



TECHNICAL BRIEFING NOTE

The value of our seabed: Showcasing South Africa's co-developed Seabed Management Areas

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Key Messages:

1. Seabed biodiversity underpins ecological, economic and cultural services of fundamental importance to South Africa, including supporting commercially important fish stocks, nutrient recycling, carbon sequestration and providing nursery habitat for juvenile species.
2. Vulnerable Marine Ecosystems (VMEs), such as cold-water coral reefs, deep sea sponge grounds, aggregations of sea pens, anemones and other species, frequently associated with reefs, canyons and seamounts are characterised by slow growth, fragility and long lifespans and are highly sensitive to physical disturbances, such as trawling, longlining and other activities that affect the seabed.
3. Ten Seabed Management Areas (SMAs), covering approximately 8 116 km² (0.54% of South Africa's marine EEZ), were co-developed among the trawl industry, scientists and government between 2023 and 2025 to protect priority seabed habitats intersecting with the South African demersal hake trawl ring-fence.
4. The accepted SMAs are estimated to improve management of 86% of VME types and 67% of priority ecosystem types in the fishery, impacting only 0.71% of total catch and 0.16% of fishing effort.
5. South Africa's deep-sea seabed remains critically under-surveyed. Expanding monitoring, precautionary management and integration of SMAs with other resource-use sectors is urgently needed.

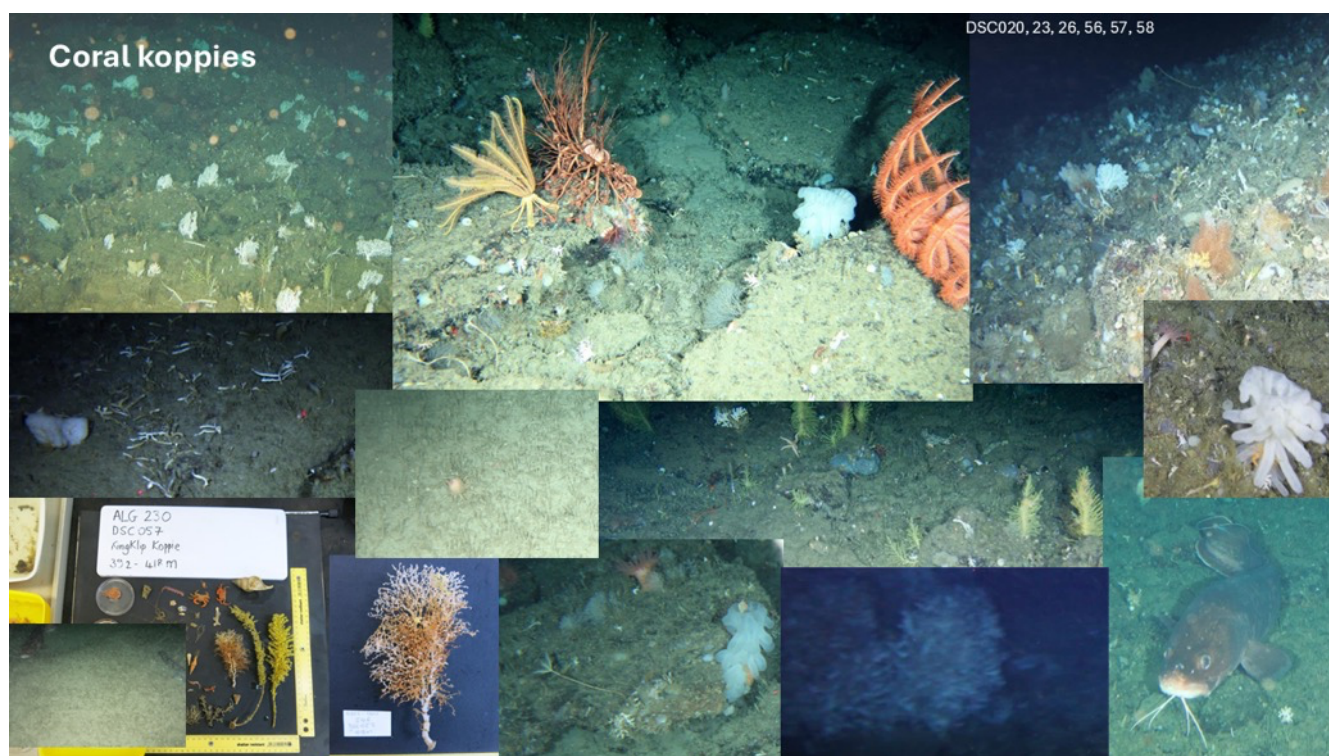


Image 1: Species recorded with a towed camera on the sea floor in the Coral Koppies Seabed Management Area
Photo credit: ACEP Deep Secrets.

1. Background and Importance of Problem

1.1. What is seabed biodiversity and why does it matter?

The seabed (also called benthos) encompasses a vast range of habitats, from shallow intertidal shores to abyssal plains thousands of metres deep. In South Africa, the deepest parts of the seabed reach to ~ 5500 m, however we have only surveyed a handful of areas deeper than 1000 m (Griffiths et al. 2010). Seabed habitats support an extraordinary diversity of life and perform ecological functions that sustain marine ecosystems and human livelihoods. Seabed biodiversity includes biogenic reef-forming animals such as cold-water corals and sponges, sediment-dwelling invertebrates that create habitat for others, and the complex communities of species that together drive nutrient cycling, carbon burial, and habitat provision across the ocean floor.

