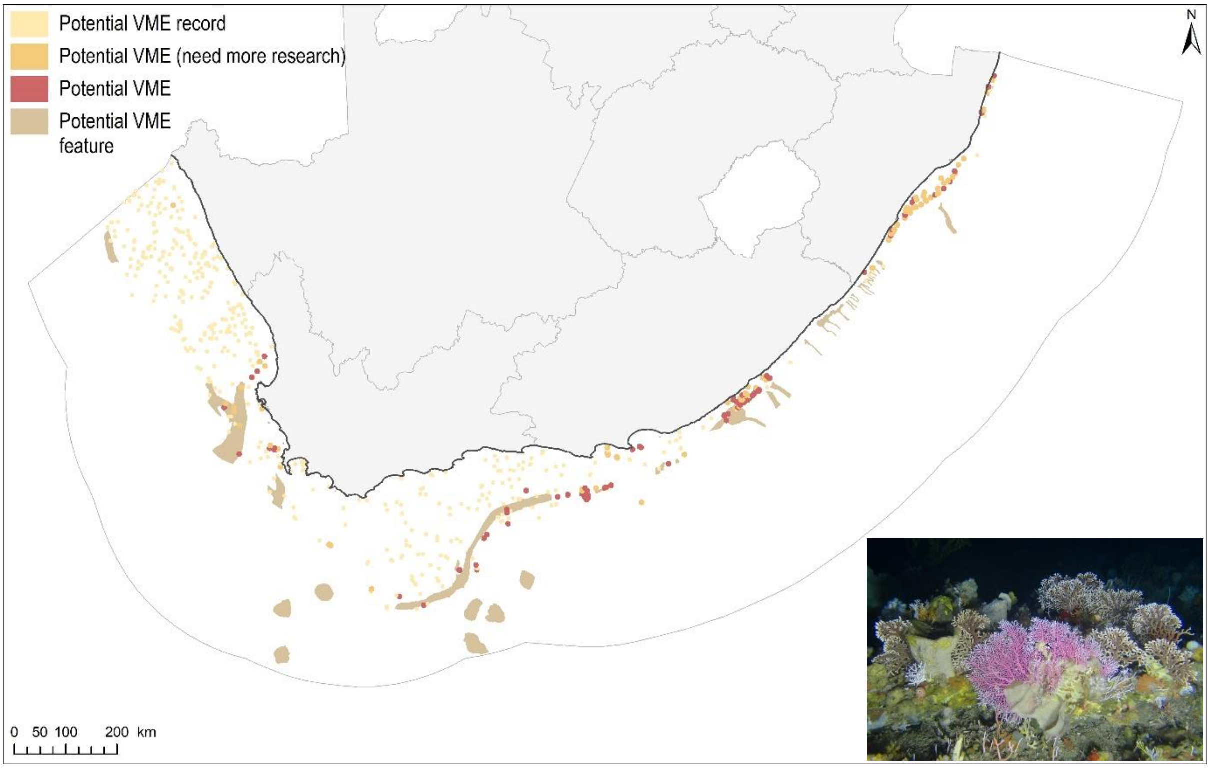



**Figure 123.** *Distribution of known and potential Vulnerable Marine Ecosystem habitat based on potential VME features, DFFE and SAEON trawl survey data, and many visual surveys indicating the presence of indicator taxa. Some sites need more research to determine their status. Insert image credit: © ACEP Deep Forests. (Data source: Sink and Atkinson 2020; Sink et al. 2021; Sink et al. 2019a).*

### 4.4.4. Ecological processes

#### 4.4.4.1. Productivity

Productivity is included in this version of the National Coastal and Marine CBA Map using the upper tail of monthly MODIS-Aqua data on chlorophyll-*a* concentrations that were averaged over the most recent year of data available (August 2019 – July 2020; Figure 124). The data used in this analysis were downloaded from the Giovanni online data system, developed and maintained by the National Aeronautics and Space Administration Goddard Earth Sciences Data and Information Services Center (NASA GES DISC) (see Acker and Leptoukh 2007). Note that productivity is also partly accounted for in some of the EBSAs (Figure 138) that rank high for productivity, e.g., Cape Canyon and Surrounding Islands, Bays and Lagoon; KwaZulu-Natal Bight and uThukela River; and Shackleton Seamount

Complex. Further, productivity was included as part of the pelagic bioregionalisation (Roberson et al. 2017) and thus, the pelagic ecosystem types (Figure 11). To some extent, upwelling areas also contribute to climate-change adaptation (see Section 4.4.7.4), because they have been found to be refugia for macroalgae in areas where the climate has been changing (Lourenço et al. 2016).

- Data representing areas of very high productivity, including upwelling areas, were extracted from the annual averaged chlorophyll-*a* concentrations. The data used in the analysis were downloaded from the Giovanni online data system, developed and maintained by the National Aeronautics and Space Administration Goddard Earth Sciences Data and Information Services Center (NASA GES DISC) (see Acker and Leptoukh 2007).
- The chlorophyll-*a* concentrations were split into ten quantiles, of which the quantile containing the highest values was retained. This subset of the data was reclassified 1-10 by splitting the data into 10 quantiles.
- Data were coded to the planning units based on a zonal statistics analysis, where zones were planning units.

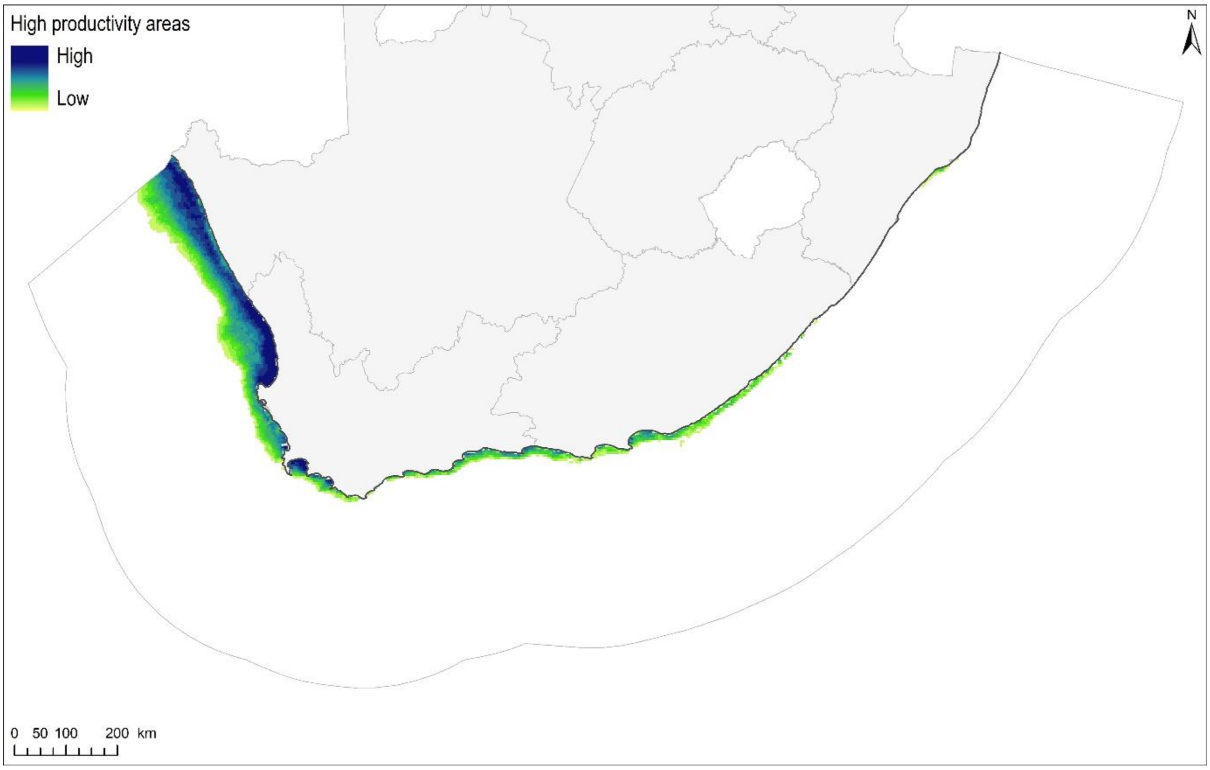



**Figure 124.** *Areas where productivity (chlorophyll-a) is high, including upwelling areas. (Data source: NASA GES DISC Giovanni Portal; see Acker and Leptoukh 2007).*

Beaches with surf diatom accumulations (Figure 125) are globally rare, and South Africa has several sites that support these accumulations, primarily along the south coast (Campbell 1996; Campbell and Bate 1991). These accumulations are visible in the surf as brown patches, forming only on beaches with wide surf zones of medium to high wave energy, with well-developed rip currents, and that are adjacent to dunes that have nutrient-rich aquifers (Campbell and Bate 1997). Surf diatom accumulations contribute to particularly high productivity for those associated beach and surf-zone communities (Campbell 1987; Campbell and Bate 1988).

Beaches with beach-cast kelp (Figure 126) similarly have elevated productivity, with the wrack piles also playing a key role in carbon efflux (Coupland et al. 2007). Microbes play a particularly important role in recycling the nutrients from wrack (Koop and Griffiths 1982; Koop et al. 1982). Wrack piles also support particularly high abundances of macrofauna such as sandhoppers and beach hoppers (e.g., *Africorchestia* and *Capeorchestia*), which in turn provide food for numerous shorebirds, such as plovers (Dugan et al. 2003).

- Data representing beaches with surf diatom accumulations and beach-cast kelp were coded to the planning units on the basis of area.

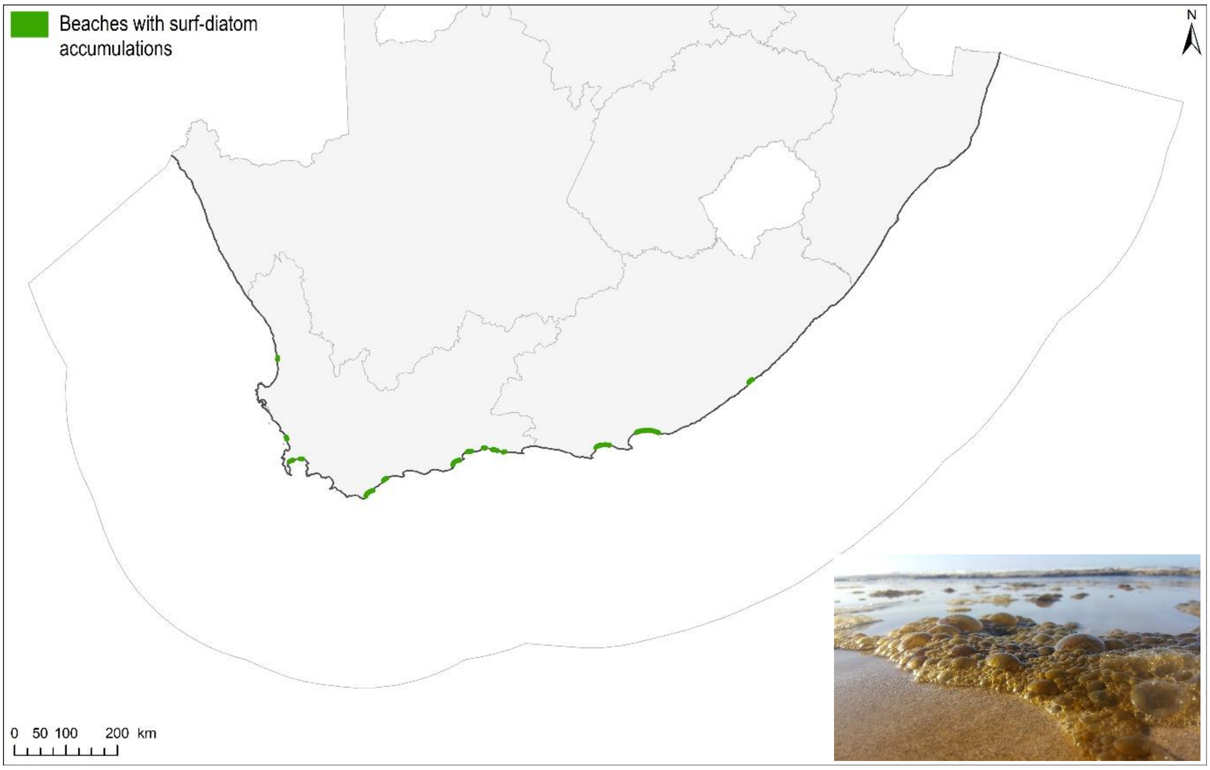



**Figure 125.** *Distribution of beaches with surf diatom accumulations that support particularly high coastal productivity. The symbology has been expanded so that the features are visible at this scale. Image: © Linda Harris. (Data source: Harris 2012; Harris et al. 2019a; Harris et al. 2010).*

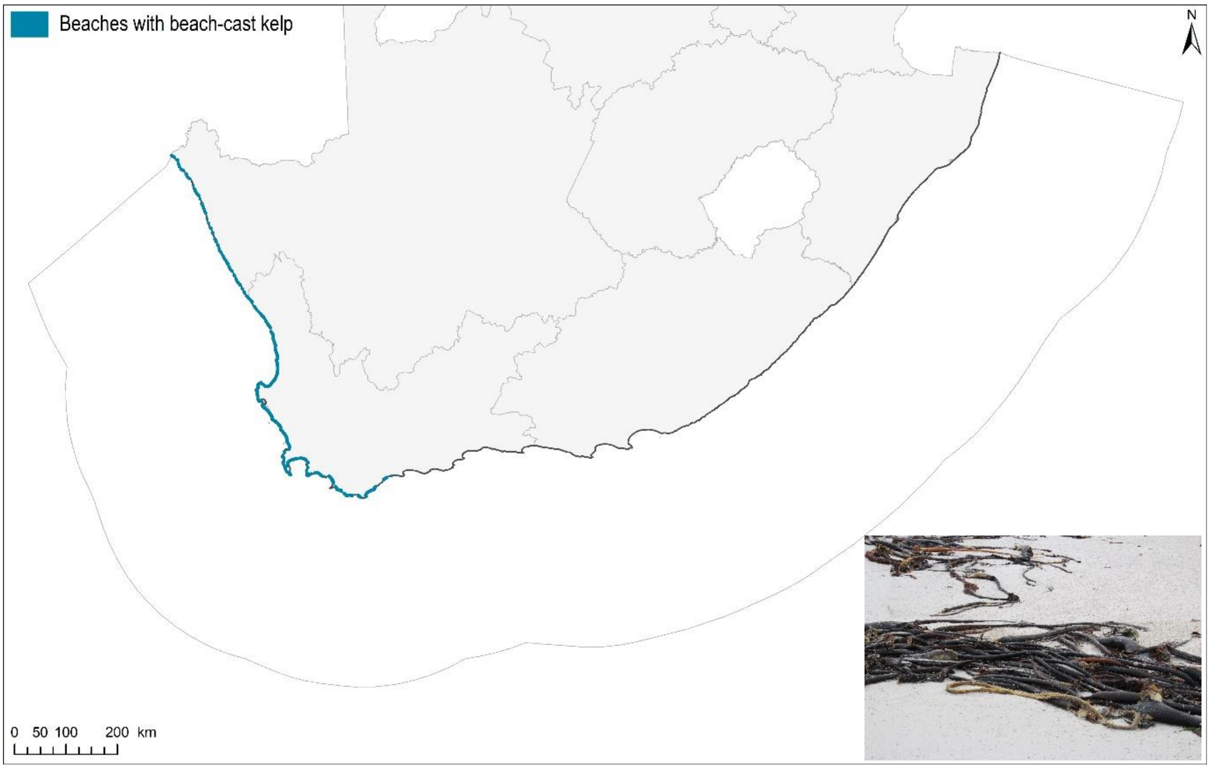



**Figure 126.** *Beaches that have beach-cast kelp wrack, which supports high productivity on beaches. The symbology has been expanded so that the features are visible at this scale. Image: © Tony Rebelo (CC-BY-SA 4.0). (Data source: Harris 2012; Harris et al. 2019a).*

#### 4.4.4.2. Spawning and nursery areas

Spawning and nursery areas are critically important for securing fishing and food-provisioning opportunities into the future. Such areas that were included in this iteration are areas with high anchovy (Figure 127) and sardine (Figure 128) egg densities (Twatwa et al. 2005); spawning and nursery areas for fish (Figure 129) (Hutchings et al. 2002); squid spawning areas (Figure 130) (Roberts et al. 2012); and the shores of estuaries ranked with DFFE's fish-nursery importance rating (Figure 131) (Van Niekerk et al. 2019a; Van Niekerk et al. 2019b). It is recognised that there are other spawning and nursery areas that need to be included in future iterations (see Appendix 2). (See also Red Steenbras spawning areas in Section 4.4.3.1).

- Data representing fish and squid spawning and nursery areas were digitized from published sources and coded to the planning units on the basis of area.
- In the case of sardine and anchovy spawning areas, the area value within each planning unit was doubled in areas of higher egg densities to represent their comparatively higher value compared to areas of lower egg densities.

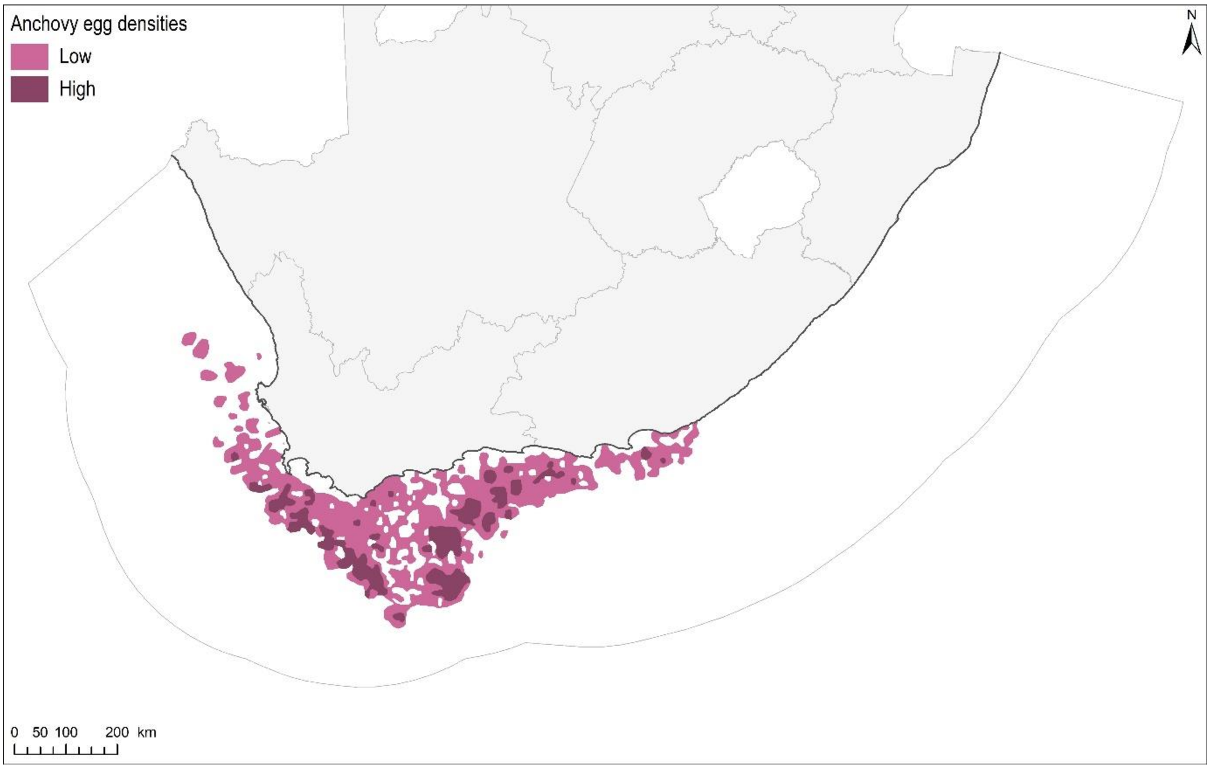



**Figure 127.** *Distribution of anchovy spawning areas, as measured by egg densities. (Data source: Digitized from Twatwa et al. 2005).*

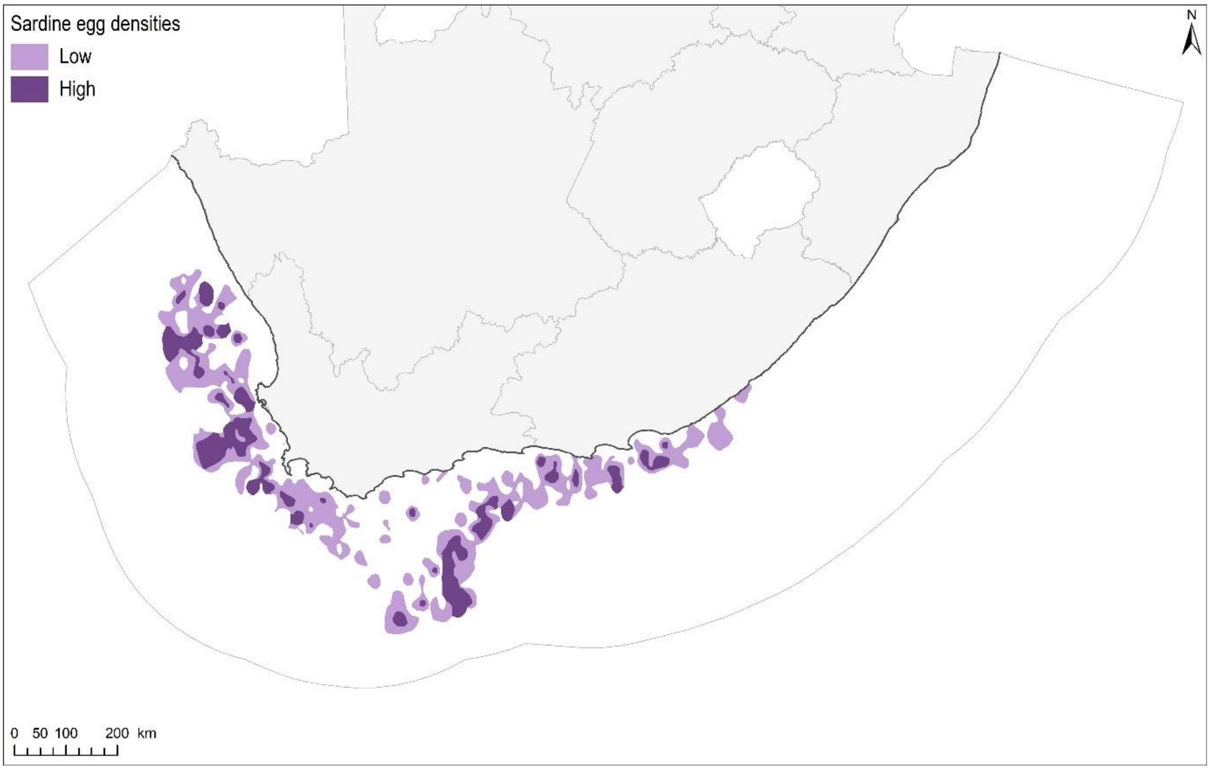



**Figure 128.** *Distribution of sardine spawning areas, as measured by egg densities. (Data source: Digitized from Twatwa et al. 2005).*

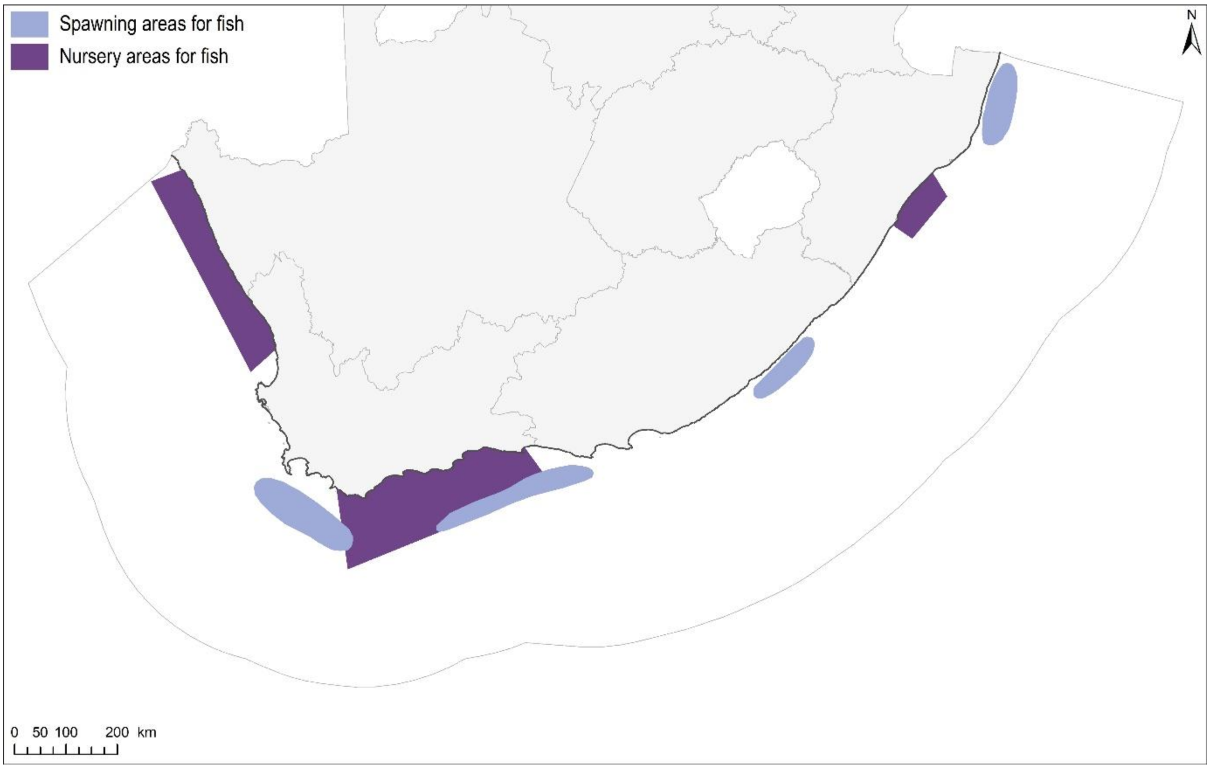



**Figure 129.** *Generalised spawning and nursery areas for fish. (Data source: Hutchings et al. 2002).*

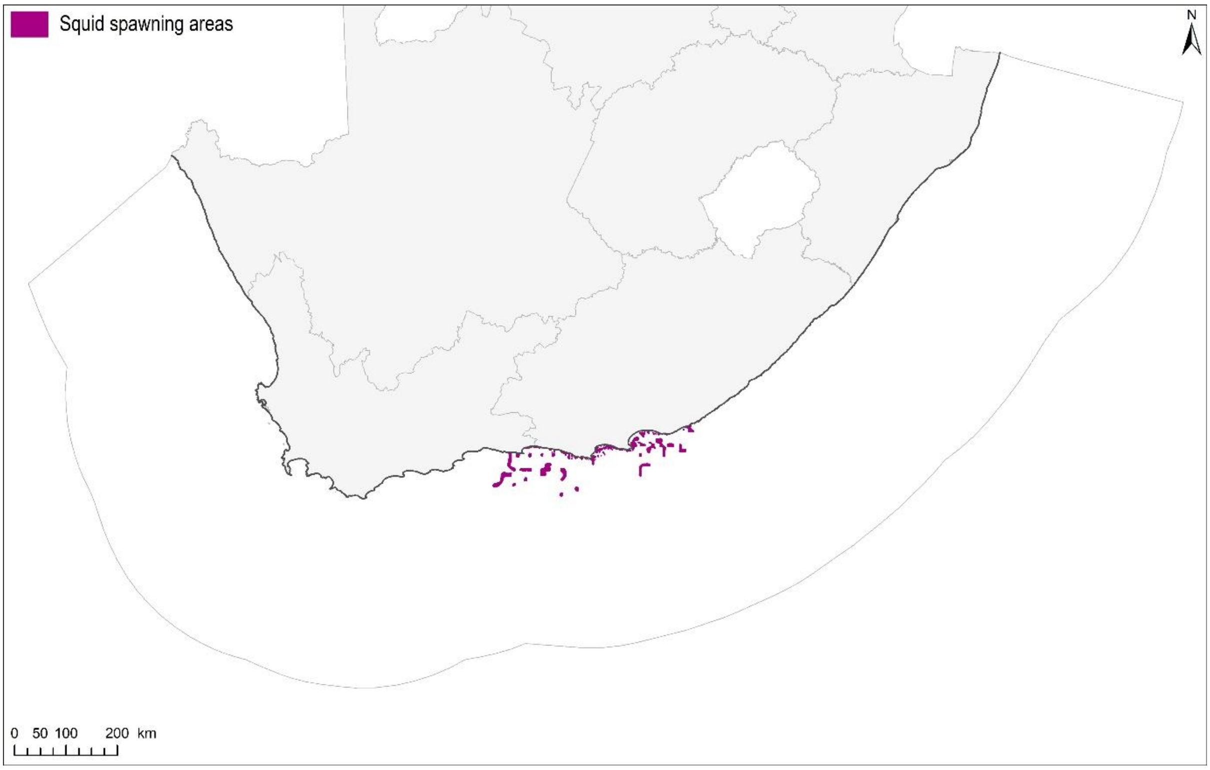



**Figure 130.** *Location of squid spawning areas along the south-eastern coast. (Data source: Digitized from Roberts et al. 2012).*

Estuaries provide particularly important habitat for spawning, nursery and developmental life-history stages of a variety of species, including commercially important fish species. Many species are also dependent on estuaries to complete their lifecycles, making the mouths of these systems critical linkages between the sea and estuaries that need to be maintained in natural to near-natural state, or as close to that state as possible (Figure 131).

- Data representing estuarine nursery areas (estuarine mouths and shores, which includes the adjacent surf zone) were coded based on their importance rating as fish nurseries (Van Niekerk et al. 2019a; Van Niekerk et al. 2019b).


**Figure 131.** *Estuary mouths and shores coloured by their nursery importance ranking for fish. Insert image is of Sundays Estuary, which has a high ranking for fish-nursery importance. The symbology has been expanded so that the features are visible at this scale. Insert image credit: © Linda Harris. (Data source: extracted from Harris et al. 2019a; importance ranking from Van Niekerk et al. 2019a; Van Niekerk et al. 2019b).*

### 4.4.5. Ecological infrastructure

Ecological infrastructure (EI) is "natural and naturally functioning ecological systems or networks of ecological systems that deliver multiple services to humans and enable biodiversity persistence" (Perschke 2022). "It is the nature-based equivalent of built infrastructure, and is just as important for providing services and underpinning economic development" (SANBI 2016). Furthermore, it plays a key role in delivering nature-based benefits to people. Two types of EI were included in this iteration: coastal protection EI (Figure 132), and recreational outdoor activities and sports events EI (Figure 133). This is based on novel techniques for mapping EI and quantifying associated ecosystem service demand, capacity, flow and delivery as part of a PhD thesis by Perschke (2022).

- Data representing ecological infrastructure (EI) were coded to the planning units using an area-based weighting of ecosystem service delivery per planning unit.
- Perschke (2022) mapped EI and quantified service delivery for recreational outdoor activities (e.g., beach visiting, coastal hiking, etc) and sports events (e.g., open-water swimming races, surfing competitions, etc) separately. These were included as a single layer by summing the service delivery values.
- Note that land-based EI was not included in the spatial prioritisation because it is outside the planning domain.

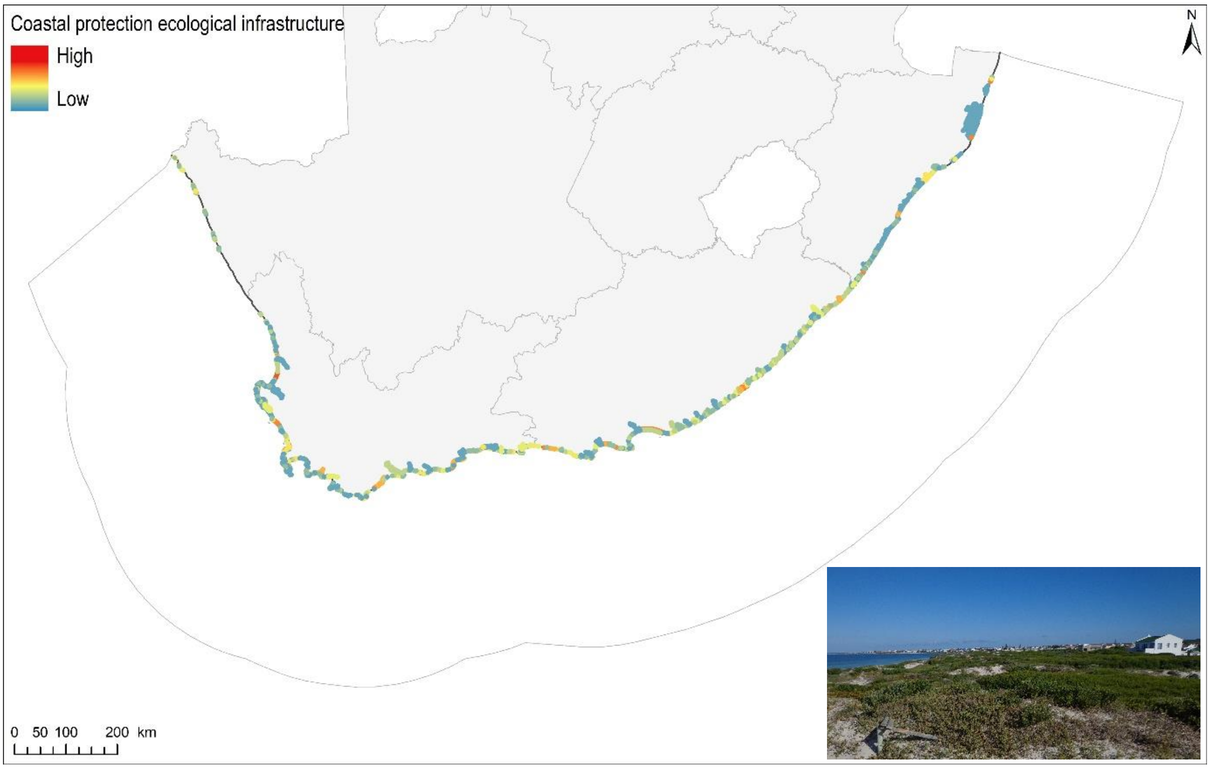



**Figure 132.** *Distribution of ecological infrastructure supporting coastal protection. Note that the map symbology has been expanded so that the features are visible at this scale. Insert image credit: © Linda Harris. (Data source: Perschke 2022).*

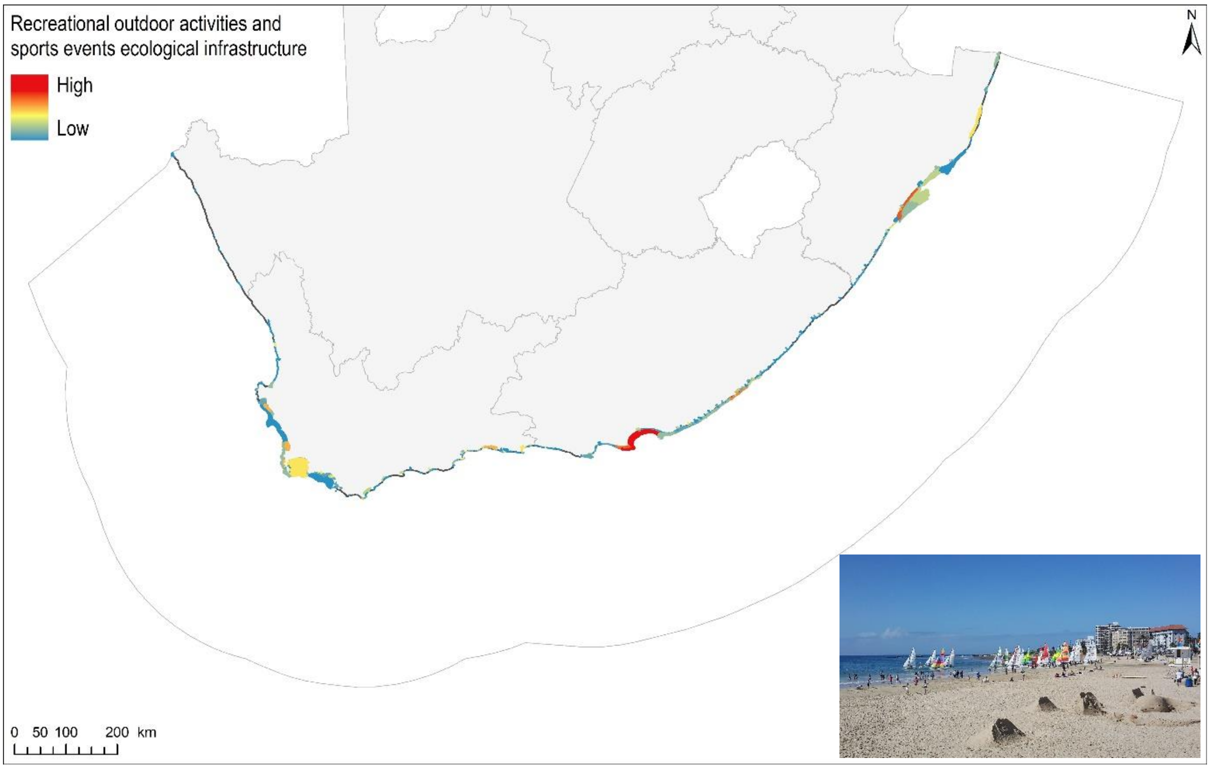



**Figure 133.** *Distribution of coastal ecological infrastructure supporting sports events and recreational outdoor activities. Note that the map symbology has been expanded so that the features are visible at this scale. Insert image credit: © Linda Harris. (Data source: Perschke 2022).*

### 4.4.6. Existing priorities

#### 4.4.6.1. Ramsar sites

Ramsar sites are internationally recognised sites that meet at least one of the nine criteria[4] for identifying Wetlands of International Importance. Emphasis is placed on the wetlands themselves (in terms of representativeness, uniqueness, and rarity) as well as their associated biodiversity, and particularly the importance of the wetlands for waterbirds. Every signatory state to the Convention on Wetlands (Ramsar, 1971) needs to have at least one Ramsar site.

South Africa has 27 Ramsar sites (www.ramsar.org/wetland/south-africa). South Africa's Ramsar sites were included in the spatial prioritisation (where present in the planning domain) to encourage selection of and around these areas. All of these sites are land-based and/or are already located in protected areas, and thus served more as a design element to align priorities (Figure 134).

- Data representing Ramsar sites were coded to the planning units on the basis of area.

[4] https://www.ramsar.org/sites/default/files/documents/library/ramsarsites_criteria_eng.pdf

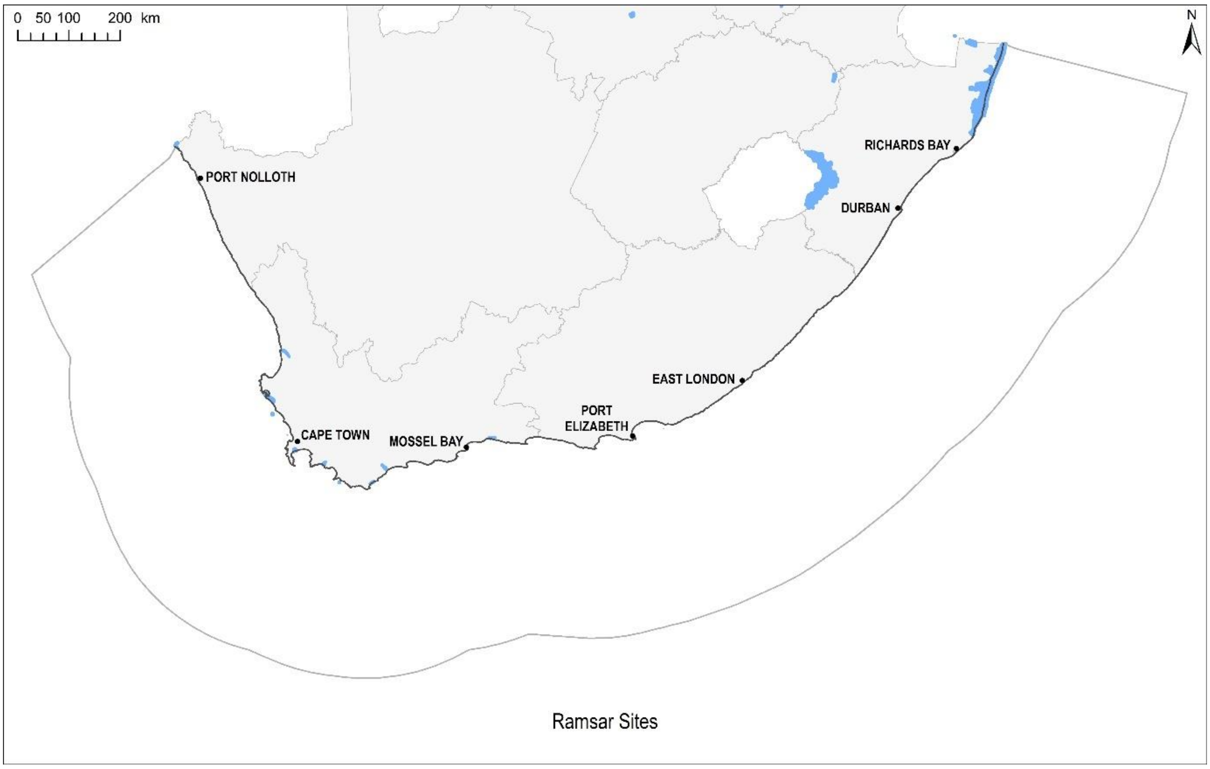



**Figure 134.** *Distribution of Ramsar sites in South Africa. (Data source: Ramsar Sites Information Service 2020).*

#### 4.4.6.2. World Heritage Sites (natural criteria)

South Africa has ten World Heritage Sites: five are inscribed for cultural criteria; one for both cultural and natural criteria; and four for natural criteria. Of the latter, only iSimangaliso Wetland Park extends into the marine territory.


**Figure 135.** *iSimangaliso Wetland Park World Heritage Site is the only World Heritage Site in South Africa that is inscribed for natural criteria and extends into the marine territory. Insert image credit: © Linda Harris. (Data source: https://whc.unesco.org/en/list/914; extracted from SAPAD, DFFE 2020b).*

#### 4.4.6.3. Network of Sites of Importance for Marine Turtles in the Indian Ocean – South-East Asia Region

iSimangaliso World Heritage Site was one of the first sites adopted into the Network of Sites of Importance for Marine Turtles (delineated as the previous Maputaland and St Lucia MPAs) that was established by the Indian Ocean and South-East Asia (IOSEA) Sea Turtle Memorandum of Understanding under the Convention on Migratory Species (see IOSEA Marine Turtles 2020). iSimangaliso is recognised for its value for hosting nesting Loggerhead (regionally Vulnerable) and Leatherback (regionally Critically Endangered) turtles during the breeding season, as well as serving as foraging and nursery areas for green turtles and hawksbills, and possibly supporting olive ridley turtles as well (Sibiya and Bachoo 2014).

- The spatial data to represent the IOSEA Turtle Site of Importance were the taken as the marine extent of the iSimangaliso Wetland Park World Heritage Site (see Section 4.4.6.2), as mentioned in the site description (Sibiya and Bachoo 2014).
- These data were coded to the planning units on the basis of area.

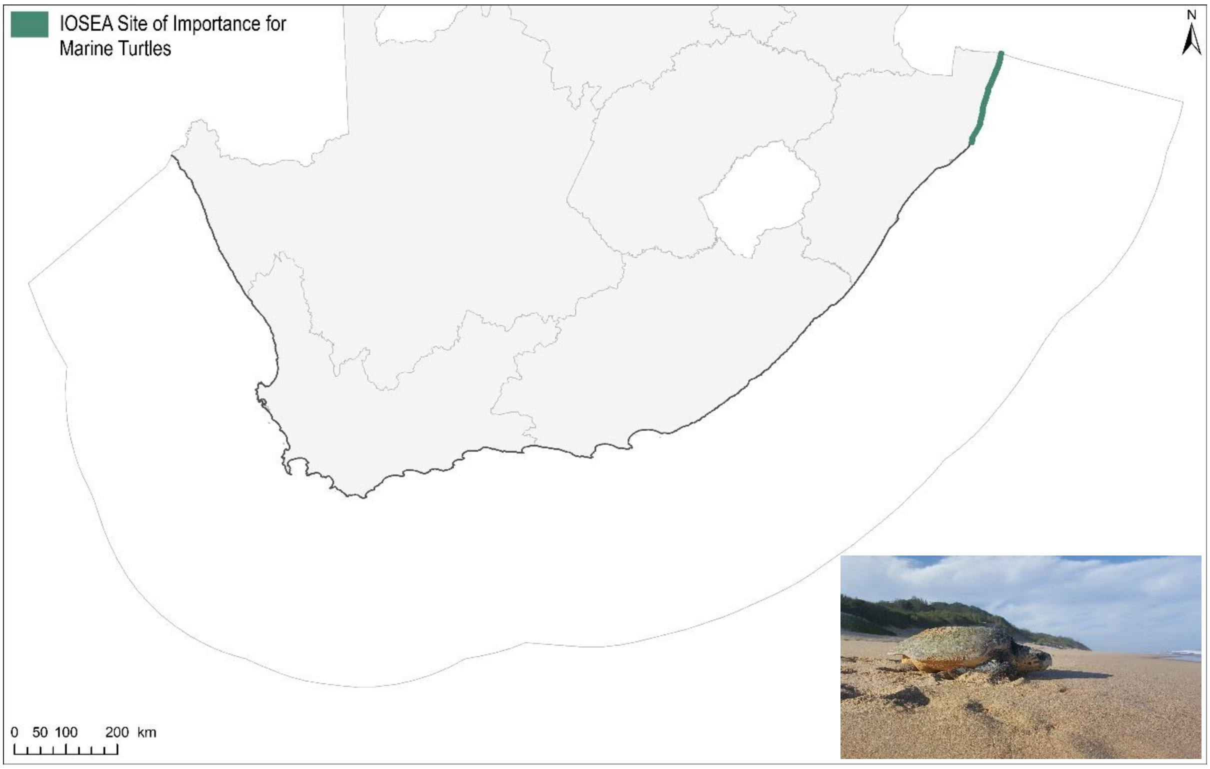



**Figure 136.** *The marine portion of iSimangaliso Wetland Park World Heritage site that is included in the Network of Sites of Importance for sea turtles that was established by the Indian Ocean and South-East Asia Sea Turtle Memorandum of Understanding (IOSEA MoU). The symbology has been expanded so that the features are visible at this scale. Insert image credit: © Linda Harris. (Data source: extracted from SAPAD, DFFE 2020b; Sibiya and Bachoo 2014; https://www.cms.int/iosea-turtles/en/activities/site-network).*

#### 4.4.6.4. Important Bird and Biodiversity Areas

The confirmed Important Bird and Biodiversity Areas (IBAs, Figure 137) were included to encourage selection of and around these key areas for seabirds and shorebirds. Most of these sites are land-based and/or are already located in protected areas, and thus – like Ramsar sites – served more as a design element to align priorities.

- Data representing IBAs were coded to the planning units on the basis of area (i.e., the 'amount' value for this feature is the area within each planning unit that comprises IBAs).

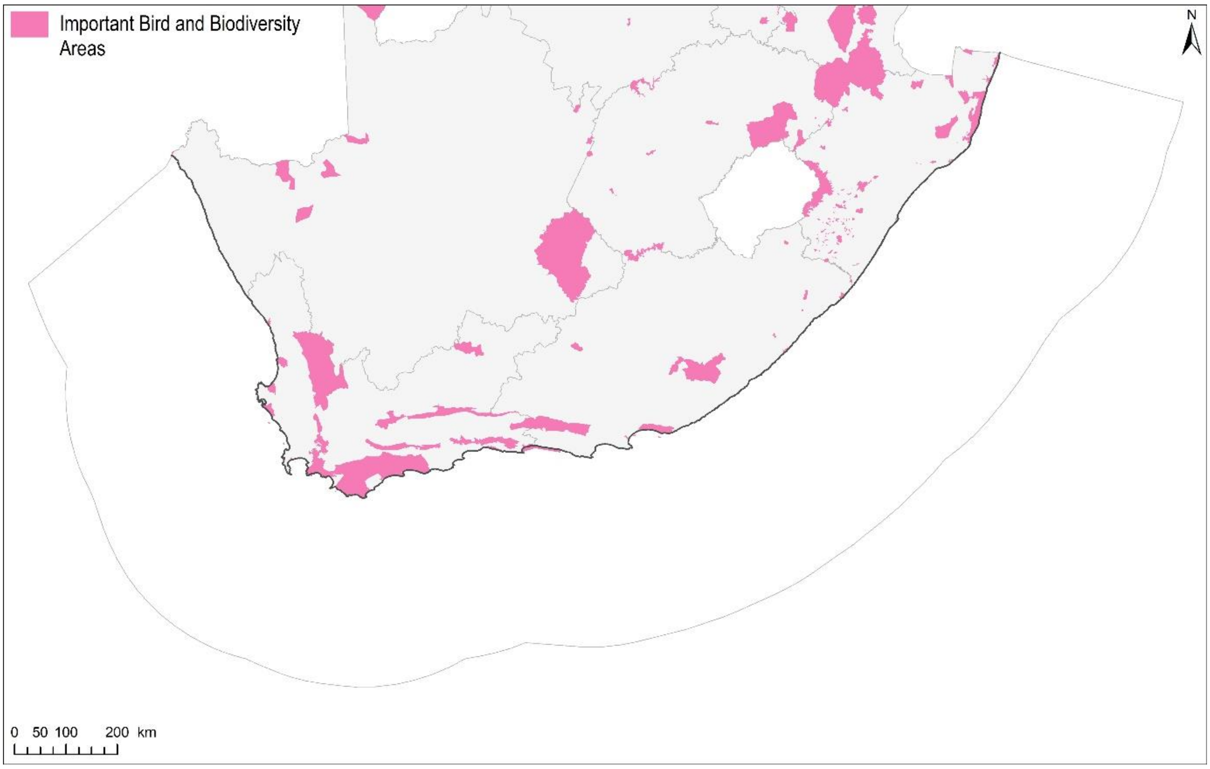



**Figure 137.** *Important Bird and Biodiversity Areas (IBAs) in South Africa. (Data source: received from BirdLife South Africa; see also BirdLife International 2021a, b).*

#### 4.4.6.5. Ecologically or Biologically Significant Marine Areas

There are 23 EBSAs that are wholly or partially under South African jurisdiction (Harris et al. 2022). Five of these (including one at Prince Edward Islands) are extensive EBSAs that extend into the high seas, and typically describe large-scale processes that are not spatially fixed, or features or processes for which the spatial extent is uncertain (e.g., oceanic fronts or upwelling regions). These EBSAs are not shown or considered here. The focus is rather on the other 18 EBSAs (Figure 138) that typically describe features or groups of features representing recognised priority areas for coastal and marine biodiversity in South Africa, and (apart from Delagoa Shelf Edge, Canyons and Slope) have been refined since their original description based on new data (Harris et al. 2022; MARISMA 2020b). These EBSAs were included as an input dataset in the National Coastal and Marine CBA Map to form part of the single, coherent input from the biodiversity sector into multi-sector processes, such as MSP (see Figure 1). Further, together with the MPAs, EBSAs represent a network of sites that are important for biodiversity, and contribute towards including connectivity in the National Coastal and Marine CBA Map. They also encompass areas that are important for ecological processes, e.g., productivity and key life-history stages. More details on EBSAs in South Africa are given in Box 3 below.

- Data representing EBSAs were coded to the planning units on the basis of area.

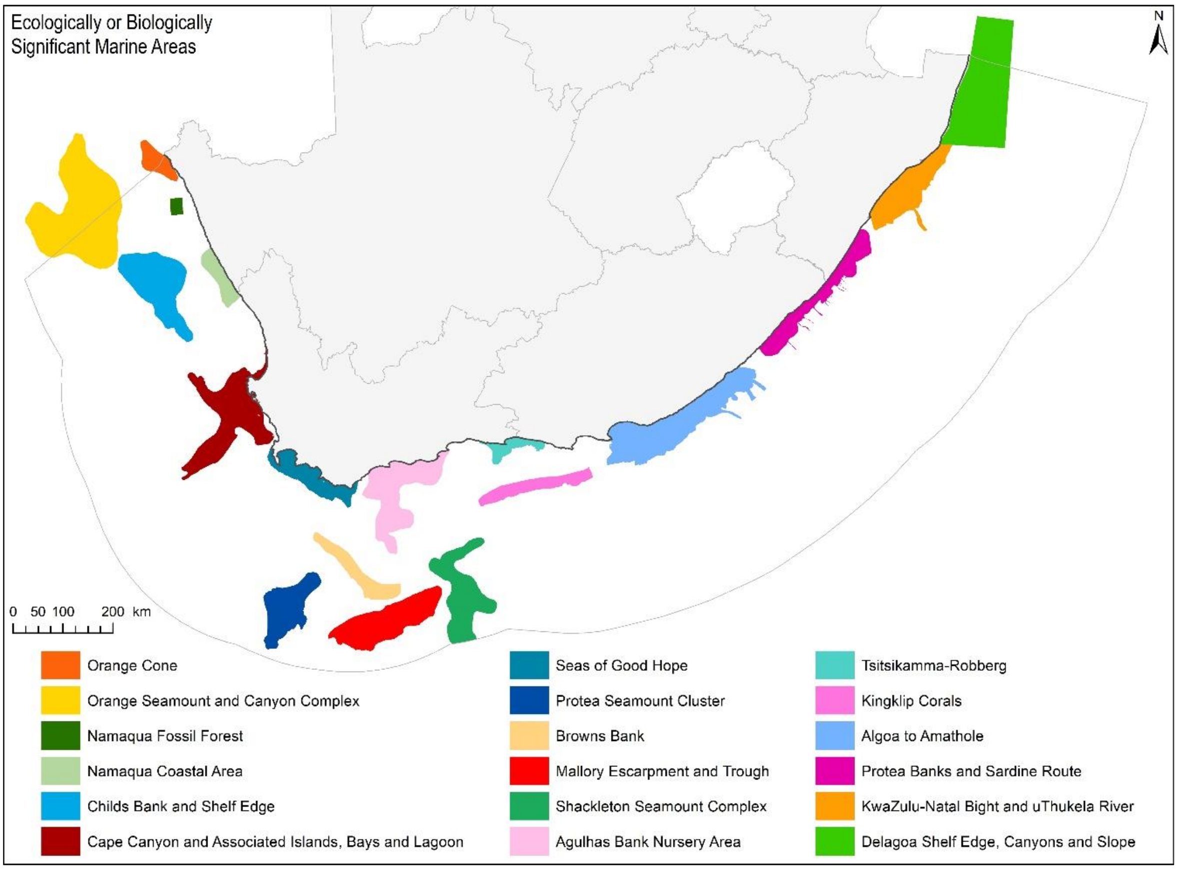



**Figure 138.** *Ecologically or Biologically Significant Marine Areas (EBSAs) in South Africa. Only those EBSAs that are entirely within South Africa's marine territory or are shared with neighbouring countries are shown. (Data source: Harris et al. 2022; MARISMA 2020b).*

## Box 3. EBSAs in South Africa

Ecologically or Biologically Significant Marine Areas (EBSAs) were conceptualised by the Convention on Biological Diversity (CBD), initially as part of the work on approaches to promote international cooperation and coordination for the conservation and sustainable use of marine biodiversity in areas beyond national jurisdiction. EBSAs are marine places that provide important services to one or more species or populations or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics. To be inscribed as an EBSA, a site must meet at least one of the seven EBSA criteria set out by the CBD (UNEP-CBD 2009).

It was also noted that EBSAs may require enhanced conservation and management measures (decision X/29) to secure their constituent marine biodiversity, and that this was a matter for States.

The value of identifying EBSAs in areas under national jurisdiction was recognised, especially for helping countries guide efforts to achieve their Aichi targets. Therefore, States were urged to identify EBSAs at the 9th Convention of Parties (COP) in 2009 (decision IX/20). Through a series of regional workshops supported by the CBD, EBSAs were identified by evaluating sites against the seven EBSA criteria, and were

**The Seven EBSA Criteria**

1. Uniqueness or rarity
2. Special importance for life history stages of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, fragility, sensitivity, or slow recovery
5. Biological productivity
6. Biological diversity
7. Naturalness

See the MARISMA EBSA Portal for more details on the criteria.

delineated within country territories, in the high seas, and across boundaries (country-country, or country–high seas). Currently, 320 sites have been identified, globally (see CBD EBSA website).

South Africa's original EBSA network was identified at two regional workshops: The Southern Indian Ocean (UNEP/CBD/RW/EBSA/SIO/1/4) and South Eastern Atlantic (UNEP/CBD/RW/EBSA/SEA/1/4) Regional Workshops to Facilitate the Description of Ecologically or Biologically Significant Marine Areas in 2012 and 2013, respectively. South Africa's proposed sites were based largely on the focus areas for offshore MPAs that had been identified using systematic biodiversity planning (Sink et al. 2011). The proposed sites met the EBSA criteria and were adopted as EBSAs by the CBD at COP 12 in 2014. Although EBSAs are not legally binding, the CBD encouraged countries to co-operate regionally, and implement improved conservation and protection measures within EBSAs to secure the special biodiversity features for which they were identified.

Since then, the Benguela Current Commission (BCC) and its member states (Angola, Namibia and South Africa), in cooperation with GIZ on behalf of the German government, have been working on a regional Marine Spatial Management and Governance Programme (MARISMA; 2014-2020). The aim was to refine the boundaries of existing EBSAs and identify relevant new ones, assess their status and management requirements, and incorporate these into Marine Spatial Planning (MSP) processes in each country to support sustainable ocean use in the Benguela Current Large Marine Ecosystem (Harris et al. 2019c; Harris et al. 2022). This builds on a previous project to map biodiversity priority areas in this region (Holness et al. 2014).

The updated priority areas were identified using systematic biodiversity planning, with improved data based on new research (Kirkman et al. 2019). In South Africa, for example, the MARISMA Project has drawn heavily on the maps and assessments produced for the NBA 2018 (Harris et al. 2019a; Majiedt et al. 2019; Sink et al. 2019a; Sink et al. 2019c; Sink et al. 2019d). This application of systematic biodiversity planning in identifying EBSAs was also shown to strengthen and advance the EBSA process (Harris et al. 2019c). The updated biodiversity priority areas (Holness et al. 2014; Kirkman et al. 2019) helped to refine the boundaries of the existing EBSAs, and new priority areas that were identified were evaluated against the EBSA criteria, and those that met the criteria were included as proposed EBSAs (MARISMA 2020b). Both the revised and proposed EBSAs have been reviewed nationally and internationally, and following Ministerial approval, were submitted to the CBD Secretariat. At the time of writing, CBD consideration and approval of the submissions is pending the finalisation of modalities for modifying descriptions of Ecologically or Biologically Significant Marine Areas (EBSAs) and for describing new areas, by the CBD.

The updated EBSA network in South Africa comprises 23 EBSAs that are wholly or partly within the country's national jurisdiction. Six of these EBSAs were not revised in the MARISMA Project: the required regional engagement process was beyond the scope of the project because these EBSAs extend from South Africa's marine territory into areas beyond national jurisdiction (including one at Prince Edward Islands) or into Mozambique. (The five EBSAs that extend into the high seas can be viewed on the CBD EBSA website).

EBSA management is fully embedded into the emerging national MSP process, where the EBSA management zones and associated regulations will come from the marine area plans. The MSP zones are being informed by the CBA Map; the regulations by the sea-use guidelines, as indicated in Figure 183.

*For detailed information about South Africa's EBSAs visit the EBSA Portal and see Harris et al. (2022).*

#### 4.4.6.6. Priority beaches

Harris (2012) identified a portfolio of sandy shores that were important for beach ecosystem types, beach macrofauna, phytoplankton and microphytobenthos, dune plants, and beach-associated vertebrates (Harris et al. 2014b), as well as a few coastal ecological processes. This was based on a fine-scale systematic conservation plan specifically for beaches in South Africa, systems that are often overlooked (globally) and yet contain a surprisingly rich diversity, with particularly high rates of endemism (Harris et al. 2014b). These areas were included as a feature to encourage Marxan to meet targets in these previously identified priority areas.