Globally, benthic ecosystems provide services estimated to be worth trillions of dollars annually (Costanza et al. 1997). In South Africa, the marine environment contributes significantly to food security, employment, tourism, and cultural identity. The seabed plays a foundational role in these contributions yet remains largely invisible to the public and poorly understood, even by the scientific community.

What are Vulnerable Marine Ecosystems (VMEs)?

VMEs are defined by the Food and Agriculture Organization (FAO) as marine ecosystems characterised by features that make them particularly sensitive to impacts from fishing and other human activities. In South Africa, VME indicator taxa include:

- Reef-building cold-water corals (e.g. *Desmophyllum pertusum*, *Solenosmilia variabilis*)
- Deep-sea sponges (e.g. *Suberites dandelenae*, *Acanthascus baculifer*)
- Sea pens, sea fans and bamboo corals (Pennatulacea, Melithaeidae, Isididae)
- Stylasterine lace corals and bryozoans

VMEs are typically slow-growing, long-lived, and highly sensitive to physical disturbance. Once damaged, recovery may take decades to centuries (Watling & Auster 2021; Sink et al. 2025).

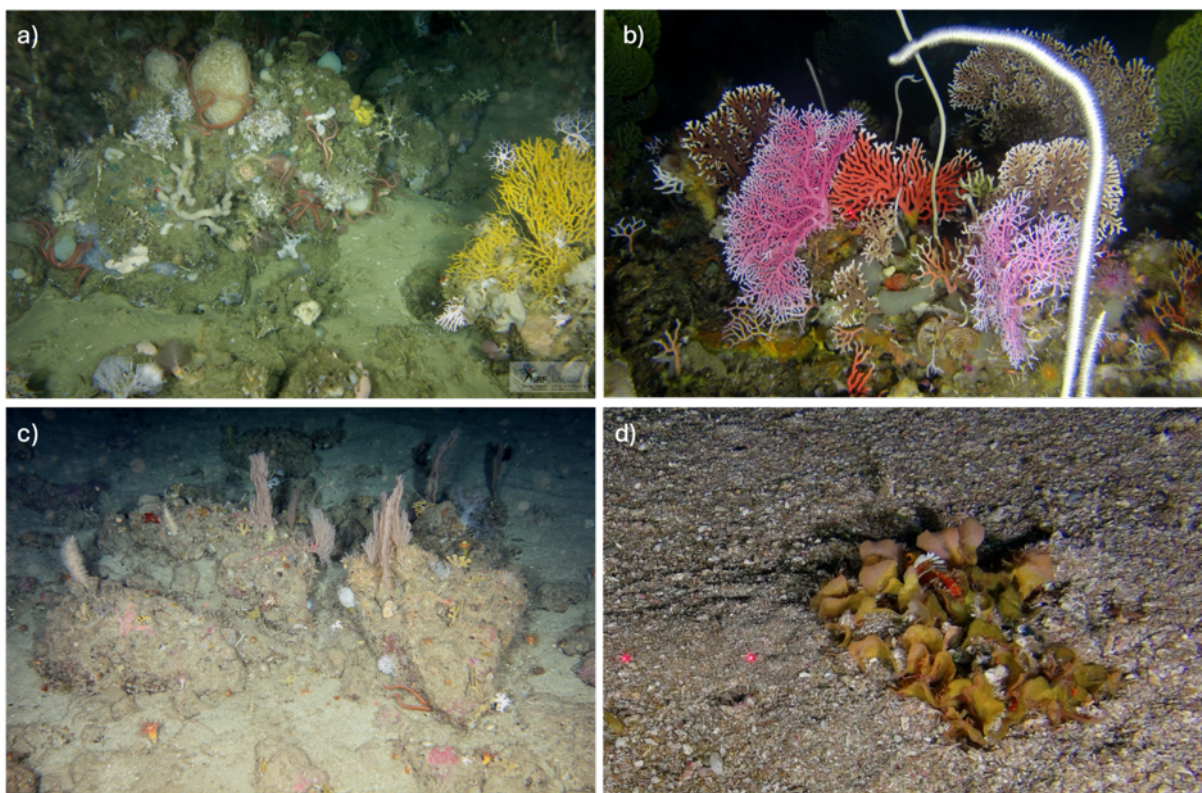


Image 2: Several Vulnerable Marine Ecosystem species observed within South Africa's mainland Exclusive Economic Zone a) Sponges, coral and seafans in Childs Bank Marine Protected Area, b) Lace corals in Amathole Offshore Marine Protected Area, c) Seafans, sponges and corals in unprotected seabed offshore of Tsitsikamma, d) Bryozoan providing refuge for fish in gravel habitat. Photo credits SAEON, ACEP Imida, ACEP Deep Secrets and ACEP Surrogacy Projects.

1.2. Ecological functions of seabed biodiversity

Biogenic habitats such as cold-water coral reefs, sponge grounds, and horse mussel beds provide three-dimensional structural complexity that supports significantly elevated densities of associated invertebrates and fishes (Levin et al 2025). These habitats function as feeding, spawning and sheltering areas, and their degradation results in measurable reductions in local species diversity and productivity (Thrush & Dayton 2002, Clark et al. 2016). In a comprehensive systematic review of 874 studies on juvenile habitat quality for marine fishes and invertebrates, Ciotti et al. (2025) document that subtidal sandy or muddy habitats and structurally complex habitats such as seagrass beds and biogenic reefs are among the most important nursery environments for commercially exploited species, highlighting the ecological connectivity between juvenile habitat quality and the health of adult fish populations. A seabed survey conducted in 2024 off Central Chile discovered carbonate mounds covered with large polychaete tube bushes at depths of 434-438 m and within the largest of these mounds, close to 50 adult red cusk eel individuals, *Genypterus chilensis*, were observed (Levin et al. 2025, see photo inset). Kingklip (*Genypterus capensis*), one of South Africa's most highly valued fish resources, belongs to the same genus and we suspect our local species prefers rocky habitat, but has also been observed occupying burrows on the sandy outer shelf (Image 3).

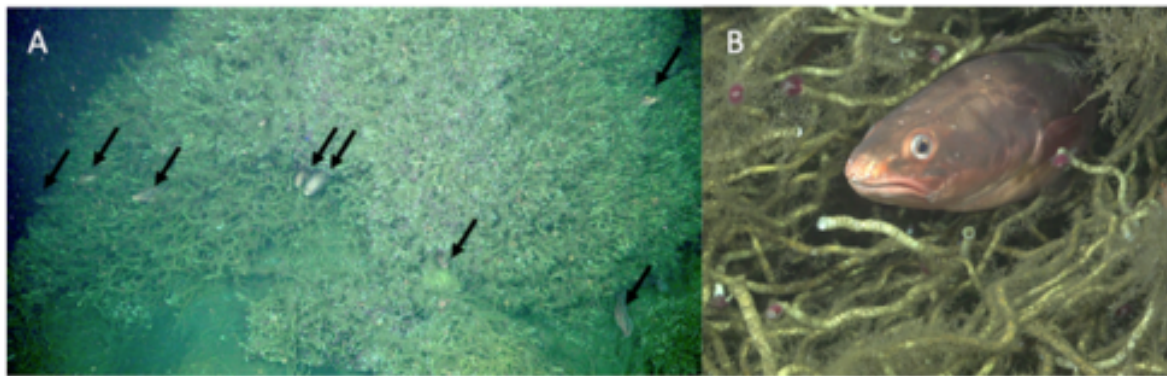


FIGURE 1 (A) A massive tubeworm bush at El Quisco methane seep off central Chile (434 m). *Genypterus chilensis* tunneled into the bush are shown with black arrows. (B) Close-up of protruding *G. chilensis* head. Fuzz covering the tubeworms are hydroids. Images are video screen shots from FK241011, SuBastian dive 729, October 17, 2024; 33° 37' S; 71° 89' W; video credit: Schmidt Ocean Institute.

Image credit: Levin et al 2025 - <https://doi.org/10.1002/ecy.70237>



Image 3: Kingklip (*Genypterus capensis*) recorded by towed camera using a muddy burrow at $\pm$ 350 m off the southern Cape, South Africa. Photo credit: ACEP Deep Secrets.

Nursery function: Juvenile fishes and invertebrates rely on structurally complex coastal and seabed habitats during their most vulnerable early life stages. Ciotti et al. (2025) established that juvenile habitat quality, measured in terms of abundance, growth, survival, and juvenile to adult contribution, directly influences the recruitment and population replenishment of commercially important species. Auster et al. (1997) showed that early juvenile (0-year) silver hake (*Merluccius bilinearis*) occurred at significantly higher densities in areas of amphipod tube cover on the continental shelf off eastern North America, where 87% of all juveniles were observed within one body

length of these biogenic structures. The hake use the amphipod tube habitat to hide from predators and co-locate with their preferred prey. The juvenile hake are camouflaged in the amphipod tube habitat with higher predation recorded in areas with low densities of amphipod tubes, illustrating how small-scale seabed complexity directly influences juvenile survivorship and recruitment success. Commercially exploited redfish (*Sebastes fasciatus*) were recorded in higher densities in structurally complex deep-water coral habitats in the Gulf of Maine (Auster 2005) with fishing-induced damage to these habitats resulting in reduced spatial extent of the species. Such studies conclude that the resilience of fish populations to disturbance is reduced when seabed structural habitats are lost. The structural complexity provided by biogenic reef-forming organisms, such as cold-water corals and sponge aggregations found in South Africa's offshore SMAs, are likely to provide similar refuge and foraging functions in deeper water environments (Sink et al. 2025).