- The priority beaches identified above were dissolved and clipped by the shores of the new map of coastal ecosystem types (Harris et al. 2019a).
- The data were then coded to the planning units on the basis of area

.


**Figure 139.** *Priority beaches identified along the South African coast, based on a fine-scale systematic conservation plan. The symbology is expanded to make the features visible at this scale, such that the overall extent looks much greater than it actually is. Insert image credit: © Linda Harris. (Data source: Harris 2012; Harris et al. 2019a).*

#### 4.4.6.7. Shores/mouths of priority estuaries

South Africa has 290 estuaries of 22 different types, and 42 micro-estuaries of three different types. Although estuaries comprise less than 2% of the mainland territory, they are highly productive systems, supporting a rich diversity of plants and animals, and contributing R4.2 billion to the national economy (Van Niekerk et al. 2019a). Furthermore, much of the diversity associated with estuaries is unique and/or limited to only a few systems. For example, a third of the estuarine-associated fish species are endemic, including some species that occur in only a handful of systems, e.g., the Knysna Seahorse (*Hippocampus capensis*) and Estuarine Pipefish (*Syngnathus watermeyeri*), and less than a third of the plant species occur in five or more estuaries (Van Niekerk et al. 2019a). Importantly, the most recent NBA (2018) found estuaries to be the most threatened of all the realms, with pressures increasing, ecological condition declining, and 45% of ecosystem types either Not Protected or Poorly

Protected, including 8 ecosystem types that are highly threatened (Critically Endangered or Endangered) (Van Niekerk et al. 2019a).

A portfolio of priority estuaries has been identified, listed in Van Niekerk et al. (2019b), which is Appendix D of the NBA 2018 Estuarine Realm Assessment (Van Niekerk et al. 2019a). The estuarine shores of these priority estuaries were included as a feature in the spatial prioritisation analysis. This is to facilitate alignment between estuarine and marine biodiversity priorities, and to include key "pinch points" of connectivity between land and sea (see also Section 7.3).

- The list of priority estuaries includes estuaries with a "High" Biodiversity Importance Rating and estuaries comprising the Biodiversity priority core set (national and/or CAPE) from Van Niekerk et al. (2019b).
- The EFZs of each of these priority estuaries was buffered; by 1 km for EFZs that are <5 km$^2$ and by 2 km for EFZs >5 km$^2$. These areas were cut to the planning domain.
- Data representing priority estuaries were then coded to the planning units on the basis of presence-absence.

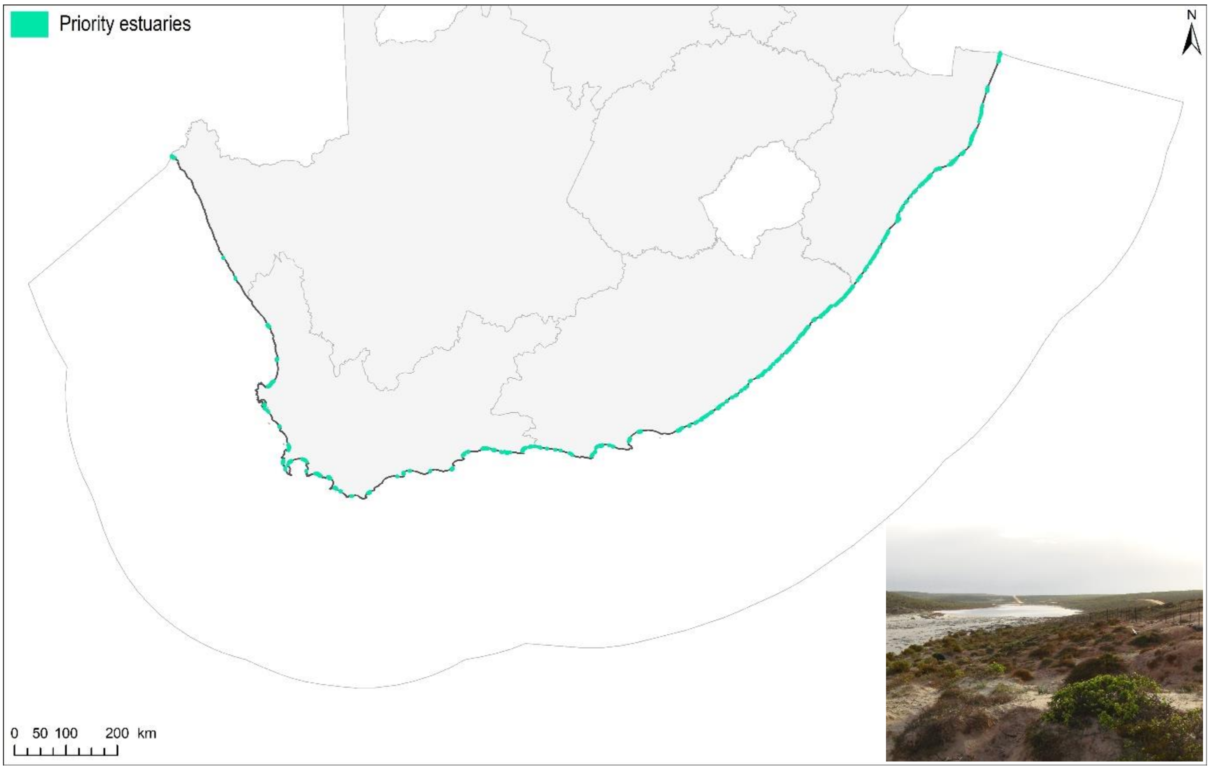



**Figure 140.** *Shores and mouths of priority estuaries in South Africa. The symbology has been expanded so that the features are visible at this scale. Insert image credit: © Linda Harris. (Data source: extracted from Harris et al. 2019a; identified by Van Niekerk et al. 2019b).*

### 4.4.7. Design elements

#### 4.4.7.1. Edge-matching, and priority and implementation alignment

There has been a notable recent expansion of South Africa's protected area estate, particularly in the marine realm with the declaration of 20 new MPAs in 2019. Full details about South Africa's protected areas can be found in the NBA 2018 (Sink et al. 2019d; Skowno et al. 2019b; Van Niekerk et al. 2019a). The protected areas included in this systematic biodiversity plan were extracted for the coastal and marine planning domain from the version of the protected areas map used in the NBA 2018 (Figure 141). The new nature reserve at the Orange River mouth was also added from the South African Protected Areas Database (SAPAD). Further, the extent of the Amathole Offshore MPA (slightly incorrect in the NBA 2018 version) was corrected using the latest data from SAPAD.

- These data were included by locking in the planning units containing protected areas (>25% of the planning unit area) into the final selection.


**Figure 141.** *Protected areas in the coastal and marine planning domain. (Data source: DFFE 2020b (SAPAD); Sink et al. 2019d; Skowno et al. 2019a).*

The Biodiversity Conservation Zones of the two transboundary EBSAs shared with Namibia were included on the Namibian side of the border to facilitate edge-matching of priorities on the South African side. These include two portions of the Orange Seamount and Canyon Complex EBSA, and the mouth of the Orange River in the Orange Cone EBSA (Figure 142).

- As noted in Section 4.3, the planning units layer extended 5 km into Namibian waters to facilitate transboundary alignment of priorities. The planning units in Namibia that contained proposed Biodiversity Conservation Zone were locked into the final selection. This means that

– all else being equal – Marxan will preferentially select areas adjacent to the Namibian proposed Biodiversity Conservation Zone, thereby aligning priorities across the border.

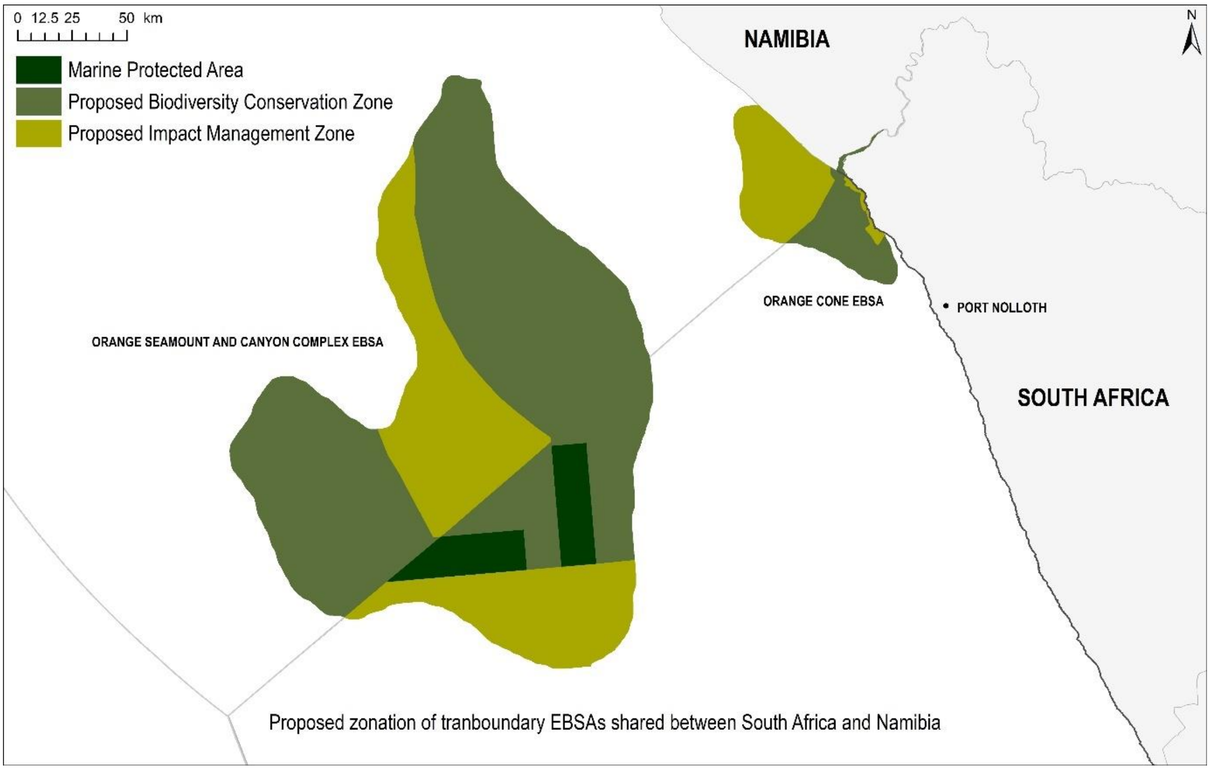



**Figure 142.** *Proposed zonation of the Orange Seamount and Canyon Complex EBSA and Orange Cone EBSA (as of 22 January 2020). (Data source: MARISMA 2020a; MARISMA 2020b).*

A fine-scale systematic conservation plan was compiled for Algoa Bay, as part of the Algoa Bay Project (Dorrington et al. 2018). The spatial prioritisation included 137 biodiversity features and fine-scale cost information, with broad stakeholder consultation (Algoa Bay Project 2019; Holness et al. In review). This plan also sought to encourage selection of marine biodiversity priorities in areas that would also bring social benefits, e.g., to support ecotourism and recreational activities. It identified highest priority areas in natural or near-natural ecological condition that were inside and outside MPAs (Figure 143).

- The spatial priorities from the Algoa Bay fine-scale systematic conservation plan were included in the same way that local, fine-scale, land-based plans are included in larger (e.g., provincial or national) plans. Areas that were identified as priority areas were locked into the final selection, and areas within the local planning domain that were not selected were made unavailable for selection in the national plan (i.e., were locked out).

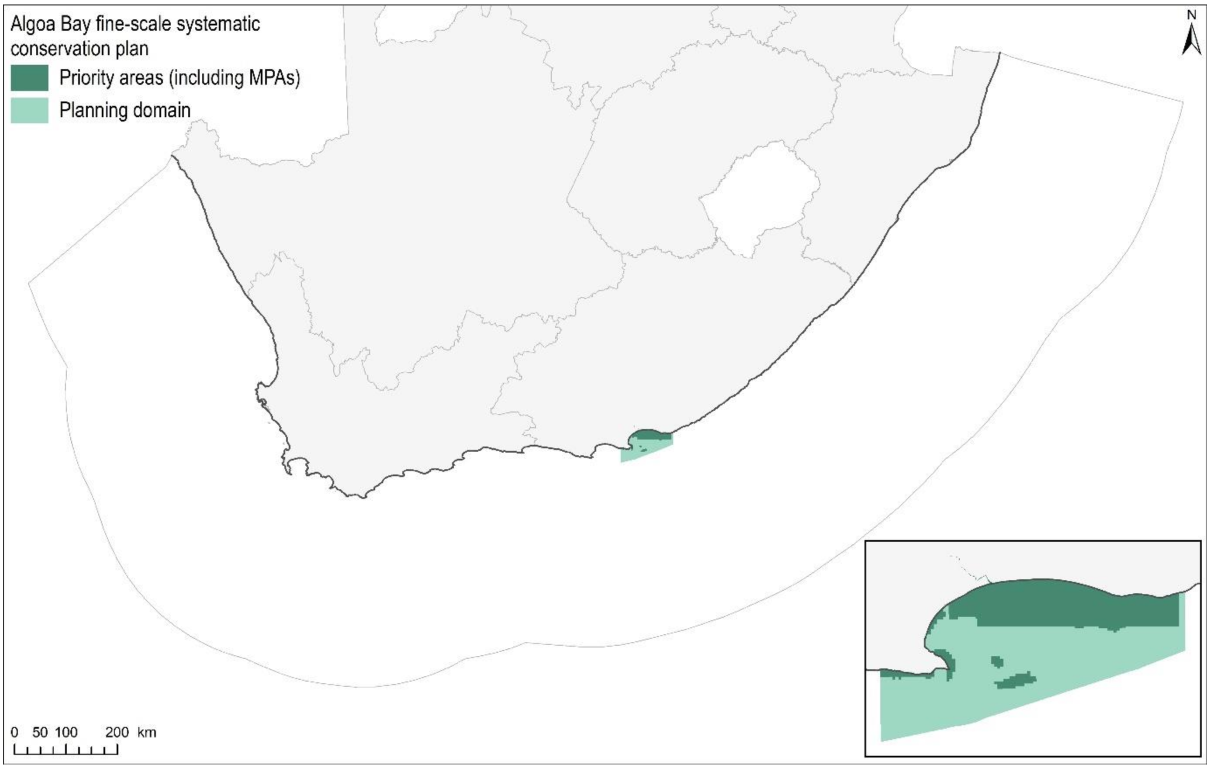



**Figure 143.** *Fine-scale marine biodiversity priority areas identified for Algoa Bay. (Data source: Algoa Bay Project 2019; Holness et al. In review).*

Given the existing systematic biodiversity planning that has been done in the four coastal provinces (Northern, Western and Eastern Cape and KwaZulu-Natal), it was decided that the already identified biodiversity priority areas should be included in the National Coastal and Marine CBA Map for the coastal terrestrial portion of the map (Figure 144). The intent is to align (edge-match) priorities where possible so that biodiversity can be secured cross-realm, with plans to advance this aspect explicitly in the next iterations of the National Coastal and Marine CBA Map (see Section 7.2).

- The data were included in the Marxan analysis by dissolving all land-based CBAs 1 and 2, and cutting them to a 1-km buffer around the shores.
- Data were then coded to the planning units whereby any planning unit that contained at least 66% CBA were assigned a value of 1.
- Given that new priorities are identified in the Marxan analysis below the dune base only, the data were displayed alongside the National Coastal and Marine Spatial Biodiversity Plan to illustrate alignment (see Appendix 3). As noted above, edge-matching priorities within the coastal zone is an area of work that needs to be further refined (see Section 7.2).

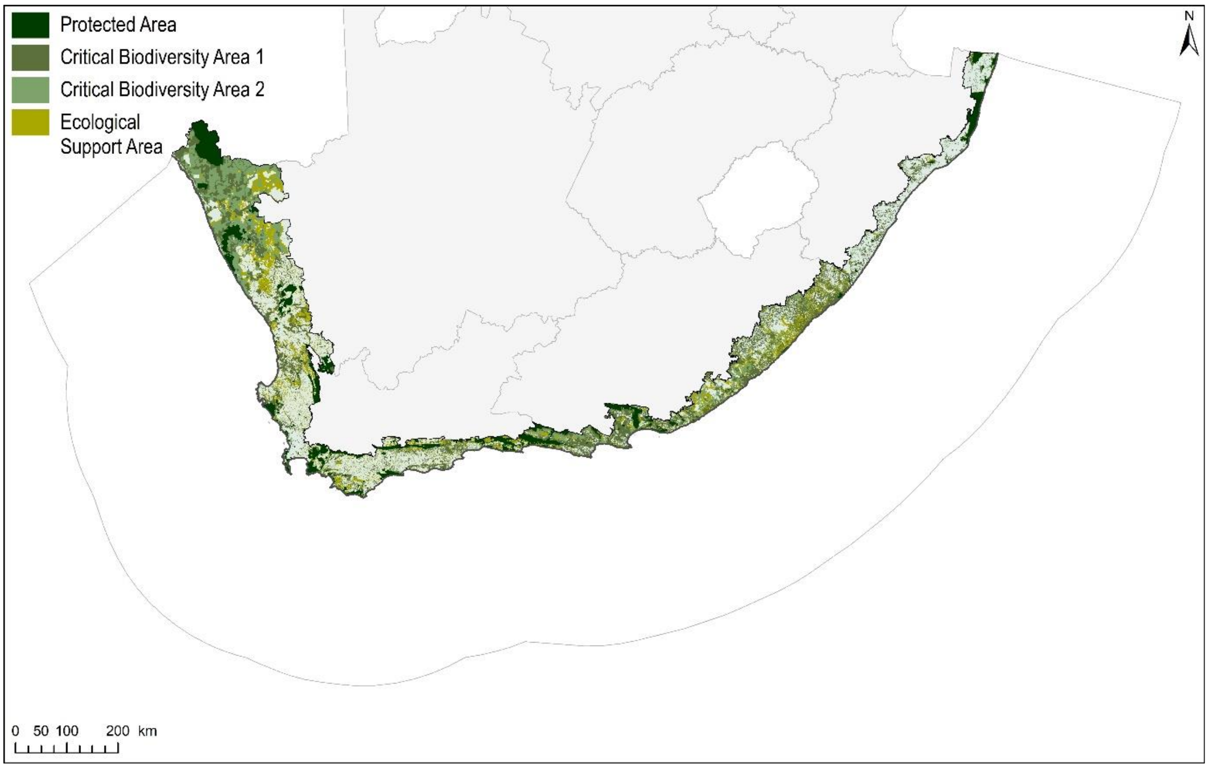



**Figure 144.** *Spatial biodiversity priority areas in the coastal municipalities, which were extracted from the provincial biodiversity plans for the four coastal provinces. (Data source: Hawley et al. 2019; Holness and Oosthuysen 2016; KZN CBA Irreplaceable version 01022016 2016; KZN CBA Optimal version 03032016 2016; Pence 2017; Pool-Stanvliet et al. 2017).*

Under-protected ecosystem types are those that are Not Protected or Poorly Protected, *sensu* Sink et al. (2019d). Portions of such ecosystem types within EBSAs and outside MPAs were included as features (Figure 145) to encourage meeting targets for these ecosystem types within EBSAs, where all else is equal. This is because EBSAs are already identified as areas where securing biodiversity is a priority, and where such actions are intended to be focussed.

- The under-protected ecosystem types were extracted from the marine map of ecosystem types (Sink et al. 2019a) and clipped by the extent of the EBSAs (MARISMA 2020b). The extent of the MPAs (Sink et al. 2019d) within the remaining portions of the ecosystem types was erased.
- Data were coded to the planning units, per ecosystem type, on the basis of area.

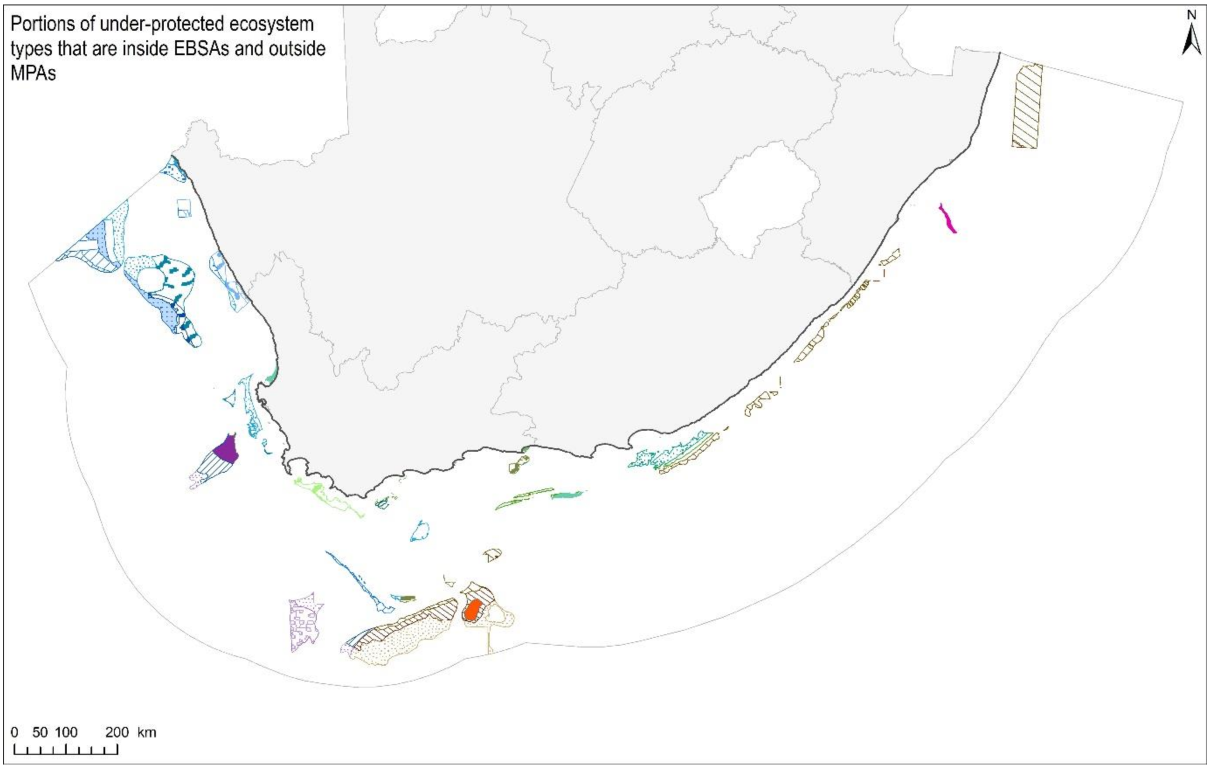



**Figure 145.** *Portions of under-protected ecosystem types within EBSAs and outside of MPAs. Under-protected ecosystem types are those that are Not Protected or Poorly Protected sensu the NBA 2018 (Sink et al. 2019d). See also Figure 10 (ecosystem types), Figure 138 (EBSAs), Figure 152 (ecological condition), and Sink et al. (2019a) for the legend. (Data source: data derived from MARISMA 2020b; Sink et al. 2019a; Sink et al. 2019d).*

The Gouritz Cluster Biosphere Reserve is currently undergoing work to extend their conservation-based activities into the adjacent marine area, specifically in terms of coastal stewardship, coastal ecological corridors and marine spatial planning. It was therefore considered prudent to seek opportunities for aligning the local and national priorities, where possible, within the Gouritz Coastal Corridor (Figure 146).

- A shapefile representing the Gouritz Coastal Corridor was digitized, extending from the eastern boundary of the De Hoop MPA to the Groot Brak estuary, from the dune base to the seaward extent of the inner shelf, *sensu* Harris et al. (2019a).
- The data were coded to the planning units on the basis of area.

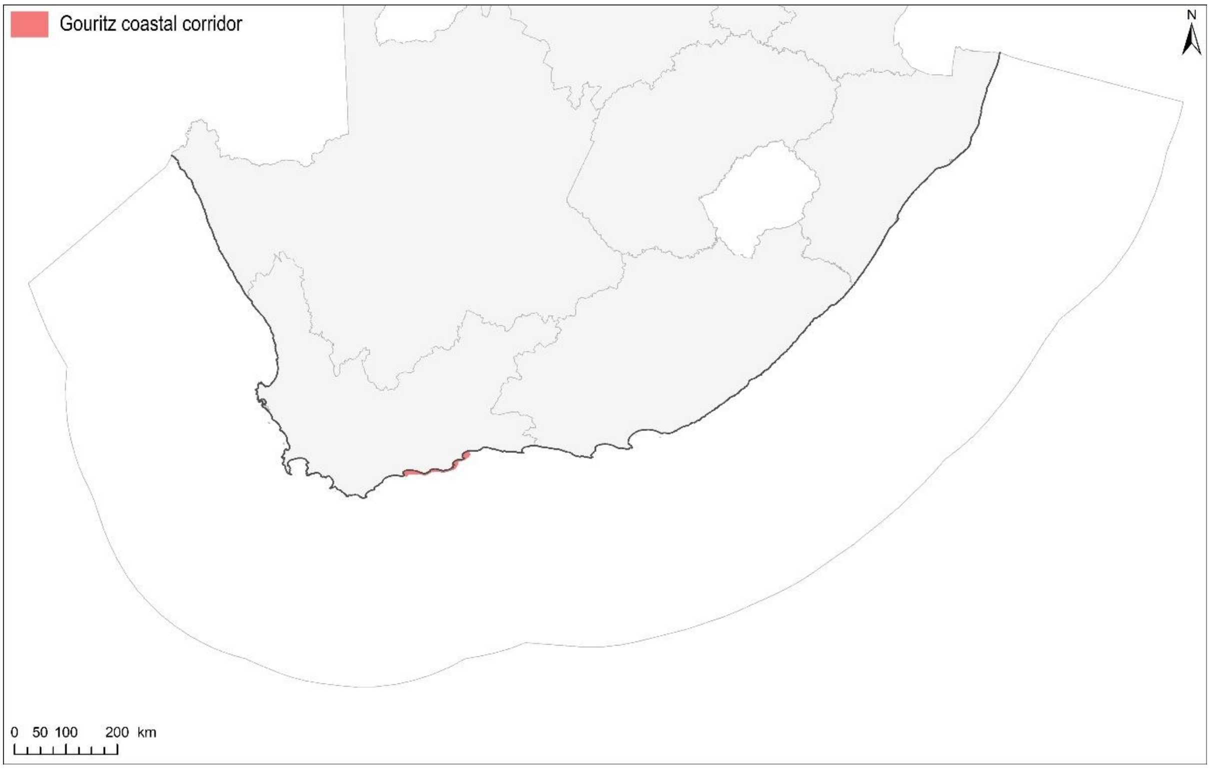



**Figure 146.** *Gouritz coastal corridor, extending from the De Hoop MPA to the Groot Brak estuary in Mossel Bay. (Data source: created from Sink et al. 2019a).*

Monitoring sites are important as reference sites against which other sites can be compared to quantitatively demonstrate the effects and/or impacts of various variables, including pressures. There are three broad types of marine monitoring areas included in this version of the National Coastal and Marine CBA Map: SAEON sentinel sites; large mooring arrays; and the Integrated Ecosystem Programme (IEP) monitoring lines (Figure 147). Information about these monitoring areas and lines is summarised here; full details are available in Atkinson et al. (2016). The sentinel sites are areas within which a variety of marine monitoring is being conducted, from physical variables to some biological sampling. Data collection began in Algoa Bay about a decade ago, with the monitoring areas expanding through the Shallow Marine and Coastal Research Infrastructure Project. The large mooring arrays, comprising the South Atlantic Meridional Basin-Wide Array (SAMBA), CrossRoads and GoodHope lines as part of the South Atlantic Meridional Overturning Circulation South Africa (SAMOC-SA) project; as well as the Agulhas System Climate Array (ASCA). These arrays have been in place for the past 5-15 years and focus largely on collecting oceanography data. Finally, the IEP lines are one of DFFE's flagship programmes. It includes sampling and monitoring a variety of aspects of the Southern Benguela ecosystem, including both physical and biological aspects. Note that all these marine monitoring areas are a starting point for a spatial layer of sites that serve as baselines and control sites for scientific research, where the desired state of the site is that it is maintained in a natural or near-natural ecological condition. Because most of these sites have been monitored for at least 5-10 years, it means that there is a lot of information available for these areas, and concomitantly, confidence in the biological value of the sites is higher compared to other areas that have not yet been sampled.

- The sentinel sites were coded to the planning units on the basis of area, per sentinel site.

- Planning units containing a point representing a station along the monitoring lines were coded with a 1. This was done separately (i.e., creating different features) for the IEP lines, Good Hope and SAMBA line, Crossroads line, and the ASCA line.

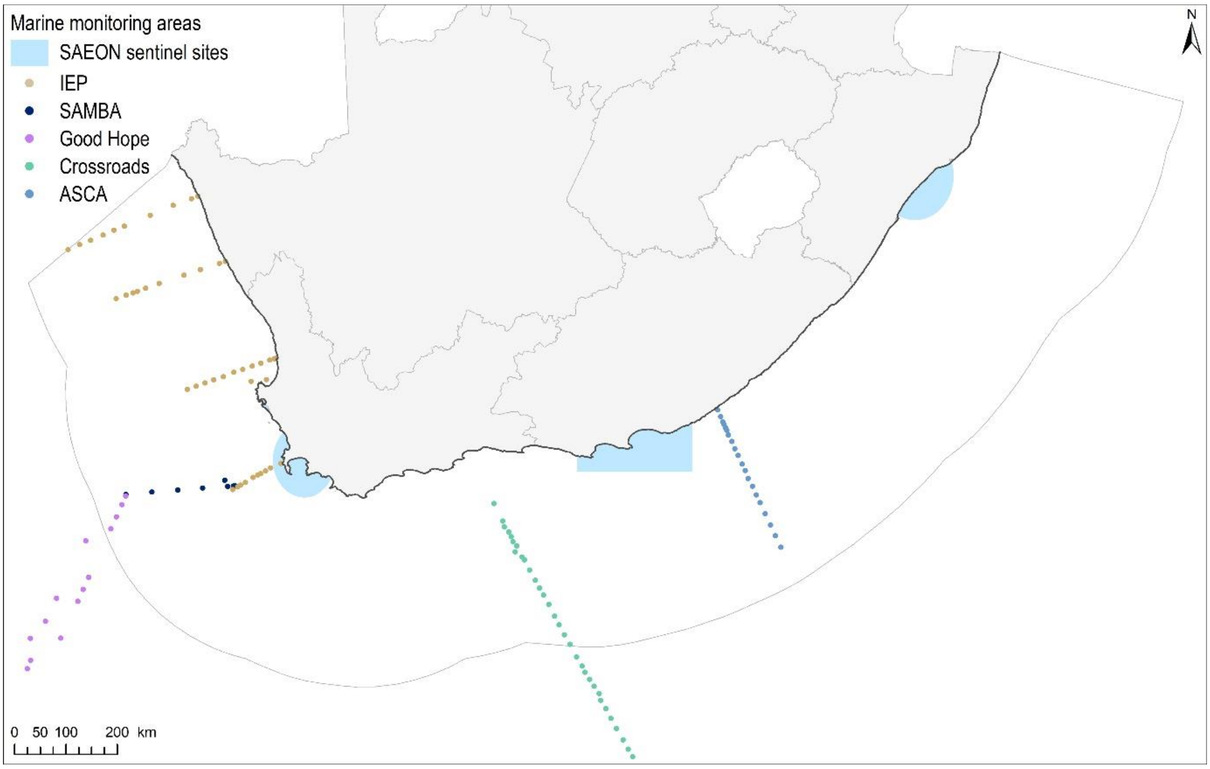



**Figure 147.** *Marine monitoring areas in South Africa, including SAEON's three Sentinel Sites, and the marine monitoring lines. (Data source: Atkinson et al. 2016).*

### 4.4.7.2. Culturally important areas

Heritage sites and culturally important areas were included as design elements rather than biodiversity features because they themselves are not biodiversity features per se. In the context of MSP, priority maps specifically for a comprehensive suite of cultural and heritage features are the remit of that sector rather than the biodiversity sector whose core focus is explicitly biodiversity features. Therefore, an initial set of features of cultural and historical importance are included where maintaining a site in a natural to near-natural ecological condition (or restoring a site to that state) would be mutually beneficial, i.e., safeguarding the site would benefit biodiversity and enhance tourism, options for alternative or supplementary livelihoods, and/or nature-based experiences for health and wellbeing, for example.

An initial, preliminary compilation of heritage-related data is included in this version of the National Coastal and Marine CBA Map. These include a compilation of key coastal sites, World Heritage Sites inscribed for cultural criteria (Figure 148), locations of fish traps (including historical and currently used traps, Figure 149), and heritage sites (shipwrecks) in areas of natural to moderately modified ecological condition (Figure 150). Examples of the former are some of South Africa's coastal caves and archaeological sites, (e.g., Pinnacle Point, Blombos cave), shell middens (e.g., Paternoster Midden, Mussel Point), and sites with cultural and heritage value, e.g., Hole-in-the-wall, Gompho Rock, Shaka's

Rock, and the Bluff Whale Heritage Site (Figure 148). This work will be expanded through the CoastWise project, where more comprehensive maps of culturally significant areas are being developed. Robben Island is the only coastal or marine World Heritage site inscribed for cultural criteria. (Note: since the analysis, we have become aware that parts of the Garden Route National Park and Nelson Bay cave on Robberg are said to be inscribed as World Heritage Sites for "biodiversity and paleo-anthropological significance", but these areas are not reflected on the list of World Heritage Sites for South Africa. This is something that will be investigated for the next iteration).

- Culturally significant sites were coded to the planning units on a presence-absence basis based on preliminary location searches in Google and Google Earth. The South African Heritage Resources Agency did not have datasets that were appropriate to use for this layer.
- Fish traps were received as point locations from the South African Heritage Resources Agency (SAHRA 2020), buffered by 50 m, and were coded to the planning units on an area basis.
- Shipwrecks were received as point counts per planning unit from the South African Heritage Resources Agency (SAHRA 2021). Planning units containing shipwreck counts that were in areas of natural to moderately modified ecological condition (see Figure 152) were retained to align areas of biodiversity value and ecotourism (e.g., wreck diving); those in poorer ecological condition were excluded. Note that this is a confidential dataset shared with us by SAHRA, and is not shown here.

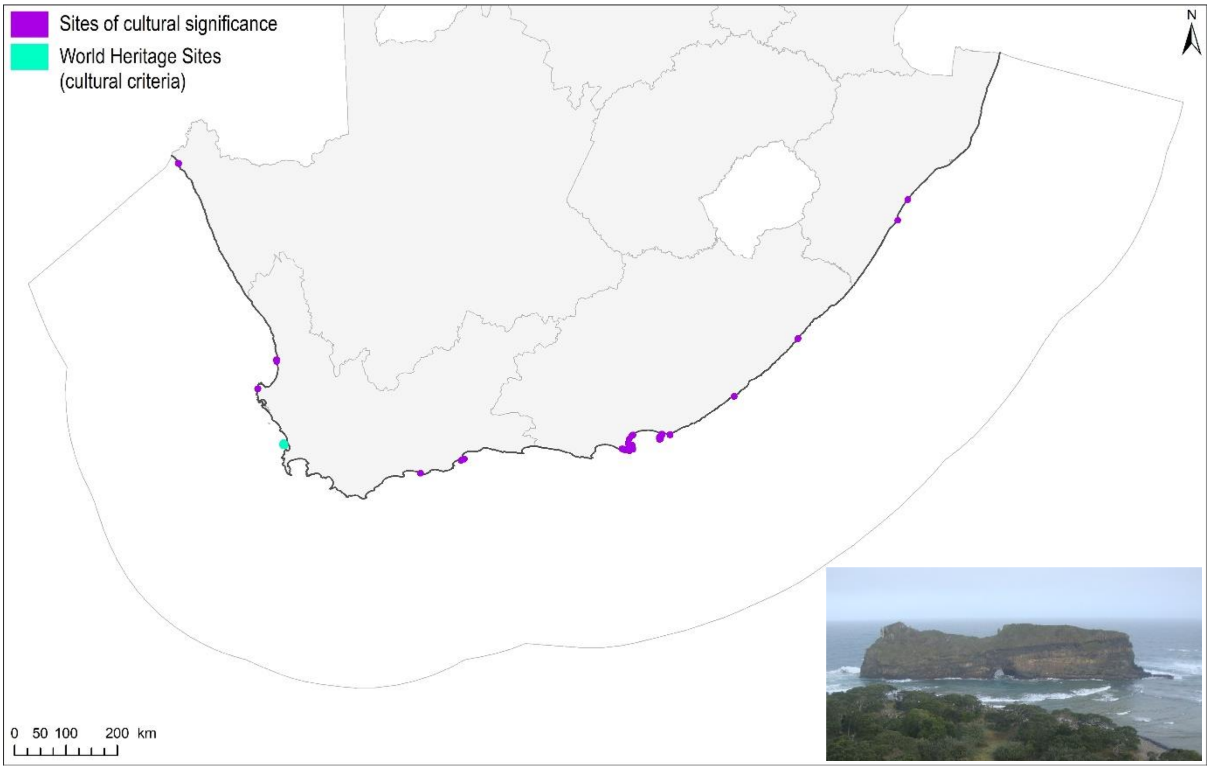



**Figure 148.** *Some of the culturally significant sites along the South African coast, including some coastal caves with archaeological and palaeontological significance, middens and sites of cultural and heritage value. World Heritage Sites inscribed for cultural criteria (Robben Island) are also included. The symbology has been expanded so that the sites are visible on the map. Insert image credit: © Linda Harris. (Data source: location searches on Google and Google Earth; data from Algoa Bay Project 2019; Harris et al. 2019d; and https://whc.unesco.org/en/list/916).*

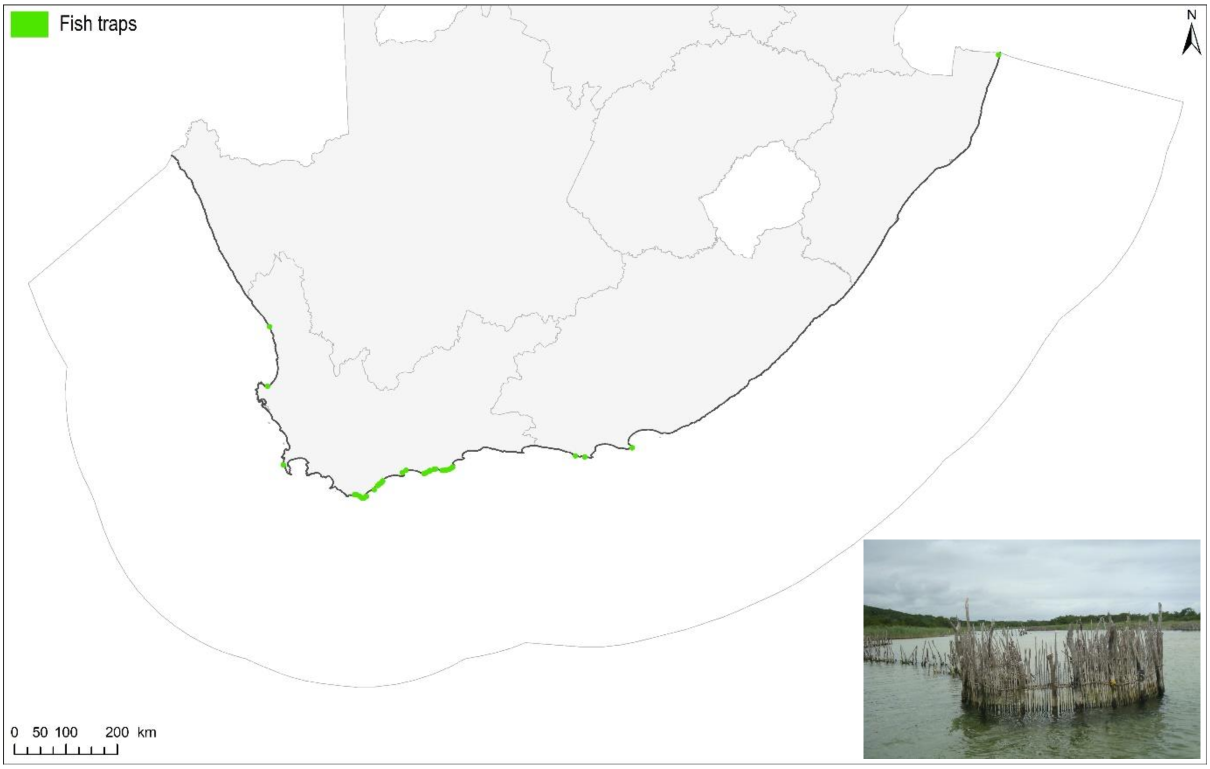



**Figure 149.** *Locations of historical and currently used fish traps along the South African coast. The symbology has been expanded so that the sites are visible on the map. Insert image credit: © Linda Harris. (Data source: SAHRA 2020).*

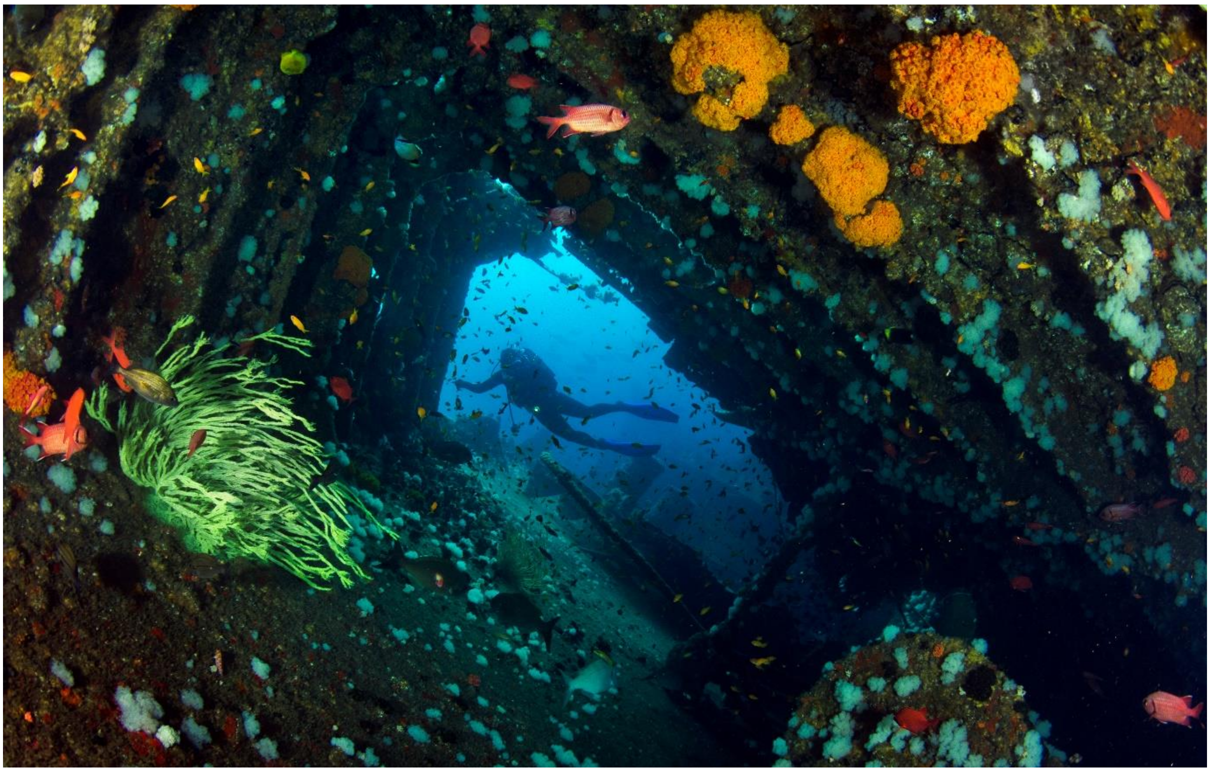


**Figure 150.** *Shipwrecks have historical, heritage value, and often support rich biodiversity that make them attractions for SCUBA divers to explore. The data are confidential from SAHRA, and are not shown here. Image source: © Geoff Spiby. (Data source: SAHRA 2021).*

A map of nature engagement was compiled from citizen science data (Figure 151). The premise for inclusion is that the citizen science data will give a relative indication of areas where people are engaging with nature, and therefore, which sites should be maintained in a natural to semi-natural ecological condition to support this activity. There is a wealth of information relating to the benefits for health and well-being of spending time outdoors and engaging with nature, especially at the coast (Harris et al. 2019d). In some ways, therefore, this dataset could also be considered a surrogate for health and well-being benefits too. We note that there is scope to expand this design element in future iterations of the National Coastal and Marine Spatial Biodiversity Plan.

- Data were received for in-water shark observations (Irion and Barron 2021). These were supplemented with data from iNaturalist (www.inaturalist.org) including:
  - All records within the *South Africa EEZ* place (iNaturalist 2021d)
  - All records within the *Offshore Waters – South Africa* place (iNaturalist 2021c)
  - All records from the *Sandy Beaches (s Afr)* project (iNaturalist 2021a)
  - All records from the *Seashore Vegetation (s Afr)* project (iNaturalist 2021b)

  The EEZ and Offshore Waters places were used instead of the SeaKeys (s Afr) project, because more records would be recorded in these places (automatically assigned based on location) than would have been manually added to the SeaKeys (s Afr) project. Because the extent of these places does not (for the most part) cover the shore itself, the two national seashore projects listed above were included. These two projects automatically include all observations of taxa that relate to sandy beach fauna and foredune and other coastal dune species.

- The points were compiled into a single shapefile, and duplicates were removed. A point density analysis was performed, using a search radius of 5 km and an output cell size of 100 m. The resulting raster was reclassified into 30 quantiles, snapped to a reference raster, and the output cell size reduced to the standard 30 m.
- Zonal statistics (mean value) were calculated, using planning units as zones, and the output data were coded to the planning units.

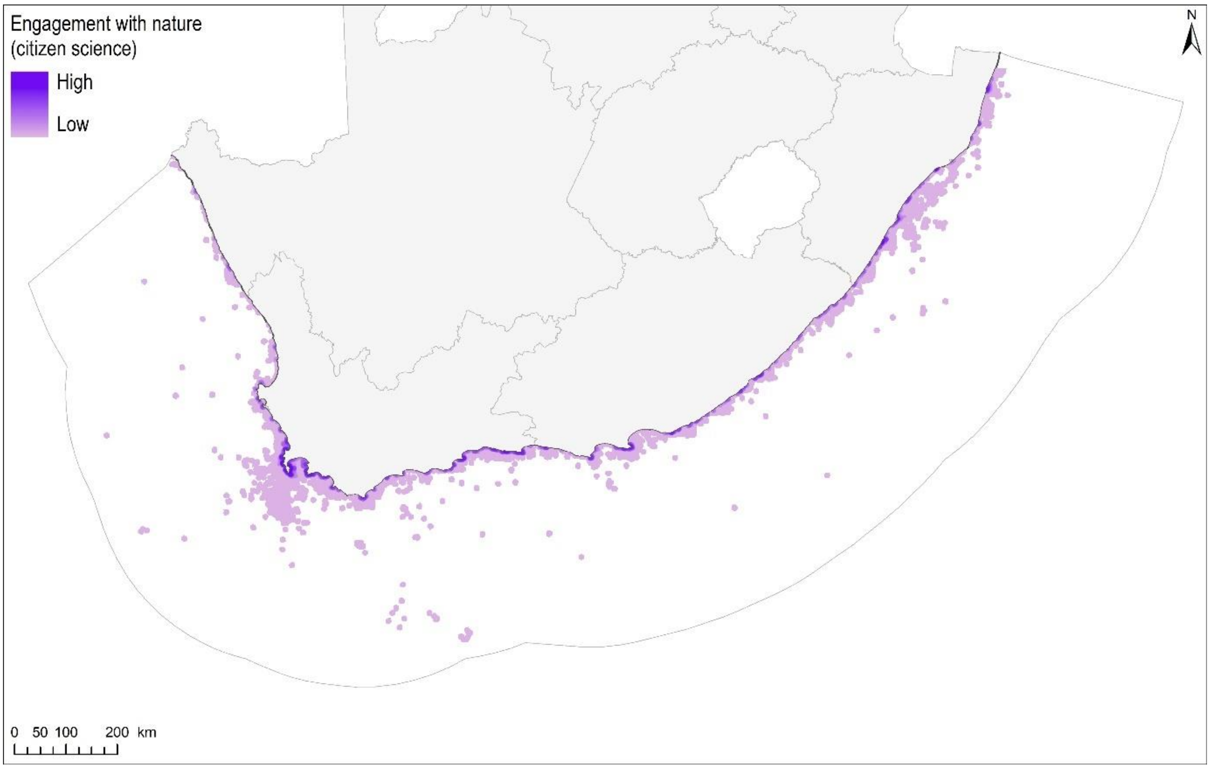



**Figure 151.** *Engagement with nature, mapped as a compilation of citizen science projects on iNaturalist and submitted in-water observations. (Data source: iNaturalist 2021a; iNaturalist 2021b, c, d; Irion and Barron 2021).*

#### 4.4.7.3. Ecological condition

The map of ecological condition for the marine realm (Figure 152) was used to encourage meeting targets in areas of the best-available ecological condition as far as possible. This map was generated as part of the NBA 2018 by doing a cumulative pressure assessment. Full details on how the map was generated are available in Sink et al. (2019c) based on pressure data compiled by Majiedt et al. (2019). In brief, the impact of ocean-based activities on marine biodiversity was determined (Figure 175) by spatially evaluating the intensity of each activity and the functional impact to and recovery time of the underlying ecosystem types (Figure 10). From this map of cumulative impact (Figure 175), a map of ecological condition was generated based on the severity of modification across the marine realm such that areas with negligible impacts are considered to be natural to near natural, and those that are intensively impacted are considered to be very severely modified. The map of marine ecological condition was used here by intersecting it with the map of ecosystem types (Figure 10) to produce two input datasets that were included as design elements (see Table 5): one layer of areas where ecosystem types are in natural or near-natural ecological condition; and a second layer of areas where ecosystem types are natural, near-natural or moderately modified. By stacking up these two layers and the map of ecosystem types, it helps Marxan to meet feature targets in areas of good ecological condition first (because it can meet features targets for all three layers simultaneously in those areas), then areas of fair (moderately modified) ecological condition are favoured (because it can meet targets for two of the three layers in those areas), and only if targets for an ecosystem type are still not met, then the remaining portion will be met in areas of poor ecological condition.

- A map of only natural/near-natural areas, and a map of natural/near-natural and moderately modified areas was extracted from the map of marine ecological condition. These were each intersected with the map of ecosystem types.
- Natural/near-natural portions of each ecosystem type were coded to the planning units on the basis of area.
- Natural/near-natural and moderately modified portions of each ecosystem type were coded to the planning units on the basis of area.

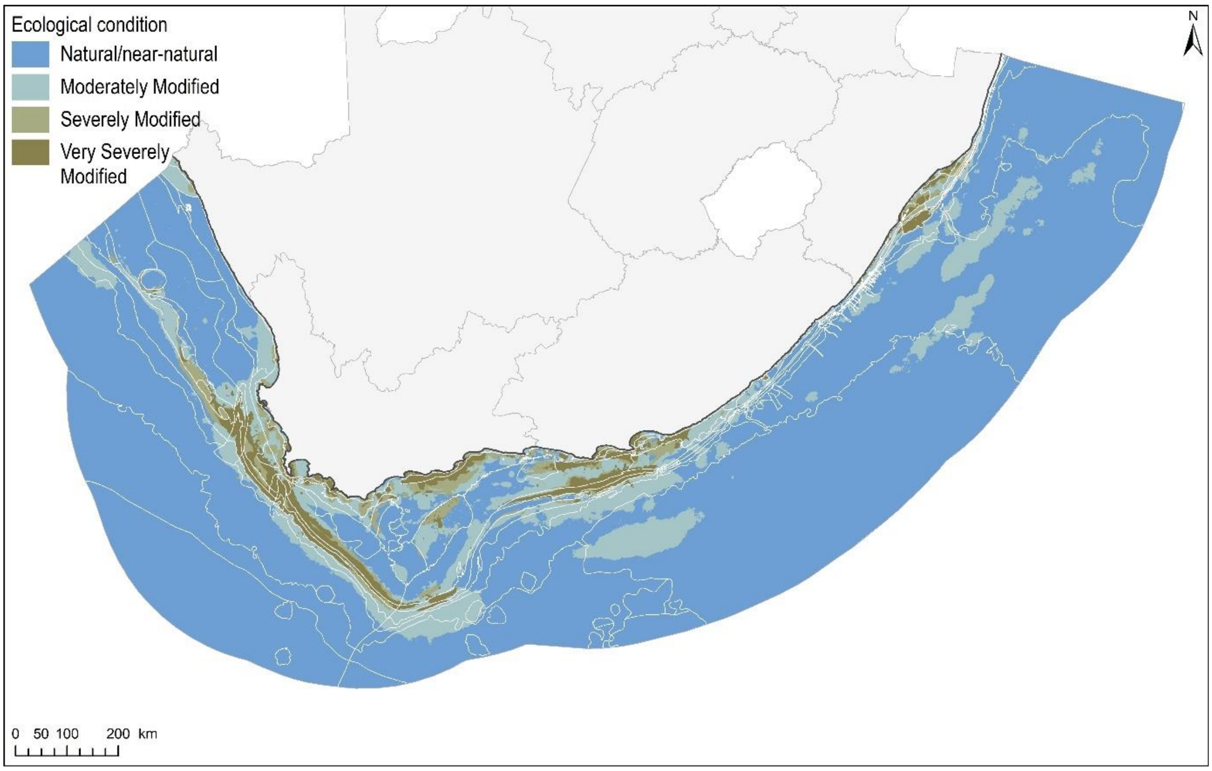



**Figure 152.** *Ecological condition of the marine realm, overlaid by ecosystem types in white outlines. (Data source: Sink et al. 2019a; Sink et al. 2019c).*

#### 4.4.7.4. Climate-change adaptation

Velocity of climate change (Loarie et al. 2009) is a vector of the direction and speed that a point (i.e., species) would need to move along during climate change in order to remain in the same climatic space (Brito-Morales et al. 2018). Areas where climate velocity is low can be considered refugia to climate change (Brito-Morales et al. 2018) because species would not have to move far to maintain their current climatic conditions. The work on climate velocity has focussed mainly on temperature (e.g., Burrows et al. 2011; Loarie et al. 2009), and in the marine environment, on sea-surface temperature, although other environmental variables can be used as well, e.g., rainfall. However, it is recognised that species can also move in response to changing temperatures in a vertical direction, and that climate velocity in the deep ocean is more rapid than at the surface (Brito-Morales et al. 2020). The most recent advances, therefore, have been to explore 3D climate velocity for the global oceans (Brito-Morales et al. 2022).

In the current version of the National Coastal and Marine CBA Map, the velocity of climate change has been included based on sea surface temperature data for the past 50 years, analysed per ecosystem type (Figure 153). Future iterations will continue to strengthen climate resilience and climate-change adaptation in the design of the CBAs and ESAs, informed by emerging science on this topic. This could include aspects such as 3-dimensionality of climate velocity, and climate connectivity.

- The data used to plot the velocity of climate change were the rate (magnitude, rather than trajectory) of sea surface temperature change over the most recent 50 years for which data are available (1970-2019), with positive values indicating areas of warming and negative values indicating areas of cooling. The raw data are from the Met Office Hadley Centre observations datasets, using HadISST1 data (Rayner et al. 2003). HadISST data were obtained from https://www.metoffice.gov.uk/hadobs/hadisst/ and are © British Crown Copyright, Met Office, 2021, provided under a Non-Commercial Government Licence http://www.nationalarchives.gov.uk/doc/non-commercial-government-licence/version/2/.
- Annual means from monthly data were computed, and the rate of climate change velocity was determined using the *gVoCC* function in the *vocc* package (Molinos et al. 2019) in R version 4.0.3 (R Core Team 2020). This was undertaken by Prof. David Schoeman (University of the Sunshine Coast), who kindly shared the results.
- For the purposes of planning for climate resilience, the direction of change (i.e., warming or cooling) is less important than the stability of the area. Therefore, the first step was to convert all raster values to absolute values.
- A natural neighbour interpolation was performed to remove the gridded nature of the global data; the hard lines of which would artificially influence the assignment of values and selection of planning units at the national scale.
- Zonal statistics were computed from these data, using ecosystem types (Figure 10) as the zones.
- Areas of natural to moderately modified ecological condition that were below the mean velocity of change for that ecosystem type were selected as the most stable areas, within which biodiversity has the highest chance of persisting into the future.
- Areas of poor ecological condition were excluded from the areas predicted to be more resilient to climate change (climate velocity below the mean for the ecosystem type) because they are already very modified areas.

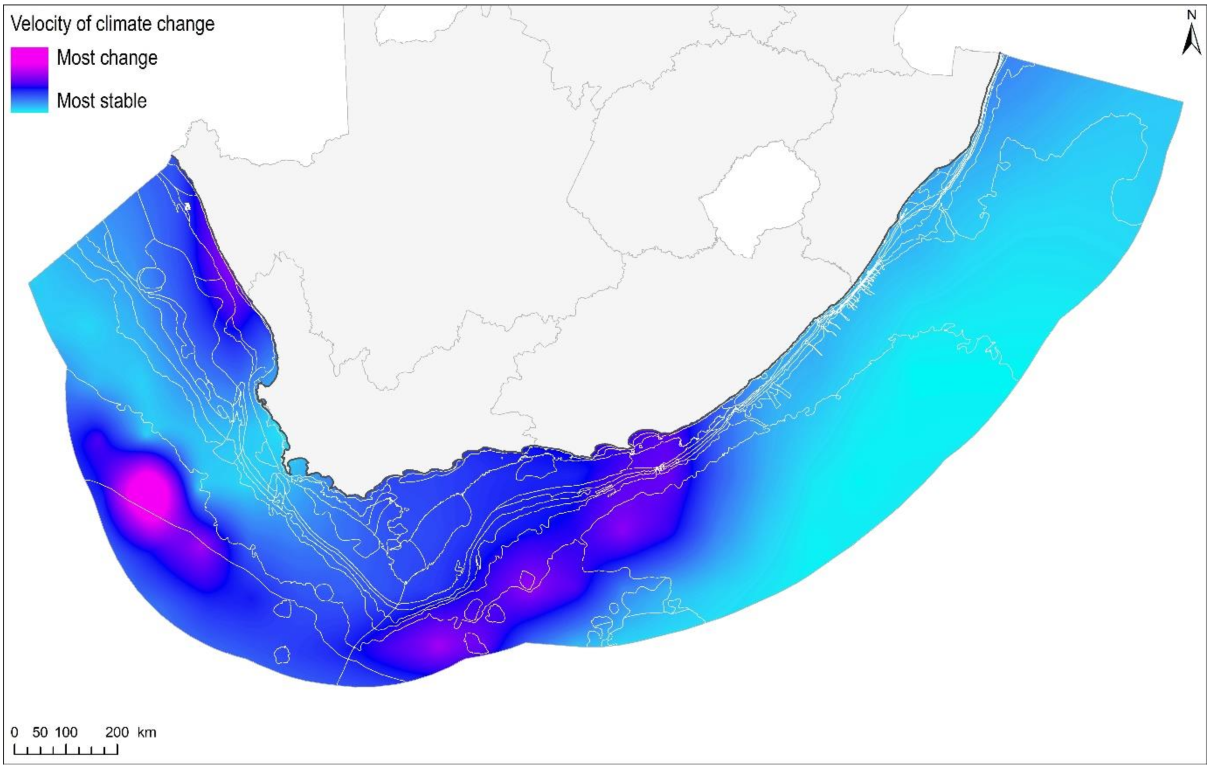



**Figure 153.** *The velocity of climate change in South Africa's marine territory for the past 50 years, where areas in light blue show the lowest rate of change in sea-surface temperature (i.e., are more stable) and areas in darker blues and purple show the highest rate of change. Note that the metric is rate and not magnitude of sea-surface temperature change. The marine map of ecosystem types (Sink et al. 2019a) is overlaid in white outlines. (Data source: Rayner et al. 2003, www.metoffice.gov.uk/hadobs (raw data); David Schoeman, pers. comm; Sink et al., 2019a; see main text for details of the analysis to produce the map).*

Seamounts (Figure 154) are refugia from ocean acidification for cold-water corals (Tittensor et al. 2010). They also provide a vertical gradient along which some species could potentially migrate, and provide stepping-stones that could possibly facilitate range shifts in some species.