Nutrient cycling and productivity: Benthic invertebrates, particularly filter-feeders such as sponges and bivalves, play a critical role in coupling pelagic production to the seafloor and transferring energy up the food web. The horse mussel beds protected in SMA Box i (Seaview Horse Mussels) are an example of habitat-forming bivalves that create substrate and food resources for a diverse associated community (Sink et al. 2025). Infaunal species (small animals that live inside the sediment) such as polychaetes, bivalves and echinoderms, drive nutrient recycling through bioturbation, physically reworking the sediments and enhancing the exchange of dissolved nutrients across the sediment-water interface, stimulating microbial activity which drives primary production in the water column (Kristensen et al 2012, Karenyi et al. 2016).



Image 4: Benthic species recorded in the Seaview Horse mussels Seabed Management Area offshore of Gqeberha
Photo credit: ACEP Deep Secrets

Carbon storage: Deep-sea sediments and the skeletal material of reef-forming organisms represent significant long-term carbon stores. Limited ocean carbon storage research has been conducted in South Africa to date, however, some international studies indicate that disturbance of deep-sea habitats may re-suspend carbon and release it back to the water column, with implications for climate regulation (Atwood et al. 2024). The protection

of intact seabed habitats in areas such as the Addo Canyons (SMA Box h), where submarine canyon systems concentrate organic material, therefore may have complimentary benefits for climate mitigation.

Biodiversity support and endemism: South Africa's marine environment is globally recognised for its high levels of biodiversity and endemism, arising from the convergence of the Benguela and Agulhas current systems with influence of the Southern Ocean. The seabed habitats targeted for protection in the co-developed SMAs span multiple ecologically distinct ecosystem types including the cold, nutrient-rich waters of the Southern Benguela to the warmer, more oligotrophic environments of the southwest Indian Ocean each supporting distinct communities of organisms (Sink et al. 2025).

1.3. Threats to seabed biodiversity from demersal trawling

Although the South African hake trawl fishery operates in a currently defined ring-fence area covering approximately 6.6% of the national EEZ, cumulative trawling impacts on benthic communities have been documented. Atkinson et al. (2011) demonstrated significant differences in benthic assemblage composition between trawled and untrawled areas along South Africa's west coast, with impacts particularly evident in epifaunal community structure. A study conducted in the southern inshore trawl areas by Rylands (2021) revealed lower benthic diversity and structural complexity in trawled areas compared to protected areas. Currie et al. (2020) concluded that a century of trawling in South Africa shifted fish assemblages from being majority reef-associated to more species that inhabit unconsolidated sediments, suggesting that the trawling activity likely altered benthic habitats, indirectly altering the fish assemblage.

VMEs are characterised by slow-growing, fragile organisms with high sensitivity to physical disturbance. Because they are unlikely to persist in frequently trawled zones, core fishing grounds are not considered priority areas for VME conservation (Sink et al. 2025). However, seldom-trawled or historically untrawled areas within the ring-fence, as well as adjacent areas at its margins, may host undiscovered or recovering VME communities that are at risk if fishing effort shifts.

Currie et al. (2023) calculated a refined Swept Area Ratio (SAR) for South Africa's commercial trawl fishery, revealing significant spatial heterogeneity in trawl intensity with maximum SAR values of up to 33.9 in some grid cells. This high-resolution mapping of trawl effort was fundamental to identifying priority areas for SMA co-development that minimise socioeconomic impacts while maximising biodiversity protection (Sink et al. 2025).

Seabed ecosystems are equally vulnerable to other industrial activities that impact the seabed such as deep-sea mining, petroleum drilling and pipelines, submarine cables and ship anchorage areas. To effectively protect these vulnerable areas we need to engage with all such sectors, raise awareness and seek collaborative solutions.

1.4. The regulatory and eco-certification context

South Africa's hake trawl fishery has held Marine Stewardship Council (MSC) certification since 2004, the longest of any South African fishery. MSC re-certification in 2021 (Andrews et al. 2021) resulted in multiple habitat conditions requiring demonstrable improvements in the identification, mapping, and spatial management of VMEs. Specifically, conditions 8–13 require the fishery to demonstrate that its operations are highly unlikely to cause serious or irreversible harm to VME habitats, and that a partial management strategy is in place to protect these habitats.

The co-development of Seabed Management Areas directly addresses these MSC conditions and represents a model of co-management in which industry, government, and the scientific community collaborate to advance evidence-based conservation within a productive fishery context (Sink et al. 2025).

2. Key findings of Research used to prepare the brief

2.1 Co-developed Seabed Management Areas: the process

Between October 2023 and June 2025, a structured, iterative process of consultation and technical analysis was undertaken to co-develop potential Seabed Management Areas for the South African demersal hake trawl fishery. The process involved representatives of the South African Deep-Sea Trawling Industry Association (SADSTIA), the South East Coast Inshore Fishing Association (SECIFA), scientists from the VME Scientific Working Group convened by the South African National Biodiversity Institute (SANBI), and officials from the Department of Forestry, Fisheries and the Environment (DFFE) (Sink et al. 2025).