- Data representing seamounts were extracted from the marine map of ecosystem types (Sink et al. 2019a) and were coded to the planning units on the basis of area.

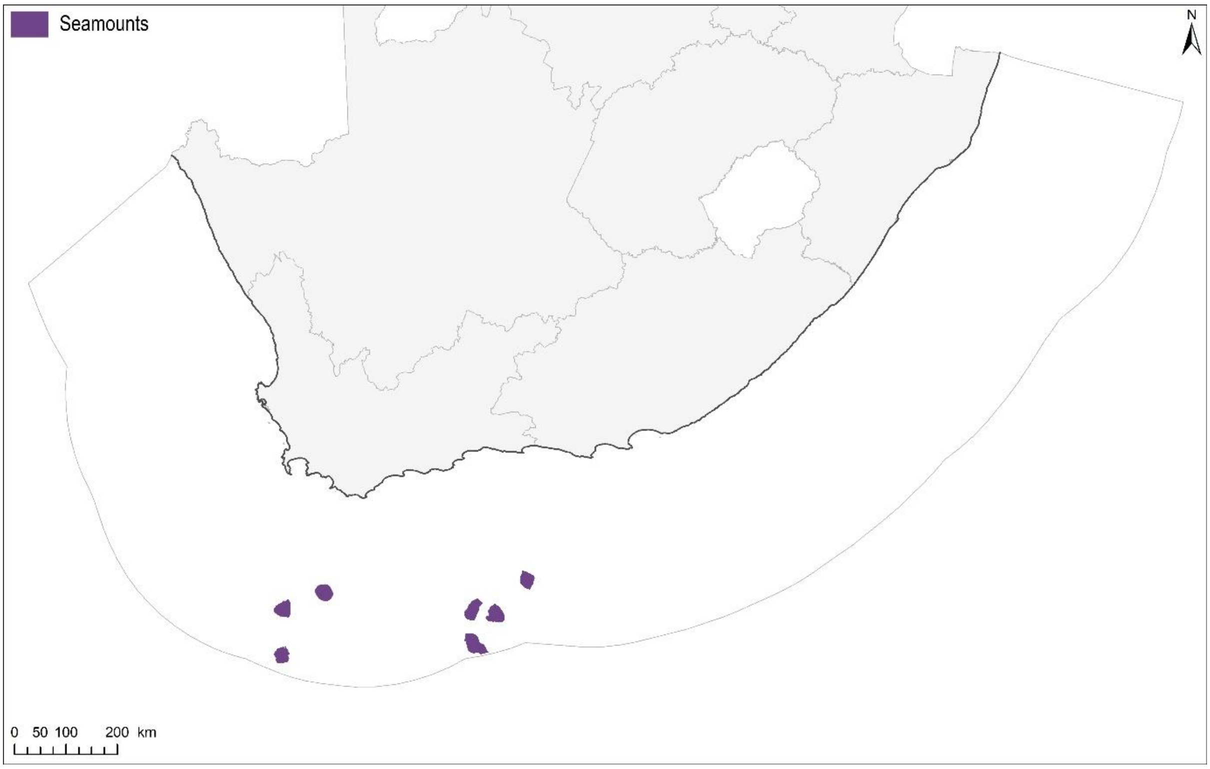



**Figure 154**. *Distribution of the seven seamounts in South Africa's mainland marine territory. (Data source: extracted from Sink et al. 2019a).*

### 4.4.8. Overall data richness

The number of datasets per planning unit ranges from 1–98; mean = 16 and median = 9. There are 1291 planning units with fewer than five datasets, which are located along the north-east border of the map, one patch offshore of St Lucia in the Southwest Indian Lower Slope, and four patches in the south-west of the EEZ in the Cape Basin Abyss and Cape Basin Complex Abyss. There are 18412 planning units with more than 50 datasets, which are located between the shore and mid shelf on the east and south coasts, and between the shore and inner shelf on the west coast. Several coastal locations have more than 90 datasets. These are found between Cape Hangklip and Cape Agulhas, and around Bird Island in Algoa Bay. The latter area has the highest data richness nationally, with 98 datasets per planning unit. Broadly speaking, the data richness is much higher on the shelf than further offshore, and is notably high along the south coast between Cape Town and East London. This is to be expected given that the highest rates of endemism are along the south coast for many taxa, and species richness is also highest along the south coast (or east coast) for some groups too (Harris et al. 2019e; Turpie et al. 2000).

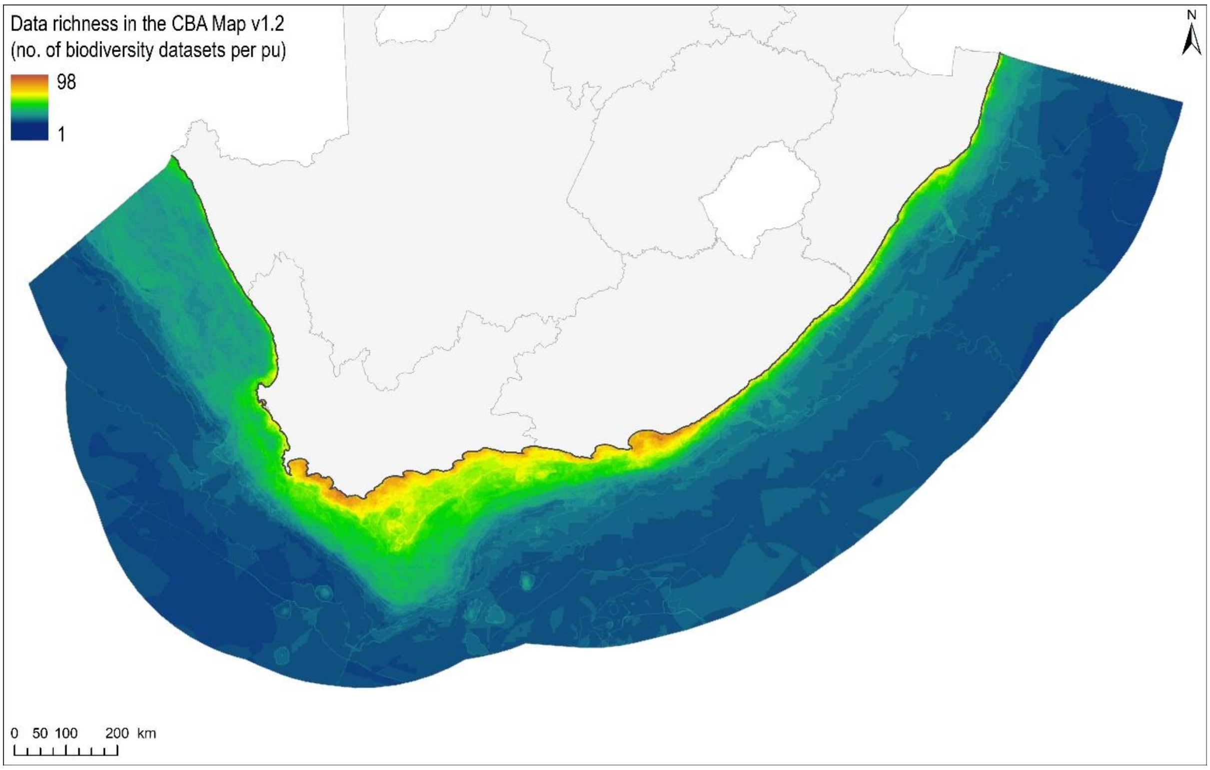



**Figure 155.** *Data richness in the CBA Map V1.2, showing the number of biodiversity datasets per planning unit (pu), from high (red) to low (blue).*

## 4.5. Avoiding and reducing spatial conflicts (Marxan cost layer)

### 4.5.1. What is the cost layer?

**Sectors are encouraged to review the data that are being used to represent their activities. We welcome further engagement if any of the current data do not fully capture the areas that should preferably be avoided. We will continue to update these maps as the MSP process unfolds and as new data become available. We recognise that the data used here are the best available at the time of analysis, and that new data on priority areas – especially for emerging sectors (e.g., mining and petroleum) – are expected in future.**

In the context of systematic biodiversity planning, 'cost' can be defined in many ways but generally relates to the amount of competing interest or use of sites in the planning domain. It is included as a layer to help Marxan preferentially select biodiversity priorities in areas of low competing use to avoid or minimise conflict between the biodiversity sector and other sectors as much as possible, streamline negotiations, and increase the likelihood of successful implementation of the spatial priorities, in this case, implementation of the National Coastal and Marine Spatial Biodiversity Plan through the MSP process. Sections 4.5.2–4.5.7 describe the data that were used to generate the cost layer, and Section 4.2.8 explains the method for integrating all the data into a single map and presents the final cost layer that was used in the Marxan analysis. Unless specified otherwise, the data included come from Chapter 4 of the NBA 2018 Marine Realm technical report (Majiedt et al. 2019). Descriptions of how the data were processed for inclusion in the cost layer are adapted from Appendix 2 of the NBA 2018 Marine Realm technical report (Sink et al. 2019f), with some additional explanations regarding the data used in this analysis.

Note that all data layers were analysed in raster format, setting the output coordinate system to Albers Equal Area customised for South Africa (the same projection used in all NBA 2018 analyses and datasets), and basing the processing extent and snap raster option on a base raster layer, with an output pixel size of 30 x 30 m. This was to ensure precision and accuracy in the calculations because every pixel was perfectly aligned across all raster datasets. Analyses were undertaken in ArcGIS 10.6 using tools in the Spatial Analyst toolbox, unless specified otherwise.

### 4.5.2. Petroleum

Four layers were included in the map of petroleum activities: areas with production rights; existing installations; areas identified as leads and prospects (i.e., areas of high prospectivity); and areas with exploration rights. Areas with production rights and installations were assigned the highest avoidance value; areas identified as leads and prospects were given avoidance values based on their prospectivity (high, medium, and low); and areas with exploration rights were assigned a lower avoidance value. This facilitated strong avoidance of the areas with highest prospectivity where future petroleum activities are intended. These data were shared under a confidentiality agreement between the Petroleum Agency South Africa (PASA) and DFFE, and therefore are not shown here (but see Figure 156). Note that the map was updated from the one used in Version 1 Beta 2 and Version 1.0 based on new data provided by the rights holders, and following consultation with OPASA (see Appendix 4) regarding the cost values assigned to the exploration, leads and prospects components to produce a map that better represents the interests of the sector. New data were also included for Version 1.2 based on updated information on leads and prospects, further refining the information that was included in Version 1.1.

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Petroleum activities** | Data provided by the Petroleum Agency South Africa (PASA), with contributions from rights holders | • Areas with production rights, drilled and high-graded undrilled resources, and existing or future planned and subsurface installations for production and export of produced petroleum fluids were assigned the highest avoidance value (100).<br>• Areas of high prospectivity with defined prospects were given an avoidance value of 95.<br>• Areas of medium prospectivity where many elements exist to de-risk the area, but more work or additional data are required to refine the prospects were given an avoidance value of 75.<br>• Areas of low prospectivity with the right play elements defined, but no specific leads defined (which may be limited by available data) were assigned an avoidance value of 40.<br>• Areas with exploration rights were assigned an avoidance value of 20.<br>• These three sets of polygons were compiled into a single shapefile, using the highest value per site. This was converted to a raster layer with 30 m x 30 m pixels. |

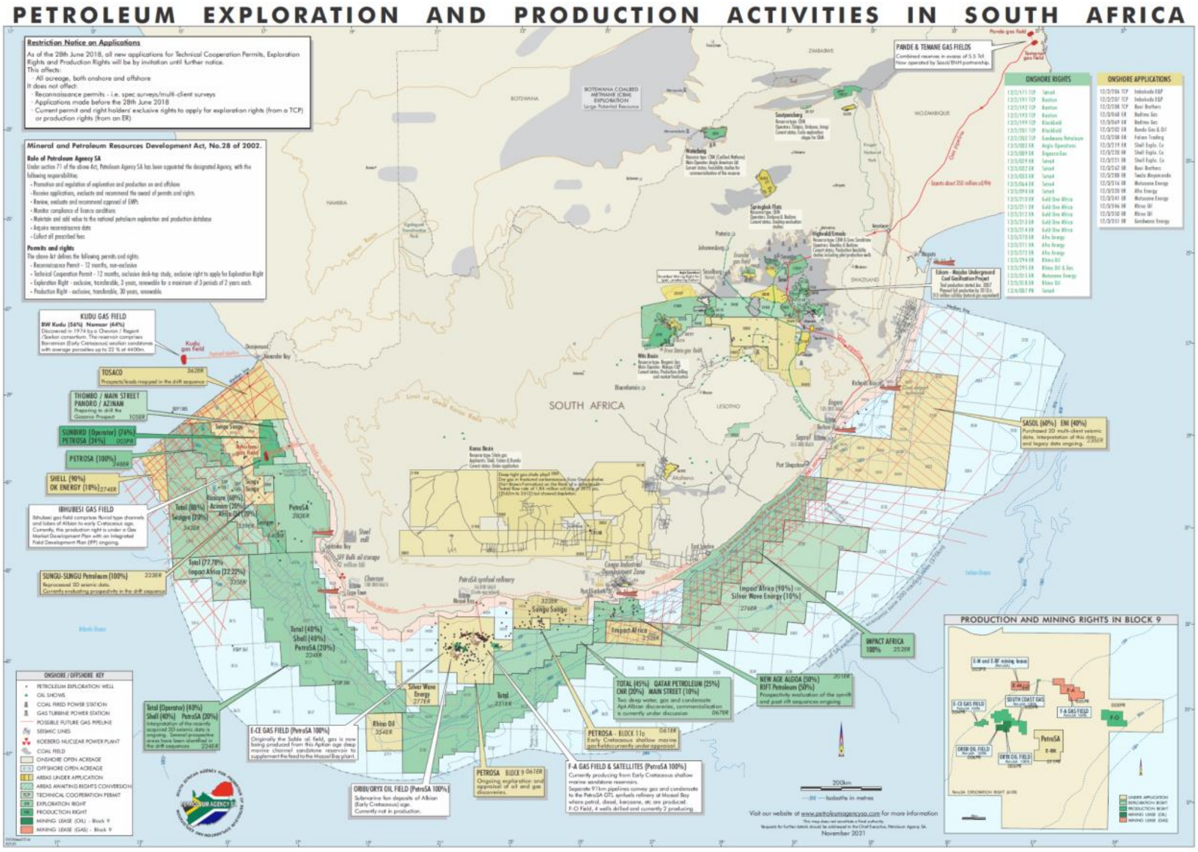



**Figure 156.** *Information on petroleum exploration and production used in the CBA Map Version 1.2 that is available in the public domain can be accessed on the* [PASA website](). *(Map shown here is from 1 December 2021 at the time of cost-layer compilation). The data shared on leads and prospectivity under the confidentiality agreement are not shown.*

### 4.5.3. Mining

Marine mining activities were included as per the NBA 2018 map of mining intensity (Majiedt et al. 2019), where all areas that have been or are being mined were assigned the highest value for avoidance (Figure 157). It was recognised that this map was not fully representative of all areas of high value for the mining sector, and hence was updated to include prospecting areas. The new data on prospecting were shared under a confidentiality agreement between De Beers and DFFE, and therefore are not shown here.

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Mining** | Various SANBI datasets (including NBA 2011 data on mine points, mined polygons from industry, and the NBA 2018 landcover) were used to identify areas that are mined or within 500 m of a mine.<br>Prospecting information was provided by De Beers. | • Different mining layers were combined into a single layer (120 m pixels).<br>• A 500 m buffer was developed in a raster environment to identify any areas near mines. A value of 100 was coded to these areas, which is used as the level of avoidance (cost).<br>• Prospecting areas were included, scaled 5-100 by De Beers based on level of priority.<br>• The prospecting and mining datasets were combined into a single raster with 30 x 30 m pixels, using the highest values across the datasets, and used to represent the mining sector. |

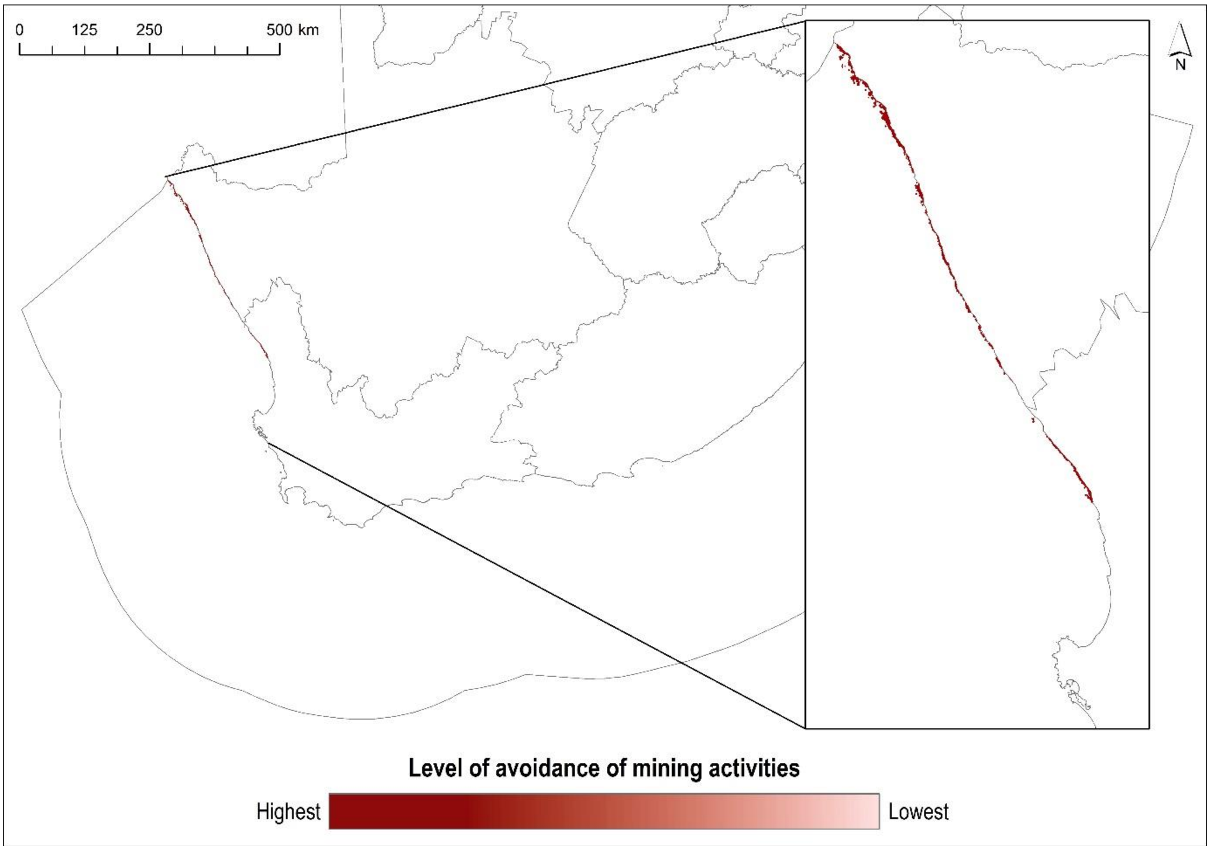



**Figure 157.** *Level of avoidance of mining activities as used in the CBA Map Version 1.2. Note that only the data from the NBA 2018 of existing or past mining is shown; the data shared under confidentiality agreement representing prospecting are not shown.*

### 4.5.4. Fisheries

The specific small-scale and industrial fisheries sectors that were included explicitly in the cost layer include: demersal hake trawling (inshore and offshore); crustacean trawling; mid-water trawling; linefishing; demersal longlining; pelagic longlining; tuna pole fishing; purse seining (small pelagics fishery); West Coast Rock Lobster harvesting; South Coast Rock Lobster harvesting; squid harvesting; gillnetting; beach seining; oyster harvesting; and kelp harvesting. These are the fisheries that were included in the NBA 2018 (Majiedt et al. 2019). Data were also requested for small-scale fisheries, but these were not available at the time of the analysis (see Section 4.5.4.16; see also Section 7.1.1 for plans to include this sector in future iterations).

For each of these specific fisheries sectors, the map of intensity of fishing was taken from the NBA 2018 as the map of relative avoidance for each fishery, respectively. There are four exceptions where the data have been updated since the previous iteration of the cost layer, for: inshore and offshore demersal hake trawling; crustacean trawling; and squid harvesting. The need for additional revisions was discussed at a fisheries data review workshop (see Appendix 4), generally with the suggestion to use fishing effort as the metric of intensity rather than catch. However, there was insufficient time to extract, share and analyse the data to update the fisheries maps (in terms of metrics and most recently available data) in time for this version of the National Coastal and Marine CBA Map. The two metrics (catch and effort) are highly correlated in most cases, and so the spatial representations at a national scale are very similar regardless of the metric used. We will continue to work with the fisheries sectors to further refine their inputs, as necessary.

#### 4.5.4.1. Demersal hake trawling (inshore and offshore)

The data that are used to represent inshore and offshore demersal hake trawling (Figure 158) are from a new map developed by Dr Jock Currie and colleagues of trawl swept area ratios (Currie et al. 2021a; Currie et al. 2021b). This was considered to be a more accurate representation of the inshore and offshore demersal hake trawl sectors at the fisheries data review workshop (see Appendix 4). Dr Currie contributed the bulk of the text in the table below.

| Cost element | Source data | Processing methodology |
| --- | --- | --- |
| **Demersal inshore and offshore trawling** | Commercial trawl effort (hours) and locations (trawl start and end coordinates) for the period 2005-2018, provided by DFFE and restricted to demersal trawling. | • Records lacking spatial coordinates were removed and obvious errors such as negative longitudes or positive latitudes were corrected.<br>• Filters were applied to remove spurious records that: were recorded to 20' grid cell corners (lacked more precise coordinates); were of an unrealistic length (either zero or > 30 NM); had coordinates outside South Africa's EEZ.<br>• A number of corrections were applied to coordinates of records affected by systematic biases, including: records that had been rounded down to 59' coordinates were re-distributed between 59' and 60'; coordinates that had been rounded up to integer degrees were re-distributed among 50' to 59' coordinates; addition of a 0-59 second 'jitter' to records that were rounded to minute coordinates.<br>• Following correction of biases, two final data cleaning steps involved: filtering by density in that start and end positions that occurred at < 4 records per $km^2$ grid cell were removed; and removal of records when their measured distance between start and end points far exceeded their expected maximum distance based on duration and an assumed maximum speed.<br>• Following the data preparation steps above, the mean swept area ratios (SAR; Amoroso et al. 2018) were calculated on a 1 $km^2$ grid for the 2005-2018 data, representing trawl intensity.<br>• Values were scaled 0-100 by dividing the data into 10 quantiles, and setting each quantile bin a value of 10-100 in intervals of 10. This map was used to represent the intensity of inshore and offshore demersal hake trawling. |

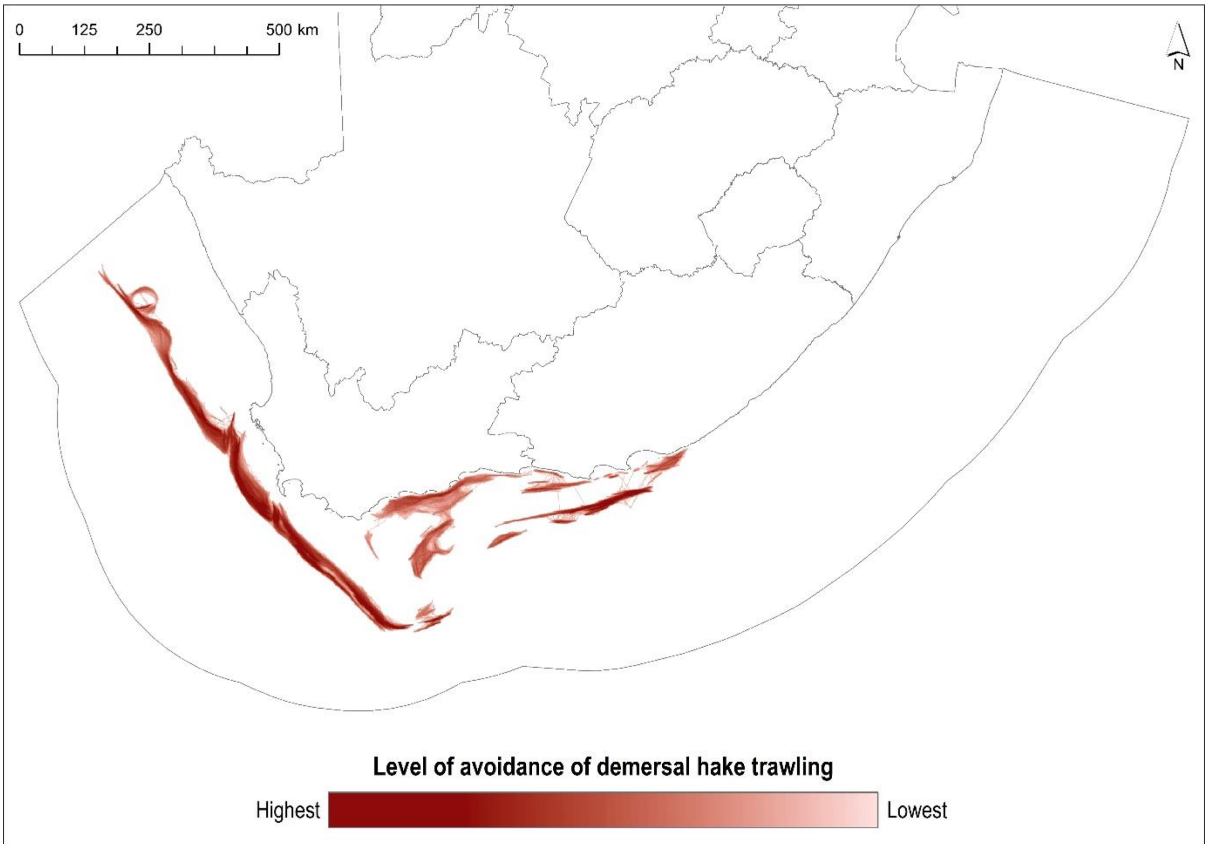



**Figure 158**. *Level of avoidance of inshore and offshore demersal hake trawling as used in the CBA Map Version 1.2. (Map derived from Currie et al. 2021a; Currie et al. 2021b).*

#### 4.5.4.2. Crustacean trawling

The data that are used to represent crustacean trawling (Figure 159) come from the NBA 2018 (Majiedt et al. 2019). The crustacean trawl footprint was refined based on expert input at the fisheries data review workshop, to remove areas that are no longer trawled (Appendix 4).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Crustacean trawling** | The NBA 2011 / OMPA crustacean trawl dataset for the period 2001-2005 was combined with more recent data for period 2006-2017. Catch was recorded as the average annual take in kilograms and effort as hours of trawling. | • Existing NBA 2011/OMPA data cleaning retained.<br>• The following analysis was done separately on the NBA 2011 / OMPA crustacean trawl dataset for the period 2001-2005 and the more recent data for period 2006-2017. Results were combined in the final stage.<br>• A point density was calculated using a 120 m grid cell and evaluating all areas within 2.5 km of the cell. Values were calculated as a total per square kilometre.<br>• We assumed very low effort (under 25 h) were errors. This eliminated most points that were unlikely (e.g., on land or deep water).<br>• Initial analysis classified the prawn trawl to ten quantiles. This was later revised to a binary footprint layer (trawled / not trawled) due to impacts of industry.<br>• The footprint from the two datasets was combined and used to represent crustacean trawling, and was assigned an intensity, and thus avoidance level, of 100.<br>• Areas within the MPA footprint and other areas where crustacean trawling no longer takes place were removed. |

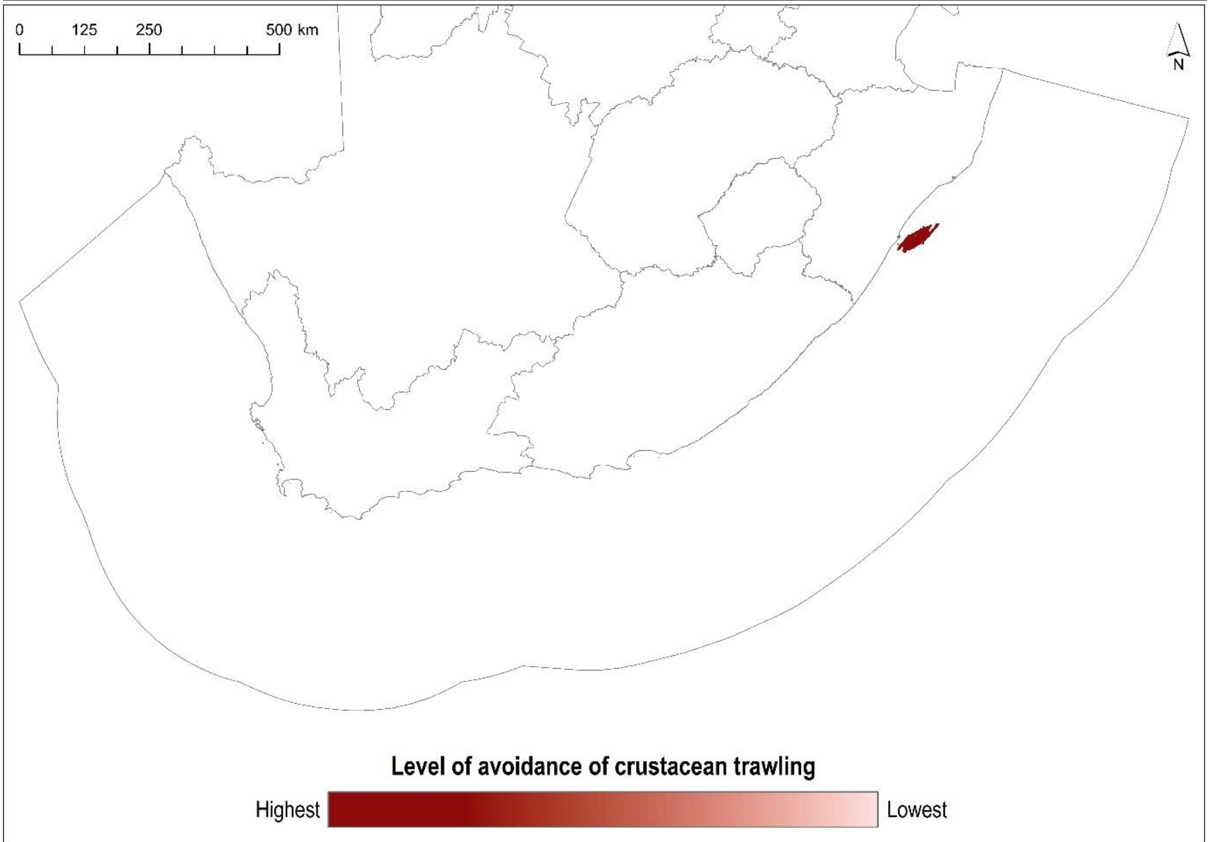



**Figure 159.** *Level of avoidance of crustacean trawling as used in the CBA Map Version 1.2.*

### 4.5.4.3. Midwater trawling

The data that are used to represent midwater trawling (Figure 160) come from the NBA 2018 (Majiedt et al. 2019). It is recognised that this sector map needs revision to include more data from dual-rights trawl vessels, and additional recent trawled areas on the west coast (i.e., trawled since 2016, which is the end date of the input data) that are not currently represented in the map.

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Midwater trawling** | Raw data were received for the period 2008-2016 with start and end positions for each trawl event, alongside data for hours of trawling and total catch in kilograms. Catch was recorded as the average annual take in kilograms and effort as hours of trawling. | • Point statistics on effort in hours per square kilometre were calculated (a cell size of 0.005° was used, with a 10-cell radius circular search area to determine effort).<br>• We used the 100*n/$n_{80}$ method to deal with a very skewed data distribution.<br>• We removed very low intensity values under 1 which represent any cells with less than 1% of the level of effort of the $n_{80}$ cell.<br>• The map of intensity of fishing scaled 0-100 was used as the level of avoidance. |

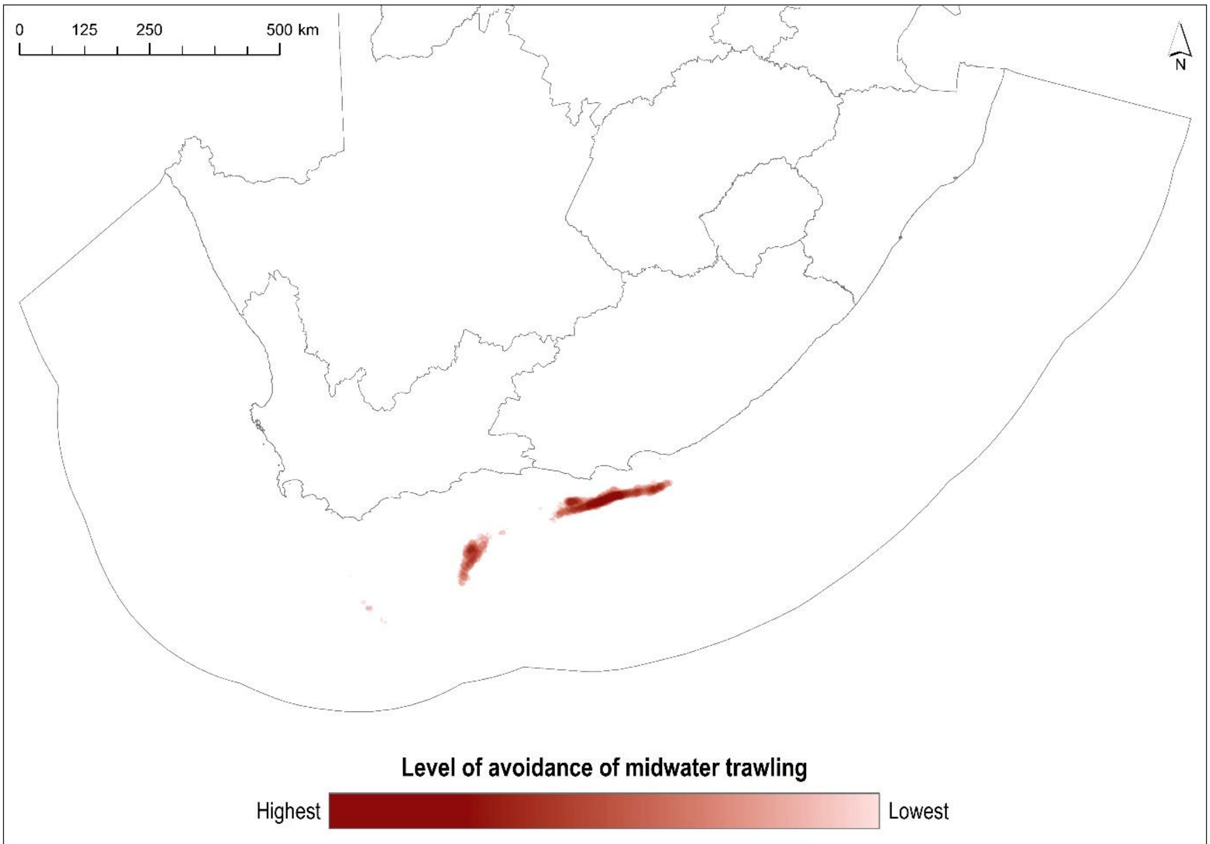



**Figure 160.** *Level of avoidance of midwater trawling as used in the CBA Map Version 1.2.*

### 4.5.4.4. Linefishing

The data that are used to represent linefishing (Figure 161) come from the NBA 2018 (Majiedt et al. 2019). This dataset is considered the best available to represent the sector. An ideal future improvement would be to generate a map of recreational linefishing from boat-based data. Note that this map also includes small-scale linefishing.

| Cost element | Source data | Processing methodology |
| --- | --- | --- |
| **Linefishing (commercial and recreational boat-based fishing)** | Point data were received for the period 2000-2016. This layer was also used as a proxy for recreational boat-based linefishing, as the patterns of use are similar to that of the commercial sector and data for actual catch by recreational fishermen were not available. | • Linefish data were summarised to centre points of a 5' grid.<br>• All values within that grid were added up to give a total kg catch for the grid square.<br>• All points with no catch were allocated a 0 kg catch.<br>• A Natural Neighbour Interpolation was done to produce a smoothed continuous surface of estimated catch.<br>• Very low values (under 100 kg for the entire period) were excluded.<br>• Values were then reclassified into 10 quantiles.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing scaled 0-100 was used as the level of avoidance. |

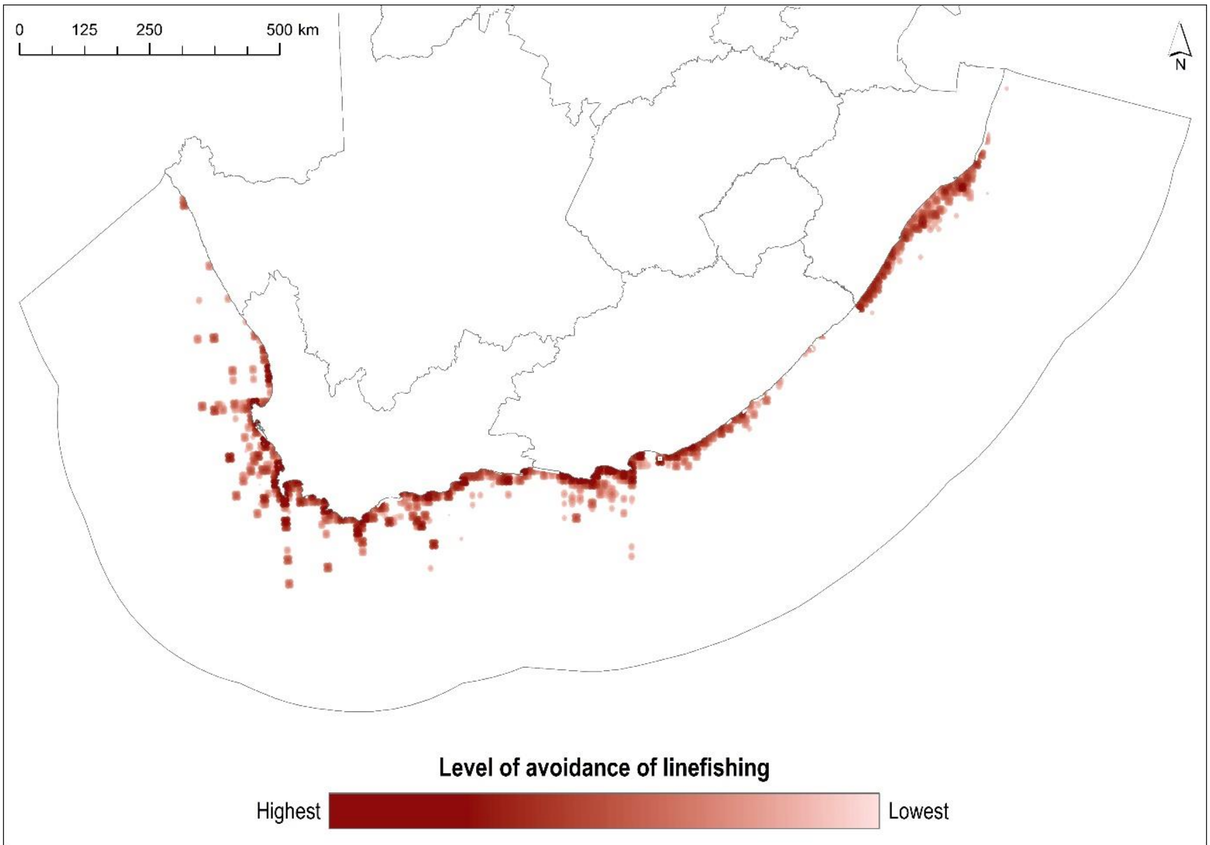



**Figure 161.** *Level of avoidance of linefishing as used in the CBA Map Version 1.2.*

#### 4.5.4.5. Demersal longlining

The data that are used to represent demersal (hake) longlining (Figure 162) come from the NBA 2018 (Majiedt et al. 2019). Future iterations will explore using fishing effort rather than catch as the metric of fishing intensity.

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Demersal Longline** | Point data of start and end positions was received from DFFE for the period 2000-2017, alongside number of hooks per line and the total catch in kilograms. | • Raw point data used for total catch of all species (largely hake and kingklip)<br>• Data presented as annual average over the period 2000 to 2017.<br>• A point density approach was used to add up all catch around an area. A 120-m grid was used, with catches within 5000 m of each grid cell being aggregated for whole period. Values were calculated in catch/km$^2$.<br>• Low values of under 1000 kg/km$^2$ removed to deal with scatter of inaccurate points and eliminate very low use areas.<br>• Due to an extremely skewed distribution, a 100* n/$n_{70}$ method was used to deal with high values. The $n_{70}$ value was 19 914 kg/km$^2$. After the calculation, values over 100 were reclassified as 100.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing scaled 0-100 was used as the level of avoidance. |

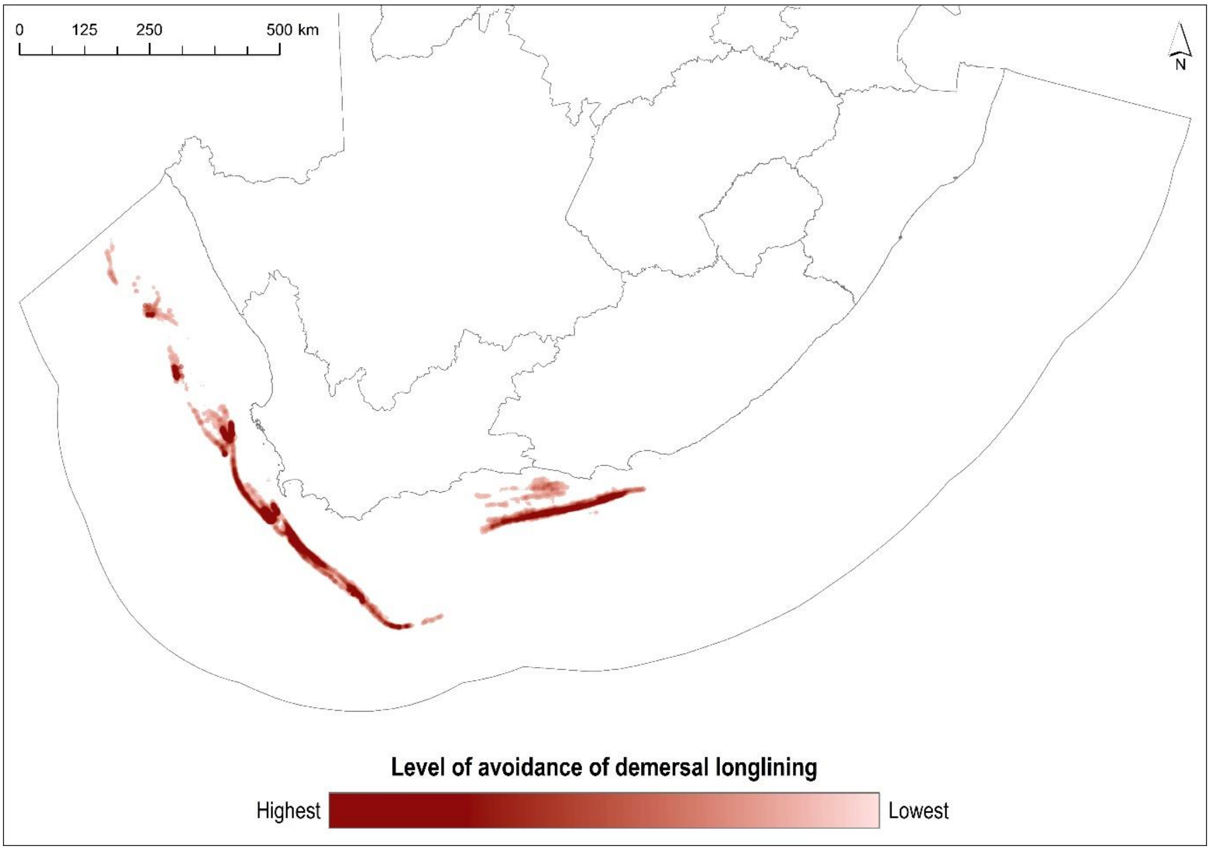



**Figure 162.** *Level of avoidance of demersal longlining as used in the CBA Map Version 1.2.*

#### 4.5.4.6. Pelagic longlining

The data that are used to represent pelagic longlining (Figure 163) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Pelagic Longline** | Point data of start and end positions was received from DFFE for the period 2000-2016, alongside number of hooks per line and the total catch in kilograms. | • Base data with line hook numbers (effort) values associated with start and end points<br>• A point density approach was used to add up all effort around an area. A 120-m grid was used, with areas within 10 000m of a point being evaluated.<br>• The effort was calculated in hooks/km$^2$. Low values of under 100 hooks/km$^2$ were removed to deal with scatter of inaccurate points and very low use areas.<br>• Reclassified into 10 quantiles (given values from 10-100).<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing effort scaled 0-100 was used as the level of avoidance. |

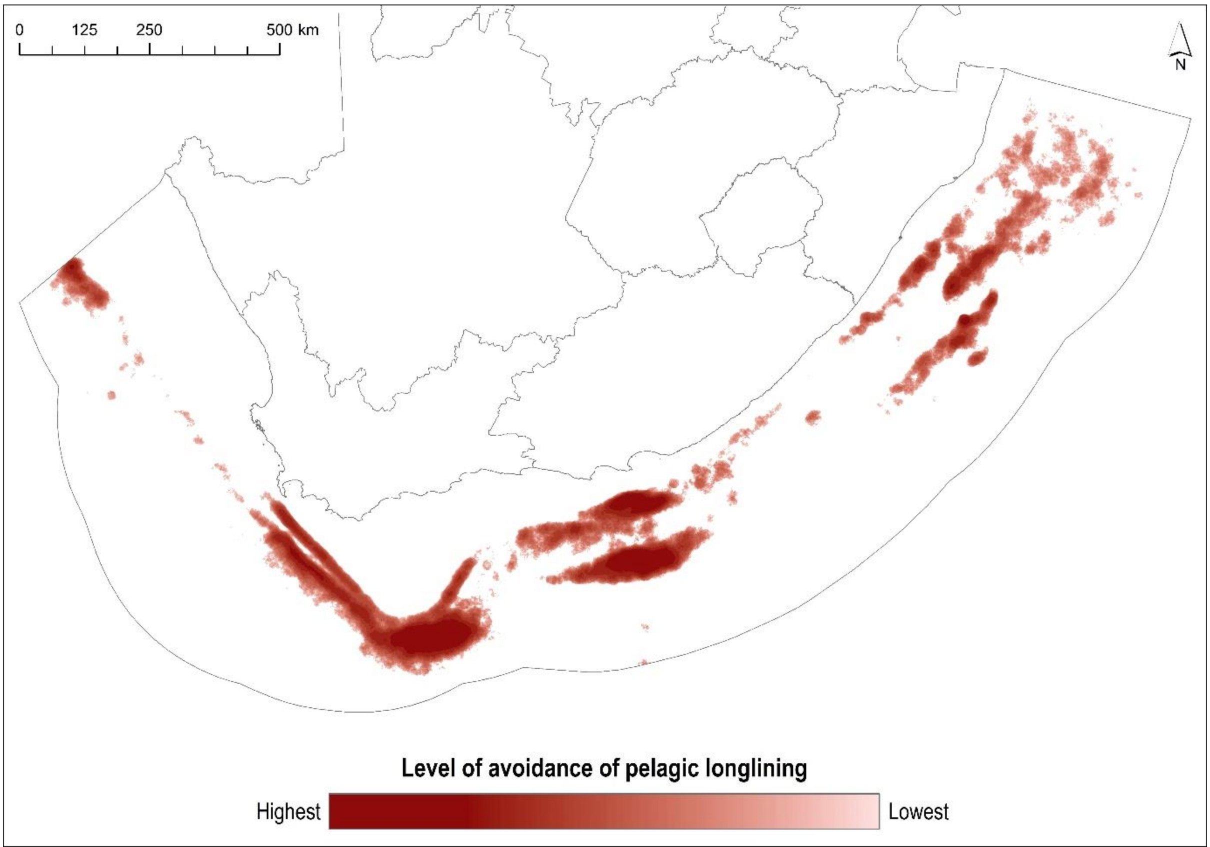



**Figure 163.** *Level of avoidance of pelagic longlining as used in the CBA Map Version 1.2.*

### 4.5.4.7. Tuna pole fishing

The data that are used to represent tuna pole fishing (Figure 164) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Tuna Pole** | Point data collated to a coarse 50-nm grid was received for the period 2007-2016. | • DFFE pole tuna catch data were collated by Capfish / SANBI<br>• The reporting used very coarse grid squares of 50 NM.<br>• The total catch records were allocated to a centroid for each grid square. Zero values were allocated to all non-fished grids squares.<br>• A natural neighbours interpolation was undertaken for marine areas.<br>• Extremely low values with under 10 000 kg catch over the recorded period were excluded.<br>• A modified 100*n/$n_{99}$ method used to deal with skewed distributions. The $n_{99}$ was 1 004 051. After the calculation values over 100 were reclassified as 100.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing scaled 0-100 was used as the level of avoidance. |

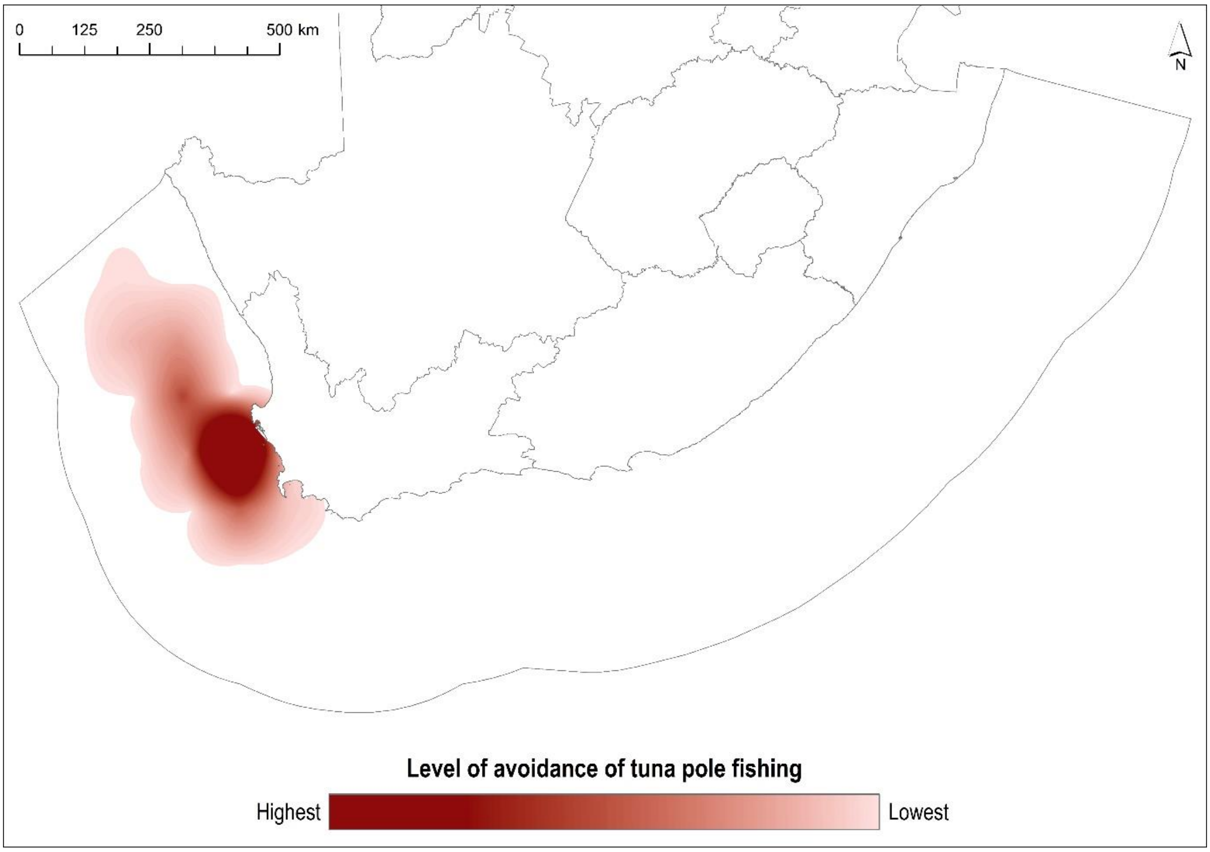



**Figure 164.** *Level of avoidance of tuna pole fishing as used in the CBA Map Version 1.2.*

#### 4.5.4.8. Small pelagics fishing

The data that are used to represent small pelagics fishing (Figure 165) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Small Pelagic Fishery** | Data were received for the period 2000-2016 and calculated to a 5 min grid by CAPFISH (DFFE/CAPFISH/SANBI) | • A centroid was used for each grid square, with total catch values for the square being allocated to this centroid. A zero value was allocated to non-fished areas.<br>• A natural neighbours interpolation was undertaken for marine areas.<br>• Extremely low values with under 200 kg catch over the record period were excluded.<br>• Reclassified into 10 quantiles (given values from 10-100).<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing scaled 0-100 was used as the level of avoidance. |

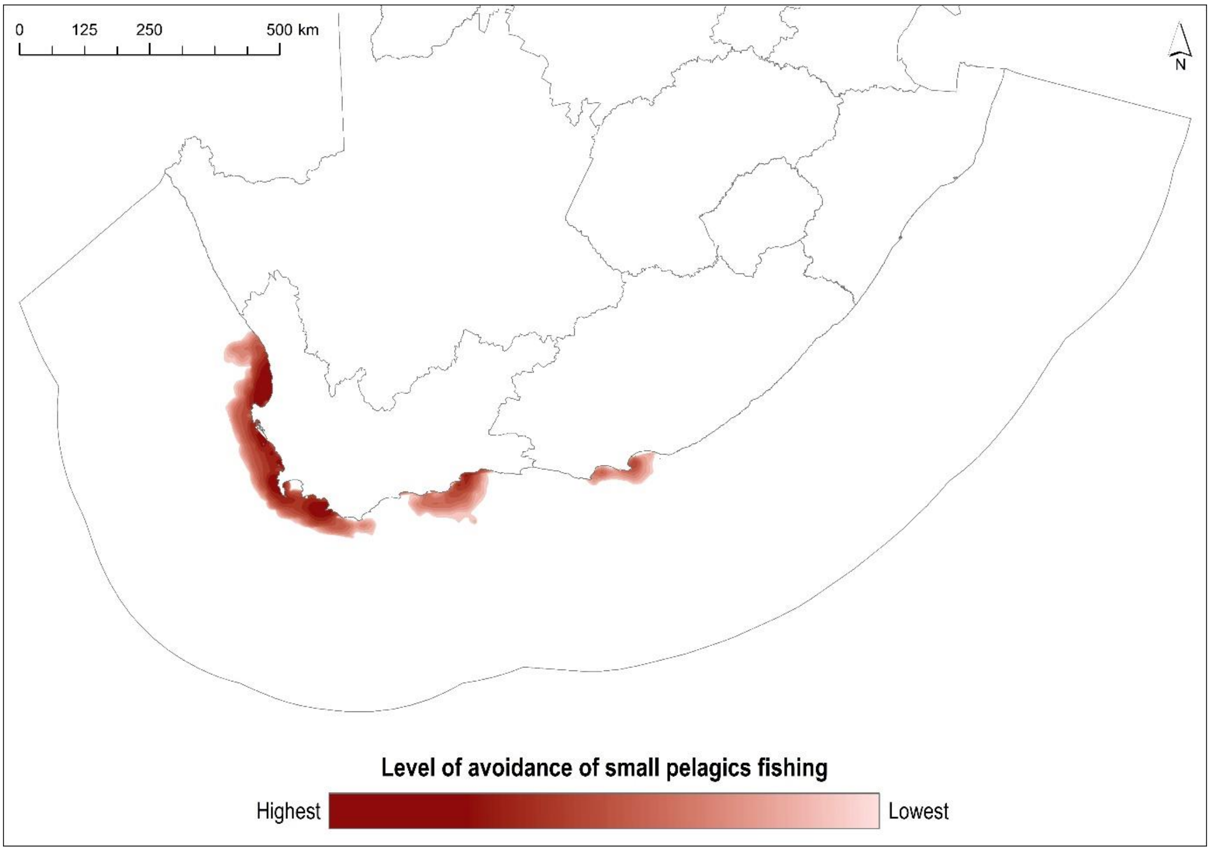



**Figure 165.** *Level of avoidance of small pelagics fishing as used in the CBA Map Version 1.2.*

#### 4.5.4.9. West Coast Rock Lobster harvesting

The data that are used to represent West Coast Rock Lobster harvesting (Figure 166) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **West Coast Rock Lobster** | West Coast Rock Lobster harvesting data was collated for each concession area for the period 2006 to 2016 | • Total catch for period for all types of rock lobster fishery were aggregated into the spatial delineations of management zones for the catch of West Coast rock lobster.<br>• Coverage extends from coastline seawards to the 20-m depth contour.<br>• Calculated as an intensity measured in total catch/km$^2$ over the period<br>• A 100*n/$n_{90}$ method used to deal with skewed distributions, with the $n_{90}$ being 992.28. We reclassified any resulting values over 100 as 100.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of harvesting scaled 0-100 was used as the level of avoidance. |

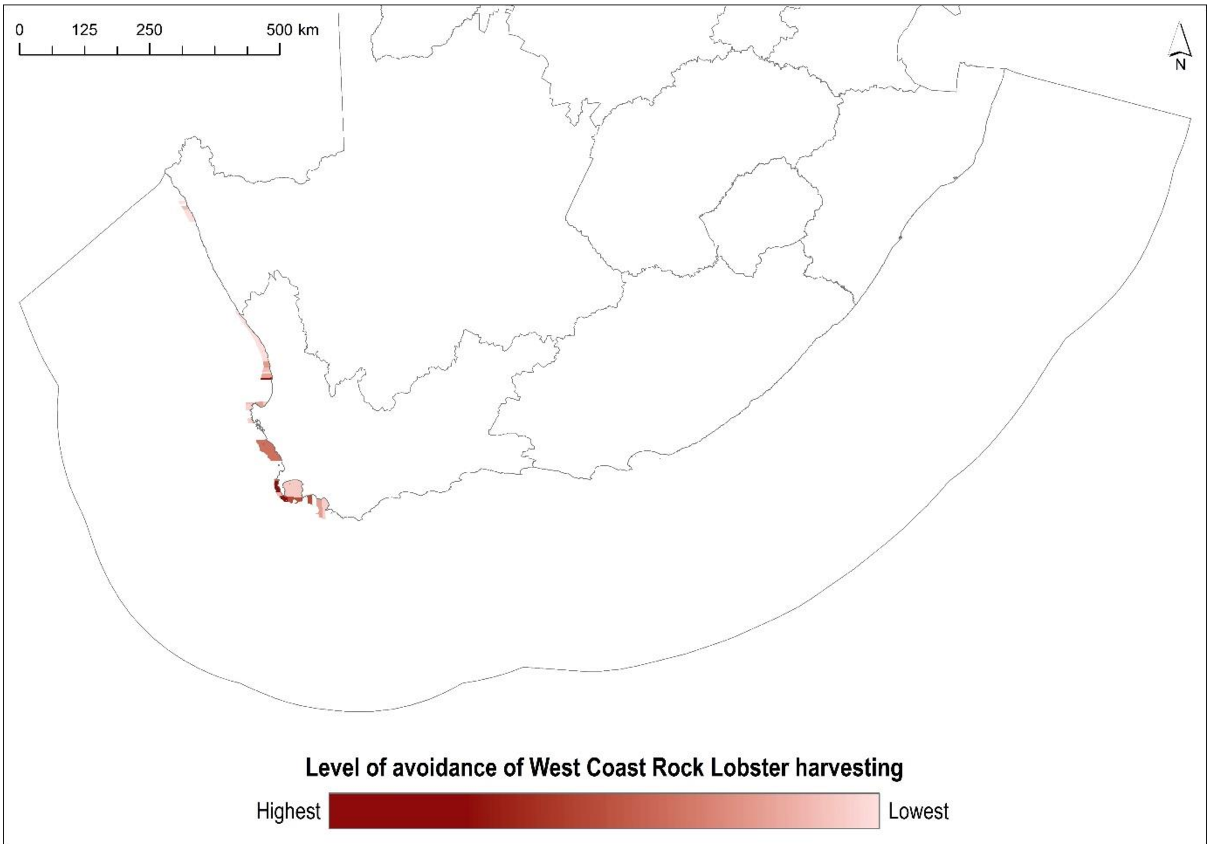



**Figure 166.** *Level of avoidance of West Coast Rock Lobster harvesting as used in the CBA Map Version 1.2.*

#### 4.5.4.10. South Coast Rock Lobster harvesting

The data that are used to represent South Coast Rock Lobster harvesting (Figure 167) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **South Coast Rock Lobster** | South Coast Rock Lobster harvesting data was collated for each concession area for the period 2007 to 2016. | • A centroid was developed from the summary grid of total catch. A zero value was allocated to all non-fished grid cells.<br>• A natural neighbours interpolation was undertaken for marine areas.<br>• Extremely low values with under 713 kg catch over the record period were excluded.<br>• A 100*n/$n_{90}$ method used to deal with the skewed distribution of values, with $n_{90}$ = 33 420. We reclassified any resulting values over 100 as 100.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of harvesting scaled 0-100 was used as the level of avoidance. |

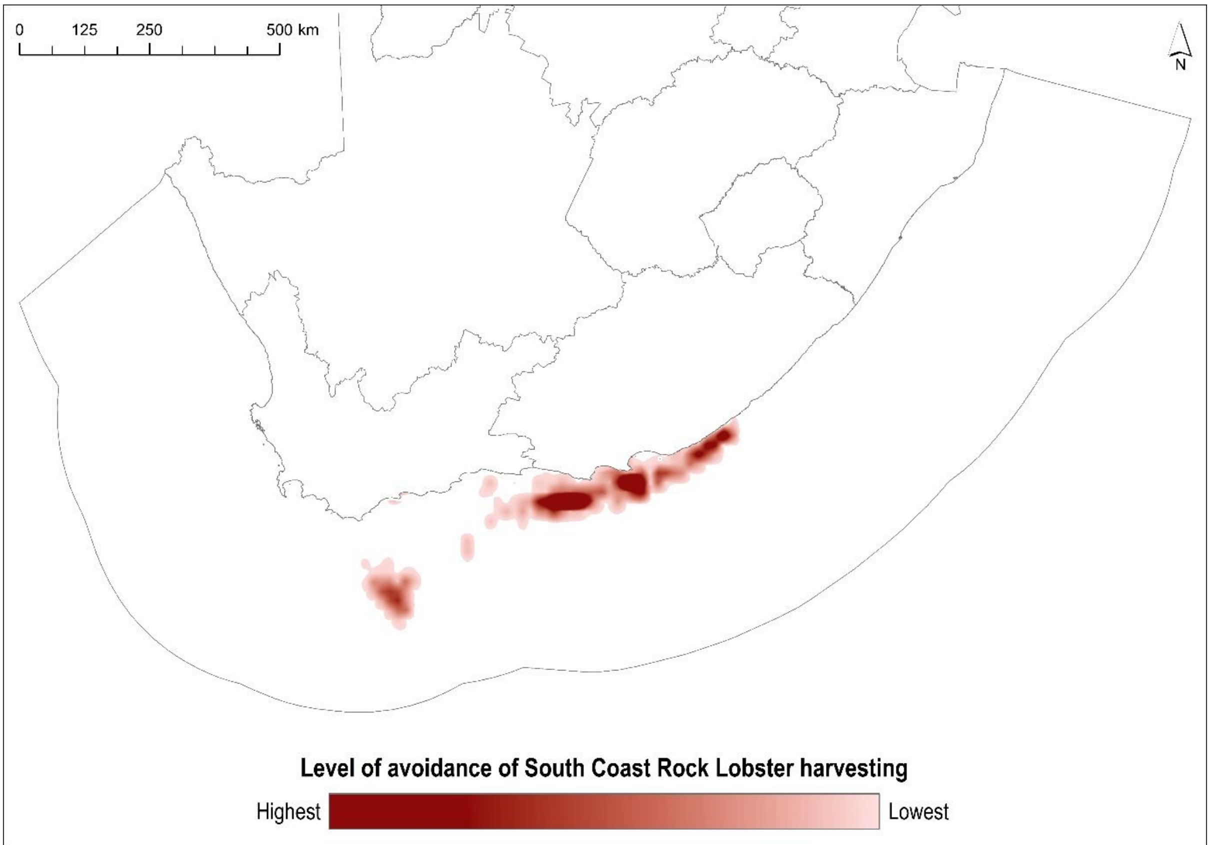



**Figure 167.** *Level of avoidance of South Coast Rock Lobster harvesting as used in the CBA Map Version 1.2.*

#### 4.5.4.11. Squid harvesting

The data that are used to represent squid harvesting (Figure 168) have been updated from those used in the NBA 2018 to a more recent dataset (2016-2020). These changes were made following expert input from DFFE fisheries scientists (see Appendix 4).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Squid** | Commercial Squid Effort values for the period February 2016 – February 2020 were provided by DFFE. | • Fishing records on land were considered to be errors and were excluded from the dataset.<br>• Data were aggregated for the full record period to a 5' grid.<br>• A centroid was developed from the summary grid of total effort (in person days/ grid cell) for the period. A zero value was allocated to all non-fished grid cells.<br>• A natural neighbours interpolation of these points was undertaken for marine areas. The analysis was undertaken to produce a 120-m grid.<br>• The data were divided into 10 quantiles and the bottom 10% (equivalent to 345 person days per 5' grid for the full period) were excluded. This threshold allowed most of the likely error sites (generally single fishing records in areas well away from other data points) to be excluded from the data without an extensive manual data cleaning process.<br>• Values were reclassified into 10 quantiles, and allocated values from 10-100 from low fishing effort to highest fishing effort.<br>• The raster was resampled to a 30-m grid to match other industry datasets. |

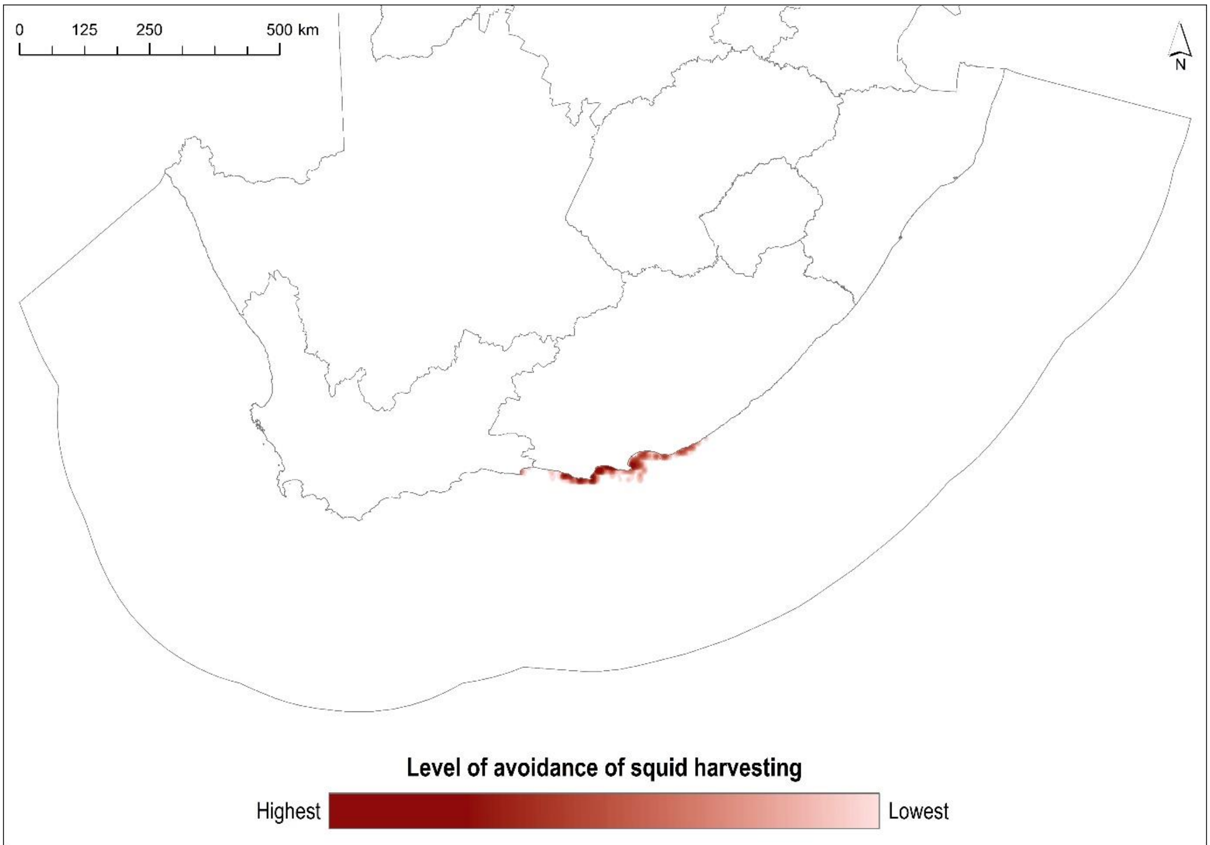



**Figure 168.** *Level of avoidance of squid harvesting as used in the CBA Map Version 1.2.*

### 4.5.4.12. Gillnetting

The data that are used to represent gillnetting (Figure 169) come from the NBA 2018 (Majiedt et al. 2019). Future iterations will consider using effort (number of net days per annum) as the metric of fishing intensity, noting that these data were not available at the time of analysis.

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Small-scale fisheries: Gillnetting** | Spatial distribution of rights per management sector for 2016/17. | • Spatial delineations of management zones for the gillnet sector with Total Allowable Effort (TAE, i.e., rights allocated) in 2016-17 for each area. Coverage extends from coastline seawards to the 50-m depth contour.<br>• Calculated as an intensity gillnet rights/km$^2$ over the period<br>• A 100* $n/n_{max}$ method used to benchmark values against the highest intensity of use.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing effort scaled 0-100 was used as the level of avoidance. |

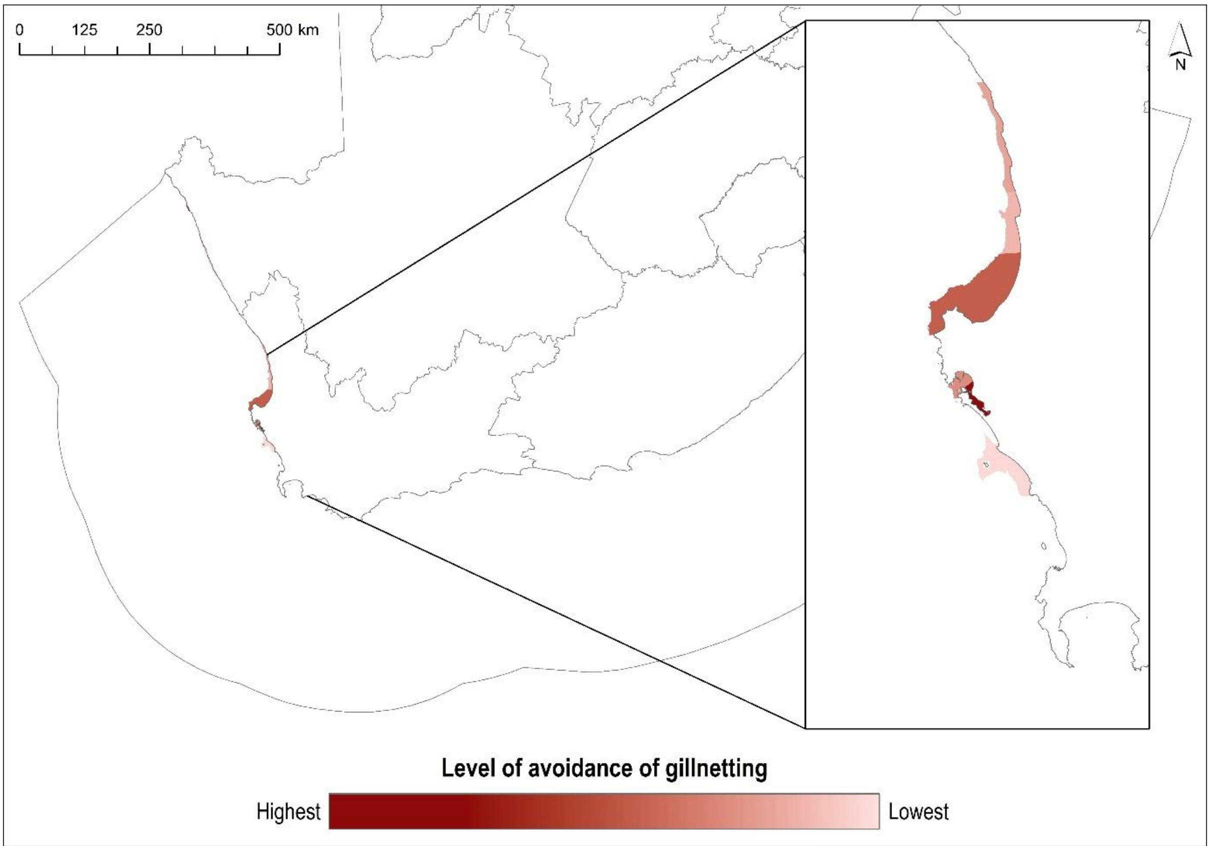



**Figure 169.** *Level of avoidance of gillnetting as used in the CBA Map Version 1.2.*

#### 4.5.4.13. Beach seining

The data that are used to represent beach seining (Figure 170) come from the NBA 2018 (Majiedt et al. 2019). Future iterations will explore using fishing effort (number of net days per annum) as the metric of fishing intensity. New and missing data for the east coast (including beach seining during the sardine run) need to be included as well.

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Small-scale fisheries: Beach-seining** | Spatial distribution of rights per management sector for 2016/17. | • Spatial delineations of management zones for the beach-seine sector with Total Allowable Effort (TAE; i.e., rights allocated) in 2016-7 for each area. Coverage extends from coastline seawards to the 10m depth contour.<br>• Calculated as an intensity seine rights/km$^2$ over the period<br>• A 100*n/nmax method used to benchmark values against the highest intensity of use.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing effort scaled 0-100 was used as the level of avoidance. |

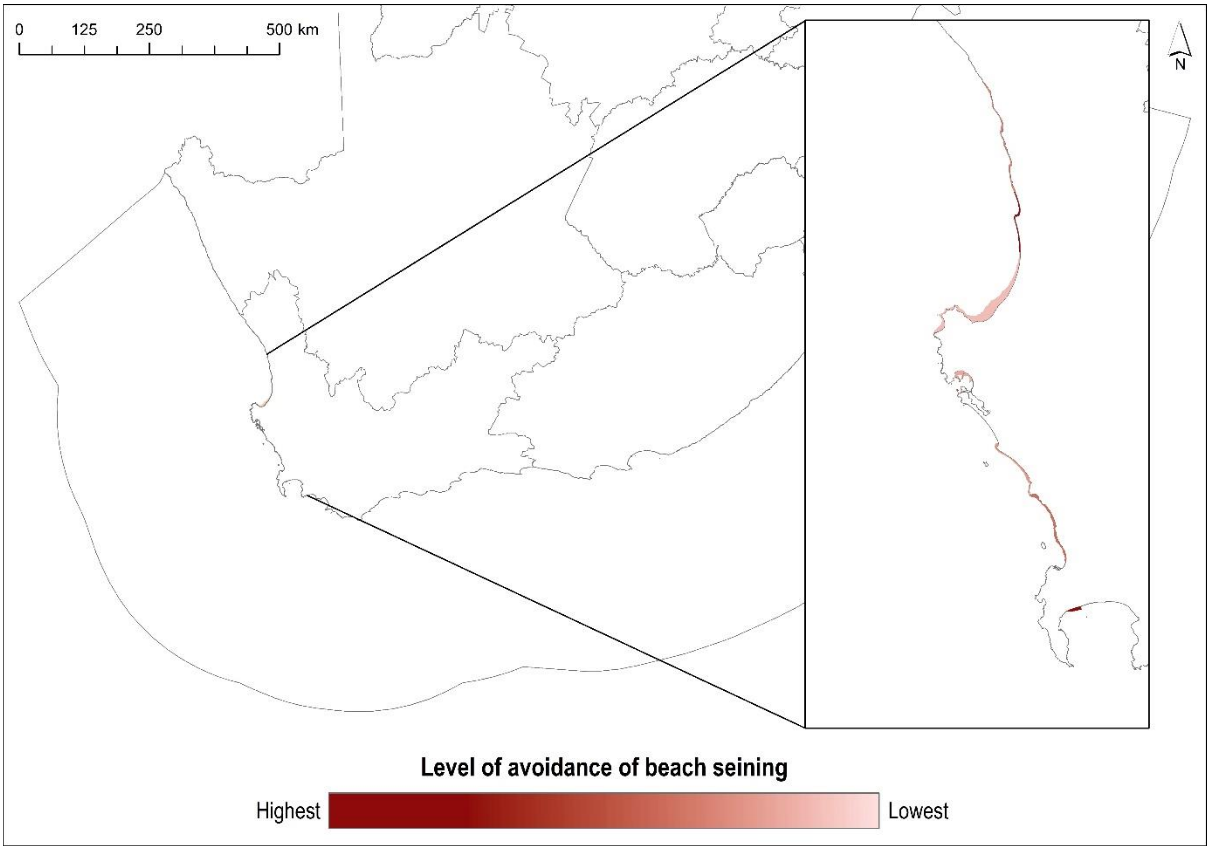



**Figure 170.** *Level of avoidance of beach seining as used in the CBA Map Version 1.2.*

### 4.5.4.14. Oyster harvesting

The data that are used to represent oyster harvesting (Figure 171) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Small-scale fisheries: Oyster harvesting** | Average number of oysters collected per year over the period 2000 to 2017 was collated per fishing area. | • Spatial delineations of management zones for the collection of oysters within the Southern Cape and KZN regions. Coverage extends from coastline seawards to the 10-m depth contour.<br>• Calculated as a fishing intensity measured in oysters/km$^2$ over the period<br>• The 100* $n/n_{90}$ method used to deal with skewed distributions, with $n_{90}$ = 2008.16. We reclassified any resulting values over 100 as 100.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of harvesting scaled 0-100 was used as the level of avoidance. |

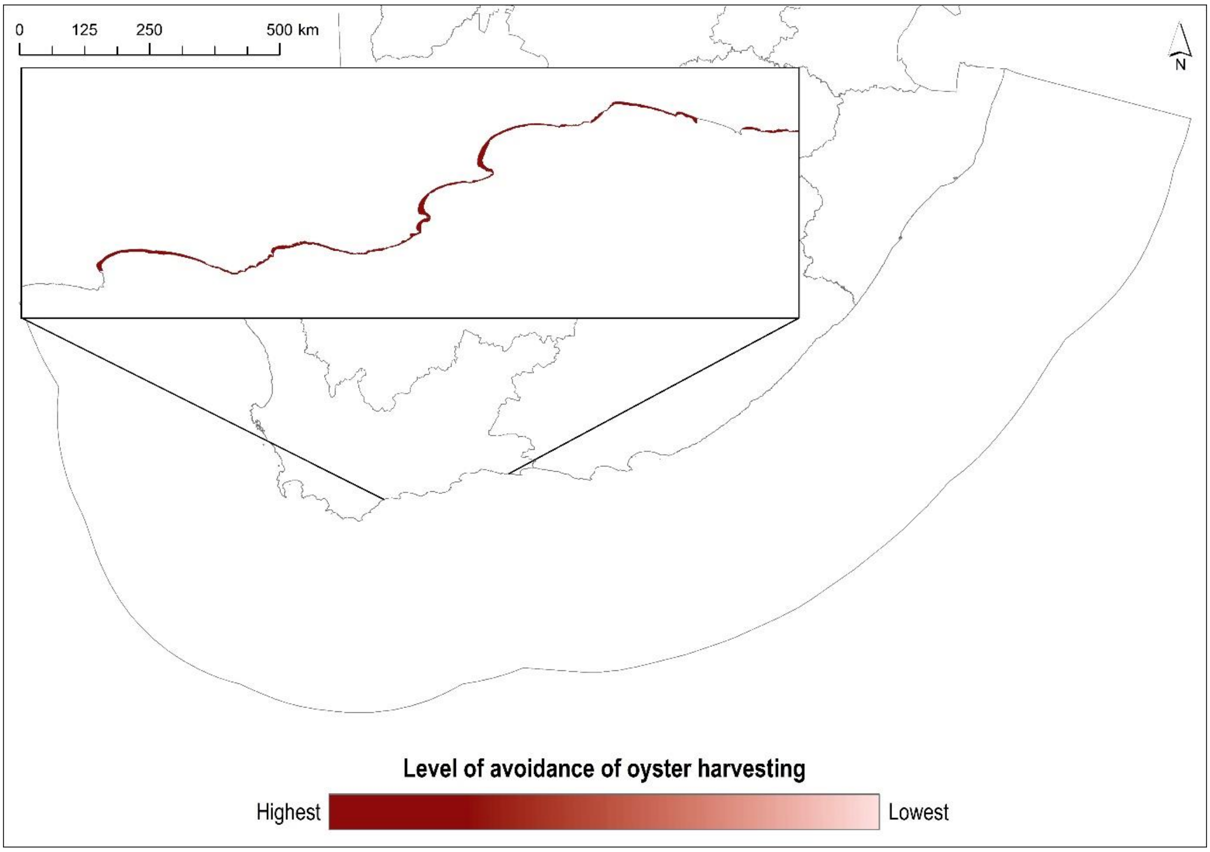



**Figure 171.** *Level of avoidance of oyster harvesting as used in the CBA Map Version 1.2.*

#### 4.5.4.15. Kelp harvesting

The data that are used to represent kelp harvesting (Figure 172) come from the NBA 2018 (Majiedt et al. 2019).

| Cost element | Source data | Processing methodology |
|---|---|---|
| **Small-scale fisheries: Kelp Harvesting** | Kelp harvesting data was collated for the period 2000- 2017 for each concession area. Based on expert input, the area of activity was mapped to the 10m depth bathy. | • The four types of kelp harvesting values were aggregated into a total take in kg.<br>• Values were calculated as an intensity in kg/km$^2$ over the record period.<br>• The 100*n/$n_{90}$ method was used to deal with skewed distributions, with $n_{90}$ = 29316. Any resulting values over 100 were reclassified as 100.<br>• Values were modified using MPA boundaries (where there are activity exclusions).<br>• The map of intensity of fishing effort scaled 0-100 was used as the level of avoidance. |

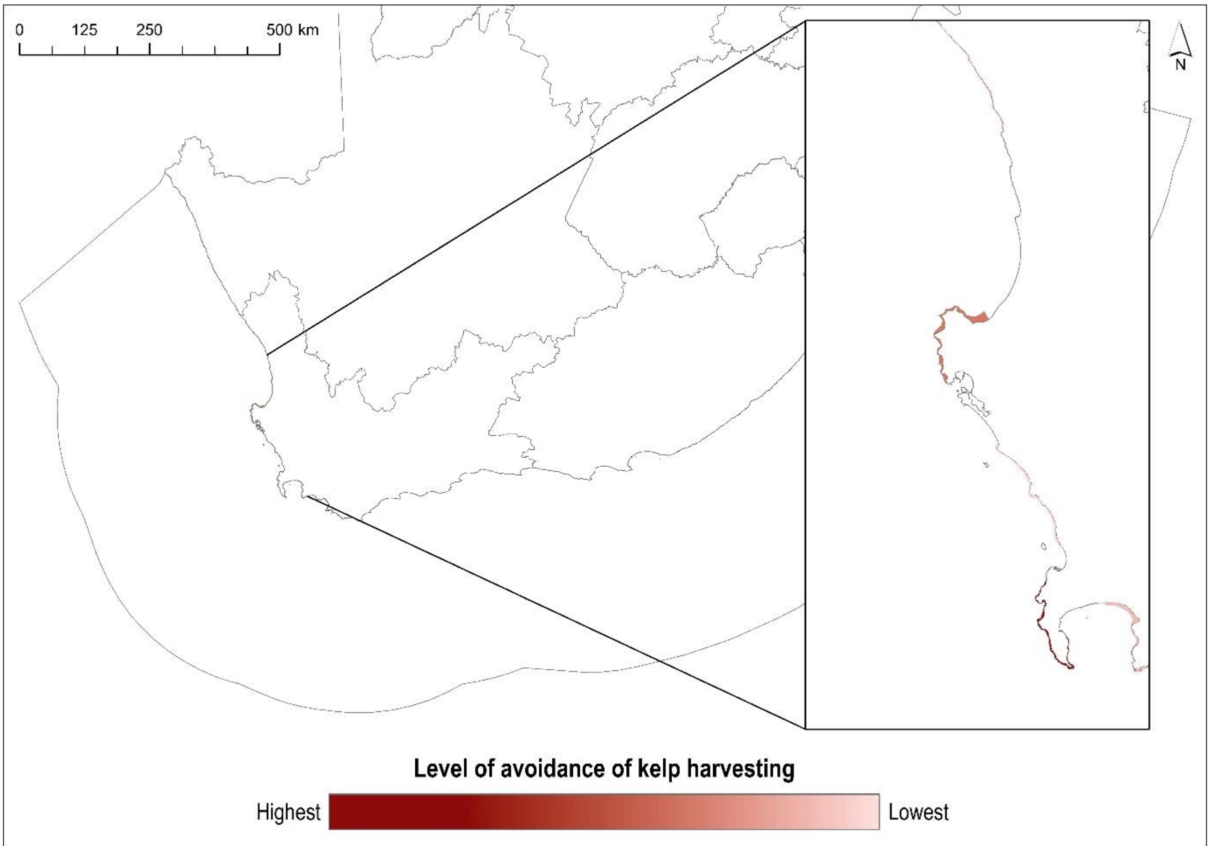



**Figure 172.** *Level of avoidance of kelp harvesting as used in the CBA Map Version 1.2.*

#### 4.5.4.16. Small-scale fisheries

Small-scale fishers were defined in South Africa's policy for small-scale fisheries (SSF; Government of South Africa 2012; see also: Sowman et al. 2014), but implementation of this policy is still underway.

Four years after the policy was promulgated, regulations for SSF were published (Government of South Africa 2016), which indicate that SSF areas need to be demarcated. Data on small-scale fisheries were requested from DFFE, and a list of 130 small-scale fisheries cooperatives across the four coastal provinces was received. The importance of SSF data is recognised and to reduce overlap between biodiversity and SSF priorities, inclusion of this sector in the cost layer is recommended. However, without spatial data to accompany the list of co-operatives, we were unable to include SSF as a cost element at this time. See Section 7.1.1 for plans to map and include SSF in future iterations of the National Coastal and Marine CBA Map.

#### 4.5.5. Aquaculture

The data that are currently used to represent marine aquaculture (Figure 173) come from the existing and proposed aquaculture development zones provided by the DFFE Chief Directorate Aquaculture and Economic Development.

| **Cost element** | **Source data** | **Processing methodology** |
|---|---|---|
| **Sea-based Aquaculture** | Aquaculture development zones (ADZs), provided by the DFFE Chief Directorate Aquaculture and Economic Development (February 2021). | • The ADZs were converted to a raster layer, and assigned a cost value of 100. |

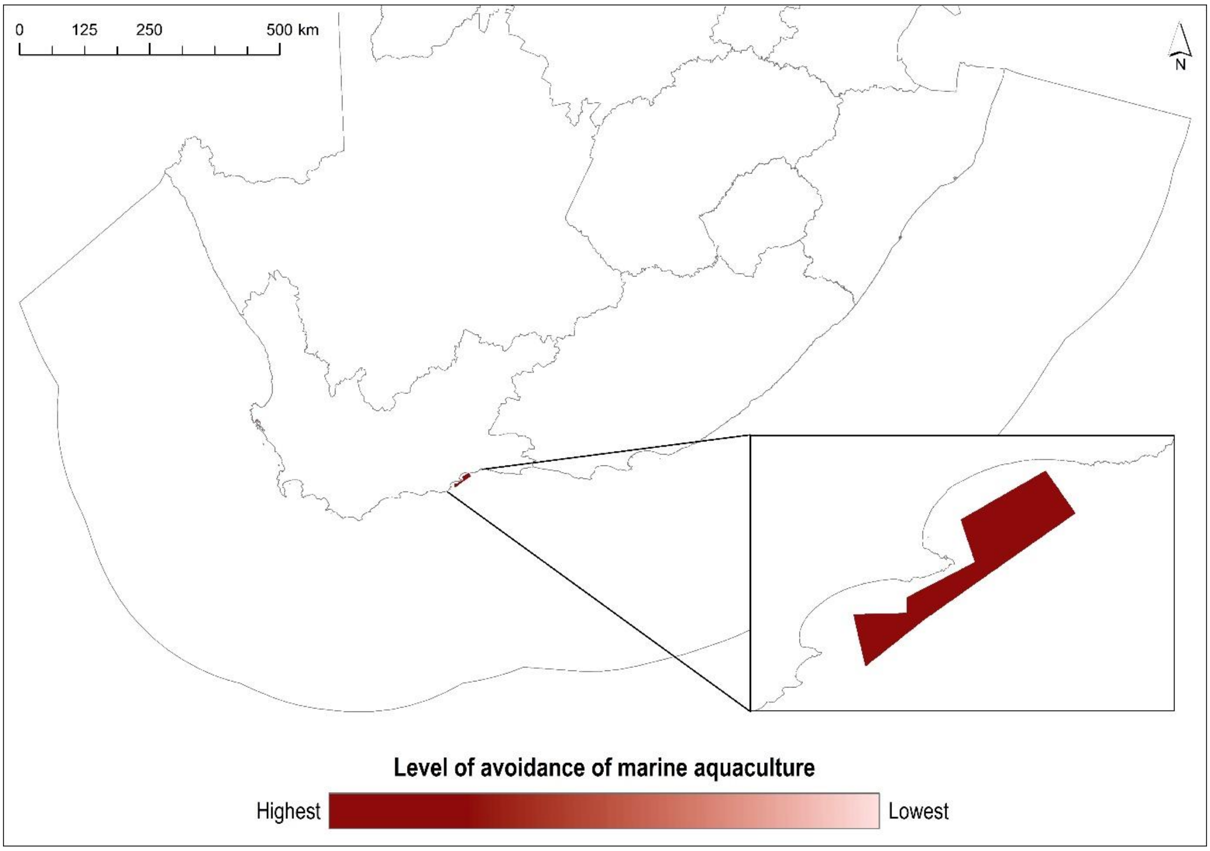



**Figure 173.** *Level of avoidance of marine aquaculture as used in the CBA Map Version 1.2. Note that there are also marine aquaculture sites in Saldanha and Algoa Bay, but these are not visible on the map at this scale.*

#### 4.5.6. Transport activities

The areas of avoidance for transport (Figure 174) included a composite layer across the NBA 2018 maps (Majiedt et al. 2019) of shipping, ports and harbours, and dredge spoil dumping sites. To prioritise avoidance of shipping lanes and remove areas of very low intensity shipping from the transport layer, the raster values of the composite map were reclassified to scale the upper 50% of the data from 0–100.

| Pressure Layers and cost element | Source data | Processing methodology |
|---|---|---|
| **Shipping** | Data for shipping was extracted from the global dataset published by Halpern et al. (2015). | • Global data were resampled to the SA EEZ.<br>• The values were in SA were rescaled to South African range (0-100).<br>• The 100*n/$n_{90}$ method was used to deal with skewed distributions, with $n_{90}$ = 72.29. We reclassified any resulting values over 100 as 100.<br>• Very low values (0-3), were reclassified as 0 |

| Pressure Layers and cost element | Source data | Processing methodology |
|---|---|---|
| **Port and harbour activities** | Various data sources were combined to develop this layer:<br>– NBA 2011 harbours mapped as part of coastal mapping<br>– Port limits (Transport/SANBI)<br>– Port infrastructure (Transport/SANBI)<br>– Harbour points buffered by 1 km (SANBI mapped and verified) | • Point and infrastructure data were buffered by 1 km.<br>• Port limits were not buffered.<br>• Different port layers combined into a single layer (120 m pixels).<br>• Note that the physical infrastructure impacts of a port are covered under coastal development. |
| **Dumping of dredge material** | Polygon data was received from the Navy National Hydrographic Office. | • Impacted areas treated as identical and coded into a dredge spoil footprint layer.<br>• A value of 100 was coded to these areas. |
| **Transport activities (cost element)** | Shipping, port and harbour activities, and dumping of dredge material, as described above. | • A single raster of transport activities was compiled by taking the maximum value per pixel across the three layers above.<br>• The raster values were reclassified so that the lower 50% of the values got a value of 0. The upper 50% of the data were divided into 20 quantiles, which was multiplied by 5 to scale the transport activities values 0–100. |

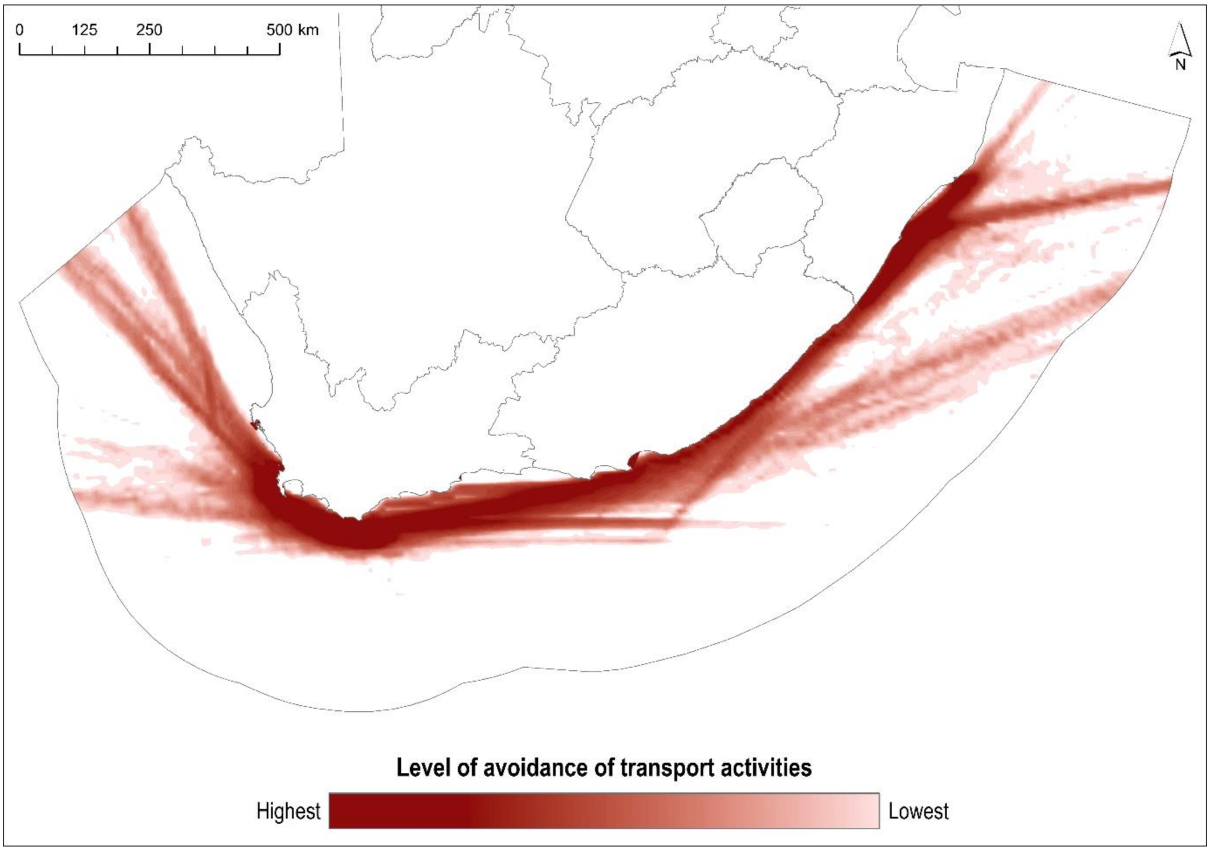



**Figure 174.** *Level of avoidance of transport as used in the CBA Map Version 1.2.*

### 4.5.7. Cumulative impacts to marine biodiversity

The map of cumulative impacts on marine biodiversity (Figure 175) is from the NBA 2018 (Sink et al. 2019c). It includes the data described in Sections 4.5.2–4.5.6 (except where there have been updates since the NBA 2018), as well as other pressures, such as alien invasive species, freshwater-flow reduction, wastewater discharge and shark netting for bather protection. It also gives an indication of ecological condition because sites exposed to higher levels of pressure are likely to be more modified than those areas exposed to lower levels of pressure. Note that this cumulative impact layer includes both current and historical activities, as well as legal and – in the case of abalone harvesting – illegal activities, to best capture the combination of current use and impact. For more details on the compilation of this layer, see Majiedt et al. (2019) and Sink et al. (2019c).

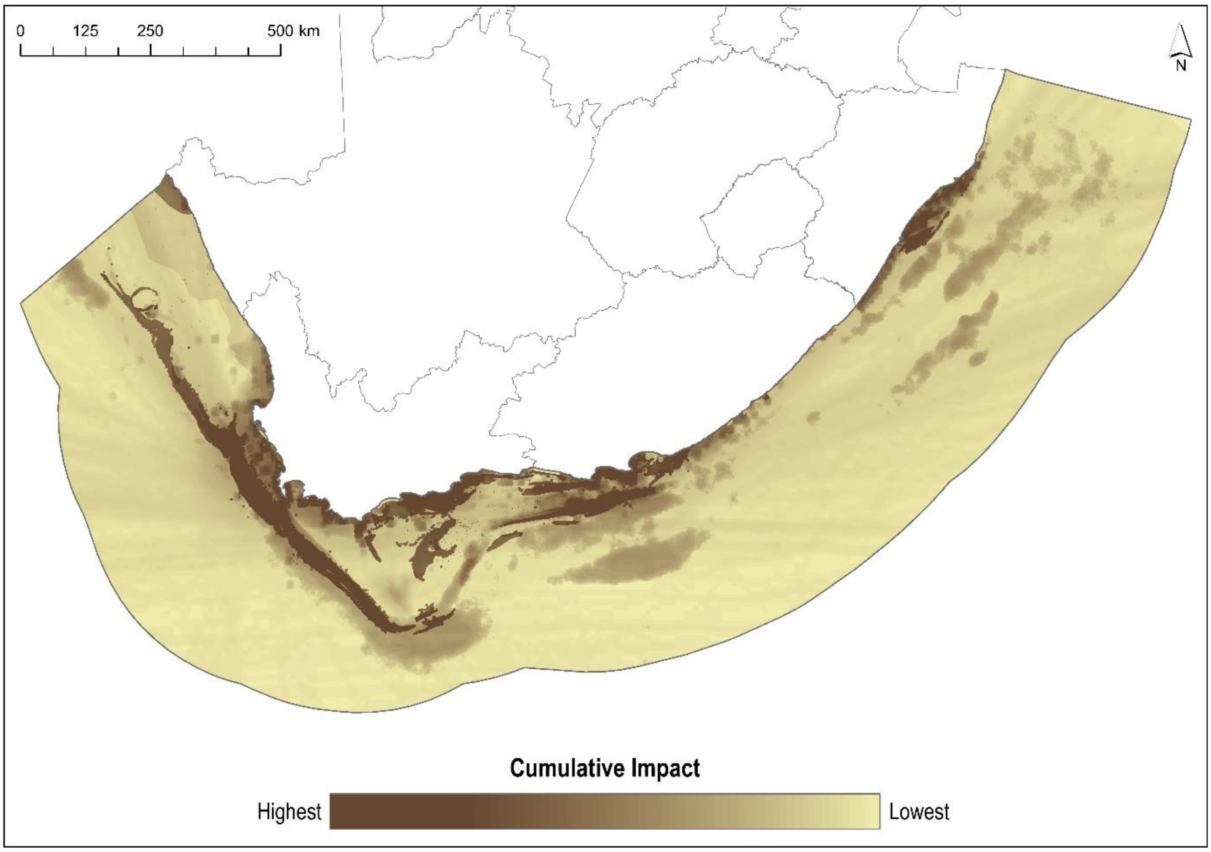



**Figure 175.** *Cumulative impact on marine biodiversity, based the intensity of all cumulative pressures and the sensitivity of the underlying ecosystem types to each of those pressures. (Data source: Sink et al. 2019c).*

#### 4.5.8. Compilation of the cost layer

Cost per planning unit was defined as follows, using three equally weighted components (all scaled 0–100; i.e., total potential cost per site is 0-300), the first two of which specifically regard conflict avoidance. To this, the area of the planning unit (in $km^2$) was added, to get a final cost score.

**Cost = [sum of avoidance across cost elements[5]] + [max of avoidance across cost elements[5]] + [cumulative impact across all pressures] + [area of planning unit in $km^2$]**

In the first component, the sum of avoidance per cost element facilitates minimizing overall conflict with other sectors in the ocean space, i.e., areas that are important (and ideally need to be avoided) for multiple other overlapping cost elements will be avoided more strongly than areas that are important (and ideally need to be avoided) for only one cost element. The cost values were summed across all cost elements using the cell statistics function in Spatial Analyst, and scaled 0-100 using 25 quantiles using the reclassify tool in Spatial Analyst, and multiplying the output by 4 to get a value range of 0-100.

[5] Cost elements are: petroleum, mining, transport, specific fisheries sectors (see Section 4.5.4), and marine aquaculture.

In the second component, the level of highest avoidance across all cost elements was used per site, also calculated using the cell statistics function. In other words, regardless of how many cost elements there are at a site, the highest value across all cost elements was used as the cost value for that site. This means that, for example, areas of the highest level of avoidance for mining will be avoided as equally as areas of highest level of avoidance for petroleum, demersal trawling, beach seining, etc. Because all of the cost elements were scaled 0-100, and this cost component was compiled as the maximum value across all cost elements, this map was already scaled 0-100 and no further processing was needed.

In the third component, areas of highest cumulative impact to marine biodiversity were avoided, based on the intensity of current and historical pressures combined with the functional impact to and recovery time of the underlying ecosystem types. The data for the third component is the NBA 2018 cumulative pressure assessment, outlined in Chapters 4 and 7 of the marine technical report (Majiedt et al. 2019; Sink et al. 2019c). As noted above, it captures and represents both current use by other sectors and modification of marine biodiversity, both of which should be avoided where possible when selecting biodiversity priority areas. The cost values from the cumulative impact map were scaled 0-100 using 25 quantiles, and multiplying the output by 4 to get a value range of 0-100, also using the reclassify tool. These three components were summed using the cell statistics function as per the equation above to produce the cost layer.

Cost values within 5 km of the EEZ perimeter in the high seas and international boundary portions of the planning domain (i.e., excluding the landward boundary along the shore) were adjusted. This was to account for the fact that some industry datasets were compiled using slightly different versions of the EEZ boundary, which resulted in artificially low-cost values and data gaps in some places along the boundary of the EEZ. The correction involved running a focal statistics analysis to calculate the maximum value in a rectangular neighbourhood of 165 x 165 cells (4950 x 4950 m) across the cost map. The maximum cost value between the original cost map and the focal statistics output was assigned to the planning units that intersected a 5-km buffer around the seaward edge of the EEZ. The focal statistics adjustment was repeated using a rectangular neighbourhood of 1200 x 1200 cells to fill in the gap in the north-eastern corner of the EEZ.

The rasters containing the cost values (the three-summed-components raster and each of the two focal statistics rasters) were coded to the planning units using the *zonal statistics as table tool* in Spatial Analyst, using mean values per planning unit. The area (in $km^2$) of each planning unit was added to this score (mean = 2.81, max = 3.06). There were 213 planning units with a final cost value of <0.01 (very tiny corners of planning units at the edge of the planning domain. These values were rounded to 0.01.

The areas of highest cost, which the Marxan algorithm will avoid more strongly, are concentrated along the shelf edge of the western margin, especially in the southwest of the country, and around Brown's Bank. Cost is also high on the shelf closer to the coast between Strandfontein on the west coast all the way to Richards Bay on the east coast, and across the KZN Bight. There are also patches of high cost on the northern west coast shelf and mid slope, and on the east coast lower slope and abyss. The abyssal areas around the southern margin of the EEZ support very few ocean-based activities, and consequently, have a very low cost and level of avoidance. Transport impacts from shipping are the primary driver of cost in these areas.

It is important to keep in mind that the cost layer is an information product that facilitates the algorithm choosing areas of lower cost where there is a choice between two areas of equivalent biodiversity value. However, **even areas of high cost (high level of avoidance) will be selected if that is the only option available for meeting biodiversity targets for particular features. For example, if a Critically Endangered ecosystem type occurs only in areas with lots of other activities (i.e., high cost), those areas will still be selected as a biodiversity priority area. It will then be identified as a site where MSP negotiations will need to be focussed and decisions made whether to safeguard the highly threatened biodiversity or to prioritise economic development.** See also Section 7.1.1.

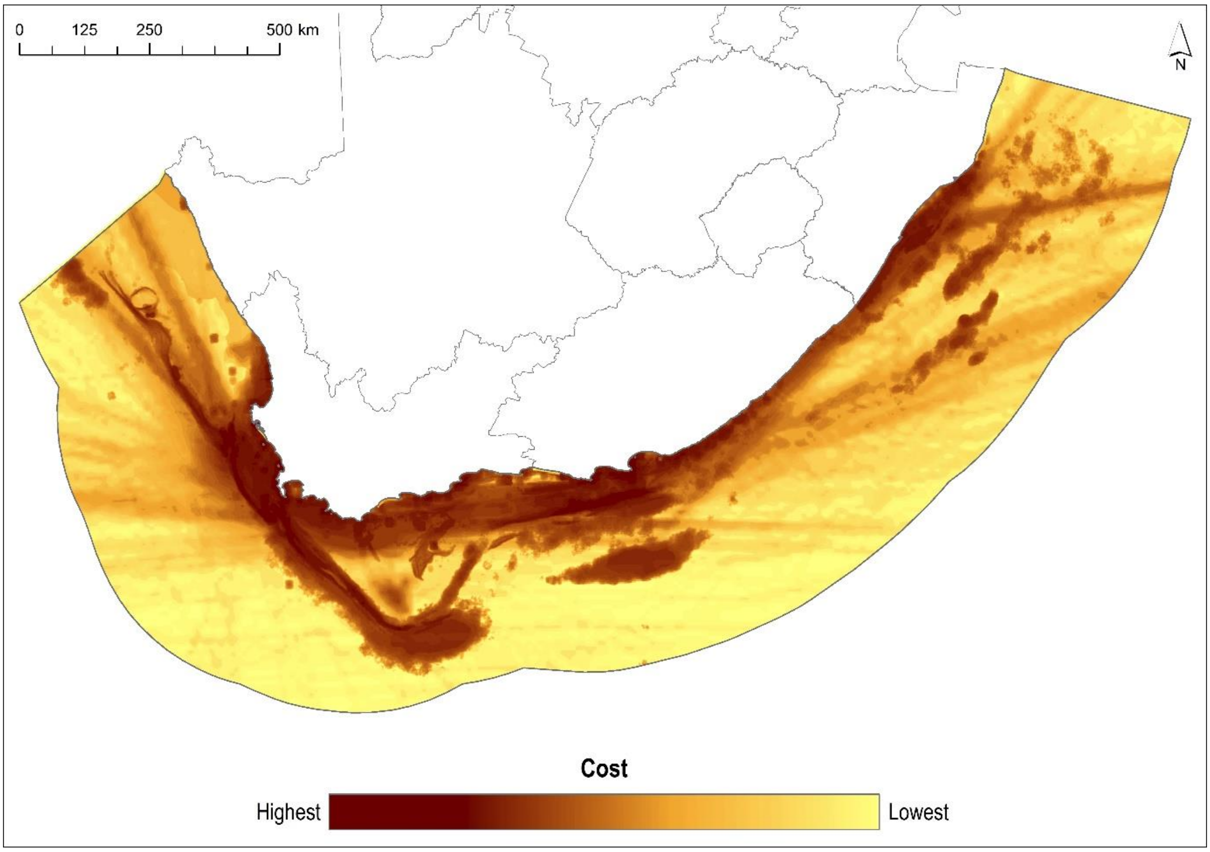



**Figure 176.** *The cost layer (V1.2) is derived from multiple datasets, including data from 19 different sectors, national cumulative impacts to marine ecosystems, and area.* ***Note that the version of the cost layer displayed here was created excluding mining and petroleum (i.e., including 17 of the 19 sectors) because the spatial representation of these two sectors contains confidential data that cannot be shared.***

## 4.6. Biodiversity targets

There are a few examples of quantitative work on setting biodiversity targets in South Africa for vegetation types (Desmet and Cowling 2004), sandy beaches (Harris et al. 2014a), and for marine ecosystems on the west coast margin and shelf (Karenyi et al. 2016). In these cases, targets selected are based on a species-area curve, where the target for an ecosystem type is the proportion of the extent at which 75% (or 80% in the latter study) of the species present would be represented. Given that there are insufficient data to quantify biodiversity targets in this way for most marine ecosystem types, a more heuristic approach was needed. Biodiversity targets were set for all the biodiversity input layers (features and design elements, see Section 4.4), guided by the studies mentioned above, recommendations for target setting from an international literature review (Porter et al. 2011), dedicated target discussions held during sessions of the Biodiversity Planning Forum and the National Biodiversity Assessment, targets used in previous marine systematic biodiversity plans (Majiedt et al. 2013; Sink et al. 2011), guidance provided in the Technical Guidelines, and an updated review of targets and approaches for setting targets (for this analysis), including global recommendations for heuristic targets (IUCN 2003). These sources were used to compile a set of heuristic principles that were systematically applied to the datasets, and targets set for features in other plans were used to benchmark the targets used in this analysis.

Carwardine et al. (2008) note that "targets can be set more objectively by accounting for factors that influence conservation requirements and persistence of biodiversity, for example, natural rarity, life-history characteristics, compositional distinctiveness, biological heterogeneity, exposure and response to natural and anthropogenic threats, and functional importance". This position is supported in other studies in which targets were increased (i.e., above a baseline target) for biodiversity features that had higher heterogeneity, diversity and/or disproportionate contributions to ecological processes; and/or had higher risk or were under higher pressure; and/or were more rare (Harris et al. 2014a; Kirkman et al. 2019; Lagabrielle et al. 2018; Lombard et al. 2007b; Pressey et al. 2003). Similarly for species, studies have demonstrated that the targets make a difference to species representation, and recommendations are that targets should be higher for more rare and more threatened species or species at higher risk (Harris et al. 2014a; Pfab et al. 2011; Pressey et al. 2003; Vimal et al. 2011). However, it is also noted that caution is needed in assigning targets for very large, expansive features (especially where this is due to coarse mapping) because targets that are too high can compromise the efficiency of the plan (SANBI 2017; see also Levin et al. 2015). Therefore, the following heuristic principles were applied:

a. Set baseline targets for a collection of features (e.g., ecosystem types, species foraging areas)
b. Increase baseline target based on:
    i. heterogeneity and diversity
    ii. disproportionate contributions to ecological processes, ecosystem services, or societal value
    iii. rarity and/or smaller distributions
    iv. ecosystem or species threat status, or ecosystems or species with high risk from pressures
    v. pinch-points where connectivity and/or ecological processes would break down without those areas being intact.
c. Decrease baseline target based on:
    i. large extent, especially if the features are represented as presence/absence rather than an amount value representing probability of occurrence, relative use, or population abundance
    ii. certainty (generalised vs fine-scale actual use), i.e., species distribution models (where the distribution metric is a relative probability of occurrence) should receive lower targets than an analysis of movement data (where the distribution metric is a utilization distribution).

The high-level summary of targets used for the biodiversity features is given in Table 2, and for the design elements in Table 3. The targets are then described in more detail below, first for biodiversity features and then design elements, with expanded tables at the end of the section, specifying the targets used for all biodiversity features (Table 4) and design elements (Table 5). (See also Table A.1.1 in Appendix 1 for an analysis of target achievement).

**Table 2.** *High-level summary of biodiversity feature targets, heuristic principles applied (see main text for full names), and references supporting the heuristic principles and/or that used the same or similar targets.*

| Feature | Target (%) | Heuristics applied | References |
|---|---|---|---|
| BIODIVERSITY FEATURES | | | |
| **Ecosystem types** | | | |
| **Baseline target: Ecosystem types** | **30** | **a** | Ban et al. (2009b), CBD (2021), Delavenne et al. (2011), Grantham et al. (2013), Harris et al. (2014a), House et al. (2017), IUCN (2003), IUCN (2016), Jumin et al. (2017), Lagabrielle et al. (2009), O'Leary et al. (2016), Solomon et al. (2003), Svancara et al. (2005), Woodley et al. (2019) |
| • Additional target percentage for higher heterogeneity, diversity, contribution to ecological processes | +10 | b-i, b-ii | Carwardine et al. (2008), Kirkman et al. (2019), Lagabrielle et al. (2018), Lombard et al. (2007a), Pressey et al. (2003) |
| • Reduced target amount for large size (>5000 $km^2$) | -15 | c-i | Hawley and Desmet (2020); SANBI (2017) , Tulloch et al. (2021) |
| **Species** | | | |
| **Baseline target: Critical areas for completing life history stages of threatened species (e.g., colonies or rookeries of relatively small extent)** | **70** | **a** | Grantham et al. (2013), Lagabrielle et al. (2018) |
| **Baseline target: Core use areas** | **50** | **a** | Core use areas were considered to have higher value than general areas where species are found, and thus the target was set to 50%, which is less than critical areas for threatened species (70%) and greater than foraging areas or general distributions of species (30%). |
| **Baseline target: Foraging areas** | **30** | **a** | Studwell et al. (2017), Studwell et al. (2021) |
| **Baseline target: Species distribution** | **30** | **a** | Grantham et al. (2013), Holness et al. (2014), Martin et al. (2007), Runge et al. (2016), Teschke et al. (2021), van Zinnicq Bergmann et al. (2022) |
| • Additional target percentage for threatened, over-exploited, or high-risk species | +<20 | b-iv | Harris et al. (2014a), Lagabrielle et al. (2018) Pfab et al. (2011), Pressey et al. (2003), Rivers-Moore et al. (2021), SANBI (2017), van Zinnicq Bergmann et al. (2022), Vimal et al. (2011) |

| Feature | Target (%) | Heuristics applied | References |
|---|---|---|---|
| BIODIVERSITY FEATURES | | | |
| • Reduced target percentage for features with a large extent | -10 | c-i | Hawley and Desmet (2020), SANBI (2017), Tulloch et al. (2021) |
| • Reduced target percentage for generalised distributions of lower site-specific certainty | -5 | c-ii | SANBI (2017), Tulloch et al. (2021) |
| **Unique, rare or special habitats or features** | | | |
| **Baseline target: Unique habitat/feature** | **80** | **a** | Harris et al. (2014a), Jumin et al. (2017) |
| • Additional target percentage for features with a very small extent that are present in a limited number of sites (planning units) | +10 | b-iii | SANBI (2017) |
| • Reduced target percentage for features with a larger extent | -10 | c-i | Adams et al. (2021), Hawley and Desmet (2020), SANBI (2017), Tulloch et al. (2021) |
| **Baseline target: Special habitat/feature** | **60** | **a** | Ban et al. (2014) |
| • Additional target percentage for features with a very small extent that are present in a limited number of sites (planning units) | +30 | b-iii | SANBI (2017) |
| **Ecological processes** | | | |
| **Baseline target: Ecological processes** | **50** | **a** | Adams et al. (2021), Harris et al. (2014a), Holness et al. (2014) |
| • Additional target percentage for higher heterogeneity, diversity, contribution to ecological processes | +10 | b-i, b-ii | Carwardine et al. (2008), Kirkman et al. (2019), Lombard et al. (2007a), Pressey et al. (2003) |
| • Additional target percentage for features with a very small extent | +10 | b-iii | SANBI (2017) |
| • Additional target percentage for pinch-points | +20 | b-v | Lötter (2015) |
| • Reduced target percentage for features with a larger extent | -10 | c-i | Adams et al. (2021), Hawley and Desmet (2020), SANBI (2017), Tulloch et al. (2021) |
| **Ecological infrastructure** | | | |
| **Baseline target: Ecological infrastructure** | **60** | **a** | As reviewed and concluded by Perschke (2022) |
| **Existing priorities** | | | |
| **Baseline target: Ramsar sites and World Heritage Sites inscribed for natural criteria** | **100** | **a** | Sayer et al. (2018) |
| **Baseline target: Internationally recognised sites of biodiversity priority** | **50** | **a** | Holness et al. (2014), Holness and Oosthuysen (2016) |

| Feature | Target (%) | Heuristics applied | References |
|---|---|---|---|
| BIODIVERSITY FEATURES | | | |
| **Baseline target: Previous spatial prioritisations** | **50** | **a** | Some plans lock in existing priorities (e.g., Hawley and Desmet 2020). We wanted to align with existing priorities but have more flexibility because the existing prioritisations for estuaries and beaches will be updated (see Section 7.2). |
| • Additional target percentage for features with a very small extent | +10 | b-iii | SANBI (2017) |
| • Additional target percentage for pinch-points | +15 | b-v | Lötter (2015) |

**Table 3.** *High-level summary of design element targets, heuristic principles applied and supporting references.*

| Feature | Target (%) | Heuristics applied | References supporting similar baseline targets (and ranges of targets if the heuristics are included) and/or a justification where no references are available |
|---|---|---|---|
| DESIGN ELEMENTS | | | |
| **Edge-matching, and priority and implementation alignment** | | | |
| Existing national and neighbouring priority areas (e.g., MPAs, existing local fine-scale systematic biodiversity plans) | Locked in | a | Ardron et al. (2010), Ban et al. (2009a), Game and Grantham (2008), Maina et al. (2020), Pasnin et al. (2016) |
| Edge-matching with coastal terrestrial priorities | Target of 80% selection for planning units within 1 km of the dune base that comprise at least 66% CBA | a | Holness and Oosthuysen (2016) |
| Design elements that help Marxan preferentially select areas to align with existing conservation and management initiatives where there is otherwise equivalent choice between sites | 50 | a | Holness and Oosthuysen (2016), Maina et al. (2020) |

| Feature | Target (%) | Heuristics applied | References supporting similar baseline targets (and ranges of targets if the heuristics are included) and/or a justification where no references are available |
|---|---|---|---|
| Marine monitoring areas | 10 | a | Current monitoring areas are not required to be kept in a natural / near-natural state as reference sites, but are sites where a lot of data have been/are being collected; therefore, they are included with a lower target. If such reference sites are included in future, the target should be increased for those areas. |
| **Culturally important areas** | | | |
| Sites with high societal and heritage value | 90 | a | Some studies set a 100% target for cultural sites (e.g., Walter and Hamilton 2014). We chose a slightly lower target because this is a biodiversity plan. The intent is to align with areas of high cultural value rather than represent them specifically. |
| Heritage features based on anthropogenic structures | 40 | a | Although some plans include a high target for features like shipwrecks (e.g., Cheng et al. 2015, 80%), we chose a target that was closer to that for reefs because they are artificial structures that have biodiversity and tourism (if shallow enough) value. The intent is to align with these heritage areas rather than represent them specifically. |
| Buffers around important cultural features (e.g., World Heritage Site inscribed for cultural criteria) | 20 | a | Target set to be lower than the baseline target for ecosystem types so that it would not drive selection of new areas, but would help Marxan preferentially select areas around World Heritage Sites inscribed for cultural criteria where there is otherwise equivalent choice between sites. |

| Feature | Target (%) | Heuristics applied | References supporting similar baseline targets (and ranges of targets if the heuristics are included) and/or a justification where no references are available |
|---|---|---|---|
| Engagement with nature (citizen science) | 25 | a | Target set to be slightly lower than the baseline target for ecosystem types so that it would not drive selection of new areas, but would help Marxan preferentially select areas with high nature engagement where there is otherwise equivalent choice between sites. This will help to secure the areas where people are engaging with nature, and contribute to maintaining tourism and the health and well-being benefits of coastal and marine biodiversity. |
| **Ecological condition** | | | |
| Natural ecological condition per ecosystem type | % Extent required to meet the target of the ecosystem type (if possible) | a | Sub-setting the ecosystem type extent into the natural, and natural plus moderately modified components helps Marxan to meet the ecosystem target first in areas of natural ecological condition (because three features overlap here: both of these design elements and the ecosystem type extent); second in areas of moderately modified ecological condition (because there are two overlapping features) and then finally, in the remaining portion of the ecosystem extent. |
| Natural and moderately modified ecological condition per ecosystem type | % Extent required to meet the target of the ecosystem type (if possible) | A | |
| **Climate-change adaptation** | | | |
| Areas per ecosystem type most stable to climate change (sea-surface temperature change) | Ecosystem type target | a | This design element helps Marxan preferentially select areas that meet the ecosystem type targets in areas that have the most stable climate velocity where there is otherwise equivalent choice between sites. |
| Features with steep slopes (seamounts) | 60 | a | Alignment with the Ecological Infrastructure baseline target, and special habitats/features baseline target. |

In terms of setting targets for ecosystem types, the key guiding principles were heterogeneity, diversity, contribution to ecological processes, and extent. The baseline target was set at 30% following many recommendations that support this target amount. An additional 10% target was added to those ecosystem types that are considered to be more diverse, more sensitive (5%) and contribute disproportionately to ecological processes (5%), such that those were included with a 40% target. There are six very large offshore ecosystem types that are each larger than 5000 $km^2$ in total extent, for which a 15% area target was set (deduction of 15% from the baseline target). See Table 2 for references supporting this range of targets, and Table 4 for the detailed targets per ecosystem type.