The co-development process was guided by three core principles:

- Avoidance of core fishing grounds of the trawl sector, to minimise socio-economic impacts and because VMEs are unlikely to persist or be in healthy condition in heavily trawled areas;
- Inclusion of known and potential VMEs within proposed SMA boundaries, using the best available evidence from visual surveys, research trawl catch records, echosounder data, and indicator species records; and
- Inclusion of priority ecosystem types, defined as those with more than 20% of their extent within the trawl ring-fence and less than 20% of their extent currently under formal protection, as identified by Currie et al. (2023).

2.2 Key data informing the Seabed Management Areas

The identification and design of SMAs drew on a rich but incomplete data landscape. Key data layers included:

- **South Africa's 2023 map of marine ecosystem types** (Sink et al. 2023a), providing a spatial framework of 33 offshore ecosystem types against which to assess trawl overlap and protection gaps;
- **VME distribution data** from research trawl records, commercial observer records, visual survey footage (tow camera and ROV), echosounder sonar data identifying coral mounds, and VME indicator taxon presence records (processed, validated and standardised by Franken (2025);
- **Swept Area Ratio mapping** (Currie et al. 2023), providing a 1 km² resolution map of trawl intensity between 2005 and 2018 as the primary indicator of seabed disturbance;
- **Systematic conservation planning outputs** from the National Coastal and Marine Spatial Biodiversity Plan (Harris et al. 2022) and the iAtlantic systematic conservation plan (Harris et al. 2024), used to situate proposed SMAs within broader biodiversity conservation priorities.

2.3 Outcomes: the ten accepted Seabed Management Areas

Of 14 proposed SMAs considered during the co-development process (encompassing 12 geographic boxes, two of which have sub-areas), ten were accepted by all SADSTIA and SECIFA members in June 2025 for implementation through permit conditions (Sink et al. 2025). The accepted SMAs are shown in Fig. 1 and summarised below:

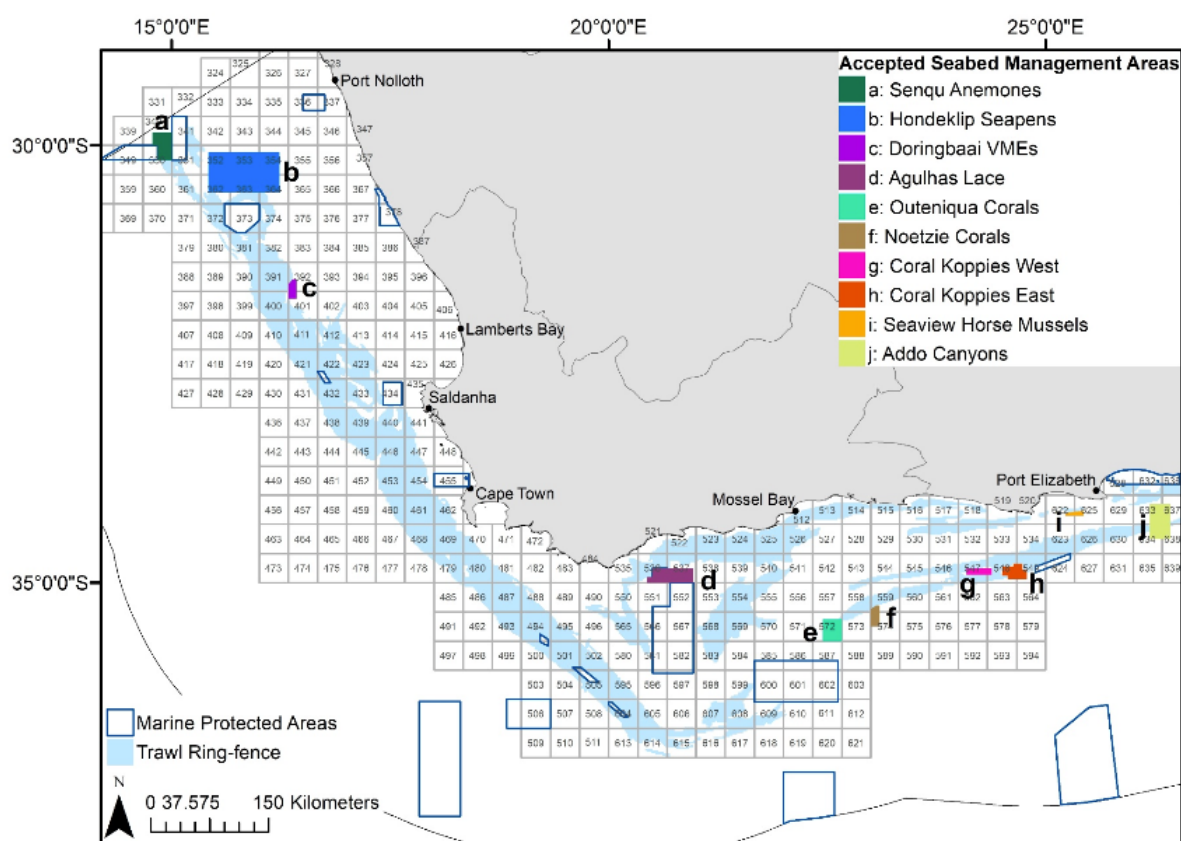


Fig. 1. Ten accepted Seabed Management Areas (SMAs) co-developed and agreed in June 2025 (Sink et al. 2025).