Targets for species were set based on the extent, rarity, threat status and risk, and importance of the features for life-history stages. The target was lowered slightly if the data were generalised distributions of lower site-specific certainty. Consequently, species feature targets varied from low to high, depending on what the feature represents and the data underpinning the feature (e.g., species distribution model or satellite-tracking data). For example, discrete, important sites for mostly threatened species, e.g., turtle nesting grounds, seal and seabird colonies, were included with high targets (70%-90%) because without these areas, species would not be able to complete their life histories; and modelled species distributions of wide-ranging species (e.g., some of the cetaceans) were included with lower targets (15% baseline, increased by up to 20% for threatened species). See Table 2 for references supporting this range of targets, and Table 4 for the detailed targets per species.

The unique or special features generally have high targets (60-90%) because there are very few known localities for those features, and therefore, they are irreplaceable to near-irreplaceable. Extent and rarity were heuristics applied to these targets. Larger features (e.g., Mallory Slope) were given intermediate targets (70%), and the unique or rare features that were small in extent or based on a few point locations were given higher targets (90%). See Table 2 for references supporting this range of targets, and Table 4 for the detailed targets per feature.

Targets for ecological processes were set based on heterogeneity, diversity, contribution to ecological processes, extent, and importance for connectivity (pinch-points). These were 50% for productivity-related features, and 30-50% for spawning and nursery areas. Estuary fish nursery importance (shores/mouths) have a high target of 80% given the particularly high value of these small areas for spawning and nursery functions (including for commercially important species) and because they are very small areas that are also pinch-points. Coastal ecological infrastructure (EI) was included with a 60% target, which is commonly used for EI. See Table 2 for references supporting this range of targets, and Table 4 for the detailed targets per feature.

Targets for existing priorities were based on what the priority sites are, their extent and importance for connectivity (pinch-points). Ramsar and World Heritage Sites inscribed for natural criteria were given a 100% target because they have high biodiversity importance. Further, in the planning domain, they are mostly already in protected areas. Other internationally recognised sites of biodiversity importance (e.g., EBSAs, IBAs) were given a baseline target of 50%. EBSAs have been identified as priorities that take into account features such as top predator distributions, and ecological process features, e.g., productivity. They are thus an additional surrogate for biodiversity, ecological processes, and to some degree, ecological connectivity. The target was set at 50% partly because EBSAs can include areas of high use by other sectors, sometimes with high levels of impact, and therefore it is preferable to prioritise the most intact portions of these priority areas. Other previous prioritisations for ecosystems got targets of 50% (for priority beaches) and 75% (for priority estuaries, because these are small areas that are also pinch points). See Table 2 for references supporting this range of targets, and Table 4 for the detailed targets per feature.

The remaining input layers were included as design elements (Table 3, Table 5). An important distinction between design elements and biodiversity features is that the targets for design elements are not required to be met. The primary purpose of design elements is to help Marxan preferentially select particular places where there is otherwise equivalent choice between sites, e.g., to align new priorities with existing ones, rather than being included as features that themselves need to be secured for the long term. Further, not all design elements were included with targets, but rather were locked in, meaning that they were coded to be automatically included in the final selection (e.g., MPAs, because these are existing priorities that already contribute to meeting many of the feature targets).

The majority of the design elements relate to edge-matching and aligning priorities with existing initiatives. Existing protected areas and the Namibian EBSA Conservation Zones that touch the South African border were locked into the planning units. This helps Marxan to align priorities both within South Africa and across the border with Namibia (by the algorithm seeking to minimize the boundary-length penalty value) where there is otherwise equivalent choice between sites. The outputs from the Algoa Bay fine-scale systematic conservation plan were also locked into the selection, where identified priority areas were automatically selected, and the remaining portion of the planning domain was made unavailable to Marxan for selection (i.e., locked out). Land-based CBAs were included with an 80% target to help Marxan to align priorities across the land-sea interface where possible. Similarly, a coastal corridor was included in the Gouritz area with a 50% target to align with existing initiatives in the Biosphere Reserve that are expanding into the sea. Portions of under-protected (Not Protected, Poorly Protected) ecosystem types that are within EBSAs but outside of MPAs were included with the half the area-based target as the ecosystem type to help align priorities by meeting feature targets inside EBSAs where there is otherwise comparable choice between sites, because EBSAs are existing priority areas. Further, marine monitoring areas were included with a 10% target to align biodiversity priorities in areas where there are data and monitoring initiatives taking place. Note that the target is relatively low because the management objective of these sites is not necessarily to maintain the area in a natural to near-natural state (because some sites are included for measuring ocean currents rather than as reference sites for biodiversity). If such sites are identified for research and monitored in future, with the intent of maintaining those sites in a natural to near-natural state as reference sites, they would need to be included with a higher target. See Table 3 for references supporting this range of targets, and Table 5 for the detailed targets per feature.

The only World Heritage Site inscribed for cultural criteria in the planning domain is Robben Island. It is included with a 90% target. The buffer around this World Heritage Site was given a lower target (20%) because its inclusion was based on alignment of priority areas around the World Heritage Site itself. Culturally significant sites, including historical and traditional fish traps, got high targets (90%) because the areas are small, discrete localities of high societal importance that should be kept in a natural to near-natural state. Many of these are also rare sites. Shipwrecks in areas of good ecological condition got a lower target (40%) because their inclusion was based largely on aligning biodiversity priorities in areas with heritage value that could have additional potential benefits, e.g., ecotourism through diving in some cases. The target is still moderately high, comparatively, because they are discrete sites that are small in extent. Engagement with nature (using citizen science data as a surrogate) was included with a target that was slightly lower than the baseline target for ecosystem types so that this design element would help Marxan to preferentially select areas where people are engaging with nature where there is otherwise equivalent choice between sites. See Table 3 for references supporting this range of targets, and Table 5 for the detailed targets per heritage feature.

The next group of design elements relate to portions of ecosystem types in the different categories of ecological condition. The natural (good ecological condition) and natural/moderately modified (good and fair ecological condition) portions of each ecosystem type were included as a design element to help Marxan to meet feature targets in the best available ecological condition where there is otherwise comparable choice between sites. To do this, the area ($km^2$) required to meet the target of each ecosystem type (see Table 4) was determined. Then, the proportion of the natural and natural/moderately modified portions of the ecosystem types that gave the same area as the target for the full ecosystem type were determined and applied. In other words, the same area target was applied per ecosystem type, but to the smaller subset of the ecosystem type extent that is in a natural to moderately modified ecological condition. Including ecological condition as a design element in this way helps the algorithm to meet targets first in areas that are natural or near-natural, then in areas that are moderately modified, and only then in areas of poorer ecological condition, such that the most intact sites are preferably chosen to represent each biodiversity feature. This also serves to avoid highly utilised areas and thereby further reduce conflict with other sectors. See Table 3 for references supporting this range of targets, and Table 5 details.

Climate-change adaptation was incorporated by including portions of ecosystem types that have the most stable velocity of climate change (based on sea-surface temperature); these areas were given the same target as the ecosystem type (15-40%). This was to help Marxan to meet the ecosystem target at least partially in areas that have the slowest climate velocity for that ecosystem type. Seamounts were included with a 60% target because they are relatively small areas that potentially have high value for species in the face of climate change. See Table 3 for references supporting this range of targets, and Table 5 for the detailed targets per feature.

**Table 4**. *Summary table of the biodiversity features included in the National Coastal and Marine CBA Map Version 1.2, the feature target, and reference to the dataset. Note that features that are made up of many components (e.g., key bay habitat for whales comprises multiple bays), there may be a target for the whole feature overall and each individual component (i.e., each bay) to avoid the feature target being met at a single location. These are indicated as "overall" and "components", respectively.*

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ecosystem types** | | | | | | | | | | | | |
| Ecosystem types (NBA 2018) | Agulhas Basin Abyss | LC | 15 | 30 | | | | | | -15 | | Sink et al. (2019a); Harris et al. (2019a) |
| | Agulhas Basin Complex Abyss | LC | 30 | 30 | | | | | | | | |
| | Agulhas Blues | NT | 30 | 30 | | | | | | | | |
| | Agulhas Boulder Shore | NT | 30 | 30 | | | | | | | | |
| | Agulhas Coarse Sediment Shelf Edge | VU | 30 | 30 | | | | | | | | |
| | Agulhas Dissipative Intermediate Sandy Shore | LC | 30 | 30 | | | | | | | | |
| | Agulhas Dissipative Sandy Shore | NT | 30 | 30 | | | | | | | | |
| | Agulhas Exposed Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Agulhas Exposed Stromatolite Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Agulhas Inner Shelf Mosaic | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Inner Shelf Reef | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Intermediate Sandy Shore | LC | 30 | 30 | | | | | | | | |
| | Agulhas Island | VU | 30 | 30 | | | | | | | | |
| | Agulhas Kelp Forest | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Lower Canyon | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Mid Shelf Mosaic | NT | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Mid Shelf Reef | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Mixed Shore | NT | 30 | 30 | | | | | | | | |
| | Agulhas Muddy Mid Shelf | CR | 30 | 30 | | | | | | | | |
| | Agulhas Muddy Outer Shelf | NT | 30 | 30 | | | | | | | | |
| | Agulhas Plateau | LC | 30 | 30 | | | | | | | | |
| | Agulhas Reflective Sandy Shore | VU | 30 | 30 | | | | | | | | |
| | Agulhas Rocky Outer Shelf | LC | 30 | 30 | | | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Agulhas Rocky Plateau | LC | 30 | 30 | | | | | | | | |
| Ecosystem types (NBA 2018) | Agulhas Rocky Shelf Edge | LC | 30 | 30 | | | | | | | | Sink et al. (2019a); Harris et al. (2019a) |
| | Agulhas Sandy Inner Shelf | VU | 30 | 30 | | | | | | | | |
| | Agulhas Sandy Mid Shelf | NT | 30 | 30 | | | | | | | | |
| | Agulhas Sandy Outer Shelf | VU | 30 | 30 | | | | | | | | |
| | Agulhas Sheltered Rocky Shore | EN | 30 | 30 | | | | | | | | |
| | Agulhas Stromatolite Mixed Shore | VU | 30 | 30 | | | | | | | | |
| | Agulhas Upper Canyon | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Agulhas Very Exposed Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Agulhas Very Exposed Stromatolite Rocky Shore | NT | 30 | 30 | | | | | | | | |
| | Aliwal Shoal Reef Complex | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Alphard Bank | LC | 30 | 30 | | | | | | | | |
| | Amathole Hard Shelf Edge | VU | 30 | 30 | | | | | | | | |
| | Amathole Lace Corals | NT | 40 | 30 | 5 | 5 | | | | | | |
| | Browns Bank Rocky Shelf Edge | CR | 30 | 30 | | | | | | | | |
| | Cape Basin Abyss | LC | 15 | 30 | | | | | | -15 | | |
| | Cape Basin Complex Abyss | LC | 15 | 30 | | | | | | -15 | | |
| | Cape Bay | EN | 30 | 30 | | | | | | | | |
| | Cape Boulder Shore | VU | 30 | 30 | | | | | | | | |
| | Cape Exposed Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Cape Island | EN | 30 | 30 | | | | | | | | |
| | Cape Kelp Forest | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Cape Lower Canyon | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Cape Mixed Shore | VU | 30 | 30 | | | | | | | | |
| | Cape Rocky Inner Shelf | VU | 30 | 30 | | | | | | | | |
| | Cape Rocky Mid Shelf Mosaic | VU | 30 | 30 | | | | | | | | |
| | Cape Sandy Inner Shelf | VU | 30 | 30 | | | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cape Sheltered Rocky Shore | EN | 30 | 30 | | | | | | | | |
| | Cape Upper Canyon | EN | 40 | 30 | 5 | 5 | | | | | | |
| Ecosystem types (NBA 2018) | Cape Very Exposed Rocky Shore | NT | 30 | 30 | | | | | | | | Sink et al. (2019a); Harris et al. (2019a) |
| | Central Agulhas Outer Shelf Mosaic | LC | 30 | 30 | | | | | | | | |
| | Childs Bank Coral | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Childs Bank Plateau | LC | 30 | 30 | | | | | | | | |
| | Cool Temperate Arid Predominantly Closed | EN | 30 | 30 | | | | | | | | |
| | Cool Temperate Estuarine Lake | EN | 30 | 30 | | | | | | | | |
| | Cool Temperate Large Fluvially Dominated | EN | 30 | 30 | | | | | | | | |
| | Cool Temperate Large Temporarily Closed | CR | 30 | 30 | | | | | | | | |
| | Cool Temperate Micro-estuary | N/A | 30 | 30 | | | | | | | | |
| | Cool Temperate Predominantly Open | EN | 30 | 30 | | | | | | | | |
| | Cool Temperate Small Fluvially Dominated | LC | 30 | 30 | | | | | | | | |
| | Cool Temperate Small Temporarily Closed | EN | 30 | 30 | | | | | | | | |
| | Delagoa Deep Shelf Edge | LC | 30 | 30 | | | | | | | | |
| | Delagoa Lower Canyon | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Delagoa Mixed Shore | LC | 30 | 30 | | | | | | | | |
| | Delagoa Rocky Mid Shelf | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Delagoa Sandy Inner Shelf | LC | 30 | 30 | | | | | | | | |
| | Delagoa Sandy Mid Shelf | LC | 30 | 30 | | | | | | | | |
| | Delagoa Shelf Edge | LC | 30 | 30 | | | | | | | | |
| | Delagoa Upper Canyon | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Delagoa Very Exposed Rocky Shore | LC | 30 | 30 | | | | | | | | |
| | Durnford Inner Shelf Reef Complex | EN | 40 | 30 | 5 | 5 | | | | | | |
| | Durnford Mid Shelf Reef Complex | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Eastern Agulhas Bay | VU | 30 | 30 | | | | | | | | |
| | Eastern Agulhas Outer Shelf Mosaic | LC | 40 | 30 | 5 | 5 | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | False and Walker Bay | VU | 30 | 30 | | | | | | | | |
| | Kei Fluvial Fan | EN | 40 | 30 | 5 | 5 | | | | | | |
| | Kei Reef Mosaic | EN | 40 | 30 | 5 | 5 | | | | | | |
| Ecosystem types (NBA 2018) | Kingklip Koppies | VU | 30 | 30 | | | | | | | | Sink et al. (2019a); Harris et al. (2019a) |
| | Kingklip Ridge | EN | 30 | 30 | | | | | | | | |
| | Kosi Coral Community | LC | 40 | 30 | 5 | 5 | | | | | | |
| | KZN Bight Deep Shelf Edge | EN | 30 | 30 | | | | | | | | |
| | KZN Bight Mid Shelf Mosaic | EN | 40 | 30 | 5 | 5 | | | | | | |
| | KZN Bight Mid Shelf Reef Complex | EN | 40 | 30 | 5 | 5 | | | | | | |
| | KZN Bight Muddy Inner Shelf | VU | 30 | 30 | | | | | | | | |
| | KZN Bight Muddy Shelf Edge | VU | 30 | 30 | | | | | | | | |
| | KZN Bight Outer Shelf Mosaic | VU | 30 | 30 | | | | | | | | |
| | KZN Bight Sandy Inner Shelf | EN | 30 | 30 | | | | | | | | |
| | Leadsman Coral Community | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Namaqua Exposed Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Namaqua Kelp Forest | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Namaqua Mid Shelf Fossils | LC | 30 | 30 | | | | | | | | |
| | Namaqua Mixed Shore | VU | 30 | 30 | | | | | | | | |
| | Namaqua Muddy Mid Shelf Mosaic | LC | 30 | 30 | | | | | | | | |
| | Namaqua Muddy Sands | LC | 30 | 30 | | | | | | | | |
| | Namaqua Sandy Inner Shelf | LC | 30 | 30 | | | | | | | | |
| | Namaqua Sandy Mid Shelf | LC | 30 | 30 | | | | | | | | |
| | Namaqua Sheltered Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Namaqua Very Exposed Rocky Shore | VU | 30 | 30 | | | | | | | | |
| | Natal Boulder Shore | VU | 30 | 30 | | | | | | | | |
| | Natal Deep Shelf Edge | LC | 30 | 30 | | | | | | | | |
| | Natal Delagoa Dissipative Intermediate Sandy Shore | LC | 30 | 30 | | | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Natal Delagoa Dissipative Sandy Shore | NT | 30 | 30 | | | | | | | | |
| | Natal Delagoa Intermediate Sandy Shore | NT | 30 | 30 | | | | | | | | |
| | Natal Delagoa Reflective Sandy Shore | VU | 30 | 30 | | | | | | | | |
| | Natal Exposed Rocky Shore | NT | 30 | 30 | | | | | | | | |
| Ecosystem types (NBA 2018) | Natal Lower Canyon | LC | 40 | 30 | 5 | 5 | | | | | | Sink et al. (2019a); Harris et al. (2019a) |
| | Natal Mixed Shore | VU | 30 | 30 | | | | | | | | |
| | Natal Upper Canyon | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Natal Very Exposed Rocky Shore | NT | 30 | 30 | | | | | | | | |
| | Orange Cone Inner Shelf Mud Reef Mosaic | EN | 40 | 30 | 5 | 5 | | | | | | |
| | Orange Cone Muddy Mid Shelf | EN | 30 | 30 | | | | | | | | |
| | Port St Johns Inner Shelf Mosaic | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Port St Johns Muddy Mid Shelf | VU | 30 | 30 | | | | | | | | |
| | Port St Johns Muddy Shelf Edge | VU | 30 | 30 | | | | | | | | |
| | Protea Mid Shelf Reef Complex | EN | 40 | 30 | 5 | 5 | | | | | | |
| | Sodwana Coral Community | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Southeast Atlantic Lower Slope | LC | 30 | 30 | | | | | | | | |
| | Southeast Atlantic Mid Slope | LC | 30 | 30 | | | | | | | | |
| | Southeast Atlantic Seamount | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Southeast Atlantic Slope Seamount | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Southeast Atlantic Upper Slope | LC | 30 | 30 | | | | | | | | |
| | Southern Benguela Dissipative Intermediate Sandy Shore | LC | 30 | 30 | | | | | | | | |
| | Southern Benguela Dissipative Sandy Shore | LC | 30 | 30 | | | | | | | | |
| | Southern Benguela Intermediate Sandy Shore | NT | 30 | 30 | | | | | | | | |
| | Southern Benguela Muddy Outer Shelf Mosaic | LC | 30 | 30 | | | | | | | | |
| | Southern Benguela Muddy Shelf Edge | EN | 30 | 30 | | | | | | | | |
| | Southern Benguela Outer Shelf Mosaic | LC | 30 | 30 | | | | | | | | |
| | Southern Benguela Reflective Sandy Shore | EN | 30 | 30 | | | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Southern Benguela Rocky Shelf Edge | VU | 30 | 30 | | | | | | | | |
| | Southern Benguela Sandy Outer Shelf | LC | 30 | 30 | | | | | | | | |
| | Southern Benguela Sandy Shelf Edge | VU | 30 | 30 | | | | | | | | |
| | Southern Benguela Shelf Edge Mosaic | LC | 30 | 30 | | | | | | | | |
| | Southern KZN Inner Shelf Mosaic | EN | 40 | 30 | 5 | 5 | | | | | | |
| Ecosystem types (NBA 2018) | Southern KZN Mid Shelf Mosaic | EN | 40 | 30 | 5 | 5 | | | | | | Sink et al. (2019a); Harris et al. (2019a) |
| | Southern KZN Shelf Edge Mosaic | NT | 40 | 30 | 5 | 5 | | | | | | |
| | Southwest Indian Lower Slope | LC | 15 | 30 | | | | | | -15 | | |
| | Southwest Indian Mid Slope | LC | 15 | 30 | | | | | | -15 | | |
| | Southwest Indian Seamount | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Southwest Indian Slope Seamount | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Southwest Indian Upper Slope | LC | 30 | 30 | | | | | | | | |
| | St Helena Bay | VU | 30 | 30 | | | | | | | | |
| | St Lucia Mid Shelf Mosaic | LC | 40 | 30 | 5 | 5 | | | | | | |
| | St Lucia Sandy Inner Shelf | LC | 30 | 30 | | | | | | | | |
| | St Lucia Sandy Mid Shelf | VU | 30 | 30 | | | | | | | | |
| | Subtropical Estuarine Bay | CR | 30 | 30 | | | | | | | | |
| | Subtropical Estuarine Lake | EN | 30 | 30 | | | | | | | | |
| | Subtropical Large Fluvially Dominated | EN | 30 | 30 | | | | | | | | |
| | Subtropical Large Temporarily Closed | EN | 30 | 30 | | | | | | | | |
| | Subtropical Micro-estuary | N/A | 30 | 30 | | | | | | | | |
| | Subtropical Predominantly Open | EN | 30 | 30 | | | | | | | | |
| | Subtropical Small Temporarily Closed | VU | 30 | 30 | | | | | | | | |
| | Trafalgar Reef Complex | EN | 40 | 30 | 5 | 5 | | | | | | |
| | Transkei Basin Abyss | LC | 15 | 30 | | | | | | -15 | | |
| | Tropical Estuarine Lake | VU | 30 | 30 | | | | | | | | |
| | uThukela Canyon | NT | 40 | 30 | 5 | 5 | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | uThukela Mid Shelf Mosaic | VU | 40 | 30 | 5 | 5 | | | | | | |
| | uThukela Mid Shelf Mud Coarse Sediment Mosaic | VU | 30 | 30 | | | | | | | | |
| | uThukela Outer Shelf Muddy Reef Mosaic | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Warm Temperate Estuarine Bay | VU | 30 | 30 | | | | | | | | |
| | Warm Temperate Estuarine Lake | EN | 30 | 30 | | | | | | | | |
| | Warm Temperate Large Fluvially Dominated | VU | 30 | 30 | | | | | | | | |
| Ecosystem types (NBA 2018) | Warm Temperate Large Temporarily Closed | VU | 30 | 30 | | | | | | | | Sink et al. (2019a); Harris et al. (2019a) |
| | Warm Temperate Micro-estuary | N/A | 30 | 30 | | | | | | | | |
| | Warm Temperate Predominantly Open | VU | 30 | 30 | | | | | | | | |
| | Warm Temperate Small Fluvially Dominated | LC | 30 | 30 | | | | | | | | |
| | Warm Temperate Small Temporarily Closed | LC | 30 | 30 | | | | | | | | |
| | Western Agulhas Bay | EN | 30 | 30 | | | | | | | | |
| | Western Agulhas Outer Shelf Mosaic | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Wild Coast Inner Shelf Mosaic | VU | 40 | 30 | 5 | 5 | | | | | | |
| | Wild Coast Mid Shelf Mosaic | LC | 40 | 30 | 5 | 5 | | | | | | |
| | Wild Coast Shelf Edge Mosaic | LC | 40 | 30 | 5 | 5 | | | | | | |
| Pelagic ecosystem types | Pelagic ecosystem type Aa1 | | 15 | 30 | | | | | | -15 | | Roberson et al. (2017) |
| | Pelagic ecosystem type Ab1 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Ab2 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Ab3 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Ba1 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Ba2 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Bb1 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Bb2 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Bc1 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Bc2 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Ca1 | | 15 | 30 | | | | | | -15 | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pelagic ecosystem type Ca2 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Cb1 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Cb2 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Cb3 | | 15 | 30 | | | | | | -15 | | |
| | Pelagic ecosystem type Cb4 | | 15 | 30 | | | | | | -15 | | |
| | | | | | | | | | | | | |
| **Species** | | | | | | | | | | | | |
| Turtles | Turtle nesting grounds | CR + VU | 90 | 70 | | | | 20 | | | | Harris et al. (2015); Nel et al. (2013); King (2019); Harris et al. (2019a) |
| | Loggerhead internesting areas | VU | 70 | 70 | | | | | | | | Harris et al. (2015) |
| | Leatherback internesting areas | CR | 60 | 70 | | | | | | -10 | | |
| | Loggerhead migration routes | VU | 30 | 30 | | | | | | | | Harris et al. (2018) |
| | Leatherback migration routes | CR | 20 | 30 | | | | | | -10 | | |
| Seabirds | Seabird colonies | EN | 90 | 70 | | | | 20 | | | | Dr Stephen Kirkman (DFFE, unpublished data); Sherley et al. (2020); Sherley et al. (2019); Sherley et al. (2017); Crawford et al. (2016); CapeNature (Unpublished) |
| | African Penguin breeding Bird Island (Algoa Bay, draft MIBA) | EN | 60 | 50 | | | | 10 | | | | BirdLife South Africa (2021) |
| | African Penguin breeding Boulders (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin breeding Dassen Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin breeding Dyer Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | African Penguin breeding Robben Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin breeding St Croix Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin breeding Stony Point (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin post-moult Dassen Island (draft MIBA): cluster 1 | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin post-moult Dassen Island (draft MIBA): cluster 2 | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin pre-moult Bird Island (Algoa Bay, draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| Seabirds | African Penguin pre-moult Dassen Island (draft MIBA): cluster 1 | EN | 60 | 50 | | | | 10 | | | | BirdLife South Africa (2021) |
| | African Penguin pre-moult Dassen Island (draft MIBA): cluster 2 | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin pre-moult Dassen Island (draft MIBA): cluster 3 | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin pre-moult Stony Point (draft MIBA): cluster 1 | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin pre-moult Stony Point (draft MIBA): cluster 2 | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin pre-moult Stony Point (draft MIBA): cluster 3 | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Bird Island (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Bird Island (pre-moult) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Boulders Beach (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Dassen Island (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Dassen Island (pre-moult) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Dassen Island (post-moult) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Robben Island (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Stony Point (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: Stony Point (pre-moult) | EN | 60 | 50 | | | | 10 | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aggregated core home range for African Penguins: Dyer Island (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for African Penguins: St Croix Island (breeding) | EN | 60 | 50 | | | | 10 | | | | |
| | African Penguin foraging areas (generalised) | EN | 40 | 30 | | | | 10 | | | | Majiedt et al. (2013), with updates |
| | African Penguin foraging areas (generalised): cluster 1 | EN | 30 | 30 | | | | | | | | |
| | African Penguin foraging areas (generalised): cluster 2 | EN | 30 | 30 | | | | | | | | |
| | African Penguin foraging areas (generalised): cluster 3 | EN | 30 | 30 | | | | | | | | |
| Seabirds | African Penguin foraging areas (generalised): cluster 4 | EN | 30 | 30 | | | | | | | | Majiedt et al. (2013), with updates |
| | African Penguin foraging areas (generalised): cluster 5 | EN | 30 | 30 | | | | | | | | |
| | African Penguin foraging areas (generalised): cluster 6 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised) | EN | 40 | 30 | | | | 10 | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 1 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 2 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 3 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 5 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 6 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 7 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 8 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 9 | EN | 30 | 30 | | | | | | | | |
| | Bank Cormorant foraging areas (generalised): cluster 10 | EN | 30 | 30 | | | | | | | | |
| | Cape Cormorant breeding Dyer Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | BirdLife South Africa (2021) |
| | Cape Cormorant breeding Jutten Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | Cape Cormorant breeding Malgas Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | Cape Cormorant breeding Stony Point (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for Cape Cormorants: Dyer Island | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for Cape Cormorants: Jutten Island | EN | 60 | 50 | | | | 10 | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aggregated core home range for Cape Cormorants: Malgas Island | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for Cape Cormorants: Stony Point | EN | 60 | 50 | | | | 10 | | | | |
| | Cape Cormorant foraging areas (generalised) | EN | 40 | 30 | | | | 10 | | | | Majiedt et al. (2013), with updates |
| | Cape Cormorant foraging areas (generalised): cluster 1 | EN | 30 | 30 | | | | | | | | |
| | Cape Cormorant foraging areas (generalised): cluster 2 | EN | 30 | 30 | | | | | | | | |
| | Cape Cormorant foraging areas (generalised): cluster 3 | EN | 30 | 30 | | | | | | | | |
| | Cape Cormorant foraging areas (generalised): cluster 4 | EN | 30 | 30 | | | | | | | | |
| | Cape Cormorant foraging areas (generalised): cluster 5 | EN | 30 | 30 | | | | | | | | |
| Seabirds | Cape Gannet breeding Bird Island (Algoa Bay, draft MIBA) | EN | 60 | 50 | | | | 10 | | | | BirdLife South Africa (2021) |
| | Cape Gannet breeding Malgas Island (draft MIBA) | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for Cape Gannets: Bird Island | EN | 60 | 50 | | | | 10 | | | | |
| | Aggregated core home range for Cape Gannets: Malgas Island | EN | 60 | 50 | | | | 10 | | | | |
| | Cape Gannet foraging areas (generalised) | EN | 40 | 30 | | | | 10 | | | | Majiedt et al. (2013) |
| | Cape Gannet foraging areas (generalised): cluster 1 | EN | 30 | 30 | | | | | | | | |
| | Cape Gannet foraging areas (generalised): cluster 2 | EN | 30 | 30 | | | | | | | | |
| | Cape Gannet foraging areas (generalised): cluster 3 | EN | 30 | 30 | | | | | | | | |
| | Cape Gannet foraging areas (generalised): cluster 4 | EN | 30 | 30 | | | | | | | | |
| | Atlantic Yellow-nosed Albatross incubation Gough Island | EN | 20 | 30 | | | | | | -10 | | BirdLife South Africa (2021) |
| | Atlantic Yellow-nosed Albatross incubation Nightingale | EN | 20 | 30 | | | | | | -10 | | |
| | Indian Yellow-nosed Albatross post-guard Prince Edward Island | EN | 30 | 30 | | | | | | | | |
| | Wandering Albatross incubation Marion Island | EN | 15 | 30 | | | | | | -15 | | |
| | Wandering Albatross non-breeding Iles Crozet | EN | 20 | 30 | | | | | | -10 | | |
| | Wandering Albatross non-breeding Iles Kerguelen | EN | 15 | 30 | | | | | | -10 | -5 | |
| | Northern Giant Petrel | LC | 20 | 30 | | | | | | -10 | | |
| Cetaceans | Indo-Pacific Bottlenose Dolphin distribution | NT | 25 | 30 | | | | | | | -5 | Purdon et al. (2020a) |
| | Common Dolphin distribution | LC | 15 | 30 | | | | | | -10 | -5 | |
| | Heaviside's Dolphin distribution | NT | 25 | 30 | | | | | | | -5 | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Indian Ocean Humpback Dolphin distribution | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Risso's Dolphin distribution | LC | 15 | 30 | | | | | | -10 | -5 | |
| | Killer Whale distribution | DD | 15 | 30 | | | | | | -10 | -5 | |
| | Bottlenose Whale distribution | LC | 15 | 30 | | | | | | -10 | -5 | |
| | Bryde's Whale distribution (summer and winter merged) | LC | 15 | 30 | | | | | | -10 | -5 | Purdon et al. (2020b) |
| | Humpback Whale distribution (summer and winter merged) | LC | 15 | 30 | | | | | | -10 | -5 | |
| | Southern Right Whale distribution | LC | 15 | 30 | | | | | | -10 | -5 | |
| | Sperm Whale summer distribution | VU | 15 | 30 | | | | | | -10 | -5 | |
| | Sperm Whale winter distribution | VU | 15 | 30 | | | | | | -10 | -5 | |
| Cetaceans | Key bay habitat for whales | | 50 | 50 | | | | | | | | Extracted from Sink et al. (2019a) |
| | Key bay habitat for whales: area 1 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 2 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 3 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 4 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 5 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 6 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 7 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 8 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 9 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 10 | | 30 | 30 | | | | | | | | |
| | Key bay habitat for whales: area 11 | | 30 | 30 | | | | | | | | |
| Seals | Seal colonies | LC | 70 | 70 | | | | | | | | Kirkman et al. (2013) |
| | Seal foraging areas: cluster 1 | LC | 30 | 30 | | | | | | | | Derived from Kirkman et al. (2013) |
| | Seal foraging areas: cluster 2 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 3 | LC | 30 | 30 | | | | | | | | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Seal foraging areas: cluster 4 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 5 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 6 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 7 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 8 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 9 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 10 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 11 | LC | 30 | 30 | | | | | | | | |
| | Seal foraging areas: cluster 12 | LC | 30 | 30 | | | | | | | | |
| Seals | Seal foraging distribution: Black Rocks colony | LC | 30 | 30 | | | | | | | | Kirkman (Unpublished), Botha et al. (2020) |
| | Seal foraging distribution: Kleinzee colony | LC | 30 | 30 | | | | | | | | |
| | Seal foraging distribution: South Coast colonies | LC | 30 | 30 | | | | | | | | |
| Sharks and rays | Core range areas of White Sharks | VU | 55 | 50 | | | | 5 | | | | Kock et al. (in review) |
| | White Shark distributions | VU | 35 | 30 | | | | 5 | | | | |
| | Lesser Guitarfish (summer) | VU | 30 | 30 | | | | 5 | | | -5 | Faure Beaulieu et al. (2021) |
| | Spotted Eagle Ray (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Spotted Eagle Ray (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Copper Shark/Bronze Whaler (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Copper Shark/Bronze Whaler (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Spinner Shark (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Spinner Shark (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Zambezi Shark, Bull Shark (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Zambezi Shark, Bull Shark (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Blacktip Shark (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Blacktip Shark (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Dusky Shark (summer) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Dusky Shark (winter) | EN | 35 | 30 | | | | 10 | | | -5 | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sandbar Shark (summer) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Sandbar Shark (winter) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Spotted Raggedtooth Shark (summer) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | Spotted Raggedtooth Shark (winter) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | White Shark (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | White Shark (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Triangular Legskate (summer) | LC | 25 | 30 | | | | | | | -5 | |
| | Triangular Legskate (winter) | LC | 25 | 30 | | | | | | | -5 | |
| | Blue Stingray (summer) | NT | 25 | 30 | | | | | | | -5 | |
| | Blue Stingray (winter) | NT | 25 | 30 | | | | | | | -5 | |
| Sharks and rays | Slime Skate (summer) | LC | 15 | 30 | | | | | | -10 | -5 | Faure Beaulieu et al. (2021) |
| | Slime Skate (winter) | LC | 25 | 30 | | | | | | | -5 | |
| | Soupfin Shark (summer) | CR | 35 | 30 | | | | 20 | | -10 | -5 | |
| | Soupfin Shark (winter) | CR | 35 | 30 | | | | 20 | | -10 | -5 | |
| | Lined Catshark (aseasonal) | LC | 25 | 30 | | | | | | | -5 | |
| | Tiger Catshark (aseasonal) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Puffadder Shyshark (aseasonal) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Dark Shyshark (aseasonal) | LC | 25 | 30 | | | | | | | -5 | |
| | Izak Catshark (aseasonal) | LC | 25 | 30 | | | | | | | -5 | |
| | Shortfin Mako Shark (summer) | EN | 25 | 30 | | | | 10 | | -10 | -5 | |
| | Shortfin Mako Shark (winter) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Yellowspotted Skate (summer) | VU | 20 | 30 | | | | 5 | | -10 | -5 | |
| | Yellowspotted Skate (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Common Smoothhound/Houndshark (summer) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Common Smoothhound/Houndshark (winter) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Whitespotted Smoothhound/Houndshark (summer) | LC | 15 | 30 | | | | | | -10 | -5 | |
| | Whitespotted Smoothhound/Houndshark (winter) | LC | 25 | 30 | | | | | | | -5 | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Common Eagle Ray (summer) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | Common Eagle Ray (winter) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | Broadnose Sevengill Shark (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Broadnose Sevengill Shark (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Sixgill Sawshark (summer) | LC | 25 | 30 | | | | | | | -5 | |
| | Sixgill Sawshark (winter) | LC | 25 | 30 | | | | | | | -5 | |
| | Pyjama Shark (aseasonal) | LC | 25 | 30 | | | | | | | -5 | |
| | Leopard Catshark (aseasonal) | LC | 25 | 30 | | | | | | | -5 | |
| | Twineye Skate (aseasonal) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Biscuit Skate (summer) | NT | 15 | 30 | | | | | | -10 | -5 | |
| | Biscuit Skate (winter) | NT | 25 | 30 | | | | | | | -5 | |
| Sharks and rays | Whale Shark (summer) | EN | 35 | 30 | | | | 10 | | | -5 | Faure Beaulieu et al. (2021) |
| | Whale Shark (winter) | EN | 35 | 30 | | | | 10 | | | -5 | |
| | Spearnose Skate, White Skate (aseasonal) | EN | 25 | 30 | | | | 10 | | -10 | -5 | |
| | Yellowspotted Catshark (aseasonal) | NT | 25 | 30 | | | | | | | -5 | |
| | Scalloped Hammerhead Shark (summer) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | Scalloped Hammerhead Shark (winter) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | Great Hammerhead Shark (aseasonal) | CR | 45 | 30 | | | | 20 | | | -5 | |
| | Smooth Hammerhead Shark (summer) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Smooth Hammerhead Shark (winter) | VU | 30 | 30 | | | | 5 | | | -5 | |
| | Spotted Spiny Dogfish (aseasonal) | VU (SA=LC) | 25 | 30 | | | | | | | -5 | |
| | African Angelshark (summer) | NT | 25 | 30 | | | | | | | -5 | |
| | African Angelshark (winter) | NT | 25 | 30 | | | | | | | -5 | |
| | Blackspotted Electric Ray (summer) | DD | 25 | 30 | | | | | | | -5 | |
| | Blackspotted Electric Ray (winter) | DD | 25 | 30 | | | | | | | -5 | |
| | Spotted Gully Shark (summer) | LC | 25 | 30 | | | | | | | -5 | |
| | Spotted Gully Shark (winter) | LC | 25 | 30 | | | | | | | -5 | |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Unique or special habitats or features** | | | | | | | | | | | | |
| Unique features | Alexandria dunefield | | 80 | 80 | | | | | | | | Extracted from Harris et al. (2019a) |
| | Mallory Slope | | 70 | 80 | | | | | | -10 | | Digitized from De Wet (2012) |
| | Childs Bank | | 80 | 80 | | | | | | | | Majiedt et al. (2013) |
| | Namaqua fossils | | 80 | 80 | | | | | | | | Extracted from Sink et al. (2019a) |
| | Port Elizabeth Ridge | | 80 | 80 | | | | | | | | |
| | Rhodolith beds | | 90 | 80 | | | 10 | | | | | ACEP Imida, unpublished data; Adams et al. (2020) |
| | Algal dominated reefs | | 90 | 80 | | | 10 | | | | | ACEP Imida, unpublished data |
| | Anemone garden | | 90 | 80 | | | 10 | | | | | ACEP Deep Secrets, unpublished data |
| | Horse mussel aggregations | | 90 | 80 | | | 10 | | | | | ACEP Deep Forests, unpublished data |
| | Aggregations of guitar sharks | | 90 | 80 | | | 10 | | | | | Prof. Kerry Sink (SANBI, unpublished data) |
| | Aggregations of red steenbras | | 90 | 80 | | | 10 | | | | | |
| | Aggregations of wreckfish | | 90 | 80 | | | 10 | | | | | ACEP Imida, unpublished data |
| Special features | Potential cold-water corals | | 90 | 60 | | | 30 | | | | | ACEP Deep Secrets, unpublished data |
| | Potential vulnerable marine indicator species | | 60 | 60 | | | | | | | | Sink and Atkinson (2020); Sink et al. (2021) |
| | Potential vulnerable marine ecosystem features | | 60 | 60 | | | | | | | | Extracted from Sink et al. (2019a); Sink et al. (2021) |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ecological processes** | | | | | | | | | | | | |
| Productivity | Upwelling areas and areas of very high productivity | | 50 | 50 | | | | | | | | NASA GES DISC Giovanni Portal; see Acker and Leptoukh (2007) |
| | *Anaulus* (surf diatom) accumulations | | 50 | 50 | | | | | | | | Harris et al. (2010); Harris (2012); extracted from Harris et al. (2019a) |
| | Beaches with beach-cast kelp wrack | | 50 | 50 | | | | | | | | Harris (2012); extracted from Harris et al. (2019a) |
| Nursery, spawning and aggregation areas | Anchovy nurseries (high egg densities) | | 40 | 50 | | | | | | -10 | | Digitized from Twatwa et al. (2005) |
| | Sardine nurseries (high egg densities) | | 40 | 50 | | | | | | -10 | | |
| | Spawning areas for fish | | 40 | 50 | | | | | | -10 | | Digitized from Hutchings et al. (2002) |
| | Spawning areas for fish: area 1 | | 30 | 30 | | | | | | | | |
| | Spawning areas for fish: area 2 | | 30 | 30 | | | | | | | | |
| | Spawning areas for fish: area 3 | | 30 | 30 | | | | | | | | |
| | Spawning areas for fish: area 4 | | 30 | 30 | | | | | | | | |
| | Nursery areas for fish | | 40 | 50 | | | | | | -10 | | |
| | Nursery areas for fish: area 1 | | 30 | 30 | | | | | | | | |
| | Nursery areas for fish: area 2 | | 30 | 30 | | | | | | | | |
| | Nursery areas for fish: area 3 | | 30 | 30 | | | | | | | | |
| | Squid spawning areas | | 50 | 50 | | | | | | | | Digitized from Roberts et al. (2012) |
| | Estuaries ranked by nursery importance (mouths/shores) | | 80 | 50 | | | 10 | | 20 | | | Van Niekerk et al. (2019b) in Van |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Niekerk et al. (2019a); extracted from Harris et al. (2019a) |
| Connectivity pinch-points | Estuary mouths of flagship free-flowing rivers | | 90 | 50 | 5 | 5 | 10 | | 20 | | | Nel et al. (2011a); Nel et al. (2011b); extracted from Harris et al. (2019a) |
| | Estuary mouths of non-flagship free-flowing rivers | | 80 | 50 | | | 10 | | 20 | | | |
| **Ecological infrastructure** | | | | | | | | | | | | |
| Coastal EI | Coastal protection ecological infrastructure | | 60 | 60 | | | | | | | | Perschke (2022) |
| | Sports events and recreational outdoor activity ecological infrastructure | | 60 | 60 | | | | | | | | |
| **Existing priorities** | | | | | | | | | | | | |
| Globally recognised sites | Ramsar sites | | 100 | 100 | | | | | | | | Ramsar Sites Information Service (2020) |
| | World Heritage Sites inscribed for natural criteria | | 100 | 100 | | | | | | | | UNESCO website; extracted from SAPAD, DFFE (2020b) |
| | SA site (iSimangaliso) in the Network of Sites of Importance for Marine Turtles in the Indian Ocean – South-East Asia Region | | 50 | 50 | | | | | | | | IOSEA website; extracted from SAPAD, DFFE (2020b) |
| | Important Bird and Biodiversity Areas | | 50 | 50 | | | | | | | | Confirmed sites from BirdLife International (2021a, 2021b), received from BirdLife South Africa |

| Feature | | Threat status | Target | a | b-i | b-ii | b-iii | b-iv | b-v | c-i | c-ii | References |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Agulhas Bank Nursery Area EBSA | | 50 | 50 | | | | | | | | MARISMA (2020b) |
| | Algoa to Amathole EBSA | | 50 | 50 | | | | | | | | |
| | Browns Bank EBSA | | 50 | 50 | | | | | | | | |
| | Cape Canyon and Surrounding Islands, Bays and Lagoon EBSA | | 50 | 50 | | | | | | | | |
| | Childs Bank and Shelf Edge EBSA | | 50 | 50 | | | | | | | | |
| | Delagoa Shelf Edge and Canyon Complex EBSA | | 50 | 50 | | | | | | | | |
| | Kingklip Corals EBSA | | 50 | 50 | | | | | | | | |
| | KwaZulu-Natal Bight and uThukela River EBSA | | 50 | 50 | | | | | | | | |
| | Mallory Escarpment and Trough EBSA | | 50 | 50 | | | | | | | | |
| | Namaqua Coastal Area EBSA | | 50 | 50 | | | | | | | | |
| | Namaqua Fossil Forest EBSA | | 50 | 50 | | | | | | | | |
| | Orange Cone EBSA | | 50 | 50 | | | | | | | | |
| Globally recognised sites | Orange Seamount and Canyon Complex EBSA | | 50 | 50 | | | | | | | | MARISMA (2020b) |
| | Protea Banks and Sardine Route EBSA | | 50 | 50 | | | | | | | | |
| | Protea Seamount Cluster EBSA | | 50 | 50 | | | | | | | | |
| | Seas of Good Hope EBSA | | 50 | 50 | | | | | | | | |
| | Shackleton Seamount Complex EBSA | | 50 | 50 | | | | | | | | |
| | Tsitsikamma-Robberg EBSA | | 50 | 50 | | | | | | | | |
| Previous ecosystem priorities | Priority beaches | | 50 | 50 | | | | | | | | Harris (2012) |
| | Shores/mouths of priority estuaries | | 75 | 50 | | | 10 | | 15 | | | Van Niekerk et al. (2019a) |

**Table 5.** *Summary of the design elements and their application in the spatial plan.*

| Feature | | Application | Reference |
|---|---|---|---|
| **Design elements** | | | |
| Edge-matching and priority alignment | Coastal (land-based) and marine protected areas | Locked into the final selection (i.e., 100% target) | Skowno et al. (2019b); Sink et al. (2019d); DFFE (2020b) |
| | Conservation Zones of transboundary EBSAs (in Namibia) | Locked into the final selection (i.e., 100% target) | MARISMA (2020a, 2020b) |
| | Algoa Bay fine-scale systematic conservation plan | Priority areas locked into the final selection (i.e., 100% target); non-priority areas made unavailable for selection (locked out) | Algoa Bay Project (2019) |
| | Terrestrial CBAs | Target of 80% selection for planning units within 1 km of the dune base that comprise at least 66% CBA | Holness and Oosthuysen (2016); Pence (2017); Pool-Stanvliet et al. (2017) Hawley et al. (2019); KZN CBA Irreplaceable version 01022016 (2016); KZN CBA Optimal version 03032016 (2016). |
| | Portions of under-protected (Not Protected, Poorly Protected) ecosystem types that are within EBSAs but outside of MPAs | Half of the area-based target for the ecosystem type | Created from Sink et al. (2019a), MARISMA (2020a), Sink et al. (2019d) |
| | Gouritz coastal corridor (whole corridor, and four corridor components) | Included with a 50% target | Created from Sink et al. (2019a) |
| | Marine monitoring: 3 SAEON sentinel sites | Included with a 10% target | Atkinson et al. (2016) |
| | Marine monitoring: monitoring lines | Included with a 10% target | Atkinson et al. (2016) |
| Heritage sites | World Heritage Sites inscribed for cultural criteria | Included with a 90% target | UNESCO website; extracted from SAPAD, DFFE (2020b) |
| | World Heritage Sites inscribed for cultural criteria: buffer | Included with a 20% target | |
| | Initial compilation of culturally significant sites, e.g., caves and archaeological sites (e.g., Pinnacle Point, Blombos cave), middens, Hole-in-the-wall, Gompho Rock, Shaka's Rock | Included with a 90% target | Harris et al. (2019d), Algoa Bay Project (2019), and personal knowledge |
| | Fish traps | Included with a 90% target | SAHRA (2020) |
| | Sites of heritage value (shipwrecks) in areas of good ecological condition. | Included with a 40% target | SAHRA (2021) |
| | Engagement with nature (citizen science) | Included with a 25% target. | iNaturalist (2021a, 2021b, 2021c, 2021d); Irion and Barron (2021) |

| Feature | | Application | Reference |
|---|---|---|---|
| Ecological condition | Marine ecosystem types in natural to near-natural ecological condition | % Extent required to meet the target of the ecosystem type (if possible) | Sink et al. (2019a); Sink et al. (2019c) |
| | Marine ecosystem types in natural, near-natural or moderately modified ecological condition | | |
| Climate change adaptation | Portions of ecosystem types that have the most stable velocity of climate change (sea-surface temperature) | Same as the ecosystem type target | Rayner et al. (2003, www.metoffice.gov.uk/hadobs (raw data)); Sink et al. (2019a); Prof. David Schoeman, pers. comm |
| | Seamounts | Included with a 60% target | Extracted from Sink et al. (2019a) |

## 4.7. Analysis

### 4.7.1. Marxan parameter calibrations

Prior to running Marxan, it is best practice that all input parameters are calibrated according to the good practices guidelines and user manual (Ardron et al. 2010; Game and Grantham 2008). The **number of iterations** is important to calibrate because it ensures that the length of the annealing routine is long enough to find the global minimum (see Box 3), and thus, the most optimal solution. This parameter was calibrated by running 10 runs of the same scenario, each time increasing the number of iterations by an order of magnitude until more iterations did not improve the solutions (in terms of lowering cost and boundary length). Solutions became less costly and more efficient (shorter boundary length) from 100 million iterations to 1 billion iterations, after which (10 billion iterations), only marginal improvements were made (Figure 177). The amount of time taken to compute the solutions is related to the number of iterations. For these 10 runs, 100 million iterations took 00:40:35 to compute; 1 billion iterations = 03:06:52; and 10 billion iterations = 04:09:21. Therefore, all further runs of Marxan comprised 1 billion iterations because very little was gained by having a longer annealing routine.

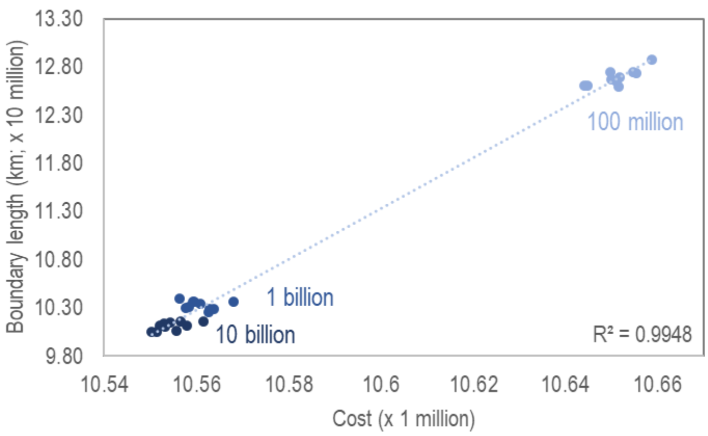



**Figure 177.** *Calibration of the number of iterations (value labels), with the value selected at the point beyond which adding more iterations did not lower boundary length (km) and cost (dimensionless index) much more than the previous number of iterations tested.*

Next, the **boundary length modifier** (blm) was calibrated as a trade-off between solution clustering and cost (Figure 178). Clustered solutions are generally favoured because there is stronger connectivity within selected areas comprising contiguous planning units compared to that of scattered, fragmented selections. There are also advantages for implementation because fewer, more discrete areas of biodiversity priority are more clear and easier to enforce than a scattered selection of very small sites. However, if the blm is set too high, it means that areas of high cost can be selected purely to keep the selected area highly clustered and compact, and are not always essential for meeting biodiversity targets. In turn, this would increase conflict with other sectors in the MSP process, and would have unnecessary real-world consequences in terms of social and economic impact. Thus, the optimum blm value is one that improves clustering for only marginal increases in cost.

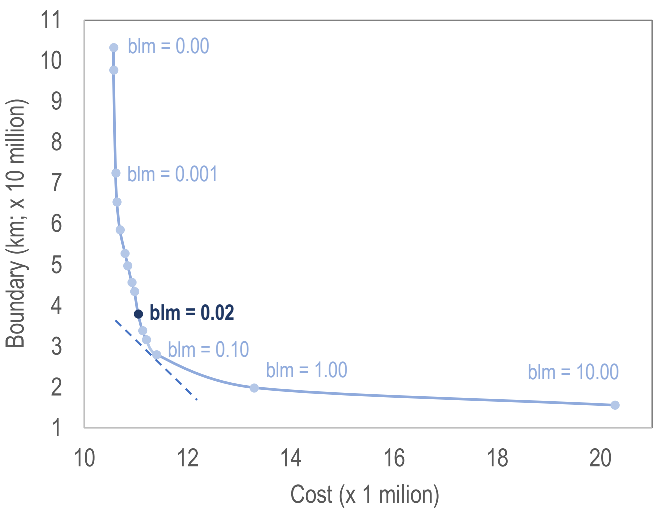



**Figure 178.** *Calibration of the boundary length modifier (blm, value labels on the chart), with the value selected (dark blue) above an approximate tangent to the fitted curve (dashed line), which is the point beyond which more solution clustering (lower boundary length) gave a rapid increase in solution cost.*

To find this value, the standard method for calibrating blm was used, following recommendations in the Marxan Good Practices Handbook (Ardron et al. 2010) and User Manual (Game and Grantham 2008). A run of 10 billion iterations was run for fifteen scenarios, where blm = 0.0000, 0.0001, 0.0010, 0.0015, 0.0025, 0.0380, 0.0050, 0.0075, 0.0100, 0.0200, 0.0350, 0.0500, 0.1000, 1.0000, 10.0000, and all other inputs kept constant. The boundary length initially lowered rapidly with a small increase in blm (0.001), for only a small change in cost. However, between blm =0.02–0.05, the improvements in solution clustering were lower, but cost increased. Beyond this (blm =0.10–10.00), there were low changes in boundary length, and dramatic increases in cost. Strictly speaking, the mathematically optimal blm value is at a tangent to the curve, close to blm = 0.10. However, a value of 0.02 was used because it is still a good trade-off between solution clustering and cost, but by being a bit lower than ‘optimal’, it trades off marginal gains in solution clustering for higher conflict avoidance, which is important for implementation, especially in an MSP context. Also, visual inspection of the outputs showed that a blm of 0.02 produced results with an acceptable level of clustering. This blm value of 0.02 was used for the rest of the scenarios.

The last parameter that requires calibration is the **species penalty factor** (spf). This parameter increases the penalty value for not meeting a feature’s target, making it “worse” for the algorithm to triage a feature’s target than to select sites of high cost in order to meet the feature’s target. The spf was set to 1 for all features, and calibrated by checking target achievement. After the algorithm was run, the outputs were reviewed to determine which features did not meet their targets, and thus, which features required an increase in the spf. However, targets for all biodiversity features (Table 4) were met at a 95% level in the final selection (best solution). Therefore, there was no need to increase the spf.

### 4.7.2. Marxan analysis

We ran two consecutive scenarios of the Marxan analysis, each with 100 runs of the algorithm, using the input settings, data and targets described above. Results from the first scenario, were plotted (Figure 179) as the selection frequency (number of times a planning unit was selected out of the 100 runs of the algorithm) versus the area of that selection (cumulative summed area of the planning units selected at that selection frequency threshold). The data were plotted in this way to calibrate the selection-frequency threshold for irreplaceable to near-irreplaceable CBA 1s (see below). This graph (Figure 179) excludes MPAs, which have a 100% selection frequency because they are locked in to the solutions. The areas selected 100% of the time in scenario 1 (i.e., in all 100 runs), excluding MPAs, comprised 14.4% of the marine territory. Areas selected 90% of the time comprised 17.3% of the marine territory.

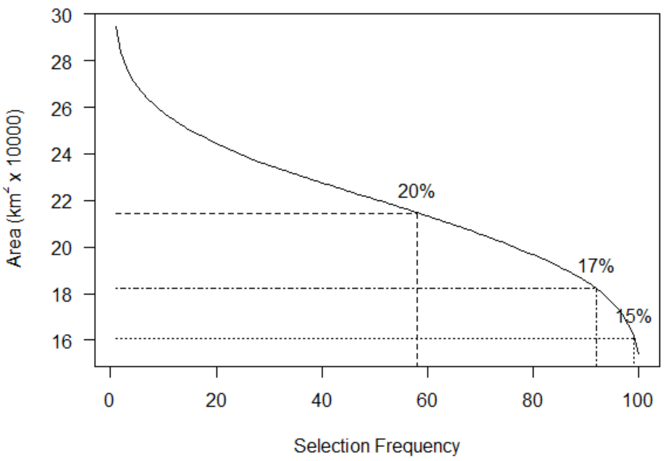



**Figure 179.** *The proportion (percentage) of the total EEZ area selected per selection frequency threshold in scenario 1, excluding MPAs.*

The areas selected at the 90% selection frequency threshold (i.e., 90–100% selection) were locked in to the design, and Marxan was run in a second scenario, with the same settings as before. We iteratively tested at which selection frequency all biodiversity feature targets (Table 4) were met in the second scenario. All biodiversity feature targets were met at a 95% level at a selection frequency of 28%, which comprises 21.5% of the marine territory, excluding MPAs (Figure 180).

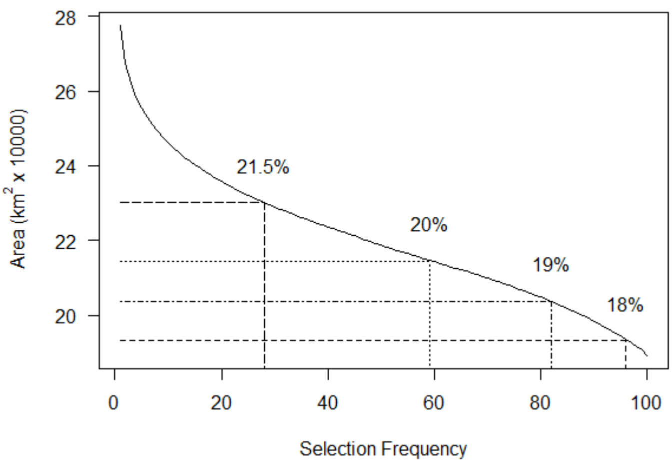



**Figure 180.** *The proportion (percentage) of the total EEZ area selected per selection frequency threshold in scenario 2, excluding MPAs.*

### 4.7.3. Compilation of the CBA Map from Marxan outputs and other criteria

CBA 1s are irreplaceable to near-irreplaceable areas, with the recommendation in the Technical Guidelines that the former are the sites with 100% selection frequency, and the latter have a high selection frequency that can be in the range of 80-90%. However, this threshold is required to be calibrated to avoid spatial inefficiency. Given the extent of the area selected at a selection-frequency threshold of 100% (Figure 179), we used this threshold to define the CBA 1s. CBA 2s are the “best design” sites that are required to meet feature targets but have some degree of choice in their location. We used the areas selected in the second scenario (that were not already selected as CBA 1s) to define the CBA 2s. This included areas identified in the first scenario (90–99% selection frequency, locked in to the second scenario), as well as additional areas identified in the second scenario that were required to meet the feature targets.

Some of the CBAs are not in a natural / near-natural ecological condition but still have high biodiversity importance and are required to meet biodiversity feature targets. Further, the reason a site was selected as a CBA (e.g., African Penguin foraging area) may be a different component of the marine environment (e.g., the water column) from that which is driving the poorer ecological condition at the site (e.g., trawling impacts on the seabed). This prompted a revision of the CBA Map categories (Table 1) to split the CBAs into natural / near-natural areas (CBA Natural) and areas that need to be restored (CBA Restore). By having two types of CBAs allowed splitting the broad management objective into two clear objectives (keep natural areas natural; and restore degraded areas, see Table 6 and Table 7), and accommodated different management recommendations for the two types of CBAs for the MSP process (see Section 6).

For most users of the National Coastal and Marine Spatial Biodiversity Plan, the distinction between CBA Natural 1 and 2, and between CBA Restore 1 and 2 is not needed because the broad management objective, and thus management recommendations, are the same. Therefore, CBAs in the National Coastal and Marine CBA Map (Section 5) and sea-use guidelines (Section 6) are presented with the split between CBA types, i.e., CBA Natural and CBA Restore, because this is most useful for general users. The usefulness in the split between CBA 1s and 2s is primarily for spatial negotiations (e.g. within MSP and for EIAs). This is because CBA 1s are irreplaceable to near-irreplaceable sites where there tends to be very little – if any – alternative option where the underlying biodiversity targets can be met. CBA 2s are best design sites, and there often alternative areas where feature targets can be met, however, these will be of higher cost to other sectors and/or will be larger areas. Details on the splits between these CBA subcategories is given in Appendix 3. Regardless of how they are split, CBAs are generally areas of low use and with low levels of human impact on the marine environment, but can also include some moderately to heavily used areas with higher levels of human impact. Together with MPAs, CBAs are required for meeting biodiversity targets, and therefore the emphasis in CBAs is strict biodiversity conservation to safeguard the biodiversity patterns and ecological processes in these areas. See Section 6 for more details.

The ESAs in the current version of the CBA Map are the portions of EBSAs that are not already selected as MPAs or CBAs, and a 5-km buffer around MPAs (except in Table Bay along the eastern edge of Robben Island MPA, where the buffer was only 1.5 km wide), noting that this could be expanded to include other areas in future iterations. These are often highly used areas that can be heavily impacted, but are still important for biodiversity. The ESAs play a supporting role to the CBAs, where the emphasis in these areas is on managing impacts to biodiversity. The CBA Map categories, management objectives, and criteria for including areas in each of the categories is summarised in Table 6.

**Table 6**. *Summary of the CBA Map categories and features in the National Coastal and Marine CBA Map V1.2.*

| Category | Description | Broad Management Objective |
|---|---|---|
| Protected Area | • Current Marine Protected Areas | As per each Protected Area Management Plan. |
| Critical Biodiversity Area 1 Natural | • Irreplaceable to near-irreplaceable sites (100% selection frequency in Marxan scenario 1) in a natural / near-natural ecological condition | Must be kept in a natural or near-natural state. |
| Critical Biodiversity Area 2 Natural | • Best design sites (sites selected at the 90–99% selection frequency in Marxan scenario 1, and 28–100% in Marxan scenario 2) in a natural / near-natural ecological condition | |
| Critical Biodiversity Area 1 Restore | • Irreplaceable to near-irreplaceable sites (100% selection frequency in Marxan scenario 1) that are no longer in a natural / near-natural ecological condition | Improve ecological condition and, in the long term, restore to a natural / near-natural state, or as near to that state as possible. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration. |
| Critical Biodiversity Area 2 Restore | • Best design sites (sites selected at the 90–99% selection frequency in Marxan scenario 1, and 28–100% in Marxan scenario 2) that are no longer in a natural / near-natural ecological condition | |
| Ecological Support Area | • EBSAs outside of MPAs and not already selected as CBAs<br>• 5-km buffer around MPAs (except for the eastern edge of Robben Island MPA, where the buffer is 1.5 km) | Avoid further deterioration in ecological condition. |

A final step was to align and refine priority areas in two ways. First, the Algoa Bay fine-scale plan (see Section 4.4.7.1) used smaller planning units than those used in the National Coastal and Marine CBA Map. Therefore, when the priority areas for Algoa Bay were locked in to the Marxan analyses for the CBA Map (Table 5), additional area was selected as a result of the larger planning unit size. These additional areas were removed so that the delineation of the CBAs matched the biodiversity priority areas identified in the local, fine-scale plan. Second, the allocation of planning units in the CBA Map were adjusted in the two transboundary EBSAs shared with Namibia to improve alignment across the border and to neaten the EBSA zonation, following similar steps to those envisaged to take place during the MSP process. This required, for example, reallocating fragmented planning units at the edges of the EBSAs to remove slivers of different CBA Map categories, based on the surrounding category to align boundaries. The reallocations included both replacing ESA slivers with additional CBA 1s or 2s (depending on what the adjacent category was), and replacing isolated (i.e., single planning unit) CBA 2s with ESAs. Note, however, that if single planning units were CBA 2s and contained potential VMEs (in any of the VME categories), then these were not reallocated to ESAs. Feature targets were checked and were still met after these minor adjustments were made. The zone-refinement steps taken in the EBSAs are considered a preliminary alignment with the biodiversity priority areas in Namibia, and further transboundary engagement processes are recommended for the MARISMA EBSA project. It is also expected that manual design refinements will be part of the MSP process across the entire marine space. These detailed design refinements will then be fed back into the CBA Map.

The coastal land-based protected areas, CBAs and ESAs were extracted from the existing coastal provincial spatial biodiversity plans for the area within the coastal municipalities (Figure 9). These are displayed together with the National Coastal and Marine Spatial Biodiversity Plan in Appendix 3 to illustrate the alignment in cross-realm spatial biodiversity priorities through the coastal zone.

# 5. National Coastal and Marine CBA Map

The National Coastal and Marine CBA Map comprises four categories of biodiversity priority areas. These are: Protected Areas, Critical Biodiversity Areas (Natural), Critical Biodiversity Areas (Restore), and Ecological Support Areas (Table 7). Within the marine territory, MPAs comprise 5.4%, CBA Natural comprises 18%, CBA Restore comprises 3.6%, and ESAs comprise 6.6% of the extent (Figure 181). This means that 33.6% of the marine territory is in one of the CBA Map categories.

**Table 7.** *Summary of the CBA Map categories in the National Coastal and Marine CBA Map Version 1.2.*

| CBA Map Category | Description | Broad management objective |
|---|---|---|
| Protected Areas | Areas that are formally protected in terms of the National Environmental Management: Protected Areas Act (No. 57 of 2003). They provide formal protection to a representative portion of biodiversity features that could persist into the future. | As per the gazetted purpose and objectives in Protected Area Management Plans. |
| Critical Biodiversity Areas (Natural) | CBAs that are in a natural ecological condition. Together with Marine Protected Areas, and CBA Restore, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs complement MPAs by securing biodiversity for long-term persistence using strict conservation measures. | Maintain in natural or near-natural ecological condition. |
| Critical Biodiversity Areas (Restore) | CBAs that are no longer in a natural ecological condition and that should be restored. Together with Marine Protected Areas, and CBA Natural, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs complement MPAs by securing biodiversity for long-term persistence using strict conservation measures. | Improve ecological condition and, in the long term, restore to a natural / near-natural state, or as near to that state as possible. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration. |
| Ecological Support Areas | ESAs are often highly used areas that can be heavily impacted, but are still important for marine biodiversity patterns, ecological processes, and ecosystem services. ESAs play a supporting role to CBAs and MPAs, where the emphasis in ESAs is on managing impacts to biodiversity. | Avoid further deterioration in ecological condition. |

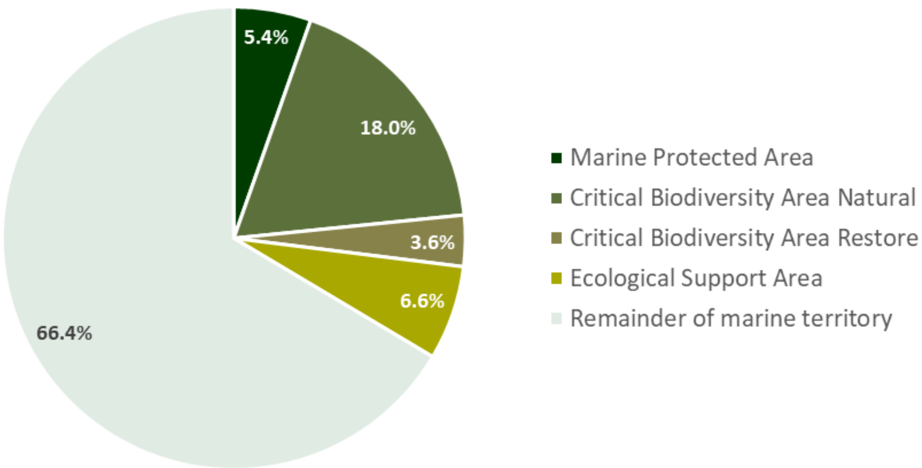



**Figure 181.** *Proportions of South Africa's mainland marine territory in each of the CBA Map categories.*

There are many priority areas for biodiversity along the South African coast, and on the Agulhas Bank where ecosystem type heterogeneity and diversity are high (Figure 182), especially along the east coast, and at the ecoregional (biogeographic) breaks (refer to Figure 6). The slope and abyssal ecosystem types on the western and eastern flanks of the EEZ are large and relatively uniform, with some of the new species information (and spatial efficiency and cost) guiding selection in these areas. Areas on the coast, shelf and shelf edge tend to be more heavily utilized and impacted, which is why almost all the CBA Restore sites are in these areas. They are mainly present along the south and south-west areas around the mainland. The reason for less of the offshore extent being selected as CBAs and ESAs, particularly along the east coast, is a combination of fewer datasets (see Figure 155), greater uniformity of areas further offshore, and lower targets for these very large ecosystem types (Table 2, Table 4). Many of the biodiversity targets are met inside the EBSAs, which is expected because these are priority areas that have been identified in previous systematic assessments.

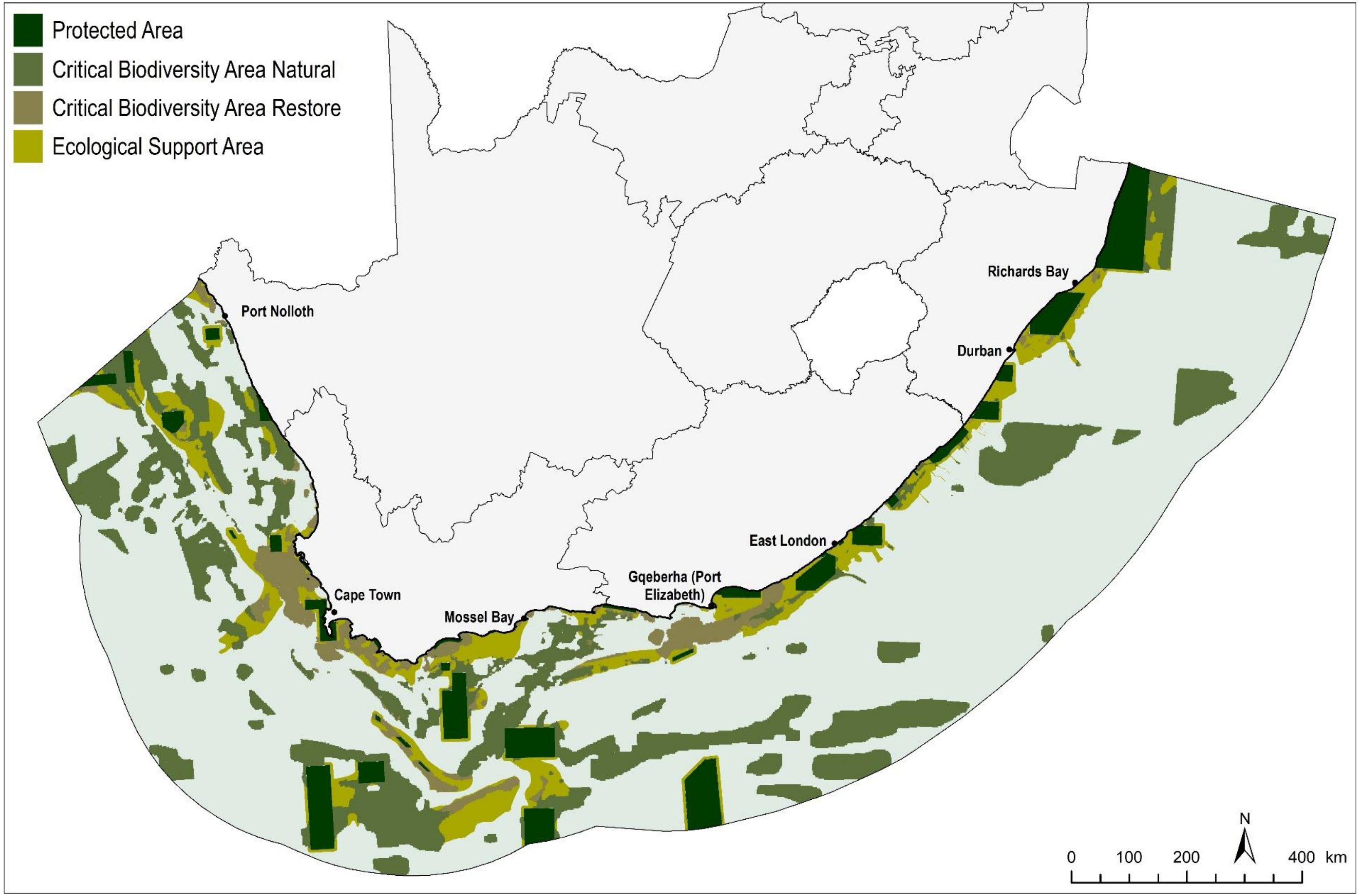



**Figure 182.** *National Coastal and Marine CBA Map Version 1.2 (Released: 12-04-2022).*

# 6. Sea-use guidelines

This section provides the sea-use guidelines to accompany the National Coastal and Marine CBA Map. These guidelines enhance the use of the CBA Map in a range of planning and decision-making processes, including Marine Spatial Planning (MSP), Integrated Coastal Zone Management (ICZM), and Environmental Impact Assessments (EIAs). Although land-use guidelines are well established from a long history in developing land-based spatial biodiversity plans (see Appendix 3), the sea-use guidelines have been developed for the first time through the iterative development of this National Coastal and Marine Spatial Biodiversity Plan (see Section 7.4, Figure 1, and Figure 183). The MSP process, currently underway in terms of the Marine Spatial Planning Act (Act No. 16 of 2018), is a key focus and application of the sea-use guidelines. The version of the sea-use guidelines presented below therefore reflects some of the discussions from the initial stages of the MSP process. **Note that there are likely to be changes to the sea-use guidelines as the MSP process unfolds. Users should make sure they have the most up-to-date version, which may or may not be the one in this technical report.**

## 6.1. Approach to developing the sea-use guidelines and links with the MSP process

As explained in the Introduction, the National Coastal and Marine CBA Map and sea-use guidelines form the basis for the biodiversity sector's input into, *inter alia*, the multi-sectoral MSP process. Current proposed zones for MSP are being developed (e.g., The Approach to a Spatial Management System for South Africa's Marine Planning Areas; Department of Environmental Affairs 2019), with the Biodiversity Zones likely to comprise a Strict Biodiversity Conservation Zone (including Marine Protected Areas, Biodiversity Conservation Areas, and Biodiversity Restoration Areas as three separate sub-categories), and a Biodiversity Impact Management Zone. Marine Protected Areas will be managed according to their gazetted regulations. The intention is that the CBAs and ESAs and sea-use guidelines inform the other MSP Biodiversity Zones and management regulations, respectively (Figure 183).

Each CBA Map category has a broad management objective (as explained in Section 3.1 and summarised in Table 7). Briefly, these objectives are: CBA Natural sites should be kept natural or near-natural; CBA Restore sites should improve in ecological condition; and ESAs should not deteriorate further in ecological condition (see Table 7 for the full management objectives). This means that activities within these areas need to be managed in a way that the management objective can be realised. To do this, each activity needs to be assessed in terms of its compatibility with the respective management objectives. The outcome of this assessment is that an activity is either compatible, not compatible, or has restricted compatibility with the management objective of the CBAs and ESAs. The compilation of compatibility assessments for all activities forms the sea-use guidelines that accompany the CBA Map (Figure 183). In turn, these guidelines form the basis for the management recommendations for each of the biodiversity zones in the MSP process. For example, if an activity is not compatible with the management objective of a zone, the management recommendation is that the activity is not permitted to take place in that zone (Figure 183).

The CBA Map and sea-use guidelines (jointly, the National Coastal and Marine Spatial Biodiversity Plan) are then included in the MSP process as the biodiversity sector's input into the multi-sector negotiations. There are likely to be iterative adjustments made to the CBA Map and sea-use guidelines through the MSP stakeholder engagement and negotiation processes (see also Figure 1). For example, where areas of conflict are identified, potential spatial adjustments to the biodiversity priority areas could be explored to try to find alternative areas in which to meet targets. Note, though, that viable options may be limited or possibly not available for features that are irreplaceable to near-irreplaceable, and finding alternative areas in which to meet targets may not be possible. In terms of adjustments to the sea-use guidelines, one example might be if sectors request that their activities are split into more appropriate components that have different impacts to biodiversity and thus, different compatibility rankings with the management objectives, and in turn, have different management recommendations. The results of the MSP process and MPA expansion process will be fed back into future updates of the National Coastal and Marine Spatial Biodiversity Plan to ensure alignment and to ensure that all biodiversity features still meet their targets (Figure 183). Descriptions of the Biodiversity Zones in the national MSP and recommended links to the CBA Map are given in Table 8.

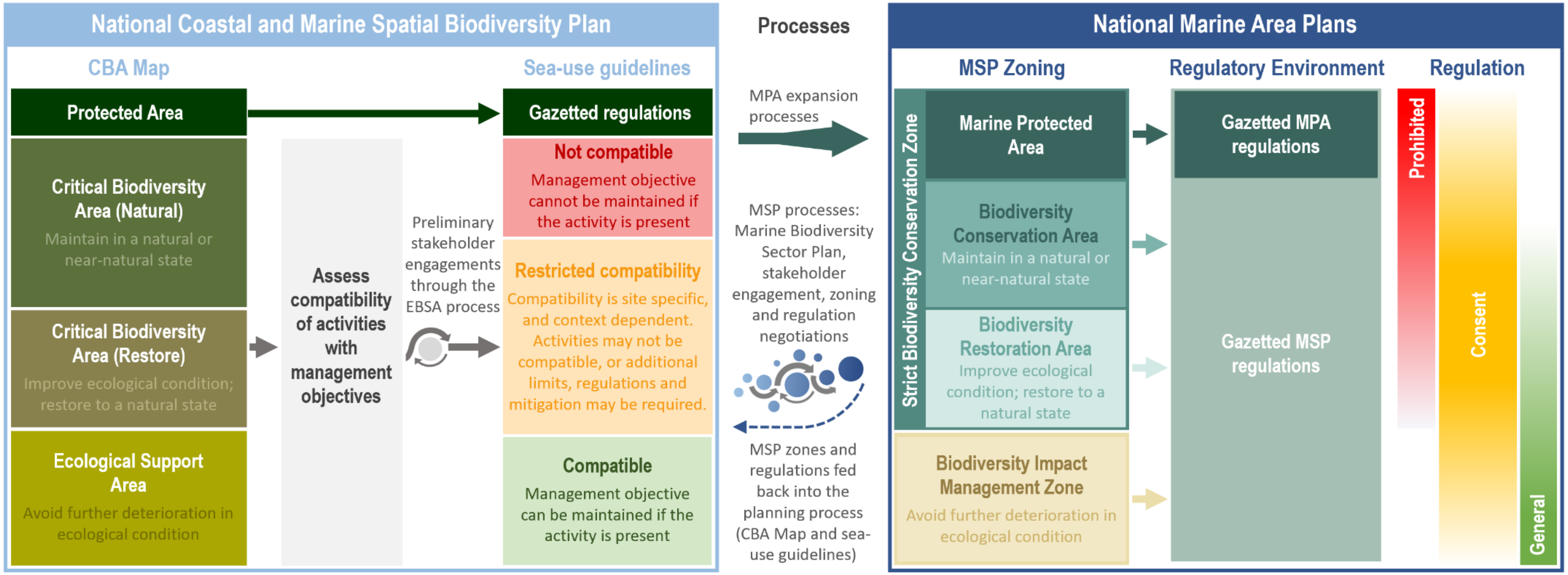



**Figure 183.** *Schematic diagram illustrating that the National Coastal and Marine Spatial Biodiversity Plan (comprising the Map of Critical Biodiversity Areas and Ecological Support Areas (CBA Map) and sea-use guidelines) will inform the Marine Area Plans through the Marine Biodiversity Sector Plan (DFFE 2022), and will be iteratively adjusted through the MSP stakeholder engagement and negotiation processes. The process for deriving the sea-use guidelines is also shown, indicating that it is based on an assessment of activity compatibility with the management objective of CBA Natural (maintain in a natural or near-natural state), CBA Restore (improve ecological condition, restore to a natural state) and ESAs (avoid further deterioration in ecological condition). Note that MPA expansion (focussing on CBAs) will also take place. MPA expansion is related to, but not part of MSP: the MPA gazetting process requires additional consultation and public participation steps (beyond the MSP process) to meet the requirements of the National Environmental Management: Protected Areas Act. The outcomes of the MSP and MPA expansion processes will be incorporated into the Marine Area Plans and will be fed back into future updates of the National Coastal and Marine Spatial Biodiversity Plan.*[6]

[6] Importantly, in addition to the specific areas that need to be secured through MSP in the Biodiversity Zones, environmental management measures must be applied beyond these zones as well. These measures are the set of overall principles and regulations applied throughout South Africa's marine territory. They represent key aspects of marine management and include all relevant non-spatial management processes and requirements for the sustainable use of marine resources, such as: ecosystem-based management of fisheries; seasonal fisheries regulations, quotas and size limits; required regulatory processes and associated impact assessments; and measures required to manage climate change impacts, introduction of alien invasive species, under-water noise, and disaster-risk management. However, because the CBA Map focusses on the specific management of particular places, this range of relevant environmental management measures applied throughout the marine space is not included here.

**Table 8.** *Overview of the Biodiversity Zones in the national marine spatial plan, proposed broad spatial regulations and explanation.*

| Type of zone | Sub-category | Spatial regulations | Justification |
|---|---|---|---|
| **Strict Biodiversity Conservation Zone** | **Marine Protected Areas** | Marine Protected Areas (MPAs) declared under the National Environmental Management: Protected Areas Act (NEMPA) and managed as per their gazetted NEMPA MPA regulations. Activities that are not permitted in the regulations will not be allowed to take place in these areas. | In the Strict Biodiversity Conservation Zone, key biodiversity features will be maintained in a natural or near-natural state, or as near to this state as possible, through strict place-based conservation measures with associated regulation of human activities.<br><br>These will include current designated MPAs regulated in terms of NEMPA, Biodiversity Conservation Areas, and Biodiversity Restoration Areas that require strict conservation management measures regulated in terms of the Marine Area Plan.<br><br>Biodiversity Conservation Areas and Biodiversity Restoration Areas are controlled by the regulations as per the legally binding Marine Area Plans that are informed by the requirements to protect the features that underpin their original selection as CBAs.<br><br>Additional areas for MPAs would be informed by the National Protected Areas Expansion Strategy (particularly the protection targets), MPA focus areas, Protected Area implementation feasibility, and alignment with other sectors. The MPA gazetting process requires additional consultation and public participation steps (beyond the MSP process) to meet the requirements of NEMPA. |
| | **Biodiversity Conservation Areas** | These are the areas identified as CBAs that will be managed by the Marine Area Plan and its regulations, informed by the rationale for their selection as CBAs. Activities that are not permitted in the regulations and/or marine area plan will not be allowed to take place in these areas. | |
| | **Biodiversity Restoration Areas** | These are areas identified as CBA Restore. These are areas of high biodiversity importance that are not in a natural or near-natural condition that will be managed by place-based regulations, informed by the reasons for their selection. | |
| **Biodiversity Impact Management Zone** | | These are areas identified as Ecological Support Areas in the CBA Map. These areas will be managed by place-based regulations, informed by the reasons for their selection. | In the Biodiversity Impact Management Zone, negative impacts of human activities on key biodiversity features are managed and minimised to maintain the features in at least a functional, semi-natural state and/or to allow the area to improve in ecological condition. |

### 6.2. Sea-use guidelines

As noted above, the sea-use guidelines are based on activity compatibilities with the management objectives of CBAs and ESAs (Figure 183). This evaluation of activity compatibility is based on the principles underlying the evaluation of the IUCN Red List of Ecosystems criterion C3, which is based on the extent and severity of environmental degradation from a reference condition of natural (Bland et al. 2017). It therefore draws from the ecosystem-pressure matrix from the NBA 2018 marine assessment (Table 23 on pg 261-262 of Sink et al. 2019c), and the principles tabulated below (Table 9). The full conceptual framework is explained in Box 4. The cross-walk from the CBA Map categories to high-level MSP zones is given (Table 10, see also Table 8), also showing which MSP zones could be broadly compatible with the broad management objective for each CBA Map category.

## Box 4. Concepts underpinning the sea-use guidelines

The sea-use guidelines are based on an assessment of activity compatibility with the management objectives of CBAs and ESAs. Because the management objectives relate to the ecological condition of the site, the extent and severity of degradation resulting from an activity is considered in the compatibility assessment to determine whether the management objective could still be maintained if the activity were present. A compatibility matrix was thus compiled as part of a conceptual framework for evaluating each activity, indicating which combinations of extent and severity of degradation are compatible, not compatible or have restricted compatibility with the management objectives of the different CBA Map categories. This matrix was informed by the IUCN Red List of Ecosystems criterion C3 and the NBA 2018 Marine assessment of ecological condition, which are both based on the same principles.

| Type of activity | Critical Biodiversity Area (Natural)<br>*Compatibility with the management objective: to keep the area in a natural / near-natural state* | Critical Biodiversity Area (Restore)<br>*Compatibility with the management objective: to improve ecological condition and, in the long term, restore to a natural / near-natural state, or as near to that state as possible. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration.* | Ecological Support Areas<br>*Compatibility with the management objective: to avoid further deterioration in ecological condition.* |
|---|---|---|---|
| Activities that could result in **Severe or Very Severe degradation** over **broad areas** (includes activities that have a high disaster risk) | **Not compatible** | **Not compatible** | **Restricted compatibility** |
| Activities that could result in **Severe or Very Severe degradation** of **localised sites** but do not result in degradation across broad areas | **Not compatible** | **Not compatible** | **Restricted compatibility** |
| Activities that could result in or contribute to **Moderate degradation** over **broad areas** | **Not compatible** | **Restricted compatibility** | **Compatible** |
| Activities that could result in or contribute to **Moderate degradation** over **localised sites** | **Restricted compatibility** | **Restricted compatibility** | **Compatible** |
| Activities that could result in **low to very low degradation** and/or are not managed by biodiversity zones | **Compatible** | **Compatible** | **Compatible** |

**Management recommendations:**

- **Compatible:** Activities should be allowed and regulated by current general rules. Notwithstanding, there should still be duty of care, possibly requiring monitoring and evaluation programmes, to avoid unintended cumulative impacts to the biodiversity features for which this area is recognised.
- **Restricted compatibility:** A robust site-specific, context-specific assessment is required to determine the activity compatibility depending on the biodiversity features for which the site was selected. Particularly careful attention would need to be paid in areas containing irreplaceable to near-irreplaceable features where the activity may be more appropriately evaluated as not permitted. The ecosystem types in which the activities take place may also be a consideration as to whether or not the activity should be permitted, for example. Where it is permitted to take place, strict regulations and controls over and above the current general rules and legislation would be required to be put in place to avoid unacceptable impacts on biodiversity features. Examples of such regulations and controls include: exclusions of activities in portions of the zone; avoiding intensification or expansion of current impact footprints; additional gear restrictions; and temporal closures of activities during sensitive periods for biodiversity features.
- **Not compatible:** The activity should not be permitted to occur in this area because it is not compatible with the management objective. If it is considered to be permitted as part of compromises in MSP negotiations, it would require alternative CBAs and/or offsets to be identified. However, if this is not possible, it is recommended that the activity remains prohibited within the CBA.

**This report: Table 9**

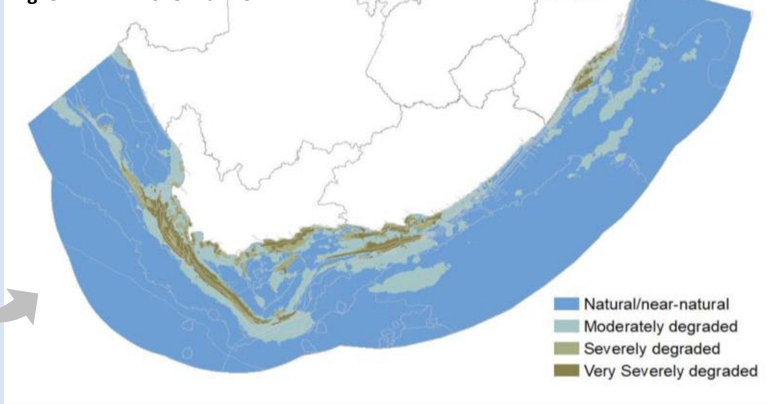
The **IUCN Red List of Ecosystems Criterion C3** is based on environmental degradation from a reference condition of natural depending on the extent and severity of degradation. Criterion C3 has the following thresholds for ecosystem threat status:

| | | Relative severity of degradation | | |
|---|---|---|---|---|
| | | **Very severely degraded** (IUCN C3: ≥90; NBA2018: impact score ≥90) | **Severely degraded** (IUCN C3: ≥70; NBA2018: impact score ≥70) | **Moderately degraded** (IUCN C3: ≥70; NBA2018: impact score ≥70) |
| **Extent of degradation (%)** | ≥90 | Critically Endangered | Endangered | Vulnerable |
| | ≥70 | Endangered | Vulnerable | |
| | ≥50 | Vulnerable | | |

See next page.

In the NBA 2018 Marine assessment, the categories of **ecological condition** were aligned to the Criterion C3 thresholds, such that >90% degradation is **Very severely degraded**; >70% degradation is **Severely degraded**; >50% degradation is **Moderately degraded**; and <50% degraded is **Natural to near-natural**.

**Fig. 81 in NBA 2018 Marine**




Based on the proportion of each ecosystem type in each of the degradation categories, an ecosystem threat status category was assigned in the NBA 2018, as per the table for Criterion C3 above.

To support the above assessment of ecological condition in the NBA 2018, the **functional impact and recovery time of each activity** per broad ecosystem group was scored using information from the literature and expert opinion. The scores were presented on a 0-100 scale, and **calibrated to the same thresholds** of 50, 70, and 90 as used in Criterion C3.

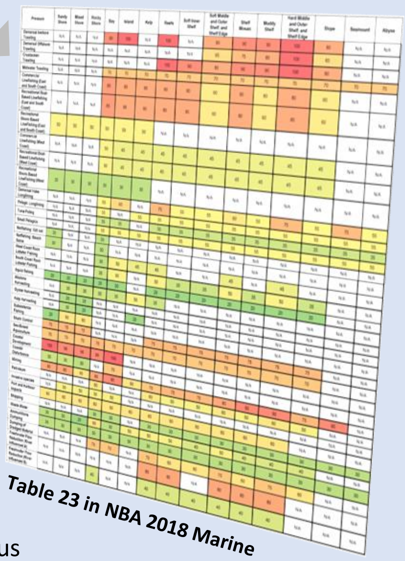


Table 23 in NBA 2018 Marine

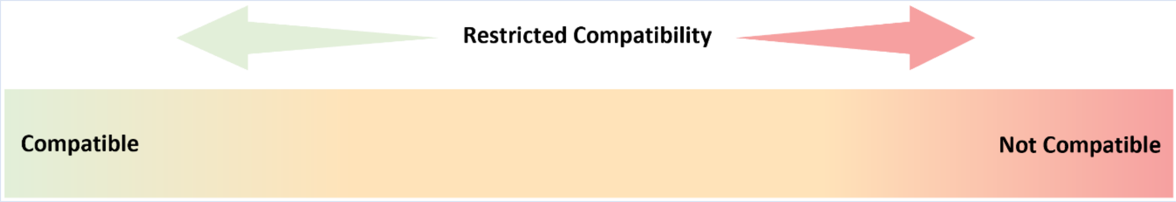
Therefore, when developing a **conceptual framework** and set of rules by which **activities could be evaluated against the management objectives of CBAs and ESAs**, a similar logic was applied as in the assessment of ecological condition and the IUCN Red List of Ecosystems Criterion C3, whereby **both the severity of ecological degradation and the extent of that degradation was taken into account**.

The scores from the ecosystem pressure matrix served as a broad guide as to the level of degradation that an activity could cause, and thus how they key out on the compatibility matrix at the top of this box (Table 9 in the main text), recognising the variability across ecosystem types and other biodiversity features, and noting that some pressures or activity components were not considered as part of the NBA.

For example, activities that had high scores (70-100) for functional impact and recovery time in the ecosystem-pressure matrix are those that could cause Severe or Very Severe degradation over either broad or localised areas (refer to the IUCN RLE matrix above), and thus could result in (or at least contribute to) a deterioration in ecological condition. Consequently, those activities are not compatible with the management objectives of CBAs, which are to maintain the site in a natural to near-natural state (CBA Natural) or to improve ecological condition and restore to a natural to near-natural state, or as near to that state as possible (CBA Restore).

Where activities have components with different levels of severity of degradation, risk of degradation, or extent, these were split into separate activities for the sea-use guidelines (e.g., petroleum and mining consist of different types of prospecting, mining and operations, exploration, production, pipelines, etc.). Therefore, each separate activity will have a different compatibility with CBAs and ESAs. Activity descriptions/names in the sea-use guidelines were also aligned with those that are used by the industry in MSP.

Importantly, **restricted compatibility** includes the full spectrum of contexts in which an activity is compatible through to contexts in which it is not compatible.




For example: small pelagics fishing could be compatible in CBAs that are identified primarily for benthic features because the activity does not necessarily have a direct impact on benthic ecosystems. However, it could be not compatible in CBAs surrounding colonies of breeding, threatened seabirds, e.g., Endangered African Penguins, because these seabirds need the sardines and anchovies for food.

Factors that drive this range in compatibility, and therefore drive whether an activity that has restricted compatibility can be permitted at a particular site, and the conditions and regulations to which it should be subject, include: the ecosystem type in which the activity occurs; the benthic versus pelagic component of the ecosystem type in which the activity occurs; the intensity of the activity; current ecological condition of the site; gear types, etc. Management recommendations, conditions and regulations for these activities need to deliberately take into account the context in which they take place or are proposed to take place (see Table 9). It is also critical to take cumulative impacts into account, which may have implications for the intensity, extent or even presence of activities, especially new or expanding activities in a biodiversity priority area. This is to avoid the tyranny of small decisions (Odum 1982), whereby significant, deleterious, unintended consequences come about as a result of small, seemingly inconsequential decisions. This also links to the IUCN RLE framework, which considers the collective severity of degradation, rather than piecemeal contributions. Particularly within CBAs, it is important to avoid expanding the diversity, intensity and footprint of activities, including of activities that are already present.

As previously mentioned, the current sea-use guidelines also take into account initial discussions as part of the MSP process. For example, consideration was given to: activities that are currently operating within identified CBAs; high-level government goals to mitigate climate change; and increasing benefits from biodiversity to vulnerable communities. This resulted in more leniency for renewable energy installations, and small-scale fishing, for example. These adjustments help to ensure that the sea-use guidelines are practical and implementable without negatively impacting other national high-level socio-economic imperatives. These kinds of adjustments are anticipated to continue, potentially with some place-specific decisions around practicality, and inevitable pragmatic considerations (e.g., economic necessity, trade-off negotiations as part of MPA expansion, etc).

**Table 9**. *Principles for assessing compatibility of activities within the CBA Map categories, and recommendations for management of those activities.*

| **Type of activity** | **Critical Biodiversity Area (Natural)**<br>*Compatibility with the management objective: to keep the area in a natural / near-natural state* | **Critical Biodiversity Area (Restore)**<br>*Compatibility with the management objective: to improve ecological condition and, in the long term, restore to a natural / near-natural state, or as near to that state as possible. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration.* | **Ecological Support Areas**<br>*Compatibility with the management objective: to avoid further deterioration in ecological condition.* |
|---|---|---|---|
| Activities that could result in **Severe or Very Severe degradation** over **broad areas** (includes activities that have a high disaster risk) | **Not compatible** | **Not compatible** | **Restricted compatibility** |
| Activities that could result in **Severe or Very Severe degradation** of **localised sites** but do not result in degradation across broad areas | **Not compatible** | **Not compatible** | **Restricted compatibility** |
| Activities that could result in or contribute to **Moderate degradation** over **broad areas** | **Not compatible** | **Restricted compatibility** | **Compatible** |
| Activities that could result in or contribute to **Moderate degradation** over **localised sites** | **Restricted compatibility** | **Restricted compatibility** | **Compatible** |
| Activities that could result in **low to very low degradation** and/or are not managed by biodiversity zones | **Compatible** | **Compatible** | **Compatible** |

**Management recommendations:**

- **Compatible:** Activities should be allowed and regulated by current general rules. Notwithstanding, there should still be duty of care, possibly requiring monitoring and evaluation programmes, to avoid unintended cumulative impacts to the biodiversity features for which this area is recognised.
- **Restricted compatibility:** A robust site-specific, context-specific assessment is required to determine the activity compatibility depending on the biodiversity features for which the site was selected. Particularly careful attention would need to be paid in areas containing irreplaceable to near-irreplaceable features where the activity may be more appropriately evaluated as not permitted. The ecosystem types in which the activities take place may also be a consideration as to whether or not the activity should be permitted, for example. Where it is permitted to take place, strict regulations and controls over and above the current general rules and legislation would be required to be put in place to avoid unacceptable impacts on biodiversity features. Examples of such regulations and controls include: exclusions of activities in portions of the zone; avoiding intensification or expansion of current impact footprints; additional gear restrictions; and temporal closures of activities during sensitive periods for biodiversity features.
- **Not compatible:** The activity should not be permitted to occur in this area because it is not compatible with the management objective. If it is considered to be permitted as part of compromises in MSP negotiations, it would require alternative CBAs and/or offsets to be identified. However, if this is not possible, it is recommended that the activity remains prohibited within the CBA.

**Table 10**. *Overview of CBA Map categories, broad management objective, and recommended MSP Zones that are broadly compatible with the desired state. The boldfaced MSP zone is the one that is informed by the CBA Map category for each row.*

| CBA Map Category | Description | Broad Management Objective | Recommended MSP Zones |
|---|---|---|---|
| Protected Areas | Areas that are formally protected in terms of the National Environmental Management: Protected Areas Act (No. 57 of 2003). | As per the gazetted purpose and objectives in Protected Area Management Plans. | **Strict Biodiversity Conservation Zone: Marine Protected Areas** Additional broad compatibility with: Marine Tourism; Heritage Protection; Fisheries Resource Protection |
| Critical Biodiversity Areas (Natural) | Areas that must remain in natural or near-natural ecological condition in order to meet biodiversity targets. | Maintain in natural or near-natural ecological condition. | **Strict Biodiversity Conservation Zone: Biodiversity Conservation Areas** Additional broad compatibility with: Marine Tourism; Heritage Protection; Fisheries Resource Protection |
| Critical Biodiversity Areas (Restore) | Areas where ecological condition should be improved and restored to a natural or near-natural ecological condition (or as close to this state as possible) in order to meet biodiversity targets. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration. | Improve ecological condition and, in the long term, restore to a natural / near-natural state, or as near to that state as possible. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration. | **Strict Biodiversity Conservation Zone: Biodiversity Restoration Areas** Additional broad compatibility with: Marine Tourism; Heritage Protection; Fisheries Resource Protection |
| Ecological Support Areas | Areas where further deterioration in ecological condition must be avoided in order to support ecological functioning, biodiversity patterns, and/or delivery of ecosystem services. | Avoid further deterioration in ecological condition. | **Biodiversity Impact Management Zone** Additional broad compatibility with: Marine Tourism; Heritage Protection; Commercial Fishing; Small-Scale Fishing; Fisheries Resource Protection; Aquaculture Development; Renewable Energy; Military; Maritime Transport; Underwater Infrastructure |

More detail is provided on specific activities in each MSP zone that are likely to be compatible or incompatible with the management objectives for CBAs and ESAs (Table 11). Activities are classified into those that are compatible, not compatible, and those that may be compatible subject to certain conditions (restricted). For example, CBA Natural should be maintained in a natural or near-natural state, which means that low-impact tourism activities such as scuba diving are likely to be compatible with CBA Natural, whereas other activities such as mining operations are not compatible with CBA Natural because such activities degrade the natural state. Note that these guidelines (Table 11) set out the minimum recommendations for management of activities. The recommendations do not override existing controls on an activity (e.g., gillnetting) or where prohibitions are already in place (e.g., ammunition dumping, which is no longer a legal activity in South Africa, or spatial or seasonal closures of certain fisheries).

**Table 11**. *Sea-use guidelines Version 1.2 (Released 12-04-2022). List of all sea-use activities, grouped by their broad sea use and Marine Spatial Planning (MSP) Zones, and categorised according to their compatibility with the management objective of Critical Biodiversity Areas (CBA-N = CBA Natural; CBA-R = CBA Restore) and Ecological Support Areas (ESA). Activity compatibility is given as Y = yes, compatible, R = restricted compatibility, or N = not compatible. Marine protected areas (MPAs) are managed according to their gazetted regulations.*

| Broad sea use | Associated MSP Zones | Associated sea-use activities | MPA | CBA-N | CBA-R | ESA |
|---|---|---|---|---|---|---|
| Conservation | Biodiversity Zones | Expansion of place-based conservation measures (e.g., MPA expansion) | Sea-use activities as per gazetted MPA regulations | Y | Y | Y |
| Recreation and tourism | Marine Tourism Zone | Beach recreation, non-motorised water sports | | Y | Y | Y |
| | | Ecotourism (e.g., shark cage diving, whale watching) | | Y | Y | Y |
| | | SCUBA diving | | Y | Y | Y |
| | | Motorised water sports (e.g., jet skis) | | R | R | Y |
| | | Recreational fishing (e.g., shore-based, boat-based and spearfishing) | | N | R | Y |
| | | Shark control: exclusion nets | | Y | Y | Y |
| | | Shark control: drumlines and gillnets | | N | R | Y |
| Heritage | Heritage Conservation Zone | Protection of sites of heritage importance, including historical shipwrecks | | Y | Y | Y |
| | | Protection of sites of seascape value | | Y | Y | Y |
| Fisheries | Commercial and Small-Scale Fishing Zones | Abalone harvesting | | R | R | Y |
| | | Linefishing | | N | R | R |
| | | Demersal shark longlining | | N | R | Y |
| | | Demersal hake longlining | | N | R | R |
| | | Midwater trawling | | N | R | Y |
| | | Pelagic longlining | | R | R | Y |
| | | Small pelagics fishing | | N | R | Y |
| | | South coast rock lobster harvesting | | R | R | Y |
| | | Squid harvesting | | R | R | Y |
| | | Tuna pole fishing | | R | R | Y |
| | | West coast rock lobster harvesting | | R | R | Y |
| | | Crustacean trawling | | N | N | R |
| | | Demersal hake trawling (inshore and offshore) | | N | R | R |
| | | Hake handlining | | R | R | Y |
| | | Seaweed harvesting | | R | R | Y |
| | | Commercial white mussel harvesting | | R | R | Y |
| | | Beach seining | | R | R | Y |
| | | Gillnetting | | R | R | Y |
| | | Kelp harvesting | | R | R | Y |
| | | Oyster harvesting | | R | R | Y |
| | | Small-scale fishing | | R | R | Y |
| | Fisheries Resource Protection Zone | Resource protection | | Y | Y | Y |
| Aquaculture | Aquaculture Zone | Sea-based aquaculture | | N | R | R |
| Mining | Mining Zone | Mining: prospecting (non-destructive) | | R | R | R |
| | | Mining: prospecting (destructive, e.g., bulk sampling) | | N | N | R |
| | | Mining: mining construction and operations[1] | | N | N | R |
| Petroleum | Petroleum Zone | Petroleum: exploration (non-invasive) | | R | R | R |
| | | Petroleum: exploration (invasive, e.g., exploration wells) | | R | R | R |
| | | Petroleum: production[1,2] | | N | N | R |
| | | Petroleum: oil and gas pipelines | | N | N | R |
| Renewable Energy | Renewable Energy Zone | Renewable energy installations | | N | R | R |
| Defence | Military Zone | Military training and practice areas | | R | R | Y |
| | | Missile testing grounds | | R | R | Y |
| Transport | Maritime Transport Zone | Designated shipping lanes (including port approach zones) | | R | R | Y |
| | | Anchorage areas | | R | R | Y |
| | | Bunkering | | N | N | R |
| | | Ports and harbours (new) | | N | N | R |
| | | Dumping of dredged material | | N | N | R |

| Broad sea use | Associated MSP Zones | Associated sea-use activities | MPA | CBA-N | CBA-R | ESA |
|---|---|---|---|---|---|---|
| Infrastructure | Underwater Infrastructure Zone | Pipelines (excluding oil and gas) | | N | R | Y |
| | | Undersea cables (new installations) | | N | R | Y |
| | Land-based Infrastructure Zone | Coastal development (new installations, including piers, breakwaters, and seawalls)[3] | | N | N | R |
| Abstraction and Disposal | Disposal Zone | Waste-water (new installations) | | N | R | Y |
| | Sea-water abstraction and disposal | Sea-water abstraction and disposal (e.g., desalination) | | R | R | Y |
| | | Sea-water abstraction and disposal (e.g., aquaculture disposal) | | N | R | Y |

[1] The activity should not be permitted to occur in CBAs because it is not compatible with the respective management objectives. However, if significant mineral or petroleum resources are identified during prospecting/exploration, then the selection of the site as a CBA could be re-evaluated as part of compromises negotiations in current or future MSP processes. This would require alternative CBAs and/or biodiversity offsets to be identified. However, if it is not possible to identify alternative CBAs to meet targets for the same biodiversity features that are found at the site, it is recommended that the activity remains prohibited.

[2] The recommended prohibition of the activity in CBAs (because it is not compatible with the management objective) refers to the location of the biodiversity disturbance rather than the location of the petroleum resource. If petroleum production is possible using lateral drilling or other techniques that do not result in any impacts on biodiversity within the CBAs, then production may be treated as an activity with restricted compatibility (i.e., recommended to be a consent activity).

[3] New coastal development should not be permitted in CBA Restore sites unless it is part of rehabilitation and restoration activities to improve ecological condition.

The sea-use guidelines presented here (Table 11) build on the proposed management recommendations from preliminary stakeholder engagement through the EBSA process. They still require further engagement with stakeholders to refine what is proposed (Figure 1, Figure 183). The MSP process is required to include robust stakeholder engagement and negotiations among sectors, which is likely where most of these discussions will take place, but we welcome additional preliminary engagements with sectors who feel that their ocean-based activities are not adequately represented in the guidelines (e.g., some of the activities may need to be split into their respective components if it is sensible for the management recommendations to be different for those different components).

Improved place-based protection within biodiversity priority areas is necessary. This requires additional MPA declaration or expansion, implementation of other effective area-based conservation measures (OECMs), and sector-specific regulations, particularly in CBAs. It is recommended that focus areas, based largely on the CBAs, are identified for MPA declaration or expansion, which could be prioritised in terms of improving biodiversity representation of the existing MPA estate, among other criteria. These focus areas could then be taken forward in a separate, dedicated process to expand the MPA network to secure biodiversity features and contribute towards meeting South Africa's national protected area expansion targets and international obligations. It is also recommended that this has a robust and inclusive stakeholder engagement process from the outset.

# 7. Current limitations and plans and recommendations for future work

> **CBA Map will always aim to use the best available data to represent biodiversity features and cost information, and it is recognised that this information will be updated over time. We welcome and encourage submissions to inform future updates. To contribute data, see the EBSA Portal for options.**

This section describes the current recognised limitations in the National Coastal and Marine Spatial Biodiversity Plan, and proposes ways to address these. Future improvements can be achieved by including a variety of new datasets (Section 7.1), revising some of the technical aspects in the methods (Section 7.2) and related prioritisations (Section 7.3), and refining the sea-use guidelines (Section 7.4). Recommendations for revisions to the Technical Guidelines are also given (Section 7.5). Progress has been made to address some of these aspects through the initial beta versions of the National Coastal and Marine Spatial Biodiversity Plan, and will continue through the next updates, including iterative changes made through the MSP process.

## 7.1. Additional data

The intent is that the National Coastal and Marine Spatial Biodiversity Plan is always based on the best-available information, which will necessitate iterative refinements over time to incorporate new data and updates from stakeholder negotiations in the MSP Process (Figure 1, Figure 183). Numerous datasets have been identified for inclusion in future iterations of the National Coastal and Marine CBA Map (see Appendix 2). We will continue to add more data through the future updates as current information is made available, and new research is undertaken and made available. **Experts are welcomed and encouraged to provide additional data that contribute to any aspect of the input data (biodiversity features, design elements, and human-use (cost) information).** The options for contributing data and providing feedback are given on the EBSA Portal. The South African Marine Science Symposium (SAMSS) provides an important forum for engagement with the marine science community. A workshop is planned for the upcoming symposium, where building the science base for assessment, planning and management in the coastal and marine environment will be discussed (see Appendix 4). This will provide a key opportunity to review available datasets and to discuss future research priorities. Further, DFFE's Marine Information Management System (MIMS: http://data.ocean.gov.za), which is still under development, will be an important source of datasets and will facilitate access to the data needed for future iterations.

### 7.1.1. Unmapped areas of high cost

The map representing cost (level of avoidance of other activities) has advanced substantially through the initial beta versions of the National Coastal and Marine Spatial Biodiversity Plan, with the initial framing around cumulative impact to the latest framing that explicitly includes two components for conflict avoidance (see Section 4.5.8). Further, the input datasets have also been refined. At first, we used the data from the NBA 2018 (Majiedt et al. 2019; Sink et al. 2019c) as the best available data for representing cost; recognising that there were shortcomings because those data focus on current and historical impact rather than areas that are of high value for current and future use. For some sectors (e.g., some fisheries), the areas of current highest use are the areas of high value for that sector, and thus the current intensity of use is a good metric for the level of avoidance in spatial prioritisation for marine biodiversity. However, for other sectors, this is not the case, especially for new, emerging and expanding sectors, e.g., petroleum, mining, aquaculture, new fisheries, and renewable energy.

Some initial engagements have been undertaken to change the level of avoidance from current and historical use for some emerging sectors to better capture areas of intended activities in the short to medium term. For example, engagement with petroleum rights holders and the Petroleum Agency South Africa has reframed the map of avoidance of petroleum activities from avoiding only existing well heads, to avoiding (at different levels) production rights, areas of high, medium and low prospectivity, and exploration rights as well. Similarly, areas of different value for mining exploration have been included over and above the existing footprint of mining, and the proposed aquaculture development zones are now included as well. Furthermore, the current intensity of use may also have changed for some activities since compilation of the maps for the NBA 2018 and need to be updated, which has been the case for some, but not all, of the fisheries. We will continue to work with all sectors to refine and validate their priority areas represented in the cost layer for future updates of the National Coastal and Marine Spatial Biodiversity Plan, and include refinements to areas of future importance to these sectors based on changing priorities and/or new information where necessary. The need for updated and improved data was highlighted in the research priorities and priority actions reflected in the NBA 2018 Marine assessment report (Sink et al. 2019b). It is our intention to combine efforts and update the pressure layers for the next NBA and improve the cost layer for future iterations of the CBA Map simultaneously.

Another sector with unmapped areas of high cost is small-scale fisheries (SSF). In the absence of existing data to reflect SSF areas, and following discussions with members of the Coastal Connections working group from the ACEP Deep Connections and One Ocean Hub (OOH) projects, plans were made to create an interim data layer that could be used in the next iteration of the cost layer as one of the cost elements for conflict avoidance. In this way, we can reduce overlap between biodiversity priority areas and priority areas for small-scale fishers. In the longer term, iteratively improved, fine-scale maps of areas of strategic importance for the SSF sector can be developed and incorporated to refine inclusion of this sector in biodiversity planning. See also Section 7.1.5.

**The intent of all these engagements and updates is to further refine compilation of a cost layer that best avoids areas of high value to other sea-use activities (i.e., high conflict) as far as possible, while still meeting biodiversity objectives.** In this way, MSP negotiations can be limited to only those areas that are legitimately contested space; it would eliminate unnecessary conflict and streamline any decision-making, declaration of protected areas and other implementation. Therefore, continued development of the fine-scale map showing areas of high value for other activities that can be included in future versions of this CBA Map will be to the benefit of both these activities and the biodiversity sector.

It is important to note that the discussions to date are not the stakeholder engagement process mandated to be part of the MSP process. These are preliminary engagements undertaken by the biodiversity sector as an additional step to compile an input for the MSP process that has the highest likelihood of implementation and requires the least

**Further engagement to refine the input cost data, where necessary, is encouraged.**

Any sectors that have evidence that the maps in Section 4.5.2–4.5.6 do not adequately represent their activities – particularly if any areas are missing – are encouraged to contact us and to provide the data required to improve avoidance.

amount of multi-sector negotiation because it has already taken into account the areas of importance for other users, as far as possible. It is anticipated that the MSP stakeholder engagement process will require further modifications to biodiversity spatial priorities and/or regulations, and will require compromises to be made by all sectors, before the national Marine Area Plan is finalised.

### 7.1.2. Species data

The National Coastal and Marine Spatial Biodiversity Plan contains a number of the most readily accessible species datasets; however, we acknowledge that this is not yet comprehensive. Further inclusion of species data (notably, fish and invertebrates) is a priority. If such data can be collated and provided, they can be included in the next updates of the CBA Map. There would also likely need to be a **workshop to determine which species are not adequately represented by their associated ecosystem types and need to be included as separate features**. Species that require particular attention are rare, threatened or protected species, indicator species of vulnerable marine ecosystems, species of commercial importance, and any other species of special concern. Inclusion of fish species is also a key priority for the next iterations. It is important to recognise that some species requirements may be better addressed under their Biodiversity Management Plans, and that modelled species' distributions should be included only where confidence in the map is high. Migratory species may be useful in terms of incorporating ocean connectivity into the prioritisation. The species included in the latest versions of the National Coastal and Marine CBA Map will also be reviewed and discussed at the next SAMSS.

Further, many of the species (cetaceans, sharks, rays) are represented by species distribution models, where the relative values are based more on a probability of presence than necessarily relative use, as is in the case for the turtles, seals and seabirds. In many cases, more data are required to be able to generate maps of relative use. Further, there are also unrepresented species, e.g., Blue Whales, which have been detected in acoustic surveys, but there are insufficient data to map the presence of these animals in the South African EEZ. These datasets will also be iteratively improved as more data become available.

### 7.1.3. Ecological corridors and connectivity

The Technical Guidelines place strong emphasis on ecological corridors, especially for ESAs, and it is one of the required minimum input datasets. This is because ecological corridors are an important component of a CBA Map; their inclusion makes provision for unimpeded movement of species through the land- or seascape as they adapt to changing conditions, thus allowing shifts in species' distributions, helping to safeguard their persistence. This is particularly important in terms of climate change. One key difference between terrestrial and marine planning is that there are many land-uses that potentially block landscape connectivity, e.g., built-up areas; but this is not the case in the marine environment. There are very few activities that present a physical barrier to species movement in the sea because it is inherently more connected than the land because of the water medium.

There needs to be **engagement with the marine scientific community to determine what these ecological corridors might be, and how they could be mapped**. Possible options that could be explored are:

- Aggregating tracking data from migratory marine species to determine seascape-level migratory pathways

- Mapping the "centre of gravity" of ocean currents
- Identifying any known areas of larval dispersal
- Identifying key areas of land-sea connectivity that are not accounted for in edge-matching the terrestrial, inland aquatic, estuarine and marine prioritisations
- Exploring climate connectivity through the trajectories of climate velocity
- Including other climate refugia and corridors or networks of sites for species adaptation and range shifts along thermal gradients (see Annexure 1 and Appendix 2).
- Exploring options (e.g., those listed above) for generating connectivity matrices that could be incorporated as connectivity data for use in the recently released programme, Marxan Connect (Daigle et al. 2020).

As described in Box 2 above (Section 3.3), there are many tools to incorporate connectivity in the marine realm that can be explored: the key challenge is data availability at a national scale. **The connectivity of the network of selected sites should also be tested.**

#### 7.1.4. Ecological infrastructure and ecological processes

Ecological infrastructure refers to "naturally functioning ecosystems that generate or deliver valuable services to people. It is the nature-based equivalent of built infrastructure, and is just as important for providing services and underpinning economic development" (SANBI 2016). Ecological infrastructure can be included as a biodiversity feature in a systematic biodiversity plan, where this information exists.

There is **current work being undertaken to map coastal and marine ecological infrastructure** (e.g., coastal protection), and to explore novel approaches to target setting for these features. Some of these datasets have been completed and included in this iteration. Maps of other ecological infrastructure (e.g., strategic fisheries resource areas) can be included in the next versions of the National Coastal and Marine CBA Map as soon as the data are available. We also encourage other scientists to undertake projects that map additional coastal and marine EI.

The inclusion of large-scale ecological processes in the National Coastal and Marine CBA Map improved through the initial beta versions, but is still limited. Areas that are important for key ecological processes will need to be mapped and included as biodiversity features. An initial set of ecological processes that could be included in future iterations have been listed in Appendix 2; these will also be discussed at the next SAMSS.

#### 7.1.5. Traditional, scientific, technical, and technological knowledge of indigenous and local communities

**Location-specific knowledge about species, habitats and ecological interactions are welcome additions to future iterations of the National Coastal and Marine Spatial Biodiversity Plan**, in line with the CBD-SBSTTA (2016). These kinds of data could be used, for example, to refine biodiversity priority areas at a fine scale. In addition, multiple forms of knowledge can be collated to better consider social and cultural criteria in spatial prioritisations for the coast and ocean. Areas of current cultural and traditional use, areas under management by indigenous or local communities and areas of cultural value such as sites with religious, historic, archaeological, heritage, artistic and other cultural values are relevant in this context (CBD-SBSTTA 2016). **Further work is underway to support mapping and integration of culturally significant areas in coastal and marine spatial biodiversity**

**plans.** Other socio-economic criteria that should be strengthened in future plans include data to better reflect social, human or economic dependency and data or new spatial layers to reflect social acceptability and compatibility or potential conflict (CBD-SBSTTA 2016).

## 7.2. Planning-unit size and coastal integration

The planning units for the initial beta version of the Coastal and Marine CBA Map comprised a 1' grid; however, these 1' grid cells were too large to be appropriate planning units for the fine-scale ecosystem types closer to shore, and locking in land-based protected areas, for example, sometimes resulted in areas on the inner shelf being selected. This was addressed by intersecting the 1' grid with the shore zone from Harris et al. (2019a), which meant that land-based priorities remained coded to the land-based planning units. Although this has improved data coding, **it may be better to do spatial prioritisation at the land-sea interface at a higher resolution compared to that further offshore**. This would need to be tested.

Improved alignment of land-based and marine biodiversity priorities is also needed. As a preliminary step towards achieving this, planning units that mostly comprised land-based CBAs were included as a design element to help Marxan select adjacent marine areas where there was otherwise equivalent choice between sites (see Section 4.4.7.1). What would be more ideal is to **do the spatial prioritisation in a planning domain that spanned land and sea**. This would require working with the coastal provincial planners to align planning unit grids, input data and ultimately, biodiversity priorities. It may additionally require fine-scale mapping of specific features that span the land-sea interface. **Improved refinement of land-sea integration will be undertaken in the CoastWise project (2021-2022).** This would also contribute to the Marine Biodiversity Sector Plan development guideline: "Marine and terrestrial biodiversity planners and decision-makers should co-ordinate planning to align management of biodiversity on land and in the sea in order to enhance management measures at the land-sea interface, and to avoid possibly contradicting and conflicting marine and terrestrial uses and management measures" (DFFE 2022).

## 7.3. Estuary priorities

A National Estuary Biodiversity Plan that identifies priority estuaries has been compiled by the estuarine researchers and managers (Turpie et al. 2012). However, these priorities **need to be brought into the CBA Map Framework**. The set of priority systems also needs to be revised in light of the updated estuarine ecosystem classification and condition assessment (Van Niekerk et al. 2019a; van Niekerk et al. 2020). Consequently, a project is planned to update the National Estuary Biodiversity Plan through the Coastwise project (2021-2022). After some preliminary consultation, a target-based approach using systematic biodiversity planning that addresses representation, persistence, complementarity, and spatial efficiency was identified as the best way to identify CBAs and ESAs for estuaries.

In developing the **updated National Estuary Biodiversity Plan**, additional alignment is also planned with the freshwater (National Freshwater Ecosystem Priority Areas Project version 2: NFEPA2) and marine (Coastal and Marine CBA Map) spatial prioritisations, both upstream and downstream. In other words, where there are river-influenced marine ecosystem types that are identified as CBAs, this may cascade upstream into the estuary and catchment because maintaining river-influenced marine biodiversity and ecological processes will likely depend on maintaining healthy rivers and estuaries.