Table 1. Key biodiversity features and total area of each accepted Seabed Management Area (June 2025).

Seabed Management Area	Key Biodiversity Features	Area / Status
Box a: Senqu Anemones	High-density anemone aggregations; links Orange Shelf Edge MPA zones; untrawled Southern Benguela Sandy Shelf Edge in good condition.	654.87 km ² — Accepted
Box b: Hondeklip Seapens	VME catch for <i>Anthoptilum grandiflorum</i> ; 10 additional VME indicator taxa including stylasterine corals, sponges, seafans and bryozoans; reef-building coral records nearby.	3988.40 km ² — Accepted
Box c: Doringbaai VMEs	Seven VME taxa; two confirmed VMEs (reef-building coral and seapens); first protection for Southern Benguela Shelf Edge Mosaic (unprotected priority ecosystem type).	198.18 km ² — Accepted
Box d: Agulhas Lace	Bryozoan and stylasterine lace coral records; only record of <i>Errina</i> sp. lace coral; links Agulhas Muds and Agulhas Bank Complex MPAs.	830.40 km ² — Accepted
Box e: Outeniqua Corals East	Reef-building coral from visual survey; two cold-water coral mounds (one confirmed by ROV); Agulhas Rocky Shelf Edge priority ecosystem type.	544.82 km ² — Accepted
Box f: Noetzie Corals	Verified cold-water coral reef (likely <i>Solenosmilia variabilis</i>); indicator records for Melithid seafans, <i>Thouarella</i> , and	231.38 km ² — Accepted

	bryozoans. Proposed in lieu of Three Oceans Deep Coral Reef Seabed Management Area (unaccepted).	
Box g: Coral Koppies West	VMEs confirmed by visual survey and dredge; bamboo coral, stylasterine corals, <i>Thouarella</i> soft corals, sponges; Kingklip Koppies ecosystem type.	219.22 km ² — Accepted
Box h: Coral Koppies East	11 coral mounds from echosounder; reef-building coral, <i>Thouarella</i> , stylasterine corals; Kingklip Koppies unprotected priority ecosystem type.	402.89 km ² — Accepted
Box i: Seaview Horse Mussels	Highest horse mussel (habitat-forming bivalve) densities recorded; <i>Spatangus capensis</i> sea urchins; all 6 visual survey stations had horse mussels.	93.15 km ² — Accepted
Box j: Addo Canyons	Two submarine canyons (VME features); <i>Desmophyllum pertusum</i> reef-building coral; highest sea anemone densities recorded; multiple VME indicator taxa.	952.44 km ² — Accepted

2.4 Conservation gains from the accepted SMAs

Implementation of the ten accepted SMAs is projected to deliver substantial and measurable biodiversity conservation gains within the demersal hake trawl sector (Sink et al. 2025):

- Management will be improved for 18 of 21 VME indicator taxa (86%) recorded within the trawl ring-fence, with remaining gaps relating to taxa with very few known records, underscoring the need for expanded surveys.
- Habitat management will be improved for 12 of 18 priority ecosystem types (67%), including several previously entirely unprotected types such as the Kingklip Koppies and Southern Benguela Shelf Edge Mosaic.
- Approximately 85% of known, mapped cold-water coral mounds (from sonar records) will fall within either SMAs or existing MPAs, providing the first substantive protection for this VME feature type.

The accepted SMAs cover approximately 8 116 km², or 0.54% of South Africa’s mainland marine EEZ, representing a pragmatic and proportionate contribution to the national conservation estate that could be further developed through OECM recognition and future MPA designation. This approach demonstrates how protecting a very small proportion of seabed can yield disproportionately high conservation gains, aligning biodiversity protection with socio-economic needs.

2.5 Socioeconomic impact of the SMAs

A central objective of the co-development process was to design SMAs that deliver biodiversity benefits while minimising disruption to fishing operations. Quantitative analysis of trawl effort and catch data for 2017–2024 confirmed that the final accepted SMAs represent a minimal socioeconomic footprint (Sink et al. 2025):

- The accepted SMAs account for 1.3% of the current trawl ring-fence area.
- Fishing effort redistributed as a result of the SMAs is estimated at only 0.16% of total effort during the 2017-2024 reference period.
- Total catch reduction is estimated at 0.71%, with national hake landings within the accepted SMAs accounting for only 0.07% of the total.

These figures demonstrate that a well-designed spatial planning process, informed by high-resolution habitat and effort data, can achieve meaningful biodiversity conservation outcomes with negligible impact on the economic performance of the fishery.

3. Recommendations on the implications for policy decision making or technical application

3.1 Implement and formalise the accepted Seabed Management Areas

The ten accepted SMAs are being implemented by DFFE through permit conditions as agreed during the co-development process. The following additional formalisation steps are recommended (Sink et al. 2025):

1. **Engage** with DFFE (including Fisheries, Oceans and Coasts and Biodiversity and Conservation Branches) and other stakeholders (including SADSTIA and SECIFA) to explore the potential for designation of SMAs as formal **Marine Protected Areas** in the longer term, through inclusive planning processes involving all rights holders and knowledge holders.
2. Maintain the four currently omitted proposed SMAs as **priority areas for future research and potential re-consideration**, with targeted visual surveys planned as a first step (Boxes 3, 5, 6, and 10a).