Similarly, where there are priorities in either the catchment or estuary, this could cascade priorities downstream, e.g., by prioritising estuaries and beaches downstream of the free-flowing rivers. This catchment-to-coast connectivity is vital for supporting many species that use more than one realm through their lifecycle, including species of commercial importance.

## 7.4. Sea-use guidelines

The sea-use guidelines presented here have been iteratively developed and reflect current, initial MSP discussion. It is anticipated that **the sea-use guidelines will continue to be advanced, particularly through the MSP process**. Although they have been discussed in two national workshops in terms of EBSA management and in some sector-specific meetings (see Appendix 4), more negotiation and engagement with stakeholders and the marine science community is required. In particular, the formal engagements and negotiations among sectors through the MSP process will play a key role in advancing the sea-use guidelines from an assessment of compatibility to management regulations per MSP Zone. New research, updated reviews of the ecosystem-pressure matrix, and other advances achieved through work to support iterative improvement in the classification and assessment of marine ecosystems for future National Biodiversity Assessments may also provide information relevant to the sea-use guidelines.

It is also noted that the next update of the National Coastal and Marine Spatial Biodiversity Plan, which will likely include an improved land-sea coastal integration, may require additional considerations for the land- and sea-use guidelines for transitional ecosystems that span both the land and sea, e.g., beaches and dunes; freshwater flow through estuaries to the marine environment, to ensure alignment between the two sets of guidelines for appropriate management of these ecosystems and processes (see also Appendix 3). This would also need to be considered in terms of the National Environmental Management: Integrated Coastal Management Act, No. 24 of 2008 (Republic of South Africa 2008).

## 7.5. Revisions to the Technical Guidelines for CBA Maps

Given that the Technical Guidelines for CBA Maps (SANBI 2017) have been developed for land-based biodiversity planning (including terrestrial as well as inland aquatic features, like rivers and wetlands), it is not always clear how to apply the detailed aspects of the guidelines in the marine realm. The experience of developing this National Coastal and Marine CBA Map (and the updated National Estuary Biodiversity Plan) should inform a **revision of the Technical Guidelines** to make them more applicable to all realms.

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# Appendix 1: Verification of target achievement

To verify if the biodiversity targets are met, the area of each biodiversity feature (Table A1.1) that is included in Marine Protected Areas (MPAs) or Critical Biodiversity Areas (CBAs) was calculated. The summed percentage extent of each feature in MPAs and CBAs was compared against its biodiversity target. All features met their biodiversity targets at a 95% level, with the exception of five features for African Penguins[7] that were addressed at a finer scale with additional data in the Algoa Bay Systematic Conservation Plan (see Algoa Bay Project 2019 for details), and therefore it was considered acceptable that these feature targets were not met here.

**Table A1.1.** *List of biodiversity input features, Threat Status (grey where not applicable), amount of the features within Marine Protected Areas (MPAs) or Critical Biodiversity Areas (CBAs) (mostly extent in km$^2$), full feature amount (mostly extent in km$^2$), percentage of the feature in MPAs or CBAs, and the biodiversity target per feature (see Table 4 of the main text). Target achievement is determined by comparing the proportion of the feature in an MPA or CBA, with the biodiversity target. The target is considered "met" if the proportion of the ecosystem type in an MPA and CBA is within 5% of the target. Threat status data are from Sink et al. (2019c) and Van Niekerk et al. (2019a), and IUCN Red List of Species: LC = Least Concern; NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered.*

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| **Ecosystem types** | | | | | | | |
| Ecosystem types (NBA 2018) | Agulhas Basin Abyss | LC | 15871.24 | 56942.8 | 27.9 | 15 | Yes |
| | Agulhas Basin Complex Abyss | LC | 1178.72 | 3747.7 | 31.5 | 30 | Yes |
| | Agulhas Blues | NT | 2959.85 | 8379.6 | 35.3 | 30 | Yes |
| | Agulhas Boulder Shore | NT | 1.40 | 1.6 | 85.4 | 30 | Yes |
| | Agulhas Coarse Sediment Shelf Edge | VU | 2666.77 | 3990.5 | 66.8 | 30 | Yes |
| | Agulhas Dissipative Intermediate Sandy Shore | LC | 88.38 | 116.4 | 75.9 | 30 | Yes |
| | Agulhas Dissipative Sandy Shore | NT | 18.06 | 25.1 | 71.8 | 30 | Yes |

[7] African Penguin breeding Bird Island (Algoa Bay): 88.3% of target met; African Penguin breeding St Croix Island: 81.0% of target met; African Penguin pre-moult Bird Island (Algoa Bay): 89.4% of target met; Core home range for African Penguins: Bird Island: 91.0% of target met; and Core home range for African Penguins: St Croix Island: 80.0% of target met.

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | Agulhas Exposed Rocky Shore | VU | 77.52 | 89.5 | 86.6 | 30 | Yes |
| | Agulhas Exposed Stromatolite Rocky Shore | VU | 6.06 | 8.3 | 73.1 | 30 | Yes |
| | Agulhas Inner Shelf Mosaic | VU | 1186.81 | 1853.6 | 64.0 | 40 | Yes |
| | Agulhas Inner Shelf Reef | LC | 17.50 | 17.7 | 99.0 | 40 | Yes |
| | Agulhas Intermediate Sandy Shore | LC | 8.94 | 14.5 | 61.9 | 30 | Yes |
| | Agulhas Island | VU | 6.03 | 6.4 | 93.6 | 30 | Yes |
| | Agulhas Kelp Forest | VU | 11.64 | 12.3 | 94.9 | 40 | Yes |
| | Agulhas Lower Canyon | LC | 847.78 | 1152.5 | 73.6 | 40 | Yes |
| | Agulhas Mid Shelf Mosaic | NT | 2148.21 | 3632.6 | 59.1 | 40 | Yes |
| | Agulhas Mid Shelf Reef | VU | 42.93 | 51.9 | 82.8 | 40 | Yes |
| | Agulhas Mixed Shore | NT | 155.76 | 188.1 | 82.8 | 30 | Yes |
| | Agulhas Muddy Mid Shelf | CR | 576.30 | 1732.4 | 33.3 | 30 | Yes |
| | Agulhas Muddy Outer Shelf | NT | 524.96 | 1278.0 | 41.1 | 30 | Yes |
| | Agulhas Plateau | LC | 1843.92 | 5469.1 | 33.7 | 30 | Yes |
| | Agulhas Reflective Sandy Shore | VU | 0.78 | 0.9 | 90.2 | 30 | Yes |
| | Agulhas Rocky Outer Shelf | LC | 1939.74 | 4214.8 | 46.0 | 30 | Yes |
| | Agulhas Rocky Plateau | LC | 2911.49 | 8592.9 | 33.9 | 30 | Yes |
| | Agulhas Rocky Shelf Edge | LC | 1918.97 | 5233.0 | 36.7 | 30 | Yes |
| | Agulhas Sandy Inner Shelf | VU | 237.38 | 521.5 | 45.5 | 30 | Yes |
| | Agulhas Sandy Mid Shelf | NT | 8547.28 | 20233.1 | 42.2 | 30 | Yes |
| | Agulhas Sandy Outer Shelf | VU | 3931.76 | 7058.5 | 55.7 | 30 | Yes |
| | Agulhas Sheltered Rocky Shore | EN | 0.87 | 1.3 | 66.4 | 30 | Yes |
| | Agulhas Stromatolite Mixed Shore | VU | 5.14 | 8.4 | 61.5 | 30 | Yes |
| | Agulhas Upper Canyon | VU | 81.57 | 102.0 | 80.0 | 40 | Yes |
| | Agulhas Very Exposed Rocky Shore | VU | 8.53 | 9.1 | 94.1 | 30 | Yes |
| | Agulhas Very Exposed Stromatolite Rocky Shore | NT | 0.70 | 1.3 | 55.0 | 30 | Yes |
| | Aliwal Shoal Reef Complex | VU | 5.22 | 5.2 | 100.0 | 40 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | Alphard Bank | LC | 31.86 | 31.9 | 100.0 | 30 | Yes |
| | Amathole Hard Shelf Edge | VU | 468.74 | 468.7 | 100.0 | 30 | Yes |
| | Amathole Lace Corals | NT | 52.80 | 131.6 | 40.1 | 40 | Yes |
| | Browns Bank Rocky Shelf Edge | CR | 895.08 | 2164.1 | 41.4 | 30 | Yes |
| | Cape Basin Abyss | LC | 8900.90 | 57855.0 | 15.4 | 15 | Yes |
| | Cape Basin Complex Abyss | LC | 11420.83 | 73071.6 | 15.6 | 15 | Yes |
| | Cape Bay | EN | 126.52 | 254.4 | 49.7 | 30 | Yes |
| | Cape Boulder Shore | VU | 2.14 | 2.6 | 81.4 | 30 | Yes |
| | Cape Exposed Rocky Shore | VU | 21.42 | 28.9 | 74.2 | 30 | Yes |
| | Cape Island | EN | 2.95 | 3.0 | 99.8 | 30 | Yes |
| | Cape Kelp Forest | VU | 8.22 | 9.8 | 84.0 | 40 | Yes |
| | Cape Lower Canyon | VU | 1486.63 | 2838.1 | 52.4 | 40 | Yes |
| | Cape Mixed Shore | VU | 24.57 | 33.7 | 72.8 | 30 | Yes |
| | Cape Rocky Inner Shelf | VU | 393.95 | 473.6 | 83.2 | 30 | Yes |
| | Cape Rocky Mid Shelf Mosaic | VU | 2586.98 | 3904.9 | 66.2 | 30 | Yes |
| | Cape Sandy Inner Shelf | VU | 373.03 | 526.2 | 70.9 | 30 | Yes |
| | Cape Sheltered Rocky Shore | EN | 0.67 | 1.5 | 45.0 | 30 | Yes |
| | Cape Upper Canyon | EN | 2028.18 | 2394.8 | 84.7 | 40 | Yes |
| | Cape Very Exposed Rocky Shore | NT | 0.51 | 0.5 | 96.7 | 30 | Yes |
| | Central Agulhas Outer Shelf Mosaic | LC | 809.82 | 2452.9 | 33.0 | 30 | Yes |
| | Childs Bank Coral | VU | 434.96 | 505.5 | 86.0 | 40 | Yes |
| | Childs Bank Plateau | LC | 1115.01 | 1620.3 | 68.8 | 30 | Yes |
| | Cool Temperate Arid Predominantly Closed | EN | 1.00 | 1.2 | 84.1 | 30 | Yes |
| | Cool Temperate Estuarine Lake | EN | 5.04 | 5.1 | 98.2 | 30 | Yes |
| | Cool Temperate Large Fluvially Dominated | EN | 3.43 | 3.4 | 100.0 | 30 | Yes |
| | Cool Temperate Large Temporarily Closed | CR | 4.71 | 4.9 | 96.8 | 30 | Yes |
| | Cool Temperate Micro-estuary | N/A | 1.01 | 1.0 | 97.3 | 30 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | Cool Temperate Predominantly Open | EN | 1.67 | 1.7 | 100.0 | 30 | Yes |
| | Cool Temperate Small Fluvially Dominated | LC | 0.03 | 0.0 | 100.0 | 30 | Yes |
| | Cool Temperate Small Temporarily Closed | EN | 2.08 | 2.1 | 98.9 | 30 | Yes |
| | Delagoa Deep Shelf Edge | LC | 605.36 | 605.4 | 100.0 | 30 | Yes |
| | Delagoa Lower Canyon | LC | 33.63 | 33.6 | 100.0 | 40 | Yes |
| | Delagoa Mixed Shore | LC | 28.72 | 28.7 | 100.0 | 30 | Yes |
| | Delagoa Rocky Mid Shelf | LC | 22.99 | 23.0 | 100.0 | 40 | Yes |
| | Delagoa Sandy Inner Shelf | LC | 172.70 | 172.7 | 100.0 | 30 | Yes |
| | Delagoa Sandy Mid Shelf | LC | 274.20 | 274.2 | 100.0 | 30 | Yes |
| | Delagoa Shelf Edge | LC | 189.79 | 189.8 | 100.0 | 30 | Yes |
| | Delagoa Upper Canyon | LC | 13.60 | 13.6 | 100.0 | 40 | Yes |
| | Delagoa Very Exposed Rocky Shore | LC | 0.27 | 0.3 | 100.0 | 30 | Yes |
| | Durnford Inner Shelf Reef Complex | EN | 288.73 | 460.5 | 62.7 | 40 | Yes |
| | Durnford Mid Shelf Reef Complex | VU | 346.42 | 431.8 | 80.2 | 40 | Yes |
| | Eastern Agulhas Bay | VU | 866.73 | 1631.2 | 53.1 | 30 | Yes |
| | Eastern Agulhas Outer Shelf Mosaic | LC | 15313.01 | 25966.2 | 59.0 | 40 | Yes |
| | False and Walker Bay | VU | 1338.71 | 1681.2 | 79.6 | 30 | Yes |
| | Kei Fluvial Fan | EN | 34.33 | 49.0 | 70.0 | 40 | Yes |
| | Kei Reef Mosaic | EN | 81.53 | 93.7 | 87.0 | 40 | Yes |
| | Kingklip Koppies | VU | 322.74 | 642.9 | 50.2 | 30 | Yes |
| | Kingklip Ridge | EN | 103.19 | 103.6 | 99.6 | 30 | Yes |
| | Kosi Coral Community | LC | 8.04 | 8.0 | 100.0 | 40 | Yes |
| | KZN Bight Deep Shelf Edge | EN | 519.93 | 1761.2 | 29.5 | 30 | Yes |
| | KZN Bight Mid Shelf Mosaic | EN | 288.03 | 534.7 | 53.9 | 40 | Yes |
| | KZN Bight Mid Shelf Reef Complex | EN | 11.27 | 23.0 | 49.0 | 40 | Yes |
| | KZN Bight Muddy Inner Shelf | VU | 328.75 | 328.7 | 100.0 | 30 | Yes |
| | KZN Bight Muddy Shelf Edge | VU | 267.42 | 515.7 | 51.9 | 30 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | KZN Bight Outer Shelf Mosaic | VU | 259.98 | 655.8 | 39.6 | 30 | Yes |
| | KZN Bight Sandy Inner Shelf | EN | 42.00 | 145.9 | 28.8 | 30 | Yes |
| | Leadsman Coral Community | LC | 12.49 | 12.5 | 100.0 | 40 | Yes |
| | Namaqua Exposed Rocky Shore | VU | 32.63 | 42.5 | 76.8 | 30 | Yes |
| | Namaqua Kelp Forest | VU | 5.65 | 7.4 | 76.8 | 40 | Yes |
| | Namaqua Mid Shelf Fossils | LC | 19.79 | 20.1 | 98.6 | 30 | Yes |
| | Namaqua Mixed Shore | VU | 44.40 | 60.7 | 73.2 | 30 | Yes |
| | Namaqua Muddy Mid Shelf Mosaic | LC | 4221.55 | 11762.5 | 35.9 | 30 | Yes |
| | Namaqua Muddy Sands | LC | 3808.33 | 12168.9 | 31.3 | 30 | Yes |
| | Namaqua Sandy Inner Shelf | LC | 369.65 | 760.2 | 48.6 | 30 | Yes |
| | Namaqua Sandy Mid Shelf | LC | 991.39 | 2853.2 | 34.7 | 30 | Yes |
| | Namaqua Sheltered Rocky Shore | VU | 1.11 | 1.2 | 93.0 | 30 | Yes |
| | Namaqua Very Exposed Rocky Shore | VU | 2.68 | 3.1 | 85.1 | 30 | Yes |
| | Natal Boulder Shore | VU | 0.16 | 0.3 | 58.7 | 30 | Yes |
| | Natal Deep Shelf Edge | LC | 727.85 | 1377.2 | 52.8 | 30 | Yes |
| | Natal Delagoa Dissipative Intermediate Sandy Shore | LC | 23.89 | 32.9 | 72.7 | 30 | Yes |
| | Natal Delagoa Dissipative Sandy Shore | NT | 0.64 | 0.7 | 90.7 | 30 | Yes |
| | Natal Delagoa Intermediate Sandy Shore | NT | 35.93 | 52.1 | 68.9 | 30 | Yes |
| | Natal Delagoa Reflective Sandy Shore | VU | 4.10 | 9.4 | 43.5 | 30 | Yes |
| | Natal Exposed Rocky Shore | NT | 21.05 | 31.5 | 66.9 | 30 | Yes |
| | Natal Lower Canyon | LC | 680.23 | 1481.4 | 45.9 | 40 | Yes |
| | Natal Mixed Shore | VU | 43.64 | 69.5 | 62.8 | 30 | Yes |
| | Natal Upper Canyon | LC | 57.02 | 83.1 | 68.7 | 40 | Yes |
| | Natal Very Exposed Rocky Shore | NT | 0.67 | 1.0 | 69.5 | 30 | Yes |
| | Orange Cone Inner Shelf Mud Reef Mosaic | EN | 230.20 | 511.0 | 45.0 | 40 | Yes |
| | Orange Cone Muddy Mid Shelf | EN | 659.09 | 1925.4 | 34.2 | 30 | Yes |
| | Port St Johns Inner Shelf Mosaic | VU | 41.08 | 48.5 | 84.6 | 40 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | Port St Johns Muddy Mid Shelf | VU | 98.92 | 124.8 | 79.3 | 30 | Yes |
| | Port St Johns Muddy Shelf Edge | VU | 104.99 | 129.4 | 81.1 | 30 | Yes |
| | Protea Mid Shelf Reef Complex | EN | 15.54 | 15.5 | 100.0 | 40 | Yes |
| | Sodwana Coral Community | LC | 5.96 | 6.0 | 100.0 | 40 | Yes |
| | Southeast Atlantic Lower Slope | LC | 27145.65 | 86412.9 | 31.4 | 30 | Yes |
| | Southeast Atlantic Mid Slope | LC | 6332.53 | 18140.1 | 34.9 | 30 | Yes |
| | Southeast Atlantic Seamount | LC | 1525.15 | 1576.3 | 96.8 | 40 | Yes |
| | Southeast Atlantic Slope Seamount | LC | 887.91 | 887.9 | 100.0 | 40 | Yes |
| | Southeast Atlantic Upper Slope | LC | 6768.89 | 15242.1 | 44.4 | 30 | Yes |
| | Southern Benguela Dissipative Intermediate Sandy Shore | LC | 29.59 | 51.5 | 57.5 | 30 | Yes |
| | Southern Benguela Dissipative Sandy Shore | LC | 16.20 | 26.2 | 61.9 | 30 | Yes |
| | Southern Benguela Intermediate Sandy Shore | NT | 23.84 | 32.3 | 73.7 | 30 | Yes |
| | Southern Benguela Muddy Outer Shelf Mosaic | LC | 1797.77 | 5574.4 | 32.3 | 30 | Yes |
| | Southern Benguela Muddy Shelf Edge | EN | 250.83 | 814.0 | 30.8 | 30 | Yes |
| | Southern Benguela Outer Shelf Mosaic | LC | 7947.39 | 19508.7 | 40.7 | 30 | Yes |
| | Southern Benguela Reflective Sandy Shore | EN | 6.06 | 10.5 | 57.5 | 30 | Yes |
| | Southern Benguela Rocky Shelf Edge | VU | 1171.17 | 2380.7 | 49.2 | 30 | Yes |
| | Southern Benguela Sandy Outer Shelf | LC | 15139.47 | 36057.1 | 42.0 | 30 | Yes |
| | Southern Benguela Sandy Shelf Edge | VU | 2274.69 | 7397.9 | 30.7 | 30 | Yes |
| | Southern Benguela Shelf Edge Mosaic | LC | 763.71 | 2181.8 | 35.0 | 30 | Yes |
| | Southern KZN Inner Shelf Mosaic | EN | 138.98 | 258.9 | 53.7 | 40 | Yes |
| | Southern KZN Mid Shelf Mosaic | EN | 500.19 | 989.6 | 50.5 | 40 | Yes |
| | Southern KZN Shelf Edge Mosaic | NT | 395.32 | 669.6 | 59.0 | 40 | Yes |
| | Southwest Indian Lower Slope | LC | 32079.52 | 197988.1 | 16.2 | 15 | Yes |
| | Southwest Indian Mid Slope | LC | 18993.63 | 78270.7 | 24.3 | 15 | Yes |
| | Southwest Indian Seamount | LC | 1608.84 | 2072.4 | 77.6 | 40 | Yes |
| | Southwest Indian Slope Seamount | LC | 997.61 | 1614.4 | 61.8 | 40 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | Southwest Indian Upper Slope | LC | 6402.65 | 17527.2 | 36.5 | 30 | Yes |
| | St Helena Bay | VU | 399.13 | 980.8 | 40.7 | 30 | Yes |
| | St Lucia Mid Shelf Mosaic | LC | 4.76 | 4.8 | 100.0 | 40 | Yes |
| | St Lucia Sandy Inner Shelf | LC | 93.39 | 120.0 | 77.9 | 30 | Yes |
| | St Lucia Sandy Mid Shelf | VU | 334.94 | 646.8 | 51.8 | 30 | Yes |
| | Subtropical Estuarine Bay | CR | 0.09 | 0.1 | 100.0 | 30 | Yes |
| | Subtropical Estuarine Lake | EN | 1.15 | 2.2 | 53.0 | 30 | Yes |
| | Subtropical Large Fluvially Dominated | EN | 3.28 | 3.3 | 100.0 | 30 | Yes |
| | Subtropical Large Temporarily Closed | EN | 5.52 | 9.8 | 56.3 | 30 | Yes |
| | Subtropical Micro-estuary | N/A | 1.28 | 1.7 | 73.8 | 30 | Yes |
| | Subtropical Predominantly Open | EN | 6.29 | 6.9 | 90.8 | 30 | Yes |
| | Subtropical Small Temporarily Closed | VU | 6.22 | 8.3 | 74.6 | 30 | Yes |
| | Trafalgar Reef Complex | EN | 32.68 | 58.7 | 55.7 | 40 | Yes |
| | Transkei Basin Abyss | LC | 33148.27 | 210710.4 | 15.7 | 15 | Yes |
| | Tropical Estuarine Lake | VU | 1.29 | 1.3 | 100.0 | 30 | Yes |
| | uThukela Canyon | NT | 185.02 | 417.8 | 44.3 | 40 | Yes |
| | uThukela Mid Shelf Mosaic | VU | 726.74 | 789.4 | 92.1 | 40 | Yes |
| | uThukela Mid Shelf Mud Coarse Sediment Mosaic | VU | 1348.70 | 1348.7 | 100.0 | 30 | Yes |
| | uThukela Outer Shelf Muddy Reef Mosaic | VU | 514.84 | 531.8 | 96.8 | 40 | Yes |
| | Warm Temperate Estuarine Bay | VU | 0.22 | 0.2 | 100.0 | 30 | Yes |
| | Warm Temperate Estuarine Lake | EN | 0.89 | 1.5 | 59.8 | 30 | Yes |
| | Warm Temperate Large Fluvially Dominated | VU | 0.70 | 0.7 | 100.0 | 30 | Yes |
| | Warm Temperate Large Temporarily Closed | VU | 9.55 | 13.3 | 71.7 | 30 | Yes |
| | Warm Temperate Micro-estuary | N/A | 1.04 | 2.2 | 47.1 | 30 | Yes |
| | Warm Temperate Predominantly Open | VU | 11.92 | 12.4 | 96.1 | 30 | Yes |
| | Warm Temperate Small Fluvially Dominated | LC | 0.72 | 0.7 | 100.0 | 30 | Yes |
| | Warm Temperate Small Temporarily Closed | LC | 6.28 | 8.8 | 71.2 | 30 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Ecosystem types (NBA 2018) | Western Agulhas Bay | EN | 556.92 | 819.7 | 67.9 | 30 | Yes |
| | Western Agulhas Outer Shelf Mosaic | VU | 1412.07 | 2786.5 | 50.7 | 40 | Yes |
| | Wild Coast Inner Shelf Mosaic | VU | 221.91 | 253.0 | 87.7 | 40 | Yes |
| | Wild Coast Mid Shelf Mosaic | LC | 1302.93 | 2385.9 | 54.6 | 40 | Yes |
| | Wild Coast Shelf Edge Mosaic | LC | 692.78 | 1435.2 | 48.3 | 40 | Yes |
| Pelagic ecosystem types | Pelagic ecosystem type Aa1 | | 14230.15 | 30774.3 | 46.2 | 15 | Yes |
| | Pelagic ecosystem type Ab1 | | 22859.07 | 53721.6 | 42.6 | 15 | Yes |
| | Pelagic ecosystem type Ab2 | | 28787.83 | 68516.8 | 42.0 | 15 | Yes |
| | Pelagic ecosystem type Ab3 | | 23531.91 | 54853.6 | 42.9 | 15 | Yes |
| | Pelagic ecosystem type Ba1 | | 1482.13 | 9522.8 | 15.6 | 15 | Yes |
| | Pelagic ecosystem type Ba2 | | 40429.12 | 125285.5 | 32.3 | 15 | Yes |
| | Pelagic ecosystem type Bb1 | | 11571.80 | 71550.7 | 16.2 | 15 | Yes |
| | Pelagic ecosystem type Bb2 | | 14838.44 | 63696.5 | 23.3 | 15 | Yes |
| | Pelagic ecosystem type Bc1 | | 22342.36 | 143701.5 | 15.5 | 15 | Yes |
| | Pelagic ecosystem type Bc2 | | 23684.47 | 97807.0 | 24.2 | 15 | Yes |
| | Pelagic ecosystem type Ca1 | | 26174.74 | 169565.3 | 15.4 | 15 | Yes |
| | Pelagic ecosystem type Ca2 | | 12364.75 | 59193.7 | 20.9 | 15 | Yes |
| | Pelagic ecosystem type Cb1 | | 11851.68 | 22465.1 | 52.8 | 15 | Yes |
| | Pelagic ecosystem type Cb2 | | 8011.76 | 28793.3 | 27.8 | 15 | Yes |
| | Pelagic ecosystem type Cb3 | | 15772.31 | 31400.8 | 50.2 | 15 | Yes |
| | Pelagic ecosystem type Cb4 | | 4789.56 | 30738.8 | 15.6 | 15 | Yes |
| **Species** | | | | | | | |
| Turtles | Turtle nesting grounds | CR + VU | 14.89 | 14.9 | 100.0 | 90 | Yes |
| | Loggerhead internesting areas | VU | 255503.13 | 255544.5 | 100.0 | 70 | Yes |
| | Leatherback internesting areas | CR | 341247.99 | 450073.0 | 75.8 | 60 | Yes |
| | Loggerhead migration routes | VU | 4038090.92 | 6798590.3 | 59.4 | 30 | Yes |
| | Leatherback migration routes | CR | 2783169.11 | 10307333.8 | 27.0 | 20 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Seabirds | Seabird colonies | EN | 19.04 | 19.8 | 95.9 | 90 | Yes |
| | African Penguin breeding Bird Island (Algoa Bay) | EN | 357.64 | 674.7 | 53.0 | 60 | No* |
| | African Penguin breeding Boulders | EN | 546.87 | 752.8 | 72.6 | 60 | Yes |
| | African Penguin breeding Dassen Island | EN | 638.87 | 687.5 | 92.9 | 60 | Yes |
| | African Penguin breeding Dyer Island | EN | 757.06 | 1138.7 | 66.5 | 60 | Yes |
| | African Penguin breeding Robben Island | EN | 335.04 | 534.6 | 62.7 | 60 | Yes |
| | African Penguin breeding St Croix Island | EN | 446.28 | 920.9 | 48.5 | 60 | No* |
| | African Penguin breeding Stony Point | EN | 365.32 | 388.5 | 94.0 | 60 | Yes |
| | African Penguin post-moult Dassen Island: cluster 1 | EN | 2566.49 | 4075.1 | 63.0 | 60 | Yes |
| | African Penguin post-moult Dassen Island: cluster 2 | EN | 947.96 | 982.6 | 96.5 | 60 | Yes |
| | African Penguin pre-moult Bird Island (Algoa Bay) | EN | 675.87 | 1259.7 | 53.7 | 60 | No* |
| | African Penguin pre-moult Dassen Island: cluster 1 | EN | 731.28 | 763.2 | 95.8 | 60 | Yes |
| | African Penguin pre-moult Dassen Island: cluster 2 | EN | 348.35 | 349.1 | 99.8 | 60 | Yes |
| | African Penguin pre-moult Dassen Island: cluster 3 | EN | 1815.12 | 2344.1 | 77.4 | 60 | Yes |
| | African Penguin pre-moult Stony Point: cluster 1 | EN | 514.74 | 632.5 | 81.4 | 60 | Yes |
| | African Penguin pre-moult Stony Point: cluster 2 | EN | 221.07 | 351.4 | 62.9 | 60 | Yes |
| | African Penguin pre-moult Stony Point: cluster 3 | EN | 2707.73 | 4378.0 | 61.8 | 60 | Yes |
| | Aggregated core home range for African Penguins: Bird Island (breeding) | EN | 2143.62 | 3930.4 | 54.5 | 60 | No* |
| | Aggregated core home range for African Penguins: Bird Island (pre-moult) | EN | 3564.08 | 5716.3 | 62.3 | 60 | Yes |
| | Aggregated core home range for African Penguins: Boulders Beach (breeding) | EN | 3350.99 | 4692.2 | 71.4 | 60 | Yes |
| | Aggregated core home range for African Penguins: Dassen Island (breeding) | EN | 7052.52 | 9366.4 | 75.3 | 60 | Yes |
| | Aggregated core home range for African Penguins: Dassen Island (pre-moult) | EN | 21834.17 | 35073.0 | 62.3 | 60 | Yes |
| | Aggregated core home range for African Penguins: Dassen Island (post-moult) | EN | 5100.17 | 7644.0 | 66.7 | 60 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Seabirds | Aggregated core home range for African Penguins: Robben Island (breeding) | EN | 5348.39 | 8650.0 | 61.8 | 60 | Yes |
| | Aggregated core home range for African Penguins: Stony Point (breeding) | EN | 3132.53 | 3460.6 | 90.5 | 60 | Yes |
| | Aggregated core home range for African Penguins: Stony Point (pre-moult) | EN | 5710.83 | 9182.6 | 62.2 | 60 | Yes |
| | Aggregated core home range for African Penguins: Dyer Island (breeding) | EN | 5810.78 | 8693.6 | 66.8 | 60 | Yes |
| | Aggregated core home range for African Penguins: St Croix Island (breeding) | EN | 2941.97 | 6160.3 | 47.8 | 60 | No* |
| | African Penguin foraging areas | EN | 6475.28 | 9376.0 | 69.1 | 40 | Yes |
| | African Penguin foraging areas: cluster 1 | EN | 1544.65 | 3135.3 | 49.3 | 30 | Yes |
| | African Penguin foraging areas: cluster 2 | EN | 501.04 | 852.4 | 58.8 | 30 | Yes |
| | African Penguin foraging areas: cluster 3 | EN | 1342.15 | 1667.0 | 80.5 | 30 | Yes |
| | African Penguin foraging areas: cluster 4 | EN | 539.40 | 883.7 | 61.0 | 30 | Yes |
| | African Penguin foraging areas: cluster 5 | EN | 1787.18 | 1971.3 | 90.7 | 30 | Yes |
| | African Penguin foraging areas: cluster 6 | EN | 760.87 | 866.2 | 87.8 | 30 | Yes |
| | Bank Cormorant foraging areas | EN | 2717.66 | 4186.0 | 64.9 | 40 | Yes |
| | Bank Cormorant foraging areas: cluster 1 | EN | 78.60 | 130.9 | 60.1 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 2 | EN | 76.73 | 213.3 | 36.0 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 3 | EN | 167.17 | 200.6 | 83.3 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 5 | EN | 647.70 | 1073.8 | 60.3 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 6 | EN | 421.82 | 448.8 | 94.0 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 7 | EN | 509.39 | 767.2 | 66.4 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 8 | EN | 281.02 | 433.0 | 64.9 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 9 | EN | 285.52 | 311.2 | 91.8 | 30 | Yes |
| | Bank Cormorant foraging areas: cluster 10 | EN | 249.73 | 607.2 | 41.1 | 30 | Yes |
| | Cape Cormorant breeding Dyer Island | EN | 1071.23 | 1550.7 | 69.1 | 60 | Yes |
| | Cape Cormorant breeding Jutten Island | EN | 908.94 | 1155.7 | 78.6 | 60 | Yes |
| | Cape Cormorant breeding Malgas Island | EN | 689.37 | 1055.0 | 65.3 | 60 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Seabirds | Cape Cormorant breeding Stony Point | EN | 787.68 | 900.1 | 87.5 | 60 | Yes |
| | Aggregated core home range for Cape Cormorants: Dyer Island | EN | 11894.96 | 18241.9 | 65.2 | 60 | Yes |
| | Aggregated core home range for Cape Cormorants: Jutten Island | EN | 3039.56 | 4814.4 | 63.1 | 60 | Yes |
| | Aggregated core home range for Cape Cormorants: Malgas Island | EN | 5078.78 | 8053.9 | 63.1 | 60 | Yes |
| | Aggregated core home range for Cape Cormorants: Stony Point | EN | 4821.60 | 5450.4 | 88.5 | 60 | Yes |
| | Cape Cormorant foraging areas | EN | 24845.36 | 46800.9 | 53.1 | 40 | Yes |
| | Cape Cormorant foraging areas: cluster 1 | EN | 1768.35 | 5327.0 | 33.2 | 30 | Yes |
| | Cape Cormorant foraging areas: cluster 2 | EN | 16442.57 | 28385.6 | 57.9 | 30 | Yes |
| | Cape Cormorant foraging areas: cluster 3 | EN | 2925.75 | 5817.7 | 50.3 | 30 | Yes |
| | Cape Cormorant foraging areas: cluster 4 | EN | 2550.10 | 4725.1 | 54.0 | 30 | Yes |
| | Cape Cormorant foraging areas: cluster 5 | EN | 1158.58 | 2545.6 | 45.5 | 30 | Yes |
| | Cape Gannet breeding Bird Island (Algoa Bay) | EN | 3801.74 | 5502.5 | 69.1 | 60 | Yes |
| | Cape Gannet breeding Malgas Island | EN | 2996.61 | 2996.6 | 100.0 | 60 | Yes |
| | Aggregated core home range for Cape Gannets: Bird Island | EN | 73438.74 | 120717.0 | 60.8 | 60 | Yes |
| | Aggregated core home range for Cape Gannets: Malgas Island | EN | 69780.26 | 111786.7 | 62.4 | 60 | Yes |
| | Cape Gannet foraging areas | EN | 1788.33 | 3310.6 | 54.0 | 40 | Yes |
| | Cape Gannet foraging areas: cluster 1 | EN | 319.80 | 674.1 | 47.4 | 30 | Yes |
| | Cape Gannet foraging areas: cluster 2 | EN | 1086.20 | 1484.0 | 73.2 | 30 | Yes |
| | Cape Gannet foraging areas: cluster 3 | EN | 149.37 | 452.3 | 33.0 | 30 | Yes |
| | Cape Gannet foraging areas: cluster 4 | EN | 232.96 | 700.2 | 33.3 | 30 | Yes |
| | Atlantic Yellow-nosed Albatross incubation Gough Island | EN | 220453.96 | 651229.9 | 33.9 | 20 | Yes |
| | Atlantic Yellow-nosed Albatross incubation Nightingale | EN | 198339.74 | 656278.5 | 30.2 | 20 | Yes |
| | Indian Yellow-nosed Albatross post-guard Prince Edward Island | EN | 157834.21 | 464525.6 | 34.0 | 30 | Yes |
| | Wandering Albatross incubation Marion Island | EN | 395689.68 | 1406521.8 | 28.1 | 15 | Yes |
| | Wandering Albatross non-breeding Iles Crozet | EN | 156148.50 | 576599.1 | 27.1 | 20 | Yes |
| | Wandering Albatross non-breeding Iles Kerguelen | EN | 25904.82 | 71269.3 | 36.3 | 15 | Yes |
| | Northern Giant Petrel | LC | 286594.07 | 941161.7 | 30.5 | 20 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Cetaceans | Indo-Pacific Bottlenose Dolphin distribution | NT | 24254.08 | 38347.4 | 63.2 | 25 | Yes |
| | Common Dolphin distribution | LC | 305837.11 | 675225.5 | 45.3 | 15 | Yes |
| | Heaviside's Dolphin distribution | NT | 48109.79 | 107807.9 | 44.6 | 25 | Yes |
| | Indian Ocean Humpback Dolphin distribution | EN | 28129.11 | 44672.3 | 63.0 | 35 | Yes |
| | Risso's Dolphin distribution | LC | 256868.27 | 738811.3 | 34.8 | 15 | Yes |
| | Bottlenose Whale distribution | LC | 109004.47 | 708217.8 | 15.4 | 15 | Yes |
| | Bryde's Whale distribution (summer and winter merged) | LC | 141169.53 | 317652.1 | 44.4 | 15 | Yes |
| | Humpback Whale distribution (summer and winter merged) | LC | 201453.63 | 540838.1 | 37.2 | 15 | Yes |
| | Southern Right Whale distribution | LC | 14860.59 | 28252.6 | 52.6 | 15 | Yes |
| | Sperm Whale summer distribution | VU | 52295.51 | 338283.7 | 15.5 | 15 | Yes |
| | Sperm Whale winter distribution | VU | 190667.20 | 800650.4 | 23.8 | 15 | Yes |
| | Key bay habitat for whales | | 4057.96 | 6120.1 | 66.3 | 50 | Yes |
| | Key bay habitat for whales: area 1 | | 399.13 | 980.8 | 40.7 | 30 | Yes |
| | Key bay habitat for whales: area 2 | | 757.03 | 1052.8 | 71.9 | 30 | Yes |
| | Key bay habitat for whales: area 3 | | 866.13 | 1121.5 | 77.2 | 30 | Yes |
| | Key bay habitat for whales: area 4 | | 471.53 | 558.7 | 84.4 | 30 | Yes |
| | Key bay habitat for whales: area 5 | | 36.22 | 126.4 | 28.6 | 30 | Yes |
| | Key bay habitat for whales: area 6 | | 275.16 | 368.9 | 74.6 | 30 | Yes |
| | Key bay habitat for whales: area 7 | | 71.98 | 98.3 | 73.2 | 30 | Yes |
| | Key bay habitat for whales: area 8 | | 241.48 | 377.5 | 64.0 | 30 | Yes |
| | Key bay habitat for whales: area 9 | | 112.09 | 118.8 | 94.3 | 30 | Yes |
| | Key bay habitat for whales: area 10 | | 105.06 | 323.4 | 32.5 | 30 | Yes |
| | Key bay habitat for whales: area 11 | | 722.17 | 1003.0 | 72.0 | 30 | Yes |
| Seals | Seal colonies | LC | 2.80 | 2.9 | 96.0 | 70 | Yes |
| | Seal foraging areas: cluster 1 | LC | 431.05 | 590.0 | 73.1 | 30 | Yes |
| | Seal foraging areas: cluster 2 | LC | 183.36 | 560.7 | 32.7 | 30 | Yes |
| | Seal foraging areas: cluster 3 | LC | 258.27 | 710.7 | 36.3 | 30 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Seals | Seal foraging areas: cluster 4 | LC | 214.23 | 646.1 | 33.2 | 30 | Yes |
| | Seal foraging areas: cluster 5 | LC | 224.49 | 644.8 | 34.8 | 30 | Yes |
| | Seal foraging areas: cluster 6 | LC | 1379.17 | 2299.2 | 60.0 | 30 | Yes |
| | Seal foraging areas: cluster 7 | LC | 191.09 | 599.8 | 31.9 | 30 | Yes |
| | Seal foraging areas: cluster 8 | LC | 1017.45 | 1484.0 | 68.6 | 30 | Yes |
| | Seal foraging areas: cluster 9 | LC | 852.34 | 1478.3 | 57.7 | 30 | Yes |
| | Seal foraging areas: cluster 10 | LC | 211.54 | 663.2 | 31.9 | 30 | Yes |
| | Seal foraging areas: cluster 11 | LC | 407.69 | 978.7 | 41.7 | 30 | Yes |
| | Seal foraging areas: cluster 12 | LC | 607.37 | 1035.4 | 58.7 | 30 | Yes |
| | Seal foraging distribution: Black Rocks colony | LC | 28381.15 | 43436.6 | 65.3 | 30 | Yes |
| | Seal foraging distribution: Kleinzee colony | LC | 62337.19 | 155119.2 | 40.2 | 30 | Yes |
| | Seal foraging distribution: South Coast colonies | LC | 96292.99 | 209284.4 | 46.0 | 30 | Yes |
| Sharks and rays | Core range areas of White Sharks | VU | 10635.92 | 16557.6 | 64.2 | 55 | Yes |
| | White Shark distributions | VU | 47068.60 | 89586.4 | 52.5 | 35 | Yes |
| | Lesser Guitarfish (summer) | VU | 111420.61 | 239734.4 | 46.5 | 30 | Yes |
| | Spotted Eagle Ray (summer) | VU | 37806.15 | 56083.8 | 67.4 | 30 | Yes |
| | Spotted Eagle Ray (winter) | VU | 24314.55 | 44554.2 | 54.6 | 30 | Yes |
| | Copper Shark/Bronze Whaler (summer) | VU | 154075.55 | 272604.9 | 56.5 | 30 | Yes |
| | Copper Shark/Bronze Whaler (winter) | VU | 77979.67 | 126577.4 | 61.6 | 30 | Yes |
| | Spinner Shark (summer) | VU | 62883.20 | 103077.4 | 61.0 | 30 | Yes |
| | Spinner Shark (winter) | VU | 57821.24 | 94314.8 | 61.3 | 30 | Yes |
| | Zambezi Shark, Bull Shark (summer) | VU | 18049.85 | 30774.9 | 58.7 | 30 | Yes |
| | Zambezi Shark, Bull Shark (winter) | VU | 39781.66 | 65101.6 | 61.1 | 30 | Yes |
| | Blacktip Shark (summer) | VU | 47982.82 | 80226.3 | 59.8 | 30 | Yes |
| | Blacktip Shark (winter) | VU | 107061.44 | 178933.7 | 59.8 | 30 | Yes |
| | Dusky Shark (summer) | EN | 71969.56 | 115241.2 | 62.5 | 35 | Yes |
| | Dusky Shark (winter) | EN | 97786.39 | 179192.6 | 54.6 | 35 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Sharks and rays | Sandbar Shark (summer) | EN | 27198.30 | 44810.2 | 60.7 | 35 | Yes |
| | Sandbar Shark (winter) | EN | 205779.89 | 371899.1 | 55.3 | 35 | Yes |
| | Spotted Raggedtooth Shark (summer) | CR | 109604.21 | 198591.2 | 55.2 | 45 | Yes |
| | Spotted Raggedtooth Shark (winter) | CR | 132876.74 | 234875.3 | 56.6 | 45 | Yes |
| | White Shark (summer) | VU | 214029.50 | 428186.1 | 50.0 | 30 | Yes |
| | White Shark (winter) | VU | 173027.94 | 343968.6 | 50.3 | 30 | Yes |
| | Triangular Legskate (summer) | LC | 239126.22 | 546635.1 | 43.7 | 25 | Yes |
| | Triangular Legskate (winter) | LC | 210037.36 | 455550.5 | 46.1 | 25 | Yes |
| | Blue Stingray (summer) | NT | 164028.87 | 329802.9 | 49.7 | 25 | Yes |
| | Blue Stingray (winter) | NT | 129003.01 | 240434.4 | 53.7 | 25 | Yes |
| | Slime Skate (summer) | LC | 246924.47 | 595739.1 | 41.4 | 15 | Yes |
| | Slime Skate (winter) | LC | 149166.03 | 343204.6 | 43.5 | 25 | Yes |
| | Soupfin Shark (summer) | CR | 284514.39 | 600800.1 | 47.4 | 35 | Yes |
| | Soupfin Shark (winter) | CR | 203395.70 | 437258.6 | 46.5 | 35 | Yes |
| | Lined Catshark (aseasonal) | LC | 49604.10 | 76974.2 | 64.4 | 25 | Yes |
| | Tiger Catshark (aseasonal) | VU | 76762.82 | 161493.3 | 47.5 | 30 | Yes |
| | Puffadder Shyshark (aseasonal) | EN | 115864.05 | 243434.8 | 47.6 | 35 | Yes |
| | Dark Shyshark (aseasonal) | LC | 153825.76 | 256063.0 | 60.1 | 25 | Yes |
| | Izak Catshark (aseasonal) | LC | 231603.61 | 586873.5 | 39.5 | 25 | Yes |
| | Shortfin Mako Shark (summer) | EN (Indo West Pacific & Atlantic = VU) | 158209.07 | 260755.7 | 60.7 | 25 | Yes |
| | Shortfin Mako Shark (winter) | EN (Indo West Pacific & Atlantic = VU) | 322450.56 | 595102.5 | 54.2 | 35 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km²) | Feature amount (mostly km²) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Sharks and rays | Yellowspotted Skate (summer) | VU | 214597.44 | 512609.6 | 41.9 | 20 | Yes |
| | Yellowspotted Skate (winter) | VU | 174292.89 | 386807.1 | 45.1 | 30 | Yes |
| | Common Smoothhound/Houndshark (summer) | EN | 114434.32 | 234136.3 | 48.9 | 35 | Yes |
| | Common Smoothhound/Houndshark (winter) | EN | 176226.98 | 347640.1 | 50.7 | 35 | Yes |
| | Whitespotted Smoothhound/Houndshark (summer) | LC | 257760.57 | 611949.7 | 42.1 | 15 | Yes |
| | Whitespotted Smoothhound/Houndshark (winter) | LC | 210211.44 | 453706.4 | 46.3 | 25 | Yes |
| | Common Eagle Ray (summer) | CR | 144403.64 | 285829.3 | 50.5 | 45 | Yes |
| | Common Eagle Ray (winter) | CR | 127061.05 | 257925.5 | 49.3 | 45 | Yes |
| | Broadnose Sevengill Shark (summer) | VU | 129449.49 | 227835.8 | 56.8 | 30 | Yes |
| | Broadnose Sevengill Shark (winter) | VU | 76999.38 | 132975.5 | 57.9 | 30 | Yes |
| | Sixgill Sawshark (summer) | LC | 158433.84 | 321902.9 | 49.2 | 25 | Yes |
| | Sixgill Sawshark (winter) | LC | 218024.43 | 438612.6 | 49.7 | 25 | Yes |
| | Pyjama Shark (aseasonal) | LC | 102190.53 | 195198.8 | 52.4 | 25 | Yes |
| | Leopard Catshark (aseasonal) | LC | 126940.71 | 241184.5 | 52.6 | 25 | Yes |
| | Twineye Skate (aseasonal) | EN | 93703.73 | 191974.2 | 48.8 | 35 | Yes |
| | Biscuit Skate (summer) | NT | 289848.15 | 682393.2 | 42.5 | 15 | Yes |
| | Biscuit Skate (winter) | NT | 245577.37 | 541212.9 | 45.4 | 25 | Yes |
| | Whale Shark (summer) | EN | 209036.66 | 423190.9 | 49.4 | 35 | Yes |
| | Whale Shark (winter) | EN | 162345.56 | 251658.9 | 64.5 | 35 | Yes |
| | Spearnose Skate, White Skate (aseasonal) | EN | 206064.55 | 444542.4 | 46.4 | 25 | Yes |
| | Yellowspotted Catshark (aseasonal) | NT | 217996.53 | 532598.9 | 40.9 | 25 | Yes |
| | Scalloped Hammerhead Shark (summer) | CR | 18083.80 | 30260.2 | 59.8 | 45 | Yes |
| | Scalloped Hammerhead Shark (winter) | CR | 40545.00 | 63951.0 | 63.4 | 45 | Yes |
| | Great Hammerhead Shark (aseasonal) | CR | 8758.79 | 16637.0 | 52.6 | 45 | Yes |
| | Smooth Hammerhead Shark (summer) | VU | 167280.71 | 319211.5 | 52.4 | 30 | Yes |
| | Smooth Hammerhead Shark (winter) | VU | 109900.86 | 207407.5 | 53.0 | 30 | Yes |
| | Spotted Spiny Dogfish (aseasonal) | VU (SA=LC) | 160059.62 | 378244.7 | 42.3 | 25 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Sharks and rays | African Angelshark (summer) | NT | 159665.07 | 319172.8 | 50.0 | 25 | Yes |
| | African Angelshark (winter) | NT | 144676.02 | 247020.8 | 58.6 | 25 | Yes |
| | Blackspotted Electric Ray (summer) | DD | 119497.47 | 263857.7 | 45.3 | 25 | Yes |
| | Blackspotted Electric Ray (winter) | DD | 110844.99 | 221271.0 | 50.1 | 25 | Yes |
| | Spotted Gully Shark (summer) | LC | 209986.30 | 431422.1 | 48.7 | 25 | Yes |
| | Spotted Gully Shark (winter) | LC | 83884.28 | 140685.7 | 59.6 | 25 | Yes |
| **Unique or special habitats or features** | | | | | | | |
| Unique features | Alexandria dunefield | | 142.27 | 142.3 | 100.0 | 80 | Yes |
| | Mallory Slope | | 2742.27 | 3441.5 | 79.7 | 70 | Yes |
| | Childs Bank | | 1212.26 | 1449.2 | 83.7 | 80 | Yes |
| | Namaqua fossils | | 49.00 | 56.0 | 87.5 | 80 | Yes |
| | Port Elizabeth Ridge | | 67.00 | 70.0 | 95.7 | 80 | Yes |
| | Rhodolith beds | | 5.00 | 5.0 | 100.0 | 90 | Yes |
| | Algal dominated reefs | | 4.00 | 4.0 | 100.0 | 90 | Yes |
| | Anemone garden | | 1.00 | 1.0 | 100.0 | 90 | Yes |
| | Horse mussel aggregations | | 2.00 | 2.0 | 100.0 | 90 | Yes |
| | Aggregations of guitar sharks | | 17.00 | 17.0 | 100.0 | 90 | Yes |
| | Aggregations of red steenbras | | 1.00 | 1.0 | 100.0 | 90 | Yes |
| | Aggregations of wreckfish | | 1.00 | 1.0 | 100.0 | 90 | Yes |
| Special features | Cold water corals | | 227.00 | 236.0 | 96.2 | 90 | Yes |
| | (Potential) vulnerable marine indicator species | | 163.00 | 260.4 | 62.6 | 60 | Yes |
| | Potential vulnerable marine ecosystem features | | 14095.24 | 22853.8 | 61.7 | 60 | Yes |
| **Ecological infrastructure** | | | | | | | |
| Coastal EI | Coastal protection ecological infrastructure | | 6.38 | 9.2 | 69.2 | 60 | Yes |
| | Sports events and recreational outdoor activity ecological infrastructure | | 101.18 | 142.2 | 71.2 | 60 | Yes |
| **Ecological processes** | | | | | | | |
| Productivity | Upwelling areas and areas of very high productivity | | 6868.00 | 13203.0 | 52.0 | 50 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Productivity | *Anaulus* (surf diatom) accumulations | | 48.51 | 76.0 | 63.8 | 50 | Yes |
| | Beaches with kelp wrack | | 119.08 | 167.9 | 70.9 | 50 | Yes |
| Nursery, spawning and aggregation areas | Areas of high anchovy egg density | | 54517.26 | 129817.9 | 42.0 | 40 | Yes |
| | Areas of high sardine egg density | | 56025.82 | 131080.3 | 42.7 | 40 | Yes |
| | Spawning areas for fish | | 18050.17 | 36781.3 | 49.1 | 40 | Yes |
| | Spawning areas for fish: area 1 | | 4000.78 | 12797.9 | 31.3 | 30 | Yes |
| | Spawning areas for fish: area 2 | | 4096.77 | 10712.2 | 38.2 | 30 | Yes |
| | Spawning areas for fish: area 3 | | 2329.08 | 5602.6 | 41.6 | 30 | Yes |
| | Spawning areas for fish: area 4 | | 7623.55 | 7668.5 | 99.4 | 30 | Yes |
| | Nursery areas for fish | | 34773.21 | 80945.8 | 43.0 | 40 | Yes |
| | Nursery areas for fish: area 1 | | 11048.06 | 26242.6 | 42.1 | 30 | Yes |
| | Nursery areas for fish: area 2 | | 20542.99 | 48391.2 | 42.5 | 30 | Yes |
| | Nursery areas for fish: area 3 | | 3182.15 | 6312.0 | 50.4 | 30 | Yes |
| | Squid spawning areas | | 895.68 | 1765.1 | 50.7 | 50 | Yes |
| | Estuaries ranked by nursery importance | | 1009.00 | 1230.0 | 82.0 | 80 | Yes |
| Pinch-points | Estuary mouths of flagship free-flowing rivers | | 37.65 | 40.7 | 92.6 | 90 | Yes |
| | Estuary mouths of non-flagship free-flowing rivers | | 56.47 | 67.2 | 84.1 | 80 | Yes |
| **Existing priorities** | | | | | | | |
| Recognised sites | Ramsar sites | | 1517.94 | 1518.9 | 99.9 | 100 | Yes |
| | World Heritage Sites inscribed for natural criteria | | 1021.20 | 1021.2 | 100.0 | 100 | Yes |
| | IOSEA Turtle Site of Importance | | 1021.20 | 1021.2 | 100.0 | 50 | Yes |
| | Important Bird and Biodiversity Areas | | 1005.95 | 1201.7 | 83.7 | 50 | Yes |
| | Agulhas Bank Nursery Area | | 7631.16 | 13620.0 | 56.0 | 50 | Yes |
| | Algoa to Amathole | | 11554.91 | 19622.4 | 58.9 | 50 | Yes |
| | Browns Bank | | 3043.65 | 5657.7 | 53.8 | 50 | Yes |
| | Cape Canyon and Surrounding Islands, Bays and Lagoon | | 9997.06 | 16584.7 | 60.3 | 50 | Yes |
| | Childs Bank and Shelf Edge | | 6990.85 | 13586.7 | 51.5 | 50 | Yes |

| Input | Feature | Threat Status | Amount within MPAs or CBAs (mostly km$^2$) | Feature amount (mostly km$^2$) | Percent in MPAs or CBAs (%) | Target (%) | Target met |
|---|---|---|---|---|---|---|---|
| Recognised sites | Delagoa Shelf Edge and Canyon Complex | | 15681.33 | 17950.1 | 87.4 | 50 | Yes |
| | Kingklip Corals | | 2812.88 | 5442.5 | 51.7 | 50 | Yes |
| | KwaZulu-Natal Bight and uThukela River | | 5377.54 | 10578.8 | 50.8 | 50 | Yes |
| | Mallory Escarpment and Trough | | 6907.27 | 13072.9 | 52.8 | 50 | Yes |
| | Namaqua Coastal Area | | 2541.89 | 3507.2 | 72.5 | 50 | Yes |
| | Namaqua Fossil Forest | | 516.49 | 831.6 | 62.1 | 50 | Yes |
| | Orange Cone | | 720.68 | 1224.9 | 58.8 | 50 | Yes |
| | Orange Seamount and Canyon Complex | | 6396.19 | 8801.7 | 72.7 | 50 | Yes |
| | Protea Banks and Sardine Route | | 4934.60 | 9344.8 | 52.8 | 50 | Yes |
| | Protea Seamount Cluster | | 6988.52 | 9019.5 | 77.5 | 50 | Yes |
| | Seas of Good Hope | | 4306.22 | 6745.5 | 63.8 | 50 | Yes |
| | Shackleton Seamount Complex | | 7742.52 | 11932.2 | 64.9 | 50 | Yes |
| | Tsitsikamma-Robberg | | 1620.47 | 2639.3 | 61.4 | 50 | Yes |
| Previous prioritisations | Priority beaches from Harris 2012 | | 217.37 | 264.9 | 82.0 | 50 | Yes |
| | Shores/mouths of priority estuaries | | 1483.00 | 1929.0 | 76.9 | 75 | Yes |

# Appendix 2: Datasets used and proposed to include in the next iterations of the National Coastal and Marine CBA Map

**Table A2.1.** *Compilation of proposed datasets to source and include in the next iterations of the National Coastal and Marine CBA Map. CR=Critically Endangered; EN=Endangered; VU=Vulnerable; DD=Data Deficient. Items that are shaded in light blue were included in the current version of the National Coastal and Marine CBA Map. Items that are shaded in grey were considered and not used for various reasons, explained in the Reference column.*

| Feature | Detailed information | Threat status | Reference |
|---|---|---|---|
| **Ecosystems** | | | |
| Ecosystem types | Marine ecosystem types | LC-CR | Sink et al., 2019a |
| | Coastal ecosystem types | LC-CR | Harris et al., 2019a |
| Pelagic bioregionalisation | Pelagic ecosystem types | | Roberson et al., 2017; Sink et al., 2011 |
| **Species** | | | |
| Turtles | Turtle nesting sites | NT, CR | King 2019; Harris et al., 2015; Nel et al., 2013; Harris et al., 2019a |
| | Loggerhead internesting areas | NT | Harris et al., 2015 |
| | Leatherback internesting areas | CR | Harris et al., 2015 |
| | Loggerhead and Leatherback foraging areas | NT, CR | Harris et al., 2018; to be updated with new data and included in future versions |
| | Loggerhead migration routes | NT | Harris et al., 2018 |
| | Leatherback migration routes | CR | Harris et al., 2018; to be updated with most recent tracking data |
| | Foraging areas of non-nesting species (green turtles; hawksbills) and juveniles/subadults | All species are threatened | Data to be shared by DFFE and the aquaria once the data-sharing agreements are in place |
| Seabirds | Colonies of threatened locally breeding seabirds | EN | Dr Stephen Kirkman, DFFE Unpublished data; CapeNature Unpublished data; Crawford et al., 2016; Sherley et al., 2017, 2019, 2020. |
| | Generalised foraging areas of threatened locally breeding seabirds: African Penguin, Cape Gannet, Bank Cormorant, Cape Cormorant | EN | Majiedt et al., 2013 (updated Cape and Bank Cormorant foraging areas using the new map of colonies listed above; updated African Penguins to include the newly established colony at De Hoop) |
| | African Penguin core use areas at various life-history stages and from different colonies; and aggregated home ranges | EN | BirdLife South Africa, 2021 |
| | Cape Cormorant core use areas from different colonies; and aggregated home ranges | EN | BirdLife South Africa, 2021 |
| | Cape Gannet core use areas from different colonies; and aggregated home ranges | EN | BirdLife South Africa, 2021 |
| | Atlantic Yellow-nosed Albatross core incubation distribution areas from different colonies | EN | BirdLife South Africa, 2021 |

| Feature | Detailed information | Threat status | Reference |
|---|---|---|---|
| | Indian Yellow-nosed Albatross core post-guard distribution areas from Marion Island colony | EN | BirdLife South Africa, 2021 |
| Seabirds | Sooty Albatross core distribution areas | EN | BirdLife South Africa, 2021; outside the mainland EEZ, therefore, not included |
| | Wandering Albatross core distribution areas at various life-history stages and/or from different colonies | EN | BirdLife South Africa, 2021 |
| | Northern Giant Petrel core incubation distribution areas from Marion Island colony | LC | BirdLife South Africa, 2021 |
| Shorebirds | Distributions of shore birds | | To be included in future versions. BirdLife South Africa / ADU data (SABAP2) |
| Cetaceans | Indian Ocean Humpback Dolphin *Sousa plumbea* | EN | Purdon et al., 2020a |
| | Heaviside's Dolphin *Cephalorhynchus heavisidii* | NT | Purdon et al., 2020a |
| | Dusky Dolphin *Lagenorhynchus obscurus* | LC | Purdon et al., 2020a |
| | Indo-Pacific Bottlenose Dolphin *Tursiops aduncus* | NT | Purdon et al., 2020a |
| | Southern Bottlenose Whale *Hyperoodon planifrons* | LC | Purdon et al., 2020a |
| | Common Dolphin *Delphinus delphis* | LC | Purdon et al., 2020a |
| | False Killer Whale *Pseudorca crassidens* | NT | Purdon et al., 2020a |
| | Killer Whale *Orcinus orca* | DD | Purdon et al., 2020a; not included because considered to be ubiquitous and there's no information on finer scale habitat use |
| | Risso's Dolphin *Grampus griseus* | LC | Purdon et al., 2020a |
| | Bryde's Whale | LC | Purdon et al., 2020b |
| | Southern Right whale | LC | Purdon et al., 2020b |
| | Sperm Whale | VU | Purdon et al., 2020b |
| | Humpback Whale | LC | Purdon et al., 2020b |
| | Key bay habitat for whales | | Findlay, K. (pers. comm). See also: Elwen & Best, 2004a,b,c, Findlay et al., 2017 |
| Seals | Seal colonies | LC | Kirkman et al., 2013 |
| | Seal foraging areas: generalised and from tracking data | LC | Botha et al., 2020, Kirkman unpublished data |
| Sharks and rays | White Sharks: core-use areas and distribution | VU | Kock et al., in review |
| | 67 layers (seasonal) of 40 shark and ray species | LC-CR | Faure Beaulieu et al., 2021 |
| Fish | Distributions of key species | | To be included in future versions, e.g., National BRUV data, ATAP data. SAIAB indicated they could assist. |
| | Community distributions | | Fish Atlas Data (Colin Attwood) |

| Feature | Detailed information | Threat status | Reference |
|---|---|---|---|
| | Black Musselcracker | VU | Murray et al., 2019 |
| | Other species | | To be included in future versions |
| Invertebrates | | | Planned inclusion through the SEAMAP project |
| Plants | Locations of threatened and not protected coastal plant species | | SANBI; outside of the current planning domain. To be included in future iterations that include new coastal land-based prioritisation as well. |
| **Key habitats and features** | | | |
| Unique features | Alexandria dunefield | | Extracted from: Harris et al., 2019a |
| | Mallory slope | | Digitized from: De Wet 2012 |
| | Childs Bank | | Majiedt et al., 2013; Sink et al., 2012; need to update to the new delineation of the feature in Sink et al., 2019a |
| | Namaqua Fossil Forest | | Extracted from: Sink et al., 2019a |
| | PE Ridge | | Extracted from: Sink et al., 2019a |
| | Cold ridge | | To be included in future versions |
| | Rhodolith beds | | ACEP Imida, unpublished data; Adams et al., 2020. In future versions, also consider using predicted areas where these features occur from Adams et al., 2020, not just actual records. |
| | Algal dominated reefs | | ACEP Imida, unpublished data |
| | Anemone garden | | ACEP Deep Secrets, unpublished data |
| | Horse mussel aggregations | | ACEP Deep Forests, unpublished data |
| | Wreck Fish aggregations | | ACEP Imida, unpublished data |
| | Red Steenbras aggregations | | Prof. Kerry Sink, SANBI, unpublished data |
| | Giant Guitarfish aggregations | | Prof. Kerry Sink, SANBI, unpublished data |
| Special features | Potential cold-water corals | | ACEP Deep Secrets, unpublished data |
| | Potential Vulnerable Marine Ecosystems, indicator species and features | | Sink & Atkinson 2020; Sink et al., 2021 |
| | Others: e.g., echinoderm aggregation areas; important crustacean areas | | To be included in future versions when the data are available |
| **Ecological processes** | | | |
| Productivity | High productivity areas including upwelling (based on chl-a) | | NASA GES DISC Giovanni Portal; see Acker and Leptoukh, 2007 |
| | Beaches with surf diatom accumulations | | Harris et al., 2010; Harris 2012; extracted from Harris et al., 2019a; see also Campbell 1996 |
| | Beaches with beach-cast kelp | | Harris 2012; extracted from Harris et al., 2019a |

| Feature | Detailed information | Threat status | Reference |
|---|---|---|---|
| | Others | | To be explored for inclusion in future versions, e.g., other ecosystems or features that are highly productive, such as mangroves |
| Spawning and nursery areas | Anchovy spawning areas | | Twatwa et al., 2005 |
| | Sardine spawning areas | | Twatwa et al., 2005. Also need to explore McGrath 2017, McGrath et al., 2020 for potential, additional information to include in future versions. |
| | Hake spawning (2 species) | | Jansen et al., 2015; to be mapped for inclusion in future versions |
| | Spawning and nursery areas for fish | | Hutchings et al., 2002 |
| | Chokka/Squid spawning areas | | Roberts et al., 2012; see also Downey-Breedt et al., 2016; Lipiński et al., 2016 |
| | Others | | Explore additional, available data, e.g., from SAIAB and other sources |
| | Estuary fish nursery importance (shores/mouths) | | Van Niekerk et al., 2019b in Van Niekerk et al., 2019a; extracted from Harris et al., 2019a |
| Pinch-points | Estuary mouths of flagship and non-flagship free-flowing rivers | | Nel et al., 2011a, b; extracted from Harris et al., 2019a |
| Connectivity | Particle modelling | | Collaboration in discussion. SAIAB also indicated their assistance in this aspect for future versions. |
| | Species' migrations and movement between habitats | | e.g., ATAP data, other telemetry data. SAIAB also indicated their assistance in this aspect for future versions. |
| | Other | | Any additional research on including connectivity in systematic biodiversity planning is welcomed, recognising that this aspect may be better regarded as a design element, depending on the nature of the data and the approach. |
| Oceanography features that contribute to processes | | | To be discussed with oceanographers (or built into a revised pelagic bioregionalization). See also: Hutchings et al., 2009; Kirkman et al., 2016. |
| Other ecological processes | | | To be identified at SAMSS. Further place-based research on marine ecological processes will strengthen the spatial prioritisation. |
| **Ecological infrastructure** | | | |
| Ecological infrastructure | Coastal protection | | Perschke (2022) |
| | Recreational outdoor activities and sports events | | Perschke (2022) |
| | Strategic fisheries priority areas | | No data currently available. To be included in future versions once these have been mapped. |
| **Existing priorities** | | | |
| Recognised sites | Ramsar sites | | Ramsar Sites Information Service, 2020. Ramsar: https://www.ramsar.org/wetland/south-africa |
| | World Heritage Sites inscribed for natural criteria | | |

| Feature | Detailed information | Threat status | Reference |
|---|---|---|---|
| | IOSEA Marine Turtle Site of Importance | | IOSEA: https://www.cms.int/iosea-turtles/sites/default/files/basic_page_documents/IOSEA_Site_Network-ISimangaliso_SouthAfrica.pdf |
| | Important Bird Areas | | BirdLife South Africa |
| | Important Marine Mammal Areas | | https://www.marinemammalhabitat.org/immas/ Data requested: no response. Shape matches that of the combined cetacean distributions included above. |
| | EBSAs | | MARISMA project: https://cmr.mandela.ac.za/EBSA-Portal |
| Previous ecosystem prioritisations | Beach priorities | | Harris 2012 |
| | Dune priorities | | Tinley 1985; outside of the current planning domain. To be included in future iterations that include new coastal land-based prioritisation as well. |
| | Priority estuaries | | Van Niekerk et al., 2019b in Van Niekerk et al., 2019a, including Turpie et al., 2012; to be updated |
| | Freshwater ecosystem priority areas | | Outside of the current planning domain. Plan in revision; we are in communication with the planners to align priorities, especially through estuaries. In this iteration, alignment is through inclusion of the estuary mouths of free-flowing rivers. |
| Previous priorities considered, but recognised as superseded and not included | Coastal fish priority areas (identified prior to declaration of the new MPAs) | | Turpie et al., 2000 |
| | NSBA 2004 | | Lombard et al., 2004 |
| | Agulhas Plan | | Clark & Lombard 2007 |
| | Offshore MPA Project (OMPA) | | Sink et al., 2011 |
| | KZN SEA Plan | | Harris et al., 2012 |
| | West Coast Plan | | Majiedt et al., 2013 |
| | NPAES 2016 (marine areas were the Phakisa MPAs that have since been declared) | | DFFE 2016 |
| **Design Elements** | | | |
| Edge-matching and priority alignment | Existing land-based protected areas and marine protected areas | | Sink et al., 2019c; Skowno et al., 2019; DFFE 2020 |
| | Algoa Bay fine-scale systematic conservation plan | | Algoa Bay Project 2019 |
| | Land-based CBAs | | Holness and Oosthuysen, 2016; Pence 2017; Pool-Stanvliet et al., 2017 Hawley et al., 2019; KZN CBA Irreplaceable version 01022016 2016; KZN CBA Optimal version 03032016 2016 |
| | Conservation zones of transboundary EBSAs (in Namibia) | | MARISMA Project 2020a, 2020b |
| | Portions of under-protected (Not Protected, Poorly Protected) ecosystem types that are within EBSAs but outside of MPAs | | Created from Sink et al., 2019a; MARISMA Project 2020a; Sink et al. 2019c |

| Feature | Detailed information | Threat status | Reference |
| --- | --- | --- | --- |
| | Gouritz coastal corridor (whole corridor, and four corridor components) | | Created from Sink et al., 2019a |
| | Marine monitoring: 3 SAEON sentinel sites | | Atkinson et al., 2016 |
| | Marine monitoring: monitoring lines | | Atkinson et al., 2016 |
| Ecological Condition | Portions of ecosystem types in natural/near-natural ecological condition | | Sink et al., 2019a,b |
| | Portions of ecosystem types in natural/near-natural and moderately modified ecological condition | | Sink et al., 2019a,b |
| Heritage sites | World Heritage sites inscribed for cultural criteria and buffer | | UNESCO website |
| | Culturally significant sites: e.g., Shaka's Rock; Hole in the Wall; Sulphur Springs; Gompho Rock; archaeological sites, coastal caves, middens, Durban Bluff Whale Heritage Site | | Harris et al., 2019b; Algoa Bay Project, 2019; and personal knowledge. Initial compilation, to be expanded; also mapping of Cultural Significant Areas in the CoastWise project (see below). Potential synergies with the One Ocean Hub. |
| | Fish traps | | SAHRA, 2020 |
| | Heritage: shipwrecks | | SAHRA, 2021 |
| | Interactions with nature (citizen science) | | iNaturalist 2021a-d |
| | Iconic seascapes | | Sites of high importance for sense of place and aesthetic value that are inspirational and invokes a sense of awe. A preliminary list includes: Kosi Lakes, Waterfall Bluff, Hole in the Wall, Port St Johns cliffs, Knysna heads, Hermanus whale cliffs, Cape Agulhas, Table Mountain, Cape Point, and Langebaan. |
| | Others | | Possible sites from emerging work on this subject (by Sizo Sibanda and the CoastWise project team). Other inputs from social scientists welcomed because this component would benefit substantially from engagement with coastal communities and indigenous knowledge. Other sites to include are: coastal education centres; lighthouses; and ecotourism ventures (dive sites, whale-watching, etc), possibly grouped under a separate data heading. |
| Climate-change adaptation | Portions of ecosystem types with the most stable climate change velocity | | Rayner et al., 2003; www.metoffice.gov.uk/hadobs (raw data); Sink et al., 2019a; David Schoeman, pers. comm. See also: Brito-Morales et al. 2019; Molinos et al. 2019; Tittensor et al., 2019. Potential to expand this work considerably; potential collaboration under discussion. |
| | Upwelling areas | | Recommended by Lourenço et al., 2016. Already included as one of the productivity features. |

| Feature | Detailed information | Threat status | Reference |
|---|---|---|---|
| | Seamounts | | Recommended by Tittensor et al., 2010. Extracted from: Sink et al., 2019a. Also need to add Mallory Slope as a steep sloped area that would play a similar function to the seamounts. |
| | Areas adjacent to low-lying inland areas without infrastructure that coastal habitats can expand into as sea levels rise | | To be included in future versions |
| | Carbon sequestration | | To be included in future versions |
| | Areas of high genetic diversity | | To be included in future versions |
| | Centres of endemism | | To be included in future versions |

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# Appendix 3: National Coastal and Marine CBA Map: details of the sub-categories and coastal integration, including coastal land-use guidelines

## A3.1 National Coastal and Marine CBA Map sub-categories

For most users of the National Coastal and Marine Spatial Biodiversity Plan, the distinction between CBA Natural 1 and 2, and between CBA Restore 1 and 2 is not needed because the broad management objective, and thus management recommendations, are the same (Table 12). However, it is useful to show the sub-categories separately for CBAs in the CBA Map in this technical report (Figure 185) because the detail can be useful for internal sector-based decisions, e.g., MSP, and biodiversity offsets. They can also be useful for multi-sector negotiations because CBA 1 indicates irreplaceable or near-irreplaceable sites that are required to meet biodiversity targets with limited, if any, option to meet targets elsewhere, whereas CBA 2 indicates best design sites that often can be adjusted to meet targets in other areas, although that generally comes at higher cost to other sectors and requires additional area. Displaying all categories of biodiversity priority also provides transparency for both internal and multi-sector processes, which is important and good practice for decision-making. Note: As explained in Section 5, the Other Natural Areas (ONA) and No Natural Remaining (NNR) map categories are not included in the National Coastal and Marine CBA Map. Therefore, these map categories are not displayed for the coastal land either (Figure 185).

Within the marine territory, MPAs comprise 5.4%, CBA Natural comprises 18% (12.3% CBA 1, 5.7% CBA 2), CBA Restore comprises 3.6% (2.2% CBA 1, 1.4% CBA 2), and ESAs comprise 6.6% of the extent (Figure 184; see Table 12 above for CBA Map category definitions). This means that 33.6% of the marine territory is in one of the CBA Map categories. This means that two thirds of the CBAs comprise irreplaceable to near-irreplaceable sites (CBA 1s combined: 14.5%) and the remaining third comprise best-design sites (CBA 2s combined: 7.1%). There are generally no other options to represent biodiversity features in the former sites, but some degree of choice in the latter sites. CBA 2s tend to be spatially complementary to CBA 1s, meaning that they are generally selected in a configuration that expands the outer edges of CBA 1s or connects separate CBA 1s into larger areas. However, there are places where separate CBA 2s are identified.

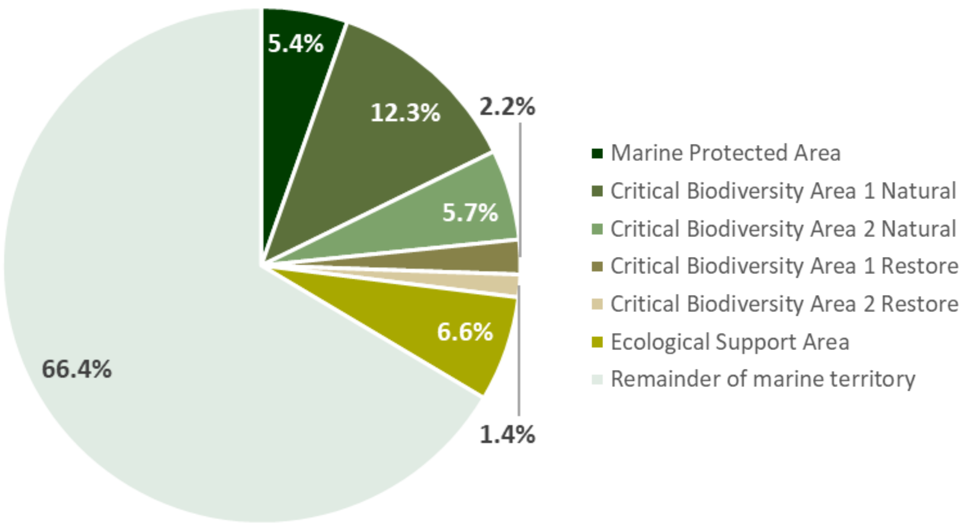


**Figure 184.** *Proportions of South Africa's mainland marine territory in each of the CBA Map categories.*

**Table 12**. *Summary of the CBA Map subcategories in the National Coastal and Marine CBA Map Version 1.2.*

| Category | Description | Broad Management Objective |
|---|---|---|
| Protected Area | Areas that are formally protected in terms of the National Environmental Management: Protected Areas Act (No. 57 of 2003). They provide formal protection to a representative portion of biodiversity features that could persist into the future. | As per each Protected Area Management Plan. |
| Critical Biodiversity Area 1 Natural | Irreplaceable to near-irreplaceable sites that are in a natural ecological condition. Together with Marine Protected Areas, and other CBAs, these sites are require to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs support MPAs by securing biodiversity for long-term persistence using strict conservation measures. | Must be kept in a natural or near-natural state. |
| Critical Biodiversity Area 2 Natural | Best design sites that are in a natural ecological condition. Together with Marine Protected Areas, and other CBAs, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs support MPAs by securing biodiversity for long-term persistence using strict conservation measures. | |
| Critical Biodiversity Area 1 Restore | Irreplaceable to near-irreplaceable sites that are no longer in a natural ecological condition and that need to be restored. Together with Marine Protected Areas, and other CBAs, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs support MPAs by securing biodiversity for long-term persistence using strict conservation measures. | Improve ecological condition and, in the long term, restore to a natural / near-natural state, or as near to that state as possible. As a minimum, avoid further deterioration in ecological condition and maintain options for future restoration. |
| Critical Biodiversity Area 2 Restore | Best design sites that are no longer in a natural ecological condition and that need to be restored. Together with Marine Protected Areas, and other CBAs, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs support MPAs by securing biodiversity for long-term persistence using strict conservation measures. | |
| Ecological Support Area | ESAs are often highly used areas that can be heavily impacted, but still are still important for biodiversity patterns and ecological processes. The ESAs play a supporting role to the CBAs, where the emphasis in these areas is on managing impacts to biodiversity. | Avoid further deterioration in ecological condition. |

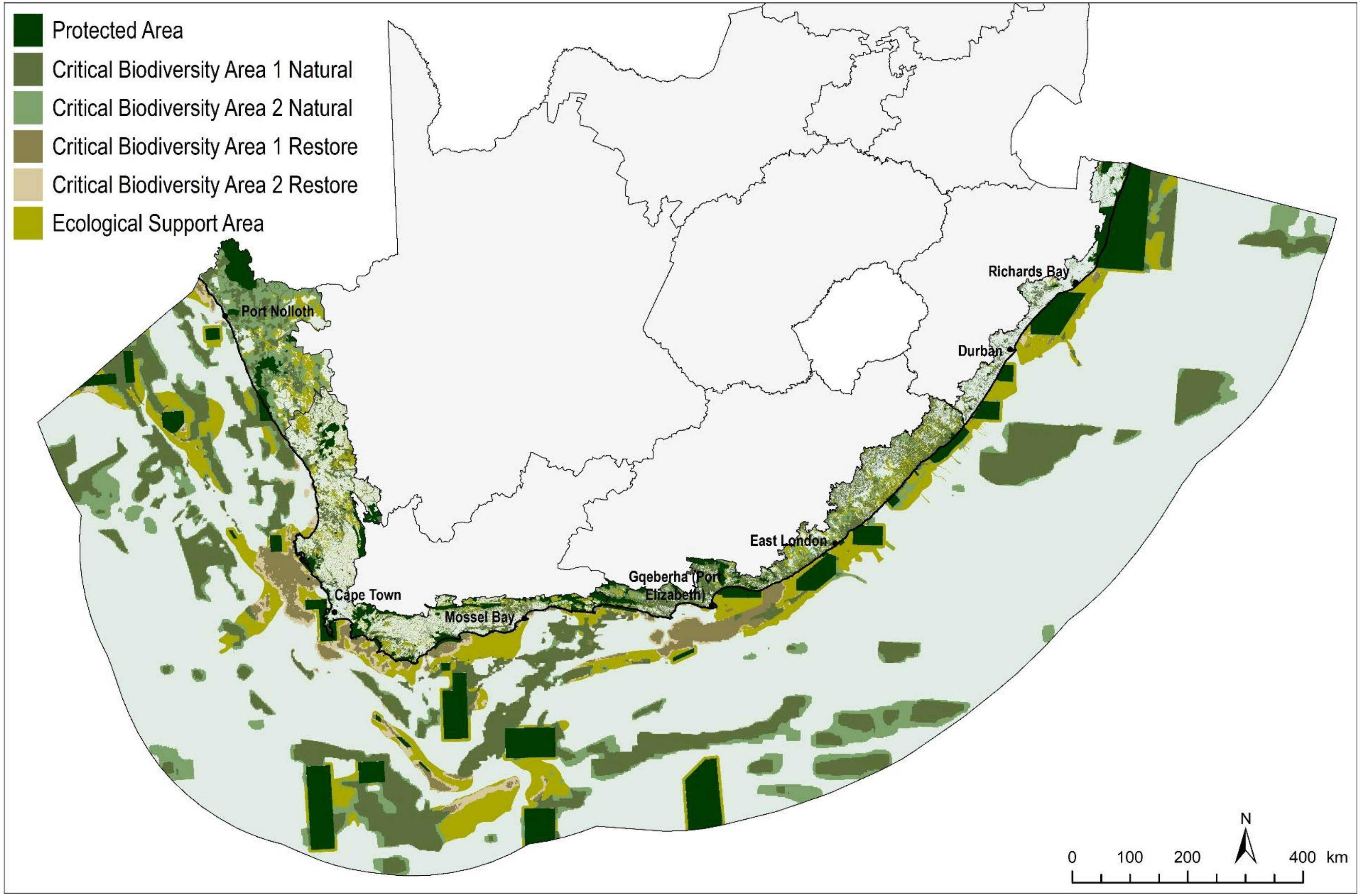


**Figure 185.** *National Coastal and Marine CBA Map Version 1.2 (Released 12-04-2022) and the protected areas, CBAs, and ESAs in coastal municipalities.*

### A3.2 Appendix 4. Coastal land-use guidelines and integrated coastal zone management

The coastal land-based biodiversity priority areas (Figure 185) come from the existing provincial plans. Therefore, for the land-use guidelines accompanying these biodiversity priority areas, see the respective provincial spatial biodiversity plans (Table 13). In future updates of the National Coastal and Marine Spatial Biodiversity Plan, a focus will be on improving the land-sea integration (Section 7.2). This may also require, *inter alia*, some cross-checks between the land- and sea-use guidelines to ensure that transitional systems (e.g., beaches and dunes) are appropriately managed across the land-sea interface (see Section 7.4), in accordance with the National Environmental Management: Integrated Coastal Management Act No. 24 of 2008.

**Table 13.** *References and links to the coastal provincial plans and land-use guidelines*

| Province | Reference | Website |
|---|---|---|
| Northern Cape | Holness and Oosthuysen (2016) | http://bgis.sanbi.org/Projects/Detail/203 |
| Western Cape | Pool-Stanvliet et al. (2017) | http://bgis.sanbi.org/Projects/Detail/194 |
| Eastern Cape | Hawley et al. (2019) | http://bgis.sanbi.org/Projects/Detail/233 |
| KwaZulu-Natal | Escott et al. (2016) | http://bgis.sanbi.org/Projects/Detail/22 |

## Appendix 4: List of meetings, workshops and work sessions held to inform and review the National Coastal and Marine Spatial Biodiversity Plan

The following meetings, workshops and work sessions were held over the period October 2018 to December 2020, to help draft the National Coastal and Marine CBA Map criteria, identify relevant data sets, and review the approach and progress. An overview of main areas of discussion and the organisations represented at each workshop or work session are provided. Note that these engagements build on the progress made during the EBSA process, which began in 2016.

**Table A3.1.** *Summary of meetings, workshops and work sessions held to inform and review the National Coastal and Marine Spatial Biodiversity Plan, and the organisations represented at each event.*

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 19 – 22 June 2018 | Biodiversity Planning Forum, Cape St Francis | Plenary session: Coastal and marine biodiversity assessment and planning: Towards ocean use guidelines. The aim of the session was to review progress and develop plans for a first National Marine Critical Biodiversity Areas (CBA) map that identifies and communicates different categories of priority areas to inform Marine Spatial Planning. Presentations and discussions informed work to identify new focus areas for Marine Protected Areas, Strategic Fisheries Areas, Coastal Ecological Infrastructure and other Ecological Support Areas. A presentation that reviewed the legal and policy framework opened the session and provincial planners shared lessons from provincial biodiversity planning. Challenges and opportunities in developing an integrated Lessons from good practice in land use guidelines helped inform the plans for ocean use guidelines. | BirdLife South Africa; CapeNature; Capricorn Marine Environmental (Pty) Ltd; CEN; Conservation Outcomes; CSIR; DFFE; DEA (Botswana); DPME; Eastern Cape DEDEAT; Eastern Cape Parks and Tourism Agency; Endangered Wildlife Trust; EOH; eThekweni Municipality; Ezemvelo KZN Wildlife; Free State DESTEA; Freshwater Consulting; Gauteng DARD; Greater Letaba Municipality; Independent consultants; IUCN SSC; JRC, European Commission; Kruger2Canyons Biosphere; Limpopo LEDET; Mondi Ltd; Mpumalanga DARDLEA; Nelson Mandela University; North West READ; North West University; Northern Cape DENC; Overberg Renosterveld Conservation Trust; Resilience Environmental Advice; SAEON; SANBI; SANCCOB; SANParks; Scherman Colloty and Associates; Stellenbosch University; University of Botswana; University of Cape Town; University of KwaZulu-Natal; University of the Free State; University of the Western Cape; Wildlands Conservation Trust; WWF South Africa. |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 30 October – 1 November 2018 | Provincial and Metro Biodiversity Planning Working Group | A dedicated session discussed the development of a national CBA<br><br>Map for the marine environment for inclusion into the NBA. The team producing the plan shared proposed approach and progress to date. Planners endorsed the proposed approach and discussion centred on connectivity, climate resilience and improved coastal integration in the longer term. | CapeNature; CSIR; Eastern Cape Parks and Tourism Agency; EOH; Ezemvelo KZN Wildlife; Free State DETEA; Gauteng DARD; Limpopo EDET; Mpumalanga TPA; Nelson Mandela University; North West DEDECT; Northern Cape DENC; SANBI; SANParks. |
| 6 December 2018 | Marine Biodiversity Working Group | Review of approach, discussion on best ways to align with provincial priorities and to incorporate climate resilience, social benefits, and connectivity. The proposed approach and targets were endorsed. Additional data sets that can be used to support species inclusion in future iterations (2021/2022) were identified with follow up data provided by Alison Kock (SANParks).<br><br>The value of the CBA Map in supporting future priority areas for MPA expansion (next 5% target) was recognised. The importance of spatial alignment between CBAs, EBSAs and future MPA expansion priorities was emphasised. | Cape Nature; DFFE; DENC; Eastern Cape Parks and Tourism Agency; SAEON; SAIAB; SANBI; SANParks; University of Cape Town. |
| 29 May 2019 | National EBSA Working Group Meeting, Cape Town | The National Coastal and Marine Critical Biodiversity Areas Map was presented and an explanation of how this aligned with the proposed EBSA Conservation and Impact Management Zones, and that the CBA Map was proposed to be used as the basis for EBSA zoning, with a first draft of the EBSA zoning presented for discussion. | Anchor Environmental Consulting; BirdLife; Cape Research and Diver Development; De Beers; DFFE; IOI; Nelson Mandela University SANBI; SAEON; SANCCOB; SANParks. |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 4 – 7 June 2019 | Biodiversity Planning Forum, Alpine Heath Resort, KwaZulu-Natal.<br>Work session: Coastal and Marine Critical Biodiversity Area Map | The National Coastal and Marine Critical Biodiversity Areas Map and associated sea-use guidelines was presented. The presentation was given in plenary with an open invitation to discuss it in a later work session that addressed:<br>• Interrogation of the CBA Map<br>• Edge-matching progress and challenges<br>• Links among the prioritisation processes (CBAs, EBSAs, KBAs)<br>• Sea-use guidelines and links to MSP<br>• MPAs | AES; African Conservation Centre (Kenya); Amphibian and Reptile Conservation Trust; Anchor Environmental; AWARD; BBreedlove (Pty) Ltd; BirdLife South Africa; Cape Analytical Services Laboratories (Pty) Ltd; CapeNature; CBD Focal Point Assistants (Cameroon); CBD Secretariat; City of Cape Town; College of Science and Technology; CSIR; DFFE; DEA (Botswana); DEA (Malawi); Eastern Cape Parks and Tourism Agency; Eco-Pulse Consulting; Endangered Wildlife Trust; ESRI South Africa; eThekweni Municipality; Ethiopia; Ezemvelo KZN Wildlife; Gauteng DARD; Independent consultants; Institute for Natural Resources; Johannesburg City Parks and Zoo; KBA Secretariat; Land use and Spatial Planning Department (Ghana); Limpopo EDET; Malawi University of Science and Technology; Ministry of Environment and Tourism (Namibia); Mpumalanga TPA; National Environment Management Authority (Uganda); Nelson Mandela University; North West READ; Northern Cape DENC; Rhodes University; SANBI; SANParks; Southern Connections; The Cirrus Group; The Msunduzi Municipality; UNEP-WCMC; University of Botswana; University of Cape Town; University of Kent; University of the Free State; Western Cape Department of Agriculture; Wildlands Conservation Trust; Wildlife Conservation Society; WWF South Africa. |
| 29 – 31 October 2019 | Provincial and Metro Biodiversity Planning Working Group, Malibu Country Lodge, Pretoria | Review of process and outputs with positive feedback from participants. Suggestion that this work is fed into EIA screening tools as the presented work is a significant advancement on what is currently used in for example EIAs. Provincial planners recommended that provincial priorities are not used to seed coastal priorities as the work under review represents an improvement on the 2011 work. Further improvement and discussion with coastal planners recommended building on planned improvements through the CoastWise project. EKZNW requested 3 new national layers: MPA boundaries, MPA zones and a national fine-scale bathymetry layer. Birdlife expressed willingness to provide bird data for future iterations. | BirdLife; CapeNature; CES; CSIR; DFFE; Eastern Cape Parks and Tourism Agency; Ezemvelo KZN Wildlife; Free State DETEA; Gauteng DARD; Independent consultants; Limpopo EDET; Mpumalanga TPA; Nelson Mandela University; North West DEDECT; Northern Cape DENC; Resilience Environmental Advice; SANBI. |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 12 February 2019 | National EBSA Working Group Meeting, Cape Town | The National Coastal and Marine Critical Biodiversity Areas Map was presented, as well as the revised EBSA zoning based on the CBA Map and taking into account feedback from the meeting on 29 May 2019. The proposed management regulations (the principles of which underpin the sea-use guidelines) were also presented for discussion. | BirdLife; Cape Research and Diver Development; DFFE; De Beers; Environmental consultants; I&J Limited; IOI; KZN Sharks Board; Lwandle Technologies (Pty) Ltd.; Nelson Mandela University; SANBI; SAEON; SANCCOB; SANParks; SAPFIA; Stellenbosch University; Two Oceans Aquarium; University of the Western Cape; Wildlife Conservation Society |
| 13 February 2020 | Marine Biodiversity Working Group, Cape Town | Alignment of EBSAs and other spatial tools such as Critical Biodiversity Areas was emphasised to ensure consolidated biodiversity input into MSP and other multi-sector processes. The revised proposed zoning of EBSAs was presented showing alignment of the broad management of objectives of the EBSA zones with that of CBAs and ESAs. Proposed management recommendations for the two EBSA zones were also presented. Recommendation for a special session to obtain further inputs and identify key data layers to improve the National Coastal and Marine Spatial Biodiversity Plan at the South African Marine Science Symposium. | CapeNature; DFFE; DENC; Nelson Mandela University; SANBI; WWF |
| May, July, September 2020 | Virtual meetings | Virtual meetings with PASA and the individual petroleum rights holders regarding the specific priority areas for the petroleum industry, and engagement over the sea-use guidelines. The meetings were initially part of engagements regarding the EBSA zoning and management recommendations, but expanded to include the broader priorities for inclusion in the National Coastal and Marine Spatial Biodiversity Plan. | Africa Energy; DFFE; Impact Africa; New Age; NMU; Petroleum Agency South Africa; PetroSA; Shell; Sunbird Energy; Total. |
| 22 October 2020 | Virtual online information sharing session | Virtual information sharing session on Marine Spatial Biodiversity Priorities as an input for Marine Spatial Planning. All meeting content (agenda, videos and pdfs of the presentations) is available on the EBSA Portal. | 143 participants from a range of government departments, industries, NGOs, consultancies, and universities (including scientists, and social scientists). |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 10 November 2020 | Virtual meeting of the Provincial and Metro Biodiversity Planning Working Group | The National Coastal and Marine Spatial Biodiversity Plan Version 1 Beta 1 was presented and was received with very positive feedback. Some of the technical aspects were discussed, e.g., technical options for enhancing land-sea alignment of priorities in the coastal zone based on how some of the land-based planners have edge-matched priorities across provincial boundaries. | BirdLife South Africa; CapeNature; CSIR; DFFE; Department of Environment and Nature Conservation; DESTEA; Eastern Cape Parks and Tourism Agency; Ezemvelo KZN Wildlife; FS DESTEA; Gauteng Department of Agriculture and Rural Development; Independent consultant; MTPA; NC Department of Agriculture, Environmental Affairs, Rural Development & Land Reform; Nelson Mandela University; NWDEDECT; SANBI; SANParks. |
| 21 January 2021 | Virtual meeting of Fisheries data review | Virtual workshop to review all of the fisheries data used in the NBA 2018 Marine assessment and the National Coastal and Marine Spatial Biodiversity Plan to:<br>1. assess the accuracy of the data we currently have.<br>2. provide insight into potential expansion of activities.<br>3. provide expert advice on the best ways in which each dataset should be interpreted, analysed and presented.<br>Discussions around the best approach for including this information in the map representing the different fisheries sectors for the cost layer in the CBA Map. | DFFE, SANBI, NMU, ORI, SANParks |
| 22 January 2021 | Virtual meeting with De Beers | Virtual meeting for De Beers to present information on planned activities and discussions around the best approach for including this information in the map representing mining for the cost layer in the CBA Map | De Beers, DFFE, NMU |
| 2 February 2021 | Virtual meeting with Shell and PASA | Virtual meeting for Shell to feedback on CBA Map v1 beta2 with regards to new areas of spatial overlap in priorities. Discussions around the best approach for including this information in the map representing petroleum for the cost layer in the CBA Map. | PASA, NMU, Shell |
| 9 February 2021 | Virtual meeting with PASA | How to best include the petroleum data in the cost layer: identifying areas of highest to lowest priority | DFFE, PASA, NMU |
| 9 February 2021 | Virtual meeting with OPASA | How to best include the petroleum data in the cost layer | Africa Energy Corp, DFFE, ENI, Impact Oil and Gas, New Age, NMU, PASA, PetroSA, Shell, Sunbird, Total |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 12 March 2021 | Virtual meeting with SAPFIA and SADSTIA | Meeting with the South African Pelagic Fishing Industry Association and South African Deep-Sea Trawling Industry Association to discuss and clarify the CBA Map process including incorporation of fisheries data, software used to identify the priority areas, etc; clarify the differences between the CBA Map, MSP process, and MPA expansion; an confirm South Africa's national and international commitments to and targets for marine protection. | DFFE, NMU, SADSTIA, SANBI, SAPFIA, SAPFIA Scientific Subcommittee, UCT. |
| 22 April 2021 | Virtual meeting with OPASA | Reviewing the revised, proposed inclusion of petroleum data in the cost layer | DFFE, Impact Africa, NMU, PASA, Total. |
| 14 May 2021 | Virtual meeting to discuss the inland extent of the CBA Map | Meeting with SANBI to discuss the inland extent of the National Coastal and Marine CBA Map and delineation of the ecologically determined coastal zone, comparing options for an ecological inland extent or an administrative boundary, and proposing a way forward for better land-sea integration between the National Coastal and Marine CBA Map and the Provincial CBA Maps. | NMU, SANBI |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 3 August 2021 | Biodiversity Planning Forum (Virtual) | Update on the National Coastal University of and Marine Spatial Biodiversity Plan. | Anchor Environmental, AWARD, Big Thorn Environmental, BirdLife SA, CapeNature, City of Cape Town, Connect Project (Ghana), CSIR, DALRRD, DFFE, DPME, DWS, Eastern Cape Parks and Tourism Agency, Eco-Pulse Consulting, Ecological, EI4WS, Endangered Wildlife Trust, Environmental Officer: Criminal Investigations, ESRI South Africa, Ezemvelo KZN Wildlife, FS DESTEA, Gauteng Department of Agriculture and Rural Development, Groen Sebenza, Independent consultants, Limpopo Economic Development Environmental Affairs and Tourism, Malawi University Of Science And Technology, Mpumalanga Tourism And Parks Agency, NMU, NC Department of Agriculture, Environmental Affairs, Rural Development and Land Reform, North West Department of Economic Development, Environment, Conservation and Tourism, Resilience Environmental Advice, SANBI, SANParks UNEP-WCMC, Stellenbosch University, University of Botswana, University of Cape Town, University of KwaZulu-Natal, University of the Free State, Western Cape Department of Agriculture, Wildlands Conservation Trust, WWF. |
| 18 August 2021 | Virtual meeting to discuss inclusion of small-scale fisheries with the Coastal Connections Working Group | Meeting to discuss the inclusion of human elements, with a focus on small-scale fisheries, in the CBA Map. Information sharing on: how Marxan works and what kinds of data can be incorporated in the spatial prioritisation; SBSTTA's perspectives on including traditional ecological knowledge, indigenous knowledge in identification of EBSAs, including potential criteria; South Africa's SSF history, policy and context; technical discussion on the next steps for mapping and inclusion of SSF in the CBA Map, and discussions on the relationship between the CBA Map, sector plans and MSP. | DUT, NMU, OOH, Rhodes, SANBI, UCT. |
| 14 October 2021 | Virtual meeting to discuss cetacean distributions and data | Meeting to look at the modelled cetacean distributions included in the CBA Map to cut them from the fundamental niche to the realised niche, and revise the map of key habitats for whales. | CPUT, DFFE, NMU |

| Date | Workshop or work session | Overview | Organisations represented |
|---|---|---|---|
| 11 November 2021 | Biodiversity Planning Technical Working Group (Virtual meeting) | Updates on the National Coastal and Marine Spatial Biodiversity Plan, and updates on the plans for fine-scale, cross-realm planning. | Big Thorn Environmental, BirdLife SA, CapeNature, CSIR, DEDECT, Department of Agriculture, Environmental Affairs, Rural Development and Land Reform, DWS, FS DESTEA, GDARD, Independent consultants, MTPA, NMU, Resilience Environmental Advice, SANBI, SANParks. |
| Postponed to June 2022 due to Covid-19 | South African Marine Science Symposium: Workshop. | Building the science base for assessment, planning and management in the coastal and marine environment: EBSAs, CBA Map, and MSP.<br><br>Planned discussions on current progress and future intentions in: (1) the foundational map of marine ecosystem types; (2) Ecologically or Biologically Significant Marine Areas; (3) the National Coastal and Marine Spatial Biodiversity Plan and (4) Marine Spatial Planning. Identification of where existing marine science can support these initiatives; current research priorities; and what collaborative groups need to be established to work on key systems. | Expected: Marine scientists from academic institutions, NGOs, provincial and national government departments |

# Appendix 5: Version history

## Version 1.2 (Released 12-04-2022)

**Biodiversity data:** 976 features, including 437 biodiversity features and 539 design elements. The biodiversity features include: ecosystem types (n=190 features); species such as turtles, seabirds, dolphins, whales, seals and sharks (n=188 features); unique or special habitats or features (n = 15); ecological processes (n=18); ecological infrastructure (n=2); and existing priority areas (n=24). The design elements include: edge-matching and aligning priority areas across land and sea, shared international boundaries and with existing initiatives (n=52); culturally important areas (n=6); ecological condition (n=332); and climate-change adaptation (n=149).

**Cost layer:** Integrated cost layer comprising the maximum and summed level of avoidance of 19 sectors and the NBA 2018 cumulative impact map and area of the planning units. Data for one sector updated.

**Method:** two Marxan scenarios; CBA 1s: 100% selection frequency of the first scenario; CBA 2s: selection frequency ≥28% of the second scenario – the point at which all feature targets were met at 95%; CBA 1 and 2 split into Natural and Restore based on ecological condition. ESAs: remaining portions of EBSAs and a buffer around MPAs.

**Report:** 279 pp

## Version 1.1 (June 2021)

**Biodiversity data:** 911 features, including: ecosystem types (190), species (124), unique and special habitats or features (18), culturally significant areas (5), ecological processes (16), ecological infrastructure (2), EBSAs (18), other priority areas (6), ecological condition of ecosystem types (332), climate-change adaptation (149), under-protected ecosystem types inside EBSAs and outside MPAs (36), marine monitoring (7), implementation alignment (6), known fragile areas (2).

**Cost layer:** Integrated cost layer comprising the maximum and summed level of avoidance of 19 sectors and the NBA 2018 cumulative impact map and area of the planning units. Data for one sector updated.

**Method:** two Marxan scenarios; CBA 1s: 100% selection frequency of the first scenario; CBA 2s: selection frequency ≥34% of the second scenario – the point at which all feature targets were met at 95%; ESAs: remaining portions of EBSAs

**Report:** 212 pp

## Version 1.0 (Released 26-02-2021)

**Biodiversity data:** 886 features, including: ecosystem types (190), species (105), ecological processes (16), culturally significant areas (3), ecological infrastructure (2), other priority areas (6), unique and special habitats or features (16), ecological condition of ecosystem types (332), EBSAs (19), climate-change adaptation (150), known fragile areas (2), under-protected ecosystem types inside EBSAs and outside MPAs (36), marine monitoring (7), implementation alignment (2).

**Cost layer:** Integrated cost layer comprising the maximum and summed level of avoidance of 19 sectors and the NBA 2018 cumulative impact map and area of the planning units. Data for 6 sectors updated.

**Method:** two Marxan scenarios; CBA 1s: 100% selection frequency of the first scenario; CBA 2s: selection frequency ≥19% of the second scenario – the point at which all feature targets were met at 95%; ESAs: remaining portions of EBSAs

**Report:** Release note (6 pp) made available while the full report was being updated

### Version 1 beta 2 (Released: 15-12-2020)

**Biodiversity data:** 615 features, including: ecosystem types (190), species (41), ecological processes (6), culturally significant areas (2), ecological infrastructure (2), other priority areas (6), unique and special habitats or features (14), ecological condition of ecosystem types (332), EBSAs (19), known fragile areas (2), implementation alignment (1).

**Cost layer:** Integrated cost layer comprising the maximum and summed level of avoidance of 19 sectors and the NBA 2018 cumulative impact map

**Method:** two Marxan scenarios; CBA 1s: 100% selection frequency of the first scenario; CBA 2s: selection frequency ≥28% of the second scenario – the point at which all feature targets were met at 95%; ESAs: remaining portions of EBSAs

**Report:** 105 pp

### Version 1 beta 1 (Released: 4-11-2020)

**Biodiversity data:** 541 features, including: ecosystem types (179), ecological condition of ecosystem types (342), EBSAs (19), Mallory slope unique feature (1).

**Cost layer:** NBA 2018 cumulative impact map

**Method:** single Marxan scenario; CBA 1s: ≥83% selection frequency; CBA 2s: Marxan besign-design solution; ESAs: remaining portions of EBSAs

**Report:** 64 pp

### Version 0 (Internally available for NBA 2018: 21-03-2019)

**Biodiversity data:** 541 features, including: ecosystem types (179), ecological condition of ecosystem types (342), EBSAs (19), Mallory slope unique feature (1).

**Cost layer:** NBA 2018 cumulative impact map

**Method:** single Marxan output; CBA 1s: >83% selection frequency; CBA 2s: Marxan besign-design solution; ESAs: remaining portions of EBSAs

**Report:** 15 pp

## List of Figures

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# Acronyms

| | |
|---|---|
| ACEP | African Coelacanth Ecosystem Project |
| BCC | Benguela Current Commission |
| CBA | Critical Biodiversity Area |
| CBD | Convention on Biological Diversity |
| CBD-SBSTTA | Convention on Biological Diversity Subsidiary Body for Scientific and Technological Advice |
| COP | Convention of Parties |
| DFFE | Department of Forestry, Fisheries and Environment |
| EBSA | Ecologically or Biologically Significant Marine Areas |
| EEZ | Exclusive Economic Zone |
| EFZ | Estuarine Functional Zone |
| EI | Ecological Infrastructure |
| EIA | Environmental Impact Assessment |
| ESA | Ecological Support Area |
| FEPA | Freshwater Ecosystem Priority Areas |
| GIZ | Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH; German Development Cooperation |
| ICZM | Integrated Coastal Zone Management |
| IOSEA | Indian Ocean and South East Asia Sea Turtle Memorandum of Understanding |
| IUCN | International Union for the Conservation of Nature |
| KBA | Key Biodiversity Area |
| KZN | KwaZulu-Natal |
| MARISMA | Marine Spatial Management and Governance Project |
| MBKDE | Movement-based Kernel Density Estimation |
| MIBA | Marine Important Bird Area |
| MIMS | Marine Information Management System |
| MPA | Marine Protected Area |
| MSP | Marine Spatial Planning |
| NBA | National Biodiversity Assessment |
| NDP | National Development Plan |
| NFEPA | National Freshwater Ecosystem Priority Areas |
| NM | Nautical Mile |
| NNR | No Natural Remaining |
| NPAES | National Protected Area Expansion Strategy |
| OECM | Other Effective Area-Based Conservation Measures |
| OMPA | Offshore Marine Protected Areas Project |
| ONA | Other Natural Areas |
| OPASA | Offshore Petroleum Agency South Africa |
| PA | Protected Area |
| PASA | Petroleum Agency South Africa |
| PEI | Prince Edward Islands, comprising Marion Island and Prince Edward Island and their EEZs |
| SAEON | South African Environmental Observation Network |
| SAHRA | South African Heritage Resources Agency |
| SAMSS | South African Marine Science Symposium |
| SANBI | South African National Biodiversity Institute |
| SAPAD | South African Protected Areas Database |
| SCP | Systematic Conservation Planning |
| VME | Vulnerable Marine Ecosystem |

## Glossary

This glossary of terms is compiled from a subset of terms in the Lexicon of Biodiversity Planning in South Africa (SANBI 2016), National Biodiversity Assessment 2018 (Harris et al. 2019f; Sink et al. 2019f; Skowno et al. 2019a), MSP Act (no. 16 of 2018), Oceans and Coasts Annual Science Report 2020 (DFFE 2020a) and a few terms specific to this Plan. See the references listed above for additional terms.

| Term | Definition |
|---|---|
| Benthic | Relating to the bottom of the ocean or the seabed. |
| Biodiversity assessment | An assessment of the state of biodiversity, at the ecosystem, species or genetic level. The output of a biodiversity assessment could be, for example, a map of ecosystem threat status or ecosystem protection level. |
| Biodiversity asset | Ecosystems, species and other biodiversity-related resources (such as genetic material) that generate social, cultural or economic benefits, including supporting livelihoods, providing the basis for economic activity, and contributing to human wellbeing. |
| Biodiversity Conservation Areas | One of three sub-categories under the proposed Strict Biodiversity Conservation Zone in the Marine Biodiversity Sector Plan. These areas are equivalent to Critical Biodiversity Areas (Natural). The other two sub-categories are Marine Protected Areas and Biodiversity Restoration Areas. |
| Biodiversity Restoration Areas | One of three sub-categories under the proposed Strict Biodiversity Conservation Zone in the Marine Biodiversity Sector Plan. These areas are equivalent to Critical Biodiversity Areas (Restore). The other two sub-categories are Marine Protected Areas and Biodiversity Conservation Areas. |
| Biodiversity feature | An element of biodiversity included as part of an input layer in a biodiversity plan. A biodiversity feature could be, for example, an ecosystem type, a species occurrence or population, a special habitat, an ecological corridor. |
| Biodiversity Impact Management Zone | One of two proposed zones in the Marine Biodiversity Sector Plan, equivalent to Ecological Support Areas. The other proposed zone is the Strict Biodiversity Conservation Zone. |
| Biodiversity offset | Measurable conservation outcome resulting from actions to compensate for significant residual negative impacts (of a development project) on biodiversity after appropriate prevention and mitigation measures have been taken. Biodiversity offsets are the last option in the mitigation hierarchy (avoid/prevent; minimise; rehabilitate; offset), and should be considered only after options to avoid, prevent, minimise or rehabilitate impacts have been pursued. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity. |
| Biodiversity pattern | The compositional and structural aspects of biodiversity, at the genetic, species or ecosystem level. |
| Biodiversity pattern and ecological processes | The combination of the compositional, structural and functional aspects of biodiversity, at the genetic, species or ecosystem level. |
| Biodiversity plan | A spatial plan that identifies one or more categories of biodiversity priority area, using the principles and methods of systematic biodiversity planning |
| Biodiversity planning | The process of developing a spatial plan that identifies one or more categories of biodiversity priority area, using the principles and methods of systematic biodiversity planning. |

| Term | Definition |
|---|---|
| Biodiversity priority areas | Natural or semi-natural areas in the landscape or seascape that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services. |
| Biodiversity target | For ecosystems: The minimum proportion of each ecosystem type that needs to be kept in good ecological condition (natural or near-natural state) in the long term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with them. It is expressed as a percentage of the historical extent of an ecosystem type (measured as area, length or volume). For species: The minimum number of occurrences or populations that need to be kept extant (ideally with some form of protection) in order to ensure the persistence of the species, or the minimum amount of suitable habitat that needs to be kept in good ecological condition (natural or near-natural state) in order to ensure the persistence of a minimum viable population of the species, or similar. |
| CBA Map | A map showing Critical Biodiversity Areas and Ecological Support Areas, based on a systematic biodiversity plan. Protected Areas are also shown if they are present in the planning domain. |
| Coast | Terrestrial and marine ecosystem types with strong coastal affinities, including all estuaries and river-influenced marine ecosystem types (*sensu* the National Biodiversity Assessment 2018). It is recognised that this ecological definition of the coast is different to the definition of the coastal zone in the Integrated Coastal Management Act. |
| Conservation | Refers to management for explicit biodiversity conservation objectives. It may or may not include formal protection. It is also a subset of actions to secure biodiversity for the long term. |
| Critical Biodiversity Area (CBA) | An area that must be maintained in or restored to a good ecological condition (natural or near-natural state) in order to meet biodiversity targets. CBAs collectively meet biodiversity targets for all ecosystem types as well as for species and ecological processes that depend on natural or near-natural habitat that have not already been met in the protected area network. One of five broad categories on a CBA Map, and a subset of biodiversity priority areas. |
| Critical Biodiversity Area 1, (CBA 1) | An area that is irreplaceable or near-irreplaceable for meeting biodiversity targets. There are no or very few other options for meeting biodiversity targets for the features associated with the site. |
| Critical Biodiversity Area 2, (CBA 2) | An area that has been selected as the best option for meeting biodiversity targets based on complementarity, spatial efficiency, connectivity and/or avoidance of conflict with other sea-use activities. Other options for meeting biodiversity targets for the features associated with the site are likely, but may be less efficient have and higher cost to other sectors/users. |
| Critical Biodiversity Area (Natural), CBA Natural, CBA-N | Critical Biodiversity Areas (CBAs) that are in a natural ecological condition. Together with Marine Protected Areas, and CBA Restore, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs complement MPAs by securing biodiversity for long-term persistence using strict conservation measures. |

| Term | Definition |
|---|---|
| Critical Biodiversity Area (Restore), CBA Restore, CBA-R | Critical Biodiversity Areas (CBAs) that are no longer in a natural ecological condition and that should be restored. Together with Marine Protected Areas, and CBA Natural, these sites are required to meet biodiversity targets so that a representative sample of coastal and marine biodiversity can persist into the future. CBAs complement MPAs by securing biodiversity for long-term persistence using strict conservation measures. |
| Dune base | The foot of the dune, often the seaward point to which dune pioneer plants extend. This is a coastal boundary line separating the shore (marine) and backshore (terrestrial) zones, and thus the marine and terrestrial realms, and is considered equivalent to a decadal-scale high-water mark. |
| Ecological condition | An assessment of the extent to which the composition, structure and function of an area or biodiversity feature has been modified from a reference condition of natural. Broad ecological condition categories are good (natural or near-natural state), fair (semi-natural/moderately modified state) or poor (severely, very severely or irreversibly modified state). |
| Ecological infrastructure | Naturally functioning ecosystems that generate or deliver valuable services to people. It is the nature-based equivalent of built infrastructure, and is just as important for providing services and underpinning economic development. |
| Ecological processes | The functions and processes that operate to maintain and generate biodiversity. In order to include ecological processes in a biodiversity plan, their spatial components need to be identified and mapped. |
| Ecological Support Area (ESA) | Ecological Support Areas (ESAs) are sites where further deterioration in ecological condition must be avoided. They are often highly used areas that can be heavily impacted, but are still important for marine biodiversity patterns, ecological processes, and ecosystem services. ESAs play a supporting role to CBAs and MPAs, where the emphasis in ESAs is on managing impacts to biodiversity. |
| Ecoregion | A relatively large area of land or water, containing characteristic, geographically distinct assemblages of natural communities and species. Used in South African river and marine ecosystem classification systems, the ecoregion is larger than an ecosystem type. The flora, fauna and ecosystems that characterise an ecoregion tends to be distinct from that of other ecoregions. |
| Ecosystem protection level | Indicator of how well represented an ecosystem type is in the protected area network. Ecosystem types are categorised as well protected, moderately protected, poorly protected or not protected, based on the proportion of the biodiversity target for each ecosystem type that is included in one or more protected areas. Not protected, poorly protected and moderately protected ecosystem types are collectively referred to as under-protected ecosystems. |
| Ecosystem services | The Common International Classification of Ecosystem Services (CICES) defines ecosystem services as "the contributions that ecosystems make to human well-being". Ecosystem services are the flows of value to human society that result from a healthy stock of ecological infrastructure. If ecological infrastructure is modified or lost, the flow of ecosystem services will diminish. |
| Ecosystem threat status | Indicator of how threatened an ecosystem type is, in other words the degree to which it is still intact or alternatively losing vital aspects of its function, structure or composition. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of ecosystem type that remains in good ecological condition relative to a series of biodiversity thresholds. Critically Endangered, Endangered and Vulnerable ecosystems are collectively referred to as threatened ecosystems. |

| Term | Definition |
|---|---|
| Endemic | A species or ecosystem type that is native to, and restricted to, a particular geographical region. Highly endemic species and those with very restricted natural ranges, are especially vulnerable to extinction if their natural habitat is eliminated or significantly disturbed. |
| Estuarine functional zone (EFZ) | The open water area of an estuary together with the associated floodplain, incorporating estuarine habitat (such as sand and mudflats, salt marshes, rock and plant communities) and key physical and biological processes that are essential for estuarine ecological functioning. |
| Free-flowing river and flagship free-flowing river | A long stretch of river that has not been dammed, flowing undisturbed from its source to the confluence with another large river or to the sea. There are 63 remaining free-flowing rivers in South Africa. Of these 63, 19 have been identified as flagship free-flowing rivers, representing the different freshwater ecoregions of the country. |
| Freshwater Ecosystem Priority Area (FEPA) | A river reach or wetland that is required to meet biodiversity targets for freshwater ecosystem types. |
| Irreplaceability | A measure of the degree to which spatial options exist for meeting biodiversity targets. May refer to a site or to a biodiversity feature. |
| Level of avoidance | “Level of avoidance” is used synonymously with the term used more traditionally in systematic conservation planning, “cost”. Both of these terms refer to the relative amount by which Marxan will attempt to avoid selection of a planning unit because of the relative value it contains for other sectors. In the National Coastal and Marine Spatial Biodiversity Plan, the overall cost/level of avoidance also includes avoidance of areas that are more heavily impacted by cumulative pressures, and area. |
| Locked in (locking in) | A technical term used in systematic conservation planning when a feature is coded to the planning units such that those planning units are automatically selected as part of the final selection. |
| Locked out (locking out) | A technical term used in systematic conservation planning when a feature is coded to the planning units such that those planning units are made unavailable for selection and cannot be part of the final selection. |
| Marine area | A bio-geographic area that will serve as a planning unit for a marine area plan. There are four marine areas: Western, Southern and Eastern areas around the mainland, and PEI. |
| Marine area plan | A plan developed within a marine area by analysing and allocating the spatial and temporal distribution of human activities in the South African waters to achieve ecological, economic and social objectives, taking into account all relevant principles and factors set out in the MSP Act (Act No. 16 of 2018). A marine area plan comprises a gazetted zoning scheme and management regulations, encompassing the area between the high-water mark (landmass boundary line) and the EEZ as the seaward boundary. |
| Marine Biodiversity Sector Plan | The biodiversity sector’s input into the national marine spatial planning process. This includes a proposed set of spatial zones and management recommendations (equivalent to the CBA Map and sea-use guidelines). |
| Marine protected area | An area of the sea that is formally protected in terms of the National Environmental Management: Protected Areas Act (No. 57 of 2003) and managed mainly for biodiversity conservation. |

| Term | Definition |
|---|---|
| Marine realm | "Includes all connected saline ocean waters characterised by waves, tides and currents" (Keith et al. 2020). In the South African context, it includes the sea space from the dune base to the outer edge of the EEZ. It is the equivalent area to the marine territory. |
| Marine spatial planning | A governance process of collaboratively assessing and managing the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives. |
| Marine territory | The territorial seas (extends to 12 NM offshore), and the EEZ (extending from 12 NM to 200 NM offshore) around the country's mainland and Prince Edward Islands. Note that in this report, reference to the country's marine territory refers only to that around the mainland (i.e., excluding the marine territory around the Prince Edward Islands). This is the same extent as the marine realm in the National Biodiversity Assessment 2018. |
| National Protected Area Expansion Strategy (NPAES) | A strategy for expanding South Africa's network of protected areas. Sets ecosystem-specific protected area targets and identifies important geographic areas for protected area expansion. |
| No Natural Remaining (NNR) | An area in poor ecological condition (severely or irreversibly modified) that is not required to meet biodiversity targets for ecosystem types, species or ecological processes. One of five broad categories on a CBA map. |
| Operation Phakisa | Operation Phakisa is an initiative of the South African government designed to fast track the implementation of solutions on critical development issues highlighted in the National Development Plan (NDP) 2030 such as poverty, unemployment and inequality. Operation Phakisa is an innovative and pioneering approach to translate detailed plans into concrete results through dedicated delivery and collaboration. 'Phakisa' means 'hurry up' in Sesotho and the application of this methodology highlights government's urgency to deliver. Through Operation Phakisa, government aims to implement priority programmes better, faster and more effectively. www.operationphakisa.gov.za |
| Other Natural Area (ONA) | An area in good or fair ecological condition (natural, near-natural or semi-natural) that is not required to meet biodiversity targets for ecosystem types, species or ecological processes. One of five broad categories on a CBA Map. |
| Pelagic | Relating to the water column in the ocean. |
| Priority estuary | An estuary that is required to meet targets for representing estuarine ecosystem types, estuarine habitats and estuarine-dependent species, as identified in the National Estuary Biodiversity Plan. |
| Protected area | An area of land or sea that is formally protected in terms of the National Environmental Management: Protected Areas Act (No. 57 of 2003) and managed mainly for biodiversity conservation. Includes state-owned protected areas and contract protected areas. |
| Protected area estate | All protected areas |
| Protection / protect | Refers to formal protection in terms of the National Environmental Management: Protected Areas Act (No. 57 of 2003), and involves the establishment of statutory protected areas that are managed primarily for biodiversity conservation purposes, with sustainable use options where appropriate. Implies long-term security. It is a subset of securing biodiversity. |
| Seashore | The land-sea interface comprising the backshore and shore zones, extending from the scrub-thicket break to the back of the surf zone. |

| Term | Definition |
|---|---|
| Shore | The coastal zone that spans the intertidal systems from the dune base to the back of the surf zone. The combined backshore and shore are defined as the seashore. |
| Secure | Refers to both formal protection and other conservation measures as a means to safeguard biodiversity. |
| Strict Biodiversity Conservation Zone | One of two proposed zones in the Marine Biodiversity Sector Plan, comprising three sub-categories: Marine Protected Areas; Biodiversity Conservation Areas (equivalent to Critical Biodiversity Area Natural); and Biodiversity Restoration Areas (equivalent to Critical Biodiversity Area Restore). The other proposed zone is the Biodiversity Impact Management Zone. |
| Systematic biodiversity plan / planning | A scientific method for identifying geographic priority areas of biodiversity importance. It involves: mapping biodiversity features (such as ecosystem, species, spatial components of ecological processes); mapping a range of information related to these biodiversity features and their ecological condition; setting quantitative biodiversity targets for biodiversity features; analysing the information using software linked to GIS and developing maps that show spatial biodiversity priorities. The configuration of priority areas is designed to be spatially efficient (i.e., to meet biodiversity targets in the smallest area possible) and to avoid conflict with other land and resource uses where possible. In academic contexts, this is synonymous with systematic conservation planning. |