3.2 Expand VME monitoring and knowledge generation

South Africa's VME knowledge base remains critically limited, with most records concentrated in areas with existing survey coverage while there are likely many un-surveyed areas and features that may host large VMEs. A precautionary management approach is recommended until more comprehensive data are available. Specific actions include:

3. Prioritise **visual surveys (ROV and tow camera)** of VME catch record areas, under-surveyed MPAs, and proposed SMAs, with particular focus on reef-building scleractinian corals (*Desmophyllum pertusum* and *Solenosmilia variabilis*), to expand the evidence base for conservation planning.
4. Accelerate the adoption of **emerging monitoring technologies** including acoustic telemetry, eDNA and automatic image annotation (including AI-assisted species identification), for advancing habitat quality assessment at relevant spatial and temporal scales.
5. Maintain the **SAEON-DFFE demersal research trawl invertebrate monitoring programme** to generate long time-series data needed to detect changes in benthic communities in response to anthropogenic and climate disturbance.
6. Establish **multiple metrics of seabed habitat quality** beyond presence/absence, including measures of community structure, biomass, and, where feasible, juvenile–adult contribution metrics, to evaluate the effectiveness of SMAs in supporting fish and invertebrate population recovery (Ciotti et al. 2025).

3.3 Integrate seabed biodiversity into Marine Spatial Planning

The SMAs co-developed for the hake trawl fishery represent an important but partial contribution to South Africa's broader marine spatial planning objectives. VMEs are affected by multiple marine activities including other fishing sectors, seabed mining, petroleum activities, cable laying and other offshore development. Ensuring that seabed biodiversity is adequately considered in national marine governance requires:

7. Integration of the accepted SMAs and their underlying biodiversity data into the **National Coastal and Marine Spatial Biodiversity Plan** (Harris et al. 2022) and subsequent updates, ensuring that spatial

planning for other marine sectors (including oil and gas, aquaculture, renewable energy and shipping) considers these ecologically significant areas.

8. Encourage application of the co-development methodology to **other fishing sectors** operating in South African waters (including longline, trap, linefish and crustacean trawl fisheries) to ensure that seabed management gains are not undermined by unregulated activity in adjacent areas.
9. Consider the **seascape nursery concept** (Nagelkerken et al. 2015; Ciotti et al. 2025) in spatial planning, recognising that individual habitat patches (including SMAs) may derive their conservation value partly through functional connectivity with adjacent habitats rather than from their intrinsic properties alone.

3.4 Recognise and communicate the multiple values of seabed biodiversity

10. Develop accessible **public communication products** that articulate the value of seabed biodiversity in terms that resonate with diverse audiences, including fishers, coastal communities, and the wider public. An example of such is the “Diep Respek” video clip that was developed by a South African team as part of One Ocean Hub, ACEP Deep Forests and the MzanSea initiative: <https://unworldoceansday.org/diep-respek/>. The co-development of the SMAs provides a compelling narrative of responsible stewardship that can be leveraged to build broader public support for marine conservation.
11. Invest in **economic valuation** of the ecosystem services provided by South Africa’s seabed habitats, including their role in supporting fish population replenishment, carbon storage, and biodiversity-based tourism, to provide a quantified evidence base for conservation investment decisions.

4. References

- Andrews, J., et al. (2021). South Africa Hake Trawl — Public Certification Report. Re-Assessment. Marine Stewardship Council. Available: <https://fisheries.msc.org>.
- Atkinson, L.J., Field, J.G., & Hutchings, L. (2011). Effects of demersal trawling along the west coast of southern Africa: multivariate analysis of benthic assemblages. *Marine Ecology Progress Series*, 430, 241–255.
- Atwood, T.B., Romanou, A., DeVries, T., Lerner, P.E., Mayorga, J.S., Bradley, D., Cabral, R.B., Schmidt, G.A. & Sala, E. (2024). Atmospheric CO₂ emissions and ocean acidification from bottom-trawling. *Frontiers in Marine Science*, 10, 1125137. <https://doi.org/10.3389/fmars.2023.1125137>.
- Auster, P.J., Malatesta, R.J. & Donaldson, C.L.S., 1997. Distributional responses to small-scale habitat variability by early juvenile silver hake, *Merluccius bilinearis*. *Environmental Biology of Fishes*, 50(2), pp.195-200.
- Auster, P.J., 2005. Are deep-water corals important habitats for fishes?. In *Cold-water corals and ecosystems* (pp. 747-760). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Clark, M.R., Althaus, F., Schlacher, T.A., Williams, A., Bowden, D.A. & Rowden, A.A. (2016) The impacts of deep-sea fisheries on benthic communities: a review. *ICES Journal of Marine Science*, 73(S1): i51–i69. <https://doi.org/10.1093/icesjms/fsv123>.
- Ciotti, B.J., Brown, E.J., Colloca, F., Eggleston, D.B., Hyman, A.C., Le Pape, O., Lipcius, R.N., Maathuis, M.A.M., Poiesz, S.S.H., Rose, K.A., Seitz, R.D., Ventura, D., & van de Wolfshaar, K.E. (2025). Measuring juvenile habitat quality for fishes and invertebrates. *Biological Reviews*, 100, 2346–2395. <https://doi.org/10.1111/brv.70050>
- Costanza, R., d’Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O’Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., & van den Belt, M. (1997). The value of the world’s ecosystem services and natural capital. *Nature*, 387(6630), 253–260.

- Currie J.C., Atkinson L.J., Sink K.J. & Attwood C.G. (2020) Long-Term Change of Demersal Fish Assemblages on the Inshore Agulhas Bank Between 1904 and 2015. *Frontiers in Marine Science* 7:355. doi: 10.3389/fmars.2020.00355
- Currie, J., Harris, L., Atkinson, L., Fairweather, T., & Sink, K. (2023). Mapping fine-scale demersal trawl effort for application in ecosystem assessment and spatial planning. *African Journal of Marine Science*, 45(3), 165–179.
- Franken M.L. (2025). A systematic approach to the identification, mapping and spatial prioritisation of Vulnerable Marine Ecosystems in South Africa. PhD Thesis. University of Cape Town. 291 pages
- Griffiths C.L., Robinson T.B., Lange L., Mead A. (2010) Marine Biodiversity in South Africa: An Evaluation of Current States of Knowledge. *PLoS ONE* 5(8):e12008. doi:10.1371/journal.pone.0012008
- Harris L.R., Holness S.D., Kirkman S.P., Sink K.J., Majiedt P., & Driver A. (2022). A robust, systematic approach for developing the biodiversity sector's input for multi-sector Marine Spatial Planning. *Ocean & Coastal Management*, 230, 106368.
- Harris, L.R., Sink, K.J., Kirkman, S.P., Atkinson, L.J., & Holness, S.D. (2024). iAtlantic Case Study from South Africa: Systematic conservation planning to identify offshore focus areas for Marine Protected Area expansion. Technical Report. Nelson Mandela University, Gqeberha.
- Kristensen, E., Penha-Lopes, G., Delefosse, M., Valdemarsen, T.B., Quintana, C.O. & Banta, G.T. (2012). What is bioturbation? The need for a precise definition for fauna in aquatic sciences. *Marine Ecology Progress Series*, 446, 285–302. <https://doi.org/10.3354/meps09506>
- Karenyi N., Sink K. & Nel, R., 2016. Defining seascapes for marine unconsolidated shelf sediments in an eastern boundary upwelling region: the southern Benguela as a case study. *Estuarine, Coastal and Shelf Science*, 169, pp.195-206.
- Levin, L.A., Eulogio S., Yerko C., Patricia E., and Jeffrey M. 2025. Congregation of Cusk-Eels (*Genypterus chilensis*, Ophidiiformes) at a Deep-Sea Methane Seep off Chile. *Ecology* 106(10): e70237. <https://doi.org/10.1002/ecy.70237>
- Nagelkerken, I., Sheaves, M., Baker, R., & Connolly, R.M. (2015). The seascape nursery: a novel spatial approach to identify and manage nurseries for coastal marine fauna. *Fish and Fisheries*, 16(2), 362–371.
- Rylands, S. 2021. The effects of inshore demersal trawling on seabed habitats: the application of visual surveys and indicators in South Africa. Master of Science dissertation, Department of Biological Sciences, University of Cape Town, pp. 96.
- Sink, K.J., Adams, L.A., Franken, M.-L., Harris, L.R., Currie, J., Karenyi, N., Dayaram, A., Porter, S., Kirkman, S., & Pfaff, M. (2023a). Iterative mapping of marine ecosystems for spatial status assessment, prioritization, and decision support. *Frontiers in Ecology and Evolution*, 11, 1108118.
- Sink, K.J., Lombard, A.T., Attwood, C.G., Livingstone, T.C., Grantham, H., & Holness, S.D. (2023b). Integrated systematic planning and adaptive stakeholder process support a 10-fold increase in South Africa's Marine Protected Area estate. *Conservation Letters*, e12954.
- Sink, K., Franken, M.-L., Atkinson, L., Norman, S., Wilkinson, S., Augustyn, J., du Plessis, K., Landman, R., Sands, M., Maritz, K., Besseling, N., Kirkman, S.P., & Fairweather, T.P. (2025). Co-Development of Seabed Management Areas in support of Marine Stewardship Council habitat eco-certification conditions. Version 3.2. November 2025.
- Thrush, S.F. & Dayton, P.K. (2002) Disturbance to Marine Benthic Habitats by Trawling and Dredging: Implications for Marine Biodiversity. *Annual Review of Ecology and Systematics*, 33: 449–473. <https://doi.org/10.1146/annurev.ecolsys.33.010802.150515>.
- Watling, L., & Auster, P.J. (2021). Vulnerable marine ecosystems, communities, and indicator species: confusing concepts for conservation of seamounts. *Frontiers in Marine Science*, 8, 622586.

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